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MONTHLY REVIEW INDEX OF CIVIL ENGINEERING LITERATURE

A classified index and review of the civil engineering papers, articles, reports, pamphlets and books published during the month just passed is given in the succeeding pages. The literature indexed and reviewed—with the exception of books—relates solely to civil engineering. In the section devoted to Book Reviews all books in all branches of engineering are listed as received and such of them as seem worthy are reviewed as fully as due regard for conciseness will permit. In choosing books for review rigid selection is exercised. Next to careful choice of books for review timeliness of review is sought. All books are reviewed within a month of their receipt. The same statement is true of the articles and papers that are indexed. Also, as in choosing books for review, the choice of articles and papers for indexing is based on merit. Numerical strength in "titles indexed" is not sought; excellence of selection is sought.

The purposes of the Monthly Review Index are: First, to inform civil engineers and contractors of the articles and papers of merit that are published each month, in such a way as will give a clear idea of their character and scope; second, to supply the user with the date and place of publication, the length of each article and the cost at which it can be secured. The name, adopted abbreviations, place of publication and price per number of each periodical examined for civil engineering articles are given in the list immediately following. The other information is given in the index proper for each article separately.

Books reviewed will be sent post paid on receipt of price by the Book Department of ENGINEERING-CONTRACTING; periodicals, etc., containing articles indexed should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

American Architect (Am. Arch.), New York, N. Y.; w; 7x10 in.; 15 cts.
American Builders' Review (Am. Bldrs. Rev.), San Francisco, Cal.; m; 7x10 in.; 50 cts.
American Carpenter and Builder (Am. Car. & Bldr.), Chicago, Ill.; New York, N. Y.; m; 7x10 in., 20 cts.
American Engineer and R. R. Journal (Am. Engr. & R. R. Jl.); York, N. Y.; m; 7x10 in.; 20 cts.
American Gas Light Journal (Am. G. L. Jl.), New York, N. Y.; w; 10x13 in.; 10 cts.
American Institute of Electrical Engineers Proceedings (Am. I. of E. E. Proc.), New York, N. Y.; m; 4x7 in.; 50 cts.
American Machinist (Am. Mchst.), New York; w; 7x10 in.; 15 cts.
American Society of Civil Engineers Proceedings (Am. Soc. C. E. Proc.), New York, N. Y.; m; 4x7 in.; 75 cts.
American Society of Mechanical Engineers Journal (Am. Soc. M. E. Jl.), New York, N. Y.; m; 4x7 in., $1.
Annales des Ponts et Chaussees (An. P. & C.), Paris, France; m.
Applied Science, Toronto, Ont.; m; 6x9 in.; 20 cts.
Architects and Builders' Journal (Arch. & Bldrs. Jl.), Baltimore, Md.; m; 9x12 in.; 20 cts.
Architects and Builders' Magazine (Arch. & Bldrs. Mag.), New York, N. Y.; m; 5x8 in.; 20 cts.
Architect and Engineer of California (Arch. & Engr.), San Francisco, Cal.; m; 5x7 in.; 15 cts.
International Railway Congress Bulletin (Int. Ry. Cong. Bul.), Brussels; m; 50 cts.
California Journal of Technology (Cal. Jl. of Tech.), Berkeley, Cal.; m; 4x7 in.; 25 cts.
Canadian Architect (Can. Arch.), Toronto, Ont.; m; 7x19 in.; 20 cts.
Canadian Cement and Concrete Review (Can. Cem. & Conc. Rev.), Toronto, Ont.
Canadian Engineer (Can. Engr.), Toronto, Ont.; w; 7x11 in.; 20 cts.
Canadian Machinery and Manufacturing News (Can. Mach. & Mfg. News), Toronto, Ont.; m; 7x10 in.; 15 cts.
Canadian Mining Journal (Can. Min. Jl.), Toronto, Ont.; bi-w; 7x10 in.; 20 cts.
Canadian Municipal Journal (Can. Mun. Jl.), Montreal, Que.; m; 6¾x10 in.; 10 cts.
Canadian Society of Civil Engineers Proceedings (Can. Soc. C. E. Proc.), Montreal; m; 4x7 in.; 50 cts.
Carpentry and Building (Carp. & Bldg.), New York, N. Y.; m; 11x8 in.; 10 cts.
Cassier's Magazine (Cas. Mag.), New York; m; 5x8 in.; 25 cts.
Cement, New York, N. Y.; bi-m; 5x8 in.; 25 cts.
Cement Age (Cem. Age), New York, N. Y.; m; 4¾x8 in.; 15 cts
Cement and Engineering News (Cem. & Eng. News), Chicago, Ill.; 7x10 in.; 25 cts.
Cement Era (Cem. Era), Chicago, Ill.; m; 7x10 in.; 10 cts.
Cement Record (Cem. Rec.), Kansas City, Mo.; m; [illegible]
Cement World (Cem. Wld.), Chicago, Ill.; m; 9x11 in.; 10 cts
Chemical Engineer (Chem. Engr.), Chicago, Ill.; m; 4x7 in.; 15 cts.
Clay Worker (Cl. Wkr.), Indianapolis, Ind.; m; 7x10 in.; 20 cts.
Compressed Air (Comp. Air), New York, N. Y.; m; 5x7 in.; 10 cts.
Concrete, Detroit, Mich.; m; 6x9 in.; 15 cts.
Concrete Age (Conc. Age), Atlanta, Ga.; m; 9x11 in.; 10 cts.
Concrete and Constructional Engineering (Conc. & Cons. Eng.), London, England; m; [illegible] in.; 25 cts.
Concrete Engineering (Conc. Eng.), Cleveland, O.; m; 7x10 in.; 10 cts.
Contractor (Contr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Cornell Civil Engineer (Cor. Civ. Engr.), Ithaca, N. Y.; m; 4x7 in.; 25 cts.
Domestic Engineering (Dom. Engr.), Chicago, Ill.; [illegible]
Electrical Age (Elec. Age), New York, N. Y.; m; 7x10 in.; 10 cts.
Electrical Review (Elec. Rev.), New York, N. Y.; 8x10 in.; 10 cts.
Electric Railway Journal (Elec. Ry. Jl.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electrical World (Elec. Wld.), New York, N. Y.; w; [illegible]
Electric Traction Weekly (Elec. Trac. Wkly.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Engineer (Engr. Lon.), London, England; w; 4x11 in.
Engineer (Engr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Engineering (Eng.), London, England; w; 8x11 in.
Engineering-Contracting (Eng.-Contg.), Chicago; [illegible] cts.
Engineering Digest (Eng. Dig.), New York; m; 5x8 in.; 20 cts
Engineering and Mining Journal (Eng. & Min. Jl.), New York; w, 7x10 in.; 15 cts.
Engineering Magazine (Eng. Mag.), New York; m; 5x7 in.; 25 cts.
Engineering News (Eng. News), New York; w; [illegible]
Engineering Record (Eng. Rec.), New York; w; 8x11 in.; 10 cts.
Engineers' Club of Philadelphia Proceedings (Engr.'s Club, Phila Proc.), Philadelphia; qr; 4x7 in.; 25 cts.
Fire and Water Engineering (F. & W. Eng.), New York, N. Y.; 8x11 in.; 10 cts.
Le Genie Civil, Paris, France; w.
Good Roads Magazine (Gd. Rds. Mag.), New York, N. Y.; m; 7x10 in.; 10 cts.
Industrial Magazine (Ind. Mag.), Cleveland, O.; m; 4x7 in.; 10 cts.
Industrial World (Ind. Wld.), Pittsburg, Pa.; w; 7x10 in.; 10 cts.
Insurance Engineering (Ins. Eng.), New York; m; 4x6 in.; 25 cts.
Iron Age, New York, N. Y.; w; 7x11 in.; 15 cts.
Iron Trade Review (Iron T. Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Irrigation Age (Irr. Age), Chicago, Ill.; m; 7x9 in.; 10 cts.
Journal Association of Engineering Societies (Jl. Assoc. Engr. Soc.), Boston, Mass.; m; 4x7 in.; 30 cts.
Journal Franklin Institute (Jl. Frank. Inst.), Philadelphia, Pa.; m; 4x7 in.; 50 cts.
Journal New England Waterworks Association (Jl. N. E. W. W. Assoc.), Boston, Mass.; q; 4x7 in.
Journal Western Society of Engineers (Jl. W. Soc. Engrs.), Chicago, Ill.; bi-m; 4x7 in.; 50 cts.
Journal of Electricity, Power and Gas (Jl. Elec., P. & G.), San Francisco, Cal.; w; 7x10 in.; 10 cts.
Journal of Worcester Polytechnic Institute (Jl. W. P. I.); m; 4x7 in.; 20 cts.
Machinery, New York, N. Y.; m; 7x11 in.; 20 cts.
Marine Review (Marine Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Mines and Minerals (Mi. & Mis.), Scranton, Pa.; w; 7x9 in.; 20 cts.
Mining and Scientific Press (Min. & Sci. P.), San Francisco, Cal.; w; 7x11 in.; 15 cts.
Mining Reporter (Min. Rep.), Denver, Colo.; w; 7x10 in.; 15 cts.
Mining World (Min. Wld.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Modern Machinery (Mod. Mchy.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Municipal Journal and Engineer (Mun. Jl. & Eng.), New York, N. Y.; w; 7x10 in.; 10 cts.
Municipal Engineering Magazine (Mun. Eng. Mag.), Indianapolis, Ind.; m; 4x7 ins.; 25 cts.
Ores and Metals (O. & M.), Denver, Colo.; bi-w; 6x10 in.; 10 cts.
Pacific Building Engineer (Pac. Bldg. Engr.), Seattle, Wash.; w; 9x11 in.; 15 cts.
Popular Mechanics (Pop. Mech.), Chicago, Ill.; m; 5x7 in.; 10 cts.
The Polytechnic (Poly.), Troy, N. Y.; m; 5x8 in.; 15 cts.
Power and Engineer (Pwr. & Engr.), New York; m; 7x10 in.; 20 cts.
Railway Age-Gazette (R. R. Age Gaz.), New York, w; [illegible] in.; 15 cts.
Railway Master Mechanic (Ry. M. M.), Chicago; m; 7x10 in.; 10 cts.
Railway and Engineering Review (Ry. & Eng. Rev.), Chicago, Ill.; [illegible]
Railway and Locomotive Engineering (Ry. & Loc. Eng.), New York, N. Y.; m; 7x10 in.; 20 cts.
Railway and Marine World (Ry. & M. Wld.), Toronto, Ont.; m; 7x10 in.; 15 cts.
Railway Engineering and Maintenance of Way (Ry. Eng. & M. W.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Roadmaster and Foreman (Rd. & For.), Chicago; 7x10 in.; 10 cts.
Rock Products (Rk. Prod.), Chicago, Ill.; bi-w; 9x11 in.; 10 cts.
Rose Technic, Terre Haute, Ind.; m; 4x7 in.; 15 cts.
School of Mines Quarterly (Sch. Min. Quart.), New York, N. Y.; qr; 4x7 in.; 50 cts.
Schweizerische Bauzeitung, Zurich; w.
Scientific American (Sci. Am.), New York; w; 9x14 in.; 10 cts.
Scientific American Supplement (Sci. Am. Sup.), New York, N. Y.; w; [illegible]
Sibley Journal of Engineering (Sib. Jl. Eng.), Ithaca, N. Y.; m; 4x7 in.; 20 cts.
Stevens Institute Indicator (Stev. Inst. Ind.), Hoboken, N. J.; m; 4x7 in.; 20 cts.
Street Railway Bulletin (St. Ry. Bul.), Boston; m; 6x10 in.; 10 cts.
Surveyor (Surveyor), London, England; w; 6x11 in.; 10 cts.
Technology Quarterly (Tech. Qr.), Boston; qr; 4x6 in.; 35 cts.
U. S. Department of Agriculture Bulletin (Dept. Agr. Bul.), Washington, D. C., 4x7 in.
U. S. Geological Survey Bulletin (Geo. Surv. Bul.), Washington, D. C.; 4x7 in.
Zeitschrift d. Oest. Ing. u. Arch. Ver., Vienna; w.
Zeitschrift d. Ver Deutscher Ing.; Berlin; w.

ROADS AND STREETS.

A Comparison of the Specifications for Creosoted Wood Paving Blocks of Fourteen American Cities.—Eng.-Contg., June 15, 1910. 1 p..

Gives a table showing the requirements specified for wood block paving in 14 of the larger cities of the United States. The text comments on and explains the various features of the table.

The Steam Rolling on Roads, and the Management and Care of Steam Road Rollers.—Eng. Contg., June 8, 1910. 3¼ pp.

This is an excellent article on British practice on the steam rolling of roads, methods employed by a number of road engineers are described and a number of cost data are given.

English Methods and Experience in Dust Prevention and Road Preservation and in the Construction of Tar Bound Roads.—Eng.-Contg., June 1, 1910. 3⅔ pp.

This article outlines the general practice in dust prevention and road preservation employed in a score or more of English cities. An unusually valuable symposium of practice.

Bituminous Macadam in State Road Construction Work in New Jersey.—Eng.Contg., June 1, 1910. ⅔ p.

Describes in a general way the methods of constructing bituminous macadam roads and gives table showing the constructing process of such roads constructed in the state of New Jersey in 1909

Groove Wooden Block Pavement for a 6 Per Cent Street Grade.—Eng.-Contg., June 15, 1910. ⅓ p.

Describes the construction of a special grooved wooden block pavement designed for a steep grade.

Comparative Cost of Macadam and Stone Block Pavements at Belfast, Ireland.—Eng.-Contg., June 15, 1910. ¾ p.

This article is chiefly of interest for the cost figures which it gives of stone block pavement of various constructions. Data are given of the quantities of material required and of the areas covered by one ton of paving blocks of various sizes.

The Patching of Macadamized Roads and a Special Type of Roller for Doing the Work.—Eng.-Contg., June 15, 1910. ½ p.

This article urges the desirability of systematic patching of macadam roads and describes the special type of roller which he has used for patching work.

Concrete Pavement Construction at Mason City, Ia.—Eng.-Contg., June 15, 1910. ⅓ p.

Describes the method of constructing some 6,000 sq. yds. of macadam pavement and gives general costs.

Life and Cost of Maintenance of Wood Block Pavement at Hampstead, England. — Eng.-Contg., June 29, 1910. 1½ pp.

This article gives data on the construction and maintenance of some seven miles of wooden block pavement. A table is given showing the area, amount of pavement, age, first cost, and cost of repairs.

Tar Macadam at Mankato, Minn.—Eng.-Contg., June 22, 1910. ⅓ p.

Describes the construction of a tar macadam road, gives some general costs and presents the analysis and results of tests of the tar used.

Dust Prevention by the Tarring of Road with Oil Gas Tar.—Eng.-Contg., June 22, 1910. ½ p.

Gives the composition of oil tar and describes the methods employed for applying this tar to prevent dust.

Mechanical Road Haulage (Considered Commercially.)—Eng.Contg., June 29, 1910. 1½ pp.

Discusses the possibilities of mechanical road haulage and gives costs of haulage by various mechanical motors. An unusually good article on this subject but relating entirely to English practice.

Notes on the Influence of Tramways on Street Paving.—Eng.-Contg., June 29, 1910. 1¾ pp.

This article is a general description of English practice in the construction of street railway track on paved streets. The influence of track construction on pavement work is considered.

The Maintenance of Trunk Roads in Bedfordshire County, Ireland.—Eng.-Contg., June 22, 1910. ¼ p.

Describes the methods of maintaining two macadam roads aggregating some 28 miles in length in Bedfordshire, Ireland.

Notes on Road and Street Work.—Eng.-Contg., June 22, 1910. ½ p.

Gives notes on tar spraying on steep grades and prices for paving in Iowa cities.

An English Formula for the Camber of "Hanging" Roads.—Eng.-Contg., June 22, 1910. ½ p.

Gives diagrams and formulas for calculating the camber of hanging roads. The formulae are illustrated by examples.

Road Work in Newton, Mass.—By Edwin H. Rogers. Mun. Jl. & Eng., June 15, 1910. 2½ pp.

Describes the methods employed at Newton, Mass., in the use of oils, emulsions and bituminous dust layers. In some cases different makes of asphaltic oils have been sprinkled over the surface and on this coarse sand or gravel has been spread evenly on the street in a layer just thick enough to cover the oil.

Dust Laying in St. Paul.—By C. L. Annan. Mun. Jl. & Eng., June 15, 1910. 2½ pp.

The street sprinkling at St. Paul, Minn., is conducted by the Commissioner of Public Works. This article describes the organization of the department, the method of assessing the property benefited and the calculation of assessment. The blanks used for various reports are illustrated.

Jefferson Avenue Improvement.—By Frank J. Hubbard. Mun. Jl. & Eng., June 15, 1910. 1 p.

A description of the methods employed in making an asphaltic concrete road from an impassable sand road.

Dust Laying in New Bedford.—By William F. Williams. Mun. Jl. & Eng., June 15, 1910. 1 p.

Describes the work accomplished last year in treating the macadam streets of the city with dustoline, heavy asphalt oil and standard road oil. Data on the cost of the work are included.

Sand-Clay Roads.—Mun. Jl. & Eng., June 15, 1910. 1½ pp.

An abstract of circular 91 issued by the U. S. Office of Public Roads, describing the methods employed in the construction of sand-clay roads in the Middle West.

Tar Macadam at Poughkeepsie.—By Robert J. Harding. Mun. Jl. & Eng., June 15, 1910. 1½ pp.

Describes the construction of macadam with bituminous binder at Poughkeepsie, N. Y. In constructing the macadam the interstices in the two courses of stone were filled with dried sand to within about ¾ in. of the surface, and were then covered with Tarvia.

State Supervision of Roads.—Mun. Jl. & Eng., June 15, 1910. 1 p.

An outline of the work accomplished by the Highway Departments or Commissions of a number of states.

Bituminous Macadam in Knoxville.—By S. D. Newton. Mun. Jl. & Eng., June 15, 1910. 1 p.

A description of the construction of a short experimental section of tar macadam at Knoxville, Tenn.

Meeting of the Special Committee on Bituminous Materials.—Gd. Rds. Mag., June 1910. 5 pp.

An abstract on the progress report of the committee on bituminous material for road construction of the American Society of Civil Engineers. The article contains much valuable data on the use of bituminous materials.

Road Work in Rhode Island.—Mun. Jl. & Eng., June 15, 1910. 1½ pp.

Describes the work of the State Board of Public Roads of Rhode Island, in constructing plain macadam, bituminous macadam, gives methods of doing the work, and sets forth the results obtained.

Present Day Bituminous Road Construction.—By Herbert C. Poore. Gd. Rds. Mag., June, 1910.

During the years 1907, 1908 and 1909, the bituminous experimental work of the Massachusetts Highway Commission were carried out under the supervision of Mr. Poore. In this article he gives methods and figures obtained on the actual work in Massachusetts, specifications for the various methods are given as well as methods of using them. Excellent data on the cost of constructing bituminous roadways, by grouting, by hand mixing and by machine mixing are given. An excellent article.

Road Treatment in Eastern Massachusetts.—Mun. Jl. & Eng., June 15, 1910. 8 pp.

An excellent article describing the road treatment work carried out by the Massachusetts Highway Commission, the Metropolitan Park Commission, and several cities in Eastern Massachusetts. The methods of making the various treatments are described and some data on the cost of the work are given.

The Ohio Experimental Roads at Columbus.—Gd. Rds. Mag., June, 1910. 2½ pp.

Descriptions of the construction of an experimental road by the State Highway Department of Ohio, using various kinds of binders and wearing surfaces.

Road Materials and Simple Rules for Testing Them.—By Austin B. Fletcher, M. Am. Soc. C. E. Con. Engr., June 16, 1910.

A paper dealing with sand and clay, gravel, rocks, bituminous materials, refined tar, asphaltic oil, and oil asphalt.

SEWERS.

Flushing the West Branch of Bubbly Creek, Chicago.—Eng. Rec., June 11, 1910. 1⅓ pp.

General description of design and structural features of reinforced concrete sewer, sewer intake and sewer siphon under a canal. Some data are given on contractors' methods.

Details of the Design of the Sewers of Louisville, Ky.—Eng.-Contg., June 15, 1910. 5¾ pp.

This article illustrates in great detail and describes the structural features of the new sewer system being constructed at Louisville, Ky. Typical sections are shown and detail drawings are given of outlet structures, siphons, junction chambers, manholes, etc.

The New Sewerage System of Louisville, Ky.—General Description of the System.—Eng.-Contg., June 8, 1910. 2⅓ pp.

This article outlines the plan of a new sewerage system for Louisville, Ky. A map is shown of the new sewers and organization under which the work is being done is described.

General Methods of Constructing the Louisville Sewers with Some Data on Costs.—Eng.-Contg., June 22, 1910. 2⅔ pp.

This article describes the general methods of construction employed in constructing the large concrete sewers for Louisville, Ky. Methods of trenching, tunneling and concreting are outlined. Costs are given of lining a concrete sewer with brick, of trenching with a Potter machine, mixing and placing concrete by hand and of knocking down arch forms.

Methods of Constructing 2,723 Ft. of the Northwestern Trunk Sewer, Louisville, Ky., with Some Costs.—Eng.-Contg., June 29, 1910. 1⅔ pp.

Describes the general methods of constructing a large concrete sewer in the city named. Some costs are given of trenching and of certain portions of the concrete work.

The Calumet Sag Channel of the Chicago Drainage Canal Recommended as the Best Means of Sewage Disposal for the Calumet District.—Eng.-Contg., June 29, 1910. ¾ p.

This is a reprint of the report of the engineering committee of the Sanitary District of Chicago, pointing out the necessity of constructing the canal named to purify the waters of Calumet Lake and River.

Typical Structural Details of Large Concrete Sewer Work at St. Louis, Mo., with Some Notes on the Specifications.—Eng.-Contg., June 29, 1910. 1¼ pp.

Illustrates cross-sections, manholes and other structural details of two large reinforced concrete sewers, planned to be constructed in St. Louis. Extracts from the specifications are given.

Sewage Pumping Plant at Woodside, Long Island.—Eng. Rec., June 11, 1910. ⅝ p.

Shows section of pump chamber and arrangement of machinery comprising two motor-driven centrifugal pumps. Methods of constructing and waterproofing the underground concrete pump chamber are described.

The Leicester Sewage Disposal Works.—Eng. Rec., June 4, 1910. 2⅓ pp.

General description of the existing plants for sewage disposal at the city named. Analysis are given of crude sewage and of affluents from sedimentation tanks, bacteria beds, and outfalls. General costs of the works are given.

Metropolitan Sewage Commission Against the Discharge of Treated Passaic Valley Sewage into New York Bay.—Eng. News, June 9, 1910. 1 p.

Reprint of the report of this special commission urging sewers and advocating action for preventing discharge of sewage into New York bay from New Jersey towns as proposed by the Passaic Valley Sewerage Commission.

New Sewage Experiment Station of the Massachusetts Institute of Technology.—By C. E. A. Winslow and E. B. Phelps. Eng. News, June 2, 1910. 2¼ pp.

Describes the construction and equipment of this experiment station comprising trickling filters, septic tank, sand filters, sedimentation tanks and slate contact bed.

Septic Tank and Contact Beds for Treating the Sewage of Cherryvale, Kan.—By J. S. Whorley. Eng. News, June 30, 1910. 1¼ pp.

General description of small purification works chiefly interesting for description given of the use as a filtering material of crushed refuse from zinc smelting retorts.

Municipal Works in Leigh-on-Sea.—Surveyor, June 3, 1910; 9 pp.

The principal feature of interest in this article is a description of the method of sewage disposal. The city originally had four contact beds; one of these has been converted into two settling tanks; two others have been retained to act as single contact beds, and the fourth bed has been converted into a "Zonic filter"—to provide further treatment for the effluent from the contact beds. The "Zonic filter" consists of three separate zones of filter material in the form of ridges with open spaces between them. The affluent undergoes lateral filtration. This filter has been in operation 19 months and has given good satisfaction.

Water Purification at Lindsay.—Mun. Jl. & Eng., June 22, 1910. 2½ pp.

A report of the Ontario Board of Health on the water purification plant of the city of Lindsay, Ont. The water is purified by ozone on the Howard-Bridge system. A description of the plant is given.

Meter Testing in New Orleans.—Mun. Jl. & Eng., June 29, 1910. 2 pp.

A description of the methods employed in testing waters for the new municipal water supply of New Orleans. About 12,000 meters were tested in three months. A description is given of a device for testing ten meters at once.

Sulphur-Sand Joints in Louisville.—Mun. Jl. & Eng., June 29, 1910. 1 p.

Describes the methods employed in using sulphur-sand joints for small sanitary sewers at Louisville, Ky.

Sewage Pumping Appliances.—By George T. Hammond. Mun. Jl. & Eng., June 8, 1910. 3 pp.

The author discusses the general arrangement of the plant and treats of centrifugal pumps and pneumatic ejectors and gives data on the efficiency of each. It is an excellent statement of the principles of sewage pumping.

An Efficient Plant on a Large Sewer in St. Louis.—Contr., June 1, 1910. 2½ pp.

Illustrated description of double cableway and concrete plant used on a 24x16 foot concrete sewer.

WATERWORKS AND HYDRAULICS.

The Hydroelectric Development of the Great Western Power Company.—Eng. Rec., June 11, and June 18, 1910. 5½ pp.

A general description of an 80,000 kw. plant. Details of intake tower and tunnels are shown. General description of construction methods.

Method of Constructing Submerged Pipe Line Under the Kaministiqua River, Fort William, Ontario, Water Supply.—Eng.-Contg., June 8, 1910. 2¾ pp.

Describes the method of laying submerged pipe line under a river. Methods of work are given in detail and general itemized costs are presented.

The Cost of Furnishing Water with Reference to Rates and Rate Making.—Eng.-Contg., June 22, 1910. 3 pp.

This is an excellent article and discussion on the subject named. The paper presents comparisons in detail and the operating expenses of two water works are given. The discussion points out the necessity of finding the full cost of water service when the water rates of different cities are compared.

Depreciation in Water-Works Accounts, with Reference to Uniform Reports.—Eng.-Contg., June 29, 1910. 1½ pp.

A general discussion of the necessity of providing for depreciation in keeping water works accounts. Discusses uniform report recommended by the census bureau and presents an argument in favor of depreciation reserve accounts.

Use of Hydrochlorite in Connection with Pre-Filtration.—Eng. Rec., June 25, 1910.

Describes series of tests made at the Philadelphia filtration plant and gives results. Tests indicate that "hypochlorite is not a panacea for all water ills."

Experiments with a Model of the Gatun Spillway.—Eng. Rec., June 4, 1910. 2⅔ pp.

Illustrates plan and section of spillway for Gatun Dam and discusses requirements. Describes experiments made on model of this spillway to determine action and character of baffles for reducing velocity of flow of discharge below the spillway.

Glenwood Hydroelectric Plant, Central Colorado Power Company.—Eng. Rec., June 25, 1910. 3¾ pp.

A general description with plans and tunnel sections of this 18,000 hp. power plant. Details of value are given of the forms and methods employed in lining the tunnels with concrete.

The Moodna Pressure Tunnel of the Catskill Aqueduct.—Eng. Rec., June 4, 1910. 2¾ pp.

Describes and illustrates structural features of 14 ft. 2-in. circular tunnel some 4½ miles long constructed from seven shafts. Contractor's plant and construction methods are described. A good general descriptive article.

Report on the Proposed Board of Water Supply Tunnel Beneath New York City.—Eng. News, June 2, 1910. 2 pp.

This is the report of the committee of engineers appointed to consider the practicability, cost and proposed route of this tunnel planned to carry the new Catskill water supply to Brooklyn and Richmond by tunnel under Manhattan and the rivers.

Construction of the Cataract Dam, Sidney, New South Wales.—By L. A. B. Wade. Eng. News, June 23, 1910. 3 pp.

Gives sections and describes structural features and general construction methods for cyclopean masonry and concrete dam 811 ft. long and 182 ft. high from base to crest. Quantities and general costs are given.

Chaudiere Dam, Ottawa, Canada.—By D. L. McLean. Eng. News, June 30, 1910. 3½ pp.

Describes main structural features and some structural details of reinforced concrete dam of the pier and sluice type. A general descriptive article.

The Waterworks at Madison, Wis.—By Ralph Birchard. Mun. Eng., July, 1910. 2½ pp.

The supply is obtained from deep wells, and three of the wells are equipped with deep well pumps operated by electric motors. Some data on the cost of the deep well pumping are given.

Rebuilding Dam at Hauser Lake, Mont.—Cem. Era, June, 1910. 3 pp.

Description of the construction, and plant for handling same, on a dam being built across the Missouri River in Montana.

Colorado Hydroelectric Installation. — Elec. Wld., June 23, 1910. 3½ pp.

An illustrated article on the Glenwood generating station of the Colorado Power Co. A plant with minimum capacity of 5,000 kw.

The Disinfection of the Toronto Water Supply.—By T. Aird Murray, M. Can. Soc. C. E. Can. Engr., June 16, 1910. 1½ pp.

A paper relating to the reduction of total bacteria and total elimination of intestinal bacteria by the temporary use of hypochlorite.

RIVERS, HARBORS AND CANAL

The Cost of U. S. Reclamation Works.—Eng. Rec., June 11, 1910. 1¾ pp.

Statement by Director F. H. Newell of the reasons for the increased cost over original estimates of the works of the U. S. Reclamation Service. Increase is charged to great advance in prices of materials, supplies and sustenance

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and wages of labor coupled with decrease in efficiency of labor

The Stockton, California, Diverting Canal.—Eng. Rec., June 18, 1910. 1 p.

Describes the purpose of this canal and the general methods adopted by the contractor in excavating it.

Building a Concrete Slope Wall Under Water.—Eng. Rec., June 4, 1910. 1¼ pp.

Describes plant used and methods employed in constructing a concrete slope wall for a canal, placing the concrete under water. Gang organization and progress data are given.

The Silt Problem: Kaw River.—By Herman Stabler and H. N. Parker. Eng. News, June 2, 1910. 1¼ pp.

Describes methods followed for determining relative proportions of suspended matter and the variation thereof with season and river stage. The methods are of general application.

The New York State Barge Canal.—Eng. News, June 9, 1910. 3¾ pp.

A general account of the history, engineering features, construction organization, and progress of work on the New York State Barge Canal.

Records of Evaporation Obtained at 23 Different Stations in Various Parts of the United States.—Eng. News, June 16, 1910. 1¼ pp.

Gives brief description of each station and a tabular statement by months of the evaporation at each station. The stations are mostly located in the west.

Making a Stream Excavate its Own Reservoir and Build Its Own Dam.—By Burt A. Heinly. Mun. Eng., July, 1910. 2½ pp.

A description of the construction of a hydraulic filled dam containing 146,000 cu. yds. of earth. Hydraulic gets water used to excavate the earth which was carried by the water into a sump. Here it was sucked up by a centrifugal pump and forced through an 8-in. pipe to the dam site.

RAILWAYS.

The Treatment of Depreciation of Street Railway Properties.—Eng.-Contg., June 15, 1910. 2¼ pp.

A general discussion of the subject named.

Gang Organization for Cost of Track-laying by Machine, Erie R. R.—Eng.-Contg., June 15, 1910. ½ p.

Gives the gang organization for laying track by machine and itemizes the cost of machine track-laying.

The Average Car-Mile Cost of Operating Seventy-five Electric Railways in New York State, Second District.—Eng.-Contg., June 8, 1910. 1 p.

This article gives the itemized unit cost of operating the mileage of electric railway named in the caption. The operating costs are given in cents per car mile.

Cost of Operating the Long Island Electric Railway.—Eng.-Contg., June 22, 1910. ⅔ p.

The article gives the cost of equipment and plant and complete operating cost of an electric railway having some 26½ miles of track. The operating costs are itemized.

Methods and Cost of Calking and Grummeting Joints in Cast Iron Lining of the Hudson River Tunnels, Pennsylvania R. R. — Eng.-Contg., June 15, 1910. ⅓ p.

Describes the methods of calking the joints of the cast iron lining of the Hudson River Tunnels and gives itemized cost of the work. These are practically the only cost figures or this kind of work.

Cost of Operating All the Surface Electric Railways in Greater New York City.—Eng.-Contg., June 22, 1910. ¾ p.

This article gives the equipment and itemized operating cost per mile of some 1,250 miles of surface railway in New York City. The costs are given per mile of track and per car mile.

Design of Tunneling Shield and of Steel Lining Used in Constructing the River Sections of the Pennsylvania R. R. Hudson River Tunnels. Eng.-Contg., June 15, 191 1½ pp.

Illustrates and describes the construction of the tunneling shields and of the cast iron lining used in the Hudson River tunnels. Itemized weights of the various styles of cast iron lining are given.

Methods and Costs of Railroad Surveys in Bolivia.—Eng. Rec., June 25, 1910. 2⅔ pp.

An interesting description of survey methods

"Text Book on Graphic Statics"

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in a South American country with statement of salaries paid and general costs of the work.

The New Chicago Station of the Chicago & Northwestern Ry.—Eng. Rec., June 18, 1910. 4⅓ pp.

General description of station building with details of structural work. Chiefly of value for the drawings of roof trusses, floor priming and spandrel wall and girder details.

The Winnipeg Railway Terminal Elevated Passenger Yard.—Eng. Rec., June 18, 1910. 2 pp.

Describes and illustrates structural features of viaduct platform or elevated yard 520x127 ft. A good general descriptive article.

Tests of Freight-Train Resistance. — Eng. Rec., June 4, 1910. ¾ p.

Describes method of conducting and purpose of tests and gives in tabular form resistance per ton of 15 to 75-car trains at speeds from 5 to 45 miles per hour.

Decision of the Railroad Commission of Wisconsin in the Appleton Water-Works Case.—Eng. News, June 16, 1910. 2¼ pp.

Chiefly of interest for the physical valuation which it gives of the property of the Appleton Water-Works Co. A notably good water-works valuation article.

One Hundred and Twenty Foot Turntable for Handling Mallet Locomotives with Their Tenders; A., T. & S. F. Ry.—Eng. News, June 23, 1910. 1⅓ pp.

Illustrates plan and section and special details of turntable construction and describes structural features and operating mechanism.

Reinforced Concrete Locomotive Coaling Station of 2,000 Tons Capacity.—By L. M. Ewell. Eng. News, June 23, 1910. 3 pp.

Describes pocket construction and illustrates it with several sections and sectional plans. Also describes coal, ash and sand handling outfits. Some details of the reinforced concrete work are shown. A general descriptive article.

Northern Pacific Railroad Construction in Washington.—Cont., June 1, 1910. 3½ pp.

Description of various contracts in southwestern Washington where double-tracking and grade change work is going on.

Car Weights as Affecting Operating Cost.—By M. V. Ayres, E. E. Can. Eng., June 16. 1910. 3½ pp.

A concluding article, illustrated by diagrams, on the effect of heavier rolling stock on costs of repairs, etc.

Curve Easements: Present Practice.—R. R. Age Gaz., June 17, 1910. 2 pp.

Being the replies of engineers of various railroads throughout the country as to the present practice of curve easements.

The Erection of the St. Paul's Missouri River Bridge.—By J. H. Prior. R. R. Age Gaz., June 10, 1910. 5½ pp.

Being condensed from a paper read before the Western Soc. C. E., descriptive of the construction of the bridge at Mobridge, S. Dak.

Relining Compound Curves.—By W. H. Wilms. R. R. Age Gaz., June 17, 1910. 1¾ pp.

A unique method devised by W. R. Hillary of the Pennsylvania and used on many of the western lines of the road. Illustrated with diagrams.

Autogenous Welding in a Railway Shop. — By H. W. Jacobs. R. R. Age Gaz., June 17, 1910. 5 pp.

An article by the Asst. Supt. of Motive Power on the Santa Fe, with illustrations showing the results and operation of the oxy-acetylene flame for cutting and welding.

BRIDGES, BUILDINGS AND FOUNDATIONS.

Methods and Appliances Employed in Erecting the Chicago, Milwaukee & St. Paul Railway, Missouri River Bridge at Mobridge, South Dakota.—Eng.-Contg., June 8, 1910. 4⅓ pp.

This is an exceedingly valuable article on steel bridge erection. The various features of the work and of the plant used are illustrated and described. The methods of operating the plant and planning the work are stated in considerable detail.

Method and Cost of Constructing Three Short-Span, Single-Track Concrete Arch Bridges, Lake Champlain & Moriah Railroad. — Eng.-Contg., June 15, 1910. 1¾ pp.

The bridges described are reinforced concrete arches of small span. Methods of [illegible] for each structure.

Methods and Cost of Constructing Concrete Arch and Cast Iron Pipe Culverts by Day Labor, Illinois and Mississippi Canal. — Eng.-Contg., June 29, 1910. [illegible]

Describes the methods of construction of arch and pipe culverts and gives 10 tables of itemized costs of these culverts.

Comparative Economy of Steel I-Beams with Jack Arches vs. Reinforced Concrete for Railroad Culverts and Short-Span Solid Floor Bridges.—Eng.-Contg., June [illegible]

Discusses the comparative economy of concrete arch and I-Beam floors with reinforced concrete floors. Gives two diagrams for computing costs.

A Machine for Cutting Off Submerged Piles to Exact Elevation.—Eng.-Contg., June 29, 1910. 1 p.

Illustrates the construction of a device for sawing off piles under water, describes its operation and gives the itemized cost of sawing piles for the foundation of a break-water.

Methods of Building the Foundations for a Twenty-Story Building in the Downtown District of Chicago.—Eng.-Contg., June 22, 1910. 1½ pp.

A general description of the methods employed in constructing concrete cylinder foundations for a 20-story building. During the work the walls of a six story building had to be underpinned. The article describes the method of underpinning this wall.

Experience with Day Labor Work in the Maintenance and Repairs of Bridges in Chicago.—Eng.-Contg., June 29, 1910. 2½ pp.

This is a reprint of the report of the engineer giving the results of his investigations into the economy of day labor in the repair and maintenance of city bridges in Chicago. The report shows generally that the cost of day labor work has been excessive. Cost data of various sorts are given.

Wrecking the Gillender Building, New York.—Eng. Rec., June 11, 1910. 1½ pp.

Describes method of wrecking a steel skeleton building 27x74 ft. and 16 stories high. Some account is given of the appearance of the steel work where the embedding masonry has been removed.

Replacing and Depressing the Manhattan Elevated Railway.—Eng. Rec., June 11, 1910. [illegible]

Describes method of reconstructing to a lower level some 1,200 ft. of three-track elevated railway. The old structure had to be maintained for traffic during the new work and the description of the mode of procedure followed is the interesting feature of the article.

The superstructure of the Mobridge Bridge on the Chicago, Milwaukee & St. Paul Railway. Eng. Rec., June 11, 1910. [illegible]

Gives general detail drawings of truss spans, falsework, travelers and other erection plants for the large steel bridge named. Methods of design and erection are described at length.

Vanadium Structural Steel.—Eng. Rec., June 4, 1910. [illegible]

A general discussion of the possibilities of vanadium steel for structural work with results of tests of plates and angles and of rivets in comparison with open hearth carbon steel and Class E steel rivets. The data are interesting and suggestive.

The Twentieth Street Viaduct, Denver, Colo.—Eng. Rec., June 4, 1910. 2⅔ pp.

Describes principal structural features of a 4,407-ft. viaduct consisting of riveted truss spans of 98 to 165 ft. and plate girder spans 16 to 80 ft. Detail drawings are given of steel work.

Replacing a Short Truss Span by Plate Girders — [illegible]

Shows staging used and describes method of replacing three 77-ft. truss spans of a railway bridge with plate girders without interrupting traffic.

Pneumatic Caisson Foundations, Whitehall Building, New York.—Eng. Rec., June 18, 1910. [illegible]

Describes construction of foundations for 71 columns for 170x235 ft. 32-story building. Location plan of caissons and derricks is given with details of typical caissons and cofferdams.

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A detail of value is the method of testing hard pan at the bottom of caissons.

Early Specifications for a steel Bridge: The Glasgow Bridge Over the Missouri River.—Eng. News, June 2, 1910. 1¼ pp.

This bridge built in 1878-79, was the first steel truss bridge in America. This article describes the character of steel used and gives the specifications. Contains various historical notes on Hay steel.

Arch Coefficients. Transformation of Dimensions in Symmetrical Rib Arches: with Tables of Coefficients for Twenty Arches of Different Proportions.—By M. A. Howe. Eng. News, June 2, 1910. 3¾ pp.

A purely mathematical discussion under the headings of horizontal thrust, moments at supports, vertical reactions, ordinates locating the equilibrium polygon, intermediate moments, temperature, axial or direct stress, summary and tables of coefficients of 20 arches.

Structural Details of the Columbia Theater, San Francisco.—By M. E. Couchot. Eng. News, June 23, 1910. 2⅓ pp.

Gives longitudinal and transverse sections showing structural features and presents a general description. Detail drawings of steel work are shown. Chiefly of value for the drawings.

Carrying an Elevated Railway Across a Skating Rink by a 100-ft. Truss Span.—Eng. News, June 16, 1910. 1⅓ pp.

Gives drawing and descriptions of truss construction with some general remarks on methods of erection.

Structural Economy.—By E. A. Slater. Surveyor, June 3, 1910. 4 pp.

A paper containing suggestions whereby engineers could effect economies in construction, especially in reference to building work.

Steel Sheds Erected by Novel Outfit.—Contr., June 1, 1910. 1¼ pp.

Description of the erection of market house trusses in Kansas City with a traction engine hoist and a portable derrick frame.

Piling and Trestling.—By F. R. Archibald. Can. Engr., June 16, 1910. 2 pp.

Being a paper concerning various classes of piles and containing compact descriptions, bearing power, costs, etc.

CONCRETE AND REINFORCED CONCRETE.

Construction of a Large Reinforced Concrete Grandstand.—Eng. Rec., June 4, 1910. 2¼ pp.

Describes general construction of a grandstand seating 30,000 people having reinforced concrete frame, tile walls and reinforced concrete and tile floors. Forms and supports for stepped platform are shown.

Concrete as a Fireproof Building Material.—Eng.-Contg., June 8, 1910. 1 p.

An article pointing out the special use of concrete as a fireproof building material.

Requirements of Successful Granolithic Floor Construction with Specifications for Mill Floors.—Eng.-Contg., June 1, 1910. 1⅓ pp.

This article discussess the cost and rapidity of construction and general principles of construction of granolithic floors. Complete specifications for such floors are also given.

Standard Specifications for Reinforcing Bars for Concrete.—Eng.-Contg., June 1, 1910. ½ p.

This is a reprint of the standard specifications for reinforced bars which has been prepared by the Association of American Steel Manufacturers.

Results of Tests Made by the Louisville Sewer Commission to Determine Impermeable Mixtures for Concrete.—Eng.-Contg., June 8, 1910. ⅔ p.

This article gives in tabular form the results obtained in testing a number of water proofing compounds and methods for making concrete water tight. The work was conducted in connection with the extensive construction of concrete sewers at Louisville, Ky.

Method of Inspecting and Testing Cement for the Louisville Sewer Work with Costs.—Eng.-Contg., June 15, 1910. ¾ p.

Outlines the methods of sampling and testing cement used in the construction of the extensive concrete sewer system at Louisville, Ky.

Some Applications of Concrete and Cement to a Central Station System.—Eng.-Contg., June 29, 1910. 3¾ pp.

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V	Stone Masonry	55
VI	Concrete	110
VII	Waterworks	161
VIII	Sewers	143
IX	Timberwork	124
X	Buildings	54
XI	Railways (Steam and Electric)	348
XII	Bridges	246
XIII	Steel Work (Not given in other sections)	29
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[illegible] forced concrete to constructions in electrical [illegible]

[illegible] **Finishing and Coloring Stucco.**—Eng.-Contg., June 22, 1910. 1 p.

[illegible] to be followed in doing stucco work. The arti- [illegible] coloring stucco.

[illegible] **Concrete Fence Posts.**—Eng.-Contg., June 22, [illegible]

[illegible] molding reinforced concrete fence posts. Drawings of forms are given with tables of quantities of materials required and the costs of construction. The method of mixing, molding, and curing posts are described in detail.

Diagrams for Designing Reinforced Concrete Beams. [illegible]

Presents diagrams for designing depth of beam, and of reinforcement, spacing of rods, selection of most favorable per cent of steel, unit [illegible]

The New German Standard Specifications for Cement.—Eng. Rec., June [illegible] 2¼ pp.

An outline of the cement specifications of the [illegible]

Reinforced Concrete Poles.—Eng. Rec., June [illegible]

A summary of practice and experiment in the construction and use of reinforced concrete poles.

Concrete and Tile Floors with Two-Way Reinforcement.—[illegible]

Describes and illustrates the Butchartz, an American, and the Aragon, a French, construction of two-way reinforced concrete and tile floor systems. Methods of computing and [illegible]

Long Reinforced Concrete Railway Viaduct Through the City of Rotterdam, Holland.—Eng. News, June 16, 1910. [illegible]

The viaduct is 5,300 ft. long and carries a double truck electric railway. It consists of a series of arches on reinforced concrete piers. This article illustrates sections of the arches and piers and gives various views with a general description of the structural features.

Reinforced Concrete Low Head Water Tank and its Waterproofing.—By H. F. Blomquist. [illegible]

Describes the construction of a 75x30 ft. circular reinforced concrete water tank with particular reference to its waterproofing.

Experiment to Determine the Pressure of Concrete Upon Forms.—By L. E. Ashley. Eng. News, [illegible]

Describes methods of tests and gives in tabular form pressure per square foot on forms of concrete ranging in depth from 1 ft. to 6 ft.

Leigh-on-Sea Gasworks Extensions, with Particular Reference to Reinforced Concrete Gasholder Tank.—By Charles F. Hunt. Sur- [illegible]

The principal feature of this article is the description and drawing showing the detaile of the reinforced concrete gasholder tank. The tank is 64 ft. in diameter, and 29½ ft. deep.

Concrete-Making Machinery.—By Vere Sussex Hyde. Surveyor. 4 pp.

A description of the chief features of a number of types of concrete mixers now being used in England.

Construction Plant for Long Arch at Spokane.—Contr., June 1, 1910. 1 p.

A short description of the tandem cableways and Haines gravity mixer in use for construction of the Monroe St. Bridge, Spokane.

The "Integral" Method of Waterproofing vs. the "Pitch & Felt" Method.—By A. H. Harri- [illegible]

A comparison of the system of waterproofing concrete with the system using the Harrison Compound. Some costs are given.

Cast Reinforced Concrete Buildings at Fort Myer, Va.—Cem. Age, June, 1910. 3 pp.

Methods and cost of constructing buildings at the military post near Washington, D. C. The system consists of casting the walls in a horizontal position, and then erecting them by means of jacks.

Centering as Applied to the Catskill Aqueduct.—By W. Van R. Whitall. Conc. Eng., June, 1910. 4½ pp.

Describes the steel centers used on the aqueduct work. Illustrated.

Concrete Features of the Toledo Filtration Plant.—By B. M. Baker. Cem. Age, June, 1910. 6 pp.

An illustrated description of a $900,000 plant at Toledo, Ohio, together with a general description of the construction of the plant.

Forms for the Construction of the Locks and Dams of the Pacific Division, Panama Canal.—By Alexander P. Cradey. Conc. Eng., June, 1910. 3 pp.

An illustrated article describing details of the forms named.

Laying Concrete under Water—Detroit River Tunnel.—By Olaff Hoff. Cem. & Eng. News, June, 1910. 3 pp.

Describing the plant used and the progress made on the work. Some data on tests of the concrete laid under water are given.

Reinforced Concrete Telegraph Stores in England.—Cem. Age, June, 1910. 3 pp.

Showing photographs of the four-story buildings under construction.

An Analysis of Concrete Bridge Failures—By C. R. Young. Cem. Age, June, 1910. 4 pp.

Illustrated article describing and analyzing five different cases of bridge failures.

The Immense Concrete Dam Across the Mississippi River.—Conc. Age, June, 1910. 1 p.

A short illustrated description of the Keokuk dam where 200,000 kw. will be generated.

Great Concrete Stadium at Tacoma.—Cem. Era, June, 1910.

Illustrated article showing various stages of the construction with description.

The Preparation of Concrete: From Selection of Materials to Final Disposition.—Harry Franklin Porter, C. E. Cem. & Eng. News, June, 1910. 3 pp.

Giving the principles of selecting and mixing concrete.

Long Span, Light Floor, Reinforced Concrete Construction, with Comparative Cost.—By Emil G. Perrot. Cem. Age, June, 1910. 5 pp.

Illustrated article describing the floors over a swimming pool of the Turngemeinde Club House, Philadelphia.

Rapid Construction of a Reinforced Concrete Storage Building.—Cem. Age, June, 1910. 3 pp.

Story of the construction of a building for the Pierce Arrow Motor Co. in twelve weeks. Building was 4 stories high and contained 107,500 sq. feet of floor space. Illustrated.

EARTH AND ROCK EXCAVATION.

Some Notes on the History of the Rock Drill.—Eng.-Contg., June 8, 1910. ¾ p.

This article is an outline of the history of the development of the rock drill, giving the names of the various inventors who have been instrumental in perfecting this useful tool.

Remedies for Landslides and Slips on the Kanawha & Michigan Ry.—Eng.-Contg., June 8, 1910. 1½ pp.

Illustrates and describes the methods employed for checking landslides and slips endangering road bed of a railway along the bank of a river.

Some Progress Data and Cost of Driving the South Portal Heading of the Elizabeth Tunnel, Los Angeles Aqueduct.—Eng.-Contg., June 8, 1910. 1½ pp.

Gives the organization employed and itemized cost of making the record run of 604 ft. per month during April, 1910, on this tunnel. Examples of the progress report blanks and monthly cost blanks are shown. A notably interesting lot of data.

A Modern Stone Crushing Plant of 600 Cu. Yds. Capacity per Hour—Some Costs of Drilling, of Maintenance of Plant, and of Erecting Machinery.—Eng.-Contg., June 1, 1910. 3½ pp.

Illustrates and describes the construction of an unusually large and well equipped stone crushing plant. Data are given of the operation of well drills and some general costs are stated.

Earthwork Shrinkage, Application and Amount.—Eng.-Contg., June 1, 1910. 1½ pp.

An article discussing the amount of shrink-

Cost Keeping and Management Engineering

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RICHARD T. DANA

This is the first book ever published on the subject of cost keeping on contract work. Its authors are pioneers in the field, and, although they have written much that has appeared in the form of articles—particularly in the pages of *Engineering-Contracting*—this book is the first presentation on the subject in a complete and logical sequence.

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age which should be allowed for in earthwork. Quotations from various authorities are given and discussed by the author, who presents figures which he has found to work well in actual practice.

An Economical Substitute for a Timber Trestle in Making a High Embankment.—Eng.-Contg., June 1, 1910. 2/3 p.

Describes the method of making a deep fill by dumping material from a wire rope trestle.

Some Published Costs of Tunnel Work in the Los Angeles Aqueduct.—Eng.-Contg., June 1, 1910. 2½ pp.

This article summarizes the methods and costs of tunnel construction on the Los Angeles aqueduct. It is the most complete summary of such costs yet published.

Pressure Resistance and Stablity of Earth.—Eng.-Contg., June 1, 1910. 8 pp.

This article is a description of a very complete investigation into the pressure resistance and stability of earth. The tests are described in detail and a complete mathematical discussion of the results is given. The article is of wide interest to contractors and engineers.

Time and Material Costs of Excavating 35 Cu. Yds. of Rock in Trench Bottom. — Eng.-Contg., June 15, 1910. 1/4 p.

Describes the method of excavating a small amount of rock on the bottom of a trench and gives the cost of the work.

Method and Cost of Excavating a Mine Shaft by Raising.—Eng.-Contg., June 15, 1910. 1/2 p.

The shaft described was excavated by working from the bottom up. Methods of handling the material are given and also complete itemized costs of the work.

Structural Details of Two Earth Dams for the Porto Rico Irrigation Service.—Eng.-Contg., June 22, 1910. ½ p.

Illustrates a cross-section of two earth dams, one having a concrete diaphragm wall 4 ins. thick and nearly 100 ft. high. Extractions from the specifications for earthwork are given.

The New Buffalo Water-Works Tunnel. — Eng. Rec., June 25, 1910. 4 pp.

An excellent article describing the methods of construction followed in driving a tunnel through rock with records of progress, giving organization and other useful data.

Borings for the Panama Dock at Chistobal: with Table of Costs.—E. B. Karnapp. Eng. News, June 16, 1910. ⅔ p.

Describes method of making wash drill borings to rock and continuing with diamond drill, giving gang organization and costs.

Difficult Work in Quicksand at East St. Louis.—Contr., June 1, 1910. 2 pp.

Illustrated article describing the construction of foundations for a pumping station on the East St. Louis sewers.

SURVEYING AND DRAFTING.

Office Methods in a Concrete Designing Office.—Eng. Rec., June 11, 1910. 2⅓ pp.

Describes the system of blanks and records used by a large contracting engineering firm in designing and constructing reinforced concrete buildings. An article of more than usual value.

Recent American Precise Leveling.—Eng. Rec., June 25, 1910.

Describes the instruments and methods employed in recent precise leveling work of the U. S. Coast and Geodetic Survey.

MISCELLANEOUS.

A Public Service Commission's Library. — Eng. Rec., June 4, 1910. 1¼ pp.

Describes manner of collecting, arranging and filing material for the library of the Public Service Commission for the First District of New York.

Method of Constructing Two Public Comfort Stations in Small Cities with Some Costs of Construction and Operation.—Eng.-Contg., June 8, 1910. 2½ pp.

Plans and sections of two public comfort stations are shown and the construction of the stations and the accommodations provided are described in some detail. General costs are given of the construction of one of the stations.

Economy of the Piece Work System in Handling Supplies.—Eng.-Contg., June 29, 1910. 2/3 p.

Di[illegible] to the handling of supplies on railways. Gives cost figures showing the economy of piece work as compared with [illegible].

An Efficient Derrick Used on Louisville, Ky., Sewer Work.—[illegible]

Illustrates the details of a special derrick for handling clam shell bucket. Figures of output are given.

The Compensation of Workmen.—Eng.-Contg., June 29, 1910. 1/2 p.

General discussion of the method of compensating workmen on the basis of increased pay for increased output. A suggestive article to contractors.

The Fundamental Principles of Efficiency.—Eng. Contg., June 29, 1910. 1½ pp.

This article relates particularly to the efficiency of railway operation but many of the principles laid down are of general application. Twelve principles are defined and illustrated by presenting specific examples. A notably interesting article.

Building the Miah Maul Shoal Lighthouse.—By T. J. Rout, Jr., and A. E. Arledge. Eng. News, June 2, 1910. 2 pp.

Describes and illustrates structure consisting of concrete filled steel cylinder poured on piles and grillage. Weights of various parts of structure are given, showing load per pile of 10.7 tons. General methods of construction are described.

The Design and Working of a Modern Refuse Destructor.—By W. F. Loveday. Eng. News, June 23, 1910. 1⅓ pp.

General discussion of the requirements and operating characteristics of machine refuse destructors with some account of the lines of development and costs of operation.

Town Scavenging and Refuse Disposal.—By Hugh S. Watson. Mun. Eng., July, 1910. 3 pp.

The third installment of an article on English practice in Town Scavenging and Refuse Disposal. This installment treats of the utilization of residuals from refuse destructors.

The Young Engineer and His Working Tools.—By Charles Lyon Wood. Mun. Eng., July, 1910. 2 pp.

Suggestions for the young engineer regarding field and office equipment and the use of the same.

Market House of Knoxville, Tenn.—By Jesse S. Cottrell. Mun. Jl. & Eng., June 29, 1910. 2 pp.

A description of the new market house building at Knoxville, Tenn.

Public Market of St. Paul.—By C. L. Annan. Mun. Jl. & Eng., June 8, 1910. 2½ pp.

An illustrated article describing the public market of the city of St. Paul, Minn. Some details of construction are given.

Milwaukee Incinerating Plant.—Mun. Jl. & Eng., June 29, 1910. 1½ pp.

Describes the methods of making the final tests at the incinerating plant of the city of Milwaukee, and gives the results attained.

Building San Francisco's New Fire Protection System.—Contr., June 1, 1910. 1 p.

A short description of the system about to be constructed.

Design of Cone Pulleys Using Open Belts.—By C. S. MacCaughey. Eng. Dig., June, 1910. 3 pp.

Containing formulae and graphical methods in determining the diameters of pulleys with reference to speed ratios. The author has devised the formulate after considerable experience with other formulae in a successful effort to arrive at closer results in practice.

The Economic Value of Motion Study in Standardizing the Trades.—By Frank B. Gilbreth, M. E. Eng. Dig., [illegible]

Third of a series of articles on motion study. The author goes into detail in analyzing and standardizing the motions of the different tradesmen with a view to lessening the amount of work and producing better results for less money. This article deals particularly with bricklaying and handling.

Employers' Liability Insurance.—By Miles M. Dawson. Eng. Dig., June, 1910. 3 pp.

Deploring the conditions made by the present system now in use in the U. S. and outlining more desirable [illegible] them introduced.

The May, 1910, Issue Contains

"The Value of Geological Science to the Petroleum and Natural Gas Business."

By FREDERICK G. CLAPP,
[illegible]

An extensive illustrated paper with discussion on the relation of oil and gas pools to geological structure in different parts of the world.

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One of a series of articles intended for engineers, outside of the electrical field, to secure knowledge of the simpler electrical problems.

Elementary Electrical Engineering.—By L. W. Gill, M. Sc. Can. Engr., June 3, 1910. 3 pp.

Chapter III. of a series of articles on the elements of electricity intended for the civil engineer who is unfamiliar with the simpler electrical problems.

Garbage Reduction and Disposition of By-Products.—By Chas. S. Wainwright. Can. Engr., June 16, 1910. 1½ pp.

An illustrated paper on the Wheelwright hot water process and the plant of the New Bedford Extractor Co.

Reducing the Cost of Handling Material in Power Plants.—Can. Engr., June 3, 1910. 2 pp.

An illustrated description of the coal and ash handling apparatus at the plant of the Peoria Gas & Electric Co., Peoria, Ill.

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MONTHLY REVIEW INDEX OF CIVIL ENGINEERING LITERATURE

A classified index and review of the civil engineering papers, articles, reports, pamphlets and books published during the month just passed is given in the succeeding pages. The literature indexed and reviewed—with the exception of books—relates solely to civil engineering. In the section devoted to Book Reviews all books in all branches of engineering are listed as received and such of them as seem worthy are reviewed as fully as due regard for conciseness will permit. In choosing books for review rigid selection is exercised. Next to careful choice of books for review timeliness of review is sought. All books are reviewed within a month of their receipt. The same statement is true of the articles and papers that are indexed. Also, as in choosing books for review, the choice of articles and papers for indexing is based on merit. Numerical strength in "titles indexed" is not sought; excellence of selection is sought.

The purposes of the Monthly Review Index are: First, to inform civil engineers and contractors of the articles and papers of merit that are published each month, in such a way as will give a clear idea of their character and scope; second, to supply the user with the date and place of publication, the length of each article and the cost at which it can be secured. The name, adopted abbreviations, place of publication and price per number of each periodical examined for civil engineering articles are given in the list immediately following. The other information is given in the index proper for each article separately.

Books reviewed will be sent post paid on receipt of price by the Book Department of ENGINEERING-CONTRACTING; periodicals, etc., containing articles indexed should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

American Architect (Am. Arch.), New York, N. Y.; w; 7x10 in.; 15 cts.
American Builders' Review (Am. Bldrs. Rev.), San Francisco, Cal.; m; 7x10 in.; 50 cts.
American Carpenter and Builder (Am. Car. & Bldr.), Chicago, Ill.; New York, N. Y.; m; 7x10 in., 20 cts.
American Engineer and R. R. Journal (Am. Engr. & R. R. Jl.); York, N. Y.; m; 7x10 in.; 20 cts.
American Gas Light Journal (Am. G. L. Jl.), New York, N. Y.; w; 10x13 in.; 10 cts.
American Institute of Electrical Engineers Proceedings (Am. I. of E. E. Proc.), New York, N. Y.; m; 4x7 in.; 50 cts.
American Machinist (Am. Mchst.), New York; w; 7x10 in.; 15 cts.
American Society of Civil Engineers Proceedings (Am. Soc. C. E. Proc.), New York, N. Y.; m; 4x7 in.; 75 cts.
American Society of Mechanical Engineers Journal (Am. Soc. M. E. Jl.), New York, N. Y.; m; 4x7 in., $1.
Annales des Ponts et Chaussees (An. P. & C.), Paris, France; m.
Applied Science, Toronto, Ont.; m; 6x9 in.; 20 cts.
Architects and Builders' Journal (Arch. & Bldrs. Jl.), Baltimore, Md.; m; 9x12 in.; 20 cts.
Architects and Builders' Magazine (Arch. & Bldrs. Mag.), New York, N. Y.; m; 5x8 in.; 20 cts.
Architect and Engineer of California (Arch. & Engr.), San Francisco, Cal.; m; 5x7 in.; 15 cts.
California Journal of Technology (Cal. Jl. of Tech.), Berkeley, Cal.; m; 4x7 in.; 25 cts.
Canadian Architect (Can. Arch.), Toronto, Ont.; m; 7x19 in.; 20 cts.
Canadian Cement and Concrete Review (Can. Cem. & Conc. Rev.), Toronto, Ont.
Canadian Engineer (Can. Engr.), Toronto, Ont.; w; 7x11 in.; 20 cts.
Canadian Machinery and Manufacturing News (Can. Mach. & Mfg. News), Toronto, Ont.; m; 7x10 in.; 15 cts.
Canadian Mining Journal (Can. Min. Jl.), Toronto, Ont.; bi-w; 7x10 in.; 20 cts.
Canadian Municipal Journal (Can. Mun. Jl.), Montreal, Que.; m; 6¾x10 in.; 10 cts.
Canadian Society of Civil Engineers Proceedings (Can. Soc. C. E. Proc.), Montreal; m; 4x7 in.; 50 cts.
Carpentry and Building (Carp. & Bldg.), New York, N. Y.; m; 11x8 in.; 10 cts.
Cassier's Magazine (Cas. Mag.), New York; m; 5x8 in.; 25 cts.
Cement, New York, N. Y.; bi-m; 5x8 in.; 25 cts.
Cement Age (Cem. Age), New York, N. Y.; m; 4¾x8 in.; 15 cts.
Cement and Engineering News (Cem. & Eng. News), Chicago, Ill.; 7x10 in.; 25 cts.
Cement Era (Cem. Era), Chicago, Ill.; m; 7x10 in.; 10 cts.
Cement Record (Cem. Rec.), Kansas City, Mo.; m; 4¾x8 in.; 15 cts.
Cement World (Cem. Wld.), Chicago, Ill.; m; 9x11 in.; 10 cts.
Chemical Engineer (Chem. Engr.), Chicago, Ill.; m; 4x7 in.; 15 cts.
Clay Worker (Cl. Wkr.), Indianapolis, Ind.; m; 7x10 in.; 20 cts.
Compressed Air (Comp. Air), New York, N. Y.; m; 5x7 in.; 10 cts.
Concrete, Detroit, Mich.; m; 6x9 in.; 15 cts.
Concrete Age (Conc. Age), Atlanta, Ga.; m; 9x11 in.; 10 cts.
Concrete and Constructional Engineering (Conc. & Cons. Eng.), London, England; m; 5x7 in.; 25 cts.
Concrete Engineering (Conc. Eng.), Cleveland, O.; m; 7x10 in.; 10 cts.
Contractor (Contr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Cornell Civil Engineer (Cor. Civ. Engr.), Ithaca, N. Y.; m; 4x7 in.; 25 cts.
Domestic Engineering (Dom. Engr.), Chicago, Ill.; w; 6x9 in.; 10 cts.
Electrical Age (Elec. Age), New York, N. Y.; m; 7x10 in.; 10 cts.
Electrical Review (Elec. Rev.), New York, N. Y.; 8x10 in.; 10 cts.
Electric Railway Journal (Elec. Ry. Jl.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electrical World (Elec. Wld.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electric Traction Weekly (Elec. Trac. Wkly.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Engineer (Engr. Lon.), London, England; w; 4x11 in.
Engineer (Engr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Engineering (Eng.), London, England; w; 8x11 in.
Engineering-Contracting (Eng.-Contg.), Chicago; w; 7x10 in.; 10 cts.
Engineering Digest (Eng. Dig.), New York; m; 5x8 in.; 20 cts.
Engineering and Mining Journal (Eng. & Min. Jl.), New York; w;
Engineering Magazine (Eng. Mag.), New York; m; 5x7 in.; 25 cts
7x10 in.; 15 cts.
Engineering News (Eng. News), New York; w; 8x11 in.; 15 cts.
Engineering Record (Eng. Rec.), New York; w; 8x11 in.; 1[illegible] cts.
Engineers' Club of Philadelphia Proceedings (Engr.'s Club, Phila. Proc.), Philadelphia; qr; 4x7 in.; 25 cts.
Fire and Water Engineering (F. & W. Eng.), New York, N. Y.; 8x11 in.; 10 cts.
Le Genie Civil, Paris, France; w.
Good Roads Magazine (Gd. Rds. Mag.), New York, N. Y.; m; 7x10 in.; 10 cts.
Industrial Magazine (Ind. Mag.), Cleveland, O.; m; 4x7 in.; 10 cts.
Industrial World (Ind. Wld.), Pittsburg, Pa.; w; 7x10 in.; 10 cts.
Insurance Engineering (Ins. Eng.), New York; m; 4x6 in.; 25 cts.
International Railway Congress Bulletin (Int. Ry. Cong. Bul.), Brussels; m; 50 cts.
Iron Age, New York, N. Y.; w; 7x11 in.; 15 cts.
Iron Trade Review (Iron T. Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Irrigation Age (Irr. Age), Chicago, Ill.; m; 7x9 in.; 10 cts.
Journal Association of Engineering Societies (Jl. Assoc. Engr. Soc.), Boston, Mass.; m; 4x7 in.; 30 cts.
Journal Franklin Institute (Jl. Frank. Inst.), Philadelphia, Pa.; m; 4x7 in.; 50 cts.
Journal New England Waterworks Association (Jl. N. E. W. W. Assoc.), Boston, Mass.; q; 4x7 in.
Journal Western Society of Engineers (Jl. W. Soc. Engrs.), Chicago, Ill.; bi-m; 4x7 in.; 50 cts.
Journal of Electricity, Power and Gas (Jl. Elec., P. & G.), San Francisco, Cal.; w; 7x10 in.; 10 cts.
Journal of Worcester Polytechnic Institute (Jl. W. P. I.); m; 4x7 in.; 20 cts.
Machinery, New York, N. Y.; m; 7x11 in.; 20 cts.
Marine Review (Marine Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Mines and Minerals (Mi. & Mls.), Scranton, Pa.; w; 7x9 in.; 20 cts.
Mining and Scientific Press (Min. & Sci. P.), San Francisco, Cal.; w; 7x11 in.; 15 cts.
Mining Reporter (Min. Rep.), Denver, Colo.; w; 7x10 in.; 15 cts.
Mining World (Min. Wld.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Modern Machinery (Mod. Mchy.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Municipal Journal and Engineer (Mun. Jl. & Eng.), New York, N. Y.; w; 7x10 in.; 10 cts.
Municipal Engineering Magazine (Mun. Eng. Mag.), Indianapolis, Ind.; m; 4x7 ins.; 25 cts.
Ores and Metals (O. & M.), Denver, Colo.; bi-w; 6x10 in.; 10 cts.
Pacific Building Engineer (Pac. Bldg. Engr.), Seattle, Wash.; w; 9x11 in.; 15 cts.
Popular Mechanics (Pop. Mech.), Chicago, Ill.; m; 5x7 in.; 10 cts.
Power and Engineer (Pwr. & Engr.), New York; m; 7x10 in.; 20 cts.
Railway Age-Gazette (R. R. Age-Gaz.), New York; w; 8x11 in.; 15 cts.
Railway Master Mechanic (Ry. M. M.), Chicago; m; 7x10 in.; 10 cts.
Railway and Engineering Review (Ry. & Eng. Rev.), Chicago, Ill.; w; 9x11 in.; 10 cts.
Railway and Locomotive Engineering (Ry. & Loco. Eng.), New York, N. Y.; m; 7x10 in.; 20 cts.
Railway and Marine World (Ry. & M. Wld.), Toronto, Ont.; m; 7x10 in.; 15 cts.
Railway Engineering and Maintenance of Way (Ry. Eng. & M. W.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Roadmaster and Foreman (Rd. & For.), Chicago; 7x10 in.; 10 cts.
Rock Products (Rk. Prod.), Chicago, Ill.; bi-w; 9x11 in.; 10 cts.
Rose Technic, Terre Haute, Ind.; m; 4x7 in.; 15 cts.
School of Mines Quarterly (Sch. Min. Quart.), New York, N. Y.; qr; 4x7 in.; 50 cts.
Schweizerische Bauzeitung, Zurich; w.
Scientific American (Sci. Am.), New York; w; 9x14 in.; 10 cts.
Scientific American Supplement (Sci. Am. Sup.), New York, N. Y.; w; 9x14 in.; 10 cts.
Sibley Journal of Engineering (Sib. Jl. Eng.), Ithaca, N. Y.; m; 4x7 in.; 20 cts.
Stevens Institute Indicator (Stev. Inst. Ind.), Hoboken, N. J.; m; 4x7 in.; 20 cts.
Street Railway Bulletin (St. Ry. Bul.), Boston; m; 6x10 in.; 10 cts.
Surveyor (Surveyor), London, England; w; 6x11 in.; 10 cts.
Technology Quarterly (Tech. Qr.), Boston; qr; 4x6 in.; 35 cts.
The Polytechnic (Poly.), Troy, N. Y.; m; 5x8 in.; 15 cts.
U. S. Department of Agriculture Bulletin (Dept. Agr. Bul.) Washington, D. C.; 4x7 in.
U. S. Geological Survey Bulletin (Geo. Surv. Bul., Washington, D. C.; 4x7 in.
Zeitschrift d. Oest, Ing. u. Arch. Ver., Vienna; w.
Zeitschrift d. Ver Deutscher Ing.; Berlin; w.

ROADS AND STREETS.

Highway Construction in Cuba.—Eng.-Contr., July 27, 1910. 3 pages.

This is a general description of the methods of highway construction being employed in Cuba under American engineers. Costs of some of the work are given.

The Highway Traffic Census of the Massachusetts Highway Commission.—Eng.-Contr., July 27, 1910. ⅔ page.

This article gives the results of the traffic census made by the Massachusetts Highway Commission.

Notes on Road and Street Work.—Eng.-Contr., July 27, 1910. 1 1-6 page.

This article gives miscellaneous methods and cost data on road work of various kinds.

An Instrument for Ascertaining the Tenacity and Ductility of Bituminous Materials.—Eng.-Contr., July 20, 1910. 1½ pages.

This is a description of a very interesting device for determining the ductility of such bituminous materials as are used in road construction. The testing machine is illustrated and the methods of test operation are described.

Proposed Standard Tests for Road Materials of the American Society for Testing Materials.—Eng.-Contr., July 20, 1910. 1 1-6 pages.

This is the report of the special committee of the society named giving the standard tests proposed for road materials.

Road Maintenance Work in 1909 of the Massachusetts Highway Commission.—Eng.-Contr., July 20, 1910. 1⅔ pages.

This article is a summary of the experimental work done by the Massachusetts Highway Commission during the year 1909. Methods of construction are described and results obtained are stated.

Methods of Constructing Natural Mixture Sand-Clay Roads in Georgia.—Eng.-Contr., July 13, 1910. ½ p.

Describes the methods of construction and gives some general costs of sand-clay road work in Georgia.

A New Machine for Testing the Adhesive Quality of Pitch.—Eng.-Contr., July 13, 1910. ½ p.

Illustrates and describes a machine for testing the adhesive quality of pitch used in road construction.

The Economy of Good Stone in Macadam Road Work. Eng.-Contr., July 13, 1910. ⅓ p.

A general discussion of the best stones for use in macadam road construction with some records of experience.

The Determination of Soluble Bitumen.—Eng.-Contr., July 6, 1910. 2½ pp.

This is a general discussion with criticism of the various common methods of determining soluble bitumen. Tables are given showing the results obtained by each of the methods.

Experiments of the State Highway Department of Ohio with Various Road Binding Materials.—Eng.-Contr., July 6, 1910. 3 pp.

This article describes the experiments made by the state highway department of Ohio on various preparations for preventing dust and binding the surface of macadam roads. Seventeen sections of road each 400 feet long are treated by different methods. The methods and cost of treatment are given for each section and such results as have been obtained up to date are described.

District Engineer Work in the Philippines.—Eng. News, July [illegible], 1910. [illegible] pp.

A general article describing character of and organization for district engineer work and discussing particularly methods of road work and giving conditions and some costs.

A Road Roller of Improved Design with Novel Form of Front Truck.– Eng. News., July 7, 1910. 3½ pp.

Describes in detail the construction of a road roller having a special turntable joint truck construction. The theory of the new construction is explained and its merits discussed.

Modern Methods of Street Cleaning. –Eng. News, July 8, 1910. 1½ pp.

Discusses the subject under the headings of cost and principles of administration, technical considerations, apparatus and methods of collection and final disposition.

San Joaquin County Highway Improvements.—Eng. Rec., July 23, 1910. 1 p.

Describes the general plans and construction methods being followed in constructing 238 miles of improved roads in the county named.

Dust Prevention Experiments.—Mun. Jl. & Eng., July 27, 1910. 2 pp.

Abstract of a circular issued by the U. S. Office of Public Roads, giving an account of the experimental work on that office in dust prevention and road preservation work.

Tar Macadam Roads.—Surveyor, July 8, 1910. 1½ pp.

Contains statistics relative to tar macadam roads in a number of English districts and towns. Data is given in tabular form as regards the mileage and gradients on which tar macadam is laid.

Tar for Road Works.—By R. O. Wynne-Roberts. Surveyor, July 1, July 8 and July 15, 1910. 10 pp.

An excellent article describing the methods of producing tar, and the effects on its quality. The essential features of the distillation of tar is explained and data on the cost of installing and operating distilling plants are given.

New York Street Cleaning.—Mun. Jl. & Eng., July 13, 1910. 5 pp.

A description of the general work of the Department of Street Cleaning of New York City. The matter is taken from the annual report of the Commission on Street Cleaning.

SEWERS

Methods of Constructing Stream Crossings for a Large Trunk Sewer.—Eng.-Contr., July 20, 1910. 1½ pp.

This article describes and illustrates the plans of some half-dozen crossings of small streams by a large trunk sewer.

Infiltration of Ground Water Into Sewers, with Notes on Tar Cement Joints, Wooden Underdrains and Leakage of Manhole Covers.—Engr.-Contr., July 20, 1910. 1¼ pp.

This article gives the results of some interesting experiments made to determine the extent to which ground water enters sewers through manhole covers. It also describes the method of constructing tar cement joints for pipe sewers to reduce infiltration.

Methods of Construction on the Southern Outfall Sewer, Louisville, Ky., with Some Costs.—Eng.-Contr., July 6, 1910. 2 pp.

This article is a general description of the methods of constructing about 5 miles of 15 x 15 ft. concrete sewer at Louisville, Ky. Tables are given showing the plant employed on each section of the work.

Method of Constructing by Tunneling a Sewer Siphon Under the River Dee, Aberdeen, Scotland.—Eng.-Contr., July 6, 1910. 2⅓ pp.

This article is a general description with illustrations of the methods employed in driving a small sewer tunnel under a river. The conditions of construction were quite difficult and several interesting methods were developed.

Difficult Sewer Reconstruction.—Eng. Rec., July 9, 1910. 2⅔ pp.

The original sewer had a hump underneath which at even grade the new sewer was built. Article describes methods adopted for merging the new and old structures at the ends of the hump. A notably ingenious piece of construction work.

Automatic Revolving Sewage Distributors.—Eng. Rec., July 30, 1910. 1 p.

Describes distributors and gives general results of tests made to determine their efficiency.

The Agricultural Use and Value of Sewage.—Surveyor, July 8, 1910. 1½ pp.

A paper by J. A. Voelcker, Consulting Chemist to the Royal Agricultural Society of England, read before Association of Managers of Sewage Disposal Works. The paper discusses the circumstances which make the application of sewage to lands different to ordinary agricultural practice.

Rapid Sewage Sedimentation.—By Emil Kuichling. Mun. Jl. & Eng., July 20, 1910. 2 pp.

An abstract of experimental investigations on the sedimentation of sewage at Cologne, Germany.

Modern Biological Sewage Treatment.—Surveyor, July 8 and July 15, 1910. 3½ pp.

A review treating of the rise and progress of the science of modern biological treatment of sewage. The matter is taken from the presidential address by W. J. Dibdin delivered before the Association of Managers of Sewage Disposal Works.

WATER-WORKS AND HYDRAULICS.

Method and Cost of Laying 10,377 Ft. of 12-In. Water Pipe by Day Labor at Tuscaloosa, Ala.—Eng.-Contr., July 6, 1910. ⅓ p.

This article illustrates and describes the method of laying some 10,000 feet of water pipe in sections of 100 feet each. Each section of 10 lengths of pipe was connected and calked on the bank and lowered into the trench as a unit. The itemized costs of the work are given.

Conservation of Water-Powers.—Eng. News, July 7, 1910. 2½ pp.

The subject is discussed under the headings of relation of forests and stream flow, imposed rates as a tax on water-power enterprises, features of present regulations which should be changed and an alternative plan.

Notes on the Water-Supply of Havana, Cuba.—Eng. News, July 14, 1910. 1⅔ pp.

Describes the old and new water-supply system of Havana with an analysis of the water. The filter plant of the old works, stated to be probably the oldest filter plant in the world, is interestingly shown by drawings and views.

Hypochlorite Disinfection of the Water-Supply of Toronto, Ont.—Eng. News, July 21, 1910. 1 p.

Relates experience in reduction of bacteria and total elimination of intestinal bacteria by the temporary use of hypochlorite as a disinfectant. An interesting dosing apparatus is illustrated. Tables of bacterial reduction are given.

The Owens Valley and Olancha Divisions of the Los Angeles Aqueduct.—Eng. Rec., July 2, 1910. 2⅓ pp.

General description of structural features of the aqueduct sections named with several views of working plant and typical cross-sections, and some notes on construction methods.

The Construction of the Great Western Power Plant.—Eng. Rec., July 16, 1910. 2⅓ pp.

Describes camp and plant layout, methods of getting in materials and particularly methods of constructing rock tunnel 15,168 ft. long. Drawings are given of traveling centers for concrete lining. A good general methods article.

Electricity in the Construction of the Los Angeles Aqueduct.—Eng. Rec., July 16, 1910. 2 pp.

Describes the various developments of electric power along the Los Angeles aqueduct for construction purposes and methods of transmitting and utilizing this power. Some general costs are given.

A Mechanical Filter for the Removal of Iron.—Eng. Rec., July 23, 1910. 2 pp.

Illustrates the general plans and describes the construction and equipment of a filter plant at Iowa City, Ia., for removing iron from water by precipitation with lime and subsequent mechanical filtration.

The Boulder Hydroelectric Plant.—Eng. Rec., July 30, 1910. 2⅓ pp.

Describes the reservoir and pipe line construction of the plant named. Some of the hydraulic features are particularly interesting. Methods of construction are described.

Poor Pipe Causes Red Water in Springfield.—Eng. Rec., July 30, 1910. 2⅓ pp.

Reprint of a report by Geo. C. Whipple on an investigation made to determine the cause of "red water."

The Water Supply System of Santiago, Cuba.—Eng. Rec., July 30, 1910. 1⅓ pp.

A general description of this new waterworks including dam, reservoir and pipe line.

New Cast-Iron Conduit of the Syracuse Water-Works.—Eng. Rec., July 2, 1910. 2¾ pp.

Good general description of structural features of 30 and 42-in. cast-iron conduit line 19 miles long. Some interesting notes are given on thickness of pipe.

Maiden Creek Filters.—Mun. Jl. & Eng., July 27, 1910. 3 pp.

A description of the slow sand filters being built for the city of Reading, Pa. The filters will be 10 in number, each 98 x 206 ft. inside measurement and will have a combined capacity of 10,000,000 gals. per day. Details of design and methods of construction are given.

The Sterilization of Water by Chlorine and Ozone.—By Prof. G. Sims Woodhead. Surveyor, July 22, 1910. 2 pp.

A discussion of the sterilization of water by oxidation methods, the methods applying specially to clear, bright water, and especially to water containing a small amount of organic matter. The paper describes the treatment with small quantities of bleaching powder, ozonization and sterilization by the ultra-violet rays.

Water Purification by Ozone.—Mun. Eng. Mag., Aug., 1910. 2 pp.

A description of the installation at Lindsay, Ont. In this installation the cooling of the air is by water. The air is handled completely throughout its course through the ozonizers and into and through the water by means of hydraulic agencies.

RIVERS, HARBORS AND CANALS.

The Relative Value of Irrigating Waters.—Eng. News, July 14, 1910. 1½ pp.

Discusses the removal of alkali in alkali soils by surface waters, and develops an "alkali coefficient" which is defined "as the depth of water which on evaporation would yield sufficient alkali to render a 4-ft. depth of soil injurious to the most sensitive crops."

The Shoshone Dam of the United States Reclamation Service.—Eng. Rec., July 23, 1910. 8 pp.

Describes structural features and general methods of constructing the dam named. Numerous illustrations are shown. A notably good general descriptive article.

Driving the Laramie-Poudre Irrigation Tunnel in Colorado.—Eng. News, July 28, 1910. 1 p.

A description of the drilling and blasting methods employed in driving this 12,000-ft. rock tunnel.

Forms for the Construction of the Locks and Dams of the Pacific Division, Panama Canal.—Eng.-Contr., July 27, 1910. 1 p.

This article illustrates and describes the use of sectional forms being employed in constructing certain of the concrete locks for the Panama Canal.

Municipal Water Front Improvements at Oakland.—Eng. Rec., July 9, 1910. [illegible] p.

General description of a $2,500,000 water front improvement comprising bulkhead and quay walls, a water front street and wharves, piers, etc.

Sinking Large Steel Cylinders by Piledriver.—Eng. News, July 7, 1910. ⅓ p.

Describes and illustrates piledriver and its operation for sinking steel cylinders 7 ft. 7 ins. in diameter and 50 ft. long for wharf construction at San Francisco.

The Municipal Wharf at Montgomery, Ala.; A Novel Solution of the River Loading Problem.—Eng. News, July 14, 1910. 1 p.

A general description of the construction and equipment of this new public wharf. Interesting as showing the possibilities of modern methods of wharf operation on shallow streams subject to fluctuations in height.

Progress on Dry Dock Number 4, Brooklyn Navy Yard.—Eng. Rec., July [illegible], 1910. 1½ pp.

This article shows a plan of the contractor's plant employed in the construction of the large concrete dry dock named and gives a general description of the work. The notes on plant and plant layout are chiefly of value.

An Improvement in Pier Construction, San Francisco.—Eng. Rec., July 16, 1910. 1 p.

Describes manner of driving large steel cylinders by pile driver. Details of driving cap are shown, and construction of cylinders is described.

The Siphon Lock on the Barge Canal at Oswego.—Eng. Rec., July 30, 1910. 1½ pp.

Describes the construction and operation of the novel siphon lock located at Oswego on the New York Barge Canal.

Progress on the Cape Cod Ship Canal.—Eng. Rec., July 30, 1910. 1 p.

A general article [illegible] the plan of operation and the progress made on excavation of the Cape Cod Canal.

RAILWAYS.

Methods and Costs of Surfacing and Smoothing Track.—Eng.-Contr., July 27, 1910. 2⅔ pp.

This is a very complete article describing gang organization and giving actual progress and cost records of work obtained by the writer.

The Appraised Values of the Electric Street Railways of Detroit, Mich.—Eng.-Contr., July 13, 1910. 4¼ pp.

A complete statement of the appraised values of the street railways of Detroit, Mich., comprising some 170 miles of line. This is the most complete article on street railway appraisal that has come to our notice.

Australia's Railway System and Some of Its Problems.—Eng. News, July 14, 1910. 1⅔ pp.

A general article on the [illegible] and traffic characteristics of the Australian railway system with suggestions for improvement and further development.

Power Economy from Coasting Tests on the Manhattan Elevated Railway, New York.—Eng. News, July 14, 1910. 1½ pp.

This paper describes some tests made on the Manhattan elevated railways in which a clock was used to record the amount of coasting employed in the operation of trains, the object of this device being to obtain from the motormen a better manipulation of trains with the resulting economy in the use of power.

Reconstruction of the Washington St. Tunnel under the Chicago River.—Eng. News, July 21, 1910. 4½ pp.

A good general description of the structural features and broad methods of construction of a street car tunnel under the Chicago River.

Economics of Railway Electrification.—Eng. Rec., July 23, 1910. 1½ pp.

Discusses importance of analyzing each method of electrification applicable with regard to interest, depreciation and operating expenses and gives many useful conclusions and data.

Substructure of a Double-Track Railroad Bridge at Peoria.—Eng. Rec., July [illegible], 1910. 1½ pp.

Describes and illustrates concrete piers and abutments with a surface reinforcement. General methods of construction are described.

Elimination of the Susquehanna Crossing, Lackawanna Railroad.—Eng. Rec., July 23, 1910. ⅔ p.

Describes method of removing a nine-track grade crossing without interruption to a traffic of 206 passenger trains daily.

The Precooling Plants of the Pacific Fruit Express Company.—Eng. Rec., July 23, 1910. 3 pp.

Describes in detail two large plants recently erected for precooling fruits, vegetables and other products previous to shipment by railway. A notably interesting installation.

The Central of Georgia Railway Erecting and Machine Shop.—Eng. Rec., July 30, 1910. 3⅔ pp.

An illustrated description of the structural features of the work named. The detail and general drawings are of especial value.

BRIDGES, BUILDINGS AND FOUNDATIONS.

Comparative Sections of Thirty Retaining Walls and Some Notes on Retaining Wall Design.—Eng. News, July 28, 1910. 2 pp.

Shows comparative sections of some 30 retaining walls designed by different engineers and presents a discussion of earth pressures and retaining wall design. A notably interesting article.

Tests of Full Size Timber Stringers at the University of Illinois Engineering Laboratories.—Eng.-Contr., July 13, 1910. 3¾ pp.

An important article giving the results of tests made on full size timbers for bridge stringers. In addition to the full size tests, small test beams of the same material were experimented with. A comparison is drawn between the full size and small test results.

Results of Tests of Strength of Steel from I-Beams.—Eng.-Contr., July 13, 1910. 2 pp.

These tests were made to determine the difference in the quality of steel located on the web, flange and root of steel I-beams.

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Strength of Steel in I-Beams.—Eng. Rec., July 9, 1910. 2⅔ pp.

Gives results of tests made to determine variation in structure, etc., of steel located in web, flange and root of steel I-beams.

Foundation Work on the Municipal Building, New York.—Eng. Rec., July 9, 1910. 1⅔ pp.

General description of deep foundation work for the 25-story building named. Chiefly interesting for the methods and results given of making subsoil tests by a special apparatus.

General Features of the Curtis Building, Philadelphia.—Eng. Rec., July 9, 1910. 4⅓ pp.

The features described are principally the foundations, which comprise some notable concrete embedded steel beam grillage footings, and the concrete floor construction. A general description of the steel work is given.

The Corrosion of Iron and Steel.—Eng. Rec., July 9, 1910. 3⅓ pp.

Gives at length report of committee of American Society for Testing Materials with results of numerous tests in tabular form. A particularly reliable investigation.

Underpinning the Astor Building, New York.—Eng. Rec., July 2, 1910. 1 p.

Describes method of sinking eleven 3-ft. diamter cast-iron shells and filling with concrete to underpin wall with shallow foundation. Cylinders were jacked down in sections.

The Movement of the Peak of the Eiffel Tower Under Wind Pressure.—Eng. News, July 7, 1910. ⅓ p.

Describes tests made to show character of movement of the Eiffel Tower under wind load and also gives results of tests made to determine wind pressure. Conclusion is that the pressures to be expected from wind have been greatly overestimated. A suggested change in the standard formula is given.

The Hudson River Bridge at Waterford, New York.—Eng. News, July 14, 1910. 2 1-6 pp.

Illustrates general plans of new truss bridge recently completed to replace the old wooden bridge built in 1803-4. Some views of the old bridge are shown, and historical notes on its construction are given.

The Condition of the Steel of the Gillender Building; a Preliminary Report.—Eng. News, July 14, 1910. 1⅓ pp.

Gives an account of the condition in which the steel frame was found when tearing down the 20-story building named. The paint on the steel frame had completely disappeared but the cement of the masonry inclosing the steel had almost completely preserved it from corrosion.

The Mississippi River Bridge at St. Louis for the Illinois Electric Traction System.—Eng. News, July 28, 1910. 6½ pp.

A general description of the structural features of the bridge named, consisting principally of three 500-ft., clear, truss spans, and of the general methods of erection. Chiefly of value for the full general and detail drawings of the steel work.

The Seventh Street Bridge, Los Angeles, California. Eng. Rec., July 2, 1910. 1⅓ pp.

Describes general structural features of a reinforced concrete arch bridge of three 80-ft. spans. Interesting chiefly for description and drawings of hollow pier and abutment construction.

The Design and Construction of the Paulin's Hill Viaduct.—Eng. Rec., July 16, 1910. 2⅓ pp.

Illustrates and describes general structural features and methods of constructing concrete arch railway bridge 1,100 ft. long. An interesting collapsible center for small arches is illustrated.

A Wood Floor Supported by Concrete Beams.—Eng. Rec., July 16, 1910. ⅔ p.

Describes construction of a wood floor of the type named and gives some interesting comparisons of cost with reinforced concrete slab floor.

Perilous Bridge Erection.—Eng. Rec., July 16, 1910. 1 p.

Describes method of erecting a railway bridge under severe conditions of ice, snow and wind; the work was done in Alaska.

The Extension of the Columbia Building, New York. Eng. Rec., July 23, 1910. 1⅔ pp.

"Text Book on Graphic Statics"

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The Erection of the Dumbarton Point Bridge.—Eng. Rec., July 23, 1910. 1⅓ pp.

Describes general method of erecting 310-ft. draw span and six 180-ft. fixed spans of a railway bridge by floating into place on barges.

The Erection of the Gimbel Building, New York.—Eng. Rec., July 30, 1910. 1⅓ pp.

A general description of the methods employed in erecting a 10-story steel frame building, 197 x 400 ft. for a department store.

Reinforced Concrete Bridge.—By Edward P. Bailey. Mun. Jl. & Eng., July 13, 1910. 1½ pp.

General description of the construction of the bridge at 7th street, Los Angeles, Cal. The concrete was placed by a tower and flumes. A photograph of the arrangement is shown.

CONCRETE AND REINFORCED CONCRETE.

Apparatus for Repeated Load Tests of Concrete Cylinders and a Typical Result.—Eng.-Contr., July 27, 1910. 1 1-6 pp.

This article describes the machine devised for making repeated road tests of concrete prisms. A diagram showing typical test result is given and its various features commented on.

Methods and Cost of Constructing Concrete Core Wall in Moline Pool Dam in Mississippi River at Moline, Ill.—Eng.-Contr., July 27, 1910. 1½ pp.

This article describes the method of constructing the concrete core wall of a rock filled dam and gives itemized costs of the work.

The effect of Sea Water, Alkali Water and Sewage on Portland Cement and Methods Used for Counteracting Same.—Eng.-Contr., July 20, 1910. 2½ pp.

This article is a symposium of opinion and experience relating to the effect of various kinds of polluted waters on concrete.

Results of Tests of Second Set of Six Model Arches for the Medina Aqueduct, New York Barge Canal.—Eng.-Contr., July 20, 1910. 1½ pp.

This article gives the results of the second series of tests made on model concrete arches by the engineers of the New York Barge Canal. The results bring out some interesting conclusions effecting concrete arch design.

Progress Report on the Long Time Tests of Concrete in Sea Water by the Scandinavian Association of Portland Cement Manufacturers.—Eng.-Contr., July 20, 1910. 1¼ pp.

The tests described in this article are perhaps the most complete ever undertaken to determine the effect of sea water on concrete. Only the general results are given.

Tests on Reinforced Concrete Columns Subjected to Repeated and Eccentric Loads.—Eng.-Contr., July 20, 1910. 3½ pp.

This article gives diagrams and tables showing the results obtained in testing reinforced concrete columns both by repeated and by eccentric loads. A series of conclusions summarize the results of the tests.

Investigation on Waterproofing Concrete by the American Society for Testing Materials.—Eng.-Contr., July 20, 1910. ½ p.

A reprint of the report of the committee appointed to investigate the value of various water proofing compounds for concrete. The conclusions are of decided interest.

Methods of Waterproofing Engineering Structures Using Pitch and Felt.—Eng.-Contr., July 13, 1910. 3¼ pp.

This is an exceedingly useful article based on actual experience in waterproofing concrete by the membrane method.

Method of Constructing and Waterproofing a Circular Reinforced Concrete Water Tank.—Eng.-Contr., July 13, 1910. 1[illegible] p.

This is a brief article describing the method of waterproofing a water tank 75 ft. in diameter and 30 ft. high.

Method and Cost of Constructing a Concrete Tunnel Lining with an 80-ft. Gravity Chute.—Eng.-Contr., July 6, 1910. 1 p.

This article describes the method of lining a small tunnel with concrete using a gravity mixer located on the shaft. Itemized costs of work are given.

The Effect of Sodium Silicate Mixed with or Applied to Concrete.—Eng.-Contr., July 6, 1910 1 p.

This article describes some interesting experiments made to determine the effect of mixing sodium silicate with concrete in the strength and abrasive qualities.

Repeated and Eccentric Load Tests of Reinforced Concrete Columns.—Eng. Rec., July 9, 1910. 3 pp.

Gives methods and results of tests of reinforced concrete columns by repeated and eccentric loads.

Reinforced Concrete Siphon for a 65-Ft. Head.—Eng. Rec., July 9, 1910. 1⅔ pp.

Describes methods of construction and gives some costs of constructing a 10-ft. reinforced concrete siphon on the Los Angeles aqueduct. Section of siphon and details of forms are illustrated.

Aluminates; Their Properties and Possibilities in Cement Manufacture.—Eng. Rec., July 9, 1910. 1⅔ pp.

Gives account and results of experiments involving some 30,000 tests. Results point out value of combination of aluminates in increasing strength, hardness and hydraulic properties of cement.

The Effect of Included Sulphuric Acid on the Strength and Behavior of Portland Cement Exposed to Sea Water.—Eng. News, July 7, 1910. ⅓ p.

Gives results of a series of tests made by German Portland cement manufacturers to determine the effect of inclusion of 1 per cent and upward of sulphuric acid in cement.

Concrete Conduits for Electric Cables.—Eng. News, July 14, 1910. ½ p.

Describes and illustrates conduit construction of concrete molded in place.

Failure of Concrete Piles Under Ocean Pier at Long Beach, Cal.—Eng. News, July 21, 1910. ⅓ p.

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By W. H. Carrier, Consulting Engineer Carrier Air Conditioning Co. An illustrated paper describing various types of apparatus used in air washing and conditioning plants.
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Small Steam Turbines
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Journal of the Association of Engineering Societies, June, 1910
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Disintegration appears to have been the result of poor material.

A Concrete Plant for Foundation Work. Eng. Rec., July 16, 1910. ⅔ p.

Describes and illustrates the layout of a concrete mixing and transporting plant used in concreting a building foundation.

Recent Investigations on the Constitution of Portland Cement. Eng. Rec., July 16, 1910. 2⅓ pp.

An excellent review by Mr. Clifford Richardson of the latest studies and investigations into the constitution of Portland cement.

A Reinforced Concrete Conduit Operating Under a Head. Eng. Rec., July 23, 1910. 1½ pp.

Describes structural features and general method of constructing a 7-ft. reinforced concrete conduit operating under a head of 12 to 16 ft. Details of the formwork are illustrated.

Concrete Building with Steel Columns in the Lower Stories. Eng. Rec. July , 1910. 1⅔ pp.

Describes the structural features of a 5-story building having steel columns in the lower stories but otherwise of reinforced concrete construction.

Corrosion of Iron Embedded in Concrete.—Eng. Rec., July 30, 1910. 1⅔ pp.

An excellent report of the results of experiments made to determine the corrosion of iron embedded in concrete.

EARTH AND ROCK EXCAVATION.

Methods of Transporting Materials and Transportation Forces Employed in Constructing the Pennsylvania R. R. Hudson River Tunnels.—Eng.-Contr., July 27, 1910. 1 p.

Describes the methods of handling materials in the tunnel named and illustrates the two types of cars used. Some general costs are given.

Bracing and Sheeting Trenches.—Eng.-Contr., July 27, 1910. 1¾ pp.

A notably valuable article on the subject named. Diagrams and formulæ are given for use in actual computation.

Methods and Cost of Steam Shovel Work Loading Slag, Earth and Sand into Cars for Railway Ballasting and Grading.—Eng.-Contr., July 27, 1910. 1 p.

A very complete article giving unit cost data obtained from actual work of the character named.

Methods of Making Deep Fills by Suspending Track from Cableway.—Eng.-Contr., July 20, 1910. 1⅓ pp.

Describes the method of making fills from suspended cableways. Records of work and general costs are given.

Some Records of Drag Line Bucket Excavator Work on Canal, with Costs.—Eng.-Contr., July 20, 1910. ½ p.

This article describes the methods of constructing a large canal using drag line excavators. Records of output and general cost are given.

Methods and Costs of Making a Test of the Bearing Power of Soil, for a Building.—Eng.-Contr., July 13, 1910. ½ p.

A brief article describing a simple method of testing the bearing power of soil and giving the cost of making the test.

Cost of Repair Parts for a Rock Crushing Plant.—Eng.-Contr., July 13, 1910. ¼ p.

Gives brief figures of the repair costs on a rock crushing plant.

Method and Cost of Raising Embankment and Filling Trestles Using Steam Shovel and Hart Convertible Cars with Lidgerwood Unloader.—Eng.-Contr., July 13, 1910. 1 1-6 pp.

This article gives some unusually complete data on the cost of steam shovel and grading work of the character named.

Freezing Method of Tunneling, Metropolitan Subway, at Paris.—Eng. Rec., July 16, 1910. 1⅔ pp.

Describes and illustrates method of constructing short length of tunnel through water bearing soil by first freezing the ground. The apparatus used and mode of procedure are described.

Gold Dredging and Rock Crushing in California. Eng. Rec., July 16, 1910. 2 pp.

Railroad Location Surveys and Estimates

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Methods and Costs of Midwinter Surveying, the St. Louis and Cloquet River Surveys, Minnesota. [illegible]

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Reference Maps in the City Engineer's Office, Seattle. [illegible]

[illegible] improvement work in the city of Seattle, Wash.

MISCELLANEOUS.

Precarious Expedients in Engineering Practice. [illegible]

[illegible] between engineer and contractor on construction work.

Contractors' Cost Keeping and Organization. [illegible]

[illegible] keeping employed by the large contractors' organization [illegible] in recording and figuring the cost of the work.

Applying an Industrial System for Efficiency in Technical Instruction. [illegible]

[illegible]

The Construction and Testing of the Milwaukee Refuse Incinerator.—Eng. News, July 21, 1910. [illegible]

A general description of the main structural features of this new modern garbage incinerating plant, with results of efficiency tests. The test results [illegible]

Chicago Waste Disposal System.—Eng. Rec., July 2, 1910. 1⅓ pp.

Describes one of the most novel public services in the country; a system for disposing of [illegible] Chicago.

Washington's Municipal Markets.—Mun. Jl. & Eng., July 27, 1909. 2½ pp.

General description of the outdoor market and market building maintained by the Commissioners of the District of Columbia.

Town Scavenging and Refuse Disposal.—By Hugh S. Watson. Mun. Eng. Mag., Aug., 1910. [illegible] pp.

Treats of the utilization of residuals from refuse destruction. The practice in a number of English [illegible] described.

The Municipal Abattoir and Reduction Plant at Paris, Tex.—By Ed. H. McCuistion. Mun. Eng. Mag., Aug., 1910. 2 pp.

A description of the combination abattoir, cold storage and reduction plant of the city of Paris, Tex. This plant cost $10,000, and was [illegible]

Motive Powers for Municipal Engineers.—By Arthur E. Collins. Surveyor, July 1, 1910. 3 pp.

[illegible] methods of obtaining motive power for the general purposes of municipal engineers in carrying out their everyday duties of water supply, [illegible] similar operations.

Hydrated Lime. By Richard K. Meade. Mun. Eng. Mag., Aug., 1910. 3 pp.

[illegible] hydrated lime. Standard formulas for its use for plaster mortar, for mixing with Portland cement, for use in laying brick and stone, and [illegible] blocks are given.

Publications Received.

Traction Plowing. [illegible] 45 pp.; illustrated.

Presents data on the extent of plowing by traction engines, describes equipment and methods and gives many data on costs.

The Middle Devonian of Ohio. [illegible]

Stauffer, Geological Survey of Ohio, Columbus, O. Paper; 6x9 ins., 204 pp., illustrated.

The purpose of this report is to bring together the more important facts that have previously been published regarding the Middle Devonian formations of Ohio; to discuss the sections and faunas of a number of characteristic outcrops scattered over the entire area of outcrop within the state; to discuss the relationships of the faunas; and to give a few notes on certain species, together with figures and descriptions of certain others which have thus far remained undescribed.

Proceedings of the Sixteenth Annual Convention of the American Society of Municipal Improvements.—Secy. A. P. Folwell, 239 W. 39th St., New York. Cloth, 6x9 ins.; 411 pp.; illustrated.

This volume contains the excellent list of papers, committee reports and discussions which were presented at the Little Rock, Ark., convention of the society in 1909. The papers on road and street work are particularly deserving of mention and should be secured by those interested.

The Manufacture of Hydraulic, Gypsum and Other Gypsum Products.—By M. Glasenapp Translated by Dr. W. Michaelis, Jr. Cement and Engineering News, Chicago, Ill. Paper, 6x9 ins.; 47 pp.; illustrated; 50 cts.

The character of this pamphlet is perhaps, best described by the author as an essay, describing the various products obtainable by reciting and calcining of native gypsum, based upon a microscopical research intended to throw light upon the excellent properties of some kinds of burnt gypsum and to end the confusion existing in the classification of gypsum products.

Methods Used in Preliminary Work on Catskill Reservoirs for a 500,000,000 Gallon Daily Supply for the City of New York.—By J. S. Langthorn. Engineering News Publishing Co., New York. Paper, 6x9 ins.; 158 pp.; illustrated; $1.00.

This excellent paper, which was presented originally before the Brooklyn Engineers' Club, describes in detail the methods employed in making soundings and borings, stream measurements, rainfall and snowfall observations and surveys for this enormous water supply project. The data given and particularly the methods described are of exceptional usefulness.

Quality of the Surface Waters of Illinois.—By W. D. Collins. U. S. Geological Survey, Washington, D. C. Paper, 6x9 ins.; 94 pp.; illustrated.

This report furnishes the means of stating with fair accuracy the quality of water which may be found at any point along the larger streams within or bordering the State of Illinois. It also includes some explanation of the variations in the quality of the water at different times and places. The natural and economic features which determine the character of the streams are considered in a general way. The larger drainage divisions are described briefly. A short account of the distribution of population and principal industries of the State shows how these are affected by the streams and how they influence the quality of water in the streams. Methods of collecting and analyzing samples of water are described. The surface waters of the State were represented by samples taken at 27 different points. Each river is discussed in detail with reference to its source, course, discharge, and quality of water.

Quality of the Surface Waters of California.—By W. Van Winkle and F. M. Eaton. U. S. Geological Survey, Washington, D. C. Paper, 6x9 ins.; 142 pp.; illustrated.

This report gives the results of an investigation of the natural waters of California, their seasonal variation in composition and in physical characteristics and the damage which they have sustained by reason of pollution. An analytical study was made of the state's surface waters and the results of these studies are given for each stream. Generally in each case a description of the stream and of the character of its water is followed by complete analyses in tubular form. In addition a number of data are given on municipal water supplies.

Surface Water Supply of the United States; Part IV. Missouri River Basin. By Robert Follansbee and J. E. Stewart. U. S. Geological Survey, Washington, D. C. Paper, 6x9 ins.; 311 pp.; illustrated.

This publication gives the results of gagings on various streams of the Missouri River Basin. Methods of work are described and then follows the record for each stream, covering area,

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source, tributaries, topography, rainfall, etc., and finally tabulations of the gaging records.

Subaqueous Concrete Work.—By H. R. Lordly. Canadian Society of Civil Engineers, Montreal, Canada. Paper, 6x9 ins.; 26 pp.; illustrated.

This is a reprint of a paper presented to the Canadian Society of Civil Engineers describing a method employed in constructing concrete slope paving under water on the Lachim canal. The paper is a valuable one and engineers will find it convenient to have in this separate form.

Workmen's Insurance and Benefit Funds in the United States.—Annual Report for 1908 of the Commissioner of Labor. Chas. P. Neill, Commissioner, Washington, D. C. Cloth, 6x9 ins.; 810 pp.

This volume is a most complete summary of the features of some 1,200 funds or societies providing for workingmen's insurance. The subject matter is presented in nine chapters, as follows: Chapter I, National and International Labor Organization Benefit Funds; Chapter II, Local Labor Organization Benefit Funds; Chapter III, Railroad Relief Funds; Chapter IV, Establishment Benefit Funds; Chapter V, Hospital Funds; Chapter VI, Miscellaneous Funds; Chapter VII, Industrial Benefit Societies; Chapter VIII, State and Savings Banks Insurance; and Chapter IX, The Legal Status of Benefit and Relief Organizations.

Proceedings Brooklyn Engineers' Club, 1909.—Secy. Joseph Strachan, 352 Putnam Avenue, Brooklyn, N. Y. Paper, 6x9 ins.; 222 pp.; illustrated; $2.

Besides the club constitution, membership list and business proceedings, this volume contains the following papers: The Manhattan Bridge Cables, by Arthur I. Perry; Some Observations on the Organization and Methods Adopted for Highway Work in France and Other European Countries, by Nelson P. Lewis; Fire Hazard and Fire Protection in the United States, by Hugh T. Wreaks; Steel Transmission Towers, by J. Edward Jennings; Problems of the American Gas Producer, by William B. Chapman; The Generating and Distributing Systems of the Brooklyn Edison Company, by G. Laurence Knight; Brooklyn's Water Supply, by Walter E. Spear.

Transactions Connecticut Society of Civil Engineers for 1909.—J. Frederick Jackson, Secy., New Haven, Conn. Paper, 6x9 ins.; 165 pp.; illustrated.

This volume contains the society constitution and list of members and reprints and discussion of papers prescribed at the annual meeting, as follows: Eight Weeks Civic Study Abroad, by F. Luther Ford; Problems Handled by the Test Department of a Large Corporation, by B. S. Hinckley; The Hammond Mining and Metallurgical Laboratory of the Sheffield Scientific School, Yale University, by Louis D. Huntoon; State Control of Connecticut Dams, by C. E. Chandler; Memorandum of Work on Connecticut Dams, by N. J. Welton; Dams Approved by Mr. Henry T. Potter, by Charles E. Chandler; The Sea Wall in Connection With Power Stations and Manufacturing Buildings, by George A. [illegible]. The Water Resources of the Navajo Reservation, by Professor Herbert E. Gregory.

Statistics of Railways of the United States for 1908. Interstate Commerce Commission, Washington, D. C. Cloth, 6x9 ins.; 999 pp.

This volume is the report of the statistician of the commission and contains the regular statistical tables of railway mileage, capitalization, earnings and expenditures.

Concrete Bridges and Culverts

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Concrete Inspection
(HILL)
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Price, $1.00 net, postpaid.

A Text Book on Graphic Statics
(MALCOLM)
Gives proofs together with full explanations of constructions. Easy reference.
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MONTHLY REVIEW INDEX OF CIVIL ENGINEERING LITERATURE

A classified index and review of the civil engineering papers, articles, reports, pamphlets and books published during the month just passed is given in the succeeding pages. The literature indexed and reviewed—with the exception of books—relates solely to civil engineering. In the section devoted to Book Reviews all books in all branches of engineering are listed as received and such of them as seem worthy are reviewed as fully as due regard for conciseness will permit. In choosing books for review rigid selection is exercised. Next to careful choice of books for review timeliness of review is sought. All books are reviewed within a month of their receipt. The same statement is true of the articles and papers that are indexed. Also, as in choosing books for review, the choice of articles and papers for indexing is based on merit. Numerical strength in "titles indexed" is not sought; excellence of selection is sought.

The purposes of the Monthly Review Index are: First, to inform civil engineers and contractors of the articles and papers of merit that are published each month, in such a way as will give a clear idea of their character and scope; second, to supply the user with the date and place of publication, the length of each article and the cost at which it can be secured. The name, adopted abbreviations, place of publication and price per number of each periodical examined for civil engineering articles are given in the list immediately following. The other information is given in the index proper for each article separately.

Books reviewed will be sent post paid on receipt of price by the Book Department of ENGINEERING-CONTRACTING; periodicals, etc., containing articles indexed should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

American Architect (Am. Arch.), New York, N. Y.; w; 7x10 in.; 15 cts.
American Builders' Review (Am. Bldrs. Rev.), San Francisco, Cal.; m; 7x10 in.; 50 cts.
American Carpenter and Builder (Am. Car. & Bldr.), Chicago, Ill.; New York, N. Y.; m; 7x10 in., 20 cts.
American Engineer and R. R. Journal (Am. Engr. & R. R. Jl.); York, N. Y.; m; 7x10 in.; 20 cts.
American Gas Light Journal (Am. G. L. Jl.), New York, N. Y.; w; 10x13 in.; 10 cts.
American Institute of Electrical Engineers Proceedings (Am. I. of E. E. Proc.), New York, N. Y.; m; 4x7 in.; 50 cts.
American Machinist (Am. Mchst.), New York; w; 7x10 in.; 15 cts.
American Society of Civil Engineers Proceedings (Am. Soc. C. E. Proc.), New York, N. Y.; m; 4x7 in.; 75 cts.
American Society of Mechanical Engineers Journal (Am. Soc. M. E. Jl.), New York, N. Y.; m; 4x7 in., $1.
Annales des Ponts et Chaussees (An. P. & C.), Paris, France; m.
Applied Science, Toronto, Ont.; m; 6x9 in.; 20 cts.
Architects and Builders' Journal (Arch. & Bldrs. Jl.), Baltimore, Md.; m; 9x12 in.; 20 cts.
Architects and Builders' Magazine (Arch. & Bldrs. Mag.), New York, N. Y.; m; 5x8 in.; 20 cts.
Architect and Engineer of California (Arch. & Engr.), San Francisco, Cal.; m; 5x7 in.; 15 cts.
California Journal of Technology (Cal. Jl. of Tech.), Berkeley, Cal.; m; 4x7 in.; 25 cts.
Canadian Architect (Can. Arch.), Toronto, Ont.; m; 7x19 in.; 20 cts.
Canadian Cement and Concrete Review (Can. Cem. & Conc. Rev.), Toronto, Ont.
Canadian Engineer (Can. Engr.), Toronto, Ont.; w; 7x11 in.; 20 cts.
Canadian Machinery and Manufacturing News (Can. Mach. & Mfg. News), Toronto, Ont.; m; 7x10 in.; 15 cts.
Canadian Mining Journal (Can. Min. Jl.), Toronto, Ont.; bi-w; 7x10 in.; 20 cts.
Canadian Municipal Journal (Can. Mun. Jl.), Montreal, Que.; m; 6¾x10 in.; 10 cts.
Canadian Society of Civil Engineers Proceedings (Can. Soc. C. E. Proc.), Montreal; m; 4x7 in.; 50 cts.
Carpentry and Building (Carp. & Bldg.), New York, N. Y.; m; 11x8 in.; 10 cts.
Cassier's Magazine (Cas. Mag.), New York; m; 5x8 in.; 25 cts.
Cement, New York, N. Y.; bi-m; 5x8 in.; 25 cts.
Cement Age (Cem. Age), New York, N. Y.; m; 4¾x8 in.; 15 cts.
Cement and Engineering News (Cem. & Eng. News), Chicago, Ill.; 7x10 in.; 25 cts.
Cement Era (Cem. Era), Chicago, Ill.; m; 7x10 in.; 10 cts.
Cement Record (Cem. Rec.), Kansas City, Mo.; m; 4¾x8 in.; 15 cts.
Cement World (Cem. Wld.), Chicago, Ill.; m; 9x11 in.; 10 cts
Chemical Engineer (Chem. Engr.), Chicago, Ill.; m; 4x7 in.; 15 cts.
Clay Worker (Cl. Wkr.), Indianapolis, Ind.; m; 7x10 in.; 20 cts.
Compressed Air (Comp. Air), New York, N. Y.; m; 5x7 in.; 10 cts.
Concrete, Detroit, Mich.; m; 6x9 in.; 15 cts.
Concrete Age (Conc. Age), Atlanta, Ga.; m; 9x11 in.; 10 cts.
Concrete and Constructional Engineering (Conc. & Cons. Eng.), London, England; m; 5x7 in.; 25 cts.
Concrete Engineering (Conc. Eng.), Cleveland, O.; m; 7x10 in.; 10 cts.
Contractor (Contr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Cornell Civil Engineer (Cor. Civ. Engr.), Ithaca, N. Y.; m; 4x7 in.; 25 cts.
Domestic Engineering (Dom. Engr.), Chicago, Ill.; w; 6x9 in.; 10 cts.
Electrical Age (Elec. Age), New York, N. Y.; m; 7x10 in.; 10 cts.
Electrical Review (Elec. Rev.), New York, N. Y.; 8x10 in.; 10 cts.
Electric Railway Journal (Elec. Ry. Jl.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electrical World (Elec. Wld.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electric Traction Weekly (Elec. Trac. Wkly.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Engineer (Engr. Lon.), London, England; w; 4x11 in.
Engineer (Engr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Engineering (Eng.), London, England; w; 8x11 in.
Engineering-Contracting (Eng.-Contg.), Chicago; w; 8x11 in.; 10 cts.
Engineering Digest (Eng. Dig.), New York; m; 5x8 in.; [illegible]
Engineering and Mining Journal (Eng. & Min. Jl.), New York, w;
Engineering Magazine (Eng. Mag.), New York; m; 5x7 in.; 25 cts.
7x10 in.; 15 cts.
Engineering News (Eng. News), New York; w; 8x11 in.; 10 cts.
Engineering Record (Eng. Rec.), New York; w; 8x11 in.; 10 cts.
Engineers' Club of Philadelphia Proceedings (Engr.'s Club, Phila. Proc.), Philadelphia; qr; 4x7 in.; 25 cts.
Fire and Water Engineering (F. & W. Eng.), New York, N. Y.; 8x11 in.; 10 cts.
Le Genie Civil, Paris, France; w.
Good Roads Magazine (Gd. Rds. Mag.), New York, N. Y.; m; 7x10 in.; 10 cts.
Industrial Magazine (Ind. Mag.), Cleveland, O.; m; 4x7 in.; 10 cts.
Industrial World (Ind. Wld.), Pittsburg, Pa.; w; 7x10 in.; 10 cts.
Insurance Engineering (Ins. Eng.), New York; m; 4x6 in.; 25 cts.
International Railway Congress Bulletin (Int. Ry. Cong. Bul.), Brussels; m; 50 cts.
Iron Age, New York, N. Y.; w; 7x11 in.; 15 cts.
Iron Trade Review (Iron T. Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Irrigation Age (Irr. Age), Chicago, Ill.; m; 7x9 in.; 10 cts.
Journal Association of Engineering Societies (Jl. Assoc. Engr. Soc.), Boston, Mass.; m; 4x7 in.; 30 cts.
Journal Franklin Institute (Jl. Frank. Inst.), Philadelphia, Pa.; m; 4x7 in.; 50 cts.
Journal New England Waterworks Association (Jl. N. E. W. W. Assoc.), Boston, Mass.; q; 4x7 in.
Journal Western Society of Engineers (Jl. W. Soc. Engrs.), Chicago, Ill.; bi-m; 4x7 in.; 50 cts.
Journal of Electricity, Power and Gas (Jl. Elec., P. & G.), San Francisco, Cal.; w; 7x10 in.; 10 cts.
Journal of Worcester Polytechnic Institute (Jl. W. P. I.); m; 4x7 in.; 20 cts.
Machinery, New York, N. Y.; m; 7x11 in.; 20 cts.
Marine Review (Marine Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Mines and Minerals (Mi. & Mls.), Scranton, Pa.; w; 7x9 in.; 20 cts.
Mining and Scientific Press (Min. & Sci. P.), San Francisco, Cal.; w; 7x11 in.; 15 cts.
Mining Reporter (Min. Rep.), Denver, Colo.; w; 7x10 in.; 15 cts.
Mining World (Min. Wld.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Modern Machinery (Mod. Mchy.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Municipal Journal and Engineer (Mun. Jl. & Eng.), New York, N. Y.; w; 7x10 in.; 10 cts.
Municipal Engineering Magazine (Mun. Eng. Mag.), Indianapolis, Ind.; m; 4x7 ins.; 25 cts.
Ores and Metals (O. & M.), Denver, Colo.; bi-w; 6x10 in.; 10 cts.
Pacific Building Engineer (Pac. Bldg. Engr.), Seattle, Wash.; w; 9x11 in.; 15 cts.
Popular Mechanics (Pop. Mech.), Chicago, Ill.; m; 5x7 in.; 10 cts.
Power and Engineer (Pwr. & Engr.), New York; m; 7x10 in.; 20 cts.
Railway Age-Gazette (R. R. Age-Gaz.), New York; w; 8x11 in.; 15 cts.
Railway Master Mechanic (Ry. M. M.), Chicago; m; 7x10 in.; 10 cts.
Railway and Engineering Review (Ry. & Eng. Rev.), Chicago, Ill.; w; 9x11 in.; 10 cts.
Railway and Locomotive Engineering (Ry. & Loco. Eng.), New York, N. Y.; m; 7x10 in.; 20 cts.
Railway and Marine World (Ry. & M. Wld.), Toronto, Ont.; m; 7x10 in.; 15 cts.
Railway Engineering and Maintenance of Way (Ry. Eng. & M. W.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Roadmaster and Foreman (Rd. & For.), Chicago; 7x10 in.; 10 cts.
Rock Products (Rk. Prod.), Chicago, Ill.; bi-w; 9x11 in.; 10 cts.
Rose Technic, Terre Haute, Ind.; m; 4x7 in.; 15 cts.
School of Mines Quarterly (Sch. Min. Quart.), New York, N. Y.; qr; 4x7 in.; 50 cts.
Schweizerische Bauzeitung, Zurich; w.
Scientific American (Sci. Am.), New York; w; 9x14 in.; 10 cts.
Scientific American Supplement (Sci. Am. Sup.), New York, N. Y.; w; 9x14 in.; 10 cts.
Sibley Journal of Engineering (Sib. Jl. Eng.), Ithaca, N. Y.; m; 4x7 in.; 20 cts.
Stevens Institute Indicator (Stev. Inst. Ind.), Hoboken, N. J.; m; 4x7 in.; 20 cts.
Street Railway Bulletin (St. Ry. Bul.), Boston; m; 6x10 in.; 10 cts.
Surveyor (Surveyor), London, England; w; 6x11 in.; 10 cts.
Technology Quarterly (Tech. Qr.), Boston; qr; 4x6 in.; 35 cts.
The Polytechnic (Poly.), Troy, N. Y.; m; 5x8 in., 15 cts.
U. S. Department of Agriculture Bulletin (Dept. Agr. Bul.) Washington, D. C.; 4x7 in.
U. S. Geological Survey Bulletin (Geo. Surv. Bul.), Washington, D. C.; 4x7 in.
Zeitschrift d. Oest. Ing. u. Arch. Ver., Vienna; w.
Zeitschrift d. Ver Deutscher Ing.; Berlin; w.

ROADS AND STREETS.

Day Labor Wages on Road Work in California.—Eng. Rec., Aug. 20, 1910. ½ page.

A tabulation of rates of wages paid for day labor road work in California.

Bituminous Roads—Mixed and Poured.—Eng.-Contr., Aug. 10, 1910. 1 1/6 pages.

Summarizes the advantages and disadvantages of pouring methods of construction and argues the superiority of the mixing method. The advantages and disadvantages of hand and of machine mixing are summarized.

Some Costs of Street Paving Work at Baltimore, Md.—Eng.-Contr., Aug. 10, 1910. 1 5/6 pages.

Describes briefly the methods and character of work and gives costs for various jobs of asphalt block, macadam, brick, vitrified block and other pavement construction and repairs.

Experimental Work in 1909 of the U. S. Office of Public Roads in Dust Prevention and Road Preservation.—Eng.-Contr., Aug. 3, 1910. 6⅓ pages.

Summarizes the long list of experiments during 1909 of the bureau named in dust prevention and road preservation work. Methods of construction are described and many construction cost data are given. Altogether 14 separate experimental sections of road are included.

The Training and Duties of a Street Superintendent.—Eng.-Contr., Aug. 3, 1910. 1⅓ pages.

A well written article outlining the duties of a superintendent of streets and pointing out the requirements that enter into a good organization for street cleaning work.

Supplementary Reports on the 1907 and 1908 Dust Prevention and Road Preservation Experimental Work of the U. S. Office of Public Roads.—Eng.-Contr., Aug. 3, 1910. 1 page.

Gives results of experience since construction with the various sections of experimental roads constructed one and two years ago.

Street Cleaning Methods.—Eng.-Contr., Aug. 10, 1910. 5/6 page.

Discusses general principles of street cleaning and describes and comments on various methods of cleaning now practiced.

Notes on Road and Street Work.—Eng.-Contr., Aug. 10, 1910. 1 1/6 pages.

Covers a variety of data, oak joint filler and sectional oak blocks for repairing granite block pavement; cost of maintaining street asphalt and asphalt block pavements; methods of repairing macadam roads.

Notes on Road and Street Work.—Eng.-Contr., Aug. 17, 1910. 1 page.

Gives data on cost of rattler brick testing outfit, water absorption by paving materials, bitumass pavement specifications, and street cleaning methods in Vienna, Austria.

The Physical and Chemical Characteristics of Bituminous Road Materials.—Eng.-Contr., Aug. 17, 1910. 2⅓ pages.

Summarizes the characteristics named of the most common types of bituminous road materials and discusses the purpose and value of the various common tests of specific gravity, melting point, volatilization, solubility, etc.

Average Practice in Street Cleaning and Sprinkling in the Larger Towns of Great Britain.—Eng.-Contr., Aug. 24, 1910. 2¼ pages.

A general summary of practice based upon studies in some 20 British towns, covering cleaning, snow removal and watering.

Concrete Pavement Construction at Boise, Idaho.—Eng.-Contr., Aug. 31, 1910. [illegible]

Describes method of construction and plant and tools used and gives records of output and cost. A very good [illegible].

The Conclusions of the Sections of the Second International Road Congress Regarding Various Phases of Road Construction and Maintenance.—Eng.-Contr., Aug. 3, 1910. [illegible]

A reprint of the conclusions of the Congress on the nine questions submitted for consideration. These sections considered the following subjects: (1) Metalled and Paved Roads; (2) Foundation and Drainage of Road; (3) Light Railways and Tramways; [illegible]tering; (5) Choice of Surfacing; (6) Distribution Systems Under Roads; [illegible] Weight and Speed of Vehicles on Bridges; [illegible] Design of Road Vehicles; (9) Motor Omnibusses. W[illegible] do not [illegible] that is new, yet they express in concrete form ideas which formerly in many cases have been held but vaguely.

Snow Removed in New York City.—Eng.-Contr., Aug. 31, 1910. 1 page.

The report of a committee appointed to consider the problem of snow removal in New York city and to suggest methods for conducting such work.

Concrete in Highway Construction.—Conc. & Cons. Eng., August, 1910. 10 pages.

The application of concrete to highway construction is here presented in an article extracted from a more comprehensive article published by the Atlas Cement Co. The article covers the various divisions of highway construction, including sidewalks, curbs, gutters, roadways, culverts and bridges.

SEWERS.

The Sewage Disposal Works of Mount Vernon, N. Y.—Eng. Rec., Aug. 20, 1910. 3 pages.

General description with plans of a sewage disposal plant to serve a community of about 30,000 population. A special feature of the plant is the ventilating system to obviate foul odors.

Operation of the Reading Sewage Purification Works.—Eng. Rec., Aug. 13, 1910. 2⅓ pages.

A notably good article descriptive of experience in operating the plant named. Methods of operation, and difficulties encountered are described and records of results by months for two years are given.

Sewage Disposal Works, North Attleboro, Mass.—Eng. Rec., Aug. 27, 1910. 2 pages.

General description of structural features of a plant designed for a population of 12,000. Plant consists of two double, hopper-bottom settling tanks and 16 intermittent sand filters. Drawings are given of a trough distributor.

Some Costs of Small Sewer Work by Day Labor in Baltimore, Md.—Eng.-Contr., Aug. 3, 1910. 2 pages.

Gives itemized costs of 10 small sewer jobs done by day labor. Jobs ranged in magnitude from a thousand to fourteen thousand dollars.

Some Structural Details of the River Des Pere's Foul Water Sewer at St. Louis, Mo.—Eng.-Contr., Aug. 3, 1910. 1⅓ pages.

Describes general structural features of some 32,000 ft. of trunk sewer ranging from a 9x9-ft. concrete section to a 6-ft. circular brick section. A notable feature is the reinforced circular brick sewer construction.

Leaping Weirs, Syracuse Intercepting Sewers.—Eng.-Contr., Aug. 24, 1910. ⅓ page.

Illustrates and describes a novel construction for controlling the amount of sewage intercepted where lateral sewers pass over interceptors.

The Fourteenth Street Sewer Tunnel, Washington, D. C.—Eng. Rec., Aug. 6, 1910. 1 page.

Describes general method of constructing a section of concrete sewer in tunnel. Drawings of shaft head house and hoists are given.

Sewage Disposal in the Vicinity of London, England.—Eng. Rec., Aug. 6, 1910. 2 pages.

A general discussion on septic tanks, sludge disposal and humus tanks based on studies of some dozen sewage disposal plants in the vicinity of London, England. A notably interesting article.

A Series of Notable Reports on Sewage Disposal by Dilution at Rochester, N. Y.—Eng. News, Aug. 11, 1910. 4½ pages.

A notable series of reports involving the general question of sewage disposal by dilution and dispersion made by a number of engineers prominent in sanitary fields.

Heavy Railway Work Along the Des Chutes River, in Oregon.—Eng. News, Aug. 11, 1910. [illegible] pages.

A good general description of the topographical features and heavy work of the two new railways being built up the valley of the Des Chutes River to the so-called tableland of Oregon. Diagram elevations are shown of two rather notable viaducts.

WATERWORKS AND HYDRAULICS.

Hydroelectric Development of the Arizona Power Company.—Eng. Rec., Aug. 20, 1910. 3 pages.

General description of the structural features of a large water power development chiefly of value for the methods and costs given of concrete flume construction.

Laying a 30-in. Pipe Line Under the Pequonnock River.—Eng. Rec., Aug. 13, 1910. ⅓ page.

Describes method of laying pipe in 45-ft. sections under water with illustrations of bottom supports and pipe joints.

Capital City Plant, United Missouri River Power Co.—Eng. Rec., Aug. 13, 1910. 1⅓ pages.

General description of concrete dam and power plant near Helena, Mont. The concrete dam is 1,400 ft. long and sections are shown.

Water Purification Plant, Putman, Conn.—Eng. Rec., Aug. 13, 1910. 2 pages.

General description with plans of a water purification plant for a city of 8,000 population. Drawings are given of a rate controller which are useful.

Curved Dams in New South Wales.—Eng. Rec., Aug. 27, 1910. 1⅓ page.

Describes practice in design and construction and gives essential dimensions of 14 curved masonry dams built in New South Wales mostly for irrigation work.

Moving 370 Feet of Conduit Intact.—Eng. Rec., Aug. 27, 1910. ⅓ page.

An interesting small job of pipe moving.

Fill Dams With Hollow Core Walls.—Eng.-Contr., Aug. 17, 1910. ⅔ page.

Describes the construction of a new form of dam in which a cellular concrete core wall is employed. The advantages claimed for the construction are accessibility for repairs and for stopping leakage.

Conservation of Water Powers.—Eng.-Contr., Aug. 17, 1910. 3 1/6 pages.

A brief discussion of the practical bearing and effect of existing laws governing the appropriation of water powers located on public land, and an argument for a more wise interpretation of these laws such as not to retard the utilization of these powers.

Methods and Cost Preparing and Placing Ashes or Cinders for Filtering Material in Contact Beds.—Eng.-Contr., Aug. 31, 1910. 1 page.

A notable valuable article describing method of crushing and placing cinders and gives itemized unit costs of the work.

Some Experience in Treating High-Colored Water from the Penobscot River at Bangor, Me.—Eng.-Contr., Aug. 31, 1910. 1¾ page.

Gives in tabular form results of various studies made to determine the best method of handling the high colored water named for water supply.

Hydroelectric Development of the Michoacan Power Company.—Eng. Rec., Aug. 27, 1910. 2 pages.

General description of development consisting of a division dam and spillway, head gates, rating flume, 4.1 miles of canal, 11 aqueducts and 1.06 miles of steel penstock binders minor structures.

The Appleton Water-Works Decision.—Eng. Rec., Aug. 6, 1910. 2 pages.

Valuable for the comparison in tabular form of valuations made by four separate engineers, and for the discussion by the engineers of the Railroad Commission of Wisconsin of the methods and prices employed by the commission's engineers in their appraisal.

The Water-Works of Monterey, Mexico.—Eng. Rec., Aug. 6, 1910. 3 pages.

A general description of the structural features of the new water-works named. The general description of the concrete aqueduct and the details of the covered concrete reservoir are the features of particular interest. The most notable detail is the traveling forms for constructing concrete slope walls for the reservoir.

Stoney-Gate Dam in the Albula Canyon for the Hydro-Electric Power Plant of the City of Zurich, Switzerland.—Eng. News, Aug. 25, 1910. 2 pages.

Illustrates the general details of the gate and pier construction of the dam named. Some general costs are given. The novel feature is the arrangement for protecting the roller mechanism of the gates from wear.

Experiments on Small Weirs and Measuring Modules.—Eng. News, Aug. 18, 1910. 6 1/6 pages.

A notably interesting account of a series of studies made on small wiers and measuring modules with results of tests in diagram and tabular form. Irrigation and hydraulic engineers will be particularly interested.

Effects of the Length of Penstock on the Weight of Revolving Parts of a Water-Wheel Unit.—Eng. News, Aug. 11, 1910. ⅔ page.

Points out the necessary relation between length of penstock and weight of revolving turbine parts; presents formula for the determination of this relation and illustrates a case by solving a typical problem.

Field Assay of Water.—Eng. News, Aug. 11, 1910. 1⅔ pages.

Gives computative determinations of water by laboratory analyses and by field assay using solid reagents and apparatus of knapsack size. Results are discussed. A suggestive article to engineers doing exploration work.

Determination of the Resultant Angle in Laying Out Combined Bends for Pipe Lines.—Eng. News, Aug. 11, 1910. 1⅗ pages.

Presents both graphical and analytical methods for determining the resultant angle where both a horizontal and a vertical bend at the same point exists in a pipe line. There is an editorial discussion.

RIVERS, HARBERS AND CANALS.

Emergency Gates on the Illinois and Mississippi Canal.—Eng. Rec., Aug. 20, 1910. 1⅓ pages.

Describes the operation of the emergency gates which divide the summit level of the Illinois and Mississippi Canal into sections during a break which occurred in May, 1909. A general description of the gate construction is given, with comments on the utility of such structures.

Dike at Herring River, Wellfleet, Mass.; Mosquito Extermination Works.—Eng. News, Aug. 11, 1910. 1 page.

Gives plans and describes structural details of an earth dike with sluice gates for excluding tide water from salt marshes.

Some Details of the Siphon Lock at Oswego, New York, Barge Canal.—Eng.-Contr., Aug. 10, 1910. 1½ pages.

This article illustrates the siphon feature of the lock named, explains the principal and describes the method of operation.

Wharf Construction at Fort Mason, Calif.—Eng. Rec., Aug. 6, 1910. 2 5/6 pages.

General description of the construction work comprising a concrete sea wall and several wharves of concrete and steel beam construction on circular concrete piers or piles. The method of construction of the concrete piers is the item of particular interest.

The Harbors of Great Britain, with Some Reference to Those of North Europe and North America.—Eng. News, Aug. 11, 1910. 3⅓ pages.

The purpose of this article is to study briefly and in general principles only the harbors of Great Britain as they exist to-day and in comparison those of northern Europe and America. The author touches on the organization for administration, deduces some of the main principles underlying their design, points out differences and suggests lines of possible improvement.

RAILWAYS.

Design of the Fourth Avenue Subway, Brooklyn.—Eng. Rec., Aug. 20, 1910. 1 page.

Illustrates cross-section and some of the principal structural details of the reinforced concrete construction for the section named of the New York subway. The next explains the drawings.

Methods and Costs of Unloading, Spacing and Renewing Ties.—Eng.-Contr., Aug. 10, 1910. 1 page.

Gives costs of unloading ties on two jobs of track work; describes gang organization and gives records and cost of renewing ties on seven jobs.

Methods and Cost of Loading Rail from Roadbed to Cars.—Eng.-Contr., Aug. 3, 1910. ⅓ page.

Gives methods of work and itemized cost of four jobs of loading rails onto cars from side of roadbed. Manual labor was employed and gang organization is stated.

Record of Gravel Ballasting, Using Hopper Bottom Coal Cars on a 75 Mile Haul.—Eng.-Contr., Aug. 3, 1910. 1⅓ pages.

A notably good cost article. The work consisted of ballasting 32 miles of track with 32,000 cu. yds. of gravel. Methods of excavation hauling and spreading are stated and itemized unit costs are given.

Methods and Costs of Tracklaying with a Harris Tracklaying Machine.—Eng.-Contr., Aug. [illegible] 1910. [illegible]

Records cover one month's work. Full gang organization and wages are stated and methods of work are described. Complete costs are given.

Methods and Cost of Unloading Railway Rails. Eng.-Contr., Aug. 10, 1910. [illegible]

Describes methods employed in unloading rails and gives time and progress records of unloading from both gondola and flat cars on four jobs.

Clearance and Grade Requirements for Carrying Highways Over or Under Railway Lines.—Eng.-Contr., Aug. 17, 1910. ½ page.

Summarizes the requirements and present practice in the matter.

Equipment Depreciation and Renewal on Railways.—Eng.-Contr., Aug. 31, 1910. 2⅓ pages.

Valuable for the actual records given in tabular form of equipment depreciation and removal on the lines of the Southern Pacific Co.

Methods and Cost of Renewing Rail.—Eng.-Contr., Aug. 31, 1910. 1¼ pages.

Describes various gang organizations and gives time records and costs covering various jobs of renewing rail, applying tie plates, tightening spikes, applying rail braces and wrenching.

The Valuation of the Detroit Street Railways.—Eng. News, Aug. 25, 1910. 2 pages.

A general description of the purpose and some of the methods of this valuation with a comparative summary by totals of the valuations made for the city and by the street railway company.

The Imperial Peking-Kalgan Railway and Its Extension.—Eng. News, Aug. 25, 1910. [illegible] pages.

Describes the construction of the railway named which is chiefly interesting for having been carried out by Chinese engineers. Several interesting views of Chinese scenery and structures are shown.

Water Softening Plants of the Florida East Coast Railway.—Eng. News, Aug. 11, 1910. 1⅓ pages.

Describes briefly and illustrates softening plant to treating artesian water for locomotive use.

Double Track Work Near Indianapolis.—Contr., Aug. 15, 1910. 2½ pages.

An illustrated article describing the construction of a 20 foot fill and a 3 span 60 foot arch bridge on the Pittsburg, Cincinnati, Chicago and St. Louis Rrailroad, near Indianapolis.

BRIDGES BUILDINGS AND FOUNDATIONS.

Plate Girder Arch Bridge Carrying a Concrete Roadway.—Eng. Rec., Aug. 20, 1910. 1⅓ pages.

Illustrates and describes an interesting form of bridge construction consisting of plate girder arch ribs carrying spandrel walls and interior spandrel columns of reinforced concrete supporting a concrete deck. Details are illustrated.

A Temporary Single-Track Lift Bridge.—Eng. Rec., Aug. 20, 1910. ⅔ page.

Gives general plans for a temporary lift bridge for use during construction of permanent bridge. Text explains drawings.

Hand Driver Steel Sheet Piling, Bush Terminal, Brooklyn.—Eng. Rec., Aug. 20, 1910. 1 page.

Describes method of driving steel sheeting for pits about 12x12x12 ft. to be excavated around the heads of groups of foundation piles to permit the construction of concrete caps. General costs are given, and some interesting comparisons made with previous practice using wood sheet piles.

The Main Street Bridge Over the Buffalo Belt Line.—Eng. Rec., Aug. 27, 1910. 1⅔ pages.

Describes structural details of a concrete embedded metal bridge with a concrete deck. An unusually solid piece of bridge construction fo carrying a street across railway tracks.

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General structural description with details of an unusual form and construction of roof truss.

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The Substructure of the Dumbarton Point Bridge.—Eng. Rec., Aug. 13, 1910. 2 pages.

Describes general methods of constructing concrete filled steel shell piers on piles for a heavy railway bridge. The bottom was soft mud and there was a swift current. The steel shell construction is of particular interest in certain details.

Steel Gasholder Tanks with Bulging Sides.—Eng. Rec., Aug. 13, 1910. 2 pages.

A description of some recent practice in building gasholder tanks with bulging sides with an analysis of stresses and of general design. An interesting article for structural designers.

Derrick Tower for Erecting the Montana Capitol.—Eng. Rec., Aug. 13, 1910. 1 page.

Describes and illustrates in some detail construction of derrick towers 15 ft. square and 110 ft. high. The article is valuable for the drawings.

Tests of Nickel Steel Riveted Joints.—Eng. Rec., Aug. 20, 1910. 5⅔ pages.

This is a notable record of tests of riveted jointes and complete results are given in tabular form and by diagrams. There were 18 types of joints tested and five joints of each type were tested. The joints were duplicates in every way of carbon steel joints tested by the American Railway Engineering and Maintenance of Way Association except that they were of nickel steel and the tabulations show the comparative results.

Erection of an Eight-Track Rolling Lift Bridge.—Eng. Rec., Aug. 13, 1910. 2 pages.

Describes methods followed in removing an 8-track railway bridge and replacing it with a bascule structure of the rolling lift type.

Structural Steel Details in the Ball Realty Building.—Eng. Rec., Aug. 13, 1910. 1⅓ pages.

General description of the steel work for the lower 6 stories of an 8-story building. One of the details, a suspended wall beam, is deserving of attention.

Unfilled Voids in Concrete Foundations.—Eng. Rec., Aug. 13, 1910. ⅓ page.

Describes condition of voids found in foundation piers built by depositing concrete in curved wells.

Formulas for the Design of Gravity Retaining Walls.—Eng.-Contr., Aug. 10, 1910. 2 pages.

Presents the various formula commonly used and deduces a series of formulas and illustrates their use by examples.

The Corrosion of Iron and Steel.—Eng.-Contr., Aug. 17, 1910. 3 1/6 pages.

A valuable report giving in detail the results of tests conducted by a committee of the American Societey for Testing Materials.

Some Exposure Tests of Structural Steel Coatings.—Eng.-Contr., Aug. 24, 1910. 1 page.

A record of tests of coatings subjected to the weather.

The Substructure of the American River Bridge.—Eng. Rec., Aug. 27, 1910. 1⅓ pages.

The work comprised several piers built in cofferdams of sheet piling and one pier founded by sinking a reinforced concrete caisson. Article describes general features of cofferdam and caisson work.

The Miles Glacier Bridge.—Eng. Rec., Aug. 6, 1910. 4⅓ pages.

Describes and illustrates main structural features and general construction methods for a railway bridge some 1,670 ft. long with one 300-ft., two 400-ft. and one 450-ft. main truss spans. The drawings of structural work are chiefly of value, and a feature of the article is the adjusting devices used in erecting the chords. Drawings of these devices are given.

Steel Pile Foundations of the Putnam Building, N. Y.—Eng. Rec. Aug. 27, 1910. ½ page.

A brief summary of the methods employed in sinking 27 steel piles or piers for a building foundation.

Derrick EErection of Light Truss Spans.—Eng. Rec., Aug. 6, 1910. [illegible] pages.

Describes procedure followed in erecting a number of footbridge spans over railway tracks using a derrick.

The Design and Erection of the Missouri River Bridge for the Pacific Extension; C. M.

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& St. P. Ry.—Eng. News., Aug. 25, 1910. 3⅓ pages.

A general description of the structural features of the large truss bridge named with a more detailed account of methods of erection and with drawings of framework, erecting traveler, etc.

Concrete Pedestal Bridge Abutments on the New York State Barge Canal.—Eng. News., Aug. 18, 1910. 1 page.

Illustrates and describes the special abutment construction used for highway bridge crossings of the New York State Barge Canal.

Effect of Locomotive Gases on Concrete Bridges.—Cement, August, 1910. [illegible] pages.

A description of the physical and chemical examinations of test specimens of concrete taken from the arches and abutments of two bridges over railroads in Austria with explanations of the results of the observations made.

CONCRETE AND REINFORCED CONCRETE.

Building a Concrete Railroad Bridge Under Traffic.—Eng. Rec., Aug. 20, 1910. 1 page.

An interesting article describing methods of constructing an 80-ft. concrete arch through a railway embankment.

The Behavior of Hydraulic Compounds in Sea Water.—Eng. Rec., Aug. 27, 1910. 2⅓ pages.

Describes conduct of a series of exposure tests in sea water of various cement, truss and lime concretes; gives results in tabular form and presents certain conclusions. One of the most valuable of several recent papers on this general subject.

Circular Bins for Cement Storage at Dewey, Oklahoma.—Eng. Rec., Aug. 13, 1910. 1 page.

Illustrates general structural features and describes construction of a four bin storage plant of 60,000 bbls. capacity. The bins are circular reinforced concrete 32 ft. in diameter and 80 feet high.

Three-Hinged Reinforced Concrete Arch Bridge, Los Angeles.—Eng. Rec., Aug. 13, 1910. 2⅓ pages.

General description of structural features and methods of construction for a three span bridge of three hinged arches of 87½ ft. span. Details of hinges and hollow reinforced concrete abutments are shown and itemized contract prices are given.

Plant of the Ogden Portland Cement Company.—Eng. Rec., Aug. 13, 1910. ⅔ pages.

General description with plans of this new cement plant recently built in Utah.

Combined Unit and Monolithic Method of Constructing a Reinforced Concrete Factory Building.—Eng.-Contr., Aug. 3, 1910. 1 5/6 pages.

Describes principally the methods of moulding and erecting separately reinforced concrete columns, beams and slabs for several large factory buildings. Methods and plant are mentioned in detail making an unusually interesting account of building work of separately moulded reinforced concrete members.

Cost of Constructing Concrete Abutments for a Railway Bridge.—Eng.-Contr., Aug. 3, 1910. ⅔ page.

The abutments were of small size but the costs are itemized and subdivided in unusual detail.

The Designing of Footings of Reinforced Concrete.—Eng.-Contr., Aug. 17, 1910. ⅔ page.

A brief mathematical discussion of the subject.

The Grafton Bridge, Auckland, New Zealand; the Longest Concrete Arch Bridge in the World.—Eng.-Contr., Aug. 24, 1910. ⅓ page.

A general view and brief description of the dimensions and main structural features of this large arch.

Reinforced Concrete Sea Wall Construction of Separately Molded Members.—Eng.-Contr., Aug. 24, 1910. 2 pages.

Describes the construction of sea walls of separately molded L-section wall blocks giving some costs and discusses the advantages of this type of construction. A suggestive article.

Methods of Employing Concrete in Marine Structures with Data on Durability of Concrete in Sea Water and Examples of Typical Marine Structures of Concrete.—Eng.-Contr., Aug. 31, 1910. 5 pages.

A general discussion [illegible] the use of concrete in marine structures chiefly valuable for the numerous illustrations given of sea walls, breakwaters, piers, etc.

A Tall Reinforced Concrete Bridge Pier.—Eng. Rec., Aug. 6, 1910. [illegible]

Pier described is 165 ft. high; the lower 72 ft. of which is solid concrete and the upper 93 feet of cellular construction of reinforced concrete. The structural features are summarized in some detail.

Reinforced Concrete Deck Dam, Pulaski, Va.—Eng. Rec., Aug. 6, 1910. ⅓ page.

Brief description of structure with some general costs.

German Standard Specifications for Delivery and Testing of Portland and Iron-Portland Cement.—Eng. News, Aug. 25, 1910. 1 page.

A reprint partly in abstract of the standard specifications of the American Portland Cement manufacturers.

Methods for the Computation of Reinforced Concrete Flat Slabs.—Eng. News, Aug 25, 1910. 1⅓ pages.

A discussion of a method of computing reinforced concrete flat slabs and a comparison of results of this and other methods.

A Reinforced Concrete Pumping Cistern Sunk Into Place in the Ground.—Eng. News, Aug. 25, 1910. 1 page.

Illustrates structural details of circular cistern built by being sunk as an open caisson building up the walls as the sinking progressed.

The Effect of Alkali Water on Cement Mortars.—Eng. News, Aug. 18, 1910. 5/6 page.

Describes methods of constructing and gives results of tests on cement mortar briquettes both mixed with and cured in alkali water. The tests indicate rather more serious action than has usually been credited to alkali water.

Manufacture and Use of Slag Cement and Other Substitutes for Portland Cement.—Eng. Contr., Aug. 24, 1910. 1⅓ page.

A descriptive summary of the nature, char-

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acteristics and methods of manufacture of various hydraulic cementing compounds which may be used as substitutes for Portland cement.

Cement Stucco.—Conc. Age, August, 1910. 2 pages.

An article describing and illustrating the use of Portland cement stucco in making artistic effects.

Construction of the Barker Dam.—Cem. Era, August, 1910. 3½ pages.

A description of the construction of a dam 185 feet high and containing 140,000 cubic yards of cyclopean masonry, near Boulder, Colo.

Yacht Pier of Concrete Construction.—Cem. Era, August, 1910. 1½ pages.

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The Construction of a Reinforced Concrete Cathedral at Poti, Russia.—Conc. Eng., August, 1910. 5 pages.

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Concrete in Canal Work.—Conc. Eng., August, 1910. 2 pages.

Brief abstract of a review of the entire project of the New York State Barge Canal by the resident engineer in charge of tests. The abstract takes up the testing of materials, cyclopean concrete, and use of belt conveyors for carrying concrete.

Concrete Work on the Lachine Canal.—Contr., Aug. 1 and 15, 1910. 7 pages.

An article describing the extensive operations on the Lachine canal, Canada, taking up more particularly the construction of 5 miles of concrete wall under water, and a description of the plant and its operation in building the wall.

The Choice of Reinforcement.—Conc. & Cons. Eng., August, 1910. 9 pages.

The article, by a correspondent, is a discussion of the objections to the use of high carbon steel as a reinforcing material together with various other interesting information regarding the choice of reinforcement.

Combined Unit and Monolithic Method of Constructing a Reinforced Concrete Factory Building.—Cement, August, 1910. 6 pages.

A description of the construction of the plant comprising three buildings for the National Casket Co.

Sewage Disposal Works at Bushey.—Con. Engr., Aug. 25, 1910. 4 pages.

From a paper read by the author, Earnest E. Ryder, Surveyor, Bushey Urban District Council, before the Inst. of Municipal Engrs. at Bushey, a description of the 53,000 gal. sedimentation tank, percolating filters, and beds.

Cost of Concrete River Wall at Moline.—Contr., Aug. 1, 1910. 2 pages.

Being a description of the construction of the corewall of the Moline Pool Dam across the Mississippi at Moline, Ill. The work is being conducted by the government and a statement of costs to date is given.

Reinforced Concrete, Theory and Practice.—By Frederick Rings. D. Van Nostrand Co. New York; B. T. Botsford, London. Cloth; 5¼x8 ins.; 190 pp.; $2.50.

This book is essentially British in nomenclature and therefore not well suited to American readers. For example, the writer speaks of "breeze" instead of cinders, of "ballast" instead of broken stone, etc. Throughout the book there is evident a lack of familiarity with practical construction work and such familiarity with design that many important matters are overlooked. The book is a compilation, principally from publications distributed free of cost for advertising purposes. The lack of actual out-of-doors construction experience of the author is manifest in several places in contradictory statements, or rather in statements not in complete harmony. The author makes some broad statements about cement and does not display an intimate acquaintance with this material. An ingenious graphical calculator for designing slabs is placed in a pocket inside the back cover. In design the treatment is limited to slabs, beams, girders and columns.

Railroad Location Surveys and Estimates

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I	Principles of Engineering Economics	118
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III	Rock Excavation	87
IV	Roads and Streets	217
V	Stone Masonry	55
VI	Concrete	110
VII	Waterworks	161
VIII	Sewers	143
IX	Timberwork	124
X	Buildings	54
XI	Railways (Steam and Electric)	348
XII	Bridges	246
XIII	Steel Work (Not given in other sections)	29
XIV	Engineering and Surveys	34
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[illegible] grams to assist the designer. The symbols used [illegible] ters by the author is annoying to men accustomed to American authors. It is flattering to note the number of references to American au- [illegible] matter contained in the book and the manner of presentation the price is rather high.

EARTH AND ROCK EXCAVATION.

The Bergen Hill Stone Crushing Plant, Erie Railroad.—Eng. Rec., Aug. 13, 1910. 1 page.

Gives plans and describes construction and equipment of this crushing plant of 500 cu. yds. per day capacity. The striking device illustrated has particular interest.

A Large Steam Crane Excavator.—Eng. Rec., [illegible]

General description of steam crane excavator designed to excavate a space 60 ft. high and [illegible]

Two Months Record of Steam Operated $3\frac{5}{8}$ In. Percussion Drill in Quarrying for Crushed Stone.—[illegible]

Describes material and methods of operation and gives record of drill operation by days for two months, during which time over 1100 ft. of hole were drilled. Costs are given.

A Record of Blast Hole Drilling with a Well Drilling Machine.—Eng.-Contr., Aug. 3, 1910. [illegible] page.

This record covers 43 consecutive day's work during which 1,886 ft. of hole were drilled at an average cost of about 10½ cents per foot. Gang required and methods of operation are given.

A Novel Construction of Tunnel Intake.—Engr.-Contr., Aug. 10, 1910. 2 pages.

Illustrates and describes the design and construction of two intake tunnels for condenser water supply for two power plants.

Working Costs of Gold Dredging in California. Eng.-Contr., Aug. 10, 1910. ½ page.

Gives in tabular form working costs compiled from records of various dredging companies of dredges of different capacities. The costs are itemized with costs, and although given specifically for gold dredging are applicable gen- [illegible]

A Device for Making Subsurface Tests of the Bearing Power of Soils with Some Examples of Operation.—Eng.-Contr., Aug. 3, 1910. ⅔ page.

A notably interesting record of tests made on the bearing power of soils by means of a device which permits tests to be made at any reasonable depth below the surface. The testing ap- [illegible]

Hammer Drills for Overhead Stoping and Raising in Gold Mines.—Eng.-Contr., Aug. 17, 1910. 5/6 page.

Describes the construction of hammer drills, explains their operation, presents their advantages over piston drills and gives various general costs.

Sharpening and Tempering the Miner's Tools. [illegible]

A discussion of methods used in sharpening and tempering miner's tools with comments on their success and suggestions for improvement.

Construction Methods and Organization in Constructing the Buffalo Water Works Tunnel. [illegible]

This is a complete detailed account of the plant, gang organizations and methods employed in constructing rock tunnels under unusually troublesome conditions. Progress rec- [illegible]

Methods of Handling by Scows Some Four and One-Half Million Cubic Yards of Soil from

Excavation.—Eng.-Contr., Aug. 24, 1910. 1½ pages.

Illustrates loading wharf plant and describes methods of handling and keeping records of scow loads and gives some figures on costs of scow repairs.

Belt Conveyors for Handling Crushed Stone.—Eng. Rec., Aug. 6, 1910. 1 page.

General description of a belt conveyor plant for handling crushed stone from quarry to storage bins and to barges.

Handling Wet Clay on Chicago Canal.—Contr., Aug. 1, 1910. 3 pages.

An illustrated description of work on the north shore channel of the Chicago Drainage Canal, where wet clay hauled in small cars in skips is dumped by derricks. Costs are given.

MISCELLANEOUS.

Civil Service Efficiency System, Chicago.—Eng. Rec., Aug. 20, 1910. 2⅓ pages.

Describes the nature and operation of an efficiency recording system recently adopted by the Civil Service Commission of the city of Chicago.

The Operation of the Seattle Refuse Destructor.—Eng. Rec., Aug. 13, 1910. 1⅔ pages.

Describes refuse handled and methods of operation and presents data covering operating results for 26 months. This article is valuable for the useful data contained.

A Method of Indexing Engineering Information.—Eng. Rec., Aug. 13, 1910. 1⅓ pages.

Describes method employed for indexing published articles and items; a system simple and suitable for the individual practitioner.

Underground Duct Construction.—Eng. Rec., Aug. 27, 1910. 1⅓ pages.

A paper reviewing present practice in underground duct construction and presenting suggestions for improvements. Some general costs are given.

The Necessity for Standardizing Contracts of the City of New York.—Eng.-Contr., Aug. 3, 1910. 1 page.

A general argument on the necessity of standard contracts and outlining what the provisions of such contracts should be.

Increased Cost of Construction Due to Increased Wages and Decreased Efficiency.—Eng.-Contg., Aug. 10, 1910. 2½ pages.

Presents the opinions based on their records of a number of contractors as to the increase in cost of wages and prices of material and the decrease in the efficiency of labor during the last five years.

Method of Keeping Fall Block on a Derrick from Twisting and Swinging.—Eng.-Contr., Aug. 10, 1910. ¼ page.

Illustrates and describes a simple device used for the purpose named.

Traction Plowing Outfits—Operating Methods and Costs.—Eng.-Contr., Aug. 24, 1910. 4¼ pages.

Valuable for the directions given for maintaining and operating traction engines and for the general data on operating costs and repair costs.

Specifications for Determining Cost of Garbage Incineration.—Eng.-Contr., Aug. 24, 1910. 1⅔ pages.

Extracts from the specifications governing the construction of two large refuse incinerating plants at San Francisco.

An Act to Amend the Labor Law in Relation to Workmen's Compensation in Certain Dangerous Employments in New York—Eng.-Contr., Aug. 31, 1910. 2 pages.

A reprint of the law which became operative in New York state on Sept. 1, 1910, providing for the insurance by the employers of workmen engaged in certain occupations classed as dangerous.

Draft of a Suggested Law Licensing of Land Surveyors. Eng [illegible] pages.

A suggested form for an act regulating the work of surveyors.

Disposal Methods for Manufactural Wastes. [illegible] Rec., Aug. 27, 191[illegible] [illegible] page.

A review of the various methods employed to dispose of trade wastes of various natures.

Cost Keeping and Management Engineering

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Municipal Disinfecting Station at Westminster, England.—Eng. News, Aug. 25, 1910. ⅔ page.

Gives plan of and describes briefly a municipal plant for disinfecting clothing and household articles possibly infected by use where communicable diseases have existed.

Field and Office Methods in a Triangularion and Plane-Table Survey of the Ducktown Copper Mining District.—Eng. News, Aug. 18, 1910. 1⅔ pages.

A general description of the [illegible] followed and instruments used. Plans are given of a drawing table with roller arrangement for handling large maps.

The Library of the New York Public Service Commission, First District.—Eng.-Contr., Aug. 31, 1910. 1⅓ pages.

A general description of the organization of the library named.

Disposal of City Refuse.—Con. Engr., Aug. 25, 1910. 6 pages.

An excellent article taking up a discussion of what to do with garbage in growing towns and further describing very clearly the methods of disposal of garbage by incineration. Illustrations are given of some of the plants and methods described, the descriptions being given for both high and low temperature furnaces. The article devotes its greatest space, however, to a description of the high temperature incineration in a continuous grate furnace of recent design, operating at the city of Westmount.

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The purposes of the Monthly Review Index are: First, to inform civil engineers and contractors of the articles and papers of merit that are published each month, in such a way as will give a clear idea of their character and scope; second, to supply the user with the date and place of publication, the length of each article and the cost at which it can be secured. The name, adopted abbreviations, place of publication and price per number of each periodical examined for civil engineering articles are given in the list immediately following. The other information is given in the index proper for each article separately.

Books reviewed will be sent post paid on receipt of price by the Book Department of ENGINEERING-CONTRACTING; periodicals, etc., containing articles indexed should be ordered direct from the publishers.

LIST OF PERIODICALS INDEXED.

American Architect (Am. Arch.), New York, N. Y.; w; 7x10 in.; 15 cts.
American Builders' Review (Am. Bldrs. Rev.), San Francisco, Cal.; m; 7x10 in.; 50 cts.
American Carpenter and Builder (Am. Car. & Bldr.), Chicago, Ill.; New York, N. Y.; m; 7x10 in., 20 cts.
American Engineer and R. R. Journal (Am. Engr. & R. R. Jl.); York, N. Y.; m; 7x10 in.; 20 cts.
American Gas Light Journal (Am. G. L. Jl.), New York, N. Y.; w; 10x13 in.; 10 cts.
American Institute of Electrical Engineers Proceedings (Am. I. of E. E. Proc.), New York, N. Y.; m; 4x7 in.; 50 cts.
American Machinist (Am. Mchst.), New York; w; 7x10 in.; 15 cts.
American Society of Civil Engineers Proceedings (Am. Soc. C. E. Proc.), New York, N. Y.; m; 4x7 in.; 75 cts.
American Society of Mechanical Engineers Journal (Am. Soc. M. E. Jl.), New York, N. Y.; m; 4x7 in., $1.
Annales des Ponts et Chaussees (An. P. & C.), Paris, France; m.
Applied Science, Toronto, Ont.; m; 6x9 in.; 20 cts.
Architects and Builders' Journal (Arch. & Bldrs. Jl.), Baltimore, Md.; m; 9x12 in.; 20 cts.
Architects and Builders' Magazine (Arch. & Bldrs. Mag.), New York, N. Y.; m; 5x8 in.; 20 cts.
Architect and Engineer of California (Arch. & Engr.), San Francisco, Cal.; m; 5x7 in.; 15 cts.
California Journal of Technology (Cal. Jl. of Tech.), Berkeley, Cal.; m; 4x7 in.; 25 cts.
Canadian Architect (Can. Arch.), Toronto, Ont.; m; 7x19 in.; 20 cts.
Canadian Cement and Concrete Review (Can. Cem. & Conc. Rev.), Toronto, Ont.
Canadian Engineer (Can. Engr.), Toronto, Ont.; w; 7x11 in.; 20 cts.
Canadian Machinery and Manufacturing News (Can. Mach. & Mfg. News), Toronto, Ont.; m; 7x10 in.; 15 cts.
Canadian Mining Journal (Can. Min. Jl.), Toronto, Ont.; bi-w; 7x10 in.; 20 cts.
Canadian Municipal Journal (Can. Mun. Jl.), Montreal, Que.; m; 6¾x10 in.; 10 cts.
Canadian Society of Civil Engineers Proceedings (Can. Soc. C. E. Proc.), Montreal; m; 4x7 in.; 50 cts.
Carpentry and Building (Carp. & Bldg.), New York, N. Y.; m; 11x8 in.; 10 cts.
Cassier's Magazine (Cas. Mag.), New York; m; 5x8 in.; 25 cts.
Cement, New York, N. Y.; bi-m; 5x8 in.; 25 cts.
Cement Age (Cem. Age), New York, N. Y.; m; 4¾x8 in.; 15 cts.
Cement and Engineering News (Cem. & Eng. News), Chicago, Ill.; 7x10 in.; 25 cts.
Cement Era (Cem. Era), Chicago, Ill.; m; 7x10 in.; 10 cts.
Cement Record (Cem. Rec.), Kansas City, Mo.; m; 4¾x8 in.; 15 cts.
Cement World (Cem. Wld.), Chicago, Ill.; m; 9x11 in.; 10 cts.
Chemical Engineer (Chem. Engr.), Chicago, Ill.; m; 4x7 in.; 15 cts.
Clay Worker (Cl. Wkr.), Indianapolis, Ind.; m; 7x10 in.; 20 cts.
Compressed Air (Comp. Air), New York, N. Y.; m; 5x7 in.; 10 cts.
Concrete, Detroit, Mich.; m; 6x9 in.; 15 cts.
Concrete Age (Conc. Age), Atlanta, Ga.; m; 9x11 in.; 10 cts.
Concrete and Constructional Engineering (Conc. & Cons. Eng.). London, England; m; 5x7 in.; 25 cts.
Concrete Engineering (Conc. Eng.), Cleveland, O.; m; 7x10 in.; 10 cts.
Contractor (Contr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Cornell Civil Engineer (Cor. Civ. Engr.), Ithaca, N. Y.; m; 4x7 in.; 25 cts.
Domestic Engineering (Dom. Engr.), Chicago, Ill.; w; 6x9 in.; 10 cts.
Electrical Age (Elec. Age), New York, N. Y.; m; 7x10 in.; 10 cts.
Electrical Review (Elec. Rev.), New York, N. Y.; 8x10 in.; 10 cts.
Electric Railway Journal (Elec. Ry. Jl.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electrical World (Elec. Wld.), New York, N. Y.; w; 7x10 in.; 10 cts.
Electric Traction Weekly (Elec. Trac. Wkly.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Engineer (Engr. Lon.), London, England; w; 4x11 in.
Engineer (Engr.), Chicago, Ill.; bi-w; 7x10 in.; 20 cts.
Engineering (Eng.), London, England; w; 8x11 in.
Engineering-Contracting (Eng.-Contg.), Chicago; w; [illegible]
Engineering Digest (Eng. Dig.), New York; m; 5x8 in.; [illegible]
Engineering and Mining Journal (Eng. & Min. Jl.), New York; [illegible]
Engineering Magazine (Eng. Mag.), New York; m; [illegible] 7x10 in.; 15 cts.
Engineering News (Eng. News), New York; w; 8x11 in.; [illegible]
Engineering Record (Eng. Rec.), New York; w; 8x11 in.; [illegible]
Engineers' Club of Philadelphia Proceedings (Engr.'s Club, Phila. Proc.), Philadelphia; qr; 4x7 in.; 25 cts.
Fire and Water Engineering (F. & W. Eng.), New York, N. Y.; 8x11 in.; 10 cts.
Le Genie Civil, Paris, France; w.
Good Roads Magazine (Gd. Rds. Mag.), New York, N. Y.; m; 7x10 in.; 10 cts.
Industrial Magazine (Ind. Mag.), Cleveland, O.; m; 4x7 in.; 10 cts.
Industrial World (Ind. Wld.), Pittsburg, Pa.; w; 7x10 in.; 10 cts.
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Iron Trade Review (Iron T. Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Irrigation Age (Irr. Age), Chicago, Ill.; m; 7x9 in.; 10 cts.
Journal Association of Engineering Societies (Jl. Assoc. Engr. Soc.), Boston, Mass.; m; 4x7 in.; 30 cts.
Journal Franklin Institute (Jl. Frank. Inst.), Philadelphia, Pa.; m; 4x7 in.; 50 cts.
Journal New England Waterworks Association (Jl. N. E. W. W. Assoc.), Boston, Mass.; q; 4x7 in.
Journal Western Society of Engineers (Jl. W. Soc. Engrs.), Chicago, Ill.; bi-m; 4x7 in.; 50 cts.
Journal of Electricity, Power and Gas (Jl. Elec., P. & G.), San Francisco, Cal.; w; 7x10 in.; 10 cts.
Journal of Worcester Polytechnic Institute (Jl. W. P. I.); m; 4x7 in.; 20 cts.
Machinery, New York, N. Y.; m; 7x11 in.; 20 cts.
Marine Review (Marine Rev.), Cleveland, O.; w; 7x10 in.; 15 cts.
Mines and Minerals (Mi. & Mls.), Scranton, Pa.; w; 7x9 in.; 20 cts.
Mining and Scientific Press (Min. & Sci. P.), San Francisco, Cal.; w; 7x11 in.; 15 cts.
Mining Reporter (Min. Rep.), Denver, Colo.; w; 7x10 in.; 15 cts.
Mining World (Min. Wld.), Chicago, Ill.; w; 7x10 in.; 10 cts.
Modern Machinery (Mod. Mchy.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Municipal Journal and Engineer (Mun. Jl. & Eng.), New York, N. Y.; w; 7x10 in.; 10 cts.
Municipal Engineering Magazine (Mun. Eng. Mag.), Indianapolis, Ind.; m; 4x7 ins.; 25 cts.
Ores and Metals (O. & M.), Denver, Colo.; bi-w; 6x10 in.; 10 cts.
Pacific Building Engineer (Pac. Bldg. Engr.), Seattle, Wash.; w; 9x11 in.; 15 cts.
Popular Mechanics (Pop. Mech.), Chicago, Ill.; m; 5x7 in.; 10 cts.
Power and Engineer (Pwr. & Engr.), New York; m; 7x10 in.; 20 cts.
Railway Age-Gazette (R. R. Age-Gaz.), New York; w; 8x11 in.; 15 cts.
Railway Master Mechanic (Ry. M. M.), Chicago; m; 7x10 in.; 10 cts.
Railway and Engineering Review (Ry. & Eng. Rev.), Chicago, Ill.; w; 9x11 in.; 10 cts.
Railway and Locomotive Engineering (Ry. & Loco. Eng.), New York, N. Y.; m; 7x10 in.; 20 cts.
Railway and Marine World (Ry. & M. Wld.), Toronto, Ont.; m; 7x10 in.; 15 cts.
Railway Engineering and Maintenance of Way (Ry. Eng. & M. W.), Chicago, Ill.; m; 7x10 in.; 10 cts.
Roadmaster and Foreman (Rd. & For.), Chicago; 7x10 in.; 10 cts.
Rock Products (Rk. Prod.), Chicago, Ill.; bi-w; 9x11 in.; 10 cts.
Rose Technic, Terre Haute, Ind.; m; 4x7 in.; 15 cts.
School of Mines Quarterly (Sch. Min. Quart.), New York, N. Y.; qr; 4x7 in.; 50 cts.
Schweizerische Bauzeitung, Zurich; w.
Scientific American (Sci. Am.), New York; w; 9x14 in.; 10 cts.
Scientific American Supplement (Sci. Am. Sup.), New York, N. Y.; w; [illegible]
Sibley Journal of Engineering (Sib. Jl. Eng.), Ithaca, N. Y.; m; 4x7 in.; 20 cts.
Stevens Institute Indicator (Stev. Inst. Ind.), Hoboken, N. J.; m; 4x7 in.; 20 cts.
Street Railway Bulletin (St. Ry. Bul.), Boston; m; 6x10 in.; 10 cts.
Surveyor (Surveyor), London, England; w; 6x11 in.; 10 cts.
Technology Quarterly (Tech. Qr.), Boston; qr; 4x6 in.; 35 cts.
The Polytechnic (Poly.), Troy, N. Y.; m; 5x8 in.; 15 cts.
U. S. Department of Agriculture Bulletin (Dept. Agr. Bul.) Washington, D. C.; 4x7 in.
U. S. Geological Survey Bulletin (Geo. Surv. Bul.), Washington, D. C.; 4x7 in.
Zeitschrift d. Oest, Ing. u. Arch. Ver., Vienna; w.
Zeitschrift d. Ver Deutscher Ing.; Berlin; w.

ROADS AND STREETS.

Bituminous Road Work in Germany. Eng. Rec. Sept. 17, 1910. 2 pages.

A summary of the status of bituminous road construction in Germany. Interesting for giving design, practice and experience.

The Maintenance of Roads. By John M. Lynch. Norwegian. Sept. 9, 16, 23; 7 pages.

This article deals with the causes of wear, both in the surface and in the under part of the road coating and discusses the methods by which road repairs are best executed.

The Question of Traffic Statistics. Surveyor, Sept. 16, 1910. 1 page.

Contains a copy of the form recommended by the English Road Board for use in the taking of a traffic census.

Bituminous Roads Mixed and Poured. By George C. Warren. Min. Eng. Mag., Sept. 1910; 3 pages.

Discusses the advantages and disadvantages of bituminous road construction by the mixing and pouring methods, and also compares hand mixing and machine mixing.

Selection of Material and Method of Street Paving. Eng.-Contr., Sept. 28, 1910. 1⅔ pages.

Discusses the characteristics which are required in the different kinds of road material. Tables of cost are given.

Some Notes on the Drainage of Country Roads. Eng.-Contr., Sept. 21, 1910, 1⅓ pages.

An interesting general article on the methods employed in draining country roads. Illustrations are shown of several forms of drain construction.

Work Preliminary to Road Construction and Street Pavement Maintenance. Eng.-Contr., Sept. 28, 1910, 1⅔ pages.

An argument pointing out the importance of the preliminary work in road construction and describes the characteristics which such preliminary construction should have for successful road building.

A Study Into the High Cost of Asphalt Pavement Repairs in Chicago in 1908-09. Eng.-Contr. Sept. 21, 1910. 4 pages.

A report discussing the cost of asphalt pavement repairs by contract in the city named.

The Use of Binding Materials in the Construction of Macadamized Roadways. Eng.-Contr., Sept. 7, 1910. 2⅔ pages.

A general discussion of the use of bituminous cements in the construction of macadam roads. The requirements demanded of cemented materials are stated and the two general methods of applying them are described and discussed.

Notes on Road and Street Work. Eng.-Contr. Sept. 7, 1910. 1 page.

A series of notes on steam rolling of roads. A portable hose flushing rig, cost of working a road metal quarry, width of tire and road resistance, and size of broken stone for road processes.

Construction and Maintenance of Parkway Roads. Eng.-Contr. Sept. 7, 1910. 1 page.

A general description of the methods employed in constructing and maintaining the roads of the Metropolitan Park system of Boston, Mass.

Street Cleaning and Watering in Twenty Great Towns of the United States. Eng.-Contr., Sept. 7, 1910. 1½ pages.

A summary of the methods employed in a number of English cities in cleaning and sprinkling streets.

Bituminous Road Construction. Con. Engr., Sept. 29, 1910. 1½ pages.

Extractions from a paper read by Geo. C. Warren before the International Road Congress and other various opinions as to the quality, durability and methods of constructing roads of the above class.

Construction and Maintenance of Parkway Roads. By John R. [illegible] Con. Engr., [illegible] 1910. 2 pages.

Gravel surfaced roads as being better for horse driving, less affected by automobiles and more easily repaired than macadam. Surface treated with asphaltic oil.

SEWERS.

Annual Congress of the Royal Sanitary Institute. Surveyor, Sept. 9, 1910. 8 pages.

An account of the Annual Congress of the Royal Sanitary Institute of Great Britain. The account contains the Presidential address of Philip H. Palmer, the Inst. C. E., and the following papers which were presented at Conference of Engineers and Surveyors in connection with the Congress: "The Development and Road Improvement Act, 1909 (From a Sanitary Review)," by Reginald Brown; "Town Planning Procedure Regulations (England and Wales)," by F. S. Fremantles; "Economy in Water Supply," by Henry Rofe; "The Sterilization of Water and Sewage Effluents," by H. C. H. Shenton. In this last named paper the author suggests that sterilization should be limited to the removal of harmful organisms, and that the removal of organic matters should be effected by other means.

Drainage Improvements at Syracuse. Mun. Jl. and Eng., Sept. 7, 1910. 6½ pages.

A general description of the work being done in constructing an intercepting sewer for the city of Syracuse, N. Y. The sewer is of a modified horse shoe shape and is being constructed of concrete. The article is accompanied by numerous illustrations showing the plan of the outlet chamber, sections of the sewer, and the work in progress.

The Sewage Question and Treatment of Trade Effluents.—By John D. Watson. Surveyor, Sept. 16, 1910. 2 pages.

A paper read before the Royal Sanitary Institute of Great Britain. In it the author discusses various phases of the question and cites a number of acts of Parliament for the prevention of the pollution of streams.

Sewage Disposal Under Difficulties at Leicester, England.—Eng. News., Sept. 22, 1910. 1⅓ pages.

Describes the special difficulties which confront sewage disposal in the city named and presents the methods which have been devised to solve these difficulties.

Economy in Sewage Disposal.—By C. Chambers Smith. Surveyor, Sept. 23, 1910. 2 pages.

The author discusses and compares from the standpoint of economy, various methods of sewage disposal. He states that experience has shown that the cost of treatment by sedimentation tanks and percolating filters is less than in contact beds. Some figures showing the cost of complete treatment by contact beds and percolating filters are given.

An Unusual Sewer. Outlet Structure.—Con. Eng., Sept. 8, 1910. 1½ pages.

A description of the outlet structure for the Southern Outfall Sewer at Louisville, Kentucky. Also some drawings showing obstruction of Beargrass Creek, which materially prevented the flow in flood times.

Sewage Disposal in Saskatchewan.—By T. Aird Murray. Con.-Engr., Sept. 8, 1910. 1½ pages.

A paper read before the American Health Association indicating the questionable benefits of sewage purification by septic tanks, with outlines of schemes for sewage disposal in cold climates.

WATER-WORKS AND HYDRAULICS.

Hypochlorite Treatment of Public Water Supplies; Its Adaptability and Limitations.—Eng. Rec., Sept. 17, 1910. 3 pages.

A notably good critical review of the advantages and disadvantages of the method of water purification named.

Concrete-Lined Reservoirs in Seattle.—Eng. Rec., Sept. 24, 1910. 2⅓ pages.

Describes the general structural features and methods of construction of pure water works reservoirs with concrete lining. Of interest chiefly for the details shown of concrete lining construction.

Slow Sand Filters at Oakland Lake, Long Island, N. Y.—Eng. Rec., Sept. 24, 1910. ⅔

Describes the construction of a plant of five slow sand filters; gives plans and sections.

Water Pipe Tunnels in Milwaukee. Eng. Rec., Sept. 3, 1910. 1 page.

—Eng. Rec., Sept. 3, 1910. 2 pages.

Gives the premises employed in the valuation of the plant named and also the itemized figures of valuation in tabular form. A notably useful article.

The Scraping of Water Mains.—By M. Sellars, Surveyor, Sept. 2, 1910. 1½ pages.

Discusses the causes of the formation of rust nodules in water mains, and describes methods of removing the incrustation. The use of a scraper driven by water pressure is described in some detail.

Removing Iron From Water.—By Churchill Hungerford. Mun. Jl. and Eng., Sept. 7, 1910. 1½ pages.

Describes the method of treating well water at Fort Hancock, N. J. Calcium hydrate and filtration were adopted for the treatment. An attempt to use aeration having proved unsuccessful.

The Influence of Underground Water on Health.—By Baldwin Latham. Surveyor, Sept. 16, 1910. 2½ pages.

A paper dealing with the question of the influence of the level of underground water in effecting the health of a community. The paper was read before the Royal Sanitary Institute of Great Britain.

Hypochlorite Disinfection.—Mun. Jl. and Eng., Sept. 21, 1910. 2½ pages.

A synopsis of the present practice and knowledge concerning the treatment of public water supplies by bleaching powder and other hypochlorites. The matter is taken from a paper by Geo. A. Johnson, presented at the recent convention of the American Public Health Association, at Milwaukee.

The Water Purification Plant of the Chicago Stock Yards.—Eng. News., Sept. 8, 1910. 1 page.

A brief presentation of both sides of the dispute between the city of Chicago and the stockyards company, regarding the use of the water from this plant for household purposes.

Results of Double Filtration Experiments at Albany.—Eng. Rec., Sept. 3 and 10, 1910. 4⅔ pages.

A summary of the experiments made to determine the efficiency of pre-filtration of water in conjunction with a slow sand filtration plant.

Sterilization of Polluted Water By Ultra-Violet Rays.—Eng. News, Sept. 15, 1910. 5/6 page.

Describes the apparatus used and the methods being employed at the laboratories of the Sorbonne in Russia, to determine the possibility of employing the sterilizing effect of ultraviolet rays for the purification of water.

Progress on the Toronto Filtration Plant.—Contract Rec., Sept. 28, 1910. 1½ pages.

The fourth article of a special series in the description of the details of the plant and the methods employed in carrying on the work. Illustrated with views of the construction work.

Modern Filter Plants.—By Langdon Pearse. Con. Engr., Sept. 22, 1910. 3 pages.

Illustrated description of typical modern mechanical or rapid filter type and of the slow sand type of filter plant.

Fort William Water Supply.—Con. Engr., Sept. 5, 1910. 1½ pages.

A history of the struggles to obtain a water supply and a short description of the new supply from a lake six miles from the city.

DRAINAGE AND IRRIGATION.

Irrigation By Pumping on the Patterson Ranch.—Eng. Rec., Sept. 10, 1910. 2⅓ pages.

General description of pumping plant and canals for irrigating an 18,000-acre tract. Some notes are given on concrete canal lining.

Rolling Dams for Irrigation in Mexico.—Eng.

Gives general plans and describes the construction of water pipe tunnels under the Milwaukee River.

Operating Results of the Bubble Creek Filter Plant, Chicago.—Eng. Rec., Sept. 24, 1910. 2⅔ pages.

An interesting article discribing the operation and giving in tabular form and by diagrams, the operating results of the [illegible] filtration plant.

Valuation of the Fond du Lac Water-Works. Rec., Sept. 10, 1910. 1 page.

General description with illustrations of dam consisting of steel cylinder which rolls up and down inclined abutments, thus opening or closing waterway.

The Reclamation of Low Lands Near Stockton, California.—Eng. Rec., Sept. 3, 1910. 1 page.

Describes the general plan of drainage ditches and levers and pumping works for draining some 150,000 acres near the city named. Some of the ditching machinery is described.

The Ancient Irrigation and Water-Supply Tanks or Reservoirs of Ceylon.—Eng. News., Sept. 22, 1910. 5 1/6 pages.

A popular historical account of ancient Indian irrigation works, by an engineer formerly of the Indian public works department. Rather a popular theme, a technical article, but interesting.

Methods and Cost of Constructing an Irrigation Conduit of Separately Molded Half-Rings of Reinforced Concrete.—Eng.-Contr., Sept. 7, 1910. 4 pages.

Describes a novel construction employed in building an irrigation canal. Reinforced concrete half-cylinders are molded separately and used to line the canal. The method of molding metal and connecting at these cylinders is described and some general figures of cost are given.

Construction of the Barker Irrigation Dam.—Com. Wld., Sept., 1910. 5 pages.

A description of the construction of the Barber dam, 185 feet high, containing 140,000 yards of cyclopian concrete, for the Eastern Colorado Power Co., near Boulder, Colo. Illustrated.

RIVERS, HARBORS AND CANALS.

Floats For Studying Tides.—Mun. Jl. and Eng. Sept. 7, 1910. 2 pages.

A description of the kinds of floats used by the Metropolitan Sewerage Commission of New York in its studies of the tides and currents in the harbor and adjacent waters.

Costs of Building a Timber Pleasure Pier on Pile Bends.—Eng.-Contr., Sept. 28, 1910. 1½ pages.

Describes the construction of a small timber trestle recreation pier under unusual conditions and gives the cost of the work.

RAILWAYS.

Tri-Borough Subway and Elevated System, New York City.—Eng. Rec., Sept. 10, 1910. 1 1/6 pages.

Illustrates and describes routes of the new lines of rapid transit railway and explains method of letting contracts for construction and operations.

Two Concrete Locomotive Coaling Stations.—Eng. Rec., Sept. 3, 1910. 2⅓ pages.

Describes and illustrates the structural features and the machinery equipment of two coaling stations. A notably good article on this type of structure.

Recent Improvements of the Oregon & Washington Railroad.—Eng. Rec., Sept. 24, 1910. 1 page.

Describes the yard and terminal station construction at Seattle, Wash., with details of high reinforced concrete retaining walls.

Rapid Transit Problems.—Mun. Jl. and Eng., Sept. 7, 1910. 1 pages.

An abstract of the report of Bion J. Arnold on the rapid transit problems of Pittsburg, Pa.

An Economic Comparison of Railway Ties of Different Materials.—Eng. News., Sept. 22, 1910. 1⅔ pages.

Describes methods of determining the most economical railway ties to use, with comparative value tables, formulas and diagrams.

The Strengthening of Railway Track For High-Speed Traffic.—Eng. News., Sept. 8, 1910. 1 page.

Gives brief abstracts of four of the papers on this subject before the International Railway Congress.

Operating and Maintenance Costs of Locomotive Coal and Ash Handling Stations. Eng. News, Sept. 8, 1910. 1 [illegible]

Gives a number of cost data collected by the author and outlines with illustrations of record blanks [illegible] for the purpose named.

Valuation of the Track of the Detroit Street Railway System.—Eng. News, Sept. 8, 1910. 1 page.

Describes the premises in the Barcraft valuation of Michigan in the Detroit street railway appraisal and gives tables showing prices used and examples of track values.

Improvements and Experiments in Rail Joints. Eng. News, Sept. 15, 1910. 1½ pages.

Gives abstracts of four papers on the subject, which were presented at the International Railway Congress at Brussels.

Inaugural of the New York Extension of the Pennsylvania Railroad: Opening of the Passenger Station.—Eng. News, Sept. 15, 1910. 8 1/6 pages.

A good general descriptive article on the station, yard and tunnel work making up the terminal named. Maps and views are presented.

Methods of Conducting the Valuation of the Physical Properties of the Chicago Consolidated Traction Co., With Summaries of Costs.—Eng.-Contr., Sept. 28, 1910. 2 1/6 pages.

A somewhat detailed summary of the valuation figures obtained in appraising 123 miles of street railway track in the city of Chicago.

Valuation of Two Street Railway Power Plants. Eng.-Contr., Sept. 28, 1910. 1⅔ pages.

Gives the main structural features and complete valuation figures for the machinery equipment of two street railway power plants.

Cost of Cleaning Weeds and Grass From Track.—Eng.-Contr., Sept. 7, 1910. ¼ page.

A brief record of actual costs of removing weeds from railway track.

Two Records of Cost of Railway Track Reconstruction. Eng.-Contr., Sept. 7, 1910. ¼ page.

Gives the costs obtained in reconstructing two sections of railway track.

Fifth Ave. Retaining Wall, Oregon and Wash. R. R., Seattle.—R. R. Age.-Gaz., Sept. 16, 1910. 2 pages.

This is a short description showing plans of a retaining wall of reinforced concrete to be built in connection with the new passenger station of the Oregon & Washington Ry., in Seattle.

Railway Signaling.—By J. A. Whyte. Con.-Engr., Sept. 15, 1910. 1½ pages.

A description of the Manuel Block System, the Controlled Manuel Block and the Automatic Block Systems, with notes on the manufacture and the use of the systems in England and America.

Philippine Railway Co.'s Lines.—R. R. Age-Gaz., Sept. 30, 1910. 3 pages.

A general description and survey of the lines of this company, built on the islands of Cebu, Panay and Negroes, about 100 miles on each. With photographs showing the standard bridges, stations, and methods of construction.

Strengthening Old Trestles on the Wabash Railroad.—R. R. Age-Gaz., Sept. [illegible], 1910. [illegible] pages.

A description of tests to determine the value of reinforcing the steel column supports of girder bridges [illegible] Wabash Railroad. Diagrams and drawings showing the results of the tests, and the materials tested are given, together with photographs illustrating the methods used in encasing the columns of the St. Charles bridge.

Steel Transmission Towers.—By J. Edw. Jennings. [illegible]

Problems confronting an engineer in the design of towers for high tension power transmission lines. Descriptions of tests, shop work [illegible] Illustrated.

Railway Development in Canada.—By R. A. [illegible] page.

A number of articles tracing briefly the beginning [illegible] of Canada.

BOOKS

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Railway Transition Spiral. Talbot [illegible]
Railroad Curve Tables. Henderson [illegible]
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Design of Typical Steel Railway Bridges. Thompson 2.00
History of the Slide Rule. [illegible]
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Grading Work on the C. N. O. Ry. Toronto-Ottawa Line.—Con.-Engr., Sept. 15, 1910. 2¼ pages.

Notes on the construction of a line in the Province of Ontario with various illustrations showing the methods of handling the grading work. Also describes the use of straw ticks used successfully to keep concrete above freezing temperature.

A Modern Locomotive Repair Shop.—Con. Engr., Sept. 15, 1910. 3½ pages.

A description of a shop for a division, to care for the general repairs of ten or twelve locomotives. List of men employed. Illustrated with plans.

Progress of Locomotive Construction. By Lacey R. Johnson. Con.-Engr., Sept. 15, 1910. 5 pages.

History of the locomotive on Canadian Railroads. Illustrated.

Promotion of Interurban and Branch Railways.—By J. Stanley Richmond. Con.-Engr., Sept. 15, 1910. 2½ pages.

A general article showing the progress and evolution of principles and regulations for interurban railways.

The Electrification of Steam Roads.—By R. R. Kiely. Con.-Engr., Sept. 15, 1910. 6½ pages.

A discussion of the advantages of electrification, and of the choice of a system. Tables showing the names of railways using different systems in Europe and America.

BRIDGES, BUILDINGS AND FOUNDATIONS.

Standard I-Beam Railroad Bridges Over City Streets. Eng. Rec., Sept. 17, 1910. ¾ page.

Illustrates and describes essential structural features of standard bridges over city streets, for New York Central & Hudson River R. R.

Removal of Wrecked Superstructure, Quebec Bridge.—Eng. Rec., Sept. 17, 1910. 1½ pages.

Describes various means being employed to cut apart and remove the wrecked steelwork.

Improving a Granite Viaduct, Boston & Providence Railroad.—Eng. Rec., Sept. 10, 1910. 2 pages.

Illustrates and describes method of repairing a masonry arch bridge by strengthening arches of reinforced concrete.

Replacing the Otterkill Bridge Lehigh & Hudson River Ry.—Eng. Rec., Sept. 24, 1910. ½ page.

Illustrates and describes method and plan employed in replacing a truss span within plate girders.

The Plant For Constructing the Quebec Bridge Substructure.—Eng. Rec., Sept. 24, 1910. 2 pages.

General description of the new Quebec bridge pier and foundation work and, particularly, of the plant for construction work. Sketches of plant layouts are given.

Structural Steel Details in the Wick Building, Youngstown.—Eng. Rec., Sept. 24, 1910. 2 pages.

Describes and illustrates the typical structural steel work details of the 12-story building named.

The Reconstruction of the Quebec Bridge.—Eng. Rec., Sept. 10, 1910. 1½ page.

Illustrates diagram plan of new bridge with a historical account of the work and a description of the new bridge.

Steel Substructure, Pennsylvania Terminal Post Office.—Eng. Rec., Sept. 10, 1910. 3⅔ pages.

General description with drawings of details of heavy steel girder and column work. Drawings are chiefly of value.

Protection Sheds Over Sidewalks.—Eng. Rec., Sept. 3, 1910. ½ page.

Gives requirements of the New York City Building Department for the design and construction of protection sheds over sidewalks. An article of interest to building contractors.

Construction of the Whitehall Building Extension.—Eng. Rec., Sept. 3, 1910. 1½ page.

General description of the structural [illegible] and method of construction of a [illegible] building.

"Text Book on Graphic Statics"

By C. W. MALCOLM,

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This text was prepared for the author's students in elementary Graphic Statics and Stresses. It has not been the object of the writer to discover new principles, but rather to present the subject clearly and logically. Many texts on Graphic Statics are open to the criticism that they have a tendency to state principles and give constructions without proofs, and the student is therefore compelled to memorize propositions and constructions without being taught the underlying principles. It has been the aim of the writer to give the proofs, together with full explanations of the constructions. No attempt has been made to give elaborate solutions which have little or no pracical applications. Particular attention has been given to the order of presentation; and the text has been divided into chapters, articles and numbered sections to facilitate easy reference.

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Typical Compression Members in Long Span Bridges.—Eng. Rec., Sept [illegible] 1910. 1⅓ pages.

Compares the compression members in a number of long span bridges under the headings of general design, working stresses, equivalent total, and mean working stresses, and sectional areas. A notably interesting article.

A Steel and Reinforced Concrete Grand Stand.—Eng. Rec., Sept. 3, 1910. 1⅔ pages.

Describes and illustrates the main structural features of a large grand stand for the American league base ball park at Chicago.

Recent Howe Truss Railroad Bridges.—Eng. Rec., Sept. 3, 1910. ⅔ page.

Gives general plans for trusses and details of castings and forgings for recent Howe truss bridges used on the Chicago & Northwestern Ry.

Formulas for Use in Detailing Steel Structures.—Eng. News., Sept. 1, 1910. 3 pages.

Discusses methods and gives formulas for determining the angles required in detailing steel hoppers and towers and oblique bends in rivetted pipe. A notably valuable mathematical article.

The Erection of the Broad River Bridge.—Eng. Rec., Sept. 17, 1910. 2 pages.

General description with some useful illustrations of methods of erecting a 1,366-ft. viaduct.

Caissons for the Main Piers of the New Quebec Bridge; Launch of the North Pier Caisson. Eng. News, Sept. 8, 1910. 1¾ pages.

Illustrates the caissons for this new Quebec bridge and presents a general discription of caissons, rivers, etc. A diagram elevation of the new bridge superstructure is also given.

Method of Reconstructing a Building Foundation Undermined by Leakage from a Water Supply Tunnel Pierced by Foundation Piles.—Eng.-Contr., Sept. 21, 1910. 2¾ pages.

Describes the failure of a building foundation which had been constructed over the line of a water-works tunnel. The foundation piles had pierced the tunnel and caused leakage which had undermined the foundation structure. The article describes the methods employed in reconstructing the foundation and repairing the tunnel.

A Hand Operated Device for Cutting Off Submerged Piles to Uniform Level.—Eng.-Contr., Sept. 7, 1910. ⅔ page.

Describes a convenient hand operated device for cutting off piles and gives the cost of such work on an actual job.

Centering Collapse of Spokane Bridge.—Con. Eng., Sept., 1910. 1⅓ pages.

A description of the destruction of the timber center for a 281 span arch which was blown over by a wind storm.

Methods of Bridge Construction, Cedar Rapids.—Con. Wld., Sept., 1910. 6 pages.

A detailed description of a reinforced concrete arch bridge over the Cedar River at 16th Ave., with notes on the methods of construction. Illustrated with plans and photographs.

CONCRETE AND REINFORCED CONCRETE.

The Cement Mill of the Los Angeles Aqueduct. Eng. Rec., Sept 17, 1910. 1½ pages.

A general description of the equipment and operating methods of this municipal cement plant.

Concrete Lining of the Rondout Pressure Tunnel.—Eng. Rec., Sept. 17, 1910. 4⅔ pages.

Shows plans and views and describes methods of placing concrete. Interesting for drawings of forms and centers and special grouting machines.

The Christian Science Temple, Pasadena.—Eng. Rec., Sept. 17, 1910. [illegible]

Gives details of reinforced concrete dome construction, which are of interest.

Reinforced Concrete Water Tower at Westerly, R. I.—Eng. Rec., Sept [illegible] 1910. 1 page.

Describes the steel forms and erection tower and the methods of work employed in constructing the reinforced concrete standpipe named.

Notes on Drilling Holes in Concrete.—Eng Rec., Sept. 3, 1910. ⅔ page.

[illegible] in drilling holes in concrete for anchor bolts. Costs of drilling are given.

Constructing a Concrete Standpipe.—Min. Jl. and Eng. [illegible]

A [illegible] forced concrete standpipe at Westerly, R. I. The standpipe is 40 ft. inside diameter with 14 in. walls and is designed for a maximum depth of water of 70 ft. Steel forms and a movable steel staging were used in the construction work. The standpipe embodies several good features, both in design and construction methods.

The Equipment of the Cement Mill of the Portland Cement Company of Utah.—Eng. News, Sept. 8, 1910. [illegible]

A general description of the raw materials and their sources and of the plant equipment and processes employed at this new cement works. Of interest as an example of the latest cement mill practice.

A Three-Hinged Concrete Covering Over a Canal in Paris, France.—Eng. News, Sept. 15, 1910. 1 page.

Gives details and general description of a reinforced concrete three-hinged arch of 89-ft. space.

Methods and Cost of Placing Concrete in Long Wall by Chutes.—Eng.-Contr., Sept. 28, 1910. 1½ page.

Describes briefly a car mounted mixing plant employed in constructing concrete retaining walls along side railway track. Records of output and estimated cost are given.

Siphon Spillways New York State Barge Canal.—Eng.-Contr., Sept. 28, 1910. ⅓ page.

Illustrates and describes the structural features of one of the siphon spillways employed on the New York Barge Canal.

Method and Cost of Deepening and Lining a Creek Channel Under the Arch of a Canal Aqueduct.—Eng.-Contr., Sept. 7, 1910. 1 page.

Illustrates and describes the construction of a concrete lined stream channel under an arch

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aqueduct. Methods of work and costs are stated.

Notes on the Construction of a Reinforced Concrete Arch Bridge, With Some Costs.—Eng.-Contr., Sept. 7, 1910. 2½ pages.

A critical discussion of the general methods to be employed in constructing concrete arch bridges. A specific bridge is selected for illustration and the methods employed are explained in detail. An interesting article by a practical concrete bridge builder.

Steel Construction Towers for Concrete Work. Eng.-Contr., Sept. 7, 1910. ⅔ page.

Illustrates and describes the construction of a steel hoist tower used for concrete building construction. Detailed drawings of a special foot block for attaching the derrick boom to the steel tower are given.

Report of the Committee of the National Cement Users Association On the Treatment of Concrete Surfaces.—Eng.-Contr., Sept. 21, 1910. 3½ pages.

This article summarizes all the more common methods of finishing concrete surfaces. Each method is described and its effectiveness and adaptability are discussed. General costs are given. This is the most complete article ever published upon this feature of concrete work.

A Reinforced Concrete Cellular Approach Viaduct for a Railway Bridge.—Eng.-Contr., Sept. 21, 1910. 1 page.

Illustrates and describes briefly the construction of a cellular viaduct. Details of the forms used are shown.

Exterior Treatment of Concrete Surfaces; Committee Report to the National Association of Cement Users.—Eng. News., Sept. 15, 1910. 2½ pages.

An excellent summary of all the more common methods of finishing concrete surfaces with comments and discussion and general notes.

Method and Cost Wedging and Chiseling Out Concrete in Tunnel Lining.—Eng.-Contr., Sept. 14, 1910. 1/6 page.

Describes the method of cutting out some 28 cu. yds. of concrete by means of chiseling and gives general costs of the work.

Labor Cost of Laying 12,952 Sq. Ft. of 6-in. Concrete Basement Floor.—Eng.-Contr., Sept. 14, 1910. ¼ page.

A short article describing the method of laying a cement floor and giving costs of the work.

The Construction Methods on the Rocky River Bridge With Some Costs.—Eng.-Contr., Sept. 14, 1910. 6½ page.

A detailed description of the methods employed in constructing the large concrete arch bridge named. Drawings are given of the forms and centers and their construction, erection and moving are described. The method of placing the concrete is described in detail and figures of progress are given. Records of output and costs of work are scattered through the descriptive text. A notably good article on concrete bridge construction.

An Economical Method of Using a Movable Form for Long Concrete Walls, With Some Costs. Eng.-Contr., Sept. 21, 1910. 1½ pages.

Describes a notably interesting use of traveling forms for constructing concrete retaining wall. Methods of handling the forms and general costs of the work are given.

Construction Plant and Methods For Building an 85,000 Cu. Yd. Rubble Concrete Dam.—Eng.-Contr., Sept. 21, 1910. 2⅔ pages.

This article describes the general methods of construction for the structure named. A layout plan of the contractor's plant is shown and general methods of work are described. Some costs are given.

Method of Constructing Concrete Tunnel, in Open Cut, Pennsylvania Railroad.—Eng.-Contr., Sept. 14, 1910. 1⅔ pages.

Describes the structural features and general methods of constructing open cut concrete tunnels for the Pennsylvania railroad extension in New York City. Interesting drawings are given of the special traveling sidewall forms and centers used.

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Tension and Compression. By E. W. Hazel. Rk. Prod., Sept. 22, 1910. 4 pages.

The complete text of a paper with diagrams, etc., read before the American Society for testing materials.

Concrete Piles in Sewer Foundations.—Contr. Sept. 1, 1910. 2½ pages.

A description of the foundations of concrete piles put in for a stretch of concrete sewer located in marshy ground in Louisville, Ky.

Tacoma's High School Stadium of Concrete.—Con. Wld., Sept., 1910. 6½ pages.

A description of the construction of a stadium, the second in size in the United States, with various photographs and plans.

The formation of Cracks in Concrete Slabs and Their Prevention.—Cement, Sept., 1910. 3 pages.

Some notes for designing concrete slabs with calculations, with the object of introducing the reinforcement in proper manner to eliminate contraction cracks, which are sometimes observed running in a direction at right angles to that of the beams.

The Cement Industry in the United States.—By Ernest F. Burchard. Cement, Sept., 1910. 2 pages.

Statistical information showing the amount of cement produced in the United States during 1909, by the various plants, its geographical distribution and the fall in price for various years since 1880.

Concrete Work at Gatum Locks, Panama Canal.—Con. Age, Sept., 1910. 4 pages.

A short description of the locks at Gatum which will contain 2,300,000 cubic yards. Excellent recent photographs taken as late as July, 1910, are given.

Pioneer Reinforced Concrete Construction.—By Carlton Strong. Con. Age, Sept., 1910. 13 pages.

A story of the construction of the reinforced concrete Berkley Hotel in Buffalo, showing by this example of construction in 1894, the development of cement construction in this country.

Steel Construction Towers for Concrete Work. Con. Engr., Sept. 29, 1910. ½ page.

A short illustrated description of distributing tower for concrete used in Massachusetts by the Aberthaw Construction Co.

EARTH AND ROCK EXCAVATION.

Method of Jetting Down Concrete Piles and Records of Output.—Eng.-Contr., Sept. 14, 1910. 1 page.

Describes the method of sinking reinforced concrete piles by water jet. The jet was used to excavate the hole into which the pile was lowered and was not attached by derricks to the pile in sinking as is the usual method. General figures of cost are given.

East Side Levee and Sanitary District, East St. Louis.—Eng. Rec., Sept. 17, 1910. 1½ pages.

Gives ways of work and sections of levee with description of structural features.

Hauling With Traction Engines on the Los Angeles Aqueduct.—Eng. Rec., Sept. 3, 1910. 1½ pages.

Describes the special caterpillar traction engine used in some detail and gives performance records and hauling costs for these engines for one month.

Precautions for Maximum Safety and Effectiveness in Blasting.—Eng. News., Sept. 22, 1910. 2 2/3 pages.

A series of practical directions, rules and suggestions for handling and using explosives in blasting work.

The Hydraulic Giant and Dredge Plants for Excavating Some 7,800,000 Cu. Yds. on the Pacific Division of the Panama Canal.—Eng.-Contr., Sept. 28, 1910. ¾ p.

A general description of the hydraulic dredging plant which appears to be used on the Pacific Division of the Panama Canal.

Trenching for a Sewer, Using a Grab Bucket Excavator, with Some Data on the Concrete Work.—Eng.-Contr., Sept. 28, 1910. 1⅓ pages.

Describes the method of constructing sewer trench, using a special form of grab bucket. Records of output and some costs are given of both the excavation and of the concrete sewer work.

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Methods and Cost of Earth Excavation with Three Types of Excavators, New York State Barge Canal.—Sept 28 1910 ½ page.

Gives cost data for one month for three types of excavating machines used on one contract section of the New York State Barge Canal.

Method and Cost of Excavating Canal Prism Using a Ladder Dredge and Special Conveyor; New York State Barge Canal.—Eng.-Contr., Sept. 7, 1910. ¾ page.

Describes the excavating and conveying device named in the title and gives detailed costs of excavation for three months' work.

A Comparison of Gyratory and Jaw Crushers; the Field in Which Each is Superior.—Eng.-Contr., Sept. 21, 1910. 2⅓ pages.

A notably interesting article comparing gyratory and Jaw crushers. These two types of crushers are compared in feed, weight, capacity, horse-power, operating advantages, repairs, and cost. Tables are given showing comparative figures and a diagram is presented for figuring the proportion of rock crushed and various degrees of fineness.

Methods and Cost of Constructing the Elizabeth Tunnel of the Los Angeles Aqueduct.—Eng.-Contr., Sept 14, 1910 1½ pages.

A general summary of the methods employed and some of the special apparatus used in constructing the tunnel named. Detailed figures of progress, quantities and cost for the year 1909, are also given.

Remedies for Landslides on Kanawha & Michigan Ry.—By R. P. Black. Con.-Engr., Sept. 22, 1910. 2½ pages.

Description of piling and of rip-rap as remedies at certain localities for landslides or slips, where the embankment tends to slide into the adjacent stream. Illustrated with drawings.

Wagontrains Hauling Road Material.—Contr. Sept 1, 1910. 1 page.

A short description with photographs showing method of hauling a train of dump wagons with a traction engine.

New Steel Belt Conveyor Used in Sweden.—By Alfred Gradenwitz. Eng. & Min. Jl., Sept. 3, 1910. 3 pages.

A complete description of the Sandvik steel belt, its construction, operation and maintenance advantages. With diagrams and photographs.

COST KEEPING.

Cost-Keeping in the U. S. Reclamation Service.—Eng. News 2¾ pages.

Describes the cost keeping system of the service named, with illustrations of record blanks, etc.

Engineers' Cost Keeping System New York State Barge Canal.—Eng.-Contr., Sept. 7, 1910. 2⅔ pages.

This article describes the system by which the State engineers department keeps record of costs on the New York state Barge Canal work. Illustrations are given of the special record blanks employed.

Cost Keeping System for a Mine.—Eng.-Contr., Sept 14, 1910 6 pages.

A notably complete article outlining the cost keeping system for a mine. Illustrations are presented of 3 different special record blanks employed.

MISCELLANEOUS.

A Method of Illustrative Sketching.—Eng. Rec., Sept. 24, 1910 ¾ page.

Illustrates and describes a method for making rapid sketches.

Modern Practice in Garbage Disposal.—Eng. Rec., Sept. 24, 1910 2 pages.

A paper summarizing the features of the best modern practice in refuse disposal.

Some Profitable Methods of Utilizing Municipal Waste.—By L. S. G. Wilkinson. Surveyor, Sept. 2, 1910. 2 pages.

A resume of various ways employed for disposing of municipal waste. A considerable portion of the article is devoted to a description of the method for utilizing the waste products of sewage disposal works.

The Collection and Disposal of House and Trade Refuse. By H. Thomson Lyon. Surveyor, Sept. 23, 1910. 1½ pages.

A paper presented at the last annual congress of the Royal Sanitary Institute of Great Britain. A description of the system employed at Westminster, England. The main portion of the city was washed by direct labor, while in three important districts, the work was executed under separate contracts.

The Classification and Filing of Technical Memoranda. By Henry A. Adams, Mun. Eng Mag. Sept., 1910. 2½ pages.

Describes the system adopted by a well-known firm of English engineers. The index is arranged in sections under headings, representative of the main branches, each section being subdivided to deal with the secondary branches, which are in turn divided up to the extent necessary to deal with specific details. A number is allotted to each entry in the index.

Garbage Incinerators For San Francisco.—Mun. Jl and Eng., Sept. 2, 1910. 4 pages.

Except for the specifications prepared by Marsden Manson, City Engineer of San Francisco, for the construction for the city, of two incinerating plants, of a combined capacity of 120 tons per day, the article contains the results of the study of the composition of rubbish, and the methods employed in sampling and testing. A description of the test which is to be made before the plant is accepted from the contractor is also given.

Progressive Subsidence Near Main St., Cambridge, Mass., and the Design of the Main Street Subway.—Eng. News., Sept. 8, 1910. 3 pages.

Describes the circumstances and nature of a subsidence of a large area of ground in the city named and describes this subway, design and instruction worked out to meet the conditions. Tables showing rates of subsidence are given. An interesting presentation of unusual phenomena in earth subsidence.

Refuge Chambers in Coal Mines.—Eng. News., Sept. 22, 1910. 1 1/6 page.

Describes the purpose and use of refuge chambers, describes their construction and gives costs.

Benefits Derived From the Incineration of Refuse in the City of Westmount.—Eng.-Contr., Sept. 28, 1910. 2 pages.

Describes methods and gives costs of collecting and disposing of refuse in a small Canadian City.

Methods of Garbage Collection and Disposal in the Canal Zone, Panama and Colon.—Eng.-Contr., Sept. 28, 1910. 5/6 page.

A general description of the methods employed in handling garbage in the cities of the Canal Zone.

An Improved Mast Step for Derricks Which Permits Removal of Sheaves Without Unshipping Mast.—Eng.-Contr., Sept. 21, 1910. ¾ page.

Illustrates and describes a mast step for a derrick. The step permits the removal of sheaves without unshipping Mast.

Power Used in Mining.—By Edward O'Toole. Mi. & Mls., Sept., 1910. 2½ pages.

In discussion of various sources of power used for mining, namely, human labor, animal labor, animal hydraulic, steam and electricity. Suggestions for decreasing the number of accidents and for payment in case of accident.

Evolution of Mine Haulage.—Mi. and Mls., Sept., 1910. 6 pages.

An article (continued from the August number), describing and illustrating methods of hauling in mines by locomotives propelled by steam, electricity and compressed air. With calculations.

The "Interval" Method of Determining Elevations in Stadia Surveys.—Eng. News., Sept. 1, 1910. 1¼ pages.

Discusses the advantages of the method named and illustrates and describes methods of using it with examples of notes, and working diagrams and tables.

The Leveling Operations of the United States Government.—Eng. News., Sept. 15, 1910. 1¼ pages.

Describes methods of spirit leveling employed by the Government and discusses the possibilities of the use of these surveys by engineers [illegible] work.

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Licensing Engineers.

Various attempts have been made to draft and have enacted statutes regulating the practice of civil engineering. In another column we publish a summary of the results as compiled by a special committee of the American Society of Civil Engineers together with the recommendations of that committee of the general requirements which any law licensing engineers should embody. The wisdom of licensing engineers is not proven nor is it agreed among engineers that the need exists, but as the committee truly states, there is an unmistakable tendency toward such legislation. If laws licensing the practice of engineering are to come there can be no two questions about the desirability of following certain general lines in drafting them. In emphasizing this the work of the committee named is valuable, and it is to be hoped that the new laws which are certain to be submitted to the coming sessions of various state legislatures will reflect this fact.

Opportunities for Contractors in the New Drainage Canal and Subway Work for Chicago.

Two decisions of extreme importance to the public works interests of Chicago have been made within the last week. On June 30 the acting secretary of war granted a permit to the Sanitary District of Chicago to construct the proposed Calumet-Sag Channel connecting Lake Michigan through the Calumet River and Lake by canal with the main drainage channel at Sag, near Lemont. Two days earlier the Supreme Court of Illinois handed down a decision establishing the underground rights of the city of Chicago in its streets and also the right of the city to use its accumulated and prospective traction funds for underground railway construction. The construction of the Calumet-Sag channel will involve an expenditure of from $7,000,000 to $10,000,000, while the fund available within the next twelve months for subway work will be fully $5,000,000, with an equal amount in sight as soon as this is expended.

The necessity of the Calumet-Sag Channel is great. The so-called Calumet District of the Chicago Sanitary District has an area of 95.48 square miles and a population of some 500,000, the sewage from which has free access to Lake Michigan through the Calumet lake and river. The object of the Calumet-Sag Channel is to reverse the flow of the lake and river and divert their sewage laden waters into the main drainage channel diluted with water drawn from Lake Michigan. In brief the scheme is to handle the polluted waters of the Calumet river exactly as the main drainage channel now handles the waters of the Chicago River.

The construction work to be done on the Calumet-Sag Channel will be to deepen and clear the present natural channels of the Calumet lake and river probably by dredging, and to construct an artificial canal from Calumet Lake westward to the main drainage channel. This artificial canal will be some 18 miles long partly in earth and partly in rock. The section of the canal will be trapezoidal in earth probably about 70 ft. wide with side slopes of say 3 on 5, and in rock it will probably be about 90 ft. wide with practically vertical sides. In accordance with the previous policy of the Sanitary District engineers the great bulk at least of the work will be let to contract.

Plans for the subway work are now being prepared under the direction of Mr. Bion J. Arnold and, it is stated, will be completed sometime in September. Only surmise is possible as to the exact nature of the construction that will be called for. In 1902 Mr. Arnold reported in favor of a combined low level and high level subway system, one level to handle the west side traffic and another to handle the traffic of the north and south sides. Then the plan was to handle by subway only the surface street car traffic, but now it is planned to handle also the elevated railway traffic. This will, of course, enlarge the subway provisions necessary. The new plans will, however, it is stated, adhere to the original scheme of the engineer for high level and low level systems. It is stated also that the plans will call for doing all the excavation in tunnel, so that street openings will be practically eliminated. The excavation will be practically all in a firm clay. In the course of things the subway work will be done by contract.

To summarize, the two improvements named will call for, within the next few years, some $20,000,000 of earth and rock excavation and concrete work, the bulk of which will be paid to contractors.

A Noteworthy Article on Electrical Street Railway Appraisal.

It is not often that the reports of engineers on appraisals contain all the quantities and unit prices used in arriving at the appraised values. Records of this kind are particularly scarce in the electric railway field. In our issue of May 25, we printed an article by Mr. Henry L. [illegible] Chief Engineer of the Washington Railroad Commission, giving his appraisal of an [illegible]. In this issue we give Mr. Frederick T. Barcrofts' appraisal of the street railways of Detroit as compiled by [illegible]. The report is a 240-page book, admirable in its completeness. Unfortunately many engineers have been unable to secure authority to have their appraisal data printed in such detail, partly, perhaps, because doubt exists as to the general usefulness of a printed document of this sort. We believe, however, that it is the act of wisdom to put such data on record in a form available not only to successors but to other commissions and their engineers in other cities and states. Typewritten reports ordinarily do not receive the publicity that they merit, and are usually unsatisfactory for future reference if at all voluminous. It was with great satisfaction, therefore, that we availed ourselves of the chance to abstract this excellent volume containing Mr. Barcrofts' appraisal data. We have endeavored to make our abstract so complete that few engineers will deem it necessary to refer to the original report itself. In doing so we have frequently rearranged the original data, and we have also reduced many totals to unit costs. For example, we have deduced the itemized costs per kilowatt of power plant, which we believe will prove of value not only to other engineers engaged in appraisal work but also to those who are making preliminary estimates of the cost of power plants.

This leads us to remark that we should not publish as many data on appraisals as we do publish were it not that such costs and prices are often of exceeding usefulness to engineers who are making cost estimates of similar structures and plants that they are designing. For this reason we give both unit prices and the number of each class of units. In many instances an engineer is in doubt as to the approximate number of units required for a given service. Hence records of the actual number used in a given instance are very desirable.

An engineering journal of high standing recently commented editorially on certain costs of operating a suburban railway by electricity as compared with its former operating costs when steam engines were used; and the statement was made that if the interest on the money invested in the electrification of the road were added to operating costs "there can be little doubt that the steam locomotive would make the better showing."

Clearly the editor had no definite knowledge of the cost of electrifying a railway, for the statement was absurd, as the difference in operating cost was more than 10 cts. per car mile in favor of the electric operation. The editor failed to note, however, that this 10 ct. difference was largely due to other causes than the use of electricity, the chief of which was that the maintenance expense of the old locomotive plant (including cars) was much greater than the maintenance expense of a new electric plant. Even a glance at a few of the recorded costs of constructing and equipping electric lines would have shown the fallacy of the statement above quoted. Yet wild guesses of this kind—harmful as they often are—find their way into engineering literature, and garb themselves in type that could have been used to infinitely better advantage in clothing actual cost data.

In the part of his report relating to track, Mr. Barcroft says:

> The track department is not in charge of a civil engineer and it is apparent that proper engineering judgment is lacking. [illegible] cease repairing track and replace it with new.

There is text for several technical sermons in this quotation. We believe that the opportunities for civil engineers in the operating departments of electric railways have never been fully appreciated by civil engineers themselves. Until engineers take more active part in the business management of street railways generally, it is not likely that any great reductions in operating expenses will occur. It

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takes an engineer, for example, to appreciate the enormous saving in power that can be effected by reducing the weight of street cars; for men to whom the formula $K=\frac{1}{2}Mv^2$ has no meaning can hardly be expected to realize that a very large part of the power of operating street cars in a city is consumed in accelerating the cars, as necessitated by the frequent stops and changes in speed.

Modern systems of engineering cost analysis, in both shop and street work, would greatly reduce the maintenance expenses that now form such a considerable part of the cost of operating the average street railway.

We can not close this brief comment on Mr. Barcroft's work without a word of warning to the city of Detroit, which appears to have in contemplation the purchase and operation of the street railway lines. Whatever may be the present inefficiency of management on the part of the Detroit United Railways Co., municipal management will unquestionably be not only worse but it will ultimately cost the citizens more than they now pay.

While we do not know that any precedent exists under which a city can regulate the rates charged by street railways during the life of a franchise, it is clear that the same principles of common law will apply to the rail highways within a city which apply to the rail highways within a state. Therefore, upon the expiration of a street railway franchise there can be no doubt that the municipality can govern the rates charged by a street railway company, precisely as some states now regulate the rates of steam railways. By the end of 1915, the franchises on more than 90 of the 170 miles of street car trackway in Detroit will have expired. Hence fully half the trackway will be subject to the complete control of the municipality without the expenditure of a cent. Detroit can then so regulate the rates upon this mileage that it will yield to the owners a low rate of interest on the appraised value, plus a fair percentage of profit on the gross revenue. Then by establishing such a rate and adhering to it for a specified term of years, the railway managers will still have strong incentive to introduce labor-saving machinery and methods, while the city will ultimately share in the savings thus effected when it again lowers the rates at the expiration of the term for which they are fixed. Such periodic rate fixing will enable the city to secure all the advantages of private ownership coupled with all the advantages of public control.

CONCRETE AND REINFORCED CONCRETE SECTION

Method and Cost of Constructing a Concrete Tunnel Lining with an 80-Ft. Gravity Chute.

BY W. D'ROHAN.

The Orchard Mesa Construction Co., a Colorado branch of the Woodland Company of Chicago, was formed by the Magenheimer Brothers, to irrigate 12,000 acres of the Mesa lands lying south of the Grand River between Palisades and Grand Junction, Colo.

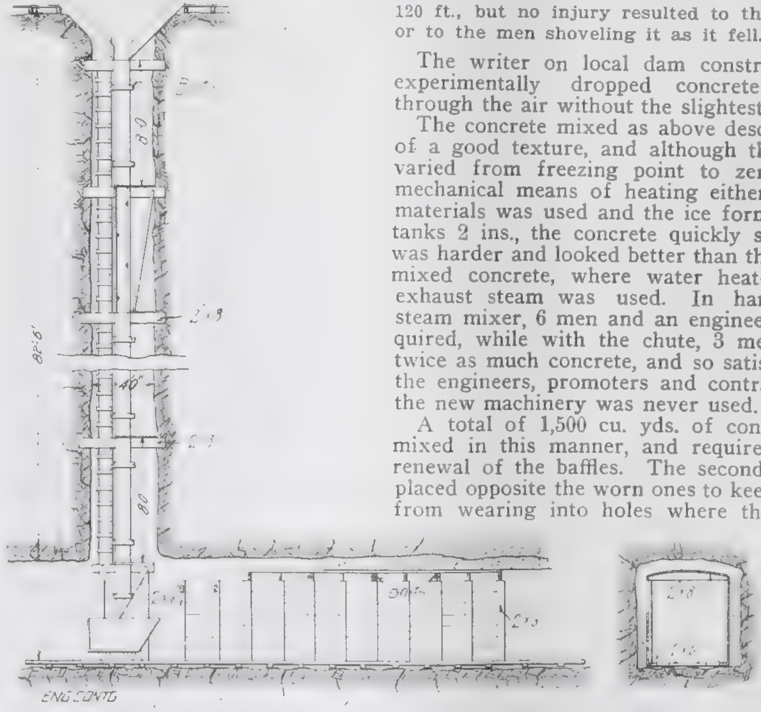
Part of the construction consists of a tunnel 6x7 ft., 1,740 ft. long, driven through 940 ft. of black shale rock, and 800 ft. of dirt. The dirt section was timbered, roof and sides, in 4-ft. sections, being lined with 2-in. sheeting, supported by 6x6-in. posts with caps and sills.

The original intention was to line the timbered section with 9 ins. of concrete and let the shale section go, but as the shale quickly disintegrated in the air, it became necessary to concrete the whole tunnel.

This contingency totally unexpected, found the company in a remote locality with but one steam mixer available and only two months to complete a large amount of concrete work. Extra machinery was immediately wired for, and as it would take from three to four weeks to ship it from Chicago, the writer, as superintendent of construction, suggested the use of a gravity chute through the central air shaft, and after a prolonged discussion, this plan was adopted.

Starting at the bottom, a trestle 7 ft. high was built and arranged so as not to interfere with the form work, and from this was placed a series of platforms 8 ft. apart, supported by 2x8-in. girders sunk into the walls of the shaft which was 4 ft. in diameter, all being connected with short ladders.

The chute proper was simply a trough 10x10 ins. with a series of baffles nailed on alternate sides, spaced 2 ft. apart. The baffles were made by cutting 4x4s diagonally. The first section rested on the trestle, and the remaining parts were held in place by cleats and so braced that each platform bore the weight of its own section. Three sides were securely nailed, and the fourth, which was cut to suit the platforms, was held in place by clamps made of two pieces of 2x4s with two bolts 3/8 in. x 16 ins., two clamps to each section. This made it easy to remove one side for repairs. The top of the chute had two V-shaped hoppers at an angle of 45° with the vertical fitted with a wooden slide door. Into these hoppers the gravel and cement were dumped from wheelbarrows, six wheelbarrows of gravel making a hopper full. This was placed as follows: Two wheelbarrows of gravel, then 1 sack of cement spread over it, 2 more barrows of gravel and another sack of cement, finishing off with 2 barrows of gravel. This kept the cement from blowing away. One hopper was kept continually full so that no delay resulted. A cowbell with some wire and 3 sections of ½-in. hose made a first-class telephone. It was originally intended to apply the water by means of a hose about 30 ft. down the chute, but this was abandoned as much better and more uniform results were obtained by fixing an old bucket with perforated bottom at the top of the chute, and getting water, cement and gravel all together at the start. The mix went down slowly, the vertical stream being continually broken by the rebound of the rest from the baffles, and was caught at the bottom in ½ cu. yd. wooden scoop cars, designed and built by the writer, and conveyed to the shovelers on an 18-in. gage track. The forms were built in 12-ft., 14-ft. and 16-ft. sections, resting on a 2x6-in. sill and braced to the rail. They were so arranged that when the sill was removed the side dropped down and could be moved ahead, while the arches for the roof were built in 4-ft. sections, all the segments being cut from a pattern and so arranged that each section could be bolted to the last one filled, thus ensuring a uniform roof line.



Sketch Showing Arrangement of Gravity Mixer in Shaft for Lining a Tunnel With Concrete.

At the outset there was considerable speculation as to the results of dropping concrete so far, as it is a question that very seldom crops up and many engineers are somewhat chary of injuring the concrete. In his exhaustive work on reservoirs, Schuyler mentions (p. 268) in the construction of the San Mateo Dam, California:

> The concrete was mixed in a battery of 6 cubical iron mixing-machines revolved by steam power. It was delivered to the work by a double-track tramway on a high trestle carried part way across the canyon at the level of the top of the dam on the lower side. The cars on this tramway were pushed by hand and dropped into hoppers let into the floor between the rails, leading to vertical pipes, 16 ins. in diameter, which extended down to platforms that were placed from time to time at a level with the top of the work as it progressed. The concrete dropped down these pipes, striking on steel plates, from which it was shoveled into wheelbarrows and trundled to the place of use. The height of this drop was sometimes as great as 120 ft., but no injury resulted to the concrete, or to the men shoveling it as it fell.

The writer on local dam construction has experimentally dropped concrete 210 ft. through the air without the slightest damage.

The concrete mixed as above described, was of a good texture, and although the weather varied from freezing point to zero and no mechanical means of heating either water or materials was used and the ice formed on the tanks 2 ins., the concrete quickly set up and was harder and looked better than the machine mixed concrete, where water heated by the exhaust steam was used. In handling the steam mixer, 6 men and an engineer were required, while with the chute, 3 men got out twice as much concrete, and so satisfactory to the engineers, promoters and contractors that the new machinery was never used.

A total of 1,500 cu. yds. of concrete were mixed in this manner, and required but one renewal of the baffles. The second set being placed opposite the worn ones to keep the sides from wearing into holes where the concrete hit on the rebound off the baffles. The total cost of chute, renewal of baffles and labor of building in place was $75 or 5 cts. per cu. yd.

Very often engineers, especially in western irrigation projects, are confronted with situations where the installation of mixing machinery is a physical impossibility, and hand-mixing out of the question. To these, the gravity chute offers an easy road. Many adaptations of it can be made by using bolts for baffles, ordinary corrugated iron for the sides, and by varying the spacing of the baffles, lengths from 6 ft. to 1,000 ft. can be made.

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†Superintendent of Construction, 39 Glenn Court, California St., Denver, Colo.

The handling of the lining for the timbered section offered some nice points in construction. It was found that the timbers could not be moved without grave danger, and it was decided to concrete them in, and the problem of packing concrete back of the caps arose. For this, three suggestions were made: (1) To cut a V-shaped notch in the center of the cap and pack the concrete in with a trowel; (2) To use reinforcing rods 1 in. in diameter bent into shape of side and roof, and then remove upright posts and caps, and (3) to fill in the roof as much as possible and afterwards pump grout to fill the vacant spaces.

The first idea was too dangerous, and as it was difficult to obtain the rods, the second scheme was abandoned, leaving the third as the only alternative.

An ordinary wagon pump was rigged up with a 3-in. suction and 2-in. delivery hose, with reducer to attach to 1-in. pipes inserted in the roof. Grout mixed 1 to 2 was used, and the results were more than satisfactory. The first pumping caused a little leakage through the weak spots in the roof and sides near the top. That these were closed up was shown by a second pumping, which did not even cause sweating, while a third application, as an extra precaution, was found totally unnecessary.

Gravel, cement, lumber and water for this work had to be hauled 5 miles over a rough mountain road and were delivered by contract at $1.25 per yard for gravel, cement 75 cts. per ton, and water 10 cts. per barrel. Lumber cost $30 per M. ft. B. M. Ideal Portland cement, a Colorado product, cost $3.25 on the job; labor cost $2.50 for carmen and outside men, $2.75 for overhead shovelers; carpenters 40 cts. per hour, and foremen $4 per day. Two 10-hour shifts were worked and the whole tunnel lining of 2,400 cu. yds. of concrete was completed in 40 working days.

The comparative itemized cost of lining by steam mixing and by the chute were as follows:

STEAM MIXER.

1 engineer	$ 4.20
4 men feeding	10.00
1 roustabout	2.50
2 men loading into cars	5.00
4 men placing in forms	11.00
3 carpenters	12.00
3 carpenters' helpers	7.50
2 carmen	5.00
1 trackman	2.50
1 general foreman	6.50
Total labor for 15 yds.	$66.20
Labor, per yard	$ 4.41
Gravel, per yard	1.50
Cement, per yard	2.50
Water	0.20
Lumber	0.08
Light	0.10
Coal and oil for mixer	0.25
Wear and tear of mixer	0.25
Total cost per yard	$ 9.29

GRAVITY CHUTE.

3 men mixing	$ 7.50
4 carmen	10.00
6 men placing in forms	16.50
4 carpenters	16.00
4 carpenters' helpers	10.00
2 trackmen	5.00
1 general foreman	6.50
Total labor for 35 yds.	$71.50
Labor, per yard	2.04
Gravel, per yard	1.50
Cement, per yard	2.50
Water	0.20
Lumber	0.08
Light	0.10
Mixer	0.05
Total cost per yard	$ 6.47

The biggest run with steam mixer was 26 cu. yds. and the smallest 8 cu. yds., due to breakdowns, while the chute made 54 cu. yds. maximum and 21 minimum, due to water giving out.

Messrs. Field, Fellows & Hinderlider, Consulting Engineers, Denver, Colo., were in charge of construction, Mr. Hinderlider being resident engineer. As this firm has successfully completed more irrigation works than any other firm in the West, their adoption of the gravity mix above described, is a sufficient guarantee of its excellence. Messrs. C. C. Magenheimer and G. J. Magenheimer, both of Chicago, are respectively President and General Manager of the Orchard Mesa Construction Co.

The Effect of Sodium Silicate Mixed With or Applied to Concrete.*

The easy abrasion, or what is commonly called "dusting" of cement concrete floors in office buildings, has called my attention to the need of a material which could be readily and economically applied, resulting in the hardening of the concrete itself and not producing a veneer which would soon wear off under foot or other traffic.

Nearly all of the so-called floor finishes which are designed to protect the floor from dusting prove to be merely oil paints, some of them simply Portland cement ground up in varnish or linseed oil with some coloring matter and possibly other harmless materials which would enable the inventor to obtain a patent.

There did not seem to be any material on the market which would sink into the pores and itself harden so as to form an actual wearing surface and not a veneer, with the possible exception of a chemical formula often used in France and Germany to protect plaster and prepare same for mural decoration. This material is hydrofluosilicide of magnesium and zinc. The objection to its use for the protection of concrete floors or the hardening of concrete surfaces for any purpose whatever, is entirely from the standpoint of economy, it costing from 8 to 10 cts. per sq. ft. to correct the bad workmanship which is so often the cause of the dusting of concrete floors.

I, therefore, started some experiments with sodium silicate both in powdered form and in the form of water glass. I found that the powdered sodium silicate which can be obtained commercially contained impurities which did not render it readily soluble in water. The sodium silicate in the form of water-glass of about 40° Baumé was readily mixed with water, the object being to thin the sodium silicate down to a point where it would penetrate as deeply as possible into the pores of the concrete, making several applications until the pores were all filled and the sodium silicate flushed with the surface. That which flushed with the surface, being soluble, was readily washed off with water and that which remained in the pores having come in contact with the lime and other alkalies, hardened into what we may be pleased to term "mineral glue." From experiments extending over several months I found that we had obtained the results we had been striving for.

This suggested various other uses all of which had the object in view of hardening and waterproofing the surface of concrete; such as the protection of arrises, waterproofing hollow concrete blocks, hardening, waterproofing and protecting interior surfaces of cisterns and protecting buttermilk vats against the action of lactic acid; the protection of porous concrete surfaces against the action of oils, preventing efflorescence, seeping out of soluble salts from Portland cement mortar, concrete or stone, and the possible prevention of hair cracks and crazing.

It is also entirely within the range of possibility that such treatment of interior and exterior surfaces of concrete may be of valuable assistance in solving the drain tile, alkali, and sea water problems. After the tile has been made and set hard for two or three weeks, and has then dried out so as to permit the introduction of sodium silicate in thin solution into the pores, the drain tile may be immersed into a bath of sodium silicate, composed of 1 part water-glass, 40° Baumé, and 3 parts water, a total of four parts; the immersion to be a sufficient length of time to allow the tile to absorb the maximum quantity. It is then removed from the bath and allowed to dry. Thus the sodium silicate coming in contact with the lime and other alkali present in the concrete forms into a mineral glue which is insoluble and very hard. I believe I have suggested a sufficient number of uses to illustrate the possibilities of sodium silicate applied to concrete.

The action of sodium silicate applied to dry concrete is vastly different from that which is mixed with the cement while the concrete is being gaged. Through the courtesy of Mr. S. Warren Hartwell, Mr. W. R. Dunn, and some opinions, advice and suggestions from Dr. Allerton S. Cushman, we carried on some experiments with cement and sand briquettes which were mixed with a thin solution of sodium silicate and water, compared with normal briquettes treated in the usual way, and also compared with normal briquettes afterward immersed in water containing 10 per cent of sodium silicate.

I also made up some briquettes of 1 part hydrated lime, 3 parts standard sand and water; also briquettes of 1 part hydrated lime, 2 parts building sand mixed with a solution of 1 part water-glass, 2 parts water; the initial set was a half hour, final set 1 hour. As soon as dry, they were immersed in a solution of sodium silicate, 1 part water glass, 40° Baumé, 3 parts water. After the briquettes had absorbed the maximum amount of this solution, they were allowed to dry out. They had become hard but showed very little strength in tension. They were then immersed in water for several days, no disintegration taking place. The object of this test was to ascertain the solubility of lime briquettes so treated.

A series of briquettes were made of 1 part Portland cement, 3 parts Ottawa sand, mixed with the usual quantity of water containing 10 per cent of sodium silicate, the results show a falling off in strength compared with the same sample of cement mixed with the usual quantity of water, no sodium silicate added, and the briquettes immersed in water in the usual way. This falling off was noticed both in the 7 and 28 day periods.

Briquettes of 1 part cement, 3 parts Ottawa sand, mixed with the usual percentage of water containing no sodium silicate, after 24 hours were immersed in water containing 10 per cent of sodium silicate, with the result that the strength was increased, as compared with the same sample of cement treated in the usual way, no sodium silicate having been added in mixing the cement with the water.

No neat cement tests were made for the reason that the comparisons we wished to obtain were those which would tend to show that the introduction of sodium silicate into concrete after final set would strengthen such concrete. Reducing the results to figures, I give below the average results of a full set of experiments:

One part Portland cement, 3 parts Ottawa sand, briquettes mixed with the usual amount of water and immersed in water: 7 days, 285 lbs. per sq. in. cross section; 28 days, 347 lbs. per sq. in. cross section. Mixed with water containing 10 per cent sodium silicate and immersed in water: 7 days, 117 lbs.; 28 days, 203 lbs.

You will note a considerable falling off in strength.

Mixed with the usual amount of water containing no sodium silicate and after 24 hours immersed in water containing 10 per cent of sodium silicate: 7 days, 360 lbs.; 28 days, 497 lbs.

Quite a considerable increase in strength is to be noticed.

We assume that the sodium silicate coming in contact with the lime or other alkalies and alkaline earth salts gives a reaction which causes a deposit of silicic acid which forms into an insoluble gelatinous silica and hardens into and acts as a mineral glue.

Sodium silicate mixed with the cement while the mortar is being gaged quickens the setting time, an arbitrary period determined by the stiffness of the mortar to a degree which will bear a wire or needle under certain pressure. The final hardening, however, never attains as great strength as normal slow setting concrete.

I mixed up some water glass in proportion of 1 part water-glass, 3 parts lime water—that is water containing all the lime which it would take up in solution then decantered off. On standing for a few minutes it became a jelly. I then mixed up a solution of sodium silicate and ordinary water, mixed with it neat cement to a wet consistency, probably 30 per cent water. Within a few minutes this mass had become a stiff jelly; this jelly is very quickly formed, thus quickening the time of setting, which in reality is merely a period of definite stiffness, and has little or no relation to the time of maximum hardening. This jelly having been formed before the cement had time to harden, interfered with the process and weakness resulted, which is shown by the tests.

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*A paper by Albert Moyer, read before the American Society for Testing Materials, Atlantic City, N. J., June 30, 1910.

I would suggest that those interested in this subject experiment by using a retarder, such as a 10 per cent solution of sodium hydrate caustic or a similar solution of magnesium sulphate. If the formation of the gelatinous silica is retarded until the cement has had an opportunity to set, it is possible that the strength of laboratory specimens will be increased. We might thus obtain some information as to the effect of sodium silicate on concrete if experiments are made extending over long time periods. A set of specimens in the form of briquettes and cubes for tensile and crushing strength may be made and stored in water, breaking these specimens in regular periods of time up to two years. As far as I know this has not been done and might possibly lead to some interesting data on this subject.

Concrete is strengthened and hardened when sodium silicate in solution is applied to the surface. The concrete has hardened normally and that which is porous will allow the introduction of sodium silicate to some little depth in the pores, the depth depending upon the porosity of the concrete. The action of forming into a jelly thus takes place without interfering with the process of hardening and this gelatinous substance forms into an insoluble mineral glue.

Without experimental proof and based upon the theory of maximum density, it is my opinion that this method or treatment by the application of sodium silicate to concrete surfaces, will act as waterproofing and prevent the action of salt, alkaline or sulphurous water on the surface.

This is a field which requires quite some laboratory experiments which should be followed up by field experiments. Sodium silicate in the form of water-glass is very cheap, less than 1 ct. per lb., and a pound thinned down with water to the proper consistency that will enter the pores of the concrete, will cover quite an area. I treated the floors of the office in which I am located, covering some 1,400 sq. ft., at a cost of 0.3 ct. per sq. ft. which includes all labor and material.

Should exhaustive experiments and field tests demonstrate by long time results that there is no further action of water on surfaces so treated, and that the sodium silicate remains in the form of an insoluble mineral glue, many very serious problems have been solved, such as the action of alkalies or sulphurous soil on drain tile and other concrete products, the action of sea water on concrete, waterproofing tanks, the protection of tanks against certain acids and oils, and the dusting of concrete floors.

I have taken the precaution to apply for a patent, as I find that no patent has been issued covering the use of sodium silicate for these purposes. The reason for making application for patent is to prevent others from obtaining same and thus protect the engineer and user of Portland cement by allowing the use of sodium silicate without fear that anyone is infringing on the patent. I hereby give notice that if the patent is obtained I shall donate same to the concrete industry.

ROADS AND STREETS SECTION

The Determination of Soluble Bitumen.*

One of the fundamental tests in the examination of bituminous materials is undoubtedly the determination of soluble bitumen, or total bitumen as it is sometimes called, and yet in common with most other tests of such materials, important variations exist in the methods adopted by different analysts. Owing to the variety of materials which are classed as bitumen and to a diversity of opinion as to the definition of the term, this subject is a difficult one to handle in a satisfactory manner, and many analysts have adopted the method of reporting their results, merely as the solubility of the material examined, in a given solvent. This is perhaps the wisest procedure at present, and will be adhered to in the following paper. With the hope of placing this matter upon a more rational basis, it is the authors' present purpose to open a general discussion of the subject by the presentation and brief consideration of data which they have so far secured.

The soluble bitumen determination is employed mainly for the purpose of ascertaining what percentage of material is held in suspension as inert matter in so far as binding value it concerned. Such products are usually divided into two classes, organic and inorganic, and so reported, the separation being accomplished by igniting the residue obtained, until all organic matter has been burned off. The organic matter is often called free carbon, especially in the case of tars, although there are many reasons for thinking that free carbon constitutes only a portion of this substance.

Without entering into a discussion as to what materials should and should not be classed as bitumens, it may be said that in this paper the term is made to include all organic substances commonly known as tars; mineral oils; the commercial residues obtained from each, known as pitches and artificial asphalts; native asphalts; and other solid native organic products composed mainly of hydrocarbons soluble in carbon bisulphide. In view of the variety of substances which are included under this term, and to the fact that mixtures of any two or more may be encountered as commercial products, it is most essential that a method of determining soluble bitumen be selected which is applicable to all or to the greatest number of materials. Accuracy, ease of manipulation, time consumed, and cost are also important factors to be considered, and have been constantly borne in mind by the authors in the work here described.

In selecting a solvent for our investigations, we noted that carbon bisulphide, chloroform, benzol, toluol, and turpentine, have been used for the determination of total bitumen, and had time permitted it would have no doubt proven interesting to have shown correlated results with the use of each of these materials. As such volume of work would have precluded the possibility of our being able to present these data for discussion at this time, we aimed to select two solvents that would prove scientifically, as well as commercially applicable, and therefore adopted carbon bisulphide (C. P. Baker and Adamson) and commercial 90 per cent benzol B. P. 80.5°. We appreciated the fact that chloroform is preferred by some chemists for the reason that in certain cases it exhibits a slightly greater solvent action than carbon bisulphide, but the results as a rule are so slightly different that we doubt its coming into general use on account of its much higher cost. The same objection holds for the use of C. P. Benzol, which would no doubt have given more satisfactory results than were obtained through our use of the commercial material. Turpentine was not considered on account of the difficulty of obtaining a pure product of definite composition.

Having decided upon our solvents, it was our object to apply them in such manner as would be typical of the various methods now in general use among chemists engaged in bitumen work, comparing the results obtained, and possibly recommending or evolving a method that would give a maximum degree of accuracy consistent with a proper economy of time. Consideration was given to the fact that there is a division of opinion among various operators as to the merits of hot or cold solvents, while with some the different forms of extractors appear to be preferred. For the purpose of meeting these conditions, the following general methods of procedure were adopted, using from 1.75 to 2 grams of material to be analyzed in each case.

EXTRACTOR METHOD.

For the purpose of our investigation, the Wiley extractor was selected as embodying the general principles of most of the other types. This form of apparatus may be briefly described as consisting of a glass tube 9 ins. long by 2 ins. in diameter, shaped like a large test tube, and having a metal condenser which is attached to the cover and extends downward through the upper half of the tube. The sample, which has been weighed in the cone of a tarred filter paper, is suspended in a bottomless porcelain receptacle from the apex of the condenser, and the solvent is heated in the bottom of the tube.

A few preliminary tests were made on filter papers of different make and size, single and double, after which the following method was adopted and used throughout the series reported below. Two 15 cm. C. S. and S. No. 575 hardened filters were folded lightly in the usual way after which, taking their center point as the apex, they were rolled into narrow cones, having a diameter of about one inch at the base. They were then counterpoised and 1.75 to 2 grams of material was weighed in one of them. The paper containing the sample was placed inside of the counterpoise filter, the two were suspended in the receptacle of the extractor, and using about 35 cc. of solvent, the extraction was allowed to proceed until the washings came through practically clear. The papers were then removed from the apparatus, dried in a hot-air oven at 100° C., cooled, and weighed.

For the determination of inorganic matter insoluble it was necessary to accept the stated weight of ash for filter paper, which was deducted from the weight of residue obtained upon ignition of the total insoluble material and the paper containing same.

COLD METHOD.

The sample was weighed in a 100 cc. Erlenmeyer flask, which had been previously tarred. It was dissolved by the slow addition of 100 cc. of solvent, with constant twirling until the material was entirely broken up, after which the flask was in a dark closet for 17 hours. At the end of that time the solution was filtered through a felt of long fibre amphibole asbestos, contained in a large platinum Gooch crucible, which had been previously ignited and weighed.

The form of Gooch crucible best adapted for such determinations holds 30 cc., is 4.4 cm. wide at the top, tapering to 3.6 at the bottom, and 2.6 cm. deep. The felt is made by beating up the asbestos in a mortar and suspending the finer particles in water. The suspended asbestos is poured into the crucible, which has in the meantime been placed in the vacuum filtering flask. As soon as the asbestos has somewhat settled vacuum is applied and the felt deposited on the bottom of the crucible, which is then dried, ignited, cooled in a desiccator and weighed. The prepared felt should be dense enough to just barely transmit light when held so that the bottom of the crucible is between the eye and the source of light. If it is denser than this the filter is apt to clog, and if much thinner to let through the finer particles of insoluble material. With a little practice it is possible to prepare a uniform felt without difficulty.

All the insoluble matter was brought on to the felt by scrubbing out the flask, a slight suction was applied when necessary, and the

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*A paper by Prevost Hubbard and C. S. Reeve, presented at the 13th annual meeting of the American Society for Testing Materials, Atlantic City, N. J., June 28-July 2, 1910.

TABLE I. RESULTS OBTAINED BY THE EXTRACTOR METHOD.

Material.	Solvent.	Sol. Bitumen	Organic matter insoluble	Inorganic matter insoluble	[illegible]	[illegible]	Residue [illegible]
Residual coal tar..........	Carbon bisulphide	81.01 81.18	18.90 18.82	.09 .10		100.00 100.00	.... 1.98
Residual coal tar............	90% benzol	61.08 69.48	38.76 30.46	.16 .06		100.00 100.00	.98
Residual water gas tar......	Carbon bisulphide	99.80 99.94	.08 .03	.12 .09		100.00 100.00	.14
Residual water gas tar......	90% benzol	99.54 99.11	.38 .77	.08 .12		100.00 100.00	2.79
Residual petroleum	Carbon bisulphide	99.91 100.17	.01 —.30	.08 .13		100.00 100.00	
Residual petroleum	90% benzol	100.35 100.10	—.35 —.20	.... .10		100.00 100.00	
Blown petroleum residue....	Carbon bisulphide	99.98 100.13	—.10 —.24	.12 .11		100.00 100.00	
Blown petroleum residue....	90% benzol	100.40 99.97	—.40 —.11	.... .14		100.00 100.00	
Bermudez asphaltic cement..	Carbon bisulphide	96.80 96.58	1.44 1.56	1.59 1.72	.17 .14	100.00 100.00	
Bermudez asphaltic cement..	90% benzol	96.74 96.74	1.45 1.41	1.64 1.67	.17 .18	100.00 100.00	
Bermudez asphalt	Carbon bisulphide	95.61 95.73	2.29 2.12	1.92 2.01	.18 .14	100.00 100.00	
Bermudez asphalt	90% benzol	95.44 95.75	2.29 2.12	2.09 1.99	.18 .14	100.00 100.00	

contents of the crucible washed until the washings came through clear, or nearly so. The crucible and contents were dried in a hot-air oven at about 100° C. cooled and weighed, after which any organic matter was burned off and the inorganic matter or ash determined by again weighing.

The flask was also dried and weighed in a number of cases in order to determine the possible error due to adhering material or variations in the weight of the flask under different atmospheric conditions. In the case of the asphalt and asphalt cement, the usual procedure of burning off the filtrate and recovering any ash therefrom was followed. The time of subsidence—17 hours—was selected as being sufficient and most convenient, for the reason that the samples could be dissolved and set away at 4 p. m. and be ready for filtration the following morning at 9.

HOT METHOD.

The sample was weighed in a 100 cc. Erlenmeyer flask as before, and broken up by the addition of 50 cc. of solvent. The flask was then connected to a short spiral reflux condenser and placed over a steam bath where the solution was maintained at its boiling point for three hours. The flask was then disconnected and the solution filtered, the procedure being exactly the same as in the cold method.

Bearing in mind the variety of materials which may be classed as bitumens, the authors endeavored to select six typical commercial products which represent through their different origins, three distinct classes of bitumens. We therefore made use of (1) a residual coal tar; (2) a residual water gas tar; (3) a residual petroleum; (4) a blown residual petroleum; (5) a Bermudez asphaltic cement; (6) Bermudez asphalt. A general method of analysis that would prove applicable to such a series of materials should be accurate for the determination of soluble bitumen in practically all bituminous substances with the exception of Trinidad asphalt, which owing to the peculiar nature of its fine material, has thus far been thought to require special treatment, and has therefore been purposely omitted from consideration in the present discussion.

The following tables are not only of interest in comparing the different methods, but the duplicate results show their probable limit of accuracy, as in every instance one set of determinations was made by each of the authors.

In Table I it will be noted that under the column headed "Organic Matter Insoluble," a number of negative quantities are found. This is due to the almost invariable passage of some of the insoluble matter through the first paper and its retention by the second. This, together with the fact that it is almost impossible to wash all of the bitumen out of the paper as evidenced by a residual stain, constitutes the chief objections to the extractor method. One other which may be mentioned, however, is that while the closest check results for the tars were obtained with the 575 C. S. and S. filter, this paper proved too close-grained for the asphaltic cement and asphalt, and soon filled to overflowing. B. and A. 9 cm. filters were therefore used for these two samples. That insoluble organic matter passes through both filters in the case of the tars is shown by the results in the last column which were obtained by immediately refiltering the filtrate from the extractor, through a Gooch crucible fitted with an asbestos pad. In comparing the two solvents, it will be noted that for the tars carbon bisulphide is the most powerful, and that with it closer check results were obtained than with benzol. It may be added that in the extractor that fraction of the benzol coming in contact with the bitumen is probably almost chemically pure.

In Table II it will be seen that very uniform results are obtained by the 17-hour cold method where carbon bisulphide is used as a solvent, the maximum variation in check results in soluble bitumen being under [illegible] per cent. Here again benzol is shown to be a less powerful solvent for the tars, and gives much poorer check results, the maximum variation being over 2 per cent. It was found that such variations occurred only when different lots of solvent were employed and not when two determinations were made from the same lot. Different lots of carbon bisulphide, however, gave as close checks as where the same lot was used. The error due to the small amount of residue remaining in the flask is seen to be negligible, not only in this table but in Tables III and VII.

Table III shows that the flask method hot produces just as uniform results as the 17-hour cold method, when carbon bisulphide is used, and here again 90 per cent benzol is shown to be an inferior solvent. As compared with the cold method, the most noticeable difference is the apparent increase in solubility of the various materials. Much of the organic matter insoluble is known to be in a very finely divided state, and as the method allows no opportunity for quiet settlement of this residue, it was feared that a portion of the insoluble matter had passed through the filter. This seemed to be corroborated by the fact that upon standing the filtrates from even the 17-hour cold tests invariably showed a deposit of insoluble matter in the bottom of the flask.

To determine how much this really amounted to, a series of refiltrations with carbon bisulphide was made on the residual coal tar, the residual petroleum and the Bermudez asphaltic cement, with results as shown in Table IV. All digestions were made in the dark. As the deposition continued beyond the period of three or four days, by which time complete sedimentation should have taken place, we were led to suspect that insoluble matter was actually being formed in the filtrate, possibly through a gradual reaction of the solvent with the bitumen.

Another series of refiltrations, starting with

TABLE II. RESULTS OBTAINED BY THE FLASK METHOD COLD 17 HOURS.

Material.	Solvent.	Sol. bitumen	Organic matter insoluble	Inorganic matter insoluble	Ash in filtrate	Total	Residue in flask
Residual coal tar	Carbon bisulphide	77.00 77.09	22.89 22.79	.11 .12		100.00 100.00	.06 .05
Residual coal tar............	90% benzol	76.75 74.00	23.14 25.93	.11 .07		[illegible] 100.00	.03
Residual water gas tar......	Carbon bisulphide	98.48 98.39	1.43 1.55	[illegible] .06		100.00 100.00	.00 .05
Residual water gas tar......	90% benzol	94.85 94.45	5.03 5.47	.12 .08		[illegible] 100.00	.00 [illegible]
Residual petroleum	Carbon bisulphide	99.88 99.86	.08 .11	.04 .03		100.00 100.00	.05
Residual petroleum	90% benzol	99.71 99.79	.19 .13	[illegible] .08		[illegible] 100.00	.00 .02
Blown petroleum residue....	Carbon bisulphide	99.78 99.75	[illegible] .16	.06 .09		[illegible] [illegible]	.02
Blown petroleum residue	[illegible]	99.60 99.70	.29 [illegible]	.11 [illegible]		[illegible] [illegible]	.01 .00
Bermudez asphaltic cement..	Carbon bisulphide	[illegible] 96.69	1.45 1.52	1.54 [illegible]	.29 .18	[illegible] [illegible]	.05 .00
Bermudez asphaltic cement..	90% benzol	96.41 96.71	1.84 1.62	1.67 [illegible]		100.00 100.00	.00 .03
Bermudez [illegible]	Carbon bisulphide	[illegible] 95.65	2.25 2.32	1.94 [illegible]		100.00 100.00	.06 .03
Bermudez [illegible]	[illegible]	[illegible] [illegible]	[illegible] [illegible]	[illegible] [illegible]	[illegible] .16	100.00 100.00	.03 .07

TABLE III.—RESULTS OBTAINED BY THE FLASK METHOD, HOT, 3 HOURS.

Material.	Solvent.	Sol. bitumen.	Organic matter soluble.	Inorganic matter insoluble.	Ash in filtrate.	Total.	Residue in flask.
Residual coal tar.	Carbon bisulphide	78.76 78.58	21.15 21.35	.09 .07	... ...	100.00 100.00	.05 .00
Residual coal tar...........	90% benzol	75.20 75.88	24.73 24.05	.07 .07	... ...	100.00 100.00	.00 .06
Residual water gas tar......	Carbon bisulphide	99.42 99.46	.51 .44	.07 .10	... ...	100.00 100.00	.06 .00
Residual water gas tar......	90% benzol	95.74 95.73	4.14 4.15	.12 .12	... ...	100.00 100.00	.00 .03
Residual petroleum	Carbon bisulphide	99.85 99.83	.12 .08	.03 .09	... ...	100.00 100.00	.03 .04
Residual petroleum	90% benzol	99.73 99.83	.21 .12	.06 .05	... ...	100.00 100.00	.00 .00
Blown petroleum residue....	Carbon bisulphide	99.79 99.76	.19 .17	.02 .07	... ...	100.00 100.00	.00 .05
Blown petroleum residue...	90% benzol	99.55 99.70	.28 .19	.13 .11	... ...	100.00 100.00	.01 .03
Bermudez asphaltic cement..	Carbon bisulphide	96.61 96.69	1.52 1.46	1.53 1.57	.34 .28	100.00 100.00	.01 .01
Bermudez asphaltic cement..	90% benzol	96.52 96.64	1.58 1.51	1.76 1.61	.14 .24	100.00 100.00	.00 .04
Bermudez asphalt	Carbon bisulphide	95.63 95.55	2.25 2.32	1.92 1.97	.20 .16	100.00 100.00	.00 .03
Bermudez asphalt	90% benzol	95.33 95.73	2.44 2.20	2.09 1.92	.14 .15	100.00 100.00	.00 .03

one-hour cold digestions shown in Table V, added to this suspicion, which was further confirmed by results given in Table VI where coal tar, digested in cold carbon bisulphide for 52 hours, and then boiled for one hour shows a higher percentage of organic matter insoluble than either the 1 or 6 hours cold digestion. In this table it is also seen that the percentage of organic matter insoluble increases with the time of digestion, irrespective of settlement or agitation.

TABLE IV.—ORGANIC MATTER INSOLUBLE. REFILTRATION TESTS. (CARBONIC BISULPHIDE.)

Material.	Residual coal tar.	Residual petroleum.	Bermudez asphaltic. cement.
First filtration 17 hours.	22.78	.13	1.48
Refiltration 1 day later..	.32	.07	.11
Refiltration 2 days later	.22	.04	.06
Refiltration 3 days later	.23	.08	.07
Refiltration 4 days later	.30	.01	.02
Refiltration 5 days later	.16	.12	.05
Refiltration 14 days later	.25	.09	.11
Total refiltration 29 days	1.48	.41	.42
Grand total	24.26	.54	1.90

TABLE V.—ORGANIC MATTER INSOLUBLE. REFILTRATION TESTS. (CARBON BISULPHIDE.)

Material.	Residual coal tar.	Residual petroleum.	Bermudez asphaltic cement.
First filtration 1 hour...	21.74 21.93	.14	1.52
Refiltration 5 hrs. later	.13 .10	.10	.14
Refiltration 29 hrs. later	.43 .42	.05	.09

To determine once and for all whether or not any organic matter insoluble had passed through the asbestos felt, a number of hanging drop specimens were prepared from both original solutions and filtrates for microscopic examination. When viewed under high magnification, these specimens proved conclusively the following facts:

(1) That while suspended organic matter could invariably be detected in the original solution, none was present in either the filtrates from the hot method or from the cold, even when the filtration was made immediately after solution.

(2) That filtrates which showed no suspended material immediately after filtration were found to contain suspended matter upon standing for some time.

(3) That solutions refiltered a number of times during 30 days showed no formation of insoluble material upon standing 3 days longer.

These facts taken in connection with the results given in the preceding tables, would seem to establish the following principles:

(1) That prolonged digestion is unnecessary in making soluble bitumen determinations, in so far as the passage through the filter of finely divided insoluble organic matter is concerned.

(2) That upon prolonged contact with bitumens carbon bisulphide causes the precipitation of small quantities of insoluble organic matter.

TABLE VI.—EFFECT OF DIGESTION OF RESIDUAL COAL TAR FOR DIFFERENT PERIODS IN CARBON BISULPHIDE.

Filtered after standing ..	6 hrs.	29 hrs.	53 hrs.	52 hrs. cold 1 hr. boil'd
Organic matter insoluble ..	22 hrs.	23.15	23.49	22.74

(3) That this insoluble material is precipitated slowly, but that with the concentrations employed precipitation is practically complete within 30 days.

(4) That for equal periods of time the greatest amount of precipitate is formed during the first 24 hours of digestion.

In view of these facts it seemed of interest to run a series of soluble bitumen determinations with carbon bisulphide according to the cold method, allowing a minimum length of time for digestion and settlement. This was accordingly done, the filtrations being made 15 minutes after the sample was dissolved.

TABLE VIII.—ORGANIC MATTER INSOLUBLE. COMPARISON OF METHODS. (CARBON BISULPHIDE.)

Method.	Extractor.	Flask cold. 17 hrs.	Flask cold. 15 min.	Flask hot. 3 hrs.
Residual coal tar..	18.90 18.82	22.89 22.79	21.88 21.74	21.15 21.35
Residual water gas tar	.08 —.03	1.43 1.55	.70 .50	.51 .44
Residual petroleum	.01 —.30	.08 .11	.09 .14	.12 .08
Blown petroleum residual	—.10 —.24	.16 .16	.15 .24	.19 .17
Bermudez asphaltic cement	1.44 1.56	1.45 1.52	1.62 1.53	1.52 1.46
Bermudez asphalt.	2.29 2.12	2.25 2.32	2.30 2.45	2.25 2.32

Table VII, which contains the results of these tests, shows this method to give excellent checks, and in Table VIII the four methods are directly compared.

From these results the authors have come to the following conclusions with relation to the selection of a method:

(1) That for the determination of soluble bitumen carbon bisulphide is to be preferred to benzol for a solvent.

(2) That the flask method with Gooch crucible is to be prefered to the extractor method.

(3) That short periods of digestion are to be preferred to long ones.

(4) With regard to the final selection of a method, it is felt that either the cold 15-minute extraction or the hot extraction will give sufficiently close results for commercial purposes, and that there is little choice to be made between the two.

(5) In favor of the latter, it may be urged that for a determination of soluble matter this method is more scientifically correct, as it shows a somewhat smaller amount of organic matter insoluble.

(6) On the other hand, it may be contended that the cold method gives a more correct idea of what it is desired to ascertain, i. e., the percentage of insoluble material actually held in suspension, for it is believed that while the insoluble organic matter approaches free carbon in composition, a portion of it is composed of hydrocarbons rich in carbon, which are very difficultly soluble in the cold carbon bisulphide, but somewhat more readily in the hot.

(7) So far as this investigation has been carried, the 15-minute flask method would seem to be the most rapid practicable method yet found. It is not improbable, however, that the hot flask method could be shortened and that in both, the quantity of solvent could be diminished somewhat.

Everything considered, the cold 15-minute flask method has been adopted by the laboratory of the U. S. Office of Public Roads until data are forthcoming to show that some other method is superior.

TABLE VII FLASK METHOD, COLD, 15 MINUTES.

Material.	Solvent.	Sol. bitumen.	Organic matter insoluble.	Inorganic matter insoluble.	Ash in filtrate.*	Total.	Residue in flask.
Residual coal tar...........	Carbon bisulphide	78.07 78.23	21.88 21.74	.05 .03	... ...	100.00 100.00	.03 ....
Residual water gas tar......	Carbon bisulphide	99.23 99.45	.70 .50	.07 .05	... ...	100.00 100.00	.03 ....
Residual petroleum	Carbon bisulphide	99.80 99.78	.09 .14	.11 .08	... ...	100.00 100.00	.01 ....
Blown petroleum residue....	Carbon bisulphide	99.75 99.71	.15 .24	.10 .05	... ...	100.00 100.00	.00 ....
Bermudez asphaltic cement..	Carbon bisulphide	96.66 96.58	1.62 1.53	1.52 1.69	.20 .20	100.00 100.00	.00 ....
Bermudez asphalt	Carbon bisulphide	95.59 95.40	2.30 2.45	1.91 1.95	.20 .20	100.00 100.00	.03 ....

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*Averaged from Tables I, II and III.

Experiments of the State Highway Department of Ohio with Various Road Binding Materials.

A special appropriation was made last year by the State Legislature of Ohio for the use of the State Highway Department in testing various preparations for preventing dust and for binding the surface of macadam roads. The State Highway Department accordingly constructed an experimental road giving each of the materials tested a section 400 ft. long with a roadway 16 ft. wide, the section being connected and forming a continuous road, all parts receiving very nearly the same amount of travel. In selecting a road for the experiment it was desirable that it should be easily accessible, that it should be well traveled and, if possible, in the condition of an unimproved country road. Nelson Avenue was accordingly selected for the experimental work. This road is located near the city of Columbus and carries a large amount of wagon and automobile traffic. The road had been macadamized several years ago and there was a very good foundation over the distance which was used for the experiments. A census of the travel over the road for two weeks, beginning Nov. 29, 1909, was taken, and the results are shown in the accompanying table. The weather during almost this entire time was inclement, and the travel was consequently restricted to those who must of necessity go over the road. During the fine weather of the previous weeks, frequently several hundred automobiles passed over the road within one day. At this time, however, that the census was taken the weather had changed, and the results show more nearly the average travel during the winter season, which will be but a small percentage of the average travel on this road.

In preparing for the work the State Highway Department wrote to the different firms advertising road building materials and advised them of the proposed experimental road, its scope and purpose and expressed the hope that the manufacturers would participate in the work. With few exceptions the firms addressed complied with the request and applied their materials on the road. The State Highway Department paid for all labor and materials required in this work, but stipulated that each firm should furnish an expert to superintend its particular section in order that the work should be constructed exactly according to the manufacturer's ideas. In addition a few sections of the road were constructed using Portland cement as a binder. A report on this experimental road is given in a bulletin issued by James C. Wonders, Commissioner of Highways, under whose direction the experimental sections were constructed. This report covers the work up to January, 1910. The construction of the sections and the results obtained so far are described in the bulletin as follows:

In the construction of the road arrangements were made with a contractor to do the work on a force account, allowing his 15 per cent. of the pay-roll for the use of his outfit and his own services. In preparing the road to receive the various treatments, the old road was spiked up, new stone was added, and it was rolled and watered to the condition of a finished water-bound surface.

In the beginning an attempt was made to use macadam stone from all of the principal quarries in the state, building each section from a different quarry, but the delivery was so uncertain and irregular that the Department was compelled to abandon this feature.

It was not possible to separate the cost of the foundation of each section, and this expense was kept as a whole for all sections receiving like treatment, and in determining the cost of any section the cost of application of the binder was kept separate and added to the proportionate cost of its base to determine the cost of the section.

During the months of July and August good labor was plentiful at $1.50 per day, but beginning with Sept. 1, it was necessary to pay $1.75 per day for labor that was not as efficient as that for which the lower wages were formerly paid. This condition affects unfavorably the sections constructed after Sept. 1st, as they will show a higher proportional labor cost than the sections constructed before that date.

In justice to manufacturers furnishing the materials for this work, it is but fair to state that the relative cost of the sections is not in proportion, and the cost of each per foot is considerably higher than it would be were the sections a mile or more in length. This is owing to the small quantity of material required for each 400-ft. section, which made it impossible to handle large quantities at one time, and prevented systematic, routine work on the part of laborers, teams and machinery. The wide variance in freight rates and the nature of the materials used also contributed to this discrepancy.

In the descriptions that follow the sections are taken up in the order of their location, beginning at the north end, near the entrance to St. Mary's Academy, and proceeding from there south to the end of the work.

Experiment No. 1—Glutrin.—This material was applied on a well-constructed, two-course macadam road that had been thoroughly rolled and bonded. The company furnishing this material does not give the process of its manufacture. It is said to be prepared from materials produced during the manufacture of cellulose. It is described by the manufacturers as a "calcium-magnesium-ligno-sulfonate, and at the specific gravity of 1.26 at which it is sold, contains probably about 18.00 per cent of glucosides." It is a viscous liquid, soluble in water, and in addition to its binding qualities, it is claimed to form a chemical action upon the road material that increases the flow of the binder, probably silicate of soda and silicate of potash, which results from the action of water upon the road metal.

The surface of the macadam was sprinkled with water, and while it was still damp, glutrin was applied by sprinkling with an ordinary road sprinkler. Two applications were made, a day elapsing between the first and second applications. The road was ready for travel in four hours after each application.

The manufacturers of this material were permitted to apply it in the manner they desired, and under this arrangement about 1 gal. per square yard was used. When the work was completed there was an excess of binder remaining on the surface, which assumed the appearance of little pools with a glassy surface. After a few rains this excess material disappeared. It would seem that a less amount of material might have given as good results.

A few days after the second application the road was remarkably hard, and has continued in good condition up to the present time. This treatment is of an entirely different nature from the ordinary oils and tars and the effect of the winter season upon it will be watched with much interest.

The cost of this application was as follows:

Crushed stone	$191.18
Labor on macadam	[illegible]
Glutrin (711.9 gallons at 15 cts.)	106.79
Freight and transfer	14.69
Labor applying Glutrin	5.60
Total	$560.78

This material is manufactured by The Robeson Process Co., of Au Sable Forks, N. Y.

Experiment N[illegible] Standard Macadam Asphalt Binder.—The section of road on which this treatment was applied was first prepared in the usual manner of treatment for the lower course of a water-bound macadam road. Crushed limestone, ranging in size from 3 ins. to 1½ ins., was then spread to a depth of about 3 ins. This course was then rolled with a 10-ton roller until it presented a fairly smooth and uniform surface. The asphaltic binder, which had been heated in a small tank at the side of the road, was then applied by means of hand sprinkling cans. About 1½ gals. of the binder was used for each square yard of surface treated. Screened screenings varying in size from ½ to ¾ in. were then spread upon the road and the roller again brought into use. Additional screenings were added where the binder appeared on the surface, and this work of rolling and adding screenings continued until no more binder appeared on the surface. On a portion of this section a second coat of the binder, consisting of from ¼ to ½ gal. per [illegible] coat of screenings and more rolling.

The cost of this section was as follows:

Crushed stone	$191.18
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

No charge was made by the company for the binder used in this work. This material is manufactured by the Standard Oil Co.

Experiment No. 3—Pioneer Ashpalt Cement.—The material used as a binder in this experiment is refined from rock asphalt mined in Utah. In the construction the foundation course was finished as a water-bound macadam road, thoroughly rolled and bonded. The second layer was composed of stone ranging in size from 1½ to 2½ ins. This was rolled to a finished depth of about 2 ins., no water being used. Screenings ½ to ¾ ins. were broomed into the surface in a quantity sufficient to reduce the voids about 50 per cent. The asphaltic cement was then poured at a temperature of between 390° and 410° F., until all of the stone was thoroughly coated. When the coating had cooled, a thin dressing of screenings was sprinkled over the surface. These screenings were sprinkled but a short distance ahead of the roller, which followed immediately after the screenings were placed. The screenings were sprinkled at first in a thin layer, and as the rolling proceeded more screenings were added, until the coating had absorbed all the screenings which it was possible to absorb. The quantity of the binder used was 1¾ gals. per square yard.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Pioneer asphalt	77.24
Freight	[illegible]
Labor on top course	143.10
Total	$663.26

This material is manufactured by the American Asphaltum & Rubber Co., of Chicago.

Experiment No. 4—Tarvia "X."—In the preparation of Tarvia X, ordinary coal tar is heated to drive off the water and ammonia. The manufacturers have not seen fit to state what further treatment, if any, is given.

The road was prepared for this treatment in a manner similar to section No. 3, except that the stones in the top course were from 1½ to 3 ins. in size. No screenings were used. When this course was thoroughly dry, the refined tar, under pressure, at a temperature of from 250° to 300° F., was spread over the surface by means of a hose attached to a tank wagon. The tank was hauled by a steam roller to avoid the displacement of the stone that would be caused by horses' feet. By the use of the tank wagon the tar was kept heated and under pressure, and this method of applying the tar greatly facilitated the work. The time required for one pouring over the entire section was about one-half hour.

Between 1 gal. and 1¼ gals. of the tar was used in the first pouring for each square yard of surface. Screened stone, ranging from ½ in. to ¾ in. in size, were then swept over the surface in sufficient quantity to fill the voids. The road was then rolled. After rolling, from ½ to ¾ gal. of tar was spread over each square yard of surface, and the surface was again covered with the above described screenings, a sufficient amount of screenings being used to cover the surface and protect the road while the tar was setting up. This was then thoroughly rolled, which completed the treatment of the section, and it was immediately opened for travel.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Tarvia X	[illegible]
Labor on top course	55.90
Total	$570.80

This material is manufactured by the Barrett Manufacturing Co.

Experiment No. 5—Tarvia "B."—This material is a tar preparation that may be applied without heating. In this instance it was placed on a macadam road that had been filled and rolled, but had not been watered, and had been under travel for about two weeks. In making the application, all of the dust and dirt was carefully swept to the sides of the macadam, and on the clean surface the binding material, which had been heated for this work, was applied by means of the same tank wagon that was used for Tarvia "X." Two-thirds of a gallon was used per square yard. As soon as the Tarvia had been applied the dust that had been removed from the road was swept back over the surface.

This treatment is the most easily applied of any of the tar products that were used, and the results up to the present time have been very satisfactory. The surface of the road has kept in as good condition as any that was treated by the more expensive methods. It is not likely that the treatment will be as lasting as those in which the binding material was incorporated in the body of the stone.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	242.52
Tarvia "B"	30.55
Labor applying Tarvia "B"	32.99
Total	$497.24

This material is manufactured by the Barrett Manufacturing Co.

Experiment No. 6—Liquid Asphalt.—The material used in this section is the Indian Refining Company's heavy asphalt binder, said to contain 90 per cent asphalt. It was shipped in barrels and was heated for use on the road in a large heating tank. The barrels were rolled on skids to the top of the heating tank, and when in place one head of the barrel was knocked in and the material allowed to flow out of the barrel thus opened. Notwithstanding the fact that the weather was very warm while this work was being done, the material was so heavy that it flowed very slowly, and several minutes were required to empty a barrel in this manner. The material was heated to a temperature of about 200° F. and applied to the road under conditions similar to those used for the "pioneer asphalt," described above.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Labor on top course	118.39
Total	$500.09

No charge was made by the manufacturer for the material.

This material is manufactured by the Indian Refining Co., of Cincinnati.

Experiment No. 7—Ugite.—The material used in this treatment is claimed by the manufacturers to be a true tar, made by treating water-gas tar in such a manner that the hydro-carbon compounds of the paraffins in the water-gas undergo a chemical change, resulting in the production of a true tar, without producing free carbon, which is commonly found in the coal-gas tars; consequently, a material that does not have the deep black color of the ordinary tar.

The preparation of the macadam for this section was similar to that for experiment No. 3. The treatment was applied in two different ways, as follows:

At the beginning of the section, extending south for a distance of 273 ft., or a total of 485 sq. yds., after rolling in sufficient three-quarter inch stone in the top course to bind it well 2.05 gals. of the tar were poured on the road, at a temperature of 240°. The maximum air temperature during this work was 87°, the minimum 75° and the mean 81° F. The tar was heated in a small heating tank placed at the side of the road and the average rate of application on this part of the section was about 1,200 gals. per day. After pouring the tar on the road a small quantity of ¾ in. stone was then applied, just sufficient to keep the roller from the tar compound, and the surface was well rolled. Stone chips about ½ in. in size (France & Co., Dunkirk, O.) were then spread on and well rolled in. A light coating of ¼ in. screenings and dust (Woodruff & Pausch, Columbus, O.) was put on, to protect the road surface until the compound had a chance to set up. This was rolled until firm.

On the remainder of the section—127 ft. in length, or a total of 226 sq. yds.—the compound was applied in two coats. On the top course of stone, which had been filled previously with ¾ in. stone, well rolled in, 1.67 gals. per square yard was poured, at a temperature of 250° F. This was applied at the rate of 1,000 gals. per day. Sufficient ¾ in. stone was spread over the surface to keep the roller from sticking and was well rolled in. A surface coating of .44 gals. per square yard, at a temperature of 280° F., was then put on at the rate of 3,000 gals. per day. One-half inch chips (France & Co.) were put on and well rolled in. This was followed by a light coating of ¾ in. screenings and dust, to protect the road surface while setting up. On this section, therefore, there was applied a total of 2.11 gals. of the compound per square yard.

The weather conditions during the construction of the second part of this section were slightly unfavorable, due to a shower at night which delayed the completion of the rolling of the section.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Ugite	92.40
Freight and transfer	58.12
Labor on top course	119.76
Total	$651.98

This material is manufactured by the United Gas Improvement Co., of Philadelphia.

Experiment No. 8—Fairfield Asphaltic Cement.—This material, which is described as a refined asphaltic cement, was applied to the top course of a two-course macadam road. This top course consisted of stone from 1½ to 3 ins. in size, in a layer 4 ins. thick, and it was thoroughly rolled before applying the asphalt, but without any screenings or other filler. The asphalt was heated in a small heating tank at the side of the road, and applied on the road by the use of buckets. The work was done about the first of August, when the weather was extremely warm. The asphalt had been shipped in barrels, and it was so heavy and viscous that in order to remove it the barrels were cut in halves with axes, and on account of its adhering to the staves it was frequently necessary to throw them into the heating tank to save the material. After the asphalt had been applied, stone chips, varying in size from ½ to ¾ in., were applied to the surface of the road to a depth of about ½ in. This was then thoroughly rolled, the chips being forced into the voids of the macadam and also forming a surface over the top which prevented the asphalt from sticking to the roller. When this rolling was completed, the road was ready for public travel. Thirteen thousand three hundred and fifty pounds of the material were used in treating the section. The completed road remained remarkably firm during the warmest weather, and the horses' shoes made but slight impression on it.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Asphaltic cement	115.35
Freight and transfer	35.04
Charge on heater	5.00
Labor on top course	65.81
Total	$602.90

This material is manufactured by the Impervious Product Co., of Baltimore, Md.

Experiment No. 9—Asphaltoilene.—In the manufacturer's description of this material it is stated that it "is made from a heavy natural oil with an asphalt base and not containing paraffin. This natural oil contains so little of the illuminating oils or valuable products that it is not worth refining for their extraction. It is, therefore, never 'cracked' or coked, but contains a high percentage of liquid asphalt with sufficient oil to act as a solvent and vehicle."

This material was applied on a macadam road prepared after the manner of experiment No. 8, excepting that the stone in the top course ranged in size from 1 to 2½ ins. The material was heated in a small heating tank placed at the side of the road and poured on the road with buckets. Twelve hundred gallons of asphaltoilene were used on this section, which was about 1.7 gals. per square yard.

After the asphaltoilene had been applied, ½ in. stone screenings and dust, in about equal parts, were spread over the surface of the road to a sufficient thickness to fill the voids and make a smooth and uniform surface, and the road was rolled until it was thoroughly consolidated and the asphaltoilene showed a tendency to stick to the wheels of the roller.

A few weeks after the completion of this section the oil appeared to rise from the body of the stone over a distance of about 100 ft. in length, and, combining with the dust that settled on the road, formed an excellent, smooth coating which was readily marked by horses' shoes. Over the remaining part of the surface the binding material did not rise to the top.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Asphaltoilene	116.32
Labor on top course	70.36
Total	$568.38

This material is manufactured by the Good Roads Improvement Co., of Cincinnati.

Experiment No. 10—Wadsworth Macadam.—This material is Kentucky rock asphalt, very finely ground. It was applied on the top course of a macadam road, prepared after the manner of experiment No. 9. About 1 in. of the asphalt was spread over the surface of the stone and evenly distributed with hand-rakes and then thoroughly rolled with a steam roller, forcing the asphalt into the spaces between the stones. This probably penetrated beneath the surface of the stone for an inch or more. After this had been thoroughly rolled, another layer of about 1 in. of the asphalt was spread, and this was again rolled thoroughly.

This material was applied in warm weather, but without artificial heat. When first completed the road tracked very readily; horses' feet and the wheels of vehicles marked it in such a manner that it seemed that it would soon be destroyed. After a few weeks of travel, however, the surface began to get firmer, and in a short time became very smooth. Several months after the completion of this work, it was as smooth as the best finished asphalt street, with no waves or cracks, and entirely free from dust.

This is an interesting construction, as it provides a surface very much like a sheet asphalt street, and can be constructed without artificially heating the material.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on base	190.52
Kentucky rock asphalt	145.05
Freight	94.95
Lumber	10.29
Labor on top course	119.71
Total	$751.70

This material is manufactured by the Wadsworth Stone & Paving Co., Pittsburg, Pa.

Experiment No. 11—Carbo-Via.—This material is a refined coal tar product. It was applied on a macadam road prepared after the manner of experiment No. 9. The material was heated to a temperature of about 300° F., in the same tank that was used for experiment No. 9, and was poured on the road with hand sprinkling cans. In making the first application about 1½ gals. per square yard were poured. Immediately after the pouring the surface was rolled with a steam roller, the wheels of the roller having been oiled with an emulsion of kerosene and water, to prevent the carbo-via from adhering to the roller. After this rolling, a thin layer of stone chips was swept into the voids, and the surface was again rolled. About ½ gal. of carbo-via per square yard was then applied and rolled as before and covered to a depth of about ¾ in. with stone screenings and dust. This large amount of covering has caused the section to remain quite dusty.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on macadam	190.52
Carbo-Via	108.55
Labor on top course	78.70
Total	$568.95

This material is manufactured by the Continental Bitumen Co., of Toledo, O.

Experiment No. 12—Concrete Macadam.—The construction of this section was practically the same as that of a water-bound macadam road, except that Portland cement was mixed with the screenings for the binder of the top course, with the expectation of increasing the cementing power of the stone dust. The cement was mixed with the dry screenings in the proportion of one part of cement to six parts of screenings. The mixing was done by hand on board platforms placed at the side of the road, the mixture being turned until it was of a uniform color. Upon the lower course of macadam, which had been shaped, rolled and thoroughly bonded, was spread a layer of limestone varying in size from 1½ to 3 ins., to a depth of about 3 ins. After this course had been thoroughly rolled, the above described filler was applied dry, using a spreading motion of the shovel, the rolling being continued during the process of filling until all the voids were completely filled. Water was then applied and the rolling continued until a wave of grout was produced in front of the roller over the entire surface. This section was closed against travel and the surface was kept damp by repeated sprinklings for several days after the work had been completed. Two months after completion this section had the appearance of a water-bound macadam and it was doubtful if the addition of the cement had been of any advantage. Fifteen barrels of cement were used in this experiment.

The cost of the section was as follows:

Crushed stone	$191.22
Labor on base	226.12
Cement	17.10
Lumber	5.00
Labor on top course	42.00
Total	$481.44

Experiment No. 13—Taroid.—Taroid is described by the manufacturers as being "a coal tar pitch prepared in liquidized form as a binder." The lower course, or base, for this section was shaped up with rather small size stone, filled and thoroughly rolled. The stone for the top course varied in size from 3½ ins. to 1½ ins. This stone was spread to a depth of about 3 ins. The method of treatment was similar to Section No. 3. From 1 to 1½ gals. of hot taroid was poured on each square yard of surface. This pouring was done by hand; 4 gal. galvanized pouring cans equipped with fan shaped nozzles being used. After the taroid had partly cooled, the surface was well rolled. Coarse torpedo sand was then spread over the entire surface and the road was again rolled, which completed the treatment.

The cost of this section was as follows:

Crushed stone	$191.18
Labor on base	174.02
Taroid	93.21
Freight and transfer	38.24
Labor on top course	86.05
Torpedo sand	14.00
Total	$596.70

This material is manufactured by the F. J. Lewis Co., of Chicago.

TABLE SHOWING DAILY TRAVEL ON EXPERIMENTAL ROAD FROM NOV. [illegible] TO DEC. 12, 1909, BETWEEN [illegible] A. M. AND [illegible] P. M.

Days.	29	30	1	2	3	4	5	6	7	8	9	10	11	12	[illegible]
One-horse buggy	61	59	51	57	[illegible]	58	108	49	26	40	[illegible]	[illegible]	42	34	690
Two-horse carriage	12	2	4	7	3	11	15	2		[illegible]	5	4	8		[illegible]
One-horse wagon	50	57	50	71	38	[illegible]	1	58	42	43	43	61	63	7	641
Two-horse wagon	[illegible]	57	49	54	26	52	1	70	42	[illegible]	54	[illegible]	57		618
Runabout automobile	..	2	3	..	3	6									14
Touring car	55	65	40	69	28	62	106	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Motor cycle	2	..	..	6		1	6								15
Horseback rider	[illegible]		[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	1	2					54
	[illegible]	242	[illegible]	266	[illegible]	[illegible]	264	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Experiment No. 14—Petrolithic Pavement.—This process of road treatment was introduced by the Petrolithic Pavement Co., of Los Angeles, Cal., who incorporate a heavy asphaltic oil into the road material by means of various tools and devices, some of which are patented by the company. The tamping roller is an important factor in the construction of this type of roadway. It consists of a roller about 3 ft. in diameter whose surface is studded with iron teeth 9 ins. in length and having an end area of about 4 sq. ins. The action of these teeth on the road material is said to approximate that of a flock of sheep, and to produce a tamping, puddling and kneading action which compacts the lower portion first and gradually works the material into so compact a mass that the teeth or feet of the roller will finally ride on the surface without penetrating or indenting the roadway. The old macadam roadway where this section was constructed was first broken up with a rooter pulled by a steam roller and the loosening completed by turning with a common road plow pulled by horses. The loose stone was then smoothed with a heavy "A" harrow. The California liquid asphalt heated to a temperature of 200° F. was then applied by means of a Petrolithic Glover Road Oiler. Three applications of 1 gal. each per square yard were made. The mass was then mixed by means of the petrolithic road cultivator and tamped and compacted by means of the petrolithic rolling tamper. A road grader was used to crown and shape the roadway. After the work of tamping had been completed, a small amount of limestone screening was applied and the surface smoothed with a steam roller. A fourth application of the asphalt consisting of about ½ gal. per square yard was used, the surface covered with limestone screenings and again rolled. This section presents a rather uneven surface at the present time, in some places the material seeming to have heaved or raised up. The cause of this has not yet been ascertained.

The analysis of this material by Chas. A. Blackmar, city oil inspector of Los Angeles, Cal., is as follows:

Test No. 3022. Sample No. 1. Tested, date June 26, 1909.
Kind of product, Residuum. Received, date June 25, 1909.
Source of supply, Whittier-Fullerton.
Manufactured by Atlas Refinery.
Water 0% B. S. 0%; Sediment .4%.
Volatility .2% to 220° Fahr.; .1% at 220° Fahr.; Total .3%.
Organic matter insoluble in Ccl .22%
Inorganic or mineral matter Ccl .06%
Sulphur 1.15%
Asphalt 83.63%. Penetration 80° at 77° Fahr. D. of C. standard.

The cost of this section was as follows:

Crushed stone	$ 27.00
Asphalt oil	302.60
Labor	293.00
Total	$622.60

Experiment No. 15—Limestone Concrete.—This section was constructed of concrete made of crushed limestone and Portland cement rolled in place with a steam roller. The foundation was prepared by grading and shaping the old macadam road to give it the cross-section desired for the surface of the finished work. It was well rolled before placing the concrete. The concrete was made in the proportion of one part cement, three parts screenings, ranging in size from ½ in. to dust, and six parts limestone from 1 to 3 ins. in size. It was machine mixed. Water was used very sparingly on account of the impossibility of rolling wet concrete. It was difficult to secure a concrete mixer for this small amount of work, and the machine that was obtained was not of sufficient capacity to produce the quantity that would secure best results. Owing to the slowness of the work the roller was obliged to work over such short spaces that in part of the work a wavy surface resulted. If the work had been done more rapidly a much better surface would have been secured. The concrete was uniformly 6 ins. deep and had vertical joints across its width at several places. Two months after completion this section showed a very satisfactory surface, and it seems possible that work of acceptable nature could be made after this manner, if done under more favorable conditions.

The cost of this section was as follows:

Crushed stone	$[illegible]
Cement	180.60
Rent of concrete mixer	30.00
Lumber	8.90
Labor	[illegible]
Total	$[illegible]

Experiment No. 16—Gravel Concrete—This section was constructed as an experiment to determine the utility and economy of gravel concrete for construction of highways in localities where a good quality of bank gravel is found. The concrete used in this section was made from unscreened pit gravel and Portland cement in the proportion of one barrel of cement per cubic yard of concrete The gravel was obtained from the Barnes Sand & Gravel Co., of Piketon, O. This gravel cost 16 cts. per ton f. o. b. cars at pit, and the freight rate was 50 cts. per ton, making the cost of gravel 66 cts. per ton on board cars at the siding about ¼ mile distant from the work. The concrete, which was a wet mixture, was placed on the road 6 ins. thick and the surface was formed by dragging a template over it. This method of construction was used in order to secure a concrete at a low cost that would be uniform in quality from top to bottom with a surface that would not be slippery. The principal objection to rich concrete for paving has been its slipperiness. This work was made without joints and is in reality a slab 6 ins. thick, 16 ft. wide and 400 ft. long. It presents a smooth, hard, dustless surface, which gives indications of great durability. During the cold weather of December transverse cracks developed at irregular intervals due to the contraction of the concrete. No longitudinal cracks have developed.

The cost of this section was as follows:

Gravel	$113.81
Cement	149.19
Concrete mixer	30.00
Lumber	8.90
Labor	206.00
Total	$507.90

Experiment No. 17—Water-Bound Macadam.—This section was constructed in accordance with the specifications for water-bound macadam now in use by the State Highway Department. The road is built in two courses, the methods employed on the two courses being identical. The stone ranges in size from 3 ins. to 1½ ins. The stone is first rolled dry until there is no longer any waving or creeping movement, and the voids are reduced to a minimum. Dry screenings varying in size from ½ in. to dust are then applied during the finishing process of dry rolling. When the voids are completely filled, water is freely applied and the rolling continued until a wave of limestone grout appears in front of the roller as it passes over the surface. After the surface has been treated in this manner it is allowed to dry out or set before traffic is permited to pass over it.

The cost of this section was as follows:

Crushed limestone	$129.82
Labor	210.18
Total	[illegible]

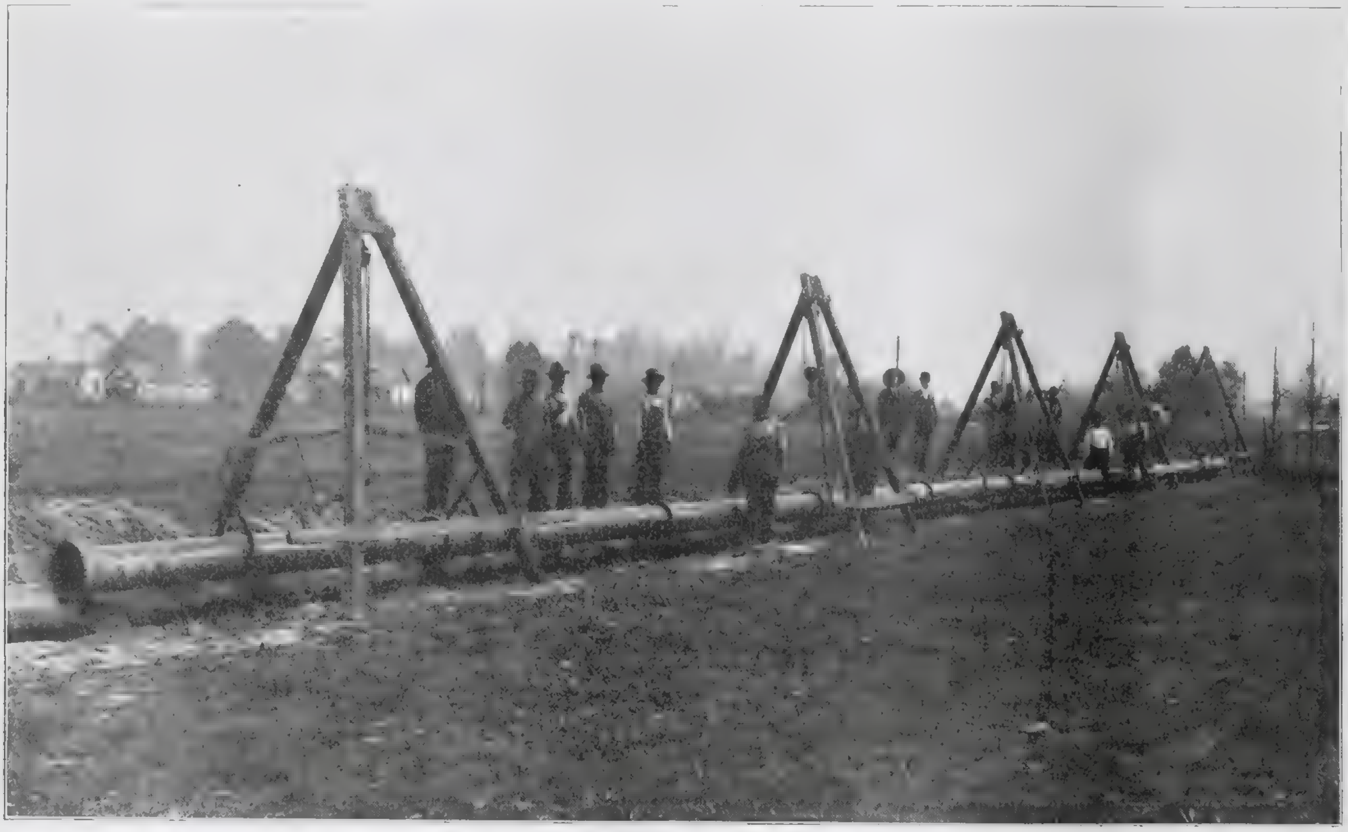
Advices from Williams, Ariz., state that the Grand Canyon Scenic Railway, which is backed by a Cleveland brewer named Oppman, has applied for a permit to build a gasoline scenic motor line about 16 miles along the brink of the Grand Canyon from the El Tovar hotel to the Grand View point about 3,000 feet below the rim of the canyon. The plans are said to call for the expenditure about $1,000,000.

The Vaiden Dredging & Drainage Co., according to advices from Winona, Miss., has adopted plans by which all necessary money will be raised and a canal survey made to begin at once through Hay's Creek Valley. If the plans are perfected a large body of submerged land will be drained, cleared and put into a state of cultivation.

WATER-WORKS AND SEWERS SECTION

Method and Cost of Laying 10,137 Ft. of 12-In. Water Pipe by Day Labor at Tuscaloosa, Ala.

The work consisted in laying 10,187 ft. of 12-in. pipe and erecting thereon two hydrants with 92 ft. of 4-in. pipe. Prior to starting the work all the pipe had been placed along the line of trench. For laying the pipe five Mueller derricks and equalizers* were set us as shown by the accompanying cut and 10 lengths or 120 ft. of pipe were connected, calked and handled at once. The trench was 3 ft. deep. With an average gang of 40½ men and two teams the work was accomplished in 19 working days and 23 days total time. The average length of pipe laid per 10-hour day was 533.5 ft.; the maximum day's work was 1,059 ft. of pipe laid. After completion the pipe was tested to 125 lbs. hydrostatic pressure and only two leaks developed. These were at joints whose pipe had been laid one length at a time in crossing another pipe line and where the ground was too rough to permit lining up 10 lengths at once. There were no leaks in any of the joints caulked on the surface.



View Showing Method of Handling Ten Lengths of Water Pipe Calked and Laid as a Unit.

The wages paid, working a 10-hour day, were: Laborers, $1.25; yarners and calkers, $1.50 and $2; foreman, $2, and team and driver, $3.50. The cost of the work was as follows:

Labor	$1,051.69
950 lbs. oakum at 3½ cts.	33.25
15,864 lbs. lead at 5.15 cts.	817.00
1,800 lbs. coal at $2 per ton	1.80
15 gals. coal oil at 17 cts.	2.55
Lanterns, nails, etc.	11.95
Total	$1,918.24

This gives a cost of 18.9 cts. per lin. ft. of pipe laid. A bid received for the work asked 30 cts. per lin. ft. for laying the 12-in. pipe, 10 cts. per lin. ft. for laying the 4-in. pipe, and $3 each for setting the hydrants or a total of $3,056.30. The pipe was laid under the direction of Mr. C. E. Abbott, Manager, Water Works Commission, Tuscaloosa, Ala., who writes as follows:

The price does not include my salary, as I attended to my duties as manager while this construction was going on, and if work had been awarded to a contractor the salary of the inspector would not have been paid by the contractor, but would have been an additional cost to the Water Works Commission; it does include the entire cost of the improvement. The pipe laying plant used has been in use over a year, having laid about one mile of 8-in. and a half mile of 6-in. pipe. The cost of the entire equipment used was $278.

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*H. Mueller Manufacuring Co., Decatur, Ill.

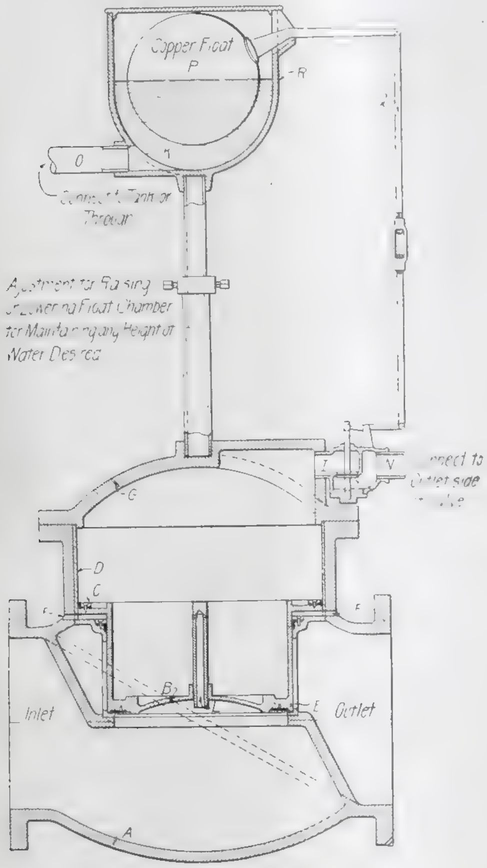
General Costs of Concrete Sewers in Louisville, Ky.

The data concerning the cost of work to the contractors of the construction of sewers in Louisville has been compiled, and is being compiled daily by the engineers of the Commissioners of Sewerage of Louisville. The method of arriving at the costs is given as follows: The expenses of the contractors are divided into three items; Plant, including machinery and equipment; Materials of Construction; and Labor. The data relating to these items is collected by the inspectors on the several contracts. Record of all machinery, tools and other equipment is kept and the values ascertained.

In the estimate of the cost of the work, the probable expense to the contractor on account of his plant is reached by assuming the rental to be from 20 per cent to 60 per cent per annum, of the original cost, depending on the nature of the machinery and the duration of the work. The full cost of small tools and supplies is generally considered a part of the cost of the work except when, particularly upon the smaller work, it is expected that they will be of considerable value after the contract is completed. Itemized record is kept of all materials entering into the construction of the work, such as cement, steel, brick, sand, gravel, etc. In the report on labor, account is kept of the hours spent by the entire construction force, from the superintendent to the laborers and the time spent by them upon the different classes of work. In addition to these expenses, there is allowed the usual cost of such general expenses, as the cost of the surety bond, liability insurance, etc. In this way an attempt is made to estimate with a reasonable degree of accuracy the cost of the excavation, masonry and all other classes of work. The results of these accounts have not been made public, but a few figures on the average cost on different portions of the work are given.

On the Southern Outfall, covering a length of 24,040 ft. or 4.55 miles, the sewer ranging in size from 8 ft. to 15 ft. 6 ins. in diameter, and in depth of excavation, from 22 to 49 ft., it has been estimated that the average cost of earth excavation has been 85 cts. per cu. yd.; the cost of concrete $6.50 per cu. yd. and the cost of steel in place, 2½ cts. per pound. On another class of sewers, covering five contracts, the sewers ranging in size from 18 ins. to 96 ins, but almost entirely masonry sewers (only 400 ft. of pipe), with an average size probably over 5 ft. in diameter and being on the average 18 ft. deep, with a maximum cut of 31 ft, the cost of earth excavation has been estimated at about 90 cts. per cu. yd., the concrete $7 per cu. yd. and the steel for reinforcement 2½ cts. per pound in place. On a group of sewers almost entirely of concrete, of still smaller size and in less depth of excavation, the maximum size in this group being 4 ft. 6 ins. in diameter, and the depth of cut not over 17 ft., the cost of earth excavation has been estimated at $1.11 per cu. yd. and the cost of concrete $7.80 per cu. yd.

In all these estimates the amount of excavation upon which the figures are based is the excavation which would have been made if the trench were opened to a width of 6 ins. greater on each side than the outside of the masonry, and to the depth of the underside of the masonry. In most cases, the actual excavation was much in excess of this. In the estimates for the cost of concrete masonry, the amount used in the calculation has been the amount required, but this amount has very often been exceeded, particularly in the smaller sewers, as the contractors have found it cheaper to put in additional amounts than to go to the expense of forms and labor to make the sections perfectly true to the required dimensions.


Copper Float
P
R
O
Connect to Tank or Reservoir
Adjustment for Raising or Lowering Float Chamber for Maintaining any Height of Water Desired
Connect to Outlet side of Valve
I
V
G
D
C
F
B
E
Inlet
Outlet
A

Automatic Controlling Float Valve for Gate Chambers.

An Automatic Controlling Float Valve for Water-Works Gate Chambers.

The accompanying drawing shows a sectional view of an automatic controlling float valve manufactured by the Golden-Anderson Valve Specialty Co., Pittsburg, Pa.

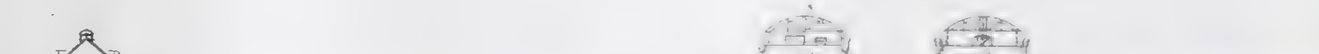


Fig. 1. Longitudinal Sectional Profile and Details of Sewer Siphon Under the River Dee, Aberdeen, Scotland.

Referring to the sectional view, interest centers in the positive manner of operation and construction. Attention is called to the upper portion of the body being lined with bronze, also to the piston or valve *B* being bronze fitted, with rubber cups and disc, preventing any metal parts coming in contact. The valve operating in a vertical position and being cushioned at all times by water and air in opening and closing, absolutely insures positive operation on the varying pressure without chattering or hammering. In fact, the valve is practically indestructible, due to the easy operation, which is as follows:

In accordance with the sectional view, the valve is closed. The water coming under the piston or valve *B* also enters through port *L* and *H* on top of the valve or piston *B*. When water is drawn from the tank, standpipe or reservoir, the water pressure is removed from the float chamber *K*, causing the copper float *P* to drop and in doing so, the lever connection *Q* attached to the arm of the copper float, opens the auxiliary valve *J*, allowing water above the piston or valve *B* to escape through the auxiliary valve. This discharge can be connected to the outlet side of valve or into effluent. Owing to the pressure above the valve being removed the pressure under valve *B* forces it open. The water above the valve acts as a perfect cushion in opening and at the same time as the valve begins to travel upward, it draws in air through ports *F* in the sides of the body, to cushion the valve in closing. Water in the tank, standpipe or reservoir having reached the required height, the pressure from same coming through the pipe connection into the float chamber *K* raises the copper float *P*, which operation closes the auxiliary valve *J*, shutting off the escape of the water above the piston or valve *B*. This allows the water pressure to come through port *L* and *H* on top of valve *B* and owing to the greater area above the valve, it is forced to its seat, *E*, thereby shutting off the water. This action of the main valve brings the air cushion into operation, compressing the air and forcing it out through ports *E*, thus preventing any shock, chattering or hammering in closing.

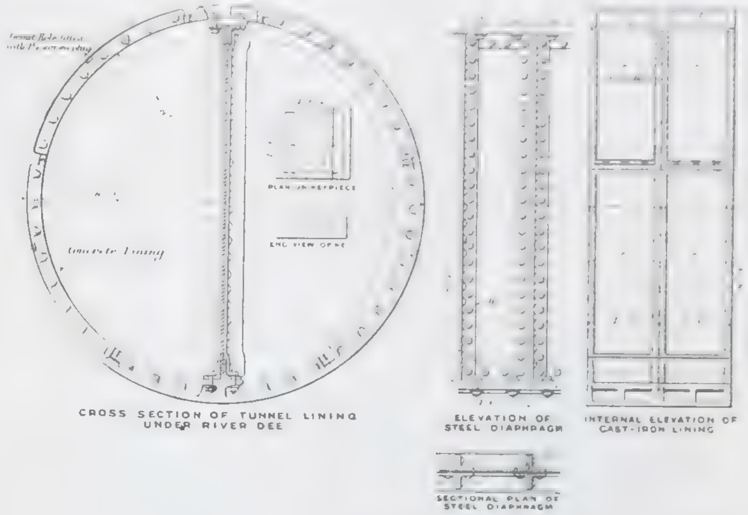

Concrete Lining
PLAN OF KEY PIECE
END VIEW OF KEY
CROSS SECTION OF TUNNEL LINING UNDER RIVER DEE
ELEVATION OF STEEL DIAPHRAGM
INTERNAL ELEVATION OF CAST-IRON LINING
SECTIONAL PLAN OF STEEL DIAPHRAGM

Fig. 2. Details of Cast Iron Lining for Sewer Siphon, Aberdeen.

Method of Constructing by Tunneling a Sewer Siphon Under the River Dee, Aberdeen, Scotland.*

This tunnel, Figs. 1 and 2, is constructed at right angles under the river, and is designed to form duplicate siphons for conveying the sew- [illegible] bank of the River Dee. The depth from high-water mark of ordinary spring-tides to the top of the tunnel was fixed, by agreement with the Harbor Commissioners, at 41 ft., so as to allow a future dredging depth of 38 ft.

Tunnel Lining.—The tunnel is 344 ft. in length, measured from center to center of the shafts, Fig. 1. Its external diameter is 8½ ft., and it is formed of rings of cast-iron segments 1 in. in thickness and 18 ins. in length, each ring being made up of five segments and a special key-piece. The following Table gives the weight of one ring:

	Cwt.
Key-piece	2.68
Two upper segments	[illegible]
Two lower segments	[illegible]
Bottom segment	5.49
Total	26.26

The whole of the flanges are machined throughout and are provided with a caulking space. Each segment is tapped and fitted with screw-plugs for grouting purposes. The bottom segment and the key-piece have cast upon them special machined flanges, 10 ins. wide, to receive the vertical steel diaphragm, which was placed in position after the tunnel was driven. The tunnel has a fall of 12 ins. from Point Law to Torry.

Shafts.—At the Torry and Point Law sides

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*Extracted from [illegible] R. G. Conway [illegible] Aberdeen M[illegible] Works: Girdleness Outfall Scheme." Proceedings Institution of Civil Engineers, Vol. CLXXVII.

of the river cast-iron shafts were sunk; these were 13 ft. in external diameter, the metal being 1¼ in. in thickness; the ordinary rings were 6 ft. in depth, made up of seven segments with 6-in. bracketed flanges. All the flanges were machined for a distance of 3½ ins. from the outside, leaving a calking space for rust of 2½ ins. horizontally and vertically.

The Torry shaft was sunk to a depth of 62½ ft. below high-water mark of ordinary spring tides, or 70 ft. below the finished wharf level, a depth sufficient to form a permanent drainage sump below the level of the tunnel. In sinking this shaft no special difficulty was experienced until the level of the top of the tunnel was reached, the method adopted being to dig the material out by hand and to load the shaft internally with kentledge. The upper 10 ft. of the ground passed through consisted chiefly of a fine red clay, used locally in former times for brickmaking. Underlying this was an impervious bed of grey clay, and the shaft passed through the upper 40 ft. without any trouble. When, however, that depth was reached, the clay was found to contain numerous pockets of sand, and water burst into the shaft very rapidly, soon filing it up; pumps were then placed in the shaft and the excavation was continued by hand and by means of grabs under difficulties for the remaining 23½ ft. The quantity of water dealt with amounted to between 60,000 and 80,000 gals. per hour. Great care had to be exercised in preventing the shaft from sinking too far, as the segments on the line of the tunnel had been placed vertically without breaking joint, in order that a horizontal and a vertical joint should fall exactly in the center line of the tunnel. When the shaft had been sunk to the exact depth and hung from large balks of timber at the top, considerable difficulty was experienced in obtaining a suitable foundation to prevent it from settling. The surrounding ground had also been disturbed by the operation of sinking the quay-cylinders, referred to later, which was being carried on simultaneously with the sinking of the tunnel-shafts. The method adopted to plug the shaft and to form a foundation was as follows: It was allowed to fill with water, which rose to slightly above high-water mark, the rise and fall of the tide, normally about 12¾ ft., making practically no difference to this level. A diver was then sent down to excavate the ground below the bottom of the shaft, and a little beyond the side (the cutting edge had previously been taken off and a special ring with a bracketed lower flange, 12 ins. wide, had been substituted in its place). By excavating an additional 3 ft. below the shaft a solid foundation was reached consisting of hard boulder-clay overlaying the rock. The space excavated was then plugged with 2-to-1 concrete, which was lowered in closed skips and placed carefully in position by the diver. This concrete was continued up 21 ins. above the lower flange of the shaft, giving an average depth of foundation concrete of 4¾ ft. The shaft was then allowed to stand full of water for a fortnight, when it was pumped out and found to be perfectly watertight.

Practically the same course had to be adopted in sinking and plugging the Point Law shaft on the north side of the river; exactly the same strata were met with, and the difficulties were accentuated by the closer proximity of the quay-wall cylinders and the presence of large water-worn boulders in the shaft, some of them several tons in weight. The shaft was sunk to a depth of 53 ft. below high-water mark and the excavation for the foundation was carried about 4¾ ft. below this level, when a firm foundation of very hard boulder-clay was reached.

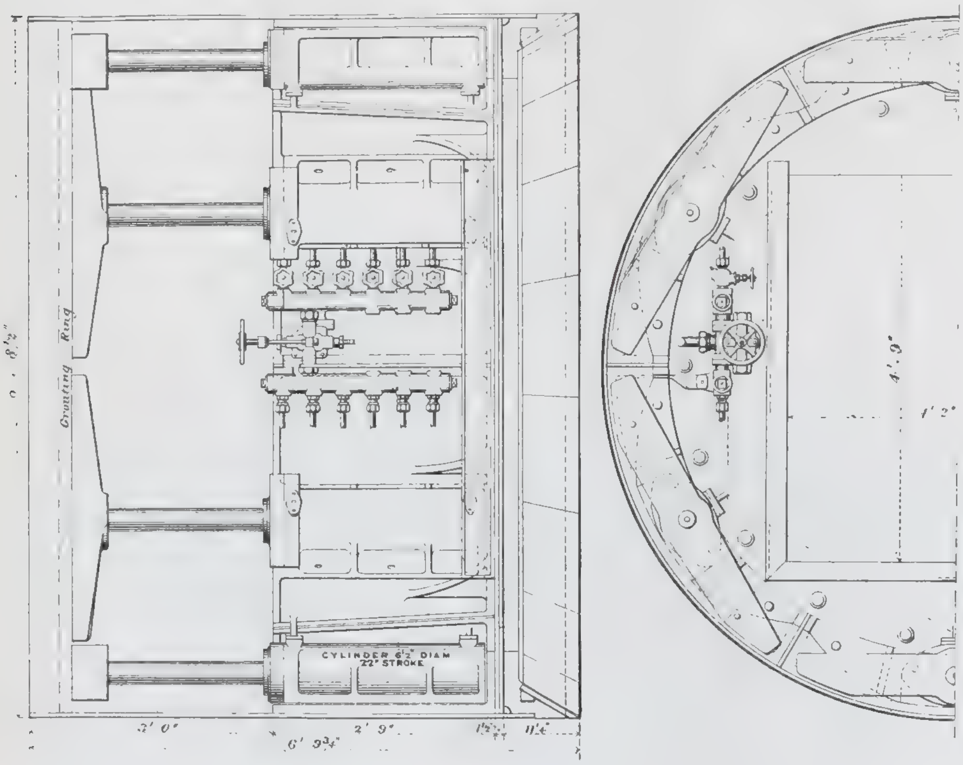

Fig. 3. Details of Tunneling Shield for Sewer Siphon, Aberdeen.

Quay-Wall Abutments for Tunnel.—In connection with a scheme then in process on the River Dee for constructing docks (now completed), a joint arrangement was entered into with the Aberdeen Harbor Commissioners to substitute for the proposed timber wharfing a permanent abutment on either side of the river. This was formed of granite-faced concrete retaining-walls, laid on a foundation of concrete cylinders and sunk to give a clear navigation space of 250 ft., Fig. 1. This proposal was adopted to prevent any disturbance to the tunnel in the future, a proportion of its cost being borne by the Town Council. The plan, designed and carried out under the direction of Mr. R. Gordon Nicol, M. Inst. C. E., the Engineer to the Commissioners, was for the construction of a 70-ft. length of quay-wall on either side of the river. Two pilot cylinders were first sunk 21 ft. off the center line of the tunnel; these were 14 ft. square and were formed of concrete blocks faced with granite dowelled and bonded together, with a well-hole measuring 7½ by 8½ ft. They were sunk to a depth of 48 ft. below low-water mark by means of grabbing, about 400 tons of kentledge being used; at this level they reached a firm foundation on the boulder-clay. A large cylinder was then sunk between them, 38½ ft. long by 14 ft. wide, and having three well-holes.

In the large cylinder on either bank an opening for allowing the tunnel to pass through was provided, but for facility in sinking this was temporarily faced on the outside with an outer skin of 14-inch brickwork stiffened by concrete piers within the well-holes. When these cylinders were sunk to the required depth, a circular tunnel was constructed within them exactly on the line of the tunnel, and 9½ ft. in internal diameter, thus allowing a clear space of 6 ins. on all sides for surrounding the tunnel with concrete, as it was driven through. The well-holes were afterwards filled up with 6-to-1 concrete to the tops of the cylinders, which were at the level of low-water mark, and the quay-walls were then constructed on these as foundations.

Tunnelling.—Upon the completion of the quay-wall cylinders, a commencement was made to drive the tunnel from the Torry side. It was at first proposed to do the work without the aid of compressed air, but the experience gained in sinking the shaft and in an attempt to drive a small heading to discover the actual conditions of the strata, led to the adoption of compressed air; the presence of large quantities of water under pressure rendering satisfactory work impossible otherwise.

The air-lock of the Torry shaft, designed to suit the existing conditions, consisted simply of two circular steel floors supported upon girders, which in turn were suspended from the cast-iron flanges. The lower floor was placed 12 ft. above the center-line of the tunnel, with the upper floor 6 ft. above it; this allowed a depth of 4½ ft. inside between the main girders, but the full height was available between the decking. To render the floors air-tight, the floor-plates, etc., were bolted together with canvas and red-lead, and the clearance space between the shaft and the outer skin of the floors was grouted with plastic bitumen. In the lower floor was provided a cast-iron hinged door, and in the upper floor a sliding door that could be operated from either inside or out. On the top floor and immediately over the lower door a steel tube 18 ins. in diameter was fixed; this was 12 ft. long, and was fitted with an air-tight cover opening externally, so as to permit of rails, bars, etc., being passed through the air-lock.

For the purpose of lowering material into the tunnel from the air-lock, an electric hoist was provided, the motor and switches being fixed to the upper floor. The air-lock was fitted with a ¾-in. inlet and outlet air-tap, controlled only from the inside, and for passing through materials a 2-in. tap controlled from the outside was provided. Telephonic communication was arranged from the top of the air-lock to the compressor station and also to the tunnel.

The air-compressing plant was laid down on the Torry side about 200 yards west of the shaft, and adjoining the old Torry brickworks, the engine- and boiler-house of which were utilized as far as possible. Two Ingersoll-Sergeant horizontal air-compressors were used; these were provided with piston inlet-valves and water-jacketed air-cylinders and heads; the steam-cylinders were 16 ins. in diameter and the air-cylinders 18¼ ins. Each machine was capable of supplying 37,800 cu. ft. of free air per hour to the tunnel. The usual custom was to run the two machines at a low speed simultaneously, except during cleaning and repairs, when one compressor run at a higher speed was sufficient. Steam was supplied to the compressors from a Lancashire boiler having a working pressure of 80 lbs. per sq. in. The air was supplied to the tunnel through 7-in. diameter steel pipes, which were reduced to 5 ins. at the air-lock.

Before erecting the steel floors to form the air-lock, the shield was lowered into the Torry shaft in a position to commence driving. This shield (Fig. 3) was 6 ft. 9¾ ins. long and 8 ft. 8½ ins. in external diameter. The shell was composed of two 1¼-in. steel plates riveted together, the cutting edge being formed of eighteen steel knives. The diaphragm was double, being composed of two ¾-in. steel plates, and had an opening 4 ft. 9 ins. by 4 ft.

2 ins. with steel channels riveted on to permit of planking being used to close up the space. The shield was fitted with six hydraulic rams, 6½ ins. in diameter, having a 22-in. stroke; the working pressure was 1 ton per sq. in., but the actual pressure used never exceeded ½ ton per sq. in. The rams had forged cross-heads. In the diaphragm 14 holes were tapped to 2¼ ins. gas-thread and fitted with screw-plugs; these holes were occasionally used for passing a drill through where the cutting edge struck large boulders.

After the fixing of the air-lock and applying the pressure, operations were begun by driving a tunnel to form a shield-chamber to the back of the quay-wall cylinder—a distance of 33 ft. 6 ins. This tunnel was driven in the ordinary way by means of 10-in. bars and poling boards, and was sufficiently large to permit of its being lined up with four rings of blue brickwork within the bars and to leave an internal chamber of 9 ft. The ground being in such a dangerously disturbed condition, the whole of the timber was left in and the back of the brickwork was packed with concrete. An air-pressure of 17 lbs. per sq. in. was required to keep this length clear of water. The space between the shaft and the quay-wall was taken out in three lengths and lined up immediately each length had been dug out. Upon completion of this short length of brick tunnel, the shield was moved along to the back of the quay-wall; the outer skin on both sides of the cylinder was then removed, and the shield was set into position to start under the river. After this the brick tunnel was lined with cast-iron segments up to the shield, and 6 to 1 concrete was packed in at the back of the plates.

A small heading, measuring 5½ ft. by 3½ ft., was driven in advance of the shield exactly on the center line of the tunnel; this heading was timbered, generally for about 12 ft. in advance of the cutting edge, with 9 in. by 4-in. side and head trees and sills, placed close together without poling-boards. The ground kept perfectly dry and firm under the air pressure, and as the shield was driven forward and the segments were erected the timbering in the advance heading was removed and used over again.

No further difficulty was experienced in tunnelling under the river until the quay wall at Point Law was reached. Great care, however, had to be taken to prevent the lining from "cork-screwing" owing to the necessity of having the special flange in the key and bottom segments in accurate alignment for the erection of the steel diaphragm; the progress of tunnelling was consequently slow, never exceeding three rings a day, generally two. The actual driving from quay-wall to quay-wall occupied from the 14th March to the 14th June, 1905.

When the Point Law quay-wall was reached the work of tunnelling was carried on by similar operations to that on the Torry side, a blue-brick tunnel being formed in the space of 19½ ft. between the north side of the concrete cylinder and the Point Law shaft. To prevent the air from escaping up the Point Law shaft and to allow a proper watertight connection being made between the tunnel and the shaft a very satisfactory air-tight floor was constructed, as follows: timber planking supported upon old tram-rails was placed above the level of the top of the tunnel, upon this came 7 ft. of well-rammed clay, and the shaft above was then filled to the top with water.

In driving the tunnel, there was little or no escape of air at the face, except in passing through the quay-wall cylinders, but the purity of the air was maintained by always delivering it at the shield and exhausting it at the air-lock. The air was frequently analyzed in the tunnel by means of a Haldane apparatus for determining the amount of CO_2, and larger samples drawn from the tunnel were also examined in the chemical laboratories of Aberdeen University. The amount of CO_2 varied at different times between 10 parts and 14 parts in 10,000. As far as possible, a supply of [illegible]00 cubic feet of free air per hour was allowed for each man. Electric light was used throughout.

The entire tunnel was grouted with Portland cement [illegible] and before the removal of the air-pressure it was carefully rust-jointed.

[illegible] cleaning operations being carried on at all times, duplicate siphons were formed, the tunnel being divided by means of a ⅝-in. steel-plate diaphragm (Fig. 2). The diaphragm was stiffened every 18 ins. by two vertical angle-stiffeners on each side, and the steel plates were placed in position in 6-ft. widths, templates being used to obtain the exact size. The stiffeners were hydraulicly riveted to the plates above ground, and the sections were riveted together with wrought iron ship rivets below ground; all the joints were carefully arranged to break bond, and were packed with two layers of canvas and red-lead. The diaphragm was secured by steel angles to the special flanges on the cast-iron lining, the steel angles being also embedded completely with canvas and red-lead.

After the steel diaphragm had been completed the west siphon was closed temporarily at the ends by steel plates, and the work was tested for watertightness under a pressure of 25 lbs. per sq. in. Beyond a few leaks through the bolt-holes connecting the steelwork to the cast-iron flanges, the diaphragm was found to be quite water tight and the leaky bolt-holes were remedied by placing lead washers round the heads and nuts.

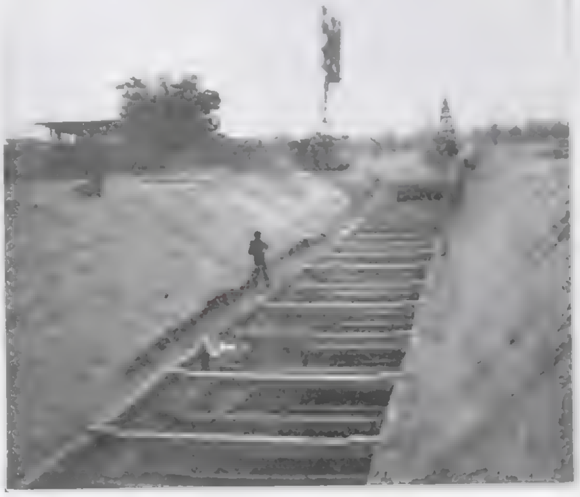

Fig. 1. Cableway and Trench With Sloped Banks on Section A.

The two siphons were then lined with concrete to the required shape (Fig. 2), each being 6½ ft. high by 3 ft. wide on the center line of the tunnel; this gave a total thickness to the diaphragm of 14 ins. The concrete for this lining was composed of 2½ parts of crushed granite (¾-in. mesh), 1½ part of pit-sand and 1 part of Portland cement. The concrete was well rammed against planed laggings, the fine stuff being worked with specially-shaped iron tools to bring it to the face, thus leaving a perfectly smooth surface without and plastering. The inverts of either siphon were slightly flattened to allow of easy walking during the operations of cleaning.

The two siphons are connected to the outfall sewer on either side by means of cast-iron flanged pipes 51 ins. in diameter with special bends at the top. At the bottom of each shaft these pipes were connected to either half of the tunnel and also to the vertical shaft by special junction castings (Fig. 1).

On the Torry side the 51-in. pipes are fitted with doors at the tunnel level, so as to allow of access to each siphon; they are also provided with 8-in. sluice valves for draining the siphons into the sump below the tunnel level. At Point Law access doors are also provided together with sluice-valves for draining into either siphon when not in use any water which may gather on the floor of the shaft. The bottoms of the 51-in. castings are closed with ribbed cast-iron plates, which at Point Law are encased in concrete and at Tory rest upon rolled steel joists and the concrete roof of the drainage sump.

[illegible] chamber to connect the outfall-sewer to the tunnel siphons (Fig. 1). The chamber is pro[illegible] fitted with gun-metal facings, these penstocks being raised by means of 10-in. diameter hydraulic cylinders; for this purpose a pressure of 40 lbs. per sq. in. is obtained from the Corportion water-main. Over the top of the shaft is a small house in grey granite for containing the hydraulic cylinders, etc., and from which access to the siphons can be obtained.

On the Torry side two sets of penstocks and hydraulic cylinders are also provided, and by closing the respective penstocks on both sides of the river either siphon can be thrown out of use. A very effective method of flushing is obtained by allowing the sewage to accumulate in the sewer at Point Law and then raising the penstocks on one siphon rapidly. The actual fall between the inlet at Point Law and the outlet at Torry is 16 ins., giving a hydraulic gradient of 1 in 250, and if sewage were running at its maximum depth in the outfall-sewer, a velocity of 7 ft. per second would be obtained.

For cleaning purposes the contents of either siphon can be pumped out in 2 hours by means of a 4½-in. high-pressure centrifugal pump placed on the roof of the drainage-sump at the tunnel level. This pump is driven by a 30-B. HP. electric motor, compound wound and placed vertically in the floor of valve-house; the connection between the motor and pump is by means of a vertical steel spindle, 2¼ ins. in diameter, on special bearers fixed to girders placed across the shaft.

The siphon inlet house is octagonal in plan and is built of grey Kemnay granite with fine-axed dressings. An overhead traveling crane is fixed in the roof, with quick and slow motions for raising and lowering skips to remove the silt in the siphons. Ventilation is obtained by means of an 18-in. Blackman electric fan fixed in the roof. A 36-in. electric fan, fitted with an enclosed motor, is also provided in the roof of this house for special ventilation during the cleaning operations; this fan runs at a speed of 800 revolutions per minute and gives a velocity of 600 ft. per minute in each siphon.

Methods of Construction on the Southern Outfall Sewer, Louisville, Ky., With Some Costs.

The Southern Outfall sewer is the largest trunk sewer of the Louisville system. The sewer is about 5 miles long and is horseshoe shaped in its largest section, the dimensions being 15 ft. 6 ins. x 15 ft. The smallest section is of the semi-elliptical type and is 7 ft. high and 7 ft. wide between side walls. Table I shows the approximate sizes of sewer and conditions affecting the construction work, and gives the type of general plant employed on each of the seven contracts for the different sections of the work.

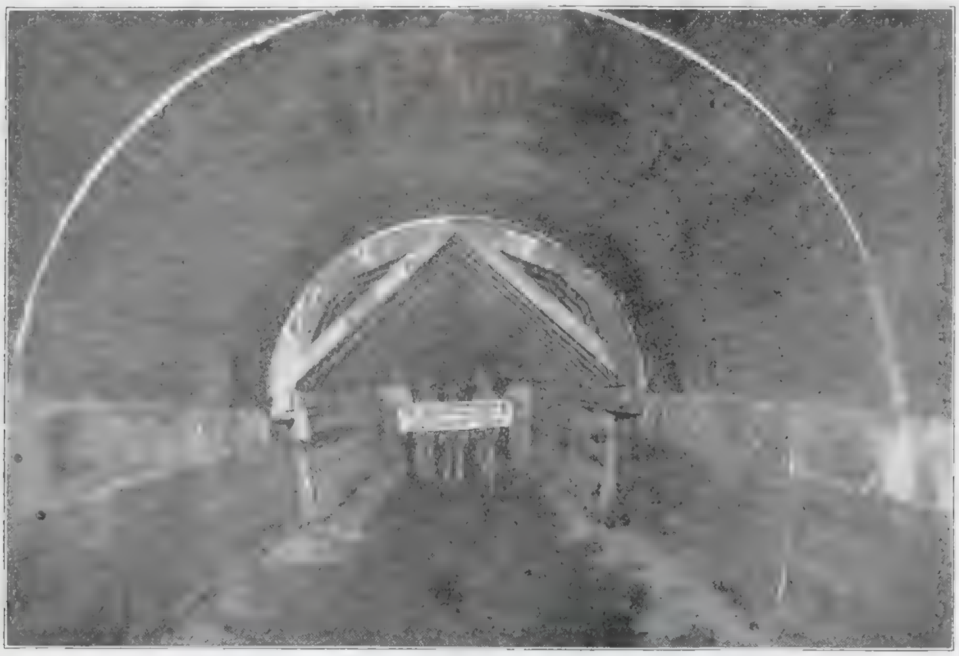

Fig. 2. Interior of Sewer Section A, Showing Collapsible Wooden Forms.

The contracts for the whole work amounted to approximately $1,150,000. On Section A the work included the construction of the outlet structure at the Ohio River which was described in Engineering-Contracting of June 22, 1910. The balance of this section was on level ground in a very deep cut, the depth in places being about 50 ft. The upper portion of the trench was excavated to a depth of about 10 ft. with horse scrapers and the banks sloped at an angle of about 45°. Below this the excavation was done by hand; the earth being removed and the trench backfilled by means of a 400-ft. cableway and buckets, Fig. 2.

The trench on Sec. A was sheeted by the poling board method. This is unusual for work of this size and in this material. This work had to be handled with great care to do the work safely. The method worked successfully, however.

The concrete work was accomplished in three operations. The invert was poured first including a few inches of the sidewalls. Next the sidewalls were poured, and last, the arch. A view of the work showing the interior of the finished sewer and the collapsible wooden forms used, is shown by Fig. 3.

Section B of the sewer was worked in two openings. The excavation for each was first carried down 10 ft. by a steam shovel and the material hauled away in standard railroad cars. A complete standard gage railroad plant was maintained on this work throughout construction. Upon the first westerly opening a double Lidgerwood cableway of 700 ft. span was employed for the balance of the excavation. Two yard buckets were used, and the material was carried immediately to the backfill. The maximum amount of excavation handled by the cableway in one week was 2,016 cu. yds. (loose measure.)

On the second or easterly opening the steam shovel was followed by two derricks which were run on a track alongside of the trench. These were followed by a third derrick used for back filling. An orange peel bucket was used on the head derrick to remove the middle third (in depth) of the excavation. Following this derrick the second derrick handled skips filled by hand; this outfit excavating the bottom third, of the trench. The maximum amount of excavation taken out in one week by these two derricks was 1,589 cu. [illegible]

The 700 ft. double Lidgerwood [illegible] this work was moved several times. Each time the cable way was dismantled and two traveling cranes assisted in the moving. The towers were 60 ft. high. About 20 men were employed in moving and the cost of moving and setting up each time was between $380 and $400.

On one of the openings steel sheet piling was tried and was driven for some distance before excavating. The cut here was about 40 ft. deep, and in gravel, and it was found upon excavation that the sheeting had curved in toward the bottom so that the distance between the rows of sheeting was several inches less than the width of the sewer. The sheeting was finally pushed out by heavy jacks and braces to a sufficient width for construction of the sewer, but the delay and extra cost caused a loss of 18 cts. a yard on this portion of the work.

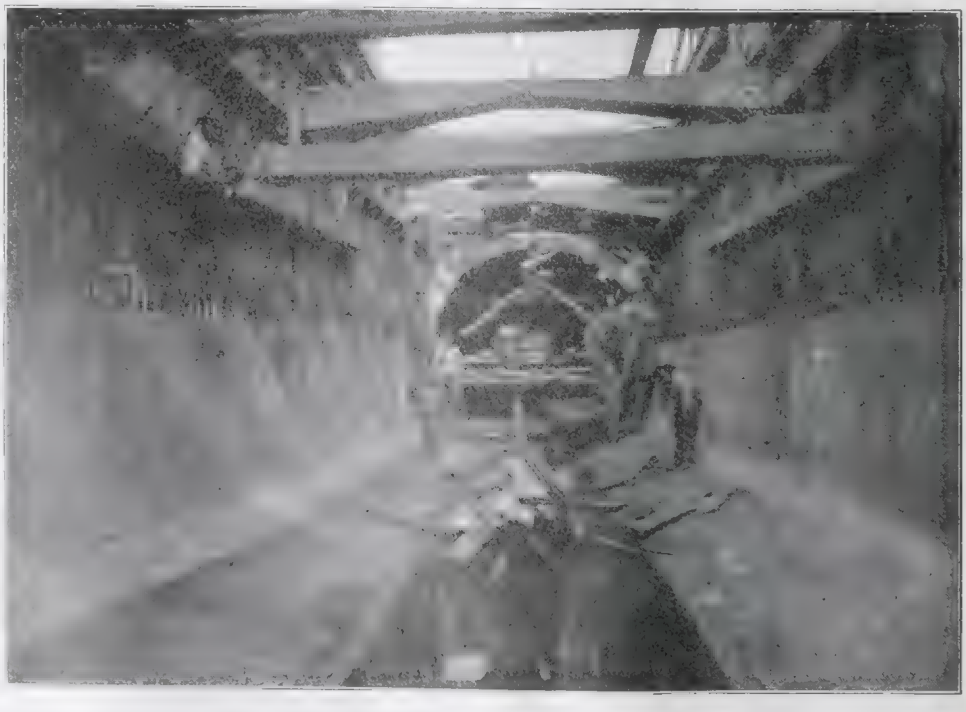

Fig. 3. Showing Condition After Completion of Invert and Side Walls, Section B.

The concrete work on this section was done under a subcontract and the contractors employed two similar outfits which did very efficient work. An illustration of one of these plants is shown by Fig. 4. The mixer was mounted on the end of a flat car, as shown, and the charging hopper placed above it. The balance of the flat car was housed in and used for cement storage. The manner of charging the mixer is as follows: Two 1 yd. buckets are used and handled from the ground to the hopper. The proper proportions of mixture, sufficient for one batch, are placed in a bucket on the ground and raised to the hopper by a locomotive crane. While one bucket is being dumped, another is being filled. The standard gage track laid along the trench is connected with the railroad and the gravel and sand is brought in on gondola cars and distributed conveniently along the work.

On section C a steam shovel was started for the purpose of taking out the first 8 ft. of trench but was abandoned after a few weeks and the revolving derrick which followed was employed to take out all the excavation to within 14 ft. of the bottom. The derrick operated an orange peel bucket and the material was loaded on Koppel cars and hauled back and dumped into the trench over the completed sewer. The plans of this derrick were given in Engineering-Contracting of June 29, 1910.

On Section D the first 8 ft. in depth was taken out by two steam shovels operating over the trench and carried on rollers on the surface of the street. All material removed by the shovels was wasted and was hauled away by teams. The balance of the excavation was handled by a locomotive crane operating an orange peel bucket. The crane was operated from a track supported over the trench. Koppel cars were used for carrying the excavation from the crane to the backfill. They were operated on both sides of the trench. For driving the lower set of sheeting in this section a steam hammer was used. On the next section of the work, the first 8 ft. of excavation was taken out with horse scrapers. This was followed by two portable stiff leg derricks mounted to straddle the trench; both derricks operating orange peel buckets. The first derrick operated to a depth of 28 ft. and the balance was taken out by the second derrick. The material taken out was dumped on to cars and hauled back by mules to be dumped over the completed sewer.

The sheeting was driven by hand and was pulled by means of a derrick operated by an electric motor. The sewer was built in three operations. There were two Smith mixers, one mounted over the trench and the other along side the trench. The material for each batch of concrete, cement, sand and gravel, was thrown into a cart in the storage yard and hauled from there to the mixer. The concrete was discharged from the mixer to chutes which carried the material to place.

On section E, the first 12 ft. of excavation was handled by a stiff leg derrick mounted on a car which was supported over the trench. Most of this material was wasted and was hauled away by teams and wagons. The derrick was followed by a Carson machine which carried the excavation to completion and made the backfill. The sewer on this section was built in two operations, the invert and a portion of the sidewalls being poured first, and then the arch and balance of the side walls were poured.

Section G is the last section of the Southern Outfall and also includes Section A of the South Louisville Branch sewer. Section A is, however, only 256 ft. in length. The excavation was made by horse scrapers to a depth of 6 ft. and the material was hauled away as waste. The remainder of the excavation was handled by a stiff leg derrick operating an orange peel bucket. The material thus excavated was placed in Koppel cars and hauled back by mules and dumped over the completed sewer.

Concrete was run to place in the sewer through chutes made of galvanized iron. The concrete mixer is located at a railroad siding where all the material is received. An industrial railroad is in use here for carrying material from the cars to the mixer and also to carry the mixed material from the mixer to the work.

Several short tunnels on this work were decided upon for passing under the railway tracks and street car tracks. One tunnel 600 ft. long was carried under the property of the Standard Oil Co. This work in tunnel was made advisable on account of the danger from fire by the operation of a steam plant in the vicinity of the oil storage tanks.

The tunnel was excavated its entire length before any concrete work was started. The progress in each of the four headings worked amounted to 4½ ft. per day. The sewer section here is semi-elliptical in shape and about 7½ ft. in diameter. A single cap and pair of legs was used as a tunnel bent and the sheeting was driven ahead with the cap and legs of the bents for guides. The concrete in the tunnel work was mixed and placed under a different method than that used in open cut. The concrete was mixed in a special gravity mixer, designed by the contractor and suspended in one of the two shafts. The invert of the sewer was placed in 18 ft. lengths and the arch in 9 ft. lengths. Instead of building the side walls and invert together, the side walls were built with the arch. The arch centers were made in lengths [illegible] wood) each section being made in two panels, [illegible] panels met at the crown of the arch. Their weight is light and they were taken down and erected by hand. A section or panel was of such size as to be easily carried forward under other centers without wrecking or removing any braces. The lagging was placed [illegible] placing of the concrete necessitated, so as to afford opportunity to tamp the concrete as it was placed. Very wet concrete was used and it set up slowly so that it was possible to place a 9-ft. section of arch in each heading once every four days. There were four headings to be worked, however, and this made the work continuous at a rate of progress of 9 ft. per day.

An unusual difficulty was encountered during the excavation work of the tunnel. The loose sand in the top of the heading of the tunnel was found to be saturated with volatile oils, so that wherever the planks in the roofing of the heading were driven, the gases liberated were very troublesome, the men being [illegible] ticable to ventilate the heading suffi[illegible] than half time of the 10 hour day. The accumulation of gas was attributed to leaks and years of accumulated wastes of oil from the Standard Oil Co.'s storage tanks and houses [illegible] the Louisville Sewers is under direction of the [illegible] B. F. Brud is Chief Engineer and Mr. Harrison P. Eddy is Consulting Engineer. Mr. Frank C. Williams is Resident Engineer

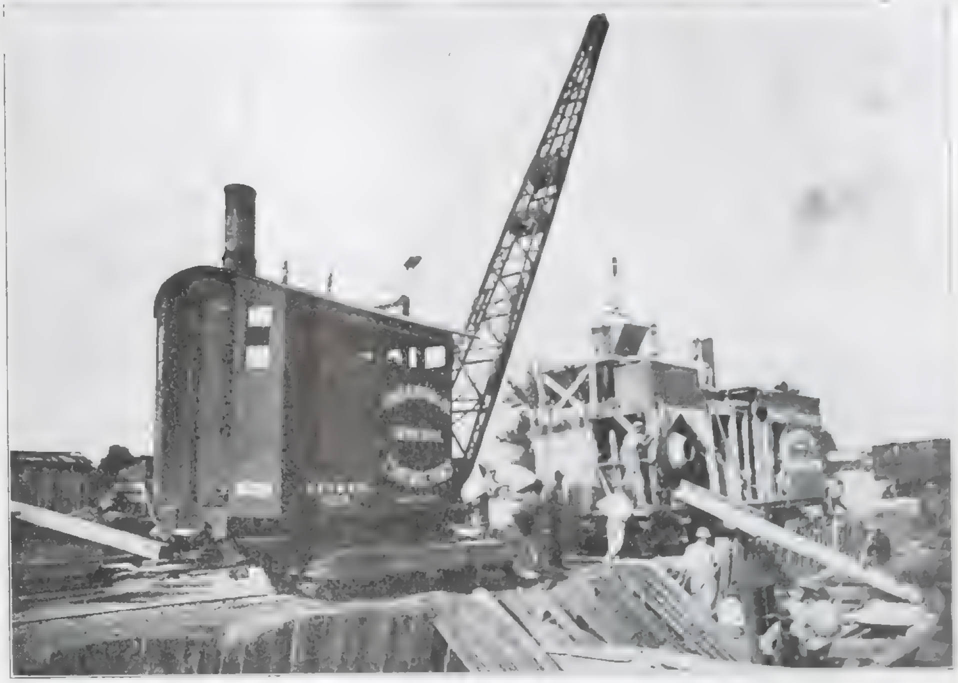

Fig. 4. Concrete Outfit on Section B.

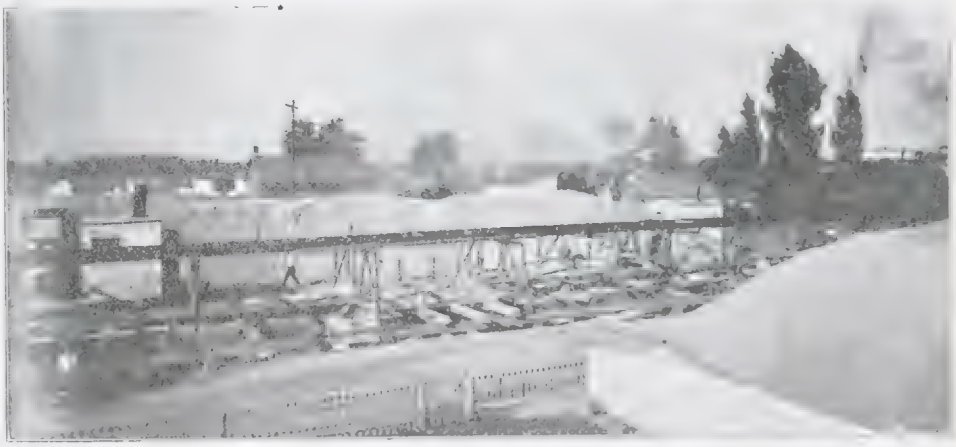

Fig. 5. Showing Potter Machine Mounted Over Trench and Two Mixers Alongside Section C.

TABLE I. SOUTHERN OUTFALL SE[illegible]

	Approx. Length, Ft.	Av. Size of Sewer, Ft. and Ins.	Av. Depth of Cut, Ft.	Nature of [illegible]tion.	Paving	Excavating Plant.	[illegible]	[illegible]	[illegible]	[illegible]
Section A	2000	10′ 0″	38.9′	Loam, Clay Sand, Grav.	Open Country	Horse Scrapers 400′ Cableway	[illegible]	[illegible]	[illegible]	[illegible]
Section B	6000	15′ 0″	32.1′	Loam, Clay Sand, Grav.	Open Country	1st Opening. No. 1 Steam Shovel 700′ Double Cableway 2nd Opening. No. 1 Steam Shovel 3 Derricks Standard R.R Cars	[illegible]	[illegible]	[illegible]	[illegible]
Section C	4200	14′ 0″	39.3′	[illegible] Gravel	2200′ Improved	Revolving Derrick Orange Peel Potter Machine Koppel Cars	[illegible]	[illegible]	[illegible]	[illegible]
Section D	5700	13′ 3″	33.3′	Clay, Sand Gravel	Macadam 400′	2 [illegible] Locomotive Crane Orange Peel Koppel Cars	[illegible]	[illegible]	[illegible]	[illegible]
Section E	3400	12′ 3″	34.8′	Clay, Sand Gravel	Brick 500′ Macadam 400′	Scrapers 2 Derricks 2 Orange Peel	[illegible]	[illegible]	[illegible]	122.5
Section F	2400	12′ 0″	34.9′	Loam, Clay Sand, Grav.	Brick 225′	Derrick Orange Peel Carson Machine	1715	[illegible]	[illegible]	[illegible]
Section G	4100	8′ 0″	24.8′	Clay, Sand Gravel	Brick 1100 Asphalt 100	Scrapers Derricks Koppel Car	[illegible]	[illegible]	[illegible]	[illegible]

Note: Average cost of excavation per cubic yard was 85 cts.; the cost of concrete was $5.50 per cubic yard

STEAM AND ELECTRIC RAILWAY SECTION

The Appraised Values of the Electric Street Railways of Detroit, Mich.

An appraisal of all the street railways of Detroit has recently been completed under the direction of Mr. Frederick T. Barcroft, M. Am. Soc. C. E. Mr. Barcroft's report is the most complete published record of its kind that we have ever seen. This completeness of the report has led us to abstract the data in great detail. We have also deduced the costs per mile of tracking and have otherwise presented the data in such form as to permit ready comparison with similar unit costs.

The Detroit United Railway controls all the street railways in the city of Detroit. The franchises on many miles of its track will soon expire. This fact led the mayor, Mr. Philip Breitmeyer, to appoint a committee of 50 citizens to make an investigation and report on the street railway question, one of the duties of the committee being to appraise the value of the physical property of the railways. M. Frank W. Eddy was chairman of the committee, and Mr. Joseph Boyer was chairman of the sub committee on appraisal. On Feb. 25, 1909. Mr. Frederick T. Barcroft, consulting engineer, of Detroit, was appointed director of appraisal. His report of the results of the appraisal was dated Oct. 1, 1909.

The first street railway franchise was granted to the Detroit City Ry. Co. in 1862. Since that time 50 corporations have received franchises, but their stock was eventually absorbed by the Detroit United Rys. Co.

The appraisal, which includes 170.4 miles of track and 1,000 revenue cars, gives not only the cost of reproduction new, but the depreciated, or second-hand value of the property. We shall first give a summary, followed by costs in great detail. The cost of reproduction new was as follows:

Cost of Reproduction, New

1.	Real estate	$ 513,548
2.	Buildings, except power houses and battery stations	654,884
3.	Power plants, including bldgs.	1,481,328
4.	Battery stations, incl bldgs	228,252
5.	Power distribution, incl. overhead feed wires and telephone system	1,211,897
6.	Track	3,601,336
7.	Rolling stock, incl. equipments	3,676,098
8.	Shops	390,968
9.	Tools, materials, supplies, furniture, etc.	751,016
10	Overhead charges	1,268,000
	Total	$13,777,327

Item 10 was not given in the report, and we have estimated it as explained below.

The depreciated or present value was as follows:

Depreciated Value.

1	Real estate	$ 513,548
2.	Buildings	578,763
3.	Power plants	1,019,051
4	Battery stations	200,488
5.	Power distribution	1,088,063
6.	Track	2,799,222
7.	Rolling stock	2,861,403
8.	Shops	308,719
9.	Tools, supplies, etc.	728,158
10.	Overhead charges	1,024,310
	Total	$11,121,725

Attention should be called to the fact that item 6, track, includes grading, as well as rails, ties, etc., and it includes broken stone, gravel and concrete foundations, but does not include wearing coat of the pavement.

The report says:

> Paving has not been considered an asset of the company in the preparation of this appraisal. * * * Disturbing and replacing the pavement adds no value to it. Neither can the company obtain credits, as it requested, for theoretical items. If there is any value to the pavement to which the company is entitled, it must be upon some different theory than that it is an asset, for so far as the company is concerned it is an obligation foreign to its needs as a transportation proposition, and is in lieu of other taxes. When certain taxes or municipal charges are remitted by the authorities, and the company assumes the obligation of paving, there can be no question that the paving thereby becomes a tax.
>
> The paving can have a value to the company when it was all new and laid at one time, and then only in the sense that they have prepaid their taxes up to the point of the first renewal. Thereafter the repairs and renewal become an annual maintenance charge or tax.
>
> If the company has charged the maintenance of this paving to capital account, it is not justified in so doing, and has done so because it has not provided for the renewal of any physical property by a depreciation reserve, and if it has charged this to operation or maintenance under those circumstances, the result is a tax, by whatever name it has labeled it.
>
> The company should have been compelled to charge the cost of original paving to "cost of initial paving account," which would be automatically wiped out in eight years, assuming, for example, that this is the life of the paving, by being credited with one-eighth of the cost of the paving annually. The maintenance and repairs after the above date should be charged to operating account "paving."

While there can be no doubt that pavement maintenance should never be charged to capital account, we can not subscribe to the proposition that a street railway company should not charge the entire first cost of a pavement to capital account, unless it is clearly established that city taxes have been remitted to the full extent of the money expended for pavement construction. Nor can we subscribe to the statement that "Disturbing and replacing the pavement adds no value to it," when this veiwpoint is used as a reason for not charging paving work to the construction account. The same line of reasoning would lead to rejecting also the item of grading, for "disturbing and replacing" the earth can add no value to the earth, yet it is a necessary part of the labor of construction. However just may have been the reason for excluding an allowance for paving work from the appraised values, it could be proven just only on the ground that the city of Detroit had itself paid for the pavement by remitting taxes equal to its first cost. We should explain that Mr. Barcroft's omission to include the cost of paving rested upon the opinion of the City Corporation Counsel and a majority of the legal committee to the effect that "the legal title to the pavement is in the city of Detroait and not in the company." This reason is fallacious, for "legal title" does not determine costs nor values in the case of a public service corporation. "Legal title" to the earth beneath the pavement also rests in the city of Detroit. Shall the cost of grading be excluded from the appraisal for that reason? Clearly not, and it is equally clear, therefore, that the cost of paving should be viewed in the same light.

Aside from this one point, the appraised values appear to have been very liberal, taken as a whole, as will be better appreciated from a study of the cost of reproduction new per mile of trackway, given below.

Regarding item 10, overhead charges, the report says:

> Overhead charges should be depreciated in the same proportion as the present condition of the physical property bears to its cost, and this charge, when added to the physical elements depreciated, represents the net depreciated physical and overhead value of the property. * * * The sum total of this analysis, therefore, leads to the conclusion that $1,024,310 is ample to cover such overhead charges as are necessary to reproduce this property.

Deducting this $1,024,310 from the total present value leaves $10,097,415, which is 80.74 per cent of the cost of reproduction new of the total physical property (Items 1 to 9 inclusive). Hence we have divided the $1,024,310 by 80.74 per cent to obtain the undepreciated overhead charges, which are $1,268,000 as thus found. If the real estate is not included, the ratio is 79.89 per cent, instead of 80.74 per cent, and we get $1,282,000 as the undepreciated overhead charges.

Apparently the undepreciated overhead charges were estimated at a little more than 10 per cent of the cost of the property. The overhead charges include: Organization, finance, interest and taxes during construction, legal expense, insurance, contingencies, technical assistance employed in the various engineering branches, and other miscellaneous expenses.

The track mileage was as follows:

	Miles.
Single track	170.41
Car stations, yards, etc	12.93
Total	183.34

Dividing each of the ten items of cost of reproduction new by the 170.41 miles of trackway, we have the following cost per mile of trackway:

Cost of Reproduction, New.

		Per mile.
1.	Real estate	$ 3,013
2.	Buildings (other than power)	3,843
3.	Power plants (incl. bldgs.)	8,694
4.	Battery stations (incl. bldgs.)	1,339
5.	Power distribution	7,112
6.	Track (incl. grading, but excluding paving)	21,135
7.	Rolling stock (6 cars per mile)	21,572
8.	Shops	2,294
9.	Tools, supplies, etc	4,407
10.	Overhead charges	7,441
	Total	$80,850

Since there are 1.076 miles of all track to each mile of trackway, each of these 10 items must be divided by 1.076 to get the cost per mile of track.

The annual number of car miles per mile of track is evidently large, for there are 6 revenue cars per mile of trackway. This accounts for the high cost of power plants per mile of trackway. Items 8 and 9 are inordinately high, but the shops and tools are used not only for the street railways within the city but for interurban lines.

We pass now to the detailed estimates of cost of reproduction new and present value.

1. *Real Estate.*—There are 50.021 acres used for railway purposes, valued at $513,548, or an average of $10,265 per acre. In addition there are 18.374 acres valued at $121,772, but not used for railway purposes. The following is a summary of the real estate, not including buildings:

	Land for:	
1.	General offices	$ 27,750
2.	Power houses	185,169
3.	Emergency station	9,375
4.	Mechanical shops	50,000
5.	Track shops	24,832
6.	Battery stations (two)	18,514
7.	Car stations (ten)	186,664
8.	Air changing stations (two)	2,600
8a.	Car clearances (two)	1,944
8b.	Switching yards (two)	6,200
8c.	Loop property	500
9.	Freight depot (interurban traffic)	50,000
	Total	$563,548

2. *Buildings.*—The following is the estimated cost of reproduction new:

1.	General office, 5-story brick, trimmed with cut stone, pile foundation, 37x100 ft.	$ 42,000
2.	Power houses (see Power Plants):	
	Pipe house, 1-story brick, 44x142	7,500
	Stable, 1-story brick, 52x111	3,500
	Two frame buildings	600
	Miscellaneous: Sheds, paving, walks, etc.	10,000
3.	Emergency station, 2 and 3 stories, 75x200	42,459
4.	Car repair shops:	
	2-story brick, 72x463 ft.	44,000
	1 to 3-story brick, 85x538 ft.	89,000
	Sprinkler system in buildings	21,000
	Scrap yard buildings	2,600
5.	Machine shops, 1-story frame, 79x145 ft.	8,500
	Stock room	2,500
	Carpenter shop	6,000
	Cement shed	3,000
	Stone crusher building	3,300
	Miscellaneous	500
6.	Battery stations (see Battery Stations).	
7.	Car stations:	
	1 and 2-story brick, 41x166 ft.	10,900
	1-story brick, 94x215 ft.	14,000
	1-story frame office, 30x39 ft.	2,000
	1-story brick, 158x353 ft.	38,000

1½-story brick (65x254) an[illegible] story office and barn (69x[illegible])	30,000
2-story brick, 43x151 and 43x35 ft...	13,500
Brick storage shed [illegible]	10,000
Coal and tool sheds	800
1-story brick, 94x228 ft	1[illegible]
Office and air charging station....	2,800
1-story brick, 100x243 ft...........	17,000
1 and 2-story brick, 80x389 ft......	36,000
1-story brick, 64x470 ft...........	20,000
Frame office, 41x52 ft..............	2,600
1-story brick, 73x366 ft...........	30,500
2-story frame office, 28x46........	2,500
Shed, 16x68 ft..........	725
Brick, steel trussed roof, 82x141 ft.	23,500
2-story brick, wood trussed roof, 58x150 ft.	12,300
1-story frame office...............	1,650
1-story brick, steel trussed roof, 73x158	[illegible]
8. Air charging stations:	
Frame, 10x40 ft.....................	200
Frame, 32x70 ft.....................	2,600
Total	$617,884
9. Freight depot:	
Masonry building, 43x200 ft........	13,500
Masonry building, 38x250 ft........	12,600
Milk depot	3,200
Platform, ret wall, paving and grading	7,7[illegible]
Grand total	$654,884

Item 9, freight depot, is owned by the Electric Depot Co., and is used in handling interurban freight. These buildings having a cost of reproduction new of $654,884, are given a present value of $578,763.

In addition there were buildings not used for railway purposes to which were assigned a cost of reproduction of $64,084 and a present value of $24,045.

Item 4, car repair shops, is not pro rated to city use only, but includes all the shops. Since these shops are also used for cars on suburban and interurban lines, it is probable that their cost is somewhat greater than necessary for the urban traffic only.

Buildings for housing power plants are not given under this heading but under Power Plants.

3. *Power Plants.*—There are two power plant stations built in 1894-5. The power buildings are of brick and stone with concrete bases. The combined capacity of the two stations is 13,500 kw., but the railway company secures 3,500 kw. additional by purchase from the Edison Co.

The cost of reproduction new of Station A, which has 5,500 kw. capacity, is as follows:

1. Machinery, foundations, stone, brick and concrete	$ 26,250
2. Boilers and settings: 12 Babcock & Wilcox, 250 h. p. each, 4 Sterling boilers, 354 h. p. each. Total	44,384
3. Coal and handling apparatus.........	6,917
4. Coal storage bins and chutes	6,588
5. Grates and stokers: 16 Murphy furnaces and stokers...	13,176
6. Breeching connections	2,965
7. Stack: Self-supporting steel, fire brick lined to top, 11½ ft. diam. of flue, 183 ft. high above brick foundation, 205 ft. above ground level, rests on 168 piles..............	11,550
8. Feed water heaters: 1 Cochran open heater (2,000 h. p. 1 Worthington duplex. Total	1,500
9. Purifiers: 6 Hoppe, 750 h. p. each....	3,150
10. Intake tunnels	19,050
11. Condensing equipment: 4 Worthington duplex air pumps and condensers. 1 Tomlinson barometric condenser. 1 Lawrence centrifugal (10-in.) pump and engine. Total	16,500
12. Circulating and boiler feed pumps: 3 Worthington feed pumps. Total	3,294
13. Piping, valves and covering..........	44,000
14. Engines: 4 Allis-Chalmers, 1,500 h. p. each, tandem compound, condensing. 1 Allis-Chalmers, 2,500 h. p., cross-compound, condensing. Total	1[illegible]
15. Generators: 2 General Electric, 1,000 K.W. each. 2 Westinghouse, 1,000 K.W. each. 1 Westinghouse, 1,500 K.W. each Total	[illegible]
16. Boosters: 1 Westinghouse generator [illegible] K.W. 1 Westinghouse generator, 350 K.W. 1 Westinghouse motor, 272 K.W. 1 Cutler-Hammer, 272 K.W 1 Westinghouse motor, 388 K.W. 1 Westinghouse starting box, 388 K.W. Total	10,617
17. Crane, Brown Hoistg. Co., hand operated, 60-ft. span, 25-ton cap......	4,400
18. Generator and switchboard cables .	[illegible]
19. Switchboard and accessories.........	42,380
20. Miscellaneous	[illegible]
21. Contingencies and engineering	[illegible]
22. Buildings: One [illegible] (about). One [illegible] (about). Total [illegible]	[illegible]
Grand total	$626,248

The land on which this power station stands is 200x300 ft. = 60,000 sq. ft., or about twice the area actually occupied by the buildings. This land was appraised at $37,500, or about 62 cts. per sq. ft., which is included under Real Estate.

Since the capacity of this plant is 5,500 kw., we obtain the cost per kw. by dividing each of the foregoing 26 items by 5,500.

	Per KW.
1. Machinery foundations	$ 4.77
2. Boilers and settings...........	8.07
3. Coal and ash bldg. appar....	1.26
4. Coal storage bins and chutes	1.20
5. Grates and stokers...........	[illegible]
6. Breeching connections	0.54
7. Stack	2.10
8. Feed water heaters...........	0.27
9. Purifiers	0.57
10. Intake tunnels	3.46
11. Condensing equipment	3.00
12. Circulating and boiler feed pumps....	0.60
13. Piping, valves and covering...........	8.00
14. Engines	23.64
15. Generators	15.82
16. Boosters	1.93
17. Crane	0.80
18. Generator and switchboard cables..	1.82
19. Switchboard and accessories........	7.71
20. Miscellaneous	2.53
21. Contingencies and engineering.	3.75
22. Building	19.66
Total	$1[illegible]
Land	6.82
Total	$120.[illegible]

If we take ¾ of the foregoing, we have the approximate cost per horsepower.

The depreciated or present value assigned to this power plant, Station A, was as follows:

1. Machinery foundation	$ 26,250
2. Boilers and settings................	30,907
3. Coal and ash appar.	3,890
4. Coal storage bins...................	4,650
5. Grates and stokers.................	9,345
6. Breeching connections	1,656
7. Stack	8,463
8. Feed water heaters.................	941
9. Purifiers	1,[illegible]
10. Intake tunnels	19,[illegible]
11. Condensing equipment	9,116
12. Circulating and feed pumps..........	1,971
13. Piping, valves and covering..........	35,141
14. Engines	94,172
15. Generators	73,871
16. Boosters	7,963
17. Crane	[illegible]
18. Generator and switchboard cables...	8,290
19. Switchboard and accessories.........	35,634
20. Miscellaneous	6,017
21. Contingencies and engineering........	12,480
22. Building	1[illegible]
Total	$502,681

The plant was about 14 years old, with the exception of the 4 Sterling boilers (total 1,416 hp.), the 2,500 hp. engine, and the 2,000 hp. Cochran heater, which were about 4 years old; also the three generators, which were about 6 years old. A comparison of the above depreciated values with the cost of reproduction new will indicate the rates of depreciation allowed. Including buildings and machinery foundations (Items 1 and 22), it will be seen that the average depreciated value is 80.3 per cent of the cost of reproduction; but, deducting items 1 and 2, the percentage is 74.8 per cent. This last would indicate an average depreciation of nearly 2 per cent per annum.

We pass now to the power plant equipment of Station B, having a rated capacity of 8,400 kw. and an estimated cost per kw. slightly less than for Station A. The cost of reproduction new was as follows:

1. Machinery foundations	$ 32,619
2. Boilers and settings: 8 Stirling boilers, 250 h.p. each. 8 Stirling boilers, 300 h.p. each. 8 Stirling boilers, 350 h.p. each. Total	[illegible]
3. Coal and ash building apparatus......	11,489
4. Coal storage bins and chutes.........	10,942
5. Grates and stokers: 20 Murphy furnaces and stokers. 4 Detroit furnaces and stokers. Total	[illegible]
6. Breeching and connections...........	4,924
7. Stacks: Two [illegible]	[illegible]
[illegible] 2 Cochran, each 2,500 h.p.....	[illegible]
9. Economizers: [illegible] with 16 Stirling boilers (4,400 h.p.) [illegible]	18,900
11. [illegible]	[illegible]
12. Circulating and boiler feed pumps: [illegible] 1 Worthington duplex.	5,471
13. Piping, valves and covering..........	43,150
14. Engines: 2 Filer & Stowell, cross compound, condensing, 2,250 h.p. each. 2 E. P. Allis Co., ditto, 1,200 h.p. ea. 2 E. P. Allis Co., ditto, 600 h.p. ea.	129,150
15. Generators: 2 Westinghouse, 1,500 KW. each. [illegible] 2 Walker Mfg. Co., 400 KW. each.	[illegible]
16. Turbo-generator plant: 1 Westinghouse, 3,000 KW. generator. 1 Parson's steam turbine, 4,500 h.p. 1 Baragwanath jet condenser (42-in.). 1 Baragwanath centrifugal pump (18-in.). Exciter, induction motor, engine, etc.	146,500
17. Boosters: [illegible] 1 Westinghouse motor, 250 KW. 4 Westinghouse generators, 500 ea. 4 Westinghouse motors, 540 ea. 1 Westinghouse exciter generator, [illegible]	[illegible]
18. Crane: Hand operated, 51-ft. span, 15-ton [illegible]	4,320
19. Generator and switchboard cables....	13,542
20. Switchboard and accessories	9,898
21. Miscel. apparatus and tools..........	[illegible]
22. Contingencies, incidentals and engineering	21,450
23. Building: About 54,800 sq. ft..................	138,080
Grand total	$855,080

The land assigned to this power plant covers about 168,000,000 sq. fit. (or about three times the area occupied by the buildings), and its appraised value is $147,669.

Dividing each of the above 23 items by 8,400 we have the following cost of the plant per kw.:

	Per KW.
1. Machinery foundations	$ 3.88
2. Boilers and settings.....................	7.81
3. Coal and ash hdlg. appar.	1.37
4. Coal storage bins and chutes..........	1.30
5. Grates and stokers....................	2.60
6. Breeching and connections.............	0.59
7. Stacks (brick)	2.96
8. Feed water heaters....................	0.54
9. Economizers (for 2-3 of the boilers)..	2.66
10. Intake tunnels	2.25
11. Condensing equipment	1.93
12. Circulating and feed pumps...........	0.60
13. Piping, valves and covering..........	5.14
14. Engines	[illegible]
15. Generators	10.25
16. Turbo-generator plant	17.44
17. Boosters	0.69
18. Crane	[illegible]
19. Generator and switchboard cables....	1.61
20. Switchboard and accessories..........	1.18
21. Miscel. apparatus	2.06
22. Contingencies and engineering........	2.55
23. Buildings	[illegible]
Total	$101.79
Land	[illegible]
Grand total	$119.37

The depreciated or present value of this Station B is as follows:

1. Machinery and foundations..........	$ 32,619
2. Boilers and settings...................	43,743
3. Coal and ash hdlg. appar.............	7,003
4. Coal storage bins and chutes........	8,754
5. [illegible]	[illegible]
6. Breeching and connections...........	3,774
7. [illegible]	[illegible]
8. Feed water heater....................	3,[illegible]
9. [illegible]	[illegible]
10. [illegible]	[illegible]
11. Condensing equipment	10,530
12. Circulating and feed pumps..........	3,421
13. Piping, valves and covering..........	32,832
14. [illegible]	[illegible]
15. [illegible]	[illegible]
16. [illegible]	[illegible]
17. [illegible]	[illegible]
18. Crane	2,350
19. Generator and switchboard cables....	11,340
20. Switchboard and accessories........	7,563
21. Miscellaneous appar.	14,589
22. Contingencies, incidentals and engrg.	14,240
23. [illegible]	[illegible]
[illegible]	[illegible]

duction new. But if we deduct items 1, 10 and 23, the corresponding percentage is 79.1 per cent.

The equipment of Station B was about 14 years old, with the following exceptions: 8 Sterling, 350 hp. boilers, about 2 years old; 2 Cochran heaters, about 1½ years old; 2 Filer & Stowell engines, 2,250 hp. ea., about 10 yrs. old; 3 condensers, about 3 yrs. old; 2 Westinghouse generators, 1,500 kw. ea., about 10 yrs. old; brick stack, about 2 yrs. old; turbo-generator plant, about 1½ yrs. old. If we deduct the turbo-generator plant (item 16), as well as items 1, 10 and 23, the present value is 73.2 per cent of the cost of reproduction new, which corresponds closely with the per cent of depreciation assigned to Station A.

4. *Battery Stations.*—There are two battery stations, designated as *K* and *L*. Part of the machinery in Station *K* is owned by the Edison Illuminating Co. and is not included in the following appraisal of the cost of reproduction new:

Station K.

1 Electric Storage Battery Co.'s storage battery, 2,500 ampere-hour capacity, 260 cells of 67 plates ("G" type) per cell	$ 89,300
1 Western Electric booster, type "P-6," connected to a 300 h.p. motor	11,000
Switchboard and accessories	2,959
Battery and equalization station accessories	3,542
Tools	187
Furniture and fixtures	315
Heating	200
Stock	3,517
Buildings (53x113 ft.), lighting, etc.	15,000
Total	$126,021

The depreciated or present value is appraised at $110,575.

The cost of reproduction new of Station *L* is as follows:

Station L.

1 Electric Storage Co.'s storage battery, 2,000 ampere-hour, 250 cells of 53 plates ("G" type), per cell	$ 72,250
1 Western Electric booster, type "I-6," and a 200 h.p. motor	6,400
Switchboard connections	1,815
Battery and equalizing sta. accessories	2,391
Tools	342
Furniture and fixtures	98
Heating	287
Stock	12,652
Stationary testing insts.	296
Buildings (39x158 ft.) and lighting	5,700
Total	$102,231

The depreciated value is $89,912.

5. *Power Distribution.*—The cost of reproduction new of the power distribution system is as follows:

1. Iron Poles:	
7,498 iron poles, various sizes, 4,395,946 lbs. at $2.75 per C lbs.	$120,888.52
Labor erecting at $9.78	73,330.44
Total, iron poles	$194,218.96
2. Cedar Poles:	
2,198 cedar poles, 30-ft., at $5.50	$12,089.00
201 cedar poles, 35-ft., at $7.25	1,457.25
9 cedar poles, 40-ft., at $10.25	92.25
1 cedar pole, 45-ft., at $12.50	12.50
2,409 cedar poles, labor at $4.00	9,636.00
Total, cedar poles	$23,287.00
3. Idaho Poles:	
92 Idaho poles, 50-ft., at $14.25	$1,311.00
1 Idaho pole, 55-ft., at $16.00	16.00
20 Idaho poles, 60-ft., at $21.00	420.00
113 Idaho poles, labor at $5.35	604.55
Total, Idaho poles	$2.351.55
4. Northern Pine Poles:	
73 Octagon Northern Pine poles, 28-ft., at $7.50	$ 547.50
112 Octagon Northern Pine poles, 30-ft., at $10.25	1,148.00
16 Octagon Northern Pine poles, 35-ft., at $12.50	200.00
201 poles, labor at $4.00	804.00
Total Northern Pine poles	$2,699.50
5. Pole Tops and Guy Stubs:	
2,540 Eye bolts, washers and fittings, various prices	$ 303.44
76 Eye bolts, various prices	7.59
12,053 Iron and wood pins	373.64
580 (3-pin) iron pole tops, at $3.65	2,117.00
2,804 Wood pole tops, at 50 cts.	1,402.00
68 Wood pole tops, with iron caps, at 75 cts.	51.00
11 Wood pole tops, with iron caps, at 85 cts.	9.35
2,437 Wood pole tops, with 1½-in. iron pins, at 90 cts.	2.193.30
224 Iron pole tops, at 90 cts.	201.60
12 Iron pole tops, at 50 cts.	6.00
878 Iron pole tops, at 95 cts.	834.10
15 Iron pole tops, at $1.10	16.50
10 Pole top extensions, at $2.80	28.00
14 Special insulated lamp pole tops, at $1.50	21.00
21 Cedar guy stubs, at $2.00	42.00
15,605 lbs. iron cut stubs, at $2.75	429.14
1,102 Locust pins, at 2 cts.	22.04
75 Maple pins, at 3 cts.	2.25
80 Iron pine, at 17 cts.	13.60
Total pole tops and stubs	$8,073.55
6. Iron Pole Strap Bands:	
Various sizes and values	$6,067.77
7. Iron Crossarms:	
342 No. 10 iron crossarms at $3.50	$1,197.00
234 No. 20 iron crossarms, at $2.75	643.50
549 No. 20 iron crossarms, at $2.75	1,509.75
119 Ft. Wayne iron crossarms, at $2.20.	261.80
Labor erecting 1,244 iron crossarms, at $1.00	1,244.00
Total, iron crossarms	$4,856.05
8. Wood Crossarms:	
378 2-pin maple crossarms, at 30 cts.	$ 113.40
1,806 4-pin. maple crossarms, at 35 cts.	632.10
28 6-pin maple crossarms, at 60 cts.	16.80
Labor erecting 2,212 wood crossarms, at 50 cts.	1,106.00
Total, wood crossarms	$1,868.30
9. Insulators:	
2,387 (500,000 C. M.) shell top feeder insulators, at 70 cts.	$1,670.90
1,825 (1,000,000 C. M.) shell top feeder insulators, at 50 cts.	1,460.00
474 (500,000 C. M.) shell top corner insulators, at 90 cts.	426.60
210 (1,000,000 C. M.) shell top corner insulators, at $1.00	210.00
1,932 Ohio brass clinch corner insulators, at 40 cts.	772.80
5,177 Feeder glass insulators, at 66 cts.	341.68
3,734 Wood strain insulators, at 20 cts.	746.80
875 Small Brooklyn strain insulators, at 60 cts.	525.00
5 Small double Brooklyn strain insulators, at 60 cts.	3.00
507 Large Brooklyn strain insulators, at 90 cts.	456.30
10 Large double Brooklyn strain insulators, at $2.00	20.00
214 (2/0) sectional insulators, at $3.75	802.50
97 Clinch top insulators, at 40 cts.	38.80
190 Ohio brass clinch top insulators, at 40 cts.	76.00
242 Top groove glass insulators, at 66 cts.	15.97
9 Mica Medbury insulators, at 50 cts.	4.50
802 No. 1 Giant strain insulators, at 35 cts.	280.70
6,972 No. 2 Giant strain insulators, at 25 cts.	1,743.00
2,470 Medbury spool insulators, at 20 cts.	494.00
676 Medbury feeder insulators, at 63 cts.	425.88
20 Special tower clamp insulators, at $2.20	44.00
Total, insulators	$9,758.43
10. Ears:	
155 Double ears, 2/0, at 60 cts.	$ 93.00
4 Feed-in ears, at 60 cts.	2.40
297 Strain ears, at 61 cts.	181.17
Total, ears	$ 276.57
11. Anchor Rods, Turnbuckles.	
253 Turnbuckles and rods, various sizes and prices	$ 154.90
167 Anchor rods, various sizes and prices	53.70
Total, anchor rods, etc.	$ 208.60
12. Arresters:	
357 Lightning arresters, various prices	$2.295.51
48 Lightning arresters, various prices	208.15
Labor	680.40
Total, arresters	$3,184.06
13. Circuit Breakers:	
10 (450-ampere) Westinghouse automatic circuit breakers, 600-volt, slate base, special box, at $40.00	$ 400.00
1 (800-ampere) Westinghouse automatic circuit breaker, 600-volt, slate base, special boxes	85.00
1 (1,200-ampere) hard automatic oil circuit breaker, 600-volt, special box, lamps, etc.	115.00
1 (450-ampere) Westinghouse automatic circuit breaker, slate base, special boxes	40.00
Labor on circuit breakers	115.50
Total, circuit breakers	$ 755.50
14. Bolts, Screws, Washers, Chairs:	
26,196 Machine bolts, various sizes and prices	$ 261.96
2,503 Carriage bolts, various sizes and prices	21.28
6,975 Lag screws, various sizes and prices	121.37
166 Pounds of washers, various sizes and prices	10.00
1,358 Chairs, various sizes and prices	1,874.30
Total, bolts, etc.	$2,288.91
15. Switches:	
14 (400-ampere) 600-volt, G. E. switches, slate base, at $4.00	$ 56.00
2 (400-ampere) 600-volt switches, G. E., S. P. D. T., at $10.00	20.00
7 (1,200-ampere) 600-volt switches, G. E., S. P. D. T., at $16.88	118.16
11 (1,200-ampere) 600-volt switches, Anderson, at $16.00	176.00
21 (600-ampere) 600-volt switches, G. E., at $10.00	210.00
22 (600-ampere) 600-volt switches, Anderson, at $9.50	209.00
1 (600-ampere) 600-volt switch, G. E., S. P. D. T., at $14.00	14.00
1 Perkins 600-volt switch	.90
2 Westinghouse cut-out switches, at $7.50	15.00
16 No. 2 steel motor cut-out switches, at $6.25	100.00
21 cut-out switches, at $7.50	157.50
1 (600-ampere) G. E. switch, at $10.00	10.00
Labor	623.56
Total, switches	$1,710.12
16. Switch Boxes and Fuses:	
14 Pine record boxes, at $1.85	$ 25.90
2 Feeder dividing blocks, at 50 cts.	1.00
2 (30-ampere) 600-volt fuse boxes, leather cover, at $2.25	4.50
20 Switch boxes, average $5.50	110.00
16 15-ampere Noark fuses, at 57 cts.	9.12
15 Switch boxes, 6x6x18-in., at $4.25	63.75
3 Switch boxes, 6x6x18-in., at $3.50	10.50
1 Switch box, 8x12x30-in.	6.65
49 Switch boxes, 9x10x30-in., at $5.50	269.50
2 Switch boxes, 40x24x10-in., at $5.50	11.00
1 Brass switch lock, at 75 cts.	.75
Labor	22.10
Total, switch boxes	$ 534.77
17. Miscellaneous Iron Fittings:	
40 ½-in. by 7-ft. lightning arrester rods	$ 26.00
25 Trolley rods, ⅝-in. by 9-ft. 9-in.	25.00
1 Truss rod, ¾-in. by 24-ft.	6.00
2 Truss rods, ½-in. by 1-ft.	1.00
188 ft. iron truss rods, ¾-in.	5.65
26 ft. iron truss rods, ½-in.	.35
1 ½-in. by 5-ft. iron rod	1.07
13 Iron rods and braces, various sizes	13.45
1 ¾-in. by 10-ft. special truss rod	1.80
3 Trolley sign rods, ⅝-in. by 9¾-in.	3.00
Miscellaneous labor	4.00
1,002 Crossarm braces	60.12
805 1¼-in. by 24-in. galvanized crossarm braces	48.30
78 Corner iron "U" clamps	113.10
6 ½x3x8-in. clamps	6.60
6 ½x3x6-in. clamps	6.00
162 ½x4x5-in. "U" bands	81.10
52 ft. ⅜x8-in. band iron	10.61
4 8x30-in. "U" bands	14.00
6 ½x3x8-in. double bands	4.50
6 ½x3x6-in. double bands	3.90
45 5-in. iron pole bands	42.75
4 ⅜x1¾-in. by 3-ft. strap bands	6.00
2 ½x8-in. by 3-ft. strap bands	3.50
2 ½x3x24-in. iron plates	4.80
22 ½x4x4-in. iron plates	4.40
52 ⅜x8x10-in. iron plates	18.20
214 9/16x9-in. iron pole steps	6.42
5 ¼x4-in. by 3-ft. 9-in. iron straps	3.75
2 Wrought iron straps, ½x½-in., 15 in. square	2.50
Total, miscel. fittings	$ 527.87
18. Wood Braces:	
154 Pieces wood braces, various sizes and prices	$ 219.20
101 ft. B. M. Norway pine, various sizes, at $36.00 per M.	3.64
Total, wood braces	$ 222.84
19. Trolley Signs:	
138 Trolley signs, 9x18-in. sheet iron	$ 138.00
16 "F" signs, 1/16x8-in. sheet iron	8.00
1 Illuminating sign	26.00
Labor	234.05
Total, trolley signs	$ 406.05
20. Trolley Brackets:	
34 Flexible pole trolley brackets	$ 66.30
195 Straight line trolley brackets	487.50
7 Single pin side brackets	1.05
Total, trolley brackets	$ 554.85
21. Brackets:	
7 Single arm trolley brackets	$ 13.65
5 Tower feeder brackets	25.00
13 Special iron extra feeder brackets	45.50
96 Single pin side brackets, at 15 cts.	14.40
26 Double pin side brackets, at 75 cts.	19.50
72 Wooden side brackets	1.01
449 Lag brackets, at 21 cts.	94.29
Total, brackets	$ 213.35
22. Hangers:	
6,720 Straight line hangers, at 45 cts.	$3,024.00
1,105 Feed-in hangers, at 67 cts.	740.35
Total, hangers	$3.764.35
23. Wooden Trolley Troughs:	
Materials	$ 753.35
Labor	1,486.75
Total, wooden trolley troughs	$2,240.10
24. Special Feeder and Trestle Constr.:	
Total at 35 places	$6,012.00

(To be continued.)

The New York, New Haven & Hartford R. R. has petitioned the Massachusetts Railroad Commissioners for right to construct an extension of its line from Southbridge branch near its terminus at Southbridge, to connect with New London and Northern Railroad at Palmer. The length of the line is 19.3 miles and four stations are contemplated. Total cost will be $2,810,000, which is at the rate of $145,000 per mile of main track. Surveys for this line were made in the summer of 1907, but it was not until the Grand Trunk became active in that section that the subject was given serious consideration.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Contractors' Cost Keeping and Organization.*

In discussing the question of contractors' organization, the consideration of cost-keeping or cost analysis at once becomes important, since the organization may be considered as two divisions.

CHAS. CRANFORD

Contract No.. 190

Employe's Number	Hrs	Amt	Hrs	Amt	Hrs	Amt	Hrs	Total

Remarks: ...

Name of Foreman

Fig. 1a.

1st. The organization necessary to the actual performing of the work of construction.

2d. The organization necessary to so record and analyze the cost of the work and the amounts performed, *i. e.,* the unit costs, that the contractor may not only know whether he is coming out with a profit on his contract and may detect excessive costs and correct the same speedily while the work is in progress, but may also have a record that will guide him in bidding on future work.

Again, in considering the question of cost keeping organization, the degree of fineness into which the work is to be subdivided becomes an important one, whether the costs are to be kept so that each morning the contractor or his [illegible] able to tell what each class of work cost him the previous day, whether weekly statements only are desired, and also whether the records must be in such shape that a stranger, without a mental picture of the work and its details, may use the records in bidding on other work after a reasonable amount of study; or whether the records are intended solely for the use of the contractor himself, his engineer or manager who have, through constant oversight of the work, such a familiarity with the conditions that few notes are needed in explanation of the conditions under which the various classes of work were performed.

BRIGHTON BEACH IMPROVEMENT
FOREMAN'S DAILY REPORT

.190

EXCAVATION

Class	Total Hours	Amount
Foremen		
Labor.......		
Signalmen		
Engineers ..		
Firemen		
Tallymen		
Trucks		
Watchmen		
	Total..	

Cu. Yds. Excavated by Hand

" " " Bucket .

" " " Orange Peel

No. of Cars Loaded for Dump

" " " " Screens

Tons of Coal Used by Derrick

" " " Received ... ...

Foreman......................

Fig. 1b.

In the latter case, at any future time in looking over the records, a very few memoranda will suffice to call up into the mind of the contractor who actually performed the work, a complete picture of the situation and conditions obtaining at the various stages of progress.

It is with the latter purpose that the organization and records of Charles Cranford, with which this paper deals, were adopted.

The ordinary foreman under this system is furnished with blank reports (Fig. 1*a*) upon which he reports the number of each man in his gang. These numbers are written in a vertical column, and in the successive columns are written the number of hours each man works at each of the various jobs, at which he may be employed during the day. The heading at the top of each column is filled in by the foreman, with the various classifications. A space for remarks on each report and the signature of the foreman completes this record, with of course the date of the report. Figures 1*b*, 1*c*, 1*d*, and 1*e* show other forms for daily reports.

The writer has never found any trouble in getting as much information upon one of these reports as is desired, even from an Italian foreman. In the case of one Italian foreman who could not write, his water boy turned in for him as complete records as could be desired, dividing the time, for example, between unloading spoil from the excavation into the receiving hopper of a screening plant, screening the gravel out of the spoil, excavating gravel from an adjacent pit, running stone crusher, and loading lumber, cement, vitrified conduits and other material at the store yard, and recording the number of flat and dump cars of spoil received from the excavation, the number of narrow-gauge cars of gravel, sand, etc., from the pit, the number of flat cars of gravel loaded at the screen, the number of flat cars of sand loaded, the number of flat cars of cobble from the screen to the crusher, the number of flat cars of spoil and refuse screened from the gravel and sent to the dump, the num-

BRIGHTON BEACH IMPROVEMENT
[illegible]

190

CONCRETE

Class	Total Hour	[illegible]
Foremen		
[illegible]		
Laborers		
[illegible]		
	Total	

Material Received

Bags of Cement........

Cu. Yds. of 1½ Stone

" " Gravel .

" " Sand

Foreman. ..

Fig. 1c.

[illegible]

CONCRETE FORMS

Total Hours

Foreman..

Fig. 1d.

BRIGHTON BEACH IMPROVEMENT
FOREMAN'S DAILY REPORT

190

SPOIL TRAIN SERVICE

Class	Total Hours	Amount
[illegible]		
Engineers ...		
Firemen		
[illegible]		
[illegible]		
Switchmen .		

" of Cars to Dump........

Stone ....

Coal Received

Fig. 1e.

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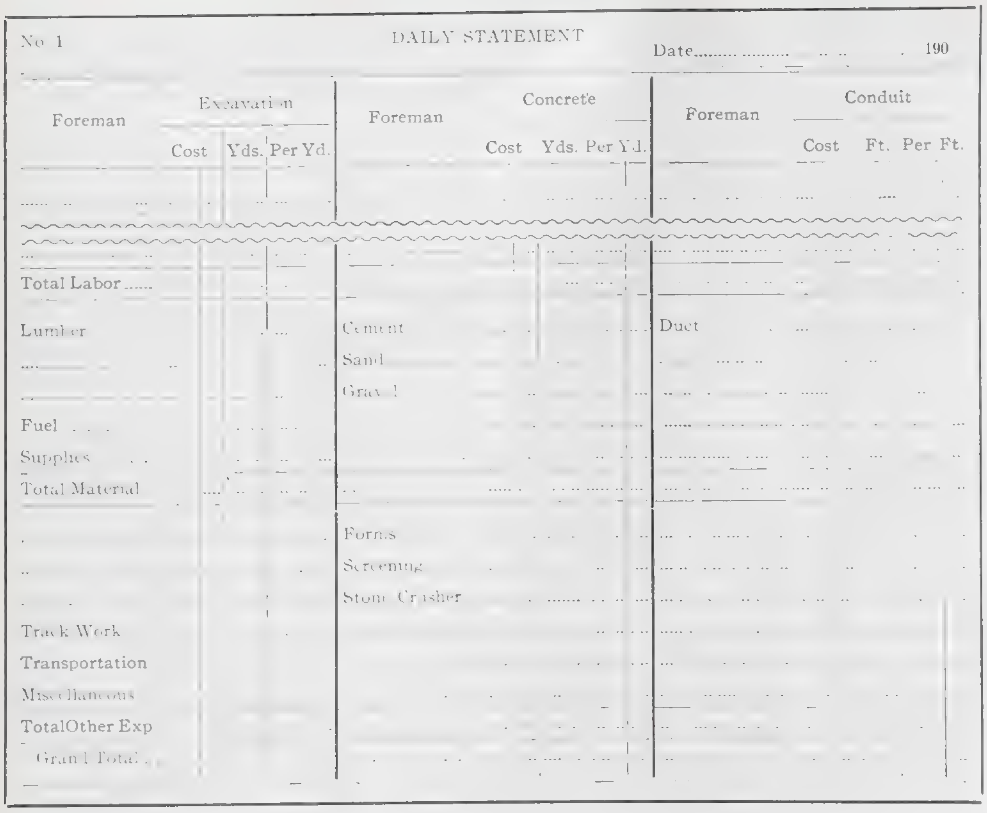
*Paper read before the Brooklyn Engineers' Club by Richard L. Russell, Chief Engineer, Charles Cranford, General Contractor, Brooklyn, N. Y.



No 1 DAILY STATEMENT Date.................. 190

Foreman	Excavation Cost	Yds.	Per Yd.	Foreman	Concrete Cost	Yds.	Per Yd.	Foreman	Conduit Cost	Ft.	Per Ft.
Total Labor											
Lumber				Cement				Duct			
				Sand							
				Gravel							
Fuel											
Supplies											
Total Material											
				Forms							
				Screening							
				Stone Crusher							
Track Work											
Transportation											
Miscellaneous											
TotalOther Exp											
Grand Total											

Fig. 2a.

ber of flat cars of stone loaded at the crusher, and the amount of various material loaded at the store yard.

Of course, phonetic spelling is the rule and some of the effects are ludicrous, but intelligible.

These reports are first inspected by the superintendent to see if they give distribution and information desired, and agree with his knowledge. This superintendent, or the engineer, is also required to roughly cross-section each day the yardage of excavation and concrete for each foreman, and to write these on the report, the foreman recording on his report the number of contractor's tubs of material excavated, or the number of flat cars or dump cars loaded with excavated material, and the concrete foreman reporting the number of batches of concrete mixed and the number of bags of cement used, while both foremen, of course, report the amount of material received, the time of unloading it and any detentions suffered.

As soon as the foremen of the various classes of work find they are being compared as to output with the other foremen on the same class of work, they will be quick enough to report detentions, and indeed separate their time so as to show all the work they did which was non-productive, and to enable the time and cost of productive work, excavation of concrete, or lineal feet of sewer, or square feet of face forms and square feet of rear forms, or feet of sheeting driven and number of feet of rangers and braces placed, to be seen at a glance. It requires but a few words from the superintendent or engineer, making comparison with another gang or criticism of the lack of information on report, to make each foreman give all the information necessary.

The superintendent or engineer, having noted the various quantities on these reports, as he has measured them, and noting any force account of extra work on them, also any special or unusual distribution of time on account, they go to the storekeeper.

The storekeeper enters the cost and quantity of the various classes of work on the "Daily Statement" forms (Figs. 2*a* to 2*c*) which collects in columns under the proper headings, all costs chargeable to each classification and the quantities, and shows the cost per unit for each foreman; and in addition the storekeeper writes in the amount of material and the cost of same, used for each class of work; the transportation from the conductors' reports transferred from the Daily Statement for Transportation, any rigging work from the rigger foreman's reports; under excavation, the reports of the dump foreman separated between unloading, spreading and track work.

To the concrete costs at the mixers are added the handling of material, transportation, cost of material, cost of forms (transferred from the Daily Statement for Forms) and the cost at the screen and the crusher, and any repairs from the master mechanic's report.

There is a separate daily statement for the forms, wherein the labor, material (lumber and nails) are separated, and the square feet of front and rear forms are given. The total cost, including material, is then transferred to the concrete column, and while this may increase the total unit cost per cubic yard for a day when the yardage placed is small, the total is analyzed on the statement, and on the monthly statement the average is shown correctly. This may sound like considerable work, but in practice on the Brighton Beach Improvement contract, for example, where each daily statement consisted of five of these sheets clipped together, the statements were in Mr. Cranford's and the writer's hands, in duplicate, by 2:00 p. m. daily, at the latest, and generally before noon, and the foreman's reports were in the timekeeper's hands before that, in order to check his time-book.

These daily statements were then transferred to monthly statements (Figs. 6a to 6d) classified as desired, and from these the average costs for long terms are determined.

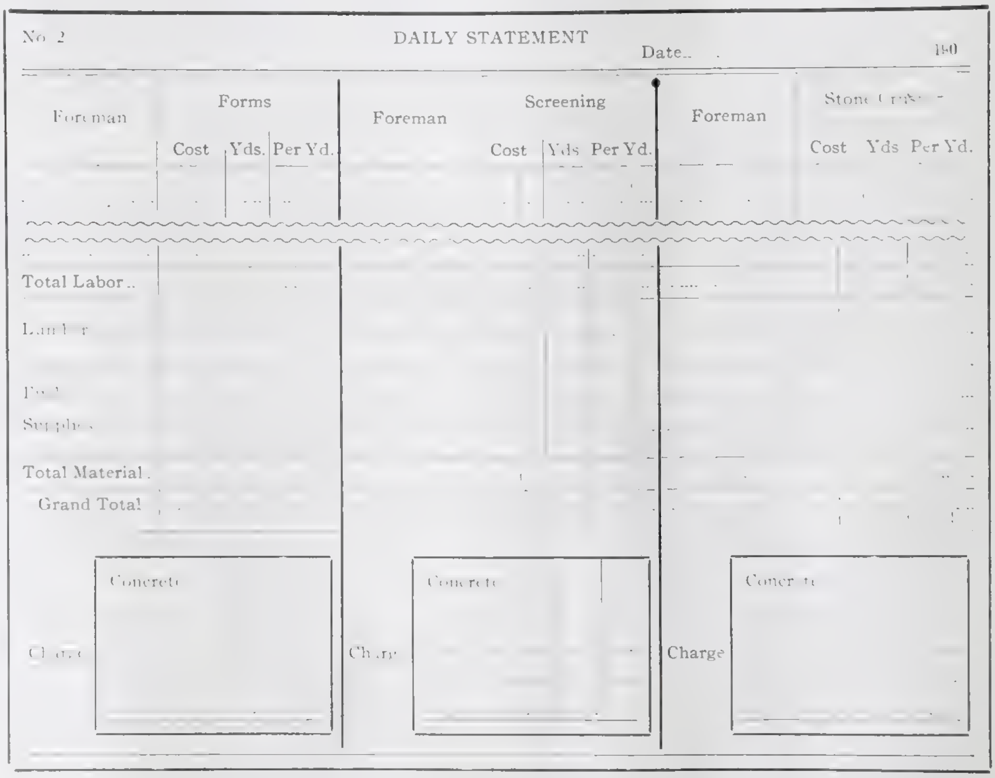
Fig. 5 shows a simple report for foremen on cement sidewalk work, which seems to give all the information necessary.

This method of cost-keeping distributes the cost of repairs daily against each class of work, the time of machinists, etc., being taken from the distribution on the master material being charged by the storekeeper as on excavating machines and appliances on concrete mixers, water supply, etc., and the material being charged by the storekeeper as sent out.

In addition to these direct costs of doing the work are the general expenses of administration, plant, etc. These need not be included in the daily statements of cost, providing that the comparison of the daily cost is made with the bid price, less profit and less general expense; but if on unit price work, the daily statements are to be compared with the bid price to see how the work is going, the distribution of general expense must be made and the proper proportion charged on the daily statement against each class of work. On the writer's work the latter method is employed.

The general expense or administration charges, may be subdivided as follows:

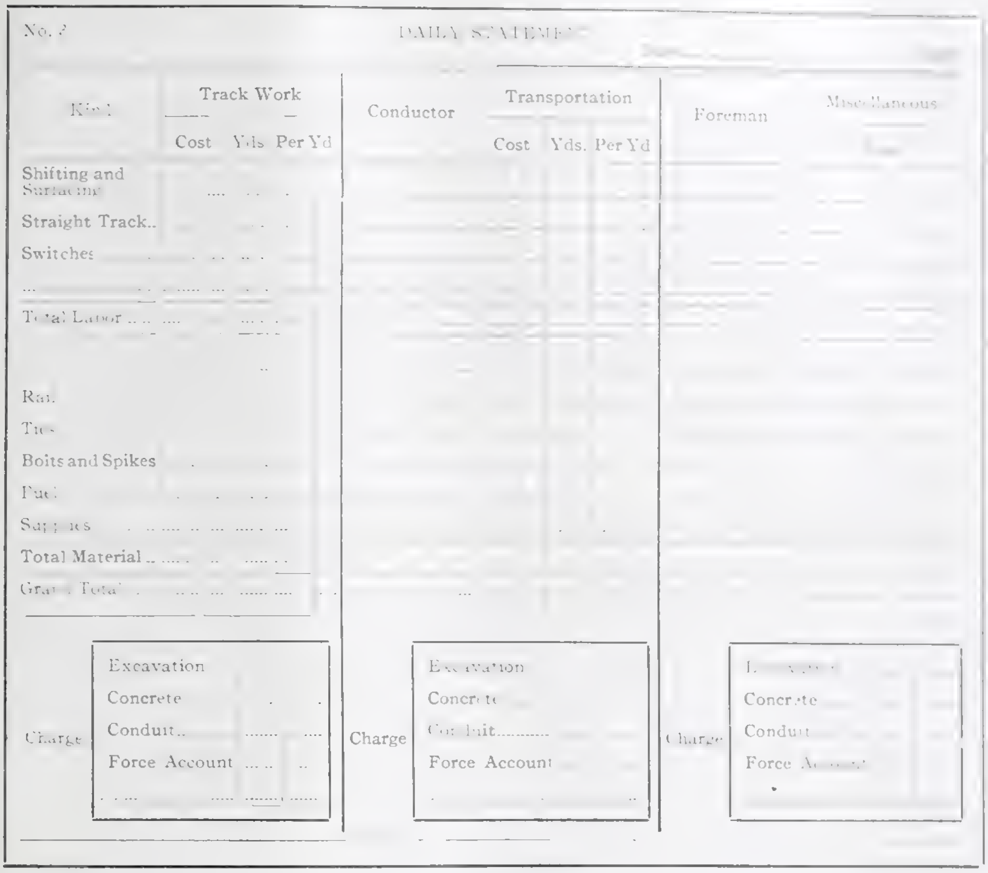
1. Engineering and superintendence.
2. Timekeeper and storekeeper.
3. General office force (stenographer, clerk and boy).
4. Telephone and office supplies.
5. Liability insurance, surety bond and legal expenses.
6. Rental of yards, office, etc.
7. Watchmen.
8. Interest, depreciation on general plant and



No 2 DAILY STATEMENT Date.. 190

Foreman	Forms Cost	Yds.	Per Yd.	Foreman	Screening Cost	Yds	Per Yd.	Foreman	Stone Crusher Cost	Yds	Per Yd.
Total Labor											
Lumber											
Fuel											
Supplies											
Total Material											
Grand Total											
Charge	Concrete			Charge	Concrete			Charge	Concrete		

Fig. 2b.



No. 3 DAILY STATEMENT

Date

Kind	Track Work Cost	Yds	Per Yd	Conductor	Transportation Cost	Yds.	Per Yd	Foreman	Miscellaneous
Shifting and Surfacing									
Straight Track..									
Switches									
Total Labor									
Rail									
Ties									
Bolts and Spikes									
Fuel									
Supplies									
Total Material									
Grand Total									

Charge	Excavation Concrete Conduit Force Account	Charge	Excavation Concrete Conduit Force Account	Charge	Excavation Concrete Conduit Force Account

Fig. 2c.

miscellaneous small tools.
9. Interest and discount.

The daily general expense then should be proportioned by the engineer, between the various items, and included by the storekeeper in making up the daily statements.

Assume a contract that would require an engineer, superintendent, stenographer, storekeeper, bookkeeper, office boy and boy at the storeroom. If the concrete form work is of any extended amount, the salary of an assistant engineer will be well spent, to lay this out in advance, see that the lumber is used to the maximum and not wasted, measure the square feet of forms erected, and measure the quantities of excavation and concrete done by the different gangs.

With this organization, the foreman will order their material on little pads of blanks, to be O. K.'d by the superintendent stating purpose for which material is to be used. The storekeeper will fill these orders from stock, and as stock decreases will make a requisition in duplicate on the engineer, giving the amount of proposed order and amount on hand, for any given item. The engineer will approve or disapprove the order and the authorized orders should be made out in triplicate on forms of three colors for quick identification, the original to the manufacturer or dealer, the duplicate to the storekeeper, and the triplicate to be retained in the main office, Figs 3a, 3b.

On receipt of invoice, it should be forwarded to the storekeeper to be checked against the order and returned to the main office. The voucher system of payment of all bills and payrolls should be used where the bills [illegible] of check, and name of the bank, and date [illegible]

[illegible] numbered consecutively, a line to each voucher, and the vertical columns are first the number of the voucher, next the total amount and then a column for each contract under way, in which is written the proportion of the amount of each voucher charged against that contract. This voucher book gives at once the total cost of each contract

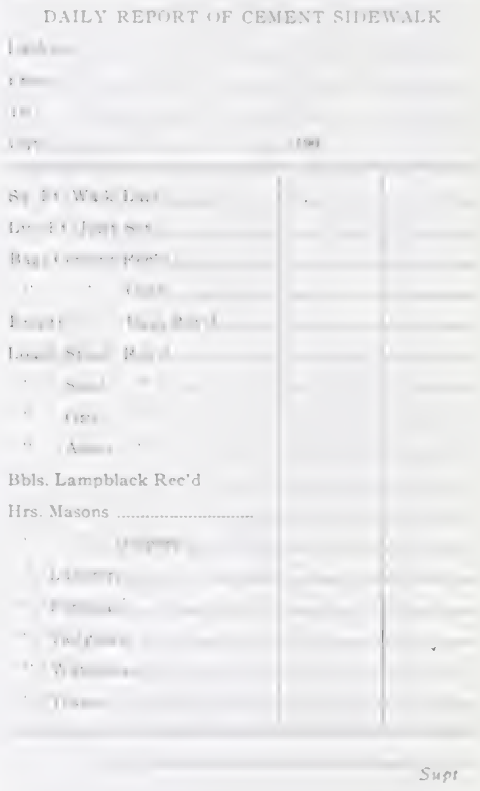
This system may be amplified or simplified to any desired extent, depending upon the character of the work. When it comes to using the records thus kept, in figuring on new work, the conditions under which the work was done must be carefully compared with the character of the new work

After the cost of labor and material and delivery of the latter have been estimated, the interest and depreciation on the special plant required for each class of work and the supplies therefor then must be carefully estimated, the maximum time for completion of the work, the rental and salaries and general expenses for this period, including all of the items before enumerated under general expenses.

If the bid is to be by unit prices, these general expenses must be proportioned against the various items before bidding and then the profit added.

Most contractors now have printed books for preparation of bids on the various classes of work, on which the headings of the various items of general expenses and also the direct expenses are printed, in order to be sure that none are left out in making up the total cost. When this practice is universal, there will be fewer bids which are so disproportionately low that something has evidently been overlooked.

For such blanks and the subdivision, nothing could be more admirable than the subdivisions suggested by Mr. Gustave Kaufman in his paper read before the American Society of Engineering Contractors on Janu- [illegible]



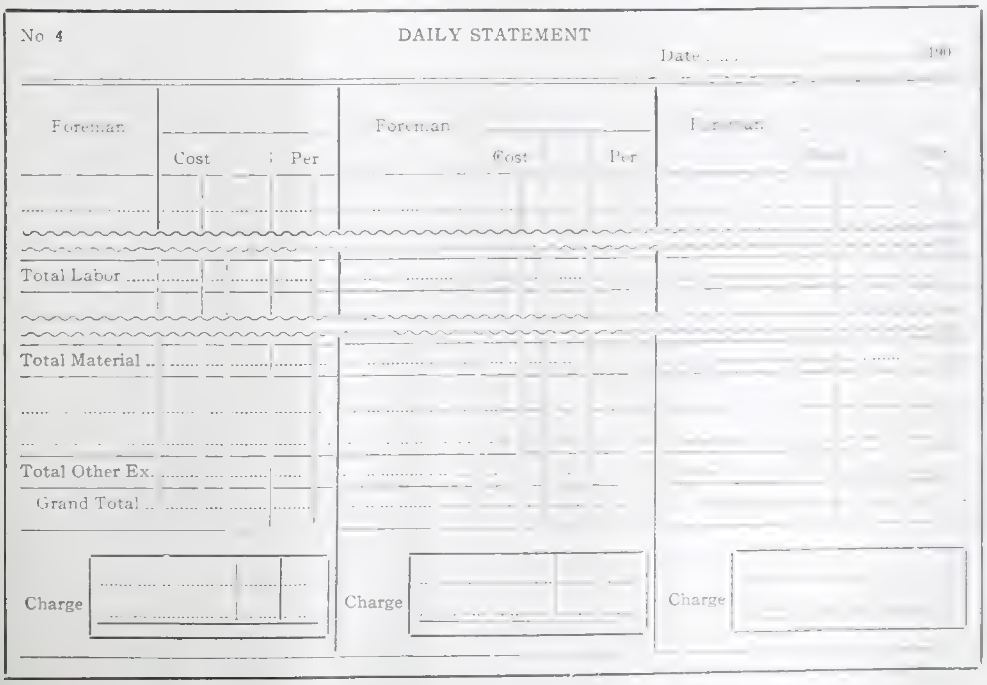
DAILY REPORT OF CEMENT SIDEWALK

190

[illegible]		
Bbls. Lampblack Rec'd		
Hrs. Masons		

Supt

Fig. 5.

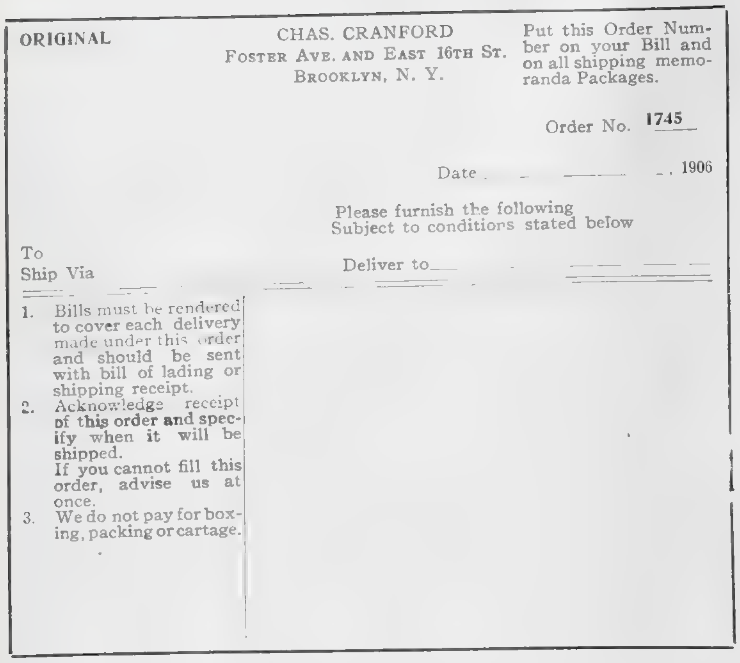


No 4 DAILY STATEMENT

Date 190

Foreman	Cost	Per	Foreman	Cost	Per	Foreman
Total Labor						
Total Material						
Total Other Ex.						
Grand Total						
Charge			Charge			Charge

Fig. 2d.



ORIGINAL

CHAS. CRANFORD
Foster Ave. and East 16th St.
Brooklyn, N. Y.

Put this Order Number on your Bill and on all shipping memoranda Packages.

Order No. 1745

Date . . . . , 1906

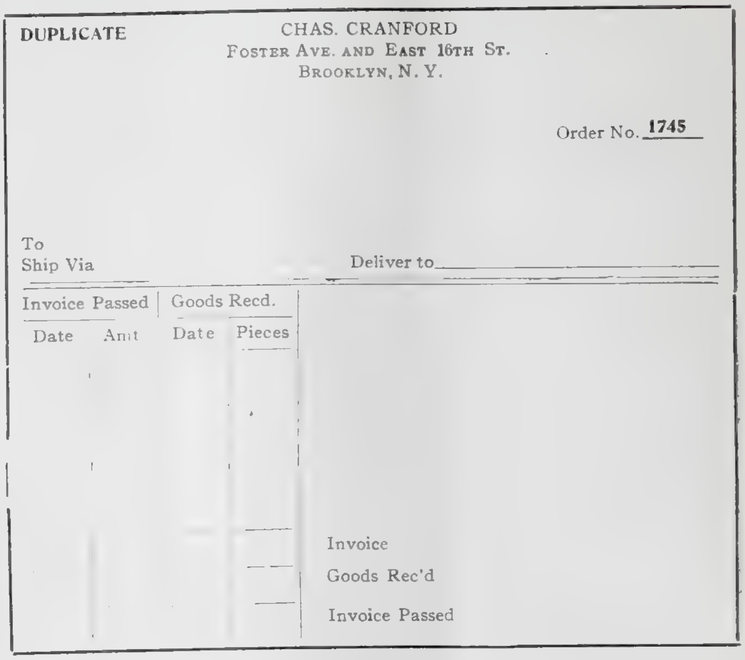
Please furnish the following
Subject to conditions stated below

To
Ship Via

Deliver to

1. Bills must be rendered to cover each delivery made under this order and should be sent with bill of lading or shipping receipt.
2. Acknowledge receipt of this order and specify when it will be shipped.
If you cannot fill this order, advise us at once.
3. We do not pay for boxing, packing or cartage.

Fig. 3a.



DUPLICATE

CHAS. CRANFORD
Foster Ave. and East 16th St.
Brooklyn, N. Y.

Order No. 1745

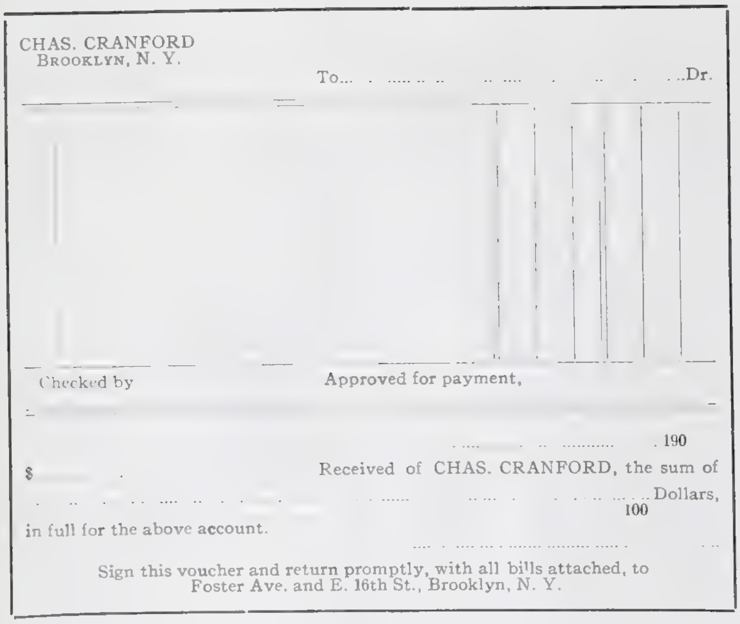
To
Ship Via

Deliver to

Invoice Passed		Goods Recd.	
Date	Amt	Date	Pieces

Invoice
Goods Rec'd
Invoice Passed

Fig. 3b.



CHAS. CRANFORD
Brooklyn, N. Y.

To. . . . . .Dr.

Checked by

Approved for payment,

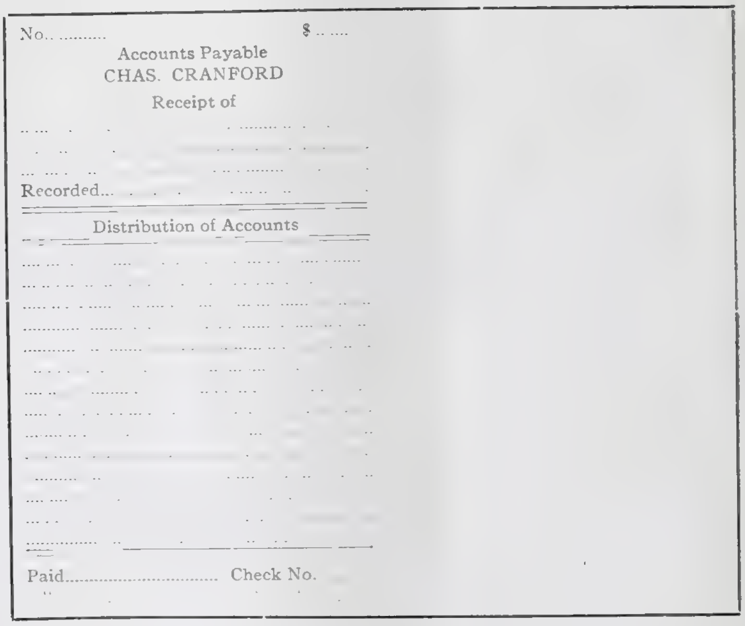
. . . . 190

$ . . . . . . Received of CHAS. CRANFORD, the sum of
. . . . Dollars,
100

in full for the above account.

Sign this voucher and return promptly, with all bills attached, to
Foster Ave. and E. 16th St., Brooklyn, N. Y.

Fig. 4a.



No. . . . . $ . . . . .

Accounts Payable
CHAS. CRANFORD
Receipt of

Recorded. . . . .

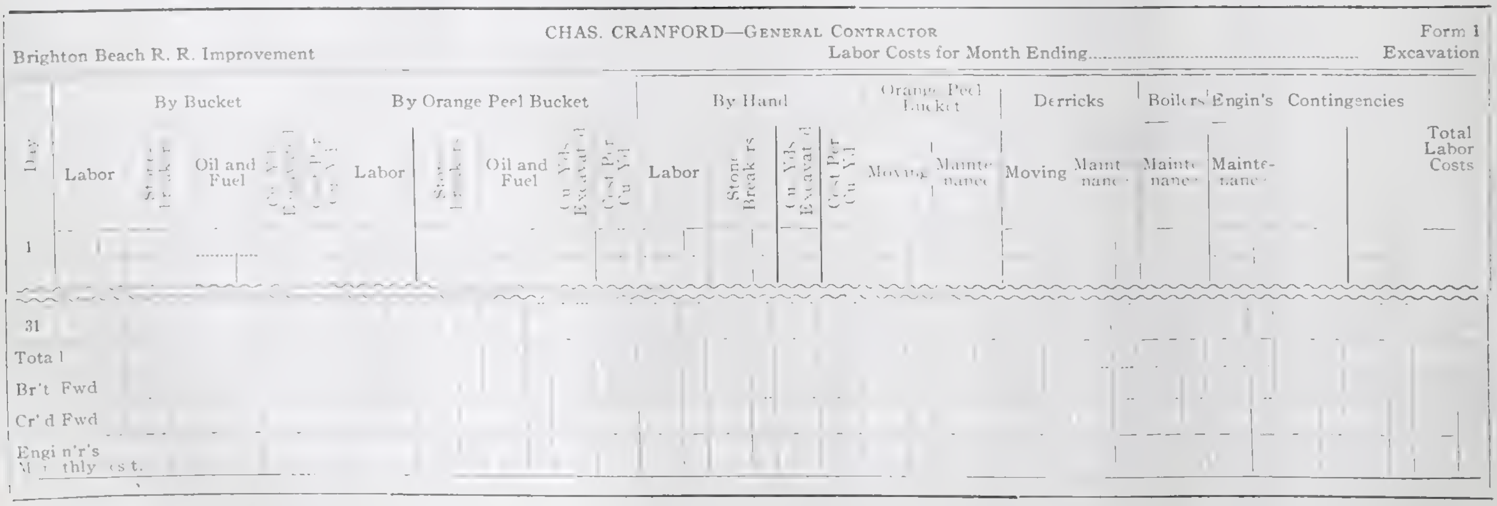
Distribution of Accounts

Paid. . . . . Check No.

Fig. 4b.

Contracting of February 23, 1910. Mr. Kaufman proposed ledger accounts for each class of work to take the place of the daily statements and monthly statements used by the writer as described herewith.

In addition to the cost records, the writer suggests the great benefit of a pocket kodak to snap features of the work, which will be valuable in recording the conditions under which work was done, and especially of any disputed points which may require arbitration after the completion of the contract.



CHAS. CRANFORD—General Contractor Form 1
Brighton Beach R. R. Improvement Labor Costs for Month Ending. Excavation

	By Bucket					By Orange Peel Bucket					By Hand				Orange Peel Bucket		Derricks		Boilers	Engin's	Contingencies	
Day	Labor	Stone Breakers	Oil and Fuel	Cu Yds Excavated	Cost Per Cu Yd	Labor	Stone Breakers	Oil and Fuel	Cu Yds Excavated	Cost Per Cu Yd	Labor	Stone Breakers	Cu Yds Excavated	Cost Per Cu Yd	Moving	Maintenance	Moving	Maintenance	Maintenance	Maintenance		Total Labor Costs
1																						
31																						
Total																						
Br't Fwd																						
Cr'd Fwd																						
Engin'r's Monthly Est.																						

Fig. 6a.

Brighton Beach R. R. Improvement

CHAS. [illegible]

Form 2

Day	By Cars					Dumping and Spreading				By Wagons				[illegible]			[illegible]			[illegible]			[illegible]				[illegible]
	Labor	Oil and Fuel	No. of Cars	Haul in 100 Ft.	Cost per yd per 100 ft	Labor	Oil and Fuel	Cu. Yds. Dumped	Cost per Cu Yd	Team and Drivers	[illegible]	Haul in 100 Ft.	[illegible]	Labor	[illegible]	[illegible]	Labor	[illegible]	[illegible]	Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
1																										
2																										
31																										
Total																										
Br't Fwd																										
Cr'd Fwd																										
Engin'r's monthly est.																										

Fig. 6b.

Brighton Beach R. R. Improvement

CHAS. CRANFORD—General Contractor

Labor Costs for Month Ending............

[illegible]

Day	Bracing			Taking Out Bracing			Temporary Bridges			Trestle			Care of Pipe Lines			Erection of Buildings			[illegible]		[illegible]	[illegible]
	Labor	Ft. B. M. Used	Cost per Ft B. M.	Labor	Ft. B. M. Taken Out	Cost per Ft B. M.	Labor	Ft. B. M. Used	Cost per Ft B. M.	Labor	Ft. B. M. Used	Cost per Ft B. M.	Labor	Ft. B. M. [illegible]	Cost per Ft B. M.	Labor	Ft. B. M. Used	Cost per Ft B. M.	Handling	Carting		[illegible]
1																						
2																						
31																						
Total																						
Br't Fwd																						
Cr'd Fwd																						
Engin'r's monthly est.																						

Fig. 6c.

Brighton Beach R. R. Improvement

CHAS. CRANFORD—General Contractor

Labor Costs for Month Ending

[illegible]

Date	Handling Materials	Massive Concrete			Reinforced Concrete			Arch Concrete			Foundations and Drains			Facing Wall			Forms		[illegible]		[illegible]		[illegible]	[illegible]
		Mixing and Placing	Cu. Yds. Placed	Cost per Cu. Yd.	Mixing and Placing	Cu. Yds. Placed	Cost per Cu. Yd.	Mixing and Placing	Cu. Yds. Placed	Cost per Cu. Yd.	Mixing and Placing	Cu. Yds. Placed	Cost per Cu. Yd.	Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
1																								
2																								
31																								
Total																								
Br't Fwd																								
Cr'd Fwd																								
Engin'r's monthly est.																								

Fig. 6d.

Report of the Special Committee of the American Society of Civil Engineers on Licensing Engineers.*

At a meeting of the Society, April 6, 1910, the following resolution adopted by the Board of Direction was presented:

Resolved, That it is the sense of the Board that it is the duty of the American Society of Civil Engineers to use its influence in the proper formulation of all legislation by the General Government, or by any of the States of the Union, which affects the practice of Engineers; and the Board recommends the appointment by the [illegible] duty it shall be to formulate the general lines on which such legislation should be based, and that said Committee be requested to report at the next Annual Convention.

Your committee issued a circular to the membership of the Society asking for information [illegible] force, or have been proposed, in the various States of the Union and in other countries. While this circular did not ask for an expression of opinion from the membership as to the advisability of the enactment of laws relating to the practice of engineering, 32 of the 70 members who replied expressed themselves as decidedly in favor of such laws if properly drawn, and only 6 expressed opposition.

As far as the Committee has been able to [illegible] in Canada, Mexico, and in the States of W[illegible] statutes governing the practice of land survey[illegible]

Canada.—The Committee has been informed that the licensing of Engineers is in the hands [illegible] the law requires that a practitioner of Engineering [illegible] Canadian Society of Civil Engineers.

Mexico.—Engineers may practice anywhere in the Republic without a license, except in the City of Mexico, where a diploma from the National Engineering School is required.

[illegible] practice of Irrigation Engineering. There is a Board of Examiners, consisting of the State

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*This committee consisted of J. A. Bensel, Wm. H. Burr, James Owen, and Charles Warren Hunt and its report was presented at the annual convention held in Chicago, June 21-24

Engineer and two engineers "of thorough training and experience, appointed by the Governor," and serving without compensation. Fees collected go to defray expenses of the Board. Certificates are issued to five classes of Engineers, as follows: (1) Land Surveyor. (2) Topographic Engineer (examination in plain and topographical surveying). (3) Hydraulic and Hydrographic Engineer (examination in surveying and hydraulics). (4) Construction and Designing Engineer (examination in surveying, design of irrigation works and structures, and computation of earth work). (5) Administrating Irrigation Engineer (examination in surveying, hydraulics, construction work, irrigation law and practice). This law is said to be an unqualified success, in that it has placed irrigation work on a higher plane, protecting, to a certain extent, those who are capable of good work, and in a great measure protecting the public.

Louisiana.—The law in this State was enacted in 1908, and makes it a misdemeanor, punishable by fine or imprisonment, or both, to practice civil engineering without a license. Engineers practicing at that time were allowed to continue to practice by registering, before a certain date, at the court house of their respective parishes. After that date, all those not registered were required to demonstrate their fitness before a State Board of Examiners.

The following statement is briefed from the reply of a correspondent of the Committee: A majority did register, but many did not. Some passed the examination, some failed to pass, and some looked at the examination and did not try it. In this way some incompetent persons were gotten rid of by this law, "simple as it is." Doubtless there are some who practice without a license, but no one has been reported to the Grand Jury for so doing. One of the Examining board has stated that he would rather not antagonize these people until the public began to see the good effects of the law. While the law is intended to cover engineers working for corporations, as well as those in private practice, corporation lawyers contend that it does not so apply, but this question has never been decided. The examinations cover both the practical and theoretical knowledge of the applicant, but are not made difficult. The following is a brief statement of the requirements of the law: (1) A diploma from an engineering college or school of good standing (said standing to be determined by the Board), or the passing of a satisfactory examination before the Board, upon the following: For Surveying: geometry, trigonometry, land surveying, and practical use of instruments. For Civil Engineering; same as surveying, and in addition thereto, natural philosophy or physics. (2) The practitioner must be 21 years old, of good moral character, and possess "at least a fair preliminary education."

Five members of the Board of Examiners are appointed by the Governor, from a list presented by the Louisiana Engineering Society. Members of the Board are paid $10 per day and expenses. The fees charged are $1 for the issue of a certificate, and $10 for each examination.

The law expressly states that its provisions "shall not apply to the Engineering Department of the United States, nor to the Civil Engineers and Surveyors of other States and Territories when in actual consultation with registered Civil Engineers or Surveyors of this State."

Florida.—In this State there is only one restriction, viz.: That anyone calling himself a Civil Engineer, and practicing as such, shall pay the State an annual privilege tax of $10.

In Idaho and South Dakota, as stated before, the law concerns only Land Surveyors, who must pass an examination before a Board of Examining Surveyors, file a bond of $500, and pay fees of $5 and $15, respectively.

The above covers the information in the hands of the Committee as far as existing laws are concerned, but it appears that the subject of the licensing of Engineers has been agitated in the following five States, in all of which legislative bills have been unsuccessfully introduced: New York, Ohio, Pennsylvania, South Carolina and Washington.

Your Committee believes that there is an unmistakable tendency toward legislation regulating the practice of Civil Engineers, and that it is important that there should be uniformity in all States, at least in so far as the requiremnts for admission to practice are concerned. It is believed also that the statutes enacted by any State on this subject should define the term "Civil Engineer" alike, and that the following is properly descriptive:

A Civil Engineer, within the meaning of this Act, is one who practices any branch of the Profession of Engineering other than Military. Said Profession embraces the design and construction of public or private utilities, such as railroads, bridges, highways, roads, canals, harbors, river improvements, lighthouses, irrigation works, water supplies, sanitary systems, and the development, transmission and application of power, and includes all industrial, hydraulic, municipal, structural, electrical, mechanical, mining and other works which require experience and the same technical knowledge as engineering schools of recognized reputation prescribe for graduation.

Your Committee further recommends that all such statutes should prescribe the following minimum requirements for a practitioner of civil engineering: 1. That he shall be not less than 25 years of age. 2. That he shall be of good moral character. 3. That he shall have been engaged actively in civil engineering work, as an assistant to a licensed practitioner, for at least six years, and as such shall have had responsible charge of engineering work for at least one year. 4. For a graduate from a school of engineering of recognized reputation, the term of actual engagement as an assistant shall be four years.

The foregoing are the minimum requirements for corporate membership in the American Society of Civil Engineers, and in the opinion of your Committee, there should also be inserted in any law a clause to the effect that the Certificate of Corporate Membership in this Society entitles its holder to practice as a Civil Engineer without examination.

All State laws should also be uniform in their provision for the necessary examination of candidates for admission to practice, and your Committee suggests that such examinations be conducted by a Board of five (5) Civil Engineers, appointed by the Governor of the State, and serving without compensation other than actual expenses, each of whom shall be not less than thirty (30) years of age, and shall have been in active practice for not less than ten (10) years. Said Board to conduct examinations not less than three times each year at different places in the state; to prepare all examination papers; rate each candidate and certify to said rating to the State Board of Regents, or other similar authoritative body. Said authoritative body shall thereupon issue to successful candidates licenses to practice as Civil Engineers. The Committee recommends that the fee for the issue of a certificate giving the right to practice shall not exceed the sum of $25.

Your committee recommends that all laws shall prescribe that it shall be unlawful for anyone unlicensed to accept engagement as a Civil Engineer, and that no unlicensed person shall be allowed to sue in any court of the State for compensation for services rendered, or to qualify as an expert witness before any State or Municipal Court.

Your committee deems it beyond its duties to go into detail in matters which would in any event be governed by conditions which are variable, but it is recommended that the license to practice in one State should be, if possible, made effective in other States, so that Civil Engineers who are licensed to practice in any State or Territory shall have the right to practice in any other State without examination.

If laws are passed in all States of the Union upon the basis above outlined, it does not appear that there can be any valid objection from properly qualified Civil Engineers, and it is the opinion of your Committee that the enactment of such laws would result in placing the profession upon a better basis, and would, in some measure at least, protect the public from incompetent and irresponsible practitioners.

Your Committee recommends that the Board of Direction be empowered in behalf of the Society to take up this matter with the proper authorities from time to time as may be deemed expedient, and to urge the enactment of State laws governing the practice of Civil Engineers in general conformity with the suggestions of this report, and further, that the Board appoint from the membership of the Society a Committee of three in each State to co-operate with the Board in this matter, and to act under its direction."

Records of Performances of Steam Shovels for May, Central Division, Panama Canal.

The total amount of material excavated during May in this division was 1,352,314 cu. yds. of which 960,823 were rock and 391,691 cu. yds. were earth. The best records for the month are shown by the table below, taken from the *Canal Record*. Monthly records are from place measurement, and the daily records are based on car measurement.

BEST RECORDS FOR THE MONTH.

Shovel No.	Cubic Yards. Earth.	Cubic Yards. Rock.	Cubic Yards. Total.	No. of days at work.
Chagres District.				
127	34,894	......	34,894	25
114	31,303	......	31,303	24
Empire District.				
211	......	44,500	44,500	25
210	......	37,144	37,144	25
Culebra District.				
224	......	41,672	41,672	25
208	......	40,539	40,539	24

Best Records for One Day.

Shovel No.	Location.	Date.	Character of material excavated.	Cubic yds. exvated.
111	Chagres	May 6		
209	Chagres	May 3	Earth	1,500
111	Chagres	May 7	Earth	1490
211	Empire	May 12	Earth	1,450
211	Empire	May 11	Rock	2,432
210	Empire	May 23	Rock	2,391
217	Culebra	May 5	Rock	2,165
217	Culebra	May 6	Rock and earth	3,477
208	Culebra	May 23	Rock and earth	3,249
231	Ped. Mig'l	May 26	Rock	3,059
			Rock	2,850

Electric Locomotives Used at Gatun.—The following statement taken from the Canal Record indicates the loss of time due to repairs on the electric locomotives used for hauling concrete from the mixers to the locks. Two additional electric locomotives have been ordered for use on the industrial railroad. Ten are now employed and when all are in use represent the maximum of operation on the road, but usually one or two are laid up for repairs, impairing the movement of the concrete trains to some extent. The new locomotives will obviate this by being kept in reserve.

Records for Concreting Again Broken at the Gatun Locks, Panama.

On June 6, 3,998 cu. yds. of concrete were laid in the locks at Gatun. This represents the work of eight mixers, a total of 76 mixer hours, and an average of 9½ hours per mixer. Of the 3,998 cu. yds. placed 150 cu. yds. were large stone laid in mass. This indicates the average hourly output per mixer was 53 cu. yds. The previous high record for weekly output was also broken and the 20,000 cu. yd. mark, on the basis of a week's work was passed for the first time. The daily average for the week was 3,477 cu. yds. This average was also the highest so far for a period of five or more days. A statement of the week's work in detail follows:

	Cubic Yards. Construction plant.	Cubic Yards. Auxiliary plant.	Cubic Yards. Large stone.	Cubic Yards. Total.
June 6	2,754	1,094	150	3,998
June 7	2,418	454	108	2,980
June 8	2,520	696	131	3,347
June 9	2,294	1,006	98	3,398
June 10	2,552	1,002	107	3,661
June 11	2,250	1,140	88	3,478
Total	14,788	5,392	682	20,862
Previously reported	......	.....	...	437,461½
Grand total	......	.....	...	458,323½

Contract News Section

of

ENGINEERING-CONTRACTING

A Consolidation of ENGINEERING-CONTRACTING—CONTRACT NEWS—ENGINEERING WORLD—THE DIRT MOVER.

Containing Items of Interest to Railroad, Public Works and Other Contractors.

The Doings of the Week.

The principal railway construction contract of the past week appears to have been the one for the grading of the joint double track line of the Denver & Rio Grande and Colorado & Southern Rys., between Walsenburg and Pueblo. The contract was let on July 1 to the Utah Construction Co., of Salt Lake City, Utah. The line will be 52 miles long and the contract is said to amount to about $4,000,000. Among the other railroad construction contracts let recently are the following: Gordon & Grace, Savannah, Mo., sub-contract for grading for the St. Joseph & Savannah interurban line; H. H. Nelson, Great Falls, Mont., sub-contract for work on the Sun River line in Montana; M. Cassidy, Oklahoma City, Okla., for the grading work for the first section of the Denver, Kingfisher & Gulf R. R.; Henry McLaughlin, Pensacola, Fla., for constructing the first section of the Pensacola & Southwestern R. R., from Millview to Lillian, Ala., including a 4,000-ft. trestle and bridge over Perdido Bay; The Hall Construction Co., Los Angeles, Cal., for constructing 16 miles of roadbed up Pit River Canyon, California, for the Nevada-California-Oregon Ry.; The Aberdeen Construction Co., Aberdeen, Wash., for two miles of clearing and grading on the Willapa branch of the Union Pacific in Washington; James McRae, Gladstone, Canada, for 12 miles of grading for the Oakland branch of the Canadian Northern R. R.—The State Superintendent of Public Works, at Albany, N. Y., will shortly call for bids for two large contracts for work on the New York State Barge Canal. These are Contracts No. 50 and No. 67. Contract No. 50 calls for the construction of a reservoir and dam on the West Canada Creek, the estimated cost being $1,076,000. Contract No. 67 calls for the construction of the canal prism with the two locks and other structures at Lockport, at the estimated cost of $1,290,880.—A large piece of levee work is projected in Posey, Gibson and Pike Counties, Indiana, and surveys for the work have already been started by the Consulting Engineer, Harry N. Pharr, of Memphis, Tenn. The improvement will cost between $750,000 and $1,000,000.—A recent decision of the Circuit Court of Illinois has declared the special act of the Illinois Legislature creating the East Side Levee & Sanitary District of East St. Louis, Ill., constitutional, and the district can now go ahead with the construction of its $6,000,000 improvements, which include a levee wall and a diversion channel. Contracts for the latter piece of work have already been let.—The State Supreme Court of Pennsylvania on July 1 rendered a decision declaring the ordinance of the Pittsburg City Council of Sept. 24, 1909, providing for the submission of a $6,775,000 bond issue to the voters, null and void. A perpetual injunction was issued restraining the Mayor of Pittsburg from increasing the city's debt along the lines laid down in the ordinance. The proceeds of the bond issue were to have been used for extensive improvements in Pittsburg.—The Board of Estimate and Apportionment of New York City has decided to widen 42nd St., New York City, between Park and 8th Aves. By the plan a total increase of 15 ft. from curb to curb is to be secured by reducing the width of each sidewalk 7½ ft. A reduction in sidewalk width will in part be [illegible] removal of building encroachments. Following a custom in some foreign cities, it is reported that the cost of the improvement, which is estimated at $500,000, will be borne by the property owners.

William H. Brown.

To come to a railroad when it was a single track line and leave to a [illegible] track system; to have had the giving out of contracts amounting to over half-billion dollars; to have had charge of the engineering work during practically the entire growth of one of the greatest railways system in this country. Such, in brief, was the life work of the late William H. Brown, for 25 years Chief Engineer of the Pennsylvania R. R. William H. Brown was born at Lancaster, Pa., on Feb. 29, 1836. His education was obtained in the district schools and in the Central High School of Philadelphia. Early in life he showed an inclination for engineering, and by making and selling axe helves he bought engineering books. Later by working in the woods and selling tool handles he secured the money to buy a few instruments. Shortly before the commencement of the civil war he entered the Survey Department of the city of Philadelphia and while there gave the stakes for the first passenger railway to enter the city. At the beginning of the civil war, he entered the railway service for the Federal Government, reporting to Thomas Scott, at that time Assistant Secretary of War, shortly after the first battle of Bull Run. He was placed in charge of the Orange, Alexandria & Manassas Gap R. R. and practically rebuilt the whole line of this road. Twice in one summer he was obliged to rebuild all the bridges on the line, owing to the activity of the confederate forces. In 1862 he became Assistant Engineer of the Pittsburg, Cincinnati, Chicago & St. Louis Ry., and in the succeeding year was promoted to be Principal Assistant Engineer. In 1864 he entered the employ of the Pennsylvania R. R. as Assistant Engineer for the Pittsburg Division. Three years later he became Engineer of the Philadelphia & Erie Division. In 1869 he was placed in charge of the construction of the Altoona Car Shops with the title of Assistant Engineer. In 1870 he was appointed Resident Engineer of the Middle Division; in the next year he became Chief Engineer and Superintendent of the Lewistown Division. He became Superintendent of the Bedford Division in 1872 and in 1874 he became Engineer of Maintenance of Way of the Pennsylvania R. R. He remained in this position until 1881, when he was [illegible] the Pennsylvania R. R. He served in this position until March 1, 1906, when having reached the age limit of 70 years, he retired on a pension. To enumerate the work done under his direction would be like giving the construction history of the Pennsylvania R. R. for the past 40 years. He, himself, considered the building of the Broad Street terminal and station in Philadelphia, as having been his greatest work. The improvements in and around New York City, consisting of the company's terminals at Jersey City and Greenville, the rebuilding of the Jersey City station four times, the building of a new line to Bergen Hill, the [illegible] to Cresson. A few days later, much to the [illegible] Brown on another route over the Alleghanies. This route was not considered at the time but was later taken up, perfected and adopted. Mr. Brown had a great belief in stone bridges and he [illegible] to take the place of steel structures. He built the bridge over the Susquehanna River west of Harrisburg which [illegible] stone arch bridges in the world. Few engineers could equal him as a bridge builder and that fact gives point to the following story: One time he was introduced to a clergyman, as the greatest bridge builder in the world. The clergyman thinking to show the futility of human effort said: "Mr. Brown, could you construct a bridge from here to eternity?" [illegible] Mr. Brown replied: "Yes, if you will furnish the abutments."

The 8-Hour Law and Levee Contractors.

A decision of much interest [illegible] the U. S. Circuit Court at [illegible] levee contractor, who was indicted by the Federal Grand Jury on July 16, 1909, on the charge of having violated the Act of Aug. 1, 1892, known as the 8-hour law, while engaged in building certain public levees on the bank of the Mississippi River in St. James Parish, La. The attorneys for Mr. Garbish interposed a general demurrer to the indictment on the [illegible] against the laws of the United States. The ruling of the court in sustaining the demurrer and discharging the defendant was in part, as follows: "The defendant rests his case on the proposition that the building of levees on the Mississippi River, in the Ea[illegible] trict of Louisiana, at all times pr[illegible] extraordinary emergency, and hence that particular work is exempted from the operation [illegible] and the indictment contains the general averment that no extraordinary emergency existed [illegible] cisive of the case, if defendant's cont[illegible] ana has at all times presented many problems [illegible] levees should be built on the ba[illegible] Mississippi River in this locality; th[illegible] of the day has never been restricted to eight hours. In the nature of things, it is impossible to employ an unlimited number of men or teams in the building of levees, as no mat[illegible] It is necessary that levees be built in as short [illegible] settle as much as they can, and that the grass may become well rooted upon them before they are called upon to bear the strain of a high river. It is true that the months of August, September, October, November and December are the most favorable for levee building, but there is no certainty that during any part of these months the river will maintain a low stage. When the river is bank full necessarily no levee can be built. Statistics of the river's height at New Orleans show that during the past twenty-five years the river has been bank full on nearly every day of the year, and these statistics may well apply to the locality where the defendant was working. An unprecedented rain, or an early freeze, followed by a thaw, anywhere in the valley of the Mississippi River, or its tributaries, might unexpectedly cause the river to rise in New Orleans. No one can foresee or anticipate the acts of nature, and who can say that a few days more time in which it might have become solidified would not have so materially added to the levee strength as to enable it to withstand the pressure from that which it might signally fail. All of these facts are within common knowledge of the people of this district, and in connection with the specific allegations of facts in the indictment, overcome the mere conclusions of the pleader that no extraordinary emergency exists. The case presented here is not that of a contractor trying to complete his job on schedule time, nor is it a question of expediency, or the saving of expense. In my opinion the building of levees on the banks of the Mississippi River in the Eastern District of Louisiana presents at all times an extraordinary emergency. It may be that the indictment is otherwise demurrable, but I prefer to base my decision on the broad ground above set forth."

RAILWAYS, STEAM AND ELECTRIC

Alabama Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Five miles of the projected railway extending south from Brent on the Mobile & Ohio R. R. have been completed, and contracts have been let for eight additional miles to be constructed during the next ten months. Surveys now under way to extend the line through Marion and to the Tombigbee River. The line will open up extensive timber lands owned by the promoters.

Engineers of the Louisville & Nashville R. R. have completed their work in the vicinity of Hartselle. It is understood that a contract will be let shortly for the double track from Holmes Gap to Flint. J. E. Willoughby, Louisville, Ky., is Engineer of Construction L. & N. R. R.

The Selma Street & Suburban Ry. Co. of Selma, is said to be planning to have work started soon on the extension of its line from the northern part of Selma to Summerfield, requiring nine miles of track.

Capitalists of Birmingham, who are interested in the construction of the proposed railroad from Selma to the Birmingham District, have asked the Selma promoters for a copy of the maps and surveys made some years ago in order that they may consider extending financial aid for the projected work. The secretary of the Selma, Ala. Commercial Club and George Hunting Clarke, Birmingham, Ala., are interested.

Henry McLaughlin, Pensacola, Fla., has been awarded the contract for constructing the first section of the projected line of the Pensacola & Southwestern R. R., recently organized to build from Pensacola, Fla., to Point Clear. The contract covers the section from Millview to Lillian, Ala., and includes a 4,000-ft. bridge over Perdido Bay. Work is to be started this month and the section completed in four months. Col. Charles Barclay, Bay Minette, Ala., is President.

Arkansas Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Location surveys have been started from Harrison for the projected line of the Fort Smith, St. Louis & Chicago R. R. The first section to be surveyed will be from Harrison to Fort Smith. Engineering offices have been opened at Harrison by Col. L. S. Powers, the promoter of the road.

The McCrory Transportation Co. of McCrory, Ark., has completed final surveys for its railroad between Woodruff and Jackson counties.

A meeting of the Busch Interests was recently held at St. Louis to consider the proposition of constructing a railroad through the Ozark region of Southern Missouri and northern Arkansas. A. A. Busch, St. Louis, Mo., chairman of the Board of Directors of the Manufacturers Ry., is interested.

The Gulf & Magnolia Northern R. R. has completed surveys and has received the capital for the construction of its projected line. We are advised that construction contract will be let sometime between July and September. The projected length of this line is 125 miles, and the route is from Junction City, Ark., via Magnolia and Hope to the Oklahoma State Line near De Queen on the Kansas City Southern. Henry Nunun, Gurdon, Ark., is chief engineer and S. Q. Servier, Hope, Ark., is president.

Engineers of the Arkansas, Louisiana & Gulf Railway are now working toward Pine Bluff from Hazen on the survey for the projected extension. About $35,000 has already been expended for land along the proposed route. J. M. Parker, Hamburg, Ark., is General Manager.

California Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Mutual Home Building Co., of Los Angeles, is to construct an electric railway to the top of Monticello Hills in the northeast corner of the original city of Los Angeles, to serve a new subdivision which the company is to develop.

The contract for the first of the shops to be erected at Sacramento for the Western Pacific R. R. has been let to the Ransome Concrete Co., San Francisco. The building will be 138 ft. wide and 221½ ft. long and will be used as machine shop, tool shop and air-brake shop. Excavation has been started. The shop site given by the city is 4,000 by 1,000 ft. in size and contracts for the rest of the building are to be let as fast as plans are completed.

The last of the tracklaying on the Fullerton cutoff has been completed at the yard tracks of Richfield, Cal., and Fullerton. There remains now but the ballasting of the tracks to be done to finish up the work and it is now a matter of but a very short time before the entire operations will be completed.

The City Council of Oakland are giving favorable consideration to the application of the Central Pacific Ry., a subsidiary corporation of the Southern Pacific, for a franchise to run an electrolized extension from its present Melrose terminus to Stanley Road in Elmhurst.

The Nevada-California-Oregon Ry. has awarded a contract to the Hall Construction Co., Los Angeles, for the construction of 16 miles of road up Pit River Canyon.

Colorado Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The City Council of Greeley has granted a franchise to the Greeley Street Car Company to run on 8th Ave. from 11th to 3rd St., and from 14th St. through to Island Grove Park.

The Denver & Gulf Ry. Co. has work well under way on the proposed line and grading is progressing about as rapidly as the committee can secure right of way. A preliminary line has been run into Denver, cutting the distance between that city and Lamar, Colo., to 155 miles.

The Manitou & Pikes Peak Ry. Co., controlling the line up Pike's Peak, built by the late Z. G. Simmons, of Kenosha, Wis., has been reorganized and the officers of the same are as follows: C. W. Sells, Manitou, Colo., President; Z. G. Simmons, Jr., Vice President and Treasurer, Kenosha, Wis.; A. H. Lance, Secretary, Kenosha, Wis.; H. S. Hold, Assistant Secretary and Auditor.

Bids were opened at Denver on June 20 by the Denver & Rio Grande and the Colorado & Southern for constructing a double track line between Pueblo and Walsenburg, a distance of 52 miles. On July 1 the grading contract was let to the Utah Construction Co. of Ogden, Utah. The contract amounts to about $4,000,000, it is said.

Charles Fuller, Cripple Creek, at present in charge of driving the Roosevelt drainage tunnel, is said to have been awarded a contract for the completion of the Vidler tunnel through Argentine pass for the Montezuma & Western R. R. Co., which will use it for railroad purposes. The contract is said to call for the boring of 300 ft. of tunnel per month.

Georgia Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

A party consisting of Colonel J. A. Finch, pardon attorney in the department of justice in Washington, D. C., Congressman William E. Cox, of DuBois County, Indiana, and Albert Fenn, will sometime this month make a trip through the counties north of Hall, including Lumpkin, White, Habersham, Dawson, Rabun, Towns and Union, with a view to looking over timber lands and the possible construction of a railroad north from Gainesville to either Blue Ridge, Ga., or Murphy, N. C.

William J. Oliver, Knoxville, Tenn., who recently purchased the Savannah, Augusta & Northern R. R. at court sale, is reported to have made arrangements in the east whereby the road is to be extended. It is reported that Mr. Oliver has made a sale of the property to other railroad interests and that the Knoxville, Sevierville & Eastern R. R. may be extended toward the Atlantic coast, as one of the results of the consummation of the new plans for the S., A. & N. The Savannah, Augusta & Northern R. R. is 25 miles long and was built by Mr. Oliver under contract, from Savannah to a point near Augusta. It is now stated that it is to be completed into Augusta and probably on to Athens, Ga., which is in a direct line from Augusta to Knoxville.

Idaho Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

We are advised that the Pacific & Idaho Northern Ry. has completed surveys and has secured the capital for the construction of a 15-mile extension from Evergreen, Idaho to New Meadows. Construction contracts are to be let at once. Lee Highley, Weiser, Idaho, is Chief Engineer, and E. M. Heigho, Weiser, Idaho, is President and General Manager.

Illinois Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Funds for preliminary work are being raised for the projected interurban line from Princeton to Mendota via Dover and La Moille. Arrangements are said to have been made with engineers to make the necessary investigations as to the feasibility of the line. L. J. Kendall, La Moille, and A. R. Unholz, Princeton, are interested.

The city council of Pana has granted the Decatur-Pana interurban a franchise for the electric road through the streets of the city.

Promotion work is well under way for the Galesburg, LaSalle & Kankakee Ry., and much right of way has already been secured. As proposed gasoline motor cars will be operated for the passenger service and the freight will be handled by steam. J. W. Scott, LaSalle st., Streator, Ill., is president.

The Chicago, Wheaton & Western R. R. has been granted a franchise in St. Charles. The company was granted the right to operate single or double tracks in St. Charles for regular Aurora, Elgin trolley service as well as St. Charles-Chicago third rail car service. Attorney Henry C. Wood, Wheaton, is president. The line will be a feeder for the Aurora, Elgin & Chicago Ry.

The Kankakee & Urbana Electric Ry. Co. has secured most of the right-of-way for its projected line. The route of the road, which has been proposed for some time runs from Urbana to Philo, thence to Hindsboro, Villa Grove, Camargo and Charleston. At Charleston it is planned to connect with a road now being constructed between that city and Casey and between Casey and Oblong. Ten miles of this road is in operation. George M. Bennett, Urbana, is vice president.

The Waukegan, Rockford & Elgin Traction Co., a new company, in connection with its other plans proposes an electric railroad from Palatine, Cook County, to Lake Zurich, and thence to Wauconda in the immediate future, and ultimately to Velo, Pistakee Lake and Fox Lake. As soon as $100,000 stock subscription is secured, it is said, that construction work will be taken up. R. D. Wynn, Waukegan, Ill., is president.

The Alton & Southern Ry. Co. has filed its articles of incorporation in county recorder's office in Belleville. The company has a capital stock of $10,000 and proposes to build an outer belt line from Alton to East St. Louis. The stockholders are: A. V. Davis, R. B. Mellon, C. M. Hall, C. S. Fox, Gilbert McCullach, Charles Souder and W. H. Hebenstreit.

The East St. Louis, Columbia & Waterloo R. R. Co., a new concern, has filed notice at East St. Louis of the increase of its capital stock from $10,000 to $1,000,000.

The improvement of the Elgin, Joliet & Eastern R. R. yards at Joliet, Ill., now under way, will, it is said, entail an expense of about $1,000,000. The trackage will be increased and steel and wood car shops built.

According to an announcement made by P. F. McManus, Joliet, Ill., Superintendent Elgin, Joliet & Eastern R. R., upon the completion of the extensive improvements now under way at Joliet, the matter of constructing another double track line to Gary, Ind., will be taken up, making a total of four tracks between Joliet and that city.

Advices from Monmouth, Ill., state that the Rock Island-Alexis Ry. Co., the subsidiary company of the Rock Island Southern Ry., mentioned in our last issue, is about ready to close the contract for the construction of the line to Alexis. Monmouth has already subscribed $13,000 for the purpose and Alexis is securing the necessary amount.

The Chicago & Northwestern Ry., has commenced work on the reballasting of the main line tracks between Sterling and Clinton. Roadmaster C. H. Bowen of Sterling, Ill., will have charge of the work, which will take several months. Tearing out the old gravel ballast, which will be replaced with crushed white limestone, has been started. Several train loads of the stone were shipped in from the quarries at Cedar Rapids, Iowa, and dumped along the right of way. Several stone trains now in use at Nelson will soon be taken to the Iowa city to carry stone to the new work.

Indiana Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

According to a reported announcement of E. Q. Lockyear, Evansville, Secretary of the Evansville, Mt. Carmel & Olney Electric Ry. Co., construction work on the projected interurban line will be started this summer. J. J. Burns, Isabella Bldg., Chicago, Ill., and M. A. Peoples, Chicago, are to build the line.

The necessary capital for the construction of the Madison-Scottsburg Interurban line, the continuation of the Southern Indiana Traction Co.'s road has been secured and it is thought the line will be in operation by Jan. 1. A large power house will be erected at Madison, and this, with the one now in operation at Seymour, will furnish power for the entire line. J. E. Greeley, Louisville, Ky., is President.

The Chicago, South Bend & Lake Shore Ry., South Bend, is considering making an extension from South Bend to Elkhart, Kalamazoo and Toledo, it is said. The company will take up the Bucklin lines now in operation east of Elkhart and also the old Elkhart & Western, which connects Elkhart with Mishawaka.

It is expected that the Indianapolis & Cincinnati Traction Co., which has been in the hands of a receiver for the past four years, will be sold to a new company which will construct an extension from Connersville to Hamilton. C. L. Henry, Indianapolis, is the receiver.

The Indianapolis, New Castle & Toledo Electric Ry. Co., New Castle, which has recently placed a line in operation between Indianapolis and New Castle, will start construction work this fall on a branch line from the latter place to Muncie.

The City Council of New Albany has granted the Louisville & Southern Indiana Traction Co., New Albany, a franchise to extend its tracks to the proposed new fairgrounds near New Albany. It is probable that a line will be built from New Albany to French Lick Springs.

The Commissioners of Allen County have granted the Fort Wayne & Winona traction line, projected by J. A. Barry, a franchise through this county. A bond of $2,000 will be given for the completion of the work in 1912.

Work is progressing rapidly on the Cleveland, Cincinnati, Chicago & St. Louis Ry. (Big Four branch from Evansville to Mt. Carmel. A large bridge will be included in the construction work, spanning the Wabash River. The structure will be of steel resting on concrete foundations and will consist of seven spans and will be 1,156 ft. in length. Very little difficulty has been experienced by the company in securing right of way for the road and it is expected that work will be pushed through to completion. Walsh Construction Co. has the contract for constructing the line while Hollerback & May of Evansville, Ind., are building the bridge.

The Baltimore & Ohio R. R. is said to be planning large improvements in the vicinity of Chicago. These are said to include the abandonment of the old right-of-way from Gary to Chicago, the removal of the South Chicago yards and shops to Gary and the cutting off of 30 miles between Gary and Chicago. The B. & O. recently acquired the Chicago & Calumet Terminal Ry. and it intends to use its tracks into Chicago.

Iowa Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Fort Dodge, Des Moines & Southern Ry., Boone, Ia., is said to be planning to build a connecting line along First avenue south from 15th to 18th street at Fort Dodge to be used for the operation of the city street cars.

Resurveys have been made of a portion of the proposed route of the Iowa City-Ottumwa interurban line. The deviation commences near Frytown and the old survey was met just beyond Wellman. The resurvey was made by F. C. Young of Iowa City.

The Charles City Western Ry. of Charles City, which has grading work under way on its line from that city, has increased the construction force by the addition of 70 Greeks.

Grading work on the Waterloo, Cedar Falls & Northern Ry. to Waverly is well along and the work will be completed to the city limits of Waverly within three months. The cut at the old Buesing place two miles east of the city has been finished and 20 men and 30 mules are now working on the cut in the Goodspeed Hill. Harrington Bros. have the contract.

It is believed at Fort Dodge, Ia., that the Chicago & Northwestern is running surveys for the construction of a line from some point on the main line, probably at Ogden, to Fort Dodge.

Bonds amounting to $1,000,000 have been issued by the Muscatine North & South Ry. Co. to provide funds for the construction of an [illegible] dent.

Kentucky Notes.

[illegible]

The Louisville Ry. Co., Louisville, is [illegible] a direct trolley service with West Louisville and Parkland.

Engineers believed to be in the employ of [illegible] completed two surveys across McCracken [illegible] line from Herrin, Ill., to Metropolis, Ill., and it is thought that the surveys were made for [illegible] connection would be made with the Nashville, Chattanooga & St. Louis R. R.

[illegible] contract for a 1,100,000 cu. yd. job on the Chesapeake & Ohio Ry., at Brent, Ky. They are now working their 70-ton shovels, and [illegible]

Kansas Notes.

[illegible]

The Union Pacific Ry. has purchased 3½ acres of land between 16th and 18th sts., at Kansas City, to be used in connection with the enlargement of its terminal in that city.

Work has been started on the New Rock Island yards at Wichita, Kan., and material for the improvements is now on hand. The work, which will cost about $200,000, includes the construction of 12 tracks, round house, power plant, water tank, coal chutes and cinder pits. [illegible] on the job.

According to reports from Garden City, Kan., the prospects for the construction of the Garden City, Gulf & Northern Ry., are at the present time very bright. B. M. McCue, promoter of the project, has been busy for the past few weeks making arrangements for financing the road.

The outfit of Amis & Dean, Grading Contractors, who have a contract for grading on the Santa Fe, have shipped their outfit to Lawrence, Kan. The stretch of track to be rebuilt commences about a mile west of Lawrence, where the Santa Fe has had so much trouble in flood times. The track will be moved a considerable distance from the river to an entirely new right of way, and will be elevated about four feet. The present curves will also be eliminated as far as possible. It is thought that it will require about five months to complete the job.

The Wichita Terminal Association, of Wichita, composed of the Missouri Pacific, the Santa Fe, the Rock Island and Frisco railways is considering building a terminal warehouse near 21st st., Wichita. The warehouse will be about 300 ft. long, 40 ft. wide, one story and will cost about $75,000.

Surveys for the projected line of the Oklahoma & Kansas Ry. have been completed and the engineers are now working on the [illegible] and estimates. We are advised that it w[illegible] some little time, however, before contracts are let. The company projects a line to connect [illegible] through Sunny Side, Lincolnville and H[illegible] mer Co., Kansas City, Mo., are the eng[illegible]

The Metropolitan Street Ry. Co. of K[illegible] City, Mo., has accepted the franchise r[illegible] Kansas City, Kan. The line is to go west to 22nd St., thence north to Brown Ave.

Louisiana Notes.

[illegible]

The Louisville & Nashville R. R. has negotiations under way by which it will obtain control and practical ownership of the St. Louis Southwestern Railway Company, known as the Cotton Belt route. By the acquisition the Louisville & Nashville will gain a short route to the West and Southwest through Memphis and St. Louis.

Michigan Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The promoters of the Battle Creek, Coldwater & Southern Electric Ry. Co., have asked the State Railroad Commission at Lansing for permission to issue bonds to the value of $450,000 as first mortgage, $420,000 of which amount have already been contracted for and sold at par. Several years ago the Pennsylvania lines graded the proposed road from Battle Creek to Coldwater and abandoned the project. It now looks as though the line was to be completed.

Surveys have been made and construction work may be started soon on a projected interurban line from South Bend, Ind., to Kalamazoo, Mich., via Sister Lakes, Dowagiac, Decatur, Paw Paw and Mattewan. It is reported that the capital for building the line will be furnished by Chas. M. Murdock. Edward G. Folsom, Logansport, Ind., is interested.

Work is well along on a 12-mile interurban line which is being built to Lansing. Eugene Pennebaker, Cairo, Ill., is engineer in charge of construction.

The Northern Construction Co., Lansing, has commenced work double tracking the Michigan United Ry.'s line on Washington street, Lansing. The work will extend from Ottawa street to the bridge and will be completed in two months.

The Hart Cedar & Lumber Co., of Hart, and W. R. Roach & Co., are to build a standard gage railroad from Hart in a southeasterly direction, terminating in the township of Elbridge. The road will probably be extended over an old grade for part of the way.

Right of Way Agent E. W. MacPherran, of the Duluth, Southt Shore & Atlantic Ry. Co., is at present in Marquette, Mich., making arrangements for the vacation of the right of way through that city.

The Detroit, Bay City & Western R. R. Co. has secured right of way along First St. at Bay City, for its projected line.

The Grand Rapids & Indiana Ry. has petitioned the City Council of Muskegon for right of way for a spur track. The proposed spur would cross the tracks of the Pere Marquette at two places requiring two interlocking plants costing about $30,000 each. E. H. Barnes, Grand Rapids, is Chief Engineer.

Minnesota Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The work of double tracking the final 87 miles of the Chicago, Milwaukee & St. Paul R. R., between St. Paul and Chicago, is now over 70 per cent completed and it is expected that all of the work will be finished by September. One of the most interesting features of the improvements under way is the reconstruction of the tunnel at Tunnel City, Wis. This tunnel has been abandoned since 1876, when the new tunnel, which parallels it about 40 feet distant, was opened. The old tunnel was built in 1856 and is 1,330 ft. long. For 30 years the old tunnel has lain idle and is in bad shape. It is being cleared of the debris that has fallen, the floor lowered about 25 ft. and new arches and walls of concrete built. The intention is to use the old tunnel for eastbound trains and the other tunnel for westbound trains. McIntosh Bros., Milwaukee, Wis., have the contract for this portion of the work.

Surveyors of the Chicago, Milwaukee & St. Paul, who are running lines for the proposed extension of the line from Hutchinson through Litchfield, Minn., are now in the western part of Stearns County, in the vicinity of Paynesville. It is believed that the survey will be made to Warroad and from there to Winnipeg, Man. W. B. Swartout has charge of the surveys.

According to advices from Sparta, Minn., the recently organized railroad company to construct a railroad from Ontaria to Wilton, in Monroe County, has been incorporated and has preliminary work well under way. Financial support has been obtained and A. E. Rau, Engineer in Charge, is at work on the surveys.

Engineers of the Winnipeg, Sioux Falls & Southern Ry., have gone over the route of the Brookings & Sioux Falls Ry. to a point a short distance west of Pipestone, Minn., preparatory to making a report looking toward the purchase of the right of way. The proposed road is a north and south trunk line and the survey is practically complete between Fargo and Sioux City. It will pass through Watertown, Brookings and Egan, S. D., going directly south from the latter place to Sioux Falls and Sioux City. From Kansas City the line, it is said, will be built through to the gulf.

Duluth and the Ranges.

BY PETER E. MEAGHER.

G. A. Jones and F. R. Jones of Jones Brothers, Railroad Contractors, spent a couple of days with us here recently. They were up looking at their work at the Crosby mine, and are well pleased with the progress they are making. Their contracts in the east are in very good shape.

P. G. Pastoret, of the Pastoret-Lawrence Company, was a caller here this week. They have four or five large sewer contracts under way at the present time, are using machines on all of them, and are rushing them to completion as fast as possible.

Andrew Perrin of Carl Hall & Company, was a visitor recently. They are in the market for some new work.

George Slater, representing the Illinois Steel Company, spent a couple of days with us here recently.

C. J. A. Morris, of Morris & Shepard, General Contractors, came in from his work in North Dakota and spent a day here looking over his large dock contract. He reported everything in very fine condition.

We were agreeably surprised the other day to receive a letter from our old friend John A. Buchanan, better known as "Buck," formerly General Manager of the Pittsburg Tubular Steel Whiffletree Company. In his letter he advised us that this firm had gone out of existence, and has been succeeded by the Standard Whiffletree and Forging Company, Pittsburg, Pa., and that he had been appointed Manager of this concern, that they would continue to manufacture articles got out by the old firm as well as very many new ones. That they would be in shape to deliver goods by the first of July, and would be glad to hear from all old friends, and were very willing to make new ones. This office wishes Mr. Buchanan all kinds of luck in his new venture

Will Phillips, representing the Taylor Iron & Steel Company, Highbridge, New Jersey, spent a few days with us here recently. He reported business in his line very good.

J. T. Morris, representing MacArthur Brothers Company, Chicago, spent a day here last week. He was up here looking over their work. They have two large stripping contracts on the Iron Range, and are working night and day shifts on the same.

Dale & Bumgardner, railroad contractors, are working three shovels on the Soo Line, and two shovels on the Northern Pacific Railway at the present time. They report their work in very satisfactory condition.

At the time of writing this letter there are quite a few rumors in the air as to who were the successful bidders on the extension of the Duluth, Winnipeg & Pacific Railway from Virginia to Duluth. The contract, amounting to eighty-seven miles, was to be let on the twentieth of June. There were nine or ten bidders on this work, but so far no definite statement as to who secured the contract has been announced. There is going to be a lot of good work on this line for sub-contractors, and this office is in a good position to supply subs with work whenever it is definitely settled.

Any contractors interested in the subject of new work, by addressing Peter E. Meagher, 409 West Michigan Street, Duluth, Minn., will receive full information. Will be glad at any time to answer any correspondence relating to business in general in this section of the country.

The labor situation at the Head of the Lakes at the present time is in a very good condition. There is quite a bit of work and also quite a few laborers. The wages have not gone up any, and are the same as they were thirty days ago.

Missouri Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Grading work has been started on the interurban line from St. Joseph to Savannah, contract for which was let some time ago to the J. H. Flick Construction Co., Chicago, Ill. Gordon & Grace, Savannah, Mo., have a sub contract for part of the work. One of the principal features in the line will be a 500 ft. trestle 60 ft. high over Dillon Creek. J. H. Van Brunt, St. Joseph, Mo., is General Manager.

Sampson Bros. have moved their grading outfit from west of the Missouri to a point northwest of Steele, N. Dak., to work on the N. P. extension.

L. J. Smith Construction Co., Bank of Commerce Bldg., Kansas City, Mo., contractors who have been working for the past nine months on the Missouri Pacific main line between Kansas City, Mo., and Pueblo, Colo. and Kansas City and Omaha, Neb., report fine progress and outside of short delays caused by heavy rains work has been pushed rapidly. It is expected that the Kansas Colorado division will be completed by Sept. 1, and that the new rail line improvement will be completed on the Kansas City, Omaha Division in time for the heavy grain traffic this fall.

The Kansas City Terminal Railway Co., J. V. Hanna, Chief Engineer, according to reports from Kansas City, Mo., has purchased 40 acres of ground in West Armourdale for the purpose of constructing a large yard. The location of the property is south of the Kansas City Belt Line tracks, extending to the tracks of the Kansas City Southern Railway, east of Twelfth St. to Mill, eight city blocks, is about 500 ft. wide, and cost $181,170. The yards will be used to handle and transfer freight from the various railroads connected by the Terminal Railway, and will accommodate 2,000 cars and a roundhouse large enough for the twelve locomotives to be used on the system. Adequate freight houses also will be built. The new yard already is connected with the new Union Station by the Kansas City Belt Line Railway. Work will be begun as soon as the details of transferring the various tracts of land has been completed.

The Western Construction Co. of Kansas City, Mo., has submitted a proposition to the citizens of Kingston for the construction of a standard gage steam railroad from that place to Hamilton. The Construction Company proposes to construct on the old Hamilton & Kingston grade, provided the people will subscribe for and take $45,000 in interest bearing first mortgage bonds, nothing to be paid in until the road is in operation. It is further agreed by the company that work on the proposed road will begin the day the amount of the necessary bonds are subscribed for.

At a hearing at Kansas City to consider the application of the Inter-City Viaduct Freight Ry. for a 30-year franchise to lay switches in parts of the alleys east from Bluff to Central, north to 5th and south to 8th Sts., at Kansas City, J. A. Reinhart, Kansas City, President of the road, stated that all surveys, both on the Missouri and Kansas sides, had been completed, and that money and men were waiting to lay tracks to the Missouri Pacific, Chicago Great Western, Orient, Union Pacific, Rock Island and the terminals of other railway systems on the Kansas side of the Kaw as soon as authorized by the city.

Surveys have been made for a 5-mile electric railway from Columbia, Mo., to the coal fields near that city. The capital for construction has not been secured as yet nor has a company been organized to operate the road. M. M. Stephens, East St. Louis, Ill., is the promoter.

The St. Louis, St. Charles & Northern Traction Co., which projects a 65-mile line from St. Charles through Troy, Laddonia and Middletown, has made a survey and has partly secured the capital for construction. We are advised that construction contracts will be let this year. R. E. Race, Mexico, Mo., is vice president and general manager.

Montana Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Officials of the Montana, Idaho & Pacific Ry., a Harriman line, have filed in Boise with the Secretary of State, plats showing the route of the proposed route, which will be 350 miles in length and which is estimated to cost $16,000,000. As proposed the line will be from Lewiston to Butte, Mont., across the Bitter Root via Lolo Pass. The last action of the officials seems to indicate that construction work will soon be started.

H. H. Nelson, a Great Falls, Mont., railroad contractor, will probably take a sub-contract from A. Guthrie & Co., for building the Sun River line. The offices of the latter company are at St. Paul, Minn.

Grading has been commenced by J. M. Scott on the Hagerman Valley Ry. The line will be 10 miles in length and is being promoted and financed by Idaho capitalists and will furnish facilities for marketing the crops, which were heretofore transported overland. The installation of the large power plant at Lower Salmon Falls has made this project feasible. It is expected that the grade will be completed to a connection with the Rupert-Bliss cutoff of the Oregon Short line within 90 days. The road will probably be electric although the track will be broad gage in order that steam cars may be used if advisable.

The Gilmore & Pittsburg surveyors, who, as noted in our last issue, were nearly to Dillon, Mont., have reached that city and are preparing to retrace their steps and resurvey the route. According to the present survey, the line will enter Dillon just back of the Normal College grounds in the south suburbs of the city and follow California St. north to the plot of ground recently purchased by the company for terminals.

Surveying crew has completed surveys for the Northern Pacific Railway's Glendive-Helena cutoff from Helena, Mont., to a point on the Smith River beyond White Sulphur Springs. Three lineswere surveyed across the Missouri, a low line, a high line and an intermediate line. Soundings for a bridge site, however, were made at only one crossing, that about a mile down the river from the Canyon Ferry wagon bridge. These three routes all begin at the mouth of White's gulch. The low line proceeds by a fairly direct route to Canyon Ferry. If adopted, it means that the road will drop down, and then recover the elevation on this side of the river. The high line from White's gulch follows the river down to a point near the Trout creek wagon bridge, crosses the river there, and then rewinds back toward Helena on the crest of the hills. It is a little longer than the other two routes and more expensive to build, but a better grade is secured. The middle or intermediate line will give a better grade than the low line, but not so good a grade as the high line. It was for this line that the bridge soundings were made.

Surveys for the Anaconda-Big Hole R. R. are progressing rapidly. The survey party has 16 men in the field and have completed the survey from Anaconda to Ralston, where they are now camped. The line is to terminate at Wisdom.

Nebraska Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Surveys have been made for a projected interurban line between Spencer, Neb., and Valentine, and efforts are now being made to have the line extended to Sioux City, Ia. This is the project promoted by E. W. Cornell, of Valentine, Neb. It is proposed to secure the power by the development of water rights at Valentine.

In connection with its proposed new $800,000 freight station at Omaha, Neb., the Chicago, Burlington & Quincy R. R., proposes to change the contour of 8th street from Farnam to Howard street by cutting the east two-thirds of it to a lower level of 23 ft. and of b[illegible] wall.

The construction of an interurban road from Madison to Elgin, Neb., is under consideration. W. L. Dowling, Madison, Neb., is interested.

Surveys for the Nebraska & Dakota R. R. have been completed from Burwell, in Garfield County, through Loup County and north through Rock and Keya Paha Counties into South Dakota to Murdo. The company was recently incorporated with a capital stock of $4,500,000 and headquarters at Pierre, S. Dak. Construction work is to be started, it is said, about the middle of August.

Nevada Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Tonopah & Goldfield R. R. has approved the surveys of R. C. Cattermole, Chief Engineer, Tonopah, Nev., for the Mono Route R. R. and it is announced that construction work on the road which is to extend from Mino to Mono Lake will be started this month. The road will be 75 miles long, and is expected to be completed in about nine months. It will connect with the Bodie and Benton timber road at Warm Springs, on the Western side of Mono Lake in California. Charles E. Knox is president of the Mono Route Co., which is a subsidiary corporation of the Tonopah & Goldfield R. R. A great deal of heavy rock work will be encountered in building the road.

New York Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Town Board of Cairo has granted the franchise for the Catskill Traction Co., of Catskill, to extend its line from Leeds to Cairo. The extension will be constructed with as little delay as possible.

The New York Central is considering the construction of a large number of improvements. The chief features of the move include extending the third and fourth tracks on the West Shore and Lake Shore lines, enlarging the yards at Buffalo, Rochester and other points, improving the block signals, constructing new roundhouses and shops and building a new station at Rochester, N. Y.

It is reported in Buffalo, N. Y., that the Buffalo, Rochester & Pittsburg R. R. officials have asked for bids for the construction of an extension of their lines from Iselin in Indiana County to Clairton, Allegheny County, where it will make connections with the West Side Belt Line of the Wabash system. E. F. Robinson, Rochester, N. Y., is Chief Engineer.

The New York, New Haven & Hartford has it is said, applied to the Massachusetts Railroad Commission for permission to construct an extension from a point near its terminus at Southbridge at Palmer, where it will connect with the London & Northern. The projected line will be about 19 miles long and is estimated to cost about $2,810,000. B. T. Wheeler, Boston, Mass., is Engineer of Construction.

The Union Ry. Co., 204 E. 128th St., New York City, has applied to the Public Service Commission for a franchise permitting the extension of its tracks from Sedwick Avenue and Fordham road through 184th St. over University Heights Bridge and thence through West 207th St. and Amsterdam Ave. to a junction with the tracks at Emerson St. and Broadway, New York City.

The State Public Service Commission gave a hearing at Albany on June 30, on the application of the Hudson Valley Railway Co., Glens Falls, N. Y., for permission to construct an extension of its lines at Saratoga Springs. The village has granted a franchise for the proposed extension. The extension will connect the Glens Falls division with the Waterford division, making a continuous line of railroad from Glens Falls on the north to Saratoga Springs and southerly to Ballston Spa, Mechanicsville, Waterford and Troy.

A tentative agreement has been reached between the city of New York and the Long Island R. R., J. R. Savage, Chief Engineer, Jamaica, N. J., concerning the six tracking on grade crossings on the main lines between Long Island City and Jamaica. Under the proposed agreement the railroad will straighten out the route between Woodside and Winfield [illegible] ish all bridges now in co[illegible] structure over or under the re[illegible] toward the cost of the entire grade crossing elimination.

The New York Central & Hudson River R. R. is planning to construct an extension of the Kellogg branch. The extension will include 1½ miles of track and will run from the Kel-[illegible] line will necessitate the building of 1,200 ft of trestle and will have an average grade of 3 per cent. It is expected that work will be started shortly and will occupy three or four months.

Ohio Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Promotion work is well under way for the Sharon, New Wilmington & New Castle street car line, and it is reported that over $100,000 of stock subscriptions have already been secured. It is expected that construction work will be started this year.

The Toledo & Ohio Central Ry., J. A. Stocker, Chief Engineer, Toledo, O., according to unofficial reports, is considering plans involving the expenditure of more than $2,000,-[illegible] ent docks at Toledo. An important feature of the new work planned is that it will provide the Big Four R. R. Co. with its own terminals in Toledo and with a new freight house. The proposed improvement is largely the result, it is said, of the purchase of the Toledo & Ohio Central by the Lake Shore.

The General Traction Development Co. of Cleveland, O., has begun preliminary work on a traction system of 107 miles radiating from Mt. Gilead, O., and connecting Mansfield, Mt Vernon, Delaware, Marion, Galion and intervening towns. This company, which will have charge of the construction of this new interurban road, is financing, developing and constructing a hydro-electric project at Eugenia Falls, Owen Sound, Canada.

The Western Ohio Railway Co. has leased its line to the Western Ohio R. R. Co., a recent incorporation, with a capital of $1,000,000. Certificates of deposit of the former company will be exchanged for certificates of the new company. This refinancing virtually means the absorption of the old company and the Fostoria-Fremont link in the system provided for in a bond issue of $500,000 already subscribed. The system will extend from Fremont to Piqua, with a branch to Celina. F. D. Carpenter, Lima, O., is General Manager.

The Hocking Valley Ry. is said to be planning to build a cutoff from Logan to Orland, twelve miles, shortening the present mileage and avoiding heavy grades at Summit and New Plymouth. It is also said that a line will be built from Dundas, the first station south of here, to Huntington, W. Va. McArthur, O., will give a direct route from the West Virginia coal field to the lake. The road from Dundas to Huntington will be by way of Wellston, Jackson and Oak Hill.

Oklahoma Notes.

[illegible]

Work has been started on the construction of an electric railway from Enid to North Enid. The line will be 4 miles long and will be owned by J. M. Spaulding, North Enid. W. H. Bryant, Enid, has the contract.

Surveys are under way for a proposed interurban line to Hobart. G. Van Brunt, Houston, Tex., is interested.

[illegible] Oklahoma Union Traction Co., Tulsa, [illegible]ne work started on its interurban line to connect Sapulpa and Tulsa. The work will require the construction of a bridge over the Arkansas River.

The Enid, Ochiltree & Western R. R., which has about 40 miles of line completed in Texas, is stated to have received the necessary capital for at once commencing work on the Oklahoma end of the line. F. W. Tallmadge, Enid, Okla., is General Manager.

Oscar Ayers, president of the Arbuckle & Western R R., has notified business men of Lawton that bonds for the road have been sold and the road will be built from Ardmore to Lawton at once.

A special election has been held at Lawton, Okla., to vote on granting the Chicago, Rock Island & Pacific Ry. 15 ft. of additional right of way in order to make it possible for the company to reach any of the small industries and to increase its present trackage facilities. The work planned by the company will cost, it is said, about $50,000.

It is said that P. A. Hines, representing Chicago capitalists, has taken the matter up with Capt. George Silsby, Oklahoma City, Okla., of constructing the projected line of the International & Great Southern. Surveys for a great deal of the line have been completed. It is understood that the first division is planned to run from Oklahoma City to Trinidad, Colo.

The Clinton, Oklahoma & Western R. R., recently completed from Clinton to Butler, is planning the extension of the line through Korn, Colony, to either Anadarko, Okla., or Chickasha. Farmers along the right of way express their willingness to subscribe a bonus for the work. The road is also being promoted northwest from Butler, to intersect with the Mountain, Valley & Plains at Arnett, thence but a few miles to the Santa Fe at either Goodwin or Shattuck.

Advices from Albuquerque, N. Mex., state that the contract for the first 220 miles of the Denver, Kingfisher & Gulf R. R., from Oklahoma City to Guymon, Okla., has been let to the Northwest Motor Co., who in turn has sublet part of the work to M. Cassidy, Oklahoma City. As projected the route is from Oklahoma City via Kingfisher, Piedmont, Okeene, Seilling and Shattuck to Guymon. Other contracts are being considered which will likely land the road at Des Moines, New Mexico, within a few months.

Oregon Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

According to a report from Crescent, Ore., Douglas Kyle, Engineer of the Oregon Trunk Line, has been ordered to alter the survey on that road to Klamath Falls, and work on the former survey has been stopped.

Bids were received June 15 by John F. Stevens, Portland, Ore., President of the Oregon Trunk Line, for the construction of the new Hillsboro, Tillamook, Ore., railroad, which is 60 miles in length. The award of contracts will be delayed some time, it is thought. The work will cost, it is estimated, about $4,000,000. Surveys have been completed and right of way obtained. The line will include no less than 17 tunnels, one being 6,000 ft. in length.

Contractors working on the Natron Extension of the Southern Pacific, according to advices from Eugene, Ore., are preparing to push the work with all possible speed this summer. More equipment and laborers are being rushed to the scene and it is expected to have the 35 miles of line at that end completed by December. The work on the tunnels is progressing very rapidly. The usual cut on each of them is about six feet a day. On tunnel No. 3, which is the longest, the cutters have entered the mountains 938 feet, which is over half the distance. Machinery and supplies are now being hauled over the mountain to set up a compress and power plant so that men can bore from the other side, and be working both ways. The crew will commence laying the 90-lb. steel about July 15, and continue through the winter

Right of way has been cleared and grading started for the construction of a logging railway from the terminus of the Oregon & Southeastern Ry., to the forest reserve, a distance of 2½ miles. The road, which is really but an extension of the above railroad, will be rushed to rapid completion. The Fir Lumber Co., of Eugene, Ore., will use the road for logging operations.

Pennsylvania Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Baltimore & Pennsylvania R. R. Co., which projects an electric railway from Reisterstown, is soon to issue about $600,000 of first mortgage, 30-year, 5 per cent bonds for the construction of the road. The Maryland Construction & Developing Co., Baltimore, Md., as previously noted, has the contract for constructing the line. As projected the line is to be built along the Reisterstown and Hanover Turnpike, its southern terminal to be Reisterstown and it will connect with the United Railways Emery Grove line, while its northern terminal will be in Pennsylvania, connecting with the Hanover and York systems at their intersection above Melrose.

The city councils of Norristown have granted a franchise to the Philadelphia & Western Railway Co., of Philadelphia, to build an electric railway through the city, thus completing the preliminary work for connnection with the Lehigh Valley transit system.

The Ephrata & Lebanon Street Ry. Co., which proposes a line from Lebanon to Ephrata, has begun an active campaign for stock subscriptions. If the amount needed, $425,000, is raised or guaranteed in the next 60 days, the building operations will start before the present summer is ended. Geo. D. Krause, of Lebanon, is president of the company.

The Lake Shore & Michigan Southern Ry. is to straighten out its tracks between Raymilton and Polk in Venango County, eliminating a number of curves. The reason for constructing one of these reverse curves, according to ancient history, was as follows: It is said that at the time the road was being built, some 40 years ago, the engineers laid out the line near a house where the men were taking their meals. The owner of the boarding house, seeing the stakes, notified the engineers that if the line were laid there they would have to seek another boarding place. As the nearest settlement was about five miles away and the engineers had no desire to forego the splendid meals there, they ran the line to pass some rods from the house. To accomplish this the reverse curve was necessary.

The Midland Pennsylvania R. R. Co., which proposes the construction of the proposed railway from Millersburg, Pa., to Ashland, Pa., has acquired right of way and large freight yards at Millersburg and station sites along the line. Connection will be made with the Northern Central R. R. at Millersburg and with the Lehigh Valley and Reading at Ashland, Pa. The route as proposed will pass through Gordon, Hegins, Taylorsville, Mabel, Weishample, Valley View, Sacramento, Springville, Gratz, Berrysburg and Killinger, a distance of forty-four miles. The maximum grade will be 2 per cent. Adjacent and contributory to the road will be the towns of Georgetown, Hickory Corners, Paxton, Elizabethville, Short Mountain, Pillow, Urben, Hete, Klingerstown, Rebucke, Greenbrier, Lickkill, Rough and Ready, Hepler, Pitman, Good Spring, Fountain, Laville, Mt. Pleasant and the State Hospital. The road will be financed by the sale of $2,000,000 first mortgage 50-year 5 per cent, sinking fund gold bonds, which are to be taken over by a syndicate of Philadelphia bankers, with a bonus of $800,000 common stock, out of $2,000,000 stock authorized. This will place $1,500,000 in the treasury with which immediate construction can be commenced. Among those largely intersted in the project are Finley Acker, Dimner Beeber, W. E. Harrington, Samuel F. Houston of Philadelphia; C. Henry Stinson, president of the First National Bank of Norristown; L. K. Griffith, general manager of the Railway Steel Spring Company, Latrobe, Pa.; and G. Genge Browning, a director of the Camden and Suburban Railway, Camden, N. J.

The Pittsburg, Shawmut & Northern R. R., is said to be negotiating with the Wabash-Pittsburg Terminal Ry. to secure an entrance to Pittsburg over the tracks of the latter company. If the Pittsburg, Shawmut & Northern succeeds in getting rights over the Wabash tracks it intends to take two partially completed belt lines in Pittsburg district. The Fairmount & Pittsburg R. R., a new line which has begun construction work 20 miles south of Pittsburg, is also said to be negotiating for an entrance to Pittsburg over the Wabash-Pittsburg Terminal line. The plans of the Fairmonunt & Pittsburg involve the electrification of the Wabash terminal for four miles out of the city at a cost of $4,000,000.

The Wilmington & Philadelphia Traction Co., has been incorporated under the laws of Delaware with a capital stock of $6,500,000, and will lease present lines and construct new ones.

South Carolina Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Southern States Lumber Co., Dunbarton, S. C., has been asking bids for building 15 miles of logging railroad, including the grading, bridge building and building same. Bids were also asked for excavating a log pond and building a dam for same.

Tennessee Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Lewisburg & Northern R. R. Co., of Marshall County, Tenn., has been chartered with a capital stock of $100,000, the incorporators being R. C. Armstrong, C. C. Houston, J. A. Hardison and Alex Austin. The road is to start at a point on the Tennessee and Alabama line, eight miles east of Veto, in Giles county, and extend via Lewisburg and Comersville to Portland, Sumner county, running in a northeasterly direction.

Texas Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The citizens of Austin have voted to grant C. V. Birkhead of San Antonio and his associates a franchise for a new street car line to extend into South Austin and over certain streets of Austin.

We are advised that the Fort Worth Mineral Wells & Western R. R. Co. will let contracts in about 60 days for the construction of its projected line between Fort Worth and Mineral Wells. Paul Hurley, Fort Worth, Tex., is Secretary of the company.

The Stamford & Eastern Ry. Co. of Stamford, Tex., has been organized and will at once begin the construction of a line from that city to the coal fields 60 or 70 miles east. The stock has been subscribed and surveys are already under way. The officers of the corporation are: W. T. Andrews, president; R. V. Colbert, Frank S. Hastings, P. P. Berthelot, R. L. Penick, J. C. Bryant, B. E. Sparks, L. M. Buie, J. A. White, Charles Brewington and T. M. Richardson, directors, all of Stamford, Texas.

It is reported that bids have been received by the Kansas City, Mexico & Orient R. R. for grading 25 miles of main line east of Fort Stockton. C. H. Webster, Sweetwater, Tex., is Chief Engineer of the company.

The Taylor, Somerville & Gulf R. R., which projects a 60-mile line, has completed preliminary surveys and has secured about $100,000 for construction purposes. No date has been set for awarding construction contracts. F. F. Fielder, Houston, Tex., is President.

Col. I. D. Polk, of Beaumont, has applied to the Commissioners of Jefferson County for a 50-year franchise for the Beaumont-Port Arthur Electric Interurban Ry. to cross over and upon the county roads. Arrangements are said to have practically been made for the private right of way for the line and the franchise is sought merely to give the right to the company to cross with the line over and upon certain of the county roads designated in the application.

Preliminary reports are to be made by the surveyors now in the field running lines for the construction of the Quanah, Acme & Pacific R. R. southwest toward El Paso and Roswell, N. Mex. Samuel Lazarus, St. Louis, Mo., is President of the railroad company.

Contracts will be let at once, it is reported, for the grading of the Brownwood Southwestern line. All difficulties concerning right of way and town sites have been surmounted and it is expected to have the road in operation in time to handle the Fall crops this year. Headquarters of the company are at Brownwood, Texas.

Survey has been completed by R. Y. Walker Chief Engineer of the Quanah, Seymour & Gulf, for the line between Quanah and the Pease River and work will now be started running lines for the road between Thalia and Seymour, Tex. Temporary office will be opened at the latter city. The citizens of Crowell, Tex., have offered substantial inducements to secure the line instead of Medicine Mount or Bradley's Spur.

Profiles of the survey for the Santa Fe between Eden and Eldorado have been prepared. A very satisfactory route between these two points is said to have been located by H. L. Erisman, of Galveston, locating engineer for the road.

Location surveys are to be started at Dalhart, Texas, under supervision of J. H. Colen, Chief Engineer of the Mountain, Valley & Plains Ry., for the road between Dalhart and Springer, N. Mex. Financial arrangements have been made for the construction of the entire line from Springer, N. Mex., to Guthrie, Okla., via Dalhart, Tex., and work will be pushed energetically until completed.

The Southern Pacific Ry. is preparing to construct a new passenger station and enlarge its terminal facilities in San Antonio in order to accommodate the prospective increase of traffic that will come from the Frisco connection.

Bids will be received at the office of the U. S. Reclamation Service, Room 15, Chamber of Commerce Building, El Paso, Tex., until 2 p. m., Aug. 8, for constructing the road bed, bridges and culverts for a branch railway from the A., T. & S. Ry., at a point between Engle, N. Mex., and Cutter, N. Mex., to the Engle dam site, near Elephant Butte, N. Mex., a distance of about 10 miles. The work involves the excavation of about 14,000 yds. of earth, 56,000 yds. of rock, and the placing of approximately 400,000 ft. B. M. of timber.

The city council of Sweetwater is considering granting a franchise to C. W. McClain of Sweetwater, for installing a street car system. If the franchise is granted the road will be in operation within 12 months.

Announcement has been made at Austin by R. H. Baker, of Waco, the new president of the Texas Central R. R., that that line will continue to be operated as an independent property. Plans for extending the line in two directions are now under consideration, and if the proper arrangements can be made 400 or 500 miles of new track will be added to it. The proposed extension that is to run from Waco southeast has Beaumont for its objective point. This extension will penetrate the timber belt of East Texas, its projected route lying through a virgin forest country that has a big available tonnage. The Beaumont & Great Northern, which runs between Trinity and Knox, is to become a part of the Texas Central and will be utilized as a link in the Beaumont extension of the latter line. The Northwestern extension of the Texas Central will traverse the Panhandle region and Eastern New Mexico, having Roswell for its proposed terminus. A gradual extension of the line into the Panhandle has been going on for the last two or three years. H. S. McCall, Waco, Tex., is Resident Engineer.

The citizens of Alice have given the Frisco a cash bonus of $20,000 free right of way through the county and depot grounds in order to secure the building of a line from Kingswell, 30 miles distant.

The Gulf, Texas & Western Ry., Ben. B. Cain, General Manager, Dallas, Tex., is said to have made tentative arrangements for financing two extensions, with the idea of having construction work started this fall. The State Railroad Commission has been advised that the company is considering the matter of extending its line east from Jacksboro to Dallas, a distance of about 1,000 miles. It has also taken preliminary steps to build west from Seymour to Amarilla, about 250 miles. The Gulf, Texas & Western is a new road, that was recently finished between Jacksboro and Seymour, 75 miles. The road is owned by a syndicate of Pennsylvania men who are largely interested in the coal-mining industry. The route from Seymour to Amarillo will be through a territory being rapidly settled by farmers. It will run to the south of and parallel with the Fort Worth and Denver City Division of the Colorado and Southern.

An interesting experiment is being carried out on the branch line of the St. Louis & San Francisco R. R., from Brady to Menardsville, 36 miles. In order to complete the work at the earliest possible date the contractors are working their grading forces at night. It is claimed that the night shift works more rapidly than the day forces, and that the experiment is proving a big success. Tracklaying is in progress out of Brady. It is reported that as soon as this branch line is finished the contract will be let for the construction of the Fort Worth and Rio Grande division, south from Brady to a connection with the San Antonio and Aransas Pass at a point about 50 miles above San Antonio. F. G. Jonah, St. Louis, Mo., is Chief Engineer of Construction, St. Louis & San Francisco Ry.

The Railroad Committee of Lubbock has signed a contract with the Crosbyton-South Plains R. R. for building a road from Lubbock to Crosbyton, 35 miles. Prentiss L. Coonley, 39th St. and Stewart Ave., Chicago, Ill., is President.

Utah Notes.

FROM CORRESPONDENTS AND OTHER SOURCES

The Colorado-Utah Mines & Oil Co. has engineers in the field making a reconnaissance with a view to building a railroad from Marysville to Loa, the county seat of Wayne. The company also plans to develop the mineral resources in Wayne County. The general operating headquarters will be at Loa, and an office has also been opened in Salt Lake City. A. C. Burton, Denver, Colo., is President and George C. Weber, Denver, is Secretary. J. F. Chidester, Richfield, Utah, is a director.

The construction crews on the Oregon Short Line are rushing track laying to Pingree, Utah, and expect to complete the work in a short time. Surveying parties are outfitting at the several headquarters for various parts of the country, and as soon as present track-laying is finished the company has an immense amount of work planned for future extensions.

Right of way is being cleared through the city of Cheyenne, Wyo., for the construction of the connecting link between the Chicago, Burlington & Quincy and the Colorado & Southern Ry., a distance of one-half mile. The latter company has settled all condemnation suits and expects to have the stretch of track completed within a short time.

The Arizona & Eastern Ry. has filed right of way maps in the land office at Phoenix, Ariz., indicating the construction of two new roads. One, the Buckeye Road, was mapped out as far as Arlington, striking the Hassayampa three miles north of that city. The other map was for the construction of the line from Benson to Winkleman, a project absolutely new in railroad circles.

Directors of the Virginia & Truckee Ry. are now considering the construction of a railroad south from the main line. Plans and estimates are now being made by W. H. Kirk, Carson City, Nev., Chief Engineer, and the Board will decide the matter at the next meeting.

Virginia Notes.

FROM [illegible]

The Washington-Virginia Ry. Co. has been chartered and proposes to operate an electric line from Vienna, Fairfax county, near Alexandria, to Bluemont, in Loudoun county, a distance of 50 miles. The maximum capital stock is placed at $1,000,000. The officers are M. E. Church, president; G. B. Fadeley, vice-president; F. E. Parker, secretary; L. L. Northrop, treasurer—all of Falls Church, Va.

At a meeting of the stockholders recently held it was decided to proceed with the location of the Floyd & Benton Mountain Ry. It is stated that New York and Richmond capitalists are ready with the money to finance the road when the promoters are ready to begin work. It is necessary for construction work to actually begin by September 1, or the company will loose about $50,000 of cash sub[illegible] county.

The Norfolk & Portsmouth Belt Line R. R., George S. Shafer, Superintendent, Port Nor[illegible] ley ward to Pine Beach.

The Virginia Ry., Raymond Du Puy, General Manager, Norfolk, Va., has surveys under way for a railroad to run through Buchanan county, tapping fields and forests. The line [illegible] down Louisa Fork of the Big Sandy river, passing Grundy, 12 miles below the mouth of Gordon creek.

W. O. Lipscomb, 1209 Jefferson St., Roanoke, Va., as noted in our last issue, has the contract for grading work for the Campbell Creek Ry. Co. The work is located near Charleston, W. Va., and requires about 30,000 cu. yds. of earth excavation. Raubich & Lipscomb, Putney, W. Va., have the sub-contract for the work.

A committee of citizens of Prince George and Surrey Counties have asked the Virginia Railway & Power Co., Richmond, to take steps for the construction of a trolley line between Petersburg and Norfolk, to form a connecting link between the Virginia Railway & Power Co. line and the Norfolk system.

It is rumored that the Baltimore & Ohio Ry and the Baltimore & Ohio Southwestern Ry. have been consolidated and that the general offices of the initial lines will be moved to Baltimore, Md. It is planned to operate the B. & S. S. W., as the southwestern division of the Baltimore & Ohio, it is said, and to improve the line as noted in our last issue.

A proposition is on foot to construct a railroad between Jackson and Dyersburg, Tenn. R. M. Hall, of the latter city, is promoting the project and asks that the citizens of the county contribute a bonus of $75,000 for the work.

Rights-of-way have been secured and maps have been filed in the county clerk's office at Fayetkesville, W. Va., of the branch line the Chesapeake & Ohio will build to the Gauley River branch. The new line will be known as the Meadow Creek extension of the Gauley River branch, and will open up valuable timber and mineral lands in Fayette, Nicholas and Greenbriar counties. The route will begin at the mouth of Twenty-Mile Creek, on Gauley, extending up Meadow River to Rupert, a distance of 61 miles. H. Pierce, Richmond, Va., is Engineer of Construction, Chesapeake & Ohio Ry.

Washington Notes.

[illegible]

Farmers in the Western part of Whatcom county are considering building a co-operative interurban line between the towns of Ferndale and Blanit. F. S. Whitney, Ferndale, is to make a survey and estimate of cost. It is planned to secure the right of way and build roadbed in the belief that such an inducement will attract some corporation to the field that will be able to equip and operate electric line in connection with the road into Bellingham.

The Bellingham Eastern Logging & Ry. Co. has secured practically all of the right of way for the construction of 9 miles of road to connect with the Northern Pacific near Wickersham. T. W. Waters, Bellingham, Wash., is attorney for the road.

City Council of Anacortes, Wash., has granted the Frazer & Skagit Ry. Co. a franchise to construct a steam road from Skagit River to Anacortes, a distance of 16 miles. According to the terms of th[illegible] tween the city council and th[illegible] of the company, work must be started within 18 months and completed within two years

[illegible] the Northern Pacific Ry. cutoff from Ellensburg to Ritzville in the Columbia River Valley, Washington. Engineers are now taking soundings to locate bed rock for placing the piers of the proposed bridge across the Columbia, permission for which congress recently granted. It is hoped to have the piers above the high water mark by May, 1911.

Contractors in charge of the grading, bridge, trestle, culvert and other masonry work on the double tracking of the Northern Pacific between Tenino and Kalama, Wash., are planning on completing the work about November 1, two months earlier than at first anticipated. This 65-mile link will complete the double-tracking for the entire 185 miles between Tacoma and Seattle, and it is planned to have the steel strung along the stretch of roadbed so that a record for track-laying can be made. It is estimated that the 65 miles of track can, under fair conditions, be laid within 30 days from the time the first spike is driven. The aggregate cost for converting the Northern Pacific into a double-track system between Portland and Seattle will not fall far short of $7,000,000. The Tenino-Kalama work is the last of the connecting links that have been built within the last few years.

The Chicago, Milwaukee & Puget Sound Ry. is now considering the extension of the Enumclaw Line through to a connection with the Tacoma Eastern at Kapowsin, Wash., along the old survey made by the latter road several years ago. Such a line will give the Milwaukee practically a through route from Grays Harbor to the Main line.

The Aberdeen Construction Co., Aberdeen, has been awarded the contract for two additional miles of clearing and grading on the Willapa branch of the Union Pacific. The Aberdeen Construction Co., already had 6½ miles of work on this branch.

Wisconsin Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Advices from Janesville quote President Zigler of the Cincinnati Construction Co. as stating the construction work on the proposed interurban line from Janesville to Madison will be started this month.

The Minneapolis, St. Paul & Sault Ste. Marie Ry. has purchased 50 acres of land near New Richmond and it is reported that this land will be used for storage tracks to relieve the congestion of the company's Twin City terminals.

The Twin City & Lake Superior Ry. Co., Minneapolis, Minn., has been making surveys through Douglass county for an electric line from Minneapolis and St. Paul to the Twin Ports.

It is very probable that the Minneapolis, St. Paul & Sault Ste. Marie Ry. will be unable to begin work this year on its ore dock line through the 9th ward in Superior, Wis. The hearing before the State Railroad Commission was completed the latter part of June but it will probably be the middle of September before a transcript of the evidence taken here can placed in the hands of the State Railroad Commission.

Canadian Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The British Columbia Electric Ry. Co., Vancouver, B. C., has two parties in the field running lines for the projected railway from Victoria through the adjacent peninsula. Three routes are to be surveyed; one along the east coast of the peninsula, one along the center and one along the west coast.

The Toronto, Hamilton & Buffalo Ry., R. L. Latham, Chief Engineer, Hamilton, Ont., will ask permission of the Dominion Railway Commission to construct three tracks in the southeastern part of Hamilton. The city recently refused to consent to this.

James McDonald has commenced work at Stewart, B. C., on a large wharf for the Mackenzie & Mann interests. The contract for the grading work for the 15-mile railroad from the town through the mining camp has been let to Sol Cameron, who has also started work.

The Toronto, Niagara & Western Ry. Co., of which D. D. Mann, Toronto, Ont., is President, has filed a plan of a proposed change in route between Burlington and Hamilton and has asked the Dominion Railway Commission to sanction it. The new route will carry the line along the north shore of the bay, skirting the water, instead of on the high land, and the proposal is to cross the western end of the bay on trestles, to tunnel under the Grand Trunk at Desjardins bridge in Hamilton, and to parallel the C. P. R. line to the Hamilton city limits.

The promoters of the Halifax & Eastern Ry. recently chartered, have secured a $6,400 per mile bonus from the Province of Nova Scotia and a like bonus from the Canadian Government. The line as projected will extend from Dartmouth to Guysboro' with Country Harbor and Sunny Brae branches. J. B. Bartram of Toronto, Thomas B. Fogg of Toledo, and Segmund Hirch of Toledo, named as the incorporators of the Halifax & Eastern Railway Co., have been in Halifax conducting the negotiations on behalf of the initial interests in London which they represent, with the Provincial Government.

Active work is well under way on the construction of the extension of the Gypsumville, Man., extension of the Canadian Northern Ry. Oak Point branch, and it is expected to have the line in operation by next winter.

It is reported that the Toronto, Niagara & Western Ry. Co. is considering filing an application with the Ontario Ry. Board for permission to construct a line from Burlington to Hamilton, Ont.

The Ottawa, Rideau Valley & Brockville Ry. Co., chartered at the last session of the Canadian Parliament, is to have surveys completed so that construction work can be started this fall. The line will run from Ottawa to Brockville, branching off from the G. T. R. at Graham's Bay and passing through Manotick, North Gower, Burritt's Rapids, Merrickville, North Augusta and Algonquin to Brockville. The road will be extended from Ottawa by way of the interprovincial bridge to the iron mines at Ironsides and a company is to be formed to operate the mines. The directors of the company are: William C. MacLaren and James H. Gilmour of Brockville, ex-Warden Heney, E. W. Clarke, Donald Hector MacLean and G. H. Kidd, K. C., of Ottawa; Alfred McDermott and R. E. Elliott of Montreal.

Advices from Ottawa state that although the work of the arbitrators appointed to adjudicate upon the disputed classification of material on the National Transcontinental Railway is not yet completed, the preliminary report of Messrs. Schreiber, Kelliher and Grant, the engineers, shows that the total amount of over-classification allowed on sections "F" and "E" is comparatively very small. On contracts aggregating about $15,000,000 on section "F" the total amount of over-classification found by the arbitrators after thorough examination is only about $200,000. On section "E" the over-classification amounts to less than $25,000. The Government is amply protected against any loss from over-payments made to the contractors, the percentage of payment held back on the progress estimates being several times larger than the total amount now in dispute.

James McRae, Gladstone, has been awarded the contract for 12 miles of grading for the Oakland branch of the Canadian Northern R. R. The grade is now finished some little distance beyond Totogan, on the west side of Lake Manitoba, north of Westbourne. It will eventually be extended to link up with the spur from Ochre River on the main line to Rose du Lac.

Mexican Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Reports from the City of Mexico indicate that the National Railways of Mexico will soon acquire the Pan-American, which recently came under the control of D. E. Thompson. It is also said that the Tehuantepec National and other roads will soon be acquired, so as to make a complete governmental system, leaving out only the Mexican Railway and the lines controlled by the Southern Pacific.

The Mexican Ry. has decided to make improvements during the next two years which will involve the expenditure of $2,000,000. Definite plans for these improvements have not been worked out but it is safe to say that they will include grade reduction along certain portions of the main line, extension of branches recently purchased by the company, and the installation of steam traction on the Tlascala branch. It is also proposed to construct a new bridge across the Metlac barranca and eliminate the two tunnels through which the road passes. To do this it will be necessary to make a detour, but it will save about six kilometers of way and enable a grade reduction to be made at that point. The bridge will be one of the highest and longest over the line. The Huatusco branch will be extended into the coffee district, with Huatusco as the terminus. The road now only reaches Coscomatepec. The plans also include the establishment of steam traction on the Tlaxacala branch and its extension to San Martin Texmelucan, where connection will be made with the Interoceanic. The improvement on this line, which has been conducted with mule traction, is expected to develop heavy freight traffic, especially pulque, which in the past has been a source of heavy earnings for the Mexican.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

CALIFORNIA.

Levee District No. 2, of Yuba City, Cal., has been granted permission to raise the levee along the river front of the district about 5 feet for a distance of five miles. The improvement will extend from a point on the levee south of Nicholaus north to the mouth of Bear River and a dredger will be used for the work.

COLORADO.

The Ellsworth-Klaner Construction Co., 413 Central Block, Pueblo, Colo., which has the contract for constructing the dams for the Rio Grande reservoir site, will sub-let about 60,000 cu. yds. of earth work, bids for which are to be opened Aug. 1. The dam contract is located 30 miles west of Creede, Colo., in Hinsdale County, and includes 120,000 cu. yds. earth fill, 58,000 cu. yds. of rock fill, 7,000 cu. yds. of riprap and 6,000 lin. ft. of piling. We are also advised that the Ellsworth-Klaner Co. has a contract from the Pueblo Rocky Ford Irrigation Co., for the construction of eight miles of canal to carry 3,000 second feet. The canal will be 7 ft. deep, 32½ wide at the bottom with ¼ to 1 slopes. This work is located 30 miles south of Pueblo.

The Happy Home Reservoir Canal Co., has been incorporated at Montrose with a capital of $500,000. The company will construct reservoirs for the conservation of the waters of the upper Uncompahgre, Dallas and Cow Creeks, and canals for their distribution on lands lying in lower Ouray county and upper Montrose, above the ditches of the tunnel irrigation system.

South Poudre Irrigation Co., has purchased the Portner reservoir, capacity 26,500,000 cu. ft. The reservoir is located southeast of Fort Collins.

FLORIDA.

As previously noted in this paper the contract for constructing 184 miles of canal in the

Everglades of Florida has been awarded to the Furst-Clark Construction Co., of Baltimore, Md., and Galveston, Tex. The contract includes 20,000,000 cu. yds. of excavation of which about 15,000,000 cu. yds. is earth and 5,000,000 cu. yds. is rock. The contract price was 8 cts. per cubic yard for earth excavation and 20 cts. per cubic yard for rock excavation. The work is to be completed within three years and the contractors are to take over the four dredges now being operated by the State at their appraised value. They will also put additional plant on the work so as to complete the contract within the time specified. They now have some large hydraulic dredges they expect to put to work on the muck excavation. Their local office will be at Miami, Fla.

ILLINOIS.

The East Side Levee & Sanitary District, of East St. Louis, can now go ahead with its project for constructing the proposed levee wall on the east side of the Mississippi River and a diversion channel for Cahokia Creek. Contracts for the latter work have already been awarded as noted sometime ago in this paper. A recent discussion of the Circuit Court at Belleville declared that the special act of the Illinois Legislature of 1907, under which the East Side Levee and Sanitary District, embracing portions of St. Clair and Madison counties, was created, was constitutional, and the district legally organized, and that the Board of Trustees, duly elected Sept. 22, 1908, could proceed with the project. The construction of the levee wall and diversion channel of Cahokia Creek will cost something like $6,000,000, and is meant as a protection for the East Side cities, and hundreds of acres of rich bottom lands in St. Clair and Madison counties. The survey and plans for the construction of the levee wall and channel were made by army surveyors and engineers of the United States Government, and have been approved by the government and the State of Illinois.

INDIANA.

Harry N. Pharr, Consulting Engineer, Memphis, Tenn., has started surveys for a large levee project to be built for Posey, Gibson and Pike counties. The improvements will involve the expenditure of $750,000 to $1,000,000. The levee is to commence at New Harmony on the Wabash River in Posey county, Ind., and runs east to Mount Carmel on the Indiana side. From here it goes to Oakland City, Gibson county. In addition to the leveeing of the Wabash many of its tributaries will have to be given this same improvement. The Pattoka River, a very crooked stream, will also have to be straightened out and dredged.

IOWA.

Commissioners of LaGrange County, LaGrange, are to dredge and straighten Fly Creek at a cost of about $20,000.

Engineers of Northwestern, Omaha and Milwaukee Railroads have proposed to the City Council of Sioux City to construct a new conduit from a point between Second and Third on Elm Sts. down Park St. to the river, at a cost of approximately $50,000 to safeguard the city against any future floods of Perry Creek. K. C. Gaynor is City Engineer.

N. C. McGinnis, of Bement, Ill., has moved one of his dredge ditch outfits to a point near Fort Dodge, where the Shaw & McGinnis Co. have a large contract for dredging. [illegible] plete the ditch.

KANSAS.

W. E. [illegible] employed to make surveys and plans for flood [illegible] Kan.

City Engineer McLane of Hutchinson, has completed plans and specifications for flood gates, constructed of concrete and reinforced with steel, with bronze and creosote wood gates, to be built at the junction of Cow Creek and the drainage canal in that city. The concrete work in the head gate will cost $1,700. The plan is to construct a driveway along the top of the gate, as a part of the drive which will be formed along the entire creek dike.

LOUISIANA.

Bids were opened June 27 at the office of Major H. Burgess, U. S. Engineer, New Orleans, La., for levee work in the Lower Tensas Levee District, Fourth District of the Mississippi River Improvement Commission, contracts being let as follows: Loyd levee, 110,000 cu. yds.; Israel R. Bobbitt, Natchez, Miss., at 17.7 cts.; Buck Ridge levee, 78,000 cu. yds.; Donovan & Daley, Lake Providence, La., at 15.4 cts.; Elk Ridge Levee, 131,000 cu. yds. Robt. T. Clark, Natchez, Miss., at 19.05 cts.

MINNESOTA.

The Valley Dredging Co., Stephen, Minn., has been awarded the contract for constructing County Ditch No. 19 for Kittson County, Minn. We are advised that the work includes 86,137 cu. yds. of excavation at 11.7 cts. per cu. yd., and road work on the ditch, the latter amounting to $1,560. Bids were opened June 20 at Hallock, Minn.

MISSOURI.

Lewis & Davis, Champagne, Ill., have been awarded the contract for ditch work in drainage District No. 15, bids for which were opened June 28, at Chillicothe, Mo. The wodk includes one main ditch, two laterals, five steel bridges and one dam and flood gates. The contract price was $11,494.

W. B. Hazen, St. Joseph, Mo., and J. W. Krusor have completed the topographical survey of the Little Tarkio Drainage District, of Holt County, Missouri. It is expected that bids will be called for about the first to middle of October.

NEW YORK.

The Barge Canal Board, Albany, has approved plans for the following large canal contracts and bids will be asked at once by the State Superintendent of Public Works, Albany. Contract No. 50, for the construction of a reservoir and dam on the West Canada creek. The area of this reservoir, known as the Delta reservoir, is about six square miles, the estimated cost for the construction of this work being $1,076,000. Contract No. 67 for the construction of the canal prism with the two locks and other structures at Lockport, at the estimated cost of $1,290,880.

The Atlantic Gulf & Pacific Co., Park Row Bldg., New York, which has the contract for the barge canal work, near Whitehall, started on June 27 to blast in the bed of Wood Creek. Work is now being carried on night and day and a number of men will be added as the work progresses. The rock excavation is being hauled to Boardman St., Whitehall, where it will be used to grade the approach to the new bridge to be built this summer.

[illegible]

[illegible] across the valley into Klamath River. The [illegible] claimed by evaporation and draina[illegible] country by the Government. The river is [illegible] as Lost River Gap. Here a dam is to be erected to raise the water several feet and then by wooden flumes and canals it will be [illegible] the Klamath River. W. W. Patch, Klamath Falls, Ore., is Project Engineer.

The Berney Construction Co., Lakeview, [illegible] Irrigation Project of the Oregon Valley Land Co. The work is located about 20 miles from Lakeview, Ore., and the contract includes 2,000 cu. yds. earth excavation, 20,000 cu. yds. rock excavation, 40,000 cu. yds. of embankment, 500 cu. yds. of cement masonry, 2,500 cu. yds. stone masonry and 30,000 lin. ft. of piling. The contract for the canals was let some time ago to the Hall Construction Co., as noted at the time in this paper, and this contract has been completed.

TENNESSEE.

At the recent annual session of the St. Francis Levee Board at Memphis, President W. B. Miller recommended that an effort be made to pass a bill through the Arkansas legislature, giving the board authority to levy a privilege and commodity tax to enable the board to continue improvements. In his report President Miller stated that in the present financial condition of the Board it cannot undertake any further levee construction, nor can it meet any great emergency that might arise, such as high water, building loops around caving banks, etc., beyond the amount of $21,000 in negotiable certificates authorized by the last legislature. At the same session Chief Engineer B. C. Covington recommended that the levee work in Lee County be extended five miles at the south end.

TEXAS.

The commissioners of Wharton County, at Wharton, have authorized the formation of Wharton County Drainage District No. 1, comprising 120,000 acres of land adjacent to Trespalacios, Blue and Carancahua Creeks. John A. Norris has been appointed engineer in charge.

Drainage District No. 2 of Galveston County will vote July 16 on bonds for construction of drainage canals estimated to cost $45,000.

A bond issue of $124,000 has been voted by the Pearland Drainage District, comprising 50,000 acres of land near Pearland, for the construction of a drainage system.

WASHINGTON.

A drainage canal is proposed for the Yakima Indian Reservation at North Yakima and surveys have already been made by W. H. Martin, Assistant Engineer of the Indiana Service. The canal will reclaim about 35,000 acres of land and will cost about $240,000. W. H. Code, Washington, D. C., is Engineer for the Indian Service.

MISCELLANEOUS CONSTRUCTIONS

ARKANSAS.

A mortgage by the Arkansas National Gas Co. for $5,000,000 to the Colonial Trust Co. of Pittsburg, Pa., has been filed at Little Rock. The mortgage covers all rights, privileges, franchises, real estate and trunk gas lines owned by the gas company.

CALIFORNIA.

Jenkins & Wells, Contractors, Sacramento, have been driving test piles in the land owned by the projected Sacramento & Sierra Ry. near the mouth of the American River at Sacramento, where it is intended to build the proposed wharf in connection with this railway. About 100 acres are owned by this road along the Sacramento River between Sacramento and the American River. It has been given out that several hundred feet of wharf is to be built and that a factory is to be erected where lumber from the lumber regions which this road taps is to be worked.

The Los Angeles County Board of Supervisors on the recommendation of the highway commission, granted E. E. Shaffer, Los Angeles, an extension of time to Aug. 31, 1910, on the construction of the Newhall tunnel. Conglomerate has been discovered, which will necessitate blasting and otherwise retard the work.

The United Land Co., of San Francisco, a holding company for the Acme Lumber Co., has recorded a trust deed for $725,000 for the purpose of financing the work of reclaiming five blocks of tide lands lying along Isais Creek by the Yerba Buena Improvement Co. This will make 700 ft. more of wharfage along Isais Creek, which will be devoted to lumber docks and warehouses. The improvement company is taking down three blocks of Rincon hill, hauling the dirt to Isais creek and filling in.

The Decker Electric Co., 115 New Montgomery, San Francisco, Cal., has been awarded the contract for installing a complete light system including fixtures and substation at the Presidio of San Francisco, for the U. S. Government. The contract price was $46,000. Bids for this work were opened June 15.

ILLINOIS.

Engineers representing Chicago parties have been taking levels and securing data along the Little Vermillion river near Ridgefarm with a view to constructing a concrete dam and erecting a power plant in connection with turbines operated by the water in connection with the dam.

The city of Ottawa, Ill., opened bids on June 7 for the construction of four concrete retaining walls. We are advised that no definite action was taken and all the work was declared off for the present. The work for which bids were asked included the construction of four concrete retaining walls, containing approximately 1,775 cu. yds., four cement block balustrade walls, total length 1,120 ft.; for certain light poles, wiring, lamps, etc.; two concrete sidewalks, total length 585 ft.; 4,210 cu. yds. of earth embankment inside of retaining walls; 3,000 cu. yds. of earth embankment outside of retaining walls. Benj. T. Krouse is City Clerk.

INDIANA.

The Great Lakes Dredge & Dock Co., Chicago, Ill., has work under way at Gary, constructing a $1,000,000 harbor for the American Sheet Steel & Tinplate Co. The sand taken from the lake will be used to fill in the lake shore under the terms of the 1907 submerged land bill.

KANSAS.

Steps are being taken by the citizens of Ottawa, Kan., to construct a concrete dam on the site of the old dam at Ottawa.

LOUISIANA.

The Standard Oil Co. is to lay a second pipe line from the Caddo oil fields to the refinery of the company in Baton Rouge. The company now has a pipe line from the Oklahoma fields, through the Caddo fields to Baton Rouge. The line from Oklahoma to Caddo will not be doubled, but the one from Shreveport its entire length will be paralleled with a line of equal capacity to the one now in operation.

MISSOURI.

The Mississippi River Commission, Liggett Bldg., St. Louis, Mo., at its final session on June 25, provided for a survey to ascertain the feasibility of making a permanent separation between the Red and Atchafalaya Rivers, and the Mississippi River. The survey is to ascertain the feasibility of throwing a dam across the mouth of the Red River and of dredging a new channel for it to the Atchafalaya. The towns on the Red River are to retain their traffic connection with the Mississippi by means of locks at Grand Cutoff, about 20 miles north of the mouth of the Red River, where the Red River approaches very near the Mississippi without entering. The Red River empties into the Mississippi at ordinary stages of the latter, having no connection with the Atchafalaya. At flood stages, however, the Mississippi sends a portion of its water as well as most of that from the Red River down the Atchafalaya, so that the latter is greatly enlarged to the detriment of lands along its course. The project is to make a new water course in Louisiana, composed of the Red and the Atchafalaya rivers. The Atchafalaya empties into the Grand River which, with its series of lakes, carries the water in to the Gulf of Mexico at a point about 150 miles west of the Delta of the Mississippi. The project is specially mentioned in the present Rivers and Harbors bill.

NEW YORK.

The Board of Aldermen of New York City on June 28, adopted resolutions providing for issues of corporate stock in excess of $32,000,000, to be expended immediately on subways and other permanent improvements.

Bids were received June 27, by Col. W. L. Fisk, U. S. Engineers, Buffalo, N. Y., for the construction and erection of steel lock gates, valves and operating machinery for the ship lock in Black Rock Harbor at Buffalo. The bids received were as follows: (1) standing for the Penn Bridge Co., Beaver Falls, Pa.; (2) the D'Olier Engineering Co., Philadelphia, Pa.; (3) for Mac Arthur Bros. Co., New York City; (4) for New Jersey Foundry & Machine Co., New York City; (5) for the Monarch Engineering Co., Buffalo, N. Y., and (6) for the Strobel Steel Construction Co., Chicago, Ill.:

No.		Quantity.	(1)	(2)	(3)	(4)	(5)	(6)
1	Miter Sills, each	5	$ 118.00	$ 300.00	$ 206.25	$ 192.00	$ 264.00	$ 150.00
2	Steel Guard Gates, each	2	16,230.00	16,000.00	18,569.00	17,875.00	16,645.00	18,000.00
3	Steel Lock Gates, each	3	18,969.00	18,300.00	22,069.00	21,500.00	17,900.00	21,000.00
10	Stoney Culvert Valves, each	6	1,988.00	2,042.00	2,250.00	2,375.00	2,800.00	3,100.00
11	Pumping Plant, all for	1	6,669.00	8,400.00	7,000.00	7,850.00	7,100.00	11,300.00
12	Capstans, each	4	1,633.00	1,338.00	2,000.00	2,180.00	2,300.00	2,000.00
13	By-Pass Valves, each	2	432.00	425.00	375.00	545.00	690.00	1,100.00
14	Drain Pipe Valves, each	1	161.00	150.00	125.00	143.00	220.00	440.00
15	Cofferdam, Pumping and Maintenance	L'p sum	13,300.00	12,000.00	10,000.00	24,250.00	25,000.00	11,000.00
	Total		$129.414	$127,404				
4	Cable Gate Operating Machines	8	1,600.00	1,625.00	2,375.00	2,225.00	2,850.00	3,230.00
5	Plow Steel Cable, all for	L'p sum	466.50	500.00	750.00	825.00	450.00	630.00
6	Vertical Cable Sheaves	80	33.00	35.00	84.40	43.75	110.00	60.00
7	Horizontal Cable Sheaves	24	58.30	100.00	110.45	75.00	150.00	105.00
18	Cable Counterweights	16	86.30	55.00	84.40	110.00	85.00	72.00
	Total		$18,686	$19,580				
9	Spar Gate Operating Machines	8	2,219.00	3,175.00	3,312.50	2,800.00	3,790.00	3,830.00
	Total with Cable Gate Operating Machines		$148,100	$146,984	$174,254.45	$183,098	$185,020	$186,232
	Total with Spar Gate Operating Machines		$147,166	$152,804	$170,251.25	$179,913	$178,330	$181,930

Items 4 to 8 inclusive are alternative with item 9 depending on which system is adapted.

OHIO.

Thomas Sheridan of the Sheridan-Kirk Contracting Co., of Cincinnati, and his daughter had a narrow escape recently from serious accident at Cincinnati. Sheridan was crossing the Eighth St. viadict in his automobile with his daughter, when the machine skidded and plunged against the railing, ripping it loose for 6 feet. The front wheels of the auto were crushed and hung over the side of the viaduct, but the railing held and the machine stopped, although part of it hung over the brink. Sheridan and his daughter jumped backward from the machine, which swayed for a moment and seemed about to take the plunge. The auto was pulled from the edge and later was towed to a garage.

OREGON.

The Commissioners of the Port of Coos Bay, Marshfield, are planning to expend about $150,000 for widening the channel of the bay. It is planned to have some dredging company take the contract from the port commission to accept bonds in payment. If the contractors do not care to do this the commissioners will float a $250,000 bond issue. The $150,000 will be spent on the channel, and it is planned to spend the other $100,000 for tide lands and suitable sites for public docks and also to dredge some of the inlets emptying into the bay.

PENNSYLVANIA.

Jas. G. Biddle of Philadelphia has been awarded a contract for furnishing under circular No. 253, one spherometer for $135, for the Frankfort arsenal. Bids were opened June 20.

TEXAS.

F. L. Dormant, Houston, Consulting Engineer for the city, has completed plans for the wharves at the turning basin and contracts for the work will be let soon. Dredging for the slips has already been completed.

A new port, known as Port San Antonio, has been recently established at Aransas Pass, and will handle some 25,000 bales of cotton this year. The company owning the port will construct permanent wharves and warehouses during the coming winter.

Work is to be resumed shortly on the construction of Lock and Dam No. 6 on the Trinity River for the U. S. Government. The contract for completing the work was recently let to J. G. White & Co., New York City.

The Fred A. Jones Co., Dallas, contractors for the White Rock dam for that city, have been making good progress with the work. At the middle of last month the state of the work was as follows: The concrete sluiceway, 6 ft. x4 ft.x322 long, had been completed. This extends entirely through the dam and will carry off the water during the period of construction. The concrete walls are 12 in. thick. There is a fall of 12 in. to the 100 ft. Except about 200 ft. on the east side of the creek, all of 1,900 ft. of sheet piling was driven. Over the section of the puddling ditch in which the piling has been driven the clay puddling has been laid to a depth of 2 ft. and will be carried on to the full depth and to a level above the ground level. At the extreme ends, where the hard pan is too close to the surface for advantageous driving of the piles, the ditch will be filled with a concrete core wall.

WASHINGTON.

S. Z. Mitchell, president of the Electric Bond & Shares Co. of New York, the financial sub-corporation of the General Electric Co. and allied electric interests, has obtained an option on a controlling interest in the Hanford Irrigation & Power Company of Seattle, for a consideration said to be close to $750,000. The Hanford company owns valuable water rights on the Columbia River at Priest Rapids, where there is sufficient power to generate 100,000 electric hp.

The City Commissioners of Tacoma have voted to acquire for municipal dock purposes all the water front on the west side of the channel between the Eleventh St. and the Northern Pacific drawbridge. The action will require the voting of a bond issue.

WISCONSIN.

The New York Belting & Packing Co., of 150 Lake St., Chicago, Ill., has been awarded a contract by Marshfield, Wis., for furnishing 500 feet of fire hose for $.85 per ft. Bids for the work were opened June 30.

The Board of Public Works of Appleton, Wis., has awarded the contract for constructing the Mason St. subway to Bartz & Sullivan. Bids for this work were opened June 15, the bid of the successful contractor being as follows: Excavation 38 cents per cu. yd.; concrete, 1-2-4 mixture, $5.35 per cu. yd.; 1-3-5 mixture, $4.98 per cu. yd.; 1-3-6 mixture, $4.62 per cu. yd.

CANADA.

The City Engineer of Toronto is to make an estimate of the cost of constructing the concrete wall in front of the lake front boulevard, Toronto, from the westerly limit of the wall under under construction at Grenadier's Pond, to the Humber River.

A syndicate has acquired possession of the Healey Falls, Burleigh Falls, and the Auburn Waterpower of Peterboro, Ont. They have also purchased the plant and interests of the Peterboro Light & Power Co. and electric lighting. It is stated that the Auburn power will be improved by the construction of a new concrete dam and power plant. The syndicate has also purchased the Peterboro Radial Railway, which, it is stated, will have several miles of line added in Peterboro and vicinity. A site for an amusement park in connection with the railway is also being selected.

[illegible] Credit Harbor, at Toronto, on June 25, for the purpose of facilitating the dredging of the slip to make it sufficiently deep for steamers to swing alongside the docks which Haney & Miller, contractors, are to construct for the Port Credit Brick. About 60,000 sq. yds. of rock bottom was loosened by the blast.

The Canadian Shipbuilding Co. has purchased a large tract of land at Bridgeburg, Ont., 18 miles from Welland, on which it proposes to erect a large shipbuilding plant, including a drydock. Plans for the shipbuilding plant and drydock are now in the hands of the architects. It is announced that building operations will begin in about a month. It is understood that several large sized shops will be a part of the plant.

The Reese Engineering Co. has bought the Keewatin Power Co's. power and property on Tunnel Island, Norman. It is said that the [illegible] tionally accepted their offer for supplying 2,- [illegible] tage la Prairie will enter into a similar ar- [illegible] ing made to secure contracts with other M[illegible] delivery of the power is December, 1911, this would mean that the new owners of the power would have to start development at once. It is understood they will have a large gang of men at work within a week or two.

BRIDGES AND BUILDINGS

Sacramento, Cal.—In accordance with the recommendation of Mrs. J. Henry Miller, Chairman of the McKinley Park Commission, the trustees have instructed the city engineer to prepare plans for the construction of a new bridge to replace the old one at 31st and H Sts. The estimated cost of the work is $2,000.

Stockton, Cal.—A joint committee of the Supervisors of San Joaquin and Stanislaus Counties was held recently to arrange details for the construction of a bridge over Stanislaus River at or near the old Bailey ferry, almost directly north of Modesto. Surveys and plans are now being made by the Engineers of the Counties. Cost of the work will be evenly devided.

Los Angeles, Cal.—It is proposed by the residents of the northwestern part of Los Angeles and South Pasadena to construct a concrete bridge across the Arroyo Seco to connect the two places instead of building the dirt fill as previously planned, by the cities of Los Angeles, South Pasadena, county of Los Angeles and the Salt Lake Ry. Co. The matter was presented to the Streets & Boulevard Committee and as it was shown that the railroad tracks so near the roadway would menace drivers, it was decided to drop the railroad from the proposition. The structure is estimated to cost $288,000, each city and the county paying one-third.

Denver, Colo.—Representatives of the Rio Grande, Colorado & Southern and Santa Fe R. R., also the Denver City Tramway, are making final arrangements for a conference with the citizens regarding the proposed West Colfax viaduct. The structure as proposed will be 5,500 ft. long and is estimated to cost about $700,000. City Engineer, who investigated the feasibility of the project, states that nothing but the inactivity of the railroads will delay the work. C. S. Thompson, Pueblo, Colo., is Bridge Engineer of the Denver & Rio Grande R. R.

Bridgeport, Conn.—All bids received for the construction of the Boston Avenue concrete arch bridge by Director M. A. Kenny have been rejected on account of their being too high. The lowest responsible bid was from Schwerr & Luther Co., New York, which was above the estimate. City Engineer will be called upon to prepare new plans and bids for the work will be readvertised.

Atlanta, Ga.—Fuller & Co. has been awarded the contract for the construction of the Garins hotel at the corner of Peachtree St. and Ponce de Leon Ave. Work will begin at once and it is to be completed by Sept. 1, 1911. W. L. Stoddard of New York is the architect.

Cedartown, Ga.—Bids opened June 20 by the board of county commissioners, for the construction of three concrete arch bridges, have been rejected. J. L. Moore, Rockmart, Ga., is chairman of the board.

Metropolis, Ill.—Lieut. Col. J. G. Warren, U. S. Engineer, will hold a hearing at the office, 1301 Liggett Bldg., St. Louis, Mo., to consider plans for the construction of the proposed bridge over the Ohio River at Metropolis, Ill. As noted before in these columns the structure is to be built by the Paducah & Illinois R. R. Co. and this will be the second hearing held regarding the proposition. Maps of the locality and plans of the proposed bridge are now on file.

Paris, Ill.—The advertisement by the Highway Commissioners of Grand View township for the construction of a bridge over the West Fork of the Big Creek at Kime's Mill resulted in some close figuring by several bridge companies. The proposals being as follows: Vincennes Bridge Co., $3,045; Paris Bridge Co., $3,047; S. L. Sheets, $3,047. As yet no contract has been let for the superstructure but the substructure was awarded to S. L. Sheets.

Springfield, Ill.—Board of county commissioners has let a contract to C. E. Trowbridge of Chandlerville for the construction of six concrete bridges, named according to their localities. The Leeper bridge will cost $994; the Redshaw bridge, $449; the Rausch bridge, $620; the Fox bridge, $367; the Shiloh bridge, $344; the Crawford bridge, $471.

Chariton, Ia.—Board of Lucas County Supervisors are issuing bonds amounting to $20,000 for the construction of bridges. The policy of the board is said to be to construct more permanent structures.

Sioux City, Ia.—City Council has instructed that all pile bridges over Perry Creek, below W. 3d St., to be taken out and replaced with permanent structures. The Chicago, Milwaukee & St. Paul and the Chicago & Northwestern Railroads and the Combination Bridge Co. will bear the expense, which will amount to about $60,000.

Allison, Ia.—Arrangements have been completed by County Commissioners for replacing the 90-ft. bridge on the line between Floyd County and Butler County and townships of Powersville and Dayton. The new bridge will be of concrete.

Marion, Ia.—Alan McDuff, County Supervisor, advises the construction of a new bridge over the stream at Bever Ave., Cedar Rapids, beyond the limits of the Park. The new structure will be of concrete and steel and will be wide and strong enough to accommodate all kinds of traffic including automobile.

Kansas City, Kan.—The Grand View Improvement Association of this city is taking steps to get a viaduct built across the tracks of the Union Pacific and Rock Island railroads at Eighteenth St. and Muncie Blvd. As proposed the structure will be built to support street cars.

Minneapolis, Kan.—Commissioners of Ottawa County have been advised by Highway Eng[illegible] Agricultural College to reject all bids re- [illegible] county bridges as the lowest bid was nearly $3,000 in excess of the estimate.

Louisville, Ky.—It is said that Louisville, Ky., will be chosen as the site for another large bridge across the Ohio River. According to the reports, the Pennsylvania, R. R Co. will erect a new bridge to span the Ohio, connecting Louisville with Jeffersonville, the starting point on the Louisville, Ky., side to be at Fourteenth street. The new structure will supplant the old bridge at Fourteenth street, and will be built at a cost of $3,000,000 or $4,000,000.

New Orleans, La.—The contract for the construction of the William A. Kernaghan wharf has been awarded by this city to W. T. Carey & Bro. The work will call for an expenditure of $53,118.

Baltimore, Md.—Raymond Concrete Pile Co. of New York and Chicago has been awarded a contract for the foundation of public school No. 2, at Stiles & Gough Sts. Otto H. Simonson, architect; Engineer-Constructing Co., Baltimore, Md., general contractors.

Boston, Mass.—City Engineer has completed plans for the location and construction of the proposed temporary bridge over the Mystic River between Chelsea and Charleston and same has been filed with Col. Frederick V. Abbot, U. S. Engineer, Boston, Mass. Plans for the structure, which will be erected by the cities of Boston and Chelsea, call for a pile bridge with a 100 ft. draw 25 ft. above mean water The draw in the present Charlestown-Chelsea bridge will be taken out and the foundation removed, so that a clear opening of 100 feet through the present structure can be secured for the passage of vessels. The fender pier will also be extended about 200 feet up the Mystic river.

Menominee, Mich.—Congress has passed a bill authorizing the construction by the cities of Menominee and Marinette, Wis., to construct a bridge over the Menominee River between the two cities.

Pipestone, Minn.—All bids tendered the committees in charge of letting the contracts for the construction of three steel bridges in Holland and one at Lake Lillian were rejected on account of their being too high and new bids will be advertised for.

Arrow Rock, Mo.—A bill has been introduced into Congress providing that the St Louis-Kansas City Electric Ry. Co., be authorized to construct, maintain and operate a bridge and approaches thereto across the Missouri River at or near this town.

St. Joseph, Mo.—City Council has taken the first steps toward the construction of viaducts over the railroads at dangerous crossings. At a recent meeting the body passed an ordinance extending the city limits to take in sufficient territory to include [illegible] will be compelled to start the improvement at that place.

Schuyler, Neb.—The Elkharn Construction Co. of Fremont, Neb., has been awarded a contract for repairing a wagon bridge over Platte River, near this city. The work includes six 175-ft. steel spans at $24.90 per ft., substructure 60-in. piers at $16.85 per ft., web bracing at 8½ cts. per lb., concrete in tubes at 34 cts. per cu. ft., piling in tubes at 50 cts. per ft., superstructure 24-ft. wood span at $3.80 per ft., oak piling at 45 cts. per ft., caps, etc., at $34; placing old lumber at $8. Bids for this work were opened June 27.

Trenton, N. J.—Board of Freeholders are considering the construction of a bridge across the Water Power connecting River Drive Ave., with the Delaware River Drive. It is estimated that the cost of the proposed structure would not exceed $1,500.

Patterson, N. Y.—At a recent meeting of the various bridge committees of the Board of Freeholders, County Road Superintendent was authorized to repair the approaches to the Fifth Ave. structure.

Rochester, N. Y.—Chairman of the Public Works Committee of the Common Council has directed Richard H. Curran, Assistant Clerk, to ask E. A. Fisher, City Engineer, to make some suggestion in regard to the erection of the foot bridge over the New York Central railroad tracks at North Goddman St. An estimate of the cost is also desired.

Albany, N. Y.—The Canal Board has approved plans for the construction under Contract No. 22, new highway bridges and raising existing structures over the Erie Canal between Cold Spring and Free Bridge in the limits of the barge canal contract No. 12. The work is estimated to cost $107,126, also plans for the construction of a bridge under Contract No. 79, over the Oswego Canal at Bridge St., in Oswego, N. Y.

Cincinnati, O.—County commissioners have awarded a contract to F. J. Brackett of Glendale, O., for the construction under Specifications No. 61, superstructure and substructure of lift bridge over Miami & Erie Canal on Section Ave., in Hartwell, Springfield township. Bids were opened June 17.

Cleveland, O.—Chas. A. Wright, 3856 N. 40th St., city, at $1,499, and Chas. Patterson, 7606 Shaw Ave., city, have been awarded contracts for the construction of culverts, as per report No. 2650 and report No. 2638. Bids were opened June 25.

Cleveland, O.—Chas. A. Wright, 3856 W. 40th St., city, has been awarded the contract for the construction of bridge work per Report No. 2629, culvert, Center Ridge road, Rocky River township, for $1,420. Bids were opened June 22.

Cleveland, O.—County Commissioner W. F. Eirick has recommended the straightening of the east approach of the present Superior viaduct to St. Clair Ave., N. E. As the steel work of the bridge is at the present time in very bad condition it would be advisable to replace the entire section and at the same time make the change.

Defiance, O.—Board of county commissioners has awarded the contract to the Toledo Massillon Bridge Co., of Toledo, O., for the construction of the superstructure of the new Francis St. river bridge, and to Schneider Bros., for the construction of the substructure. The superstructure will be erected for $17,000, and the substructure for $7.75 per cu. yd.—concrete work.

Hubbard, O.—Quiggley & Meeker have been awarded the contract for the construction of the substructure of a bridge over Yankee Run on East Liberty St., in this city. N. H. Merwin received the contract for the construction of the superstructure bridge on the Park Ave. extension at this of the bridge. Bids were opened June 27.

Lakewood, O.—Council has passed a resolution urging the county commissioners at Cleveland, O., to build a high level bridge over the river to replace the Superior viaduct, which is now unfit for use.

Niles, O.—The Mt. Vernon Bridge Co. of Columbus, O., has been awarded the contract for the construction of the proposed bridge on the Park Ave. extension at this city at $9,879. Bids were opened June 27.

Muskogee, Okla.—It has been decided by the Commissioners of Muskogee County to hold a special election July 23 for the purpose of voting bonds amounting to $100,000 to provide funds for the construction of 34 bridges. The structures will be of steel resting on cement abutments and piers and are estimated to cost about $3,000 each.

Tulsa, Okla.—The Canton Bridge Co., of Canton, O., has been awarded a contract by the county commissioners for the construction of 28 bridges throughout the county. The company's bid being $78,174.

Harrisburg, Pa.—Board of Public Grounds and Buildings has approved the plans for the construction of the 3-span concrete arch bridge over the creek near Hummelstown. The contract for the structure which is estimated to cost about $15,000 will be let in the near future. Mason D. Pratt is Engineer.

York, Pa.—Nelson-Meredith Co., Chambersbury, Pa., received a contract for the construction of a concrete bridge over Codorus Creek, near Larus, at the site of Bridge Case No. 3, for $1,545. The structure will have a 40-ft. clear span with a 14-ft. roadway. Bids were opened June 27.

York, Pa.—Plans have been submitted to the Highway Committee of the City Council by A. B. Kraft for the construction of a bridge across Tyler's Run at Jackson to replace the old structure recently destroyed by high water.

Fort Crockett, Tex.—F. E. Newbery & Co., 614 Century Bldg., St. Louis, Mo., at $11,944, has been awarded a contract for the construction of an electric lighting system. The work includes sub-station for transformers, installation of fixtures, transformers and watt meters, pole line and service wires. Bids were opened May 31.

Fort Sam Houston, Tex.—Following contracts have been awarded by Capt. Fred H. Gallup for repairs to heaters: Higgins Co., San Antonio, Tex., $3,246; James B. Clow & Sons, Chicago, Ill., $205; San Antonio Sheet Metal Works, $23; H. Mueller Manufacturing Co., Decatur, Ill., $328; The Lunkheimer Co., Cincinnati, O., $215; New York Central Iron Works, Geneva, N. Y., $107. Bids were opened June 16.

Goliad, Tex.—No contract was let by the County Court June 15, for the construction of the bridge across Fifteen-Mile Colletto connecting Goliad and DeWitt Counties.

Houston, Tex.—An announcement has been made to the effect that the contract for the construction of the San Jacinto St. bridge will be let within a few days. Plans and specifications have been prepared by the City Engineer.

Dallas, Tex.—Plans for the proposed Dallas-Oak Cliff Viaduct have been practically completed and county engineer will probably be authorized for bids in the near future. Ira Hedrick is the Architect.

San Antonio, Tex.—Property owners have raised $12,000 for the construction of a new bridge over the San Antonio River at Travis St. It is expected that bids will soon be asked for a concrete and steel structure.

Sherman, Tex.—City has awarded the contract for the construction of a concrete bridge over Post Oak Bayou in West Lamar St. The structure will be used by the Texas Traction Co., for its West Hill extension.

Roanoke, Va.—The Roanoke Bridge Co. has been awarded a contract for the construction of 13 bridges in Allegheny County. The bridges will be located as follows: Four over Potts creek, two over Dunlap creek, two over Wilson Creek, two over Karnes creek, two over Jackson's river and one at Indian Draft. The work will require over 1,000,000 lbs. of steel. The contract was awarded at $46,000.

Fort Ward, Wash.—The Higgins Manufacturing Co. of Newport, Ky., has been awarded a contract for furnishing window screens for this place at $1,107. Bids were opened May 26.

Laramie, Wyo.—J. A. Warren of Boulder, Colo., has been awarded the contract for the construction of the new Elks hall in this city for $37,937. J. C. Hulett of Rock Springs at $1,200 for wiring the building; W. H. Inman of Laramie at $3,990 for the plumbing and heating work. The building is to be completed in seven months.

Verdun, Que.—Council is considering taking steps toward having the bridge on Church St. widened to permit the installation of street car tracks over the structure.

ROADS, STREETS AND PAVEMENTS

New Decatur, Ala.—City has let contracts for street paving and sidewalk building to the total amount of $38,620. A contract to the amount of $26,696, for the paving of Johnson and Jackson Sts., was given to Goodrich & Crinkley of Decatur and a contract for cement sidewalks to the amount of $11,924 was given to W. M. Leftwick & Co. of Nashville, Tenn.

Sisson, Cal.—The county viewers who have been over the proposed road to Mount Shasta have completed their report. The route is from a point near Sisson to what is known as the Timber Belt Camp. The road will be put into condition for the use of automobiles.

Los Angeles, Cal.—Board of supervisors has awarded two contracts to the Oil Macadam Paving Co., for work on two sections of the Long Beach Blvd.; one for grading and culverts at $1,935 and the other for the same kind of work at $1,840, with $1.75 for each ton of stone, screenings or sand in the construction of oil macadam paving, oiled shoulders or stone shoulder drains.

Los Angeles, Cal.—The following bids were received by the board of supervisors on June 20, for the construction of the Hollywood-Toluca road: A. C. St. John, $39,049; W. N. Crandall, $45,860; Barber Asphalt Paving Co., $87,512. The highway commissioner's estimate for this work is $37,355.

Long Beach, Cal.—Supervisor C. J. Nellis has promised the chamber of commerce parks and roads committee that work will soon be started on the improvement of the present highway between this city and Los Angeles. The improvement will extend to Manchester Ave., at the Los Angeles city limits, and the Los Angeles city authorities will be asked to improve about two miles of road inside the city, leading to this point.

Palo Alto, Cal.—Supervisor Frank E. Mitchell of this Fifth Supervisorial District contemplates the construction of a number of macadam and gravel roads. At present the supervisor is experimenting with different kinds of top dressing for graded roads.

Blue Lake, Cal.—County Surveyor Conners is making a survey for the proposed new county road to the Mendocino line at Garberville. This road will eliminate the Bell Spring mountain.

Blue Lake, Cal.—Board of county commissioners has awarded a contract to J. S. Ullathorne at $1,050 and $950 respectively for the construction of the two sections of the Martins' Ferry Orleans road, aggregating 10,125 ft.

San Francisco, Cal.—Board of county supervisors will probably construct a well-built road from Bakersfield to Moron, by way of Cole's levee, a distance of 34 miles.

Denver, Colo.—A bill has been passed by the board of supervisors providing for the extension of Speer Blvd., from West Colfax Ave., to the 14th St. viaduct, carrying with it an appropriation for $102,500 for the improvement.

Fruita, Colo.—City has purchased 20 acres of land on which will be built a half-mile speedway and a swimming pool for the public. The chamber of commerce is promoting the project.

Washington, D. C.—The Northeastern Suburban Citizens' Association has asked the district commissioners to use the appropriation which has been available since last July for the macadamizing of Mills Ave., from Rhode Island Ave., to its intersection with 24th St., Langdon and Evarts St., from 22d St. to 24th St., Langdon and that 28th St., Avalon Heights, between Franklin St. and Bladensburg road, be put in passable condition for vehicles; that West Virginia Ave. be improved as a public thoroughfare from 22d St., Langdon, to Florida Ave., northeast.

Washington, D. C.—The government will buy the 12 squares of land between the Capitol and Union station within the next eight years. The conferees of the Senate and House have agreed that $3,600,000 shall be expended at the rate of $500,000 a year. The tract will be used as an addition to the present Capitol grounds. The plan contemplates also the construction of a 150-ft. avenue from Pace monument at the foot of the Capitol to the west fountain in the plaza.

Carterville, Ill.—City council has passed an ordinance for the construction of 18 miles of concrete sidewalks at an estimated cost of $55,000. L. E. Robertson is mayor.

Chicago, Ill.—Judge Brentano has confirmed projects for the resurfacing of La Salle St., Adams St., and a part of Congress St. in the downtown district.

Alton, Ill.—Board of local improvements has awarded a contract to Valentine Wolf for street paving on Milton road.

Elwood, Ill.—Commissioners of highways of the town have awarded a contract to D. H. Fatout of Indianapolis, Ind., at $9,249, for the grading and constructing of two and one-half miles of macadam roads. The road will be commenced at the cross-roads at Vermilion Grove, extending east and west from that point. Another road will be extended from the east end of the rock road, south to the county line.

Kokomo, Ind.—City has awarded a contract to the Union Asphalt Construction Co., of Indianapolis, for the grading, paving, curbing and construction of walks on Taylor St. The contract was awarded at $11,280. Bids were opened June 27.

Marion, Ind.—Wabash County Commissioners recently met with the county commissioners of this county relative to the proposed improvement of the road between the two counties, extending from the Lagro road west to the Mississinewa river. Aaron Singer, of Wabash County, and Fisher Blinn, of Grant County, were named viewers, and Will Fowler of Wabash as engineer for the road.

Logansport, Ind.—J. B. Winters, representing the Broadway resident property owners, who have petitioned the board of public works for the paving of that street from the east line of Seventh St. to the east line of 26th St., has asked the board to proceed with the work this summer. The board has instructed Harry Thompson, city engineer, to prepare the plans and specifications for the pavement. It has not been decided what kind of pavement will be used.

Albia, Ia.—[illegible] guttering streets in this city at $24,653. The work includes grading, curbing, guttering and paving with vitrified blocks on concrete foundation about 9,410 sq. yds., and about 7,690 lin. ft. of combined curb and gutter. Bids [illegible]

Cedar Rapids, Ia.—City council has awarded a contract to the Cedar Rapids Construction Co., represented by Mr. Bealer, at $1.60 per sq. yd., for the paving with brick blocks the block between Seventh and Eighth Aves. in 11th St.

Bedford, Ia.—City council has awarded two contracts to M. A. Camery of Harlan, Ia. The first is for putting down 21 blocks of brick paving and the other for 18 blocks of sewer. These contracts will amount to about $75,000.

Marshalltown, Ia.—City council on June 23 rejected the bids for the construction of four miles of concrete pavement and will advertise for new bids. The lowest bid received was $1.68. The low bid on 12,000 sq. yds. of brick block pavement was $1.95. This work will probably also be readvertised.

Johnsville, Ky.—The Nelson Fork Turnpike Road Co. has been incorporated with a capital stock of $2,350. The incorporators are Harry Taylor, Clarence Arnold and S. M. Jordan.

Jeffersonville, Ky.—Charles W. Kelley and Peter Heller of this city have completed the work of surveying the line for a free gravel road from Bethel church to Bethlehem in the eastern part of the county. The highway will be six and three-quarter miles long and slightly diverges from the old Camp Creek road.

Baltimore, Md.—State road commission at Baltimore, Md., has announced through its chairman, John M. Tucker, that it will ask for bids for about 19 miles of road construction in different sections. The roads to be built at this time include: In Hartford County—Four and one-half miles, extending west from the end of Conowingo bridge via Glenco and Berkley to the Dublin Crossroad. In Frederick County—Five miles, from Jefferson to Petersville. In Baltimore County—Belair road, from the city limits to Overlea, three and one-half miles; Hartford road, from North Ave. to Atlantic Ave.; Liberty road, from Twelfth St. to Buck's lane. Garrett County—From the Allegany county line toward Piney Grove, to include two sections of the National turnpike, between Cumberland and Piney Grove.

Baltimore, Md.—Board of Awards has awarded a contract to Patrick Flanagan at 76c per sq. yd., for the paving of 26th St., between Eastern Ave. and Sydenham Hospital, with macadam.

Detroit, Mich.—Council committee on parks and boulevards has recommended that $35,000 be turned over to Commissioner Hurlburt for the improvements on the boulevard.

Menominee, Mich.—On June 23 the road commissioners received several bids for road improvements. Most of the work is repair work on the macadam or gravel roads, together with work on culverts and bridges. It will also include the rebuilding of about eight miles of macadam road.

Albert Lea, Minn.—Fielding & Shepley, 216 University Ave., St. Paul, Minn., have been awarded a contract by this city for paving alleys. The work includes 4,016 sq. yds. of paving; 1,762 cu. yds. of excavation; 3,440 lin. ft. of protection curb. Bids were opened June 24.

Chisholm, Minn.—D. C. Hacket, and C. D. Purple of this city have circulated a petition in the Sturgeon Lake country for the county's portion of the road which is to be constructed by the township of Stuntz. The whole road will be about four and one-half miles long. The petition will be presented to the board of county commissioners at its July meeting.

St. Joseph, Mo.—Board of public works [illegible]

St. Joseph, Mo.—Employes of the city en[illegible]

Springfield, Mo.—State Highway Engi[illegible] proposed road will connect with ot[illegible] leading into Washington, Carthage, Joplin, [illegible] those interested is the Automobile club of St. Louis, with headquarters at the Planters' Hotel.

Cleveland, O.—The Wheeling & Lake [illegible] city of Cleveland, O., plans for the construction of a new high level roadway to the flats along Canal road and Vinegar Hill. The plans call for a roadway 26 ft. wide requiring a fill of 10,000 cu. yds. of earth and the cost will be $200,000 [illegible] that is at least 60 ft. wide, and cutting down the present grade of 10 ft. to that of two and one-half ft.

Caldwell, O.—Petition has been presented to the commissioners of Noble county by J. B. Racey and others for the establishment of a county road along the foll[illegible] described route in Noble townsh[illegible] the Hoskinsville road near the residence of William Beckett to the brick road leading from Caldwell to Belle Valley, O.

Columbus, O.—J. L. Hamil of the Ritter Lumber Co., this city, has succeeded in raising the required $23,000 for the improvement of East Broad St., from the Norfolk & Western Railroad tracks east to the Bullitt Park line. The street will be paved with a patent material and modeled along the park plan, as the rest of East Broad St.

Portsmouth, O.—Engineer Sam Harper, having charge of the paving of the Chillicothe pike, has presented the profile of the part to be graded to the state highway commissioner for his approval. If the profile is approved bids for the construction will be advertised for immediately.

Columbus, O.—County commissioners have adopted a resolution providing for the building of a macadam road between Dublin and Hilliard, in Norwich and Washington townships. The road is not to be surfaced. The commissioners will ask for bids at once. The distance is 12 miles.

Ashland, O.—County commissioners have decided to pike the McKay road leading north from Loudonville for a distance of several miles.

Cincinnati, O.—City council has passed an ordinance authorizing the Park Commission to construct a macadam roadway in Woodward Park, at a cost not exceeding $4,500.

Crooksville, O.—City has sold bonds in the sum of $3,500 and the contract for paving State St. for a distance of nearly a mile was let to J. H. Henderson, Coshocton, at $14,378.

New Lexington, O[illegible] at $13,240 for the paving [illegible] Adams Bros.' Contracting [illegible] $14,435.

Quaker City, O.—County Commissioners have awarded a contract to A. T. Warrick of Barnesville for $4,600, for the construction of the second section of the Quaker City-Salesville pike. This section is a little over one-half mile. When completed the pike will extend from the Quaker City corporation line to that of Salesville.

Portland, Ore.—Directors of the Portland Automobile club have decided to cooperate with the newly organized Vancouver Automobile club for the improvement of the highway between Vancouver and Kelso, and probably as far north as Toledo. The counties through which the road passes between Vancouver and Toledo are Clarke, Cowlitz and a small portion of Lewis county. The distance is about 50 miles.

The Dalles, Ore.—City council has awarded a contract to the Warren Construction Co., at $1.87 per sq. yd., for the paving of Fourth St. This company has completed Second St., and is now paving Third St.

York, Pa.—City council has awarded contracts for the paving of West York Ave. and South George St. with sheet asphalt to the Filbert Paving & Construction Co., at $1.78 per sq. yd., and to the Central Construction & Supply Co., of Harrisburg, for paving Market St., with sheet asphalt, from the M. & P. railroad to Sherman St., at $1.67 per sq. yd.

McKeesport, Pa.—W. E. Hawley was awarded the contract for the construction of the Turtle Creek and Monroeville road for $22,398, and Foley Bros., for the Perryville Extension No. 1, for $39,754.

Mount Pleasant, Pa.—Thaney Pietro of Morgantown, W. Va., has been awarded a contract for paving Dramond and Bridgeport Sts. at $11,463. Bids were opened June 24.

Pittsburg, Pa.—County Controller R. J. Cunningham has awarded a contract to Foley Bros. at $39,764, for the permanent improvement of the Perryville Extension No. 1 road from the West View Borough line, a distance of 1½ miles, and the Turtle Creek road from Turtle Creek Borough line, a distance of 2¼ miles. Bids were opened June 24.

Philadelphia, Pa.—City councils have appropriated the sum of money which Director Stearns has asked for in his estimate for next year, $11,454,874, for the improvement of streets in this city. The sum of $5,583,684 is required for the Bureau of Highways.

Philadelphia, Pa.—The Ambler-Davis Co. has been awarded the contract for macadamizing Church road in Springfield township, Montgomery county, for $19,874, for a distance of 10,100 ft.

Olyphant, Pa.—City council has awarded a contract to the highest bidder, Cummings & Johnson, at $16,715, for the paving of Race, River and Susquehanna Sts., with vitrified brick. The Cunningham Paving & Construction Co., of Philadelphia under bid the successful bidder by $611.

Pittsburg, Pa.—Universal Portland Cement Co. has been awarded a contract for furnishing Allegheny County with cement for year beginning July 1, 1910. The contract was let for $1.32 per bbl.

Winnsboro, S. C.—The town council has awarded the contract for paving a part of the northern end of Congress St., to Weston & Brooker of Columbia. A concrete walk will be laid commencing at the corner of College and Main Sts., and running for a distance of a block, being an extension of the walk from the Methodist church.

Knoxville, Tenn.—Plans have been made for the paving of W. Jackson Ave. extension with macadam at an estimated cost of $75,000. The work will require 7,500 cu. yds. of excavation, being 60 per cent solid rock, and the construction of 1,700 lin. ft. of stone curb. The contract for the work will be let after the right of way is secured. J. E. Thompson, city engineer, has charge of the work.

Nashville, Tenn.—The Southern Bitulithic Co. has been awarded a contract by the board of public works for the paving of the Broadway viaduct with brick. The job will cover the territory from 10th to 12th Aves., totalling about 5,400 sq. yds. The contract was awarded at $1.57 per sq. yd.

Walla Walla, Wash.—Commercial club of this city has appointed a committee composed of R. H. Johnson, F. W. Kaser and George E. Kellough to petition the city council to connect the city paving with the College Place macadam road. They will endeavor to get the desired improvement of the streets at the end of Main and Rose, near the O. R. & N. depot.

Olympia, Wash.—State highway commission has awarded the contract for three sections of state road No. 5 in Lewis county, to Young & Landes of Chehalis; for state road No. 2 in Stevens county to J. M. Noble & Co., of Spokane; and for state aid road No. 78 in King county to F. Kerr Folliott of Seattle.

Fort Monroe, Va.—Following bids were received by Ernest R. Tilton, constructing quartermaster at this place, for filling, grading, etc., around new building on the 27th inst.: R. H. Richardson & Bros., Hampton, Va., $2,248; G. E. Trice & Co., Hampton, Va., $2,027; P. F. Connolly Co., Jamaica Plains, Mass., $3,166.

Moundsville, W. Va.—County court has voted to widen the county road from the Glendale postoffice to a few feet on the north side of Newman's run, a distance of about 400 ft. A strip of ground, about seven ft. in width, will be taken from the property on the west side of the road.

Beckley, W. Va.—City has voted the issuance of bonds in the sum of $60,000 for paving the streets and sewerage.

Green Bay, Wis.—Brown County commissioners and Supt. of Highways Henry Van den Heuvel have awarded contracts for the improvement of three highways as follows: M. Brunette, at $1.44 per yd., river road in the town of Ashwaubenon, with crushed stone; Peter Larson, at 90c to $1.15 per yd., Ridge road in the same town, with gravel; Charles Kropp, at $5.25 per rod, Shawano road west of Burdon's hill, with crushed stone.

WATER-WORKS AND SEWERAGE

Fort Morgan, Ala.—The constructing quartermaster at this place has awarded a contract to W. C. Pease of Atlanta, Ga., for the construction of a reinforced concrete cistern with a capacity of 11,500 gals. Bids were opened June 21.

Albertville, Ala.—Mayor W. D. Goodwin has called an election on July 12 for the purpose of allowing the citizens to vote on the question of issuing $25,000 of bonds for building a system of water works for the town.

Bessemer, Ala.—City council has granted a franchise to the Birmingham Water, Light & Power Co. The company proposes to construct the system within two years.

Phoenix, Ariz.—On June 15 city voted to issue bonds in the sum of $400,000 for the construction of a sewer system.

Ola, Ark.—City council has awarded a contract to the Kress Construction Co., of Struttgart, Ark., for the construction of the waterworks and electric light plant for the city. The amount of the contract is $35,000

Little Rock, Ark.—Homer Water Co., of this city has filed a certificate with the secretary of state, showing that it had increased its capital stock from $50,000 to $500,000 for improvements. S. A. Setarns is president of the company.

San Francisco, Cal.—Board of public works has awarded a contract to the Mettropolis Construction Co., for laying the new sewer in Seventh St., from Howard to Hubbell, the accepted bid being $59,000.

Willows, Cal.—Town trustees contemplate the extension of the sewer system and will probably call for a bond issue at once.

Oakland, Cal.—City council has recommended an appropriation of $1,500 for the purpose of building a sewer on Alice St., from 13th St., to 19th St.

Sawtelle, Cal.—The Commercial club's special committee named at a recent public meeting for the purpose of securing estimates and data relative to the proposed sewer system, has submitted a report showing that the cost would not exceed $50,000.

San Francisco, Cal.—The Green Valley Improvement club has appointed a committee to secure a right-of-way for a bond sewer from Mt. Vernon Ave., to Springdale St.

Sutter Creek, Cal.—Town contemplates the construction of a sewer system.

Alameda, Cal.—Plans and specifications for the construction of the south side sewers have been adopted by the city council. Bids for the work will be advertised for in the near future.

Oakland, Cal.—Bay Cities Water Co., of Oakland, Cal., has announced that preliminary plans are being perfected for the development of its watersheds at Mount Hamilton and the delivery into this city, Alameda and Berkeley, of an estimated 20,000,000 gals. of water daily. The work is to necessitate the expenditure of $15,000,000. Two-thirds of the amount is needed in building four reservoirs and a series of trunk mains from the watersheds into this district. The remaining $5,000,000 is to be expended in installing the local distributing system. Engineer C. E. Gilman is local manager of the company.

Sacramento, Cal.—Directors of the White Crusaders recently held a meeting in the office of Dr. Briggs', 1005 K St., city, and decided to put in a new sanitary sewer system at the sanitarium at Alta. The estimated cost of the system is $400. A new water system is also to be installed to serve for irrigation purposes. It is estimated that the water system will cost $1,400.

San Francisco, Cal.—The sewer committee of the Ocean View Improvement club has reported that the bonds for the construction of the San Jose Ave., branch of the Wyoming Ave., sewer had been sold and that work on the construction of the outlet will commence within a short time.

San Pedro, Cal.—The water mains on Terminal Island will be extended to Brighton Beach Hotel and connected with the fire pump at the mill of the National Lumber Company.

Colorado Springs, Colo.—The State Realty Co., has let a contract to Argust Bros., for the construction of 1,700 ft. of 8-in. sewer through their recent State addition to the city.

Denver, Colo.—The Denver-Arapahoe Underflow & Water Co., of which Howell Givens and W. D. McKinney are president and engineer respectively, has offered a full supply of water to this city. This company has filed on certain sites along the north side of the Arkansas ridge, where they contemplate installing headworks to tap the underflow in the sand beds beneath the surface. By this means it is asserted that they can secure 50,000,000 gals. of water daily. The plans also include the building of five storage reservoirs outside the city, with combined capacity of approximately 5,250,000,000 gals.

Denver, Colo.—Board of suprvisors has passed a bill providing for a special election Sept. 6, to vote on an $8,000,000 bond issue for the construction of a new water system or the purchase of the present plant at $7,000,000.

Denver, Colo.—City will hold a special election Sept. 6 to vote on the issuance of bonds in the sum of $8,000,000 for the construction of a new water works system.

Bristol, Conn.—Bristol Water Co., of this city will erect a new gate house in the near future from plans prepared by Metcalf & Eddy, Engineers of Boston, Mass.

Atlanta, Ga.—City has awarded the contract for the construction of a 10,000,000 gal. capacity filtration plant to the New York Continental Jewell Filtration Co., for $31,000.

Grangeville, Ida.—City council has awarded a contract for the construction of a sewer system and septic tank to Triber & Moore of Tacoma for $39,000. Other bidders were: John Fife, Spokane, $53,000; John F. Costello, Spokane, $51,000; W. A. Smith, Lewiston, $49,318; J. Broad, Spokane, $47,695.

Pocatello, Ida.—Plans and specifications for the construction of a sewer system in this city are on file at the office of the city engineer.

Anna, Ill.—Board of local improvements has employed Charles W. Brown of Jacksonville, Ill., to make surveys and get up plans and specifications and estimates of cost for a system of sewers and water mains for the city.

Beecher, Ill.—Village board has decided to install an air pressure water works system in the city. Attorney Richard J. Barr of Joliet will be the legal adviser.

Belvidere, Ill.—City council has voted to advertise for bids for a pump at the waterworks for the new artesian well.

Bushnell, Ill.—Peter Simons of Quincy, Ill., has been awarded the contract for the construction of the new sewer system for this city at $22,000.

Clinton, Ill.—City has awarded a contract to Messrs. Lillard & McNier of this city for the construction of a sewer on North Madison St. The length of the sewer will be 1,105 ft. Work will be commenced at once.

East Alton, Ill.—City contemplates the installation of a waterworks system.

Galesburg, Ill.—City will soon advertise for bids for furnishing the following for improvements at the waterworks: Two Franklin fly wheel pumps with capacities of 6,000,000 and 4,000,000 each; one cover for the storage reservoir; a partition in the reservoir; two 350 h.p. boilers, with a steam pressure of 150 lbs. each, a smoke stack, coal house, etc.

Joliet, Ill.—Plans and specifications for the construction of a $100,000 trunk sewer system for this city will be completed by City Engineer Stevens next year. The sewer will be two miles long, having a circumference of 8 ft. at its mouth. It will practically have the same course as the present slough drain and will empty into the Desplaines River. J. R. Cronin is mayor.

Kankakee, Ill.—Board of public works has awarded a contract to C. W. Lake for $1,000 and $875, for building two sections of sewers in Swannell's Second addition.

Monmouth, Ill.—Waterworks committee of the city council has decided to buy another compressor for the pumping station.

Peoria, Ill.—City council has passed ordinances for the construction of sewers in districts No. 2 and 3. These two districts cover practically all of the north side of the city and means an expenditure of approximately $114,000, of which $84,000 is for No. 3.

Rock Island, Ill.—Condemnation proceedings in the west section of the proposed Seventh ward sewer system took place in the county court recently and considerable of the necessary right of way was secured.

Rockdale (P. O. Joliet), Ill.—Plans are under way for the installation of a water works system. The system will probably be installed this summer.

Springfield, Ill.—Waterworks committee has taken favorable action on an order authorizing the committee to investigate the advantages of enlarging the waterworks plant for the purpose of installing the electric generating plant, also authorizing the mayor and city council to advertise for bids for a 12,000,000 gal. high pressure pump to be installed at the waterworks.

Michigan City, Ind.—City Engineer Miles has submitted plans for a district sewer to be known as the Holliday district sewer to the board of public works. The sewer is to be laid in Holliday St., from Carroll Ave., to the Romel ditch. Plans have also been completed for a 12-in. vitrified tile sewer in Holliday St., from Case St., to Vail St.

Terre Haute, Ind.—City council has decided in favor of the issuance of bonds in the sum of $40,000 for the building of sewers in the city.

Perry, Ia.—City council has awarded contracts to Zitteral & Sullivan of Iowa City at $2,579, and William Horabin at $1,255 for the construction of a storm and sanitary sewer respectively.

Columbus Junction, Ia.—A sewerage system is to be put in operation in this city this fall. The movement has been agitated by the Commercial association for several months.

Cresco, Ia.—Bids opened June 20 by City Clerk P. J. McCullow, for the construction of the following sewers have been rejected: Sec. 1, main sewer No. 2, about 1,900 ft. of 12-in. sewer; Sec. 2, main sewer, No. 2, about 1,750 ft. of 12-in. sewer; lateral sewer No. 9, about 1,300 ft. of 8-in. sewer; lateral sewer No. 10, about 1,300 ft. of 8-in. sewer. The work will probably be readvertised in July.

Knoxville, Ia.—J. W. Turner Improvement Co., of Des Moines, Ia., has been awarded a contract by this city for the construction of an 8-in. sewer. The work includes 2,185 ft. of 8-in. sewer, 4-in. drain, at $1.41½, six manholes, one combination manhole and flush tank; 2,740 ft. of 8-in. sewer, 4-in. drain, $1.03¾, seven manholes, two combination manhole and flush tanks. Bids were opened June 27.

Waterloo, Ia.—Water commissioners have ordered new water main laid as follows, all of 6-in. pipe: On Courtland St., from Elm to Mobile, 500 ft.; Vermont St., from Fourth to Fifth, 450 ft.; Randolph St., Ninth St. to Grant Ave., 800 ft.; Sunnyside Ave., Leland to Randall, 300 ft.; Linden Ave., Independence to Glenwood, 650 ft.; Bayard, Fourth to Fifth, 550 ft.; Barclay, Sumner to Oneida, 730 ft.; Oneida, Barclay to Jackson, 730 ft.; Ricker, Fourth to Manson, 800 ft.; Hammond Ave., Byron St., 450 ft.; Bayard, Fifth to Willison, 100 ft., 12-ft. main; Riehl, Columbia to Broadway, 675 ft., 12-in. main.

Englewood, Kan.—Plans and specifications are being prepared by J. S. Worley Co., 206-7 Reliance Bldg., Kansas City, Mo., for the construction of a new waterworks system for this city. It is estimated that the system will cost $20,000. The contract will be let some time in October or November.

Holton, Kan.—Attorney General Jackson has examined and approved the bonds for the sewer and disposal works issued by this city. The bonds are in two issues, $16,000 for disposal works and $9,000 for sewers.

Nickerson, Kan.—A committee of the city council headed by Chas. Wooddell was in Hutchinson recently to have ordinances drawn up to provide this city with a sewerage system. The entire city is to be established into a sewer district and it is the intention of the council to have the sewer installed before school opens next fall.

Topeka, Kan.—City commissioners for Topeka, Kan., are planning the construction of a belt line sewer that will cover the entire southwestern and western part of the city, including several of the new additions and connecting as well as relieving existing sewers. Commissioner Tandy and City Engineer W. S. Fulton are at present laying out the permanent route. The sewer will head from Euclid Ave., out near Washburn college and follow the College Hill addition, north on Washburn Ave., to 10th Ave., thence east on 10th Ave., to Summit Ave., and over to Sixth Ave., thence along the asylum road [illegible]

Topeka, Kan. [illegible]

Yates Center, Kan.—Plans and specifications are being prepared by J. S. Worley Co., 206-7 Reliance Bldg., Kansas City, Mo., [illegible] system for this city. The work will in- [illegible] $25,000. The sewer system will cost about $85,000.

Bangor, Me.—[illegible] N. Y., has received an appointment from [illegible] is $70,000. Bids for the plant will be [illegible]

Portland, Me.—The Mahoney Construction Co. of 102 Cumberland Ave., this city, has been awarded a contract for the construction of 2,598 lin. ft. of 8 and 10 in sewers for $10,190. The work includes 373 lin. ft. of earth excavation, depth not exceeding 23 ft.; 640 lin. ft. of earth excavation, depth not exceeding 18 ft.; 632 ft. of earth excavation, depth not exceeding 14 ft.; 953 ft. of excavation, depth not exceeding 10 ft.; 3,400 lin. ft. of 1-ft. ledge excavation; nine manholes; 12 cu. yds. of concrete masonry in trench; 600 lin. ft 6 and 8 in. under drain. Bids for this work were opened July 1.

Laurel, Md.—Mayor William Gilbert called a special election for July 5 to vote on the proposition of issuing bonds in the amount of $35,000 for the construction of [illegible]

Worcester, Mass.—City council committee on sewers voted to recommend the expenditure of $12,975 for sewer construction, and also to consult Mayor James Logan with a view to raising $10,500 more for additional work.

Calumet, Mich.—Wick O'Connell & Co., have been awarded a contract by the city council for the construction of the new west Hancock district sewer at $18,497; Close & Hodgson receiving the contract for furnishing the sewer pipe for same at $2,377.

Minneapolis, Minn.—Water committee of the city council is considering the necessity of installing new pumps and new mains to reinforce the system. Supervisor Sykes has recommended that an electric pump of 30,000,000 gal. capacity be installed, and City Engineer Andrew Rinker has advocated the installation of a triple-expansion pump of 20,000,000 gal. capacity.

Cleveland, Miss.—[illegible] pared by Xavier A. Kramer, [illegible] Miss., for the construction of a [illegible] works for this city at an estimat[illegible] $20,000. The work will include a [illegible] pumps and 150 tons of pipe. The co[illegible] will be let in about 60 days.

Dexter, Mo.—City contemplates the con- [illegible]

Liberty, Mo.—Plans have been prepared by City Engineer E. H. Collins for extensions to the water works system. The [illegible] includes 16,000 ft. of 4-in. cast iron [illegible] and 5,000 ft. of 6-in. pipe and [illegible] obtained from wells. The contract for the work will be left about July 22

Montgomery City, Mo.—C[illegible] present water works system. Muller [illegible] Co., Chemical Bldg., St. Louis, Mo., has been retained as engineer.

Lestershire, N. Y.—City contemplates the construction of a settling tank at the water works and the extension of the mains through the Jenison tract and Main St.

St. Louis, Mo.—The board of public improvements of St. Louis, Mo., has awarded a contract for the construction of the first section of the Baden sewer to the Hoffman-Hogan, Construction Co., for $288,157, which is about $25,000 above the original estimate. Following bids were opened on the second section of the River Des Peres' foul water sewer, the Universal Construction Co., submitting the lowest: Scott, Hannon & Hickey, $616,519; John F. McMahon, $614,638; Fruin-Colnon Contracting Co., $678,033. Universal Construction Co., $604,519. The estimate was $615,000. The contract has not as yet been awarded.

Grand Island, Neb.—City will shortly secure a consulting engineer to superintend the proposed extension of the water works.

Lincoln, Neb.—City held an election June 30 to vote on the issuance of bonds for the construction of the N and B Sts. storm sewers.

Atlantic City, N. J.—City has awarded a contract for the construction of a new pumping station to Edward L. Baden of Bartlett Bldg., this city, at $48,200. The contract for electrical wiring, etc., has been awarded to F. A. Chapman of this city at $2,240. Bids were opened June 28.

Las Vegas, N. Mex.—Messrs. Metcalf & Eddy, Engineers, of Boston, Mass., are acting as consulting engineers for this city regarding the improvement of its water supply. The improvements will include a new storage reservoir.

Brooklyn, N. Y.—The Department of Water Supply, Gas and Electricity, has awarded a contract to Hagerty, Drummond & Co., 41 Park Row, New York, for furnishing, delivering and laying high pressure mains with valves, hydrants and other appurtenances in Livingston and Remson Sts., and in Elm and Gallatin Places in Borough of Brooklyn. Bids were opened June 22.

Lyndonville, N. Y.—Village board held a meeting recently to discuss the question of constructing a system of waterworks.

Perry, N. Y.—City held a special election June 21 to vote on the proposition of expending $12,000 in improvements to the pumping station at Silver Lake.

Schenectady, N. Y.—City contemplates the construction of a system of reservoirs to increase the water supply. George T. Ingersoll is interested.

Spencerport, N. Y.—Bids were opened June 21 by this village for constructing waterworks, the contract being let to Chas. R. Lewis, Tilton, N. Y., at the following bid:

Trenching & laying 4" lin. ft.	1,850	$ .21
Trenching & laying 6" lin. ft.	11,226	.23
Trenching & laying 8" lin. ft.	5,850	.28
Trenching & laying 10" lin. ft.	3,890	.30
Setting Hydrants	44	2.00
Setting 4" Valves	9	.50
Setting 6" Valves	21	.60
Setting 8" Valves	3	.75
Setting 10" Valves	5	1.00
C. I. Pipe Furnishings, 4" tons	20	26.60
C. I. Pipe Furnishings 6" & 10" tons	490	24.60
Special Castings, Furn. lbs.	20,000	.02½
Hauling Pipe, tons	520	.50
Furnishing Hydrants	44	23.00
Furnishing Valves, 4"	9	6.50
Furnishing Valves, 6"	21	10.50
Furnishing Valves, 8"	3	16.00
Furnishing Valves, 10"	5	21.00
Furnishing Valve Boxes	38	3.00
Concrete, cu. yds.	[illegible]	[illegible]
Elevated Tank	1	5,130.00
Pumping Station		[illegible]
Pumping Equipment	1	[illegible]
Well	1	[illegible]
1 Well Extra per ft. below 18'	1	150.00
Earth Excavation, cu. yd.	[illegible]	[illegible]
Rock Excavation, cu. yds.	100	.50
Canal Crossing	...	25.00
Total		$ [illegible]

Morrison & Farrington & Bowman, Syracuse, N. Y., are the Consulting Engineers.

Yorkville, N. Y.—Board of trustees has engaged Engineer W. G. Stone of Whitestown to make complete plans and specifications for the construction of a sewer system. After the plans are drawn up and approved by the state authorities an estimate on the cost will be made and the proposition voted on at a special election.

Minot, N. Dak.—City council has voted to extend the water main in the city.

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Hardin, Ill.—Until 1 p. m., July 11, by John Day, Jr., County Clerk, for the construction of a steel bridge across the Lessig branch in Point precinct in Calhoun County.

Forest City, Ia.—Until 1 p. m., July 10, by L. J. Nelson, County Auditor, for the construction of a concrete bridge with two 50-ft. arches, 16 ft. clear highway and 5-ft. walk.

Frankfort, Ind.—Until 2 p. m., July 6, by Board of County Commissioners for three pair of 20 bridges and the construction of one new bridge. C. F. Cromwell is Auditor of Clinton County.

Minneapolis, Kan.—Until noon, July 25, by H. A. Brownlee, County Clerk, for the construction of Morton Bridge, No. 1, 30-foot reinforced concrete span; 16-foot roadway; concrete railing; height of abutments 9.5 feet. Total amount of concrete 76.5 cubic yards; steel reinforcement about 7,999 pounds. Excavations will be in gumbo; foundations are to be carried 3.5 feet below bed of stream. Nearest railroad station. Tescott, 1-2 mile. Crushed stone and sand must be shipped by railroad.

Minneapolis, Kan.—Until noon, July 25, by H. A. Brownlee, County Clerk, for Buckeye Bridge No. 2. Three reinforced concrete spans of about 18 feet, 3 inches each; 16-foot roadway; concrete railing; height of piers and abutments, 7 feet. Total amount of concrete 109.2 cubic yards; steel reinforcement about 7,366 pounds. Excavations will be in clay; foundations to be carried 3.5 feet below bed of stream. Nearest railroad station, Birdseye, 2¾ miles. Crushed stone must be shipped in. Sand can be had at twenty-five cents per load one mile from bridge site.

Minneapolis, Kan.—Until noon, July 25, by H. A. Brownlee, County Clerk for Buckeye Bridge, No. 1. Three reinforced concrete spans of about 18 feet 3 inches each; 16-foot roadway; wrought iron pipe railing; height of piers and abutments 7 feet. Total amount of concrete 96.2 cubic yards; steel reinforcement about 7,121 pounds. Excavations will be in sand; foundations are to be carried 5 feet below bed of stream and piles may have to be used. Nearest railroad station, Bennington, 3¼ miles. Crushed stone must be shipped in. Sand can be had one mile south of bridge site and probably closer for twenty-five cents per load.

Hastings, Minn.—Until 10 a. m., July 26, by F. A. Hoffman, County Auditor, for the construction of an approach to the Cedar Ave. bridge located over the Minnesota River, in Dakota County.

Minneapolis, Minn.—Until noon, July 25, by H. A. Brownlee, County Clerk, for Garfield Bridge, No. 1., 150-foot steel span; roadway 16 feet; wood floor, concrete floor, alternative. Plain concrete abutments; East abutment 38 feet high and West abutment 16 feet high. Total amount of concrete about 398.4 cubic yards. Excavation will be in clay; foundation east abutment is to be carried 5 feet below bed of stream; footing of West abutment will be above water of ordinary flow. Piles may have to be used. Nearest railroad station, Summerville, ½ mile. Crushed stone must be shipped in. Sand can be gotten from river, haul 2 mile.

New York, N. Y.—Until 2 p. m., July 7, by Department of Bridges, 13-21 Park Row, New York, for the construction of a temporary, bridge over the Hutchinson River at Boston Road in the Borough of Bronx. Kingsley L. Martin is Commissioner.

Schenectady, N. Y.—Until July 11, by County Commissioners for the reconstruction of the iron bridge over the Chenango River at Chenango Bridge. Bids will be received for either steel or concrete structures. Bonds amounting to $19,000 have been issued for the improvement.

Williston, N. Dak.—Until 10 a. m., July 20, by Board of County Commissioners, for the construction of six county bridges. E. M. Atterberry is auditor of Williams County, N. Dak.

Defiance, O.—Until 2 p. m., July 18, by S. I. Gruner, County Auditor, for the necessary labor and material for the superstructure of two bridges across the Miami & Erie Canal one on Thurston street and the other on Deat[illegible] street, in Defiance, O. A certified check for $500 must be filed with each bid.

Barberton, O.—Until noon, August 1, by Jay W. Tracy, Village Clerk, for the construction of a viaduct over the Erie R. R. tracks at Cornell St. The estimated cost of the village's share is $39,224. Official advertisement will be found elsewhere in this issue.

Philadelphia, Pa.—Until noon, July 20, by Department of Public Works, for Schedule D, construction of a substructure of seven track steel bridge over "N" street under Connecting Ry., consisting concrete abutments and [illegible] grading and paving the st[illegible]

Winnipeg, Man.—Until [illegible] p. m., July 20, by J. E. Schwitzer, Assistant Chief Engineer, Canadian Pacific Ry., Winnipeg, Man., for the erection of the substructure of bridge over the North Saskatchewan River at Edmonton, Alta. Plans are on file at the offices of A. L. Hertzberg, Division Engineer, Toronto; C. N. Monsarrat, Engineer of Bridges, Montreal; N. E. Brooks, Division Engineer, Calgary, Alta.; H. Rindal, Division Engineer, Vancouver, B. C.; and J. E. Schwitzer, Assistant Chief Engineer, Winnipeg.

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Chicago, Ill.—Until 11 a. m., July 6, by Department of Public Works, B. J. Mullaney, Commissioners for the labor and material necessary for the construction of a one story frame ward office at the northwest corner of North avenue and Paulina street.

Litchfield, Ill.—Until 3 p. m., August 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Litchfield, Ill.

Decorah, Ia.—Until 3 p. m., August 10, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at this city.

Fairport, Ia.—Until 2 p. m., July 26, by Commissioner of Fisheries, Department of Commerce and Labor, Washington, D. C., for the construction of a boiler and pump house at the biological station on government reservation at Fairport, Ia.

Brazil, Ind.—Until 11 a. m., August 8, by Board of County Commissioners for the construction of plumbing, heating and electric plant for new county infirmary. J. L. Burns is Auditor of Clay County.

Newport, Ind.——Until July 11, by County Commissioners for the construction of concrete milk house, 20 x 14 at poor farm. H. T. Payne is Auditor of Vermilion County.

Munden, Kan.—Until noon, July 11, by George W. Bushby, Clerk, Board of Education, for the construction of a four-room brick and stone school building. N. P. Nielson, 501 Jackson St., Topeka, Kan., is Architect.

Chelsea, Mass.—Until 3 p. m., August 4, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Chelsea, Mass.

Woburn, Mass.—Until 3 p. m., August 9, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas fitting, heating apparatus, electric conduits and wiring, of the United States post office at this city.

Norfolk, Neb.—Until 8:30 p. m., July 15, by D. Mathewson, Chairman of the Building Committee of the Y. M. C. A., for the construction of a 3-story brick association building at Norfolk.

Amsterdam, N. Y.—Until 3 p. m., August 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at this city.

Cincinnati, O.—Until 2 p. m., July 27, by Lieut. Col. J. G. Warren, U. S. Engineer, Cincinnati, O., for the construction of four lock tenders' dwellings at Dam 37, Ohio River.

Sherwood, O.—Until noon, July 18, by H. C. Lindersmith, Clerk, Board of Education, for the erection of a 6-room school building. R. A. Bradley, 208 Bank Blk., Fort Wayne, Ind., is Architect.

Sioux Falls, S. Dak.—Until 3 p. m., July 26, by Rt. Rev. Thomas O'Gorman, Sioux Falls, S. Dak., for the complete erection of a three-story basement and attic fireproof hospital building, also the enclosure of said building without any plaster or finish.

Palestine, Tex.—Until 3 p. m., August 19, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office at Palestine, Tex.

Fort Monroe, Va.—Until 10 a. m., July 18, by Capt. Ernest R. Tilton, Constructing Quartermaster, for the construction of an addition to the post hospital at Fort Monroe, Va.

Toronto, Ont.—Until noon, July 12, by Chairman of the Board of Control, G. R. Geary, for the construction of a new fire hall on Main St., East Toronto. Plans and specifications are on file with the City Architect. The work includes mason work, carpenter work, galvanized iron and roofing, gas fitting and plumbing, hot water heating, electric wiring, plastering, painting and glazing.

Saskatoon, Sask.—Until 6 p. m., July 9, by Sawyer-Massey Co., Ltd., Winnipeg, Man., for the complete work of erection of a reinforced concrete and brick warehouse to be built at

Saskatoon, Sask. W. W. [illegible] Yorktown and Saskatoon, is architect

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Atlanta, Ga.—Until 3 p. m., July 18, by City Clerk, for paving the following streets: Marietta from Tabernacle Place to North av., approximately 17,000 sq. yds., with creosoted blocks. Forsyth st., from Marietta st. to Luckie st., approximately 3,300 sq. yds., with creosoted blocks. DeKalb ave., from Moreland ave. to Mayson's ave., approximately 12,000 sq. yds. with macadam with asphalt binder. R. M. Clayton is City Engineer.

North Chicago, Ill.—Until 10 a. m., July 12, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for constructing roads and walks under schedule 2610 at Naval Training Station, North Chicago, Ill.

Osceola, Ia.—Until 7:30 p. m., July 14, by W. N. Temple, City Clerk, for the construction of approximately 13,000 sq. yds. of [illegible] lin. ft. of curb. The pavement will be of vitrified brick on 5-in. concrete foundation and sand cushion.

Marshalltown, Ia.—Until 8 p. m., July 11, by City Clerk, for paving certain streets and alleys. Work comprises about 12,700 sq. yds. of brick block pavement and 4,800 lin. ft. of concrete curb and gutter.

Frankfort, Ind.—Until 2 p. m., July 9, by Board of County Commissioners for the construction of fifteen gravel roads in the county. Charles F. Crowell is Auditor of Clinton County.

Indianapolis, Ind.—Until 10 a. m., July 8, by Board of Public Works, for the improvement of Dayly St., from the west property line of Cruse St. to the east property line of Pine St. by grading and paving the roadway.

Indianapolis, Ind.—Until 10 a. m., July 8, by Board of Public Works for the improvement of Maryland St., from the west property line of Alabama to the north east property line of Virginia avenue, by resurfacing the roadway with brick.

Indianapolis, Ind.—Until 10 a. m., July 8, by Board of Public Works for the improvement of Maryland St., from the southwest property line of Virginia Ave., to the south east property line of Kentucky Ave., by resurfacing the road way with brick.

La Porte, Ind.—Until 10 a. m., July 14, by County Commissioners, for the construction of a macadam road in Center township 7½ miles in length. C. H. Miller is Auditor of Laporte County.

Boston, Mass.—Until 11 a. m., July 23, by N. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for paving between rails of the crane track, U. S. Navy Yard, Boston, Mass.

Crystal Falls, Mich.—Until 8 p. m., July 11, by William J. Gribble, City Clerk, for grading and paving with tar macadam portion of Superior Ave.

Dowagiac, Mich.—Until noon, July 18, by Wm. T. Easton, City Clerk, for furnishing all labor and material, grading, excavating and paving Green St. from Division to Wayne St. The work includes 4,300 ft. of curb and gutter and 7,000 sq. yds. of macadam.

Lansing, Mich.—Until 4 p. m., July 11, by City Clerk, for paving Capitol Ave. The work includes 6,354 sq. yds. of asphaltic concrete, 3,175 lin. ft. of cement curb and gutter. H. A. Sparks is City Engineer.

Littleton, N. H.—Until 1 p. m., July 15, by H. C. Hill, State Engineer, Concord, N. H., for the construction of native stone road in this town. The work is estimated to cost $5,000.

New York, N. Y.—Until 11 a. m., July 7, by Cyrus C. Miller, President of the Borough of Bronx, Municipal Bldg., Crotona Park, for seven street improvement contracts the largest one being as follows: No. 2, for paving with asphalt blocks on a concrete foundation the roadway of Vyse (St.) Avenue, from Home Street to East One Hundred and Seventy-second Street, and setting curb where necessary. The Engineer's estimate of the work is as follows: 5,670 sq. yds. of completed asphalt block pavement, and keeping the same in repair for five years from date of acceptance. 913 cu. yds. of concrete, including mortar bed. 800 lin. ft. of new curbstone, furnished and set in concrete. 2,650 line ft. of old curbstone, rejointed, recut on top and reset in concrete.

Beach City, O.—Until noon, July 12, by Clerk of the Council for the improvement of Main St. and West St. The improvement includes setting stone curb and concrete combined curb and gutter, paving with vitrified paving block on gravel foundation with necessary drainage. The estimated cost of the work is $13,789.31. L. E. Chapin, Canton, O., is Engineer.

Cincinnati, O.—Until noon, July 8, by Board of County Commissioners for constructing under Specifications No. 71, concrete bridge and widening of road on Harris Ave., Mt. Washington in Anderson Township.

Cincinnati, O.—Until noon, July 22, by Board of County Commissioners, for the improvement of Miles road under Specifications No. 66, between the two iron bridges in Springfield township. Fred Dreihs is Clerk.

Mt. Gilead, O.—Until July 8, by W. B. Ells, [illegible]

[illegible]

LaFollette, T[illegible]

Freehold, N. J.—[illegible] gravel road under the provisions of the New Jersey State Aid Road Laws in Mo[illegible] third section thereof beginning at th[illegible] River and running southerly a distan[illegible] miles to the southerly end of secti[illegible] is Engineer in Charge.

Freehold, N. J.—Until 11 a. m., July 13, by Board of Chosen Freeholders, George W. Patterson, Jr., Clerk, for the construction of a gravel road under the provisions of the New Jersey State Aid Road Laws in Monmouth County, New Jersey, known as the Allentown and New Egypt Road (via Davis and Cream Ridge), a distance of 10,276.4 ft. or 1,946 miles. George K. Allen, Jr., County Engineer.

Sherman, Tex.—Until Aug. 10, by J. Q. Adamson, County Judge, for the construction of 65 miles of roadway 14 ft. wide on steel and concrete foundation with asphalt binder. The estimated [illegible] Feild Bldg., Denison, Tex., is Engineer.

Fort Ward, Wash.—Until 11 a. m., July 11, by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for roads, walks, grading, etc., at this post.

Fort Worden, Wash.—Until 11 a. m., July 12 by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of roads, walks, grading, etc. at this post.

Martinsburg, W. Va.—Until about July 15, by Tuscarora Realty Co., Martinsburg, W. Va., for the construction of about 12,000 sq. yds. of stone macadam pavement, 5,000 ft. of concrete curb and gutter, 13,500 sq. ft. concrete sidewalks. The work includes about 10,000 cu. yds. of excavation, largely rock.

Waukesha, Wis.—Until July 11, by Board of Public Works, for furnishing labor and material necessary for paving with tar macadam White Rock Ave., East Park Ave., Cook St., and Center Street and Lincoln Ave., with brick pavement on a concrete base. The work includes gutter. The estimate of Morgan R. Butler, City Engineer is as follows: 15,450 cu. yds. of excavation; 31,139 sq. yds. of macadam, 21,435 ft. of curb gutter; 5,770 sq. yds. of brick paving together with necessary drains, foot bridges and catch basins.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Putnam, Conn.—Until 4 p. m., July 6, by City Clerk, for the first contract of the proposed sewer system. C. E. Chandler, Norwich, Conn., is Engineer.

Dubuque, Ia.—Until 8 p. m., July 7, by Otto P. Geiger, City Recorder, for the construction of a reinforced concrete storm water sewer, known as the Bee Branch Sewer, top and walls, between the 16th and 17th Sts., and Ceder and Sycamore Sts. A certified check for $500 must be filed with each bid.

Indianapolis, Ind.—Until 10 a. m., July 11, by Board of Public Works, for the construction of local sewers with appurtenances in and along the alley east of Sherman Drive from Washington street of a point 18 ft. north of the second alley south of Washington St.

Indianapolis, Ind.—Until 10 a. m., July 11, by Board of Public Works, for the construction of local sewers with appurtenances in and along the alley north of 33d St. from Clifton St. to Barnes Ave.

Indianapolis, Ind.—Until 10 a. m., July 11, by Board of Public Works for the construction of local sewers with appurtenances in and along the alley north of Thirty Fifth St. from Clifton St. to Barnes Ave.

Indianapolis, Ind.—Until 10 a. m., July 11, by Board of Public Works, for the construction of local sewers and appurtenances in and along Beecher St. with extensions.

Fort Wayne, Ind.—Until 7.30 p. m., July 14, by Board of Public Works, for the construction of a number of sewers in this city. H. W. Becker is Clerk of the Board.

Herington, Kan[illegible] 12th as noted in our last issue), by City Council for the construction of about [illegible] sewer including the construction of [illegible] Engineers.

Sabetha, Kan.—Until July 12, by City, for the construction of approximately 8 miles of sewers including two septic tanks. Burns & McDonnell Scarritt Bldg., Kansas City, Mo., are Engineers.

Haddon [illegible] by Frederick P. Burkart, Borough Clerk, for the construction [illegible] in this city. City Wastes Disposal Co., 156 Fifth [illegible] pipe sewers, 8-in. to 12-in., laid complete, with manholes and flush tanks; a small indeterminate [illegible]

[illegible] point about thirteen [illegible]

New York, N. Y.—Until 11 a. m., July 14, by [illegible] construction company [illegible] and Fifty-sixth St.), and in La Fayette Av[illegible] cu. yds. of brick masonry; 32,500 cu. yds [illegible] concrete; 4,500 cu. yds. of Class "D" concrete, [illegible] to 1 1-4 inch); 261,000 pounds of structural steel; 6,600 sq. ft. of wire netting, 2-in. by 2-in. mesh. [illegible] ft. of wrought iron fence; 90 sq. yds. of vitrified brick pavement.

Hampton, O[illegible] to Reservoir St.

Lakewood, O.—Until noon, July 18, by B[illegible] avenue.

Philipsburg, Pa.—[illegible] partment of [illegible] for the follo[illegible]

LaFollette, Tenn.—Until July [illegible] lor is Mayor.

[illegible] sary labor [illegible] for $1,000. C. [illegible] gineer.

Amarillo, Tex.—Until 10 a. m., July 20 (readvertisement of bids called June 28), by Samuel J. Brown, City Secretary, for the construction of sanitary sewers. The work will consist of approximately 11,100 ft. of 15-in., 8,155 ft. of 12-in., 30,835 ft. of 6-in. E. L. Dalton, Dallas, Tex., is Engineer.

Steelton, Ont.—Until 8 p. m., July 13, by J. Robinson, town clerk, for the following: A, Labor and certain materials in construction of sewers. B, Vitrified tile pipe and junctions. C, Cast iron manhole covers. D, About 600 ft. of concrete sewer, sixty-six inches in diameter. The entire length of the system is about 6 miles.

Toronto, Ont.—Until noon, July 26, by Board of Control, G. R. Geary, chairman, for the Section No. 6. of High Level Interceptor. The sewer consists approximately of 1,340 lin. ft. of reinforced concrete pipe sewer, 5 ft. internal Diameter, extending from Defoe St. at Stanley Park, in a northerly direction to a point about 500 ft. north of Queen St. Specifications may be obtained from, and original drawings will be on file and can be seen at the Main Drainage Department, City Engineers' Office.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Clinton, Ia.—Until 8 p. m., July 12, by S. G. Mitchell, City Clerk, for drilling an artesian well. A certified check for $300 must be filed with each bid. Iowa Engineering Co., Clinton, Ia., are engineers.

Wyandotte, Mich.—Until 7:30 p. m., July 13, by John L. Sullivan, Secretary of the Board of Public Works, for a pumping engine and intake pipe.

Chisholm, Minn.—Until noon, July 22, by E. I. Casey, Village Recorder, for the construction of two reinforced concrete settling basins and appurtenances for the improvement of the water purification plant of the village. Daniel W. Mead, Madison, Wis., is Consulting Engineer. The estimated cost of the work is $8,000.

Pike, N. Y.—Until 7 p. m., July 11, by T. H. Culver, president, and trustees of village for the construction of a gravity water supply system. Bids will be received as follows: 1st. Hauling and laying, as follows: About 8,913 ft. of 4" cast-iron pipe; about 930 ft. of 6" cast-iron pipe; about 1,835 ft. of 8" cast-iron pipe; about 5,160 ft. of 8" wood pipe; hauling and setting hydrants, valves, valve-boxes, specials, etc., according to the plans and specifications. 2d. Constructing concrete reservoir, spring house, overflow pipe and ditch pipe line about 128 ft. long from spring house to reservoir, according to plans and specifications. The village will furnish the pipe, hydrants, valves, valve boxes and specials, f. o. b. Hardys, N. Y.

Lakewood, O.—Until noon, July 18, by B. M. Cook, village clerk, for the necessary labor and material for the construction of the water main in Donald Ave. Plans and specifications are on file at the office of the Village Clerk.

Wausau, Wis.—Until July 27, by Board of Water Commissioners for the construction of a system consisting of 10 deep driven wells; two batteries of boilers, each battery having two boilers; one boiler house and coal storage. John F. Lamont is president of the Commission. B. C. Gowan is city engineer.

Wheatland, Wyo.—Until 8 p. m., July 15, by Charles Brechner, Town Clerk, for furnishing materials and labor for the construction of water works, sanitary sewer and electric light plant. J. C. Hadsall, Wheatland, is Engineer.

Miscellaneous.

Bids are asked on following work, the notes being arranged alphabetically by states:

Denver, Colo.—Dam—Until noon, July 9, by North Fort Morgan Reservoir Co., 726 Symes bldg., Denver, Colo., for the construction of an earthen dam across Wildcat Creek in Morgan County, Colo. The work will require the excavation and placing in embankment of about 50,000 cu. yds of earth. Plans and specifications can be seen either at the office of the company or at the office of Prince & Izett, 212-214 Armstrong Bldg., 1520 Champa St., Denver, Colo., the engineer. W. Rolla Wilson is secretary of the Reservoir company.

Washington, D. C.—Vault—Until 3 p. m., July 28, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for a new vault in the 4th floor of the United States Treasury, Washington, D. C.

Washington, D. C.—Monument—Until 11 a. m., July 18, by William C. Coates, Commissioner for marking graves of Confederate dead, 410 Lemon Bldg., Washington, D. C., for furnishing and erecting complete, including foundation in the confederate cemetery near the post office of Cornfield Harbor in the vicinity of Point Look Out, St. Mary's County, Md., a monument or marker to the Confederate prisoners of war buried therein, the same to be of either crystalline white marble or of white or light gray granite and to bear the name, rank, company and regiment of 3,386 soldiers.

Madison, Ind.—Retaining Wall—Until 1 p. m., July 7, by County Commissioners for the construction of a retaining wall in Jefferson County. G. F. Crozier is Auditor.

New Orleans, La.—Boat—Until 11 a. m., July 28, by Maj. H. Burgess, U. S. Engineer, 3338 St. Charles Ave., New Orleans, La., for the construction and delivering the sternwheel towboat "Lafourche."

Pelican Rapids, Minn.—Light Plant.—Until 8 p. m., July 18, by Village Council, for the furnishing of material, machinery, equipment, labor and skill necessary for the changes and additions to the electric light plant in this village.

Strawberry Point, Neb.—Electric Light Plant. —Until 4 p. m., July 19, by A. R. Coe, Town Clerk, for the installation of a complete electric light plant. Oscar Claussen, 514 National German-American Bank Bldg., St. Paul, Minn., is Consulting Engineer.

Albany, N. Y.—Erie Canal—Until noon, July 19, by F. C. Stevens, Superintendent of Public Works, Albany, N. Y., for the improvement of the Erie Canal (under Contract No. 62, Section 10) from the west line of Monroe County to the east end of Contract No. 9, at Eagle Harbor, a distance of 14.15 miles. Sheets 1 to 140 inclusive.

Batavia, N. Y.—Concrete Dam.—Until about July 20, by Fred New, Village Clerk, for the construction of a concrete dam of about 500 cu. yds. R. A. Wentworth is City Engineer.

Creston, O.—Electric Lighting System—Until noon, July 14, by the village council for furnishing the necessary labor and material for the installation of an electric lighting system in the village. Each proposal must be accompanied with a bond for $500. Charles Tenney is Village Clerk.

Pittsburg, Pa.—Reservoir—Until noon, July 14, by Board of Prison Inspectors, Western Penitentiary of Pennsylvania, Pittsburg, Pa., for the construction of a steel tank of from 125,000 to 150,000 gal. capacity and on a 100 ft. tower. John Francis is Warden.

Pittsburg, Pa.—Railroad—Until 2 p. m., August 8, by United States Reclamation Service, Room 15, Chamber of Commerce Bldg., El Paso, Texas, for the construction of the roadbed, bridges and culverts for the branch line from the A. T. & S. F. Ry., between Cutter and Engle, N. Mex., to the Engle dam site near Elephant Butte, N. Mex., a distance of about 10 miles. The work includes 14,000 cu. yds. of earth and 56,000 cu. yds of rock excavation, and about 400,000 ft. of timber. R. A. Ballinger is Secretary.

Fort Worden, Wash.—Wharf.—Until 11 a. m., July 13, by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of a proposed addition to the new wharf at Port Worden, Wash.

Edmondville, Ont.—Telephone System—Until noon, July 9, by Thomas G. Shillinglaw, president of the Tuckersmith Municipal Telephone System, for the erection of a telephone system in townships of Tuckersmith, Stanley and elsewhere. Specifications and plans are on file at the office of G. J. Beattie, 109 Victoria St., Toronto, Ont., the Engineer.

Excavation, Earth and Rock.

Bids are asked on following work, the notes being arranged alphabetically by states:

Helena, Ark.—Ditches—Until noon, July 15, by Board of Directors of the Yellow Banks Drainage District, for the construction of Two Drainage Ditches of about 700,000 cu. yds. of excavation in Phillips County, Ark. E. M. Allen is Secretary of the Board of Directors, Helena, Ark.

Woodstock, Ill.—Drainage Work.—Until 1 p. m., July 23, by Commissioners of the Kishwaukee Special Drainage District in McHenry County, for the construction of drainage work in that district. H. M. Price, 1207 Hartford Bldg., is Engineer. The work includes about 260,000 cu. yds. of earth and about 20,000 ft. of tile drains from 10 to 15-in.

Sioux City, Ia.—Ditch Work.—Until 2 p. m., August 1, by E. E. Hosmer, County Auditor, for the construction of the Garretson ditch and laterals in Woodbury County, Ia. The main ditch will be 10 miles long, including about 255,000 cu. yds. of excavation. The 16 laterals aggregate 23 miles and include approximately 262,000 cu. yds. of excavation.

Materials, Machines, Supplies, Etc.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washington, D. C.—Until 10:30 a. m., July 19, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for the furnishing under Canal Circular 593, the following: Manganese tumblers and rollers, bushings, lag and set screws, engine indicators, steam traps, hose couplings, flanges, rubber tires, rubber valves, gauge glass, gaskets, asbestos packing, rubber boots, emery cloth.

Washington, D. C.—Motor Generator Sets—Until 11 a. m., July 16, by R. C. Hollyday, Chief of Bureau, for furnishing 100 k.w. synchronous motor generator sets, one 2½ kilowatt booster set and switchboard controlling equipment.

Washington, D. C.—Filing Cases—Until July 12, by William Crozier, Chief of Ordnance, War Department, Washington, D. C., for furnishing steel filing cases for mechanical drawings, a gallery for filing cases and one steel filing case of one or more units.

Chicago, Ill.—Bank Sand—Until 11 a. m., July 11, by Department of Public Works, for furnishing and delivering about 800 eu. yds. of bank sand to the various ward yards of the city of Chicago. B. J. Mullaney is Commissioner of the department.

Monticello, Ia.—Iron Water Mains—Until 6 p. m., July 15, by city council for furnishing f. o. b. at Monticello, Ia., 4,732 ft. of 4-in. cast iron mains, standard; 10 4-in. valves; 5 4-in. hydrants; 10 T 4-in. and 6 4-in. plugs, 4 4-in. elbows.

Jeffersonville, Ind.—Quartermaster's Supplies. —Until 10 a. m., July 20, by Depot Quartermaster, for furnishing necessary quartermaster's supplies.

St. Louis, Mo.—Brush, Stone & Spalls—Until 11 a. m., July 27, by Lieut. C. H. Knight, U. S. Engineer, Custom House, St. Louis, Mo., for furnishing 30,000 cords of brush, 50,000 cu. yds. of stone and spalls and 10,000 piles.

Columbus, O.—Cement.—Until noon, July 13, by Board of Public Works, for furnishing and delivering 1,500 barrels of cement at New Bremen, Auglaize County, O., and 500 barrels at Minster, O.

Guayama, Porto Rico.—Reinforcing Steel, Etc. —Until 2 p. m., July 25, by John A. Wilson, Commissioner of the Interior of Porto Rico, at the office of Porto Rico Irrigation Service, for furnishing about 165,000 lbs. of steel bars for concrete reinforcement; about 42,000 sq. ft. of metal fabric for concrete reinforcement; about 1,500 ft. of 12-in. pipe. B. M. Hall is Chief Engineer, Porto Rico Irrigation Service. Official advertisement of the work will be found elsewhere in this issue.

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REINFORCING METAL AND PIPE.

OFFICE OF PORTO RICO IRRIGATION SERVICE.

Guayama, Porto Rico, June 10, 1910.

Sealed proposals will be received at this office until 2 o'clock p. m., July 25, 1910, for furnishing about 165,000 pounds of steel bars for concrete reinforcement; about 42,000 square feet of metal fabric for concrete reinforcement; and 1,500 feet of 12-inch pipe. Further details can be had by applying to this office; to the office of the Commissioner of the Interior, San Juan, Porto Rico, or to the Bureau of Insular Affairs, War Department, Washington, D. C. The right is reserved to reject any and all bids.

B. M. HALL,
Chief Engineer, Porto Rico Irrigation Service.

By order of:
JOHN A. WILSON,
Commissioner of the Interior of Porto Rico.

(Proposal Advertisements Continued on Page 61.)

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CHAS. S. HILL
C. T. MURRAY
H. P. KIRKLAND . . . . . . EDITORS
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Revised Data on the Strength of Timber.

The engineer who refers to the text book of ten years ago for data to use in determining the properties of timber of structural sizes under the conditions of ordinary purchase and practical service gets rather poor aid. Timber test data are there in great variety, but all are data obtained from small test [illegible] such, [illegible] stringers. [illegible] a r[illegible] ducted at the [illegible] of Illinois:

The values [illegible] timber most [illegible] pocket books [illegible] mined from [illegible] book gives the [illegible] sion as 15,000 lbs per sq. in., [illegible] 9,000 lbs per sq. in., and in longitudinal shear 500 lbs per sq. in. An [illegible] gives the value of the [illegible] of yellow pine as 15,350 lbs per sq. in. [illegible] cites several authorities as giving mean values of the modulus of rupture of yellow pine [illegible] 9,000 to 15,000 lbs per sq. in., but the results of his own tests he reports as averaging [illegible] lbs per sq. in. for modulus of rupture and 224 lbs per sq. in. for longitudinal [illegible] very emphatically shows that the strength of commercial timber is much lower than usually quoted. Johnson[†] gives for yellow pine 9,000 lbs per sq. in. in compression, 13,000 lbs per sq. in. in cross breaking and 600 lbs per sq. in. in longitudinal shear, while for loblolly pine, values of the corresponding strengths are 7,000, 10,000, and 400 lbs per sq. in. The handbook of the Southern Lumber Manufacturers' Association (1904) gives for longleaf pine the following strengths: tension 15,200 lbs per sq. in., compression 6,850 lbs per sq. in., cross breaking 10,900 lbs per sq. in., longitudinal shear 706 lbs per sq. in.; for shortleaf pine the corresponding values are 13,400, 5,900, 9,230, and 688; and for loblolly pine 14,400, 6,500, 10,100, and 690. These values are stated to be based upon 15 per cent moisture content on beams from which defective pieces were excluded and to give fairly well the range of strength of commercial timber. With such illustrations as these in mind, it does not seem strange that engineers may hold to higher values for the strength of commercial timber than later tests have shown to be tenable. A comparison of the foregoing values with the tests herein recorded shows that these tests gave strengths much lower than the values which are commonly cited.

In another part of this issue we give the results of the tests mentioned above. Space has permitted us to present only summaries, but they tell the essential features of the story. It is plain that tests of small selected specimens of wood give a very inadequate indication of the strength of large timbers of the same wood. This is the striking result of the tests described. Another conclusion of importance is that defects such as [illegible] and seasoning checks act much more than is commonly realized to give low strength. These facts are of vital interest in view of the growing scarcity of timber and the necessity of utilizing the poorer grades.

A Series of Articles on Railway Track Costs.

In our earth and rock section this week we publish an article on the cost of raising track and embankment and filling in trestles for a railway. We call attention to this article because it is one of a series which will be published in this journal during the next few months. This series will embrace costs of surfacing, unloading rails, ties and other track materials, smoothing, tie renewals, turnouts and sidings, tracklaying, rail renewals, etc., with minor operations, such as curving rail, tightening fastenings, grassing and cutting weeds, gaging track, applying tie plates and railbraces and tightening spikes.

These records of costs have been derived from data collected in actual work. No attempt is made to show records of low cost. On the contrary, data were collected on work performed under varying conditions, regardless of whether the conditions were favorable to low cost or otherwise. In each case methods of work and gang organization [illegible] are given.

[illegible] ing more serious each year, and as the efficiency of labor decreases the unit costs of work are increased. The decreased efficiency of track labor is due to the generally low [illegible] lack of steady employment throughout the entire year. Especially is the latter cause true for Western and Southern roads. The poor quality of the present track labor is also due [illegible] ever known—the Irishman.

The position of a foreman requires a man who has had long years of training in the road department, in which his knowledge of track work has been gained, and his sense of loyalty to the road and the habit of integrity of work have been developed. It is impossible now to keep such a man in the service long enough for him to secure sufficient experience to carry the responsibilities of a section foreman. The wage paid for section labor does not justify a man of ordinary common sense in staying on the job. The time has come when the older man with his wide experience is replaced by the younger, less intelligent man, with scant experience in track work.

The present remedy for the trouble is closer supervision by the supervisors and a gradual raise of wages, eventually ending in a sliding scale of wages for each gang, the higher wage being paid to the most efficient members of the gang and the lower wage to the least efficient laborer. The average length of supervisors or roadmasters districts is too great to permit him to give to each gang the daily attention which is generally needed by the green foreman. On a district of 50 or 60 miles in length, the supervisor using a speeder or motor car, can easily visit each one of his gangs each day. He is then able to personally help and instruct the young foreman, showing him short cuts and how to place his men in each kind of work.

The new foreman, given the benefit of this constant instruction will very quickly develop into an efficient foreman. Instead of sending the foreman a "butterfly," telling him "Track is out of line through East switch," and running the risk of the inexperienced foreman making the improper adjustments to the switch, on a short district the supervisor can take the gang and personally do the work, affording the young foreman a chance to learn how similar troubles may be remedied.

As the foreman grows older in the service the daily presence of the supervisor will have a very wholesome effect on him. He will see that every inch of his work is closely inspected and will quickly form the habit of the thoughtful planning of his work and its honest execution.

Sewage Disposal Costs.—The net cost of maintenance of the purification works at Worcester, Mass., for the current year has been $49,892.31, which is 36.6 cents per capita. This includes all administrative expenses, but does not include interest on the capital invested. The cost of purification may be subdivided as follows:

	Total.	Per million gals.
Chemical precipitation...	$18,899.28	[illegible]
[illegible]	[illegible]	[illegible]
Sand filtration	15,232.69	9.78

The foregoing costs include the amount expended in "Laboratory," as per Schedule 4, the same being apportioned equally to the three accounts. The amount received for house rent, $205.34, is applied to "Filter Beds" account as that is the account under which the property is maintained. The results of analyses combined in proportion to the amount treated each way show a removal of 56.4 per cent of the total organic matter measured by albuminoid ammonia. The quality of the average effluent shows an improvement over last year.

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[*] Applied Mechanics, by G. Lanza. [†] The Materials of Construction, by J. B. Johnson.

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CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Waterproofing Engineering Structures Using Pitch and Felt.*

The purpose of this paper is to present some points of possible general interest, and to briefly describe waterproofing by use of pitch and felt, of certain viaducts, retaining walls, cut and cover tunnels, pipe subways, elevator pits, conduit banks, etc., which have been designed and constructed in New York City under the writer's supervision. The work to be described was performed under three separate contracts, but the materials used were the same in each case, the specifications varying only as to number of plies, methods of procedure and character of backing or protection of waterproofed surface. The clauses of the specifications, which apply to materials and application, are as follows:

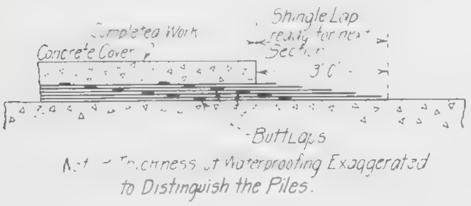
Completed Work
Concrete Cover
Shingle Lap ready for next Section
3'0"
Butt Laps
Note — Thickness of Waterproofing Exaggerated to Distinguish the Piles.

Fig. 1—Section Showing Single Lap Waterproofing. Six-Ply Work.

> Pitch used shall be straight run coal-tar pitch, which shall soften at 60° F. and melt at 100° F., being a grade in which distillate oils distilled therefrom shall have a specific gravity of 1.105.
>
> The felt shall be "Hydrex" felt, manufactured by F. W. Bird & Son, East Walpole, Mass.,† or felt equally satisfactory to the engineers.
>
> Pitch, when applied, shall be of a temperature of not less than 250° F. The pitch shall be mopped on the surface of the masonry to a uniform thickness of not less than 1/16 in. Each layer of pitch must completely cover the surface on which it is spread without cracks or blow holes. The felt must be rolled out into the pitch while the latter is still hot and pressed against it so as to insure its being completely stuck to the pitch over its entire surface. Great care must be taken that all joints in the felt are well broken, and that the ends of the rolls of the bottom layer are carried up on the inside of the layers on the sides, and those of the roof down on the outside of the layers on the sides, so as to secure the full laps herein specified.

Other important clauses are:

> It is intended that the interior of waterproof structures shall be permanently free from moisture or discoloration due to the percolation of water or other liquids from outside sources. This end shall be attained by means of a continuous flexible waterproof sheet surrounding the exterior of the structure (as shown by drawings).
>
> Waterproofing must be protected against injury at all times to the satisfaction of the engineers.
>
> Any waterproofed structure that is found to leak at any time prior to the completion of this contract, shall be made tight by the contractor in a manner satisfactory to the engineers
>
> Waterproofing will be measured by the square of 100 superficial feet and paid for accordingly.

Composition of the waterproof sheet is specified as follows:

> For all construction, except electric conduit lines and electric conduit manholes, waterproofing shall consist of six layers of felt and seven layers of pitch alternating, and shall consist of four layers of felt and five layers of pitch alternating, for electric conduit lines and manholes, each strip to lap not less than 1 ft. upon the previously laid strip, and each section of waterproof sheet shall lap at least 1 ft. with the adjoining section.

The specifications have, in most particulars, served their purpose admirably, but the following comments may be of interest: The felt used comes in rolls 36 ins. wide, and each roll contains 400 sq. ft. The method of practical procedure to be followed in placing the felt so that the specification requirements as to laps might be complied with, caused much concern.

In the writer's judgment, the most effective way to lap the plies is by the "shingle method," or, as sometimes called, the "feather-edge method," similar in principle to that employed in pitch and felt roofing; but it is evident that with felt sheets only 36 ins. wide, the prescribed lap of 12 ins. cannot be effected in six-ply work by the "shingle method," and because of the superiority of this method, it was concluded to fit the laps to the felt, and the work was actually carried out wherever practicable with 6-in. laps "feather-edged" or "shingled." The felt was laid transversely of the structures. The requirement "each strip to lap not less than 1 ft. upon the previously laid strip" occasioned some confusion, owing to the fact that it might be interpreted to mean that each 36-in. strip should lap the prescribed amount at edges and ends over the previously laid strip of the ply of which it was a part, but as this was manifestly impracticable, the requirement was interpreted as applying to the relation of the joints in one ply to the joints in the ply beneath it, as was doubtless intended; but, as stated above, the lap was reduced to 6 ins.

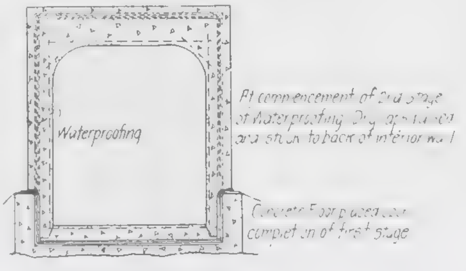
Waterproofing
At commencement of 2nd stage of Waterproofing Dry laps turned and stuck to back of interior wall
Concrete Floor placed after completion of first stage

Fig. 2—Section Showing Method of Lapping Waterproofing. Subway Work.

The usual waterproofing practice of sticking each strip to its neighbor by lapping at least 1 in. was followed in making up each ply. The writer believes that a better result will be obtained, however, if this butt lap (so called) be made 2 ins. wide.

The system of shingling adopted keeps the shingle at the head of the work with all six plies in evidence, and with all sheets securely stuck, as shown by Fig. 1. Thus the waterproof sheet is entirely completed back of the shingle lap, and may be covered and permanently protected up to the lap. By this method there is little difficulty in obtaining the correct number of plies, and, in the writer's opinion, the method gives the best obtainable quality of work.

In providing for connection of two sections of standing work, as in subways, or for connection of standing work and flat work, as at tops of walls, dry laps were left, which appeared at first to be the only solution of the problem which would insure a continuous waterproof sheet of the character intended; but on six-ply work this procedure required that dry ends of sheets varying from 6 ins. to 36 ins. be left, in order to effect the shingle bond with the flat or standing work, as the case might be. (See Fig. 2) Despite the specification requirements that "waterproofing must be protected from injury at all times to the satisfaction of the engineers," the writer does not hesitate to state that it was quite impracticable to protect dry laps, and despite all efforts made to do so, such laps were invariably found almost wholly destroyed and unfit to join on to, when ready to proceed with the connecting waterproofing.

The destruction of dry laps was due to various causes, such as dragging timber and other materials over them, deposits of debris and of concrete from the work preceding the next waterproofing stage, traffic of laborers over them, and last, but by no means least, the absorption of water. If the felt becomes water-soaked, it is thereby destroyed. The saturation and coating of high-grade felts, such as that used on the work described herein, renders the sheets impervious to water on their surfaces, but the edges are not impervious, hence the necessity for so conducting the work that the edges of the felt be at all times protected from the influence of water.

To overcome the trouble experienced with dry laps, the total lap was reduced from 36 ins. to 24 ins. for connections of standing work, sticking the two first sheets solid on the top of the backing wall, leaving four dry laps of 6 ins., 12 ins., 18 ins., and 24 ins. for the remaining plies. (See Fig. 2.) Then when the joining was effected, four plies were carried through by shingle method, and two plies were stuck by solid lap method. Due to the reduction in width of total dry lap, the felt was more easily preserved, but the destruction of these laps was not wholly avoided.

The writer believes that, under similar conditions, the best procedure would be to reduce the dry laps to two plies and stick four plies with solid lap. This solution of the difficulty is wholly a practical suggestion, which does not satisfy theoretical consideration of the problem, but will none the less give good results.

The instances of dry laps so far discussed and illustrated were an incident of the construction of the reinforced concrete subways, for pipes, wires and express trucking, about a mile of which, varying in clear width from 6 ft. to 17 ft., have been constructed beneath track grade. The procedure which brought about the above-noted conditions may be more readily understood if we depart a little from the subject and breifly describe and illustrate a typical subway. The cross section (Fig. 3) shows a subway 12 ft. wide, and varying from 12 ft. to 17 ft. high inside, designed to carry a railroad on its roof, and to resist hydrostatic pressure, due to an assumed head, measured from the average level of the open joint drainage system, which is about 1 ft. 6 ins. below the roof of the subway. It will be noted that the excavation is wholly in rock, and the drawing requires that a volume be

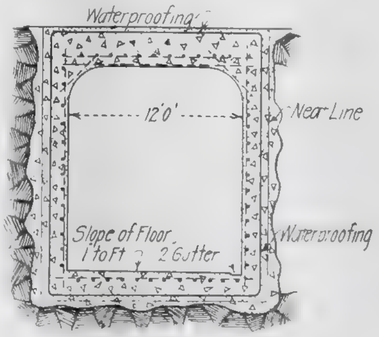

Fig. 3—Typical Section of 12-ft. Trucking and Pipe Subway.

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*A paper by Joseph H. O'Brien before the Boston Society of Civil Engineers, Nov. 1, 1909, published in the Journal of the Association of Engineering Societies for May, 1910.

†Now the Hydrex Felt & Engineering Company.

excavated only 6 ins. wider on each side than the neat section. The nature of the rock was such, however, that the trench was blown out from 5 ft. to 10 ft. wider than required in places.

The first step after completing the excavation was to build the floor base and backing walls ready for waterproofing.

After careful consideration, it was determined to make the backing walls 12 ins. thick, and to limit their height to 4 ft. in the first stage. (See Fig. 2.) The height determined upon was sufficient to keep water out of the waterproofed trench, except occasional flooding after heavy rains, and it was a convenient bench from which to work in placing rod reinforcement against interior forms, and upon which to construct exterior forms of the subway. It was considered, owing to lapse of time which must ensue in constructing the monolithic tube within the waterproof enclosure, that standing work would probably often be lost if carried higher than 4 ft. by sags due to weight of fabric and augmented by temperature exposure. Likewise the danger of damaging the fabric while building the reinforced tube inside of it was anticipated. Fears in respect to these matters were fully justified, as illustrated, by the case of an 8-ft. subway, which was so situated that the complete waterproof sheet had to be placed up to the roof connection, and the subway built within. Much valuable waterproofing work was destroyed in this trench, due to the causes above cited.

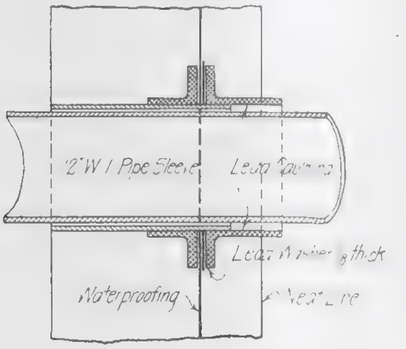

Fig. 4—Section Showing Method of Waterproofing Sleeve for 10-in. Cast Iron Pipe.

Another point bearing upon the practical application of the felt in the first stage of the subway waterproofing, above referred to, and in similar situations, is the importance of so making angles and corners that they will be durable during construction and tight after. Angles at junction of flat and standing work are natural weak spots in pitch and felt waterproofing.

In the subways referred to, the first scheme tried required that the sheets be carried full across the floor and up both backing walls in one continuous strip, but two very serious objections to this procedure soon became evident. In the first place it was impracticable securely to stick the sheets throughout, especially at the angles of floor and walls, and as a result, the standing work bulged and sagged. In the second place, the scheme resulted in much waste of material, and annoyance to the contractor, who was accustomed to cut and fit according to his material with a minimum of waste.

The method was changed, therefore, so that the floor plies would break joint with the wall plies, partly on the wall, and partly on the floor, as shown in Fig. 2-A, and as an additional safeguard a strip was laid longitudinally and fitted snug into the angle over all, and this was found to be a very practical and satisfactory solution of the detail.

It was found necessary to leave openings in the walls of pipe subways for pipes varying in diameter from 1½ ins. to 12 ins. and in order to insure a watertight job upon completion, screw sleeves with sheet lead washers, and with calking rims were devised, as shown in Fig. 4. The pipe sleeve details were de[illegible] pipes after the subways had been completed. The sleeves were easily applied and the use of them has so far resulted in tight work.

In conduit bank waterproofing, several miles of which were included in the work herein described, dry laps were left at first on the flat at the floor base, owing to the necessity for laying the conduits in advance of placing the side wall and roof waterproofing. Figure 5 shows section of typical conduit bank, and Fig. 6 shows first stage of waterproofing with dry laps.

Practically all of the laps beyond the edge of the masonry base were found to be destroyed when the conduits had been made ready for the completion of the waterproofing, hence the laps were reduced successively to two dry and two stuck, and finally to all four stuck of the width of base projection beyond the conduits. Wherever conditions made it possible to require the construction of the complete waterproof basin to the top of the conduits in advance of laying the latter, this practice was followed, but while it produced the best job of waterproofing, it required the construction of the conduit bank end on in a narrow trench, at the risk of bad duct alignment. Furthermore, the rate of progress by this latter method was very much less than by the method generally followed.

In the writer's judgment, however, and despite the fact that tight work has been obtained by the method of first placing the floor sheets, joining the wall and roof sheets to them, after the duct bank was made ready, it would be better, where similar work is required, henceforth to design the waterproofed trench of sufficient width, and with suitable backing walls to permit of the construction of the ducts in the usual manner, after the trench has been completely waterproofed.

Waterproofing of baggage lift pits was placed in accordance with the principles outlined above for pipe subways, but the pits were open at the top and one end, and the waterproofing problem was complicated by the presence of foundations for superstructure columns, and by the necessity of providing for plungers.

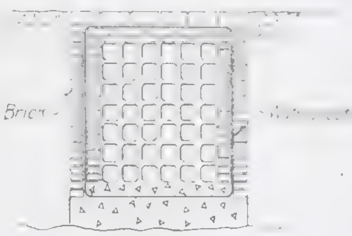

Fig. 5—Typical Section of Bank of Conduits.

It was determined that the plunger borings should be made after the baggage lift pits were completed, and to insure a watertight pit, a plunger casting was devised, with a clamping ring and stud ring, between which the waterproofing was placed (see Fig. 7).

This casting had to be set accurately and securely in position, hence the base course of concrete was carried through beneath it, and the casting was set on same, and stayed by lateral bracing during the placing of the finished work. The detail of the casting required that the connecting sheets of waterproofing be cut to fit the stud bolts, which was a rather unusual waterproofing detail, but a very satisfactory result was obtained.

Due to a necessity which arose, bearing upon the general advancement of the project, the backing walls of two baggage lift pits, which had been excavated for most of their height through earth, were placed in the form of retaining walls some months in advance of the completion of the lift pits, and construction tracks were carried over them on temporary trestle stringers.

After the floors of these pits were completed, the steel framing of the walls (composed of 15-in. I-beam studs, set apart 4 ft. 0 in. centers) was erected, in advance of com[illegible] next to the backing wall. The mats were [illegible] panel had been placed, the intervening space was waterproofed in the usual manner. The joining between floor and wall work was effected by solid lap method, and the joint was protected by three courses of brickwork in Portland cement mortar, set about 3 ins. away from the wall waterproofing, thus forming a pocket, which was filled with pitch.

In the case of one viaduct which was constructed under an avenue, the waterproofing was placed to full height of walls, and turned down on top of same before the backing was placed, dependence being put in the adhesiveness of the waterproofing, and weighting down of top of same while backing was laid. When the backing followed immediately after waterproofing this scheme worked out all right, but when the backing was delayed, the waterproofing sagged and bulged badly, and in some cases had to be renewed. Hence on walls and elevated railroad foundations of another avenue viaduct the waterproofing was carried up in first stage to height of 5 or 6 ft., the work being stuck securely in each stage and backed up immediately.

Due to necessity for transfer of street railway, sewer, water and gas pipes from temporary to permanent supports, during construction of the latter viaduct the floor plate work had necessarily to be finished in some instances within 18 ins. to 20 ins. of walls and piers, in advance of waterproofing the latter. In such instances the shingle lap method was abandoned and the floor waterproofing was carried through solid against the walls or piers, and when the latter were ready, a six-ply flashing of waterproofing was placed over the angle of floor and wall and extended up the wall, and out on to the floor waterproofing. Over this flashing the wall waterproofing was placed and carried out over full width of exposed floor waterproofing, making a very satisfactory job of solid lap work.

The principles of application of the waterproof sheets hereinbefore described for other work apply with equal force to this cut and cover work. The writer will, therefore, briefly describe the mode of procedure in the general construction of this work, so that a few points of interest may be brought out, which are partially, though not wholly, related to the waterproofing problem, but which may be of sufficient value to warrant the liberty of a description in this paper. The tunnel roof is composed of steel girders resting on concrete abutment walls and intermediate columns, all founded on solid rock. The excavation from an average elevation of 10 ft. above the roof

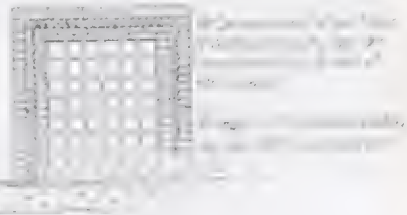

Fig. 6—Section of Bank of Conduits Showing Method of Applying [illegible]

[illegible] entirely [illegible] chise requirements, together with the fact that a portion of the work encroaches on very valuable private property, it became the engineer's duty to restrict the over-all width of the excavation to a minimum.

The roof of the structure is at an average depth of 20 ft. below street level and about

9 ft. below sewer level, and the track subgrade is at an average depth of 49 ft. below street level, 38 ft. below sewer level and 12 ft. below mean high water.

It was apparent that, owing to the above conditions, some surface water and the ground water below sewer level would have to be effectually shut out, and under less restricting conditions the design of abutment walls, capable of resisting hydrostatic pressure due to a head measured from bottom of sewers, might be warranted. After due consideration, however, it was determined to design the abutment walls of suitable section to safely support the vertical loads to be carried by them, trusting to a free drainage scheme to relieve these walls of hydrostatic pressure. The writer devised a free drainage scheme, which is illustrated by Fig. 8, and which, owing to the fact that it has been completed and doing good service for over a year, may be pronounced a success.

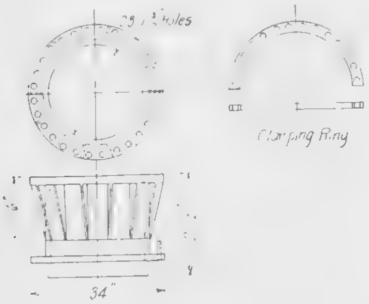

Fig. 7—Detail of Casting for Waterproofing Hydraulic Elevator Pits at Plunger Cylinder.

The scheme consists merely of the application of well-known materials in a simple but unusual manner, namely, the space from standard section line to ledge, varying from 6 ins. to 4 or 5 ft., was filled back of a suitable form to full height of abutment walls with a porous concrete, 1 part cement, 4 parts sand and 8 parts broken stone. This porous backing was faced with hollow, light-burned porous terra cotta partition blocks, 12x12x4 ins., laid with openings set vertically and bonded for continuity of vertical hollow spaces. These blocks were anchored to the concrete backing by cut nails, driven into the latter and clinched over the inner walls of the blocks at joints. The bed joints were buttered in such manner that the back half of the joint was left open as far as practicable and the build joints were similarly made.

This tile drainage sheet was at first footed on a longitudinal tile drain, made by splitting out end cells from the blocks and laying same on bed. Due to the underburned quality of the material many blocks were wasted in an effort to produce one suitable end cell. Hence the type of longitudinal drain was changed to that shown in the upper right-hand corner of the plate. The end walls and partitions of the blocks were chipped out to approximately the form shown, by use of a bricklayer's chipping hammer, and thus the longitudinal drain was obtained with very little waste. This longitudinal drain is connected with a gutter at the toe of the abutment wall, which is, in turn, connected to the underdrainage system. Upon the face of the tiling above described, the wall waterproofing was placed for full height, with dry laps extended over the backing wall and weighted down. A section at a time, varying from 25 ft. to 50 ft., was thus prepared and the abutment walls completed as soon as practicable after waterproofing.

As may be readily understood many months elapsed after waterproofing abutment walls before the roof work was connected and the dry laps were found to be very seriously damaged. The roof work was advanced a section at a time, dependent upon the opportunity for moving equipment, and the roof work sections were of varying areas, and frequently broke part way over the roof. This work was all performed by the shingle method, hereinbefore described, but the patchy procedure on the roof was permitted solely because of the contractor's obligation to make the work tight. The writer is convinced that a better result will be secured if roof or other flat waterproofing is extended full across the work, thereby leaving joints at one edge only.

After the roof waterproofing was completed, it was covered with concrete, varying in thickness from 4 in. to 6 in., and the highways were restored by backfilling over this cover to a height of about 20 ft. So long as the backfilling was kept well back of the end of the completed work, and was stepped off in bench formation, the plain concrete cover served its purpose, but in one case when the backfilling was advanced in bank formation, close upon the completed construction work, the concrete cover broke and the waterproofing was damaged, requiring removal of much backfilling to effect proper repairs. After the occurrence just cited, the writer had the cover reinforced by Clinton wire cloth, and no further trouble was experienced. This reinforced cover was also used on a viaduct roof which was built after the cut and cover tunnel work just referred to had been completed.

Some additional points of interest in the protection of the waterproofing work described herein are the following:

Where excavation for subways below track level was excessive (see Fig. 2), the contractors were not required to fill back solidly against the rock, but were permitted to build 12-in. backing walls of concrete and to backfill behind the latter. They came to the conclusion that much time would be saved by using terra cotta blocks for backing up subway waterproofing above the 4 ft. wall shown in Fig. 2, and they were permitted to substitute these blocks laid on bed in the usual manner in Portland cement mortar. Recently it became necessary to remodel a section of the subway work, and the adhesion between the terra cotta backing and the waterproof sheet proved to be so strong as to require splitting of the blocks in order to remove them.

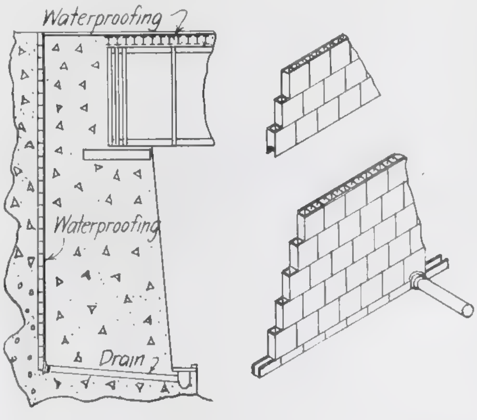

Fig. 8—Free Drainage Method of Waterproofing Tunnel Wall.

An 8-in. brick backing was provided for waterproofing on back of viaduct retaining walls under avenues. During construction of one viaduct a settling down and bulging of the backing wall was noted, accompanied by vertical cracks, due apparently to slipping of the backfilling placed against the wall. To overcome the difficulty, the thickness of the backing was changed from 8 in. to 4 in., and a substantial footing was provided, as shown in Fig. 9. No recurence of the trouble was experienced after the section of the brick backing was modified.

Many schemes were tried for substantial protection of stuck lap joints in cases where these had to be left for long periods of time before connecting work could be placed, but the most satisfactory protection was afforded by covering the laps with 2 in. of clean sand.

No special effort was made to obtain better surfaces upon which to waterproof than result from ordinary practice, but the writer believes that it would be worth while to insist on smooth finish for surfaces upon which to waterproof, so that complete adhesion may be obtained and air cushions, bulges, sags and water pockets avoided, in so far as the quality of the surface waterproofed affects these conditions.

When connection of a new to an old section of work is made, the surface of the old work should be thoroughly cleaned by stiff brooms and flexible wire brushes.

The felt used on the work described herein was selected after many comparative tests and analyses had been made for the purpose by chemists, and the requirements adopted as a result of their investigation are as follows:

The felt must be saturated and coated with asphaltic products and must conform to the following requirements:

(a) The weight per 100 sq. ft. shall be from 12 to 14 lbs., saturated, and from 5 to 6 lbs. unsaturated.

(b) The weight of the saturation and coating shall be from 1.25 to 1.75 times the weight of the unsaturated felt if coated on both sides, and from 1 to 1.5 times the weight of the unsaturated felt if coated on one side.

(c) The saturation shall be complete.

(d) The ash from the unsaturated felt shall not exceed 5 per cent by weight.

(e) The wool in the unsaturated felt shall not be less than 25 per cent by weight.

(f) Soapstone or other substances in the surface of the felt to prevent adhesion shall not exceed .5 lb. per 100 sq. ft. of felt.

(g) The saturating and coating materials shall remain plastic after being heated to 250 degrees Fahr. during 10 hrs. The coating not to crack when the felt is bent double at ordinary temperature.

(h) The felt shall be soft, pliable and tough when received from the factory and until placed in the work.

(i) The quotient obtained by dividing the tensile strength in pounds of a strip 1 in. wide, cut lengthwise, by the weight in pounds of 100 sq. ft. shall not be less than 7.

(j) The quotient obtained by dividing the tensile strength in pounds of a strip 1 in. wide, cut crosswise, by the weight in pounds of 100 sq. ft. shall not be less than 3.5.

(k) The strength saturated shall be at least 25 per cent more than the strength unsaturated, taken lengthwise.

(l) The strength saturated shall be at least 15 per cent more than the strength unsaturated, taken crosswise.

The quality specification for pitch quoted in the fore part of this paper was likewise determined after careful consideration by the chemists.

The pitch used differs from the coal-tar pitch known to the waterproofing trade in New England. It is received on the work in a soft, almost fluid state, and spreads splendidly in average and cold temperatures. It flows too freely in hot weather and does not set so effectively in high temperatures, as the harder coal-tar pitch used for waterproofing in New England. The waterproofers obtained a harder pitch for hot weather work which overcame the objection noted in application.

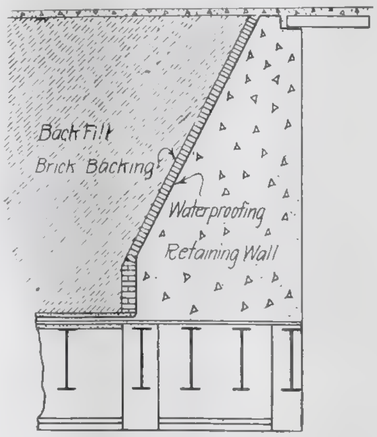

Fig. 9—Method of Waterproofing Back of Retaining Wall.

It was at first found to be somewhat unreliable as to quality, but the manufacturers succeeded in making a hard pitch with melting point 110 degs. Fahr., which had 36 per cent free carbon and was considered satisfactory material for hot weather.

It is important that the pitch be not overheated, as it volatilizes and insufficient body remains. The danger of overheating is minimized if a first-class kettleman is employed. Practical tests relied upon by a waterproofer to determine the proper temperature of pitch in the kettle are first to observe whether yellowish fumes rise from the kettle, which are an indication of excessive heating; and second, if the pitch cracks too quickly when spat into, it is too hot, but if a very short interval elapses before cracking, it is heated sufficiently. The degree of kettle heat is wholly dependent upon the grade of coal-tar pitch used. For standing work, the pitch may be advantageously heated much less than for flat work. If heated too much for standing work, it falls away from the mop and much of the body of the coating is lost.

It has been observed that the first coating of pitch will adhere to or coat a concrete surface which is just damp enough to be dustless, better than a concrete surface which is dusty dry. A wet or decidedly moist surface is not suitable for pitch and felt waterproofing. If it is necessary to waterproof a surface which has been under water, the surface should be dried by brooming with sawdust. Cement is sometimes used for this purpose, but the result is not quite so effective and it is a more costly method. It requires from 2.5 to 3 gal. of coal-tar pitch per mopping for one square, or 18 to 21 gals. per square for six-ply work.

The quantity of waterproofing placed on the work described herein is 1,000,000 sq. ft.

In closing, the writer wishes to call attention to the need of practical inspection on waterproofing work. An experienced waterproofer, familiar with the tricks of the trade, and possessed of the proper temperament for the position of inspector, may readily become a most valued assistant to the engineers in charge.

The engineers for the work described herein are Westinghouse, Church, Kerr & Co., the work being designed and constructed under the immediate direction of the writer, reporting to Mr. George B. Francis, consulting civil engineer.

The writer wishes to acknowledge the faithful service and untiring zeal of Mr. F. F. Skinner, who had direct charge of the work in the field, and Mr. Frank L. Butters, waterproofing inspector, and the many other assistants whose care and skill aided in the accomplishment of the work.

Cost of Mixing and Placing Concrete by Hand, Placing in a Four-Foot Circular Sewer.

The work on a 4-ft. circular sewer in Louisville, Ky., was carried on entirely by hand. The sewer was located through a park and near a roadway and materials for the work were placed at convenient points. The invert contained 0.21 cu. yds. of concrete and the arch 0.18 cu. yds. per lineal foot, and each was built separately. A light mixing board was made, and was shifted along by the gang as the work progressed.

The gang consisted of 17 negroes and a foreman whose duties consisted of excavation and concreting for the sewer. The successive steps of their work were alternated with another gang which attended to the forms and reinforcement. The length of concrete laid at one operation was 72 ft. of either arch or invert and the time required to do the work averaged 3¼ hours. The men were divided as follows:

2 men on mortar.
4 men on gravel.
2 men on sand.
4 men on mixing board.
1 man on water and cement.
4 men in trench spading.
1 foreman.

All the men received 20 cts. per hour and the foreman received 35 cts. per hour. The cost of concreting 72 ft. of invert or arch was thus:

17 [illegible]	$11.[illegible]
1 foreman at 35 cts per hour, 3¼ hrs.	1.14
Cost of laying 72 ft. of invert or arch	$12.19

This gives for 72 ft. of complete sewer a cost of $24.38 which divided by 28.08 cu. yds gives a cost of 87 cts. per cu. yd. In this work there were about 2.23 lbs. of steel reinforcement per lineal foot of sewer. Two men were employed continually to bend the steel and place it in position in the forms.

Method of Constructing and Waterproofing a Circular Reinforced Concrete Water Tank.*

The city of New Ulm, Mich., has just completed a reinforced concrete reservoir of 1,000,000-gals. capacity, a cylindrical structure 75 ft. in diameter with the walls 30 ft. high, and covered with a conical concrete roof. The ground on which the reservoir is built consists of hard clay well drained by natural drainage, and upon this clay was spread a layer of stone with an average thickness of 12 ins. the voids of which were filled with a wet, fine-grained concrete poured in. This formed the foundation for the floor which is 10 ins. thick, and reinforced near the surface with expanded metal of No. 16 gage thickness and 3-in. mesh. The floor is bound to the walls by means of 1-in. round steel rods 8 ft. long bent so as to extend 4 ft. into the floor and 4 ft. up into the walls. These were placed 12 ins. apart throughout the circumference.

The walls are 20 ins. thick at the bottom and taper to 15 ins. at the top, with the batter on the outside. They are reinforced with 123 1⅛-in. and 40 1-in. round steel rods rolled to the required radius and placed horizontally, and by 20 upright supports made of steel angles with lacing bars, which served as supports for the horizontal rods during the time of construction, as well as vertical reinforcement in the walls. The horizontal reinforcement is sufficient to take all the stress without assuming tension in the concrete, or counting on the support of the earth embankment on the outside.

The roof consists of a conical concrete slab 3 ins. thick and reinforced with No. 12 gage, 3-in. mesh expanded metal, and is supported by eight trusses radiating to the wall from a center pillar. The trusses are bound together with steel I-beams as purlins 5 ft. apart. The steel trusses are 6 ft. high from c. to c. of chords at the ends which rest on the center pillar, and taper down to 3 ft. at the ends resting on the walls.

Since it was of the utmost importance that the walls and the floor should be water-tight, special care was taken during the construction to grade the aggregate for the concrete. It has been found by experiments that the densest concrete can be made when rounded pebbles varying in size from about ¼-in. to about 2½ ins. are used instead of broken stone on account of the ease with which such pebbles will move about in a quaking mixture while it is being worked in place, and adjust their positions so as to form the least amount of voids. For this reason pebbles were screened from a gravel bank and used instead of crushed stone for the walls and upper part of the floor, and the sand used was a mixture of very coarse and ordinary fine sand. To reduce the permeability of the concrete to a minimum, 20 lbs. of hydrated lime was used to every barrel of cement, and after the forms were removed the walls were brushed and cleaned with steel brushes, and two coats of cement plastering were applied on the inside. The mortar for the plastering consisted of one part cement, two parts of sand, hydrated lime to the extent of 10 per cent and Medusa waterproofing compound to the extent of 3 per cent of the cement used.

The proportion used for the concrete in the walls and the upper 4 ins. of the floor was 1:2:4 and this proportion of concrete together [illegible]

[illegible] walls, which were removed after the concrete had acquired its initial set. The holes formed [illegible] strong cement mortar. Only one round of forms was used, as the contractor found that he could work most economically filling the forms in one day and removing them the next, and set them up for the pouring of concrete again on the third day. When it was necessary to build scaffolding two days were taken to remove and set up the form and build scaffolds.

The bond between old and new concrete was made by brushing the old concrete thoroughly clean and pouring on a neat cement grout just before pouring on the new concrete.

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*[illegible]

The Painting of Cement and Concrete Structures.

In painting cement and concrete structures, failure to produce satisfactory results has, in most cases, been due to the painter's lack of knowledge of the oil destroying properties of the alkali in the cement and of the chemicals necessary for the neutralization of these alkalies. Mr. Chas. Macnichol of Washington, D. C., in a paper read before the American Society for Testing Materials describes a method of treating cement surfaces for painting, which he has now used for several years with success. The method consists in applying to the cement surface, a solution of zinc sulphate and water, mixed in equal parts by weight, and using an ordinary bristle brush. It is applied after the cement is dry. The wall is allowed from 48 to 72 hours for drying and is then, it is stated, as safe to paint as an ordinary plaster wall. The reason why some such treatment should be necessary before applying a paint coating to the surface of concrete is stated as follows: When Portland cement sets, a certain amount of lime is set free in a hydrated condition as calcium hydroxide. This being a strong alkali tends to saponify the oil in the paint coating, and thus destroy it. The work done by the applications of the zinc sulphate is to destroy this alkalinity, and chang[illegible] the calcium hydroxide into a mixture of [illegible]cium sulphate and zinc oxide. Another point of advantage, and a very important one to the painter, is the filling of the pores of the concrete thus saving a considerable amount of [illegible] penetrating too deeply into the wall.

Nails for Concrete Form Construction.

[illegible] used over more times than they are, is because of the difficulty in getting carpenters to leave a portion of the nail sticking out, so as to be able to pull it with a hammer when stripping the forms. The Ferro Concrete Construction Co., of Cincinnati, O., has been experimenting with different types of nails to obviate this difficulty, and has developed one which is giving satisfaction.

The nails are of wire and are fitted with square washers forced into position about ⅜ in. below the head. The diameter [illegible] between the head and washer is [illegible] washers are 3-32 in. thick, ⅝ in. square for 12d, and ½ in. square for 10d nails.

These nails can be driven "home" and are used for all temporary work. When stripping forms or taking down scaffolding the nails can be pulled without injury to the lumber, and if some care is taken the nails can be used over indefinitely. The nails are made by the F. A. Neider Co., of Augusta, Ky.

EARTH AND ROCK SECTION

Method and Cost of Raising Embankment and Filling Trestles Using Steam Shovel and Hart Convertible Cars With Lidgerwood Unloader.

The Frisco line (St. Louis & San Francisco R. R.) from Beaumont, Tex., to Baton Rouge, La., was built through the Alabopolya Swamp in alternate embankment and temporary trestle. The original plans were made for continuous embankment of station work, but continued high water in the swamp prohibited 50 per cent of the station work and temporary trestling was resorted to for filling in the gaps between the embankment which had been started or completed. The greater portion of the grade was 8 ft. high. The material in the embankment was the black gumbo commonly encountered in Southern Louisiana swamps. The work described consisted of raising the embankment and filling in the temporary trestling. The conditions were difficult.

The track was laid following closely behind the trestle gang, and frequent use of the track by the bridge material train put the track into a very poor condition. A great portion of the embankment built by station work was partially washed out by high water leaving holes 4 ft. deep for 15 or 20 ft. of track. The temporary trestles stood 12 or 18 ins. higher than the approaches. This condition was due to the excessive settlement of the swamp soil when put up by station work and also to heavy rains. The worst holes were cribbed up with ties and tree branches but even then a great amount of delay was caused the unloading trains by derailment and trains breaking in two in attempting to get over the bad places. It was necessary to unload dirt at these places before the track could be surfaced, as the gumbo would not hold a surface under one trainload of dirt. In many instances cars were unloaded standing on track 18 ins. out of level and 3 ft. out of surface in a distance of 10 ft. along the rail.

Hart convertible cars were used and were unloaded by Lidgerwood and plow. Before dirt was unloaded on the fills it was necessary to jack the track up out of the gumbo. It was impossible to move the track with No. 6 Barrett jacks after the dirt was unloaded. In many instances it was found necessary to strip out the track before it could be lifted from the gumbo with 12 No. 6 Barret jacks, resting on boards, per rail length. The grade on embankment was raised not less than 12 ins. at any point.

The unloading was planned so that when the first gangs were unable to get the track in shape ahead of the unloading or when they were not able to care for the dirt as fast as it came, the unloading was done on the trestles, and as they were being filled a gang was kept busy tamping the dirt in under the caps and stringers. Following a rain, the dirt packed hard and the cars and stringers were removed by the Lidgerwood and cable.

The shovel pits from which the dirt for filling was got, averaged a 15-ft. face and 1,600 ft. in length. The dirt was a sandy clay compacting very quickly in embankment. The pit was opened up along one side of the main line and track laid behind the shovel in the first cut and used as a loading track for the next cut of the shovel. More difficulty than usual was experienced in keeping the pit properly drained. Good drainage was very necessary to take care of the frequent and heavy rains common to the country. Three trains were used, 1 loading train, which handled the water cars for the shovel, 1 swing train which made the run of 12 miles to the front in 40 minutes and 1 unloading train. The unloading was started 12 miles from the pit. A siding and water track were located there affording water to the swing and unloading trains. About 25 minutes were generally consumed there in switching empties and locals.

TABLE I.

Date.	Cars Loaded.	Cu. Yds.	Cars Unloaded.	Delays.
Sept. 12	44	1,320	44	
Sept. 13	44	1,320	22	
Sept. 14	82	2,460	60	1 hr. shovel breaking.
Sept. 15	..	.....	..	Sunday.
Sept. 16	83	2,490	83	
Sept. 17	43	1,290	43	
Sept. 18	92	2,760	88	
Sept. 19	100	3,000	125	1 hr. 30 mins. shovel breaking.
Sept. 20	82	2,460	43	
Sept. 21	46	1,920	102	
Sept. 22	..	.....	..	Sunday.
Sept. 23	52	1,560	63	5 hrs. acct. rain.
Sept. 24	104	3,120	62	1 hr. 10 mins. pit men—mud.
Sept. 25	105	3,150	124	
Sept. 26	102	3,060	106	
Sept. 27	83	2,490	61	2 hrs. 40 mins. acct. rain.
Sept. 28	104	3,120	122	
Sept. 29	..	.....	..	Sunday.
Sept. 30	94	2,820	124	
Oct. 1	106	3,180	30	
Oct. 2	66	1,930	82	
Oct. 3	82	2,460	82	3 hrs. acct. rain.
Oct. 4	86	2,580	62	6 hrs. moving shovel.
Oct. 5	32	960	54	
Oct. 6	..	.....	..	Sunday.
Oct. 7	64	1,920	64	1 hr. 10 mins. truck and eng. failure.
Oct. 8	..	.....	..	Rain.
Oct. 9	40	1,200	32	
Oct. 10	94	2,350	94	
Oct. 11	22	440	64	
Oct. 12	82	2,460	82	1 hr. derailment at shovel.
Oct. 13	..	.....	..	Sunday.
Oct. 14	60	1,800	62	
Oct. 15	82	2,460	82	
Oct. 16	..	.....	..	All day moving.

The work recorded was done from Sept. 12 to Oct. 16, 1907. The daily expenses were as follows:

Loading, Transporting and Unloading:

1 Teamster at $150 per mo.	$ 5.00
3 Conductors at $100 per mo.	10.00
3 Brakemen at $75 per mo.	7.50
3 Brakemen at $60 per mo.	6.00
3 Engineers at $100 per mo.	10.00
3 Firemen at $75 per mo.	7.50
3 Engine watchmen at $60 per mo.	6.00
1 Hostler at $75 per mo.	2.50
1 Hostler helper at $1.80 per day	1.80
1 Steamshovel engineer at $150 per mo.	5.00
1 Steamshovel craneman at $90 per mo.	3.00
1 Steamshovel fireman at $75 per mo.	2.50
1 Steamshovel watchman at $60 per mo.	2.00
1 Machinist at $0.35 per hour	3.50
1 Machinist helper at $1.80 per day	1.80
1 Blacksmith at $0.35 per hour	3.50
1 Blacksmith helper at $0.20 per hour	2.00
1 Car repairer at $0.25 per hour	2.50
1 Car repairer at $0.225 per hour	2.25
1 Carpenter at $0.275 per hour	2.75
1 Pumper at $60 per mo.	2.00
1 Lidgerwood engineer at $90 per mo.	3.00
6 Pit men at $2 per day	12.00
6 Cablemen at $2 per day	12.00
Total wages	$116.10
20 tons coal at $4	$ 80.00
Supplies	2.56
Ice	1.00
Water at 50 cts. per tank from city	2.00
10 gals. gasoline at 10 cts.	1.00
Total supplies	$ 86.56
1 Steam shovel rent	$ 10.00
3 Engines rent at $5.53 per day	16.59
62 Cars rent at 50 cts. per day	31.00
1 Water car rent at 50 cts. per day	0.50
1 Spreader rent at $2 per day	2.00
1 Lidgerwood rent at $5 per day	5.00
Total plant rental	$ 65.09
Add 10% super. and 5% misc.	$ 40.15
Grand total	$307.90

Note.—The 5% misc. includes overtime, etc.

The record of the steam shovel work loading, of the number of cars unloaded and of delays for the 29 working days was as shown by Table I.

The division of labor at pit and at front and the lineal feet of track raised were as shown by Table II.

In the above record the labor under the heading of pit labor includes labor on the trackwork and drainage. Labor under the heading of front labor includes all labor used in handling material when unloaded. This same statement also applies to the cost records of the work which are given in Table III.

TABLE II.

Date.	Pitmen at $75	Pitmen at $1.75	Cost.	Front $100	Labor at $75	Labor at $1.74	Track raised ft.	Cost.
9-12	3	30	$60.00	..	..	..	....	....
13	2	31	56.75	0	1	16	400	$ 30.50
14	1	10	20.00	0	1	17	400	32.25
15	1	..	2.50	0	1	..	....	2.50
16	1	13	35.25	0	2	53	1,166	97.75
17	1	4	9.50	0	2	41	902	76.75
18	1	13	25.25	0	1	37	814	67.25
19	1	14	37.00	0	2	54½	1,199	100.37
20	1	17	42.25	0	2	59	1,298	108.25
21	1	14	37.00	0	2	55	1,210	101.25
22	1	..	2.50	1	2	..	.....	5.00
23	..	..	.....	1	3	92	2,024	171.83
24	1	5	11.25	1	3	112	2,464	206.83
25	1	5	11.25	1	2	117	2,574	213.08
26	..	..	....	1	2	93	2,046	171.08
27	..	.	.. .	1	2	76	1,672	141.33
28	..	..		1	2	68	1,496	127.33
29	.	..	.. .	1	2	..	.....	8.63
30	1	10	20.00	1	2	85.8	2,178	158.48
10-1	1	6	12.90	1	2	67	.....	125.32
2	..	..	....	1	2	68	.....	127.07
3	1	22	40.92	1	2	83.3	2,000	153.85
4	..	.	....	1	2	78	1,000	144.57
5	1	20	37.42	1	2	74½	1,320	138.45
6	..	.	....	1	2	..	.....	8.07
7	1	33	60.17	1	2	56.4	1,023	106.77
8	1	4	9.42	1	2	11.5	....	28.19
9	1	22	40.92	1	1	60	....	110.65
10	1	23	42.67	1	1	72.4	1,056	132.35
11	1	27	49.67	1	1	66.5	1,700	122.08
12	..	..	.....	1	1	58.6	1,848	108.20
13	..	.	.....	1	1	..	....	5.65
14	1	18	33.92	1	1	73	1,780	133.40
15	..	.	....	1	1	66	....	121.15
16	1	25	46.19	1	1	73	....	133.40

TABLE III.

Pit	Front	Shovel	Total	Cubic	No.
$ 60.00	....	......	$ [illegible]	1,[illegible]	44
56.75	$ 30.50	$ 308	[illegible]	1,[illegible]	44
20.00	32.25	308	[illegible]	2,400	82
2.50	2.50	200	205.00	.....	.....
35.25	97.75	308	441.00	2,490	83
9.50	76.75	308	394.25	1,290	44
32.25	67.25	308	410.50	2,760	92
37.00	100.37	308	445.37	3,000	100
42.25	108.25	308	458.50	2,460	82
37.00	101.25	308	446.25	1,920	64
2.50	5.00	200	207.50	.....	.....
....	171.83	308	479.83	1,560	52
11.25	206.83	308	526.08	3,120	104
11.25	213.08	308	532.33	3,150	105
....	171.08	308	479.08	3,060	102
....	141.33	308	449.33	2,490	83
....	127.33	308	435.33	3,120	104
....	8.33	200	208.33	.....	.....
20.00	158.48	308	486.48	2,820	94
12.92	125.32	308	446.24	3,180	106
....	127.07	308	435.07	1,930	66
40.92	153.85	308	502.77	2,460	82
....	144.57	308	452.57	2,580	86
37.42	138.45	308	483.87	960	32
....	8.07	200	208.07	.....	.....
60.17	106.77	308	474.94	1,920	64
9.42	28.20	308	345.01	.....	.....
40.92	110.65	308	459.57	1,200	40
42.67	132.35	308	483.02	2,350	94
49.67	122.03	308	479.70	440	22
....	108.20	308	416.20	2,460	82
....	5.65	200	[illegible]	.....	.....
8.92	133.40	308	475.32	1,800	60
....	121.15	308	429.15	2,460	82
46.19	133.40	308	487.59	.....	.....
$754.72	$3,518.28	$9,932	$4,306.00	63,080	2,035

The grand total cost of the work was $14,306, which gives a cost of $7 per car load of earth under the track. At 30 cu. yds. per car the cost would be $0.233 per cu. yd.

Methods and Costs of Making a Test of the Bearing Power of Soil, for a Building.

The following test was made at Evanston, Ill., in the preliminary work of construction of the First M. E. Church. The test was made for Talmadge & Watson, Architects, Chicago,

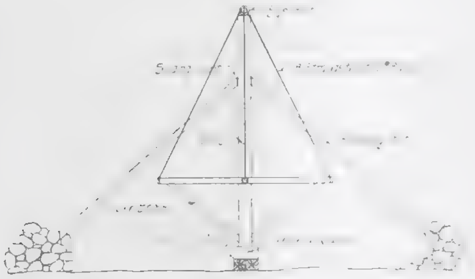


Fig. 1—Arrangement for Testing Bearing Power of Soil.

and was conducted by the Noel Construction Co., Contractors for the work. Figure 1 shows the apparatus used. The base consisted of four 12x12 in. timbers 2 ft. long, two laid transversely on top of the other two. An upright 12 in. x 12 in. timber about 20 ft. in height was stood on end on the base, being fitted in by a mortise and tenon joint. The platform was made on four 6x6 in. pieces, each about 6 ft. long and mortised into each side of the [illegible] top of the 12x12 in. center post served for fastening [illegible] running from the ring to the 6x6-in. pieces supporting the platform. In order to keep the apparatus plumb four timbers were planted solidly in the ground and leaning against the center post at an angle of about 45°. These posts were beveled off at the end touching the center post, but, in order not to cause any friction at this point the timbers were well greased.

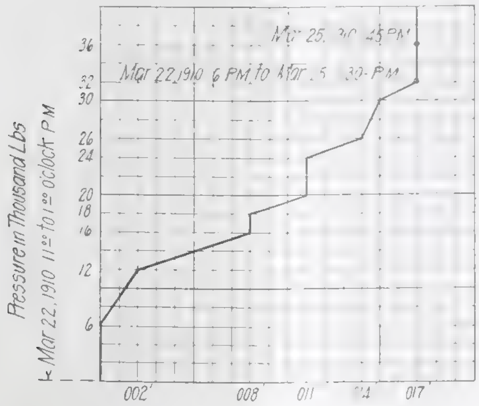
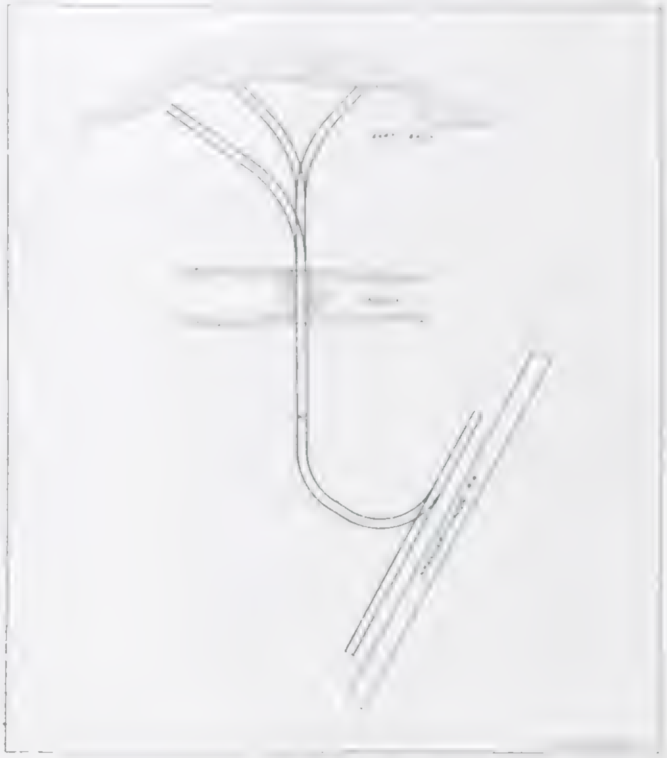


Fig. 2—Pressure Penetration Diagram for Loading Tests on Soil.



Track Arrangement for Loading Cars by Hand.

The framework thus built was loaded with bags of cement, an average weight being taken on a number of bags.

The diagram (Fig. 2) shows the results of elevations which were read at the different intervals indicated. A nail driven into the post was used for the readings and its elevation was referred to a permanent bench.

The elevation of the soil tested was about 17.65 ft. above Lake Michigan and about ¼ mile from the lake and was sand.

The cost of the test was as follows:

Carpenters, 29 hours	$18.13
Laborers, 119 hours at 37½ cts	44.63
	[illegible]

The cost of the material was negligible because the same material was used in the construction of the building.

We are indebted to Mr. W. T. Shirer, Engineer in charge of the work for the Noel Construction Co. for information from which this article has been prepared.

A Short Cut in Excavating; How a Contractor Reduced Time, Labor and Costs.

[illegible]

A very novel and economical method of handling earth excavation was recently employed at Cumberland, Maryland, by one of the younger contractors of the town. The topography of the land at the base of operation necessitated the solving of some very perplexing problems of transportation—the solution of which had previously prevented the [illegible]

Briefly, the immense bank of special earth was practically encircled by a deep canyon with the exception of a very narrow stretch of land connecting the mainland as it were, with the high bank.

The margin of profit being small, ordinary [illegible] question. The length and narrowness of the stretch of connecting land did not permit the use of wagons or carts while the use of [illegible] out of the question due to the impracticability of transporting the shovel to the bank. [illegible] able tracks was also impracticable unless they could be loaded with the minimum of labor. This, therefore, meant that the material could not be transported at any distance in shovels from the bank to the cars; in short, that the cars must be placed at the very feet of the laborers shoveling—permitting them to transfer the earth directly from the bed to the car—yet there was no room for a vast complicated system of switches.

With all this to contend with, the contractor laid a portable railroad across the narrow strip of ground to the bank. Here, by means of several short spurs, Fig. 1, he placed his cars abreast at the distance of about 10 ft. apart. This permitted the laborers to load the respective cars from three sides and without moving a step to secure the load. As the work progressed another section of the portable track (attached to steel ties) was laid and the next cars loaded at a position closer to the base of supply. The cars when loaded were conveyed by gravity to the unloader on the opposite side of the ravine, some 625 ft. [illegible]

By this method coupled with the use of Koppel all steel dump cars and portable tracks made by the Orenstein-Arthur Koppel Co., Pittsburgh, Pa., the material was loaded, conveyed and dumped for less than 6.3 cts. per cu. yd.

Cost of Repair Parts for a Rock Crushing Plant.

The crushing plant of the Illinois Stone Co. at Lemont, Ill., is now about five years old. This plant is run for crushing [illegible] 700 cu. yds. in 10 hours. The quarry which is operated in connection with the plant is adjacent to the Chicago Drainage Channel and a large part of the product is shipped to the company's yards which are located on the Chicago River in Chicago.

The top layers of stone from the quarry were soft limestone but this has been worked out for a depth of about 20 ft. over an area of, approximately, 15 acres and the stone now being handled is considered harder than that at any other quarry now being operated in that district.

The crushing plant is a timber structure and cars are hauled up a short incline to the main crusher, where they are dumped automatically. The stone passes through a No. 7½ and two Nos. 4½, gyrating crushers and 3-ft. cylindrical screens of sizes from ⅜ in. to ½ in. All machinery was built by the Power Mining & Machinery Co., of Milwaukee, Wis. The cost of repairs on this machinery given below is for the new parts purchased and does not include labor of making the repairs. The original cost of the machinery—the three crushers, screens, belts, etc., was $23,000. The cost of the new sorts purchased here were:

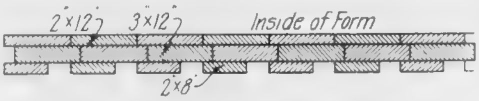
First year	$1,900
Second year	600
Third, fourth and fifth years	1,400
Total for 5 years	$3,900
Average per year for 5 years	780

This includes, during the first year, one broken crusher shaft, which was broken by an accident, and under ordinary circumstances should not have occurred. One set of wearing plates on one of the crushers has been replaced by a new set in the five years, and the ¼-in. steel plates of the screens have been replaced on an average of twice a year. The balance of the repairs were made to the smaller machinery. We are indebted for the above figures to Mr. Hogan, Manager of the Illinois Stone Co., Chicago, Ill.

Driving Wooden Sheet Piles for Wall Forms by Steam Hammer.

In the open cut work at the south end of the LaSalle Street Tunnel, Chicago, sheet piles are now being driven for the concrete wall forms. The timber piles are made by fastening three planks together so that the edges of the two outside planks lap two inches beyond the edge of the center plank, forming a groove to fit against the adjacent pile. For center pieces 3-in. x 12-in. material is used. The other pieces, 2 ins. in thickness, are different widths, an 8-in. plank being wide enough to serve the purpose where it is to be on the outside of the wall form. See Fig. 1. The piling is 26 ft. long. The concrete wall will be from 3 ft. to 6 ft. in width.

The sheet piling is driven with an Arnott Pile Hammer weighing 4,700 lbs. and operated by steam. The force of the blow struck by this hammer does not depend entirely upon the weight of the hammer. The blow is delivered by the piston under steam pressure, the stroke being 14 ins. The hammer is rated at 300 blows a minute but while timed on this particular occasion was hitting 120 blows per minute.



Sketch of Sheet Piling

The hammer is suspended from the boom of a stiff leg derrick. Steam is furnished for the derrick engine and hammer by a 30 hp. vertical boiler. The ordinary crew consists of 1 engineer, 1 fireman, 1 niggerhead man, and 3 men guiding hammer. In this work, however, it was necessary to employ 5 men guiding the hammer on account of the difficulties due to lack of space and difficult position of the hammer. The average number of piles driven per day is from 28 to 35. M. H. McGovern, Chicago, is the contractor.

Costs of Mining, Joplin District, Missouri.

The following table is taken from an article by Lucius L. Wittich in *Mines and Minerals* for June in which mining on a royalty basis is discussed. This table, however, shows the costs on this class of work obtained from Mr. W. A. Christy, General Manager of the Federated Mines & Milling Co.:

COSTS PER TON OF OPERATION IN SOFT AND SHEET GROUND.

	No. 1 soft ground.	No. 2 sheet ground.
Superintendence	$ .021	$ .010
Surface labor	.157	.176
Underground labor	.340	.337
Explosives	.049	.137
Timber	.067	
Supplies	.098	.162
Fuel	.085	.083
Oil and waste	.012	.014
Fire insurance	.005	.004
Liability insurance	.015	.016
Interest	.026	.019
Total	$ .875	$ .958
Cost of two shafts	$ 3,200	$ 9,800
Preliminary work	1,800	4,000
Cost of mill	11,000	16,500
Drilling	2,000	1,600
Total	$18,000	$31,920

Column 1 is for mining in what is known as soft ground; the ore is in a conglomerate mass and in runs. The drifts are 12 to 14 ft. high; the stope is hard, requiring drilling, but the heading and roof are soft, requiring heavy timbering. There is enough water in the ground to require a 2-in. pump column pipe. Two shafts each 160 ft. deep, have been sunk at a total cost of $32 per foot. Column 2 is for mining in a sheet-ground mine with a 16 ft. face. The ore is four parts zinc blend to one of galena. A 5-in. pump column pipe is required, the motive power for pumps and hoists being steam.

ROADS AND STREETS SECTION

A New Machine for Testing the Adhesive Quality of Pitch.

The value of pitch, as a binder in road construction, is due largely to its adhesive quality. A new method of testing for this quality has been devised by W. H. Fulweiler, of the United Gas Improvement Co., and at his request Mr. Thorsten Y. Olsen designed a new type of impact tension testing machine which will subject all samples of pitch to the same conditions and provide a test which can be duplicated at any time on any machine built on this principle. At the recent convention of the American Society for Testing Materials, Mr. Olsen described the machine as follows:

The method of testing the pitch, consists of forcing apart two specially designed dies held together by the pitch and determining the amount of energy thus required:

To make this method a success two important factors must be considered:

1st. The size and form of the dies.

2nd. The method of applying and recording the energy.

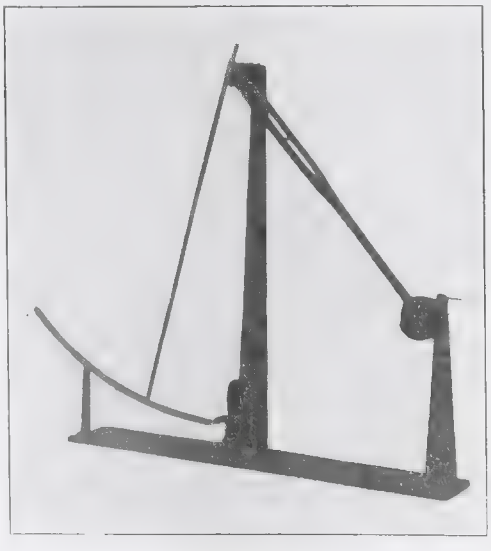
The first factor was carefully determined by Mr. Fulweiler, after numerous experiments and the Standard die is 1.1 in. in diameter with three concentric grooves turned in the one half into which the other half fits in such a manner that when pressed together, a thin filament of pitch will be left on all sides of the concentric grooves. The grooves are also so prepared that the pitch is forced out from the center, thus filling all the grooves uniformly.

The present form of die was shaped to cover the points mentioned above and also by experiment until it reached such a form that any further change altering the thickness of the pitch filament would decrease the amount of energy required to force the dies apart.

As pitch has a certain viscosity, varying considerably with the various grades and with the temperate, etc., is essential that it be tested always under the same conditions and also owing to this viscosity, it is essential that time as a factor be eliminated in the method of testing.

To force the dies apart, it is therefore necessary to apply impact tension.

The machine designed for this purpose is shown by the illustration. It consists of a weighted pendulum which is dropped a certain heighth striking a crank lever which in turn forces the dies apart. The crank lever was used as the only medium by which the force of impact could be transmitted to the dies and at the same time allow the pendulum to continue its course and thus provide a means whereby the energy used in parting the dies could be measured.



Device for Testing Adhesive Quality of Pitch.

The capacity of the machine as graduated on scale eliminates the energy utilized in operating the crank lever by itself, as well as that required to move the set pointer, so that the energy used in parting the dies is read directly off the scale.

The pendulum is held in place and released by a latch as shown in the illustration.

The dies are so arranged that the lower half may by a quarter turn be gripped firmly in the frame of the machine and the upper half is placed in a yoke swung from the crank lever at the top and guided by the frame at the lower end so as to insure a direct straight pull on the pitch.

Thus far, but few tests have been made on this machine as it has only been completed recently. It being a new type of machine, it has taken more time than was expected to perfect it, but as the principle involved is correct, there is little doubt but that this machine will form an excellent one for this purpose.

This type of machine can be arranged so it can make impact tension tests of Standard cement briquettes which may give some interesting data on cement. A machine of larger capacity built on this principle and with the proper gripping device would form an ideal machine for impact tension tests of metals, or of testing small nicked bars over a die in determining the fragility of steel.

Direction Posts and Warning Signals.*

With the advent of the motor car the need for the systematic erection of legible direction posts, which would enable the tourist to easily distinguish their characters in passing without the necessity of slowing down, became greatly increased.

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*A paper by Rees Jeffreys, Secretary of the British Motor Union, read before the Irish Road Congress at Dublin, Ireland, April 20, 1910.

The posts that have been erected by the various authorities throughout the country differ considerably in their position, their legibility, their number and their information, and have been marked and placed to correspond with the comparatively slow movements of the horse-drawn vehicle, and adapted to local traffic rather than to the modern needs of the swifter motor car. In those countries where no steps have been taken to elaborate the direction posts erected within their boundaries, road travel is fraught with considerable discomfort and inconvenience. It should be recognized that with the increased touring facilities afforded by the motor car, direction posts have ceased to be of local value only, and are regarded by the tourist as an essential assistance in his travels.

In many cases the tourist, although aware of the ultimate destination of the road upon which he is traveling is unacquainted with the name of the place where he may be at the moment; it is, therefore, desirable that posts should be erected at the approaches to each town or village, bearing the name of the town or village; and in the country that a plate should be attached to the post bearing the name of the village or parish.

A considerable number of the existing direction posts have ceased to be of any practical utility from the fact that they are erected in such positions that their wording is obscured by foliage; or it is necessary to make a detour to read their inscriptions, or the arms are so placed that one hides the wording on another. In many other instances they are illegible through insufficient maintenance and occasionally are damaged or broken.

The post should be constructed of cast iron or tubular steel, and the arms of enamelled iron, as experience and exeriment have shown that superior durability and legibility are obtained with these materials.

The many difficulties that beset the tourist could be reduced to a minimum by the general adoption of a uniform, legible and instructive direction post, and the recommendation by the Local Government Board of such a post to the various authorities would be a progressive step in this direction. This model post, in order to be effective, should embody the following features:

(1) All direction posts should be erected in conspicuous positions so as to be readily visible, and at forked roads placed in such positions as to be read from all sides.

(2) The arms should point in the direction of the plates indicated on them, and at such an angle that the place-names can be read as the traveler approaches.

(3) Where two or more arms are on the same post, the arms should be fixed at different levels so that from no point does one arm hide another.

(4) The name of the next chief town should be the first name on each arm, and followed by the names of the nearest towns or villages in slightly smaller letters.

(5) The mileage from the place of erection to the respective places mentioned on the arm should be clearly defined after each name by figures only.

(6) The name of the village or parish in which the post is erected should be indicated on a plate attached to the post beneath and away from the lowest arm.

(7) The arms should not be overcrowded with detail, and all superfluous information should be omitted.

(8) The lettering should be on both sides of the arms and in legible characters.

The careful and efficient erection of danger signals has the double object of increasing the safety of the highways for all classes of persons using them, and the promotion of considerate driving of road vehicles.

Under the provisions of Section 10 (2) of the Motor Car Act, 1903, Local Authorities, within the meaning of Section 9 (4) of the Act, are empowered to erect danger signals at dangerous corners, cross-roads and precipitous places. [illegible] roads and not on by-roads, however dangerous the latter may be.

[illegible] Municipal Corporations Association adopted the hollow equilateral triangle sign for use at these points, and this design was approved by the Local Grovernment Board for such purpose. Experience has shown, however, that these triangles do not command the respect of drivers to the extent that is desirable, mainly owing to the fact that their erection has been carried out in too general a manner, and also because they give no intimation to the driver of the specific danger which has suggested their erection. In order to be effective, danger signals should be legible and specially worded to inform the motorist of the conditions which he has to meet, and a sign denoting the existence of a Dangerous Hill, Corner or Cross-Roads, or a School or Concealed Turning, has the effect of causing motorists to slacken speed and proceed with greater caution than before.

This object may be secured by the general adoption of a uniform sign embodying the recognized triangle as part of its design, and by the attachment of a separate plate beneath the main portion of the sign bearing upon it in bold characters a description of the special character of the danger.

The following points in particular should be marked by danger signals:

(1) Cross-Roads.
(2) Steep Hills.
(3) Dangerous Corners.
(4) Sharp Bends.
(5) Concealed Turnings.
(6) Schools.
(7) Level Crossings.

The erection of signs at cross-roads should be carried out with special discrimination and when it is necessary to give warning of the existence of concealed cross-roads the less important road only should be posted. Main road traffic having the priority, the onus rests upon the drivers of the vehicles entering from the side road to ascertain that the main road is clear before entering or crossing it. Similarly, corners should only be marked when they are concealed by bends in the road, high hedges, banks and similar causes. Signs erected to indicate the proximity of steep hills should be placed at not less than 75 yards from the commencement of the descent so as to enable the driver ample time to slow down.

The observance of the following conditions in carrying out the erection of danger signs would secure the desirable combination of uniformity and efficiency:

(1) Signs should be erected to denote the existence of danger spots which are not apparent.

(2) Signs should embody the recognized triangle as part of their design.

(3) Signs should be on the rear side of the road and at an angle to face the driver.

(4) Wherever possible, the signs should be 100 yards from the danger spot, and in no case less than 50 yards.

(5) [illegible] not less than 8 ft. from the ground level.

(6) The back of each sign should be painted white.

(7) All signs should be erected with due consideration of background.

(8) Each sign should give an indication of the specific danger that has to be encountered.

The Economy of Good Stone in Macadam Road Work.*

There are many varieties of rocks, and each has different qualities varying with the mode of ocurrence, the mineral character, the stratigraphical position, and the weathering of the stone.

[illegible] traffic is carried continuously; [illegible]

The converse of the last statement, however, contains a greater truth—in other [illegible] delivered than soft stone, which may occur in the vicinity, should be brought—for it will be found that the greater cost is more apparent than real. In other words, if the period of time through which the stone surface survives, and the labor expended in cleaning and repairing it are taken into account, it will be found the hard stone is generally, in the end the cheaper.

The hard stone, however, should be uniform in quality, and (for light traffic) broken to a smaller gauge—say 1½ in. The temptation to mix stones of different qualities and to send out the metal too large becomes greater, the harder the rock to be broken

These two faults have sometimes given a bad name to a quarry which contained excellent road material. In Dublin county soft and hard stone are found, the former being, mostly, the carboniferous limestone, which is the formation exposed, generally, over the greater part of the county, as over the whole central plain of Ireland, and containing beds of variable qualities—the latter igneous intrusions through the Silurian slates commonly known as "greenstone," and Metamorphic beds of lower Silurian age, the most serviceable of which, for road purposes, is known as "quartzite."

Other Metamorphosed rocks, such as gneiss, schists, etc., and plutonic rocks, laid bare [illegible] denudation, such as granite, are [illegible] abundantly, but most of them, being friable [illegible] easily disintegrated, are almost useless for road purposes.

Unfortunately, the limestone occurs on the north side of the country, which is chiefly agricultural, and where the traffic, the products of agriculture inwards and manure or goods outwards, is heaviest.

For many years most of the main roads in this area have been repaired with limestone from the hardest or crystalline beds, but the experience gained during that period of time has shown the writer that it would be foolish to prolong the experiment, and the sooner a hard stone is brought to these road the better for them and the users of them

[illegible] Santry. This forms portion of the principal main highway from Dublin to the North, via Balbriggan and Drogheda, and is the route taken for the carriage into the Dublin markets of the agricultural produce of the northern area of the county as far as Gormanstown.

On the section described, which is the nearest to the city, and on which a tally kept on one occasion showed 115 loads to have passed a given point in 3 hours, equivalent to about 75 tons per hour, carried on 2½-in. tir[illegible] from the best beds in Pass quarry, broken to [illegible] ring, has been rolled for the past five years

[illegible] stone broken properly, though by hand, and the failure of the road to retain a[illegible] face was at first ascribed to irregular breaking. During the past two years this has been improved, with the result that the surface did not become so pitted and bumpy as before.

Under the heavy traffic, however, the excessive wear continued, but more uniformly than before, the disintegrated surface, as thick and greasy mud in wet, and dust in dry, weather, not only causing, while it remained, great dissatisfaction to the public, but great expense in its removal.

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*[illegible] Dublin County read before the Irish Road Con-[illegible]

The section of the road under consideration is 526 statute perches in length, has an average width of 6 yards, and has cost £500 a year, or nearly £1 a perch, to maintain.

About 1,200 cu. yds. of limestone have been rolled in on about three-fourths of the length each year, and two surfacemen are kept constantly at work on it cleaning and patching it.

From the last statement it follows the road is rolled throughout three times in four years. It must be admitted this is excessive, and the cost of maintaining this road is absurdly high. The fault is in the material used, and its use, dictated latterly by the desire to give employment in the district, has been continued too long.

On the writer's application for the current year a sum of £600 has been allowed for the road, and he has decided to discontinue the use of limestone, substituting 850 cu. yds. of broken quartzite from Howth, and 200 cu. yds. of quartzite screenings, these costing on the road 7s 6d per cu. yd., against 5s 6d paid previously for limestone.

It is estimated the quartzite will last three times as long as the limestone, and will require about one-fourth only of the labor in cleaning. There should, therefore, result in the use of this stone on the road a saving of about 60 per cent after three years, when the whole road will have rolled with the quartzite, if the above assumptions are correct. To the users of the road, too, there will be a distinct gain in the use of the better material, requiring, as it will, to be rolled less often, and causing, therefore, less interruption to the traffic. Add to this, there will be less mud and dust, and, therefore, greater comfort to the public.

Methods of Constructing Natural Mixture Sand-Clay Roads in Georgia.

The estimated public road mileage of the state of Georgia in 1909 was 82,182. Of this mileage, 554 miles were surfaced with stone, 56 miles with shells, 502 miles with chert and gravel and 3,421 miles with sand clay mixture. The sand clay roads of Georgia are of two types: The artificial mixture and the natural mixture, where common earth roads have for long stretches the right proportion of sand and clay to make a typical sand clay road. The construction of natural mixture sand-clay roads has been carried on with much success in Clarke county and in the recently issued second report on the Public Roads of Georgia Mr. S. W. McCallie, State Geologist, gives the following description of the methods as adopted in that county:

First. The grading of the road bed is first done to a width of 30 ft.

Second. In the center a bed of top soil 10 in. deep and 16 ft. wide is laid. The teams haul over this bed as the work progresses. With clay foundation, it would be a mistake to prepare a trench to receive the top soil.

Third. The road machine excavates flat-side ditches 6 in. deep and 4 ft. wide; throwing the earth as a shoulder against the top soil bed, and then crowning the whole from ditch to ditch.

Fourth. The construction teams and traffic pass over the green bed and pack it down chiefly in the center. When several hundred yards are thus partially packed, the road machine pulls in the material from the sides and resurfaces the bed. New top soil is delivered for weak places and shaped up.

Fifth. As fast as the grading of the bed is finished, the top layer is spread on it. Thus by the time ½ mile of road has been graded and covered with top soil, the first ¼ mile has undergone considerable packing and resurfacing and getting into good shape.

Sixth. For some weeks close attention is paid to the new bed, watching for weak places, doctoring them, maintaining the grade with new top soil and keeping the crown fully up to 1 in. per foot.

Seventh. Wet weather hastens the period of consolidation if followed by a dry spell. When packed quite wet, the wheels consolidate the material from the bottom upward. In dry or moist weather, the top layer only is consolidated and may cut through at the next rain. A period of wet weather is usually necessary for a full packing down of the top soil into permanent firmness.

Eighth. Usually, in two months, a new top soil roadbed is consolidated, shaped to its correct crown, and able thereafter to withstand the rains and the traffic. Much of the reshaping and doctoring of the surface coat is done at odd times incidental to the main grading work while the teams are in transit from barracks to the work."

The cost per mile to Clarke county of putting on this "top soil" coat, using convict labor at 50 cts. per day and the county teams at $1.00 per day, is $400.

The material which is used for road surfacing in Clarke county, designated as "top soil," is a residual sandy clay, resulting from the weathering of granites and granite-like rocks. It usually contains 50 per cent or more of hard, coarse residue, consisting of quartz and feldspar, 'the latter often partially altered into kaolin. Experience shows that the best "top soil' is found in cultivated fields where the fine particles of mica are wanting and the clay has the essential plasticity. The results which have been obtained in Clarke county with the natural sand-clay mixture are very satisfactory, and the work fully demonstrates what can be done throughout the Crystalline Area region of Georgia where like material for building sand-clay roads is abundant.

A somewhat different material from the above natural sand-clay mixture has recently been extensively used in road construction in Sumter and other counties in South Georgia. The material there is a reddish sandy clay widely distributed throughout the Coastal Plain. It, like the clays of the Crystalline Area, is often partially residual, having resulted from the weathering of the underlying formations. In Sumter county excellent results have been obtained by using the clay directly from the roadway without any previous mixture. The only attention necessary to keep these roads in first-class condition, after they have been once properly graded and drained, is an occasional use of the split log drag, which fills up all ruts and washes and at the same time restores the former crown and leaves the surface in a smooth, even condition. These roads, are what may be termed ideal country roads, over which from 8 to 10 bales of cotton may be drawn by a two-horse team with comparative ease. Roads constructed of natural sand-clay mixture may be found in a large number of other counties of South Georgia. In many places throughout this part of the State, it is true, surface sands occur, in which case artificial sand-clay mixtures must be resorted to, but, fortunately, even here only a few inches, or at most a foot or so, beneath the surface sands generally occurs an abundance of clay suitable for sand-clay mixtures.

Permanent International Association of Road Congresses.

A Permanent International Association of Road Congresses was formed under the resolution adopted at the general assembly of the first Congress held at Paris in 1908. This association has for its object:

1. The organization of successive congresses.

2. The publication of sundry articles, reports and documents relating to roads.

3. The collection of the results found in every country from the tests of materials, used or suitable for use in the construction and maintenance of roads, obtained by an application on the roads or by researches in the laboratory.

This association, which has its headquarters 1 Avenue d'Jéna, Paris, is directed by a permanent international commission, composed of delegates from every country, having at its head a permanent council formed in the same way and a French Executive Committee.

It is thought that there are great advantages in a federation of all persons using the road or interested therein, because it will give the means of insuring equal facilities of circulation in all lands, and of becoming informed at all times about discoveries made in all parts of the world.

Every person belonging to the Association as a permanent member acquires the right, on the payment of 10 francs annual dues, to receive all the publications issued by the Executive Committee, to take part in all congresses, and especially in the second, which will be held at Brussels from July 31 to August 7, 1910. However, every one joining the Association as a permanent member, during the year in which a congress is held, for instance, in 1910, pays for that year annual dues of 25 francs; for other years, the ordinary subscription is that of 10 francs, as aforesaid. Requests for membership must be sent to Mr. Mahieu, Secrétaire Général de l'Association, 1 Avenue d'Jéna, Paris, with the subscription of 25 francs for the year 1910.

STEAM AND ELECTRIC RAILWAY SECTION

The Appraised Values of the Electric Street Railways of Detroit, Mich.

(Continued from July 6 issue.)

25. Overhead Positive Feeder System:

T. B. Cable.	Miles	Dollars
1,000,000	[illegible]	[illegible]
800,000	[illegible]	[illegible]
750,000	[illegible]	[illegible]
600,000	2.95	34,766
500,000	[illegible]	[illegible]
400,000	7.60	62,342
350,000	1.31	[illegible]
300,000	[illegible]	[illegible]
300,000—Aluminum	0.11	303
250,000	[illegible]	[illegible]
4/0 T. B. cable	11.16	[illegible]
4/0 Bare cable	1.68	[illegible]
3/0 T. B. cable	4.30	14,292
2/0 T. B. cable	.99	2,617
2/0 Bare cable	1.61	3,427
1/0 T. B. cable	0.70	1,506
Total	266.99	[illegible]

2,710,459 lbs. copper....................$486,313.62

26. Miscellaneous Articles:

1,101 hexagon head cup screws at .51	$56.15
5 wood rollers at .75	3.75
[illegible] bronze lock washers	5.51
30 span wire take-ups at .25	7.50
4 porcelain knobs at .02	.08
136 No. 4 porcelain knobs at .01	1.36
[illegible] No. 1 porcelain knobs at .015	2.31
15 feet 1" gas pipe at .05	.75
[illegible] circular loom at [illegible]	1.50
1 16"x3" C. I. pole guard	7.00
1 ¼"x2"x3' angle iron, per lb., .035	.25
12 Pcs. ¼"x1⅛"x7" copper, per lb., .35	4.20
27 Pcs. C. I. lining blocks, per lb., .04	50.63
2,690 ft. 4-ply 10" rubber belting at .48	1,291.20
154 1"x18" wood screws, per gr., .31	.33
[illegible] iron clevices, at .45	.90
109 wooden feed rollers at .75	81.75
1 ½"x4' eye bolt, per C. $9.80	.10
115 assorted eye bolts, 12" to 16" long, per 100 lbs., at $4.41	5.07
1 14" insulated eye bolt	.37
13 11" insulated eye bolt at .37	4.81
1,201 assorted eye bolts, ⅝"x16", per 100 lbs., at $6.45	79.15
1 special made wall plate, ½"x4"x30"	3.50
1 special made wall plate, 1"x6"x36"	4.25
63 feet 4-ply 10" rubber belting at .59	37.17
Total, miscellaneous	$1,649.59

27. Span Wire:

290 ft. double galvanized span wire, ¼", at $0.75 per 100 ft.	$ 2.18
240,530 ft. double galvanized span wire, 5-16", at $1.00 per 100 ft.	2,405.30
915 ft. double ganvanized span wire, ⅜", at $1.20 per 100 ft.	10.98
300 ft. double galvanized span wire, ½", at $1.80 per 100 ft.	5.40

37,287 ft. double galvanized guy wire, ¼", at $0.75 per 100 ft.	[illegible]
70,790 ft. double ganvanized guy wire, 5-16", at $1.00 per 100 ft.	707.90
50,172 ft. double galvanized guy wire, ⅜", at $1.20 per 100 ft.	602.06
34,627 ft. double galvanized guy wire, ½", at $1.80 per 100 ft.	623.29
92 ft. double galvanized guy wire, ¾", at $5.00 per 100 ft.	4.60
267 ft. wire cable, 1", at $0.19 per ft.	50.73
625 ft. iron wire, No. [illegible] per lb.	[illegible]
75 ft. iron wire, No. [illegible] per lb.	.13
5,068 ft. barbed wire, [illegible] rods, at $1.25	4.89
Labor erecting 9,010 spans at $1.00 each	9,010.00
Total, Span Wire	$13,709.41

28. Miscellaneous Copper:

63,620 lbs. (about), at 17 cts. per lb.	$10,815.40

29. Track and Pipe Negatives:

78,050 lbs. (about) copper for track, at 17 cts.	$13,266.68
Labor on same	769.40
66,800 lbs. (about) copper for pipe neg., at 17 cts.	11,353.91
Labor on same	823.63
Total, Track and Pipe Negatives	$26,173.62

30. Overhead Special Work:

88,990 lineal ft. ¼" galvanized iron span wire at $0.75 per 100 ft.	$ 667.43
69,400 lineal ft. 5-16" galvanized iron span wire at $1.00 per 100 ft.	694.00
1,695 lineal ft. ⅜" galvanized iron span wire at $1.20 per 100 ft.	20.34
4,151 lineal ft. 2/0 copper wire, 1,673 lbs., at $0.18 per lb.	301.14
467 overhead trolley switches at $7.50	3,502.50
37 insulated overhead trolley cross-overs at $4.38	162.06
222 metallic overhead trolley cross-overs at $4.00	888.00
1,851 single, single wire pull-overs, at $0.40	740.40
94 single, double wire pull-overs, at $0.58	54.52
1,493 double, single wire pull-overs, at $0.60	895.80
66 double, double wire pull-overs, at $0.93	61.38
377 hangers at $0.45	169.65
114 No. 1 strain insulators at $0.35	39.90
1,894 No. 2 strain insulators at $0.25	473.50
34 large Brooklyn strain insulators at $0.90	30.60
317 small Brooklyn strain insulators at $0.60	190.20
107 strain ears at $0.61	65.27
697 wood breaks at $0.20	139.40
480 collars at $0.15	72.00
104 Meadbury composition at $0.20	20.80
158 eye bolts at $0.08	12.64
117 iron rings at $0.025	2.92
31 turnbuckles at $0.50	15.50
120 "V" guards at $0.50	60.00
2 double and single trolley metallic crossings at $5.50	11.00
9 double and single trolley insulator crossings at $7.27	65.43
Labor erecting 293 layouts	22,277.09
Total, Overhead Special Work	$31,633.47

31. Underground Return System:

Various negative connections	$47,009.11
Positive feeder lines	6,388.30
Total, Underground System	$53,397.41

32. Underground Pipe Connections:

85 connections	$7,122.86

33. Trolley Wire (2/0):

201.91 miles plus 1% for sag = 1,075,640 lin. ft., at 0.403 lbs. = 433,481 lbs. copper	$78,026.58
Labor	7,023.42
Total, Trolley Wire	$85,050.00

34. Overhead Line Material in Car Stations, Shops and Yards:

Material	$ 6,828.78
Labor	9,948.00
Total	$16,776.78

35. Telephone System:

Materials, No. 10 iron wire, 546,023 ft.	$4,231.85
Labor, 51.706 miles circuit (or 103.412 miles sgl. wire) at $15	775.59
Total, Telephone System	$5,007.44

36. Potential Lines:

Potential wires and material from power station "A" to Adams avenue.	
Total for material and labor	$110.06
Total for material and labor from battery	270.48
Total, Potential Lines	$380.54

37. Cross Bonding:

347 Single track cross bonds at $4.19	$1,453.93
343 Double track cross bonds at $9.06	3,107.58
Total, Cross Bonding	$4,561.51

38. Straight Track Bonding:

490 lin. ft. 500,000 c. m. T. B. W. P. copper cable	$ 157.76
31,520 lin. ft. 2/0 copper wire, 12,932 lbs.	2,286.15
27,098 42" 4/0 flexible copper bonds	21,678.40
1,995 36" 4/0 flexible copper bonds	1,396.50
2,136 32" 4/0 flexible copper bonds	1,324.32
27,035 10" form 8 flexible copper bonds	20,276.25
10,769 "U" copper bonds	7,538.30
110 21" 4/0 copper stubs	55.00
75 lbs. No. 14 copper wrapping wire	18.75
62 lbs. solder	11.47
4,302 4/0 solid copper bonds	3,441.60
40 36" 4/0 solid copper bonds	28.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total, Straight Track Bonding	[illegible]

39. Special Work Bonding:

166,052 lin. ft. 2/0 copper wire, 68,321.4 lbs., at $0.[illegible]	[illegible]
[illegible]	[illegible]
3,840 36" 4/0 flexible copper bonds at $0.[illegible]	[illegible]
347 32" 4/0 flexible copper bonds at $0.[illegible]	[illegible]
[illegible]	[illegible]
554 10" 4/0 figure "S" copper bonds at $0.[illegible]	[illegible]
[illegible] copper [illegible]	[illegible]
[illegible] copper [illegible]	[illegible]
70 16" 4/0 flexible copper stubs at $0.[illegible]	[illegible]
1,862 lin. ft. No. [illegible] copper [illegible] wire, [illegible]	[illegible]
2,434 lbs. solder at $0.18½	450.29
105 42" 4/0 solid copper bonds at $0.80	[illegible]
220 42" 2/0 channel pin copper bonds with 2 pins at $0.87	191.40
761 36" 2/0 channel pin copper bonds with 2 pins at $0.78	593.58
89 30" 2/0 channel pin copper bonds with 2 pins at $0.67	59.63
55 24" 2/0 channel pin copper bonds with 2 pins at $0.61	33.55
63 2/0 channel pin copper plugs at $0.10	[illegible]
58 2/0 copper "U" bonds at $0.70	40.60
30 4/0 flexible copper soldered bonds at $0.52	[illegible]
258 lin. ft. 1,000,000 c. m. T. B. W. P copper cable, 948 lbs., at $0.17.	161.16
158 lin. ft. 4/0 insulated cable, 126.4 lbs., at $0.17	21.49
Total, Special Bonding	$29,984.25

40. Equalizing Stations:

11 stations	$ 21,737.08
Total of Items 1 to 40	$1,154,187.43
41. Contingencies	57,709.37
Grand total	$1,211,896.80

Dividing each of the above 41 items by 183.34, we have the following costs per mile of all track.

	Per mile of track.
1. Iron poles (40.9 poles)	$1,059.30
2. Cedar poles (13.1 poles)	127.00
3. Idaho poles (0.6 poles)	12.80
4. Northern pine poles (1.2 poles)	14.50
5. Pole tops and guy stubs	44.00
6. Iron pole strap bands	33.10
7. Iron cross arms	26 50
8. Wood cross arms	10.20
9. Insulators	53.20
10. Ears	1.50
11. Anchor rods, turnbuckles	1.10
12. Lightning arresters	17.40
13. Circuit breakers	4.10
14. Bolts, screws, washers, chairs	12.50
15. Switches	9.30
16. Switch boxes and fuses	2.90
17. Miscel. iron fittings	2.90
18. Wood braces	1.20
19. Trolley signs	2.20
20. Trolley brackets	3.00
21. Brackets	1.20
22. Hangers	20.50
23. Wooden trolley troughs	12.20
24. Special feeder and trestle constr.	32.80
25. Overhead positive feeder system	2,652.00
26. Miscellaneous	9.00
27. Span wire	74.70
28. Miscel. copper	59.00
29. Negative tracks and pipe feeders	142.70
30. Overhead special work	[illegible]
31. Underground return system	291.20
32. Underground pipe connections	38.80
33. Trolley wire	463.80
34. Overhead material in car stations, etc.	91.50
35. Telephone lines	27.30
36. Potential lines	2.10
37. Cross bondings	24.90
38. Straight track bonding	457.00
39. Special work bonding	163.50
40. Equalizing stations	118.60
Total	[illegible]
41. Contingencies	314.70
Grand total	$6,609.70

The depreciated or present value of the power distribution system is as follows:

1. Iron poles	$ 174,797.06
2. Cedar poles	11,643.50
3. Idaho poles	1,175.78
4. Northern pine poles	674.88
5. Pole tops and guy stubs	7,260.96
6. Iron pole strap bands	5,764.32
7. Iron cross arms	4,370.45
8. Wood cross arms	1,494.64
9. Insulators	8,309.61
10. Ears	[illegible]
11. Anchor rods, turnbuckles	198.17
12. Lightning arresters	2,865.66
13. Circuit breakers	679.95
14. Bolts, screws, washers, chairs	2,174.47
15. Switches	1,539.11
16. Sw[illegible]	[illegible]
17. Miscellaneous iron fittings	482.20
18. Wood braces	189.44
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
26. [illegible]	[illegible]
[illegible]	[illegible]
33. [illegible]	[illegible]
34. [illegible]	[illegible]
35. [illegible] lines	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
40. Equalizing stations	[illegible]
Total [illegible]	[illegible]
41. [illegible]	[illegible]
[illegible]	[illegible]

[illegible] ground line.

Calibrations (horizontal and vertical) were made of the trolley wire, and the feed wire was inspected in different locations.

The trolley wire system is as follows:

	Miles
Single trolley span wire constr., double [illegible]	[illegible]
[illegible] track	43.22
Double trolley span wire constr.	26.21
[illegible]	[illegible]
Single trolley center pole bracket constr., [illegible]	[illegible]
[illegible]	[illegible]
Total	[illegible]

6. *Track.*—There are 21 different types of rail and 95 different forms of track construction. The following is a summary of the 21 types of rail used, not including special track work.

				Miles
2⅞"	25	-lb.	T	0.1763
[illegible]	[illegible]	[illegible]	T	1.3986
1¾"	60	-lb.,	T	1.5320
[illegible]	[illegible]	[illegible]	TG	0.3831
[illegible]	67	-lb.,	T	0.0437
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]
7	70	-lb.,	T	2.893
	72	-lb.,	GG	0.967
7	85	-lb.,	GG	47.53
7	86	-lb.	GG	11.8125
7	91	-lb.,	[illegible]	[illegible]
7	91	-lb.	[illegible]	[illegible]
7	95	-lb.	[illegible]	[illegible]
8	95	-lb.	[illegible]	[illegible]
9	90	-lb..	GG	4.574
9	91	-lb.,	[illegible]	[illegible]
9	98	-lb.,	GG	58.49
[illegible]				[illegible]

[illegible]

TG = Tram girder rail

GG = Girder grooved rail.

[illegible] follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Car stations, yards, etc.	12.93
Total track	183.341

Most of the rails were laid in 1895-1896.

Including the differences in paving, there are 204 different types of track construction. A detailed estimate was made for each type based on the following unit prices:

Excavation:

	Per cu. yd.
Earth and sand trench work	$0.[illegible]
Earth and sand	0.[illegible]
[illegible]	[illegible]

Haul:

	cu. yd.
[illegible]	[illegible]

Grading:

	cu. yd.
Earth and sand on street	$0.25

Track Foundation:

	Per cu. yd
Earth filling	$0.22
[illegible]	1.[illegible]0
Crushed stone	1.95
Concrete	4.50

Cushion:

	Per cu. yd.
[illegible]	$1.50

Ties:	Each.
White oak 6"x8"x7' 0'	$0.75
White oak 5"x11"x9'x10"	1.44
White oak 6"x10"x6' 8"	1.18
Cedar and pine 6"x8"x8' 0"	0.65
Cedar and pine 6"x8"x6 10"	0.60
Angle iron ⅜"x2½"x6' 0"	1.09
Channel iron 7"x7' 0"	2.52
Bar iron ½"x1½"x6' 0"	0.42
Tie clips	0.22
	Per lin. ft.
Drain:	
Soft tile	$0.04½
	Per ton.
Rail:	
"T"	$31.75
"T"	33.75
Girder groove	40.00
Plain girder	40.00
Tram	40.00
	Per keg.
Spikes:	
Standard spikes	$4.00
	Per keg.
Bolts:	
Bolts and nuts	$4.75
	Each.
Tie Rods	
¾"x5' 2" round	$0.25
⅜"x1½" flat	.67
	Per pair.
Joints:	
4 hole strap plates	$0.07⅔
4 splice plates 20"	76½
4 hole splice plates 20"	.34⅛
4 hole splice plates 20"	.57
4 hole splice plates 20"	.22⅞
4 hole splice plates 24"	.55½
4 hole splice plates 27"	.68¾
4 hole splice plates 44"	1.34
6 hole splice plates 28"	1.07
6 hole splice plates 26"	.65
10 hole splice plates 36"	.94
10 hole splice plates 36"	.907
6 hole splice plates 36"	.835
12 hole splice plates 32"	1.31
4 hole continuous plates	1.62½
4 hole continuous plates	1.36⅛
4 hole continuous plates 24"	1.71 3/10
4 hole continuous plates 20"	1.42½
4 hole continuous plates 20"	1.38
4 hole continuous plates 20"	1.54½
4 hole continuous plates 26"	2.53¾
6 hole continuous plates 26"	2.53¾
8 hole continuous plates 30"	4.65
8 hole continuous plates 22"	4.08
American rail joint	2.50
Cast weld joint, each	3.00
Rail straps	.51½
	Per cu. yd.
Retaining Wall:	
Concrete	$6.50

The unit prices used for the special track work are as follows:

	Cost in place.
Nine-inch—	
Plain layout (switch, mate and frog)	$390.90
Hard center layout (switch, mate and frog)	467.70
Hard center diamond switch ends	807.05
Plain street crossing	243.70
Hard center street crossing	333.30
Plain frog	96.25
Hard center frog	126.33
2-point hard center frog	246.06
3-point hard center frog	307.70
Hard center mate	166.65
Plain tongue switch	160.50
Hard center tongue switch	185.85
Curved or guard rail (per lin. ft.)	2.18
Switch lock boxes	32.00
Switch spring boxes	8.96
Seven-inch—	
Plain layout (switch, mate and frog)	$358,90
Hard center layout (switch, mate and frog)	435.70
Plain diamond switch ends	410.25
Hard center diamond switch ends	551.05
Plain street crossings	224.50
Hard center street crossings	314.10
Plain frog	86.01
Hard center frog	11.55
2-point hard center frog	224.30
3-point hard center frog	281.90
Plain mate	130.81
Hard center mate	156.41
Plain tongue switch	147.45
Hard center tongue switch	173.05
Curved or guard rail (per lin. ft.)	2.02
Six-inch	
Plain layout (switch, mate and frog)	$320.50
Hard center layout (switch, mate and frog)	403.70
Hard center street crossing	307.70
Plain frog	77.05
Hard center frogs	102.65
2-point plain frog	153.85
3-point hard center frog	262.70
2-point hard center frog	205.10
Plain mate	115.45
Hard center mate	141.05
Plain tongue switch	128.25
Hard curved switch	160.25
Curved or guard rail (per lin. ft.)	1.83
100-lb. "T" Rail—	
Combined steam and electric railway crossing	$443.00
80-lb. "T" Rail—	
Combined steam and electric railway crossing, straight	$410.60
Combined steam and electric railway crossing, curved	442.60
70-lb. "T" Rail—	
Plain frog	$ 57.85
Plain split switch	61.69
Curved or guard rail (per lin. ft.)	1.61
60-lb. "T" Rail	
Plain layout (switch, mate and frog)	$237.30
Plain street crossing	173.30
Plain frog	46.33
2-point frog	102.65
Plain switch	47.61
Curved or guard rail (per lin. ft.)	1.45
4¼-inch, 56-lb. "T" Rail—	
Combined steam and electric railway crossing, curved	$278.50
Plain frog	43.77
Split switch	47.61
Curved or guard rail (per lin. ft.)	1.45
4-in., 50-lb. "T" Rail—	
Plain layout (switch, mate and frog)	$182.26
2-point plain frog	102.65
Plain mate	64.25
Plain switch	77.05
Curved or guard rail (per lin. ft.)	1.42
3¾-in., 45-lb. "T" Rail—	
Plain layout (switch, mate and frog)	$182.26
Curved or guard rail (per lin. ft.)	1.42

The following are estimates of a few typical sections of track, per mile of single track:

4¼-in., 60-lb. "T" Rail on Cedar Ties, Dirt Construction:

1,776 cu. yds. earth excavation	$ 621.60
822 cu. yds. earth spread over street	205.50
954 cu. yds. earth replaced for track foundation and filling between ties	209.88
729 (6"x8"x7') white oak ties laid 15 to rail	546.75
1,911 (6"x8"x8') cedar ties, 15 to rail	1,242.15
94,286 tons 4¼" 60-lb. "T" rail in 30-ft. lengths	3,182.15
31¼ kegs 9/16"x5½" standard railroad spikes	125.00
255 pairs 20" 4-hole spliced joint plates, 18 lbs. per pair	87.55
97 pairs 20" 4-hole continuous joint plates	138.23
5⅞ kegs ¾"x3½" joint bolts with nuts	27.91
1 mile track laying	1,375.00
Total	$7,761.72
Contingencies	776.17
Cost per mile	$8,537.89

6-in., 72-lb. Plain Girder Rail on White Oak Ties, 6-in. Concrete Construction:

977 cu. yds. earth and sand excavation	$ 341.96
977 cu. yds. earth and sand removed from street	781.60
818 cu. yds. broken concrete removed from street	818.08
818 cu. yds. 6" concrete for track foundation	3,681.00
38 cu. yds. sand cushion for tamping, lining and surfacing ties	57.00
2,640 (6"x8"x7') white oak ties, 15 to rail	1,980.00
113,143 tons 6" 72-lb. "T" rails in 30-ft. lengths, joints laid even and suspended between ties	4,525.72
31¼ kegs 9/16"x5½" standard railroad spikes	125.00
352 pairs 28" 6-hole splice joint plates, 56 lbs. per pair	376.64
11½ kegs ⅞"x3½" joint bolts with nuts	54.63
1 mile of track laying	1,400.00
Total	$14,141.62
Contingencies	1,414.16
Cost per mile	$15,555.78

6-in., 77-lb. Girder Grooved Rail on White Oak Ties, 6-in. Concrete Construction:

1,304 cu. yds. earth and sand excavation	$ 456.40
1,304 cu. yds. earth removed from street	1,043.20
1,104 cu. yds. 6" concrete for track foundation	4,968.00
28 cu. yds. sand cushion for tamping, lining and surfacing	42.00
528 (6"x10"x6' 8") white oak ties, 3 to rail	623.04
1,408 (6"x8"x7') white oak ties, 8 to rail	1.056.00
121 tons 6" 77-lb. girder grooved rail in 30-ft. lengths, joints laid even and suspended between ties	4.840.00
23 kegs 9/16"x5½" standard railroad spikes	92.00
1,232 ¾"x5' 2" round tie rods, 6 to rail, four ¾" nuts per rod	308.00
1 mile of track laying	1,400.00
352 cast welded joints	1,056.00
Total	$15,884.64
Contingencies	1,588.46
Cost per mile	$17,473.10

7-in. 85-lb. Girder Grooved Rails on White Oak Ties, 6-in. Concrete Construction:

1,222 cu. yds. earth and sand excavation	$ 427.70
1,222 cu. yds. earth removed from street	977.60
978 cu. yds. 6" concrete for track foundation	4,401.00
41 cu. yds. sand cushion for tamping, lining and surfacing ties	61.50
2,816 (6"x8"x7') white oak ties, 16 to rail	2,112.00
133,571 tons 7" 85-lb. girder grooved rail in 30-ft. lengths, joints laid broken and supported on ties	5,342.84
33 1/3 kegs 9/16"x5½" standard railroad spikes	133.33
352 cast welded joints	1,056.00
704 (¾"x5' 2") tie rods, four ¾" nuts per rod	176.00
1 mile of track laying	1,400.00
Total	$16,087.97
Contingencies	1,608.79
Cost per mile	$17.696.76

7-in., 85-lb. Girder Grooved Rail on White Oak and Cedar Ties, 6-in. Crushed Stone Construction:

1,338 cu. yds. earth and sand excavation	$ 468.30
1,338 cu. yds. earth removed from street	1,070.40
1,070 cu. yds. 6" crushed stone for track foundation	2,086.50
880 (6"x8"x8') cedar ties laid 5 to rail	572.00
880 (6"x8"x7') white oak ties, 5 to rail	660.00
133,571 tons 7" 85-lb. girder grooved rail in 30-ft. lengths, joints laid broken and suspended between ties	5,342.84
20⅞ kegs 9/16"x5½" standard railroad spikes	83.50
352 pairs 36" 10-hole splice joint plates, 54½ lbs. per pair	330.88
25⅛ kegs 1"x3½" joint bolts with nuts	118.75
1 mile of track laying	1,400.00
Total	$12,133.17
Contingencies	1,213.31
Cost per mile	$13,346.48

7-in., 85-lb. Girder Grooved Rail on Angle Iron Ties, 6-in. Concrete Construction:

318 cu. yds. earth and sand excavation	$ 111.30
318 cu. yds. earth removed from street	254.40
212 cu. yds. 6" concrete for track foundation	954.00
1,232 (⅜"x2½"x6') angle iron ties, 7 to rail	1,349.04
133.571 tons 7" 85-lb. girder grooved rail in 30-ft. lengths, joints laid broken and suspended between ties	5,342.84
2,464 pairs cast iron tile clips, 2 pair per tie with two ¾"x2¼" bolts per pair	550.09
352 pairs 36" 10-hole splice joint plates, 54½ lbs. per pair	330.88
25⅛ kegs 1"x3½" joint bolts with nuts	129.34
1 mile of track laying	1,400.00
Total	$10,421.89
Contingencies	1,042.18
Cost per mile	$11,464.07

7-in. 85-lb. Girder Grooved Rail Without Ties, 12x14-in. Concrete Beam Construction:

489 cu. yds. earth and sand excavation	$ 171 15
489 cu. yds. earth removed from street	391.20
457 cu. yds. concrete for track foundation	2,056.50
133.571 tons 7" 85-lb. girder grooved rail in 30-ft. lengths, joints laid broken without ties	5,342.84
352 pairs 36" 10-hole splice joint plates, 54½ lbs. per pair	330.88
25⅛ kegs 1"x4⅜" joint bolts with nuts	119.34
528 (⅜"x1½") flat tie rods, 3 to rail, four ¾" nuts per rod	352.44
1 mile of track laying	1,400.00
Total	$10,164.35
Contingencies	1,016.44
Cost per mile	$11,180.79

8-in., 95-lb., Girder Grooved Rail on Pressed Steel Channel Ties, Concrete Construction:

301 cu. yds. earth and sand excavation	$ 105.35
301 cu. yds. earth removed from street	240.80
160 cu. yds. 6" concrete for track foundation	720.00
1,232 (7"x7') pressed steel channel ties, bracket fastening, 7 to rail	3,113.88
149,286 tons 8" 95-lb. girder grooved rail in 30-ft. lengths, joints laid even and suspended between ties	5.971.44
352 pairs 22" 8-hole continuous plates	971.52
23 kegs 1"x4⅜" joint bolts with nuts	109.25
1 mile of track laying	1,400.00
Total	$12,632.24
Contingencies	1,263.22
Cost per mile	$13,895.46

9-in., 98-lb., Girder Grooved Rail on Oak Ties, 8-in. Crushed Stone Construction:

1,761 cu. yds. earth and sand excavation	$ 616.35
82 cu. yds. earth excavation for 4" drain tile	28.70
1,843 cu. yds. earth removed from street	1,474.40
5,280 lin. ft. 4" drain tile	237.60
68 cu. yds. crushed stone for covering 4" tile	132.60
1.092 cu. yds. 8" crushed stone for track foundation	2,129.40
301 cu. yds. concrete for track foundation	1,354.50
1,760 (6"x10"x6'x8") white oak ties, 20 to rail	2,076.80
154 tons 9" 98-lb. girder grooved rail in 60-ft. lengths, joints laid broken and suspended between ties	6,160.00
20⅞ kegs 9/16"x5½" standard railroad spikes	83.50
352 ¾"x5' 2" tie rods, 4 to rail, four ¾" nuts per rod	88.00

1 mile of track laying	1,400.00
176 cast welded joints	528.00
Total	$16,309.85
Contingencies	1,630.98
Cost per mile	$17,940.83

9-in., 98-lb., Girder Grooved Rail on Pressed Steel Channel Ties, Concrete Construction:

345 cu. yds. earth and sand excavation	$ 120.75
345 cu. yds. earth removed from street	276.00
223 cu. yds. concrete for track foundation	1,003.50
1,232 (7"x7') pressed steel channel ties, 7 to rail	3,113.88
154 tons 9" 98-lb. girder grooved rail in 30-ft. lengths, joints laid even and suspended between ties	6,160.00
352 pairs 32" 12-hole splice joint plates, 68½ lbs. per pair	461.12
30¼ kegs 1"x3½" joint bolts with nuts	143.69
1 mile of track laying	1,400.00
Total	$12,678.94
Contingencies	1,267.89
Cost per mile	$13,946.83

9-in., 98-lb., Girder Grooved Rail on Oak Ties, 6-in. Concrete Construction:

1,401 cu. yds. earth and sand excavation	$ 490.35
1,401 cu. yds. earth removed from street	1,120.80
1,119 cu. yds. 6" concrete for track foundation	5,035.50
30 cu. yds. sand cushion for tamping, lining and surfacing ties	45.00
1,936 (6"x10"x6' 8") white oak ties, 11 to rail	2,284.48
154 tons 9" 98-lb. girder grooved rail in 30-ft. lengths, joints laid even and suspended between ties	6,160.00
22⅞ kegs 9/16"x5½" standard railroad spikes	91.50
352 pairs 22" 8-hole continuous joint plates	1,436.16
23 kegs 1"x4⅜" joint bolts with nuts	109.25
1,056 ¾"x5' 2" round tie rods, 6 to rail, four ¾" nuts per rod	264.00
1 mile of track laying	1,400.00
Total	$18,437.04
Contingencies	1,843.70
Cost per mile	$20,280.74

The following is a summary of reproduction new of the track:

1. Straight track (156.72 miles)	$2,534,565
2. Track in car stations and yards (12.93 miles)	116,686
3. Special and curved track (13.7 mi.)	708,894
Total track	$3,360,145
4. Interlocking	31,442
5. Catchbasins (1,395)	22,725
6. Manholes (568)	16,482
7. Water hydrants (8)	590
8. Machinery, tools, track, stock, etc.	130,566
9. Division foremen's outfit	39,386
Total track, etc.	$3,601,336

Item 3 includes curved track and guard rails (for which there were 94,000 lin. ft. or 17.8 miles of rail), frogs, switches, crossings, and the necessary excavation, concrete and broken stone foundations. The unit prices used for curved track (previously given) appear to cover the cost of ties, track fastenings, etc. While, as previously stated, the "Special Y's, turnouts, etc.," occupied 2.922 miles of track, there is no definite statement as to the total mileage of curved and special track; but, if we subtract the 156.72 miles of straight track and the 12.93 miles of track in car stations and yards from the 183.34 miles of all track, we have 13.7 miles, which is probably the entire mileage of curved and special track.

Dividing each of the above 9 items by 183.34, we have the following cost per mile of track:

	Per Mile.
1. Straight track, 0.855 mile	$13,823
2. Track in car stas. and yds., 0.070 mile.	636
3. Special and curved, 0.075 mile	3,866
Total track	$18,325
4. Interlocking	171
5. Catchbasins	124
6. Manholes	90
7. Water hydrants	3
8. Tools, stock, etc.	712
9. Division foremen's outfits	215
Total	$19,640

It will be noticed that the straight track cost $16,170 per mile of straight track, and that the special track cost $51,750 per mile of special track. The amount of track stock, etc. (Item 8), is obviously more than normal.

The present value of track, etc., is $2,599,222, or 72.2 per cent of the cost of reproduction new ($3,601,336). It is stated by Mr. Barcroft that no very accurate determination of the condition of the ties was possible, and that no rail renewal records had been kept by the rail[illegible] the companies' trackmen an approximation to th[illegible] was arrived at.

"The company requested that $12,000 be added for rail inspection at the mills. No inspection of rails has ever been made, although contemplated in the future, and consequently the item has not been included."

Most of the rails had been laid 14 years prior to the appraisal, "and are generally in a run down condition."

7. *Rolling Stock.* There are 1,000 passenger cars, of which 250 are open cars and the rest closed. The average cost of reproduction new is:

Car body and truck	[illegible]
Electrical equipment	1,187
Total	[illegible]

We shall give the costs of several typical cars in detail, which are based upon the following unit prices. Closed double end car bodies for single trucks:

	F. O. B. [illegible]
16 ft. length of body	$1,100
18 ft. length of body	1,200
20 ft. length of body	1,300
21 ft. length of body	[illegible]
22 ft. length of body	1,400
23 ft. length of body	1,450
24 ft. length of body	1,500
25 ft. length of body	1,550

To these prices of car bodies $30 to $32 is added for freight to Detroit. The above prices include the following and all other minor items installed:

Monitor Roof	Sashes
Hood	Signs
Platform	Switch Iron
Steps	Curtains
Hangers	Ceiling
Glass	Trimming
Gongs	Headlight
Bells	Hand Bells
Straps	Finishing

Cords and hangers
Lighting equipment
Register fixtures

Closed cars (body only) double truck—

	F. O. B. Factory
28' Closed single end	$1,910
29' Closed single end	2,085

Open cars (body only) single truck, double end, reversible.

	F. O. B. Factory
10 bench, 4 stationary against bulkheads	$1,000
9 bench, 2 stationary against bulkheads, all inside	[illegible]
10 bench, 2 stationary against bulkheads, all inside	1,100
11 bench, 3 stationary against bulkheads, 8 inside	[illegible]

Open car (body only), double truck, single end.

14 bench, 4 stationary against bulkheads, 10 reversible, F. O. B. Factory	$1,450
14 bench, 4 stationary against bulkheads, 10 reversible, F. O. B. Detroit	1,490

The above prices include the following and all other minor items installed:

- Switch iron
- Bells
- Veneer ceiling
- Chipped glass, D. S. A.
- Push buttons
- Drop guard on grab handles each side
- Bulkhead with sashes at each end
- Folding running board on each side
- Incandescent headlights
- Open platforms with dashers
- Chain guard on each side
- Lighting equipment
- Printed duck curtains to floor
- Cherry and ash seats with slat or spindle backs
- Gongs
- Ash finish
- Bronze trimmings
- Vestibule signs
- Bulkhead seats

Additional equipment—

Stove	[illegible]
Hot air heater	[illegible]
Electric heater	30
Truck, Brill 21-E	275
Truck, Dupont, 7,000 lbs.	[illegible]
Storage air brake trucks, complete	$180 to 205
[illegible]	[illegible]

The unit prices for the electrical equipment, f. o. b. Detroit, are as follows:

Motors—

Westinghouse 12-A	$418
[illegible]	562
[illegible]	

[illegible]

Grid Resist[illegible]

[illegible]

[illegible]	$ 2.75

Choke Coils:

[illegible]

1 set cables—

[illegible]

50 ft. No. 1
300 ft. No 6
185 ft. No. 4
100 ft. of 2-in. cotton hose
Total [illegible]

[illegible]

50 ft. No. 1
900 ft. No. 6
120 ft. of 2½-in. cotton hose
Total [illegible]

[illegible]

50 ft. No. 2
[illegible]
150 ft. of 3-in. cotton hose

[illegible]

The following are costs of reproduction new of typical cars.

Group A: Jones 16 ft. closed car body, [illegible] truck, double end, single door, cherry finish, veneer ceiling, carpet seats, Dupont truck.

Car body ($1,130 less $35 for carpet seats)	$1,095
[illegible]	[illegible]
Handling, assembling, installing, including [illegible]	[illegible]
[illegible]	[illegible]
Car fuse, 1	4
[illegible]	
Choke coil, 1	9
[illegible]	[illegible]
Total	[illegible]

[illegible] body (seating capacity 25), 32 ft. over all, [illegible] finish, carpet seats.

[illegible]	[illegible]
[illegible]	1,516
Total	$3,181

Group C: Cincinnati 23 ft. closed car body (seating capacity 30), 34¾ ft. over all, single truck, single end, single door, oak finish, hot air heater, veneer ceiling, one register rod, cross-seats with stationary backs and spring rattan cushions, side aisle, Dupont trucks.

Car body	$1 442
Air heater	15
Fittings and assembling	442
Truck, single	350
Total body and trucks	$2 249
Motors, two 93-A at $735	1,470
Controller, 1 steel	85
Auto, 1	12
Westinghouse circuit breaker 1	25
Grid resistances	25
Car fuse, 1	4
Lightning arrester, 1	3
Choke coil, 1	9
Wiring and hose	105
Trolley	23
Grand total	$4,010

Group D: Cincinnati 29 ft. closed car body (seating capacity 40), 41 ft. over all, double truck, single end, double door, oak finish, veneer ceiling, spring rattan seats.

Car body	$2,125
Fittings and assembling:	
Single end storage air brake	183
Drop fender	30
Hot air heater	40
Signs	10
Hangers, racks, etc	37
Fare register	29
Rear end snow scraper	18
One track scraper	15
Incandescent headlight	4
Lamps, resistance, switch bars, crushing bars, trolley rope, folder boxes, coal box, etc	16
Handling, assembling, installing, incl. electrical work ($40) and material	173
Total fittings and assembling	$ 555
Double trucks, Standard 0-50	550
Total body and trucks	$3,230
Electrical Equipment:	
Motors, 2 Westinghouse (93-A-2), at $735	$1,470
Controller, one K-12	110
Auto, 1	12
Circuit breaker, 1 Westinghouse	25
Grids, 2	21
Lightning arrester, 1	3
Choke coil, 1	9
Wiring and hose	94
Trolley	23
Total	$4,997

Group E: Stephenson 10 bench open car (seating capacity 50), 25 ft. body, 32½ ft. over all, single truck, single end, painted interior, painted slat seats with spindle backs, bronze trimmings, duck curtains, Dupont trucks.

Car body	$1,132
Fittings and assembling:	
Fender	30
Fare register backs	7
Signs, hanger and racks	5
Handling, assembling, installing, incl. electrical work	109
Total fittings and assembling	$ 153
Trucks	350
Total body, fittings and truck	$1,635
Electric Equipment:	
Motors, 2 steel D at $485	970
Controller, 1 steel	75
Auto, 1	12
Overhead switch, 1	7
Resistances, 2 strap	21
Car fuse, 1	4
Lightning arrester, 1	3
Choke coil, 1	9
Wiring and hose	94
Trolley	23
Grand total	$2,853

Group F: Stephenson 14 bench open car (seating capacity 70), 34 ft. body, 42 ft. over all, double truck, single end, St. Louis No. 47 and Brill 27-F truck, 4 Westinghouse 12-A motors.

Car body	$1,490
Fittings and assembling	373
Trucks	558
Total body, fittings and trucks	$2,421
Electrical equipment	2,052
Grand total	$4,473

Summarizing the cost of reproduction new of the revenue cars, we have:

Car bodies, fittings and trucks:	
518 closed single truck cars	$1,095,603
230 closed double truck cars	745,705
230 open single truck cars	374,569
20 open double truck cars	48,420
3 miscel. revenue cars	14,046
1,001 car bodies, etc	$2,278,343
Electrical equipment for same	1,186,427
Grand total, 1,001 cars complete	$3,464,770

The average cost of reproduction new of each revenue car is as follows:

Car body, fittings and truck	$2,278
Electrical Equipment:	
Motors	977
Controllers	39
Automatoneer	8
Overhead switches	4
Resistance grids	22
Circuit breakers	11
Car fuse boxes	3
Lightning arrester	3
Choke coil	9
Car wiring	90
Trolley stand	21
Total electrical equipment	$1,187
Grand total	$3,465

The depreciated or present value of these revenue cars is:

Car bodies, fittings and trucks:	
518 closed single truck cars	$ 765,768
230 closed double truck cars	662,071
230 open single truck cars	188,800
20 open double truck cars	43,234
3 miscel. revenue cars	13,456
1,001 car bodies, etc	$1,673,329
Electric equipment	998,747
Grand total	$2,672,076

It will be noted that this depreciated value is 77.1 per cent of the cost of reproduction new. An idea of the age of the cars may be gained from the following tabulation:

	Year Purchased.
Closed single truck cars (518):	
99 in	1895
339 prior to	1900
12 in	1905
68 in	1906
518	
Closed double truck cars (230):	
60 in	1903
46 in	1904
49 in	1905
50 in	1907
25 in	1908
230	
Open single truck cars (230):	
230 prior to	1900

There are 104 non-revenue work or service cars and 2 non-revenue special cars whose cost of reproduction new is as follows:

Car bodies, fittings and trucks:	
104 work cars	$ 97,692
2 special cars	3,703
Total car bodies, etc	$101,395
Electrical equipment	95,808
Total	$197,203

The depreciated value is:

Car bodies, fittings and trucks	$100,670
Electrical equipment	74,532
Total	$175,202

This is 88.8 per cent of the cost of reproduction new.

The work car equipment comprised the following:

	Cost of each.
22 snow plows	$2,300 to $5,550
1 sprinkler (3,700 gal.)	2,733
2 wreckers	2,925
3 derrick cars	3,028
3 air compressor cars	2,000 to 3,224
8 locomotives, electric	2,000 to 2,300
1 concrete breaker (pile driver)	2,091
2 concrete mixer cars	3,755 to 7,596
12 ballast dump cars	900
26 flat cars, elec. ry	450 to 700
16 flat cars, steam ry	700 to 800
2 dry sand cars	800 to 2,770
1 rail grinder car	3,470
5 miscel. cars	
104 total.	

The grand total cost of reproduction of the 1,001 revenue cars and the 104 work cars and 2 specials is $3,676,098; and the depreciated value is $2,861,403.

8. *Shops.*—The valuation of the shop buildings has already been given under Buildings. There are two car shops whose cost of reproduction is as follows:

Monroe Shops:	
Machinery and tools	$93,464
Patterns	4,737
Furniture and fixtures	11,586
Total	$109,787
Stock	121,688
Total Monroe Shops	$231,475
Harper Shops:	
Machinery and tools	$24,591
Furniture and fixtures	405
Total	$24,996
Stock	4,189
Total Harper Shops	$ 29,185
Grand total both shops	$260,660

It should be noted that nearly half this amount is not shop machinery, but stock, and the amount of stock on hand appears to be excessive. A considerable part of the stock is scrap and second-hand material.

About $34,000 worth of patterns were not included in the appraisal. The report says: "Patterns are not an asset, as their cost is lost in the articles to which they are necessary as a matter of manufacturing. To have given the company the so-called cost of making patterns would have made it necessary to have eliminated the cost from the manufactured articles."

In the shops and at the various car stations there are 14 air compressors having a total cost of reproduction of $18,552. There are 5 air charging plants having a total cost of reproduction of $2,931. The following is a fairly typical cost of reproduction of one of the air compressor outfits:

1 (9"x4½"x14") Hall Steam Pump Company's 2-stage water jacketed air compressor, capacity 125 cu. ft. free air at 125 r. p. m., operated with silent chain, not including Rochester automatic oil pump. This includes 50 hp. Westinghouse motor and starter, automatic	$2,000.00
1 (9"x4½"x14") Hall Steam Pump Company's 2-stage water jacketed air compressor, capacity 125 cu. ft. free air at 125 r. p. m., operated with belt	1,050.00
1 75 hp., type 75, series wound, Walker motor	500.00
2 Steel D controllers for hand starting, at $75	150.00
3 (3' diameter x 15'x7/16") steel air storage tanks, lap jointed and double riveted, at $190	570.00
2 Air gages, at $3.90	7.80
1 Rochester automatic oil pump, lubricators, tubing, etc	141.82
Pipe, valves and fittings	118.31
Hose, shafting and charging boxes	152.39
Belting and pulleys	140.06
Lumber	33.79
Foundations	84.00
Chain falls and track	45.46
Electric switch board and wiring	250.79
Tools	50.00
Furniture and fixtures	67.85
Labor	773.60
Total	$6,135.87

The cost of a typical air charging plant is as follows:

2 air tanks at $190	$380.00
1 air gage	5.40
Valves, pipe and fittings	46.90
Hose and fittings	30.65
Charging boxes	12.50
Labor	136.70
Total	$612.15

The cost of reproduction of car inspectors' stock and outfits at the 11 car stations is:

Tools	$ 6,168.88
Furniture	2,829.65
Stock	39,826.24
Total	$48,824.77

Summarizing, the following is the cost of reproduction and present value:

	Cost Reprod.	Present Value.
Monroe Shops	$231,475	$174,074
Harper Shops	29,185	24,578
Air compressors, etc	81,483	71,298
Inspectors' outfits	48,425	38,769
Totals	$390,968	$308,719

9. *Tools, Materials, Supplies, Furniture, Etc.*—The cost of reproduction new is appraised as follows:

Emergency station outfit	$ 76,144
Car station furniture	30,736
Office furniture, etc	14,137
Total	$121,017
Stock for shop	237,541
Stock for track dept	357,980
Stationary	34,478
Grand total	$751,016

The present value is estimated at $728,158.

The items of stock and stationary were inserted as given by the railway company, and the report states that the items were not checked by the appraisers as it was impossible at the time to distinguish what part of the stock was needed for the city lines and what for the interurban lines. The subcommittee on appraisal recommends a reduction of about $600,000 in this item.

In the fore part of this article it has been shown that this item 9, "Tools, materials, supplies, etc.," amount to $4,407 per mile of trackway, which clearly shows that it includes a great amount of stock not needed for ordinary operation.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Tests of Full Size Timber Stringers at the University of Illinois Engineering Laboratories.*

The timber stringers were 8 x 16 ins. x 15 ft., to 7 x 12 ins. x 14 ft. in size. The woods included longleaf pine, shortleaf pine, loblolly pine and Douglas fir and 112 sticks were tested among which were a number of creosoted pine stringers. The stringers were tested as beams with load applied equally at the one-third points of the span length. Minor test pieces were cut from the stringers and their flexural and shearing strengths determined.

Stringer Tests.—The number and sizes of the stringers tested with other data are given in Table I. The tests of series C were made to give a comparison of the properties of creosoted and untreated timber of shortleaf and loblolly pine under the conditions of treatment then (1905-6) used by the Illinois Central R. R. The horizontal shearing stress developed in the many beams failing by horizontal shear in this series was so small that it was decided to make tests on beams of several depths to find whether a smaller depth of beam would permit the full value of the modulus of rupture of the wood to be developed. At the same time the effect of pronounced seasoning checks and of large knots was taken up and also a further comparison of treated and untreated loblally pine. These further tests comprise Series A, B and D. Two conditions of seasoning were included in the longleaf pine stringers; a period of 18 months in series A and a period of 4 months in series B. The stringers in series E had been in service 11 years in a trestle in Nebraska and the timber may be expected to represent the [illegible] of [illegible] checks attained by such wood in service. Series F consisted of unused partly seasoned stringers and may be expected to represent such timber when first put into service.

The stringers were tested as beams having a span of 11½ ft. for [illegible] and of 13½ ft. for the other series. Load was applied at the one-third points progressively to failure the head of the testing machine being run down at a speed of 0.17 in. per minute.

The average results of the beam tests are given in Table II.* The elastic limit was determined from deflection diagrams by finding the point at which the deflection increased markedly more rapidly than the load. The values so found are somewhat smaller than those which would be obtained by finding the points at which the slope of the curve is 50 per cent greater than the general slope at lower loads. The stress in outer fibre both at the elastic limits and at failure was calculated by using the usual formula $M = 1/6 f b d^2$. The horizontal shearing stress at the neutral axis was calculated by the formula $V\acute{o} =$ [illegible], where V is the total vertical shear at the section considered. The manner of failures may be classed at (1) tension, (2) compression, (3) horizontal shear. In the tension failure the beam generally failed suddenly by tension in the lower fibre, the crack extending into the beam some distance. In a few cases this tension crack was nearly vertical but there were more instances of cross-grain tension and a few of splintering tension. Beams fail[illegible] portion of the beam. T[illegible] tension side. The failures in [illegible] horizontal slip was shown by th[illegible] shown on the deflection curves near the maximum load was probably due to the horizontal shearing movement. After the shear failure and before the head of the testing machine had been moved, the upper portion of the beam at the failed end projected over the lower portion ¼ in. or more. The stick continued to carry load, acting as two beams one on top of the other, and when the test was carried to destruction the second failure was generally by tension and at a load considerably under that causing the shear failure. The strength of the beams to resist horizontal shear was much affected by seasoning checks and ring shakes.

[illegible] cut from the stringers after full size tests had been made. These minor test pieces included shear test pieces and small test beams. The shear test pieces were about 8 to 10 ins. wide and 12 ins. long and the full thickness of the stringer. Each was cut so as not to contain knots, but it did include seasoning checks. Altogether 155 shear pieces were tested. The small beams were 3x3x40 ins. and were tested on a span of 36 ins. The average results of the tests are given in Table II. In pieces from creosoted sticks the failure was gradual but in the untreated shear pieces it was generally quite sudden. In the few pieces in which small knots were present along the line of the shearing surface, greater resistance to shear was noted. Generally speaking, failure was more frequently along seasoning checks or else the failure line coincided with such checks for some distance. In the small beam tests the failures were generally by tension or compression at loads well above the elastic limit of the material.

Miscellaneous Tests.—Small beam and shear block tests were also made on pieces cut from untested stringers. The beams were 4x4x42 ins., tested on a 36-in. span and the shear blocks were 7x8x12 ins. These tests were divided into two series, M and N; in series M all the pieces were creosoted and in series N alternate pieces were creosoted. Some of the results of these series of tests will be referred to later.

TABLE I.—CLASSIFICATION OF TIMBER STRINGERS.

Series	Wood	No. of Pieces	Condition	Nominal Size in. x in. x ft.	Seasoning
C	Shortleaf pine	4	Untreated	[illegible]	12
C	Shortleaf pine	4	Creosoted	[illegible]	[illegible]
C	Shortleaf pine	4	Creosoted	[illegible]	10*
C	Loblolly pine	4	Untreated	[illegible]	12
C	Loblolly pine	4	Creosoted	[illegible]	[illegible]
C	Loblolly pine	4	Creosoted	7 x 16 x 14	[illegible]*
A	Longleaf pine	8	Untreated	[illegible]	[illegible]
A	Longleaf pine	6	Untreated	7 x 14 x 14	18
A	Longleaf pine	6	Untreated	7 x 12 x 14	12
B	Longleaf pine	8	Untreated	[illegible]	[illegible]
B	Longleaf pine	6	Untreated	[illegible]	[illegible]
D	Loblolly pine	8	Untreated	[illegible]	[illegible]
D	Loblolly pine	6	Creosoted	7 x 16 x 14	6
D	Loblolly pine	6	Untreated	[illegible]	[illegible]
D	Loblolly pine	6	Creosoted	7 x 14 x 14	[illegible]
E	Old Douglas fir	12	Untreated	7 x 16 x 15	[illegible]
F	New Douglas fir	16	Untreated	8 x 16 x 15	Partly seasoned

*Time of seasoning at treatment. Creosoted beams of Series C were tested about [illegible] after treatment; those of Series D seven months after treatment.

TABLE II.—SUMMARY OF RESULTS OF TESTS.
(All stresses are given in lbs. per sq. in.)

	Series A Longleaf Pine	Series B Longleaf Pine	Series C Shortleaf Pine Untreated	Series C Shortleaf Pine Creosoted	Series C Loblolly Pine Untreated	Series C Loblolly Pine [illegible]	Series D [illegible] treated	Series D [illegible]	[illegible]	[illegible]
Number of stringers tested	[illegible]	[illegible]	[illegible]			[illegible]	14	[illegible]		[illegible]
Percentage of horizontal shear failures	60	93	100		[illegible]	62	50	[illegible]		[illegible]
Percentage of tension and compression failures	40	[illegible]	[illegible]	25	[illegible]	38	50	75	17	71
Average horizontal shearing stress at failure	344	386	364	302	368	257	[illegible]	330	[illegible]	
Average fiber stress at elastic limit	4336	4392	4343	[illegible]	[illegible]	[illegible]	2960			
Average fiber stress at failure	[illegible]	[illegible]	[illegible]	[illegible]	4936	3446	4090	4748	[illegible]	[illegible]
Failing by horizontal shear:										
Average horizontal shearing stress at failure	370	390	364		[illegible]	[illegible]	314	363		
Lowest horizontal shearing stress at failure	188	237	293		[illegible]	224	253	320		
Highest horizontal shearing stress at failure	497	474	505				381	[illegible]		
Average fiber stress at failure	5527	5483	4886		5082	[illegible]	4387	[illegible]	[illegible]	
Lowest fiber stress at failure	2640	3620	4005	3025	4890	3020	[illegible]	[illegible]		
Highest fiber stress at failure	7260	6540	6810	[illegible]	7165	4915	5740	[illegible]		
Failing by tension or compression:										
Average horizontal shearing stress at failure	306	344			334	229	[illegible]	[illegible]		[illegible]
Highest horizontal shearing stress at failure	471	344			334	243	[illegible]			[illegible]
Average fiber stress at failure	4978	5300	....	4067	4500	3043	[illegible]	[illegible]		[illegible]
Lowest fiber stress at failure	2860	5300	....		4500	2870	2530			[illegible]
Highest fiber stress at failure	8410	5300	....		[illegible]	[illegible]				[illegible]
Small beams. Average horizontal shearing stress	550	513	...				375		570	[illegible]
Small beams. Average fiber stress at elastic limit	6835	6110	....						7145	[illegible]
Small beams. Average fiber stress at failure	8810	8280	....						[illegible]	7445
Shear blocks. Average shearing stress	466	393					[illegible]	[illegible]	[illegible]	315

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*Extracted from Bulletin No. 41. "Tests of Timber Beams," by A. N. Talbot, University of Illinois Engineering Experiment Station, Urbana, Ill.

*A complete log of the results of tests and of the observed phenomena is given in the bulletin.

Horizontal Shearing Strength.—Table III gives a summary of the results of the failures in horizontal shear. The large number of failures by horizontal shear and the seemingly low values found for the shearing resistance, as compared with those quoted in books and with the results obtained from small test specimens, are worthy of note. The method of selection of stringers and the variety of conditions represented indicate that the stringers are not unusual lots and that so far as resistance to shear is concerned their general condition may be considered to be similar to that of timber in use. The range of results is from 188 to 497 lbs. per sq. in., and the average for the several series runs from 273 to 390 lbs. per sq. in. It is worthy of note in this connection that, as a general rule, for the stringers which did not fail in horizontal shear those developing a shearing stress less than the average for the series had defects like knots which obviously were the occasion of the low cross-breaking strength and that those not showing such defects gave shearing stresses not as high as the highest developed in shear failures. It is also interesting to note that in the stringer which developed the highest fibre stress, A17, the break in tension was followed so quickly by horizontal shear failure that only direct observation at the instant of failure enabled the initial cause of failure to be known. Only three beams developed a higher shearing resistance than this, and their failures were by horizontal shear.

TABLE III.—SUMMARY OF FAILURES IN HORIZONTAL SHEAR.

(Stresses are given in lb. per sq. in. In the last column is given the highest value for stringers which did not fail by horizontal shear.)

Series and Kind	No. of Pieces	Horizontal Shearing Stress Average	Highest	Lowest	Highest Stress in other Stringers
A Untreated longleaf pine	12	370	497	188	471
B Untreated longleaf pine	13	390	474	237	344
C Untreated shortleaf pine	4	364	505	293	...
C Creosoted shortleaf pine	6	302	410	224	357
C Untreated loblolly pine	3	379	388	368	334
C Creosoted loblolly pine	2	273	368	224	243
D Untreated loblolly pine	7	314	381	253	326
D Creosoted loblolly pine	3	363	391	320	420
E Old Douglas fir	10	298	383	221	282
F New Douglas fir	11	323	401	275	355

It is of interest to compare the shearing resistance developed in the stringers with the results of the shear tests of blocks cut from the stringers. These shear blocks were the full thickness of the stringer and were taken from the mid-depth at an uninjured end. Thus, although they represented the portion of the depth which received the greatest shearing stress, in the case of stringers which had failed by shear, the blocks presumably had greater shearing strength than had the timber at the end which failed. As the shear blocks contained seasoning checks and other defects, the results may be expected to be less than those which would be obtained from small pieces of selected wood or from pieces taken away from the heart wood. Table IV gives the ratio of the horizontal shearing stress developed in the stringers to the shearing stress developed in the shear blocks. It will be seen that this ratio, in the case of stringers failing in horizontal shear ranged from 0.61 for series E to 1 for series F.

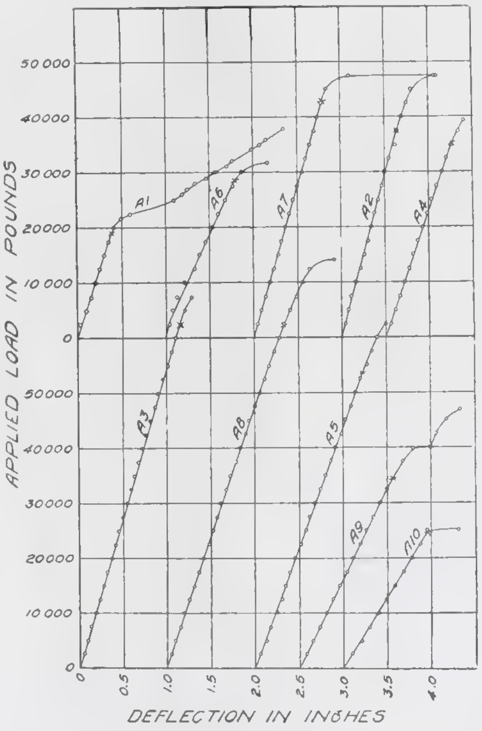
TABLE IV.—RELATION OF HORIZONTAL SHEARING STRESS DEVELOPED IN STRINGERS TO STRESS DEVELOPED IN SHEAR BLOCKS CUT FROM UNINJURED PORTION OF STRINGERS.

(Stresses are given in lb. per sq. in.)

Series and Kind	Stringers Failing in Shear No. of Pieces	Hor. Shearing Stress Stringers	Blocks	Ratio	All Stringers No. of Pieces	Hor. Shearing Stress Stringers	Blocks	Ratio
A Untreated longleaf pine	12	370	491	.75	20	344	466	.74
B Untreated longleaf pine	13	390	394	.99	14	386	393	.98
D Untreated loblolly pine	7	314	384	.82	14	289	403	.72
D Creosoted loblolly pine	3	363	483	.75	12	330	441	.75
E Old Douglas fir	10	[illegible]	491	.61	12	291	486	.60
F New Douglas fir	11	[illegible]	[illegible]	1.01	16	315	315	1.00

In examining the results of these tests it is apparent that seasoning checks are a source of weakness in horizontal shearing resistance and that a wood which develops marked seasoning checks, as longleaf pine, may have its higher tensile and compressive strength discounted by shearing weaknesses, while a softer wood like loblolly pine in beams of the dimensions used in stringers may more advantageously utilize the fibre strength it possesses. It is well to emphasize the importance of using methods of seasoning which will minimize the evil of the checks and cracks produced in seasoning.

As having a possible bearing on whether the greater exposure at the end of the stick may develop more troublesome seasoning checks than are developed in the remainder of the stick, the tests of the Douglas fir stringers may be examined. These stringers came in lengths of 32 ft. and were cut at the middle to make two test beams, thus giving one old end and one new end. Of the old Douglas fir which failed in horizontal shear, six failed at the new end and two at the old end, and for the other two there is no record. Of the new Douglas fir which failed in horzontal shear, two failed at the new end and seven at the old end, and for two there is no record.



Typical Load Deflection Diagrams for Large Timber Beams.

Maximum Fibre Stress.—The maximum fibre stress developed in the full-size beams was generally low, lower than the values generally quoted for the strength of such timber. The shear failures, of course, operated to prevent the development of the full fibre strength of the wood, but it is worthy of note that in every series the average value of the fibre stress developed in beams failing in tension was less than the average in beams failing in horizontal shear, and that with the exception of series A the highest fibre stress developed was less in the tension failures than in the shear failures. That the reason for low fibre strength may lie principally in the presence of knots and cross-grain emphasizes rather than detracts from the importance of these deductions.

The average value of the maximum fibre stress is, in the several series, from 3,445 lbs. per sq. in. in the creosoted loblolly pine of series D to 5,470 lbs. per sq. in in the longleaf of series A. The high values, as may be expected, are generally in clear, straight-grained heavy sticks, though A17 which developed a maximum fibre stress of 8,410 lbs. per sq. in., the highest strength of any beam tested, contained a number of solid knots, ¾ in. to 1¾ ins. across, all at or near the upper surface of the beam. The low values in cross-breaking failures were found in sticks having defects like large knots, cross grain, or in the case of the loblolly pine a large amount of sap wood.

Tests show that selected wood is stronger and stiffer in tension than in compression, but it is seen that the failures in cross bending were generally on the tension side. The exceptions are in the creosoted loblolly in series D. It will be shown that in series C the deformation on the tension face of the beams was greater than on the compression face. These facts seem to indicate that the defects of knots and cross grain have a greater effect on the properties of tension than on those of compression. Possibly another explanation may be found for the conditions in loblolly pine.

Relation of Fibre Stress of Small and Full-Size Pieces.—It is evident from Table V that the small test beams taken from the top and bottom of the full-size stringers developed much higher stresses than were developed in the tests of the stringers. This was true in the fibre strength of the small test beams which failed in tension or compression and also in the shearing strength developed in the beams failing in horizontal shear. The higher fibre stress developed in the small beams may be due in part to the greater freedom from knots in the small test beams selected than in the large stringers, but a large part may be attributed to greater homogeneity of structure in the small beams and to the absence of seasoning checks. The higher horizontal shearing stress developed in the small beams may be due principally to the greater freedom from seasoning checks and the consequent greater resistance of the fibres to longitudinal shear.

The comparison of the fibre stresses developed in cross bending at failure given in Table V shows that the fibre stress of the full-size stringers averaged in the several series from 48 per cent to 76 per cent of the fibre stress in the corresponding small test beams. Even with the failures by horizontal shear excluded from consideration, the relation would be but little better. In series C a systematic test of small beams was not made, but the small beams taken from four of the full-size beams showed the latter to have 47 per cent to 55 per cent of the strength of the former in the case of the shortleaf pine and 76 per cent to 83 per cent in the case of the loblolly pine. Few of the small test beams failed by horizontal shear, but the shearing strength developed in the small beams was much higher than in the large ones.

The results of the tests as a whole go to show, if it were necessary to have a new confirmation of this, that the strength of small pieces may not be taken as representative of the strength of full-size sticks. Tests of small pieces may be of service in comparing woods of different kinds, though even here one species or one shipment may be more subject to the weakness of knots, shakes, or seasoning checks than another. The high values of fibre strength and of horizontal shearing strength

TABLE V. RELATION OF MAXIMUM FIBRE STRESS [illegible] STRESS DEVELOPED IN SMALL [illegible]

(Stresses are given in lbs. per sq. in.)

Series and Kind.	Average. Large.	Average. Small.	Average. Ratio.	Highest. Large.	Highest. Small.	Highest. Ratio.	Large	[illegible]	[illegible]
A Unt. longleaf pine.........	[illegible]	8,510	.60	[illegible]	[illegible]				
B Unt. longleaf pine.........	[illegible]	[illegible]	.66	[illegible]					
D Unt. loblolly pine........	4,090	6,035	.68	5,740	8,450	.68	2,530		49
D Creo. loblolly pine........	4,718	6,210	.76	[illegible]				...	
E Old Douglas fir........	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			1,880	[illegible]
F New Douglas fir...........	4,544	7,445	.61	6,040	10,510	.57	3,250	5,300	.63

sometimes given in tables in engineering books and literature seem to have crept in through assuming that the strength of small test-pieces represents the strength of the full-size stick which would be used.

Elastic Limit.—There is a considerable range in the value of the elastic limit. In series C the range is from 1,960 to 5,830 lbs. per sq. in.; in series D from 1,460 to 4,330 lbs. per sq. in. The elastic limit is evidently affected by defects like knots and cross grain. To what extent it is affected by conditions, like seasoning chacks, which give low horizontal shearing strength or act to permit considerable longitudinal movement of fibres, is not known. The average of ratios of the elastic limit to the breaking strength is from 0.67 to 0.90.

Modulus of Elasticity.—The modulus of elasticity of the full-size beams is given in Table VI. It was calculated from the deflection for the straight portion of the deflection curve, using the formula for center deflection, $\frac{23\,Wl^3}{1296\,EI}$. The extremely low values are in sticks having large knots and cross grain. With the exception of a few values, the modulus of elasticity in each series is fairly uniform.

In the tests in series C the deformation of the top and the bottom fibre along the middle of the beam was measured. The fibre stress was calculated by the usual beam formula, and from this calculated fibre stress and the measured deformations the modulus of elasticity for the top and bottom fibre was calculated. The results are given in Table VII together with the modulus of elasticity determined from the deflections. In making comparisons it must be borne in mind that the formula for fibre stress and that for deflection are based upon the assumption of a uniform and homogeneous beam and also that the horizontal shearing deformations are neglected. The modulus of elasticity obtained from the deformation of the bottom fibre averages somewhat less than that obtained from the deformation of the top fibre, and the average modulus of elasticity obtained from the deflections is less than either. It would be interesting to know what part of this difference is due to horizontal shearing action and what part to variability of the wood from heart to outer fibre.

Table VIII gives the modulus of elasticity of the small beams taken from the stringers of series A, B, D, E and F. The values are calculated from the center deflections. The very low values of the modulous of elasticity are in beams having knots. It is seen that the averages are a very little lower than those found for the full-size beams.

Effect of Knots and Other Defects.—Certain statements bearing on the influence of knots upon the strength and manner of failure of timber beams, which are apparent from a study of the general properties of wood, are confirmed by these tests. The presence of small knots along or near the neutral axis, especially toward the ends of the beam, increases the resistance to horizontal shear. Seasoning checks do not form to the same extent nor are they continuous for so great a distance in wood having knots so located, and a shear failure passes around such knots and makes a jagged and irregular break. The presence of larger knots along the middle of the beam, located in such a way that their influence (i. e., with reference to the direction of the grain) does not extend into the lower or upper one-third of the depth of the beam, is not especially injurious. It is important to note, however, that knots located in the lower quarter or upper quarter of the beam and within the portion of the length which has the maximum bending moment, as for example the middle third in beams loaded at the one-third points, decrease the carrying strength of the beam very markedly and constitute a serious defect. The defect has greater influence when the knot carries with it a considerable change of direction of grain on either side and above and below it. Special care should be given in inspection to throw out sticks in which the size and location of knots are such as to impair the strength of the stick, even if such rejection may increase the cost of the materials. It seems to be true that the influence of knots is less when the stick is placed so that the knot comes on the compression side rather than on the tension side, provided, of course, the knot is solid.

TABLE VI.—AVERAGE MODULUS OF ELASTICITY OF TIMBER STRINGERS.

Series A (1)		1,597,000
Series B (1)		1,648,000
Series C		
	4 Stringers (2)	1,591,000
	8 Stringers (3)	1,229,000
	4 Stringers (4)	1,570,000
	8 Stringers (5)	1,083,000
Series D		
	14 Stringers (6)	1,333,000
	12 Stringers (7)	1,363,000
Series E (8)		1,780,000
Series F (9)		1,499,000

Cross grain is a common defect which seriously impairs the strength of timber. The saw marks may hide the grain. Tension breaks at low loads in full-size sticks may frequently be traced to cross grain.

TABLE VII.—MODULI OF ELASTICITY OF STRINGERS CALCULATED FROM DEFORMATIONS AND DEFLECTIONS.

Kind of timber.	Top fiber.	Bottom fiber.	Deflection.
Untreated shortleaf pine	2,096,000	1,876,000	1,591,000
Creosoted shortleaf pine	1,552,000	1,478,000	1,229,000
Untreated loblolly pine	2,094,000	1,992,000	1,570,000
Creosoted loblolly pine	1,650,000	1,329,000	1,083,000

Note—(1) Long leaf pine untreated. (2) Shortleaf pine untreated. (3) Shortleaf pine creosoted. (4) Loblolly pine untreated. (5) Loblolly pine creosoted. (6) Loblolly pine untreated. (7) Loblolly pine creosoted. (8) Old Douglas fir. (9) New Douglas fir.

Shakes and seasoning checks are deleterious to horizontal shearing strength. A shake in the lower or upper portion may cause failure in tension or compression or a combination of one of these with shear failure. The liability of a wood to check during the time of seasoning has then an important bearing upon its desirability.

That knots and cross grain contributed largely to the weakness of the timber is seen in looking over the results, although it should be noted that in most of the stringers the defects were not such as to have caused rejection under ordinary inspection. In Series A, nearly every piece which failed in tension had knots and cross grain. In Series C four sticks failing in tension gave low values, due to knots and cross grain. In Series D, six sticks showing bad knots and cross grain failed in tension. In the same way the fir stringers failing by tension at low loads contained knots and showed cross grain. All of these, however, would be called good sticks.

Relation of Depth to Length.—It is evident that for stated values of the modulus of rupture and of the longitudinal shearing stress in a beam, a ratio of length of span to depth of stringer will exist for which the stringer is as likely to fail in cross bending as in horizontal shear. Thus, for a modulus of rupture of 5,000 lbs. per sq. in. and a horizontal shearing stress of 300 lbs. per sq. in., using one-third point loading, a span twelve and one-half times [illegible] values, the carrying strengths of beams of depths greater than 13 ins. would increase only [illegible] less than 21.6 ins. would not fail in horizontal shear before the elastic limit of the material [illegible] the tests bear out such reasoning and whether other conditions may not cover up the in- [illegible]

Evidently the data are insufficient to show whether the horizontal shearing strengths will be alike for stringers of different depths. Uniformity in selection is difficult, and it is likely that any variation in the strength found in [illegible] ences in the selection of the piece and the method of seasoning.

It must be remembered that additional depth gives additional stiffness and smaller deflections at the same fiber stress and that stiffness is an important element in bridge stringers. Even if horizontal shear controlled the strength in a given depth of stringer, greater depth may be accepted as an additional safeguard against failure at relatively low loads by reason of knots and similar defects which may have passed by unnoticed, and it will be seen that the tests include a number of stringers which failed in cross bending at unexpectedly low loads. It seems to be the case that unnoticed defects which seriously affect cross-bending tensile strength are more frequent than are the defects which give low shearing strength. If the ultimate horizontal shearing strength of timber is but little higher than the yield point in horizontal shear, as seems to be the case, it would seem reasonable to use a relatively higher working stress in shear than in fiber stress, or in other words, to make a lower factor of safety for horizontal shear than for fiber stress. This, in effect, agrees with current usage.

Effect of Seasoning and of Creosoting.—The tests may not be expected to throw light upon the effect of seasoning on the strength and stiffness of timber. The presence of knots and cross grain in a few sticks in one series, even minor variations in the quality of the wood, may easily neutralize the effect of differences in moisture. Series A and B give no marked differences in either strength or stiffness. The principal difference in results in Series E and F is in stiffness, but the higher modulus of elasticity in the long-seasoned timber may be due in part to differences in wood. The effect of seasoning upon resistance to horizontal shear through the development of seasoning checks is important, and it is apparent that even in the earlier stages of seasoning (as shown in Series B) the formation of seasoning checks produces a marked weakening effect and must be taken into account in estimating the strength of large size timber. It may be expected that for such timber the differences in strength and stiffness of partly-seasoned timber and well-seasoned timber will be less than the differences due to variations in quality, except that the increase in seasoning checks is likely to reduce the resistance to horizontal shear.

It has been thought that the creosoting preservation process weakens timber through the action of the high temperatuure in the preliminary steaming process and through the presence of the oil in the walls of the cells of the [illegible] the oil had the effect of the same amount of moisture, but this seems not [illegible] fied. It has been shown, h[illegible]

TABLE VIII [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Untreated lob[illegible]	[illegible]
Old Douglas fir.	1,635,000
New Douglas fir..	1,413,000

exposure to steam at high pressures and high temperatures is detrimental. It would seem, too, that the injection of oil will retard further seasoning and thus preclude the gain in strength which would come with time. It must be expected that differences in test pieces due to knots, cross grain, and quality of the wood may exercise a greater influence than does the process of creosoting.

In the shortleaf pine stringers of Series C the creosoted sticks average 22 per cent less in elastic limit, 17 per cent less in maximum strength, and 23 per cent less in stiffness than do the untreated sticks. In the loblolly pine stringers of the same series, the creosoted sticks average 44 per cent less in elastic limit, 30 per cent less in maximum strength, and 31 per cent less in stiffness. However, in the loblolly pine stringers of Series D the creosoted sticks show the greater strength and there is little difference in the average stiffness. The greater freedom from defects found in the creosoted stringers of Series D as compared with the defects found in the untreated stringers will account for at least a part of this seeming discrepancy.

The test pieces of Series N seem to offer good conditions for comparison. Of the pieces into which the four stringers were cut, every other piece was creosoted and the remainder were left in the natural state. The untreated test pieces had nine months longer in which to season, which probably offset any advantage which the creosoted sticks may have received in the steaming process. Two pieces in the creosoted lot had bad knots. The creosoted test beams averaged 16 per cent lower in elastic limit, 22 per cent lower in maximum fiber strength, and 6 per cent lower in stiffness than did the untreated test beams. The creosoted shear blocks averaged 8 per cent less than the untreated shear blocks.

As a whole, then, the tests go to corroborate the view that the creosoting preservative process of the ordinary practice decreases the strength and stiffness of beams; but the tests do not throw light on the cause of the difference. Attention may be called to the low resistance to compression at right angles to the grain (bearing strength) which was found in some of the creosoted loblolly stringers.

Properties of the Different Woods.—It will be noted that for the untreated stringers the range of averages for elastic limit, fiber stress, and shearing stress developed in the several woods is small if we except Series D which seems to have had a large proportion of defective sticks. Omitting Series D, the range of the averages is from 3,823, 4,420 and 300 lbs. per sq. in. for elastic limit, fiber stress and shearing stress, respectively, in the old Douglas fir to 4,336, 5,430, and 354 lbs. per sq. in. in the longleaf pine. The high fiber stress shown in the small test beams cut from the longleaf pine and old Douglas fir stringers is ineffective by reason of low shearing strength and the influence of defects. The low shearing strength is due largely to the presence of large seasoning checks. The longleaf pine showed the greatest effect of seasoning checks, but the shearing strength of the old Douglas fir was much lower. The loblolly pine makes a better showing than might be expected from the general softness and brashness of its wood, and this is due to a relatively high shearing strength. The loblolly pine is less stiff than the other woods. Of course, durability is not here taken into consideration. It would be interesting to know where the elastic limit in horizontal shear lies in these woods, particularly in those having large seasoning checks.

General Comments.—The ground covered by these tests is so great and the information obtained so varied that no attempt will be made to give a summary of the results. Conclusions have been stated throughout the discussion. However, it seems proper that at the risk of repetition the following statements be given here.

(1.) The preponderance of failures in horizontal shear is very marked in every series of tests. The results emphasize the importance of the shearing resistance of the wood in beams of the dimensions of those tested. The cross-breaking failures were in sticks having bad knots and cross grain. A few of these defective sticks would not be called merchantable timber, but many of them might pass inspection as it is usually made. The influence of defects is very marked. Knots, cross grain, and seasoning checks act to give low strength. Any tendency to relax requirements and inspection should be avoided, unless accompanied with the use of lower working stresses.

(2.) The horizontal shearing resistance developed in the stringers is low in every series of tests. The averages range from 300 to 390 lbs. per sq. in., and in individual cases the stress is as low as 200 lbs. per sq. in. Comparatively little difference in shearing resistance is found for the different kinds and conditions of wood, for in the clear sticks of the stronger woods large seasoning checks act to prevent the utilization of the full cross-breaking strength of the timber.

(3.) For the cross-breaking failures the fiber stress developed was also generally low, averaging for the untreated timber from 3,690 lbs. per sq. in. in the old Douglas fir to 5,300 lbs. per sq. in. in the longleaf pine One longleaf pine stringer developed a fiber stress of 8,410 lbs. per sq. in., and a value as low as 2,530 lbs. per sq. in. was found.

(4.) The elastic limit of the beams is seriously affected by defects like knots and cross grain. However, in general, the fiber stress at the elastic limit is proportionately high, the ratio to the fiber stress at failure averaging from 0.67 to 0.90 for the several series of tests.

(5.) The strength developed in the small test beams cut from the top and bottom of the stringers averages from 50 per cent to 100 per cent higher than that obtained in the stringers, and the results show the futility of taking tests of small sticks as a criterion of the strength of full-size structural timber. The shearing strength developed in the stringers was 60 per cent to 100 per cent of the shearing strength developed in shear blocks cut from the uinjured end of the stringers at mid-depth and having their full thickness; but these strengths of the shear blocks are much less than will be obtained on small pieces of selected timber.

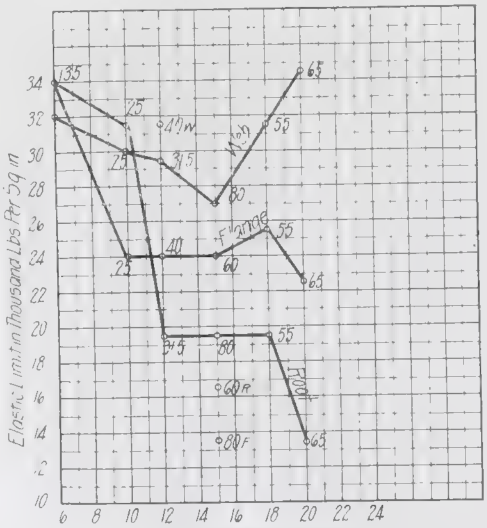


Fig. 1—Variations of Elastic Limit With Depth of Beam.

(6.) In woods which develop large checks and cracks in seasoning, care should be given to avoid rapid and uneven seasoning in large sticks. Seasoning checks should be recognized as a common source of weakness.

(7.) The tests of creosoted sticks are insufficient to warrant drawing conclusions. They seem to corroborate the view that timber treated by the creosoting process as usually operated has somewhat less strength and stiffness than untreated timber. The stopping of further seasoning in the creosoted wood is an element which should be considered in such a comparison.

(8.) The fact that sticks having knots and cross grain are generally less stiff than clear sticks results in the weaker stick taking less than its share of load and the stronger and stiffer stick taking more than its share when defective and clear sticks are placed side by side and are loaded so as to have the same deflection. It is evident that stringers having defects may not receive their calculated proportion of the load. It is interesting to note that the modulus of elasticity calculated from deflections is less than the values derived from the observed deformations of the outer fibers.

(9.) It is evident that the defects found in structural timber have a strong influence on strength and that rigid inspection should be given.

Results of Tests of Strength of Steel from Steel I-Beams.*

The writer had the opportunity to make tests of steel from standard beams during the past year. The investigations of Professor Edgar Marburg reproted at the last meeting of the Society† showed considerable variation in the strength of the steel from the web, flange and root of web. Few tests were made, however, on steel from standard I-beams, the investigation being confined principally to Bethlehem beams.

The tests reported below were made on pieces cut from standard I-beams varying in size from 6-inch, 13.5-lb. to 20-in., 65 lb., and on pieces cut from three Bethlehem beams. Crop ends of Standard beams were furnished by the Eastern Bridge & Structural Co. of Worcester. The Bethlehem material was bought on the market. The test pieces were prepared and tested at the Worcester Polytechnic Institute. The specimens were cut from the middle of the web (designated as *W*), the root of the web (designated as *R*), and the flange near the root (designated as *F*). These were very carefully prepared and finished by draw-filing. The reduced section was long enough to admit the use of the extensometer on an 8-in. gage length. The cross sections varied approximately from 1/10 in. x 1 in. to ½ in. x 1 in.

Great care was used in inserting the test pieces in the Wicksteed testing machine in order to guard against possible eccentric load. A special type of extensometer, so arranged as to detect bending of the test piece, was used. This extensometer is a modification of the Yale-Riehle instrument, differing principally in that it is provided with four screws for attachment to the specimen and provided with four micrometers for reading elongations. It is an electric contact instrument measuring to ten-thousandths of an inch. It is made by Riehle Bros. The tests were conducted with the greatest care, every precaution being taken to make all conditions of test right.

Results.—The results of the tests are shown in Tables I and II. It is to be noted that, generally, the material cut from the web shows the highest elastic limit, while that cut from the root of the web shows the lowest elastic limit. These facts are shown graphically in Fig. 1. Figures 2 and 3 show some of the stress-strain diagrams.

In planning the tests it was hoped to have a complete chemical analysis of each piece tested. On account of funds, however, this was not possible. Samples from one set *K* were examined for carbon showing a variation in carbon of 5 points. The results were as follows:

Specimen.	Carbon.
KW.	.22%
KF.	.27%
KR.	.25%

This one analysis shows that the variation of strength may be due to a difference in chemical composition. It is hoped that means may still be provided whereby a complete chemical analysis may be made of each specimen.

A small piece was cut from the end of each test specimen before test as a further means

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†Engineering-Contracting, Sept. 8, 1909.

*Abstract of a paper by E. L. Hancock, Professor of Applied Mechanics, Worcester Polytechnic Institute, read before the American Society for Testing Materials, 1910 Convention.

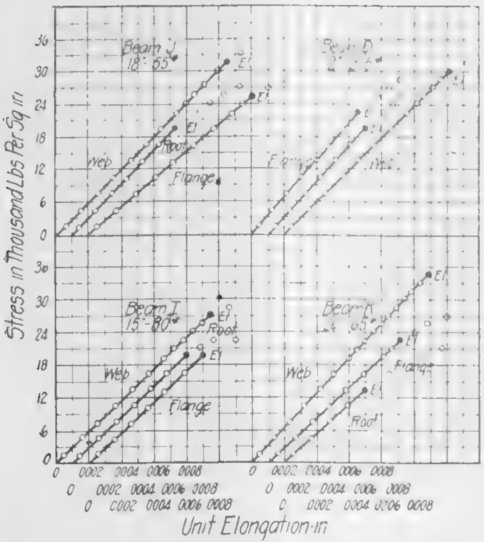


Fig. 2—Variation of Strength, Elongation and Elastic Limit With Location of Steel.

of studying the difference in structure of the pieces from web, flange and root. By means of the microscope, micro-photographs of pieces *KW*, *KF* and *KR* are shown in Fig. 4. These are magnified 80 diameters. The web shows the finest structure, the flange next, while the root is much coarser.

It was noticed that the broken test pieces also indicated this same difference of structure. If the three pieces, *W*, *F* and *R*, of any set were placed side by side, *W* showed a fine surface in the region of the fracture, while *F* and *R* were much coarser. The fractured surfaces also indicated the same difference although to a less extent. An illustration of this difference is shown in Fig. 5 where the magnification is 6 diameters. The pieces were placed side by side and a photograph taken of the surfaces about 1 in. from the fracture. This difference was especially noticeable in the beams that were comparatively thick such as the 15-in., 60-lb., and 15-in., 80-lb. beams. The fractures for these pieces, even the web pieces, were all coarsely granular. The comparatively thin beams seemed to show a finer structure. This is indicated in the last column of Table I, the word silky always indicating a finer structure.

The small beams showed a fine structure generally and all the Bethlehem beams tested showed a very fine structure and the fracture was silky. A comparison of pieces from beams *A* (6-in., 13.5-lb.), *I* (15-in., 80-lb.), and *L* (24-in., 72-lb. Beth.), is shown in Fig. 6.

The examination of the fractured pieces seems to indicate rather conclusively that the work received by the metal in rolling renders the structure finer, and that this is a probable explanation of the variation in strength. This view is further strengthened by the fact that the elastic limit for the *thin* or *light* beams is uniformly higher than for the *thick* or *heavy* beams. The same may also be said of the ultimate strength. The yield point is not given but it was found to differ from the elastic limit much more in the Bethlehem beams than in the standard. The modulus of elasticity was very near 30,000,000 in each case.

TABLE I.

Beam Standard.	Specimen cut from.	Per cent elongation in 8 ins.	Per cent contraction of area.	Elastic limit lbs. per sq. in.	Maximum strength lbs. per sq. in.	Location of fracture.	Appearance of fracture.
A— 3-in. 13.5 lbs.	Web	18.7	46	32,000	[illegible]	3rd—in.	Silky
"	Flange	29	49	34,000	63,300	3rd—in.	Silky
"	Root	29	50	34,000	64,300	4th—in.	Silky
B—10-in. 25 lbs.	Web	28.3	61.5	30,000	56,500	1st—in.	Granular
"	Flange	28.1	63	25,500	54,600	Center	and
"	Root	25	53.3	33,000	58,300	2nd—in	Silky
C—10-in. 25 lbs.	Web	20.8	39.2	24,750	72,300	2nd—in.	Granular
"	Flange	34.4	48.8	26,600	61,200	4th—in.	and
"	Root	25	54.2	27,000	66,400	3rd—in.	Silky
D—12-in. 31.5 lbs.	Web	31.3	54	29,500	61,800	4th—in.	Granular
"	Flange	26.6	50.8	22,500	59,400	3rd—in.	and
"	Root	25	53	19,500	63,700	2nd—in.	Silky
E—12-in. 40 lbs.	Web	31.2	56.5	31,500	59,800	2nd—in.	Granular
"	Flange	21.9	51.2	24,000	62,500	4th—in.	and
"	Root	31.2	55.6	19,500	61,500	2nd—in.	Silky
F—12-in. 40 lbs.	Web	30	58.7	28,500	62,200	2nd—in.	Granular
"	Flange	18.7	55	18,700	62,200	1st—in.	and
"	Root	31	58	24,000	61,700	2nd—in.	Silky
G—15-in. 42 lbs.	Web	28.2	46.7	31,500	68,700	3rd—in.	Granular
"	Flange	....	...	29,900	.....	.....	and
"	Root	26.6	48	22,500	56,000	4th—in.	Silky
H—15-in. 60 lbs.	Web	29	58.2	19,500	53,300	3rd—in.	Granular
"	Flange	29	60.8	24,000	55,200	3rd—in.	Granular
"	Root	29	59.2	16,500	53,800	2nd—in.	Granular
I—15-in. 80 lbs.	Web	36	57.8	27,000	54,300	3rd—in.	Granular
"	Flange	31	61.2	19,500	55,300	2nd—in.	Granular
"	Root	33	56.9	19,500	55,000	4th—in.	Granular
J—18-in. 55 lbs.	Web	28.5	53	31,500	55,800	2nd—in.	Granular
"	Flange	29	55.6	25,500	56,700	3rd—in.	Granular
"	Root	28.5	57.5	19,500	60,400	4th—in.	Granular
K—20-in. 65 lbs.	Web	28.5	45.3	34,500	62,700	2nd—in.	Granular
"	Flange	28	52.5	22,500	63,800	3rd—in.	and
"	Root	30	54.3	13,500	64,000	2nd—in.	Silky

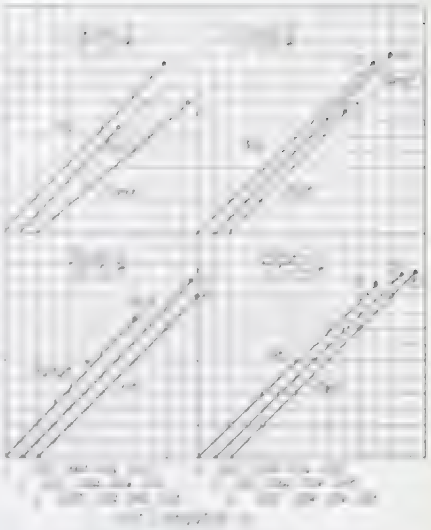


Fig. 3—Variation of Strength, Elongation and Elastic Limit With Location of Steel.

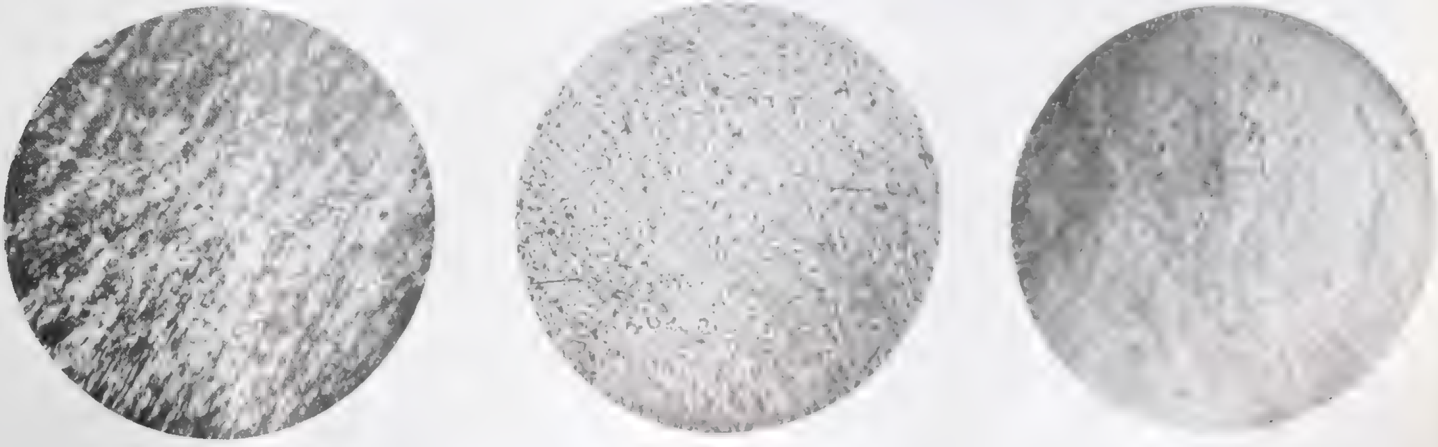
An examination of Table III shows that the material for the 15-in., 60-lb. beams and the 15-in., 80-lb. would not pass the specification for the tensile strength. Allowing the liberal margin of 8,000 lbs. per sq. in. as the amount by which the yield point exceeds the elastic limit, two of these pieces would not pass the specifications for the yield point.

Since there is a variation of strength in the material out from different parts of the I-beam it seems reasonable to suppose that the strength of the material on one side of a test piece is different from that on the other side. That this is true is indicated by the variation in the roughness of the surface of the pieces after test, especially noticeable in pieces cut from the flange. This is shown in *I F* Fig. 6, but is more noticeable in some other pieces not illustrated in this report.

To show the variation in the strength of the material in the flange of one beam, *L*, three pieces were tested, one cut near root of web, one from extreme edge of flange, and one intermediate. The results are as follows:

	Lbs. per sq. in.
Near root elastic limit	[illegible]
Intermediate elastic limit	34,000
Extreme elastic limit	[illegible]

This again shows the increase of strength with a greater working of the material.



K. R. K. W. K. F.

Fig. 4—Microphotographs of Specimens Cut from Flange Web and Root of Beam.

TABLE II.

Beam Bethlehem.	Specimen cut from.	Per cent elongation in 8 ins.	Per cent contraction of area.	Elastic limit lbs. per sq. in.	Maximum strength lbs. per sq. in.	Location of fracture.	Appearance of fracture.
L. 24-in. 73 lbs.	Web	25	52.8	33,000	72,600	Center	Silky
"	Flange	28	53.8	24,000	70,000	4th—in.	Silky
"	Root	28.1	57.3	22,500	67,300	3rd—in.	Silky
M—18-in. 48.5 lbs.	Web	26.6	55.4	19,500	59,600	1st—in.	Silky
"	Flange	32.3	55.7	21,000	57,300	2nd—in.	Silky
"	Root	31.3	58.5	28,500	56,200	4th—in.	Silky
N 12-in. 36 lbs.	Web	21.9	44	31,500	72,600	1st—in.	Silky
"	Flange	26.6	43.7	33,000	66,000	1st—in.	Silky
"	Root	25	51	24,000	68,400	2nd—in.	Silky

Conclusions.—A brief summary of the results may be made as follows:

(1) The elastic limit varies considerably for material cut from different portions of the beam, both standard and Bethlehem, being lowest in root of web, higher in flange near root, and highest in web. This confirms the work of Professor Marburg.

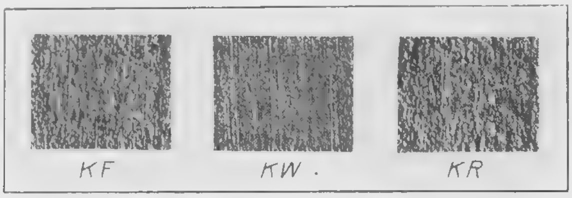


Fig. 5—Appearance of Fracture Surfaces in Specimens Cut from Flange, Web and Root of Large Beams.

(2) The indications are that there is considerable difference chemically in the material in different parts of the beam. It is desirable that these chemical tests be made and recorded as a part of this investigation.

TABLE III.

Average maximum fiber stress for web, flange and root.

Standard Beam.	Floor stress.	Remarks.
8-in. 13.5 lbs.	65,900	
10-in. 25 lbs.	60,600	Beam light for height
12-in. 31.5 lbs.	61,600	Beam light for height
12-in. 40 lbs.	61,600	Beam heavy for height
15-in. 42 lbs.	67,300	Beam light for height
15-in. 60 lbs.	53,700	Beam heavy for height
15-in. 80 lbs.	55,100	Beam heavy for height
18-in. 55 lbs.	58,100	Beam light for height
20-in. 65 lbs.	64,100	Beam light for height
Bethlehem Beam.		
24-in. 73 lbs.	70,000	Beam light for height
18-in. 48.5 lbs.	37,700	Beam light for height
12-in. 36 lbs.	69,000	Beam light for height

(3) The appearance of the fractured pieces indicates a considerable variation in the density of the material throughout the beam, due probably to the work of rolling. The thin beams (as defined in Table III) show material superior to that of the thick beams.

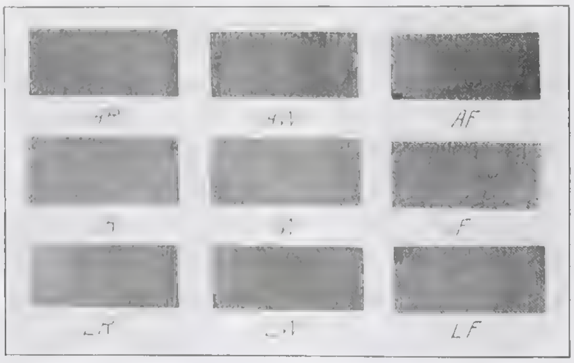


Fig. 6—Appearance of Fracture Surfaces in Specimens Cut from Flange, Web and Root of Small Beams.

Some Notes on Methods in Constructing a Concrete Sewer.

A portion of the Northwestern Trunk Sewer being built through Shawnee Park, Louisville, Ky., is a good example of deep trenching. The trench excavated is from 10 to 40 ft. in depth, averaging 36 ft. The width on top is 25 ft. The digging is mostly in sand, with a top layer of clay.

The sewer is a three centered concrete arch 13 ft. 6 ins. x 9 ft. It is built of reinforced concrete and the inside surfaces are finished with a regular sidewalk construction.

The first few feet of excavation were taken out with horse scrapers. Below this the trench is sheeted and the excavation is taken out with a clamshell bucket operated by a stiff-leg derrick with a bull wheel. Another similar derrick is working continuously at the rear end of the work, doing all the backfilling and pulling sheeting. Besides the engineer and fireman, three men are kept employed, with this derrick, in pulling sheeting and cleaning up.

The forward derrick employs the usual crew of two men and all the work of preparing the trench for placing the sewer forms, such as digging, trimming, sheeting and timbering, is carried on by the same gang that does the concreting. This gang consists of about 23 men.

The steel gang consists of 6 men and they are kept busy practically all the time on the binding and placing of steel. There are about 292 lbs. of steel reinforcement to the lineal foot of sewer; ¾ in. steel is used.

A portable carpenter's shop, containing circular and band saws, is maintained near the work, for the use of the four carpenters employed to handle all the form work. Blaw arch forms are used.

Three finishers are employed to keep the concrete surfaces finished as the work goes along. These men are paid straight time and are free to be off the job when their work is done, but must work until each section of sewer is surfaced before leaving the job.

Besides the men already mentioned, three handy men and one team are employed for various jobs.

One of the unusual features of the work is the use of 8x8-in. timbers for bracing the sheeting apart. The span of the trench is 25 ft., but the derricks are placed a safe distance away from the edge, and no trouble has yet been experienced. The braces are spaced about 7 ft. apart and in tiers which are about 4 ft. apart vertically. Three sets of sheeting are used in the deep cuts.

In driving the hardwood sheeting, a cast iron cap is placed on top of the plank as a protection. This is an inexpensive precaution, and undoubtedly has paid for itself many times on each job where it has been used.

The contract prices for the work are: for steel 3 cts. per lb.; concrete $8.50 per cu. yd., and excavation $24.60 per lin. ft. of trench.

The contractor for the work is the Jas. Duff Construction Co. of Cleveland, O. Mr. W. A. Green is Superintendent.

Personals.

Mr. R. H. Howard has resigned his position as Engineer of Maintenance of Way for the Chicago & Eastern Illinois R. R. and will take a position with an eastern railway.

Bluxome & Co., contractors for concrete and reinforced concrete construction, have removed their office from 5 Front St., San Francisco, Cal., to 532 Monadnock Bldg., that city.

Mr. B. M. Hall, Chief Engineer Porto Rico Irrigation Service, has resigned and will return to his home at Atlanta, Ga., where he will resume his professional practice as consulting engineer.

Mr. Hugh Crozer, Knoxville, Tenn., has resigned his position as Chief Engineer of Pike Road Work for Coche County, Tennessee, and is succeeded by Mr. Herbert Holt of Newport, Tenn.

William Gammons, one of the oldest civil engineers in the employ of the Chicago, Milwaukee & St. Paul Ry., died suddenly June 28, of heart trouble, while on a visit to his family at Bourbon, Ind.

Henry Clay Weeks, an architect of New York City, died July 1 at his country home at Bay Side, Long Island, aged 66 years. Mr. Weeks was one of the first men to start a systematic campaign in this country for the extermination of mosquitoes.

Col. Walter L. Fisk, Corps of Engineers, U. S. Army, at present Division Engineer of the Lakes Division at Buffalo, N. Y., has been appointed to succeed Brig.-Gen. W. H. Bixby, Chief of Engineers, as President of the Mississippi River Commission, with headquarters at St. Louis, Mo.

Mr. T. Martin, heretofore Assistant Engineer of the Canadian Pacific Ry., at Calgary, has been appointed Division Engineer of the new Saskatchewan Division, with headquarters at Moose Jaw, Sask. Mr. H. B. Sims, heretofore Resident Engineer at Moose Jaw, has been appointed Assistant Division Engineer.

Mr. Arthur H. Blanchard, M. Am. Soc. C. E., Associate Professor of Civil Engineering at Brown University, has resigned his position as Deputy Engineer of the State Board of Public Roads of Rhode Island. Professor Blanchard is now in Europe investigating the construction and maintenance of bituminous surfaces and bituminous pavements.

Dr. Charles A. White, scientific associate of the late President Langley of the Smithsonian Institution, member of many scientific societies in this country and Europe and author of numerious scientific publications, died June 29 at Washington, D. C., aged 84. The greater part of his writings were on geology and paleontology. Dr. White was born at North Dighton, Mass., and for a time was professor of natural history in the Iowa State University and in Bowdoin College. For many years he was state geologist of Iowa.

In our issue of June 15 we stated that Mr. F. E. Trask, of Los Angeles, had been appointed Chief Engineer of the Arrowhead Reservoir & Power Co. This statement was somewhat misleading, inasmuch as it might be taken to imply that Mr. Trask had given up his consulting engineering practice, which is not the case. Mr. Trask is one of the two consulting engineers of the company, and in order to meet certain contract and specification requirements he was designated as Chief Engineer. This appointment was made to tide over a period of a few weeks only and took no additional time.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week. The principal railroad construction contract let during the past week appears to have been the one awarded by the Canadian Northern interests for constructing the Duluth, Winnipeg & Pacific Ry. from Virginia, Minn., to Duluth, Minn. The contract calls for grading 87 miles of roadbed, the construction of 500 feet of rock tunnel, several wood trestles and 12 steel bridges, aggregating 1,830 lineal feet in length. It is reported that the work will cost about $35,000 per mile. Foley, Welch & Stewart, St. Paul, Minn., received the contract. Among the other railroad construction contracts let recently are the following: A. C. Mann., Winnipeg, Man., for 60 miles of the main line of the Canadian Northern Ry., from a point opposite New Westminster; J. R. Barry, Bert Beaton, A. Finlayson and J. O. Palmer, all of Fort William, Ont., for sub-contracts on the new line of the Canadian Northern Ry. from Edmonton to the Pacific coast; Burns & Co., 705 Isabella Bldg., Chicago, Ill., for constructing the projected line of the Wheeling, Cadiz & Tuscarawas Traction Co.; The Shugart & Barnes Bros. Co., Des Moines, Iowa, for grading 37 miles of the Atlantic Northern & Southern R. R. from Atlantic, Iowa, southwest to Villisca, the contract involving 500,000 cubic yards of excavation; Sundstrom & Stratton, 90 West St., New York City, for about 12 miles of double track work near Adams, N. Y., for the New York Central & Hudson River R. R.; Erickson & Peterson, for the construction of 85 miles of line on the Nation-Vale, Oregon, branch of the Oregon Trunk Line; Porter Brothers, Spokane, Wash., for the construction of the first 24 miles of the United Railways extension to Tillamook.—A meeting of the directors of the Texas Central R. R. is to be held this week at Waco, Tex., to execute a mortgage for $2,000,000. The money will be used in extending and improving the road.—The Mexican Railway, which runs between City of Mexico and Vera Cruz, last week adopted plans for improvements and extensions of branch lines which involve the expenditure of more than $2,000,000.—Continuing his policy of practical conservation, President Taft on July 7 signed orders withdrawing 35,073,164 acres of coal lands from the public domain in the states of North and South Dakota, Washington, Utah, Colorado and the territory of Arizona. Of the total withdrawals 20,698,469 acres are new, while 14,374,695 acres are covered in confirmations and ratifications under the new law, approved June 25, of withdrawals made during the past four years by both President Roosevelt and President Taft.—The first caisson to be used in the reconstruction of the Quebec bridge was launched on July 7 at Sillery and will be completed in a cove there until it attains the height of 70 feet. Actually the caisson measures 180 feet in length by 75 feet in width and 50 feet in height. On the south shore of the St. Lawrence the work of clearing away the debris at the approaches to the wrecked bridge is progressing very rapidly. Some 4,000 tons of metal have already been cleared and about as many remain to be removed. This task will, however, be accomplished before the fall of this year.—The Baltimore & Ohio R. R. Co. on July 7 placed orders for 4,000 additional freight cars and will award a contract in a few days for another 1,000 gondola cars. The management also has ordered 50 additional locomotives of the Mikado type. The aggregate cost of the equipment is about $6,100,000.—Approximately 800 miles of new main lines and branch lines were completed in Texas during the fiscal year ending June 30, according to official reports to the State Railroad Commission.—The Board of Estimate and Apportionment of New York City has approved the plans of the Board of Water Supply to extend the Catskill water system by rock pressure tunnel from the Hill View reservoir, The Bronx, under Manhattan and the East River into Brooklyn, to connect with the water system of that borough and Queens and Richmond. This scheme will involve an expenditure of $25,000,000.

Progress on the Chicago Subway Plans. One of the first official statements regarding the progress that [illegible] made in the plans for the passenger subway system of Chicago was given out on Saturday by Bion J. Arnold, chief subway engineer. According to this statement 14 different types of subways are under consideration, and the engineer is now engaged in deciding which one he will recommend to the City Council. The types under consideration include subways containing from two to eight tracks, the chief differences in the different forms of construction being in whether they are single deck or double deck. Mr. Arnold stated that since his appointment as chief subway engineer by Mayor Busse on Feb. 7, 1910, an organization had been completed as rapidly as possible, but that the force had devoted about four-tenths of its time to the collection and compilation of elevated traffic data for use in the study of methods for relieving loop congestion, four-fifths of the expense of which is borne by the elevated railway companies. On the subject of initial subways the report stated: "State street is a desirable thoroughfare in which to locate a north and south subway by reason of its extensive width, the fact that there are fewer utilities under its surface than any other street in the downtown or subway district, except Michigan avenue, and that there are no elevated lines except where the loop crosses at State and Van Buren streets. Studies for the location of initial east and west subways are being made in the streets between the Chicago River and Twelfth street, as well as east and west connections to the north and south subways on Division street and Twenty-second street to accommodate the elevated trains." An outline of the research work done was given as follows: A survey of the Illinois tunnel. Record of changes in the location of utilities, including sewers and water mains, also the location of additional utilities in the area bounded by Chicago avenue, Halsted street, Twelfth street and the lake, since July 1, 1909, the date when the department of public works ceased work on the same. Record of the location of utilities, including sewers and water mains, in the extended areas from Twelfth street to Twenty-fourth street on the south, from Halsted street to Peoria street on the west, and from Chicago avenue to Willow street on the north. Record of the subsidewalk occupancy and miscellaneous occupancy of streets and alleys in the extended area. Record of the surface location of utilities in various streets where subway location is probable. Collection of complete information as to the character of the buildings and their foundations abutting on State street between Randolph and Van Buren streets, and like information [illegible] where subway location is probable.

Francis M. Ferguson. [illegible] one of the first contractors [illegible] railroad construction work, [illegible] Denver, Colo, the direct cause of his death being fatty degeneration of the heart. Mr. Ferguson had gone to Denver to bid upon a large railroad construction contract and had just put in his proposal when he was stricken. Mr. Ferguson was born Oct. 1, 1863, in Corydon, Wayne County, Iowa, his father being Oliver Ferguson, a well known contractor of that county. He was educated in the public schools, and after he was graduated began work as a water boy in a con[illegible]. He worked his way up until he became a partner of his father in the firm of Ferguson & Son, which they organized in 1889. After the death of his father, Mr. Ferguson in 1896 removed to New York, where, together with his brother, he organized the Ferguson Constructing Co., of which he became president, remaining in this position until his death. This company has handled numerous railroad construction contracts of large proportions, [illegible] miles, and has operated in over thirty different states. Among the more important contracts handled by this company are the following: The extension of the Wabash R. R. into Pittsburg, involving 12 miles of construction and including severel tunnels, chief of which is the 3,333 foot tunnel on the north shore of the Monongahela; the West Side Belt Ry. at Pittsburg, involving 28 miles of line; 20 miles of work on the Pittsburg, Bessemer & Lake Erie R. R.; work on the Coal & Coke Ry. in West Virginia; the Greenbrier extension of the Chesapeake & Ohio Ry.; extensive work on the Buffalo, Rochester & Pittsburg R. R., and on the Cleveland, Lorain & Wheeling R. R.; three sections of the New York, Westchester & Boston Ry.; 15 miles on the Winston-Salem South Bound R. R., and work on the Orange county cut-off of the Erie R. R. In addition the company has done much government work between Mem[illegible] River; has built more than 100 miles of gravel [illegible] gravel road) in Indiana, and Contract No 2 on the New York State Barge Canal. Mr. Ferguson was married in October, 1905, to Miss Bertha Sweeney of Pittsburg, who with a young daughter survives him.

The Way of the Negro Laborer. A northern contractor [illegible] he understood them. A short time ago this contractor was engaged in putting in a sewer system in a small city [illegible] he took a contract to put in a small private [illegible] the other work he undertook to boss the six or seven negroes engaged in the trenching. Everything went well for awhile, and then the contractor was summoned to his office. Before leaving the job he appointed one of the negroes as temporary foreman, and told him to call him up on the telephone every hour and report how the work was progressing. The contractor returned to his office and presently the negro foreman called up and reported that everything was going fine, but added that the trench had begun to cave. The contractor told him to get some planks and sheet the trench. Another hour passed and the foreman called up and again reported that everything was "fine," but that the men had "busted" a water main and were half drowned. He was told to mend the main as best he could and proceed with the work. The next time the foreman called up everything was still going fine, but the men had run across a stick of dynamite and didn't know what to do with it. The contractor gave instructions as to what was to be done and waited somewhat anxiously for the next report. It came in less than half an hour: "They have struck a whole package of dynamite," said the foreman over the telephone. Reckon they're getting right into a dynamite mine. I had 'em throw it all out and they are still working fine." Another hour passed and the foreman against called up. "Hey, boss," he said, "the men all dun left. They found what they said was man bones in the trench and they riz out just like buzzards, and I reckon they're going yet."

RAILWAYS, STEAM AND ELECTRIC

Alabama Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Directors of the proposed railroad from Selma to Birmingham have been over the route and have made arrangements for securing the necessary right of way. George H. Clarke, Birmingham, Ala., is engineer.

Arizona Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

A petition has been filed with the Surveyor General of Arizona at Phoenix, Ariz., by Howell Jones, land commissioner of the Santa Fe railroad company, for the survey of 23 townships in the Hualapai valley in Mohave county, totaling over 500,000 acres. The land is within the grants to the railroad company and the survey is to put it in position to be utilized either by the railroad company or some one else. The survey will cost the company in the neighborhood of $20,000.

The L. J. Smith Construction Co. has been making good progress on its railroad construction work in Arizona. E. M. Burch is superintendent on part of this work and is located at Camp No. 1, Flagstaff, Ariz. Frank Richmond is general foreman of Camp 3, Henry Miller of Camp 4 and C. A. Scott of Camp 2.

Arkansas Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The town of Hope, which has a population of 6,000, has granted a street railway franchise to J. F. Black and L. W. Jones of Texarkana. It is believed that this franchise will also be used in connection with an interurban line to be built between Texarkana, Hope and Hot Springs.

The Memphis, Dallas & Gulf R. R. has increased its capital stock from $645,000 to $7,875,000. The company proposes to extend its line from Murfreesboro to Memphis, Tenn. H. C. McCluer, Nashville, Ark., is Chief Engineer.

Henry Dalhoff, Little Rock, has made propositions to the Business Men's League of Hot Springs, for the construction of a steam railroad from Hot Springs to a point about 17 miles west on the Onachita river. The road is to be known as the Hot Springs & Mountain Valley Belt Line. The project also involves the expenditure of about $2,700,000 for three large dams along the Onachita river for the development of electric power.

The Central Arkansas & Eastern R. R. Co. has increased its capital stock from $880,000 to $1,000,000 to cover the cost of an extension of the line from England to Stuttgart, which is already under construction.

Surveys have been started from Cave Springs, a town on the Arkansas, Oklahoma & Western R. R., to lay out the route for an electric railway from that point to Benton ville. Cave Springs is ten miles southeast of Rogers and work on that portion of the line from Rogers to Bentonville will be started this month. The Arkansas, Oklahoma & Western R. R., W. R. Felker, President, Rogers, Ark., is said to be back of the electric railway.

Advices from Stuttgart, Ark., state that Chief Engineer C. D. Purdon, of the Cotton Belt Ry., has made arrangements with the officials of the Central Arkansas & Eastern R. R. for a connection with their line in that city. By terms of the agreement it is said the companies will use the same depot.

California Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The City Council of Berkeley has granted a franchise to the Oakland Traction Co. for the extension of the Euclid Ave. car line from University and Shattuck Aves. to the north end of Euclid Ave. in the Wheeler tract. Work on the actual construction will commence at once.

The Hanford & Summit Lake Ry. Co. has filed its articles of incorporation at Hanford. The company proposes to build an electric railroad from Hanford through Grangeville and Hardwick into the Summit lake region and will return through Lemoore and Armona. The road, including the loop and an extension to Laton, will be 15 miles long. The capital stock is $500,000 of which $15,000 has already been subscribed by the following directors: Charles King Hardwick, J. O. Hickman and George C. Aydelott of Hanford, Ralph W. Heins of Santa Cruz and Clifford McClellan of San Francisco.

The San Bernardino Valley Traction Co., A. B. Merrihew, General Manager, San Bernardino, is planning to extend its Citrus Ave. line through Crafton at Mentone, coming back to Redlands in Colton Ave., making a 5-mile loop.

The Afterthought Copper Co. is to re-open its mine at Ingot, 35 miles from Redding, and will expend $100,000 for improvements, to include the building of a railroad to connect with the Terry Lumber company's road, a distance of six miles from the Afterthought mine. S. E. Bretherton, 220 Mills Bldg., San Francisco, Cal., is Consulting Engineer.

Engineers of the Southern Pacific Ry. are preparing plans for a subway under the railroad tracks at 17th and B Sts., in Sacramento.

The Northern Electric Ry. Co., of Chico, will soon have work started on its branch line from Yuba City to Colusa.

Articles of incorporation have been filed for the Warren Creek Railroad Company proposing the construction of a railroad from Humboldt, Cal., up the Warren Creek to the Minor Quarry. The incorporators are Isaac Minor, Caroline Minor and L. D. Graeter.

As the result of farmers along the proposed route of the Nevada-California-Oregon Ry. north of Alturas, Cal., charging too high prices for their land, it has been decided to alter the line from the east side to the west side of Goose Lake in order to reach Lakeview, Ore. It is also thought that the line will be extended to Klamath Falls from Alturas. George S. Oliver, Reno, Nev., is Chief Engineer of the railroad.

Colorado Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Pueblo & San Luis Valley R. R. Co. has an application before the City Council of Pueblo for a franchise to carry on a street car business within the city limits and as far as City Park, where it will connect with the main line to the San Luis Valley. It is probable that the city will require a bond of $35,000 as a guarantee that the road will be completed at the end of six months.

Florida Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Construction work is well along on the railroad being built from Ocala, Fla., to Palatka, Fla., for the Rentz Lumber Co., of White Springs, Fla., and it is expected that trains will be in operation by December from Fort McCoy to Rodman, 12 miles southwest of Palatka. The railroad has been in operation for some time from Ocala to Fort McCoy in Marion county.

Construction work on the Florida East Coast Ry. Extension is progressing rapidly and it is believed that trains will be in operation to Key West in less than a year and a half. The track across Stock Island, six miles from Key West, has been completed. Nearly 1,200 men are now employed on the grade between Key West and Boat Key Harbor. Boca Chica camp has a gang of about 200, and of this number about 70 are engaged in laying rails.

The Florida Ry. Co., Frank Drew, President, Live Oak, Fla., is said to be considering extending its line toward Thomasville, Ga.

Good progress is being made with the grading work in the Florida Ry., and it is believed that the Fernandina and Jacksonville end of the line will be in operation by Jan 1. At present that portion of the road between Piney Island and Nassau river in Nassau county is being cleared and graded. Part of the grading force will shortly go on toward Jacksonville, while a smaller firm will be engaged in the terminates in Fernandina. Frank Drew, Live Oak, Fla., is President.

Georgia Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Maps of the proposed electric railway to connect Chattanooga, Tenn., and Dalton, Ga., have been prepared and according to a statement of F. T. Reynolds, Secretary of the Chamber of Commerce of Chattanooga, the line will probably connect with Murray county points, being run from Dalton to Chatsworth and there connecting with the Louisville & Nashville R. R.

The Atlanta & Carolina Ry. Co., which proposes an interurban electric railway from Atlanta to Augusta, by way of Athens, has secured all necessary franchises and practically all right of way. In addition to its interurban line the company will control eight miles of railway in Atlanta and work on this is to be started by September. The main line, from Atlanta to Augusta, which will not be started until later, will take in nearly all the important cities between the two termini. Leaving Atlanta the route will go through East Atlanta out Confederate Ave. through White City and Grant park, through Lithonia, Conyers, Walnut Grove, Jersey, Mount Monroe, High Shoals, Watkinsville, Athens, Crawford, Lexington, Washington and then to Augusta. The company has secured authority from the the State Railroad Commission for a bond issue for $6,000,000. Capt. J. W. English, Atlanta, is President and Matthew Mason is Chief Engineer.

A resolution has been introduced in the State Legislature authorizing Governor Brown to purchase 234½ acres of land in Hamilton county, Tennessee, for use as terminal property for the Western & Atlantic R. R.

Idaho Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Construction of the Boville-Elk River branch of the Chicago, Milwaukee & Puget Sound Ry. has been completed. Elk River is a distance of 22 miles from Boville and is the site of the new sawmill of the Potlatch Lumber Company, which is soon to be constructed.

The bill authorizing the survey of all unsurveyed railroad grant lands, expense of which is to be borne by the companies to whom the lands were granted, has been agreed to by the Senate and the House at Washington, D. C. The move will result in the survey of about 729,034 acres in Washington and 571,520 acres in Idaho, all of which are Northern Pacific grants, and will be subject to taxation. If for any reason the railroads fail to make deposits within 90 days after the notice from the Secretary of Interior their lands will be forfeited.

Preliminary survey has been completed by the Oregon Short Line for the construction of the proposed branch from Montpelier to Paris, Idaho, a distance of 11 miles. A delegation of citizens of the latter city are to complete arrangements with the company at Salt Lake City, Utah, and as soon as right of way can be secured active construction work will be started on the grade. William Ashton, Salt Lake City, Utah, is Chief Engineer of the company.

Illinois Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Decatur Southern Ry. & Light Co., R. L. McCalam, Chief Engineer, Decatur, has completed surveys for the projected interurban line between Decatur at Pana. As proposed the line will enter Decatur at the foot of South Oakland Ave. at the west side of the new Lincoln park. Crossing the Sangamon river at the park will require a 20-ft. fill for a distance of more than a quarter of a mile. The bridge will span more than 500 ft., and will be constructed of reinforced concrete and steel.

The St. Louis, Iron Mountain & Southern Ry. (Missouri Pacific system) has started surveys for the proposed extension of that road from De Soto to Duquoin city, a distance of 15 miles, passing through Elkville and Hallidayboro.

The Murphysboro & Southern Illinois Electric Ry. now building into Carbondale proposes to later extend the line to Carterville to connect with the Gould electric line. An extension of the Gould line will be built to Duquoin according to present plans.

The directors of the Madison County Interurban Belt Ry. Co. held a meeting at Highlands the latter part of last month and appointed a committee composed of Eugene Schott, of Highland, Ill., and J. F. Long, of New Douglas, Ill., to confer with W. B. McKinley, head of the Illinois Traction system, for the construction of its proposed line. The Illinois Traction system is reported to have agreed, at a previous conference, to build the line if the towns of Troy, St. Jacob and Highlands would stand the expense of floating the bond issue.

Burns & Co., 705 Isabella Bldg., Chicago, Ill., contractors for constructing the line of the Northern Illinois Electric Ry. Co. between Amboy and Lee Center, have eight miles of the line northeast from Amboy now under construction.

Advices from Galesburg quote President W. C. McWhinney of the Galesburg-Rock Island Interurban as stating that he had succeeded in financing the building of the electric line and had let the contract for construction to a New York company. As the franchises and the right of way were secured last year there will be no delay in the work.

A interurban line is projected to run from Princeton via Dover and La Moille to Mendota, Ill. A company to build and operate the line has not yet been organized, and the matter is still in the hands of a committee, of which F. W. Clark, Princeton, Ill., is secretary and L. J. Kendall, La Moille, Ill., is chairman. We are advised that engineers have been over the route and are to make a [illegible]

Indiana Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

City Council of Columbia City is shortly to be asked for a franchise through the city for the interurban line from Fort Wayne to Winona, now being promoted by J. A. Barry, of Fort Wayne.

The city officials of Fort Wayne and the Pennsylvania R. R. have entered into an agreement whereby the railroad will secure three additional tracks across Calhoun St. The railway agrees to pay the extra cost of the additional track elevation work necessary. The railroad also agrees to pay any damage suits successfully brought against the city by reason of the extension of the railroad's right of way north on Calhoun St. to provide space for the tracks. The tracks are required for entrance to the new $1,000,000 station of the Pennsylvania.

Good progress is being made with the double track work on the Big Four between Anderson and Indianapolis, and it is believed that the work will be completed by October or November. It is understood that after this work is completed bids will be taken for a continuation of the double track to a point near Cleveland. The present improvement includes a five-mile change in the right-of-way in the vicinity of Pendleton in order to overcome heavy grades and curves. To do so the railroad is being shifted to the southeast so that it barely touches the edge of Pendleton. The original right-of-way, still in use, goes directly through the heart of the town. Because of Fall Creek and its valley at Pendleton, the new roadway for the double track of the Big Four will have a grade from sixteen to twenty feet high, and all streets and highways intersecting the Big Four in the vicinity of Pendleton will have subways. It also is necessary to build a new bridge over Fall Creek at Pendleton. It will be of concrete, and will cost $68,000. It will be 300 ft. long and will have six arches. At this time about 400 men are building bridges and culverts and laying steel for the double track. Contractors for the grade have about 300 men at work at various camps along the Big Four.

The Grand Trunk Ry. is to make a preliminary survey of a proposed new route from Mishawaka to and through South Bend over a private right of way, where it is proposed to lay a double track. At present the Grand Trunk in passing through the city of South Bend is compelled to confine its tracks to Division St., and to handle its traffic over a single track. The officials of that city refuse to grant additional privileges as to trackage facilities.

The Warsaw Construction Co., Warsaw, has been incorporated with a capital stock of $7,100. The directors are Earl W. Conrad, R. De Puy, Charles F. Nye, C. Edwin Stout, Edward B. Smith, John W. Nusbaum and Theodore C. Frazer.

Iowa Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Interurban Construction Co., of which August Steffens, Davenport, Ia., is President, has reached an agreement with the promoters of the Ottumwa-Iowa City interurban line whereby it will take up the financing and building of the line.

The Chicago, Great Western R. R., following a brief cessation of labor, has restored 500 or 600 men to work on the road bed between Des Moines and Oelwein. An equal or larger number will be put to work on the south end of the division as soon as laborers can be secured.

According to official announcement the Hawarden cut off of the Chicago & Northwestern R. R., will be thrown open for heavy train service on Nov. 1. A large force of men is now at work under the supervision of the company's engineers, completing the grading. Operations are under way at both ends, working toward the middle, and the dump is to be ready to receive the rails before midsummer. The Hawarden cutoff proper is 34 [illegible]

[illegible] Southern R. R. from Atlantic southwest to Villisca. The contractors will assemble the construction outfit and men at Atlantic. The road has been in operation 17 miles north of Atlantic for several years. The grading involves the removal of 500,000 cu. yds. of dirt.

The Waterloo, Cedar Falls & Northern R. R., T. E. Rust, Chief Engineer, Waterloo, Ia., has engineers at work for an extension from Cedar Falls to Grundy Center. It is believed that the company will be unable to do anything on the Grundy Center line this year, aside from establishing the route, as it is well [illegible] improvements in Waterloo. The distance between Cedar Falls and Grundy Center via Dike is about 21 miles.

Kansas Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Definite steps for the construction of the Topeka & Southwestern R. R., which proposes a line from Topeka to Council Grove, will probably be taken on Aug. 15, when the directors of the company will meet at Topeka to consider the plans of the Falkenau Electrical Construction Co. of Chicago, for building the line.

An ordinance is before the Commissioners of Kansas City, Kans., providing for the construction of a street car line south on 7th St. from Minnesota Ave. to the city limits. The plan for this proposed line contemplates its subsequent extension across the Kaw River to Rosedale, which would necessitate the building of a new bridge across the river at or near Packard St.

It is reported that the Atchison, Topeka & Santa Fe R. R. is planning on relaying the Girard branch, now under construction, with heavier rails. Work, however, will not be started on this improvement until next spring.

Kentucky Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Louisville, Henderson & St. Louis Ry. Co., now operating 188 miles of steam line, is planning to put on an interurban line of cars run by gasoline between Cloverport and Henderson and Evansville. S. Stites, Louisville, Ky., is Chief Engineer.

It has been reported in Louisville, Ky., that the Louisville & Nashville R. R. Company is now considering the construction of a third track between Louisville and Lagrange. The estimated cost of the work, which is made necessary by the increasing traffic, is $100,000. J. E. Willoughby, Louisville, Ky., is Chief Engineer of Construction

Louisiana Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Surveys have been completed and construction work is to be started soon on a railroad to be built for Frank Janes, Forest, La., to open up a timber section.

The New Orleans Great Northern R. R., N. G. Pearsall, General Manager, Bogalusa, La., is stated to have secured right of way and terminal grounds for its entrance to Jackson, Miss. Contracts for the construction work are said to have already been let.

The Southwestern Traction & Power Co. of New Orleans, has been organized and proposes to build an interurban line through Teche County. F. W. Crosby, New Orleans, La., is interested.

The Southern Pacific R. R. opened its Mamou extension on July 3. The extension runs from Eunice to Mamou, a distance of ten miles.

The Franklin & Abbeville Ry., on July 1 placed in operation its new extension from New Iberia to Milton, 17 miles. The company now has 55 miles of track, and Milton, its northern point, is but 13 miles from Lafayette. W. Y. Kemper, Franklin, is Chief Engineer.

A proposition for the construction of an independent trunk line to the Ohio River, which has been under consideration for more than a year, is said to have now reached the stage where foreign bankers may furnish the necessary funds for the line. The Mobile, Jackson & Kansas City, the Mississippi Central, the New Orleans Great Northern and several of the lumber tap lines operating through Mississippi are said to be back of the plan. The proposed line is to be built into New Orleans from Hattiesburg, utilizing as far as possible the rights of way held by a number of lumber tap lines. Plans have also been completed to extend the Mobile, Jackson & Kansas City R. R. to the Ohio River. The men who are understood to back the project are L. S. Berg, president of the Mobile, Jackson and Kansas City; F. L. Peck, Scranton, Pa., president of the Mississippi Central, and Sol Wexler, vice-president of the Whitney-Central National Bank.

Advices from Baton Rouge, La., are to the effect that contractors on the Frisco extension from Erwinsville to Lakeland, have built about three miles of embankment and are pushing the work rapidly toward completion. Steel will, it is said, be laid in time to handle the fall crop.

The Hammond Interurban Ry. Co., which projects a four mile line from Hammond to Genesee, has secured his right of way, and will let construction contracts shortly. W. E. Libby, Hammond, La., is president.

Massachusets Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Board of Aldermen of Salem, Mass., have appropriated $2,500 to defray the expense of engineering work incident to the abolition of grade crossings on the Boston & Maine R. R. in the city. Already $1,000 out of a previous appropriation of $1,500 has been expended for preliminary work by an engineer and for service rendered by the city solicitor. It is estimated that the expense of abolishing grade crossings in the city will be at least $2,000,000, of which this city will be called upon to pay 10 per cent.

The Boston & Eastern Electric R. R. Co., which proposes a high speed electric line from Boston through East Boston, Revere, Lynn, Salem, Peabody, Danvers and Beverly, has been granted permission by the state legislature to construct its proposed tunnel under Boston harbor.

Michigan Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Owosso & Corunna Electric Co., W. E. Guthrie, Superintendent, Owosso, is to improve its electric railway between Owosso and Corunna. New rails will be laid and the equipment of the line renovated generally.

The Osborn Engineering Co., of Cleveland, O., has made preliminary survey for an electric railway from Flint to Long Lake. The survey was made for several business men of Flint, who propose to organize a company if it is found that the road can be built for a reasonable cost.

Surveys for the extension of the Detroit & Mackinac Ry. to Rogers City will be completed early next month. It is expected to have trains running into Rogers City by Dec. 1.

At a recent meeting of the City Council of Muskegon Heights, Mich., permission was granted the Grand Rapids & Indiana R. R. to put a spur from that place to Muskegon and to construct the freight house providing that the work be completed within three years. E. H. Barnes, Grand Rapids, Mich., is Chief Engineer of the company.

Kneal & Ryan, Lansing, Mich., who have the contract for constructing an electric railway between Lansing and Grand Ledge, Mich., a distance of 12 miles, have some nice grading to sublet to parties with small outfits. Kneal & Ryan may also be in the market for a few second-hand wheeled scrapers in good condition.

Minnesota Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Canadian Northern Ry. has awarded the contract for the construction of its subsidiary line, the Duluth, Winnipeg & Pacific Ry., from Virginia, Minn., to Duluth, Minn., to Foley, Welch & Stewart, St. Paul, Minn. the line will be 87 miles long and will cost about $35,000 per mile. The company contemplates the erection in Duluth of independent terminals down by the water front. Part of their wharfage has already been secured. This piece of construction will give the Canadian Northern a through line from Winnipeg to Duluth and excellent connections with Chicago. The contract includes 500 lin. ft. of rock tunnel, several wood trestles, and 12 steel bridges aggregating 1,830 lin. ft. H. T. Hazen, 619 Lyceum Bldg., Duluth, Minn., is Chief Engineer.

The plans for the construction of the Minneapolis & St. Louis Ry branch from Pierre, S. Dak., to Aberdeen are still under consideration by the officials of the road. At a conference with the business men of Pierre, G. W. Seevers and W. G. Bierd, Minneapolis, Minn., General Manager, were given an extension of 90 days in which to commence construction work on the road.

It is said that the Duluth & Iron Range R. R., which has a line to the Virginia mine, under construction, is planning to connect with the Duluth, Missabe & Northern, a short distance south of the Rainy Junction and enter Virginia over their tracks, discarding the use of the Virginia-Gilbert line, and the depot on the hills. W. A. Clark, Duluth, Minn., is Chief Engineer of the D. & I. R. Ry.

A large surveying party is now working in Stearns and Todd counties, Minnesota. This party is heading north, apparently toward Winnipeg, and it is reported that a crew is working south from that city to connect up with the line being running from Minnesota. It is believed that these surveys are being made for a Winnepeg line for the Chicago, Milwaukee & St. Paul Ry. The line runs between the line of the Great Northern road which runs north from Sauk Center to Walker and the Soo line which connects Minneapolis and Thief River Falls. It passes through the counties of Todd, Otter Trail, Becker, Clearwater, Red Lake, Marshall and Roseau.

Duluth and Vicinity.

BY PETER E. MEAGHER.

The Duluth, Winnipeg & Pacific Railway Co. has let the contract for the extension of their railroad from Virginia, Minn., to Duluth, Minn., a distance of 87 miles, to Foley, Welch & Stewart, St. Paul, Minn. The work to be started immediately. There is a great deal of rock work, some steam shovel work, and a large amount of team and station work. There will be work for quite a few sub-contractors on this road, and anyone looking for new contracts, by addressing Peter E. Meagher, 409 West Michigan St., Duluth, Minn., will be supplied with full information.

John Meyers, general superintendent for this vicinity for the Barnett & Record Co., large dock contractors, was a caller last week. They have a great deal of work under way at the present time, and are giving employment to a large number of men.

Patrick McDonnell, Duluth contractor, was awarded a $98,000 paving job by the City of Duluth a short while ago, and has already started on the same and is rushing it to completion as fast as possible. He was also awarded about $26,000 worth of sewer work by the City of Duluth this week.

Mr. J. R. Morris of MacArthur Brothers Co., was a caller here last week. He was on his way up to the iron country to look over the two large stripping contracts that his firm has up there.

Contractors and others, when in this vicinity, are invited to make the labor and equipment offices of Peter E. Meagher, 409 West Michigan St., Duluth, Minn., their headquarters.

J. R. Carey of the contracting firm of Johnson & Carey was a visitor here last week. They have got quite a bit of work under way at the present time, and intend to start a new contract that they have in Canada in the next very few days.

C. J. A. Morris, contractor from St. Paul, was a visitor here last week. He said all of their work was in excellent condition.

J. B. O'Connell, who is a large paving contractor at Two Harbors, Minn., came in to see us recently. He said his work is progressing nicely.

W. S. Charles of Jones Brothers, general contractors, was a visitor here with us this week. He came up from Columbus to look over their stripping job on the Iron Range. He reported their work in various parts of the country in very nice shape.

The labor situation at Duluth is in a very satisfactory condition at the present time. There is quite a bit of work going on, but there are enough men here at the present time to just about fill all positions offered. Some of the large railway companies up this way have recently laid off quite a few of their extra gangs, and that has thrown quite a few laborers on the market. I do not look for a scarcity of men this season.

St. Louis Items.

BY A. B. KOENIG.

The L. J. Smith Construction Co. has finished its work on the Memphis division of the Iron Mountain R. R. and moved this outfit on to the Kansas and Colorado divisions of the Missouri Pacific R. R. This company is making rapid progress with their ballasting on the Missouri Pacific out in this country.

The Frisco has in contemplation the building of a new line from Kingsville, Texas, on the St. Louis, Brownsville & Mexico, to San Antonio. After the extension of the Frisco south from Brady is completed, there will be a northwest-southeast line through San Antonio to Kingsville, on the New Orleans-Houston-Brownsville road, known as the New Orleans, Texas & Mexico division of the Frisco. Albert T. Perkins, railroad expert of the St. Louis Union Trust Company, who has just returned to St. Louis, reconnoitered the projected line. The route of the Kingsville-San Antonio line lies about fifteen or twenty miles south of the San Antonio & Aransas Pass, and the road will be about 160 miles long. Robert Moore accompanied Mr. Perkins to Texas, and he inspected the new bridge across the Rio Grande at Brownsville. The bridge is in commission.

Grading work on the Hannibal-Kirksville interurban line is stated to have been started near Philadelphia, 6 miles west of Palmyra. Joseph McElroy is the contractor. Capt. F. W. Latimer, Galesburg, Ill., is President.

Grant Bros. expect to finish their work at Pendleton, Ind., in about 10 days and are in the market for work for their 20-team outfit.

G. C. Smith has finished his bridge and pile driving work on the Burlington in Southern Illinois, and is in the market for this kind of work. Coulterville, Ill., will catch him.

The F. E. Newberry Electric Co. of this city were awarded the contract by the government for wiring and installing the gas fixtures in the new postoffice building here. Their bid was $15,588.

Railroad laborers continue to be a scarce article in this neighborhood. Lots of demand for them, with not one-tenth enough labor to supply it. No trouble for all the idle laborers in the country to get work if they will come to St. Louis.

L. A. Nutter of the L. J. Smith Construction Co. passed through St. Louis the other day with a part of the L. J. Smith Construction Co's outfit, bound for Kansas and Colorado.

Dan Hickey, looking as fine as we ever seen him, spent last week in town. Dan reports their work at Belle Fourche, S. Dak., getting along nicely. They will finish this work this year.

Pat Hannon came in with a few roasts the other day. Left here for Evansville, Ind. We expect Pat back the beginning of the week and are looking for a few more frys when he returns.

The building committee of the Board of Education opened bids last Friday on a few contracts for work on [illegible] One was for fitting up [illegible] schools, on which the lowest [illegible] Fred Medart Manufacturing [illegible] $14,845. Only two bids [illegible] being $22,500. Another [illegible] placing folding door partitions in the teachers' college, on which the lowest bid was $955.35, by the Daniel Evans Construction Co.

Montana Notes.

FROM CORRESPONDENTS AN[illegible]

Reports from Wallace, Mont., state that the Chicago, Milwaukee & Puget Sound Ry. has complete surveys for the construction of a railroad up Big Creek for a distance of 10 miles and that construction work will be commenced about July 1. Later the line may be extended to Wallace. The work would require the construction of a short tunnel.

Advices from Palisade, Nev., are to the effect that the reconstruction of the line of the Eureka & Palisade R. R. from Palisade to Eureka is under way. M. L. Requa, San Francisco, Cal., is president of the company.

According to advices from Lewistown, Mont., the Great Northern Ry. Co., has practically completed location of the proposed line between that city and Philbrook and contracts will be let shortly. Right of way is being secured without much trouble and it is expected to have the line completed ready for operation by the end of this year.

The Butte, Boise & San Francisco R. R. Co. has filed its articles of incorporation at Butte. The company has a capital stock of $25,000,000, and will, it is said, shortly, award contracts to a construction company recently organized in Philadelphia, headed by V. S. Ruelens, who represents foreign capital, for the building of a line of railroad from Butte to Boise and San Francisco. Among those interested are W. H. Haviland, T. Romich of Butte, V. S. Reulens, of Paris, France, and T. H. McCabe of Butte, F. E. Haviland, Con McLaughlin and James E. Murray, all of Butte.

The Great Northern Ry. has filed at the U. S. land office, at Miles City, plats of the right of way for its new line through Montana, as far as Circle, on the Redwater, in Dawson county. The plats run in four different sections and the route as filed commences at Newton and runs along Fox creek to the Terry Baldwin ranch and from there to the Redwater near Paxton and from Paxton down the Redwater to Circle, which is the western extremity of the line as filed. At Newton the line connects with the N. P. line from Glendive to Mondak and it is considered likely the G. N. will use the N. P. line from Newlon to Mondak.

Nebraska Notes.

FROM C[illegible]RRESPONDENTS AN[illegible]

The City Council of Fremont has granted a franchise to the Nebraska Transportation Co. of Omaha, Neb., for the construction of an interurban line within the city limits. Under the terms of the franchise the road is to be complete from Omaha to Fremont by Jan. 1, 1912.

The Union Pacific R. R. is reported to have opened bids for its $1,000,000 headquarters building at Omaha. It is said that 15 competitors figured on the work, among them being the Selden & Buck, Nathan Tubbs, Thompson-Starrett, George A. Fuller Co. and Swift of Chicago and St. Louis and Mardis and Gould & Son of Omaha.

Good progress has been made in the promotion work for the Omaha, Lincoln & Western Ry project. This road has been projected for a number of years, but now all controversies regarding franchises have been adjusted and a construction company has been organized to build the line. The route of the proposed interurban lines is as follows: Starting from Omaha the line will cross the Platte river just below the mouth of the Elkhorn river, thus saving the building of a bridge across the latter, the original survey crossing both rivers a few miles north of the confluence. Reaching the right bank of the Platte, one line will run through Ashland [illegible] Wahoo, David City, Osceola and Aurora to [illegible] road will run due west from David City until [illegible] south to Osceola. Frank Schaaf, Lincoln, Neb., is the promoter.

Commercial Club of Beatrice, Neb., has decided to take up the matter with the Missouri Pacific of constructing a branch line from Virginia to that city, a distance of about 20 miles. Such a road would give Beatrice direct connection with Kansas City and would be of great benefit to business men of the place.

New Jersey Notes.

[illegible]

The newly created Utilty Commission, succeeding the State Railroad Commission, organized by electing Frank H. Sommer of Newark as president and Alfred N. Barber of Trenton as secretary. The organization is the same as that of the State Railroad Commission, which went out of existence when the new Public Utility law became effective the new Public Utility law became effective. Announcement was made that the organization of the old commission in so far as it deals with railroad supervision will be continued.

The Civic Society of North Plainfield township is endeavoring to have the Public Service Corporation extend its line from its terminus on Somerset St., North Plainfield, up the mountain, a mile or two.

The Wildwood & Delaware Bay Short Line R. R. Co. has made suveys and has partly secured the capital for the construction of its projected 7½-mile line starting from Wildwood and running northwest to the Reading R. R. and then on to the bay. We are advised that construction contracts will be let in August or September. C. L. Baker, Wildwood, N. J., is President and Harry C. Weir, Wildwood Crest, N. J., is Chief Engineer.

New York Notes.

[illegible]

The Frontier Electric Ry. Co. is to apply to the City Council of North Tonawanda for a franchise to cross the streets in that city for its proposed trolley line over the old Buffalo, Thousand Island & Portland R. R. right of way between Buffalo and Niagara Falls. James T. Simmons, Niagara Falls, N. Y., is Vice-President.

The New York Central & Hudson River R. R. is preparing to submit tentative plans to the city officials of Syracuse for elevating the West Shore tracks and for a new station.

The State Public Service Commission has been giving hearings on the application of the New York Central, West Shore and the Terminal R. R. Co. for permission to extend their terminal lines at Depew. In the proposed improvements it is planned to close Broadway in Cheektowaga and the Schoolhouse road to get the line around the outskirts of the city. This is objected to by property-owners.

Sundstrom & Stratton, 90 West St., New York City, have been awarded the contract for about 12 miles of double track work near Adams, N. Y., for the New York Central & [illegible]

North Carolina Notes.

[illegible]

Location surveys are now under way between Belton and Greenville for the permanent line of the Greenville, Spartanburg & Anderson Ry. Co. This company is planning a number of lines and has already made preliminary surveys for several of them. The first line to be built, however, will be that between Anderson and Greenville, then from Greenville to Spartanburg, and possibly on toward Greensboro, N. C. It is estimated that the line between Belton and Spartanburg will cost about $1,500,000. W. J. Thackston, Greenville, N. C., is President.

Ohio Notes.

[illegible] road.

[illegible] yards at South Akron. Eight to ten additional tracks for storage purposes will be laid.

Officials of the Southeastern Ohio Railway, Light & Power Co., Zanesville, have been over the territory between Crooksville and New [illegible] extension. As a result it was practically decided to abandon the tunnel route, [illegible] Rehoboth route the grade is only 2 per cent. [illegible]

[illegible] Louis Ry. has had surveys made for a spur track at Clyde to cost about $35,000.

B. A. Worthington, Cleveland, O., Receiver [illegible] permission to issue $200,000 receiv[illegible] cates for the purchase of tools, machinery and other equipment for the new repair shops a[illegible] Brewster.

[illegible] of the proposed electric railway from Akron [illegible] madge, Brimfield, Palmyra, Rootstown, Edi[illegible] West Austinburg. Tom L. Childs, Akron, O., is interested.

[illegible] least two years to complete the double track [illegible] yds. of dirt are yet to be removed.

Right of way for the proposed Fifth Ave. cross-town line at Columbus is assured. The next move will be to secure a franchise for the Fifth Ave. Company from the city council. The proposed car line, extending from Shepard to Marble Cliff, will cost between [illegible]

The Baltimore & Ohio R. R. has begun work at Columbus on the elimination of five grade crossings, the work being done under the direction of C. Brown, Constructing Engineer, Pittsburg, Pa. In the m[illegible] nance is to come before the [illegible] umbus for the elimination of grade crossings [illegible] at First, Second, Third, Fourth, Fifth and Eleventh Aves. on the North Side. The ordi[illegible] November on the question of issuing $1[illegible] of bonds to pay the cost.

[illegible] Ill., have secured the contract for [illegible] ing the projected line of the Whee[illegible] & Tuscarawas Traction Co. [illegible] has not been decided as to [illegible] the work will be sublet.

Oklahoma Notes.

[illegible]

The Oklahoma City & [illegible] Oklahoma City, has filed [illegible] construction purposes.

[illegible] second preliminary survey for the line from [illegible]

Okla., was too high for railroad purposes and it is believed a far better line can be secured over the old Rock Island survey from Watonga to Kingfisher.

The Guthrie Street Ry. Co., Guthrie, is to start work at once extending its west Warner Ave. line for four blocks.

Oregon Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Two construction camps of the Oregon Trunk Line Ry. have been located near Bend, Ore. One of Bryan & Youngstrom, who have the contract for the construction of the line 4½ miles north of Bend, and Rossi & Adams, who also have a contract for 2 miles of work adjoining the other contract. The latter firm has all right of way cleared.

It is reported that Erickson & Peterson have been awarded the contract for the construction of 85 miles of railroad on the Natron-Vale branch and that preparations are being made to establish a construction camp near Crescent, Ore. The preliminary survey for this line runs about 1 mile south of Crescent but arrangements are being made to purchase rights of way through that city and permission will be asked of the Interior Department to make the necessary alterations of the route through the forest reserve. The Oregon Trunk Line has also purchased right of way for a spur to the Weyerhaeuser properties in the timber belt along the Deschutes River, to the site of the proposed new mill.

Three new construction camps have been located along the right of way of the New Troutdale extension of the Oregon Railroad & Navigation Co., to keep up with the rapid progress made by the crews. Most of the necessary land has been purchased and grading is well under way for the new branch, which will eliminate the heavy grade out of Portland through Sullivan's Gulch. Work will probably be completed to the north end of the tunnel by the end of this year.

Right of way agents are now at work in the vicinity of Merrill, Ore., securing options on property for the extension of the Nevada-California-Oregon R. R. through that city from Alturas, Cal., to Klamath Falls as mentioned elsewhere in these columns. Merchants and business men are taking considerable interest in the work and assurances have been given the railroad officials that the citizens of Merrill and other points along the proposed right of way will lend every effort to assist the company and assure the success of the new road.

Surveyors are busy changing the grade stakes over a considerable portion of the old right of way of the proposed Mount Hood Ry. owing to the expensive property through which it passed in the vicinity of Gresham, Ore. According to reports the line will go into Portland over the Oregon Railroad and Navigation Company's tracks from Montavilla. Joseph W. West, Hood River, Ore., is Chief Engineer of the company.

Pennsylvania Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Residents of Steelton are asking the Central Pennsylvania Traction Co., Harrisburg, to extend its Oberlin line out Harrisburg St., past the new Kelher park, bridging Mohn St., thus making a belt line at Steelton.

The Waynesburg & Blacksville Street Railway Co., recently chartered to build a line in Green county has filed notice of extension to 51 miles. The company will build four branches covering various points in the county.

The Pennsylvania & Western Ry Co., Philadelphia, has been granted the right to lay tracks and operate cars on Swede St., Norristown, from the Schuylkill river to Airy St., thence on Airy St. to Markely, and on the old Swede road to the borough line. The franchise carries with it the right to elevate the tracks from the river to Penn St. For the franchise the borough gets brick paving on all the streets traversed, representing a probable cost of $65,000.

A large force of men is rushing the construction of the Pittsburg & Shawmut R. R., which is being extended from Jefferson county through Kittanning, Pa., to Pittsburg. Entrance to the latter city has now been assured for arrangements have been made for the company to use the tracks of the Pittsburg, Bessemer & Lake Erie from Houseville into the Pittsburg district, and final surveys will be started at once by the Shawmut along its located line from Freeport to Houseville, a distance of 14 miles. Contracts for the new extension are expected to be let soon.

As a result of a conference recently held between A. T. Dice, General Manager of the Reading Ry., and Superintendent Turk of the Shamokin Division and similar officials of the New York Central Ry., it is believed a joint shop will be constructed at Newberry Junction for the repair of steel cars. This move appears quite probable as the N. Y. C. Ry. has taken over the Western Maryland which has a connection with the Reading at Shippensburg, Pa.

Active construction work has been started on the connecting link between the Western Maryland and Pittsburg & Lake Erie R. Rs. from Connellsville to Cumberland, Pa. Eighty per cent of the right of way from Connellsville to Garrett has been cleared of timber and underbrush and another month will make a decided change in the appearance of the Yough valley. Present indications are that the line will follow the Youghiogheny river into Connellsville. The Western Maryland road filed bonds in Union county to secure property owners along the route against damages by the construction of the proposed road.

The Central Railroad of New Jersey, J. O. Osgood, Chief Engineer, New York, N. Y., according to press reports, is planning a unique method for eliminating a short rock tunnel at Glen Onoko, a short distance from Mauch Chunk. According to the report the railroad will blast away the entire cliff through which the tunnel is driven. This cliff, which is one mass of stratified rock, the strata running obliquely, is several hundred feet high and is almost perpendicular at one side, while its base measures several hundred yards.

The Lehigh Valley R. R., E. B. Ashby, Chief Engineer, New York, N. Y., is to have work started shortly on the construction of a tunnel through Bear Mountain at Mauch Chunk. The work will cost about $1,000,000, and will shorten the line about one mile.

The Lehigh Valley R. R., E. B. Ashby, Chief Engineer, New York, N. Y., has been making final surveys for its proposed cut off branch from Hayes Creek to Hazle Creek Junction. The branch when completed will cut off about 18 miles of heavy grade. It will start from the main line at Hayes Creek, crossing the Lehigh river and the C. R. R. of N. J. tracks by a bridge 90 feet high and over a quarter of a mile long. The line will cross the Drifton Branch leading in the direction of Buck Mountain running along the foot of this old mining settlement. Passing through Evergreen and Laurytown valleys it will strike the Hazleton branch two miles west of Weatherly.

The Central Railroad of New Jersey has ordered the construction of ten more miles of tracks in its interchange yard between Allentown and Bethlehem.

The Baltimore & Ohio R. R. has purchased about 200,000 sq. ft. of land at 30th and K Sts., Georgetown, Washington, D. C. The property is to be improved by a freight terminal for the Baltimore & Ohio R. R.

Tennessee Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Gunter & Thrasher Contracting Co., Chattanooga and Knoxville, have started work on the construction of 15 miles of double track on the main line of the Nashville, Chattanooga & St. Louis Ry. between Nashville and Chattanooga. The work will require 9 or 10 months for completion and it is said that the contract price is in the neighborhood of $150,000. Four steam shovel outfits are now on the work and two more will be placed in service later.

We are advised that contracts were to be let about July 10 for improvements to the Athens & Tellico Ry., requiring the expenditure of about $75,000 and including the filling in of trestles and revising of grades. This road was recently purchased by the Louisville & Nashville R. R., and the work will be done under the direction of J. E. Willoughby, Louisville, Engineer of Construction of the L. & N. R. R.

The City Commissioners of Memphis are to grant the Clarksdale, Covington & Collierville Interurban Co., an amended franchise for the line through the city. The company has now practically completed its line to Lakeview, and will have construction work started soon on the line from the north end of the city. W. W. Hayden is Chief Engineer.

Texas Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

H. J. Myers, of Dayton, O., President and General Manager of the Port Arthur Traction Co., of Port Arthur, which has 7 miles of line in operation, has applied to the County Commissioners at Beaumont for a franchise to construct an interurban line from that city to Port Arthur.

Several lines have been run for the proposed Stamford & Eastern Ry. Co., the incorporation of which was mentioned in our last issue. It is stated, however, that a definite location of the line has not been made as yet. The road will be 60 to 70 miles long and will penetrate the coal field of Shackelford, Stephens and Throckmorton counties. It is believed that this is a Rock Island project. W. T. Andrews, Stamford, is President.

According to official reports to the State Railroad Commission during the fiscal year ending June 30 approximately 800 miles of new main track and branch lines were constructed. This is estimated as the new mileage figures for all the roads had not been received at this writing. On June 30, 1909, Texas had 13,110 miles of railroads, exclusive of about 1,500 miles of logging roads and 3,200 miles of sidings and yard tracks. It is announced that grading work is in progress on new lines and extensions of existing roads covering more than 1,200 miles, a large part of which will be finished during the present fiscal year. Chief of these is the Santa Fe cut-off being constructed between Coleman and Texico, 310 miles; the Kansas City, Mexico and Orient branch line, from San Angelo to Del Rio, 150 miles, and the main line extension from San Angelo to Alpine, about 225 miles; the San Antonio, Rio Grande and Tempico, from San Antonio to the Rio Grande border crossing, 260 miles, and the Frisco branch line, from Brady to Menardville, thirty-six miles.

Governor Campbell, according to advices from Austin will request the Legislature at its special session next month to adopt a resolution authorizing the sale of the state's railroad which runs between Rusk and Palestine, a distance of about 40 miles. This road was finished to Palestine about a year ago. It has been operated at a loss ever since it was built, and, instead of proving a benefit to the state, as was expected by the men who advocated its construction, it has been a financial burden. At the time the Legislature made an appropriation to extend the line to Palestine, a strong effort was made to have enough money appropriated by the state to continue the line 100 miles further, to Dallas or Fort Worth. It is considered probable the road will be taken over by either the Southern Pacific interests or the International and Great Northern, if its sale is authorized by the Legislature. In addition to this railroad, Texas owns a small railway system upon its sugar cane plantation in South Texas. The latter system is used exclusively, however, to handle cane and other crops, and is not a common carrier. It is operated by convict labor and is said to be profitable.

The State Railroad Commission has been advised that the St. Louis & San Francisco R. R. will begin the construction of the San Antonio extension of the Fort Worth and Rio Grande division as soon as the branch line which it is building from Brady to Menardville is finished. This will be some time this fall. At the same time the construction of the road south from Brady is started, work will be commenced, building north from Kingsville toward San Antonio. The distance from Brady to San Antonio is about 125 miles, and from Kingsville to San Antonio about 160 miles. The survey for the extension from Brady to San Antonio was made some time ago and most of the right of way has been secured.

The Kansas City, Mexico & Orient Ry. Co. has sold $5,000,000 first mortgage fifty-year gold 4 per cent bonds to a syndicate of English brokers. This transaction will undoubtedly result in the early completion of the extension from San Angelo to Del Rio, Tex., connecting the system with the National Railways of Mexico, thus giving the Orient a direct through connection between Kansas City and Mexico City.

The City Commissioners of Fort Worth are considering the matter of placing all electrical wires underground and the construction of a subway to connect the business section with the Third ward, so as to open a safe avenue across the tracks east of Main St.

The first construction camp for work on the Del Rio branch line of the Kansas City, Mexico & Orient Ry. was established last week about 15 miles south of Del Rio. This branch, when completed, will form a connecting link via the Orient between Kansas City and Del Rio and then over the National Railway of Mexico to the City of Mexico. This line from San Angelo to Del Rio is a little over 100 miles in length. This line has been projected for some time, but actual starting of operations was delayed until last week. The other portions of the Orient system next will be taken up. Over 550 miles of track remain yet to be laid on the main line to Topelobampo south of Wichita. Work now is being done on several of the unfinished stretches. The line between Kansas City and Wichita will be the last gap to be closed. It is the opinion of the officials of the company that the line is not needed until the southern part of the system can develop sufficient business to justify the line into Kansas City. This portion of the system, however, has been surveyed and much of the right of way secured. The line will pass through El Dorado, Emporia and several other Kansas towns.

The Missouri, Kansas & Texas Ry. Co. has disposed of $10,000,000 of bonds. The proceeds will be used to finance the cost of new terminals in St. Louis, for new equipment and improvements and the acquisition of the stock of the Texas Central Railroad Co., a valuable feeder. The Texas Central, the purchase of which by the Missouri, Kansas & Texas has been announced, was bought about a month ago by Colonel R. H. Baker of Austin, Tex.

The Bartlett & Florence Ry., Geo. W. Hubbard, President, Bartlett, Tex., is planning extensions both east and west. At present the road has only 12 miles in operation from Bartlett to Jarrell, but will soon build east 32 miles to Rockdale, and west either to Lampasas or Marble Falls. The total mileage will be 186, valued at $1,250,000. This railroad has already secured authorization for $430,000 on the first 25 miles of track.

Chamber of Commerce of Denton, Texas, is investigating the feasibility of constructing a railroad from that city to Krum or some other point on the Santa Fe. It is estimated such a road can be constructed for about $100,000.

The Railroad Committee of Abilene, Texas, and Morgan Jones, President of the Abilene & Southern Ry., at that city, have ratified a contract providing that grading on the proposed line from Abilene via Hodges, Truby and Anson to Hamlin be completed by Jan. 1, 1911, and that the road be in operation by October 1, 1911. The branch from Anson to Hamlin is now under construction and grading will be completed within three weeks or a month. It is the intention to get this latter ready for the moving of the crop this fall, shipments being made by the Orient line via Abilene to the gulf.

According to a statement of Col. R. A. Love, of Brownwood, President of the Brownwood Southwestern R. R., work will be started as [illegible] of the right of way is secured. This road is to run to the Southwest into the Rockwood coal fields

S. F. [illegible] & Dublin Ry. [illegible] the line between [illegible] stated that work [illegible] completion. The line between Seymour and Dublin will be the next to be surveyed. Offices of the company are at Quanah, Tex

Town of Eden, Texas, has signed a contract with the Santa Fe. Railroad to furnish a bonus of $15,000 and right of way for 30 miles to secure the construction of a branch line to that place. Committee has already been appointed and is busy securing the necessary right of way.

Construction work is rapidly nearing completion on the Gulf Colorado & Santa Fe between San Angelo and Sterling City, Tex., and the officials of the company expect to have that stretch of line in operation by Aug. 1.

The Eastern Ry. of New Mexico, a subsidary line of the Santa Fe, is making extensive improvements to its roadbed, track and bridges, and the indications are that the road will be extended from Pecos to some point in the San Angelo line to make a direct route to the gulf. It is understood that the line from Pecos will be built through several of the new irrigation districts being opened up at Fort Stockton and other places.

Utah Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Hansen Saw Mill Co., Willard, has been awarded the contract for the ties to be used in the construction of the electric railway from Hot Springs to Brigham City. About 80,000 ties will be obtained at the Willard Canyon.

The Utah Light & Railway Co., Salt Lake City, is planning to extend its line in Salt Lake City to the southeast through the districts which are now building up. The line will run south on 30th East St., and will likely be completed to 9th South St. this year, to be extended later south of the penitentiary.

The San Pedro, Los Angeles & Salt Lake R. R., E. G. Tilton, Chief Engineer, Los Angeles, Cal., in co-operation with the International Smelting Co., is said to be planning to build a line to Ely, Nev., by way of Deep Creek, over the route that was surveyed, and a portion of it graded, several years ago. The proposed lines, approximately 200 miles long, would for the most part be one of easy grades and it will be relatively inexpensive to build.

City Council of Beaver, Utah, is to take action toward securing the construction of the proposed railroad from Milford on the main line of the Salt Lake route to Beaver, a distance of 32 miles and on to Minersville, Adamsville and Greenville. As planned the line will follow the county roads, making it unnecessary to secure private right of way.

Washington Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Surveys have been started and estimates of cost will be made for the construction of a 60-mile electric railway at White Salmon. As proposed the line will start from the station at Binzen, and, passing through White Salmon, will extend northeast through the Bristol, Pine Flat, Snowden, Gilmer, Camas Prairie, Fulda and Glenwood districts, thence west to the Trout Lake region. From Trout Lake the line will extend down the White Salmon River to Husum and around Bald Mountain to White Salmon, forming a complete loop. C. M. Wolfard, R. Lauterbach, C. L. Colburn, George F. Jewett, T. Wyers, of White Salmon, are interested.

It is reported that the Spokane, Portland & Seattle R. R. (Northbank) intends to abandon its proposed line from Grays Harbor to Portland via South Bend and Raymond.

The contract for the first 24 miles of the United Railways extension to Tillamook has been let, it is said, to Porter Bros., Railroad Contractors of Spokane, Wash. A large outfit consisting of teams, graders, steam shovels and other implements and machinery for [illegible] for an immediate start on the [illegible] Portland, Ore., is President.

It is reported that the Great Northern Ry [illegible] Sumas to Bellingham, Wash., as a connecting link between the new Great Northern cutoff line from Spokane to Vancouver, now in the [illegible] chase the present line from Sumas to Belling[illegible] Columbia Bay Co.

West Virginia Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Croft Railroad Co., of Alexander, Upshur county, W. Va., has been incorporated with a capital stock of [illegible] a railroad from a point near Alexander in Upshur county to or near the Zenders farm, in the same county. The incorporators are J. H. Henderson, J. L. Kendall, S. A. Kendall and Milton J. Henderson, of Pittsburg; J. Gibson McIlvain Sr., J. Gibson McIlvain, Hugh McIlvain and W. B. McIlvain, of Philadelphia.

The Norfolk & Western R. R., according to advices from Bluefield, is to start work at once building a double track in the coal fields of Southeastern West Virginia.

The State Line & Southern R. R. Co., recently incorporated as noted in this paper a short time ago, has effected its organization and has elected the following officers: President, Joseph Wood, Pittsburg; Vice-President and Chief Engineer, Samuel D. Brady, of Parkersburg; Secretary Charles Morris, of Fairmont; General Counsel, W. S. Meredith, Fairmont. The main offices of the company will be at Fairmont, W. Va. This company was organized to construct a line from Rivesville, four miles north of Fairmont, to the state line, there to connect with the Pittsburg & Lake Erie. The company is controlled by the Pennsylvania, the Pittsburg & Lake Erie and the Baltimore & Ohio.

The Elk & Little Kanawha R. R. Co. is reported to have let the contract for the construction of a narrow gage railroad from Gassaway by way of Frametown to Rosedale in Gilmer county, a distance of 22 miles.

Wyoming Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

Representatives of the Ohio syndicate that recently secured a franchise to construct an electric street car system in Sheridan, Wyo., have filed their bond, and it is expected that construction on the line will begin soon. Later a line will be built to Kool, a distance of 14 miles, via Fort MacKenzie.

Canadian Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

J. R. Barry, A. Finlayson, Bert Beaton and J. O. Palmer, all of Fort William, Ont., have taken sub-contracts on the new line of the Canadian Northern Ry. from Edmonton to the Pacific Coast. Work on 70 miles of this line has been started.

A. C. Mann, Winnipeg, Manitoba, has been awarded the contract for the first section of the main line of the Canadian Northern Ry. The contract calls for the construction of 60 miles from a point opposite New Westminster eastward. Grading work was started last week.

The Transcontinental Ry. Commission has awarded contracts for equipment on the railroad shops at Winnipeg, as follows: The Morgan Engineering Co., of Alliance, O., secured the contract for one 140-ton electric traveling crane. Mussen Ltd. of Montr[illegible] have been awarded contracts for 11 ele[illegible] Booth cranes. George Anderson & C[illegible] Montreal, will supply one 5-ton Gray foundry crane, five hand-power traveling cranes, and 15 Jib cranes, while the contract for [illegible] Jib cranes and [illegible] foundry equipment cranes was awarded to the Whiting Foundry Equipment Co. of Harvey, Ill.

Forest fires along the Transcontinental Ry. in Ontario have destroyed much property owned by the contractors engaged in constructing the line. From Nipigon it is reported that the Pembroke Contracting Co. lost camps, powder house and storehouses and supplies to a total amount of $30,000. Anderson & Mann lost two camps and a large amount of supplies; Bonfield & Harvey lost one powder house and Morris & MacKie one complete camp.

A proposition has been submitted to the City Council of Saskatoon, Sask., for the installation of a street railway system. A vote will be taken by the city.

It is probable that Jacobs & Davies, Consulting Engineers, New York city, will hand in their report to the City Council of Toronto, Ont., on a system of subway railways for the city early next month.

The Canadian Government on July 6 awarded the contract for the superstructure of a bridge across the Saskatchewan river at the Pas. This is the first step in the construction of the Hudson Bay Ry., as the building of the bridge will afford a means for the forwarding of supplies across the river from the present end of the steel at Pas. Work on the bridge will be rushed this year in order to have everything in readiness for the beginning of work on the new railway early next year.

The Windsor, Essex & Lake Shore Rapid Ry. Co., of Windsor, Ont., is considering building a switching line into the factory district at Windsor.

Mexican Notes.

FROM CORRESPONDENTS AND OTHER SOURCES.

The Mexican Pacific R. R., a new company, is making good progress with its promotion work. This road will pass through the coast country of Guerrero and Oaxaca. The Mexican-American Holding & Department Co., of which Senator Jose Castellot, City of Mexico, is one of the prime movers, obtained the concession for building the road and for utilizing the timber upon several hundred thousands of acres of land in the state of Guerrero. Its plans were gradually developed until the point was reached when it decided to begin construction. The original concession was then transferred to the Mexican Pacific R. R. Co., which proposes to build 930 miles of main line, extending down the Pacific coast from Manzanillo to Salina Cruz, and probably across the state of Tabasco. Harold G. Villard, of New York, is president of the company.

Governor Ramon Rabas of the state of Chiapas has been in conference with the Department of Hacienda, of the Federal Government relative to the construction of a railway from a point on the Pan-American to some place on the banks of the Grijalva river in the interior. The proposed road to connect with the railways of Yucatan is not now considered feasible on account of the difficult engineering problems. The road to the interior would be of great benefit to the state.

The syndicate composed of Jose Y. Limantour, minister of finance; Guillermo Escandon y Landa, governor of the Federal District; the Pimentel family of Mexico City, owning the Sautena tract of land, embracing 2,000,000 acres, which fronts on the Rio Grande and extends south for more than 100 miles to the Conchos River, are preparing to build a railroad from Matamoras to a connection with the United Railways of Yucatan at Campeche. The proposed road will be more than 1,500 miles long. At present an irrigation system to irrigate 600,000 acres of land is under construction. Antonio G. Canalizo is manager of the property and is in charge of the preliminary details looking to the early construction of the railroad. The route of the proposed road is down the gulf coast to Tampico, thence to Vera Cruz, Coatzacoalcos and through the timbered region of the states of Tabasco and Campeche.

Advices from Oaxaca state that Mrs. Maria W. Coronel de Dominguez, wife of Augustin Dominguez, and who was prominent in the affairs of the Pan-American Ry., in the days of its promotion, is now visiting the fincas in the state, with the object of organizing a company to build a railway from Oaxaca to Salina Cruz, and another to Puerto Angel or Puerto Escondido, in the state of Oaxaca.

A trackage agreement has been entered into between the Southern Pacific and the National Railways of Mexico, whereby the Southern Pacific is to use the track of the National Railways of Mexico between Orendain and Guadalajara 25 miles. A tentative agreement was also made for the use of the track of the National Railways of Mexico by the Southern Pacific between Guadalajara and this city. Orendain is the terminus of the mountain division of the Southern Pacific. The line is already built south from that station to the edge of the rougher range of mountains, where many construction difficulties are to be met with. This action will put a quietus to the report recently current in Mexico that the Southern Pacific had been unable to locate a feasible route for its west coast line across the Sierra Madre range between Tepic and Orendain.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

ALABAMA.

Mayor P. J. Lyons, Mobile, Ala., is reported to be asking bids for dredging in front of the city wharves from Dauphin street north to St. Anthony. It is proposed to dredge to a uniform depth of 24 feet throughout.

CALIFORNIA.

Charles Swezy, an attorney of Sacramento, has filed in the office of the county recorder of Butte an application for 20,000 in. of water. Of this amount 10,000 in. will be taken from Mosquito creek and 10,000 in. from French creek.

COLORADO.

The U. S. War Department has announced that the army engineers who are to act as an advisory board in irrigation projects and help spend the $20,000,000 appropriated by the last session of congress will leave Washington about July 20 in two parties, one taking in the projects under consideration in Montana, Idaho, Washington and Oregon and one the southern projects, in Wyoming, Colorado and New Mexico. The Grand valley project in Colorado will be one of the first visited and the engineers will then go to the Pathfinder dam in Wyoming.

The Kiowa-Comanche Irrigation Co. has filed its articles of incorporation with the Secretary of State in Denver. It proposes the reclamation of about 20,000 acres of dry land in Adams and Weld counties. The company is capitalized for $125,000 and among those named as incorporators are John H. Stackhouse, Lloyd Baker and Henry C. Allen of Denver. The company proposes to acquire extensive water rights in Wolf, Comanche and Kiowa creeks; to build a series of reservoirs; and to purchase real estate. Among the details of the project are the construction or purchase of the following ditches and reservoirs: Wolf ditch, Baker reservoir, Wolf reservoir, Kiowa canal, Comanche canal and five other reservoirs. The water supply for the whole project will come from Comanche, Kiowa and Wolf creeks.

IOWA.

The executive council of the state of Iowa is considering straightening the channel of the Des Moines river at the rifle range north of Des Moines. The work will require the cutting of a new channel about one-fourth mile long.

KANSAS.

The U. S. War Department has approved the plans of Maj. Edward H. S. Schulz, U. S. Engineer, for the new Kaw River Harbor lines and the Kaw Valley Drainage Board, of Kansas City, Kan., can now go ahead with its plans for the improvement of the Kaw River. The only thing now in the way of the immediate improvement of the Kaw river is the disposition of $1,750,000 of bonds voted by the taxpayers in the drainage district to make the proposed improvements, which will give protection from floods to Armourdale and its large manufacturing interests.

The Kaw Valley Drainage Board has awarded a contract to Spitcaufsky & Wagner of Kansas City, Mo., for the construction of 3,000 cu. yds. of the Santa Fe dyke in Argentine. The work is to be completed by the end of the month.

Ransom & Cook, Ottawa, Kan., as previously stated, have a contract for constructing a reservoir for the Santa Fe railway one mile south of Chanute, Kan. The work includes 3,000 cu. yds. of earth excavations, 2,500 cu. yds. of rock excavation and 50,000 cu. yds. of embankment. There may also be 3,000 cu. yds. rip rap or concrete. If the former is used Ransom & Cook will place it; and if concrete is used the work will be done by company forces. There may also be about one-half of trenching for a pipe line. Ransom & Cook have one outfit on the ground, but may sublet part of the work.

LOUISIANA.

The Water and Sewerage Board of the city of New Orleans has approved plans for the extension of drainage work in the city, which will involve the expenditure of about $5,500,000. This work cannot be begun until a $7,000,000 bond issue is sold, which will probably be done sometime in September. The new work will include, first, the Napoleon avenue canal system, which is badly needed to clear the upper rear part of the city of water at rainy season and divert the flow to Lake Borgne through Bayou Bienvenue. The intercepting canal is to extend from pumping Station No. 6, at Upper Protection Levee, to the Orleans Canal, near pumping station No. 7, which is back of the City Park, and across Bayou St. John via Marigny Avenue to station No. 3, at Broad and Marigny Avenue, and along Florida Walk to Jourdan Avenue and into the outfall canal carrying the water to Lake Borgne. The approved plans include also masonry lining and covering of several wood-lined canals and additional pumping capacity at all the stations and additional power from the water plant, which will make a loop of the power line and reduce the probability of an accident which might put the pumping stations out of business in the big storm.

MASSACHUSETTS.

The following bids were received July 1, by the Harbor and Land Commissioners, Boston, Mass., for dredging south channel of Mystic river, Boston; Bay State Dredging Co., 16.99 cts. per cu. yd; Charles M. Cole, 17.9 cts. cu. yd. Eastern Dredging Co., 14.2 cts. per cu. yd. J. P. O'Riorden, 14⅜ cts. per cu. yd. J. S. Packard Dredging Co., 16.4 cts. per cu. yd.

MINNESOTA.

We are advised that the Valley Dredging Co. has been awarded the contract for constructing Judicial District No. 10, bids for which were opened July 9, at Hallock, Minn. The contract includes 362,801 cubic yards of excavation and the contract price was 10 cents per cubic yard for this, and $160 per mile for road work in connection.

MISSISSIPPI.

R. H. & G. A. McWilliams, 1600 Steger Bldg., Chicago, Ill., have been awarded the contract for the improvement of the channel of the Bogue Phalia for a length of nine miles in Bolivar county. The work is to be done for the Bogue Hasty Drainage District, and bids for doing it were opened July 5 at Cleveland, Miss. The work includes 1,155,000 cu. yds. of earth excavation. This work is to form the outlet for all the water in the district and bids for the laterals leading to the outlet will be asked in about 90 days. W. W. Boone, Cleveland, Miss., is Chief Engineer for the District.

Brannen & Dunn, Engineers, Vaiden, Miss., have made preliminary surveys of Hay's Creek Valley for a canal to drain about 6,000 acres. The work will be done for the Vaiden Dredging & Drainage Co. of Vaiden.

OHIO.

The Two Rivers Dredge & Dock Co. of Two Rivers, Wis., has taken a subcontract for dredging at Ashtabula, amounting to about $125,000 and will use the dredge which has been at work at Sault Ste Marie, that contract having been completed. The contract for the lengthening of the river at Ashtabula and constructing a big basin for the Great Lakes Engineering works was awarded to the Inland Waterways Improvement Co. of Ashtabula, and the dredging was sublet as noted above. A large dry dock and ship yard will [illegible] improving the river is completed

Reports from Columbus state that officials of the Lake Erie & Ohio River Ship Canal C[illegible] bonds, which, it is said, can be sold quickly. It is proposed to start work on the canal next spring and to rush it to completion within 15 months. Burd S. Patterson is Secretary of the company.

Himes & Boyd, Dayton, have been awarded the contract by the county commission for constructing a levee along the river from Trenton to Middletown.

TEXAS.

The Texas Building Co. of Fort Worth is reported to have been awarded the contract for the construction of the levee in Fort Worth improvement District No. 1. It is reported that the building company will take the bond issue of $250,000 at figures slightly above par, construct the levee system and pay the commissioners of the improvement district a sum to cover the difference between the contract price of constructing the levee and the value of the bonds. The levee is intended to reclaim a large area of Trinity river bottom land in and near the city.

UTAH.

The Uinta Irrigation & Power Co. of Salt Lake City has been incorporated with a capital stock of $10,000. J. T. Pope is president; [illegible]

WASHINGTON

[illegible]

CANADA.

[illegible] and calculated to overcome certain [illegible] urged by the government to the pr[illegible] the financial arrangements and it seeks as an [illegible] the work a guarantee of 3½ per cent on the cost The government officials estimate this at [illegible] creased cost of ordinary labor

MISCELLANEOUS CONSTRUCTIONS

CALIFORNIA.

The Santa Monica Harbor and Improvement Co. of Santa Monica organized to build a breakwater a mile long has been given four months additional time by the City Council in which to begin actual work.

COLORADO.

The Colorado Central Power Co., with general offices 1210 17th St., Denver, is said to be planning to expend about $500,000 on the extension of its transmission lines to Colorado Springs and Pueblo.

The Mary Verna Mining Co., of which C. W. Young, Frisco, Colo., is President, opened bids July 11, for extending its tunnels 1,000 feet. The property is located on Colorado & Southern railroad near Frisco, Colo. One tunnel is now in to a depth of 2,782 ft., the other in to a depth of 1,740 ft. Size of tunnel 6x7.

IDAHO.

Bids were opened June 24 by the city of Idaho Falls, Idaho, for constructing a hydro-electric plant and pumping station, Louis C. Kelsey, Salt Lake City, Utah, being the Consulting Engineer for the work. The bids received for the work were as follows, (1) standing for the Chatfield & Cutler Construction Co. (awarded contract) and (2) for the Capitol Electric Co.:

		(1)	(2)
Power House and Station above main floor	1	$5,314.00	$3,900.00
Power House and Station Below Main Floor:			
Concrete cu. yd.	450	8.00	9.00
Reinforcement lb. ..	14,000	.07	.05
Excavating well cu. yd.	10	6.00	7.50
Trash racks	3	[illegible]	[illegible]
Sluice gates	1	[illegible]	[illegible]
Excavation:			
Earth, cu. yd.	500	.65	.60
Gravel and boulders, cu. yd	50	.90	1.00
Solid rock, cu. yd...	4,600	3.00	[illegible]
Excavating and Backfilling:			
Earth, cu. yd.		.75	1.00
Gravel and boulders, cu. yd.	[illegible]	1.00	[illegible]
Solid rock, cu. yd....	100	6.00	4.50
Constructing Dams:—			
Concrete, cu. yd. ...	2,900	5.80	10.85
Loose rock, cu. yd. .	4,500	3.00	[illegible]
Gravel and earth, cu. yd.	500	.90	1.10
Regulating gates ...	1	2,800.00	3,500.00
Flash boards and walk on dam, lin ft.	9	11.50	2.00
Ice fender	1	650.00	[illegible]
Rip rap cu. yd	[illegible]	[illegible]	[illegible]
Furnishing and laying C. I. pipe, 16-in. ft	[illegible]	[illegible]	[illegible]
Total		[illegible]	[illegible]

The contract for furnishing and installing machinery was let to the Minneapolis Steel & Machinery Co. at $28,288. This includes two 250 kw. General Electric generators Four 250 Trump turbines. Two 700-gal. turbine pumps, with Trump turbines, switchboard, exciter and turbine, crane.

ILLINOIS.

The water power interests at Rockford, Ill., have awarded a contract to the Newton Engineering Co., Milwaukee, Wis., for constructing a concrete dam to replace the present structure. The dam will cost about $30,000. D. W. Mead, Madison, Wis., is Consulting Engineer.

The contract for the construction of a garbage crematory for Lake Forest, bids for which were opened July 1, was not awarded at that time, but was referred to a committee which was to report July 8. The work includes brick building, brick stack with necessary furnaces and complete equipment for the cremation of 15 to 20 tons daily.

IOWA.

B. Layton of Chicago, Ill., Chief Engineer of the Federal Construction Co., Muscatine, Ia., has started surveys near Wapello, Ia., to determine the feasibility of a proposed water power plant and canal at that point.

KANSAS.

The Wichita Pipe Line Co., Wichita, Kan., is to construct an 18-in. pipe line from near Copan, Okla., to Caney, Kan., to supply natural gas.

The city of Wichita has awarded the contract for constructing the Central Ave. dam across the Little Arkansas river to the Freeborn Engineering and Construction Co. of Kansas City, Mo. The contract price was $20,394, if oak piles are used and $24,000 if concrete piles are used. By the terms of the contract, the Freeborn Co. will have to commence actual work on the dam within 15 days and complete it within four months. The dam will be, over all, 210 ft. in length and will be about 18 ft. above the piling on which it will rest. The plans for this dam were drawn by Burns & McDonnell, hydraulic engineers, at Kansas City, Mo.

LOUISIANA.

R. D. Smith, Abbeville, La., has been awarded the contract by the United States government to undertake to rid Vermilion river of the water hyacinths. He will divide the river into ten or twelve sections, of five miles each, and will employ day laborers for each section to take out all hyacinths and deposit them on high grounds, or set them afloat in the river to be followed out to the gulf. All bayous and coulees emptying into the Vermilion will be boomed to keep the hyacinths from floating from the swamps into the main stream. The system of cleaning the stream will be inaugurated from the railroad bridge at Lafayette to the mouth of the river.

MASSACHUSETTS.

The Boston Fish Market Corporation has been organized by John R. Neal, W. J. O'Brien, E. A. Rich, M. P. Shaw, F. J. O'Hara, N. D. Freeman, J. Burns, Jr., C. J. Whitman and L. B. Goodspeed, all of Boston, Mass., and will construct a 1,200-ft. dock, 1,300 ft. pier, and wharf buildings at Boston. The total cost will be about $500,000, and all the necessary capital has been secured.

MINNESOTA.

Preliminary work has been started under the direction of J. D. Du Shane, Assistant U. S. Engineer, St. Paul, on the construction [illegible] protections, recently ordered by the federal engineering department. About 100 men will [illegible] tinue through the summer and early fall Another 100 will be employed in [illegible] material. The equipment to be [illegible] quarter boats and 25 barges.

MISSISSIPPI

Bids were opened June 20, by Capt. Clark S. Smith, U. S. Engineers at [illegible] for furnishing wire rope, m[illegible] clips, and cables, the cont[illegible] as follows: Pidgeon-T[illegible] phis, Tenn., 24 pieces 1-[illegible] long, at 13.93 cts. per ft.; 12 [illegible] rope, 200 ft. long at 13.93 ct[illegible] cts. per lb.; 28,000 lbs. ¼-in. galvanized wire strands, at 2.76 cts. per lb.; 1,200 lbs. 9-in. wire spikes at 2.14 cts. per lb.; 800 lbs. 8-in. wire spikes at 2.14 cts. per lb.; 2,000 lbs. wire staples, No. 9 galvanized, at 2.34 cts. per lb.; A. Leschen & Sons Rope Co., St. Louis, Mo., 15,000 lbs. No. 9 silicon bronze wire at 15½ cts. per lb.; 180,000 lbs. ⅝-in. galvanized wire strand at 2.87 cts. per lb.; Woodward Wight & Co., New Orleans, La., 75 coils manila rope; ¾-in. to 2-in. diameter, 8.865 cts. per lb. for Plymouth rope; American Hoist & Derrick Co., St. Paul, Minn., 10,000 cable clips, Crosby or equal, for ⅜-in. wire strand, at 1.8 cts. each for Monarch (plain) clips.

NEBRASKA.

F. M. W. Price of the Lincoln Engineering Co., Lincoln, Neb., has been making surveys for the proposed dam to be built between Beatrice and Holmesville. Active work on the construction of the dam will start just as soon as the engineers have completed their maps and reports. It is estimated that the cost of construction of the dam and electric light plant, which will be operated by the Gage County Gas, Light & Power Co., will reach $75,000.

NEW YORK.

A committee of the Board of Estimate and Apportionment of New York City has reported favorably on the plans of the Board of Water Supply to extend the Catskill water system by rock pressure tunnel from the Hill View reservoir, The Bronx, under Manhattan and the East River into Brooklyn, to connect with the water system of that borough and Queens and Richmond. This scheme will involve in expenditure of $25,000,000 in addition to the $163,000,000 to be spent in the construction of the Catskill system now under way.

The Interborough Rapid Transit Co. of New York City has submitted an offer to the city for the operation and equipment of new subways and extensions to existing lines to be constructed on the city's credit at an aggregate cost of $70,000,000. The plan involves: The construction of a four-track line from Times Square through Seventh Ave. and West Broadway to Liberty St., with a two-track extension to the Battery and a two-track branch from the intersection of Liberty St. and West Broadway, under Liberty St. and the East River to Pineapple St. in Brooklyn, from Pineapple St. in Brooklyn to a junction with the existing Brooklyn subway on Fulton street, and a four-track extension from the terminus of the Brooklyn subway at Atlantic and Flatbush Ave., under the latter thoroughfare and Eastern parkway as far as Nostrand Ave. An East Side four-track line from about 35th St., under Park Ave., and private property to Lexington Ave., through Lexington Ave., across the Harlem river to some point below East 140th St. A two-track extension from that point connecting with the existing West Farms branch of the subway. Another two-track extension running up Mott Ave. and 153rd St. River Ave., with an elevated two-track line structure through that thoroughfare and Jerome Ave. as far as 194th St.

OREGON.

C. L. Hueston of Astoria commenced work July 1 on his contract to build the jetty at the mouth of the Nehalem river. The jetty, when completed, will be about 900 ft. in length, and will insure a depth of about 20 ft. of water at the bar.

CANADA.

We are advised that the Canadian Department of Public Works has awarded the contract for the extension of the wharf at Sault Ste. Marie, Ont., to J. F. Boyd, of Sault Ste. Marie, Ont.

The Canadian Department of Agriculture has awarded a contract to the Kingston Ship Building Co., of Kingston, Ont., for the construction of a steel steamer for the Quarantine Service at Grosse Isle, Que. The contract price was $60,000.

The Grand Trunk Pacific Ry. has filed plans at Ottawa, and has made application for a drydock subsidy. The company proposes to put in a floating dock at Prince Rupert, B. C., which will cost $1,500,000, and have a lifting capacity of 20,000 tons. It will be a commercial dock of the second-class, and be entitled to a subsidy of 3½ per cent for 25 years.

The Marine Department of the Canadian government has made arrangements to immediately establish a marine depot at Prince Rupert at an initial expenditure of $100,000 for ship repairs and depot for light and buoy service.

BRIDGES AND BUILDINGS

Fresno, Cal.—Board of County Supervisors are considering the construction of a bridge across the Kings river 9½ miles above Centerville on the west side of the property of the Fresno Magnesite company and on the east side of the quarry and terminus of the Reedley-Wahtoke branch of the Santa Fe.

Los Angeles, Cal.—Plans have been prepared by Architect Mark E. Williams and L. H. Nishkian, C. E., for the proposed bridge connecting the north end of Los Angeles and South Pasadena, mentioned in our last issue. The plans call for a structure entirely of concrete, 1,300 ft. long. The center span is 260 ft. in length and will be supported on two 90-ft. piers set on the foundations resting on rock. The roadway is to be 30 ft. wide, with a 5-ft. walk on each side. The estimated cost of the work according to these plans is $222,700.

Suisun, Cal.—Board of County Supervisors has instructed the Clerk to advertise for bids for the construction of a concrete bridge over Suisun Creek, near Thomasson, to replace the present wooden structure. The bridge is quite a long one and it is estimated that the new structure will cost several thousand dollars.

Richmond, Cal.—Officials of the Southern Pacific Railroad have been instructed to either place an overhead bridge the width of the street or make a grade crossing at this point in order to escape condemnation proceedings by the Contra Costa Board of Supervisors. A similar situation confronts the Santa Fe Railroad where its tracks cross 13th St. near 23d St., in Richmond.

Stockton, Cal.—The United States War Department has granted the Stockton Terminal Railroad Co. permission to construct a bridge across the diverting canal at this place.

Denver, Colo.—Plans have been submitted by the City Engineer for the construction of the proposed West Colfax viaduct, which is to be built jointly by the City, State, Tramway and Railroads. They call for a viaduct 5,870 feet in length, forty feet wide, on the east half, sixty-two feet wide on the west half, with a six-foot wide walk on each side, running from Navajo and West Colfax to West Colfax and Boulevard F. The entire viaduct is to cost $700,000.

Des Moines, Ia.—On July 1, the City Council passed a resolution directing the city engineer to revise plans for a 6-span structure over Walnut St. in accordance with those plans of the Consulting Engineer, and to submit same to the City Council for approval.

Fort Dodge, Ia.—City Council has received revised plans from the N. M. Stark Bridge Co. of Des Moines, Ia., for the proposed Third St. viaduct, and a special meeting has been called to consider same.

Ottumwa, Ia.—Board of County Supervisors has gone over plans for the construction of three steel bridges and have viewed the sites, which are in Competine and Highland townships.

Boise, Idaho.—At the recent election held by the County Commissioners it was voted by a large plurality to issue bonds for the Fruitland bridge, while the New Plymouth bonds were defeated.

Decatur, Ill.—According to advices received here, Hickory Point township highway commissioners are planning the construction of three concrete arch bridges to be placed in that township.

Lincoln, Ill.—The Chataqua Board recently held a meeting at which they indorsed the plan of several lot owners on the west bluff to construct at their own expense a 130-ft. bridge to connect that part with the main grounds. As planned the highest part of the structure will be 27 ft. above the roadway.

Streator, Ill.—Board of County Commissioners, who have been considering repairing the Illinois river bridge at Utica, Ill., have come to the conclusion that the iron work on the north spans is in fairly good condition. They, therefore, decided to refloor that portion of the structure at a cost of about $2,000.

Rock Island, Ill.—The Council Bridge Committee has recommended the reconstruction of the Rock river bridge between Vandruff's and Hake's islands, and that city engineer be instructed to draw plans and prepare specifications for a concrete and steel structure.

Bluffton, Ind.—County Commissioners have, as a result of a recent inspection trip, decided to increase the size of Bridge No. 4 over Eight Mile Creek west of Zanesville. Another appropriation of $1,500 has been made, making a total amount of $3,500 available for the work.

Crown Point, Ind.—Ola E. Nichols, of the Rochester Bridge Co., of Hebron, Ind., has been awarded the contract for the construction of a bridge in Ross township for $525. Bids were opened July 5.

Greenfield, Ind.—County Commissioners have awarded a contract to the Greenfield Bridge & Sewer Co. of this city for the construction of three concrete and steel bridges in Brandywine township and one in Sugar Creek township for $975. Bids were opened July 5.

Lawrenceburg, Ind. — The Oregonia Bridge Co. of Lebanon, O., has been awarded a contract by the County Commissioners for the construction of a bridge over Hogan creek. The superstructure will be constructed for $580, and the substructure for $6.85 per cu. yd. Bids were opened July 5.

Lebanon, Ind.—Earl Sparks of Kirklin, Ind., has been awarded a contract for the construction of the following bridges: No. 124 at $623; No. 125 at $380; No. 127 at $813; No. 129 at $469; No. 130 at $585, and No. 131 at $349. Bids were opened July 8.

Peru, Ind.—The Rochester Bridge Co. of Rochester, Ind., has been awarded a contract for repairing Eel river bridge in the town of Mexico for $1,966. Bids were opened July 6.

Leavenworth, Kan.—County Commissioners and City Council are considering the construction of a new bridge at Limit St. and Second Ave. to replace the old one. According to the proposition submitted the city by the county each share one-half the expense of a concrete structure estimated to cost not more than $2,000.

Frankfort, Ky.—A proposition has been submitted the City Council by the capitalists of this city offering to construct a new bridge over the Kentucky river at Capitol Ave., connecting on the other side with Main St. No expense will be attached to the city, but a small toll will be collected from pedestrians and vehicles using the structure.

Boston, Mass.—Congress, without opposition, has passed the bill of Representative McCall, authorizing the construction of certain bridges across the Charles river, between Boston and Cambridge, without draws. One of the bridges affected will be the new bridge which Larz Anderson will build to connect Boston with the Harvard Stadium.

Bourret, Mich.—Town awarded the contracts for the construction of the two bridges to the Port Huron Bridge & Iron Co. at $1,019.

Aitkin, Minn.—At a joint meeting between the City Council and the Town Board of Supervisors it was decided to award the contract for the construction of a new steel bridge across Mud river to A. Y. Bayne & Co. of Minneapolis, Minn., at $1,515.

Hibbing, Minn.—In accordance with the wishes of a body of business men of this city, City Council has commissioned President Weirick to investigate the feasibility of increasing the strength of the new steel bridge now under construction by the Oliver Iron Mining Co. across the Seller-Hull pit on First Ave., in order to accommodate street cars as well as wagon traffic.

Taylor Falls, Minn.—The Security Bridge Co. of Minneapolis, Minn., has been awarded the contract at $13,200 for the construction of the interstate bridge over the St. Croix river at this place. According to the terms of the contract the work must be completed by Dec. 1, 1910.

Greenville, Miss.—Board of county supervisors has awarded a contract to the Joliet Bridge & Iron Works of Joliet, Ill., for the construction of a steel bridge across Bogue Phalia at Ingraham for $6,590. Bids were opened July 4.

Vicksburg, Miss.—The W. T. Young Bridge Co., of Nashville, Tenn., has been awarded a contract for the construction of a bridge over Slough Fisher's Ferry for $1,575 and for the construction of a concrete approach to the same bridge for $1,575. Bids were opened July 5.

Kansas City, Mo.—The Raymond Concrete Pile Co. of New York and Chicago has been awarded the contract for the concrete piles and foundations of the Bemis Bros. Bag Co.'s factory at 9th and Wyoming Sts., this city. C. L. Gray Construction Co., general contractors.

St. Louis, Mo.—The City Law Department has prepared a bill authorizing the payment into court of the price agreed upon by the Circuit Court Commissioners who appraised the land for the West Side free bridge approach, and it is to be introduced in the Council at the next meeting. The amount is expected to be about $400,000.

Great Falls, Mont.—At a meeting of the City Council recently held to consider the construction of a new wagon bridge across the Missouri river from First Ave. north to First Ave. S. W., it was decided that a special election be held in the near future to vote on bonds for the work. As proposed, the structure will cost between $175,000 and $200,000.

Buffalo, N. Y.—Regarding the Hamburg Turnpike and Seawall proposition under discussion by the railroad attorneys and the Mayor, it is believed that instead of a tunnel under the river at Main street, a bridge should be built from Erie street across the river, connecting the mainland with a seawall strip, and then a viaduct along the strip as far as the turnpike.

Falconer, N. Y.—Town Board has awarded the contract for the construction of the Moon Brook bridge to the Corry Bridge & Supply Co., Corry, N. Y., at $2,459.

Watertown, N. Y.—A total subscription of $5,235 has been secured for the construction of the proposed Jackson St. bridge and a mass meeting has been held, and other plans for securing the necessary finances have been considered.

Fort Caswell, N. C.—Lieut. R. O. Edwards, constructing quartermaster, has awarded a contract to J. H. Brinson of Hampton, Va., for electric wiring and fixtures for two double sets of officers' quarters at $1,345. Bids for the work were opened June 30.

Akron, O.—City Council has asked plans for the construction of a steel and concrete bridge to be known as the North Hill viaduct. E. J. Landor, an engineer of Canton, and J. W. Payne will take the matter up immediately. Under the agreement the Northern Ohio Traction & Light Co. will pay one-half the cost, which is estimated at $400,000.

Cleveland, O.—At a meeting of the interested property owners held by the County Commissioners to take up the matter of selecting the site for the location of the new bridge over the Cuyahoga river, the Detroit-Superior site was favored by a large majority and steps toward compiling statistics as to the cost of the structure at that place and on the Columbus road are being taken.

Columbus, O.—The West Side Board of Trade is urging the County Commissioners to take action upon the construction of a bridge on Dennison Ave. over the Scioto river to connect with Bell or Starling St. on the west side. According to the claims of the promoters, such a structure is an absolute necessity.

Dayton, O.—County Commissioners have sold bonds amounting to $15,000, receipts of which will be used for the improvement of bridges.

Hamilton, O.—It is said that the steel span of the bridge over the Big Miami river north of this city will not be replaced by the Cincinnati, Hamilton & Dayton Ry., but that a temporary pile structure will be erected to serve until the new steel bridge, for which a contract has already been let, can be completed.

Youngstown, O.—The Mt. Vernon Bridge Co., at $9,879, have been awarded the contract by the County Commissioners for the superstructure of the Park avenue bridge, Work is progressing rapidly on the substructure, which was let at $10,650, making the total cost of the work above the appropriation of $14,000.

Ashley, Pa.—Borough Council and representatives of the Jersey Central and the Lehigh Valley railroads have taken up the matter of reconstructing the railroad bridges over the cemetery road. It was agreed to view the road and bridges and co-operate on the improvement.

Pittsburg, Pa.—The low bidder for the construction of the masonry and substructure of the city bridge across the Allegheny river was Lewis & Wood of Chicago, Ill., who submitted a tender of $183,000.

Reading, Pa.—H. E. Ahrens & Co. of this city have been awarded the contract for re- [illegible]

Shippensburg, Pa.—Borough officials and [illegible] bridge on King St., whereby the latter will [illegible]

Waynesburg, Pa.—[illegible] Mile creek at the mouth of Coallick run will [illegible]. The contract for the superstructure has been awarded C. I. Lantz, Wheeling, W. Va., at $3,210.

Wilkesbarre, Pa.—Viewers and interested [illegible] ships are soon to hold a meeting to consider the plans proposed for the new bridge over the river at Wyoming.

Houston, Tex.—The contract for the construction of the first of the buildings of the William Rice Institute, the administration building, has been awarded to the William Miller & Sons Co., Pittsburg, Pa., for $319,478.

San Antonio, Tex.—Finance Committee of the City Council recently held a hearing on bids received for the construction of the proposed bridge over the river at Travis St. Bids were received for concrete and steel structures, and it was decided to retain the following for the concrete structure: Aiken Cement House Co., San Antonio, Texas, $14,517; Leversedge Bridge Co., Fort Worth, Texas, $16,000; and H. B. Thompson Co., San Antonio, Texas, $20,000. The bid of the El Paso Bridge & Iron Co. for a steel structure at $15,250 was also retained.

Spokane, Wash.—O. H. Stratton, 1507 Fourth Ave., this city, has been awarded a contract for the construction of a bridge across Latah creek at Waverly. The structure will be built on tubular concrete piers and will be a 120-ft. span, replacing the pile trestle washed out last spring. The contract was let for $3,980. Bids were opened July 1.

Tacoma, Wash.—W. C. Raleigh, City Engineer, is preparing plans for the construction of a public wharf on the city waterway between 11th and 15ts Sts. The work will include a structure 300 ft. in length and a steel viaduct from 12th St. to the wharf.

Marinette, Wis.—Bill has been passed by Congress authorizing the construction of the middle bridge at this place. It also provides that actual construction work must be started within one year and be completed within three years.

Winnipeg, Man.—Board of Control on July 5 awarded a contract to the Cleveland Bridge & Engineering Co. of Darlington, Eng., for the construction of the superstructure of the Brown and Brant St. overhead bridge for $205,160, the work to be completed by June 1, 1911. William Newman & Co. have been awarded the contract for placing the piers at $54,720. This portion of the contract is to be complete on Nov. 15, 1910.

Tuxtla Gutierrez, Chiapas.—Several wagon bridges are to be constructed on the road from Jalisco on the Pan American Ry. to Tuxtla Gutierrez. Governor Ramon Rabasa recently secured the co-operation of the federal government of Mexico and the structures will be erected in a short time.

ROADS, STREETS AND PAVEMENTS

Fort Payne, Ala.—Morris & Angel of Sheffield, Ala., have been awarded a contract by this town for the following work: 850 sq. yds. of concrete sidewalks, at $.99 per sq. yd.; 100 sq. yds. of driveway at $1.40 per sq. yd.; 1,065 lin. ft. of 6-in. curb at $.30 per lin. ft. Wilburn Hill of Gadsden, Ala., engineer.

Pasadena, Cal.—City council has passed an ordinance providing for the paving of California St., from Grand Ave., to Arden road with oil macadem. It is estimated that the improvement will cost $50,000.

San Diego, Cal.—Petition has been filed in the city clerk's office for the paving of Second St., from the south line of B. St., to the north line of H. St.

Colorado Springs, Colo.—The city attorney has been asked to draw up an ordinance requiring street paving in certain districts to be decided on later.

Grand Junction, Colo.—A broad auto roadway from Glenwood Springs to Grand Junction, Delta and Montrose is being urged by the Grand Junction Good Roads association.

Wilmington, Del.—Warren Bros. Co., of

Boston, Mass., has been awarded a contract for the construction of 30,000 sq. yds. of bitulithic in this city.

Twin Falls, Ida.—City council has passed an ordinance creating a paving district covering the following streets: Main Ave., Shoshone St., Minidoka St., Second St., Fourth Ave., Third Ave., Second Ave., and a number of alleys. The city engineer has estimated the cost of this improvement at $224,167.

Aurora, Ill.—McCarthy Construction Co., of Davenport, Ia., has been awarded a contract by the board of local improvements for the paving of High and Superior Sts., and East and West Park Place for $1.64 per sq. yd.

Moline, Ill.—The Gust Ed Construction Co. has been awarded a contract for the paving with brick of 16th St., between 11th and 19th Aves., for $21,995.

Springfield, Ill.—Board of local improvements has decided to pave Canedy St., from Fifth St., to Walnut St., and to make the street from Pasfield to Walnut St. into a boulevard and also to pave Laurel St., from College St., to the west line of Hawthorne place.

Waukegan, Ill.—Board of local improvements has let contracts for street paving to James Cape & Sons Co., of Racine, Wis., totaling $56,617, and McCugo, Bulloch & Co., of this city for $57,231.

Springfield, Ill.—Board of public works has decided to pave East Edwards St., from Ninth to 19th St., with either brick or mineral asphalt

Fort Dodge, Ia.—City council has passed a resolution for the construction of sidewalks covering many lineal feet of unimproved property in the city.

Albia, Ia.—City council has awarded a contract to Magden & Sheely of Des Moines, Ia., for the construction of 9,410 sq. yds. of pavement and 7,690 lin. ft. of curb and gutter. The contract was let at $2.07 per sq. yd. for paving, $.62 per lin. ft. of combined curb and gutter, and $.44 for excavating. Also $.35 per lin. ft. for the reinforcing of curbing and steel.

Atlantic, Ia.—City council has decided to have the specifications for the new paving work to be done in this city call for bituminous macadam. The paving, it is estimated, will cost $1.85 per sq. yd.

Des Moines, Ia.—City council has awarded a contract to the J. W. Turner Improvement Co., for the paving of Beaver Ave., from the end of the present pavement to the north city limits, a distance of two miles

Cedar Rapids, Ia.—City will pave the 16th Ave. bridge with brick at an estimated cost of $1.90 per sq. yd. The work will require the construction of about 1,200 sq. yds. of pavement, and includes the construction of sidewalks and curbs

Cedar Rapids, Ia.—City council has passed a resolution ordering brick paving constructed on Grande Ave. The resolution calls for paving on Grande Ave., from 16th St. to the end of the storm water sewer, a distance of about 2,100 ft. from Third avenue. An 18 ft. parkway will be constructed in the center with paved roadways 20 ft. wide on either side.

Alexandria, La.—City board of aldermen has been petitioned for the paving of Jackson Ave., with asphalt and for the paving of sidewalks on several streets in West End.

Beech Grove, Ind.—Hoosier Construction Co. has been awarded a contract for the construction of a macadam roadway on Alton St., this city, and constructing cement gutters and sidewalks, for $20,600. Bids were opened June 28

Indianapolis, Ind.—Board of public works has awarded a contract to Marion Caldwell, Box 256, this city, at $541, for grading and paving the sidewalks on Norwood St., from West St., to Rose St. Bids were opened June 27.

Indianapolis, Ind.—Board of public works has awarded a contract to Geo. W. Shelley of this city, for the construction of sidewalks on Tacoma Ave., from St. Clair to 10th Sts. Bids were opened June 22.

Indianapolis, Ind.—The work of grading and paving sidewalks on Rawls Ave., from Michigan to St. Clair St., bids opened June 22, will not be done.

Indianapolis, Ind.—The work of grading and paving side walks on Rawls Ave., from east curb line of Audubon Rd., to Arlington Ave., bids opened June 27, will not be done.

Indianapolis, Ind.—The work of grading and paving sidewalks on Berry Ave., from Julian St., 351 1-2 ft. long, bids opened June 27, will not be done.

Indianapolis, Ind.—N. H. Holl of 1222 Windsor St. this city, has been awarded a contract for grading and paving the sidewalks on Gale St., from Washington to New York St., at about $3,200. Bids were opened June 22.

Indianapolis, Ind.—Board of public works has awarded a contract to Marion Caldwell for $2,123, for the improvement of Meridian St., from the south line of Palmer St., to the Belt Ry., and from south property line of the first alley north of Minnesota St., to the Belt Ry., by grading and paving sidewalks. Bids were opened June 27.

Indianapolis, Ind.—Marion Caldwell, Box 256, this city, has been awarded a contract for the grading and paving of sidewalks on College Ave., from 30th St., to 32nd St. for $947. Bids were opened June 27.

Indianapolis, Ind.—John Arnold, 1656 Ludlou Ave., this city, has been awarded a contract for the grading and paving of the sidewalks on Gray St., from North St., to 10th St., for $1,600. Bids were opened June 27.

Indianapolis, Ind.—William H. Holl of this city has been awarded a contract at $.15 per sq. ft., for the construction of cement sidewalks on Daly St., from Pine to Cruse Sts. Bids were opened June 22.

Indianapolis, Ind.—A contract for completing the construction of a boulevard embankment along the north bank of Fall creek, from 23d St. to Illinois St., has been awarded by the board of park commissioners to the Moore-Mansfield Co., at $.35 per cu. yd., for filling and $.27 per cu. yd. for removing top soil. It is estimated that there will be 40,000 cu. yds. of filling and about 5,000 cu. yds. of top soil.

Delphi, Ind.—Jas. F. Pierce of this city has been awarded a contract by the county commissioners for the improvement of highways in Deer Creek township, for $23,000. Bids were opened July 6.

Winamac, Ind.—No bids were received by the county commissioners on July 5 for the construction of two county roads. Ellis S. Rees is Auditor of Pulaski County.

Marion, Ind.—County commissioners have awarded a contract to Hardin & Co., for $5,997, for the construction of a road in Fairmount township, known as the C. C. Curry Gravel Road. Bids were opened July 5.

Vernon, Ind.—County commissioners received no bids July 5 for the construction of 25.6 miles of road in Campbell township. T. L. Thomas is auditor of Jennings County.

Princeton, Ind.—County commissioners have awarded contracts to the following for the construction of 13 roads throughout the county: Hawkins Bros., Brazil, Ind., for three roads; Trible & Hawkins, Brazil, Ind., for five roads; Campbell & Crabb, Brazil, Ind., for one road; W. Ewing Shields, Seymour, Ind., for two roads; A. E. & W. Construction Co., Evansville, for two roads. One road is under consideration, the probable contractor being A. E. & W. Construction Co., of Evansville, Ind.

Muncie, Ind.—County commissioners have awarded a contract to Geo. Saunders of this city for the improvement of a public highway in Center township for $25,300. Bids were opened July 6.

Mishawaka, Ind.—The Western Construction Co., of Lafayette, Ind., has been awarded the contract for paving N. Mill St. with bitulithic. The work includes grading the street from curb line to curb line and paving some with bitulithic on 5-in. concrete foundation, including necessary storm water inlets and connecting same with sewer. Bids were opened June 20, contract being let July 5.

Paoli, Ind.—O. P. Turley of Orleans, Ind., has been awarded a contract for the construction of a gravel road at $4,490. Bids were opened July 5.

Salem, Ind.—County commissioners have awarded the following contracts for the construction of roads; bids opened July 5; Jacob R. Chastain, Campbellsburg, Ind., for $5,899, road in Vernon township; Hiatt & McMahan, Plainfield, Ind., at $6,073, road in Washington township; Hiatt & McMahan, for $7,137, road in Pierce township.

Decatur, Ind.—Albert Mauller of Pleasant Mills, Ind., has been awarded a contract by this city for the construction of the J. W. Vizard road, for $2,903. Bids were opened July 6.

Lebanon, Ind.—The contract for the construction of the Smith gravel road has been let to James M. Little of Indianapolis, Ind., for $5,231. Bids were opened July 8.

Tipton, Ind.—Booker & Davis have been awarded a contract by the county commissioners for the construction of the Holeman gravel road for $5,948. W. W. Hobbs has been awarded the contract for the construction of the Rheubert gravel road for $1,696. Bids were opened July 5.

Goshen, Ind.—City has awarded a contract to W. W. Hatch & Sons Co., of this city for the placing of a new top on the Fifth St., Westrumite pavement from the Lake Shore crossing at Pike St., to the intersection of Fifth and Main Sts. The contract was let at about $10,000.

Washington, Ind.—County commissioners have awarded the E. F. Meredith gravel road petition contract of Washington township to Jean Snyder of Petersburg for $3,687. The contract calls for the improvement of one and three-quarters miles of road, the extension of a formerly improved road.

Havre de Grace, Md.—The street commission will sell bonds July 21 in the sum of $27,000 for the purpose of improving streets and building firemen's quarters. Gen. Murray Vandiver is chairman of the street improvement commission.

Benton Harbor, Mich.—Plans and specifications have been completed for the paving of Britain Ave., from the east line of Pipestone St., to the west line of the viaduct with brick. Bert C. Spalding is city clerk.

Detroit, Mich.—Wayne county commissioners have awarded a contract to the Owosso Construction Co. of Owosso for the construction of 8,465 lin. ft. of concrete pavement, 16 ft. wide on Grand River road. The company will complete the work for $16,422, or $.121 per sq. ft. The commissioners have also awarded a contract to R. D. Baker & Co., for the construction of 1,630 lin. ft. of macadam road, 16 ft. wide, at $1.27 per sq. yd.

Calumet, Mich.—Plans and specifications for the new piece of roadway to be constructed by Calumet township in the Trap Rock river district have been prepared by Engineer E. S. Grierson and are on file at the office of the clerk, George Martin, Ulseth Bldg. The specifications show that 7,000 ft. of new roadway will be built. It will likely be 16 ft. wide and will be built along the line known as "passable county roads."

Detroit, Mich.—City Council has awarded the following contracts for paving: Shipherd Ave., brick, T. E. Currie, $1,263; alley 185, James Hanley, $986; alley 186, James Hanley, $1,374; alley 187, T. E. Currie, $2,014; alley 188, R. T. Baker Co., $1,673; alley 189, R. T. Baker Co., $3,606; Butternut St., cedar, Ferdinand Porath & Sons, $5,916; Hudson Ave., cedar, J. Porath, $2,339; Waterloo St., cedar, H. W. W. Hatch & Sons, $2,073; McGraw Ave., concrete, J. Porath, $6,048; 23d St., concrete, J. Porath, $6,750.

Calumet, Mich.—Thomas Drapeau of Laurium has been awarded a contract for the construction of a new road, 8,500 ft. long and 16 ft. in width, from Saracen's "forty" in the Trap Rock River valley district, each to Sections 11 and 12. The road will be built for $2.50 per rod.

St. Peter, Minn.—The county auditor has awarded a contract for improving the state road in the township of Lake Prairie to John Keogh for $1,135, and for building a road in Traverse to Chas. Anderson for $950.

Two Harbors, Minn.—City Council has awarded a contract to D. H. Clough of Duluth for the construction of cement sidewalks at $0.13¼ per sq. ft.

Gulfport, Miss.—Board of Supervisors of Harrison County has made an order to issue bonds in the sum of $50,000 for road improvement in beat No. 2. V. A. Griffith, W. I. Quarles and I. B. Clark have been named as commissioners.

Jackson, Miss.—Board of Supervisors has decided to order a special election to be held in the two most populous seats of the county for the purpose of voting on the issuance of bonds in the sum of $250,000 for road improvements.

Meridian, Miss.—Board of Supervisors has passed a bond issue for $200,000 for the construction of good roads.

Tupelo, Miss.—County road commissioners have awarded a contract to the Good Roads Construction Co., for the construction of 20⅛ miles of gravel road for $92,785. Bids for the work were opened July 6.

Springfield, Mo.—The petition for a continuation of the brick paving on East Elm St., which has been circulated by Robert H. Walker and P. G. Meyers, has been signed and the pavement will be extended as soon as possible. The new pavement will commence at the National Blvd. and will extend to the Frisco railroad track on the east, a distance of three blocks.

Kansas City, Mo.—Board of Commissioners has ordered the paving of Ann Ave., from 10th St. to 11th st., with Hassam pavement for a width of 30 ft., and Quindaro Blvd., from the east line of 17th St. to the west line of 19th St., with bitulithic pavement, for a width of 56 ft.

Springfield, Mo.—A bill was introduced in the City Council July 5, calling for a special election to decide the issuance of bonds in the sum of $1,000,000. The bonds are wanted for the purpose of making various street improvements, a new city hall and the construction of two viaducts between the north and south sides.

Jefferson Barracks, Mo.—Stanley H. Ford, Quartermaster, has awarded a contract to Ruprecht-Voirol Construction Co., 8011 South Broadway, St. Louis, Mo., for the construction of roads, walks, etc., at this place for $5,367. Bids were opened June 30.

Florence, Neb.—The Keirle Grading Co. of this city has been awarded a contract for grading Cumming St., from 43rd to 48th St., and also for Fort St.

Omaha, Neb.—The Kreile Grading Co. has been awarded a contract for grading Cuming St., from 43d to 48th Sts., at $0.20 per yd.

Allentown, N. H.—State Engineer H. C Hill of Concord, N. H., has awarded a contract to P. A. McIntyre of Suncook, N. H., for $7,698, for the construction of 1,120 ft. of trap rock in this town. Bids were opened July 8.

Merrimack, N. H.—State Engineer H. C. Hill of Concord, N. H., has awarded a contract to Alsgood Construction Co., of Nashua, N. H., for the coustruction of 2,800 ft. of gravel road. Bids for the work were opened July 8.

Troy, N. Y.—The contract for the paving of Douw St., from River St. west to the river front, was awarded to McKenna & Walsh, the lowest bidders for Mack brick, at a cost of $2.29 per sq. yd. The total cost of the improvement is estimated at $5,873.

Winston, N. C.—Atlantic Bitulithic Co. of Richmond, Va., has been awarded a contract for the construction of 4,113 sq. yds. of bitulithic in this city.

Columbus, O. — County Commissioners have awarded contract calling for the construction of five miles of macadam road, 1¾ miles of which is to be surfaced with tarvia. The contracts and successful bidders are: Westerville road, north from Linden Heights to Mifflin and Blendon township lines, macadam unsurfaced road, 2½ miles, to Jay & R. E. Keys of Westerville for $20,403; Johnstown Pike from Greenlawn Ave., to Frank road east, distance 1¾ miles, to E. J. Rogers & Co. of Columbus for $9,475; tarvia surfacing to Barrett Manufacturing Co. for $2,970; Delayare and Franklin County line road from Columbus and Worthington Pike to Wilson Pike, macadam road unsurfaced, three-fourths of a mile, to W. O. Jewett of Worthington for $3,860.

Bucyrus, O.—A petition is being circulated for the paving of Southern Ave., from Kaler Ave. to Galion St. It is probable that the paving will not be done this year.

Canton, O.—County Commissioners have passed a resolution for the paving of one mile of roadway, beginning at the south corporation line of New Berlin and extending south.

Cincinnati, O.—The County Serveyor has estimated the cost of improving the Cleves and Dugan gap road at $53,615.

Lorain, O.—City Council will soon take action toward the repaving of Broadway from the loop to the hospital.

Cincinnati, O. — County Commissioners have awarded a contract to O. E. Robinson at $1,999 for repairing the bridge over Colerain pike.

Cleveland, O.—No bids were received by the director of public service on July 2 for the grade separation at Adelbert Road, S. E. and N. Y., C. & S. L. Ry. The work includes reinforced concrete construction. The work will be readvertised. C. F. Wetzel is contract clerk.

Akron, O. — County Surveyor Joseph Gehres has completed the surveys for the Hudson road and work on the road will soon begin. The road will start at the end of the Cuyahoga Falls pavement and follow that road to Stow Corners, and from there will go directly north through Darrowville to Hudson and Twinsbury.

Canton, O.—William H. Vogt & Sons of Massillon, O., have been awarded a contract by the County Commissioners for grading, draining and paving one mile of road in Lexington township. The pavement will be of brick. The contract was let for $16,596. Bids for the work were opened July 6.

Tulsa, Okla.—Plans have been made for the construction of approximately $160,000 worth of asphalt pavement on a concrete foundation. The work will include the paving of about 44 blocks, laying concrete and artificial stone curb, and excavating about 6,000 cu. yds. of earth. T. C. Hughes is city engineer.

Baker City, Ore.—Petition has been circulated for the paving of Southern Ave., from Main to the bridge over Powder river. It is also planned to pave the triangle formed by the intersection of Auburn and Resort Sts.

Tyrone, Pa. — Borough council has awarded a contract to the Central Construction & Supply Co., of Harrisburg, Pa., for the paving of Logan Ave., between 11th and 13th Sts. The contract calls for 4,082 sq. yds. of brick pavement at $1.96 1-2 per sq. yd.; 1,525 ft. of curbing at $.88 per ft.; 216 ft. of new headers at $.22; 108 ft. of curbing, reset, at $.30 per ft.; 40 ft. of reset headers at $.10. The total bid being $9,447.

Edgemont, Pa.—Supervisors John E. Davis, H. H. Mendenhall and Samuel Pinkerton, of Edgemont township, Delaware county, have decided to borrow $11,000 for macadamizing and rebuilding Edgemont Great road from the Middletown township line to the Thornbury township line.

Allentown, Pa.—Barber Asphalt Co., has been awarded a contract by this city for the construction of 25,000 sq. yds. of asphalt pavement. The streets that are to be paved are: Linden St., Jefferson to 10th; Walnut St., 12th to 17th; Church, Linden to Turner; Court, 13th to 15th, and a small stretch on Allen St., from Fifth St., west; two squares on 16th St., Turner to Gordon.

Pottsville, Pa.—City awarded a contract July 5 to E. H. Vare of Philadelphia for $67,605, for grading and paving Centre and other streets in the city. Bids were opened June 28.

Lafayette, Tenn.—The Lafayette Turnpike Co., has raised the proposed capital for the building of the turnpike and the directors were ordered to proceed at once to buy the necessary machinery and tools for the building of the pike. The pike will meet the Lafayette and Hartsville Turnpike at a specified point between the two towns, and later the road will probably be extended to Red Boiling Springs.

Houston, Tex.— The contract for the construction of Brays Blvd., in Magnolia Park, at an approximate cost of $9,000, has been awarded to T. A. Blair of this city. The new boulevard will run from Harrisburg road to Brays-Bayou, a distance of more than a mile. It will be 80 ft. wide, with 16 ft. of shell and four circular corners built on a base of crushed rock.

Rotan, Tex.—City will grade and gravel about 26,756 sq. yds. of street. The work includes the construction of about 10 blocks of Snyder Ave. J. W. Sanders will superintend the work. Bids were opened July 1.

Dallas, Tex.—The Texas Bitulithic Co., of this city has been awarded a contract for the construction of 5,905 sq. yds. of bithulithic pavement in this city.

Norfolk, Va.—Arthur C. Freeman, 343-5 Arcade Bldg., this city, consulting engineer for the American Boulevard Corporation, has awarded a contract to E. F. Mitchell for the grading of streets of Lochaven, a suburb of Norfolk, amounting to 15,000 yds. The contract for constructing curbs and sidewalks will be let later.

Clarksburg, W. Va.—The Concrete Construction Co., Union Trust Bldg., Parkersburg, W. Va., was awarded on July 8 a contract for the construction of pavement and curb in this city amounting to $40,000.

North Yakima, Wash.—City council has ordered 18 blocks of brick paving to cost $182,750. The council has also ordered an intercepting drain, miles of sidewalk, sewer extensions and other municipal improvements necessitating the expenditure of $300,000.

North Yakima, Wash.—The Independence Asphalt Co., of Seattle, Wash., has been awarded a contract by this city for the paving of Naches Ave., with asphalt for $129,014.

North Yakima, Wash.—City council has awarded a contract to Anderson Construction Co., of Seattle, Wash., for the paving of three blocks of Chestnut St., and two blocks of A. St. with brick for $25,326 and $28,412 respectively.

Tacoma, Wash.—County commissioners have awarded a contract to the Keasal-McDowell Logging Co., for the construction of the Lake Head-Clay City county road for $14,873. The new road will run from Lake Kapowsin to Clay City, a distance of three and a half miles.

Vancouver, B. C.—Warren Construction Co., of Portland, Ore., has been awarded a contract for the construction of 30,000 sq. yds. of bitulithic in this city.

Mexico City, Mex.—Military Engineers, Major Estanislao Gonzalez Salas and Capt. Jose Espinosa Rondero have submitted plans for the construction of the new track of the Military Riding club on the plains of Anzures, adjoining the forest of Chapultepec to the board of directors of the club. The plans call for an expenditure of $110,000. Work will be started at once.

Berlin, Ont.—Warren Bituminous Paving Co., of Toronto, Ont., has been awarded a contract for the construction of 11,117 sq. yds. of bitulithic pavement in this city.

Foam Lake, Sask.—The Royal Artificial Paving Co. has been awarded a contract for the construction of concrete walks in this city, at $0.16 per sq. ft. Bids were opened July 7.

WATER-WORKS AND SEWERAGE

Phoenix, Ariz.—City will soon construct a sewer system at an estimated cost of $400,000. Olmsted & Gilellen of Los Angeles, Cal., are the engineers.

Paragould, Ark.—Improvement District No. 2 will spend $15,000 to construct a waterworks system. The work includes a 300,000-gal. reservoir and water main.

Fort Smith, Ark.—Board of Public Affairs has awarded a contract to the United States Pipe Co. of St. Louis, Mo., for the extension of the waterworks system for $51,000. The Municipal Engineering Construction Co. of Chattanooga, Tenn., received the contract for the laying of the pipe for $15,000.

Alameda, Cal.—C. F. Fisher has been awarded a contract for the construction of a sewer on San Antonio Ave. west of Ninth St. The figures were: Six in. sewer pipe. per ft., $0.46; y's, $0.55; manholes, $35.

San Francisco, Cal.—Board of Supervisors has ordered the construction of sewers and appurtenances in Sunnyside district, and authorized the Board of Public Works to enter into contract for doing said work at an estimated cost of $20,000.

San Francisco, Cal.—Board of Public Works will soon construct a sewer in Kentucky St., from Mariposa to the bridge at Fourth St.

Colton, Cal.—The Trustees of this city will soon advertise for bids for the construction of a municipal sewer system, for which $63,000 bonds have been voted. City Engineer W. L. Brown is preparing the plans and specifications.

Willows, Cal.—City Trustees have called an election for July 12 to vote on the issuance of bonds in the sum of $10,000 for the extension of the sewer system and for better water supply.

Sacramento, Cal.—East Sacramento Water Co. has been granted a franchise by the Board of Supervisors to supply water to the people of East Sacramento. The estimated cost of this improvement is $15,000.

Carbondale, Colo.—City has voted to construct a waterworks system at an estimated cost of $27,500.

Hartford, Conn.—Hartford Paving & Construction Co., 703 Main St., this city, has been awarded a contract for the construction of the east side intercepting sewer at $158,161. The work includes approximately 6,000 lin. ft. of concrete sewer, ranging in diameter from 54 to 84 inches. Bids were opened June 27.

Macon, Ga.—President H. T. Powell of the Macon Gas Light & Water Co. has been notified by Mayor Moore of the intention of the people of the city to purchase and operate the waterworks after the contract expiration next year.

Rome, Ga.—City Council has voted unanimously for a bond election on the issue of $275,000 to be spent for the extension of sewerage and water mains, street paving and new schoolhouses. The election will probably be called for August 25.

Freeport, Ill.—Board of Local Improvements will let contracts soon for the extension of the sewer on Oak St., south of Empire St., to the city limits on the south, a distance of about 1,000 ft.

Toulon, Ill.—City has voted the isssuance of bonds for the construction of a waterworks, and will employ engineers to prepare plans and specifications for the proposed improvement.

Rockford, Ill.—With a view to establishing a branch pumping station and bringing the present main plant up to date in equipment, the committee on waterworks will recommend to the Council the employment of an engineering expert for an inspection of the waterworks and main system.

Beecher, Ill.—J. E. Pickens of Kankakee has been engaged as engineer to draw up specifications and estimate the cost of laying water mains on the streets decided upon by the Board of Local Improvements. R. J. Barr of Joliet, Ill., is interested.

New Castle, Ind.—City Council has directed the purchasing committee to contract for and install an electric rotary pump on one of the six-in. wells at the waterworks plant.

Indianapolis, Ind.—The Indianapolis Water Co. has asked for a lease of the Brightwood water plant for a period of ten years. Should the water company lease the plant it will make extensions to the mains.

Delphi, Ind.—City Council has ordered the construction of the Water St. sewer at an estimated cost of $1,948.

Indianapolis, Ind.—William Bossert & Co., this city, have been awarded a contract by the Board of Public Works for the construction of a sewer in the alley of Olney St., from Nowland Ave. to 13th St. Bids were opened June 24.

Indianapolis, Ind.—William Bossert & Co. of this city have been awarded a contract by the Board of Public Works for the construction of a sewer in alley east of Linden St. Bids were opened June 24.

Richmond, Ind.—Residents of Sherman St., between Sheridan and Boyer, in Fairview, have made application to the Board of Works for assistance from the city in having a water main laid for their benefit.

Muscatine, Ia.—City Council has passed a motion requesting the city engineer to prepare a plat and schedule showing the proposed sewerage improvement in a district hereafter to be known as Sub-Sewerage District No. 20 in Main Sewerage District No. 1. The proposed sewerage improvements to be constructed are as follows: On Lucas St. from the end of the present sewer to the turn at the cemetery, a distance 2,385 ft., 12-in. pipe. On Lucas St., from Fletcher Ave. to Newell Ave., distance 415 ft., 7-in. pipe. On Logan St. from Lucas to Slimer, distance 591 ft., 15-in. pipe. On Climer St. from Logan St. to the alley west of Geiss subdivision, distance of 1,366 ft., 15-in. pipe. On alley west of Geiss addition, distance of 171 ft., 15-in. pipe. In alley south of Geiss subdivision, easterly distance of 475 ft., 15-in. pipe. On Eighth St., from the alley, south of the present Geiss subdivision to the present main sewer, distance 158 ft., 15-in. pipe. The plat and schedule to be prepared will show the estimated cost of sewerage improvements.

Knoxville, Ia.—City has awarded a contract to the J. W. Turner Improvement Co. for the construction of the Washington and Montgomery St. sewers.

Clinton, Ia.—Plans are now being made for improvements at the plant of the Clinton Water Co.

Pella, Ia.—H. J. Catlin of Omaha, Neb., has been awarded a contract for the construction of six miles of 8 to 15-in. pipe sewer for $16,933, and N. D. Yeager Co., of Cedar Rapids, Ia., has been awarded the contract for the construction of a pumping plant for $7,964. The Iowa Engineering Co., of Clinton, Ia., are the engineers. Bids were opened July 6.

Burlington, Kan.—The Tonkana Construction Co. of Tonkana, Okla., has been awarded a contract by this city for the construction of a sewer for $33,112. The work includes mains, submains, laterals, septic tank and pump house. Bids were opened June 28.

Pollock, La.—Town Council has decided to construct a waterworks system.

Loreauville, La.—City contemplates the installation of a tower and tank with a capacity of 5,000 gals. C. F. Berard, Mayor.

Hammond, La.—Town Council has been petitioned to call an election to vote on the proposition of issuing bonds for several public improvements, including the construction of a sewer system.

Lake Charles, La.—Sewerage Commission has made known the plans decided upon for the installation of a sewerage system providing the issue of bonds in the amount of $160,000 is authorized at the special election July 14. The system is to be part gravity and part operated by a pumping station. The system includes a primary septic treatment of the sewage and its final discharge, after treatment, into the Calcasieu river.

Boston, Mass.—The McManus Contracting Co., of Philadelphia, Pa., has been awarded a contract for the extension of the sewer system at Fort Warren, Benton Harbor, Mass., for $1,628. Bids were opened July 7.

Boston, Mass.—E. F. Kennelly, 93 Journal Bldg., this city, has been awarded a contract for the construction of a sewer in Cabat St., for $3,760. Bids were opened July 5.

Fall River, Mass.—City has voted to expend $100,000 for the extension of sewers and $20,000 for water extensions.

Sangus, Mass.—City has voted to extend the waterworks system. H. A. Parker, Town Clerk.

Towson, Md.—A certificate of incorporation of the Sherwood Park Water Co. has been filed in the Circuit Court at Towson by Messrs. J. W. Huey, M. B. Meanley and F. B. Jenkins. The company is to supply water in Sherwood Park and has no capital stock. The office will be in the county.

Hartford, Mich.—County Surveyor W. V. Ackley of Bangor has been surveying two routes for the piping of water from the springs on the Henry Brown and Eugene Duffy farms, southeast of the village, to the local pumping station. It is estimated that the work will cost $2,000.

Crookston, Minn.—City Engineer has presented plans and an estimate of the cost of a relief sewer in Fletcher St., from Broadway to the Red Lake river, the same being $1,386.

Two Harbors, Minn.—Property owners on 11th St., residing between the county road and Willow St., presented a petition to the Board of Public Improvements requesting that they take action towards the construction of a lateral sanitary sewer.

Two Harbors, Minn.—J. D. O'Connell has been awarded a contract for the construction of a lateral sewer on First Ave.

St. Paul, Minn.—City Engineer L. W. Rundlett has been asked by the Water Board to submit plans and estimates for making adequate the present water distributing system. These plans contemplate a new 36-in. main from Dale St. reservoir to University Ave. Also another tank on the west side. The improvements are roughly estimated to cost $100,000.

Meridian, Miss.—Worthington Construction Co. of Brookhaven, Miss., has been awarded a contract by the Water Commission for the construction of a storage reservoir in this city, estimated to cost $37,000.

University, Miss.—Prof. J. H. Dorroh of the University of Mississippi is engineer for the construction of a waterworks for the university, estimated to cost $15,000.

Omaha, Neb.—Prof. Charles F. Crowley, city chemist, is engaged in working out a proposition for bettering the supply of water and increasing it at the same time with the present equipment.

Grand Forks, N. Dak.—The Northern Construction & Engineering Co., of this city has been awarded a contract for the construction of sewers in alley between Third and Fourth Sts., and for $2,000 for the construction of lateral sewer in Walnut and Cottonwood Sts., from Eighth St., to the city limits. Bids for the work were opened July 5.

Washburn, N. Dak.—City engineer has completed the plans and specifications for the construction of a water works in this city.

Haddon Heights, N. J.—City has voted in favor of the installation of a sewage system and disposal plant. A $44,000 bond issue was also voted for the improvement. The cost of the system and the necessary land, it is estimated, will be about $53,000. The City Council has decided to advertise for bids for the work at once.

Leonia, N. J.—The South Side Sewer Co. of this city, with a capital stock of $10,000, has been incorporated by Benjamin H. Belknap, Edward Grinsdale and A. D. Bogert. The company is to own, operate and maintain a sewer system, which is to be used in connection with its land development.

Camden, N. J.—City Council has authorized the issuance of bonds in the sum of $400,000 for the construction of an auxiliary water plant and for the laying of water mains.

Atlantic City, N. J.—Water Commissioners have awarded a contract to Ed M. Bader of this city for the city's new pumping station at Absecon for $48,200. The new building will be absolutely fireproof throughout, built entirely of brick and reinforced concrete and steel.

Jersey City, N. J.—Court of Errors and Appeals has affirmed Jersey City's right to supply the Pennsylvania Railroad shops at Kearny with water until 1933 at $30,000 per year.

Schenectady, N. Y.—John Allen has been awarded a contract for the laying of sanitary sewers in High, Raymond, Genesee and Apple Sts., and surface sewers in a portion of South Center St. The contract for laying water mains in High, Genesee and Apple Sts. was awarded to Joseph H. Clements, Jr.

East Aurora, N. Y.—Village Board Trustees contemplate the construction of a sewer system for the village. Engineer Fred Wing of Buffalo has given details as to the expense of the project. There are over 16 miles of streets within the corporation, and Engineer Wing gave an estimated cost of about $125,000 for installing sewerage and rendering plant. A survey will be made and exact figures compiled, after which the proposition will be submitted to the taxpayers for a vote.

Batavia, N. Y.—City Engineer Russell A. Weintraub has completed plans and specifications for the proposed concrete dam of 500 cu. yds. The work will be advertised at once. Fred New is City Clerk.

Niagara Falls, N. Y.—The sewer committee has approved of the proposed construction of sewers at the North End, entailing an expenditure of about $111,000. The aldermen have voted to issue bonds to pay for this work. The work contemplated comprises: A sewer in Whirlpool St. from Highland Ave. to Sugar St., $3,200; a tunnel trunk sewer in Garfield Ave. from the river to the New York Central tracks, $44,500; a sewer along the Central tracks from the tunnel shaft at the alley between Franklin and La Fayette Aves. to Roselle Ave., across railroad from Roselle Ave. to the intersection of Florida and Maryland Aves., and from Florida and Maryland Aves. to the intersection of Highland and Massachusetts Aves., $46,300; a sewer in Highland Ave. from Masssachusetts Ave. to end of present sewer north of Virginia Ave., $12,221; a sewer in La Fayette Ave. from city line to the railroad, $5,700.

Brooklyn, N. Y.—At a meeting of the Queens Local Board petitions were approved for about $40,000 worth of public improvements, as follows: Grading Franklin St., Astoria, from Halsey St., to Mills; construct a sewer and pave with asphalt block on a concrete foundation Elm St., from Crescent St. to Second Ave., two long blocks, at an estimated cost of $15,873; for grading, curbing and flagging and building sewer in 15th Ave., from Newton road to Grand Ave., one and one-half blocks, at an estimated cost of $14,000; for grading and curbing and flagging Boulevard from Sanford Ave. to Washington Ave.

Saratoga Springs, N. Y.—Judge Ray at Norwich on July 6 ordered the injunction against the Saratoga Springs sewage disposal plant lifted until the action against Knoxville, Ia., has been decided in the United States Supreme Court. This action was brought by the Cameron Septic Tank Co. against several cities and villages for damages and an injunction for alleged violation of the patent for the disposal of sewage.

Glens Falls, N. Y.—The Water Commission has instructed Supt. West to prepare plans for a new gate house at what is known as the lower junction, near the reservoirs. It is planned to install electric apparatus which will regulate water pressure in case of fire.

Canton, O.—L. E. Chapin, employed by the city as consulting engineer for the waterworks and sewage departments, has presented to Director of Service Harbert, plans and specifications and estimates for a new sewage disposal plant.

Canton, O.—City council has instructed the city solicitor to prepare legislation for a bond issue of $125,000 for the purpose of extending the waterworks system. The money will be used in erecting a standpipe at a cost of $45,000 and for laying more mains and developing the well system.

Cleveland, O.—Engineer Schulz of the water works department is making an inspection trip of tunnel work in other cities preliminary to preparing the specifications for the proposed extension of the West Side water works tunnel. An ordinance providing for the sale of bonds in the sum of $800,000 for this improvement will be effective shortly.

Dayton, O.—City will sell bonds July 26 in the amount of $20,000 for the purpose of providing fund for the improvement and extension of the water works in the city.

Hamilton, O.—City held an election June 25 to vote on the issuance of bonds for the extension of the public services, such as gas, water and sewerage.

Jefferson, O.—George Waller & Co., room 5 Ensign Bldg., Erie, Pa., was awarded the contract on June 27 for constructing a sewer system at Jefferson, the amount of the contract being about $36,000.

Jefferson, O.—Geo. Waller & Co. of Erie, Pa., has been awarded a contract by this city for the construction of sewers at $35,165. Bids for the work were opened June 27.

New Philadelphia, O.—City has accepted the proposition of the New Philadelphia Water Co. to buy the latter's plant for $130,000. The city will hold a special election Aug. 2 to vote on the issuance of bonds for that purpose.

Youngstown, O.—Paul Hanson of the State Board of Health has been consulting with Engineer William Wilson relative to the fixing of the location of sewage disposal plants of Hubbard and Girard. Engineer Wilson is making the plans for a sewer system to be installed in Hubbard and also for a sewage disposal plant at that place and at Girard.

Lebanon, O.—Thomas Hurley of Marion has been awarded a contract for the construction of a sewer in this city for $5,425. The sewer to be built is 9,500 ft. long.

Akron, O.—State Board of Health has given the Board of Control of the city permission to extend the city's main sewer two miles from the present sewer to the proposed sewerage disposal plant, providing that plans are furnished by Jan. 11, 1911.

Hamilton, O.—On June 24 this city voted the issuance of bonds in the sum of $50,000 for storm sewers, $50,000 for water, $35,000 for electric light, $75,000 for gas and $50,000 for street construction

Toledo, O.—City has awarded a contract to John McMahon at $5,414, for the construction of the sewer on Lee St., Ironville. The sewer varies from 8-in. to 24-in. and is 3,650 lin. ft. long.

Youngstown, O.—City has awarded a contract to Hamon Bros., Lane Ave., this city, at $1,132, for the construction of a sewer in Delaware Ave., from Wirt St., to Superior St. Bids were opened June 10.

Youngstown, O.—City will sell bonds July 11 in the sum of $120,000 for the improvement to the water works system by extending, enlarging and equipping. Wm. I. Davies, city auditor.

Cleveland, O.—City Council has passed an ordinance authorizing the issuance of bonds in the sum of $1,100,000 to provide for the construction of a water tunnel on the west side of the city.

Altus, Okla.—J. W. Maxey Contracting Co., of Houston, Tex., has been awarded the contract by this city for material to make additional improvements on the waterworks, light and sewer systems to the amount of $200,000, to be divided as follows: $130,000 on waterworks, $35,000 on electric lights and $25,000 on sewers. The water supply will be brought from some seven miles north of the city, where shallow wells have been tested and the quantity found to be practically inexhaustible. The water will be pumped by electric power and controlled from the central power station.

Hugo, Okla.—F. R. Stone, 30-12-3 Security Bldg., Oklahoma City, Okla., has been awarded a contract for the construction of a complete sewer system in this city for $71,823. The work includes a sewer system embracing 17 miles pipe, sewage pump, well, septic tank, 146 manholes, 44 flush tanks and 32 lamp holes. Bids were opened July 5

Mangum, Okla.—City has voted the issuance of bonds for the extension of the waterworks and sewerage system and city hall.

Oklahoma City, Okla.—Bids opened on July 5 by Bob Parman, city clerk, for the construction of lateral sewer on Winan's Highland Terraced Addition, Winan's Second Addition, University Addition and portions of Central Park, Ross, Main Grand View and Central Northwest Additions have been rejected.

Ola, Okla.—City has about abandoned the idea of putting in electric lights and water works system. A franchise will likely be granted W. W. Infield of this city. M. L. Martin is mayor.

Tulsa, Okla.—City commissioners have awarded the New State Paving & Construction Co., a contract for the construction of a storm sewer at Cincinnati Ave., and First St., at $1,386.

Bristol, Pa.—Borough council has approved the engineers' plans and detailed drawings for a complete municipal water and filtration plant. At a recent election a bond issue of $100,000 for the plant was authorized.

Collingdale, Pa.—City will probably vote in the near future to borrow $30,000 for a sewage disposal plant.

Harrisburg, Pa.—City council has passed an improvement loan ordinance authorizing the expenditure of $641,000 for an intercepter along the river front, sewers, paving of streets intersections and in front of non-assessable properties, the improvement of Paxton creek and the erection of the 13th St. bridge over the Philadelphia & Reading Railroad.

McKeesport, Pa.—Water and light committee of the city council has recommended that the superintendent of the department of water shall investigate the cost of laying water mains to Versailles borough.

Mechanicsburg, Pa.—An ordinance was presented in the council for the sewering of Washington St., at a cost of $1,000 and for the macadamizing of York St., from Marble St., to the borough limits.

McKeesport, Pa. — Glassport Borough Council has awarded a contract to P. F. Rhoades of Versailles for the construction of the Erie Ave. and Third St. sewers for $4,831.

Olyphant, Pa.—City council has awarded a contract to the Pittston Construction Co., at $2,553, for the construction of the outlet sewer, and to Flanagan & Co., at $4,650, for the construction of the Valley Ave. sewer.

Pittsburg, Pa.—An ordinance was presented at a meeting of the city commissioners calling for a special election to vote for the issuance of bonds in the sum of $300,000 with which to construct a water plant to be owned and operated by the municipality.

Philadelphia, Pa.—Plans for the construction of the first of the plants of the projected huge sewage disposal system, estimated to cost probably $50,000,000, to stop pollution of the Delaware and Schuylkill and other streams and creeks within the confines of the city, have been completed by the Bureau of Surveys and approved by State Health Commissioner Samuel Dixon.

Quakertown, Pa.—This city is preparing to establish a sewerage system to cover the entire borough and surroundings.

Williamsport, Pa.—City Engineer Otto has about completed his report giving the estimated cost of the construction of a storm water sewer down the bed of Grafius run east of Penn St., and also the estimated cost of taking the sewer directly down Penn St. to the river.

Bristol, R. I.—City has decided to issue bonds in the sum of $35,000 to provide for the construction of a sewer on Wood St.

Charleston, S. C.—City contemplates issuing bonds in the sum of $1,500,000 for the installation of a municipal water works system.

Easley, S. C.—Public work commission, consisting of Messrs. W. W. Hagood, P. M. Taylor and W. C. Smith, is perfecting plans for the installation of a water works and electric light system.

Bridgewater, S. Dak.—William Welsh has been awarded a contract by the city council for the construction of a complete sewer system for this city.

Sioux Falls, S. Dak.—Engineer L. P. Wolff of St. Paul has completed the revised plans for the proposed west side sewer district. City will ask for bids for the construction of the system at once.

Memphis, Tenn.—T. A. Garvin has been awarded a contract by the Board of Commissioners for the construction of the Olive St. District sewers at $11,469. This extension will place sewers in the territory between Mississippi Blvd. and the park boulevard, two blocks to the east end of Mississippi Blvd., and to the west as far as the Illinois Central tracks.

Memphis, Tenn. — Commissioner Love has instructed City Engineer Weatherford to prepare plans at once for the sewering of annexed territory from Trigg Ave., to Parkway, west of the Yazoo & Mississippi Valley Railroad, and from Florida St. to Main St. The cost of sewering this district has not been estimated by the engineering department.

Amarillo, Tex.—City will sell bonds July 21 in amount of $40,000 for sewer, $75,000 for streets, roads and bridges, $10,000 for fire station. J. H. Patton is Mayor.

Beaumont, Tex.—City council is considering an application presented by W. C. Teter of New York, president of the Beaumont Water Works Co., for a franchise to lay and construct water main and pipes, stand pipes and reservoirs along and upon and underneath the county roads and highways of Jefferson county, the proposed districts including the South Park school district, Spindle Top and the vicinity thereof, Nederland and Port Neches and extending to within a mile and a half of the corporation limits of Beaumont.

Center, Tex.—City has let a contract to H. G. Barrow for the extension of the waterworks. The contract specifies that a steel tower be erected and a steel tank holding 90,000 gals. of water provided, the top of the tank to be 100 ft. from the ground. The deep well will be used for water supply

Donna, Tex.—Donna Water Co. has been incorporated with a capital stock of $10,000. The incorporators are Horace H. McDowell, H. E. Rathbone, J. V. Vandenberge.

El Paso, Tex.—City contemplates the installation of a municipal water works system.

El Paso, Tex.—City recently held an election to vote on the proposition of issuing bonds for the purchase of the waterworks plant of the International Water Co., of this city.

Hamilton, Tex.—Plans and specifications are being prepared by F. H. Lancashire of Dallas, Tex., for the construction of a waterworks system for this city. The system, it is estimated, will cost $15,000.

Houston, Tex.—City Engineer Dormant will have plans and specifications completed soon for the construction of the Cleveland Park reservoir and pumping station.

San Angelo, Tex.—City contemplates purchasing the private sewerage system of this city, at present owned and operated by a private corporation. The system, it is estimated, is worth from $25,000 to $30,000.

Texarkana, Tex.—A. A. Haynes, Manager of the Texarkana Water Co., has announced that his company will construct 25,000 ft. of water main and erect a pumping station.

Port Arthur, Tex.—Port Arthur Water Co. of this city has filed amendment increasing its capital stock from $200,000 to $250,000.

El Paso, Tex.—Citizens have voted the issuance of bonds in the sum of $375,000 for the purchase of the waterworks plant of the International Water Co.

Beaumont, Tex.—County Commissioners are considering the application of W. C. Teter of New York for a franchise to construct a water plant by laying pipes and mains within a defined area in Jefferson County.

Ephraim, Utah.—David N. Beal, vice president of the Ephraim Water Works Co., and Ole Larsen, a member of the city council, are trying to float bonds for the installation of a new water works system in this city.

Ogden, Utah.—City Engineer Wm. M. Bostaph has completed surveys for the proposed sewer district for that part of the city north of Ogden River. The estimated cost of constructing the sewer is $100,000.

Salt Lake City, Utah.—The board of public works of Salt Lake City, Utah, has awarded the following contracts for the construction of sewers: A. A. Clark, at $38,718, for sewer extension No. 251, extending in the eastern part of the city, from Second South to Fifth South Sts., and from Ninth East St. to the Fort Douglas reservation; Gilkersen, & Long, at $4.46 per ft., for sewer extension No. 246, in Hawthorne St.; J. D. Hanley, at about $1,503, for sewer extension No. 267, in Second North St., between Center and Quincy Sts.

Salt Lake City, Utah.—City council adopted a resolution instructing the city engineer to survey and estimate the cost of constructing an 18-in. water pipe line for the north bench. A rough estimate of the installing of the pipe line is $150,000.

Chuckatuck, Va.—Nansemond county supervisors have granted a franchise to the Chuckatuck Water & Sewer corporation to construct a waterworks system in this city. The promotors are Dr. G. D. Butts, county treasurer; Capt. C. B. Godwin and W. C. Moore.

Norfolk, Va.—Norfolk County Water Co., is now clearing the way to make the proposed improvements which will increase its water supply and its pumping capacity. Plans are now being worked out by which more wells will be sunk on its farm alongside Little Creek. Two pumps will also be installed.

Norfolk, Va.—The government is preparing to make extensive improvements on Fisherman's Island. Plans for a new water supply have been made and bids for the construction will be opened in a few days. It is estimated that the improvement will cost $12,000 or $15,000.

Bellingham, Wash.—Board of Public Works has awarded a contract to Bartlett & Co. for $3,102 for the construction of sub-sewer No. 50, in the alley between Lincoln and Moore Sts., from Connecticut to Ohio.

Bellingham, Wash.—Greer & Both have been awarded a contract in this city for the construction of trunk sewer No. 12, on Ohio St., from James to Nevada, where it empties into the long trunk system up the Whatcom Creek valley, for $1,613.

Clarkston, Wash.—E. E. Libby, president of the improvement company of this city, has offered to supply the city with water and to install hydrants for fire purposes.

Kennewick, Wash.—Mayor L. E. Johnson has stated, it is said, that $50,000 will be spent this year for the construction of sewers.

Ritzville, Wash.—City Council has awarded a contract to J. J. Royce for the construction of the extension to the F St. sewer for $2,490.

Seattle, Wash.—B. H. Graff, American Bank Bldg., city, has been awarded a contract for the construction of a water system at Fort Ward, Wash. The work includes concrete reservoir, pumping outfit and distribution system. Bids were opened May 28.

Baraboo, Wis.—City council adopted an ordinance providing for the preparation of plans and specifications for the Birch St. sewer extending between First and Fourth Aves.

Kenosha, Wis.—City council has accepted plans for the construction of a trunk line sewer at an estimated cost of $125,000. No bond issue has been passed as yet for this work. R. H. Moth is the engineer.

Kenosha, Wis.—City council has directed the street assessment committee to advertise for bids for the construction of a sewer on Washington Island. The sewer will cost about $4,200 and is designed to furnish drain for practically all the property on the island.

Kenosha, Wis.—City council has adopted a plan for a trunk sewer in Kenosha which is designed to furnish sewage disposal for the south and southwest portions of the city. The sewer will be nearly two miles in length and will be eight and one-half ft. in circumference. It is estimated that the sewer will cost $160,000. The work will be started next year.

Kenosha, Wis.—Board of water commissioners has taken steps to secure expert advice in regard to the demand for a larger intake in Kenosha. Engineers of the Robert W. Hunt Co. of Chicago have made an investigation of the conditions here.

Milwaukee, Wis.—The recently appointed sewage commission of this city, consisting of Harrison P. Eddy of the firm of Metcalf & Eddy of Boston, Mass., J. W. Alvord of Chicago and Geo. C. Whipple of New York have recently held their first meeting. The question of disposing of the sewage of the city, now the 13th largest city in the country, presents many difficulties and the findings of the commission will doubtless furnish some very interesting information regarding the problem of sewage disposal on a large scale.

Oshkosh, Wis.—Plans for the construction of sewers in the alley from Bond St. to Market St., and in Minnesota St., have been prepared by the city engineer.

Waterloo, Wis.—James H. Thompson 324 Dearborn St., Chicago, Ill., has been retained as engineer to prepare plans and specifications for improvements to the waterworks, estimated to cost $25,000.

Spooner, Wis.—Simpson & Single of this city have been awarded a contract for $0.62 per lin. ft. for the extension of the water mains, hydrants and valves. Bids were opened July 7.

Buffalo, Wyo.—City will hold an election July 12 to vote on the issuance of bonds in the sum of $50,000 for the construction of a sewer system.

London, Ont.—City has sold debentures in the sum of $357,823, of which $123,700 worth is for water works.

Toronto, Ont.—City Engineer Rust has completed the plans for the better protection of the university buildings and they have been approved by the Fire Chief and the Underwriters' engineer. The plans involve the laying of a 12-in. main from the corner of St. George St., down Devonshire Place, through the university grounds and connecting with the city main on College St. The estimated cost of the work is $19,000.

Nanaimo, B. C.—MacDougall & Co. of Vancouver, B. C., have been awarded a contract for excavating and laying sewer pipes with outfalls in harbor and other incidental works of sewerage. This work embraces about one-third of the whole sewerage scheme. The contract was awarded at $48,346. Bids for the work were opened June 24.

New Glasgow, N. S.—City contemplates the installation of a new waterworks system, at an estimated cost of $200,000. It will be a gravity system and the source of supply will be McLillan brook. The work includes dams, headwork and supply mains. F. W. W. Doane of Halifax, N. S., is the engineer. J. E. Roy, Town Clerk, has charge of the work.

BIDS ASKED

Buildings.

Bids are asked on following work, the notes being arranged alphabetically by states:

Bluffton, Ind.—Until 2 p. m. August 1, by Board of County Commissioners for the construction of a double 40 ft. span reinforced concrete arch bridge. O. D. Garrett is auditor of Wells County.

Brazil, Ind.—Until 11:30 a. m., August 2, by Board of County Commissioners for the construction of a steel bridge with concrete abutments. J. L. Burns is Auditor of Clay County.

Fowler, Ind.—Until 1 p. m., July 18, by Board of County Commissioners for the construction of a steel bridge in town of Chase. Lemuel Shipman is Auditor of Benton County.

Jeffersonville, Ind.—Until 11 a. m., July 16, by Board of County Commissioners for the construction of a bridge over Logan Creek. Peter Nachand is Auditor of Clark County.

Rushville, Ind.—Until 2 p. m., July 18, by Board of County Commissioners, for filling grade over Milroy arch. J. M. Stone is Auditor of Rush County.

Crookston, Minn.—Until noon, July 20, by Board of County Commissioners for the construction of a 12 ft. steel bridge with 16 ft. roadway, concrete abutments and wings and floor across the Grand Marais on the county road in Section 9 in the town of Fisher. H. J. Welte is County Auditor.

Hallock, Minn.—Until 1 p. m., July 25, by C. J. Hemmingson, County Auditor, for the construction of 9 wood bridges and 9 steel culverts on county ditch No. 19 and also 2 steel bridges and 9 steel culverts on county ditch No. 18.

Great Falls, Mont.—Until 2 p. m., July 16, by Board of County Commissioners for the construction of 18 I-beam bridges running from 15 to 30 ft. in length. David M. Wood is Clerk of Cascade County.

Hamilton, O.—Until 10 a. m., July 19, by Board of County Commissioners for the construction of sub and superstructure of bridge over Elk Creek in section 7, Madison township. J. E. Brate is Auditor of Butler County.

Youngstown, O.—Until Noon, July 18, by Director of Public Service, for furnishing the necessary labor and materials for the construction of a concrete bridge over the Andrew Hollow at Elm St. A certified check of $1,000 must be filed with each bid. W. H. McMillin is Clerk.

Berwick, Pa.—Until 11 a. m., July 19, by James M. Norris, County Controller, for a permanent floor on the Verwick Nescopeck bridge across the Susquehanna River at Berwick, Pa.

Gaffney, S. C.—Until noon, Sept. 5, by E. Felix Lipscomb, County Supervisor, for the construction of repairs to the 3-span iron bridge across Broad River, in Cherokee County, S. C.; also for rebuilding the approaches to the same bridge.

Greenville, S. C.—Until 4 p. m., July 20, by Paving and Sewer Commission, for furnishing the necessary labor and material for the construction of a reinforced concrete bridge for the city.

Winnipeg, Man.—Until Noon, July 15, by Frank Lee, Division Engineer, Central Division, Canadian Pacific, Winnipeg, Man., for the construction of piers, abutments and pedestals for bridge over the Kaministiquia River at Fort William.

Quebec, Que.—Until Noon, Sept. 1, by Department of Railways and Canals, Ottawa, Ont., for the construction of the superstructure of a bridge across the St. Lawrence River near the city of Quebec. L. K. Jones is Secretary of the Department.

Everton, Ont.—Until 2 p. m., July 14, by Town, for the construction of 40-ft. concrete bridge and 15-ft. concrete bridge. Bowman & Connor, 36 Toronto St., Toronto, Ont., are Engineers.

BIDS ASKED

Bridges.

Bids are asked on following work, the notes being arranged alphabetically by states:

Atlanta, Ga.—Until Noon, July 15, by W. T. Downing, 621 Grant Bldg., Architect for the construction of a tuberculosis sanitarium for the city of Atlanta, on the city's property beyond West View Cemetery, Fulton County.

Fort Screven, Ga.—Until 11 a. m., August 1, by G. B. Bingham, Constructing Quartermaster for the construction and plumbing of one double set of non-commissioned officers quarters.

Mt. Carmel, Ill.—Until 1 p. m., July 25, by Board of County Commissioners, for the construction of a two-story brick infirmary building. F. J. Scholotter, Evansville, Ind., is Architect.

Rock Island, Ill.—Until 2 p. m., July 25, by Lieut. Col. F. E. Hobbs, Depot Commanding Officer, for the construction of a reinforced concrete brick store house at Rock Island Arsenal.

Bluffton, Ind.—Until 1:30 p. m., August 1, by County Commissioners for the repairs at the Wells County infirmary. O. D. Garrett is Auditor of Wells County.

Brazil, Ind.—Until 11 a. m., August 8, by County Commissioners for the plumbing, heating and electric plant for the new county infirmary. J. L. Burns is Auditor of Clay County.

Brookville, Ind.—Until 1 p. m., July 21, by Board of County Commissioners for the remodeling of the court house at this place. Charles A. Miller is Auditor of Franklin County.

Delphi, Ind.—Until Noon, July 25, by Board of County Commissioners for the construction of a new county infirmary building. M. G. Haun is Auditor of Carroll County.

Peru, Ind.—Until 2 p. m., July 26, by County Commissioners, for the construction of cabinet work in the new court house.

Shelbyville, Ind.—Until 5 p. m., July 28, by S. P. McCrea, Secretary of the School Board of Trustees, for the construction of a new high school building.

Amite, La.—Until July 31, by A. C. Lewis, Amite, La., for the construction of a school house in this city. Xavier A. Kramer, Magnolia, Miss., is Architect.

Baltimore, Md.—Until 11 a. m., July 20, by Board of Awards for the construction of a shed on No. 1056 and 1058 Granby St. J. Barry Mahool is President of the Board.

Mankato, Minn.—Until 8 p. m., July 26, by George W. Scherer, Chairman of the Building Committee, for the erection and completion of a school building. Chandler & Park, Racine, Wis., are Architects.

Webb City, Mo.—Until 2 p. m., July 26, by Board of Education, for furnishing all necessary labor and material for the construction of a high school building, including separate bids for heating, plumbing and ventilating systems.

Portsmouth, N. H.—Until Noon, July 15, by Civil Engineer, Navy Yard, Portsmouth, N. H., for repairing and improving the Marine Officer's quarters Navy yard.

Albany, N. Y.—Until 3 p. m., July 27, by State Commission in Lunacy, Capitol, for the improvement of State Hospitals as follows: For Central Islip State Hospital, Central Islip, L. I., N. Y., kitchen and dining room building, conduits, steam mains, feeder cables and outside sewer and water connections for new group, additional boiler capacity, North Colony, construction including heating, plumbing and electric work. For Kings Park State Hospital, Kings Park, L. I., N. Y., kitchen and dining room building, conduits, steam mains, feeder cables, sewer and water connections for new groups, construction including heating, plumbing and electric work. For Manhattan State Hospital, Ward's Island, New York City, kitchen building, steam mains and feeder cables for new cottages, construction including heating, plumbing and electric work. The estimated costs of the work are $35,000, $40,000 and $12,500, respectively. T. E. McGarr is Secretary of the Commission.

Gracemont, Okla.—Until July 25, by City, for the construction of a fireproof schoolhouse of reinforced concrete at this place. Plans and specifications are on file in the State Bank at Gravemont or at the office of the Oklahoma Engineering Co., Anadarko, Okla., the engineers for the work.

Homestead, Pa.—Until July 15, by D. T. Powelson, Secretary, Directors of the Borough School District, for the installation of a steam heating and ventilating plant for the new Central School Building to be erected in said district

National Soldiers Home, Va.—Until 1:30 p. m., July 29, by John T. Hume, Treasurer, Southern Branch, N. H. D. V. S., National Soldiers Home, for material and labor for office of commissary subsistance, toilet room and repairs to floors, building No. 14.

Saulte Ste. Marie, Ont.—Until Noon, July 15, by R. S. McCormick, Chief Engineer A. C. & H. B. Ry., for the construction of section houses at the following points along the line of the Algoma Central & Hudson Bay Ry.: Heyden, Achigan, Ogidaki, Mashcode and Mekatina

Roads and Streets.

Bids are asked on following work, the notes being arranged alphabetically by states:

Denver, Colo.—Until Noon, July 16, by Charles W. Comstock, State Engineer, for the construction and improvement of the wagon road from Rocky Ford to Fowler in Otero County, Colo. Plans and specifications can be obtained at the office of the County Clerk or Surveyor at La Junta, Colo.

Pensacola, Fla.—Until August 10, by Board of Public Works, J. B. Winslett, Secretary, for the construction of 525,000 sq. ft. of concrete sidewalks. L. Earle Thornton is City Engineer.

St. Augustine, Fla.—Until August 1, by County Clerk, for the construction of a public highway. C. M. Milburn, St. Augustine, Fla., is Engineer. Each bid must be accompanied by a certified check for $300.

Centerville, Ia.—Until 2 p. m., July 19, by City Clerk, for the construction of 20,000 sq. yds. of paving and 15,000 lin. ft. of combined curb and gutter. Hall & Adams, Centerville, Ia., are Engineers.

Downers Grove, Ill.—Until July 19, by Board of Local Improvements, for furnishing necessary labor and materials for the grading, draining and paving with brick Grove St., from the west line of Main St. to the easterly line of Carpenter St. The work includes approximately the following quantities: 1,650 cu. yds. of earth excavation for roadways, curb and gutter; 150 cu. yds. of earth excavation for parkways; 2,075 lin. ft. of combined concrete curb and gutter; 2,950 sq. yds. of vitrified paving brick pavement; 6 sewer manhole covers adjusted to the grade of finished street; 4 storm water inlets set to grade and line of curb.

Downers Grove, Ill.—Until 8 p. m., July 19, by Board of Local Improvements, for the grading, draining and paving with brick Silbert Ave., from the west line of Forest Ave. to a point 1,225 ft. west. The work includes the following approximate quantities: 2,400 cu. ft. of earth excavation for roadways and curb; 200 cu. yds. of earth excavation for parkways; 2,475 lin. ft. of combined concrete curb and gutter curb; 3,350 sq. yds. of vitrified paving brick pavement; 50 lin. ft. of 10-in. tile drain; 1 storm water inlet set to grade and line of curb; 1 storm water inlet adjusted to line and grade of curb; 5 sewer manhole covers adjusted to the grade of finished street.

Indianapolis, Ind.—Until 10 a. m., July 18, by Board of Public Works, for the improvement of Temple Ave. from the north property line of St. Clair St. to the south curb line of 10th St. by grading and paving the sidewalks.

Indianapolis, Ind.—Until 10 a. m., July 18, by Board of Public Works, for the improvement of 36th St. from the west curb line of Pennsylvania St. to the west curb line of Central Ave. by grading and paving sidewalks.

Indianapolis, Ind.—Until 10 a. m., July 18, by Board of Public Works, for the improvement of Laurel St. from the south sidewalk line of Lexington Ave. to the North curb line of Prospect St. by grading and paving sidewalks.

Indianapolis, Ind.—Until 10 a. m., July 18, by Board of Public Works for the improvement of Washington Blvd., from the south property line of 40th St. to the south property line of 42d St., by grading and paving the sidewalks.

Indianapolis, Ind.—Until 10 a. m., July 18, by Board of Public Works, for the improvement of 36th St. from Pennsylvania St. to Central Ave.

Marion, Ind.—Until 2 p. m., August 2, by Board of County Commissioners for the construction of a gravel road in Franklin township. Andrew G. Stout is Auditor of Grant County.

Vincennes, Ind.—Until August 2, by Board of County Commissioners for the construction of a gravel road in Knox County. J. T. Scott, Auditor.

Alexandria, La.—Until Sept. 6, by City Board of Aldermen, for the paving of Gould Ave. with vitrified brick from 11th to Levin St. and on to the city limits with gravel.

Hallock, Minn.—Until 1 p. m., July 23, by C. J. Hemmingson, County Auditor, for the construction of state road, as follows: 57,661 cu. yds. of grading; 2,300 cu. yds. of ditching; 20-in. by 24-ft. concrete culverts and nine 30-in. by 24-ft. concrete culverts.

Missoula, Mont.—Until 9 a. m., July 30, by A. B. Shattuck, Constructing Quartermaster, for the construction of concrete sidewalks and curbs.

Cape Girardeau, Mo.—Until 7:30 p. m., July 18, by C. E. Betten, City Clerk, for the grading and macadamizing with bituminous binder, Independence St., West End Blvd. and Whitener St., including the following approximate quantities: Excavation, 6,217 cu. yds.; embankments, 3,423 cu. yds.; granitoid curbing and guttering, 8,085 lin. ft.; crushed rock, to be placed, 5,298 cu. yds.; asphaltum or bituminous binder for 9,897 sq. yds.; rolling sub-grade and macadam, the latter 2 times, 12 blocks.

Cape Girardeau, Mo.—Until 7:30 p. m., July 18, by Chris. F. Betten, City Clerk, for grading and paving Broadway St. with creosoted wood blocks between the street car track and with vitrified brick on the outside, and necessary curbing. The work includes the following approximate quantities: Excavation, 1,260 cu. yds.; creosoted wood block paving, 1,392 sq. yds.; vitrified brick paving, 6,168 sq. yds.; curbing, 771 lin. ft.

Albany, N. Y.—Until 3 p. m., July 18, by Board of Contract and Supply, for the improvement of Morris St. from the west line of Main Ave. to the east line of West Lawrence St. The work includes grading the street, setting granite curb, paving the carriageway with repressed vitrified shale paving blocks on a concrete foundation, laying walks of concrete, building receiving basins and laying vitrified pipe sewers and appurtenances under each sidewalk. Isidore Wachsman is Secretary of the Board.

Brooklyn, N. Y.—Until 11 a. m., July 20, by Alfred E. Steels, President of the Borough of Brooklyn, Room 2 Borough Hall, for 36 paving contracts, the largest ones being as follows: No. 20. For regulating, grading, curbing and laying sidewalks on Marine Ave., from 92d St. to Ft. Hamilton Ave., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 5,990 lin. ft. of new curbstone set in concrete. 100 lin. ft. of old curbstone reset in concrete. 7,980 cu. yds. of earth excavation. 770 cu. yds. of earth filling (not to be bid for). 330 cu. yds. of concrete (not to be bid for). 30,070 sq. ft. of cement sidewalk. The time allowed for the completion of the work and the full performance of the contract is eighty (80) working days. The amount of security required is $4,500. No. 31. For regulating, grading, curbing and laying sidewalks on 43d St., from 10th Ave. to West St., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 100 lin. ft. of old curbstone reset in concrete. 2,200 cu. yds. of earth excavation. 1,170 cu. yds. of earth filling, to be furnished. 10,620 lin. ft. of cement curb. 45,370 sq. ft. of cement sidewalk. The time allowed for the completion of the work and the full performance of the contract is eighty (80) working days. The amount of security required is Forty-five Hundred Dollars.

White Plains, N. Y.—Until 1:30 p. m., July 21, by Town Board, for macadamizing, grading and otherwise improving the following roads or highways: Wards Lane, from North St. to Westchester Ave., a distance of about 1,160 ft.; Sound View Ave., from a point near the residence of John Miles to Old Mamaroneck Road, a distance of about 1,500 ft.; Hartsdale Ave., from Old Mamaroneck Road to the Scarsdale town line, a distance of about 3,100 ft.; Purdy Ave., from the Harrison town line to Scarsdale town line, a distance of about 5,050 ft.; also the two ends of Gedney Way, from Mamaroneck Ave. westerly to proposed fill of the New York, Westchester & Boston Railroad Co., and from Old Mamaroneck Road easterly to proposed fill of the New York, Westchester & Boston Railroad Co., a distance of about 1,500 feet.

Berlin Center, O.—Until Noon, July 20, by Board of Township Trustees of Berlin township, for furnishing the necessary labor and material to grade the east and west center road from Berlin Centre west. J. L. Wisdorf is Clerk of the Township at Berlin Centre, O.

Caldwell, O.—Until noon, July 22, by Hugh F. Neuhart, Village Clerk, for the construction of approximately 7,750 sq. yds. of paving and 4,500 ft. of curb.

Lockland, O.—Until noon, July 18, by C. E. Troy, Village Clerk, for furnishing necessary labor and material for the improvement of Wyoming Ave. from the west line of Wayne Ave. to the east line of the right of way of the C., H. & D. Ry., by grading, constructing concrete curbs and gutters, crosswalks and paving the right of way with vitrified brick and constructing the necessary storm sewers therein.

Napoleon, O.—Until 10 a. m., July 22, by Board of County Commissioners, at the office of the County Auditor, for necessary labor and material for the following road improvement contracts: Joint Road Improvement, Henry and Fulton Counties; Road Improvement No. 87, Harrison Township; Road Improvement No. 78, Flat Rock Township; Road Improvement No. 88, Napoleon Township; Improvement No. 96, Ridgeville Township; Road Improvement No. 95, Freedom Township; Road Improvement No. 93, Freedom Township; Road Improvement No. 92, Freedom and Napoleon Townships; Road Improvement No. 94, Liberty Township; Road Improvement No. 97, Richfield Township.

Sandusky, O.—Until noon, July 14, by Director of Public Service, for paving Washington, Franklin and Adams Sts. Joseph Loth, Jr., is Secretary of the Director.

Youngstown, O.—Until noon, July 18, by Director of Public Service, for the construction and materials necessary for the sewering and grading of Edgewood St. between Center St. and Dry Run.

Struthers, O.—Until 7 p. m., July 20, by L. S. Creed, Village Clerk, for the necessary labor and material for the construction of brick pavement on Bridge St., in the village, from the bridge over the Mahoning River southerly to the Yellow Creek bridge.

Greenville, S. C.—Until 4 p. m., July 23, by Paving and Sewer Commission, for furnishing labor and material for the construction of approximately 29,000 sq. yds. of street paving with necessary drainage and granite curb. Bids will be received for vitrified brick, wood block, bitulithic and asphalt pavement. H. S. Jaudon Engineering Co. are Engineers.

Amarillo, Tex.—Until July 25, by Samuel J. Brown, City Secretary, for the construction of 80,000 sq. yds. of pavement. E. L. Dalton, Dallas, Tex., is Engineer.

Taylor, Texas.—Until 2 p. m., July 20, by County Commissioners, for the construction of rock gravel or macadam roads in district No. 4. S. G. Yakey is Commissioner at Taylor, Texas.

Olympia, Wash.—Until 2 p. m., July 20, by Highway Board, for clearing and grubbing the Skagit Water front road, part of State Road No. 6. Henry L. Bowlby is Secretary of the Board.

Huntington, W. Va.—Until 1 p. m., July 25, by Board of Commissioners, for the grading, draining, curbing and paving with vitrified brick, sheet asphalt, asphalt block or bitulithic, the following streets: Fourth Ave., from 11th to 16th Sts.; 7th Ave., from 10th to 16th St.; 8th Ave., from 20th St. to a point 230 ft. east of Smith St.; 10th St., from 6th to 7th Ave.; Van Buren Ave., from West 13th to West 14th Sts.; West 13th St., from Van Buren Ave. to the C. & O. right of way line, and 20th St., from 8th to Ritter Ave., the whole comprising approximately 56,500 sq. yds. of paving and 24,000 lin. ft. of curbing.

Racine, Wis.—Until 10 a. m., July 23, by Board of Public Works, for furnishing necessary labor and materials for paving Park Ave. from the south line of Sixth St. to north line of Fourteenth St., including the following approximate quantities: 15,200 sq. yds. asphalt paving; 7,746 lin. ft. of cement gutters. P. H. Connolly is Chairman of the Board.

Sewers.

Bids are asked on following work, the notes being arranged alphabetically by states:

Attalia, Ala.—Until July 26, by L. S. Gray, Town Clerk, for the construction of approximately 6½ miles of pipe sewers and appurtenances. Plans are on file with William Hill, Engineer, Gadsden, Ala.

Sylvania, Ga.—Until July 20, by City Council, for the constructiton of a water works, electric light plant and sewer system. J. H. McCrary Co., Atlanta, Ga., Engineers.

Berwyn, Ill.—Until 8 p. m., July 19, by Board of Local Improvements, for the construction of a sewer system in 15th St. from Oak Park Ave. east to Clarence Ave., and south in Clarence Ave., Wesley Ave., Euclid Ave. from 15th to 16th Sts., including necessary junctions, catch basins, manholes, backfilling, etc. George H. Norton is Secretary of the Board.

Boston, Mass.—Until 2:30 p. m., July 22, by Metropolitan Water & Sewerage Board, 1 Ashburton Place, Boston, Mass., for constructing in rock and earth trench Section 66 of the Extension of the North Metropolitan System, in Broadway, Malden, in accordance with the forms of contract and specifications to be furnished by the Board. Some particulars are estimated to be as follows: Length, 2,631 feet; inside diameter of sewers, 18 in. and 12 in.; 60 cu. yds. of Portland brick masonry; 500 cu. yds. of concrete masonry in trench; 200 cu. yds. rock excavation in trench. The invert of the sewer is from 12 ft. to 22 ft. below the street surfaces. William Brown is Chief Engineer of the Sewerage Works.

Baltimore, Md.—Until 11 a. m., July 20, by Board of Awards, for the construction of storm water drains under Contract No. 10, the work including: 780 lin. ft. 42-in. circular drain, 120 lin. ft. 18-in. circular drain, 55 lin. ft. 12, 15 and 18-in. inlet connections, 10 cu. yds. brick masonry, 15 cu. yds. concrete, 1,000 lbs. reinforced steel, 500 lin. ft. 6-in. underdrain, 30 lin. ft. manholes, 6 inlets. Calvin W. Hendrick is Chief Engineer of the Sewerage Commission.

Fergus Falls, Minn.—Until 8 p. m., July 18, by S. A. Levorsen, City Clerk, for the necessary labor and material for the completion of the sewer in Lincoln Ave. west of the city, from the end of the present sewer opposite the center of lot 15, block 3, McLane's addition to the city of Fergus Falls, thence west on said avenue for a distance of 366 feet, together with all manholes, catch basins, house connections, etc.

Fort Missoula, Mont.—Until 9 a. m., July 30, by A. B. Shattuck, Constructing Quartermaster, for the construction of a water distributing system and sewer system.

O'Neill, Neb.—Until 8 p. m., July 13, by H. J. Hammond, City Clerk, for the necessary labor and material for the construction of a complete sanitary sewer system for the city. The Consolidated Engineering Co., 640 Bee Bldg., Omaha, Neb., Engineers.

New York, N. Y.—Until 11 a. m., July 14, by Cyrus C. Miller, President of the Borough of The Bronx, Municipal Bldg., Crotona Park for five sewer contracts, the largest one being as follows: No. 4. For constructing sewers and appurtenances in Drainage St., South of Boscobel Place, between Undercliff Ave. and Aqueduct Ave.; in Aqueduct Ave., between West One Hundred and Seventieth St. and Ogden Ave.; In Ogden Ave. between West One Hundred and Sixty-ninth and Aqueduct Ave.; in Lind Ave. between West One Hundred and Seventieth St. and Summit southerly therefrom; in Aqueduct Ave. (East Side), between Boscobel Ave. and Featherbed Lane; in Undercliff Ave., from existing sewer south of Boscobel Place to Boscobel Place; and in Boscobel Place, Between Undercliff Ave. and Aqueduct Ave. The Engineer's estimate of the work is as follows: Item 1, 91 lin. ft. of 18-in. cast iron pipe sewer; item 2, 190 lin. ft. of pipe sewer, 18-in.; Item 3, 1,000 lin. ft. of pipe sewer, 15-in.; Item 4, 4,570 lin. ft. of pipe sewer, 12-in.; Item 5, 488 spurs; Item 6, 61 manholes; Item 7, 13 receiving basins; Item 8, 5,960 cu. yds. of rock excavation; Item 9, 15 cu. yds. of Class "B" concrete; Item 10, 30,000 ft. (B. M.) of timber; Item 11, 100 lin. ft. of 12-in. drain pipe. The time allowed for the completion of the work will be three hundred (300) working days. The amount of security required will be Twenty Thousand Dollars ($20,000).

St. Bernard, O.—Until Noon, July 19, by Geo. Schroeder, Village Clerk, for the furnishing of the necessary labor and material for the construction of a storm water sewer in the ravine east of the Carthage pike from Church St. to Washington Ave. J. A. Stewart, 1112 Traction Bldg., Cincinnati, O., is Village Engineer.

Youngstown, O.—Until noon, July 18, by Director of Public Service, for furnishing the necessary labor and materials for sewering Watt St., between Adams St. and Oak St. and Adams St. between Watt St. and Walnut St. W. H. McMillen is Clerk of the Director of Public Service.

Wagner, S. Dak.—Until 8 p. m., July 20, by City Council, for the construction of approximately 12,000 lin. ft. of sewer, including manholes and flush tanks, in connection therewith. W. H. Frei is Auditor of the city.

Watertown, Wis.—Until 2 p. m., July 16, by Board of Public Works, for the construction of sanitary sewers and appurtenances. The work includes approximately: 1,519 ft. of 8-in. pipe, 1 manhole, 1 automatic flush tank, 1 ordinary flush tank. Charles A. Kading is Chairman of the Board.

Toronto, Ont.—Until noon, July 26, by Board of Control, for the construction of a sewer consisting of 1,340 lin. ft. reinforced concrete pipe, 5 ft. in diameter, from Defoe St. northerly to a point about 500 ft. north of Queen St. G. R. Geary is Chairman of the Board.

Moose Jaw, Sask.—Until 8 p. m., July 18, by W. F. Heal, City Clerk, for the following sewer contracts: Contract "A"—Supplying material for and constructing sewage disposal plant complete, and laying trunk sewer. Contract "B"—(1) Supplying and installing a complete air lift system; (2) supplying and installing one electrically-driven centrifugal pump and auto starter. Contract "C"—Supplying and delivering 3,000 cords of field stone. J. M. Wilson is City Engineer.

Water Supply.

Bids are asked on following work, the notes being arranged alphabetically by states:

Washburn, N. Dak.—Until 8 p. m., July 18, by Hugh Westmiller, City Auditor, for the construction of a water works system for the city.

New York, N. Y.—Until 2 p. m., July 13, by Department of Water Supply, Gas & Electricity, Room 1904, Park Row Bldg., New York, for furnishing and delivering and laying water mains in Brook, Chatterton, Grand, Kingsbridge, Park, Spofford, Townsend and Vyse Aves., in Bartholdi, Bryant, Canal (West) St., Maries, 166th, 167th, 213th, 216th, 222d, 230th, and 231st Sts. in Boroughs of Manhattan and Bronx. Henry S. Thompson is Commissioner of Water Supply, Gas & Electricity.

Cleveland Heights, O.—Until Noon, August 9, by H. H. Canfield, Clerk of the Village, 309 Beckman Bldg., Cleveland, O., or at Town Hall, Cleveland Heights, for the necessary labor and material for the improvement of Cedar Road from the east line of Coventry Road to the east line of Lee Road by laying a 10-in. water main therein. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., are Engineers.

Fort Moultrie, S. C.—Until 11 a. m., July 29, by Constructing Quartermaster, for the constructing of three reinforced concrete reservoirs and water distributing system for fire purposes at Fort Moultrie, S. C.

Fort Worden, Wash.—Until 11 a. m., July 16, by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the extension of water and sewer from ordnance machine shop, etc., at this post.

Cheyenne, Wyo.—Until August 1, by C. C. Carlisle, City Engineer, for laying ten miles of pipe lines, and for furnishing cement for diversion dams and also hauling and distributing materials. Separate bids will be received for each item.

Cheyenne, Wyo.—Until July 18, by C. C. Carlisle, City Engineer, for furnishing 3,300 tons of cast iron water pipe and necessary specials, lead, jute, etc., and laying same.

Belleville, Ont.—Until July 20, by City Clerk, for the following pumping plant: Turbine pump direct connected to proper motors with lightning preventive apparatus and starting apparatus; two triplex pumps, also direct connected to similar motors and apparatus. James G. Lindsay is City Engineer.

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CHAS. S. HILL
C. T. MURRAY
H. P. KIRKLAND
MYRON C. CLARK . . . . PUBLISHER
F. P. BURT . . . . MANAGER

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Disintegration of Concrete by Salt Laden Waters.

Two papers bearing upon the disintegration of concrete by salt bearing waters are published elsewhere in this issue. One of these papers is an account of the most extensive series of tests probably ever undertaken on the behavior of concrete in sea water. The second paper is a summary of opinions and experience on the effect of salt and acid laden waters on concrete, compiled by one who has had unusual opportunities as an officer of the Royal Engineers in the British Service to study concrete work in sea water and in irrigation work in the alkali regions of India. The author suggests that as none of the remedies for disintegration which he cites are patented in this country, engineers would do well to give them practical trial with the idea of securing some actual experience as to their effectiveness. In America, for obvious reasons, engineers have concerned themselves less with the study of concrete in marine structures than have those of Europe. On the other hand, the effect of alkali on underground concrete work is perhaps of greater concern in this country than anywhere else. The irrigation work of the West has much of it to be done in alkali soils, and it is of the highest importance to learn what precautions may render concrete immune to attack from the leachings of these soils. The experience in India in similar soils is worthy of attention. There very simple means have been employed, apparently with a considerable measure of success. After all, however, the study of all that has been recorded on the disintegration of concrete and its preservation by special compositions of cement and special admixtures, the conclusion is forced upon one that plenty of cement and careful proportioning and mixing to ensure a dense concrete is the real solution of the problem. In this connection we call attention to the report published in this issue of the Committee on Waterproofing of the American Society for Testing Materials. The means there urged to secure density as a measure of preventing penetration by water of concrete structures would seem to be quite as useful in concrete structures having to resist the action of salt-laden waters. In conclusion we wish to repeat what we have said before: Examples of actual disintegration of concrete from any of the causes mentioned are not numerous, but they have been given general application, partly by careless reasoning and partly by intention by interests antagonistic to concrete. In this way it has been easy for those unacquainted with the circumstances to be led to believe that concrete is not permanent. There is no reason of course for such apprehension. No general failures have occurred from the causes mentioned; indeed, there have been very few when the total number of concrete marine structures, sewers, conduits, etc., is considered. Concrete is a generally durable material for engineering structures. The facts do not permit any other conclusion. Conversely, the usefulness of concrete for water-carrying and submerged works makes it important to recognize that occasional want of durability is shown to exist, and imperative to find a means of guarding against such danger.

The Lessons in Arch Design of the Medina Model Arch Tests.

The unique series of model arch tests which have been conducted in working out the Medina arch aqueduct on the New York State Barge Canal, present some conclusions which are of decided interest. Altogether 12 model arches were tested in two sets of 6 arches each. These model arches were exact counterparts, but 1-36 the size, of the proposed aqueduct arch. In connection with each set of arches a set of cube and prism compression tests were made. These prism tests were notable in the fact that many were loaded uniformly and concentrically, others were eccentrically loaded, others with concentric knife-edge loads and still others were grooved to superinduce certain kinds of failure. The results of the first set of tests were published in our issue of March 16, 1910, and the results of the second set of tests are given in this issue. The absolute values obtained are given fully in these two articles and may be studied by those interested, but the significant features of the tests lie rather in the general conclusions indicated.

From the first set of arch tests it was indicated that with reasonable values of compressive working stress there need be no fear of failure due to so called shearing stresses at the springings. In the prism tests it was indicated that, if a straight line distribution of stress be assumed, the working unit stress in the extreme fiber, when the line of stress passes at the edge of the middle third, may be considered as at least 30 per cent higher than the allowable working stress when the line of pressure lies in the neutral axis. It will be noted that the second set of prism tests confirmed the conclusion just stated. To summarize the evidence, the results obtained from the first set of prisms showed an approximate ultimate strength at the extreme fiber 34 per cent greater when the load was applied at the edge of the middle third than when it was applied uniformly over the prism end. In the second set of prism tests the corresponding strength was 31 per cent greater. It is to be borne in mind that these outer fiber values are based on the straight line assumption which gives with load applied eccentrically as described a maximum fiber stress of twice the average.

Turning to the arch tests the striking fact is observed that every arch tested failed at or near the springing by crushing. This fact is remarkable because in some of the arches at least the load was so applied that the theoretical maximum stress was at the crown. For example arches Nos. 8 and 12 "show at the point where the line of pressure passed through the middle third at the crown, an apparent stress of more than 125 per cent greater than at the point of failure at the springing at which point the stress was uniformly applied." It will be noted that the second set of arch tests confirms the first set in respect to the small danger of failure by shear at the springings. The full conclusions of the engineers, based on both sets of arch tests, are as follows:

(1) That material in an arch when the line of pressure follows the axis, will take at least as high a stress as the same material in cube form uniformly stressed.

(2) That the allowable working-stress in bending in an arch may safely be much greater than the allowable unit-stress for columns.

(3) That an arch of theoretically uniform strength throughout will fail at the springing, and that the working-stress for the springing should be smaller than that for the crown, perhaps at least 25 per cent smaller.

(4) That the allowable working-stress on the extreme fiber, when the line of pressure passes through the edge of the middle third, may be 30 per cent higher than the corresponding stress when the line of pressure coincides with the axis.

A Correction.

Changes found necessary in the original manuscript has led us to reprint in this issue in corrected form the article published last week on methods and costs of raising grade and filling in trestles. In our issue of July 27 we shall publish an extended article by Mr. Wallace on methods and costs of surfacing track and smoothing and dressing track in various kinds of ballast.

Concreting at Gatun.—The total output of concrete, the daily average, and the number of days worked, by months, from August, 1909, to June, 1910, inclusive, is as follows:

1909	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]
1910			
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	24
March	[illegible]	[illegible]	27
April	[illegible]	[illegible]	26
May	74,162½	2,966½	25
June	[illegible]	[illegible]	26
Total	[illegible]	1,923	267

*Five Sundays worked. †One Sunday worked.

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CONCRETE AND REINFORCED CONCRETE SECTION

Tests on Reinforced Concrete Columns Subjected to Repeated and Eccentric Loads.*

Among some of the interesting tests carried University of Wisconsin during the past year are those made on some very strong spirally reinforced concrete columns. This paper reports some of the results obtained from tests of twelve of these columns. A more complete report of all unpublished results of reinforced concrete column tests is now being prepared for publication. For assistance rendered in making these tests and in preparing the results due acknowledgment is hereby made to Mr. J. B. Kommers of the Mechanics' Department and to Messrs. O. W. Storey, F. E. Bates, O. Lupinski and H. E. Pulver, students in engineering. The Universal Portland Cement Company donated the cement used in making the specimens.

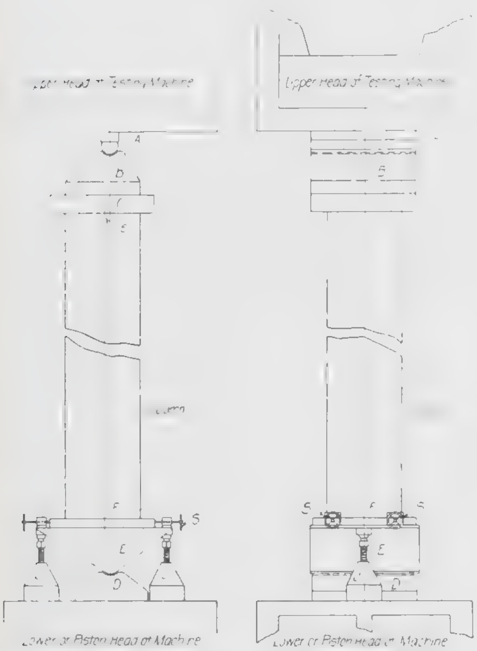
Upper Head of Testing Machine
Upper Head of Testing Machine
Lower or Piston Head of Machine
Front Elevation
Lower or Piston Head of Machine
Side Elevation
A
B
C
D
E
F
S

Fig. 1—Apparatus for Applying Eccentric Load to Reinforce Concrete Columns.

The materials used in fabricating the test pieces will now be considered. A local crushed limestone screened to pass a 1¼-in. mesh and having dust removed was used in making concrete. It weighed 80 lbs. per cu. ft. and contained 52 per cent voids. A well graded clean sand weighing 107 lbs. per cu. ft. and containing 36 per cent voids was furnished from a pit near Janesville, Wis. Tests on the cement, made in accordance with the standard specifications of this society, showed it to be satisfactory. Table I contains data derived from tension tests of the steel employed.

Concrete or mortar was proportioned by volume, measured loose cement being assumed to weigh 100 lbs. per cu. ft. Volumes were measured by weighing. After the materials had been mixed dry for about one-half minute in a No. 0 Smith batch mixer about 10 per cent of water, based upon the total weight of dry materials, was added through pipes leading to the mouth and hopper of the mixer. Three minutes of mixing was sufficient to furnish a homogeneous wet concrete which would flow around the reinforcement.

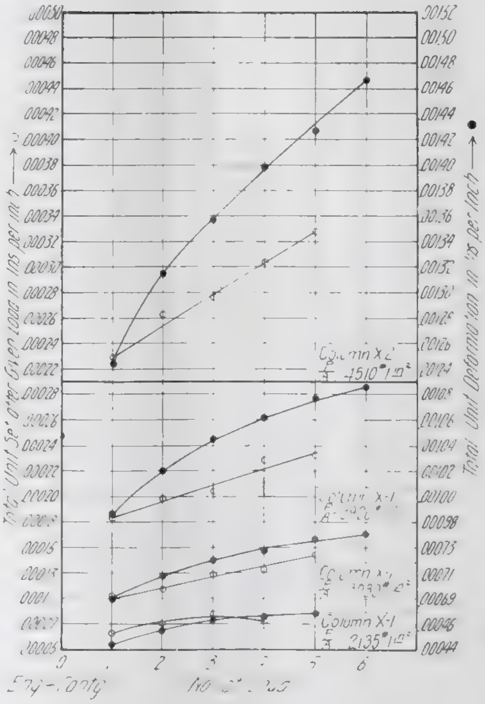

Fig. 2—Set—Repetition and Deformation—Repetition Curves for Columns X1 and X2.

TABLE III. DATA ON STRENGTH OF COLUMNS SUBJECTED TO REPEATED OF TIME LOADINGS.
(Loads are arranged in order of application.)

Col. No.	No. of Repetitions of Stress P/A	P/A held minutes.	P/A lbs./in.²	Stresses at First Application of Stress P/A lbs./in.² in Vertical Steel	Stresses at First Application of Stress P/A lbs./in.² in Concrete	Maximum Applied Load lbs.	Ultimate Strength lbs./in.²	Compressive Strength of Cylinders lbs./in.²
1	2	3	4	5	6	7	8	9
X1	3		2135		2135			
	4		3030		3030			
	4		3920		3920	523000	6330	4650
X2	4		4510		4510			
		30	4510		4510			
		210	4510		4510			
		240	4510		4510	500000	5900	4665
Y1	5		2260	10800	1750			
	2		3300	18000	2420			
	4		3300					
	5		4340	25100	3090			
	4		7300	*		617500	7300	4220
Y2		90	6230	35900	4390			
	3		7480	*		617500	7480	4120
AA1		5	7300	*		617500	—Not Broken—	6135
AA2		15	7300	*		"		7440
AB1		25	7480	*		"		6340
	1	4	7480					
AB2		20	7300	*		"		6435
	1	16	7300	*				
AC1		26	7480	*		"		6075
AC2		20	7140	*		"		5835
	2		7140					

*Beyond yield point: A few small cracks along the spacing bars were visible on Cols. AA1-AC2.

TABLE I.—TENSION TESTS OF STEEL USED IN COLUMNS.

Number of Tests.	Approx. Size of Bar in ins.	Area in sq. ins.	Stress at Yield Point lbs./in.² Maximum.	Stress at Yield Point lbs./in.² Minimum.	Stress at Yield Point lbs./in.² Average.	Ultimate Strength lbs./in.² Maximum.	Ultimate Strength lbs./in.² Minimum.	Ultimate Strength lbs./in.² Average.
31	[illegible]	0.586	39400	34700	37400	66700	61100	64330
2	[illegible]	.614	41500	41200	41350	61000	58500	59750
16	½	.1964	40600	37000	39670	60300	55000	57800
8	[illegible]	.3755	38600	35100	37200	58200	55000	56300
*12	[illegible]		83000	72000	78400	122000	110000	115400

* Tests on No. high carbon steel wire from spirals.

TABLE II.—PROPERTIES OF COLUMNS TESTED.
(All columns 8½ ft. long and 10¼-10½ in. in diameter. 1% spiral reinforcement of No. 7 high carbon steel wire 1-in. pitch.)

Col. No.	Longitudinal Reinforcement.	Long. Reinf.	Total Area Inside of Spiral A, sq. in.	Mix	Age at Test mos.	Kind of Loading
X1	None......	0	82.6	1:1½:3½	2	[illegible]
X2	"	0	84.6		2	repeated and constant
V1	8-⅞-in. round rods....	5.7	84.6		2	repeated.
V2		5.8	82.6		2	constant and repeated
AA1	8-½-in. round rods....	1.9	84.6	[illegible]	[illegible]	central.
AA2		1.9	[illegible]		[illegible]	eccentric. central.
AB1	8-11/16-in. round rods...	[illegible]	[illegible]		5 [illegible]	eccentric. central repeated.
AB2		3.5	84.6		5 2	eccentric. central repeated.
AC1	8-⅞-in. round rods....	[illegible]	82.6		5 [illegible]	eccentric. central.
AC2		5.6	86.6		[illegible]	eccentric. central repeated.
AD1	8-⅞in. round rods	5.7	[illegible]		5	eccentric.
AD2		5.6	[illegible]		5 5	eccentric. eccentric.

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*A paper by Morton O. Withey, University of Wisconsin, Madison, Wis., read before the American Society for Testing Materials, Annual Convention, 1910.

The general characteristics of the columns made are given in Table II. As it was thought desirable to study the properties of the columns within the spiral the galvanized iron molds were fitted very closely to the spiral so that there was only a thin shell of concrete encasing the metal. No account of this shell has been made in any of the computations which follow.

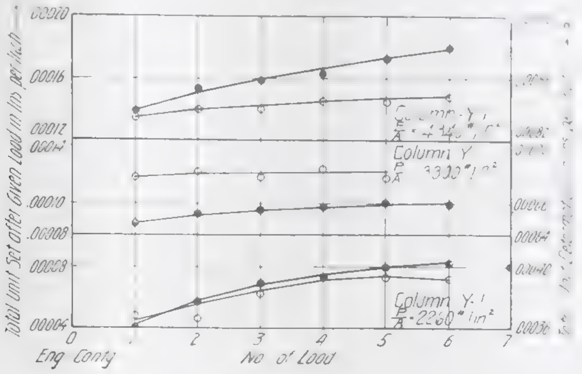

Fig. 3—Set—Repetition and Deformation—Repetition Curves for Column Y1.

In making the columns the longitudinal rods were spaced at equal distances apart and wired to the inner circumference of the spiral to prevent displacement in pouring. The forms with reinforcement inside were then set upon planed cast iron bed plates which were carefully leveled before the columns were poured. One compression cylinder 6 ins. in diameter and 18 ins. long was cast in an iron mold from every batch of concrete. A day or two after pouring, the columns and cylinders were capped with a thin layer of 1:1 mortar. While the mortar was still soft, a cast iron bed plate was placed upon it and carefully leveled, care being taken to see that the depth of the mortar over the ends of the vertical reinforcement was made as small as possible. After 6 days the forms were removed from the specimens, which were then wet twice a day for one week and then sprinkled once a week until tested.

The columns were tested in the 600,000 lb. hydraulic testing machine in the laboratory. The lower head of this machine is rigidly fixed to the piston rod of a hydraulic jack, while the upper head is free to adjust itself to a specimen through a ball and socket joint. The columns were bedded at each end on cast iron plates covered with a thickness of blotting paper.

In making the eccentric loading tests the upper adjustable head was replaced by blocks *A*, *B* and *C*, shown in Fig. 1. These blocks were held in place, while the column was being adjusted in position, by a cradle not shown in the figure. Before putting the column in the machine the vertical line on block *D* was placed in a plane half way between the uprights and top surfaces of blocks *E* and *F* were held approximately horizontal by means of the jacks *J*. The column was then swung in place and plumbed by the jacks. Plate *F* supporting the column was then moved by means of the screws *S* until measurements between the sides of the machine and the column indicated that the desired amount of eccentricity of the load had been

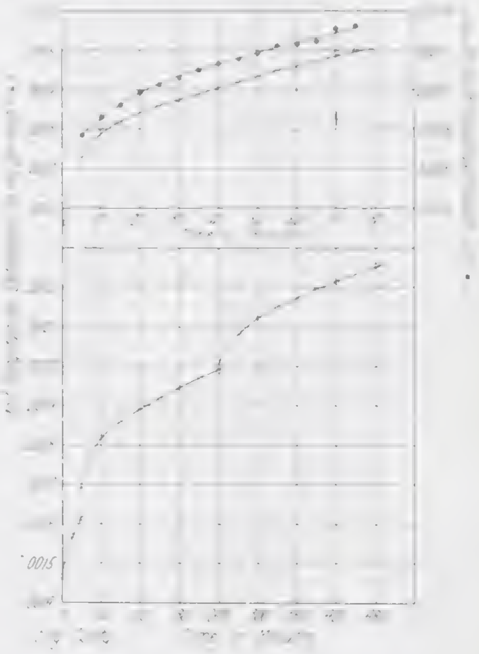

Fig. 4—Deformation Curves for Columns X2 and Y2.

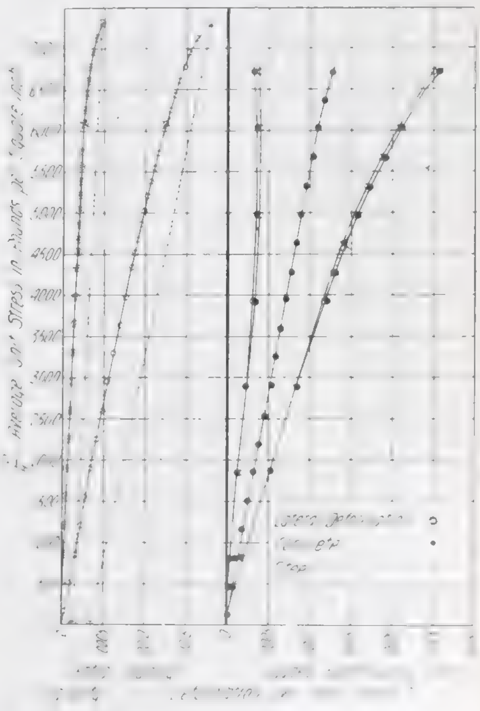

Fig. 5—$\frac{P}{A}$—Deformation Curves for Columns AA2 Centrally and Eccentrically Loaded.

TABLE IV.—DATA ON STRENGTH OF COLUMNS SUBJECTED TO ECCENTRIC LOADINGS.
(Loads are arranged in order of application.)

Col No	% Long. Reinf.	Maximum Applied Load, lbs.	Maximum Value of *P/A* lbs./in.²	Load at Yield Point, lbs.	*P/A* at Yield Point, lbs./in.²	Compressive Strength of Cylinders, lbs./in.²	Eccentricity of Load in ins
1	2	3	4	5	6	7	8
AA1	1.9	617500	7300	464000	5390	6135	0
		540000	6390*	333000	3940		1.0
AA2	1.9	617500	7300	514000	6080	7440	0
		601000	7110*	384000	4640		1.0
AB1	3.6	617500	7480	514000	6230	6340	0
		540000	6545*	335000	4060		1.0
AB2	3.5	617500	7300	514000	6080	6435	0
		594000	7020*	392000	4640		1.0
AC1	5.8	617500	7480	542000	6590	6075	0
		627000	7600	421000	5100		0.5
		590000	7150*	....	....		1.0
AC2	5.6	617500	7140	515000	5940	5855	0
		595000	6890*	351000	4060		1.0
AD1	5.7	157000	1850	....	...	6795	0
		"	"	....			0.5
		"	"	....			1.0
		"	"	....			1.5
		420000	4965*	244000	2890		2.0
AD2	5.6	275000	3180	....		6670	0
		"	"	....			0.5
		"	"	....			1.0
		"	"	....			1.5
		"	"	246000	2840		2.0
		481000	5560*	275000	3180		1.5

* Failed.

TABLE V.—STRESSES AT YIELD POINT AND ELASTIC PROPERTIES OF COLUMNS AA1 TO AD2

Col. No.	% Long. Reinf.	At *P/A*=2000 lbs./in.² Values of			Compressive Strength of Cylinders, lbs./in.²	Stresses at Yield Point, lbs./in.²		Eccentricity of Load, ins.
		E lbs./in.²	$n=\frac{Es}{Ec}$	*u*		Long. Steel.	Concrete.	
1	2	3	4	5	6	7	8	9
AA1	1.9	5800000	5.6	0.20	6135	32000	4890	0
						42000		1.0
AA2	1.9	5800000	5.6	.18	7440	37500	[illegible]	0
						42000		1.0
AB1	3.6	6200000	5.7	.21	6340	35400	5150	0
						37500		1.0
AB2	3.5	5800000	6.1	.16	6435	[illegible]	5030	0
						40200		1.0
AC1	5.8	6100000	6.4	.16	6075	36000	4760	0
						35600		0.5
						40200		1.0
AC2	5.6	6200000	6.4	.19	5835	32200	[illegible]	0
						34200		1.0
AD1	5.7	5700000	7.1	.14	6795			0
						33300		2.0
AD2	5.6	5200000	8.0	.13	6670			0
						34800		2.0
						34800		1.5

* Values in Division 7 are computed from deformation on most stressed

made. After adjusting the eccentricity the piston head of the machine was raised until the column just supported the top blocks *A*, *B* and *C*. These blocks were then adjusted so that the line on *A* was coplanar with the line on *D*; a small load was applied and the jacks removed. In this manner the load was always applied axially with respect to the machine while its eccentricity with respect to the column could be readily changed at the will of the operator.

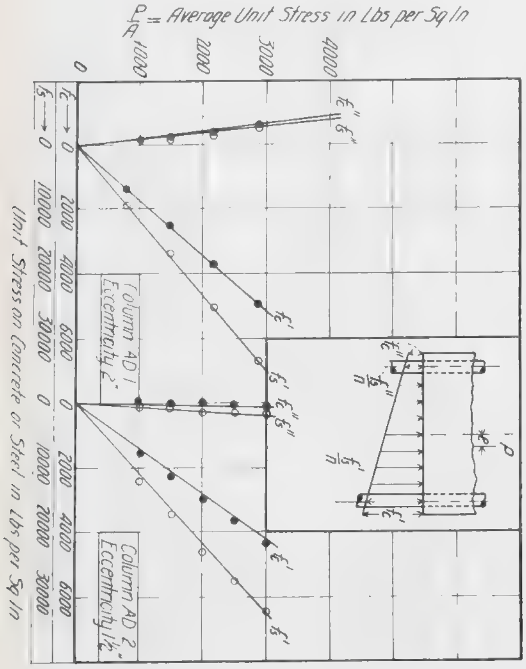

Fig. 7—Comparison of Theoretical and Actual Stresses in Eccentric Loading Tests.

Stresses were applied at the rate of approximately 500 lbs. per sq. in. per minute. The increments of load differed with the kind of column and the method of testing. In general, when the load was being progressively increased the increments were either 15,000 lbs. or 30,000 lbs. Measurements of longitudinal and lateral deformations were made with copper wire dial compressometers and collar device, respectively. In the time loading tests changes of temperature in the room probably affected the results but from the small change in thermometer readings and the fact that the wire was insulated it does not seem necessary to make any correction in the dial readings. When eccentric loading tests were being made especial care was taken to note the positions of all wires with reference to the column as this is of vital importance if an accurate computation of the deformations at various points in the cross-section of the column is to be obtained.

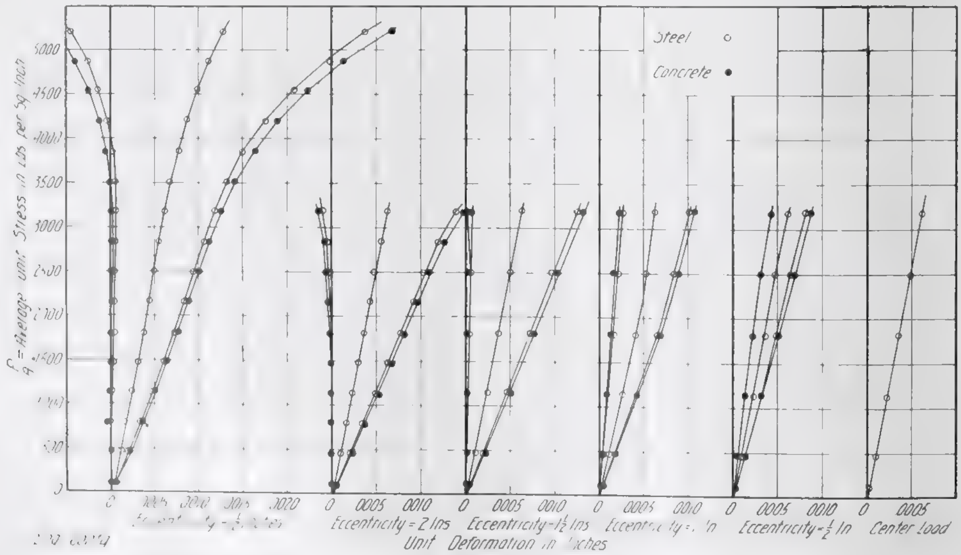

Fig. 6—$\frac{P}{A}$— Deformation Curve for Column AD2 Eccentrically Loaded.

Table III contains data on strength of columns subjected to repeated or time loadings. The main tests under these conditions were made on columns *X1*, *X2*, *Y1* and *Y2*. The other columns were not built to be tested in this way but owing to their high strength it was found impossible to crush them in the ordinary manner so repetition and time loadings were resorted to as shown. They are placed in this table to show briefly how they were tested before being subjected to eccentric loadings. Stresses in steel were obtained by multiplying the deformations per unit of length by 30,000,000 lbs. per sq. in., the assumed modulus for the steel.

Figure 2 shows several sets of curves drawn with number of repetitions and deformations or sets as variables for columns *X1* and *X2*.

The value of $\frac{P}{A}$ which was repeated is indicated in each portion of the figures. In Fig. 3 similar sets of curves have been drawn for Column Y1. Figure 4 contains deformation time curves for columns *X2* and *Y2* for values of $\frac{P}{A}$ 4,510 lbs. and 6,230 lbs. per sq. in., respectively. The breaks in the continuity of the curve for *X2* are due to the fact that the loading was stopped twice as indicated in division 3 of Table III. After the first application for 30 minutes the load was released and reapplied two days later for a period of 3½ hours. It was then released for 1½ hours and applied again for 4 hours. Subsequently the column was continuously loaded until it failed at the load indicated in division 7 of the table.

As it was found impossible to break columns *AA1* to *AD2* by a central loading the rig shown by Fig. 1 was employed to test them under loadings eccentrically applied. Data on the strength of the columns thus tested are given in Table IV. In selecting the values given for the yield point the determining factors were the stresses at which the stress deformation curves showed a perceptible change of curvature, the yield point of the longitudinal steel, and the appearance of cracks along the spacing straps on the spiral.

Under eccentric loadings the values of $\frac{P}{A}$ at yield point were determined from evidence furnished by fibres of concrete and longitudinal steel nearest the application point of the load.

The yield point of spirally reinforced concrete columns becomes more indistinct and less well defined as the stiffness and strength of the concrete employed increases. This is due both to the decrease in the rate of curvature of the stress deformation curve of the concrete and the decrease in the value of *n*. It is evident from Table V that the compressive strength of this rich concrete was not developed at the same time as the yield point of the longitudinal mild steel. Consequently the yield point of such columns as these is chiefly dependent upon the latter when mild steel is used.

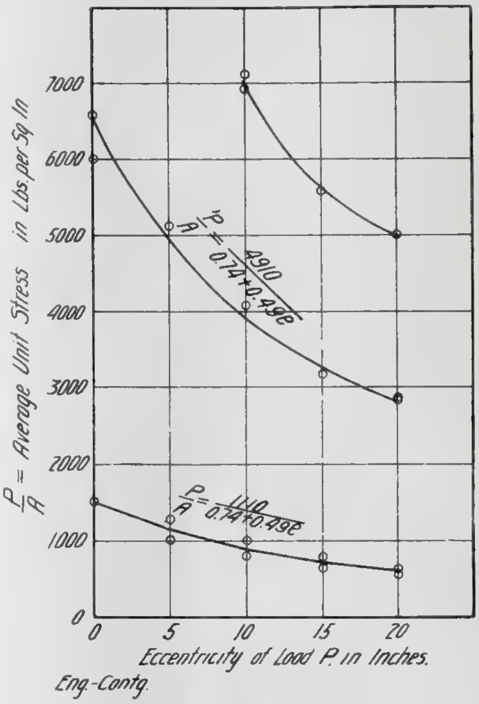

Fig. 8—Average Unit Stress Eccentricity Curves.

From division 3 of Table V a comparison or estimation of the stiffness of columns *AA1* to *AD2* may be made. The values of *n* tabulated in division 4 of this table show that a large amount of longitudinal steel is not advantageous theoretically, at least, in columns made of such rich concrete or mortar. Poissons ratio or the factor of lateral expansion μ, is considerably higher for this grade of mortar than for the 1:2:4 concrete tested at this institution last year. However, the proportionate amount of additional strength furnished by the spiral in these strong mortar columns is not materially increased because a decrease in the value of *n* counteracts the effect of the increase in μ.

Figure 5 shows the curves between $\frac{P}{A}$ and unit deformations for both central and eccentric loadings for column *AA2*. The crosses on the curves correspond with the stresses at the yield point. This column contained the strongest mortar of any tested and its $\frac{P}{A}$ deformation curves show how remarkably stiff these columns were. Passing from left to right, the five sets of curves drawn for eccentric loadings represent the $\frac{P}{A}$ deformation curves for the fibre of concrete farthest from the load, the center fibre of steel rod farthest from the load, the fibres at the axis of the column, the center fibre of steel rod nearest load, and the outer fibre of concrete nearest load.

Figure 6 contains the $\frac{P}{A}$ deformation curves for column *AD2*, in testing which four different eccentricities were tried. Similar curves were obtained from tests made on column *AD1*.

These eccentric loading tests afford an opportunity to compare theoretical stresses obtained by a modification of the formula $S = \frac{P}{A} \pm \frac{Mc}{I}$ with the stresses calculated from deformations. In using the above formula proper allowance must be made for the steel in computing *A* and *I*. As used it becomes

$$f = \frac{P}{A(1-p(1-n))} \pm \frac{Pec}{pA(n-1)\frac{r_s^2}{2} + \frac{Ar^2}{4}}$$

In this formula f = stress in concrete as f'_c, f_c'' corresponding to the distance c and the sign used between the members of the equation P = load, A = total area inside of spiral, p = longitudinal steel ratio, n = ratio of modulus of elasticity of steel to that of concrete, e = eccentricity of load P, r_s = radius of centers of longitudinal steel bars, r = radius of spiral. Stresses in the steel were computed by using the proper value of c and multiplying f by n. The formula assumes that the longitudinal steel is in the form of a thin pipe and makes no allowance for bending. However, the errors thus introduced are small for these columns.

Figure 7 shows the theoretical curves and the plotted points calculated from deformations for columns *AD1* and *AD2* when the eccentricities were 2 ins. and 1½ ins., respectively. The single primed letters refer to stresses on the outer fibres of concrete or center fibre of steel rod nearest the load and the double primed letters to stresses on the corresponding fibres farthest from the load. In computing the values obtained from deformations the same n was used as in obtaining the theoretical line. This value of n in all cases was computed from the stress deformation curve from a central loading of the column considered.

The above formula may be written:

$$f_c = \frac{P}{A}(K \pm em)$$

in which K and n are constants. Using the + sign, and average values for K and m it becomes for these columns

$$f_c = \frac{P}{A}(.74 + .49e) \text{ or } \frac{P}{A} = \frac{f_c}{.74 + .49e}$$

which is the equation of a hyperbola when $\frac{P}{A}$ and e are variables.

In Fig. 8 the quantities $\frac{P}{A}$ have been calculated with constant values of fc on the most stressed concrete fibre and for different eccentricities. The two lower curves represent theoretical curves derived from the last equation while the points represent values derived from deformations. The curves refer to values obtained from columns *AC* and *AD*. The lower curve is for columns *AD1* and *AD2* only. The upper curve has been drawn through the plotted values of $\frac{P}{A}$ at the ultimate load and, as will be noted, is quite similar to the theoretical curves drawn.

Some of the conclusions which appear to follow from these tests are noted in the succeeding paragraphs.

(1.) The remarkably great strength and stiffness of many of the columns forcibly emphasizes the advantages of rich mixtures. In such columns centrally loaded, large percentages of either longitudinal or spiral reinforcement do not seem necessary on account of the small value of n and the high cost of steel compared with the cost of cement. Longitudinal steel in larger amounts is of more advantage, however, in eccentrically loaded columns especially in cases where tension may exist on one side of the column.

(2.) The amount of data presented on repeated or time loadings is far too little to warrant drawing definite conclusions as to the limiting stress for repeated loadings which will hold true for all kinds of columns and for an infinite number of repetitions or for a prolonged loading. However, it does appear from the tables and figures that there was practically no increase in set or deformation after a few repetitions of loads equal to 40 to 50 per cent of the yield points of the columns tested.

(3.) The results also plainly indicate that there is considerable additional strength and toughness afforded by the spiral after the yield point of the longitudinal steel has been passed. That all of this additional strength may not be permanent is also suggested by the slope of the deformation time curves for columns *X2* and *Y2*.

(4.) The close agreement between theoretical values and values derived from test data shows that the formula $S = \frac{P}{A} \pm \frac{Mc}{I}$, commonly used in designing short homogeneous columns eccentrically loaded may be applied to reinforced concrete columns providing suitable allowance be made for the steel.

Investigations on Waterproofing Concrete By the American Society For Testing Materials.

The Committee on Waterproofing, of the American Society for Testing Materials, has continued through Sub-committees A and B its investigations reported upon a year ago (ENGINEERING-CONTRACTING, Aug. 11, 1909) on waterproofing concrete, and at the convention of the Society, held in June, 1910, reported as follows:

Referring to our report to the Society's 1909 Convention, the past year's work of Sub-committee A, in charge of the investigation of waterproofing methods through the incorporation of foreign substances in mortars and concretes, has principally consisted in the careful study of previously obtained test results, on which were based the broad conclusions previously intimated, and these have been reinforced by test results at longer periods than were originally available, and further strengthened by the repetition of certain investigations to check original findings. While a large number of tests on a great many waterproofing compounds, between 40 and 50 in number, have been separately made by several of the Committee, this number does not include all the materials exploited from time to time, for they are of mushroom growth. The complete tabulation of tests on those examined is not herein presented, nor considered necessary, since it is very doubtful whether the general personnel of the Society would be interested otherwise than in the deductions that the Committee now presents in line with all previous reports.

While it is admitted that laboratory methods for the study of this class of materials are necessarily somewhat different from their practical application on a large scale, and that the manufacturers might question positive conclusions from the former, as not governing in every case in field operations, due to the fact that the results of different laboratory examinations are not absolutely concordant, several facts are, in the Committee's opinion, established from such examinations:

First—That the general effect of these incorporated compounds is to reduce the tensile strength of mortars. This does not refer to the admitted variation in strength of normal mortars at different periods under the standard method of testing the tension, and which is not found to be the case as invariably under compression, in such data as are available, but the loss of strength does refer to a general strength reduction in mortars carrying these incorporated waterproofing admixtures when compared with standard untreated mortars.

Second—That resistance to water penetration in mortars and concretes, being essentially dependent upon such materials' density, such a condition can so easily be assured through proper proportioning of the normal ingredients, all other conditions of handling and placing being assured, that no addition of any foreign substance is absolutely necessary.

Further, that when, through lack of proper volumetric proportioning in the aggregate, sand in mortar or sand and stone in concrete, some extraneous material is needed to insure void filling, this can be accomplished by the use of natural materials, such as colloidal clays or hydrated limes, and practically perfect results obtained, without resorting to the use of proprietary materials, whose general effect, as stated above, is to reduce strength, with no marked improvement, as a rule, in water-resisting characteristics. Investigations to date do not show that the effect of any of the admixtures is other than mechanical.

Committee D-8, therefore, concludes that it has accomplished for this class of materials, incorporated admixtures, all that is possible under present laboratory examination conditions. Had funds and time been available to inaugurate extensive tests under field conditions, some apparent value shown in individual cases, two or three out of the 40 or 50 examined in the laboratories, particularly at early stages, might have been emphasized under field conditions, either of crude workmanship with good natural materials, or the best workmanship with poor natural materials. But, as it is an admitted fact, as stated above, that theoretically waterproof mortars and concretes can be secured by proper proportioning, proper mixing and proper handling of their ingredients, and this has been practically accomplished repeatedly under proper organization and supervision without the use of any admixtures of specially claimed waterproofing materials, and in any case can be secured, even with poor natural materials, by the addition of other similar natural material, it appears that the claim of most of the proprietary materials examined to procure waterproofing characteristics to mortars and concretes cannot be substantiated by any laboratory tests so far developed

Sub-Committee B, in charge of the investigation of waterproofing methods through the use of bituminous materials applied directly to the surface to be treated, or through cloth or similar mediums, has, as stated last year, inaugurated a series of tests there outlined in method. The concrete tanks, as described in last year's report, were protected by the various representatives of six different proprietary materials or methods of protective coating, and thereafter subjected to the influence of four different liquids as previously described. The tanks have been regularly inspected and records kept. Several have failed, but as final examination has not yet been made, no report other than this can be presented at the present time.

At the close of work on June 27, a total of 500,000 cu. yds. of concrete had been placed in the Gatun Locks of the Panama Canal. Concrete work was started on the locks on Aug. 1, 1909. Altogether the concrete work has been in progress for 267 days. Altogether there will be about 2,000,000 cu. yds. of concrete in the Gatun Locks.

Results of Tests of Second Set of Six Model Arches for the Medina Aqueduct, New York Barge Canal.

The results of the tests of the final six of the twelve model arches tested by the engineers of the New York Barge Canal in designing the 285-ft. arch aqueduct at Medina have been made public. The results of the tests of the first set of six arches were published in ENGINEERING-CONTRACTING for March 16, 1910, when the testing apparatus, model arches and methods of conducting the tests were described. The second series of tests are described in a paper by Wm. R. Davis and Russell S. Greenman before the American Society for Testing Materials and will appear in the Barge Canal Bulletin.

TABLE I.—RESULTS OF TESTS OF MODEL ARCHES.
(Arches, 7 ft. 11 ins. clear span, 2 ins. thick at crown.)

Arch Number.	Composition and Material.	Age Days.	Items.	Loads in pounds P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	Total load on arch in lbs.	Load on arch in lbs. per sq. ft.	Maximum Stresses, in pounds per square inch. Top.	Bottom.	Top.	Bottom.	Compressive strength of 6-in. cubes in lbs. per sq. in.
			Loads exerted on arch by weight of arch, plates, levers, etc.	256	240	[illegible]	217	211	207	204	203							
7	1 Portland [illegible] sand	[illegible]	Weight on levers at failure	80	85	76	73	73	63	63	62	60,026	10,700	a 3,032	a 1,362	b—1,195	b—2,905	2,330
			Total load on arch	4,256	4,490	4,025	3,867	3,861	3,357	3,354	2,803							
8	1-Portland [illegible] sand	[illegible]	Weight on levers at failure	128	128	102	91	82	56	83	101	80,626	14,380	c—5,852	c+86	d—2,314	d—2,974	1,730
			Total load on arch	6,656	6,640	5,325	4,767	4,311	3,007	4,354	5,253							
9	1-Portland [illegible] river sand, [illegible]	[illegible]	Weight on levers at failure	88	92	84	80	80	69	69	57	65,526	11,700	a—3,297	a—1,492	b—1,298	b—3,176	2,160
			Total load on arch	4,656	4,840	4,425	4,217	4,211	3,657	3,654	3,053							
10	1 Portland [illegible]	[illegible]	Weight on levers at failure	76	56	54	51	51	44	37	31	41,526	7,420	a—2,121	a—915	b—674	b—2,117	1,690
			Total load on arch	4,056	3,040	2,925	2,767	2,761	2,407	2,054	1,753							
11	1 Portland [illegible]	[illegible]	Weight on levers at failure	64	56	54	58	51	44	44	36	44,226	7,880	e—2,249	e—883	b—821	b—2,162	.
			Total load on arch	3,456	3,040	2,925	3,117	2,761	2,407	2,404	2,003							
12	Portland [illegible] limestone	[illegible]	Weight on levers at failure	72	72	57	51	46	34	46	60	47,326	8,450	c—3,539	c+87	d—1,546	d—1,596	
			Total load on arch	3,856	3,840	3,075	2,767	2,511	1,907	2,504	3,203							

[illegible] a. At P_7. b. Between P_1 and P_2. c. At crown. d. At springing. e. At P_6.

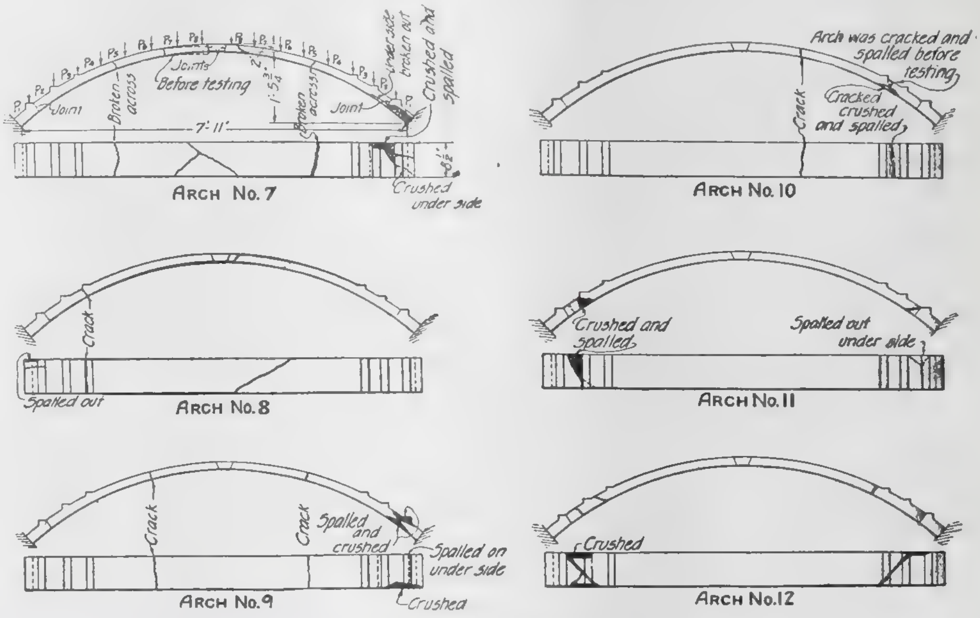

Fig. 1.—Method of Failure of Arches.

Fig. 1—Diagrams Showing Manner of Failure of Model Test Arches.

General Description.—The six models tested are shown by Fig. 1, which shows the kinds of failure. Three kinds of materials were used in molding the arches: for two a 1:2 mortar; for two more, 1:2:4 gravel concrete, and for the final two, 1:2:4 limestone concrete. Two conditions of loading were employed. In one the line of pressure was kept as nearly as possible to the axis throughout the arch; in the other the line of pressure was thrown near the upper middle third at the crown but kept near the axis throughout the haunches. The following is a detailed description of the tests:

Arch No. 7 was so loaded that the line of pressure through the rib was near the axis. While the levers were being placed on this arch, a load was accidentally applied to one of them, causing the rib to shear along one of the crown joints and producing a "fault" of about 1/16-in.; a crack was also opened in the right haunch. However, when tested it failed by crushing at the springing.

Arch No. 8 was loaded so that the line of pressure was near the upper edge of the middle third at the crown, and near the axis throughout the remainder of the rib. This arch was twice very heavily loaded. The first time the load applied was so great that the I-beam of the testing apparatus buckled and allowed the levers to deflect so much that their ratio became affected. However, the loads were left on for over an hour and during all of this time certain portions of the arch were stressed more than 5,000 lbs. per sq. in. Additional bracing was made for the apparatus and the arch was retested. In this test, after the stress had reached about 5,800 lbs., the I-beam again gave way and the arch was twisted sidewise and collapsed. Up to the time the I-beam twisted no signs of failure were apparent in the arch.

Arch No. 9 was loaded similarly to arch No. 7, and although the stress was theoretically slight-

TABLE II.—RESULTS OF TESTS OF PRISMS AND CUBES.
(Prisms, 6x6x36 ins. Cubes, 6x6x6 ins. Composition: 1 part American Portland cement, 2 parts Troy sand, 4 parts ¾-in. limestone. Specimens about 21 days old.)

Specimen Number. First batch.	Second batch.	Size, ins.	Description.	How Loaded.	Load at incipient failure.	Load at ultimate failure.	Stress lbs. per sq. in. at ultimate failure.	Av. stress lbs. per sq. in. at ultimate failure.
1		6x6x6	....	Uniformly	76,400	110,500	3,069	3,326
	13	Do.		Do	129,000	129,000	3,583	
2		Do.	....	Concentrated centrally	97,500	100,000	2,777	2,762
	14	Do.	....	Do	96,000	98,925	2,747	
		6x6x36	Plain sides	Do	79,960	79,960	2,221	2,171
	15	Do.	Do	Do	76,380	76,380	2,121	
		Do.	Do	Uniformly	70,000	74,500	2,069	2,178
	16	Do.	Do	Do	82,360	82,360	2,287	
		Do.	Do	Eccentrically, 1 in.	53,460	53,460	2,970	2,852
	17	Do.	Do	Do	49,220	49,220	2,734	
6		Do.	Sides grooved 1-in. deep	Uniformly	72,640	72,640	2,512	2,196
		Do.	at 45	Do	67,700	67,700	1,880	
		Do.	Do	Concentrated centrally	69,760	69,760	2,414	2,197
		Do.	Do	Do	71,340	71,340	1,981	
		Do.	Sides grooved 2-in. deep	Uniformly	44,290	44,290	1,942	1,887
		Do.	at 45°	Do	41,510	41,510	1,832	
		Do.	Do	Concentrated centrally	40,090	40,090	1,765	1,945
		Do.	Do	Do	48,240	48,240	2,126	
10		Do.	Reinforced with four ½-in. square bars of low elastic limit	Uniformly	80,730	80,730	2,242	2,458
		Do.		Do	88,740	88,740	2,465	
11		Do.		Do	83,130	83,130	2,309	
		Do.		Do	101,390	101,390	2,816	
		Do.	Reinforced with four ½-in. square bars of high elastic limit	Uniformly	85,670	85,670	2,379	2,491
	23	Do.		Do	97,420	97,420	2,706	
		Do.		Do	83,820	83,820	2,328	
		Do.		Do	78,400	78,400	2,178	
		Do.		Do	103,150	103,150	2,864	
		6x6x6	....	Uniformly between concrete blocks	107,560	114,000	3,167	2,968
		Do.			85,000	99,700	2,769	
		Do.		Do	87,500	112,490	3,125	2,940
		Do.	....	Do	90,600	99,200	2,755	

ly greater near the crown, it failed by crushing near the springing.

Arch No. 10 was twice knocked over and broken into pieces and then replaced. The contact in a crack in the right haunch was very poor, so that the arch began to spall and crumble at that point soon after the first loads were applied. This crumbling continued until the arch finally gave way at that point. This test is of little value, except that it is interesting to note how great a stress an arch will take even after being so abused.

Arch No. 11 failed by revolving backwards, showing that the needles may have become inclined, thus causing a sidewise horizontal thrust.

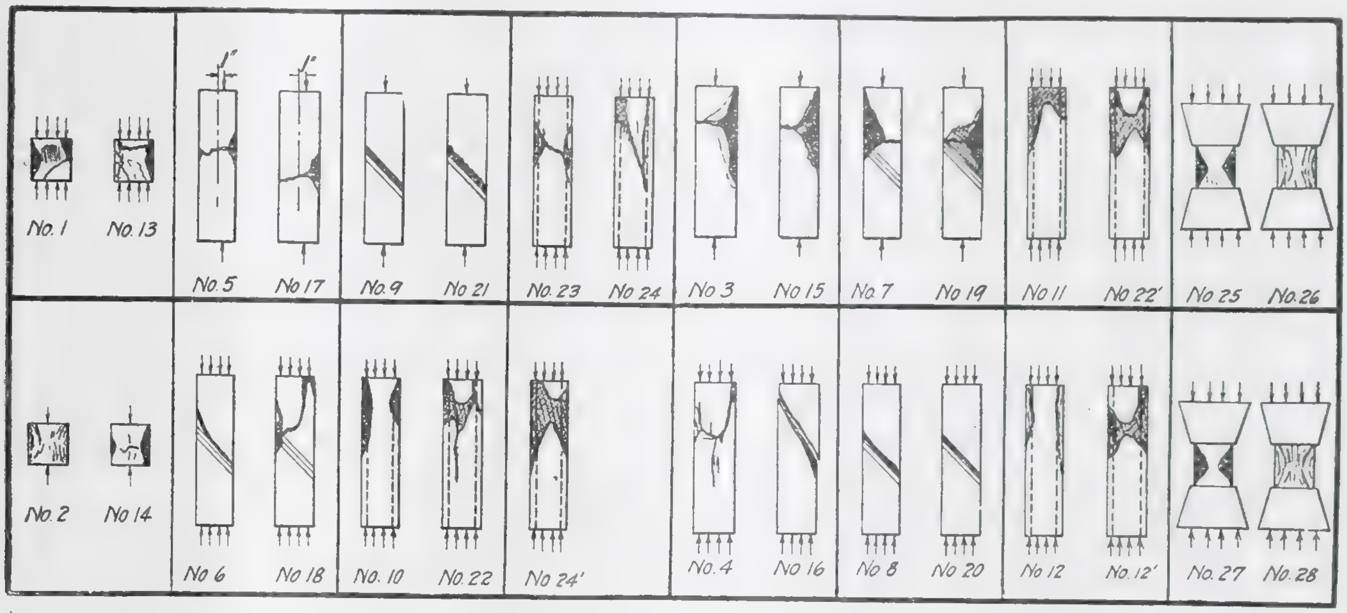

Fig. 2—Diagrams Showing Manner of Failure of Concrete Prisms and Cubes.

The concrete of this arch and of arch No. 12 apparently was not very good. The proportion of cement was not large enough to thoroughly fill the voids. No cubes were made of this material so that it was not possible to make a comparison of the strength of this material in cube form.

Arch No. 12 failed by crushing near the springing. The failure was comparatively slow.

Table I gives the results of the tests. The computed stresses are based on the assumption that the stresses over a section are distributed according to a straight line law. It is noted that all the arches of this set as well as the six arches of the first set failed near the springing line, although in most cases higher stresses theoretically existed at the crown. In arches No. 8 and No. 12, the loading was purposely made such that the theoretical stress on the extreme fiber at the crown was much greater than at any other point, yet these arches like the others failed near the springing lines. The conclusions drawn from the results of the arch tests are as follows:

(1) That material in an arch when the line of pressure follows the axis will take at least as high a stress as the same material in cube form uniformly stressed.

(2) That the allowable unit working stress in bending in an arch may safely be much greater than the allowable unit stress for columns.

(3) That an arch of theoretically uniform strength throughout will fail at the springing, and that the unit working stresses for the springing should be smaller than those for the crown, perhaps at least 25 per cent smaller.

(4) That the allowable unit working stress on the extreme fiber, when the line of pressure passes thrhough the edge of the middle-third, may be 30 per cent higher than the corresponding stress when the line of pressure coincides with the axis.

Cube Tests.—Cubes 6x6x6 ins. and prisms 6x6x36 ins. were made from the same concrete used in the test arches and were tested by applying the load (1) uniformly over the whole surface, (2) concentrated on a single line by knife edge, (3) uniformly between [illegible] The sketches of Fig. 2 show the methods of applying the loads and the manner of failure. Table II gives the results of the cube tests. The conclusions from the results of the cube tests are:

(1) The highest resistance is obtained from cubes uniformly loaded.

(2) The apparent ultimate resistance of the most heavily loaded fiber is 31 per cent greater for prisms having an eccentricity of 1 in. (center of pressure acting at edge of middle third) than for prisms centrally loaded. (This conclusion is based on assumed straight line distribution of stress.)

(3) Failure of prisms by shear in advance of failure by direct compression is not to be expected.

Progress Report on the Long Time Tests of Concrete in Sea Water by the Scandinavian Association of Portland Cement Manufacturers.[*]

Among the documents dealing with the work of the Congress, a pamphlet[†] has been handed in entitled "Cement in Sea-Water," giving information upon a series of tests which we commenced about ten years ago with a view to ascertain the principal causes which occasionally led to the deterioration of concrete work erected in the sea. The pamphlet has been presented to you by the Scandinavian Association of Portland Cement Manufacturers, and you will find therein tabular statements and diagrams showing the results so far obtained. The limited time at my disposal does not allow me to enter into many details, and I have given an abstract of the main points in this paper.

The cost of the tests in question are borne by the Association, and the tests are being carried out in connection with the Norwegian and Danish Hydraulic Works authorities and staff, whose assistance has proved of great importance and value. The program was drawn up at the time by a committee, the members of which are Messrs. Budi, Lund (since deceased), Morris-Haslinger, Wallin, engineers who were joined later by Mr. Kjellstrom, with myself as chairman, and entrusted with the supervision of the work as mapped out in the program.

I shall deal here with the pamphlet above alluded to, by taking seriatim the various points and enlarging upon them, as follows:

(a) The tests have been so carried out that the preliminary and the concluding operations only took place in the laboratory, a fact which enhances their practical value.

The tests in question may be said to be twofold, in that they apply to cubes of mortar, about 3,500 in number, and to concrete blocks, which number over 100 2-3 cu. meters (23.5 cu. ft.) in volume. The blocks were made on the sea-coast off which they were to be deposited—i. e., at Thyboron, at the entrance of the Limfjord into the North Sea, near the town of Lemvig. The cubes of mortar have the usual surface of 50 sq. cm. (7.75 sq. ins.) to enable them to be broken in the machine in the laboratory; they were made in the laboratory. The committee acknowledge with thanks the assistance they received in this matter from the State Laboratory, Copenhagen.

From the laboratory, the test specimens were sent, for exposure to the action of sea-water and climatic conditions, to the Vardo harbor at the extreme northeast point of Norway; the Esbjerg harbor at the extreme southwestern point of Denmark, and to Degerhamn harbor, on Oland island, near the southeastern point of Sweden, in the Baltic Sea. At Degerhamn care was taken that the test specimens should not be exposed to frost, by placing them sufficiently low under water level; the sea-water at that point has but a low percentage of salt (½ per cent).

At Vardo and Esbjerg a series of specimens was similarily placed below the lowest sea level. A second series was placed at the average tide level, thus being exposed twice every day to climatic effects, especially to frost and the summer heat, which alternate with the sea-water action; the water at these points contains 3½ per cent of salt. The specimens are thus caused to thaw twice a day during the winter months.

The tides at Vardo have a height of 4 m. (13 ft.) and at Esbjerg a height of 1.5 m. (5 ft.). The average temperature at both harbors, and these may be considered as ice-free, is 7½° C. (45° F.), at Esbjerg and about 0° C. (32° F.) at Vardo; these are the temperatures both of the water and of the atmosphere.

From what we have already said, it will be seen that specimens of mortar were deposited for test in five different spots, each series containing about 700 cubes.

Long before our tests were commenced it had been noticed that concrete work had to a large extent been deteriorated at Esbjerg and Vardo. The sets of specimens placed at both these spots were exposed to actions so pronounced and so different as regards their likely effect, that it was hoped they would yield most precise results. With reference to Degerhamn, where the climate is equal to that of Esbjerg, a very slight effect only was anticipated, the specimens being at a good depth in sea-water having but a low percentage of salt.

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[*] Report presented by A. Poulsen, Chief Engineer, Danish State Hydraulic Works, to the International Association for Testing Materials in 1909.

[†] Abstract of the pamphlet "Cement in Sea-Water." Report on the trials commenced in 1896 on the recommendation of the Society of Scandinavian Portland Cement Manufacturers by A. Poulsen, Copenhagen. E. & F. N. Spon, London.

Concrete tests of a similar nature have also been made at a place where the use of concrete had given unfavorable results. The concrete blocks are there placed in a groin which forms part of the dike on the western coast of Jutland, pier 59. The average temperature of the water and the atmosphere is exactly the same as that of Esbjerg, about 7½° C. (45° F.). The tides, however, are less pronounced, being 0.5 m. (19 ins.) only.

(b) The cases built to take the test specimens have given complete satisfaction; their object was to protect the specimens against becoming damaged by shock, while allowing all physical actions to have full play.

The results aimed at might easily have been compromised by the means taken to carry out the tests; fortunately, the success of the device was complete. Each case contained 77 cubes, and we were able to lower the specimens and to raise them out of the water at the expiration of the time appointed—i. e., at the expiration of 3 and 6 months, 1, 2, 4, 6 and 10 years—without the loss of a single cube, although some were cracked and others had lost their shape completely.

(c) The marking of the test specimens by colored glass in the shape of beads, or fragments of glass, to indicate composition and class of cement, has been entirely successful.

We followed this method of marking by glass heads not only for the blocks, but also for the cubes of mortar. Some specimens could not have been recognized had any other method of marking been used, whereas their origin was most accurately traced by means of the beads.

For the mortar specimens, a class of Portland cement was selected from each of the three Scandinavian countries: Denmark, Norway and Sweden. For comparison, a British Portland cement was also taken, and also a French hydraulic lime. Test pieces were made, using each of these classes of cement in the following proportions: 1:3, 1:2 1:1 and 1:0 (pure cement) four cubes of each proportions using "normal sand" of Bornholm. A series was also made using sand from the Thyboron sand-hill and Aalborg cement.

We also carried out a few trials with additions to the Portland cement and with other mortars, including: (1) trass, (2) infusorial earth, (3) a silicate with an addition of "Lomma," (4) slag cement, (5) a special "Dania" cement, (6) a "sand cement," (7) Kinniple concrete, (8) hollow "Monier" blocks, (9) santorin* and cement, (10) santorin and lime, (11) pozzolana and cement, and (12) pozzolana and lime.

Besides these blocks formed of different kinds of cement, we made blocks 2x12 ins. in the proportions of 1:3 and 1:2, using one and the same cement and sands of three different degrees of fineness mixed together.

These blocks were all manufactured, using fine sand-hill sand and shingle of the Thyboron seashore, the mortars having the proportions 1:3, 1:2 and 1:1, also in some cases 1:2:5, the proportion between the shingle and the mortar corresponding for all these mortars to that of the mixture 1:2 with 4 of single.

The total number of blocks thus exceeded 100.

(d) When the program of the tests was drafted the dates at which the results were to be ascertained should have been fixed at longer intervals during the first years, so as to be able, later on, to count upon a larger number of results.

It has been stated above, under (b), that the raising of the cases was timed to take place ofter 3 and 6 months, 1 and 2 years, etc. A period of ten years has elapsed, and there are still at each place two cases, which are to be raised after a total period of 15 and 20 years. We may state for the guidance of those engineers who may wish to carry out similar tests that in this respect a better arrangement could have been made.

(e) The chemical actions of salt-water are not alone able to deteriorate mortar; Portland cement appears to be almost intact.

Among the actions to which the cubes of mortar are exposed, the chemical action should have been most clearly shown by a comparison between the results of the exposure below the sea level of Degerhamn and those of the exposure in deep water at Esbjerg, there being between the two places only a difference in the percentage of salt in the water 3½ per cent and ½ per cent.

Mr. Czarnomsky has stated that in the Black and Caspian seas salt has a marked effect on concrete. The percentage of salt in both the latter seas, and in the temperature of the atmosphere especially, are much higher than in Scandinavia. At those two places, therefore, the salt has a more marked effect, while on the Scandinavian coasts other actions, especially frost, prevail.

(f) On the other hand, the Teil lime was found to be subject to great chemical variations. The analysis at Vardo tends to show that a mechanical action may have hastened a simultaneous chemical decomposition.

As is well known, the Le Teil lime has acquired a great renown in the French Mediterranean ports; it is there considered quite satisfactory and is almost exclusively used for constructions in the sea. The same for Italy in regard to pozzolana and lime mortars, and this notwithstanding the high percentage of salt in the Mediterranean waters, 4 per cent. Although these materials acquire after an exposure of about 20 years to the action of the sea a consistency similar to that of chalk, they are used with advantage.

In our more northern countries, Teil lime deteriorates relatively quick, and, besides, a chemical effect has been noted; this is explained by a primary action of frost which by causing cracks on the surface, accelerates and increases the chemical action. Portland cements which acquire more rapidly a sufficiently high resistance to better withstand the mechanical effect of frost, appear for this reason to be, comparatively at all events, free from chemical actions.

In some cases, a granite facing with a grouting carefully maintained might act as a protection.

The poorer kinds of mortar were not sufficiently sheltered. They cracked and a white mass issued from the cracks. In some instances we found what are styled "tulipes de beton," strange formations which, however, do not proceed from the test specimens, but from a groin of the dike to the north of Thyboron.

(g) The deterioration of the mortar tests specimens was due mostly to the mechanical effect of frost.

In comparing the test specimens from Vardo with those from Esbjerg, and specially those that were placed at the average sea level, a very great difference is found, although the water at both these harbors contains practically the same proportion of salt, 3.5 per cent. There is, however, a considerable difference in the climate of these two harbors, situated at a distance from each other, the average temperature of the atmosphere and of the water being 0° C. (32° F.) at one place and 7½° C. (45° F.) at the other.

We have here the most important result of our tests—i. e., the predominating effect of a cold climate. While at Esbjerg and at Degerhamn the test specimens kept pretty satisfactory for ten years, only a few from Vardo have revealed a high resistance in the crushing test carried out at the laboratory, a further proof of the supposition that the disintegration of the mortar cubes was not due to an internal chemical action, but to a mechanical effect on the surface.

(h) The deterioration of concrete blocks is also explained by climatic effects.

The blocks have been placed at Thyboron only; no comparison is, therefore, possible. It is hardly possible, either, though an attempt has been made to do so, to note the chemical results produced. The analyses have shown, both in regard to the blocks and mortar cubes, that the amount of oxide has decreased. In certain instances, especially in the Teil lime, the proportion of magnesia and sulphuric acid has increased. There has always been found an increase in the quantity of chlorine, which generally and from the analyses made for this, has no chemical connection with the alkali.

It should be remarked, however, that accurate analyses of a mortar, and more so of a concrete, are rendered very difficult by the foreign bodies which are introduced with the sand and the shingle; for this reason it is practically impossible to obtain exact figures. The appearance of the blocks is therefore the more reliable means for estimating deterioration.

(i) The 1:3 mixtures of mortar is too poor for use in the sea in Scandinavia.

Here, the word "sea" implies normal sea-water containing 3.5 per cent of salt; in the Baltic, weaker mixtures can no doubt be used if they be protected against frost.

In sea-water, specially at Vardo, our tests showed the 1:3 specimen of mortar to have much less durability; among the concrete blocks placed at Thyboron, those with 1:3 mortar were almost destroyed after ten years.

(j) The sand used in mortars should be mixed sand of different degrees of fineness, the greater portion, however, being fine sand: specimens having the denser mixture were not those which lasted longest.

The coarsest sand in the mixtures is formed of particles of the size of grains of corn or barley; the finest is that of the local sand-hills, and there is used also a sand of intermediate fineness. The denser mixture contains 1-3 of fine and 2-3 of coarse sand, with 24 per cent water; it contains no sand of the intermediate grade. The mixture of 1-3 fine with 2-3 average fineness was found superior to all others in tests made elsewhere. In our country the results bear upon a mixture having a larger proportion of fine grade (about half) and containing but coarse and fine sand.

(k) The addition to the cement of a material crushed fine (trass, or ordinary sand) is advantageous.

Our tests have confirmed former results, to the effect that mortar can be improved by adding to it various substances, crushed as fine as the cement itself. For us, however, this point has not the value which attaches to it in those countries where trass, or pozzolana, is found, or where slag is produced. We have ascertained the value of ordinary sand, crushed with the cement ("sand cement"), and we have also made a test with an addition of Danish infusorial earth, the cheapest addition for us, the result of which is as yet doubtful.

In conclusion, I may add that the tests in question mapped out to cover a period of twenty years have, so far, only covered half that period. The results, therefore, are not yet complete, and cannot be considered as final.

The Effect of Sea Water, Alkali Water and Sewage on Portland Cement and Methods Used For Counteracting Same.

BY W. D'ROHAN.*

The destruction of Portland Cement by sea water has been more or less recognized, ever since its invention in 1824, by Joseph Aspdin, bricklayer, of Leeds, England. To this has been added recently, reports from India, Algeria, Colorado, and Montana, of the destruction of concrete by alkali waters as well as the strenuous attacks by the exponents of the clay tile industry, on the use of cement pipe for sewer and drain purposes.

In the Mediterranean, principally North Africa, are to be found concrete submarine structures in splendid preservation, while Dutch engineers have also used concrete successfully in their sluice works. The cement used was Puzzolana, but in spite of this all recent experiments with Puzzolana, natural or artificial, have failed, and the destruction of the Portland cement concrete harbor works at Dunkirk (France) and Aberdeen (Scotland) are but recent proofs that no hydraulic material has been found to successfully resist the action of sea water.

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*A clayey sand containing about 70% silica found in the island of Santorin, Greek Archipelago

*Glen Court, California St., Denver, Colo.

The theory of Le Chatelier to account for this destruction is as follows:

Free lime, liberated during the hardening of cement reacts with the magnesium sulphate always present in sea water, to form calcium sulphate. This in turn reacts with the calicum aluminate of the cement to form a sulphaluminate of lime, which swells considerably on hydration and thus disintegrates the cement mass. The extent of the disintegration varies directly with the percentage of alumina present in the cement. Cements containing 1 or 2 per cent of alumina are, for example, practically unaffected by sea water; while in cement containing as high as 7 or 8 per cent alumina, the swelling and consequent disintegration are very rapid.

Le Chatelier, by replacing the alumina of a cement with oxides not reacting with calcium sulphate, such as iron, chromium and cobalt, found that the resistance to sea water was greatly increased, and that iron oxides gave the best effect. A cement corresponding in composition to 5 SiO_2 Fe_2O_3, 17 CaO, was not only stable in sea water, but also possessed excellent mechanical properties.

Dr. Michaelis in Germany and M. R. Feret in France, as a result of individual analysis of existing Puzzolan marine works, strongly recommended the addition of Puzzolanic material to Portland cement for use in sea water.

This may be either Puzzolan, Santorin earth, or Trass. The latter is a pale yellowish rock principally found in Germany, and consisting of earth mixed with pumice trachyte, carbonized wood, etc., and of volcanic origin—in other words, volcanic mud. (Several deposits of Trass are to be found in America.)

The results of M. Vivat's researches, condensed by Gillmore, as follows, are taken from the *Annales des Ponts et Chaussées* for 1854:

(1) The double hydro-silicates of alumina and lime are devoid of stability, and will, without exception, if pulverized and immersed in sea water, or even pure water, before they have been subjected to the action of carbonic acid, and thereby transformed to carbonates, give up to the water an appreciable quantity of lime.

(2) The other conditions remaining the same, a dilute solution of sulphate of magnesia substituted for the pure water, will convert all the lime of the silicates into a sulphate, unless carbonic acid be present during the reaction, in which case its equivalent of lime will become a carbonate.

(3) All pozuolanas, irrespective of origin or composition, require for their complete practical saturation a much smaller dose of lime than they generally receive, when made into mortar, owing to imperfect pulverization and manipulation.

(4) The affinity of carbonic acid for the lime is sufficiently powerful, in the presence of water, to separate its full equivalent of lime from combination with the other ingredients of these silicates, leaving the said ingredients, whether combined or not with each other, simply mixed mechanically in the compound.

From the foregoing, it would appear that sea water will destroy all the gangs of all mortars derived from the sources indicated, if it be allowed to penetrate the immersed masses; but as some mortars do practically withstand continuous immersion in sea water, it follows that the latter meets on the surface something to impede or prevent its penetrations. These impediments are:

First, and principally, a coating of carbonate of lime; the carbonic acid being supplied from the atmosphere before immersion, and subsequently from the water.

Second, in certain cases, particularly with gangs derived from magnesian limestones, the formation of carbonate of magnesia.

Third, an incrustation of shells and submarine vegetation.

M. Vicat was subsequently led to recommend magnesia as a suitable ingredient of mortars to be immersed in sea water, stating that if it could be obtained at a cost that would permit its application to such purposes, "the problem of making beton (concrete) unalterable by sea water would be solved." That learned experimenter also intimates that the Theil hydraulic lime is the only one with which he is acquainted, that could unquestionably furnish a mortar indestructible by sea water.

M. Balard suggests that the mother water of salt ponds, applicable to no other useful purpose, might supply magnesia at a moderate cost.

Magnesia plays an important part in the setting of mortars derived from the argillo-magnesian limestones, such as those which furnish the Rosendale cements. The magnesia, like the lime, appears in the form of the carbonate (MgO, CO_2). During calcination the carbonic acid (CO_2) is driven off, leaving protoxide of magnesia (MgO) which comports itself like lime in the presence of silica and alumina, by forming silicate of magnesia (SiO_3. $3MgO$) and aluminate of magnesia (Al_2O_3. $3MgO$). These compounds become hydrated in the presence of water, and are pronounced by both Vicat and Chatoney to furnish gangs which resist the dissolving action of sea water better than the silicate and aluminate of lime. This statement is doubtless correct, for we known that all of these compounds, whether in air or in water, absorb carbonic acid, and pass to the condition of subcarbonates, and that the carbonate of lime is more soluble in water holding carbonic acid, and certain organic acids of the soil in solution, than the carbonate of magnesia. At all events, whatever may be the cause of the superiority, it is pretty well established by experience, that the cements derived from the argillo-magnesian limestone furnish a durable cement for constructions in the sea.

As a result of the conclusions of Le Chatelier, Michaelis and Feret, German manufacturers have now placed on the market "Erz—Cement" in which the alumina content is low. The results of accelerated tests in which the cement mortar was immersed in intensified sea water are entirely favorable. A similar series of experiments started 16 years ago by the German Government at the request of the Puzzolan Cement Manufacturers tend to show that Puzzolan-Portland Cement is practically indestructible in sea water. In this, ordinary Portland cement is mixed with 30 to 60 per cent of Puzzolan. These experiments are not yet concluded and will undoubtedly be of great interest.

Briefly summarized, the failure of Portland cement concrete in sea water is due to three causes:

(1) The formation of calcium sulphoaluminate, combined with a large quantity of water, swells and bursts the concrete.

(2) Sodium chloride, the principal salt in sea water, is able to dissolve the calcium silicate of the cement, thus allowing the sea water to gradually penetrate the mortar and rot the concrete.

(3) The reaction of sulphuric acid and salt on the lime of the cement causes a softening of the concrete.

In addition, M. Feret has found that the dissolution of concrete in the ocean is in most cases due to the use of too fine sands, and he urges the use of coarse sand, even if only obtainable at much increased cost. M. Alexandre demonstrated that clay in mortar to be used in sea water is an element of danger, acting like unsound cement, to cause disintegration. No cement to which gypsum has been added should be used in sea construction.

Gillmore claims that the stability of concrete structures on the Algerian coast is entirely due to the deposits of mineral substances artificial development of oyster beds on all artifiicial development of oyster beds on all sea works.

Marshal Vaillant, member and reporter of a commission of the Academy of Sciences of France, to whom was referred a memoir of MM. Chatoney and Rivot, entitled "General Considerations Upon Hydraulic Materials Used for Constructions in the Ocean," submitted to the Academy in the year 1856, says in his report, when speaking of mortars of lime and Puzzolana:

According to MM. Chatoney and Rivot, these mistakes in submarine constructions in the use of Puzzolana could, without doubt, have been avoided if, in conformity to the uses of the ancients, they have been previously submitted to a long concoction. Those gentlemen, have as yet, no experimental results to furnish in support of this assertion, but it appears very rational. We can comprehend, in fact, that if the previous concoction is advantageous to mortars of lime, and even of cement, it is indispensable to the success of mortars of Puzzolana, which differ from the former, in that the combinations of the lime with the silica exist, for the limes and cements, already formed by the calcination, and have only to become hydrated at the time of their use; whilst, in the fabrication of mortars of Puzzolana, the silica and alumina have to free themselves from combination in which they exist in the Puzzolana, in order to form with the lime, in the wet way, those compositions which form hydrates under water.

It has been found that dense concrete withstands the action of sea water better than a porous mixture, as the water cannot penetrate so deeply and set up chemical action. The methods used to prevent this penetration are summed up by Dr. Michaelis as follows: (Trans. Inst. C. E., Vol. 17, p. 375. Transcribed from Reid, "Concrete and Reinforced Concrete Construction," p. 152.)

The main points to be considered in erecting permanent structures in sea water with the aid of hydraulic cements, in other words, concrete, are:

(1) From the physical point of view, completely impermeable mixtures should be made, composed of 1 part of cement with 2, or at the most 2½ parts of sand, of mixed grain, of which at least one-third must be very fine sand. To this the requisite quantity of gravel and ballast should be added. This impermeable layer should surround the porous kernel on all sides in sufficient thickness, even underneath. It would, perhaps, be unnecessary waste of material, in the case of thick walls, to use the impermeable mixture throughout, but, so far as possible, the compact shell and the porous kernel should be made in one operation. Where this is not possible, and the shell is added subsequently, numerous iron ties should be used.

(2) From the chemical point of view, cements or hydraulic limes rich in silica, and as poor as possible in alumina and ferric oxide, should be used, for aluminate and ferrate of lime are not only decomposed and softened rapidly by sea water, but they also give rise to the formation of double compounds, which in their turn, destroy the cohesion of the mass by producing cracks, fissures and bulges. The salts contained in sea water, especially the sulphates, are the most dangerous enemies of hydraulic cements. The lime is either dissolved and carried off by the salts, and the mortar thus loosened, or the sulphuric acid forms with it crystalline compounds as basic sulphate of lime, which are segregated forcibly by the mortar, together with a large quantity of water of crystallization, and a consequent increase of volume results. The separation of hydrate of magnesia is the only visible, but completely innocuous sign of these processes. The magnesia does not in any way enter into an injurious reaction with silica, alumina, or ferro oxide; it is only displaced by the lime from its solution in the shape of a flocculent, slimy hydrate which may be rather useful in stopping the pores, but can never cause any strain or expansion, even if it subsequently absorbed carbonic acid.

The carbonic acid, whether derived from air or water, assists the hydraulic cement as a preservative wherever it comes into contact with the solid mortar. It could only loosen the latter if present in such an excess that bicarbonate of lime might be formed.

(3) The use of substances which render the mortar, at any rate in its external layers, denser and more capable of resistance. Such substances are:

(a) Sesquicarbonate of ammonia (from gas liquor) in all cases where long exposure to the air is impossible. Such a solution, applied with a brush or as a spray, and then allowed to dry, converts the hydrate of lime into carbonate of lime. The latter is not acted upon by the neutral sulphates present in sea water. It must be repeated that it is a decidedly erroneous opinion that the texture of otherwise sound cements is injured by the action of carbonic acid: on the contrary, it renders them more capable of resistance, except in the above mentioned case, which is extremely rare, when bicarbonate of lime is formed and goes into the solution.

(b) Fluosilicates, among which magnesium fluosilicate is most to be recommended. The free lime is converted into calcium fluoide and silicate of lime, and, in conjunction with the liberated hydrate of magnesia, these new products close the pores of the mortar. Both salts are sufficiently cheap to be used on a large scale.

(c) Last, not least, barium chloride. Two or three per cent of the weight of cement is dissolved in the water with which the concrete is mixed. This forms perfectly insoluble barium sulphate with the sulphates of the sea water, while the magnesia remains in the solution as magnesium chloride. Although in this case there can be no further closing of the pores, yet the insoluble barium sulphate, which is formed, affords some protection and does not give rise to any increase of volume (swelling). From two to three per cent of barium chloride does not in any way diminish the strength, as has been proved by means of comparative tests of English and German cements. Frequently the strength of the mortar is increased by this addition. This substance is only to be used in the external, perfectly water tight skin of concrete; in other words, in 4 to 8 in. coating, composed of 1 cement, 1 to 2 sand and 3 to 4 gravel, flint, broken stone, etc.

Summarizing the experience and examples of Mr. Rudolph Herring (Eng.-Contg. June 15, 1910), the partial destruction of cement tile by either sewage gases or liquids is entirely due to the final formation of sulphuric acid, and to this, as M. Feret asserts, is also due the disintegration of all marine concrete structures.

A letter written by Professor Edward Orton of the Ohio State University, deploring the use of cement in tile drains, started a controversy which grew into large proportions.

The substance of the letter is that, cement drain tile "is exposed persistently to the very influence under which it most rapidly deteriorates," namely, "the solvent power of water more or less saturated with carbon dioxide" and organic acids which "tend to leach out lime" while "the constant filtration of air through its walls into the soil" "tends to oxidize the sulphides in the cement into soluble sulphates," and, finally, "that the soundness and qualities of cement pipe cannot be told by the appearance."

These arguments are, however, knocked sky high by Percy H. Wilson, Secretary of the Association of American Portland Cement Manufacturers. In his article, which can be easily obtained in booklet form, he says that Professor Orton's reasons are:

> Bare statements and as the context shows are purely theoretical. They assume a state of affairs which never exists. In the first place, drainage water in farming communities is very far indeed from being saturated with carbon dioxide, which is by the way, the weakest of all acids. Typical analysis of drainage water from cultivated fields are given in U. S. Department of Agriculture, Bureau of Soils Bulletin No. 26, "Investigations of Soil Management," pages 23 and 77. The average from twelve wheat fields shows only 53.5 parts of carbonic acid and 32.7 parts organic matter in 1,000,000 parts of drain water, and the worst sample taken from a drain under a black marsh soil gave only 340.6 parts of carbonic acid in 1,000,000 of water. The average amount of carbonic acid in ground water and open ditches is less than three parts in 1,000,000. The chemical activity of such exceedingly weak solutions is trifling and is not liable to attack the tile because of possible neutralization of the acid by lime in the soil. The analyses show three times as much lime as carbonic acid in solution, and carbonic acid would react with lime already in solution before it would attack solid lime in a tile.
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> Sulphides are either entirely absent from cement or present in such minute quantity as to be negligible, and the percentage of sulphates is also so small that every particle could be leached out ,after the concrete has set without weakening it. That air should be constantly filtering through a tile in one direction, while water is constantly filtering through it in the opposite direction, is almost too absurd to notice. Air cannot go through tile unless there is a difference in pressure, but since the pressure inside the tile cannot be greater than that of the atmosphere, it would be necessary to assume a partial vacuum on the outside. Actually, the pressure outside is greater than atmospheric by the length of a column of water between the tile and the ground water level unless the ground water is below the tile, when the pressure is the same on both sides. Finally, it is difficult to see why the Professor should think it more difficult to tell a sound tile of cement than of clay. It is entirely a matter of experience on the part of the inspector.

Since the methods of destruction by sewage and sea water are similar, the writer believes the same remedies are applicable to both.

In a paper recently read by Mr. Moyer before the Am. Soc. for Testing Materials (ENGINEERING-CONTRACTING July 6, 1910) on the effect of sodium silicate with, or applied to concrete, Mr. Moyer states his belief that with the silicatization of concrete, the destruction of concrete in sewer and sea water construction can be prevented. Silicate of soda, or soluble glass as it is better known, has been in use in Europe for over 30 years. It is a clear viscous substance made from pure flint and caustic soda digested by heat and its strength shows 1700 on a hygrometer. It is used as a bath or flushing, being mixed with 6 to 10 parts of water and indurates concrete surfaces subject to wear or friction, but has been found not of much account when used alone for water surfaces. The process was first proposed by Mr. Fred Kuhlmann of Lille, France, and a patent was granted in England to Fred. Ransome for this process as follows:

> Immerse or saturate surface with weak solution of silicate of soda or potash, then, when dry, apply solution of chloride of calcium or barium, when an insoluble silicate of lime or baryta is formed in the pores of the concrete.

This was found useful in marine construction, but owing to the patent rights, not much used. Mr. Ransome also patented another process, using a solution of sulphate of alumina instead of soluble glass, and then by applying baryto, a compound of sulphate of barytes and alumina is formed. This method gives good results in gases, especially coal gas and smelter smoke.

Another method patented in France is magnesium chloride dissolved in water to strength of 20° to 25° Baume; then add from 6 to 10 per cent barium hydrate or carbonate and saturate the surface with the solution. The writer has no personal experience of this method, which was first recommended by Vicat.

During the past 14 years the writer has had uniformly good results with silicate of soda solution for indurating and waterproofing floors, especially cold storage warehouses, and found the best results with good rich concrete. and after the concrete was over 6 months old. The process, in all probability, by filling the pores of new concrete prevented the crystallization of the cement and rendered the concrete brittle. On three occasions, however, the results were not satisfactory, and failure could be attributed to: (1) Poor concrete, (2) Adulteration of silicate, and, (3) Applying when concrete was still green.

In India, especially in the Presidency of Bengal and Province of Madras, alkali waters had such an injurious effect on Portland Cement concrete that masonry had to be substituted, and in nearly all important irrigation structures very little concrete is used. The process of disintegration as observed by the writer, both in India and Colorado, is exactly the same. The outer crust shales off in thin flakes, then the interior quickly ravels off. After the outer crust is picked or falls off, the inside core is generally so soft that it can be easily brushed to pieces with an ordinary broom. This result at first was attributed to too dry mixing of the concrete, but is now known as the work of alkali. To counteract this injurious effect, it is customary in Madras to mix coarse sugar "goor" or Jajeri, as it is called, with the water used in gaging, the proportion being 1 lb. of Jajeri to each gallon of water. The results were satisfactory. Experiments in this country, beyond showing that beet sugar is entirely useless for this purpose, are not conclusive, but good results were obtained by using treacle.

Possibly the best results are obtained in the Bengal Presidency. The concrete, after placing, is kept from contact with alkali water as long as possible and covered with wet sacking. A couple of days before turning in the water, the concrete is thoroughly soaked with linseed oil, mixed two parts raw and 1 part boiled oil. This oil unites with the alkali and forms an insoluble filling for the pores. This method has been used by the writer with conspicuous success in Colorado, but can hardly be recommended where the concrete is poorer than 1 to 8. Nearly all patent waterproof paints have linseed oil as a basis.

To summarize briefly, the destruction of all concrete, whether by sewage, gas, alkali or sea water, only takes place when the concrete is penetrated, allowing chemical action to take place in the interior, and while the first choice should be a cement chemically suitable to the locality, a rich, well-graded mix should be used, and after depositing, should be kept from contact with injurious matter as long as possible. Concrete sets by the absorption of carbonic acid from the air and from water, so it can be easily seen that the immediate application of an impervious coat must seriously interfere with the hardening process. (In some parts of the British Isles a coat of red lead concocted in linseed oil and applied 3 months after deposition, has been found to resist the erosive action of sea water.) Coarse sand has always been held as superior to fine, giving more room for crystallization of the cement, so that the finer materials used to fill in the pores of concrete in alleged waterproofing must have a deteriorating effect on the strength. This has been proved by various experiments.

English practice has been to make use of long concoction and rich mixes, as proposed by M. Chatoney and Rivot. The new harbor recently completed at Dover was built of large concrete blocks weighing 42 tons and seasoned on dry land for 6 weeks.

The great reinforced sea walls of Nantes and Southampton were built of 1 in 5 concrete, reinforced Hennebique style, and protected from the action of the waves, by dirt, for several days.

In mixing mortar for the Forth Bridge, the sand and cement mixed 1 in 1 were first ground slightly together with advantageous results. That this method is successful is shown by the opening up of sand-cement mills in the United States.

Plastic concrete or reset concrete was formerly used in England. Concrete is allowed to set for about 8 hours, and then deposited in water. The writer has had some satisfactory experience with this style, putting in piers in 8 ft. of water in the South of Ireland. Mr. Kinniple says that this setting does not affect the ultimate strength and less cement is washed away.

In France, large wine vates built of concrete were quickly eaten through by the acid and eventually had to be glass-lined.

On the Pacific Coast, in the new reinforced concrete wharf at Santa Monica, the concrete piles were given a steel jacket between high and low water. Tar paper is also used, and three coats of acid resisting asphaltum paint has been found very efficacious.

The cement manufacturers of Europe, now awakening to the fact that magnesia in cement can be considered as the equivalent to lime in action, if due allowance is made for the difference in their weights, have begun the manufacture of lime magnesia cements. Such an innovation is to be looked forward to in America, more especially since Professor Newberry has pointed out, that with due attention to mixing and burning, a satisfactory cement can be made with magnesia content as high as 10 per cent.

We have but comparatively little authentic information on this subject, and should this paper, by directing engineers' attention to the various preventives used, cause their more extended application, and the results of such applications published, its object will have been fulfilled.

This actual use is the only way to arrive at correct conclusions, for as M. Minard has pointed out, substituting chemical operations in the laboratories only involves new disasters.

Up to the present, however, the French are the only Nation with special standards for cement used in and near sea water. For use in the ocean, they require cement to pass the following tests:

FOR USE IN SEA WATER

Time of Setting.—Initial set shall not take place within 20 minutes and permanent set within 3 hours, but must be complete within 12 hours.

Fineness.—Not more than 40% should be retained on a sieve having 4,900 meshes per sq. cm. or more than 2% on one having 324 meshes per sq. cm

Soundness or Constancy of Volume.—Specimens are to be kept in moist air for 24 hours and then some immersed in sea water and others in water maintained at 100°C. for three hours. The points of the Le Chatelier apparatus must not change more than 5 mm. in the boiling test.

Tensile Strength.—The tensile strength shall be at least 20 kg. per sq. cm.

After twenty-four hours in the moist air the cement is to be placed in sea water and must develop a tensile strength of at least 15 kg. per sq. cm., at the end of 7 days, and at the end of 28 days, 30 kg. per sq. cm. There must be at least 2 kg. increase between the 7 and 28 day tests. Mortar specimens must develop 6 and 11 kg. per sq. cm. respectively.

FOR USE NEAR SEA WATER

Time of Setting.—Initial set shall have taken place within 6 hours and permanent set must be complete at the end of 30 hours.

Fineness.—Not more than 5% should be retained on a sieve having 900 meshes per sq. cm. or more than 2% on one having 324 meshes per sq. cm.

Soundness or Constancy of Volume.—Specimens are to be kept in moist air for 48 hours and then some immersed in sea water and others in water maintained at 100°C. for three hours. not change more than 5 mm. in the boiling test.

Tensile Strength.—After 24 hours in moist air and thereafter in sea water, mortar specimens must develop a tensile strength of at least 3 kg. per sq. cm. at the end of 7 days and 6 kg. per sq. cm. at the end of 28 days. There must be at least 2 kg. per sq. cm. increase between the 7 and 28 day tests.

Some Notes on Causes of Failure of Stucco Work.

BY A. G. CUTTING.*

A number of years ago stucco was quite generally used in certain localities, but owing to failures of the material to withstand the action of the elements and to other causes, this type of construction was almost entirely abandoned. During the last few years, however, there has been a very marked tendency by the building public to take up this class of construction again, therefore this word of caution.

We do not want to have the same experience with this type of construction, as the concrete block industry has had, and yet unless due care is used in drawing specifications and in their application, there are going to be a great many failures as in the past. Our architectural friends are very partial to stucco exterior, and if it is properly mixed and applied will come up to their expectations in every way. So much depends on the selection of the material, proper mixing and proper application that only skilled mechanics who are familiar with this class of work should be employed.

The writer has had opportunities to inspect a great many stucco residences in the past few years and is very sorry to say that the greater percentage of them are unsightly, due to cracks, discolorations caused by improper application, and lack of proper ingredients, etc. I wish to illustrate briefly by stating facts regarding two or three of the houses that have come to my attention.

I remember one residence in particular, where there were a great many horizontal cracks in the stucco running almost the entire length of one side of the building. These cracks were about 2 ft. apart and were very pronounced. The whole area of sides and ends was very unsightly. After a very careful investigation it was found that in nearly every instance where cracks had developed that they were at a point where the wire lath was lapped and in many places less than ¼-in. thickness of stucco was over these laps. In some instances by cutting out the cracks it was found that the metal lath was not even tacked solidly in place, and yet stucco work in general was condemned by a number of parties on the results obtained on this one building. It was quite apparent that the trouble was not due to any fault of the material, but in this particular instance was due entirely to the application of the wire lath and stucco. In addition to the large cracks at the laps of the wire lath, there were a number of hair cracks throughout the entire area, which apparently were caused by too much troweling of the concrete mass, and as was found by investigation there was a coating or frosting of Portland cement on some of the areas and the cracks penetrated just through this frosting. Other areas were entirely smooth and cracks had not developed.

In another case regular lime mortar plaster without any Portland cement was used for the scratch coat. The second and finishing coat consisted of a poor mixture of Portland cement and sand. The finish coat was only about ¼-in. thick. Moisture penetrated through the finish coat and the mortar composing the scratch coat being subjected to continued moisture disintegrated and the stucco came off in sheets.

The third case was very similar to the second, although wood lath was used instead of wire lath on a small building near the sea shore. The scratch coat material consisted of regular interior plaster and the second coat consisted of Portland cement, asbestos rock and asbestos fiber. The second coat was very thin and the damp salt air and moisture penetrated through to the first coat. The lath became swelled and the stucco came off in sheets. The stucco on this work was condemned and the faults were laid at the door of the asbestos and Portland cement. Upon investigating the matter thoroughly, it was readily proven that the entire trouble was due to the nature of the lath and the materials entering into the first coat.

I have referred to these buildings with a view of cautioning people interested in stucco construction to see that this particular part of the building is given proper attention. In the past stucco has been applied in two coats, the total thickness being about ½ in. to ⅝ in. Past experience is teaching us, however, that 1 in. is by far better and if the material is applied in this thickness, house owners and architects should not have reason to regret its use.

Another point of considerable importance is the color. A uniform color is rather difficult to obtain on smooth surfaces particularly, but it can be obtained if proper attention is given to the selection and mixing of the ingredients and if the stucco is properly applied. When Portland cement and sand are used it is very essential that the sand should be absolutely free from any organic materials which have a tendency to discolor. It is also of vast importance that the ingredients be mixed very accurately and carefully and that a sufficient amount be mixed at one time to cover certain areas exposed to the same lights and shadows.

For example, the work should not be left in an uncompleted condition half way between windows or half way down the side walls, for just as certain as this is done, there will be a streak showing where the later work was started. If it is necessary to do a certain given area at two operations, care should be used to get the materials properly blended and the new stucco floated or trowelled to correspond exactly to that already done. By using a little care on details of this kind the ultimate results will be much more satisfactory.

Portland cement and sand as a stucco mixture has been used with fair success where work has been carefully supervised, but there has been such a lack of proper attention to the mixing and application that there have been some very bad failures. The use of asbestos rock and fiber to take the place of sand is meeting with considerable success. The asbestos fibers have a tendency to hold the water which is used to mix the concrete mass, longer, thus giving the Portland cement ample opportunity to become properly set and in this way stucco mixtures are possible that are more uniform in color and less liable to crack as the fiber also furnishes additional bond.

There is one point which is frequently lost sight of, that is it is possible to manufacture or make concrete slabs that are free from cracks and that can be exposed to the elements for an indefinite period without discoloration. Therefore, should cracks develop in a well-constructed stucco work it can be invariably traced to settling of the building or the shrinking of the frame. By insisting upon thicker stucco walls the liability of the stucco cracking is reduced to a minimum.

The price of lumber is readily advancing and the desire for fireproof exteriors, especially in the suburban districts as well as artistic effects that may be obtained from stucco are creating a universal demand for this type of construction and while the initial cost may be slightly more it is such a small part of the total outlay and such an important part of the structure that the best is the cheapest in the end.

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*New York, N. Y.

Time and Cost of Rock Drilling in Alaska.— The following figures are from the annual report of Mr. R. A. Kinzie, superintendent of the Ready bullion mine, Douglas Island, to the Alaska United Gold Mining Company:

Stoping, 33.06 ft. drilled and 46.36 tons broken per machine-drill shift; development, 40.42 ft. and 12.07 tons; sinking, 45.08 ft. and 15.24 tons. The cost of explosives in stoping averaged about $1.95 per drill per shift; in sinking, $2.70, and in drifting, from $1.90 to $2.88. The average cost of supplies, power, repairs, etc., was $5.65 per drill per shift. On the 700-Foot Claim mine of the same company the average number of feet drilled per machine per shift in stoping was 24.99, breaking 36.94 tons of rock, and in development, 31.88 ft. breaking 7.89 tons. The cost for explosives per drill per shift varied from $1.82 to $2.28 in stoping, and from $1.85 to $3 in development. On this mine, the cost of supplies, power, repairs, etc., was $4.68 per drill per shift.

League of American Municipalities.—An innovation in instructive entertainment of delegates to the convention of the League of American Municipalities will be introduced at the St. Paul, Minn., convention, which will be held August 23-26, by furnishing what will be known as a municipal exhibition, according to a decision of the local executive committee. Everything from electric light plants to pencils—in fact, everything that a municipality purchases will be exhibited. More than 1,500 invitations will be sent out to the various firms that sell to cities. It was decided by the committee to hold the convention sessions in the banquet room of the Auditorium in order to give floor space to the exhibitions. It is expected that about 400 firms in all parts of the country will exhibit and take part in the parade. Floor space will be sold at its actual cost to the committee.

A remarkably fast piece of track-laying was recently accomplished in Syracuse, N. Y., on the Syracuse, Lake Shore & Northern Railroad, when 3,720 ft. of 56-lb. rail, weighing a total of 69,440 lbs., was taken out and replaced with a 70-lb. rail, weighing a total of 86,800 lbs., in 21 minutes and two seconds.

EARTH AND ROCK SECTION

Method and Cost of Raising Embankment and Filling Trestles Using Steam Shovel and Hart Convertible Cars With Lidgerwood Unloader.

BY L. A. WALLACE*

The Frisco line (C. S. N. O. & P. R. R.) from Beaumont, Tex., to Baton Rouge, La., was built through the Atchafalya Swamp in alternate embankment and temporary trestle. The original plans were made for continuous embankment of station work, but continued high water in the swamp prohibited 50 per cent of the station work and temporary trestling was resorted to for filling in the gaps between the embankment which had been started or completed. The greater portion of the grade was 8 ft. high. The material in the embankment was the black gumbo commonly encountered in Southern Louisiana swamps. The work described consisted of raising the embankment and filling in the temporary trestling. The conditions were difficult.

The track was laid following closely behind the trestle gang, and frequent use of the track by the bridge material train put the track into a very poor condition. A great portion of the embankment built by station work was partially washed out by high water leaving holes 4 ft. deep for 15 or 20 ft. of track. The temporary trestles stood 12 or 18 ins. higher than the approaches. This condition was due to the excessive settlement of the swamp soil when put up by station work and also to heavy rains. The worst holes were cribbed up with ties and tree branches but even then a great amount of delay was caused the unloading trains by derailment and trains breaking in two in attempting to get over the bad places. It was necessary to unload dirt at these places before the track could be surfaced, as the gumbo would not hold a surface under one trainload of dirt. In many instances cars were unloaded standing on track 18 ins. out of level and 3 ft. out of surface in a distance of 10 ft. along the rail.

Hart convertible cars were used and were unloaded by Lidgerwood and plow. Before dirt was unloaded on the fills it was necessary to jack the track up out of the gumbo. It was impossible to move the track with No. 6 Barrett jacks after the dirt was unloaded. In many instances it was found necessary to strip out the track before it could be lifted from the gumbo with 12 No. 6 Barret jacks, resting on boards, per rail length. The grade on embankment was raised not less than 12 ins. at any point.

The unloading was planned so that when the front gangs were unable to get the track in shape ahead of the unloading or when they were not able to care for the dirt as fast as it came, the unloading was done on the trestles, and as they were being filled a gang was kept busy tamping the dirt in under the caps and stringers. Following a rain, the dirt packed hard and the caps and stringers were removed by the Lidgerwood and cable.

The shovel pits from which the dirt for filling was taken, averaged a 15-ft. face and 1,600 ft. in length. The dirt was a sandy clay compacting very quickly in embankment. The pit was opened up along one side of the main line and track laid behind the shovel in the first cut and used as a loading track for the next cut of the shovel. More difficulty than usual was experienced in keeping the pit properly drained. Good drainage was very necessary to take care of the frequent and heavy rains common to the country. Three trains were used, 1 loading train, which also handled the water cars for the shovel, 1 swing train which made the run of 12 miles to the front in 40 minutes and 1 unloading train. The unloading was started 12 miles from the pit. A siding and water tank were located there affording water to the swing and unloading trains. About 25 minutes were generally consumed there in switching empties and locals.

TABLE I.

Date.	Cars Loaded.	Cu. Yds.	Cars Unloaded.	Delays.
Sept. 12	44	1,320	44	
Sept. 13	44	1,320	22	
Sept. 14	82	2,460	60	1 hr. shovel breaking.
Sept. 15	..	.....	.	Sunday.
Sept. 16	83	2,490	83	
Sept. 17	43	1,290	43	
Sept. 18	92	2,760	88	
Sept. 19	100	3,000	125	1 hr. 30 mins. shovel breaking.
Sept. 20	82	2,460	43	
Sept. 21	46	1,920	102	
Sept. 22	..	.....	..	Sunday.
Sept. 23	52	1,560	63	5 hrs. acct. rain.
Sept. 24	104	3,120	62	1 hr. 10 mins. pit men—mud.
Sept. 25	105	3,150	124	
Sept. 26	102	3,060	106	
Sept. 27	83	2,490	61	3 hrs. 40 mins. acct. rain.
Sept. 28	104	3,120	122	
Sept. 29	..	.....	..	Sunday.
Sept. 30	94	2,820	124	
Oct. 1	106	3,180	30	
Oct. 2	66	1,930	82	
Oct. 3	82	2,460	82	3 hrs. acct. rain.
Oct. 4	86	2,580	62	6 hrs. moving shovel.
Oct. 5	32	960	54	
Oct. 6	..	.....	..	Sunday.
Oct. 7	64	1,920	64	1 hr. 10 mins. truck and eng. failure.
Oct. 8	..	.....	..	Rain.
Oct. 9	40	1,200	32	
Oct. 10	94	2,350	94	
Oct. 11	22	440	64	
Oct. 12	82	2,460	82	1 hr. derailment at shovel.
Oct. 13	..	.....	.	Sunday.
Oct. 14	60	1,800	62	
Oct. 15	82	2,460	82	
Oct. 16	..	.....	..	All day moving.
Total		62,080		

The work recorded was done from Sept. 12 to Oct. 16, 1907. The daily expenses were as follows:

Loading, Transporting and Unloading:	
1 Trainmaster at $150 per mo.	$ 5.00
3 Conductors at $100 per mo.	10.00
3 Brakemen at $75 per mo.	7.50
3 Brakemen at $60 per mo.	6.00
3 Engineers at $100 per mo.	10.00
3 Firemen at $75 per mo.	7.50
3 Engine watchmen at $60 per mo.	6.00
1 Hostler at $75 per mo.	2.50
1 Hostler helper at $1.80 per day	1.80
1 Steamshovel engineer at $150 per mo.	5.00
1 Steamshovel craneman at $90 per mo.	3.00
1 Steamshovel fireman at $75 per mo.	2.50
1 Steamshovel watchman at $60 per mo.	2.00
1 Machinist at $0.35 per hour	3.50
1 Machinist helper at $1.80 per day	1.80
1 Blacksmith at $0.35 per hour	3.50
1 Blacksmith helper at $0.20 per hour	2.00
1 Car repairer at $0.25 per hour	2.50
1 Car repairer at $0.225 per hour	2.25
1 Carpenter at $0.275 per hour	2.75
1 Pumper at $60 per mo.	2.00
1 Lidgerwood engineer at $90 per mo.	3.00
6 Pit men at $2 per day	12.00
6 Cablemen at $2 per day	12.00
Total wages	$116.10
20 tons coal at $4	$ 80.00
Supplies	2.56
Ice	1.00
Water at 50 cts. per tank from city	2.00
10 gals. gasoline at 10 cts.	1.00
Total supplies	$ 86.56
1 Steam shovel rent	$ 10.00
3 Engines rent at $5.53 per day	16.59
62 Cars rent at 50 cts. per day	31.00
1 Water car rent at 50 cts. per day	0.50
1 Spreader rent at $2 per day	2.00
1 Lidgerwood rent at $5 per day	5.00
Total plant rental	$ 65.09
Add 10% super. and 5% misc.	$ 40.15
Grand total	$307.90

Note.—The 5% misc. includes overtime, etc.

The record of the steam shovel work loading, of the number of cars unloaded and of delays for the 29 working days was as shown by Table I.

The division of labor at pit and at front and the lineal feet of track raised were as shown by Table II.

In the above record the labor under the heading of pit labor includes labor on the trackwork and drainage. Labor under the heading of front labor includes all labor used in handling material when unloaded. This same statement also applies to the cost records of the work which are given in Table III.

TABLE II.

Date.	Pitmen at $75	Pitmen at $1.75	Cost.	Front $100	Labor at $75	Labor at $1.74	Track raised ft.	Cost.
9—12	3	30	$60.00	..	..	..	....	....
13	2	31	56.75	0	1	16	400	$ 30.50
14	1	10	20.00	0	1	17	400	32.25
15	1		2.50	0	1	..	....	2.50
16	1	13	35.25	0	2	53	1,166	97.75
17	1	4	9.50	0	2	41	902	76.75
18	1	13	35.25	0	1	37	814	67.25
19	1	14	37.00	0	2	54½	1,199	100.37
20	1	17	42.25	0	2	59	1,298	108.25
21	1	14	37.00	0	2	55	1,210	101.25
22	1	..	2.50	1	2	..	.....	5.00
23	..	..	.....	1	3	92	2,024	171.83
24	1	5	11.25	1	3	112	2,464	206.83
25	1	5	11.25	1	2	117	2,574	213.08
26	..	..	.....	1	2	93	2,046	171.08
27	..		.....	1	2	76	1,672	141.33
28	..	..	...	1	2	68	1,496	127.33
29	..	..	.....	1	2	..	.....	8.63
30	1	10	20.00	1	2	85.8	2,178	158.48
10—1	1	6	12.90	1	2	67	.....	125.32
2	..	..	.....	1	2	68	.....	127.07
3	1	22	40.92	1	2	83.3	2,000	153.85
4	..	..	.....	1	2	78	1,000	144.57
5	1	20	37.42	1	2	74½	1,320	138.45
6	..	..	....	1	2	..	.....	8.07
7	1	33	60.17	1	2	56.4	1,023	106.77
8	1	4	9.42	1	2	11.5	....	28.19
9	1	22	40.92	1	1	60	....	110.65
10	1	23	42.67	1	1	72.4	1,056	132.35
11	1	27	49.67	1	1	66.5	1,700	122.08
12	..	..	.....	1	1	58.6	1,848	108.20
13	..	..	....	1	1	..	.....	5.65
14	1	18	33.92	1	1	73	1,780	133.40
15	..	.	....	1	1	66	....	121.15
16	1	25	46.19	1	1	73	....	133.40

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*Leeds, Sioux City, Ia.

TABLE III.

Pit	Front	Shovel	Total	Cubic	No.
$ 60.00	....	......	$ 60.00	1,320	44
56.75	$ 30.50	$ 308	395.25	1,320	44
20.00	32.25	308	360.25	2,460	82
2.50	2.50	200	205.00	.....	.....
35.25	97.75	308	441.00	2,490	83
9.50	76.75	308	394.25	1,290	43
32.25	67.25	308	407.50	2,760	92
37.00	100.37	308	445.37	3,000	100
42.25	108.25	308	458.50	2,460	82
37.00	101.25	308	446.25	1,920	64
2.50	5.00	200	207.50	.....	.....
....	171.83	308	479.83	1,560	52
11.25	206.83	308	526.08	3,120	104
11.25	213.08	308	532.33	3,150	105
....	171.08	308	479.08	3,060	102
....	141.33	308	449.33	2,490	83
....	127.33	308	435.33	3,120	104
....	8.33	200	208.33	.....	.....
20.00	158.48	308	486.48	2,820	94
12.92	125.32	308	446.24	3,180	106
....	127.07	308	435.07	1,930	66
40.92	153.85	308	502.77	2,460	82
....	144.57	308	452.57	2,580	86
37.42	138.45	308	483.87	960	32
....	8.07	200	208.07	.....	.....
60.17	106.77	308	474.94	1,920	64
9.42	28.20	308	345.62	......	.....
40.92	110.65	308	459.57	1,200	40
42.67	132.35	308	483.02	2,350	94
49.67	122.03	308	479.70	440	22
....	108.20	308	416.20	2,460	82
....	5.65	200	205.65	.....	.....
8.92	133.40	308	450.82	1,800	60
....	121.15	308	429.15	2,460	82
46.19	133.40	308	487.59	.....	.....
$726.72	$3,519.29	$9,932	$14,178.01	62,080	2,054

The grand total cost of the work was $14,178.01, which gives a cost of $7 per car load of earth under the track. At 30 cu. yds. per car the cost would be $0.233 per cu. yd. Pit cross-sections showed a yardage of 35,445 removed. This brings the cost up to 40 cts. per cu. yd. Cars were loaded higher than the top edges and averaged 30 cu. yds. Allowing 20 per cent for swelling of material it is an interesting fact that the car measure gave 55 per cent in excess of the amount of material handled.

Some Records of Drag Line Bucket Excavator Work on Canal, with Costs.

The San Joaquin and Calaveras rivers in California form a Y between the arms of which is located the city of Stockton. The land between the arms of the Y is low and flat and is cut by numerous small streams which are tributary to the main rivers. Years ago one of these small streams passing through Stockton was canalized to a depth of 9 ft. for navigation and is known as the Stockton channel. Another stream known as Mormon slough empties into Stockton channel about 4,000 ft. from its head in Stockton; the upper stretches of Mormon slough bisect the arms of the Y. In times of flood the waters of Mormon slough inundate portions of Stockton and which is more ruinous, carry large quantities of silt, which are deposited in Stockton channel. Because of this silt deposit from 100,000 to 200,000 cu. yds. of dredging are required each year to maintain depth in Stockton channel. To obviate this heavy maintenance charge and to prevent inundation the U. S. Government planned a diverting canal from Mormon slough across the angle of the Y above Stockton to the Calaveras River. Below where the Diverting Channel connects with it Mormon slough will be dammed. Flood waters will then pass through the Diverting Channel into the Calaveras River, which will be dredged and lowered to handle them, and avoid Stockton and the Stockton Channel altogether.

The Diverting Canal is 5.25 miles long with a cross-section 150 ft. wide on the bottom, with side slopes of 1 on 1½. With a slope of 4 ft. per mile the canal has a capacity of 12,000 sec. ft. This canal is being excavated with two drag line excavators. One of these excavators is a Heyworth-Newman machine, having a 100-ft. boom and a 3½ cu. yd. bucket, built by the Bucyrus Co., South Milwaukee, Wis. The second machine was a clamshell machine with a 110-ft. boom, which had been converted into a drag line excavator with a 2½-cu. yd. Heyworth bucket. The following methods of work are given by Mr. H. A. Halleck:*

The method followed in doing the work was to set up the Heyworth excavator 7 ft. from the center line of the channel in order to control the excavation of the outer 30 ft. opposite the levee side. This allowed the boom to deposit the spoil on the levee site clear of the berm. When about 2,000 feet of progress had been made in this manner, the machine was placed in about 31 ft. and another section was taken out up to 7 ft. of the levee side. The converted clamshell machine followed, taking out the remnant. The excavating machines were all mounted on rollers, made of 8-in. extra heavy hydraulic pipe, with pine centers pressed in, and were moved forward on 12x14 in. timbers.

The fuel used on the machines was oil, from the Standard Oil Co., hauled to the work in tank wagons. It was transferred to the tanks on the machine by means of a gasoline pump. The tanks on the wagons and on the machines have a capacity of about 1,000 gals., sufficient for supplying the machines for about 30 hours. Oil cost $1 per barrel and proved more efficient, cheaper and easier to handle than coal.

One of the problems in connection with this work was the necessary water supply for the boilers. In the absence of any stream, it was found necessary to bore wells about every 4,000 ft., at which a pumping plant, equipped with Worthington duplex pumps, was installed. From here the water was supplied to the machines by means of a 1¼-in. pipe line. Even at that the water had strong liming propensities, which necessitated a shutdown of 18 hours a week for washing out the boilers and making other repairs. The work was carried on continually 7 days a week and 24 hours a day.

The progress made on the work averaged about 60,000 cu. yds. per month. Tisco teeth were used on the buckets, but the material was so hard in spots that they had to be changed as often as three times a day. The cables were attached to the buckets by means of extra heavy sockets.

Each machine is equipped with a dynamo for generating current for lights during the night-shift. Two searchlights are attached to the booms of the machines and other lights are placed along the line.

The organization under which this work is done consists of the following:

1 superintendent.
2 captains, 1 on each machine.
3 leveemen, 6 hours on and 12 off.
2 mates, 1 on each machine.
4 firemen, 2 on each machine.
8 deckhands.
1 blacksmith.
1 helper.
1 cook.
1 flunkey.
2 pumpmen.
1 handyman.
1 team of 6 horses for hauling oil and freighting.

The expenditure per month was as follows:

Pay roll	$3,754
Fuel oil	945
Lubricating oil and repairs	2,220
	$6,919

To this amount must be added the overhead expense, plant cost and interest on the money invested. The price paid for doing the work was 15½c per cu. yd.

The above prices paid for labor included board. On account of the extent of the work, it was necessary to have a camp that could readily be moved. The camp consisted of two large tents which were used as sleeping quarters by the men and two smaller tents for the engineers, superintendent and captains, also serving as offices. A cook wagon, of the same type as are used on the ranches, was used both for doing the cooking and as mess tent. This outfit proved satisfactory from every standpoint.

The following figures show the excavation record for one year in cubic yards:

1909.	Dragline.	Converted Clamshell.
April	7,945	.....
May	41,728	17,800
June	34,600	26,400
July	[illegible]	[illegible]
August	30,700	27,300
September	28,400	28,600
October	31,700	32,600
November	31,300	29,000
December	28,600	15,700
January, 1910	33,700	7,800
February	11,600	..
March	[illegible]	.
April	43,600	27,600
Totals	437,873	242,600

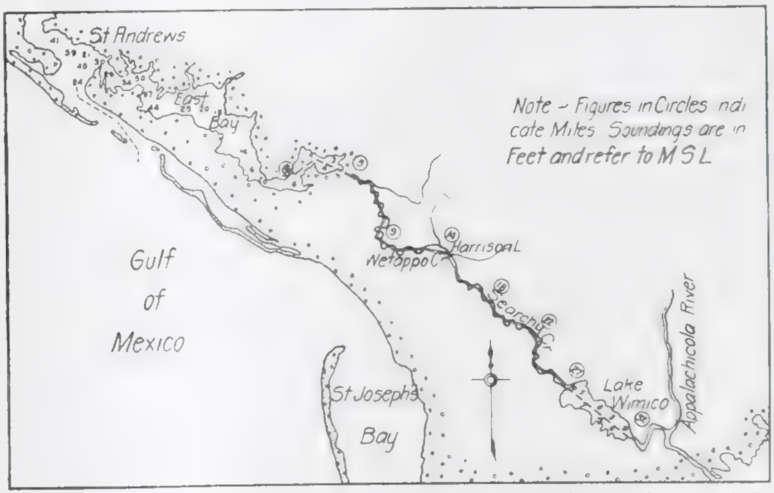
From the above figures given by Mr. Halleck we get the average output per month for the standard Heyworth-Newman machine of 33,683 cu. yds., and for the converted machine 24,260 yds., making a total for both machines of 57,943 cu. yds. Taking the expenses given, we have a cost of nearly 12 cts. per cu. yd., not including overhead expenses, etc. A notable item in the expenses given is the cost of lubricating oil and repairs of $2,220 per month for two machines.

A 3,000,000 Cu. Yd. Channel Improvement from Apalachicola River to St. Andrews Bay, Florida.

BY G. C. SCHERER.*

The River and Harbor bill, which became a law on June 25, 1910, carried two of the most important projects, commercially, which have been embodied in any bill for many years, viz.: "Improving channel from Apalachicola River to Saint Andrews Bay, Fla.," and "Improving Saint Andrews Bay, Fla." These two projects are closely allied, each being dependent upon the other for benefits to a large volume of commerce. They will complete a river system of great value. Quoting from the report of Captain H. B. Ferguson, Corps of Engineers, U. S. A., will give an idea of their importance:

> The Apalachicola River, formed at River Junction by the Flint and Chattahoochee rivers, is 137 miles long. The Chattahoochee River is navigable to Columbus, Ga., a distance of about 163 miles. The Flint River is navigable all the year



Maps Showing Proposed Channel Connecting Apalachicola River and St. Andrews Bay, Florida.

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*"Contractor," July 1, 1910.

*U. S. Engineer Office, Montgomery, Ala.

round to Bainbridge, Ga., and during medium low water to Albany, Ga., a distance of 105 miles. The other natural tributary is the Chipola River, which flows into the Dead Lakes, and, connecting those lakes, is navigable for about 65 miles. The total navigable length of the river system is about 470 miles.

The commerce carried on the Apalachicola-Chattahoochee-Flint-Chipola river system in 1908 was estimated at 120,000 tons, valued at approximately $12,000,000, although it is difficult to arrive, with accuracy, at the real volume of freight carried on this river system. With the completion of these projects, the freight from a river system passing through a rich territory of 470 miles in length can be much more economically handled. The first improvement—Apalachicola River to Saint Andrews Bay—covers a distance of about 32 miles; from Apalachicola to the east end of East Bay, an arm of Saint Andrews Bay, by way of Lake Wimico, Searcy Creek and the South prong of Wetappo Creek, as shown by the accompanying map. It is estimated that this improvement will entail the removal of approximately 3,000,000 cu. yds. of material, a portion to be dredged through the river and creek beds, and a portion to be cut through swamps and other lands, giving a channel 65 ft. wide and 5 ft. deep, the entire project to cost $450,000. The Act of 1910 carries $100,000 for commencing work under the project submitted by Captain Ferguson and approved by the Board of Engineers for Rivers and Harbors.

Another important feature of this improvement, which makes it especially valuable, is that should the proposed inland waterway from Saint George Sound to the Rio Grande River, which forms part of the entire projected intra-coastal waterway along the Atlantic and Gulf coasts, be adopted, this improvement, with enlarged depth and width, would form no insignificant link in the great chain of inland navigation.

The improvement of Saint Andrews Bay, for which the Act of 1910 appropriated the sum of $75,000 on the continuing system, carries a total authorization of $203,560.00. This bay is 110 miles southeast of Pensacola and, including its three arms known as East, North and West Bays, has an area of about 104 square miles. The bay is connected with the Gulf of Mexico by two passes—East Pass and West Pass.

The unique feature of this project is that it diverts the greater part of the commerce of the Apalachicola-Chattahoochee-Flint-Chipola system from Apalachicola Bay, its natural outlet, to Saint Andrews Bay, the latter being one of the finest natural harbors in the world. The reason for this is that Apalachicola Bay is subject to heavy silt deposits and it is not believed to be practicable, at reasonable cost, to maintain sufficient depth.

It is proposed to effect improvement by dredging a channel through East Pass and Camel's Back shoals. It is estimated that, for a channel 200 feet wide, with side slopes of 6 on 1, and a depth of 22 ft., it will require the removal of 2,000,000 cu. yds. of material. However, as in all exposed channels of this kind, the total excavation required will be increased above that figured between fixed lines, due to fill while the work is progressing, the estimate of the amount of material to be removed should be somewhat increased.

It is believed that part of the work will be done by contract and part by government plant. It is estimated that the prospective commerce affected by this improvement, together with that of the Apalachicola River to Saint Andrews Bay canal, will aggregate about $23,000,000, and that after completion of the Isthmian Canal its commerce will be greatly increased.

A total of 21,398 cu. yds. of concrete was laid in the Gatun Locks of the Panama Canal during the week ending July 2, 1910, or an average of 3,565 cu. yds. per day. This is the highest daily average for any work up to this time. The largest day's run was 3,989 cu. yds.

Methods of Making Deep Fills by Suspending Track from Cableway.

A method of making a railway fill by dumping from a wire rope suspended track was described in a paper by Mr. J. L. Ingle, Jr., reprinted in our issue of June 1, 1910, from the Journal of the American Society of Engineering Contractors. In the May, 1910, issue of the same journal there is an interesting discussion on this and similar schemes for embankment construction by Messrs. F. E. Cudworth and Daniel J. Hauer, which we print below.

Mr. Cudworth.—In the paper by Mr. J. L. Ingle, Jr., the methods for making high embankments are given as follows:

(1) By Jacking Track,
(2) By Dumping from a Trestle.

To these I would add a third—that of aerial dump. This method has also been called "cable-way" and "suspended cradle," but probably the term "aerial dump" will be generally adopted, so that is the name that we shall give it.

This interesting case so well described by Mr. Ingle would come under the third method. It is one of the early cases which doubtless led up to the present form.

First the supports of the cable were at grade. Next, the ties still being laid on the cable, one support, the one on the side toward which the fill was being made, was raised to prevent the track, when loaded, from sinking so far below grade; and this made it easier to pull the empty train away. The third step was to raise both supports for the cable or cables, and suspend the track from the cables by cross-beams or stringers, thereby making the track much steadier under load, and also making it unnecessary to dump successive cars opposite ways. The benefit from this will be mentioned later. The fourth step was to provide a way to move the cradle, as the suspended track is now called, as a whole; and also to provide a way to adjust it in height.

With these improvements worked out, the aerial dump as now used is not only an economical and satisfactory method of making high embankments over firm ground, but the only one to be used in such work over swamps or bodies of water with bad bottom. In a case mentioned later, at Freestone, Va., the fill as staked out called for 125,000 cu. yds., but 625,000 cu. yds., or five times the estimated yardage, were actually required to make the fill. This, no doubt, would have been an awkward piece of work to accomplish either by jacking the track or dumping from a trestle.

In the West, where this method was first used, a patent was taken out by a man in California. This patent right was purchased by an Eastern man, and the requisite appliances are now manufactured by the New York Cableway & Engineering Co. of New York City.

In the East, the earliest use of the aerial dump, to the writer's knowledge, was made by David W. Flickwir, a contractor, on the Lynchburg Belt Line, N. & W. cutoff. Both supports were above grade, and the track was suspended from the cables on crossbeams and stringers. Again, the aerial was used on the D. L. & W. cut-off at Roseville, track suspended. At present the method is in operation on the same contract at Andover, N. J.

As the work at Andover affords a good illustration of the use of the aerial dump, and is otherwise very interesting, a brief description of the work to be done on this part of the D., L. & W. cut-off, and the methods employed, will be given. The fill, which is said to be the largest in the world, is for a two-track roadbed, and extends from Andover to Huntsville, N. J., a distance of about 3¼ miles. It will contain about 6,500,000 cu. yds., or 2½ times the amount of excavation required for the Pennsylvania station in New York City.

Of this fill, 3,500,000 cu. yds. will be made by the first method mentioned in Mr. J. L. Ingle, Jr.'s paper, viz., jacking track. The material used will be mostly earth, and, in the highest place, the dump is 110 ft.

Two million yards, a good part of which will be in a fill 80 ft. high, will be made by the second method, viz., dumping from a trestle. This material will be mostly earth.

The remaining 1,000,000 cu. yds. of the fill will be made by the third method, viz., the aerial dump. The material will be both earth and rock, and, in the highest place, the embankment will be 108 ft.

The part of the embankment made by this method will be 2,400 ft. in length. The layout for the work is a cable-way with two spans, one being 1,000 ft., and the other 1,200 ft., supported by three towers, one set at grade, 60 ft. high, and two, 150 ft. high, the tops being 100 ft. above grade. The anchorages are placed in solid rock, 108 ft. and 300 ft. back of the outside towers. The cradle carrying the track, 36-in. gage, 45-lb. rail, is suspended from the main cables, and is intended to hold a train of eight 4-yard cars. These cars weigh about 5,500 lbs. apiece empty, making the live load 22 tons. The dead load is about 14 tons, making the total load carried by the main cables, 36 tons.

The towers are all of wood construction, four legs made of two pieces of 6x12 yellow pine with 3-inch fillers, x-braced with 3x12's, guyed half way up and at the top, and have oak block saddles 12 ft. from centre to centre. As now used, these saddles are 18 ft. from centre to centre.

The cables are 2¼-in. diameter crucible cast steel, 2,800 ft. long, and weigh 11 tons each. One end is fastened directly to the dead man; the other has a pulling up tackle consisting of four sheave blocks, "reeved" up with 1-in. wire rope, by which the tension is adjusted by using dinkey engines. A moveable "follow up" tower is used when the cradle is near the middle of the span.

The cradle is suspended from the main cables by U plates and ⅞-in. wire rope hangers, having at the bottom double blocks, reeved up with ⅝-in. wire cables for the purpose of adjustment. From these suspenders are hung 12x16 yellow pine crossbeams, carrying 10x12 yellow pine stringers, on which the track is laid. The spacing of the crossbeams is 24 ft., with the exception of the first span, which is 30 ft.

The scheme for operation is as follows: The fill was started from the high end, grade 55 per cent, the cradle being suspended between the 60 and the 150 ft. towers, clearance being provided to run trains through the base of the first tower. The cradle was moved ahead until the adjusting falls were "block and block" on the shortest hangers. The dump was then widened and the follow up tower brought forward. The cradle and short towers were moved out as the work progressed until near the 150 ft. tower, when, the short tower not being necessary, the cradle was advanced to the 150 ft, tower. The bottom of this tower having been surrounded by the fill the braces were removed to permit cars to pass through it, and the hangers were then transferred to the other side of the tower, as needed. Pulling down falls are used on the main cables near the cradle to prevent too great a deflection. They draw the main cable down until the sag that occurs when the load goes on is reduced to two or three feet.

The cost for placing the material by this method may be divided into three parts:

(1) Innitial cost.
    (a) Material, Including Delivery.
    (b) Erection.
(2) Operating Expense.
    (a) Dumping.
    (b) Moving Cradle and Follow-up Tower.
(3) Interest on Investment and Depreciation.

From this may be deducted the value of all materials above grade, which are saved at the end of the work. These consist of main cables, and all guy wires, which should be in good condition, about one-half of the timber in the towers, and the tackle for main and suspension cables, and attachments and timber in the cradle.

The first item, "Initial Cost," including Erection, is estimated at $13,000. Interest thereon for about two years at 4 per cent amounts to $1,000, making a total of $14,000.

Deducting from this total a salvage of $4,000, leaves an expenditure of $10,000.

In order to make comparisons with other cases, this item of expenditures should be charged only to that part of the fill actually put in directly from the cradle. This percentage varies with the width of the top of the embankment. In this particular case 12 ft. of the 35 ft. finished roadbed was made in this manner, which amounts to about three-quarters of the total yardage. To make this fill of 1,000,000 yds. would require about 800,000 cu. yds. pit measure; and three-fourths of this, 600,000, would make the cost a little over 1½ cts. a yard. The operating expense, includes the dumping and the moving of the cradle and of the follow-up tower, and amounts to about 2½ cts. a yard, pit measurement. The cost for moving the cradle decreases as the men become more familiar with the work. The depreciation and interest charges were combined with the item of first cost.

Summing up, this gives the cost of placing the material in the embankment (12 ft. wide on top) as 4 cts.; which is especially economical for work done under adverse conditions, such as bad bottom, absence or high price of timber, and like causes.

The advantage of this method over the one mentioned by Mr. Ingle in his paper is, that the suspended cradle affords such stability that all the cars may be dumped on one side if necessary. Two men, one on each side at the shoulder of the dump, knock the chains loose from those cars on which there is no rock that will not clear the doors. The cars are then free to go either way and to dump automatically. Those cars which are loaded with rock that may not clear the car doors, are "dogged," or chained to the rails before dumping.

The blocks are fastened to an auxiliary wire rope, which hangs just below the main cable and runs back through a block at the tower, and then to the ground. By means of this line the cradle is rolled along on the main cables. This does away with the friction in pulling the U plates along on the cables.

D. J. Hauer.—One of the earliest schemes I ever heard of for doing away with the temporary trestle of a high and large embankment was in Switzerland, some years ago, when a steel cantilever was built, extending over the end of the bank, and anchored to the new bank as it was made, being moved ahead by a system of cables and dead men. A similar cantilever was also used in the northwest by a contractor, whose name I do not remember at the present time. A large embankment in Montana was built with a smaller cantilever structure. In these cases a large amount of steel had to be fabricated and hauled and erected; and, as the salvage on it was small, I think the cost was rather high. Therefore, this method was not used very much.

A method somewhat similar to the one Mr. Ingle described was used on the Lake Erie & Pittsburg R. R. by Williams Bros. & Morse Co., a few years ago. On their embankment the anchors were 40 ft. apart. The embankment contained about 175,000 cu. yds. Instead of erecting double bents, they simply put up an A tower in the centre of their embankment, and then constructed two short pieces of trestle at each end. By means of dead men, they anchored their cables into the natural ground, and ran them over these two short pieces of trestle and over the tower, and thus had a suspended cableway similar to the one Mr. Ingle described. They were able to bed their cableways in the rock itself, which happened to be at both ends. They dumped 6 to 12 4-yd. cars in a trainload. The cost of this cableway bridge was about $1,531, or about 1 ct. a cu. yd. The contractors estimated that a temporary trestle built in place of this would have cost about $3,274, or nearly 2 cts. a cu. yd.

In regard to costs, I might say that in building a large number of temporary trestles, and keeping very accurate records, where logs could be obtained on the ground at from 3 to 5 cts. per linear foot, and carpenter wages were from $2.50 to $3.00 a day, my experience is that the cost ranges anywhere from 1 to 8 cts. per cu. yd. Over low structures, where the amount of material to be dumped is not large, the cost runs frequently from 4 to 5 cts. per cu. yd., and maybe a little higher; although in one case, near Savannah, Ga., I erected a long, low temporary trestle, at an average height of 8 ft., for 2½ cts. a yd. But I was able to get my stringers by buying and reselling, so the cost was only $2 per thousand. For the short bents, placed on 18-ft. centres, I was able to get the timber off the right-of-way. But on that same work, where we were compelled to buy our longer timbers, the cost was about 3 cts. a cu. yd. for a trestle about 28 ft. high.

On one job in North Carolina, I erected temporary trestles, varying in height from 30 ft. to 50 ft., in some cases triple-deck in their framing, and they cost from 2½ cts. to 5 cts. per cu. yd. for the material placed in the embankment. The cost of timber was 3 cts., and carpenters were paid $2.50 a day. The amount of iron was small, being in the bents mostly. The stringers and ties were not fastened with metal.

I have some costs of one structure, about 70 ft. high, where the price of timber was about 5 cts. a foot, and of labor $3 a day for the carpenter, and the average per cubic yard was between 7 and 8 cts. There were something like 150,000 cu. yds.

In California, or in Nevada, E. B. & A. L. Stone Co. used a car unloader, as they called it, which was the invention of their engineer, Mr. F. F. Floyd. This consisted of a circular piece of track. They had a single piece of track extending to the dump, where a double track was laid running into a circular track where the embankment was being made. The circular track was held up by a gin-pole, like a maypole, in the centre, with cables stretched down from it, and with a farmework to help support the whole thing, over the end of the bank itself. There was a hoisting engine between the gin-pole and the end of the embankment, which operated two cables. A car was picked up by this cable and run on to the circle, and dumped on the outer edge, and brought back to the bank. The whole structure was moved forward as the embankment was built. It was used on some embankments as high as 114 ft. The hoisting engine was of 15 h. p. Eight cars were unloaded in a minute. It was not possible to test the capacity of the unloading device for the simple reason that enough cars could not be procured for the purpose. The engineer stated that it was not an economical device for embankments less than 35 ft. in height.

I was once associated with contractors, who used a cableway to build an embankment, an ordinary cable-way, by having skips, placed on flat cars, loaded with steam shovels. We ran the train under the cable-way and picked up the skips, and carried them out and dumped them by means of an aerial dump. That was done because we had to cross a river, which it was not possible to bridge with a temporary bridge, and the embankment was built on the opposite side of the river from which we obtained the spoil. We thus made the embankment by an ordinary cable-way.

I have not any cost data of that job, but the method adopted for doing the work was the only one we could conceive of at the time without building a bridge across the river.

The work Mr. Cudworth spoke of, that Mr. Flickwir did in Virginia, was at the Freestone River. The conditions were exceptional there. The steam shovel cut was on the south side of the river, which is a slow stream and very easily flooded with back-water from the bay, and the embankment had to be made on the other side of this river through very swampy grounds. That ground is so treacherous that even today trains cannot go over it at any great speed. I passed over it a few years ago, and the bridge and the embankment had moved out of line. I believe it is still moving.

This was no doubt due to the fact that the engineers, in locating their line, did not consider the submerged sandbar at that point; and instead of building on top of the bar built on the inside slope, causing travel away from the water. I have had several experiences of that kind myself, and have learned that it is necessary, in making embankments, to make thorough tests, and to get the line located on top of such a sandbar if it is at all possible to do so. I believe it was not possible in the case mentioned to drive piles to carry any great weight. A tramway, not a cable-way, was erected by the Trenton Iron Co. of Trenton, N. J. Forty 1-cu.-yd. buckets were used on the tramway. Two ways dump cars loaded by the shovel were run onto a trestle built above some bins, into which the cars were dumped. The buckets traveling on the cable-way passed doors at the bottom of the bins and were loaded automatically. They were dumped on the embankment by means of an aerial trip. The buckets traveled slowly, and all the other work was finished before this embankment was built. The cost must have been high, but the conditions were exceptional.

ROADS AND STREETS SECTION

Road Maintenance Work in 1909 of the Massachusetts Highway Commission.

During 1909 the Massachusetts Highway Commission resurfaced about 42 miles of state highway and put a surface coating of a bituminous binder and sand or screenings on about 115 miles. Various methods were employed in the resurfacing. About 23 miles were resurfaced with stone only. On 14 miles the upper course was grouted with tar product, eight miles of which had a bituminous surface coating. This surface coating was made of refined tar, tar mixed with asphalt, asphaltic oil or residuum asphalt, all covered with sand and rolled. On about 4½ miles the stones in the upper course were coated with a bituminous material before being spread upon the road. The sand was then rolled and a surface coating applied. The materials used were refined tar, genasco and refined tar mixed with 15 per cent of asphalt.

Of the 115 miles of road treated with a bituminous surfacing coating, nearly 104 miles were coated with asphaltic oil and over 11 miles with refined tar. In both cases the bituminous binder was covered with sharp sand or stone screenings. In many cases the road so treated really needed resurfacing, and it was carefully patched with the oil or tar and sand, and in some instances broken stone was added, and afterwards the whole surface was coated. If roads so treated wear well, the commission believes it may do away with the necessity for resurfacing with broken stone.

The use of sand as a protection to macadam roads was continued wherever a bituminous surface has not been considered necessary because of excessive automobile traffic. The commission states that it has been still further demonstrated by the experience in 1909 that on an ordinary country road where the automobile traffic is not heavy, a stone road can be preserved in good condition for many years by this means, at an average cost of perhaps 1½ to 2½ cts. per square yard per year. This would amount to from $140 to $220 per mile. The above is a brief outline of the maintenance work in 1909 of the commission. Further details as to this work are given as follows in the last annual report of the commission:

BITUMINOUS WORK.

Uncertainty as to what methods and materials are best for obtaining roads that will withstand modern traffic has caused the commission to continue the construction of experimental sections of road, the object of these experiments being to find what treatment is the most economical, considering the cost of construction and maintenance combined, not separately.

Records are made of the minutest details of each method tried, and close observation of the results obtained will enable the commission in the near future to determine what methods or treatments can be most wisely adopted. Every bituminous binder used has been analyzed, over 600 analyses having been made during the year.

The satisfactory results obtained by giving the roads a light surface coating of refined tar or heavy asphaltic oil has led to extensive use of this treatment; and for the more economical and effective application of the material the commission purchased in England two machines for spraying the bituminous material under pressure, by the use of which machines a very thin coating of oil or tar can be spread uniformly, using one quarter gallon or less to the square yard.

A general conclusion has been reached by the commission as a result of work done up to this time, namely, that in many instances some bituminous binder must be used in the first construction of a road, and that no positive determination of the exact nature of the binder that will be the most economical in construction and maintenance can be made until more time has elapsed to demonstrate their qualities by actual use on the roads. Meantime, until such determination can be made, the commission considers it advisable to use in general only the commonly used and comparatively inexpensive surface treatment of bituminous binder, using about ½ gal. to the square yard of surface, and covering with stone screenings, fine gravel or coarse sand. This treatment preserves the road, renders resurfacing less urgent, and lays the dust. The general use of oil or other dust layer instead of water has largely increased during the year, possibly because of the law adopted last winter, as recommended by the commission, allowing cities and towns to assess upon the abutters or take from the tax levy the whole or a part of the cost of using these dust layers instead of water.

There are a few principles which the experience of the commission leads it to believe will become universal in future bituminous work. Bituminous surfaces should have less crown than the ordinary macadam road. While the customary crown on macadam roads is ¾ in. to the foot, a crown of ⅜ in. or less has been found to be probably sufficient and possibly more desirable than a greater crown on bituminous surfaces. Experience has also shown that with both automobile and horse traffic on a bituminous road it is advantageous, particularly with roads made by mixing or grouting tar in the top course, to apply a surface sealing coat, preferably of asphalt, as that seems somewhat less slippery, gives a better appearance, and, at the present writing, shows indications of longer life than a surface coating of tar.

An oil or tar, to be useful on a road, must bind the materials together; it must be tenacious and adhesive—a binder, not a lubricant. One can tell almost as soon as one begins to use a material whether it works well or not; at any rate, at the end of one or two days, when it has had time to set.

It seems evident that the failure of some of the materials to give satisfaction may be due to superheating, which causes them to lose their adhesive properties; or a material may be mixed or thinned or fluxed with a material which is of no value as a road binder, thus taking away the natural adhesiveness of the asphalt or tar that is fluxed with it.

The commission cannot, at this time, announce any specifications which it would feel satisfied to recommend for general adoption.

The commission, however, has had Mr. H. W. Clark, the chief chemist for the State Board of Health, at work all this season making analyses and experiments; which have proved to be of great value, and it hopes before long to adopt specifications which will insure the securing of good road material.

Oil and Sand Roads.—On a good many miles of road the commission has not only applied a surface coating of oil covered with sand or stone dust, but, where the road has been in need of resurfacing, it has patched the ruts or holes with the oil and sand before giving it a surface coating. In some instances, where the road was in a very bad order, it has been given two coats of oil and sand over the entire width, and in other cases two coats have been applied to the middle of the road and one for the entire width.

Roads treated in this manner have proved satisfactory, and at the present time it looks as if this use of oil and sand, if continued and repeated from time to time as necessary, might do away with the necessity of resurfacing such roads with broken stone.

A new road built entirely of asphaltic oil and sand, heated, and mixed by hand, has been built by the commission this year.

The commission has also built some road on the Cape, at Wareham and Rochester, where the same method has been employed, using sand instead of gravel. This road looks reasonably satisfactory, and if it wears well this method of treatment will prove of great benefit to the sandy sections of the state where the travel is not extremely heavy, as it is entirely probable that such a road can be built for one-third of the cost of macadam, or less.

It is expensive, of course, to heat the sand and oil and mix them by hand, but no doubt the cost of mixing can be largely diminished by the use of some mechanical mixer. Some concrete mixers have been used, with good results, on work of this character. The commission hopes, however, to be able, within a short time, to build sand and oil roads by a cheaper method, either building up in layers, or spreading the oil upon the sand in various coats, and cultivating, shaping and rolling it into shape. A road built in Eastham in this manner, which has been repaired from time to time, has now lasted five years, and, while not, of course, as good as a macadam road, it is reasonably satisfactory, and accommodates the travel in the place where it is located.

A sand and oil road, which was built by this same method in Brewster, Harwich and Orleans last year, is now in fairly satisfactory condition. It ruts somewhat, but every time it is shaped and patched it gets into better condition, and is, at any rate, a decided improvement over the sand road that existed there before.

At Wayland the commission has built a section of road entirely of oil, or oil and asphalt, mixed with various grades of gravel, heated, the whole being thoroughly mixed by hand and then spread upon the road. This has made a most excellent road. It has the appearance of an ordinary asphalt road with a true crown and grade, and so far there have been but few complaints as to its slipperiness.

Results of the Season's Work.—It is perhaps not too much to say that, while the commission has used various bituminous binders, both with tar and asphalt bases, has employed various methods of construction and resurfacing and various methods and materials in surface coating, the roads where these materials have been used have almost invariably been in very satisfactory condition at the end of a year. They are certainly in better condition than most of the roads where no such materials have been used.

In only a very few instances have the roads failed, or gone to pieces, to any great extent. Some places have had to be patched, and occasionally certain spots have required extensive patching, but in the main, while some are much better than others, it is true that almost every one of them is reasonably satisfactory. The failures have been very few and of very slight extent.

It is because of the indications as to comparative wear because of slipperiness, etc., that the commission has been led to adopt one material rather than another.

It can fairly say, however, as a result of this season's work, that the use of bituminous binders in road material has, in its opinion, come to stay, and will be much more prevalent in the future than it has been in the past wherever there is much automobile traffic.

The doubt that exists is not as to the use of some bituminous binder, but which binder to use, and exactly what is the best method of applying it. It will undoubtedly be found that different localities and different materials require somewhat different binders and treatment, and by experience alone can a determination be made as to what will be the best to use in any given locality with the materials that are there available.

Methods of Application.—The English spraying machines, purchased by the commission, are in very common use in England, where many hundreds of miles of road are sprayed with tar annually, and their use in that country is constantly increasing.

It has been the practice in England to spray a thin coating of tar over the road without previously preparing the road surface to any great extent. The tar is spread in a very thin coat, the first coat varying from ⅛ to ¼ gal., or even less, to the square yard of surface. A second coat, sometimes being only ⅛ or 1/9 gal. to the square yard, is then applied. The English gallon, however, is about one-sixth larger than the standard gallon of this country.

The spraying machines which the commission purchased are made to hold the tar, heat it with a steam coil by means of steam provided by a traction engine or a steam roller, and spread it upon the road in a thin and even coat. The tar is kept under pressure by pumps geared to the wheels, so that a pressure is developed by the movement of the tar-spraying machine itself.

The tar is spread hot upon the road, under pressure, through a number of fine nipples which make a very fine spray and cause the tar to spread evenly over the road and into the depressions. The nipples are on a long tube, and have a sort of hood to prevent the tar from being blown to one side by the wind. The machines work very well in applying an even coat of about ¼ to ⅓ gal. to the square yard. Their use has given very good results, particularly in putting on one coat of tar. The machines have been hauled behind the steam roller which provided the steam for heating the tar. This method of hauling is, of course, somewhat expensive.

Early in the year the commission used heavy asphaltic oil in the spraying machines, and the machines worked very well on this work. At the beginning of the season the commission was handicapped by the inexperience of the persons selected to operate this particular type of machine, as no similar machines had previously been used on work in this country, and the costs of the work done were necessarily high, inasmuch as proper arrangements could not be made for the continuous use of the machines. Toward the end of the season, however, the costs were very much reduced.

One coat of oil, using ¼ gal. to the square yard, including the cost of sand, oil, labor and expenses in connection with the steam roller, can probably be applied at a cost of less than 5 cts. per square yard.

While the work of applying the oil by means of a spraying machine has been more economical than coating roads with oil in any other manner, it should be borne in mind that a smaller quantity of oil is used per square yard. It seems probable that a single coat of ¼ gal. to the square yard will not be sufficient except upon roads which are in good condition. One-half gallon of oil to the square yard appears to give better results on most roads.

In other oil and tar work the material has been spread in various manners. The lighter oil was, in one instance, spread from a sort of trough made of two boards with an opening at the bottom, which was mounted on wheels and which received the oil from a barrel. The American Tar Co.'s distributer has been used, with very good results, where the quantity of material to be spread was about ½ gal. to the square yard. Oil has also been applied from an ordinary half-moon watering cart. When the heavy asphaltic oil has been used, it has always been necessary to heat and apply it hot.

The cost of the surfacing work has varied greatly in different localities, as it depends largely on the length of the haul, the cost of the sand or gravel covering, and on whether or not the oil or tar was purchased in tank car lots or barrel lots. When the heavy grade of oil has been used and applied hot, at the rate of ½ gal. to the square yard, the cost has varied from 6 to 11 cts. per square ward, which cost includes the cost of material, labor, and the surface covering of sand, gravel or stone screening. In many instances these costs included considerable patching which it was necessary to do in order to prepare the road surface for the oiling. In general, it may be stated that a fair price for such work, complete, is from 6 to 8 cts per square yard.

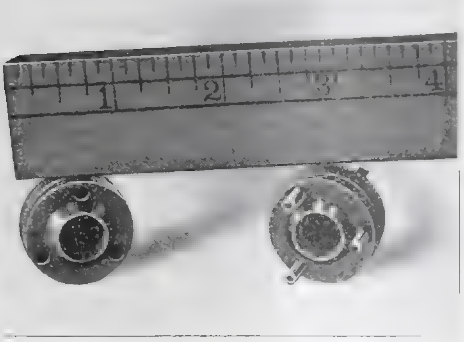

Fig. 1—View of Molds for Test Specimens of Bituminous Materials.

On account of the increased efficiency of the employes of the commission, because of the experience gained during the past season, the cost of the work done with the tar-spraying machines will probably be largely diminished.

In all cases, before applying bitumen to a road, the surface should be carefully prepared, thoroughly cleaned and compacted, all holes and depressions filled, and the roads brought to as true a crown and grade as possible. The oil or tar should then be spread as evenly as possible over the surface of the road, brooming it where necessary to secure a uniform coating, and covered with sharp sand, gravel or stone screenings.

During the first few weeks after the road has been treated, covering material should be added whenever the oil or tar appears upon the surface.

If holes or depressions are left in the road, the water which lodges there soon causes the road to become raveled.

Roads surfaced with any bitumiuous binder must shed water, or they will quickly go to pieces.

Dust pockets or loose material will invariably cause the surface to peel or scale. A road should be patched as soon as any scaling appears on the surface.

All loose material should be cleaned out of depressions, or the edges made straight, before the bituminous material is applied. The depressions should be filled with heated sand, gravel or chips, thoroughly mixed with hot oil or tar, and tamped into the depressions. Another method is to sprinkle the hot oil or tar into the depressions, after it is prepared, covering the material with all the sand, gravel or chips which it will take up. The material should be tamped and the process repeated until the depression is entirely filled.

In molding cement sewer pipe at Panama the loss resulting from breakage in removing forms is for 20 and 24-in. pipe about one length in every ten lengths molded. The loss is less in the smaller sizes.

An Instrument for Ascertaining the Tenacity and Ductility of Bituminous Materials.*

The term "ductility" as applied to bituminous substances refers to the extent that they are capable of being drawn out in the form of a fine thread. In the case of soft bituminous substances, this property may be roughly determined by stringing out a small quantity between the thumb and forefinger. Materials possessing great ductility are very often described as "stringy" or as showing "life," whereas those of low ductility are said to be "short" or "dead."

Several instruments have been devised for determining the ductility of bituminous materials. Although differing slightly in construction, they operate on substantially the same principles, measuring the extension which the bituminous substance is capable of sustaining without fracture.

The ductility test first assumed importance in connection with asphaltic cements used for paving purposes. It was probably for this reason that the form of mold which originally suggested itself for retaining the asphalt during the test† was patterned along the lines of the briquette mold ordinarily employed in connection with hydraulic cements. This same type of mold has been adhered to in a ductility machine since described by Smith.‡

During recent years, the scope of the ductility test has been extended to bituminous materials other than paving cement, including various asphalts, tars, and pitches employed in manufacturing insulating materials, rubber substitutes, paints, varnishes, waterproof fabrics, etc. It has, for example, been found that bituminous substances having the same degree of hardness (consistency) and melting point (fusibility), but varying in ductility, will behave differently towards heat and cold, and in solution. Thus, substances possessing great ductility are readily susceptible to changes in temperature, will melt easily to thin liquids, and when dissolved will form solutions of low viscosity. On the other hand, substances endowed with but little ductility will be least affected by changes in temperature, will melt to "pasty" liquids, and will form soltions of high viscosity.

Although the Dow type of mold is well fitted for handling paving cements, it is hardly adapted to receiving and retaining many of the bituminous materials ordinarily encountered. Soft semi-liquid substances are apt to run out of the mold, and hard brittle asphalts, owing to its form, are liable to be fractured while it is being attached to the clamps.

Recognizing the fact that the mold constitutes the most vital part of the entire instrument, it was subjected to careful study, and after extended tests, the form illustrated in Figs. 1 and 2 was adopted as giving the best results and overcoming the difficulties mentioned.

The mold consists of two cylindrical bronze sections, a_1 and a_2 (Fig. 2), resting together on circular knife-edges and maintained in that position by three guide rods b. The cross-section at the knife-edges is exactly one square centimeter. The further ends of these two cup-like sections are threaded, and bear the caps c_1 and c_2, which serve to fasten the mold in the instrument. The interior of the mold is amalgamated with mercury to prevent the bituminous material from adhering. This may be effected by using a solution of mercuric nitrate or mercuric sulphate.

After warming the mold it is filled by unscrewing the upper cap c_1 (Fig. 2), bringing the two sections firmly together and pouring in the melted bituminous substance, which assumes the form of a rivet as illustrated by d, the smallest cross-section of which has an area of *exactly* one square centimeter.

An illustration of the "tensometer" is shown in Fig. 3. The bronze mold A_1 and A_2 is clamped between the two guides B_1 and B_2, the lower section being fastened to the stationary cross-piece C by means of the pin D_1 and the upper section to the movable cross-head E by the pin D_2. The cross-head is attached to a chain F, which passes over the chain-wheel G fastened to the spring balance H, and then around a suitable winding mechanism I. The winding is effected by turning the handle J, which operates the endless chain K running on the sprocket wheels L_1 and L_2.

The spring balance is equipped with a trigger M to prevent recoil when the spring has been extended. The trigger may be conveniently released at the end of the operation.

The chain F also meshes with a train of gears operating the brass pointer N pressing against the dial O, which is formed of vulcanite or other insulating material. Its face is divided into one hundred divisions, each consisting of a metallic contact. As the pointer brushes over these metallic contacts, it momentarily closes an electric circuit which operates the relay P, causing an audible "click." The relay is connected with the battteries Q and the switch R. One revolution of the pointer indicates that the halves of the mold have been separated a distance of exactly one meter. Therefore, a movement of the pointer over one division of the dial corresponds to a centimeter rise of the section A_2. The gearing is shown in detail in Fig. 4.

The guides B_1 and B_2 (Fig. 3) are pivoted at S_1 and S_2, which permits the reservoir T being slipped into place. After this has been done, the guides are prevented from moving by the bolt U, which firmly locks them in position. The reservoir is filled with water maintained at any desired temperature by the heating coil Y in series with the incandescent lamps V. The bath may be conveniently agitated by squeezing the bulb W, which forces air through the liquid. X is a valve for emptying the reservoir.

The tensometer measures 77 ins. in height, 15 ins. in width at the top and 22 ins. at the base. The reservoir stands 45½ ins. high, so as to permit the sections of the mold being separated 39.4 ins. or 100 cms.

After the mold containing the bituminous material is fastened into place, it is brought to a temperature of exactly 77° F., registered by a thermometer suspended in the liquid. The

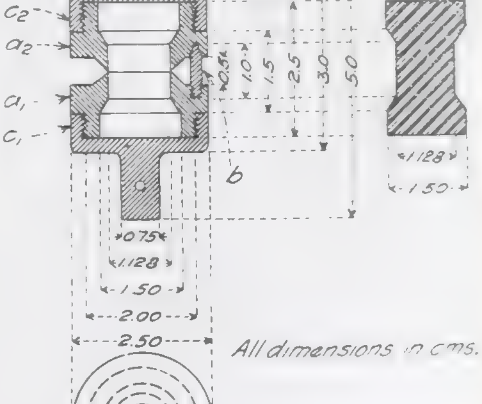

Fig. 2—Details of Molds for Test Specimens of Bituminous Materials.

maximum-indicator of the spring balance is then set at the zero mark, and the pointer on the dial also brought to the zero division by winding up the chain until it becomes taut. The

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*A paper by Herbert Abraham, presented at the 13th annual meeting of the American Society for Testing Materials. This is the second paper by Mr. Abraham on the subject of "Improved Instruments for the Physical Testing of Materials." See Proceedings American Society for Testing Materials, 1909, Vol. IX, for the first paper.

†Described by Dow in [illegible] Chemical Engineer 1905, Vol. I, No. 5, page 330.

‡"A Machine for Testing the Ductility of Bituminous Paving Cements." Proceedings of the American Society for Testing Materials, 1909, Vol. IX., pages 594-599.

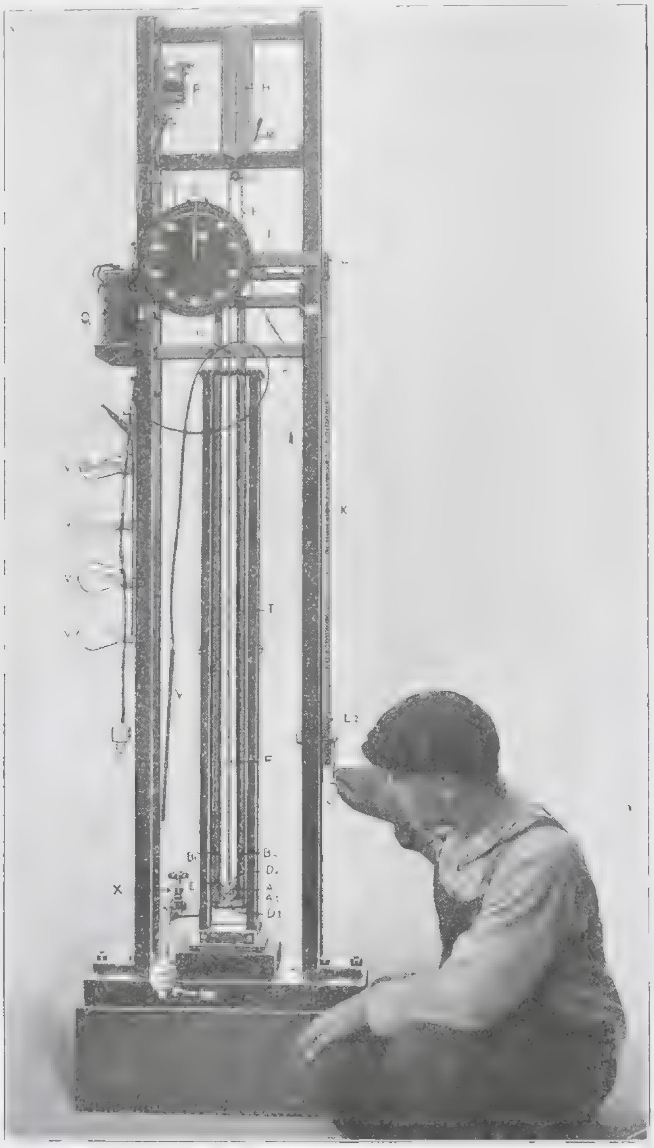


Fig. 3—View of Tensometer for Ductility Tests of Bituminous Materials.

electric circuit is then closed by means of the switch R, and the crank turned so as to draw apart the two sections of the mold at the definite speed of *five centimeters per minute*. The speed may be conveniently controlled by a metronome equipped with a bell adjusted to ring every twelve seconds, or five times per minute. The speed at which the crank is turned must then be regulated so that the "clicks" of the relay are brought in unison with the "rings" of the metronome.

The operator should watch the specimen as the sections A_1 and A_2 separate, and he should cease turning the crank at the moment the thread of the bituminous material parts. The spring balance will indicate the tenacity of the substance expressed in kilograms, and the dial its ductility expressed in centimeters. On account of the particular construction of the instrument, the actual stress applied to the specimen is one-half of the reading of the spring balance.

The tensometer may be conveniently used to test bituminous materials of any consistency. Its range is sufficiently great to handle all forms of asphalts, tars, and pitches in commercial use. A spring balance reading to 20 kilograms divided into tenths of a kilogram, which corresponds to a maximum tenacity of 10 kilograms per sq. cm., is sufficient for all practical purposes. As yet, no bituminous material has been encountered having a ductility greater than 100 cms. The highest tested by the writer showed a ductility of 82 cms.

The tensometer possesses the following distinctive features:

1. It is designed to determine both the tenacity and ductility of bituminous materials in a single operation.
2. It is capable of handling hard and brittle, as well as soft and semi-liquid substances.
3. The mold is constructed according to scientific principles, and it may readily be filled or cleaned.
4. Only a very small quantity of the bituminous material (between 3 and 4 grams) is required for the test.
5. The manner of conducting the test is extremely simple. It is but necessary to turn the crank so that the "clicks" of the machine are maintained in unison with the "rings" of a metronome, and to observe when the thread of bitumen parts. The tenacity and ductility are recorded automatically.

The instruments described in this and in the preceding poper may be used to determine the following physical properties of bituminous materials:

Consistency.—The substance is subjected to a compressive stress applied locally to its surface, so as to cause a round flat surface 0.01 sq. cm. in area to penetrate to a depth of exactly one centimeter in one minute. The square root of the maximum reading in grams is equal to the "consistency."

Resilience.—At the termination of the preceding test, the load is immediately released, and at the end of one minute the rebound is noted and expressed in percentage of a centimeter. This is equal to the "resilience."

Fusibility.—A glass tubs of 6 to 7 mms. internal diameter containing a plug of the substance 5 mm. in length and 5 grams of mercury, is heated at the uniform rate of 4° F. per minute. The temperature at which the mercury drops through the plug of material is equal to its "fusibility."

Tenacity.—The material is subjected to a tensile stress applied to a cylinder of exactly 1 sq. cm. cross-section and 1 cm. in length, so as to cause it to be drawn apart at the uniform speed of five centimeters per minute. The maximum reading in kilograms is equal to the "tenacity."

Ductility.—The elongation in centimeters at the moment the material parts in the preceding test is a measure of its "ductility."

Proposed Standard Tests for Road Materials of the American Society for Testing Materials.

At the 13th annual meeting of the American Society for Testing Materials at Atlantic City, N. J., June 28 to July 2, 1910, the Committee on Standard Tests for Road Materials, reporting through its Chairman, Mr. Logan Waller Page, Director U. S. Office of Public Roads, presented to the society for adoption by letter ballot the method for the determination of bitumen in asphalt paving mixture, refined asphalts and asphalt cements, which was tentatively presented to the society in 1906, and tentatively revised in 1909, so as to include all bituminous paving and road material.

The committee, in presenting this method of analysis, wished it understood that they did not recommend it as the best for general use, as it is longer and in several cases gives no better results than other more expeditious methods, but only as a method to be resorted to in case of dispute, as it seems to have the widest range of applicability.

The committee further recommended that

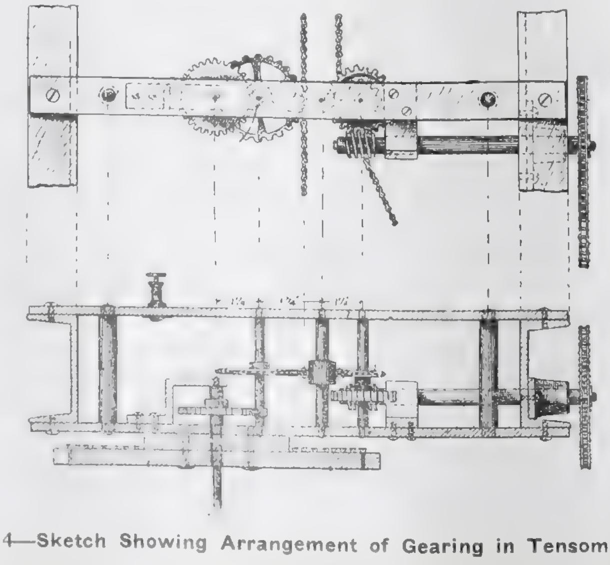


Fig. 4—Sketch Showing Arrangement of Gearing in Tensometer.

the method for sizing and separating the aggregate in asphalt paving mixtures as reported to the society in 1906 and published in the proceedings for that year, be put to vote by letter ballot for adoption as standard. The determination of residual coke in bitumens as submitted to the society in 1909 was also presented for adoption as standard. The committee further reported that methods for the determination of the loss on heating of oil and asphaltic compounds, and for the determination of the penetration of bitumens have been revised. These were also presented for adoption as standard. The proposed standard tests referred to above follow:

PROPOSED METHOD FOR THE DETERMINATION OF BITUMEN IN PAVING COMPOUNDS, INCLUDING THE DETERMINATION OF BITUMEN IN ASPHALT PAVING MIXTURES, REFINED ASPHALT, ASPHALT CEMENTS, BITUMEN TREATED ROAD MATERIALS, TARS AND TAR PITCHES, SOLUBLE IN COLD CARBON DISULPHIDE AND OTHER SOLVENTS.

Drying the Sample and Preparing It for Analysis.—It was decided, owing to the great variety of conditions met with in bituminous compounds, that it is impossible to specify any one method of drying that would be satisfactory in every case. It is therefore supposed that the material for analysis has been previously dried, either in the laboratory or in the process of refining or manufacture, and that water, if present, exists only as moisture in the hydroscopic form.

The material to be analyzed, if hard and brittle, is ground and spread in a thin layer in a suitable dish (iron or nickel will answer every purpose) and kept at a temperature of 125° C. for one hour. In the case of paving mixtures and road materials, where it is not desirable to crush the rock or sand grains, a lump may be placed in the drying oven until it is thoroughly heated through, when it can be crushed down into a thin layer and dried as above. If the material under examination contains any hydrocarbons at all volatile at this temperature, it will of course be necessary to resort to other means of drying.

Analysis of Samples.—After drying, from 2 to 15 grams (depending on the richness in bitumen of the substance) is weighed into a 150-c.c. Erelenmoyer flask, the tare of which has been previously ascertained, and treated with 100 c.c. of carbon disulphide. The flask is then loosely corked and shaken from time to time until practically all large particles of the material have been broken up, when it is set aside and not disturbed for 48 hours. The solution is then decanted off into a similar flask that has been previously weighed, as much of the solvent being poured off as possible without disturbing the residue. The first flask is again treated with fresh carbon disulphide and shaken as before, when it is put away with the second flask and not disturbed for 48 hours.

At the end of this time the contents of the two flasks are carefully decanted off upon a weighed Gooch crucible fitted with an asbestos filter, the contents of the second flask being passed through the filter first. The asbestos filter shall be made of long-fiber amphibole, packed in the bottom of a Gooch crucible to the depth of not over ⅛ in. and ignited. After passing the contents of both flasks through the filter, the two residues are shaken with more fresh carbon disulphide and set aside for 24 hours without disturbing, or until it is seen that a good subsidation has taken place, when the solvent is again decanted off upon the filter. This washing is continued until the filtrate or washings are practically colorless.

The crucible and both flasks are then dried at 125° C., and weighed. The filtrate containing the bitumen is evaporated, the bituminous residue burned, and the weight of the ash thus obtained added to that of the residue in the two flasks and the crucible. The sum of these weights deducted from the weight of substance taken gives the weight of bitumen extracted. In the analysis of hard asphalts or tar pitch for their solubility in carbon disulphide and also in the analysis of any of the bitumens for their solubility in naphtha, it is recommended that from 15 to 20 grams of glass beads be introduced into the first flask with the substance. When the flask is shaken, these beads grind up any lump of hard bitumen and thus greatly facilitate the solution of the soluble constituents. In filtering these solutions through the Gooch crucible, they should be allowed to run through by gravity, as the application of an exhaust appears to cause a clogging of the filtering medium.

This test shall be carried on at a temperature of from 20° to 25° C. When carbon disulphide or carbon tetrachloride are used as solvents, they must be chemically pure. When naphtha is employed the committee recommends that in all cases it be described by stating its specific gravity and the temperature between which it distills.

PROPOSED STANDARD METHOD FOR THE DETERMINATION OF THE PENETRATION OF BITUMEN.

The penetration of bitumen shall be the distance expressed in .01 cm. that a No. 2 needle will penetrate into it direct without friction at 25° C., under a stated weight applied for a stated length of time, the factors of weight and time being determined as follows:

The material shall first be tested for five seconds under a weight of 100 gms. If this result is less than 10 the penetration shall be determined under a weight of 200 gms. applied for one minute; if between 10 and 300, the penetration shall be determined under a weight of 100 gms. applied for five seconds; if greater than 300 the penetration shall be determined under a weight of 50 gms. applied for five seconds. In every case the factor of weight and time shall be stated when reporting the penetration.

It is recommended that the penetration may be determined at 0° and 46° C. in addition to the 25° C. test.

PROPOSED STANDARD METHOD FOR THE DETERMINATION OF THE LOSS ON HEATING OF OIL AND ASPHALTIC COMPOUNDS.

The loss on heating of oil and asphaltic compounds shall be determined in the following manner: Forty grams of the water-free material shall be placed in a circular tin box with vertical sides, measuring about 1 in. in depth by 2⅜ ins. in diameter, internal measurement. The penetration of the material to be examined shall, if possible, be determined at 25° C., in the manner heretofore described, and the exact weight of the sample ascertained. The sample in the tin box shall then be placed in a hot air oven, heated to 170° C., and kept at this temperature for 5 hours. At no time shall the temperature of this oven vary more than 2° C., from 170° C. When the sample is cooled to normal temperature, it shall be weighed and the percentage of loss by volatilization reported. The penetration of the residue shall then, if possible, be determined at 25° C., as upon the original material, and the loss in penetration found by subtracting this penetration from the penetration before heating.

PROPOSED STANDARD METHOD FOR THE DETERMINATION OF RESIDUAL COKE IN BITUMINOUS COMPOUNDS.

This determination shall be made according to the method described for coal in the Journal of the American Chemical Society, 1899, Vol. 21, page 1116. The method is as follows: Place 1 gram of pure bitumen, free from water, in a "platinum crucible weighing 20 to 30 grams and having a tightly fitting cover. Heat over the full flame of a Bunson Burner for 7 minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cms. above the top of the burner. The flame should be fully 20 cms. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon."

The residue minus the small impurity of ash in the pure bitumen is the fixed carbon, which should be calculated to 100 per cent, with the volatile hydrocarbons, excluding the inorganic matter.

PROPOSED STANDARD METHOD OF SIZING AND SEPARATING THE AGGREGATE IN ASPHALT PAVING MIXTURES.

The method consists of passing the mineral aggregate through several sieves of the following sizes:

	Diameter, in inches.
10 meshes per linear inch, size of wire	0 027
20 meshes per linear inch, size of wire	0.0165
30 meshes per linear inch, size of wire	0.01375
40 meshes per linear inch, size of wire	0.01025
50 meshes per linear inch, size of wire	0.009
80 meshes per linear inch, size of wire	0.00575
100 meshes per linear inch, size of wire	0.0045
200 meshes per linear inch, size of wire..	0.00235

PROPOSED TENTATIVE METHOD OF DISTILLATION.

The committee also suggested that the following method of distillation as presented by one of its sub-committees be put before the society as a tentative method to be tried out. This method was proposed for use in distilling oils, tars, asphalts and other bituminous materials for use in road construction. There was some discussion before the convention by the members of the committee as to the exact wording of this tentative specification, and it was finally decided that its approval by the convention should only hold in case a letter ballot of the committee should unanimously consent to its presentation. The proposed tentative method was as follows:

The apparatus shall consist of the following standard parts:

1. Flask.—The distillation flask shall be a standard 150 c.c. Engler distilling flask, having the following dimensions as adopted by the International Petroleum Congress: Diameter of bulb, 6.5 cm.; length of neck, 11.75 cm.; diameter of neck, 1.6 cm.; surface of material to tubulature, 9.0 cm.; length of tubulature, 10.0 cm.; angle of tubulature, 75°.

A 3 per cent variation from the above measurements will be allowed.

2. Thermometer.—The thermometer shall be of hardened glass filled with nitrogen under pressure, and reading 450° C. and shall have the following dimensions: Diameter of stem, 6.75-7.25 mm.; length of thermometer, 335-350 mm.; length from 0 to 450, 285-300 mm.; length of bulb, 20-22 mm.; diameter of bulb, 5.25-6.50 mm.

It shall rise from 15° to 95° in not less than 3 seconds nor over 5 seconds when plunged into boiling water.

3. Condenser.—The condenser tube shall have the following dimensions: Length of tube, 500 mm.; width of tube, 12-15 mm.; width of adapter end of tube, 20-25 mm.

4. Stands.—Two iron stands provided respectively with one universal clamp for holding condenser, and one light grip arm with cork lined clamp for holding the flask.

5. Burner and Shield.—Bunsen burner with tin shield 20 cm. long by 7.5 cm. diameter. The shield has a sight hole for observing the flame.

6. Cylinders.—The cylinders used in collecting the distillate should be of 25 cc. capacity, graduated to .1 cc.

Method.—100 cc. of the dehydrated material to be tested is placed in a tared flask and weighed. After adjusting the thermometer, shield, condenser, etc., the distillation is commenced, the rate being so regulated that 1 cc. passes over every minute. The receiver is changed as the mercury column just passes the fractionating point.

To determine the amount of residue the flask is weighed again, when the distillation is complete. During the distillation the condenser tube shall be warmed when necessary to prevent the deposition of any sublimate. The percentages of fractions should be recorded both by weight and by volume.

The new sewage pumping plant at Colon, C. Z., will consist of two direct-connected, motor driven centrifugal pumps each having a 12-in. discharge and a 14-in. suction capable of pumping 2,000 gals. per minute against a head of 67 ft.

The total force of men employed on the Panama Canal and railway on May 31, 1910, was 36,796 of which 29,560 were employes of the Isthmian Canal Commission.

WATER-WORKS AND SEWERS SECTION

Methods of Constructing Stream Crossings for a Large Trunk Sewer.

In constructing the large trunk sewer designed to furnish a joint outlet into Newark Bay for some ten or a dozen residential towns, including Summit, N. J., the Oranges, and Elizabeth, N. J., a number of stream crossings had to be made. The accompanying drawings show the plans of these crossings; with the exception of one siphon under the Elizabeth River these crossings were a continuation of the normal grade of the sewer, and thus are of a type which has not been frequently illustrated. The trunk sewer named varies from 12-in. vitrified pipe to 72-in. brick sewer, and most of the crossings came on brick sewer sections of the work. The drawings given have been made anew from the report recently issued by Mr. Alexander Potter, New York, N. Y., Chief Engineer, Joint Outlet Sewer.

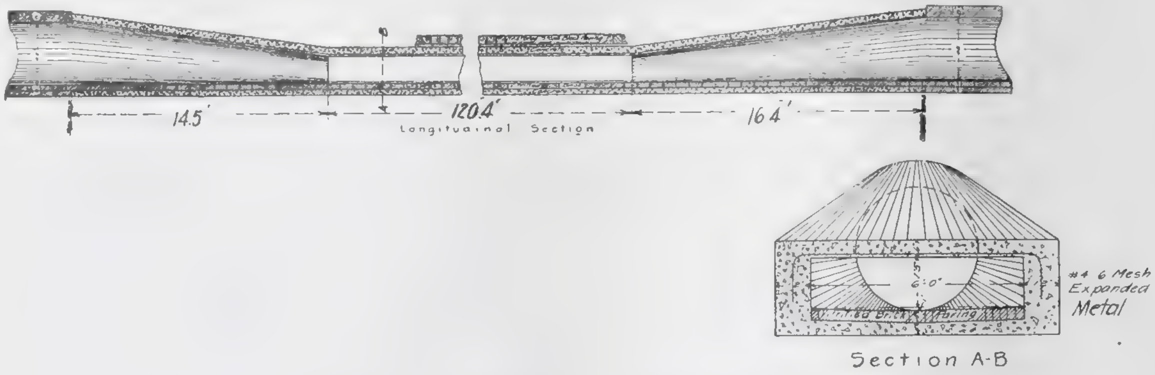


Fig. 1—Details of Sewer Crossing Under Depressed Roadway.

Figure 1 shows the method of taking a 42-in. circular brick section under a portion of a street depressed to permit of an overhead railway crossing. For 120.4 ft. under the low portion there was built a rectangular brick section 1.55 ft. high and 6 ft. wide, into each end of which the circular section was converged as shown by the illustration. This rectangular section and also the converging appproaches to it were constructed of 1:2:4 ½-in. stone concrete reinforced over the arch or roof with expanded metal. Two thicknesses of No. 4, 6-in. mesh expanded metal were placed as shown.

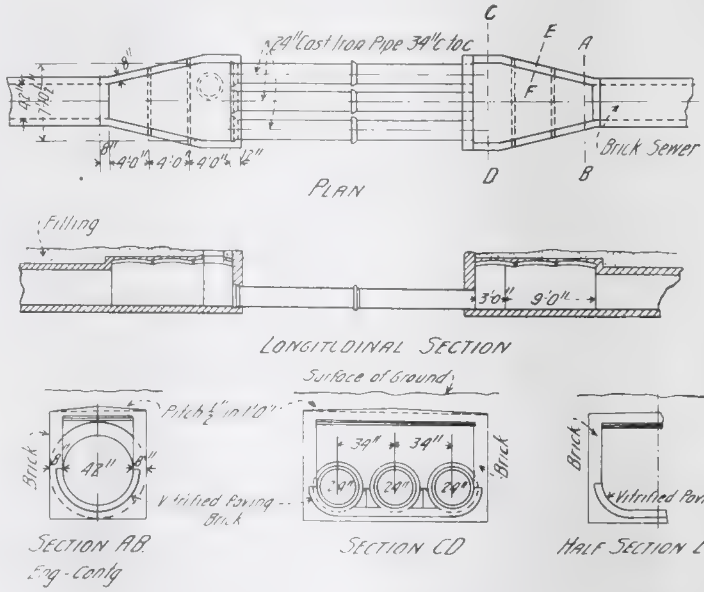


Fig. 2—Details of Sewer Crossing a Small Brook.

Figure 2 shows the crossing of a small brook, the flow of which could not be interfered with, by a 42-in. brick section of sewer. As will be seen, three lines of 24-in. cast iron pipe 24 ft. long and laid side by side were carried under the stream. At each end of the pipes a connection chamber with the 42-in circular sewer was built, and the upper chamber was provided with a manhole for cleaning or other purposes. The chambers were of brick-work, the roofs being 4-in. brick arches springing from T-rails with ends set into the side walls.

Figure 3 shows the plan of crossing at the west branch of the Elizabeth River. An earth dam just west of a highway impounded this stream and the overflow passed through the crest of this dam in a wooden spillway flume with a 4-ft. drop from the flume to the stream bed below the dam. From the end of the flume to the bridge carrying the road mentioned over the stream was only 40 ft. To have carried the 42-in. sewer along the road and under the bridge at grade would have dammed the stream, thus making an inverted siphon necessary for such a crossing. To avoid this the line of the sewer was diverted so as to pass along the toe of the dam just below the spillway flue, which was lengthened as shown to pass over the sewer. At the crossing a 42-in. cast iron pipe replaced the normal brick section. The old single floor of the flume was replaced by two thicknesses of 2-in. flooring having a layer of tarred paper between them, and the old side walls of the flume were extended over the sewer by brick walls laid in cement mortar. A concrete apron and other means to prevent wash or scour were provided as shown.

Figure 4 shows the crossing of the west fork of the East Branch of the Elizabeth River, where the grade of the line of the sewer is about 24 ins. above the normal water level in the river. About 500 ft. below the crossing the west fork and the east fork converge. The east fork responds to a rain storm much more rapidly than the west fork, its tributary area being greater. Below the confluence of these two forks, the river valley narrows to such an extent that the flood volume cannot be carried off promptly. This condition causes the damming up of both forks so that the sewer crossing is flooded, the water in the river during freshets having reached almost to the top of the iron pipe. The river channel at and for some distance above and below the point of sewer crossing was widened to over twice its normal width, and the area under the iron pipe sewer has proved sufficient to pass the severest storm without injury to the crossing, some unprecedented rainfalls having occurred since its completion in the fall of 1902. The details of this crossing are shown by Fig. 4. It will be seen that 42-in. cast iron pipes are supported on T-rail posts, embedded in Portland cement concrete piers 4 ft. high, 4 ft. wide, and 7 ft. deep. There is a support for each length of pipe, and each support consists of two 60-lb. rails bent to the shape of the pipe and bolted as shown on the drawing. A special wrought-iron plate construction was used to strengthen the post at the point where the rails diverged to form a cradle in which the pipe rests, as at this point the tendency to separate the rails is greatest. This construction was used in order to minimize the obstruction to the stream flow and secure the greatest possible clearance between supports. A 3-in. x ½-in wrought-iron band encircles the upper half of the pipe and the ends of the band are brought down to a section 1¼ ins. square and bent at right angles into hooks. The middle of a 1-in. U-bolt passes through a hole in the upper ends of the rails, and the ends of the bolt pass through holes in a 1-in. plate placed over the hook end of the band. Threads and nuts on the ends of the U-bolt allow adequate adjustment of this construction.

Figure 5 shows the crossing for a small stream. The line at this point is located about 30 ft. south of the embankment for an abandoned railway, under which embankment the stream flows through a stone culvert. The fall of the original channel of the stream from the south face of this culvert to the point of sewer crossing was sufficient to allow the carrying of the sewer by means of a 36-in. cast iron pipe across the stream (the bottom of the pipe being almost at the bottom of the stream), and still have the stream flow over the top of the sewer without any effect of damming the water. The five lengths of pipe

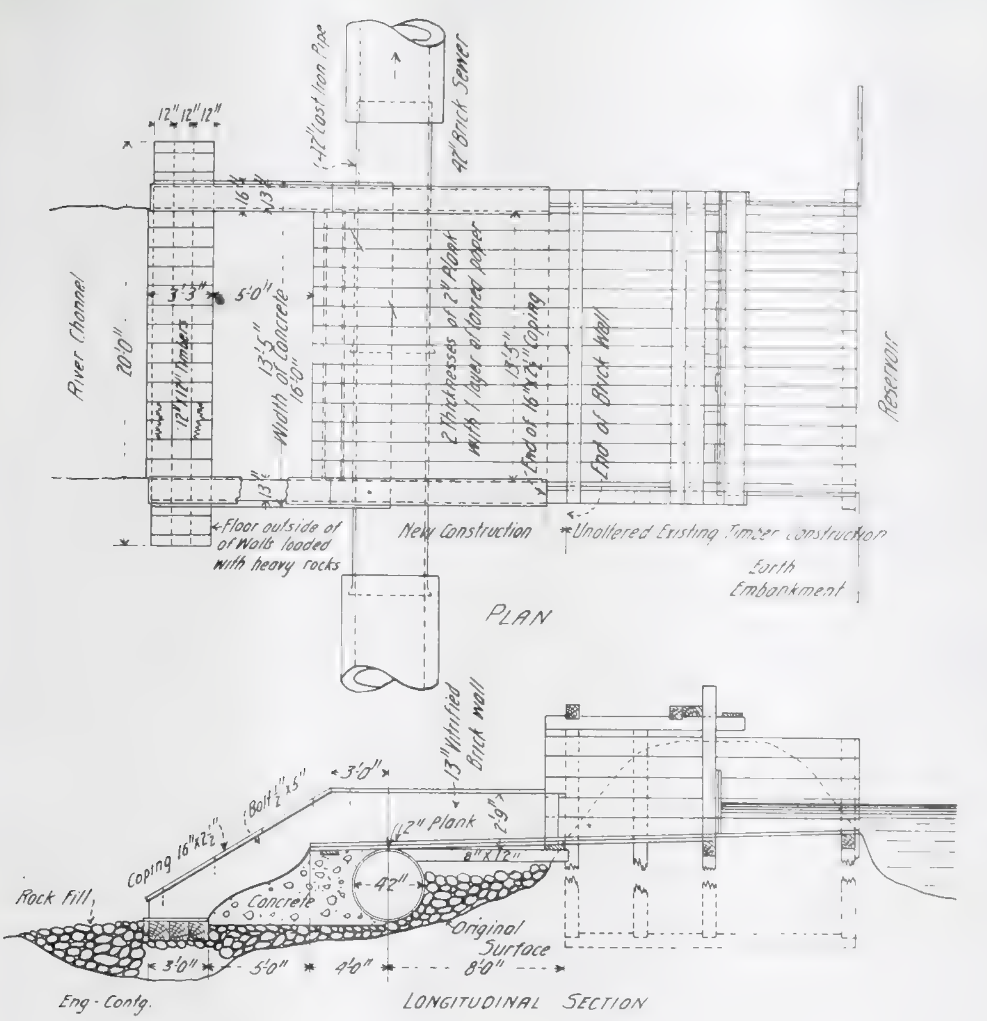


Fig. 3—Details of Sewer Crossing a Small Stream Along Toe of Dam.

composing the sewer crossing are supported by Portland cement concrete piers of the size shown, and extending down to good gravel foundation. Quicksand overlaid the gravel for 4 ft. in depth. For 16 ft. on each side of the center of the crossing, the pipe is further secured by a mass of concrete extending on the north side to the top of the pipe and 3 ft. north of its center. South of the pipe a concrete apron placed upon a plank floor spiked to longitudinal 6x8-in. timber prevents scour by the stream flow, and a liberal amount of rip rap placed in the channel above and below the sewer crossing forms a permanent stream bottom adapted to the new conditions.

Figure 6 shows the crossing at the Rahway River. This crossing consists of six 12-ft. lengths of 36-in. cast iron pipe carried by girders supported by two concrete abutments and one concrete pier at the center of the crossing. This plan provides two channels under the pipe, each about 29 ft. wide, the original river channel having been about 25 ft. wide. The concrete used was composed of 8 parts of gravel, found in the immediate vicinity, and 1 part of Portland cement. The foundation of the abutments and the concrete pier consists of 12-in. round timbers, floored with two courses of 2-in. plank. The bottom of the concrete is about 10 ft. below the grade of the sewer and about 4½ ft. below the river bed. The base of the center pier was built the entire size of the pit 8x15 ft. for a height of 5 ft. The abutments have 15-in. footing courses projecting 6 ins. beyond the neat line.

Figure 7 shows the inverted siphon crossing the Elizabeth River. The crossing consists of two 10-in. pipes, the flow through each of which is controlled by valves, so that the sewage can be diverted to either pipe, thereby causing a greater scouring and cleansing effect than if the siphon consisted of one 15-in. pipe. This design also makes it possible to clean either 10-in. pipe while the sewage is being carried by the other.

Method and Cost of Constructing Vitrified Pipe Sewers With Sulphur Joints.

A part of the new sewers of Louisville, Ky., are built as a separate system. The storm drain is built with cement joints but the sanitary sewer is jointed with a sulphur-sand mixture to make an impervious connection between pipes. With the local materials used the experiments have proved that the following properties give the best results:

Molding sand	6 parts
Ohio River screened sand, No. 20 sieve..	4 parts
Sulphur	10 parts

With this mixture the joints remain solid and no radial checks occur which would allow ground water to enter the sewer.

The trenches in which these pipes were laid were in a great many cases excavated in rock and the pipe had to be suspended or rested on blocks of stone until solidly concreted in place.

It was found cheaper to fit several lengths of pipe together on the surface and joint them before lowering them into the trench. For jointing, three or four vitrified pipe were laid in a cradle. The pipe rested on 1-in. boards, stood edgewise upon a wooden bench, and cut to an arc fitting outside the pipe. The cradle was made so that when several pipes were laid on it, end to end, they were in perfect alignment. "Pipe jointers" made of square, braided asbestos, were then fastened around each pipe at the joint to prevent the liquid running out of the bells. After these jointers were in place, the joints were poured. Within five minutes after the joints are poured the pipe section can be removed from the cradle and lowered to place in the trench. The tensile strength of this sulphur-sand joint is from 520 to 640 lbs. per sq. in. The greatest care is needed to regulate the temperature of the sulphur-sand mixture because it begins to melt at a temperature of 200° F. and becomes thin and suitable for pouring at about 260°. If it is allowed to rise 25° to 40° higher it again becomes thick and plastic, in which condition it cannot be poured. The facts are given clearly by the following table:

Physical Condition of Sulphur and Sulphur-Sand Mixtures at Different Temperatures.

	Temperature Fahr.	
Condition.	Sulphur.	Sulphur-Sand.
Began to melt	176	201
Fluid	212°	261°
Slightly vicid	234°	302°
Would not pour	248°	315°

On the Louisville work four men (two on top and two in the trench) laid, on an average, 200 ft. of 8-in. pipe a day. The men on top heated the mixture in copper kettles and used a ladle for pouring. Then they lowered the section to the men in the trench and supplied them with a ladle of the mixture for the joint which had to be made in the trench.

In this 8-in. pipe about 1¼ lbs. of sulphur are required per joint, and the cost is 3 cts. a pound. The sand costs about 50 cts per cu. yd. This is practically negligible as one cubic yard of sand would be sufficient to lay nearly 2,000 ft. of pipe of this size.

The following is an estimate of the cost of laying and jointing 200 ft. of pipe (100 joints):

4 men at 20 cts. per hour., 10 hours....	$ 8.00
125 lbs. sulphur at 3 cts.	3.75
1½ cu. ft. sand at 50 cts cu. yd.	.03
Total	$11.78

Larger sized pipe would require more sulphur and the following table shows the amount estimated to be necessary for the different sizes, applying this proportion to the volumes

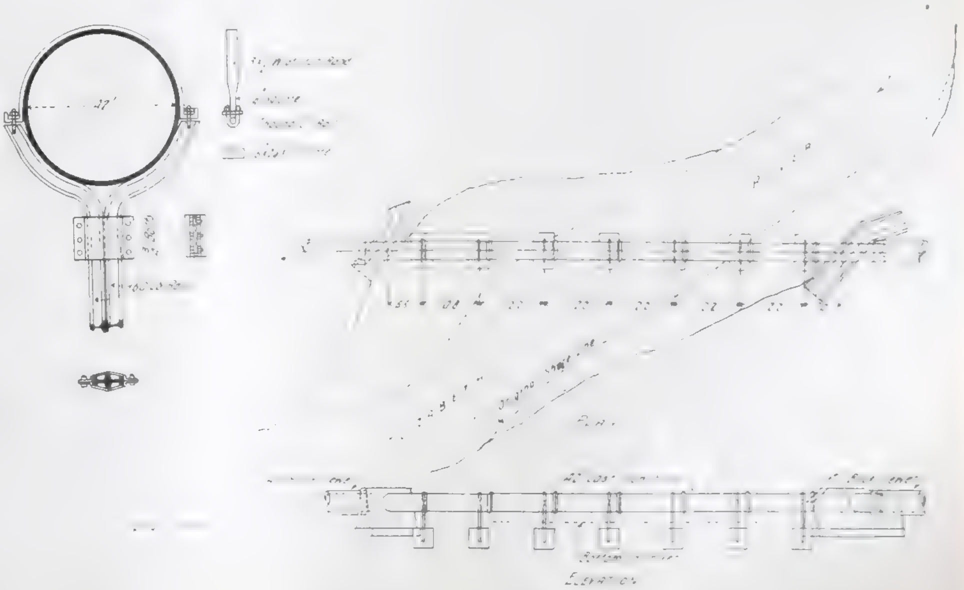


Fig. 4—Details of Sewer Crossing of Elizabeth River.

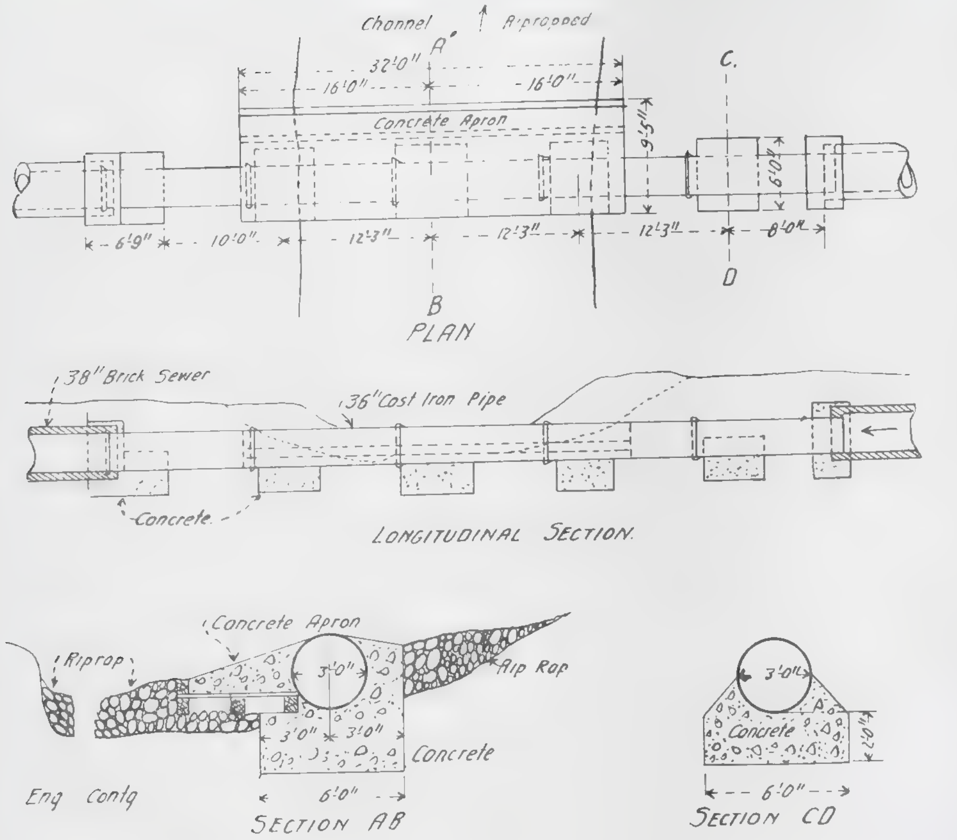


Fig. 5—Details of Sewer Crossing a Small Stream Above Bed Level.

given for flush joints in Gillette's "Handbook of Cost Data" p. 821:

Sulphur Required to Lay 100 Ft. Standard Sewer Pipe. Two ft Lengths

Size of pipe inches	4	6	8	10	12	15	18	20	24
Lbs sulphur, 1 to 1 mix	402	580	625	804	1116	1786	2232	2455	2902

We are indebted for information leading to the above article, to Mr. H. S. Morse, Resident Engineer of the Eastern Division of Sewers, Louisville, Ky.

Infiltration of Ground Water Into Sewers, with Notes on Tar Cement Joints, Wooden Underdrains and Leakage of Manhole Covers.

In constructing some 150 miles of pipe and brick sewer forming a joint outlet for the sewage of some ten or a dozen New Jersey towns of the suburban districts about New York city the Chief Engineer, Mr. Alexander Potter, New York, N. Y., made a number of interesting studies relating to the entrance into such sewers of ground and surface water. In making the original plans for the sewers named the engineer provided for an infiltration of 33 per cent of the capacity of the sewer. The actual leakage was less than 10 per cent. Even with rigorous inspection the engineer believes that it is not safe to count on a less rate of infiltration than 25,000 gals. per mile per day if cement joints are used. This can be reduced to 5,000 gals. per mile per day if sulphur sand joints are used. From the various observations made of leakage on different parts of the work and on different sizes of sewers, the engineer finds that leakage through joints varies about as the square of the diameter, that is to say four times the leakage can be expected in a 20-in. line as in a 10-in. line laid under identical conditions.

The extent to which water is admitted to sewers through holes provided for ventilation in manhole covers is worthy of attention. As illustrating this, reference is made to the conditions existing during Jan. 5 to 7, 1910, inclusive. In the territory observed there were from 6 to 8 ins. of snow covering the ground and on the afternoon and evening of Jan. 6, a rain, accompanied by a marked rise in temperature, caused a rapid melting of the snow. Construction work in progress made it possible to ascertain that the depth of frost in the ground was from 6 to 18 ins. No catch basins are connected with the system and no roof water is supposed to be admitted. Under these conditions the increased flow in the sewers must have entered through the manhole covers. There are 125 miles of sewers in the system and about 1,995 manholes, on all but 30 of which the covers are perforated for ventilation. About 250 of these manholes also had imperfectly fitting covers, so that water could enter the sewer around the edges of the covers. The normal flow in the sewer at the outlet before the thaw of Jan. 6 was 4,800,000 gals. per day. For several hours on Jan. 7 the sewer, which has a capacity of 21,000,000 gals. per day, ran full, but in 24 hours thereafter the normal flow was nearly restored. As nearly as can be determined, 3,000,000 gals. of water entered the sewer in 24 hours through the manhole covers, or an average of 1.1 gal. per minute per manhole.

Figure 1 shows a manhole cover designed to permit permanent closing of the ventilating openings. A shoulder or flange is cast at the bottom of the inside of three sides of the rectangular strengthening rib, which shoulder forms a support for a plate. The plate is inserted when desired and the perforations and the space between cover and plate are filled with cement, sulphur sand or other filling means.

To reduce infiltration a considerable amount of pipe sewer in wet trenches was laid with tar cement joints. This joint was made by using as a gasket, strands of jute soaked in North Carolina tar. The gasket was then well caulked into the annular space, the inside of the socket and the outside of the spigot of the pipes fitted together, having previously been swabbed with tar. Into a bucket filled with Portland cement, North Carolina tar is poured and kneaded by hand with the cement until a rather stiff dough-like mixture is secured. This substance was then rolled on a board to a sufficient length and diameter and placed in the annular space between the fitted pipes, into which space it is thoroughly rammed by suitable tool and hammer until the space is completely filled up to within ½ in. of the end of the socket. The usual beveled cement mortar finish is then given the pipe joint.

The tar cement mixture when properly made becomes tough and moderately hard in several hours, depending on the temperature and proportion of cement incorporated. The objectionable feature of the tar cement joint is its plasticity in warm temperature, more especially when used in the larger sizes of pipes. In filling the annular space with this mixture, the weight of the material is oftentimes sufficient to cause the mass of tar cement to flow before it sets, causing it to drop away from the under side of the upper portion of the bell before the tar cement has properly hardened. Again, unless the spigot end of the pipe is supported on solid bearing such as small chips or especially burned pieces of vitrified clay, embedded in the tar cement in the bottom of the joint before the following pipe is inserted, the weight of the pipe will compress the tar cement in the bottom of the joint before it hardens, causing the filling material in the upper portion of the annular space to be drawn away from contact with the inside of the top of the bell, thus introducing a chance of leakage in water-soaked ground.

A method of vitrified pipe support called "wooden underdrain" used on this and other sections of the joint sewer proved to have many points of excellence. It was used in wet

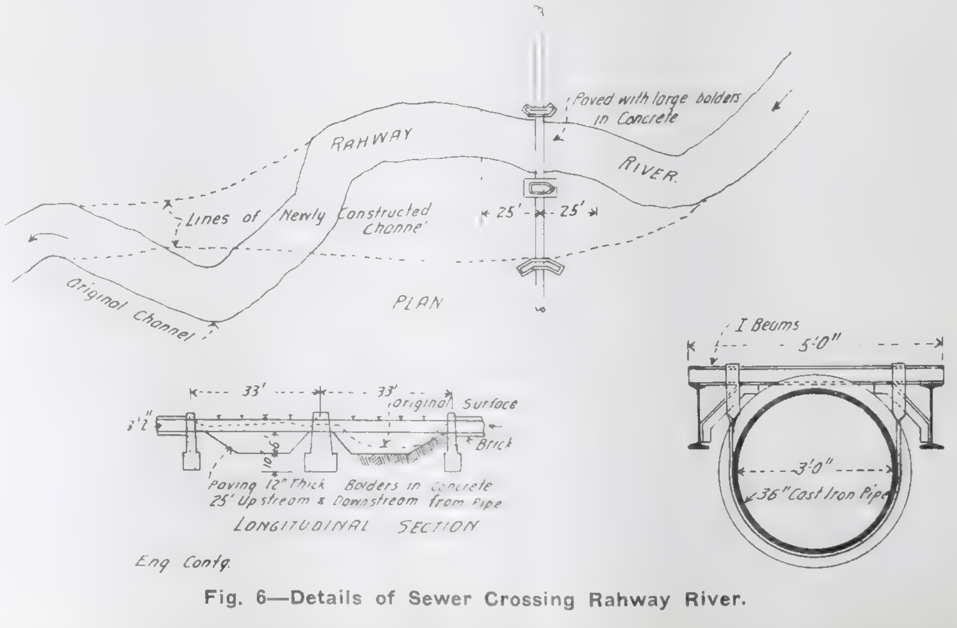

Paved with large bolders in Concrete
RAHWAY
RIVER
Lines of Newly Constructed Channel
25'
25'
Original Channel
PLAN
33'
33'
Original Surface
3'2"
Brick
10'
Paving 12" Thick Bolders in Concrete 25' Upstream & Downstream from Pipe
LONGITUDINAL SECTION
Eng Contg
I Beams
5'0"
3'0"
36" Cast Iron Pipe

Fig. 6—Details of Sewer Crossing Rahway River.

trenches and especially on quicksand, and consisted of four pieces of 2x4-in. plank laid flat and 6 ins. between centers, on top of which were nailed pieces of 4x4-in. timber 1½ ft. between centers. The pipe rested on the 4x4-in. pieces, being held in position until the backfilling was placed under and around it by wooden wedges placed between the 4x4-in. pieces and the pipe and nailed in position. The space between the 2x4-in. pieces and the space under the supported pipes acted as a channel to drain away the water in the trench to the pump pit, allowing the joints to be cemented and kept dry until set. The number of 2x4-in. pieces and the length of the 4x4-in. blocks varied with the size of the pipe to be laid, the usual length of the 2x4-in. pieces being 9 ft. to 12 ft. The filling of the space between the 2x4-in. and the 4x4-in. pieces with coarse gravel worked well to drain trenches in quicksand, which substance would have choked up even short lengths of pipe under drain, rendering them almost if not quite useless.

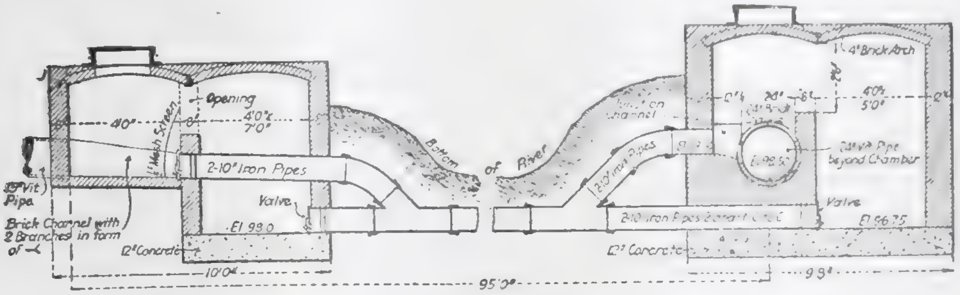
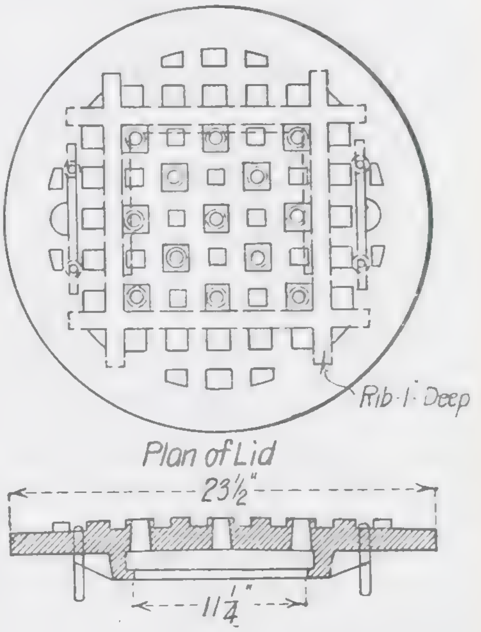


Fig. 7—Inverted Siphon for Sewer Crossing Elizabeth River.

The objection to this form of construction is that it perhaps requires greater care in backfilling in clay, loam or other compressible soils, but this is not in reality an objection. That poor backfilling is the principal cause of failure in sewer construction there is little doubt. Anything which tends, therefore, to promote and require greater care in backfilling, especially under and around the pipe, is to be desired. An inspection of the interior of the entire length of the sewer was made by an assistant engineer, and the condition of the pipes carefully noted. An assistant engineer actually crawled through every pipe of 20 ins. and over in the entire sewer. The inspection of pipes smaller than 20-in. was made with the aid of mirrors. Not a single defective pipe was found in any portion of the system where quicksand was encountered and this method of underdrain had been used in whole or in part, but both in clay gravel and rock cuts some pipes were found broken.

That infinite care had been taken in the laying of the pipes to get water tight joints, and that stern insistence upon this feature of the work had actually succeeded, were attested by an examination of the joints of the broken pipe which were removed at this time. On 12,900 ft. of 24-in. pipe sewer, 760 ft. were found to be defective and were replaced. On 4,197 ft. of 22-in. pipe no defective pipes were discovered.



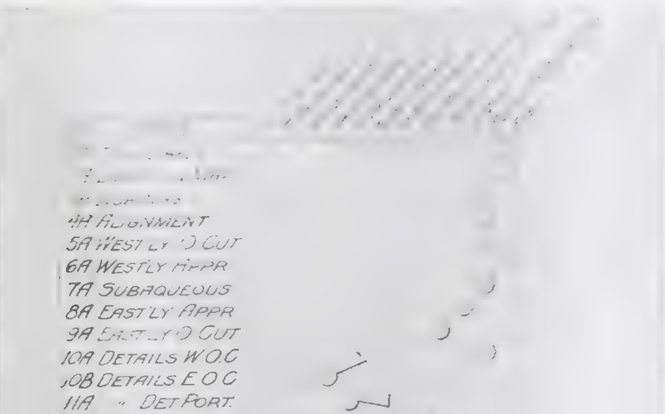
Special Manhole Cover Construction Permitting Plugging of Ventilating Holes.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Chart for Recording Progress of Drafting Work.

By J. D. Luther.*

Toward the completion of the Detroit River Tunnel I was called upon to furnish a folio of 21 drawings, 24 ins. by 36 ins., which would show the actual construction. These were to differ from the Contract Drawings only in showing the numerous minor changes made in the field for which no working drawings were required. As these drawings were to progress with the construction of the tunnel, thus being worked upon only at odd times, and as several different drawings were in progress at the same time, some rigid system was an absolute necessity. The following cut will illustrate the method adopted and its success prompts me to submit it to your readers.



Diagrams Showing Method of Recording Progress of Drafting Work.

This diagram was made on heavy detail paper pasted on a small drawing board, with thumb tacks for markers, and tracing cloth streamers bearing the name of the draftsman.

A glance at the board from a distance indicates the status of the whole work, as the tacks proceed to the right as the work progresses, the work being finished when all tacks are in the last column. In the case shown the work appears to be about two-thirds completed. A closer inspection locates and shows the condition of each drawing giving the name of the man at work upon it.

While I have not had an opportunity to test it, I believe that this system could be advantageously employed in any large drafting room. Instead of a board, however, I would suggest a printed form, leaving blank the column for "Title of Drawing" to be filled in whenever a new drawing is started. A method of dating could also be adopted.

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*Chief Draftsman Detroit River Tunnel Co. Detroit, Mich.

Some Comments on the Value of Roofing Guarantees.

By [illegible].*

Guarantees have become more of a factor in roofing than in any other work connected with building construction, and are frequently put in the foreground so that the real point at issue, the merit of the roofing, will be overlooked and they should, therefore, be subjected to the closest scrutiny.

Very naturally guarantees for 5 years or 10 years will appear in the light of a safeguard but they are not given because of a sublime faith the guarantor has in his roofing, or because of any generous impulse on his part to protect the buyer, but they are given for one purpose only, to sell the roofing. For the purpose of considering their value they may be divided into three classes.

First: Where the guarantor is responsible and gives the guarantee in good faith. In such cases the buyer has assurance that the roof will be repaired if it leaks, but there is not any protection against damage, as a guarantee against damage would be a greater liability than any solvent contractor would assume, even with the best of roofs. No matter how often leaks occur, all the owner can require is that repairs be made with reasonable promptness, and, as frequently happens, it is better to buy a new roof than stand the loss and annoyance caused by the leaks.

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*Secretary of the National Association of Master Slag and Gravel Roofers of America.

Second: Where the guarantor is responsible but purposely words the guarantee to mislead and avoid legal responsibility. This class is the most misleading and causes the greatest loss. It embraces the "painting ever so often" clause usually calling for material which the owner must buy and apply at certain specified times. One day over, and the guarantee is invalid. Also in this class are the guarantees when other than the guarantor applied the roofing. This means a division of responsibility and there are literally dozens of "excuses" why the manufacturer is not to blame.

Third: Where the guarantor does not remain in business or solvent for the term of guarantee. Statistics show that the life of a surprisingly large percentage of firms is less than 5 years to say nothing of 10 years, and this is especially true of general contractors as a class, who usually take the sub-contractors' guarantees and then guarantee direct to the owner.

Tile, slate, copper and shingle roofs are rarely guaranteed for more than one year if at all, so they need not be considered, but it is the two great classes "Ready Roofing" and "Gravel or Slag Roofs"—frequently referred to as "Built-up Roofs"—that have been and are most effected by long-time guarantees.

In buying Ready Roofing, the character of the building; the incline of the roof, the chances of the roof being recoated occasionally (if roofing requires such care is used); the length of service the roof is expected to give; the experience of others with the same material used under the same conditions for as long a time as it is claimed it will last (printed testimonials should not be accepted without investigation); and the reputation of the manufacturer for fair dealing, are factors of far more importance than any guarantee.

Several of the largest manufacturers of Ready Roofing who do not apply their roofs have consistently refused to give guarantees and large dealers who look into the merit of an article usually prefer to deal with such manufacturers. It should be borne in mind that there is no "cure all" in roofing any more than there is in medicine.

When it was the custom to buy gravel roofs on their merit and the factors considered were quality of material, amount of material (that is number of plies and weight of felt and pounds of pitch), knowledge regarding the use of the materials and a record of roofs in service, it was usual to have gravel roofs last 15 to 20 years and sometimes longer, but since the 10 year guarantee was made the basis for price, and contracts awarded to the lowest bidder, most of the responsible roofing contractors have had no option except to figure on a 10-year roof, and if the contract was secured, that is all they could give as it was all they were paid for or agreed to give.

Under these conditions contractors soon learned that it was cheaper to make a few repairs during the term of guarantee than to put on a roof that would not have to be repaired for 10 years. Usually a roof upon which there is no maintenance cost for 10 years will give good service for more than 20 years, but naturally roofs that require repairs during the term of guarantee are of little value at its expiration.

Gravel roofs have been in use so long that there is a definite known value to a ply of felt and mopping of pitch (with materials of given quality) and by using more plies or less, a roof can be made as good or cheap as any building warrants. In calling for a long-time guarantee, an architect or engineer apparently avoids responsibility as to the quality of material and manner in which it is applied. This is not done with boilers or plumbing or electric wiring or any other work in connection with building, and should not be allowed in roofing. A definite specification which meets the requirements of the building should be provided the same as is provided for the foundation and other parts of the building, and then competent inspection given so the roof will be its own guarantee the same as the foundation.

Personals.

Mr. R. S. Alexander has been elected City Engineer of Clarksville, Tenn., for the ensuing two years.

Samuel Glenville Brosius, a Civil Engineer, formerly residing at Cumberland, Md., died July 8 at Washington, D. C.

Mr. W. E. Conner and Mr. A. A. Hanscom have been appointed Junior Engineers in the U. S. Reclamation Service and have been assigned to the Milk River Project.

Mr. W. A. Hoyt, M. Am. Soc. C. E., Consulting Specialist in reinforced concrete, has removed his office from the Chamber of Commerce building, Chicago, Ill., to 455 Old Colony building, that city.

Mr. Walter B. Snow, Publicity Engineer, Boston, Mass., has added to his staff Mr. H. Ross Callaway, a graduate of the Massachusetts Institute of Technology, and late assistant to the mechanical engineer of the New York Edison Co.

Mr. Charles G. Armstrong has been appointed Consulting Engineer to the Bridge Department of New York City at a salary of $7,500 a year. His work will be chiefly to attend to the completion and furnishing of the new municipal building, New York, in consultation with Borough President McAneny. Mr. Armstrong was graduated from the State University of Illinois. He was Consulting Engineer on several of Chicago's largest buildings, including the Coliseum and on Milwaukee's new city hall and several New York skyscrapers, including the Singer building.

A. C. Downey and R. C. Soper, Assistant Engieers of the U. S. Reclamation Service, were drowned in the Shoshone reservoir, Wyoming, June 16. They, with Roy Callange, another employee of the service, were taking a pleasure ride in a motor boat. Waves caused by a heavy wind were running high and a break in the steering gear of the boat made it unmanageable and caused it to capsize about half a mile from shore. On account of the cold water and the beating of the waves, Mr. Callange was the only one of the party who was able to cling to the boat until it reached land, some time during the night.

Mr. L. R. Pomeroy, who was recently appointed Chief Engineer of the railway and industrial division of J. G. White & Co., Incorporated, with headquarters in New York City, has for a long time been considered an authority on railway shop equipment, operation and construction, and is peculiarly adapted both by nature and training for his new work. From 1874 to 1880 he was engaged in commercial business, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Co. of New York. For four years following this he was a special representative of the Carnegie Steel Co., introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Co. and the Latrobe Steel Co., jointly; this assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was Assistant General Manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Co., this work covering the electrification of steam roads, railway shops and the general application of electricity for all railway purposes. For the past two years he has been assistant to the president of the Safety Car Heating & Lighting Co.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools, and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in Engineering-Contracting. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Jeffrey Pulverizers and Crushers.—Paper 6x9 in.; 38 pp. The Jeffrey Mfg. Co., Columbus, Ohio.

A catalog of crushing and pulverizing machinery, giving illustrations of machines and details.

Cement.—Paper 6x9 ins.; 16 pp. Lehigh Portland Cement Co., Indianapolis, Ind.

A paper on Cement Tile vs. Clay Tile. Illustrated.

American System of Reinforcing.—Paper, 9½x6¾ ins., 32 pp. American System of Reinforcing, 218 La Salle St., Chicago, Ill.

Describes the system, illustrates column and beam units and gives a score of full-page illustrations showing work done.

Combined Level and Grade Finder.—Paper, 3½x5¾ ins., 28 pp. E. Howard Gill, 10 Barclay St., New York.

A very complete description of a new and useful instrument.

Cast Iron Pipe.—Paper, 6x9 ins., 100 pp. J. R. Rice, 431 The Rookery, Chicago, Ill.

Catalog of the Dimmick Pipe Company. The descriptions of the pipes are very complete. The book is of special value to designers, as tables and sketches show all dimensions, and other information is given.

Lockwood Automatic Buckets and Skips.—Paper, 6x9 ins., 16 pp. Cockburn Barrow & Machine Co., 30 Church St., New York.

A catalog giving illustrations and complete descriptions of buckets operated "by the man behind the engine." Prices are given.

The Cockburn Cubical Concrete Mixer.—Paper, 6x9 ins., 8 pp. Cockburn Barrow & Machine Co., 30 Church St., New York.

Explaining the advantages of this mixer, its operation, construction and capacities. Illustrated.

Contractors' Machinery.—Paper, 6x9 ins., 24 pp. The Cockburn Barrow & Machine Co., 30 Church St., New York.

This is a general catalog recently published illustrating and describing various wheelbarrows, grout mixing machines, punching machines, tunnel shields, contractors' buckets and mixers, with prices.

Clamshell Buckets.—Paper, 6x9 ins., 12 pp. George Haiss Manufacturing Co., 139th St. and Rider Ave., Bronx Borough, New York City.

This catalog contains illustrations and descriptions of clamshell buckets, various hoisting engines and equipment for hoisting, with tables of sizes and prices.

Chicago Concrete Mixer.—Paper 6x9 ins., 40 pp. Chicago Concrete Machinery Co., Chicago, Ill.

A very complete and detailed description of this mixer with illustrations showing different types of machines for different kinds of concrete work. The catalog contains tables of sizes, horsepower required, etc.

Reliance Hoisting Engines.—Paper, 6x9 ins., 56 pp. The Reliance Machine & Tool Works, Saint Louis, Mo.

This catalog deals especially with hoisting engines and boilers, and illustrates this class of machinery with cuts of various individual parts. Contains also various grab and dump buckets.

Curb and Gutter Construction.—Paper, 6x9 ins., 8 pp. Marsh Co., 970 Old Colony Building, Chicago, Ill.

Describes and illustrates various tools and machines for making concrete curb and gutter by what is known as the Barrer System.

The Milburn Light.—Paper, 6½x9½ ins., 48 pp. The Alexander Milburn Co., 50 W. Lombard St., Baltimore, Md.

This catalog contains descriptions and illustrations showing in detail the portable acetylene lights made by this company. The illustrations show a great many uses to which the lights are put which are novel. A "circus number" of the catalog is also published which contains several pages devoted to lighting tents, stages, etc.

Acme Road Machinery.—Paper 9½x6 ins., 32 pp. Acme Road Machinery Co., Frankfort, N. Y.

A catalog of the various types of road and dump wagons made by the company.

Acme Crushers.—Paper, 5x9 ins., 16 pp. Acme Road Machinery Co., Frankfort, N. Y.

Illustrations of portable rock crushing plants, road rollers, etc.

Road Builders' Supplies.—Paper, 9½x6 ins., 28 pp. Acme Road Machinery Co., Frankfort, N. Y.

A catalog of road making machinery, contractors' and township supplies. Illustrated.

Roads.—Paper, 3¾x8¼ ins., 8 pp. The Solvay Process Co., Syracuse, N. Y.

A pamphlet describing a new road covering, Solvay granulated calcium cloride.

Blowers.—Paper, 6x9 ins., 20 pp. Wilbraham-Green Blower Co., Philadelphia, Pa.

Catalog of blowers of various types and capacities for blast furnaces.

Modern Centrifugal Pumps.—Paper, 6x9 ins., 112 pp. R. D. Wood & Co., Philadelphia, Pa. A very complete and excellent catalog for 1910. Contains descriptions and illustrations of centrifugal pumping machinery of original design and of wide range of capacities and uses.

Pumps.—Cloth, 6x9 ins., 258 pp. Rumsey & Co., Ltd., Seneca Falls, N. Y.

This is the general catalog published by the company and contains complete indexed price lists. The book covers every type of pump made. Illustrated with useful figures and formulas.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

Steady progress has been made in the placing of concrete for the locks of the Panama Canal, and during the month of June 124,214 cu. yds. were placed. The excavation on the canal during June totalled 2,616,609 cu. yds., a daily average of 100,639 cu. yds. for the 26 working days. In addition 644,155 cu. yds. of fill were placed in the dams. The rainfall for the month was 11.67 ins.—The State Railroad Commission of Massachusetts has finally granted the Grand Trunk Ry. permission to build its projected new railroad from Palmer, Mass., to the Rhode Island state line, from which point the road will be continued to Providence, R. I. As the Grand Trunk some time ago secured permission to construct that portion of its line in Rhode Island, it is possible that construction work may be taken up this year. Considerable construction work in Massachusetts is also proposed by the Boston & Maine R. R. and steps are being taken to secure $20,000,000 to finance these and other improvements.—Press reports from Tucson, Ariz., state that contracts were awarded there on July 14 by the Arizona, Mexico & Gulf of California Ry. for the construction of a railroad from Silver Bell, A. T., to Port Lobos, a distance of 200 miles, giving Tucson a line to tidewater. No information as to the contractors was given.—An international railway commission with supervisory authority over the railroads of the United States and Canada, possibly will be the result of action taken on July 14 by this government in the appointment of Chairman Martin A. Knapp, of the Interstate Commerce Commission, as the representative of the United States to confer with Hon. John B. Mabee, chief of the Railway Commission of Canada.—The State Comptroller of New York state has disposed of state bonds amounting to $11,000,000 for the barge canal improvement. Of this sum $1,000,000 will be for the improvement of the Cayuga and Seneca Barge Canal.—A number of railway companies have made such progress in their preliminary work that they are now preparing to let construction contracts soon. Among these may be mentioned the following: The Hammond Interurban Ry. Co., of Hammond, La., for 16 miles of line from Hammond, La., north; the Decatur Southern Traction Ry. Co., of Decatur, Ill., will let contracts about Sept. 1 for a 33-mile line from Decatur to Pana, Ill., and the Nueces River Valley R. R. Co., of Beeville, Tex., for the first section of its 175-mile line from Beeville to Eagle Pass. The Iowa City, Ottumwa & Southwestern R. R., of which W. L. Kettlewell, Iowa City, Iowa, is Chief Engineer in about 90 days for its projected 70-mile line from Iowa City. In addition the Manitoulin & North Shore Ry., of which R. S. McCormick, Sault Ste. Marie, Ont., is Chief Engineer, will open bids July 23, for constructing the subgrade of 18 miles of line.—Among the railroad construction contracts let recently are the following: The Shumway Construction Co., New York City, for the building and equipping of 55 miles of line, Lamar, Colo., south from the Denver & Gulf R. R.; the London Contracting Co., New York city, for constructing the Galesburg-Rock Island Interurban line; C. W. Blakeslee & Son., New Haven, Conn., for double tracking the section of the Berkshire Division of the New York, New Haven & Hartford R. R. between Hawleyville and Botsford, Mass.; the Eyre-Shoemaker Construction Co., Philadelphia, Pa., for grading and filling for ten miles of branch road in Somerset County, Pa., for the Baltimore & Ohio R. R.; J. J. Boxley & Son, Roanoke, Va., for the construction of a 22-mile narrow gage line in Gilmer County, W. Va., for the Elk & Little Kanawha R. R. Co.; The Pinkerton Construction Co., for constructing the 44-mile line of the Midland Pennsylvania R. R., from Millersburg to Ashland, Pa.

The Sewer Contractress.

About all fields of endeavor that formerly were considered for men only have been invaded by the fair sex. The last few years have seen the entrance of women into the civil engineering field, and even the contracting field has been invaded; at least three women control very successful street grading businesses. Now comes the announcement of a young woman student in the Engineering Department at the University of Michigan that she intends to make a specialty of sewer contracting. In a recent press report she announces her intentions as follows:

"Why shouldn't there be just as much opportunity for a girl to win success building sewers as in writing stories, teaching school, doing sociological work or lecturing on woman's suffrage? I intend to devote my energies to becoming a successful sewer contractress. I don't see why one cannot be a lady supervising a crew of men digging a sewer trench just as well as governing a room full of obstinate school children."

The Pay of Surveyors.

There was once a young man who had a job as "inside" advertising man on one of the largest technical papers in this country. He was a good man in his line and commanded an excellent salary. In his position he had a chance to study the English technical papers, and he decided that they needed just such a man as he to show them the American ideas of securing ads. So he threw up his job in New York, and as he had very little money, he took passage on a cattle steamer, and worked his way to London. Here he went to the manager of a large engineering paper and stated the case to him and outlined his plans. The Englishman listened attentively. "My man," said he, "I like your ideas, and I'll give you a position at a pound a week." Somewhat the same idea regarding the pecuniary rewards of engineers is held by many of the towns of England. A recent issue of The Surveyor cites a case in point as follows: "Our attention was naturally attracted by the headline 'Appointment of a Surveyor' in the columns of the Hereford Times, and the appointment in question turns out to be the surveyorship to the Presteign Urban District Council. Care appears to have been taken strictly to limit competition for the vacancy, with the not unexpected result that three applications were received; and as one of the candidates declined to attend unless his expenses were paid, the number was finally reduced to two, both local builders. The salary, it was explained was £30 ($150) per annum, and for this extremely modest sum the officer had to contrive a double duty to serve, for the sanitary inspectorship is joined to the surveyorship. The gentleman appointed undertook to subscribe to the following conditions so far as the office of surveyor is concerned: 'Attend to the sewage distribution at Whitehall, to draw any plans required, to act as secretary to the market hall, to keep wages' sheets of the men employed by the council, no pension to attach to the office, not to resign the inspector of nuisanceship without at the same time resigning the surveyorship, to attend to the main roads and by-roads, to attend to the public lighting, to give attention to the removal of house refuse, watering streets, sewage pumping, warden, and to check the loads of stone and water.' Comment would be superfluous, except to quote a singularly characteristic remark of a local councillor—for characteristic it surely must be of the conditions prevailing at Presteign—to the effect that 'the salary was not very large, but it was quite enough, and some people thought too much!' It is a far cry from Presteign

The Burglar and the City Engineer.

This is the story of the robbery of the house of Robert Hoffman, City Engineer of Cleveland, Ohio. It took place last week under such unusual circumstances that it seems worthy of notice here. It seems that the home had been closed for some time, as the family was spending the summer in the country and was not to return until early in the fall. On the night in question one of the neighbors noticed a light in the Hoffman home that moved from room to room, and could see the shadow of a man flitting through the rooms in the upper part of the house. A woman saw the light first and she immediately realized that burglars were in the house. Although it was nearly midnight many of the neighbors were still on their porches, and she quickly spread the news. The police were notified and the situation explained to them, and a lieutenant and six policemen came to the scene as quickly as an automobile could bring them. In the meantime the entire block was aroused. Neighbors in all sorts of costumes peeped from upper balconies and windows, and porches were crowded, all watching to see the burglars driven from the house. The house was surrounded, every possible exit being guarded by a policeman with a gun in his hand. The lieutenant then advanced to the front door. He tried to open the door. It was locked. "Ha!" said he. "It's a wise boy, all right." As he stood at the front door the lieutenant saw a man appear at the head of the stairs. He was clothed in a bathrobe. Slowly he came down the stairs and opened the door. "Come in," said the man, "and tell me all about it." "He's a cool one," thought the lieutenant, but he went in. Once inside the lieutenant proceeded. "You're pinched," said he, "get into your pants." "But I own this place," said the man. "Tell it to Sweeney," said the officer, "get into your pants, there's 750 women outside." "This is where I live," insisted the man. "That's what they all say," replied the officer. Some of the neighbors were called and came timidly to the door. "Do you know this fellow?" asked the officer. "Sure," some one answered. "It's Mr. Hoffman." The City Engineer then explained that he had come home unexpectedly and was taking a bath when the interruption came.

The Reading of Technical Journals.

In an address before the graduating class of the School of Mines and Metallurgy at Rolla, Mo., Dr. Charles Sumner Howe, President of the Case School of Applied Science, made the following interesting remarks regarding the reading of technical journals:

The successful engineering graduate will subscribe for the leading technical magazines in his line of work, and he will not only subscribe for them—he will read them, in order that he may keep posted in regard to what men in his profession are doing, not only from the engineering standpoint, but from the manufacturing standpoint as well. Too many technical graduates never take a technical journal. They say they do not need it for the work they are doing, which is probably true, and if they continue in that frame of mind, the probability is they will never need to take the journals, because they will not rise to positions of high enough responsibility to make it necessary. The successful man—the man that is doing all that is in him to do—must know what other men are doing, and he must put this knowledge to use in the work which he does from day to day. I believe every engineering graduate should keep a card catalog of articles and books which he reads, and these cards should give the information under so many different heads that it surely can be found when needed. Almost every man has at some time in his career wanted very much some article which he remembers having read but cannot place. Usually, this occurs to men every week or every day. Knowledge is valuable only as it can be used. No one can remember everything which he has read; no one can know all there is to be known; but every engineering graduate should know where to go to find the information necessary in the successful pursuit of his profession. This means knowing how to search encyclopedias, magazines, books, etc., and I think the practice of keeping a card catalogue of the important things read will pay for itself many times over. Do not be afraid of a little extra work of this kind.'

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The construction of an independent electric car line from Birmingham to Ensley via Owenton and Shadeside is under consideration, and an engineer has been employed to make a preliminary survey. It is estimated that the cost of building and equipping the line would be about $1,250,000. Among those interested are: F. A. Burr, president of the Shadyside Land company; Col. Tom O. Smith, Frank Nelson, Jr., and S. E. Thompson, all of Birmingham.

The Directors of the Seaboard Air Line Ry., W. L. Seddon, chief engineer, Portsmouth, Va., at a meeting on July 13 are said to have taken definite action with reference to the proposed extension of the line to Anniston. The proposed extension is to be made from Tredegar by way of Jacksonville, the route having been thus surveyed about three years ago.

The Pensacola, Mobile & New Orleans Ry., of which Henry McLaughlin, Pensacola, Fla., is President, is reported to have awarded the contract for grading 10 miles of line north of Daphne, requiring about 13,000 cu. yds. of earth excavation per mile.

Arkansas.

The Business Men's League of Hot Springs has accepted the propoosition of Henry Dalhoff, mentioned in our last issue, for constructing a 17-mile steam railroad from Hot Springs to a dam site on the Ouachita river. The league is to raise $36,000 for the project. According to a statement of one of the promoters there already had been expended $10,000 in surveys and preliminary work on the proposed line, and the further sum of $225,000 would be spent in building and equipping the railroad. The railroad will also be extended northeast of the city later and reach Mountain Valley.

The Doniphan, Kensett & Searcy R. R., H. R. Kilpatrick, General Manager, Kensett, Ark., has work under way on its extension from Letonia to Quitman. Over 200 men with teams are now on the work and it is believed the grading will be completed by Nov. 1. Six bridges are to be constructed between Bald Knob and Quitman.

A meeting of the directors of the Pine Bluff Northern Ry., which has taken over the Meto Valley R. R. from McCraenor, Ark., on the Chicago, Rock Island & Pacific Ry., to Arros, in Lonoke County, has been called for the purpose of deciding as to the exact date upon which to start construction work on the proposed line.

All arrangements, including those for financing, have been made by J. M. Parker, General Manager, for the proposed line of Arkansas, Louisiana & Gulf R. R. Co. In company with E. M. Mills, representative of Peabody-Houghteling & Co., Chicago, Ill., he discussed with the Pine Bluff, Ark., business men, the matters concerning the extension of the line from Hamburg to Hazen by way of that city, and looked over the site for the proposed bridge at McFadden's ferry north of Pine Bluff. As stated before in these columns the citizens of the latter city have raised a bonus of $100,000 for the project and are ready to donate the necessary right of way.

California.

The Los Angeles-Pacific Co., 431 South Hill St., Los Angeles, has secured a permit from the Board of Education of Los Angeles to construct a tunnel under the Hill Street school. This is part of the plan of the company for the construction of a double-track subway, at a cost of between two and three million dollars, and the standardizing of the entire system. The plans for the building of the subway from a point on Hill street, between Fourth and Fifth, four miles west to Western avenue, and the standardazing of the entire system, has been under consideration for several years.

The city council of Oakland will give a hearing on Aug. 14 on the application of the Central Pacific, a subsidiary corporation of the Southern Pacific Ry. company, for an extension of its line from its Melrose terminus to Stanley road.

The Southern Pacific Ry. has applied to the city council of Oakland for a franchise to run a connecting link from its North Oakland terminus to its right of way granted by the Berkeley council some months ago. The franchise covers five blocks and will complete an electric loop system which will environ Berkeley. It will connect with the electric system running north on California street to the northern extremity of Berkeley.

City Council of Oakland, Cal., has passed an ordinance providing for the final grant to the San Francisco, Oakland & Santa Fe R. R., of the right to fill in a 1,000 ft. strip parallel with the present pier line and dock and wharf rights and the improvements contemplated by that company, which are estimated to necessitate an expenditure of $5,000,000 will be started at once.

Owing to heavy work on the eastern end of the Porterville Northeastern R. R., it has been thought advisable to let contracts for that section and railroad contractors are viewing the surveys preparatory to submitting bids. Included in the contract will be two long concrete and steel bridges which must be built high over the Tulare River in California, at its widest point in event of high water.

Reports from San Francisco, Cal., are to the effect that the Southern Pacific Ry., has issued bonds amounting to $25,000,000 for the completion of the finest terminal and passenger station in the west at that city, near the foot of Market St. All trains will run to the new location by way of the Dumbarton bridge, thus doing away with the old ferry.

Officials of the Western Pacific R. R., have been in Ely, and it is expected that a franchise will be asked for the construction of the line from Ely, Nev., to Goldfield, where a connection will be made with F. M. Smith's line. A connection is also planned with the Santa Fe at Los Angeles, thus giving Smith and Goulds two transcontinental lines. T. J. Wyche, San Francisco, Cal., is Chief Engineer of the Western Pacific Ry.

According to an announcement reported to have been made by W. A. Drake, General Manager, Santa Fe, Prescott & Phoenix Ry., the Santa Fe is considering the construction of a line from Ash Fork to Boise, Ariz.

Right of way agent, J. L. Buell, is reported to have been very successful in securing the necessary land for the construction of the Fernley & Lassen R. R., from Amedes to Susanville through Honey Lake Valley. If built over the lines of survey, this road will enter Honey Lake Valley at the eastern end and traverse its entire length. In fact, it may, if it is to be a part of the east of the mountain route from Los Angeles to Portland, pass through Lassen County at its greatest length, running obliquely from the southeastern to the northwestern corners.

Under an act recently passed by Congress and signed by the president, W. A. Wall, Honolulu, Hawaii, has been authorized to construct a railroad line half way around the island of Hawaii, opening a country adapted to the cultivation of cotton and tobacco and passing through a number of rich plantations in the Mamakua sugar belt. Surveys for the project are already under way, and it is estimated the cost will amount to several million dollars.

Advices from El Centro, Cal., state that the rails on the San Diego & Arizona Valley Ry. extending westerly from El Centro are now laid to Seeley, on the banks of the New River and preliminary work is under way for the construction of a permanent bridge at that point.

Colorado.

The Denver & Gulf R. R. Co. has awarded a contract for the construction of its line from Texahoma to Lamar to the Shumway Construction Co. of New York city. The contract calls for the building and equipping of 55 miles of railroad from Lamar south, the consideration being $1,000,000. The contract covers the grading, ballasting, building of culverts, bridges, laying of 70-lb. steel, broad gauge, for the distance stated. The contract also covers equipment for the road and provides that work shall begin by July 15, 1910, and be completed by January 1, 1911.

Capitalists of Boulder are planning to organize a company with a capitalization of $100,000 to purchase the local street railway system, now owned by the Northern Colorado Power Co.

The Denver & Interurban R. R. Co., of Denver, has tracklaying underway on a new branch electric railway from the main line at Wyman. The line will later be extended to the town of Morrison.

The Denver, Laramie & Northwestern Ry. according to advices from Greeley, Colo., has filed a declaration of its intention to build extensions, sidetracks, switches and bridges from Greeley by way of Severance, Wellington, Fish Creek canon to the boundary between Colorado and Wyoming. E. A. Buck, Denver, Colo., is Chief Engineer of the Company.

Florida.

The Sebastian & Fellesmere Farms R. R. Co. has been organized with a capital stock of $2,000,000 and has purchased the 115,000-acre Russell tract. The company is now engaged in reconstructing the railroad from Sebastian to the tract, a distance of 12 miles. Extensive development work is planned, involving the expenditure of nearly $1,000,000. Drainage canals, 20 feet wide at surface and 60 feet wide at the bottom, will be dug across the land, north and south and east and west. A little city will be laid out, streets constructed, business and residence buildings, church and school house erected. In the center of the town, on the public square, will be erected a $20,000 hotel. This will be the first building erected. Eastern capitalists are interested.

Henry McLaughlin, Pensacola, Fla., as noted in our July 6 issue, has been awarded the contract for constructing seven miles of the Pensacola & Southwestern R. R. The contract includes a 4,000 ft. bridge over Perdido Bay. None of the work is to be sublet.

Georgia.

Carrollton, Ga., has subscribed $50,000 for the projected railroad which is planned to run from that city to tap the Seaboard in the vicinity of Powder Springs, and it is expected that the citizens of Douglasville, Ga., will raise $25,000 in order to secure the construction of the line through that place.

Idaho.

The Oregon Short Line R. R., Wm. Ashton, Chief Engineer, Salt Lake City, Utah, has secured right of way for its Teton branch from Ashton to Driggs, and construction work will be started this summer. The branch will be 37 miles long.

Illinois.

Practically all of its right of way between Danville and Kankakee has been secured by the projected Danville-Kankakee Interurban line, and a meeting of the stockholders is to be held shortly at Danville to take action on building the line.

The project for an electric railway from Freeport to Dixon, passing through Polo, is meeting with much favor, particularly in the latter place, and it is probable that surveys for the line will be made soon. Mayor W. T. Raleigh, Freeport, Ill., is interested.

The stockholders of the Decatur Southern Traction Co. will hold a meeting at 248 North Water street, Decatur, on Aug. 31, to vote on increasing the capital stock from $25,000 to $1,500,000, and to mortgage the property and issue bonds.. H. C. Simmons is secretary.

The Illinois Western Interurban Ry. Co. is reported to have preliminary work so well along that actual construction work may be started in September. Over 89 percent of the right of way between Quincy and Macomb has been secured. The proposed interurban is to connect the following cities and villages: Quincy, Mt. Sterling, Ripley, Rushville, Littleton, Macomb and Bushnell. The preliminary work has been in charge of A. J. Wittman of New York city.

The London Contracting Co. of New York City has been awarded the contract for constructing the Galesburg-Rock Island Interurban line, and according to reports is to commence work Sept. 1 at Galesburg and Alexis. W. C. McWhinney, Galesburg, Ill., is president of the interurban company.

The Elgin Traction Co. of Elgin has been incorporated with a capital stock of $100, the incorporators being George S. Webb, Wm T. Angell and W. D. Ball.

The Waukegan, Rockford & Elgin Traction Co. is to make surveys this month for its projected 15 mile line, the route being from Palatine to Wanaconda via Lake Zurich. We are advised that $200,000 has been secured for the construction of the line. The Interurban Construction Co., Waukegan, Ill., will probably secure the construction contract. R. D. Wynn Waukegan, Ill., is Vice President.

An ordinance has been introduced into the City Council of DeKalb, Ill., providing for a franchise puermitting the Chicago, Milwaukee & Gary R. R. to enter the city over its own tracks. I. W. Troxell, Chicago, Ill., is Chief Engineer of the company.

An additional force of men have been added to hurry the work on the Bluff Line between Alton, Ill., and Elsah, which includes raising the tracks, placing in sidings at Hop Hollow and at point above, eliminating the sharp curves and cutting away points of the bluff projections.

The Chicago & Alton Ry. officials have decided upon the enlargement of shop buildings and the construction of a new depot at Bloomington, Ill., and work, it is said, will be commenced at once. The cost of the proposed work will, according to the estimate, be about $1,075,000. W. D. Taylor, Chicago, Ill., is Chief Engineer of the C. & A.

The Decatur Southern Traction Ry. Co., has completed location surveys and has secured the capital for the construction of its projected line. The company proposes a 33 mile line from Decatur to Pana, Ill. We are advised that construction contracts will be let Sept. 1. R. McCalman, 318 Citizens bldg., Decatur, Ill., is Chief Engineer.

The Chicago, Rock Island & Pacific Ry., it is said, is considering the removing of its yard from the city limits of Joliet, Ill., to a site about six miles south, near Rock Run. The work which according to plans includes the removal of the Rockdale Coal Chutes and the construction of a new and larger round house will cost, it is thought, between $75,000 and $150,000. W. H. Peterson, Chicago, Ill., is Principal Assistant Chief Engineer.

All construction work has been finished on the line of the Cairo & Thebes except the laying of steel which is being delayed by the non-arrival of rails. Upon receipt of same active work will be commenced and the line hurried through to completion.

The Chicago & Northwestern R. R., has decided it necessary to add an appropriation of $750,000 to the funds for the construction of the yards and terminals at Fulton, Ill., and East Clinton. It is planned to have the work completed by November. The yards will cost approximately $1,500,000.

According to reports from Beardstown, Ill., O. G. Wales, Manager of the Chicago Construction & Engineering Co., Chicago, Ill., has announced the intention of that company to construct a railroad from Keokuk, Ia., to Beardstown, Ill.

Indiana.

The Indiana Northwestern Traction Co., which proposes to operate an electric railway between Logansport and Chicago has filed a trust deed for $1,000,000, secured on the right of way in Cass, Lake, Newton, Jasper and White counties, to the Western Trust & Savings Co. of Chicago. Work has already been started between Hammond and Dyer, in Lake county. The company has been granted a franchise in Cass and White counties. The road will touch Lake Cicott and pass through Monticello, paralleling the Panhandle part of the way.

Right of way is being obtained for the Fort Wayne & Warsaw Interurban R. R., and a franchise has already been secured through Whitley County. The road is to be built for the Winona Interurban Ry. Co., of Winona Lake, Ind.

Work has been started by the Lake Erie & Western R. R. relaying stretches of the main line west of Lafayette, Ind., where old rails are still in use with heavier steel. The work will aggregate about 50 miles of new track.

Iowa.

The Waterloo, Cedar Falls & Northern Ry. Co., C. D. Cass, general manager, Waterloo, has awarded the contract for the construction of a power house at Waterloo to James Maine & Sons. The new power house will be a structure 154 feet in length by 102 feet in width. The building will be built of concrete, steel and brick, and the estimated cost is something like $500,000.

The Charles City & Western Ry., Charles City, now under construction from that city, has decided to build its line to Marble Rock. It is expected that construction work will be completed by Oct. 1.

The Iowa City Electric Ry. Co. of Iowa City is reported to have begun active work on its proposed lines within the city. About four [illegible] place, east of town, to the heart of the city; from town to the Rock Island railway station; from the city to the cemetery, and from the city to the city park.

The Chicago, Rock Island & Pacific Ry. is running preliminary surveys in the vicinity of Burr Oak and Canton, Minn., and this has led to the belief that an extension northwest of Decorah, Ia., to a connection with the main line at Owatonna, Minn., was under consideration.

The Great Northern R. R., has acquired possession of all the property of the Iowa & Great Northern R. R., and of the Union Terminal R. R. Co., at Sioux City. The amount paid is about $1,000,000. By the terms of the deeds the Great Northern comes into complete possession of the Union station at Third and Pierce Sts., and all property surrounding the station, which was owned by the Terminal Co.

A large grading outfit is reported to have arrived at Waukon, Ia., preparatory to an immediate start on the construction of the railroad projected to run from that town to the iron mines. It is expected that work will be completed this summer.

Kansas.

The Wichita Railroad & Light Co., W. R. Morrison, superintendent, Wichita, has been petitioned to extend the Pattie avenue line five blocks to Linwood Park.

The Chicago Great Western Ry. has purchased and taken possession of the properties of the Leavenworth Bridge & Terminal Co., located in Leavenworth, Kan. These properties consist of a bridge across the Missouri river and yard facilities in Leavenworth extending half a mile west of the river. The purchase price is said to be in the neighborhood of $1,000,000. It is understood that the Great Western will enter Leavenworth, at a station to be built by the company in the new terminals.

The Missouri Pacific R. R. is said to be planning improvements in Kansas City, Kan., which will involve the expenditure of $1,500,000. The improvements will include the work necessary to protect the right of way along the Kaw River.

Ordinance has been prepared for introduction into the city council of Wichita, Kan., providing for the reduction of the grade of the Wichita & Western Railroad on the west side of the Arkansas River, and city engineer will prepare plans and estimate of the cost.

The Metropolitan Street Ry. Co., of Kansas City, Mo., is planning to make several extensions and improvements to the car lines in Kansas City, Kan. The company has ordered materials for the Quinardo boulevard extension, and will commence work on the line along 18th St., from Minnesota Ave. south to Central Ave., as soon as the assurance is had that the property owners along the street are agreed to have it built. The Quinardo line will be extended west from the present terminus at 18th St. and Quinardo boulevard to 31st St., the west city limits.

Kentucky.

M. L. Aders, Vice-President of the Louisville & Jeffersonville Bridge Co., has submitted an ordinance to the Board of Public Works of Louisville, providing for the erection of elevated tracks from the C. and O. yards to a junction of the L. and M. in Louisville, at a cost of $300,000. Several years ago an ordinance was passed by the General Council for the erection of a trestle connecting the Big Four lines with the L. & N. R R., at a cost of $200,000. Work on this trestle has not begun as yet. It is now stated that the work on both projects will begin as soon as the ordinance submitted by him today is passed by the General Council.

The Illinois Central R. R., W. G. Arn, Assistant Engineer, Louisville, Ky., is to expend about $50,000 for the improvement of its Floyd St. yards at Louisville.

Langhorn & Waugh, Brent, Ky., are making good progress with their 1,100,000 cu. yd.

job near Brent, Ky., for the Chesapeake & Ohio Ry. They would like to get in touch with Sydney Pue, John Bawles, Dan Kite and V. Gardiner, steam shovel dump foremen.

Louisiana.

The Jennings Construction Co., which is to construct the Lake Arthur, Jennings & Northern R. R. from Lake Arthur to a junction with the Frisco, has filed its charter at Lake Charles, La. The company is capitalized at $500,000, and is allowed to begin business when $5,000 has been paid in. The company is authorized to build, maintain and operate a main line and branches of a railroad, with all the incidentals, such as depots, switches, spurs, power-houses, etc. The officers are: G. B. Zigler, president; D. Hebert, first vice president; H. A. Houssiere, second vice president; C. D. Andrus, secretary; W. B. Conover, treasurer; E. P. Fox, general manager.

The Baton Rouge, Hammond & Eastern R. R. has started its crews at Denham Springs grading for the improvements on the line. The roadbed will be made twice as wide and the entire surface graveled. The line is being put in good condition to take care of the traffic that will be handled on the short route via the Lafayette-Baton Rouge cut-off.

The New Orleans, Natalbany & Natchez R. R., T. L. Smythe, general manager, Hammond, has completed its survey for the extension of its railroad from Kentwood to Baton Rouge. The road is now built to Grangeville, over half of the distance from Kentwood, and it is said that the construction of the road for the balance of the way into Baton Rouge is to be rushed.

The E. K. Jeffries Lumber Co., Natchez hotel, Natchez, Miss., is to build a 5-mile lumber railroad in Concordia Parish, La., to tap timber lands.

The J. L. Logan Lumber Co., operating between Mansfield and Pelican, will construct a standard gauge tram railroad leading from Pelican into the pine hills about seven miles, and will haul logs to its mill, making a track about 15 miles in length.

The Hammond Interurban Ry. Co., which projects a line from Hammond north to Natalbany and Genessee and on to Amite City, 16 miles, is just getting into shape to start work this fall. Surveys for the line have not been made as yet. W. E. Libby, Hammond, La., is President.

The Railroad Commission of Mississippi has issued instructions to the New Orleans & Northeastern R. R. to build a switch track to the plant of the Southern Cement and Building Material Company, Hattiesburg, Miss. It is expected that work will be commenced soon.

Advices from Lafayette, La., are to the effect that the line which has been under construction for several years from that place to Port Allen, opposite Baton Rouge, will be completed about September 1. Owing to the difficulties encountered in crossing the Atchafalaya River the work was delayed about one year.

Massachusetts.

The State Railroad Commission of Massachusetts has approved the purchase of the Berkshire Street Ry. Co. of Pittsfield, Mass., by the New York, New Haven & Hartford R. R. The New York, New Haven & Hartford R. R. has also secured control of three small steam roads in Massachusetts. These roads are the New Haven & Northampton, Rhode Island & Massachusetts and Berkshire. The Rhode Island & Massachusetts extends from Franklin to the Rhode Island line. The New Haven & Northampton is a company whose tracks extend from New Haven to Shelburne Falls, the Massachusetts section starting from Southwick on the Connecticut line. The Berkshire runs from Pittsfield to Sheffield.

The Grand Trunk Ry., H. G. Kelly, chief engineer, Montreal, Que., was on July 12 granted permission by the State Railroad Commission to build a road from Palmer, Mass., to the Rhode Island state line as part of its proposed extension to Providence. The company has also secured permission to construct its line in Rhode Island and location surveys are well along.

The New York, New Haven & Hartford R. R. Co. has awarded C. W. Blakeslee & Son of New Haven, Conn., the contract for double tracking the section of the Berkshire division between Hawleyville and Botsford. It is understood that the contract for double tracking the 13-mile stretch between Botsford and Shelton will also be awarded shortly.

The Chamber of Commerce of Boston is desirous of having another railroad terminal in Boston and will make an effort as an organization to have the Grand Trunk R. R., which was recently granted the right by the Massachusetts railroad commissioners to build a line across the state from Palmer to the Rhode Island state line, change its original plans and construct a line from Palmer to Boston.

A considerable amount of improvement work is projected for the Boston & Maine R. R., and in order to secure funds the directors of the Boston Holdings Co., organized several months ago to hold stock of the Boston & Maine R. R., have voted to petition the Railroad Commissioners for the right to issue new preferred shares to be guaranteed by the New York, New Haven & Hartford R. R., in accordance with a law passed by the last legislature. It is stated that if the petition is granted, the New Haven company probably will turn over to the Boston Holdings Co. in the near future the $20,012,000 in 4 per cent bonds of the Holdings company, which it now has in its treasury, and will receive in return an equal amount of preferred stock. The stock issue is to be used to finance improvements. J. P. Snow, Boston, Mass., is Chief Engineer of the B. & M. R. R.

Michigan.

According to an announcement made by Thomas L. Handy, Bay City, Mich, at Caro, roadbed for the Detroit, Bay City & Western Ry. has been graded between Bay City and Akron and work is progressing rapidly east of the latter city. Citizens of Caro have taken steps to secure the pledged $3,000 to provide right of way between Akron and that village.

Surveys have been started by the crew of the Detroit & Mackinac Ry. for the proposed line from Rogers City to a connection with the main line of the D. & M. somewhere between Posen and Metz stations. It is thought that the permanent route will be located within five or six weeks. H. S. Waterman, E. Tawas, Mich., is chief engineer of the Detroit and Mackinac Ry.

Minnesota.

Storage sheds of Foley Bros., railroad contractors, near the Minnesota Transfer Midway at Minneapolis were destroyed by fire on July 8, with a loss of $20,000.

It is reported that the Twin City Rapid Transit Co., 11th St. and Hennepin Ave., Minneapolis, will complete preliminary work by Sept. 15 for extensive improvements in St. Paul.

Grading crews stationed about 1½ miles apart between Jameston and Edgeley, N. D., are rushing the work with all possible rapidity and it is expected by Engineer Beech of the Midland Central that steel laying will begin early in August.

Missouri.

The St. Louis-Kansas City Electric Ry. Co. of Kansas City, is reported to have placed a $15,000,000 bond issue in France. Officials of the road at Kansas City have announced that construction work will begin in a comparatively short time, as 75 per cent of the route has been established. The road will pass through Blue Springs, Oak Grove, Odessa, Higginsville, Marshall, Arrow Rock, New Franklin and Columbia. The company has 10,000 acres of coal land in Boone, Howard and Lafayette counties. The power plant will be built near these fields so electric power may be generated at a minimum cost.

An association, of which W. D. Miles, Kansas City, is a member, is taking steps to organize a company to operate a new street car system at Kansas City, in which the cars will be run by storage batteries. It is planned to build the first line to Swope Park, and the company is said to have secured property owners' consents to such a line from Swope Park to 39th and Olive Sts.

The Wabash R. R. is to enlarge its freight yards at Columbia by the construction of several new tracks.

The Mexico & Santa Fe Suburban R. R. of Mexico, Mo., which recently placed three miles of line in operation is to be extended to Hatton, in Callaway County, from which place branches are proposed to Fulton and Columbia. Bonds have been issued to carry on the work and farmers and others in this section have taken these up, payments of 3 per cent for each mile completed being made.

William Kenefick, Kansas City, Mo., president of the Missouri, Oklahoma & Gulf R. R. left New York July 14 for Europe, where he will open negotiations for additional capital for the railroad. According to Mr. Kenefick the trains will be running into Denison by Sept. 1, and work will be commenced on the Wagner-Kansas City line by October 1. Two routes now are being surveyed, one through Joplin and the other through Pittsburg, Kan.

Montana.

The Missoula Street Ry. Co., of Missoula, Mont., started work early this month on its 2½ mile extension to Fort Missoula. It is expected that the extension will be completed by September 15. The work is being done under the direction of Roadmaster H. E. McCulloch.

Engineers of the Northern Pacific Ry. Co. have located a pass in the Bitter Root mountains southeast of Spokane, Wash., by which the line between Missoula, Mont., and tidewater of the Pacific coast can be shortened 398 miles. The adoption of the new route will necessitate the construction of 200 miles of road principally in Idaho County, Montana, and a small mileage in Ravalli County, Montana. As planned the new line will connect with the Spokane, Seattle & Portland Ry., near Pasco, Wash., giving a water grade to Portland.

Citizens of Billings, Mont., recently held a mass meeting for the purpose of taking action on a proposition to extend the Rock Island Railroad from that place to Tonkawa.

It is reported that location surveys have been finished by engineers of the Great Northern Ry. for the proposed Libby cutoff and that construction work on this long deferred piece of trackage would be started within a short time. Part of the right of way has already been secured. A. H. Hogeland, St. Paul, Minn., is chief engineer of the company.

Nebraska.

Residents of Dakota, Neb., have raised $2,000, thus assuring a 5-mile electric railway from that city to Sioux City, Ia. M. O. Ayres, Dakota, is interested.

The Crystal Lake & Homer has been purchased by Riley Howard, of Orchard, Neb. It is planned by the new company to make Crystal Lake one of the best amusement resorts in that section. The combination expects to also secure control of the combination bridge.

New York.

The New York, Westchester & Boston Ry., of New York City, has applied to the New York State public service commission for permission to exercise the franchises which it holds for a street railroad through Mount Vernon, New Rochelle, North Pelham, White Plains, Eastchester and Scarsdale.

The State Public Service Commission has granted a certificate of public convenience and necessity to the Manhattan Bridge Three Cent Line of New York City, for a trolley line from the Flatbush Avenue station of the Long Island Railroad in Brooklyn, to the North River in Manhattan.

The Otsego & Herkimer Railroad Co. of Hartwich has awarded a contract for filling the ravine crossed by the wooden trestle, about 5 miles south of Mohawk. About 10,000 yards of earth will be required to fill it and it will be done with a steam shovel.

The Fonda, Johnstown & Gloversville R. R. Co. has been granted a franchise for a second track in E. Main St., Amsterdam, length 1.1 miles, and for a single track extension in the eastern part of Amsterdam to Rockton, a distance of 2.3 miles. Only a portion of this work will be done this year and the work will be executed by company forces. F. A. Bagg, Gloversville, N. Y., is chief engineer.

The Long Island R. R., J. R. Savage, Chief Engineer, Jamaica, N. Y., proposes to do considerable grade crossing work within the next year or so. Plans for this work, however, have not yet been completed and nothing has been done in regard to letting out any of the work on contract.

The Delaware & Hudson R. R., George H. Burgess, Chief Engineer, Albany, N. Y., is planning to have work started on improvements and changes in its yards in Binghamton. These will consist of a new yard, round house, ash pit and coal plant.

Engineers of the New York Central & Hudson River R. R. have been in conference with the city officials of Syracuse regarding the elimination of grade crossings in that city. Tentative plans in the work have been prepared by the railway, and were presented for the inspection of the city officials. Some of these looked toward elevated tracks by the West Shore route, with proposed new passenger stations, tentatively located at different points, including the old West Shore station site. Another plan is understood to have been for skirting the city by an elevated route crossing the salt lands in the northern section of the city. The frequently suggested plan for the electrification of the present New York Central tracks through Washington St. for interurban trolley service from the East was gone over. Henry C. Allen is City Engineer of Syracuse.

The Schenectady Railway Co. and Hudson Valley Railway Co. have applied to the village council of Ballston Spa for permission to connect their tracks at Milton and Malta Aves. in the village by a curve from Malta Ave. north down to Milton Ave. It was stated that is was the object of the companies to run the through cars of the Hudson Valley line from Warrensburg to Troy over the Schenectady tracks from Saratoga Springs to the village.

The State Public Service Commission has granted a certificate to the Union Ry. Co. 2042 128th St., New York City, and also has approved the terms of a franchise recently granted by the Board of Estimate for the construction of an extension of the system from Sedgwick Ave. through Fordham road to and across the University Heights bridge over the Harlem River, and on through 207th St. and Emerson St. to the 207th St. station of the subway, at New York.

North Carolina.

Construction work on the Winston-Salem Southbound R. R., running from Winston, N. C., to Wadesboro, is progressing rapidly, and a large force of men is now employed at Fairmount, near Spencer. Track has been laid from Lexington to Spencer, and work trains are being operated a distance of twelve miles. It is expected that regular trains will be running from Winston to Wadesboro within 90 days.

Ohio.

The St. Joseph Valley Traction Co. of Elkhart, Ind., which is now operating a line from Elkhart to Middleburg, is to extend the line to Pioneer, O.

The Marietta, Columbus & Cleveland R. R., J. C. Riddell, General Manager, Marietta, has surveys under way from a point near Amesville, through Trimble, at Chauncey, with a view to connecting with the Baltimore & Ohio R. R. Definite decision as to the outlet for the proposed extension will probably be made as soon as this survey is completed.

The Cincinnati, Lexington & Licking Valley R. R. Co., of Cynthiana, O., has been incorporated with a capital stock of $30,000. The incorporators are R. W. Day, F. L. Fuller, T. J. Fo, W. L. Connell, Scranton, Pa.; Don C. McVean, Covington; R. H. Reese and Wade H. Lail, Cynthiana, O.

Oklahoma.

The Osage & Western Ry., said to be an extension of the Missouri, Kansas & Texas, has let a contract for the construction of the first section of its line. This section covers a distance of 29 miles from Billings, Noble County, eastward to the Arkansas River. From Billings westward to Enid the company will use a 30-mile line, now owned by the Rock Island. The contracts for construction of the Osage & Western from the Arkansas River to the Santa Fe at Fairfax, Osage County, and from Fairfax to Pawhuska have also been let, and construction was started at Billings eastward recently. It is expected to have the road in operation between Enid and Bartlesville by next spring and to Vinita several months later.

Failing to locate a suitable route around the corner of New Mexico and Colorado into Kansas, avoiding Oklahoma entirely, the promoters of the Santa Fe, Liberal & Englewood, have returned to the original route across Cimarron and Texas counties, in Northwestern Oklahoma, and announce that the road will be built. The line was chartered to build from Des Moines, N. M., northeast to Englewood, Kan., an alleged Atchison, Topeka & Santa Fe extension.

The Amarillo & Northern R. R., a new company being promoted at the present time in the Panhandle country of Texas and Oklahoma, the line to run from Amarillo, Tex., northward to Oakley, Kan., is having preliminary work done by Clyde Foster and Frank Watson of Stratford, Tex. Amarillo and Stratford (Tex.) men are behind the project, and Stratford has raised a $40,000 bonus for the company.

The Missouri, Kansas & Texas Ry. Co., according to reports from Muskogee, Okla., is planning to appropriate a large sum of money for the purpose of improving its holdings at that city. As proposed the present yards will be doubled in size and will be of equal importance to any on the road.

It is expected that the Atchison, Topeka & Santa Fe Ry., will soon begin work on its projected improvements at Guthrie. Estimates have been made for an addition to the union station, for a new freight station, for extension of the south yards and other features, all to cost in the neighborhood of $500,000. Agreements are completed between the city and the company for gates and paving at crossings.

The McKanna Interurban Co., has been organized with a capital stock of $500,000, Dr. J. J. McKanna, Oklahoma City, being the principal promoter. The company proposes to build an interurban electric railway between St. Louis, Mo., and Oklahoma City. Oklahoma capital is behind the project. The survey is to start in a few weeks. As now planned, the road will start from Oklahoma City, extending through Ada, Roff and Stonewall. The power plant is to be established 16 miles north of Ada, Okla. The plan is to use part of the trackage of railroads running out of St. Louis.

Oregon.

Location survey has been completed along the old line laid out about two years ago from Siletz Bay to Yaquina Bay in Oregon and it is believed that either the Spalding Lumber Co., Falls City, Ore., or the United Railways Co., is behind the project and intend to construct the line.

Pennsylvania.

The Eyre-Shoemaker Construction Co., Philadelphia, Pa., has been awarded the contract for the grading and filling of ten miles of branch road in Somerset County, Pa., for the Baltimore & Ohio R. R. The road is located near the Virginia line and is to be graded to Quemahoning. The contract is said to amount to about $500,000.

The Baltimore & Ohio R. R. will have surveys completed soon for a new tunnel which it is contemplated to build on the Pittsburg division. The tunnel will be about 3 miles long and will cost in the neighborhood of $2,500,000. The improvement, it is said, will entirely eliminate the old Sand Patch tunnel on the Pittsburg division. Under the tentative plans the new tunnel can be built at a much lower altitude than the Sand Patch tunnel. The new improvement will not interfere with the plan of the Baltimore & Ohio to build a third track from Yoda, Pa., to the Sand Patch tunnel, to relieve the congestion of traffic until the proposed new tunnel is built.

Charter for the St. Mary's & Eastern R. R. Co. has been approved by the Governor of Pennsylvania. The company, which is capitalized at $125,000, has headquarters at St. Mary's, Pa., and proposes the construction of a line from the Pittsburg, Shawmut & Northern Railway in Benzinger township, Elk county, to a connection with the Pennsylvania R. R. at Beechwood station, a distance of 12 miles. The incorporators are: J. K. P. Hall, Ridgway; George C. Simons, F. A. Kaul, William Kaul, Harry C. Stackpole, J. B. Robertson and Burkett T. Darr, St. Mary's, Pa.

Advices from New Castle state that W. C. Reed, a civil engineer, and C. E. Smith, right-of-way man for the Great Lakes Connecting R. R., are at Harlensburg securing leases for railroad extensions. The Great Lakes Connecting R. R. is to connect with the Pittsburg & Lake Erie, and the Baltimore & Ohio at Ellwood City. It will go up the Slippery Rock and then north. At Raymilton, Venango county, near Franklin, it will connect with the Franklin & Clearfield branch of the New York Central lines. Connection will also be made with the Western Allegheny, near Portersville, and the Bessemer & Lake Erie at Grove City.

The Pittsburg, Steubenville & Wheeling Street Ry. Co., which proposes the connection of the three cities by electric railways, has been chartered. The charter application mentions a preliminary line of four miles between Dormont and Bridgeville. The capital stock is $40,000 and the incorporators are W. E. Hildebrand, Oliver building, Pittsburg, president; John F. Klein, Carnegie, and C. W. Behney, Cecil.

South Carolina.

The Waccamaw Transportation Co. of Georgetown, S. C., has been chartered with a capital stock of $10,000, A. A. Springs being president and manager.

Tennessee.

To encourage the city of Jackson, Tenn., to give $75,000 for the promotion of the proposed Jackson & Dyersburg R. R., the county court has resolved to release the city its share of taxes during the life of the bonds. The company agrees to have the road constructed within the next 12 months provided the counties of Madison, Crockett and Dyer, through which it will pass, furnish aid to the amount of $200,000.

The Southern Ry. Co., has submitted a proposition to the City Commissioners of Memphis, for the construction of a subway at the intersection of its tracks at Lamar Boulevard. Should the subway proposition go through, the Memphis Street Ry. Co. will, if an agreement made with the city is carried, begin at once the extension of its [illegible] Lamar.

Texas.

The Houston Terminal & Development Co., of Houston, has been incorporated with a capital stock of $200,000, the incorporators being George G. Denslow, G. M. Cole and J. E. Fowler.

G. W. Hubbard, Bartlett, President of the Bartlett-Florence Ry. Co., has applied to the State Railroad Commission for authority to issue an additional $58,000 of bonds for the purpose of completing the road to Florence. The road has already reached Jarrett, a distance of twelve miles. This road has already issued $116,500 of bonds.

The Asherton & Gulf Ry. Co., now operating 32 miles of line between Asherton and a point near Artesia, is arranging to finance the construction of extensions of the line east and west. It is proposed to extend the road from Asherton west to Eagle Pass, about 75 miles, and east from its connection with the International and Great Northern Railroad to Aransas Pass, the new deep-water port on the gulf coast, about 175 miles. It is expected to have arrangements completed for beginning construction work within the next few weeks. Asher Richardson, Asherton, Tex., is President and R. H. Gresham, Artesia, Tex., is Chief Engineer.

W. S. McGregor, of Temple, Tex., is promoting a proposition to construct a railroad between Austin and Fredericksburg, 75 miles, and to ultimately extend the line to Del Rio, 125 miles southwest of Fredericksburg. Citizens of Austin are asked to subscribe a cash bonus of $75,000 and to take $175,000 of the bonds of the proposed road when issued.

The Rock Island, Texico, Farwell & Gulf Ry. Co. of Texico, Curry County, N. M., has been incorporated with a capital stock of $250,000. The railroad to be costructed will be 75 miles long, extending from Texico to a connection with the Chicago, Rock Island & Choctaw R. R., 20 miles east of Tucumcari, N. M., traversing Curry and Quay counties. From Texico, south, a Texas corporation, similarly named, will complete the road from Texico to Pyote on the Texas Pacific. The incorporators and directors are: M. J. Healy, Texico, 2,142 shares; S. H. Withers, Farwell, Texas; J. W. Childers, Texico; D. A. Linthicum, Farwell; Ed T. Massey, Texico; T. J. Allen, Texico; K. K. Runnels, Texico; T. B. Martin, Texico; Harry L. Patton, Clovis, each 1 share.

Citizens of Sonora, Tex., are very much elated over the success in securing the necessary bonus for the construction of the Orient Railroad through that place. Already $110,000 of the required $200,000 has been subscribed.

The Gulf, Colorado & Santa Fe. Ry. is making preparations for laying steel on the old Frisco grade between Brady and Eden, Tex., a distance of 16 miles. Material for the work is already on the ground. M. F. Temple, San Angelo, Tex., is Engineer of Construction.

President L. E. Walker of the Quanah & Gulf R. R., has closed a deal with the people in the vicinity of Rockport, Texas, authorizing the commencement of construction work from that city north to Lochart, Tex. It is intended to call upon Austin next for assistance in building the line to the gulf.

The San Antonio, Rio Grande & Tampico R. R. Co., which projects the construction of a line from San Antonio to Tampico, Mexico, by way of Brownsville country, has filed an application with the Railroad Commission of Texas for authority to issue bonds to the amount of $20,000 per mile on 90 miles of line projected from San Antonio southward to the McMullen-La Salle County line, making a total of $1,800,000. George W. Nock is Chief Engineer of the railroad company. R. D. Parker is Engineer of the Commission who will investigate the matter.

Committees from Denton, Slidell, Krum and Plainview, Texas, are to hold a meeting to take up the matter and consider the feasibility of organizing a stock company, capitalized at $50,000, for the purpose of constructing a 25-mile railroad from Denton to a connection with the Santa Fe.

Railroad Commission is to take steps to have the Kansas City, Mexico & Orient Ry. construct the new extension, which is to be built in Iron County, through the county seat in accordance with the constitution and statutes providing that any line passing within three miles of the county seat must either build through or establish a connection with the courthouse town. Commission Engineer who has gone over the territory in that vicinity reports that the Sherwood route is entirely feasible and though a little more expensive to construct, it would shorten the mileage, thus offsetting the difference.

The Railroad Committee of Mason, Tex., have finally agreed to give a bonus of $40,000 and necessary right of way and depot grounds for the construction of the Texas North & South Railroad through that place. The company asks that it be given until January 1, 1913, to construct the road.

Farmers in the Lower Rio Grande Valley, according to reports, are looking upon the construction of the railroad between San Antonio and Brownsville very favorably and will, it is said, meet any fair proposition by the company to construct into that section.

Advices from Weatherford, Tex., are to the effect that the railroad contractors, Mitchell & Pigg, have started work on the line of the Chicago, Weatherford & Brazos Valley Ry. Co.

E. Dickinson, Vice President and General Manager, and Albert E. Stillwell, President of the Kansas City, Mexico & Orient R. R., have succeeded in selling $5,000,000 of railroad bonds in England. The funds will be used for the construction of the open link in Texas and Eastern Chihuahua, Mex., thus giving the Orient its own tracks from Wichita to Del Rio and beyond Bacoyne, Chihuahua on the western slope of the Sierra Madres. With these extensions completed, all that will remain to be finished will be the line from Kansas City to Wichita, and the work through the heaviest part of the Sierra Madre Oriental of Mexico. Of this last, 90 miles is surveyed through some of the heaviest construction in the history of railroad work. There are, however, but few tunnels, and the line will have a grade a trifle less than 3½ per cent. Besides this 90 miles, there is but a short stretch on the western slope to connect with the 100 miles already built out of Topolobampo, the Pacific terminus of the road.

Members of the Matador Land, Cattle & Investment Co. have taken up the matter with President Samuel Lazarus, Quanah, Acme & Pacific Ry., of constructing a line through the lands of the company to the town of Matador in Motley County, which offered the railroad a bonus of $100,000. Murdo Z. MacKenzie, Trinidad, Colo., is a member of the cattle company.

The Nueces River Valley R. R. Co. will let contracts about August 1 for the construction of a portion of its projected line. The company proposes a line from Beeville to Eagle Pass, 175 miles. Lee Frisby Beeville, Tex., is General Manager.

Utah.

The Utah & Salt Lake Electric Ry. Co., was organized at Provo on July 14, with a capital stock of $1,400,000, and proposes to build a 70-mile line passing through Sandy, Murray, Draper, Lehi, American Fork, Pleasant Grove, Provo, Springfield, Spanish Fork and into Payson. Simon Bamburger, Salt Lake City, Utah, is primarily interested in the project. The Falkenau Electrical Construction Co., 108 LaSalle St., Chicago, Ill., are said to be Engineers.

Washington.

The Pacific Ry. Co. has filed articles of incorporation at Olympia, Wash., with headquarters named as Seattle, and a capital stock of $2,000,000. The company proposes to construct railroads in the state of Washington and to purchase other railroad properties or real estate. The incorporators are Walter Stranger, G. N. Elder and R. K. Covington, Hotel Diller, Seattle, Wash.

It has been announced by George Donald, President of the North Yakima & Valley Railroad, that it is planned to continue construction work on the line and that it is expected to have the portion from Granger to Donald and also between Moxee City and North Yakima, Wash., completed this year.

West Virginia.

As noted in our last issue the contract has been let by the Elk & Little Kanawha R. R. Co. for the construction of its 22-mile line from Gassaway by way of Frametown to Rosedale in Gilmer County, W. Va., and J. J. Boxley & Son, Roanoke, Va., the successful bidders, are preparing to start work immediately on the narrow gage line.

Wisconsin.

The Ontario & Northern Ry. Co., has submitted a proposition to the town of Whitestown, asking for a stock subscription of $15,000. The company was organized for the purpose of building a railway from the Chicago & Northwestern Ry. at Wilton, to the village of Ontario. Ed. Stackman is President.

The Wisconsin Central Ry. has applied for the appointment of Commissioners to appraise the damage to property resulting from the straightening of its track in St. Croix County, in the towns of Richmond, Cyclon and Somerset.

The Minneapolis, St. Paul & Sault Ste. Marie Ry. has been running surveys from the old Mitchell-McClure log unloading landing on Pokegama bay to the main line of the Booten division below South Superior.

The Twin City & Lake Superior Ry. Co., L. N. Loomis, President, 440 Railway Bldg., Minneapolis, Minn., has completed the financing of the road and has arranged all preliminaries for the completion of the line to Superior. This company will have 129 miles of double track line construction, work on which has been underway for some time.

An ordinance is before the City Council of Milwaukee, to permit the Milwaukee Western Electric Ry. to enter the city via the Walnut St. line of the Milwaukee Electric Railway & Light Co., instead of on Locust Street on a track of its own. The Milwaukee-Western has been trying to secure a permit in Milwaukee for about a year. Each route it selected was opposed by citizens.

The Minneapolis, St. Paul & Sault Ste. Marie Ry., according to reports, is to abandon the ore dock site on the St. Louis bay front, at Superior, and build docks at some other point, presumably Allouez bay, near the Great Northern ore docks.

A mass meeting was held at Viroqua, Wis., on July 16, to discuss assisting the construction of a new railroad from Viroqua to West Prairie.

Wyoming.

Preliminary work is stated to have been completed for the proposed street railway system for the city of Sheridan, Wyo. A franchise for this system was granted some weeks ago to Albert Emanuel and Wm. R. Sullivan, of Dayton, O., and C. W. Stuckley, of Geneva, Neb. The County Commissioners also granted the same parties a franchise for an interurban line.

Canada.

Good progress has been made on the construction of the Shellbrook line of the Canadian Northern Ry., and it is stated that train service will be started in a few days on the line west of Prince Albert, Sask. Steel is now laid 50 miles northwest of Shellbrook on the way to Big River to the Crooked Lake The construction gang southwest of Shellbrook will continue until the ground freezes up, probably 45 miles being graded. Work will be started right away on the line east from Battleford in to Prince Albert.

The report that the project of building the Hamilton, Waterloo & Guelph Ry had been abandoned because of the cost of building terminals and securing an entrance into the city is generally discredited at Hamilton. It is known that John Patterson, the promoter, before he left for Europe a month ago, had every hope of being able to finish the road. A report from the Westinghouse-Church-Kerr Co., of Pittsburg, Pa., on the engineering features of the road was very favorable, and there were two English banks which stood ready to advance the money.

The MacKenzie & Mann interests are reported to have practically completed negotiations for the purchase of Central Ontario, Bay of Quinte, and Brockville and Westport railways, aggregating some 284 miles of road. These lines will be valuable feeders to the new C. N. R. line now under construction from Toronto to Montreal.

Advices from Victoria, B. C., are to the effect that Premier McBride has announced to the Board of Trade that the British Columbia Government will extend aid to the Canadian Northern Ry. to build a line to the northern extremity of Vancouver Island.

The Toronto Ry. Co. of Toronto, Ont., has accepted the order of the Ontario Railway & Municipal Board directing the company to extend its tracks at Toronto. The company was directed to lay rails on Victoria St., Wilton Ave., Shuter St., Teraulay St., Agnes St., Anderson St. and University Ave.

Surveys for the extension of the Esquimalt & Nanaimo Ry., H. J. Cambie, Chief Engineer, Victoria, B. C., towards the north end of Vancouver Island have been completed beyond Campbell river, passing within four miles of the coast and joining on a line surveyed several years ago by J. W. Gray from Quatsino Sound.

The Northern Construction Co., of Winnipeg, Man., has begun work on its contract for the grading work for the first 60 mile section of the Canadian Northern Ry., from Port Mann up the Valley of the Fraser.

Bids are asked until 12 o'clock noon, July 23, by R. S. McCormick, Chief Engineer, Sault Ste Marie, Ont., for the construction to subgrade of a section of the Manitoulin & North Shore Ry., from the north side of Goat Island Channel, near Little Current, northerly to the White Fish River, a distance of approximately 18 miles. Plans and specifications may be had at the office of the Chief Engineer, Sault Ste. Marie, Ont.

Mexico.

V. W. Yorke, president of the Mexican Ry., W. Morcom, General Manager, City of Mexico, and several engineers, have just returned from a trip of inspection of the district lying between Chiganahuapan, on the Mexican railway, and the town of Zacatlan in the interior. The trip was made for the purpose of ascertaining exactly the engineering problems to be encountered along the line of the proposed extension of the Mexican Ry. Mr. Yorke will make his report to the directors of the road in London upon his return there, and, in the event the plans for the extension are approved, it is likely work of construction will commence before the end of the year.

Bids were opened July 15, by H. M. Taylor, Director of Construction, National Railways of Mexico, Bunavista Station, Mexico City, for grading and masonry covering change of line proposed between Acambaro and Andocutin, state of Guanajuato, and between La Huerta and Lagunillas, state of Michoacan, as well as some shorter pieces of line between the districts mentioned. The whole covers new line of about 60 kilometers.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Items marked thus ✣ indicate work now open for bids.

Arkansas.

The White River Land & Investment Co. of Newark, Ark., has been organized and proposes to drain 7,500 acres of land between Newark and Black River.

D. D. McDonald & Co., Collinston, La., has been awarded the contract at $64,950 for constructing two drainage ditches in Phillips County, Ark., for the Yellow-Banks Drainage District. The work includes about 700,000 cu. yds. of excavation and bids for it were opened July 15 at Helena, Ark.

California.

The Rubio Canyon Land & Water Co., according to advices from Altadena, has increased its capital stock in order to secure means to build a large reservoir at the mouth of the canyon this summer.

The Northern California Power Co. of San Francisco, is reported to have stopped active work for the season on its conservation project on Dry Burney Creek, east of Millville. A few men were left on Dry Burney Creek to gather needed enginering data as to the depth of bedrock at the dam-site and to sink shafts to the tunnel level. A 6,400-ft. tunnel is to be dug through a ridge-watershed for a passageway for the ditch from the 1,500-acre reservoir to the power house at Kilarc. During the present season men will sink shafts from the surface of this watershed to the tunnel level. The deepest will be 35 ft.

Illinois.

S. R. H. Robinson & Sons Contracting Co., St. Louis, Mo., have started work on its contract for the diversion of Cahokia Creek at East St. Louis, for the East St. Louis Levee and Sanitary Board. The contract for this work was let some time ago, as noted in these columns. The diversion of Cahokia Creek will cost approximately $750,000. An excavation 4½ miles long and 16 ft. deep and 115 ft. wide will be made from the intersection of Indian Creek and Cahokia to the Mississippi River. The canal will run into the river near Mitchell, Ill.

Judge Henry S. Burgess of the Mercer County Court at Aledo is considering a petition for the organization of the Edwards River Drainage District of Mercer County, Illinois. This calls for the straightening of the course of the Edwards river, from the east side of Section 33 in Pre-emption township, to the point where the Edwards river joins the Mississippi in Section 5 in Keithsburg township. The channel called for will be a straight one, 26 miles long and sufficiently large to carry all the water which is brought in by the tributary streams. The ditching will be done by floating dredges, at a cost of about 9 cts. a cubic yard of earth removed.

Indiana.

✣Bids will be asked until 2 p. m., August 5, by the Superintendent of Construction, Surveyor's office of Hancock County at Greenfield, Ind., for the construction of a ditch. James A. Clear is the Superintendent.

Iowa.

✣Sealed bids will be received by the Board of Supervisors of Shelby County, Ia., at Harlan, until 10 a. m., August 10, for approximately 278,000 cu. yds. excavating in Drainage District No. 1. Main ditch about 5½ miles long, 18 ft. bottom, 240,000 yds. of excavation. Five laterals, combined length 2 miles, 4 ft. bottom, 38,000 yds. Official advertisement will be found elsewhere in this issue.

The City Council of Des Moines has taken up the matter of providing flood protection for the overflowed districts of the city. Two plans are favored. Mayor James R. Hanna proposes the straightening of the channel of the Racoon, and the abandonment of the present channel. City Commissioner John MacVicar has a plan pending for the riprapping and diking of the east river bank.

Louisiana.

Illinois parties are planning the reclamation of about 6,000 acres of swamp land near Kenner, and propose to incorporate a company with a capital stock of $700,000 to control the land. It is planned to construct a main drainage canal 50 ft. and 10 ft. deep. G. A. McWilliams, 1600 Steger Bldg., Chicago, Ill., a drainage contractor, is interested.

The Coulee Drainage Canal, the first enterprise of its kind in Morehouse Parish, was completed on July 13. The canal is supposed to drain 18,000 acres of alluvial lands near Collinston in Morehouse Parish, about 9,000 of this being already in cultivation. The canal is about nine miles long, with an average depth of seven ft. and 25 to 35 ft. wide.

Missouri.

The Spitcaufsky & Wagner Contracting Co., 2012 Agenes Ave., Kansas City, Mo., has the contract for constructing a levee on the east bank of the Kaw River, near Kansas City. The work includes 3,000 cu. yds. of embankment. R. E. Dutcher, Quindaro Pumping Station, has a sub-contract for the work.

New York.

The Baltimore Ferro-Concrete Co. of Baltimore, Md., has a $450,000 sub-contract from M. A. Talbot Co., Baltimore, Md., for concrete work on the New York State Barge Canal at Rome, N. Y.

Ohio.

The State Board of Public Works has awarded the contract for a concrete lock at New Bremen, O., to Schneider Bros., Defiance, O., at $6,480. The contract for the cement to be used in the lock was let to the Superior Cement Co., Cincinnati, O., at $2,640. Bids for the work were opened at Columbus on July 13.

The Commissioners of Marion County, at Marion, have concluded the final hearings on the proposed Little Scioto River improvement, and it is now believed that the County Surveyor will let the contract for the work on Aug. 17.

Oregon.

The Souther-Albertson Co. of Portland, which recently purchased 30,000 acres of land on the west shores of the Upper Klamath Lake, five miles from Klamath Falls, is to dike the property and completely reclaim the marshy part of it.

Tennessee.

✣Bids will be received until noon, August 1, by Maj. M. L. Walker, U. S. Engineer, room 20 Custom House, Memphis, Tenn., for about 226,000 cu. yds. of levee work in the Upper Yazoo Levee district.

Texas.

The City Commissioners of Dallas have been petitioned to build a levee along the Trinity River to protect the property of the Dallas Cooperage Co. and other companies from floods.

Arthur Stiles, Austin, State Levee and Drainage Commissioner, is shortly to commence the location of the levee sites where the topographical surveys have been completed. Maps are now being finished and when completed they will be used by engineers to be placed in the field, who will make all locations of levees, prepare statements of dimensions necessary and probable cost of same. The final maps will show the levee locations. The last described surveys are expected to commence by the latter part of the month and rushed to completion, after which the final touches will be put to the maps and they will show every thing. It is intended to complete everything in time to submit a report of results to the regular session of the Legislature next January.

The Valley Reservoir & Canal Co. has been chartered with a capital stock of $500,000 and will irrigate a large acreage near Chapin. The canal, as contemplated, will be about 25 miles in length, and will wind about through a territory stretching eight miles north of Chapin. About six miles of this canal has been completed, and water from the Rio Grande, in all probability, will be flowing onto Chapin land by Jan. 1. D. B. Chapin, of Chapin, Tex., is President.

The Texas Building Co., Fort Worth, Tex., which has the contract for constructing a levee along the banks of Trinity River in the corporate limits of Fort Worth for the Fort Worth Improvement District No. 1, previously noted in this paper, will sublet most of the work. The work will be mostly excavating and grading, clearing, etc. There will also be a few concrete culverts, which will be put in by the Texas Building Co.

Washington.

Citizens of McMillan have requested the County Commissioners at Tacoma to change the course of the Puyallup River at that place to prevent the washing of its banks. The work will cost $5,000 or $6,000.

MISCELLANEOUS CONSTRUCTIONS

Items marked thus ✣ indicate work now open for bids.

Alabama.

✣City Clerk of Mobile, Ala., will receive bids until July 21 at noon, for dredging in front of the city wharves from Dauphin St., north to St. Anthony St. The contract includes the removal of approximately 100,000 cu. yds. of material.

Colorado.

The Arundel Mines, H. P. Lowe, Central City, Colo., local manager, has awarded a contract to S. A. Knowles, of Idaho Springs, former manager of the Newhouse Tunnel, for a considerable amount of tunnel work. The work consists of driving a drift from the Arundel station to a point beneath the shaft, the excavation of a large working station and making a raise to the bottom of the shaft on the mine. The tunnel which will be in part a cross-cut from the footwall to the hanging wall of the vein and a drift for a short distance to the point where the raise will be started will be a distance of about 260 ft. and will be a comparatively simple matter. The raise from the tunnel level will be 700 ft.

Delaware.

✣Bids are asked by R. R. Raymond, U. S. Engineer, Wilmington, Del., until 11 a. m., July 25, for removing the wreck of the steamship Oakdene, lying sunk in the Atlantic Ocean off the coast of Virginia.

District of Columbia.

✣Commissioners of the District of Columbia, Washington, D. C., will receive bids until 2 p. m., August 2, for furnishing one four passenger touring car, gasoline tube completely equipped for use in the fire department of the district.

✣Bids will be received until 10:30 a. m., Sept. 14, by Capt. F. C. Boggs, Central Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing and erecting machinery to operate the Stoney Gate Valves for controlling the main culverts and machinery to operate the cylindrical valves for controlling the lateral culverts of the canal locks.

✣Bids will be received until July 25, under proposal No. 469, by Capt. A. S. Cowan, Signal Corps, Washington, D. C., for furnishing 32,000 ft. paper insulated submarine cable type 321, and 8,000 lin. ft. of paper insulated submarine cable type 327, both under signal corps specification No. 427.

Illinois.

Freeman & Sons, Mfg. Co., Racine, Wis., have been awarded a contract at $3,185 for furnishing boilers for the Rock Island Arsenal at Rock Island, Ill.

Indiana.

Wilcutts & Hoover of Marion, have been awarded the contract for the construction of a concrete dam across the Elkhart River at Syracuse, Ind., for the Syracuse Cement Co. The reinforced concrete dam is to take the place of a wooden structure now in use. By the water power obtained all the machinery of the Syracuse Cement works is operated and light and power are supplied many towns in that part of the state.

Brown Brothers, Washington, Ind., have been awarded the contract for dredging Smothers Creek for Daviss County.

Iowa.

A special election is to be held at Belle Plaine early in August to vote on granting a franchise to H. R. Mosnat for establishing a gas plant. It is proposed to install a high pressure water gas system of a modern type. Between five and six miles of mains will be laid and these later will be extended. The cost of the plant is estimated at $30,000. The money raised from stock sales, has been oversubscribed locally. If the franchise carries work will be begun as promptly as possible after the election, and it is hoped to have the plant in operation by December.

Massachusetts.

The following bids were received July 15, by the Harbor and Land Commissioners, Boston, Mass., for a stone breakwater in Cohasset Harbor, the estimated amount of stone required being 4,000 tons. The Breakwater Co., 1222 Arcade Bldg., Philadelphia, Pa., $2.87 per ton (2,000 lbs.), furnishing stone and building breakwater.; Lawler Bros., Charlestown, Mass., $2.55 per ton; William H. Connor, Middleboro, Mass., $2.97 per ton; John Cashman & Sons Co., Quincy, Mass., $2.43 per ton; Thomas Fitzgibbon, Beverly, Mass., $2.13 per ton. Bids as follows were received July 15 by the Harbor and Land Commissioners, Boston, Mass., for constructing an anchorage basin and channel in Cohasset Harbor, the estimated amount of material to be moved being 101,000 cu. yds. Scow measurement: Bay State Dredging Company, Boston, Mass., 17 cts. per cubic yard, measured in scows; Charles M. Cole, Fall River, Mass., 19 9-10 cts per cubic yard; Eastern Dredging Co., Boston, Mass., 15 6-10 cts. per cu. yd.; J. P. O'Riordan, Boston, Mass., 14 5-8 cts. per cu. yd.

Minnesota.

Bids were opened July 11 at the office of the U. S. Engineer at Duluth, for removing the wrecks of the steamers Manhattan, Alexander Nimick and Chauncey Hurlbut. The Manhattan lies off Munsing, Mich., near Grand Island, Lake Superior, and the other two boats are near Vermilion point, Lake Superior. Thomas L. Duroucher of Sault Ste. Marie, Mich., was the successful bidder, his bid for the Manhattan being $1,900, for the Nimick $800, and for the Hurlbut $1,200.

Missouri.

George H. Benzenburg, Consulting Engineer, Milwaukee, Wis., has recommended to the Board of Fire and Water Commission of Kansas City, that the banks of the Missouri River for two miles from Rockville be riprapped. The work is required in connection with the protection of the city water supply, and will cost about $100,000.

Montana.

The first two units of 6,000 H. P. each of the Rainbow Falls Development at Great Falls, Mont., have recently been successfully started. According to Mr. Chas. T. Main, of Boston, the engineer in charge of this work, the other four units of 6,000 H. P. each in this development will be in operation sometime in August. The Rainbow Falls is the second largest of the five falls in the Missouri River at Great Falls, Mont., having a fall of 54 ft. There is an aggregate drop of 536 ft. in the Missouri River within five miles, with a total possible development of about 330,000 H. P. Mr. Main is also the engineer for the work being carried on at Great Falls.

New Jersey.

MacArthur Brothers, New York city, who have the contract for building the lake in Byram Township, are preparing to raise the public road in the vicinity of Watson McPeek's about 7 ft. in order to prevent its overflow when the lake is completed.

New York.

✣Bids are asked by Col. W. L. Fisk, U. S. Engineer, 540 Federal Bldg., Buffalo, N. Y., until 11 a. m., August 16, for excavation in Niagara River section of Black Rock Harbor and Channel, New York.

✣Bids are asked by Col. W. L. Fisk, U. S. Engineer, 540 Federal Bldg., Buffalo, N. Y., until 11 a. m., August 16, for dredging the entrance channel and basin at Erie Harbor, Pa.

✣Bids will be received until 10 a. m., August 8, by W. L. Guthrie, Captain, U. S. Engineers (Oswego, N. Y.), for furnishing stone for use at Oswego Harbor, N. Y.

✣Board of Public Works, Plattsburgh, N. Y., will receive bids until 7 p. m., July 22, for the construction of a dam on the West brook about 1,000 ft. above the present dam. Bids will be received for the dam proper, for the grubbing and for mucking jointly or separately. A. G. Senecal is Mayor.

The village of Barnville has begun work on the construction of a new concrete dam for its electric light plant. The dam will cost about $15,000 and is being constructed by day labor. W. G. Stone, Utica, N. Y., is the Engineer.

The State Public Service Commission has authorized the Mohawk Hydro-Electric Co. to construct a hydro-electric plant on and along Caroga Creek, Fulton County, for generating electrical energy, and also to exercise rights and privileges under a franchise granted by the town board and superintendent of highways of the town of Ephratah, Fulton County. A considerable portion of the electrical energy developed will be sold generally for light, heat and power purposes through the Fulton County Gas & Electric Co.

Ohio.

Mayor King of Lorain, has suggested that the City Council of that city appropriate $21,000 for the dredging of the river and the filling of a swamp.

Pennsylvania.

✣Bids are to be received by Maj. Herbert Deakyne, U. S. Engineer, 815 Witherspoon Bldg., Philadelphia, Pa., until noon, August 10, for the construction of a twin screw steel suction hopper dredge for Southwest Pass, Mississippi River.

The Department of Wharves, Docks and Ferries of the city of Philadelphia, has awarded the following contracts for equipment for a municipal dredging plant: Scoop and clamshell dredge, Thomas Smith Sons Co., Jersey City, N. J., $64,160; 8-ft. tug, with compound engine, Walters Colvers Co., West New Brighton Island, N. Y., $20,855; 65-ft. tug, single engine, $11,425; 2 scows, 500 cu. yds. capacity, $9,375 each, Ira S. Bushey Co., Brooklyn, N. Y.; 3 250-yd. capacity scows, $5,250 apiece, one combination scow, John H. Mathis & Co., Camden, N. J., $2,750; 14 lengths of 18-in. pontoon pipe, 110 lengths of 18-in. shore pipe, totaling 2,746 ft., Quaker City Iron Works, Philadelphia, $4,500; 15 pontoons, Knox Ship and Engine Building Co., $2,395.

Rhode Island.

E. G. Belden & Sons, 217 Laurel St., Hartford, Conn., has been awarded the contract for repairing the breakwater at Sakonnet Harbor, R. I., for the U. S. Government. The contract amounts to $3,165, the contract price being $1.63 per ton for placing stone and $6 per hour for furnishing lighter.

Texas.

✣Bids will be received until 8 p. m., July 26, by J. R. Robertson, City Secretary of Quanah, Tex., for the necessary labor and material for the construction of a rubble masonry dam. The work includes the following approximate quantities: 1,038 cu. yds. of rubble masonry; 239 cu. yds. of reinforced concrete; 2,344 cu. yds. of loose rock paving; 5,890 cu. yds. of earthwork. Plans and specifications are on file at the office of the Fountain-Shaw Engineering Co., Andrews Bldg., Dallas, Tex.

Charles P. Taft of Cincinnati, O., has let a contract for the creation of a winter resort on that portion of the land which fronts Corpus Christi Bay. The plans so far made will involve the expenditure of nearly $500,000, it is stated, and will include a sewer system, artesian water system, hotels, golf links, boat houses, etc. State Senator John G. Willacy is to supervise the work and states that it will take fully three years to carry out all the plans.

Virginia.

But two bids were received July 6, by the City Council of Richmond, Va., for the proposed bulkhead to be erected along the water front from the mouth of Gillie's Creek to Nicholson St., as a public wharf. The P. Sandford Ross Co. (Inc.), Jersey City, N. J., and Alsop & Pierce of Newport News, were the bidders. Both bids exceeded the appropriation.

The U. S. Navy Department has invited the following firms to submit bids for extending the dry dock No. 3 at Norfolk, Va.; Holbrook, Cabot & Rollins and William L. Miller, both of Boston, and O'Rourke Engineering & Contracting Co., McArthur Brothers, the Foundation Co., James Stewart & Co., S. Pierson & Son, and the T. A. Gillespie Co., all of New York.

Wisconsin.

Surveys are reported to have been made, riparian rights secured, and capital obtained, for an extensive hydro-electric development on Upper Wolf River at Gardner Dam. The rapids at this place are said to provide a fall of 95 ft. The power from the development, which will involve the expenditure of $1,000,000, will be transmitted over a line 65 miles long to the lower Fox Valley. John I. Beggs, Public Service Bldg., Milwaukee, Wis., President of the Milwaukee Electric Railway & Light Co., is understood to be head of the plan.

Canada.

✣Bids will be received until 1 p. m., July 27, by W. D. McLellan, Clerk of Minto, Harriston, P. O., for the construction of a drain in the township of Minto, known as Municipal Drain No. 3. The work consists of the excavation of a new drain in places and widening and deepening drain or ditch already constructed and the deepening and straightening of a creek or water course in all 35,000 ft. long.

✣Department of Public Works, Ottawa, Ont., will receive bids until 4 p. m., August 9, for constructing an extension to the Colchester pier at Colchester, Essex County, Ont. A check for $1,500 payable to the Minister of Public Works must accompany each bid. Plans, specifications and form of contract can be seen and forms of tender obtained at this Department, at the offices of H. J. Lamb, Esq., District Engineer, London, Ont., J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Colchester, Ont.

The Dominion Department of Public Works has issued instructions to Z. Malholt, Government Engineer, to prepare plans and specifications for the construction of the wharf at Prince Albert, Sask.

BRIDGES AND BUILDINGS

Items marked thus ✣ indicate work now open for bids.

Arkansas.

✣Bids will be received by the Commissioners of Chicot County, at Lake Village, Ark., for the construction of four wooden bridges in this county, one heavy cypress pile and three bent bridges, until noon, July 25. The pile structure will be about 800 ft. long and the bent bridges about 150 ft. in length.

City Council of Argenta, Ark., has taken up the matter of dividing the cost of the Seventeenth St. viaduct between the Chicago, Rock Island & Pacific and the Iron Mountain Railroads.

California.

The Monarch Engineering Co., of Falls City, Neb., has been awarded a contract by the board of supervisors of Monterey County for the construction of a bridge across the Salinas River near Metz, in King City Road District, Monterey County, Cal., for $32,395.

The Class of 1910, University of California, Berkeley, Cal., has decided to present to the college as a memorial, an artistic concrete bridge over Strawberry Creek at the site of the present foot bridge between East Hall and the Faculty Club. The estimated cost of the structure is between $1,500 and $2,000.

Bridge Committee of the Board of Trade, Pasadena, Cal., is to take up the matter with the City Council of constructing a bridge at West Colorado St. The county, San Rafael Heights Improvement Association, the highway system and the city will bear the expense, which will be from $150,000 to $160,000.

Officials of the Northern Electric and the Vallejo Northern Railway Company have met at Sacramento, Cal., to discuss the matter of constructing the proposed bridge over the Sacramento River at M St. Endeavors will be made to reach an agreement with the Supervisors of Sacramento and Yolo Counties whereby the roadway for teams will be constructed on each side of the tracks and in addition passageways for pedestrians will flank the roads. Work will be started as soon as this matter is adjusted.

Colorado.

✣Commissioners of Morgan County will receive bids until noon, July 23, at Fort Morgan, Colo., for the construction of a reinforced concrete pile slab bridge over the Bijou Creek near Wiggins, Colo. W. S. Henderson is Chairman of the Board.

Connecticut.

County Commissioners at Danbury, Conn., have had plans and specifications prepared for the construction of a new bridge from that city to Packer's Island and bids for the work will be received soon. The Sunbury & Northumberland Trolley Co. have agreed to subscribe $17,000 toward the structure.

District of Columbia.

✣Bids will be received until 2 p. m., July 22, by R. A. Ballinger, Secretary, Department of Interior, Washington, D. C., for the installation of two electric passenger elevators for the Pension Office Building, Washington, D. C.

Georgia.

✣Bids for furnishing and delivering at the United States Penitentiary at Atlanta, Ga., a boiler feed pump for that institution, will be received until 10 a. m., July 29, by R. V. La Dow, Superintendent of Prisons, Washington, D. C.

John W. Ash of Austell, Ga., has received a contract from Barrett, Denton & Lynn of Dalton, Ga., for the construction of a warehouse.

Board of Commissioners of Floyd County, Georgia, have arrived at the conclusion that the Broad St. bridge over the Etowah River in Rome, is unsafe for traffic and the co-operation of the Rome Railway & Light Co. will be sought in constructing a new concrete bridge to replace the old one.

Idaho.

Residents in the vicinity of Eagle, Idaho, are circulating a petition for submission to the County Commissioners at Boise, requesting the construction of a bridge across the Boise River at a point south of Linder.

Engineers of the Oregon Short Line Ry. are now preparing surveys for the construction of a new bridge across the Snake River at American Falls, Idaho. The new structure, according to plans, will be 14 ft. higher than the old one and will be double tracked. The estimated cost of the work is $400,000. William Ashton, Salt Lake City, Utah, is Chief Engineer of the company.

Illinois.

The Illinois Steel Bridge Co., Jacksonville, Ill., has been awarded the contract at $5.45 for constructing a steel bridge over Lessig branch, Point Precinct, for Calhoun County. Bids were opened July 11 at Hardin, Ill.

Committee of County Supervisors, Macomb, Ill., have let the contract for the construction of the iron bridge over the creek north of Colchester to the Illinois Steel Construction Co. for $2,194.

Board of County Supervisors of McLean County, Ill., have awarded the contract for the construction of the proposed bridge across the Mackinaw at Fifer Crossing, Bloomington, Ill., to Schmidt Construction Co., Peoria, Ill., for $3,625.

A hearing was recently held by Maj. Thomas H. Rees, U. S. Engineer at Chicago, Ill., on the matter of removing the present Metropolitan Elevated Railway bridge from the river and building a wider bridge in its place.

City Council of Joliet, Ill., has voted to improve the bridge over Jefferson St. on Broadway at a cost of $1,050. According to the plans prepared by City Engineer Stevens, the work will include an entirely new set of stringers and a double flooring of 3-in. plank.

The Paris Bridge Co., Paris, Ill., has been awarded the contract for the construction of the superstructure of the bridge at Kimes Mill, in Grandview township, for $1,847.

Bridge Committee of the Board of County Supervisors at Dixon, Ill., has awarded the contract for the construction of four bridges in Hamilton Township to the Clinton Bridge Co., for $2,672.

Indiana.

✣Commissioners of Jasper County will receive bids until noon, Aug. 1, at Rensselaer, Ind., for the construction of three bridges in Milroy Township, three in Walker Township and one in Wheatfield Township. James Leatherman is Auditor of the county.

✣Bids will be received at Rensselaer, Ind., by the Board of Commissioners of Jasper County, for repairing Burk's bridge. James N. Leatherman is Auditor.

✣Commissioners of Hancock County will receive bids until 10 a. m., Aug. 1, at Greenfield, Ind., for the construction of two steel and concrete bridges. C. H. Troy is County Auditor.

✣Bids will be received until 7 p. m., Aug. 1, by the School Board of Monon, Ind., for the construction of a new roof on the Monon High School building. J. P. Gwin is Secretary of the Board.

✣Bids are asked by the Benton County Commissioners until Aug. 1, at Fowler, Ind., for the construction of six bridges in Pine Township. Lemuel Shipman is Auditor of the County.

✣Bids are asked until 2 p. m., Aug. 2, at Corydon, Ind., by the Commissioners of Harrison County, for the repair of bridge over Big Indian Creek. William Taylor is Auditor of the County.

✣Bids will be received by the Commissioners of Jackson County until 1 p. m., Aug. 2, at Brownstown, Ind., for the construction of seven bridges. H. W. Wacker is Auditor of the County.

✣Bids will be received by the Commissioners of Hendricks County until 10 a. m., Aug. 2, at Danville, Ind., for the construction of seven bridges. W. H. Nichols is Auditor of the County.

According to reports the Pennsylvania Railroad is planning an expenditure of $3,000,000 for the construction of a new bridge over the Ohio River at Jeffersonville, Ind.

Council Finance Committee has been requested to recommend the City Council of

Bloomington, Ind., to appropriate $2,000 to pay the city's portion of the cost of a new concrete bridge over Sugar Creek at Clinton St.

The Board of County Commissioners of Bartholomew County at Columbus, has awarded a contract for the construction of a bridge at Taylor's Mill Ford to J. E. Wagner for $1,822.

Commissioners of Clinton County, Indiana, on July 6, at Frankfort, Ind., let the contracts for the construction of bridges as follows: Earl Sparks, Kirklin, Ind., for Fulkerson bridge at $67, Hiatt bridge at $123, Kemp bridge at $117, Johnson bridge at $239, Wyrick bridge at $349, Poor Farm bridge at $87. Yundt & Miller, of Frankfort, Ind., for Skiles bridge at $213, Unger bridge at $216, Slipher bridge at $167, Alford bridge at $187. Samuel R. Paris, Jones bridge at $135, W. Sharp bridge at $197; Hendricks bridge at $189; Alter bridge at $287. Newton Sheets, Yundt bridge at $190, Murry bridge at $90, Thompson bridge at $200, Young bridge at $275, R. Sharp bridge at $280. Knapp & Knauss, Peter bridge at $165, Hillis bridge at $205. W. D. Kelly, Hiatt bridge at $179.

Iowa.

✣City Council of Fort Dodge, Ia., will receive bids until 7:30 p. m., Aug. 27, for the construction of the South Third St. viaduct. According to the plans the total length of the structure, including a new river bridge to conform with the viaduct proper, will be 823 ft. Each bid must be accompanied by a certified check for $3,000. W. L. Tank is City Clerk.

Board of County Supervisors at a recent meeting at Ottumwa, Ia., accepted the plans and specifications prepared by the engineering force of the Ottumwa Bridge Co. for the construction of four bridges in Competine, Highland and Washington townships and one over the Bear Creek in Ottumwa. The structures as proposed will be of steel with concrete floors and abutments.

At the last regular meeting of the County Board of Supervisors at Davenport, Ia., the contract for the construction of the bridge in Pleasant Valley township, Scott County, was let to the Clinton Bridge & Iron Works, Clinton, Ia., for $3,870.

According to the announcement of C. H. Cartlidge, Bridge Engineer, Chicago, Burlington & Quincy R. R., the contract for the construction of the substructure of the West Seventh St. viaduct, at Des Moines, Ia., has been let to the Phee Construction Co., Chicago, Ill., for $50,000, and the work will be started at once. The substructure includes foundations, concrete piers and approaches.

Kansas.

✣County Clerk J. W. Niehaus will receive bids at Leavenworth, Kan., until noon, Aug. 1, for building two reinforced concrete culverts.

Engineering department of the Atchison, Topeka & Santa Fe Ry. has submitted plans and blue prints for the elevation of the tracks over East Douglas Ave. to Mayor Davidson of Wichita, Kan. The structure will be built of concrete and steel and will be 116 ft. wide, supporting 8 tracks.

Kentucky.

Plans have been completed by City Engineer of Newport, Ky., for the construction of the proposed viaduct which is to do away with the grade crossing at the head of Monmouth St., and it is expected that a meeting of the representatives of the Louisville & Nashville and the Chesapeake & Ohio Rys. and the C. N. & C. St. Railway and committees of Council will be held to take definite action. The cost of the structure is estimated to be about $90,000.

Louisiana.

✣Bids will be received until Aug. 10 by T. B. Sellers, Ama, La., Secretary of the School Board of St. Charles Parish, for the construction of a modern 2-room school house in the first ward.

Michigan.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Aug. 18, for the construction, complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the United States Postoffice at Pontiac, Mich.

✣Bids will be received until July 27 by Col. James N. Cox, Michigan National Guards, Lansing, Mich., for the construction of the Ann Arbor and Pontiac, Mich., armory buildings. Contracts are to be let separately.

Jas. McDonald & Co., P. O. Box 528, Milwaukee, Wis., has been awarded the contract at $3,760 for four bridges for the County road at Bessemer. The work includes two 20 ft. O-beam bridges, one 40 ft. girder bridge and one 75 ft. span lattice bridge. Bids for the work were opened July 7 at Bessemer, Mich.

Surveyors of the Grand Trunk Railroad are making a detailed survey along the west side of the river at Bay City, Mich., for the purpose of locating a suitable site for the west side approach of the proposed railroad bridge that will give the railroad access to the east side of the river.

Minnesota.

The Board of Supervisors of the Township of Polk Center, Red Lake County, at Wylie, Minn., has awarded a contract to the Hennepin Bridge Co., for the construction of a 35 ft. steel beam bridge for $1,768. Bids were opened July 1.

Mississippi.

The Board of Supervisors at Vicksburg, Miss., has awarded the following bridge contracts: Shiliakolia Bridge, Vincennes Bridge Co., at $1,148; Crouch Trestle, Harry Lee, at $464; for tearing up old structure, H. F. Garbish, at $139; for Flowers bridge, H. E. Crouch at $188; Minto bridge, to E. E. O'Connor, at $639.50.

A meeting has been held by the City Council of Vicksburg, Miss., for the purpose of closing up the agreement between the city, the street railway and the A. & V. R. R. and the Q. & C. Ry., for the construction of the Cherry St. viaduct.

Missouri.

Officials of the Union Terminal & Stock Yards Companies have announced their intention to assist in constructing the viaduct at St. Joseph, Mo. According to the present plans the structure will curve off into Cherokee St. instead of landing in Illinois Ave., near the Transit House.

The County Court at Carthage, Mo., has approved plans and specifications for the construction of five additional county bridges, and County Highway Commissioner William Kohlman has been ordered to advertise for bids for the erection of the structures, which are estimated to cost a total of $35,000. The largest structure will be over the Spring River at Hall Ford, 6 miles northwest of the courthouse.

After the work of straightening 26th St. in St. Joseph, Mo., has been completed, the street railway company plans the construction of a new bridge over the ravine south of the Burlington trestle.

According to reports circulating in Kansas City, Mo., the Union Pacific and the Missouri Pacific Railways are considering the construction of a joint bridge over the Kaw River.

Information received from Maryville, Mo., is to the effect that the Nodaway Drainage District No. 2 and the Wabash R. R. have come to an agreement whereby the railroad will construct a bridge over the ditch high enough to allow the passage of the dredging boat.

Montana.

✣Board of Madison County Commissioners will receive bids until 10 a. m., July 20, at Virginia City, Mont., for the construction of a steel bridge across Jefferson River, 6 miles south of Twin Bridges, Mont., where the Hickman bridge was located. The new structure will be 150 ft. in length, consisting of two 75 ft. spans with 16 ft. roadway. Robert S. Bailey is Clerk of the Board.

Bids were opened July 11 by the County Clerk at Fort Benton, Mont., for constructing a number of highway bridges, the contracts being let to O. E. Peppard, Missoula, Mont., at $1,500 for a combination or steel bridge three miles west of Havre, at $9,000 for a bridge over Milk River at North Fork and at $9,000 for a bridge over Milk River at Yantic, Mont.

Nebraska.

Supervisors of Dodge County at Fremont, Neb., have decided to construct steel bridges across the ditch of the Elkhorn River drainage district, instead of wood ones for which an appropriation of $6,000 was made. The work as now planned will necessitate an expenditure of about $10,000.

New York.

✣Bids will be received until 11 a. m. until July 28 by Franklin B. Kirkbride, Secretary of the Board of Managers, Letchworth, Village Room 215 Wall St., New York City, for the construction, including heating, plumbing and electric conduit work, for the new dormitory buildings and additions and alterations to present buildings. Franklin B. Ware, Albany, N. Y., is State Architect.

✣Bids are asked until 2 p. m., August 2, by Department of Public Works, Oswego, N. Y., for the construction of a joint city and county bridge across the Oswego River at Bridge St., Oswego. John Smith is Commissioner of Works, City of Oswego, and Samuel Hunt is Chairman of Committee of the County.

Advices from Albion, N. Y., state that the old covered wooden bridge at Two Bridges over the Oak Orchard creek in the town of Calton has been condemned. It is expected that the tax payers will be obliged to construct a new structure.

Common Council of Rochester, N. Y., at the last meeting discussed the ordinance for construction of a bridge across Red Creek at West Fall road. The structure as proposed would be located near Genesee Valley Park and as estimated would cost about $15,000.

Advices from Herkimer, N. Y., are to the effect that the County Commissioners are considering the construction of a reinforced concrete bridge at East Creek. According to the plans proposed the new structure will be 240 ft. long with one pier in the center.

The contract for the construction of the temporary bridge over the Hutchinson River at Boston Road, Borough of the Bronx, New York City, has been awarded to the Alamo Construction Co., 215 West 125th St., New York, N. Y., for $11,691. Bids for the work were opened July 7. Kingsley L. Martin is Commissioner of Bridges.

North Carolina.

✣Bids will be received at the office of M. L. John, Laurinburg, N. C., by the Stewartsville township road commission for the construction of seven reinforced concrete arch bridges as follows: Roper Mill Creek bridge, 14 ft. span, 16 ft. roadway; Stewartsville bridge, 30 ft. span, 16 ft. roadway; Peddler bridge 30 ft. span, 12 ft. roadway; John Station Bit Branch bridge 14 ft. span, 16 ft. roadway; Caledonia bridge 30 ft. span, 12 ft. roadway; Fairley Old Mill, 30 ft. span, 16 ft. roadway.

North Dakota.

Advices from Grand Forks, N. Dak., state that The Road and Bridge Committee of the County Commissioners have started the inspection of several bridge petitions.

Board of Commissioners of Pembina County, N. Dak., is to be petitioned by the city of Drayton for an appropriation of $25,000 to assist in paying for the construction of the proposed new steel bridge across the Red River at that point. As planned the structure will cost approximately $53,000.

Ohio.

✣Board of Education, Chicago, O., will receive bids until noon, August 5, for the construction and necessary material of a high school building at that place. Each bid must be accompanied by a certified check for $100.

✣Board of County Commissioners at Cleveland, O., will receive bids until 11 a. m., Aug. 10, for the construction of bridge work per Report 2679, Jettie, Changrin River at Gate Mills bridge, Mayfield township. Bids will also be received at the same time for the construction of Jetties per report No. 2679. John F. Goldenbogen is Clerk of the Board of Commissioners and Frank R. Lander is County Surveyor. Plans and specifications can be obtained at the office of the County Engineer at the New Court House on West 3d St., Cleveland, O.

✣Bids are asked until 1 p. m., Aug. 1, by the Board of County Commissioners, at Warren, O., for furnishing necessary labor and material for the construction of the superstructure of a bridge over Mosquito Creek near Rice's Mill, Green township, Trumbull County. Fred T. Stone is County Auditor.

The Board of County Commissioners at Cleveland has awarded a contract to Baldwin Bros., of that city for the construction of a bridge per report No. 2658, retaining wall, St. Clair road, Euclid township. Bids were opened July 13.

Commissioners of Tuscarawas County, New Philadelphia, O., have filed a notice of their intention to construct a steel plate girder highway bridge across the canal at Lock 17, Tuscarawas County. The structure as proposed will be 47 ft. long and 18 ft. wide.

City Engineer of Lima, O., has under consideration two different styles for the construction of the proposed bridge across the Ottawa River at Pine St. It is hoped that it will be possible to receive bids by July 29.

O. E. Robinson, Hamilton Ave., Cincinnati, O., has been awarded the contract at $1,199 for repairing bridge on Colerain Pike in Colerain Township for the County. Bids for this work were opened June 24 at Cincinnati, O.

Pennsylvania.

✣Bids will be received by the Commissioners of Clinton County, Pa., until 1 p. m., August 12, at Lock Haven, Pa., for the construction of a steel span bridge with Kreodone block floor and concrete sub-structure; also for a steel bridge with a concrete floor and concrete sub-structure over Sinnemahoning Creek at Keating in East Keating township. James A. Wensel is Clerk. Official advertisement of the work will be found elsewhere in this issue.

✣Bids are asked by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., August 22, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Carbondale, Pa.

✣Bids will be received by S. G. Dixon, Commissioner of Health and Commonwealth of Pennsylvania, Harrisburg, Pa., until 4 p. m., August 1, for the necessary labor and material for the construction of buildings for the State Sanatorium for Tuberculosis, located near Cresson, Pa.

The contract for the concrete piles and foundations of the new Y. M. C. A. building to be erected at the League Island navy yard, Philadelphia, has been awarded to the Raymond Concrete Pile Co., of New York and Chicago. Alexander Mackie Adams, architect.

Plans for the construction of 40 concrete and steel bridges have been prepared by H. R. Pratt, Chief Engineer of the Western Maryland who has the supervision of the construction of the Cumberland Extension. The contract for the work has been let to McClintic-Marshall Construction Co., of Pittsburg, Pa., at $1,000,000. The largest structure will be about three quarters of a mile in length and about 100 ft. high and is to be located at Salisubry west of Myersdale, Pa.

Information has been received from Ebensburg, Pa., stating that the County Commissioners have awarded the contract for the construction of two bridges. The first being a concrete structure 27 ft. long with 16-ft. roadway in Chest Townshnip, to cost $2,200 and the second to be of concrete with a 30 ft. span having a roadway and sidewalk for pedestrians. 26 ft. wide in all, at Lilly Borough, to cost $1975. The successful bidder was J. A. Lord, Hastings, Pa.

South Dakota.

On July 9 Ludwig Trautmann, County Auditor, Fairfax, S. Dak., awarded the contract for the construction of all steel and wooden bridges and repair of same for a year from date, to the Standard Bridge Co., Omaha, Neb.

Tennessee.

At the regular session of the Fayette County Court in Somerville, Tenn., the contract to construct a bridge over the Wolf River in the southern part of the county was awarded the Memphis Bridge Co. for $3,000.

Texas.

✣Bids will be received until noon, July 25, by Daniel C. Smith, Jr., City Controller, Houston, Tex., for furnishing and setting in place about 5,900 seats in the Auditorium at that place.

✣Bids will be received until noon, July 25, by the Mayor and City Council of Houston, Texas, for the erection of an annex to the Fannin School.

Virginia.

✣Bids will be received by the Building and Grounds Committee of the State Normal and Industrial School for Women at Fredericksburg, W. Va., until noon, July 27, for furnishing necessary material and labor for the construction and completion of an Administration building in accordance with the plans prepared by Charles M. Robinson, 1025-26-27 Mutual Bldg., Richmond, Va., Architect.

Utah.

Advices from Salt Lake City, Utah, state that the officials of the Salt Lake & Ogden R. R. Co., are planning the construction of a bridge over the Webber River. E. A. Vail, Salt Lake City, Utah, is Chief Engineer.

Washington.

A committee of the Puyallup, Wash., Commercial Club, of which Bert W. Holeman is a member, has taken up with the County Commissioners the matter of constructing a bridge at the end of North Meridan St. to connect with the proposed 60-ft. macadam road leading to the state aid road.

Although the War Department of the United States has granted permission to R. T. Philbrick & Co., Hoquiam, Wash., to build a bridge across the Hoquiam River at Ramer Ave., the city council, on account of the opposition of the Hoquiam Lumber & Shingle Co., refuses to grant a franchise for the structure. R. F. Lytle, President of the latter firm, states that such a bridge would interfere with the passage of tramp steamers to his mill and that he will furnish right of way for a structure farther up the river.

No bids were submitted for the construction of the bridge on Whipple Creek and the Elmer Martin bridge and the County Commissioners at Vancouver, Wash., have decided to call for bids again.

West Virginia.

✣Bids will be received until 11 a. m., (eastern time) August 17, by F. W. Alstaetter, Captain U. S. Engineers, Wheeling, W. Va., for the construction of two 2-story houses at Dam No. 13, Ohio River.

Wisconsin.

✣Bids will be received by the Capitol Commission, Madison, Wis., until noon, July 26, for the wrecking of the South Wing of the present capitol. The work will include tearing down and removing the greater part of the material. Lew F. Porter is Secretary of the Commission.

✣Bids will be asked until 10 a. m., July 23, by F. O. Phelps, County Clerk, Milwaukee, Wis., for the necessary labor and material for the installation of an electric passenger elevator in the Court House.

✣Bids will be received by F. O. Phelps, County Clerk, until 10 a. m., July 23, for the necessary labor and material for the construction of steel vault fixtures and furniture in the register of deeds' office of Milwaukee County, Milwaukee, Wis.

Advices from Monroe, Wis., are to the effect that the officials of Decatur Township and the Bridge Committee of the County Commissioners have under consideration the construction of a concrete bridge or steel bridge on the Up River road to cost $6,000.

Canada.

✣Bids will be received by L. K. Jones, Secretary Department of Railways and Canals, Ottawa, Ont., 4 p. m., July 25, for the construction of the substructure of Le Pas Bridge. Plans, specifications and form of contract to be entered into can be seen at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Chief Engineer, Hudson Bay Railway, at Winnipeg, Man., at which places forms of tender may be obtained.

ROADS, STREETS AND PAVEMENTS

Items marked thus ✣ indicate work now open for bids.

Arkansas.

✣The Commissioners of Morgan County, Ala., will receive bids at Decatur, Ala., until 10 a. m. Aug. 9 for the grading, draining and macadamizing of approximately 10 miles of county road. Plans and specifications are on file at the office of R. P. Boyd, Box 173, New Decatur, Ala., County Engineer.

County Commissioners' Court of Greenville, Butler County, has been authorized by a recent election in this county to issue county bonds in the amount of $155,000 for the purpose of constructing sand-clay roads in the county. H. D. Lampley is Judge of Probate, Butler County.

California.

A committee of the city council of Long Beach appointed to look over the tract of land offered the city for park purposes for the sum of about $30,000 has recommended its purchase. The tract lies northeast of American Ave., beginning at the junction of the Huntington Beach and Long Beach lines and running east to the Salt Lake car tracks. Improvements will be made.

Messrs. C. Astanga, C. Thompson, J. Folsom, I. Holly and J. Sosata were appointed a committee to represent the citizens of Sierra City at the session of the board of supervisors relative to the building of the proposed wagon road from Sierra City to Gold Lake, to connect with the road that Plumas County will build from the Western Pacific railway. The plan is to follow the Young American road to the Sardine Creek crossing, thence to build a new piece of road up Sardine creek to Salmon or Church's meadows, to the east of Gold lake.

The Supervisors of Shasta County have awarded the following contracts for completing the Antler road: Chris. Stabler, Redding, at $10,929, for Division No. 2; Matt Wengler, Redding, Division No. 3, at $11,250.

E. M. Green, Clio, Cal., has been awarded the contract at $4,995, for constructing a wagon road from the Denton Ranch to the boundary line of Plumas and Sierra Counties. Bids for the work were opened July 8 at Quincy, Cal.

Trustee H. Askin has notified the city trustees of Visalia that there are at least 10 blocks included in or adjacent to the business district that the property owners are ready to have paved with asphalt, as follows: West Main and South Church, and Acequia, between Church and Garden; Garden, between Acequia and Main; Garden, between Main and Oak; Locust, between Main and Acequia; Center, between Church and Garden; Court, between Center and Oak, and Oak, between Court and Church.

City council of San Diego has granted a petition for the paving of Second St., from the north line of B St. to the north line of H St.

County Commissioner Clifford L. Anderson of San Francisco has stated that the work of repaving Peachtree St., in San Francisco, from 15th St. to Brookwood, and 15th St., from Peachtree to Piedmont Ave., with bitulithic will begin as soon as the property owners along these streets make water and sewer connections as required by the city.

Congressman Kahn of San Francisco has received notice from General James B. Aleshire, quarter-master general, U. S. A., to the effect that the war department has made an appropriation of $10,000 for improving the road leading from Lombard St., the eastern entrance of the Presidio, in San Francisco, to the Nationl Cemetery, about one mile in length.

The Park commissioners of Oakland have instructed the city engineer to prepare plans and specifications for the sidewalking of the Lake Shore Blvd., estimated to cost $10,000.

Colorado.

C. P. Allen, chairman of the state highway commission, has announced that a roadway from Denver to Grand Junction will be constructed within one year. The road will go through Glenwood Springs, Red Cliff and Leadville by Williams Pass and along the South Park to Colorado Springs and thence up to Denver.

Illinois.

✣Bids will be received by the Board of Local Improvements, Peoria, Ill., until 2 p. m., July 25, for resurfacing with asphalt of North Madison avenue from Hamilton to Cornhill streets by removing therefrom the remainder of the present asphalt and binder coat and a portion of the concrete foundation thereunder and renewing and restoring in places such foundation and thereafter resurfacing same with a new binder course and an asphalt surface, each 1½ in. in thickness, and swept with natural cement. The following is an approximate estimate of the material and labor required for such improvement: 2,025 cu. yds. of excavation of old asphalt pavement (cushion and surface coat) down to the present concrete foundation; 496 cu. yds. of excavation of old foundation; 2,980 sq. yds. of new concrete to replace disintegrated concrete in the present foundation; 29,176 sq. yds. of binder course; 29,176 sq. yds. of wearing surface; 40 barrels of natural cement swept in.

✣Advices from Ottawa, Ill., state that C. W. Peterson, Clerk of town of Farm Ridge, will receive bids until 2 p. m., July 30, for the construction of gravel road from the end of the gravel on west line of section 10 and extending westward one-half mile to center of section 9 in Farm Ridge.

Bids for the building of hard roads in Canton, embraced in district No. 5, a mile east from Main on Linn St., and district No. 6, a mile out on the Fairview road, were received July 7 by the highway commissioners of Canton township. M. Heckard & Son of Canton were awarded the contract for building the road in district No. 5 for $32,825, and Roller & Savill of Canton were awarded the contract for building the road in district No. 6 for $34,806.

The board of local improvements of Waukegan has decided to proceed with the paving of Park Ave., north of Washington, with mineral rubber asphalt.

Village board of East Peoria has passed an ordinance for the paving of East Washington St., from Main St. to the interurban tracks, a distance of some 4,000 ft.

Board of local improvements of Chicago has awarded a contract to the Citizens' Construction Co. for paving with creosoted block Adams St., from State to Market St.; Congress St., from Wabash to Michigan Ave.; La Salle St., from Madison St. to Jackson Blvd.; Monroe St., from Dearborn St. to Michigan Ave. It is estimated that these improvements will cost $65,000.

The highway commissioners of Central Township, Greenville, have awarded a contract to S. Van Deusen for $3,500 for the construction of one mile of rock road on and along the old National road in Central Township from the point of intersection of the center line of said road and that of Caroll's lane and extending in a southerly direction to the Vandalia railroad crossing.

An ordinance has been introduced in the city council of Joliet for the construction of brick pavement on Joliet St., from Washington to Jefferson St. J. R. Cronin is mayor.

Indiana.

✣Advices from Kentland state that no bids were submitted July 5 for the construction of a gravel road 2 miles in length and also a macadam road 3 miles in length. The work will, therefore, be readvertised until Aug. 1. E. R. Bringham is County Auditor.

✣As the result of a mistake in advertising for bids, no contracts for the construction of 15 gravel roads were let by the commissioners of Clinton County, Ind., and the work will be readvertised for Aug. 6. F. Cromwell, Frankfort, Ind., is County Auditor.

✣Board of Public Works, Indianapolis, Ind., will receive bids until July 22 at 10 a. m. for the improvement of Gladstone Ave., from the north property line of Washington St. to the south property lne of Michigan St., by grading and paving the roadway.

✣Bids will be asked until 10 a. m. July 22 by the Board of Public Works, Indianapolis, Ind., for the improvement of the first alley east of Park Ave., from the north property line of 24th St. to the south property line of 25th St., by grading and paving the roadway.

✣Bids are asked by the Board of Public Works, Indianapolis, Ind., until 10 a. m. July 22 for the improvement of Meridian St., from the south property line of 38th St. to the south property line of 42d St., by grading and paving the roadway.

✣Board of Public Works of Indianapolis, Ind., will receive bids until 10 a. m. July 22 for the improvement of Georgia St., from the east property line of Pennsylvania St. to the west property line of Illinois St., except a space of 17.75 in center of street occupied by the street railway company's tracks, by resurfacing the roadway.

✣Bids are asked until 10 a. m. July 22 by the Board of Public Works, Indianapolis, Ind., for the improvement of Georgia St., from the west property line of Delaware St. to the east property line of Pennsylvania St., by resurfacing the roadway.

✣Bids will be received by the Board of Public works of Indianapolis, Ind., until 10 a. m. July 22 for the improvement of Haugh St., from the west property line of Walnut St. to the east property line of Calvelage St., by grading and paving the sidewalks.

✣Jennings County Commissioners will receive bids until 11 a. m. Aug. 1 at Vernon, Ind., for the construction of a pike road in Campbell township. T. L. Thomas is Auditor of the county.

✣Commissioners of Washington County, Ind., will receive bids until 1:30 p. m. Aug. 1 at Salem, Ind., for the construction of a gravel road in Washington township. Samuel G. Ellis is Auditor of the county.

✣Bids will be received until 2 p. m. Aug. 1 by Commissioners of Wells County at Bluffton, Ind., for the construction of three macadamized roads. O. D. Garrett is Auditor of the county.

✣Bids will be asked by the Commissioners of Hendricks County at Danville, Ind., until 10 a. m. Aug. 1 for the construction of roads in Union and Washington townships. W. H. Nichols is County Auditor.

✣Bids are asked until 10 a. m. Aug. 2 by Commissioners of Wabash County at Wabash, Ind., for the construction of a road in Paw Paw township. J. P. Noftzger is Auditor of Wabash County.

✣Bids are asked by the Commissioners of Wabash County until 10 a. m. Aug. 2 at Wabash, Ind., for the construction of a gravel road in Paw Paw and Noble townships. J. P. Noftzger is Auditor of the county.

✣Morgan County Commissioners at Martinsville, Ind., will receive bids until 2 p. m. Aug. 2 for the construction of gravel roads in Green and Gregg townships. B. E. Thornburg is Auditor of the county.

✣Commissioners of Wabash County will receive bids until 1:30 p. m. Aug. 2 at Wabash, Ind., for the construction of gravel roads in Waltz and Noble townships. J. P. Noftzger is Auditor of the county.

✣Bids are asked by the Wabash County Commissioners at Wabash, Ind., until 10 a. m. Aug. 2 for the construction of a gravel road in LaGro township. J. P. Noftzger is County Auditor.

✣Commissioners of Pulaski County at Winamac, Ind., will receive bids until Aug. 9 for the improvement of five public highways. Ellis S. Rees is Auditor of the county.

The Board of County Commissioners of Bartholomew County at Columbus has awarded a contract for the Gilliland free gravel road in Hawcreek township to Garah Davis for $59,993

William B. Hutchinson has been awarded a contract by the County Commissioners at La Porte for the construction of a macadam road in Center township, 7½ miles in length, for $36,350. The work includes grading, draining and paving. Bids were opened July 14.

The Board of School Commissioners at Indianapolis has awarded a contract to Abil Bros., 26 W. Delaware St., Indianapolis, for the grading and graveling, sodding and for cement work on lot surrounding two school buildings for $1,017. Bids were opened July 12.

According to reports from Lafayette, Mahoney & Allen have been awarded the contract for the construction of the Ade road in Shelby township for $6,291.

County Commissioners at Lafayette have awarded a contract to John Haynes of Pine Village for the construction of the Clarkson road, which is to be built under the three-mile limit law. The road runs from the Granville bridge toward West Point, and is about two miles and a quarter in length. The contract was awarded for $4,190.

The City Council of Madison has awarded a contract to Jas. H. Stanley & Co. of Madison for the construction of a retaining wall on State road in North Madison for $289. Bids were opened July 7.

City Council of Bourbon has adopted plans and specifications for paving three blocks on Main and two blocks on Center Sts.

County Commissioners at Muncie have awarded a contract to George Saunders for the improvement of the Yorktown road from the L. E. & W. Railroad on Kilgore Ave. to the township line. The new road is to be 32 ft. in width and is to be made of macadam, with a combined curb and gutter on either side. The contract was awarded for $23,300.

City Council of Bloomington has awarded a contract to George T. Miller of Lebanon for the paving of the following streets: College Ave., from Fourth to Seventh St., $17,917; Walnut St., from Fourth to Seventh St., $16,479; Kirkwood Ave., from Morton to Washington St., $15,467; Sixth St., from Morton to Washington St., $12,731.

John O. Wright, Newport, Ind., has been awarded the contract at $1,997 for constructing a gravel road ¾ mile long in Clinton Township for Vermilion County. Bids for the work were opened July 11 at Newport, Ind.

Iowa.

✣City Clerk of Hampton, Ia., will receive bids until August 1 for the construction of 19,000 sq. yds. of concrete pavement and necessary curbing and grading. Hall and Adams, Centerville, Ia., are Engineers.

✣Bids will be received by the City Clerk of Hampton, Ia., until July 18 for the construction of 19,000 sq. yds. of concrete paving with curb. Hall & Adams, Centerville, Ia., are engineers.

William Horrabin of Iowa City, Ia., has been awarded a contract by the city of Osceola, Ia., for the construction of 13,000 sq. yds.

of vitrified brick pavement on a concrete foundation and sand cushion for $2.10½ per sq. yd. The work includes 8,000 lin. ft. of curb. Bids were opened July 14.

Bids opened July 11 at Marshalltown, Ia., for paving certain streets and alleys, the work comprising about 12,700 sq. yds. of brick block pavement and 4,800 lin. ft. of concrete curb and gutter have been rejected.

The City Council of Vinton, Ia., has awarded a contract to M. Ford for the construction of 35,000 sq. yds. of brick block pavement on 4-in. concrete foundation and 2-in. sand cushion for $1.74½ per sq. yd. The work includes 10,000 cu. yds. of excavation at $0.48 per cu. yd., and 10,000 ft. of cement curb at $0.36 per ft. Bids were opened July 11.

A resolution has been introduced in the City Council of Creston providing for the paving of Walnut St. from Summit St. north to Jefferson.

City Council of Cedar Rapids has passed a resolution for paving and curbing Grande Ave. The improvement will include an 18-ft. parking in the middle of the avenue and a 20-ft. paved roadway on either side.

Board of Public Works of Davenport has awarded the following contracts for the improvement of streets: Davenport Construction Co., for paving Eighth St. and alley between 12th and 13th and Main and Harrison at $0.45 per cu. yd. for excavating, $0.39 per lin. ft. for cement curb and $1.78 per sq. yd. for paving; Independent Construction Co., for paving the alley between Seventh and Eighth and Warren and Vine for $0.46 per cu. yd. for excavating and $1.12 per sq. yd. for concrete paving; McCarthy Improvement Co., for paving 18th, Iowa and 17th Sts. for $0.45 per cu. yd. for excavating, $0.66 per lin. ft. for comb. curb and gutter, $0.40 for flanges, $1.89 for asphalt paving.

The Bryant-McLaughlin Co. has been awarded a contract in Des Moines for the construction of asphalt pavement on concrete foundation with 1-in. binder and 1½-in. wearing surface, on 35th St., between Grand Ave. and Woodland Ave., for $2 per sq. yd. The Christie Construction Co. was awarded the contract for curbing for $0.37 per lin. ft. on 35th St. Bids were opened July 12.

Des Moines City Council has awarded a contract to O. P. Herrick of Des Moines for paving E. Third St. and Market St. for $2 per sq. yd. Bids were opened July 11.

Kansas.

✣Bids will be received until 10 a. m., Aug. 11, by Capt. W. M. Whitman, Constructing Quartermaster, Fort Riley, Kan., for approximately 4,500 cu. yds. of grading for roadway; 6,600 sq. yd. of macadam road surface; 3,900 lin. ft. of concrete driveway curb; 6 concrete catch basins; 500 lin. ft. of 12-in. pipe; 8,000 sq. ft. of concrete sidewalks; 950 sq. ft. of concrete walk road crossing; 200 lin. ft. of 10 in. culvert pipe.

Louisiana.

Sebastian Roy, road supervisor for the First District, New Orleans, has contracted with William J. Kelly for 50,000 barrels of oyster shells for road repairs. The material will be used principally in making repairs to the Frisco shell road, which extends through the First Ward and a part of the Second.

Maryland.

Residents along Evergreen Terrace, Baltimore, have urged the board of estimates to pave the roadway in front of Druid Hill Park, along Oren Place and Evergreen Terrace, with asphalt.

Massachusetts.

✣Commissioners of Middlesex County will receive bids at the Court House, Cambridge, Mass., until 10 a. m., July 23, for the construction of a road in Dracut, from Barnum's Landing along the tracks of the Boston & Northern Street railway along the north bank of the Merrimac River to the town line between Dracut and Methuen, a distance of 6,550 ft. Bids will also be received at the same time for the construction of 1,350 lin. ft. of road at the Training School at Chelmsford. Levi S. Gould is one of the commissioners.

✣Highway Department of the City of Haverhill, Mass., will receive bids until 10 a. m., July 21, for the construction of three miles of macadam road on Broadway in that place. A certified check for $500, must be filed with each bid.

Plans and specifications are being prepared in Tiverton for the construction of a mile of macadam road from Tiverton Four Corners easterly.

Minnesota.

The city council of Lansing, Mich., has awarded a contract to Kneal & Ryan of Lansing for the paving of Capitol Ave., with asphaltic concrete for $15,400. The work includes 6,354 sq. yds. of material. Bids were opened July 11.

J. H. Algate of Lansing, Mich., has been awarded a contract by that city for the construction of 4,150 sq. yds. of brick pavement on Turner St., for $7,889. Bids were opened July 11.

The city engineer's estimates on the cost of paving Washington St., from Fifth Ave., to 12th St., and Washtenaw Ave., from North University to Oxford road in Ann Arbor, have been presented to the city council. The Washington St. paving will cost $11,150, and the Washtenaw Ave. paving will cost $13,870.

Minnesota.

P. McDonnell of Duluth, Minn., has been awarded a contract by the city of Crystal Falls, Mich., for the grading and paving of portions of Superior Ave., for $40,000. Bids for this work were onened July 11 by City Clerk William J. Gribble.

Mississippi.

The board of supervisors of Lauderdale county at Meridian have voted good roads bond issue of $200,000. The road commissioners selected are B. V. White, C. C. Dunn and T. C. Kinard.

Board of public works of Brandon has issued notice of the construction of granolithic walks, the aggregate cost of which will be about $25,000. The improvement will include a 3 ft. extension of the walks on both sides of Rosser Ave.

Missouri.

According to Walter A. Coon of the Republic Good Roads association of Republic, it is the intention of that association to construct five miles of public highway leading a mile in each direction of Republic, the work to be done at a cost of about $1,000 per mile.

Charles Bowman has presented to the county court at Carthage, Mo., the matter of improving the Fidelity hill clear to the county line, which is a mile south of Fidelity. It is estimated that it would cost $4,000 to improve the road.

Board of public works of St. Joseph has awarded a contract for the grading of 12th St., from Hickory St., to Monterey St., to E. P. Olson, the aggregate cost being $1,376.

Missouri.

✣Bids will be received by W. E. Brandenburg, County Clerk and Recorder at Bozeman, Mont., until 10 a. m., August 1, for the construction of a wagon road from Taylor's Ford in Section 2, Township 9, South of Range 4 East to the town of Yellowstone, Mont., a distance of about 36½ miles.

County commissioners at Bozeman, after a visit to the southern end of the county, have decided to build a road from Taylor's Fork, the terminus of the present West Gallatin road, to Yellowstone, a distance of about 36½ miles. Bids for the work will be advertised for at once.

City council of Great Falls has let a contract for the paving of 10 of the cross streets in the business section of the city to the Kettle River Co., of Minneapolis, Minn., for the aggregate sum of $69,990. The contract calls for 19,000 sq. yds. of creosoted wooden blocks. The work is to be started by Aug. 1 and finished by Sept. 1.

Nebraska.

City council of Hastings has rejected all bids for paving in district No. 10, comprising that part of Bellevue Ave., between First and Second Sts.

City council of Hastings has instructed the city engineers to prepare plans and specifications for a single course brick pavement in Lincoln Ave., between Ninth and 12th Sts.

New Jersey.

The Gloucester county board of freeholders at Woodbury awarded a contract for paving a road from Swedesboro to Auburn in New Jersey to the Filbertine Construction Co., of Philadelphia, Pa., for $44,000.

Applications have been made to the Gloucester County court at Woodbury for the appointment of six surveyors to lay out a new road from the Cross Keys and Williamstown road to a road on the West Williamstown tract.

John R. LeCompte has been awarded the contract at $13,500 for contracting 10,276 ft. of gravel road in Monmouth County. Bids for the work were opened July 13 at Freehold, N. J.

Richard Hafernan, Farmingdale, Monmouth County, N. J., has been awarded the contract for constructing 2½ miles of gravel road for Monmouth County. The contract price was $6,901 and the work includes 21,675 cu. yds. earth excavation, 4½ acres of grubbing, 800 lin. ft. tile drain and 4,600 cu. yds. compacted gravel. Bids were opened July 13 at Freehold, N. J.

New York.

✣Bids will be received by the State Highway Commission, Albany, N. Y., until 1 p. m., Aug. 1, for the following road work. Construction of Portville Village road at Cattaraugus County No. 872, length .65 miles; Williamsville Village road in Erie County No. 5061, length 1.08 miles; Dolgeville Village road in Herkimer County, length 2 miles; Middleville Village road in Herkimer County No. 869, length .60 miles; Herkimer Village road in Herkimer County No. 870, length 1.90 miles; Poland Village—Cold Brook Village Road in Herkimer County No. 5069, length 2 miles; Danville Village road in Livingston County No. 867, length 1 mile; Clyde Savannah road in Wayne County No. 5070, length .60 miles. Bids will also be received for the maintenance and repair of the following roads in Erie County Section 2 of the Transit road in Amherst and Clarence, road No. 89, repair contract No. 63; Section 1, Transit road in Amherst and Clarence, road No. 88, repair contract No. 66; in Monroe County, Monroe Ave. in Brighton and Pittsford road No. 94; repair contract No. 87. Specifications and estimates may be seen and proposal forms obtained for the foregoing work at the office of the commission, and for work in the counties of Cattaraugus, Erie, Livingston and Monroe at the office of Division Engineer M. W. Wilbur, 423 Cutler Building, Rochester, N. Y.; for work in the county of Herkimer at the office of Division Engineer Guy H. Miller, Cleveland Building, Watertown, N. Y.; and for work in the county of Wayne at the office of Division Engineer Fred W. Sarr, South Clinton & West Jefferson Sts., Syracuse, N. Y.

Long & Fuller, 220 Broadway, New York City, have been awarded the contract at $16,649 for constructing roads, sidewalks, curbs, gutters and drains at Fort Slocum, N. Y. Bids for the work opened July 12 by the Constructing Quartermaster.

The following bids were received by the board of public works of Troy for the grading and curbing of Jacob St., from 16th to 17th St., the work including the excavation of 330 yds. of rock and dirt: John Mullin—Excavation, $0.60; curb, $0.85; bridge stone, $0.80; cobble gutter, $0.50; gravel surface, $0.60; catch basins, $125. E. Kelly & Co.—Excavation, $0.60; curb, $0.90; bridge stone, $0.20; gutter, $0.60; gravel surface, $0.50; catch basins, $110. Charles H. Winnie—Excavation, $1.17; curb, $1.27; bridge stone, $0.34; gutter, $0.67; gravel surface, $0.29; catch basins, $129. John Flynn, Jr.—Excavation, $0.50; curb, $0.90; bridge stone, $0.50; gutter, $0.50; gravel surface, $0.48; catch basins, $120.

The board of public works of Schenectady has awarded contracts to the Schenectady Contracting Co., for the paving of Avenue A and Mason St.

Queens board of local improvements, Brooklyn, has approved petitions for about $40,000 worth of public improvements in Long Island City The list included the following: Grading Franklin St., Astoria, from Halsey St. to Mills; grading, curbing and flagging and building sewer in 15th Ave., from Newtown road to Grand Ave., one and a half blocks, at an estimated cost of $14,000; grading, curbing and flagging Boulevard from Sanford Ave. to Washington Ave.; pave with asphalt block and construct a sewer, Elm St., from Crescent St. to Second Ave., two blocks, at an estimated cost of $15,873.

Queens board of local improvements, Brooklyn, has passed a resolution calling for the curbing, laying of concrete sidewalks and paving of Hunters Point Ave., Long Island City, from the easterly side of Jackson Ave., to the easterly side of Vandam St., a distance of 11 blocks.

Buffalo city council has awarded a contract to Henry P. Burgard for the repaving of Sycamore St., between Fillmore and Walden Aves. The street is to be repaved with asphalt and widened five ft. on each side making it a 40 ft. thoroughfare. The contract price is $38,500.

City council of Buffalo has awarded a contract to F. V. S. Bardol to pave Katharine St., between Elk St. and O'Connell Ave.

Several taxpayers of Buffalo, in Washington St., between Genesee and Chippewa St., have petitioned the common council for the repavement of that portion of the street.

Supervisor Bailey of Sterling has been notified by the state highway commission that they have acted favorably upon his application for the construction of a piece of state road in Sterling.

City council of Niagara Falls has awarded a contract to Read-Coddington Construction Co., of that city for the paving of 10th St., from the subway to Erie Ave., with hassam and for the paving of Spruce Ave., from Main to Whirlpool St., with hassam.

Ohio.

✣Commissioners of Stark County, Ohio, will receive bids at Canton, O., until 10 a. m., August 5, for draining, grading and paving with brick 2.54 miles of road in Sugar Creek Township. J. H. McConnell is County Auditor.

✣Commissioners of Stark County have decided to receive bids until August 5, at Canton, O., for the construction of a brick roadway between Beach City and Wilmot, a distance of 2.54 miles.

✣Bids will be received until 11 a. m., Aug. 10, by the Board of Commissioners of Cuyahoga County at Cleveland, O., for grading, draining and improving the Broadview Road No. 4 extending southerly from the Valley Road to the City Limits of Cleveland. Plans and specifications can be obtained at the office of Frank R. Lander, County Surveyor, New Court House, West Third St., Cleveland, O.

The county commissioners at Columbus have granted the petition for the improvement of the Avery road in Washington township, running north from the Rings and Wolfert Pike to the Union County line. The distance is about 1¾ miles and the cost will be about $10,000.

The commissioners and trustees of Madriver township, Dayton, have agreed to macadamize the Xenia pike. The county will pay the cost of cutting down the hills and grading the roadway along the pike from the corporation to the county line, a distance of about three miles, and the township the cost of macadamizing the roadway. The total estimated cost of the improvement is $15,000.

City council of Columbus has passed street improvement ordinance for the improvement of the following streets: Third St., Moler to Southwood; Frankfort St., Mohawk to Sixth; Wolfel Ave., Beech to Parsons; Lazelle St., Mound to Sycamore: Twenty-second St., Liviingston to Columbus; 17th St., Oak to Gustavus Lane; Abbott Ave., Bryden Road to Main St. Sewer improvement ordinances were: Fairmont Ave., Superior to Columbian; alley west of Sixth, alley north of Reeb to Barthman, alley west of Oakley, Sullivant to alley south of Broad.

Bids were opened July 12 by the town of Beach City, O., for constructing brick pavement, curb and sewer, the contract being let to Burd & Downs, Canton, O., at $12,196.

Village of Mt. Gilead received the following bids July 8 on 6,110 sq. yds. of brick paving; using Minerva brick. W. B. Ells, village engineer:

Contractors—	Limestone base.	Gravel base.
T. W. Hill, Bellefontaine, O...	$10,001	$9,843
M. F. O. Sullivan, Toledo, O..	9,892	9,676
A. P. Caldwell, Galion, O......	9,193	.....
I. N. Kissner Const. Co., Coshocton, O..............	8,929	8,660
Wieland & Brollier, Mt. Gilead	8,826	9,393

Engineer's estimate, limestone, low values, $9,388.

Engineer's estimate, gravel, low values, $9,050.

Contract awarded to Wieland & Brollier on gravel base.

Oregon.

City Council of Baker City has passed resolutions instructing the city engineer to prepare plans, specifications and estimates for the paving of Bridge St., from Main to the bridge, Auburn from Main to Resort, and Resort from Auburn to Bridge.

City Council of Baker City has passed a resolution for the paving of Second St., from Dewey to D. The width of the paving will be: from Dewey to Place, 40 ft.; Place to Center, 52 ft.; Center to Campbell, 40 ft.; Campbell to D, 30 ft. The estimated cost of the improvement is $61,000.

Pennsylvania.

Edwin H. Vare of Philadelphia has been awarded a contract by the City Council of Pottsville for the paving of Centre St. with wood block for $67,604. The contract figure includes excavating and regrading.

Tennessee.

A survey of the streets of McKenzie has been made by civil engineers under the direction of the W. B. Troy Co. of Memphis, for the purpose of making an estimate of the cost of graveling the streets. The waterworks system of the town is also to be extended.

City Council of Memphis has awarded a contract to the Barber Asphalt Co. for paving one block of Rayburn Blvd., from Carolina to Iowa, for $1.17 per sq. yd.

The Memphis Asphalt & Paving Co. has been awarded a contract in Memphis for covering all the old brick pavements in the downtown business district with natural lake asphalt. The work authorized to be done covers about 23,000 sq. yds., at a cost of approximately $34,000.

The district road commissioners and overseers of Madison County, Jackson, Tenn., have effected an organization, which shall have as its object the advancement of good roads construction and the extension of good roads over the entire county. The officers of the organization are Barham Caldwell of Malesus, president, and C. E. Campbell, secretary.

Texas.

✣Bids will be received until July 20 by Albert Levy, Secretary of Marlin, Texas, for paving streets. The work, including Live Oak, Commerce and Winter Sts., will include, it is said, 58,000 cu. ft.

✣Commissioners Court of Grayson County, Texas, will receive bids at Denison, Texas, until 11 a. m., August 10, for the construction of approximately 65 miles of macadam roadway in Road District No. 1 of Grayson County. J. C. Field, Denison, Texas, is Engineer in Charge. H. R. Wallace is County Auditor.

Ling & Hughes, Victoria St., San Antonio, Tex., have been awarded the contract at $25,378 for macadamizing roads and constructing concrete walks, gutters, etc., at Fort Sam Houston. Bids for the work were opened June 9 by the Constructing Quartermaster.

Good progress has been made on the plans which are on foot, in which both Galveston and Houston people are interested, for a speedway. It is proposed that a speedway costing something like $500,000 be constructed paralleling the interurban electric line or one of the railroad lines between Galveston and Houston, the driveway to be exclusively for automobiles and motorcycles. It is proposed that the driveway will be 100 ft. in width, fenced the entire way, built of a rock foundation with mudshell surfacing firmly rolled by a heavy machine.

At an election held at Groesbeck, Texas, as to whether a bond issue amounting to $125,000 should be issued with which to build permanent roads, the proposition was carried. Another district will be laid out at once, cutting off some of the territory in the district voted upon, and another election will soon be held.

Citizens of Chisholm are considering the question of constructing a pike road from Chisholm to Rockwall.

Washington.

Contracts amounting to more than $33,000 for road work in Chehalis County were awarded by the County Commissioners at Montesano July 6. W. G. Hyatt was given the contract for the approach to the Satsop bridge; Snyder & Cooper were awarded the contract for building the London road at a cost of $10,140, and the Wishkah road at $19,000.

City Council of Spokane has been petitioned for the paving of Mission Ave., from Division St. to the river. E. T. Steele is interested.

City Council of Walla Walla has decided to pave 20 blocks of streets. The paving includes Alder St., all the way to the city limits. Bids for the work will be advertised for at once.

The J. F. Hill Co. of Chicago, Ill., has been awarded the contract for paving Cannon hill, including all streets and avenues, from Monroe St. to Hangman creek, and from Fourth to 10th Ave. in Spokane. The contract was awarded for $438,171.

City Council of North Yakima has ordered an additional 13 blocks of streets paved, including five blocks of brick on West Yakima Ave., two of brick on South First St., and six of asphalt on 11th Ave. Previous orders for paving this year totaled 24 blocks, the total now being slightly more than two miles.

West Virginia.

✣Owing to the inclement weather, Henry A. Gentry, Fayetteville, W. Va., announces that all bids for road work to have been received July 1, will be readvertised for August 10.

Wisconsin.

✣City Clerk G. O. Palmiter, Antigo, Wis., will receive bids until 2 p. m., August 6, for furnishing material and labor for the pavement of four city blocks with macadam.

✣Advices from Waukesha, Wis., are to the effect that the Board of Public Works will receive bids until August 1 for the improvement of North St. and West Ave. The work includes 3,076 cu. yds. of excavation, 6,632 lin. ft. curb and gutter and 12,142 sq. yds. of tar macadam pavement. M. R. Butler is City Engineer.

The Board of Public Works of Waukesha has awarded a contract to the Advance Construction Co. of that city for the construction of tar macadam on White Rock Ave., East Park Ave., Cook St., and Center St., and brick on Lincoln Ave., for $51,357. The work includes 15,452 cu. yds. of excavation, 21,435 ft. of curb and gutter, 31,129 sq. yds. of tar macadam and 5,770 sq. yds. of brick, 132 lin. ft. of foot bridge, 274 lin. ft. of concrete drain, 16 catch basins, and 570 ft. of 8-in. vitrified stone sewer. Bids were opened July 11.

Bids were opened July 11 by the City of Waukesha, Wis., for constructing 31,000 sq. yds. of tar macadam and 5,700 sq. yds. of brick pavement. The contract was awarded to the Advance Construction Co., Waukesha, Wis., at $51,347. Other bids received on the work were as follows: Marquette Construction Co., Chicago, $52,079; A. J. Hewitt, Milwaukee, $53,381; J. Hildebrand, Milwaukee, $53,381; J. Stauchfield, Fond du Lac, $54,219; Miracle Construction Co., Minneapolis, Minn., $57,010.

WATER-WORKS AND SEWERAGE

Items marked thus ✣ indicate work now open for bids.

Alabama.

✣Town Council of Attala, Ala., will receive bids until 8 p. m., July 26, for the construction of sanitary sewer system, consisting of approximately 6½ miles of pipe sewers and appurtenances. Willburn Hill, Gadsden, Ala., is Engineer.

✣Bids will be received until 7 p. m., August 4, by the City Council for the construction of a water works station, filters, machinery and extension to the system. Hazelhurst & Anderson, Atlanta, Ga., are Engineers.

H. L. Kramer of Mississippi, consulting engineer to the town authorities of Hartselle, is on the ground to make his final report relative to a system of waterworks for the town. City will soon call a special election to vote on the issuance of bonds for the purpose of constructing the system.

City of Mobile is having preliminary surveys made by Engineer Wright Smith for the establishment of a water system and a perfect sewer and sanitary arrangement in all of the suburbs adjoining Mobile. At present the surveys are being made in Glendale.

Arkansas.

The city of Brinkley will construct eight miles of sanitary sewers this summer. Nick Peay of Little Rock, Ark., is the consulting engineer.

J. W. Vaughn and James F. Kiser of Leslie have been granted a franchise by the City Council of Leslie for the construction of a waterworks and electric lighting system.

The Board of Public Works of Fort Smith has awarded a contract to the Municipal Engineering Construction Co. of Chattanooga, Tenn., for the extension of the waterworks system, and to the United States Pipe Co. of St. Louis, Mo., for the furnishing of pipe and specials. The pipe contract calls for 1,500 tons, which will cost about $51,000. The work of laying the pipe will cost about $10,000.

California.

✣Bids are asked until 11 a. m., Aug. 6, by Maj. George McK. Williamson, Quartermaster, Fort Mason, San Francisco, Cal., for the construction of a reservoir, wooden tank, extending mains, etc., at Fort Barry, Cal.

The taxpayers of Alturas are agitating the installation of a water and sewer system. City trustees will probably take steps to call an election to vote bonds for this purpose.

The Hermosa Beach Land & Water Co., through its president, A. L. Burbank, has made a proposition to the trustees of Hermosa Beach asking the city to take over the entire sewer system for $11,410.

Surveyors have been employed to lay out the water main and sewer system for the new city of Pullman. The systems will be constructed within a few months.

City trustees of Oroville have ordered the sewer bonds, amounting to $200,000, to be sold at a meeting to be held July 29.

Major George McK. Williamson, Depot Quartermaster, Fort Mason, San Francisco, Cal., has awarded a contract to A. L. Chambers of 624 Walsworth Ave., Oakland, Cal., for the construction of an 8-in. water main from Presidio to Fort Mason for $14,947. Bids were opened July 5.

The Rubio Canyon Land & Water Co. of Altadena has recently decided to increase its capital stock in order to secure means to build a large reservoir at the mouth of the canyon this summer. The Los Flores Canyon Land & Water Co., which supplies the eastern section of Altadena and the northeastern part of Pasadena, is carrying on extensive development work and is planning to build a large reservoir.

The city of Lodi has taken possession of the light and water plants formerly owned by Cary Bros., and will commence improvements on both, so that better service will be afforded.

Colorado.

The Pike's Peak Water Co. of Colorado Springs has been incorporated with a capital stock of $500,000. The incorporators are F. B Hartzell, H. E. M. Woods, F. M. Woods.

Georgia.

✣City Council of Wrightville, Ga., will receive bids until 3:30 p. m., July 21, for furnishing materials and installing a system of water works. Bids will also be received for furnishing and laying about two miles of 6 to 10-in. pipe, setting hydrants, etc., constructing one suction basin of 100,000 gals. capacity, setting and connecting all machinery, etc., sinking one 8-in. artesian well. J. M. Blackshear is City Clerk.

Illinois.

✣Village Clerk of Winnetka, Ill., will receive bids until 1 p. m., July 30, for laying a 20-in. intake pipe from the water pumping station for a distance of 3,000 ft. into Lake Michigan.

The work of building the south end sewer system in Evanston, for which bids were taken June 21, has been awarded to Frank G. Mortimer of Glencoe for $41,621.

City Council of Connersville has awarded a contract to Boots & Gant for the construction of storm sewer drains, manholes, etc., on Columbia and Illinois Aves. A 12-in. sewer will be constructed for $0.47 per lin. ft., manholes for $30 each and inlet connections at $0.50 per lin. ft.

East Moline Council has instructed City Engineer H. G. Paddock to prepare estimates on the cost of extending sewer service into new territory south of the Rock Island and Burlington tracks between 10th and 13th Sts.

The Board of Local Improvements of Princeton has taken the initiatory steps for constructing two new sewerage districts in Princeton. One district lies on the north side and runs from Elm Pl. through Union addition to the present terminus on Euclid Ave., and the other takes in the entire southeastern section of the city. The outlet for the districts will be the present septic tank, and for this purpose the present main sewer, which has its terminus on North Euclid Ave., will be extended farther south and west.

O. T. Dunlap has been awarded a contract by the City Council of Edwardsville for the construction of the central outlet sewer along the Steam Mill Branch, the contract price being $0.68½ per ft.

The Board of Local Improvements of Bloomington has received the new estimate for the proposed 20-in. water main and adopted the same, as follows: 7,277 lin. ft. of 20-in. cast-iron pipe laid at $3.60 per ft., $26,197.20; 1,511 lin. ft. of 12-in. pipe laid at $2.20 per ft., $3,324; 1,051 lin. ft. of 10-in. pipe laid at $1.93 per ft., $2,034.22; five 20-in. double gate valves set for $153.50 each, $767.50; 23 valve basins at $22 each, $506; 10 fire hydrants, $700; relaying 786 sq. yds. of brick pavement, $628.80; 50 ⅝-in. lead service pipes, $900. For all labor and material it is estimated the cost will be $39,826.42; court costs, $2,300; total, $42,126.42.

At a special election held in the village of East Dundee recently for the purpose of voting on the issuance of bonds in the sum of $4,000 for extending and improving the city water system, the proposition was carried. A sum of $10,000 is now available for the work.

The city of Toulon has voted the issuance of bonds for the construction of a waterworks system.

The Streator Aqueduct Co. will begin about Aug. 1 to erect six or more filters and connect the same to the present plant. The cost of these extensions will be about $8,000. W. B. Jones of Streator will construct tanks used in connection with the plant

Indiana.

The Board of Public Works of Indianapolis on July 11 opened bids for the construction of local sewers with appurtenances in and along the alley north of 35th St., from Clifton St. to Barnes Ave., the contract being let to Manley-O'Donnell Co., Columbia Ave. and 21st St., Indianapolis, for $1,000.

The Board of Public works of Indianapolis has awarded a contract to the American Construction Co. of 1201 E. Georgia St., Indianapolis, for the construction of a sewer with appurtenances in and along the alley east of Sherman Drive from Washington St., to a point 18 ft. north of the second alley south of Washington St., for $1,850. Bids were opened July 11.

Board of Public works of Marion has awarded a contract to F. M. Benner for the construction of the 18th St. sewer for $8,430. This sewer lies between Branson and Washington Sts., and has its outlet in a branch near the Hoosier stove foundry.

City engineer of Marion has been instructed by the Board of Public Works to prepare plans and specifications for the construction of a sewer between Washington and Branson St.

The City Council of Terre Haute has passed an ordinance providing for the issuance of bonds in the sum of $40,000 for the purpose of building sewers.

The S. T. Sheets Construction Co. of Paris, Ill., has been awarded a contract for the building of a cement tile ditch seven miles long between Anderson and the towns of Linwood and Frankton to the north. The work will be done for $17,000.

Iowa.

✣City Clerk of Oelwein, Ia., will receive bids until 8 p. m., July 21, for the construction of about 2,231 ft. of 6-in. and about 4,292 ft. of 8-in. salt glazed clay pipe sewer, including 4 manholes and 7 combined manholes and flush tanks. C. D. Shippy is City Clerk.

✣City of Harwarden, Ia., will receive bids until August 3, for the construction of a sanitary sewer in streets, avenues and alleys, including approximately 18,400 lin. ft. K. C. Gaynor, Sioux City, Ia., is Engineer. J. K. Hutchinson is Mayor.

M. T. Peterson, Madison, Wis., has been awarded the contract for drilling an artesian well from a depth of 850 ft. to a depth of 300 ft., for the town of Corydon, Ia. Bids for the work were opened July 11.

The following bids were received July 6 for the construction of sewers at Pella, Ia.:

City Sewer.—Cook Construction Co., Des Moines, Ia., $27,568; O'Farrell Contracting Co., Dubuque, Ia., $19,328; J. W. Turner Improvement Co., Des Moines, Ia., $18,905; W. D. Yeager Co., Cedar Rapids, Ia., $18,618; Independent Construction Co., Davenport, Ia., $18,196; Katz-Craig Const. Co., Omaha, Neb., $18.42; H. J. Cathroe, Omaha, Neb., $16,968. Outlet.—H. J. Cathroe, Omaha, Neb., $10,632; Cook Construction Co., Des Moines, Ia., $11,432; Independent Const. Co., Davenport, Ia., $9,364; Katz-Craig Const. Co., Omaha, Neb., $9,017; J. W. Turner Improvement Co., Des Moines, Ia., $9,104; O'Farrell Contracting Co., Dubuque, Ia., $8,529; W. D. Yeager, Cedar Rapids, Ia., $7,950. Charles P. Chase of the Iowa Engineering Co., Clinton, Ia., Engr.; A. C. Kuyper, City Clerk.

The O'Farrell Contracting Co. of 79 Clark St., Dubuque, Ia., has been awarded a contract by the city of Dubuque for the construction of a concrete storm sewer, known as Bee Branch sewer, top and walls, between the 16th and 17th Sts. and Cedar and Sycamore Sts. Bids were opened July 7.

G. B. Healy, superintendent of the parks and public property of Sioux City, has been instructed by the City Council to ask F. W. Cappelen of Minneapolis, consulting engineer for the waterworks for this city, to return to

Sioux City for the purpose of taking observations preparatory to drawing plans and specifications for a throughly modern, up-to-date water service for the Morning Side suburb.

The City Council of Des Moines has awarded a contract to T. J. Casselberry of that city for the construction of the E. 12th St. sewer system for $2 per lin. ft. Bids were opened July 11.

The City Council of Des Moines has awarded a contract to the Cook Construction Co. for the construction of the 23d St. sewer system for $1.84 per lin. ft. Bids were opened July 11.

The city of Leon has awarded a contract to the O'Farrell Contracting Co. of Dubuque, Ia., for the construction of two miles of 6 to 12-in. pipe sewers and a disposal plant for $10,995. M. T. Peterson of Madison, Wis., obtained the contract for the sinking of a deep well. Bids were opened July 12.

The Des Moines Bridge & Iron Co. has been awarded a contract by the city of Indianola for the laying of 12,000 ft. of water mains. The work includes 15 Eddy hydrants and 17 Eddy gates. The contract was awarded for $7,000. Bids were opened July 11.

The contract for the construction of a 12-in. well at the pumping station in Mason City has been let to W. L. Thorne & Co. of Platteville, Wis., for approximately $1,634 for a finished and tested well.

The city of Centralia has voted the issuance of bonds with which to install an ample water supply.

The City Council of Hopkinton has decided to further extend its water mains, a sufficient number of patrons having agreed to take the service. They will be run south from H. Moulton's to Charles Hull's, west to C. E. Green's, north to A. G. Smith's and east to N. A. Gearhart's.

A contract has been awarded to James Maine & Sons of Des Moines, Ia., for the erection of the new Waterloo, Cedar Falls & Northern power house at Waterloo, at an estimated cost of $500,000. The new power house will be 154 ft. in length by 132 ft. in width, with 30-ft. walls. The building will be fireproof, being built of concrete, steel and brick.

City officials of Logan are busy with preparatory work to install the new engine, pump and other machinery for the well to increase the water supply of the city. Levels are being run to obtain the necessary data for proper location and extension of the water mains. A water tower will be erected on the Milliman hill. The tower will be 100 ft, or 205 ft. above the business part of the city, and is designed to supply water for those located above the present site of the reservoir.

Kansas.

✣Bids will be received until 10 a. m. Aug. 3 by R. V. LaDow, Superintendent of Prisons, Washington, D. C., for furnishing and delivering at the United States Penitentiary at Leavenworth, Kan., sewer and water pipe to be used in connection with the hospital building at that institution.

✣City Council of Horton, Kan., will receive bids until 8 p. m., August 2, at the office of B. B. Norris, City Clerk, for the construction of a main sewer and 22 laterals. A certified check for $500 must be filed with each bid. Official advertisement will be found elsewhere in this issue.

The contract for installing the new drainage and sanitary sewers, four in number, for Hutchinson was awarded by the City Commission to Davis and Everett of Hutchinson for $5,593.

The city of Sabetha, Kan., has awarded a contract to J. A. Johnson & Co. of Kansas City, Kan., for the construction of a complete sewerage system and disposal works for $19,206, and to Lewis & Kitchen of Kansas City, Mo., for the construction of septic tank for $12,500. Bids were opened July 12.

The city of Pittsburg, Kan., held an election July 12 to vòte on the proposition of issuing bonds in the sum of $300,000 for the erection of a municipal waterworks plant.

Maryland.

The Improvement Association of Hamilton contemplates the construction of a sewerage system. Osborne I. Yellot is interested.

Massachusetts.

The following bids were received at Attleboro by the commission on sewerage for the construction of a trunk sewer and filtration fields: Contract A, filtration field: R. H. Newell, Uxbridge, $36,792; C. E. Trumball Co., Boston, $41,864; Rome Contract Co., Boston, $42,560; Thomas Fitzgibbon, Beverly, $43,160; Bruno & Petiti, Boston, $44,262; Tyrell & Gill Co., Winter Hill, $49,749; James H. Fannon, Somerville, $52,741; A. J. Tomasello, Dorchester, $53,265; Michael Kane, Worcester, $65,501. Contract awarded to R. H. Newell. Contract B, first section concrete sewer from fields to Tiffany, 30-in. pipe concrete: Bruno & Petiti, Boston, $58,876; A. G. Tomasello, Dorchester, $63,931; Geo. Phillips, Boston, $67,165; John J. Falvey, Somerville, $98,562. Contract not awarded. Contract C, concrete and iron pipe, 30-in., extending from Tiffany to Thacher St.; Bruno & Petiti, Boston, $33,189; A. G. Tomasello, Dorchester, $47,373; John J. Falvey, Somerville, $52,492. Contract not awarded. Contract D, vitrified pipe, for filter fields, from 3 to 24-in.; Brownell Hardware Co., Attleboro, $4,295; Eastern Clay Goods Co., Boston, $4,295; Berry & Ferguson, Boston, $4,661; David W. Lewis, Boston, $4,555; American Pipe Co., Boston, $4,690; Thomas Robinson Co., Philadelphia, $5,356; Waldo Brothers, Boston, $5,361. Awarded to Brownell Hardware Co., Attleboro. Contract E, iron pipe from 6 to 30-in., with special castings; to be used in contracts A, B and C: Chas. Miller & Sons, Utica, $10,714; R. D. Wood & Co., Philadelphia, $11,106; Fred A. Houdelette, Boston, $11,148; Fred A. Houdelette, Boston, $11,180; Warren Foundry & Machine Co., New York, $11,321; M. J. Drummond Co., New York, $11,528; U. S. Cast Iron Pipe Co., New York, $12,530; awarded to Charles Miller & Sons, Utica, N. Y. Contract F, manhole covers and collars: Concord Foundry Co.. Concord, $589; Milford Iron Foundry, Milford, $637; Sessions Iron Foundry, Bristol, Conn., $650; Sessions Iron Foundry, Bristol, Conn., $723; Builders' Iron Foundry, Providence, $774; Paul Hannigan, Lawrence, $850; Springfield Foundry, $870; White, Warner Co., Taunton, $872. Awarded to Concord Foundry Co. Contract G. water and sewer gates and boxes: Ludlow Valve Co., Troy, $4,093; Coffin Valve Co., Neponsett, $4,654; Chapman Valve Co., Indian Orchard, $4,678; H. H. Davis, Boston, $6,017; awarded to Ludlow Valve Co., Troy, N. Y.

The Superintendent of Streets of Boston has awarded a contract for the construction of sewerage works in Beech St., between the N. Y. & N. H. R. R. and junction of Centre St., and Manthorne road, West Roxbury, to A. M. Cusack, 95 Milk St., for $522. Bids were opened July 5.

The Superintendent of Streets of Boston has awarded a contract for the construction of a sewerage works in Wait Place, Roxbury, to C. J. Jacobs Co., 107 Terrace St., Roxbury, for $394. Bids were opened July 5.

Michigan.

Plans have been prepared by the city engineer of Flint to relieve the sewers on Baker, Taylor and other streets in that vicinity of the water. The plans of the engineer provide for sanitary sewers on Baker and Taylor St., to connect with the sewer on Industrial Ave., and a storm water sewer on Industrial Ave., through private property to Taylor St., and then to North Saginaw St.

City council of Saginaw has adopted resolutions unanimously to have the bonding issue for $400,000 to build a water plant and filtration station put to the people again within a short time.

Minnesota.

✣Village Recorder of Janesville, Minn., will receive bids until 7:30 p. m., July 28, for furnishing labor and material for the excavating of trenches and laying 8,878 ft. of 4-in. water mains and hydrants. M. W. Keeley is President of the Common Council.

✣City Council of Willmar, Minn., will receive bids until 8 p. m., July 25, for furnishing necessary labor and material for the construction of a steel water tank of 50,000 gals. capacity. H. Gunderson is City Clerk.

City council of Wilmar has again voted to present to the voters of this city the proposed amendment to the charter, authorizing the issuance of bonds for the construction of a sewer system in the city.

Plans and specifications have been prepared for the construction of a sewerage system and water extension for the city of East Grand Forks and have been placed on exhibition at the Fargo Builders' & Traders' exchange rooms.

P. McDonnell of Duluth was the successful bidder on two contracts let by the water and light department of Duluth, one for the construction of water and gas mains in Third alley for $10,867 and the other for the construction of water and gas mains on Garfield Ave., for $3,803. The Third alley contract calls for the laying of a 16-in. water main and ⅛-in. gas main from 12th Ave., east to Lake Ave., a distance of 5,688 ft. About 180 ft. of 10-in. water and 4-in. gas mains will also be laid under the contract. On Garfield Ave., 3,000 ft. of 6-in. water main will be removed and 4,500 ft. of 12-in. water main and 3,500 ft. of 4-in. gas main will be laid

The commission at Stillwater, Minn., to take over and manage the waterworks under municipal ownership has chosen O. H. Olson, chairman; J. J. Eichten, vice president; J. H. Ward, the city clerk, as secretary.

Mississippi.

At a meeting of the city council of Ellisville steps were taken toward installing a sewerage system. A civil engineer will be employed to estimate the cost. An election will be ordered to vote on the bond issue.

Missouri.

Consulting Engineer George H. Benzenburg of Milwaukee, Wis., has recommended to the board of fire and water commissioners of Kansas City, Mo., the riprapping of the Missouri river banks for two miles this side of Parkville, the repairing of the intake at Quindaro, the construction of a new settling basin and the installation of new pumps for the waterworks plant. It is estimated that the riprapping will cost $100,000. The engineer also recommends that a new intake be built further up the river, the installation of a 25,000,000-gal. pump at Quindaro, the installation of another pump at the Turkey Creek station, and the building of a trunk line from Turkey Creek to the city's new territory. The improvements will be covered by the proposed $1,000,000 bond issue.

The board of public works of St. Joseph has awarded the following street and sewer improvement contracts: Grading Seventeenth St., Walnut to Bell, to E. P. Olson, $0.23 8-10 per cu. yd. Grading State St., 26th to Ashland Ave., to J. F. Buis, $0.24 per cu. yd. Grading 33rd St., Mitchell Ave. to Monterey, to M. Costello, $0.18 per cu. yd. Grading Seventh St., Hamburg to Shady Ave., to S. S. Duncan, $0.25 per cu. yd.

The board of public works of St. Joseph has recommended an ordinance for the laying of water mains in Sacramento St., between 29th and 30th Sts.

The city of California, Mo., has awarded a contract to Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the engineering work of a waterworks system to cost about $30,000.

Montana.

George H. Stanton, E. K. Barnum and C. C. Proctor of Great Falls were recently in Libby endeavoring to make arrangements with the town council for the installation of a waterworks system in that city. It is the intention, if they can secure a franchise, to put in a gravity system, using the water from Flower Creek, which flows through the town.

Nebraska.

The city of O'Neil, Neb., has awarded a contract to Donahue & Peterson of 315 N. 30th St., Omaha, Neb., for the construction of a complete sanitary sewer system for $16,507. The Consolidated Engineering Co., 640 Bee

Bldg., Omaha, Neb., are the engineers. Bids for the work were opened July 13.

City council of York has passed a resolution to offer the York Water Co., $50,000 for its plant as it now stands, subject to the approval of the voters of the city. The company's franchise expires May, 1912.

The citizens of the town of Johnson are agitating the construction of a water system.

New Jersey.

Edmond F. Saxton of 114 Liberty St., New York, has been awarded a contract by the city of Plainfield, for labor only, for constructing a storm sewer. The work includes 265 ft. of 30-in. storm sewer, 375 ft. 24-in. storm sewer, 400 ft. 12 and 15-in. connections, two manholes, 12 inlets. The material will be furnished by the city. Bids were opened July 5.

New York.

✣Board of Water Commissioners will receive bids at the office of O. N. Bolton, Clerk of the Village of Perry, N. Y., until 1 p. m., July 28, for furnishing and erecting a 2,000,000-gal. cross compound, crank and flywheel Corliss condensing pumping engine.

✣Bids will be received by Fred New, Village Clerk of Batavia, N. Y., until noon, July 23, for furnishing all material and labor necessary for the construction of a concrete dam of 600 cu. yds., 500 ft. of 16-in. c. i. pipe screen chambers, waste gate and valves. R. A. Wentworth is Engineer.

✣Bids will be received until 7 p. m., August 25, by J. B. Mace, President Board of Water Commissioners, Keeseville, New York, for laying approximately 1 mile of 10-in. cast iron water pipe and the construction of a reservoir for the proposed new source of water supply for Keeseville. The work includes: Laying 10-in. water pipe, cast iron, 5,300 ft.; specials, 1 ton; rock excavation, granite, in reservoir, 1,604 cu. yds.; rock excavation, granite, other than reservoir, 166 cu. yds.; concrete, in reservoir, 345 cu. yds.; concrete in manhole, if used, 5.28 cu. yds.; brick in manhole, if used, 3,200; sundry iron work, 250 pounds.

✣Bids will be received by J. B. Mace, President Board of Water Commissioners, Keeseville, Essex County, New York, until 7 p. m., August 25, for furnishing the following material f. o. b. Keeseville, N. Y.: 450 pieces of 10-in. B. & S. C. I. water pipe Class C weighing 850 pounds per length; 11,000 pounds pig lead; 300 pounds jute; 1 standard M-H frame and cover 22 in. to 24 in.; 1 ton special castings; 2 10-in. gate valves and boxes; 1 4-in. gate valves and box; 1 10-in. by 24-in. copper strainer.

O'Leary & Flanagan of 245 E. 202 St., New York, have been awarded the contracts for the construction of sewers in Northern Ave., between 181 St. and 190 St., New York City, for $41,248. Bids were opened July 6.

T. B. Bidwell has been awarded a contract for the construction of sewers in Gold St. and Elm St., by the city of Binghamton for $419 and $732, respectively. Bids were opened July 13.

Hayes & Hodge have been awarded a contract by the city of Watertown for the construction of the new First ward trunk sewer for $18,836.

Plans and specifications for the construction of a sewer system for the city of Yorkville have been prepared and the proposition will soon be presented to the citizens at a special election.

The city engineer of Fulton has completed plans and specifications for a partial reconstruction of the 15-in. vitrified pipe sewer alongside of the 36-in. drain now being built by the state at the Upper Landing.

The Board of Estimate and Apportionment of New York City has given a preliminary authorization for plans for the construction of a system of sewer mains for the benefit of the Richmond Hill and Ridgewood Heights sections, aggregating in amount $567,000, estimated cost. The number includes: Lefferts Ave. from Liberty Ave. to Ulster, estimated cost, $90,000; Lefferts Ave. from Ulster Ave. to Rockaway road, $98,500; Panama St. from Lake Ave. to Rockaway road, $70,000; Panama St. from Vienna Ave. to Blake, $70,000, and Panama St. from Cozine Ave. to Vienna, $99,500; also, temporary open drain in Panama St. between Cozine St. and Jamaica Bay, $65,000. All of the above will provide mains for the future sewer system of Richmond Hill. For the Ridgewood Heights district plans were authorized for mains in Seneca Ave. from DeKalb Ave. to Putnam and From Cornelia St. to Myrtle Ave.; in Himrod St. from Seneca Ave. to the Brooklyn line, and in Putnam Ave. from Seneca to Myrtle, cost $74,000. These mains will all connect with the big Myrtle Ave. main now in full operation.

Ed J. Grannis, 886 Irvine St., New York city, has been awarded the contract for alterations and improvements to sewer in 75th St. between Park and 5th Aves. for the Borough of Manhattan, New York city. The contract price for $11,140 and bids were opened June 27.

Bids were opened July 11 by the Board of water Commissioners of Livonia, N. Y., for a pumping station and connections and pumps, the contracts being let as follows: Pump, Runsey & Co., Seneca Falls, N. Y., at $755; pumping plant and connections, Diarz, Whitcomb & Co., Rochester, N. Y., at $2,415. The latter work includes rebuilding a lined well about 30 ft. deep, 16 ft. diameter, making connection with a spring about 40 rods from big well; building and pump house and laying about 400 ft. of 6-in. pipe to mains.

North Dakota.

Plans and specifications are being prepared by L. P. Wolf of St. Paul, Minn., for the construction of a sewer system including septic tank for Carrington. The city has just purchased a site for the septic tank.

The town of Bowbells, N. D., has voted the issuance of bonds for the construction of a waterworks system.

Ohio.

✣Bids will be received by the city of Galion, O., until Aug. 1, for the construction of sewers. The work includes the following approximate quantities: 2,402 lin. ft. of 15-in. vitrified sewer pipe; 435 ft. of 12-in.; 1,472 ft. of 10-in.; 43,446 ft. of 8-in.; 4,434 ft. of 6-in.; 36,812 ft. of 4-in.; 42,441 cu. yds. of excavation; 192 manholes; 50 ft. of 16-in. cast iron pipe; 90 ft. of 6-in. cast iron pipe; 24 ft. of 8-in. cast iron pipe; 146 tons of cast iron specials. Plans and specifications are on file at the office of Henry Hocker, Director of Public Service. A. O. Theobold is City Engineer.

✣Bids will be received until noon, Aug. 22, by Nelson J. Brewer, Clerk of the village of Euclid, O., for furnishing labor and material for the construction of a 6-in. water main in Lawnview Ave., from the north line of Euclid Road to the center line of Roseland Ave. Plans and specifications are on file at the town hall or at the office of F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O.

✣Bids will be received by the Director of Public Service, Youngstown, O., until July 23, for the construction of sewers in sub district No. 3 of District No. 1, which will include all the streets north of Robbins Ave. and east of Vienna Ave.

✣Director of Public Service, Galion, O., will receive bids until noon, August 1, for furnishing necessary labor and material for the construction of sanitary sewer laterals in the following sewer districts of the general sewer plan: Parts of sewer districts Nos. 1, 2, 3, 5, 6 and all of sewer district Nos. 7, 8 and 9 as provided for in ordinance No. 768 of the ordinances of the city of Galion, O., and parts of sewer district No. 11 provided for in ordinances Nos. 758 and 759 of the ordinances of the city. The plans and estimates of the engineer of said city contemplate the use in all of the districts described of vitrified sewer pipe in quantity as follows: 4-in., 36,812 ft.; 6-in., 4,434 ft.; 8-in., 43,446 ft.; 10-in., 1,472 ft.; 12-in., 435 ft.; 15-in., 2,402 ft.; excavation is estimated at 42,441 cu. yds.; manholes required are 192; cast iron pipe required is estimated as follows: 16-in., 50 ft.; 6-in., 90 ft.; 8-in., 24 ft.; special, 1.46 tons.

Bids were opened June 24 by the Director of Public Service of Youngstown, O., for constructing two sewers, the contracts being let as follows: Fountain St. sewer, P. Diorio, at $468, Gibson St. sewer at grading, Jas. McCarron, at $3,975.

The Garver Contracting & Transfer Co. has been awarded a contract by the city of Hamilton for the construction of a sanitary sewer in N. Sixth St., for $1,711. Bids were opened July 7.

W. E. Gartland of Youngstown, O., has been awarded a contract by the city of Struthers for the construction of sewers both sanitary and storm in Short St. and Elm St., for $4,982. Bids were opened July 6.

City has awarded a contract to Bockinham, Clark & Zigler, Center and Marion Sts., Mt. Gilead, for the construction of 4,000 ft. of 4-in. 6-in. and 8-in. vitrified pipe sewer main. The work includes nine plain manholes, three drop manholes and one flush tank. The contract was awarded for $1,933. Bids were opened July 8.

Oklahoma.

✣City Council of Bridgeport, Okla., will receive bids until August 15, for the extension of the water system and building a new power house. The work will include one 5 h. p. two-cylinder gasoline engine, one 7x5 triplex pump single acting. Oklahoma Engineering Co., Anadarko, Okla., Engineers.

The Oklahoma Engineering Co., of 120 Broadway, Anadarko, Okla., are preparing plans and specifications for the reconstruction of the Bridgeport, Okla., waterworks. Bids for the work will be asked next month. There will be required one 25 hp. double cylinder gasoline engine and one 7-in. x 8-in. single acting triplex pump.

The city of Altus has retained the J. W. Maxcy Co., of Houston, Tex., as engineer for the proposed improvements to the waterworks, estimated to cost $130,000.

The city council of Sapulpa has ordered the establishment of a filtering plant. Surveys have been made for the building of a $250,000 water system. The plans of making the Arkansas River as a base of supply has been abandoned, and Rock and Pole Cat creeks will probably be made the sources of supply.

The Oklahoma Engineering Co. of Anadarko, Okla., has been retained by the city of Carnegie as engineer for the proposed improvements to the waterworks. The estimated cost of the improvements is $25,000.

Oregon.

Citizens of Brandon at the city election voted a bond issue of $60,000 for a municipal waterworks. J. W. Mast is mayor.

Pennsylvania.

An ordinance has been presented to the city council of Harrisburg providing for the construction of a sewer to care for additional drainage for Market St., east of 13th. It is estimated that it will cost $100,000 to construct the sewer. M. B. Cowden is city engineer.

City council of Lancaster has awarded a contract to the F. X. Hinden & Son Co., for the construction of the Susquehanna St., sewer for $4,226, and for the construction of the Rockland St. sewer for $972.

The Pitt Construction Co., 821 Fulton Bldg., Pittsburg, Pa., has been awarded the contract for constructing a sewage disposal and cast iron pipe lines at the State Hospital for the Insane at Norristown, Pa. The contract price was $39,629, and bids for the work were opened July 8.

An ordinance has been introduced in the city council of Lancaster providing for the borrowing of $75,000 for the erection of a dam and bridge at the pumping station, an auxiliary plant at the reservoir and for the laying of water mains in various sections of the city.

Civil Engineer H. B. Norton of Ridgeway, Pa., has been retained to prepare plans and specifications for extending the waterworks system of Emporium. The work includes the construction of three miles of mains and the construction of a 40,000,000-gal. reservoir.

The citizens of Masontown have voted the issuance of bonds in the sum of $25,000 for the construction of a waterworks and sewer system.

South Dakota.

City council of Bridgewater has awarded a contract to William Welsh to construct a complete sewer system. This system, together with the drainage project and electric lighting plant aggregates over $20,000 expended in public work for the summer.

Texas.

✣Bids are asked by J. G. Sutton, City Secretary, Beaumont, Tex., for the construction of extensions to the sewer system. The work, according to plans prepared by C. L. Scherer, City Engineer, will include 100 lin. ft. of 27-in. pipe; 1,140 lin. ft. of 24-in. pipe; 1,080 lin. ft. of 18-in. pipe; 3,445 lin. ft. of 15-in. pipe; 1,600 lin. ft. or more of 3.5x3 concrete; 1,500 lin. ft. or more brick or concrete sewer. Each bid must be accompanied with a certified check for $1,000, payable to E. A. Fletcher, Mayor.

Bids were opened July 6 by the Belton Sanitary Sewer Co., Charles B. Smith, Secretary, Belton, for constructing a sewer system. All bids were rejected and the company will build the system itself under the direction of its engineer. The work on which bids were asked included the following: 4,017 ft. of 12-in., 718 ft. of 10-in., 18,680 ft. of 8-in. vitrified pipe sewers, 67 manholes, 10 flush tanks, a sewage purification plant including approximately 3,556 cu. yds. earth excavation, 366 cu. yds. rock excavation, 118 cu. yds. reinforced concrete, 80 cu. yds. plain concrete, 500 cu. yds. broken stone, piping and accessories.

Utah.

The city council of Provo has passed an ordinance providing for the construction of a sewer in district No. 11 at an estimated cost of $30,356. It is probable that the sewer will be constructed this year.

City of Pocatello, Idaho, has voted the issuance of bonds in the sum of $164,788 for the construction of a sewer system two miles long, according to the approved surveys and estimate of cost. This sum does not allow for laterals, which will be considered at a later period, the cost of them being estimated to be $250,000.

Washington.

Municipal Commissioner Nicholas Lawson of Tacoma has conferred with the Northern Pacific officials in an effort to get easements over 10 miles of the railway company's right-of-way for the pipe line of the Green River gravity water system. Plans have been prepared by Engineer J. R. Preble. The plans call for the construction of two tunnels, one 1,100 ft. long, the other 250 ft.

Plans have been drawn for the construction of a sewer system for the city of Hoquiam. The system as planned will cover the entire city and will cost approximately $200,000.

The board of public works of Seattle has awarded a contract to C. J. Erickson for the construction of the Lake Washington division of the North trunk sewer for $720,000. Previous to awarding the contract the board has twice rejected bids as being higher than the estimate of City Engineer R. H. Thompson, prepared three years ago.

Wyoming.

Laramie, Wyo., has awarded a contract to W. H. Inman for the construction of a sewer between Seventh and Eighth Sts., for $1,375. The sewer will be 2,830 ft. in length.

Canada.

✣Bids will be asked until noon, July 26, by P. E. Ryan, Secretary of the Commissioners of the Transcontinental Ry., Ottawa, Ont., for Piping System; Water System; Pipe Tunnels and Wiring Ducts in connection with the Transcontinental Railway shops east of Winnipeg, Man. Plans and specifications may be seen in the office of Gordon Grant, Chief Engineer of the Commission, Ottawa, Ont., or in the office of S. R. Poulin, District Engineer, St. Boniface, Man.

ADVERTISEMENT.

Houston, Texas, July 7, 1910.

Plans and specifications are invited for the heating and ventilating system of the Houston City, Auditorium.

Contractors submitting bids are required to submit their own layout with complete specifications.

It is proposed to heat the Auditorium proper by the Plenum System, and the offices by direct radiation. The outside temperature to be taken at 10 degrees above zero and inside air to be heated to 70 degrees. Seating capacity of Auditorium 7,000, and each seat to be provided with 2,400 cubic feet of air per hour. Change of air to be every 20 minutes, and air to be washed.

The Contractor is to guarantee that the apparatus when completed in accordance with his specifications and plans will be of ample capacity to evenly maintain a temperature of 70 degrees F., when the outside temperature is at 10 degrees above zero, and that the apparatus throughout will have a free and rapid circulation when in operation.

Bids, plans and specifications to be addressed to Dan C. Smith, Jr., City Secretary and controller of the City of Houston. Bids, etc., to be received until Aug. 1, 12 M., or noon.

Plans of Auditorium can be seen at the offices of Mauran & Russell, architects, St. Louis, and at the office of F. L. Dormant, Consulting Engineer, Houston, Texas.

A certified check of the bidder on any bank in Houston, Texas, payable to the order of H. B. Rice, Mayor, for 5 per cent of the bid will be required to be deposited with each bid, plans and specifications.

Bidders must examine the building before submitting their bids. The successful bidder will be required to give bond and comply with the City Charter respecting contracts and to execute the usual form of contract as prepared by the City Attorney.

The right is reserved to reject any or all bids, plans and specifications or to accept any bid considered advantageous to the City of Houston, Texas.

H. B. RICE, Mayor.

THE SANITARY DISTRICT OF CHICAGO.

TO CONTRACTORS.

Sealed Proposals Addressed to the Board of Trustees of The Sanitary District of Chicago and Endorsed "PROPOSALS FOR PAINTING THE EIGHT-TRACK BRIDGE" will be received by the Clerk of the said Sanitary District at the offices of the said District, on the fifteenth floor of the American Trust Building, Chicago, Illinois, until 12 m., standard time, on Wednesday, July 27, 1910, and will be publicly opened by the Board of Trustees at a meeting to be held on that day, or the first meeting thereafter.

The work for which said tenders are invited consists of PAINTING CERTAIN PARTS OF THE EIGHT-TRACK BRIDGE crossing the Main Channel of The Sanitary District of Chicago, in Campbell Ave., near Thirty-first street, in the City of Chicago, County of Cook, State of Illinois.

The said work is to be performed in accordance with specifications and contract furnished by The Sanitary District of Chicago, which specifications and contract may be obtained upon application at the said office of the said District.

A deposit of five ($5.00) dollars will be required for each set of specifications taken out, said sum to be refunded by the said Sanitary District upon the return of said specifications to said District on or before August 15, 1910.

All bids must be upon blank forms of proposal furnished by the Sanitary District, and shall be made in accordance with and to conform with all the terms and conditions stated therein.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO,
By ROBERT R. McCORMICK,
President of Its Board of Trustees.
Attest:
J. J. CORCORAN, Acting Clerk.
Chicago, July 15, 1910.

(Proposal Advertisements Continued on Page 53.)

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The Contract System on Government Land Surveys to Be Abandoned—A Bonus System Should Be Substituted.

Recent press reports state that the federal government has determined upon abandoning the contract system of surveying government lands. Unquestionably the contract system has enabled the government to secure the division of lands into townships and sections at a cost much below the cost of doing the same work on a salary basis, but it has always been a question whether the money thus saved was wisely saved. The inevitable tendency has been to rush through the contract survey at the expense of accuracy, and the subsequent litigation where sections corners have disappeared has probably cost the land owners far more than was saved by a cheap survey.

Inspection of contract work is obviously an essential part of a successful contract system, but inspection of a land surveyors' work is not always made readily without an expense that is unreasonably great. In fact, a thorough inspection amounts to a partial resurvey to check the accuracy of the work, for a dishonest surveyor can so fudge his notes as to make an appearance of accuracy in "closing." The writer has had occasion many times to subdivide sections whose corner posts were 50 ft. or more away from where they should have been. In one instance the error was 150 ft. Doubtless this survey had been made with a compass, and in a manner so hurried as to make accuracy an impossibility.

In spite of such serious objection to the contract system of land surveying, its merit of cheapness has been so pronounced as to warrant an effort to secure its continuance in a modified form. The modified form that we would propose is the application of the bonus system in the payment of the salaried surveyors employed by the government. Having established what is a fair day's work under any given conditions, a bonus should be offered for every mile of line run in excess of the standard. The bonus should be distributed among the members of the surveying party in proportion to their respective monthly salaries. In order to provide against any tendency to slight the work, a thorough system of inspection should be developed. This might well include the remeasurement (by inspectors) of at least one section in every township, and it should certainly include the careful examination, not only of all field notes, but of office computations. The latter should be made in office books—not on loose leaves—and should be part of the exhibits used in inspecting the work.

We have understood that on the U. S. Geological Survey staff there are certain engineers who have developed cost keeping systems that have resulted in a very great decrease in unit costs. If, in addition to the use of a cost keeping system, the bonus method of payment were adopted, it can scarcely be doubted that much greater reductions in unit costs would follow. The payment of bonuses on government construction work is very likely to lead to corrupt practice, due to the large sums involved as well as to the character of the employes. But the men engaged on government surveys are of high intelligence and integrity, the sums involved in bonuses would be relatively small, and the work is of a class that can not be covered up. The conditions, therefore, are extremely favorable for an application of the bonus system.

We are aware that the payment of anything more than a fixed salary to a government employe, particularly to an engineering employe, is not in accord with precedent. Yet the bonus principle is obviously so sound that no one can present anything else than a specious argument against the proposed practice.

Engineers in private practice and those in charge of railway surveys, etc., will do well to establish bonus payments on all surveys. The invariable effect is a stimulus, both to the mental and physical energy of the men. Perhaps no class of men require such a stimulus less than do engineers on a railway survey. Yet even they will be found to have available reserve energy, particularly of the kind that involves a greater use of the wits. And the thought suggests itself to us that another form of bonus might well be offered to the chief of a railway party and his principle assistants, namely, a bonus for reducing construction quantities and costs without increasing subsequent operating expense. How often has it happened that a survey over the same general route has developed a far better line, when the only stimulus was to excel the work done by a predecessor. So well known is this phenomenon that certain chief engineers never select a final location until at least two experienced locating engineers have competed with one another in securing the best route. Were a substantial bonus offered to the party whose location possessed the greatest economic merit, there can be no doubt whatever that the bonus would prove itself the wisest kind of investment.

Cost Per Mile of Roads Constructed in 1909 in Massachusetts.—The average cost per mile exclusive of bridges for the section of macadam roads completed during 1909 under the direction of the Massachusetts Highway Commission was $8,177. The following table shows the cost per mile for the various sections:

Town or City.	Sq. yds.	Miles.	Cost per mile.
Agawam[1]	7,705	.876	$11,530.01
Attleborough	6,500	.740	5,651.01
Becket, 1908	31,983	3.532	12,005.24
Billerica, 1908	5,088	.578	9,909.05
Chilmark, 1908[2]	5,332	.814	5,798.46
Chester-Huntington	11,367	1.292	7,737.47
Clarksburg, 1907-09	4,152	.478	15,122.17
Deerfield[1]	5,245	.600	14,646.73
Dighton, 1908	5,943	.677	5,920.97
Duxbury[1]	6,070	.690	7,435.24
Erving	3,755	.454	10,590.24
Foxborough, 1908	5,963	.677	5,922.62
Harwich-Brewster-Orleans, 1908[3]	10,301	1.951	4,572.35
Holden, 1908	3,217	.366	7,060.25
Ipswich	7,750	.881	9,221.06
Littleton	4,583	.521	1,420.40
Marlborough, 1908[4]	7,160	.814	5,858.75
Marshfield[1]	6,498	.738	6,307.77
Milford[1]	5,488	.624	8,528.00
Montague	5,308	.603	8,177.18
Norton, 1908	6,957	.790	5,569.50
Oxford, 1908	5,500	.625	8,707.60
Oxford, 1909[1]	6,313	.718	8,212.74
Palmer, 1908	30,450	3.441	10,214.65
Randolph	4,553	.517	5,212.90
Rowley[5]	12,331	1.401	4,837.42
Scituate[1]	4,500	.510	11,654.71
South Hadley	5,473	.622	11,154.29
Sterling	5,333	.606	7,900.64
Sunderland	1,488	.170	9,388.94
Tyngsborough	16,423	1.867	8,026.61
Wareham-Rochester[3]	13,743	1.562	3,723.92
Weymouth, 1908	7,750	.881	4,653.42
West Newbury	12,085	1.373	9,461.47
Totals	283,407	33.189	

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[1] Includes cost of bituminous surfacing. [2] Macadam 12 ft. in width. [3] Sand and oil mixture greater than 3 ins. in thickness. [4] Gravel road with sand and oil surface. [5] 2,420 ft. gravel; balance macadam.

Tree Planting by the Massachusetts Highway Commission.—The State Highway Commission of Massachusetts early recognized the advantage of the systematic planting and maintenance of shade trees along state roads and during the past six years the Forester of the Commission has planted 13,666 new trees. The number of new shade trees planted in 1909 was 730, the varieties being as follows:

American elm	194
Norway maple	159
Sugar maple	159
English ash	104
American ash	91
Russian willow	23

In addition to the above, 119 seedling ash trees were planted. The average cost of new planting in 1909 was $0.74 each, to which should be added the cost of preparing the ground the previous year $0.49 each, making the total cost $1.23 each. The cost of maintenance in 1909 was 22 cts. per tree.

The total number of trees replaced in 1909 was 794. The Commission at the end of 1909 had 5,174 trees on hand in its nursery, of which 4,084 were small trees.

In order to reduce the number of weeds that naturally grow about the planted trees, the dressing in 1909 was placed under the roots of the newly planted trees instead of over them as a mulch, as had been done previously. To further aid in keeping a neat appearance, an experiment was made of sowing white clover seed around the tree to crowd out the weeds; later this is to be dug into the soil for its fertilizing value.

Cost of Manholes.—The cost of constructing concrete manholes complete on the Louisville sewer is about $20 per cu. yd., or about $20 for every 4 ft. vertical height of manhole.

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CONCRETE AND REINFORCED CONCRETE SECTION

Forms for the Construction of the Locks and Dams of the Pacific Division, Panama Canal.

BY ALEX. P. CRARY.[*]

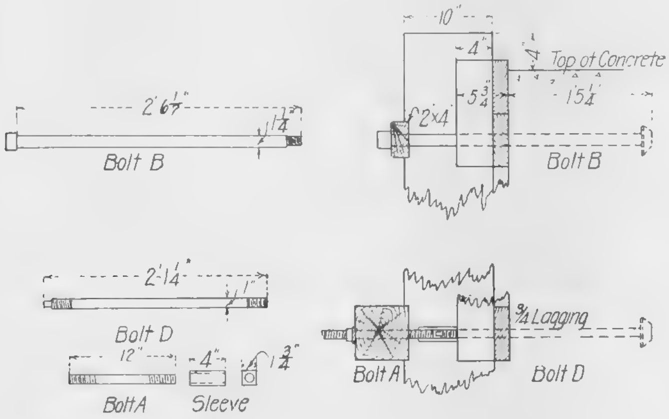

Fig. 1.—Details of Anchor Nuts and Bolts for Holding Form Panels.

In the construction of the locks and dams at Pedro Miguel and Miraflores, wooden forms of the built-up panel type are being used for the face walls. They are so constructed that they carry the walls up in 6-ft. layers. The uprights, which are spaced 2 ft. 6 ins. on centers, act in cantilever and are anchored to the layer of concrete next below that for which the forms are set. The anchor nut, with bolts *A* and *D* and the sleeve nut, Fig. 1, form the anchoring device. The anchor nut is placed 8 ins. below the top of the layer and about 18 ins. in from the face, and is held in position while the concrete is being put around it by bolt *B*, Fig. 2, on which it is screwed; bolt *B* is supported by the forms. The diameter of the shank of bolt *B* is larger than that of its threads. It is made so for the purpose of molding a hole in the concrete sufficiently large that a bolt of the same diameter as that of the threads at the end of the bolt *B* can be freely inserted after it has been removed. By this arrangement it is possible to remove bolt *B* before it becomes frozen in, thereby leaving a hole into which the anchor bolt *D* can be inserted and screwed into the anchor nut at any time thereafter.

One set of forms consists of three pieces—the built-up panel, which is the main part, and two guide pieces. The panel is the lagging, the uprights and the waling nailed and fastened together in one piece, and the guide pieces are simply boards which are placed above and below the panel and through which the belt holes are bored. In the panel the holes go through the waling and lagging about 4 ins. from the center of the uprights.

In operation the forms for the first or bottom layer are set up and braced by struts in the ordinary way with top line of lagging being the guide pieces through the holes ot which are placed bolts *B* with the anchor nuts on their inner ends. From 6 to 18 hours after the concrete has been laid, bolts *B* are removed and bolts *D* inserted and screwed into the anchor nuts with a Stillsin wrench which takes hold of the turned down ends. Then on the outer ends of these bolts are placed the sleeve nuts which are tightened to hold the guide piece snugly against the concrete. The next step is to take the form away from under the guide piece which is now bolted to the concrete and begin the regular form work by placing the built-up panel on top of the guide piece. The panel is so placed that the bolt holes in the waling come directly in front of the sleeve nuts. Through these holes and screwing into the sleeve nuts are inserted the bolts *A* on the outer ends of which are placed cast iron washers and nuts which are tightened. The guide piece is now placed on top of the panel, being lightly nailed to the projecting uprights and the bolts *B* with the anchor nuts inserted. Next the form is lined up by bracing the lower ends of the uprights, if the form has to come out, or wedging out the lower ends if it has to go in.

After the second layer of concrete is completed, the same operation as that described above is again performed, except that the panel is raised instead of using a new one and that which served as the lower guide piece now becomes the upper one and in this way the same forms are carried right up for each successive layer as the wall progresses. In the upper layers the forms are brought to line by means of bolts inserted through the lower waling into old anchor nuts in the wall and by wedges between the lower ends of the uprights and wall. Thus, to throw the line out, loosen up on the wedges and tighten up on the bolts; and to throw the line in, reverse the operation.

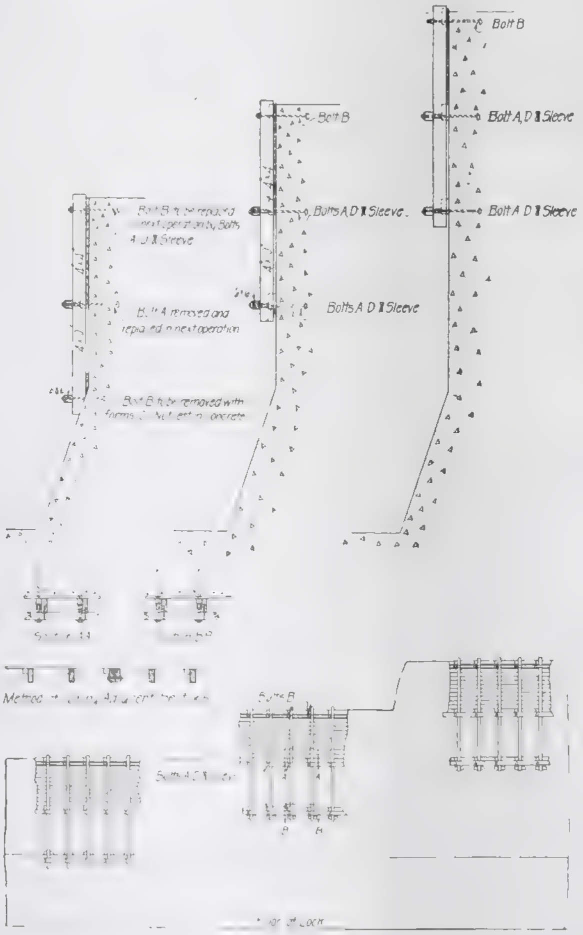
Bolt B
Bolt A, D & Sleeve
Bolt A D & Sleeve
Bolt B
Bolts A D & Sleeve
Bolts A D & Sleeve
Bolt B to be replaced next operation by Bolts A D & Sleeve
Bolt A removed and replaced in next operation
Bolt B to be removed with forms
Bolts B

Fig. 2—Sketch Showing Sequence of Positions of Form Panels as Work Progresses.

The forms are raised by a stone derrick and a hand winch mounted on a car, which runs on a narrow gauge track on the top of the wall.

There are two objects in using guide pieces in connection with a panel as above described, namely: the guide piece forms a foundation on which to set the panel; and by keeping it snug against the face of the wall at the joints between layers, it prevents the formation of a lip or slight over-hang which always occurs when new forms are placed against old concrete. To accomplish this requires the use of two bolts joined together by a sleeve nut instead of one single bolt. The sleeve acts as a nut to hold the guide piece in place while the panel is being raised, also as a coupling to hold the two bolts together.

Incubator for Thawing Dynamite—Mr. A. L. Lamb in the Mining and Scientific Press recommends the use of ordinary chicken incubators for thawing dynamite. He writes: "I have used a common chicken incubator for the past two years for thawing giant powder, with most gratifying results. It has the following advantages: (1) There is a dry even heat, just what is wanted for powder; (2) no danger of overheating; (3) the powder is always ready; (4) the time saved is worth many times the cost of the machine; (5) always having the powder in prime condition for firing, you will get the very best results; (6) the cost of fuel is low; (7) last, but not least, it is perfectly safe."

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[*] Junior Engineer, Pacific Division, Isthmian Canal Commission, Corozal, C. Z.

Methods and Cost of Constructing Concrete Core Wall in Moline Pool Dam in Mississippi River at Moline, Ill.*

The Mississippi River at Moline is divided into two parts, known locally as the "Main Channel" and the "Moline Pool." The pool is formed and the two channels divided, by a longitudinal dam, the lower end of which is at Moline Lock. The lock lies on the channel side of Rock Island (called Arsenal Island), owned by the United States Government and occupied by the Rock Island Arsenal, the head of which island lies about opposite 20th St., in Moline. The arsenal water-power station, and also one of private ownership, lie between Arsenal Island and the Moline shore. The head for their power is obtained by the above-mentioned longitudinal dam, which extends upstream to a point just above what is known as Duck Creek Chain, in the main channel of the river, about 3 miles. The fall at low water in this 3 miles is about 8 ft.

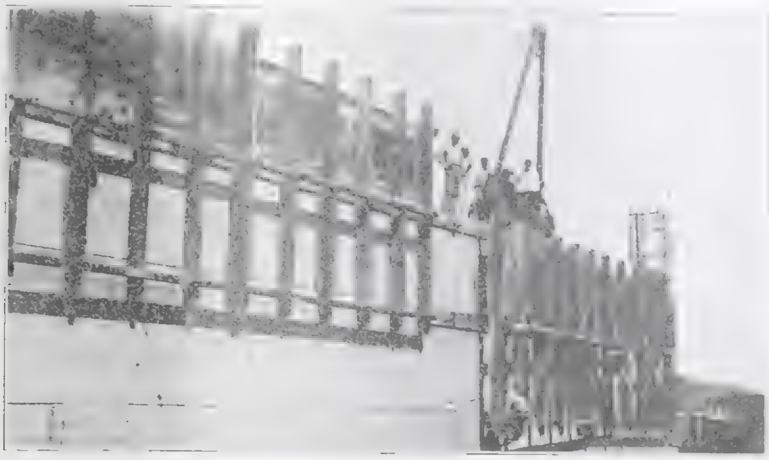

Fig. 3—View of Work Showing Method of Handling Panel Forms.

The lower half mile of the dam is practically new, having been constructed in 1906 and 1907, at the time of the construction of the lock. This part is built of gravelly sand, heavily riprapped with rock obtained from the nearby channel excavations, to a height of 2 ft. above any known high water. Above this half-mile stretch the dam is old, having been built in sections, the beginning of construction dating back to the sixties. About 2,300 ft. at the lower end of the old portion of the dam is built of rock-filled cribs reinforced on the outside with rock, some of which was laid by hand in the shape of paving. This portion, except at a few points, rises above high water, but leaks badly in spots. The remainder of the dam was constructed of sand-filled cofferdam, double-lap sheathing of mill slabs, etc., and all covered with loose rock. This portion was very irregular as to height and acted as a spillway during high water stages of the river. It was, therefore, subject to disintegration from the top, and crevasses of considerable size occurred annually, which heretofore had been repaired by the use of waste rock from the channel excavation. The expense of this repair work was inconsiderable, as the excavated material had to be wasted, anyway, and it cost no more to place it on the dam than to dispose of it in other ways. In anticipation of the time when the completion of the channel excavation would exhaust the supply of rock available for this purpose, it became necessary to adopt some method of making the dam permanently secure. In this day and age of concrete construction, that material was naturally turned to for a solution of the problem, and the writer was directed to make a report on the subject. After considerable study, it was decided that the best plan would be to build a concrete wall on the pool side of the dam to a uniform height, then pile rock, etc., against its face up to the crest, and make the wall become eventually a core-wall in fact as well as in name. It will be noted that in this wall the crest is really the vital part, all the crevasses occurring from disintegration beginning at the top.

Following the above general plan, about 6,300 lin. ft. of wall has been constructed during the past two seasons. In addition to the wall proper, the fill on the back, or river side, is leveled down to a grade a few inches below the crest of the wall, and after being thoroughly washed and puddled with a stream of water under heavy pressure, is slushed over with a layer of wet concrete and smoothed up to the elevation of the wall. The average thickness of the paving above the level of the backfill is about 5 ins.; but the effective depth is much more, owing to the wet concrete sinking into the voids of the rock. On the portion constructed in 1908 the paving averages 19 ft. in width and slopes slightly toward the river side. After last spring's high-water season, it was found that the loose rock immediately under the lower edge of the paving had been washed away to some extent, although the concrete was not broken down except at one point where a small piece had fallen. Along the wall constructed in 1909 the paving is about 15 ft. in width, due to the fact that there is much less material in this portion of the dam; but it is sloped toward the river side so that the outer edge will be under the surface of the water in the river at times of spill. In its original condition the dam was very irregular as to alignment, width and slope of sides. In constructing the wall the general line of the dam is followed, but the small irregularities are smoothed out.

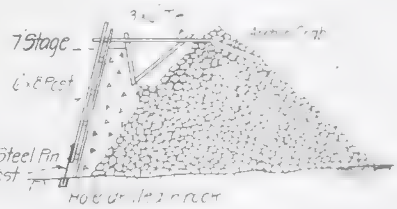

Fig. 1—Details of Forms in Place with Concrete Filling.

The construction details are as follows: a dipper dredge is first employed to dig a trench along the toe of the dam to steepen the slope to its most abrupt angle of repose and to get down through the mud, sand, etc., to the solid rock bottom. Following the dredge a drillboat is employed to drill holes 10 ft. apart along the toe of slope and approximately 3 ft. therefrom. These holes are carefully placed, as the alignment of the wall depends on their proper location. Upright 6x8 in. form posts having a 2-in. steel rod, pointed on the lower end, bolted thereto, and allowed to extend about 1½ ft. below the end of the post, are then set, being dropped into the holes by the drillboat crew as fast as the holes are drilled, and left standing. Later the posts are lined up, slanted to a batter of about 1 to 3½, and tied to anchorages in the rock dam by 3x6-in. strips bolted to the sides of the posts. The remainder of the form consists of horizontal 6x6-in. waling strips spaced by means of sink planks about 3½ ft. between centers, and 2-in. plank sheathing set on end to make as good a contact as possible with the irregular bottom. It will be noted that only the face side of the wall is joined, the rough slope of the dam forming the back side, except near the top, where the section is reduced to a finish to a 2-ft. width of coping.

The concrete plant was erected on a flat barge and consists of a rolling drum mixer and small, stiff-leg derrick with a 40-ft. boom, together with the necessary boilers, hoisting apparatus, etc. This barge is floated alongside the form, with the gravel and cement barges on its other side. A straight sided, bottom-dumping bucket was designed for the work, arranged with two doors joining at the center and held shut by latches that can be tripped at fill by latch strings. The concrete is deposited directly in the water with this bucket with very little agitation or loss of cement. For conveying the raw material to the mixer a special arrangement of an automatically dumping skip car was devised. A hinged and counter-weighted track extension allows the car to run out to the center of the gravel barge moored alongside, where it is filled by hand. The car itself is gaged so that the proper quantity may be secured. A small barge containing the cement is moored alongside the gravel barge, the cement being carried a few steps by hand and dumped into the skip car from the containing sacks.

The proportions used average about 1 cement to 6 gravel. For the deeper portions of the wall, the gravel is reduced to about a 1-to-5 mixture to allow for some loss of cement, but the top of the dam is made of proportions of about 1 to 7. The gravel is furnished on United States barges by contract, being pumped direct from the river bed. It is not screened and re-mixed, as is the practice in some localities, since the natural mixture is quite uniform and tests show voids running from 12.5 to 17 per cent. The depth of water in which concrete has been deposited varies from 5.5 to 1.7 ft. A considerable length of wall was built with the depth at the latter figure. In this case it was found inadvisable to attempt to carry the wall to completed height in one day, due to the excessive pressure on this style of form. It can be readily seen that a continuous contact between the form and the rough rock bottom would not be had. Occasionally, a stone would fall from the dam and, lodging along the line of the form, would prevent the sheathing from reaching to the proper depth, and a hole would be the result. It was found that concrete to a height of 3 or 4 ft. would not run out, but if an attempt was made to carry the section to completion a leak would result, and, once started, it could not be stopped until equilibrium was restored. For this reason the custom was established of building the deeper sections in two layers. Scrap steel rods, etc., in short lengths were stuck into the first layer to assist in bonding.

When the work was started, alternate sections were constructed, the intermediate sections being filled later; but in some cases where the dam behind the wall had quite a strong leakage it was found better to build continuously and push the leak ahead, each day's work being ended at a bulkhead. Later, this practice was followed altogether. Some

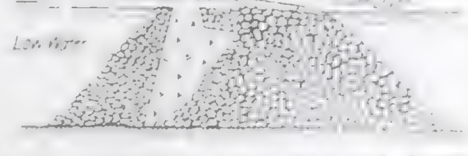

Fig. 2—Completed Core Wall and Apron with Rock Filling.

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*A paper by J. B. Bassett in "Professional Memoirs," Engineer School, Washington Barracks, D. C.

cement was lost at points opposite the leaks, but not enough to materially weaken the dam. It must be remembered that the upper part of this wall is the vital part, as the dam breaks from disintegration on the crest. For this reason a reinforcing rod of about seven-eighths inch diameter is run longitudinally about 6 ins. below the coping of the wall, tied by 8-ft. rods set vertically near the face of the wall and bent at the top to hook over the longitudinal rod. This is done to hold in place any chunks of concrete which might come loose through shrinkage cracks or from impact of running ice.

The work is being conducted by hired labor, and the wages paid on the concrete outfit are as follows:

One foreman, at $90 per month; 1 derrickman, at $90 per month; 2 firemen, at $40 per month; 1 hoistman on conveyor, at $40 per month; 1 watchman, at $40 per month; 11 laborers, at $1 to $1.25 per day, depending on scarcity of labor. Also, the drillboat crew, of 1 drillrunner, at $60 per month, and 1 fireman, at $40 per month.

Subsistence and sleeping quarters are furnished to all employes in addition to the above wages. Eight hours constitute a day's work, and the usual Saturday half-holidays are allowed at full pay during July, August and September. Full pay is allowed to all employes for all legal holidays. Weather conditions are usually good in the summer season, but about six weeks in the spring and four weeks at the end of the season in November are usually attended by storms and exceedingly high winds.

The cement is taken from the cars and stored in a warehouse and afterwards loaded on the barges by hand. All cement is tested in a laboratory on the office boat.

The dredging and towing expense is also charged for the time put in by the dredge at digging the trench and by the towboat in carrying the various supplies to the work.

A cost statement of the work to date is as shown by the accompanying table:

The above statement includes all money spent on the work in plant construction and operation, material, and supplies of all kinds, repairs during season, superintendence, field and main office charges and a plant charge presumed to be equal to its rental charge were it not owned by the United States Government.

The strengthening of this dam is of great importance in the now approved 6-ft. channel project, in that the low-water level in Moline Pool is to be raised 2 ft. above present height of 4 ft. minimum, and the dam will have to stand an added pressure due to this increase in height.

There is a total length of about one and one-third miles of the wall yet to be built.

Cost Statement.

Expenditures, 1907				$8,043.38
Expenditures, 1908:				
Vouchers paid	$22,307.34			
Quota R. I. office charges	680.85			
		$22,988.19		
Less material, etc., on hand		3,792.37		
				$19,195.82
Expenditures, 1909:				
Vouchers paid	$33,561.28			
On hand (1908 cost statement)	3,792.37			
Quota miscellaneous charges	375.12			
Quota R. I. office charges	1,380.07			
		$39,108.84		
On hand December 31, 1909, cement	$ 963.60			
Salvage on plant (60 per cent, $3,959.98)	2,375.99			
		$3,339.59		
			$35,769.25	
Miscellaneous			283.40	
				$35,485.85
Total net expenditures				$62,725.05

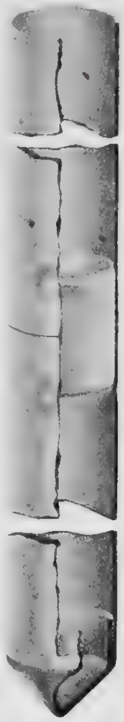
13,112.6 cubic yards concrete, 6,301.8 linear feet of wall.

Items.	Amount.	Cost per cu. yd. of concrete.		Cost per lin. ft. of wall.
Preliminary expense (plant equipment warehouse etc.)	$6,530.12		$0.4980	$1,037
Quota miscellaneous charges	375.12		.0286	
Superintendence and office:				
Field	5,551.26	$0.4233		
Quota R. I. office charges	2,060.92	.1572		
Total			$0.5805	
Excavation	1,241.56		.0947	
Forms:				
Material	2,752.39	$0.2099		
Labor	2,514.95	.1917		
Drilling	660.67	.0504		
Drilling, coal for	186.53	.0142		
Total			$0.4662	
Materials:				
Cement	17,952.72	$1.3691		8,917
Cement handling	936.02	.0714		
Cement tests	627.39	.0479		
Gravel	7,140.71	.5446		
Reinforcement	290.08	.0221		
Towing	2,889.68	.2204		
Towing, coal for	942.03	.0718		
Total			$2.3473	
Mixing and depositing:				
Labor	7,890.41	$0.6017		
Coal	843.10	.0643		
Total			$0.6660	
Backfilling	766.47		.0585	
Plant repairs	572.92		.0437	
Total	$62,725.05		$4.7835	$9.954
Miscellaneous	283.40		.0216	.045
Plant charge (rental)	4,995.74		.3810	.792
Total, including plant charge	$68,004.19		$5.1861	$10.791

A Sectional Steel Shell for Concrete Piling Work in Confined Spaces.

In constructing the New York passenger subway connecting the Brooklyn and Williamsburg bridges a portion of the line crossed the area formerly occupied by the Collet Pond and it was considered advisable at this point to carry the structure on piles. Owing to the limited headroom the driving of full length piles was impracticable and to supply the need a sectional steel tubular casing, which could be sunk, a section at a time, and afterward filled with concrete, was designed in the shops of John Simons Co., of New York city. This casing is illustrated in the accompanying cut. It is made in sections of any length from 4 ft. to 20 ft. and the pilot section is fitted with a driving point. The mode of procedure is to drive a section by jacking or jetting, then extend the casing by a second section, and so on. The sections of casing have butt joints held in place by a snugly fitting interior sleeve, as shown by the illustration.

In the subway work 100,000 lin. ft. of this casing were driven in sections ranging from 4 ft. to 10 ft. The piles ranged from 30 ft. to 80 ft. in length. Out of the 100,000 ft. of casing driven only 100 ft. were lost by accident or oversight, none was lost by failure.



Sectional Steel Shell for Concrete Piles.

Since the work described, the same form of casing has been used in underpinning the walls of buildings adjacent to which brick foundations were being built. These piles have been driven to 85 ft. in depth. The casing is manufactured by John Simons Co., New York city.

Apparatus for Repeated Load Tests of Concrete Cylinders and a Typical Result.*

The apparatus for the repetition of loads on concrete cylinders was devised by the writer and built under his direction in the shop of the Civil Engineering Department of the University of Pennsylvania. The investigation was undereaken with a view to determine the per cent of the ultimate strength of concrete that might be repeated an unlimited number of times and to study the elastic behavior of the specimens as the number of loadings increased. The first object entails the determination of a curve to show the relation between the per cent of ultimate strength and the number of repetitions that will ultimately cause failure of the specimen. The second object may show us whether there is, as has been indicated, a limit to the "set" of concrete as the number of repetitions is increased. In other words, is there a certain amount of deformation that a specimen of concrete will take under repetition of load after which there is little or no effect from further applications of the same load, or does this "set" continue to increase with repetitions, and if the latter is the true supposition, at what time does this increase in the deformation cease to be a real "set" and disintegration begin?

The specimen adapted for this work is the

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*A paper read by H. E. Berry, Assistant Professor, Materials of Construction, University of Pennsylvania, before the American Society for Testing Materials, Convention of 1910.

8-in. cylinder 16 ins. high, which is gradually becoming the standard for compression tests. Consequently the results may be compared with the results from the regular compression tests without any assumption as to the effect of size. The large size also tends to minimize the effects of slight variations in the mixing, molding and placing of the individual specimens.

The 8-in. cylinder, 50 sq. ins. area., made it necessary to design an apparatus of large capacity and since we wished to adapt the mechanism previously used in the repeated load test on concrete beams, in which 20,000-lb. proving levers were used to apply the load, it was necessary to compound the lever system. As shown in the Fig. 1 this was done by placing the proving levers at one end between the main levers tied together at the other end by heavy rods, the whole having the apearance of a huge nut cracker.

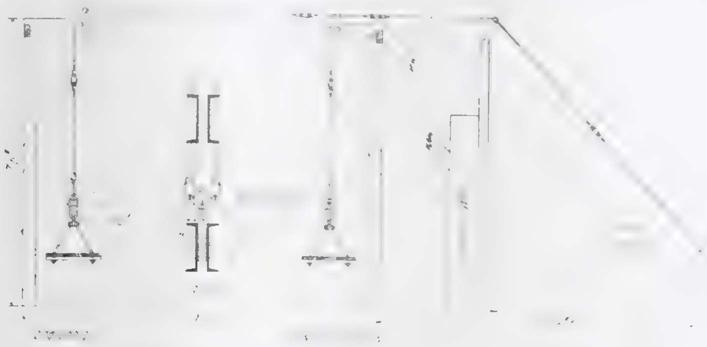


Fig. 1—End Elevation of Apparatus for Repeated Load Tests of Concrete.

Clearance for the specimen limited the short arm of the lever to a minimum of about 10 ins. The space in which the machine was to be erected set a maximum limit on the length of the lever of about 6½ ft. The preliminary computations were made on the assumption of 150,000 lbs. capacity, of a main lever with lever arms of 75 and 10 ins. and a maximum motion at the end of the long lever of ¾ in. Careful computations of the bending deflections, and the effect of the elongations of the tie rods, and the probable effect of the compression in the concrete, caused some doubt as to whether the full load could be developed with the ¾-in. motion. When tried it was found that the deflections were about twice what the bending computations had indicated. This may be accounted for in part by the effect of the bending in the connecting parts, but it is also due to the effect of the shearing deflection, which is rather high in the short arm of the main lever. Measurements in the web of these beams of the deformations on lines inclined at 45° with the horizontal have shown 0.00025-in. elongation [illegible] .00007-in. compression [illegible] the other.

The lever ratio was changed by making the short arm of the main lever 15 ins. This reduced the capacity of the machine to 90,000 lbs. which has been sufficient so far. With this lever ratio there has been no trouble in the operation of the machine. At a speed of 30 applications per minute there is not the least indication of impact in the loading.

As indicated on the drawing these main levers are made up of two 15-in., 33-lb. channels set 3 ins. apart. Only the lower one moves. It rests on a 1½-in. steel roller that bears on a hardened piece of tool steel, ground true and inserted in the soft steel 4x4-in. yoke across the bottom. A similar roller and hardened steel bearing is used beneath the specimen. Rollers instead of knife edges were used because of the motion and the high unit pressures which it was thought would soon destroy an edge. The rollers have failed to show the least sign of wear on the hardened surfaces from about 300,000 applications of loads, causing a pressure of about 6,000 lbs. per lin. in., although they have embedded themselves perceptibly in the soft steel of the bearing attached to the lever.

Spherical compression blocks are used at each end of the specimen. It is set in plaster of Paris, which is allowed to harden under slight pressure before the loading is begun. Several specimens at failure have cracked all round and spread in all directions in a manner to indicate very uniform application of stress. The readings of the deformations, as taken at three points in the circumference also indicate truly axial loading.

In beginning a test the first load is applied by increments up to the stress to be repeated and the deformations measured to the nearest 0.0001 in., so that a regular stress-strain curve may be plotted. Thereafter the readings of deformations are taken only with the load on and load off. These readings are made frequently at the beginning [illegible] they are taken only after intervals of about [illegible] only as often as about 40,000 applications.

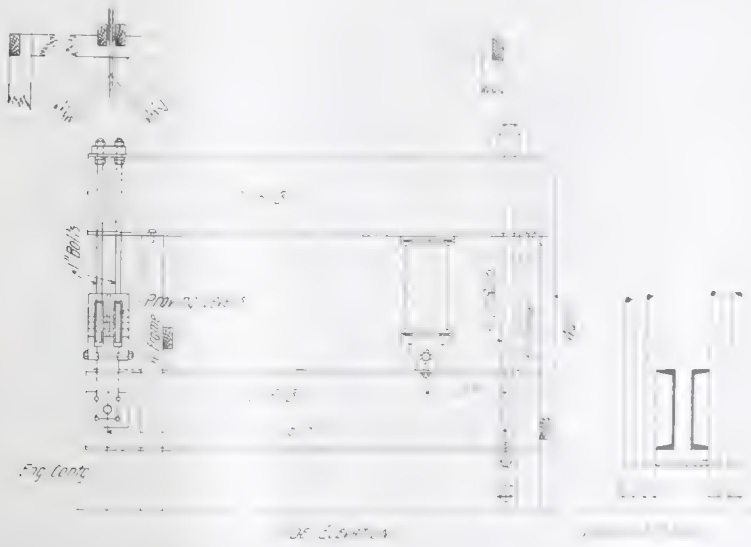


Fig. 2—Side Elevation of Apparatus for Repeated Load Test of Concrete.

The deformations are measured with a special strain gage developed and made in the shop of the Civil Engineering Department. Instead of being permanently attached to the specimen, where it might be injured by an unexpected failure, it is held in the hand and applied to the gage points. It consists of a frame with a fixed conical point at one end, and a bell crank lever with a similar steel point at the other end. The motion of the long arm of the lever as the distance between the points changes is measured with a micrometer. The gage points may consist of small pieces of steel rod attached to the concrete by plaster, though a special gage point has been arranged fastened to the specimen by a wire and touching it at three points, one of which is a steel ball free to roll in a guide, the other two in a line at the end of the gage length under measurement. By this device there is no uncertainty as to the length of the concrete from which the measured deformation arises.

Readings are [illegible] in. A record is taken of the temperature of the room and of the standard gage with which all the readings are compared. In the reduction of these readings any temperature variation may be corrected.

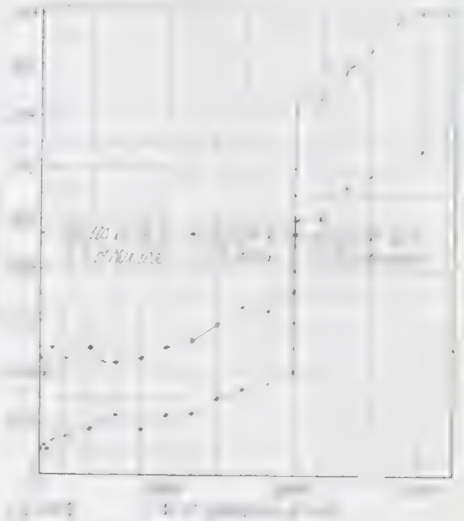


Fig. 3—Plat of Data from Repeated Load Test of Concrete.

A plot of the data taken from one specimen is shown in Fig. 2. The cylinder was loaded to slightly over one-half the average ultimate strength of 5 specimens made from the same batch of concrete. Readings were made on a 6-in. gage length at intervals of about 5,000 applications. As shown on the diagram the first few applications made a set of about .00015 and the first 50,000 applications about .00055. This was increased to about .00065 by the second 50,000 applications.

After 100,000 applications of 52 per cent of the ultimate strength, the load was increased to 1,070 lbs. per sq. in., or 63 per cent of the average ultimate strength. About 50,000 applications of this load increased the "set" from about .00065 to .00095, almost 50 per cent. The specimen was then taken from the machine and tested in the usual manner for its ultimate strength. It developed 1,700 lbs. per sq. in. which was slightly higher than the average of the five specimens tested without repetition for the "hundred per cent" strength: so we can not say that the 150,000 applications of loads greater than are allowed in practice, 50,000 of which were more than 60 per cent of the ultimate strength of the material, [illegible] any harmful effect on the strength of this cylinder. But the slope of the li[illegible] the increase in the "set" would [illegible] some action resulted from the repetition of the load: what may be the real significance of this action, is one of the purposes of the investigation.

EARTH AND ROCK SECTION

Notes on the Selection of Explosives for Tunnel Blasting.

(CONTRIBUTED.)

The selection of explosives for tunnel blasting, probably requires a more careful study of conditions than for any other kind of excavating. Maximum speed in driving cannot be attained unless the explosive best adapted to the work is used. When starting a tunnel or drift, it is a good plan thoroughly to try out several explosives, which are distinctly different in action, before finally adopting any one of them. The results, however, from this preliminary trial will be of little or no value, unless all the explosives are used under exactly the same conditions. Care must be taken to see that no change occurs in the character of the rock, number and direction of the bore holes, strength of the detonator, kind and quantity of tamping, amount of water encountered, method of connecting up the bore holes for firing, and that the explosive is always thoroughly thawed. If a material change in any of these conditions occurs as the work progresses, further tests should be made to determine whether a quicker or slower, a stronger or weaker, explosive might not break the ground, or bottom the bore holes better, or make it possible to bring out the cut with fewer holes or deeper ones. The speed at which rock can be drilled does not indicate how it will break, and not infrequently that which can be easily drilled is very difficult to blast.

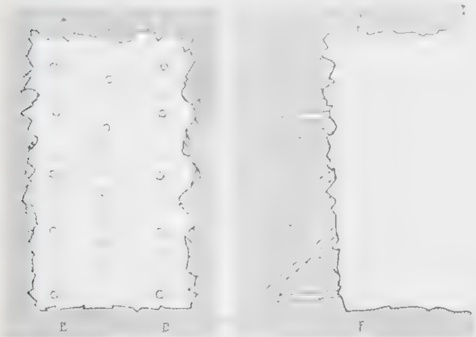

Section E F
Section A B and C-D

Fig. 1.

High explosives suitable for tunnel blasting, should not give off objectionable fumes on detonation, and accordingly gelatin dynamite, blasting gelatin or ammonia dynamite should always be selected. Gelatin dynamite is made in various grades of strength, from 25 to 80 per cent, inclusive. It is comparatively slow in action, the higher grades being little, if any, quicker than the lower ones. Blasting gelatin is manufactured in only one strength, which for comparative purposes may be said to be 100 per cent. It is more powerful and quicker acting than any other blasting explosive. It should be used sparingly, therefore, until the maximum safe charge has been learned from experience. Good results will often be had in hard ground, if a few cartridges of blasting gelatin are used in the point of the bore hole, with gelatin dynamite on top. When this is done, it is best to put the detonator in one of the cartridges of blasting gelatin. Ammonia dynamite is made from 25 to 75 per cent strength. All grades are quicker than gelatin dynamites, and generally speaking the quickness increases with the strength. That is, the stronger grades are quicker, and the lower grades slower in action. The various grades of these three high explosives offer a wide range in strength and quickness to select from, and it is always possible, after a few trials to find an explosive exactly suited to the conditions.

Railroad tunnels, mine tunnels and drifts, highway tunnels, and irrigation tunnels, are being driven daily through various kinds of "ground." Often it is a matter of first importance to finish them quickly, and consequently details in regard to methods an equipment are matters of general interest. Within the past few months, a number of speed records in tunnels of different sizes have been made, and descriptions of them have appeared in various technical magazines.

In ENGINEERING-CONTRACTING of Oct. 20, 1909, Mr. J. B. Lippincott, assistant Chief Engineer of the Los Angeles aqueduct, gave an interesting account of the driving of the Red Rock tunnel of the Los Angeles aqueduct system. In August, 1909, this tunnel, which is 9 ft. 10 ins. by 10 ft. 8½ ins. in section, was advanced 1,061.6 ft. Mr. Lippincott states that the explosives used were Du Pont 40 per cent ammonia dynamite and blasting powder.

In the *Engineering News* of November 18, 1910, the Red Rock tunnel is again referred to, and details are also given by Mr. C. H. Richards, division engineer, in regard to a tunnel on the Little Lake Division of the Los Angeles aqueduct. The explosives used in this tunnel were Hercules 40 per cent and 60 per cent gelatin dynamite, the average weight of explosives per cubic yard of rock, place measurement, having been only 3.3 lbs., or about 35 lbs. per lineal yard of tunnel, almost 10x10 ft. in section.

A short time before, accounts were given in several engineering magazines, of a record driving speed made in the Roosevelt drainage tunnel at Cripple Creek, Colorado. The explosives used in this tunnel were 40 per cent, 50 per cent and 60 per cent Repauno gelatin dynamite and Du Pont blasting gelatin.

A very interesting description of the Rondount pressure tunnel of the Catskill aqueduct, written by Mr. John P. Hogan, assistant engineer of the New York City Board of Water Supply, was published in the Jan. 1, 1910, number of the *Engineering Record*. Very rapid progress was made in this tunnel, and also in the Moodna pressure tunnel of the same system, described in the *Engineering Record* of June 4, 1910. The explosive which gave best results, and which was used exclusively in both of these tunnels, was 60 per cent Forcite—a gelatin dynamite.

Reference to a paper by B. H. M. Hewett and W. L. Brown, on the land sections of the Pennsylvania Railroad North River tunnels, published in Vol. XXXVI of the Proceedings of the American Society of Civil Engineers, and reprinted in part in ENGINEERING-CONTRACTING of May 11, 1910, shows that 40 per cent Forcite was used in blasting on the Manhattan section, and 60 per cent Forcite on the Weehawken section.

The records of many other tunnels recently constructed, further illustrate how many kinds and strengths of explosives, are used for blasting under the different conditions encountered in one class of work.

The specific cases referred to above, were all connected with large and important contracts, where equipment and methods were of the best, and several of these tunnels were driven at record speed. The fact that so many different explosives were used in the seven tunnels goes to show that care was taken to use the explosive which was best adapted to the conditions, and it is not unlikely that the speed of driving these tunnels was largely due to the attention given to the selection of the explosives.

This point is equally important when driving narrow tunnels and drifts. After a study of the rock in a cross cut 3 ft. 6 ins. by 7 ft. in section, recently driven by J. R. Marling in the Callie shaft at Cripple Creek, it was decided that best execution would be given by a 40 per cent gelatin dynamite. Repauno 40 per cent gelatin was accordingly adopted, and it was necessary to drill 14 holes as shown in Fig. 1, from 3 ft. 6 ins. to 4 ft. 6 ins. deep and blast them with about 35 lbs. of 40 per cent gelatin dynamite, in order to advance the tunnel about 3 ft. In an attempt to increase the speed of driving, and to reduce the cost, the face was drilled with seven holes, as shown in Fig. 2, and these holes were loaded with Du Pont blasting gelatin in the points, and Repauno 40 per cent gelatin dynamite on top. In this method of loading about 7 lbs. of the blasting gelatin, and 17 lbs. of the gelatin dynamite were used, making a reduction of about 15 per cent in the cost of explosives, and 20 per cent in the amount of drilling, while the tunnel was still advanced fully 3 ft. each shift. Here the adoption of a more suitable explosive for the work resulted in a great reduction in cost instead of increase in speed.

Methods and Cost of Steam Shovel Work Loading Slag, Earth and Sand Into Cars for Railway Ballasting and Grading.

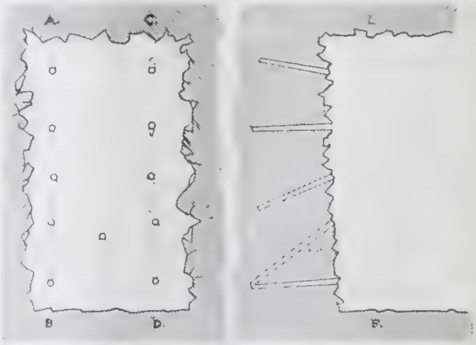
BY D. A. WALLACE.

Slag for Ballasting.—This slag was loaded by a 45-ton shovel working against a 20-ft. face, into cars placed on a spur track on a 3 per cent grade. The grade permitted the spotting of cars by hand while the engine was unloading the loaded cars. The greatest haul was 4 miles. There was no delay to the slag train due to meeting revenue trains. The slag was in alternate vitrified and spongy layers. The use of the light shovel necessitated some use of powder but not more than the ground gang could drill the necessary holes for and handle. Holes were drilled on an average 9 ft. horizontally into the face 3 ft. from the ground line and about 10 ft. centers. Rodgers ballast cars were used. The size of the slag permitted easy unloading. The train crew with the help of one of the gang did the unloading and sweeping off. The wages were as follows:

Engineer, per month	$125.00
Craneman, per month	90.00
Fireman, per month	60.00
Foreman, per month	65.00
Ground hands, per day	1.25

The daily expense was as follows:

Engineer	$ 4.80
Craneman	3.46
Fireman	2.31
Foreman	2.50
6 ground men	7.50
2 tons coal at $2	4.00
Waste and oil	0.50
Dynamite	0.93
Work train	25.00
Total	$51.00



Section E-F
Section A-B and C-D

Fig. 2.

The slag cost $2 per car load of 40 cu. yds. or 5 cts. per cu. yd. Including this the cost of loading, hauling and unloading was as follows per cubic yard:

6 cars, 240 cu. yds	$0.262
7 cars, 280 cu. yds	0.232
8 cars, 320 cu. yds	0.209
9 cars, 360 cu. yds	0.191
12 cars, 480 cu. yds	0.156

Earth for Grade Raising.—Loose earth was loaded into Hart convertible cars spotted on the main line. The shovel was cut in on both sides of the main line and cuts were widened. A 12-ft. face was worked. The dirt was unloaded by the railway company in widening fills or grade raising just as was most convenient, depending on the progress of the gangs and the time of revenue trains. The contractor was paid 7 cts. per cu. yd. pit measure for dirt loaded on cars and the following costs were for loading alone. The shovel used was a 70-ton Giant with a 2-cu. yd. dipper. The wages paid were as follows:

Engineer, per month	$150.00
Craneman, per month	90.00
Foreman, per day	2.00
Groundmen, per day (6 worked)	1.50
Watchman, per day	1.85

About 1½ gals. of cylinder oil at 40 cts. per gallon were used per day and 2 gals. of black oil at 10 cts. per gallon. The daily expenses were as follows:

Engineer	$ 6.00
Craneman	3.60
Fireman	2.00
Watchman	1.85
Ground hands	9.00
Total labor	$22.45
Cylinder oil	$ 0.60
Black oil	0.20
Waste	0.10
1 ton coal	1.50
Int. at 6% on $10,000	2.00
Total	$26.85
Grand total	49.30

The shovel loaded 45 cars of 24 cu. yds. per car or 600 cu. yds. per day, giving a cost of 4½ cts. per cu. yd.

Sand for Ballast.—Two sand pits were opened up, one on each side of the main line, and the lead track to each pit was used as a loading track. A 60-ton Marion shovel was cut into one pit and a 45-ton Vulcan shovel into the other pit. Three work trains were used for spotting cars, hauling and unloading. Each crew handled different parts of the work depending on the arrival of the unloading trains and the speed of loading. One crew usually spotted cars for both shovels. This was done very easily because of the frequent moves of the shovels due to the shallow face of the cut. The sand was a white sand containing about 20 per cent loam. It made a very satisfactory ballast for light traffic. Hart convertible cars were used and were unloaded by Lidgerwood and plow on new track. A large amount of time was lost due to the slow running necessitated by the very rough track.

The following records cover the work of two months, and are given separately for each month.

The following was the daily output of the 60-ton Marion for 21 working days in July.

Date. July	No. cars loaded.	Cu. yds. per car.	Cu. yds. per day.
6	29	30	1,170
8	48	25	1,200
9	50	25	1,250
10	67	25	1,675
11	42	35	1,470
12	42	30	1,260
13	34	25	850
15	54	25	1,350
16	79	30	2,370
17	74	25	1,850
18	81 4	25 12	2,078
19	41	25	1,025
20	18	25	450
22	10	25	250
23	36	25	900
24	32	25	800
25	38	25	950
26	60	25	1,500
27	59	30	1,770
29	73	25	1,825
30	49	28	[illegible]
31	55	30	1,650
Total	1,075		29,008

The number of days worked was 22 or 223 hours, during which time there were 91 hrs. 45 mins. delays distributed as follows:

Cause.	Hrs.	Mins.
Moving shovel	[illegible]	[illegible]
Waiting for cars	53	10
Closing car doors	4	35
Coal and water	5	50
Derailments	[illegible]	20
Shovel repairs	0	55
Total	91	45

The following was the output of the 45-ton Vulcan shovel for 7 days' work:

Date. July	No. cars loaded.	Cu. yds. per car.	Cu. yds. per day.
24	[illegible]	30	[illegible]
25	[illegible]	[illegible]	990
26	[illegible]	30	720
27	[illegible]	[illegible]	1,260
29	10	[illegible]	350
30	[illegible]	[illegible]	1,120
31	[illegible]	[illegible]	2,170
Total	235		7,570

The number of days worked was 7 or 70 hours during which time the delays amounted to 49 hrs. 43 mins. distributed as follows:

Cause.	Hrs.	Mins.
Moving shovel	[illegible]	[illegible]
Waiting for cars	[illegible]	20
Tank repairs	7	0
Shovel repairs	7	[illegible]
Derailments	[illegible]	15
Total	49	[illegible]

Summarizing the work of the two shovels we have:

Item.	60-Ton.	45-Ton.
No. cars loaded	1,075	[illegible]
Cu. yds. loaded	29,008	[illegible]
Av. No. cars per day	43¾	[illegible]
Av. cu. yds. per day	1,318.5	[illegible]
Av. cu. yds. per car	27.2	32.2

The face worked averaged 10 ft. and the haul was 10 miles.

TABLE I.

	Marion 60-Ton.			Vulcan 45-Ton.		
Date, August.	[illegible] loaded.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	13	30	390	60	30	1,800
2	43	30	1,290	60	30	1,800
3	79	30	2,370	41	35	1,435
4	54	30	[illegible]			[illegible]
5	32	18	2,196	[illegible]	[illegible]	[illegible]
6	50	18	[illegible]			
7	129	[illegible]	2,322	19	30	[illegible]
8	[illegible]	18	1,602	[illegible]	20	1,700
9	[illegible]	18	1,656	50	[illegible]	[illegible]
10	[illegible]	18	54	[illegible]	30	[illegible]
12				95	25	2,375
13				65	25	1,625
14	33	30	990	41	[illegible]	1,230
15				38	30	1,140
16	84	30	2,520	[illegible]	30	[illegible]
17	66	20	1,320			
19	87	30	2,610	5	[illegible]	150
20	58	30	1,740	65	30	1,950
21	31	30	[illegible]	[illegible]	30	1,290
22				[illegible]	40	2,400
23	35	30	1,050	35	30	1,050
24	63	30	1,890	45	[illegible]	1,575
26	[illegible]	12		51	30	1,530
27	32	30	960	10	[illegible]	300
28	62	30	1,860			
29	55	30	1,650	[illegible]	[illegible]	800
30	35	30	1,050	30	30	900
31	40	[illegible]	1,200	[illegible]	30	1,980
Total	1,268		33,486	1,046		30,710

The total yardage loaded by both shovels was 36,578 cu. yds. The cost of loading, transporting and placing the material in the track was as follows:

Item.	Total.	Per cu. yd.
Loading	[illegible]	$0.0403
Transporting	[illegible]	0.0744
Surfacing	[illegible]	0.2316
Fuel and supplies	2,332.59	0.0639
Rental equipment	2,539.91	0.0690
Supervision	[illegible]	0.0251
Total	$18,334.35	$0.5037

The face worked averaged 8 ft. and the haul was 10 miles.

In August the two shovels worked more nearly the same amount of time and the records are given side by side in Table I.

The total working time of the 60-ton shovel was 26 days or 310 hours during which time there were the following delays:

60-Ton Marion.

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]

45-Ton Vulcan.

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]

Summarizing the work of the two shovels we have:

Item.	60-Ton.	45-Ton.
No. cars loaded	[illegible]	[illegible]
No. cu. yds. loaded	33,486	30,710
Av. cu. yds. per day	1,272	1,121
Av. cars per day	48 4/5	40
Av. cu. yds. per car	26½	28⅔

The total yardage for the month for both shovels was 63,196 cu. yds. The cost of loading, transporting and placing this material in the track was as follows:

Item.	Total.	Per cu. yd.
Loading	[illegible]	[illegible]
Transporting	2,973.74	0.0464
Surfacing	9,504.71	0.1504
Fuel and supplies	4,761.56	0.0753
Rental equipment	3,422.07	0.0541
Supervision	1,161.30	0.0183
Total	$23,031.03	$0.3635

Methods of Transporting Materials and Transportation Forces Employed in Constructing the Pennsylvania R. R. Hudson River Tunnels.

[illegible] the Manhattan Shaft the contractor laid a spur siding into the yard from the freight tracks of the New York Central R. R., which immediately adjoins the yard on the west. There was also wharfage on the river front about 1,500 ft. away.

At the Weehawken Shaft there were four sidings from the Erie R. R. and one from the West Shore R. R. Access to the river was gained by a trestle direct from the yard, and Baldwin Avenue adjoined the yard.

All the iron lining arrived by railroad. It was unloaded by derricks, and stacked so that it was convenient for use in the tunnel.

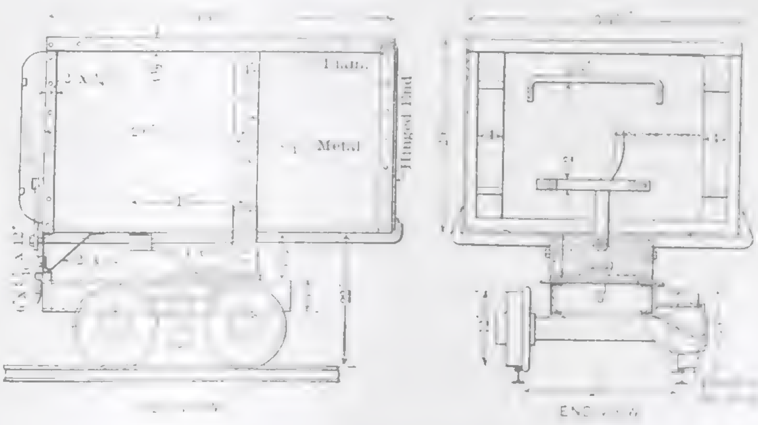


Fig. 1—Mucking Car, North River Tunnel, Pennsylvania R. R.

The Manhattan derricks were a pair of steel [illegible] 250-volt, electric motor. There was also a stiff-leg derrick with 50-ft. boom, on a plat-

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[illegible] tension of the Pennsylvania R. R.; North River [illegible] Proceedings American Society of Civil Engineers, Vol. XXXVI, p. 696.

form near the shaft, which was worked by a 40-h.p., 250-volt motor. At Weehawken there were two 45-ft. boom, stiff-leg derricks of 2 tons capacity, one worked by a 42-h.p. Lidgerwood boiler and engine, and the other by a 25-h.p., 250-volt, electric motor. These derricks were set on elevated trestles near the Erie Railroad sidings. There was a 50-ft. stiff-leg derrick with a 70-h.p. Lidgerwood boiler and engine near the cement warehouse on the West Shore R. R.

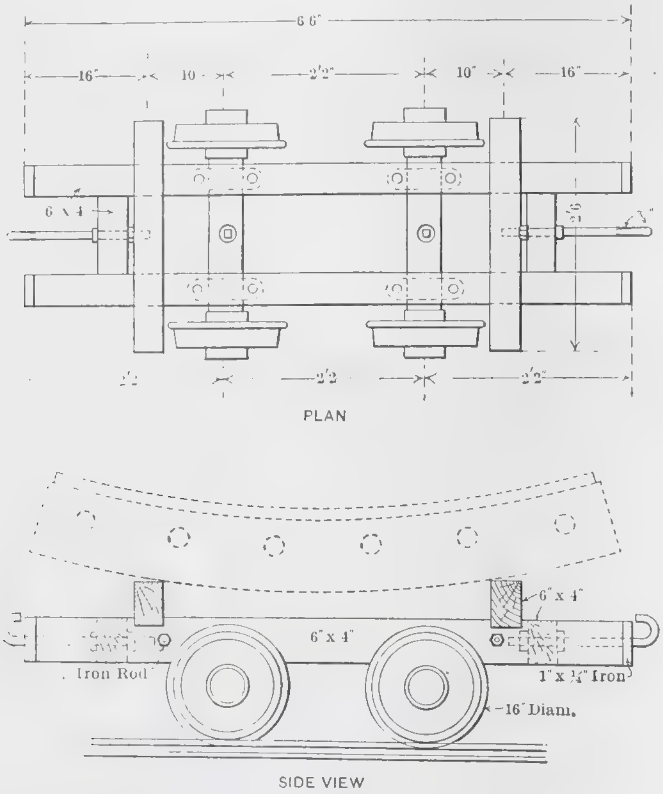

Fig. 2—Flat Cars for Handling Lining Segments, North River Tunnel, Pennsylvania R. R.

The storage area for iron lining was 1,800 sq. ft. at Manhattan and 63,000 sq. ft. at Weehawken; the maximum quantity of lining in storage at any one time was 150 rings at Manhattan and 1,200 rings at Weehawken.

The cement, which was issued and sold by the company to the contractor, was kept in cement warehouses; that at the New York side was some 1,200 ft. from the shaft, to which it was brought by team; that at Weehawken was adjacent to the shaft, with a 2-ft. gage track throughout it and directly connected with the shaft elevator.

Surface transportation.—In the early days the excavation was handled in scale-boxes of 1 cu. yd. capacity which were hoisted up the shafts by a derrick, but, when the iron period began, two-cage elevators were put in at each shaft. They were worked by a single, friction-drum, Lidgerwood, steam hoisting engine of 40 h.p.

All materials of construction were loaded on cars on the surface at the point where they stored, and hauled on these to the elevators, sent down the shaft, and taken along the tunnels to the desired point without unloading.

The narrow-gage railway on the surface and in the tunnel was of 2-ft. gage with 20-lb. rails. About 70 flat cars and 50 mining cars were used at each shaft. On the surface at Manhattan these were moved by hand, but at Weehawken, where distances were greater, two electric locomotives on the overhead trolley system were used.

Tunnel Transportation.—The mining cars shown in Fig. 1 were of 1¼-cu. yd. capacity. The short wheel base and unbalanced loading caused a good many upsets, but they were compact, easily handled, and could be dumped from either side or end.

The flat cars shown in Fig. 2 were of 3 tons capacity, and could hold two tunnel segments. As the working face was down grade from the shafts, the in-bound cars were run by gravity. For out-bound cars a cable haulage system was used, consisting of double cylinder Lidgerwood single friction-drum, hoisting engines (No. 32) of 6 h.p., with cylinders 5 in. in diameter and 6 in. stroke and drums 10 in. in diameter. These were handily moved from point to point, but, as there was no tail rope, several men had to be used to pull the cable back to the face. After the second air-lock bulkhead walls had been built, a continuous-cable system, worked electrically, was put in each tunnel between the first and second air-locks.

The engine consisted of an electric motor driving a 3-ft. 6-in. drum hoist around which a ¾-in. steel wire cable passed three times. The cable was led around a sheave, down the tunnel on the right side of the in-bound track, and returned on the left side of the out-bound track. It was then carried around a set of sheaves, where a tension of 1,000 lbs. was supplied by a suspended weight which acted on a sheave with a sliding axle on the tension carriage. The cable was supported throughout its length on 8-in. pulleys set in the floor at 50-ft. intervals. All the guide sheaves were 36 ins. in diameter.

Each car was attached to the cable by a grip at its side. This was fastened and unfastened by hand, but was automatically released just before reaching the turn in the cable near each lock. This system could haul without difficulty an unbalanced load of 10 muck cars, spaced 100 ft. apart, up a 2 per cent grade. The cable operated over about 1,000 ft. of tunnel, the motor being placed at the top of the grade. The driving motor was of the semi-armored, 8-pole, series-wound type, rated at 25 h.p., 635 rev. per min., and using direct current at 220 volts. The speed of handling the cars was limited by their having to pass through the air locks on a single track. As many as 106 cars have been hauled each way in one 8-hour shift.

Disposal.—At Manhattan the tunnel muck was carried from the elevator over the upper level of the yard trestle and dumped into bins, whence it was teamed to the public dump. At Weehawken the rock excavation was removed by the Erie R. R. on flat cars on which it was dumped by the tunnel contractor, but all the silt muck was teamed away to some marshy ground where dumping privileges were obtained.

The typical forces employed on transportation were as follows:

At Manhattan Shaft, on 10-hour shifts:

	Per day.
2 Engineers on derricks	$3.00
2 Foremen	3.25
15 Laborers loading and unloading iron	1.75
7 Laborers on disposal	1.75
6 Teams	7.50

At Weehawken Shaft, on 10-hour shifts:

	Per day.
3 Engineers on derricks & locomotives	$3.00
16 Laborers loading and unloading iron	1.75
3 Foremen	3.50
11 Laborers on disposal	1.75
6 Teams on disposal	6.50

Tunnel Transportation (including shaft elevator); shaft elevators and to and from the first air-lock on 10-hour shift:

	Per day.
2 Engineers	$3.00
2 Signalmen	2.00
1 Foreman	3.00
12 Laborers	1.75

Between the first lock and working face, on 8-hour shifts, the force varied:

	Per day.
From 1 to 3 (average 2) hoist engineers	$3.00
From 0 to 2 (average 1) lockmen	2.75
From 1 to 2 (average 2) truckmen	3.00
From 2 to 7 (average 4) cablemen	3.00

Bracing and Sheeting Trenches.

BY FRANK H. CARTER, ASSOC. MEM. AM. SOC. C. E.*

The design of sheeting and shoring for trench excavations even in difficult places and for large and important work is generally left to the judgment of the foreman of excavation, in a majority of cases too, it may be said to their credit, with good results. That bracing, however, is sometimes uneconomical with too generous an allowance of timber, is pretty generally admitted as well, especially in places where the work is done quickly and well underdrained.

Theoretical earth pressures according to the generally accepted Rankine or Coulomb formulas cannot be realized where cohesion exists in virgin soil. To destroy cohesion in earth it is necessary to expose the material to the elements. This does not obtain with ordinary trench excavation carried on with average speed, hence a factor of safety exists which is not generally reckoned with.

TABLE II.—WOODEN BEAMS. BENDING MOMENTS IN THOUSAND INCH POUNDS FOR A FIBRE STRESS OF 1,200 POUNDS PER SQUARE INCH.

$$m = f\frac{I}{y} = f\frac{fh^3}{12} = f\frac{bh^2}{6} = \frac{1200}{6} \times bh^2 = 200\ bh^2$$

Width in inches.	Depth in inches = h. 1. h²=1.	2. 4.	3. 9.	4. 16.	5. 25.	6. 36.	8. 64.	10. 100.	12. 144.	14. 196.	16. 256.
1	.2	.8	1.8	3.2	5.0	7.2	12.8	20.	28.8	39.2	51.2
2	.4	1.6	3.6	6.4	10.	14.4	25.6	40.	57.6	78.4	102.4
3	.6	2.4	5.4	9.6	15.	21.6	38.4	60.	86.4	117.6	153.6
4	.8	3.2	7.2	12.8	20.	28.8	51.2	80.	115.2	156.8	204.8
5	1.	4.	9.	16.	25.	36.	64.	100.	144.	196.	256.
6	1.2	4.8	10.8	19.2	30.	43.2	76.8	120.	173.	235.	307.
8	1.6	6.4	14.4	25.6	40.	57.5	102.5	160.	231.	313.	410.
10	2.	8.	18.	32.	50.	72.	128.	200.	288.	392.	512.
12	2.4	9.6	21.6	38.4	60.	86.3	153.5	240.	347.	470.	615.
14	2.8	11.2	25.2	44.8	70.	101.	179.	280.	405.	548.	715.
16	3.2	12.8	28.8	51.2	80.	115.	205.	320.	462.	626.	820.

In several cases the writer has known of substructures designed for corporations where it was absolutely necessary to observe the ut-

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*Designing Engineer, Cambridge Main Street Subway, Boston Elevated Railway Co., No. 2 Central Sq., Cambridge, Mass.

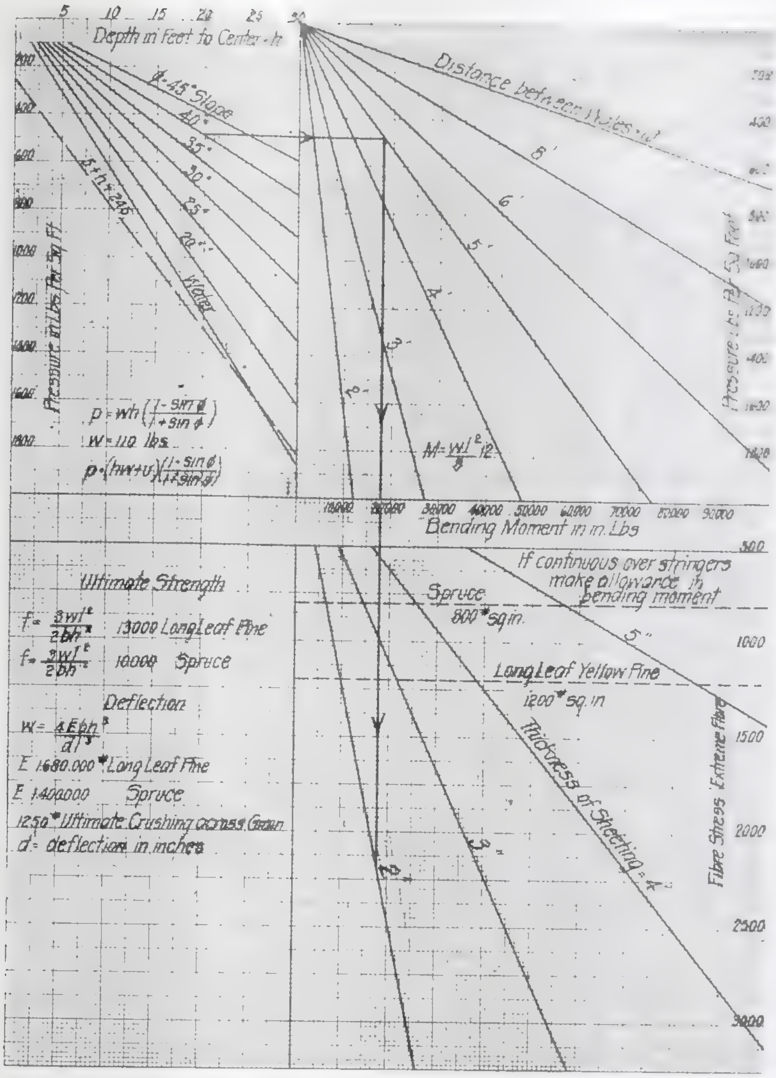

Fig. 1.

most economy, where drawings had been made according to the usual theories of earth pressure, and then the thickness of walls cut down sometimes in half because of the obvious fact from past experience that the structure would answer all purposes, and be absolutely safe with the revised thickness, Rankine and Coulomb to the contrary notwithstanding. In no case known to the writer have these structures failed or shown any signs of failure.

The writer does not advocate this method of procedure for other structures nor as a rule for the design of earth resisting structures, but merely quotes the facts in further substantiation of the statement he is about to make, namely, that structures designed according to the generally accepted theories probably have a factor of safety from earth pressure of about 2 to begin with, before making allowance for the usual factors of safety in wood, concrete or steel in the structure itself.

The preceding principles have lately been applied to several recent deep and wide trench excavations, to the apparent complete verification of the assumptions.

The writer therefore now computes pressures on bracing and shoring for well underdrained excavations in virgin soil, done rapidly and thoroughly, with no possibility of superimposed load, as follows:

In well drained sand or similar material having little or no cohesion, assume one-half the usual earth pressure.

In well drained materials with cohesion, assume one-third to one-quarter the usual earth pressures.

The accompanying diagrams may be used either to study existing trench bracing, or for the design of bracing under the usual Rankine theory of earth pressure, the diagrams however making no allowance for cohesion, etc., excepting such as the theory itself accounts for.

Figure 1 is for the design of vertical sheeting according to the formula—

[illegible] (Rankine).

With earth at 110 lbs. per cu. ft., the formulas are as follows:

Theoretical pressure against vertical plane with angle of inclination of surcharge equal to zero.

$$P = (wh. + L)\frac{[illegible]}{[illegible]} = (wh + 500)\,Z.$$

when surcharged weighs 500 lbs. per sq. ft.

With $\phi = 20°$, $P = 53.9\,h + 245$
[illegible]
[illegible]

Without surcharge of course the latter term disappears, and we have (approximately):

[illegible]

To use the diagrams for well underdrained trench excavations in undisturbed natural soil done quickly, both without and with allowance for cohesion, divide the earth pressures as found in the upper left hand corner by 2, 3 or 4, as experience and judgment may dictate, before entering other parts of diagram.

TABLE I.—LONG LEAF GEORGIA YELLOW PINE—SAFE LOAD IN POUNDS

Length Ft.	4x4	6x6	8x8	10x10	12x12
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16......	6100	19300	41600	73000	112000
18......		17600	38800	68000	108000
20......		[illegible]	[illegible]	[illegible]	[illegible]
22......		[illegible]	[illegible]	[illegible]	[illegible]
24......		13700	31300	57500	93500
26......			29400	55000	88500
28......			27500	51500	85000
30......			[illegible]	[illegible]	[illegible]
32......			24300	47000	77000
34......				[illegible]	[illegible]
36......				42000	70500

Based on formula of U. S. Department of Agriculture, Div. of Forestry.

$$P = F \times \frac{700 + 15c}{[illegible]}$$

l = length of column in inches.
d = least diameter in [illegible]
F = ultimate crushing strength of column in pounds per sq. inch. $c = \frac{l}{d}$
Factor of safety = 5.

Figure 2 shows the relation between earth pressures as developed by the Rankine formula and stresses in wales and cross bracing with no reduction for cohesion, or for rapidity of trench excavation. The stresses in the wales and the sheeting in both these diagrams are carried out beyond the usual safe figures for the reason that some engineers prefer to design according to the usual the-

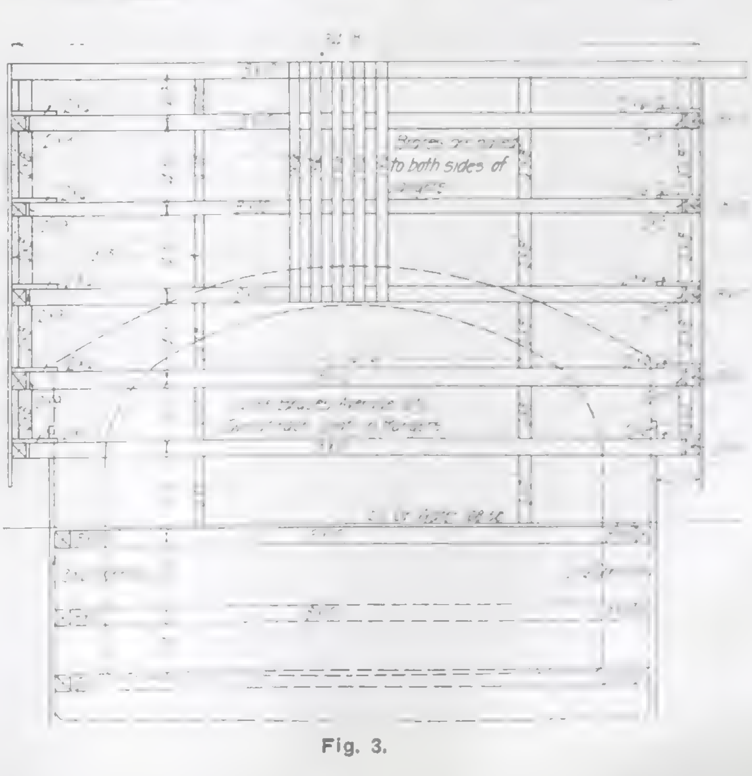

Fig. 3.

ory and to assume that the timbers may be stressed up to 2,000 or 2,500, or even 3,000 lbs. per sq. in.

In closing the writer offers the following example (shown in Fig. 3) of recent trench excavation in dry sand and clay designed and built by the Hugh Nawn Contracting Co. for the Cambridge Main Street Subway, the timbers of which had been holding up so well that the trench foreman decided to economize in the use of lumber, notwithstanding the approach of the trench to a four-story brick building within ten feet of the side of the trench. Stringers 10x8 ins. and cross braces had been used 10 ft. on center longitudinally of the trench and 4 ft. on center vertically. The saving was made by increasing the vertical spacing of the stringers so that at a depth of 21 ft. they were 5 ft. and 10 ins. center to center. This would have stressed the 2-in. plank sheeting up to from 2,500 to 3,000 lbs. per sq. in., and the wales to about the same figure, by the usual theories, but from the appearance of the timber itself there is scarcely evidence of any pressure whatever.

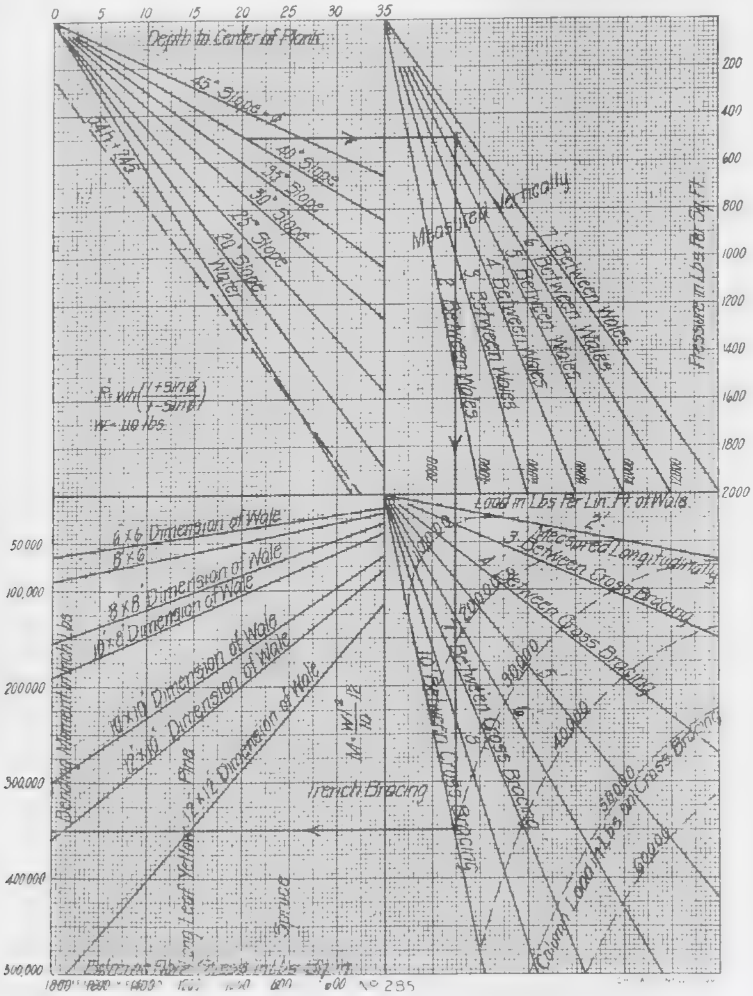

Fig. 2.

To use Fig. 1 on the example given, enter the upper left hand corner of the diagram with a depth of 21 ft. and a slope of $\phi = 40°$ reading 500 lbs. pressure per sq. ft., thence running along the horizontal line to the inclined line in the upper right hand part of the diagram reading "Distance between wales = 5 ft." read 19,000 inch pounds bending moment, thence following down the 19,000 line to the inclined line in the lower right hand part of the diagram read 2,400 lbs. per sq. in. stress on 2-in. sheeting, allowing $M = \frac{Wl^2}{8} 12$ (an assumption excessively on the side of safety excepting for the last span in a series of continuous spans). In the process of concreting the side walls the rangers are removed, causing the 2-in. plank to span 8 ft. for a short time instead of 4 ft. as computed. The trench was dug in material which would probably assume a slope of 40° when exposed to the weather but the work was done quickly and thoroughly and well underdrained, hence we may assume that the earth pressures are but one-fourth of those theoretically developed. Dividing 500 by 4 we have 125 lbs. per sq. ft. pressure. Entering the upper left hand part of the diagram with a pressure of 125 lbs. per sq. ft. and running along the horizontal line 125 lbs. to the inclined line 5 ft. 0 ins. (distance between wales) we find a bending moment of 5,000 in. lbs., thence running down the vertical line representing 5,000 in. lbs. to the inclined line in the lower right hand corner of the diagram, we find a stress of about 600 lbs. per sq. in. for 2-in. plank sheeting, a figure probably not much exceeded, if at all.

To use Fig. 2 with the same problem, enter the upper left hand corner of the diagram with a depth of 21 ft. and a slope of 40° we find as before a pressure 500 lbs. per sq. ft. Running along this horizontal line to its intersection with the inclined line in the upper right hand corner of the diagram marked (by interpolation) "5 ft. 10 ins. between wales," we find a load of 2,900 lbs. per lin. ft. of wale at the given depth. Thence running down the vertical line representing 2,900 lbs. per lin. ft. of beam to its intersection with the inclined line in the lower right hand part of the diagram marked 10 ft. between cross bracing we find a bending moment of 350,000 in. lbs., assuming $M = 12 \frac{wl^2}{10}$, also by interpolation we read about 29,000 lbs. load on each cross brace as a column. Running along the 350,000 lbs. horizontal line to the lower left hand corner of the diagram to 10x8-in. wales (outside the figure) we estimate 3,200 lbs. stress in the wale. Assuming as before that the horizontal earth pressure will not be developed by ¼ and by going through the same process as outlined above we find a stress of 800 lbs. per sq. in. in the wale, a figure probably not exceeded. It is of course obvious from the equation of $f = \frac{3wl^2}{2bh^2}$ that the stress in the extreme fibre is directly proportional to *w*, hence we might have divided the high stress found from the theoretical earth pressures by *4*.

Table I is a table of resisting moments in wooden beams of various sizes and Table II gives safe loads on wooden posts, as developed from the formula of the U. S. Board of Agriculture, Department of Forestry.

ROADS AND STREETS SECTION

The Highway Traffic Census of the Massachusetts Highway Commission.

In our issue of Oct. 6, 1909, mention was made of the traffic census conducted in 1909 by the Massachusetts Highway Commission on the 740 miles of state roads. Further details regarding this census are given in the last annual report of the Commission, from which the notes that follow have been taken:

The chief reasons for taking this census were to determine the relative importance of the different routes of travel and to secure at least a rough approximation of the relative use of such routes by motor vehicles and by horse-drawn vehicles.

Some untrained observers only could be secured, the data recorded were as simple as possible, and the tally cards were prepared carefully, so as to leave little or nothing to the judgment of the observers.

No attempt was made to secure records which would determine the volume of traffic in terms of weight, per unit of width of roadway, per unit of time. Such records would be of the greatest value to the commission in its work, but because of the expense involved such a determination would have been impossible.

The following classes of traffic only were observed: single horse (light vehicles); single horse (heavy vehicles); two or more horses (light vehicles); two or more horses (heavy vehicles); automobiles (runabouts); automobiles (touring cars).

In the instructions furnished to the observers a "light vehicle" was stated to mean "a buggy, carryall, democrat wagon or any other vehicle, other than an automobile, which is used usually for pleasure or light business purposes." A "heavy vehicle" was defined as "a farm wagon, milk wagon, tip-cart, grocery or provision wagon, or any other vehicle, except an automobile, which is used for carrying heavy loads."

Two separate records were taken, the first in the month of August, beginning on Sunday, August 23, at 7 A. M., and continuing for 14 hours each day, until 9 P. M. on the following Saturday evening.

The second census began on Sunday, Oct. 10, at 7 A. M., and continued for the full week in precisely the same way as in August.

The August records were taken advisedly, so as to show the abnormal summer travel, particularly that in automobiles, and the October census was expected to indicate the normal traffic conditions which may fairly be considered to apply during the months of March, April, May, September, October and November. During the winter months the roads of Massachusetts are usually either frozen or are covered with snow or ice.

In August, the week chosen [illegible] a period of almost perfect weather. There was no storm, and only very light showers were reported and those only in a few localities. In October, however, there were two days on which fairly heavy rains were generally reported.

For the August records 237 observers were employed, and in October 240 observers' stations were established. Arrangements for the employment of the observers were made by the division engineers, and in most cases boys and girls in advanced grades of the public schools were selected, although in some instances the repair agents of the commission kept the records. The observers generally were interested in the work, and it is believed that the results of the census are as accurate as should be expected. Both weeks selected were normal in that there were no county fairs or other unusual events which would affect the traffic. On the other hand the two rainy days during the week of the October census were perhaps rather more than the average week usually contains.

The census cost as follows:

	August.	October.
Observers' pay	$2,217.53	$2,159.70
Printing and postage	159.31	57.40
Clerical work	[illegible]	41.60
Total	[illegible]	[illegible]
Average cost per station	10.14	9.41

The observers mailed each day to the division engineers their records for the day, so that an opportunity was had to correct quickly any obvious errors. The work moved very smoothly, and but few errors or misunderstandings occurred.

On certain of the main roads leading into Boston the records were taken during the August census for 24 hours each day, so as to include the vehicles which carry milk and produce into Boston and its suburbs.

In addition to the records taken by the employees of the commission, the Metropolitan Park Commission, the park commissioners of the city of Boston and the street commissioner of the city of Newton caused similar counts of the traffic over the roads under their respective jurisdictions to be made, in the same manner and for the same periods.

After a preliminary examination by the division engineers of the observers' tally cards, they were sent to the office of the commission and there checked carefully and the data analyzed. Tables of averages were then compiled.

The following table shows the recapitulation of the results of both records:

	August Census 237 sta.	October Census 240 sta.
Horse-drawn:		
Light	19,622	16,456
Heavy	[illegible]	17,967
Total	37,591	34,423
Automobiles:		
Runabouts	[illegible]	3,995
Touring cars	[illegible]	14,514
Total	[illegible]	18,509
All kinds	[illegible]	[illegible]
Per cent horse-drawn	[illegible]	65
Per cent automobile	[illegible]	35
Averages per station:		
Horse-drawn:		
Light	[illegible]	[illegible]
Heavy	76	75
	159	144
Automobiles	[illegible]	77
All kinds	274	221

It is greatly to be regretted that there are no figures available showing the traffic conditions before the advent of the automobile, with which to compare the above figures. It may be said, however, that in seven years the motor vehicle traffic has increased on the State highways from substantially nil to 42 per cent in the summer months and to 35 per cent during the remainder of the year, when climatic conditions are favorable.

With the data now at hand the commission should be able to determine the character of surface which is needed for each road, and whether or not one of the bituminous products is needed as a binder to protect the road from the destructive effect of fast-moving automobiles.

Notes On Road and Street Work.

Cost of Street Cleaning at Geneva, N. Y.—The cost of all street cleaning at Geneva, N. Y., during 1909, according to the annual report of the Board of Public Works, was $4,971.53, not including team labor. The cost of cleaning the paved streets was $4,480.13, divided as follows: Asphalt pavement, $1,396.28, at rate of .0476 per sq. yd.; macadam, $1,404.90, at a rate of .02 per sq. yd.; tar macadam, $234.95, at a rate of .0063 per sq. yd.; brick, $1,444, at a rate of .014 per sq. yd.; all other streets, $491.40.

Dust Laying with Terracolio.—During 1909 the city of Chelsea, Mass., conducted experiments with Terracolio as a means for preventing dust on the streets in the residential sections. According to the recently issued report of the City Engineer the results were very satisfactory. The preparation was mixed with water and applied to the roadway from an ordinary watering cart.

[illegible] being as follows:

		Per [illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

These streets were all resurfaced in the fall of 1909, and the report states that after a winter of extreme severity and after having been subjected to the wear and tear of all classes of travel, not one bad place in the entire length has shown.

Cost of Paving Work at Holyoke, Mass.—During 1909 the city of Holyoke, Mass., constructed by day labor 17,731 sq. yds. of tar macadam, 1,420 sq. yds. of wood block, and 1,445 sq. yds. of granite block pavement. The following table taken from the annual report of James L. Tighe, city [illegible]

Streets.	Kind of Pavement.	Foundation.	Length in feet.	Square yards.	Cost per sq. yard.
[illegible] Street	[illegible]	[illegible]	585	[illegible]	[illegible]
Maple Street	[illegible]	[illegible]	998	[illegible]	0.52
Newton Street	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pine Street	[illegible]	[illegible]	[illegible]	6,530	[illegible]
Mosher Street	[illegible]	[illegible]	669	2,527	[illegible]
Jackson Street	Granite block*	Gravel	325	[illegible]	0.61
Main Street	Wood block	P. C. concrete.		1,420	2.78

*Blocks taken up from Main St. and relaid on Jackson St.

to five weeks. The total area treated with Terracolia consisted of 51,070 sq. yds., with 7,470 gals. of Terracolia, at a cost of $1,072.63 and labor and teaming $154.05, making a total cost of $1,226.68 or 2.4 cts. per square yard for the entire season, with an average of eight treatments.

Spencer Av. from Webster Av. to Vernon St. had also long been in an unsatisfactory condition and nothing but a complete rebuilding of its roadway would have improved

Crushed rock, f. o. b. cars Holyoke. Cost $90 per ton. Wooden blocks, f. o. b., Holyoke, cost $30.15 per M.; 54 blocks made 1 sq. yd. The tar was obtained from the Municipal gas plant. Common labor was paid 25 cts. per hour, pavers were paid $2.25 per day and teams and drivers were paid for at rate of $4.50 per day. An 8-hour day was worked.

A number of streets were also resurfaced, data on the cost of this work being as follows:

Streets.		Length in feet.	Square yards.	Cost per sq. yard.
Lincoln Street	Tar finish on macadam.	[illegible]	5,986	$0.055
Mosher Street	Tar finish on macadam.	1,098	4,150	0.065
Northampton Street		4,050	17,100	0.015
Pleasant Street	Tar finish on macadam.	[illegible]	4,981	0.055
Smith's Ferry Road	Tar finish on gravel	1,600	[illegible]	[illegible]
Springfield Road	Tar finish on gravel	[illegible]	[illegible]	[illegible]

After the first application it was found only necessary to apply this solution on heavily traveled streets once every two weeks and on the less traveled streets once every four its condition. This street was picked up and rebuilt with Tarvia X on a broken stone foundation of 4 ins. in depth. The total yardage was 2,680 and about 1¾ gallons of Tarvia were used to the square yard. The cost of this work was as follows:

	Total.	Per sq. yd.
Labor	[illegible]	[illegible]
Teaming	[illegible]	[illegible]
311 tons broken stone at $1.24	386.01	.144
4,732 gals. Tarvia at 7 cts.	331.24	.124
Teaming on tarvia returned	1.75	....
Fuel and oil	16.50	.006
Total (2,680 sq. yds.)	$953.73	$0.355

Eastern Av. from Broadway to across Hoopers St., was likewise in a very unsatisfactory condition on account of the heavy travel, causing cradle holes from side to side. The street was completely resurfaced with Tarvia X on a foundation of broken stone, 4 ins. in depth. The total yardage was 2,410 and 4,118 gals. of Tarvia or 1¾ per sq. yd. were used.

The cost of the work was as follows:

	[illegible]	Per [illegible]
Labor	$223.16	$0.092
Teaming	9.45	.004
Broken stone at $1.24	434.80	.181
4,118 gals. Tarvia at 7 cts.	288.26	.119
Fuel and oil	16.50	.006
Total ([illegible] 410 [illegible])	[illegible]	[illegible]

Crescent Av. from Broadway to Tudor St., was a source of complaint from the large number of carriages using it, on account of the fact that its macadam surface had almost completely worn off, exposing the large stone of its sub-surface. This street was resur-

A total of 7,927 lin. ft. or 6,491 sq. yds. of the concrete sidewalk was constructed at a cost of $0.73 per square yard. Portland cement concrete sidewalk, of which 896 lin. ft., or 651 sq. yds., was constructed, cost $1.40 per square yard.

The length and average cost of curbing laid in 1909 were as follows:

4,068	4-in. second class granite	$0.50	$0.78
7,149	6-in. first-class granite	0.72	0.99
[illegible]	Granite circles	0.95	1.22

Data on Street Sprinkling and Flushing at Geneva, N. Y.—The following data on street sprinkling and flushing at Geneva, N. Y., relate to work done during 1909 and are taken from the recently issued annual report of the Board of Public Works of that city. The city owns four Studebaker sprinkling wagons of a capacity of 750 gals. each and one Sanitary auto washer combination flushing and sprinkling wagon of 600 gallons capacity. The latter is fitted so that it can be used as a sprinkling wagon during the day and as a flusher for the asphalt streets at night. In charging this machine the water pressure from the hydrant compresses air in a tank giving the force necessary for flushing. The machine cost $999.51 f. o. b. Geneva, and the Board of Public Works states that it has proved to be entirely satisfactory both for flushing and sprinkling purposes.

The street sprinkling and flushing is done by contract and all of the above wagons are rented to the contractor at $60 each per season. At the beginning of the season the streets to be sprinkled were divided into four groups, one group for each cart. The contract for sprinkling the four groups was awarded at $78 per week. Work was begun under contract with the four wagons, on May 10, but as four additional streets were added to the list, it was found impossible to cover satisfactorily the entire yardage with the four wagons and on June 21 an additional group was added at the same proportionate price and from then until the end of the season the combination wagon was used during the day for sprinkling. The total length of streets sprinkled was 63,432 ft., the number of yards sprinkled being 200,030. The cost per square yard was $0.0159. The contractor began work May 10 and the season closed Nov. 15. The general figures on the cost of the sprinkling were as follows:

Labor previous to contract	$ 122.80
6 weeks at $78	468.00
21 weeks at $97.50	2,407.50
5 Sundays on Lochland Road at $4	20.00
Water charged to sprinkling	150.00
Advertising	2.33
One-half cost of combination flushing and sprinkling wagon	499.76
Insurance on wagons	13.50
Painting and repairs to wagons	134.64
Repairs to Castle St. crane	6.74
Sprinkling valves for hydrants	16.45
Total	$3,481.72
Less rentals of wagons to contractor	286.62
Total	$3,195.10

In previous years the flushing of the asphalt pavement on certain of the streets had been done three or four times a week by means of a hose. In 1909, however, the flushing wagon was used. In the early part of the season a man was hired to do the flushing at 40 cts. per hour, but on May 27 a contract was let to flush the streets at $17 per week. The contract began May 27 and the season closed Nov. 15. The total length of streets flushed was 5,150 ft., and the number of square yards flushed was 25,531. The cost per square yard was $0.04 and the average cost per front foot was $0.114. The general cost figures for the flushing were as follows:

Work done previous to contract	$ 36.80
25 weeks at $17 per week	425.00
Water charged to flushing	50.00
One-half cost combination flushing and sprinkling wagon	499.75
Insurance on wagon	12.00
Painting wagon	25.00
Advertising	1.17
Total	$1,049.72

It will be noted that one-half the cost of the new combination wagon was charged to the streets flushed, and one-half to the streets sprinkled. The rate on this account is therefore considerably lighter than usual. This is especially true on the flushing assessments where the cost is distributed over a much smaller frontage than by sprinkling.

Tarvia Macadam at Chelsea, Mass.—A greater part of the streets of the city of Chelsea, Mass., are surfaced with macadam. These streets at the beginning of 1909 were in a rather bad condition and it was decided to resurface a number of them with broken stone, applying hot Tarvia to the stone, sprinkling with stone dust and rolling. In the last annual report of James O'Brien, City Engineer, a description of this work is given and the following notes have been taken from that report:

Cary Av., from Spencer Av. to Washington Av., was one of the streets improved. This street had long been in a bad condition, on account of the flat grade and the heavy travel. This street was picked up and shaped, then thoroughly rolled and a layer of broken stone, 3 ins. deep, was laid and rolled; the Tarvia X was then applied hot, about 1¾ gals. to the square yard, until all voids were filled. Stone dust was then sprinkled over it and the whole rolled until the Tarvia flushed to the surface. The cost of the work was as follows:

	Total.	Per sq. yd.
Labor	$ 245.70	$0.065
Teaming	9.12	.002
304.4 tons broken stone at $1.24	377.45	.099
Fuel and oil	27.50	.006
6,828 gals. Tarvia at 7 cts	477.96	.126
Total (3,874 sq. yds.)	$1,137.73	$0.298

Cost of Maintaining Macadamized "Main" Roads in the Borough of Hampstead, England.

The Metropolitan Borough of Hampstead, England, has about 42 miles of macadamized roads, many of which are main roads and consequently are subjected to much traffic. Data on the cost of maintaining these main roads for a period of six years are given in the annual report for the year ending March 31, 1909, of Mr. Oliver E. Winter, Borough Engineer and Surveyor. The accompanying tabulation showing these data has been compiled from this report.

TABLE SHOWING THE COST OF REPAIRING MACADAMIZED "MAIN ROADS" FOR A PERIOD OF SIX YEARS.

Name of Road.	Area Paved. sq. yds.	When last Coated	Cost of repairs in cents per square yard. 1903-4	1904-5	1905-6	1906-7	1907-8	1908-9	Average for period cts. per sq. yd. per year.
Adelaide Road	8,893	During 1903-7	2.766	4.628	3.252	10.706	10.966	1.412	5.62
Avenue Road	7,302	During 1906-7	21.330	3.190	1.698	27.244	3.072	3.122	9.94
Belsize Road	3.616	During 1904-5	4.146	24.946	.546	3.678	1.74	8.138	7.20
Eton Avenue	7,553	During 1905-8	1.752	1.824	11.376	13.626	11.668	.194	6.74
Finchley Road	10,937	During 1903	54.38	.024[1]	.....	.....	.....	....	...
Finchley Road	8,423	During 1903[2]	54.38	10.248	16.392	.....	.....	....	
Finchley Road	5,193[3]	During 1906-7	.....	.....	.....	43.570	.....	....	.
Finchley Road	3,162[4]	During 1906-7	.....	.....	.....	.....	47.254	2.446	.
Haverstock Hill	12,272	During 1904-6	3.352	10.78	17.050	.....	.....	....	...
Haverstock Hill	10,366	During 1905-6	.....	.....	.....	1.986	3.424	.116	..
Health Street	4,848	During 1906-7	4.50	16.604	.010	24.10	.528	3.502	8.20
High Street	1,571	April 1902[5]	1.232	1.304	46.8	.....	2.246	1.658	8.87
Mill Lane	5,508[6]	During 1905-8	3.550	8.526	4.772	8.288	10.318	1.450	6.15
West End Lane	3,128	Partially 1904-5	4.544	27.186	.656	12.410	8.846	.350	9.165

1. Maintained until June 25, 1904.
2. And partially in 1904-5-6.
3. Maintained from Aug. 27, 1906.
4. Maintained in macadamized road from September 16, 1907; paved with wood in summer, 1908.
5. April and May, 1902, and partially in 1905-6. In 1903-4 area was 3,261 sq. yds., of which 1,687 sq. yds. was paved with wood in September, 1904.
6. Area in 1903-4 was 9,518 sq. yds., of which 3,201 sq. yds. were paved with wood in June and July, 1904.

Highway Construction in Cuba.*

In April, 1907, about six months after the beginning of the last American intervention in Cuba, the Provisional Governor decided to devote considerable sums of money to the construction of a number of good roads on the island. There were many excellent reasons for undertaking such work. During the whole time Cuba had been under Spanish dominion, and during the time it had been in the hands of the Cubans, but 610 kilometers (about 380 miles) of improved roads had been built on the island, the area of which is 41,000 square miles. The unimproved roads hardly deserved the name. In the low country many of them were veritable quagmires in wet weather, and so full of ruts and mud holes in dry weather as to be frequently impassable by ordinary wheeled transportation. In the hilly sections they were mere trails, steep, often rocky, and scarcely passable for lightly loaded pack animals. All transportation was exceedingly costly and very slow. Off the improved roads all transportation was by pack train and by "carretas" (two-wheeled carts, wheels about 7 ft. in diameter with tires only about 2½ in. wide, drawn by from four to sixteen bulls). It was no uncommon sight to see these "carretas" mired in mud holes to their axles. When loaded, they rarely made more than about 20 kilometers per day. The hardship that these conditions imposed upon isolated farmers and communities can be imagined easily; the military disadvantages of such a lack of practicable roads is equally apparent.

Economic considerations and matters of policy also had their influence; many laborers were idle; there was beginning to be some suffering, and consequent unrest; the building of roads would give employment to local labor and probably relieve the situation, which might otherwise grow menacing.

During the intervention, in addition to repairs made to many kilometers of existing roads, the construction of entirely new roads, aggregating about 750 kilometers in length, was undertaken, and most of these new roads were entirely completed, or well advanced toward completion, when the intervention ended on the 1st of April, 1909.

The work of building these new roads was entrusted to the Department of Public Works, but this department did not have under its control, at that time, a sufficient force of trained employes to permit the entire road building program to be undertaken; hence the Provisional Governor sought the aid of the Engineer troops with the Army of Cuban Pacification.

By orders from the headquarters of that army, the writer was directed to assume charge of the construction of four certain roads in the Province of Pinar del Rio. Upon his recommendation an officer of the Second Battalion of Engineers was placed in local charge of each road, and the writer was further given authority to detail such enlisted men as might be necessary for service on the different roads and to change them from time to time as the exigencies of the service might demand.

The multifarious duties devolving upon the battalion, and orders from Washington affecting both officers and men, made it necessary to change the personnel on each of the roads many times. Furthermore, the experience to be gained on this work was valuable, and an effort was made to permit as many of the officers and men as possible to benefit by it.

Right here it is desired to place on record the fact that this service was most exacting and arduous, and that the work done by all the officers and men of the battalion was performed faithfully and well, and often under most trying conditions. The four roads, whose construction was placed under the supervision of the writer, are described at some length below. All were macadam, or of telford-macadam, the width of metal 5 meters, and the maximum grade 6 per cent.

ROAD FROM PINAR DEL RIO TO VINALES.

Length, 26 kilometers. This road ran almost due north from the town of Pinar del Rio, about 170 kilometers west of Havana, and for about 11 kilometers it passed over a gently rolling country; then for some 13 kilometers it wound over the ridge, or, rather, series of ridges, to the beautiful valley of Viñales, into which it descended along the hillside, with the maximum grade for about 2 kilometers.

The work on this road was done under contract with a Cuban firm. This contract provided for the payment to the contractors the actual cost to them, plus 10½ per cent for all labor and for all materials incorporated in the work; $1.25 per day per $1,000 valuation of all plant employed during the time it was actually in use; $1 per day for each animal employed; cost, plus the 10½ per cent, of forage for animals; and the net cost of all freight. The contractor was also reimbursed for his own necessary, approved traveling expenses to and from the work, and for the cost of transporting his laborers and other employes to the work. It was further agreed that when the work was completed the Government should pay the net cost of returning all his plant to Havana, whence it all had to be taken to the work.

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*From a paper by Lt. Col. Mason M. Patrick, Corps of Engineers, U. S. A., in the Professional Memoirs of the Corps of Engineers, July, 1910.

A railroad runs from Havana to Pinar del Rio. All supplies and materials for the highway had to be hauled from the railroad station to the points where they were needed.

Work was begun on this road at the Pinar del Rio end in May, 1907, the beginning of the rainy season, which generally lasts from about May to about the last of October. Attempting to do road work during the rainy season was something of an innovation and necessarily made the work somewhat more costly. Work on this road was prosecuted through three rainy seasons. The fact that it was desired to put some of the local labor at work, without delay, was partly responsible for commencing at such a season of the year.

But little time was given for surveying and locating the route for this road; a somewhat elaborate survey of a possible route for about 4 kilometers from Pinar del Rio was found in the Department of Public Works; a bridge already built across the San Jose River some 7 kilometers from Pinar determined a point on the route; a line closely following the survey for the 4 kilometers was staked out, and then a line to the San Jose, selected after a hasty reconnaissance. The grading was started at once on this 7-kilometer stretch, and thereafter a number of possible routes for the remainder of the road were examined, and the best one finally chosen.

Stone was exceedingly scarce along the route of the road, only one quarry from which any considerable quantity could be obtained being discovered, and this a little more than halfway from Pinar to Viñales, at kilometer 15, where the road passed through a so-called "Mogote," an outcrop of blue limestone, which furnished an unlimited quantity of road metal. Some little stone was procured from two or three small quarries nearer Pinar del Rio, and a short stretch of road just outside this town was metalled with stone brought by rail from a quarry about 10 kilometers west of the town, and then hauled by wagon to the road. At the Viñales end of the road there were more "mogotes," and from one of them stone was procured for the last 6 kilometers.

The officer in local charge was given as much latitude as possible; the total length of road was at one time divided into three districts, with an Engineer sergeant in charge of each; one enlisted man served as clerk; other enlisted men as timekeepers; one, or more when necessary, in charge of transportation, keeping track of the number of wagons and animals employed, the number of trips made, the length of haul, and the quantities of materials hauled. All surveying was done by Engineer soldiers, who gave lines, set grade stakes, and made calculations of quantities. Rations in kind were furnished the enlisted men, as a rule, and prepared by an enlisted man as cook.

The contractor kept his own timekeepers, etc., but they were all checked by engineer soldiers. Work ordinarily commenced at 6 a. m. and continued until 6 p. m., with a two-hour rest from 11 a. m. to 1 p. m.

The contractor's orders for supplies were required to be submitted, for approval, to the officer in charge, and no bills for materials or services were paid unless approved by the officer in local charge. Every possible check was used and all vailable means were employed to insure the accuracy of the accounts rendered by the contractor, and to enforce due economy on his part. See remarks below on this form of contract.

An effort was made to keep accurately all unit costs, but in this particular the results were not as satisfactory as were desired. This was due to many reasons: the officer's time was so fully occupied that he could not do this himself; the enlisted men, while excellent in other capacities, were unfamiliar with such work, and but few of them could do it at all; work on different features was progressing simultaneously; men, materials, and plant were frequently moved from one job to another, making it a matter of no small difficulty to separate the costs. Some unit costs were secured, and are given below, as well as the approximate total cost of the entire road.

For a span no greater than 10 meters the bridges were constructed with concrete abutments, the floors of reinforced concrete supported by I-beams, and designed to support a rolling load of 15 tons. Bridges over 10 meters were steel trusses on concrete abutments and piers. On this road there were six 10-meter bridges; two 50-ft. truss bridges; one 110-ft. truss bridge; one truss bridge with a channel span 120 ft., and two 50-ft. shore spans.

A traction engine and cars were purchased by the Department of Public Works and sent to this road for use, but failed to cheapen the cost of transportation, as had been hoped. This was due to several reasons: possibly, partly to inexpertness of the men who were employed to run it, but more decidedly due to the fact that the engine selected was not of the proper type, was poorly constructed, constantly breaking down, due apparently to poor material used in its construction, and to faults of manufacture. This engine was too wide for use on the road; special turning points had to be provided, and, as much of the road was on side hill cuts and on fills where turning space could not be provided, time was lost in going to and from a point where the engine could be turned. The maximum haul from the quarry was about 8 kilometers, and though this was costly with wagons, yet, owing to the difficulties with the traction engine and train, wagon transportation was more economical, though the very best that could be gotten out of a four-mule team was about 30 kilometers actual travel per day. This made the average cost of hauling about 40 cts. per cubic meter of stone per kilometer.

Grading was done by hand and with drag and wheel scrapers. With the drag scrapers both mules and bulls were used; bulls were slow moving, but the steadiness of their pull and the ease with which they loaded the scrapers made them as efficient as the mules where the haul was short. Bulls required no forage, living on grass, while the forage for each mule cost, on an average, about 70 cents per day. Wheeled scrapers were not economical, as a rule, partly due to the inefficiency of the foremen and their inability to handle the outfit to the best advantage, resulting in crowding, delays in loading, and improper loading.

All drilling was done by hand; men who could operate steam drills could not be found. The cost of quarrying stone varied within wide limits, but, finally, it was arranged with a subcontractor to quarry stone at the largest quarry for 65 cts. per cubic meter, this to include furnishing explosive, dynamite, and fuses, and breaking the stone into pieces of suitable size to enter the crusher.

Two small jaw crushers, capacity about 40 cubic meters each per day, and one gyratory crusher, capacity about 150 cubic meters per day, were used on the work. The cost of crushing the stone varied from 20 cts. to 60 cts. per cubic meter, the latter figure being much in excess of what it should have been.

A roller, operated by an internal combustion engine using alcohol, was used on this road. Owing to the relatively high cost of coal, it proved more enonomical than the ordinary steam roller; it weighed, however, but 10 tons and was too light for rolling Telford, but gave good rusults rolling macadam.

To anchor the road metal, and to a certain extent to discourage driving off the edge of the metal, borders of large stones were embedded along the sides; the natives called these "paseos," or walks, though they were made rough and jagged intentionally to prevent passing over and along them. These "paseos" required about 1⅓ cubic meters of stone per lineal meter of road, added to the cost of the road, and as the interstices soon filled with fine material, they interfered with the drainage from the road surface, and were later omitted.

ROAD FROM VIÑALES [illegible] ANO-ESPERANZA.

The portion of this road from Viñales to San Cayetano, 16 kilometers in length, was constructed under a cost plus 10½ per cent contract similar to the one described above. [illegible] seacoast some 7 kilometers from San Cayetano, and the road between these two places was unfinished; the new road from Pinar del Rio, the nearest railway station, 26 kilometers from Viñales, was just begun, and it was absolutely impossible to get materials and supplies by rail. A single steamer from Havana, whence everything had to be brought, touched at Esperanza; this steamer had an absolute monopoly, and freight rates by it were abnormally high. The local owners of transportation, bulls and bull carts, had formed a "trust," and they gleefully charged all the traffic would bear. To haul a small stone-crushing plant from the port about 15 kilometers to the quarry took ten days and cost $270. The existing road, or trail, was repaired, and some ten temporary bridges were built as soon as possible; thereafter all hauling was done by the contractors' mule teams in ordinary wagons.

From near Viñales, for about half its length, the road runs along the bases of towering "mogotes" and through gaps between them; along this part of the road, of course, stone was abundant, and the quarries were so selected as to reduce the average haul to a little less than 2 kilometers. The remaining 8 kilometers of the road had to be metalled almost entirely from a quarry at the southern end of this stretch, making the haul longer and more costly; a small quarry was opened about halfway along this piece of road, but the supply of stone that could be obtained from it at reasonable cost was soon exhausted.

There were six bridges of 10-meter span on this road, all built like the similar ones on the Pinar-Viñales road, and numerous culverts, but no truss bridges.

Beyond the northern end of this road, for about 2.5 kilometers, metal was placed on the roadbed which had been graded under another contract, making the total length of this road, finished, about 18.5 kilometers.

At Los Banos de San Vicente, some 6 kilometers from Viñales, there are warm springs strongly impregnated with sulphur; a short distance farther, but a little off the road, there is one producing copper mine.

ROAD FROM GUANE TO LUIS LAZO.

Length, 33 kilometers. This road was constructed by a firm composed of Americans under a cost plus 10½-per-cent contract.

Leaving Guane, this road crosses a depression, over which it was carried on a fill about 1 kilometer long and 3½ meters high, with an opening 50 ft. wide for drainage, spanned by a steel truss bridge.

The first available quarry was about 5 kilometers from Guane; thereafter, for about 25 kilometers, quarries were opened close to the road, and so located that the haul was short for both Telford and crushed stone. At the Luis Lazo end of the road the maximum haul from the quarry would be about 4 kilometers. This road was longer than any of the others, and was not entirely finished when the American intervention ended.

When it was commenced, the then terminus of the railroad was some 12 kilometers from Guane, the road over which all supplies had to be taken in was execrable, and it was nearly a year before the railway was extended to Guane.

There were two 50-ft truss bridges, one such bridge with two 90-ft. spans, one with a 70-ft. span, two with an 80-ft. span each, one with a span of 100 ft., one with a channel span 100 ft. and two shore spans of 50 ft. each.

On this road the piece [illegible] (see below) was applied more extensively than on any of the others, and with excellent results. All work that it was possible to do in this manner was so executed—grading, quarrying, mixing, and placing concrete in bridge piers, laying telford, spreading crushed stone.

Leaving the Luis Lazo valley, the road runs west for several kilometers through a narrow gorge between high "mogotes" along the Cuyaguatehe River, the second largest stream in Cuba, which it crosses twice. The Cuyaguatehe is an ever-flowing stream, one of the few rivers in Cuba which has, apparently never been known to run dry; it enters the Luis Lazo valley through a natural tunnel, more than a kilometer long, under the "mogotes;" at ordinary stages of the river this tunnel can be traversed by men on foot, but the high-water marks are well up on the sides of the tunnel, and in times of flood the stream carries a great volume of water, overflows its banks, and frequently does considerable damage.

The contractors used a traction engine of their own, of a type which proved more satisfactory than those purchased by the Government. With it there were some flat-bottomed, side-dump cars, from which the broken stone did not unload easily; this was remedied by putting in false bottoms about one-half meter high along the axes of the cars, sloping to the outer edges, and increasing the height of the sides of the cars to compensate for the space thus taken up.

A small steam shovel was used in making the fill about 1 kilometer long across the low ground just north of Guane; the average height of fill, 3 meters; side slopes, 1 on 1; top width, 7 meters; material hauled in dump cars from shovel to fill; cost 42 cents per cubic meter.

ROAD FROM SAN JUAN Y MARTINEZ TO PUNTA DE CARTAS.

Length, 16.7 kilometers. It was decided to undertake this road by hired labor. For a little over 5 kilometers from the seacoast the route of the road ran through a swamp, whose elevation was only a little above high-tide level, which was frequently flooded by storm tides, and invariably so during rainy seasons, and when the San Juan River, flowing through it, overflowed its low banks. It was necessary to carry the road on embankment for most of this distance; material of which to make this fill was hard to obtain in the swamps, and this added largely to the cost of the road.

The only quarry where stone could possibly be obtained was about 1 kilometer from the inland end of the road, so that the maximum haul for stone was about 18 kilometers, also very costly. At the beginning, the Government had but little plant available for this work, and it was necessary to purchase almost everything from picks and shovels to a complete stone-crushing plant. All the cost of this plant, about $50,000, was charged to this one road, and figures in the total cost as given below. The deterioration of the larger pieces of this plant was not great during the progress of the work, and it was available for use elsewhere when this road was finished. As it was expected that other roads in the vicinity would be built, and as the quarry was the only one in the neighborhood, the stone-crushing plant was installed in a substantial building, where it would be protected and could be operated during rainy seasons. A traction engine and cars, similar to those used on the Pinar-Viñales road, were bought by the Public Works Department for use on this road, but the experience with them was practically the same as with the traction train on the Pinar road: The engine was so wide that nothing else could pass it on the road, it could not turn around on the road, and turning places were hard to find; there were constant breakdowns, due, apparently, to poor material and poor workmanship. Most of the hauling was done with mules in dump wagons and slat-bottom wagons holding about 1.5 cubic meters of stone. By keeping one engineer soldier continually after the transportation, it was found possible to get about 48 kilometers a day travel by a mule team. By fixing a long and short haul the teams made a round trip on each haul per day. The wagons were loaded in the late afternoon and driven to the stable, about 2 kilometers along the road from the quarry. They started the next day at about 3 a. m. on their long haul, returned to the quarry, made their short haul, back to the quarry, loaded for next day and went to stable. They rested for about three hours in the middle and hottest part of the day. Later, a considerable amount of hauling was done by bull teams, which made slower progress but the price paid made the cost of hauling per cubic meter no greater.

On this road the only work done by the piece system was the quarrying; the officers in local charge, and the soldiers assisting them, were not familiar with it, and at first did not speak Spanish well enough to manage it. All these men did acquire a good working knowledge of Spanish after a time. At first, one fine, old sergeant reasoned thus with a laborer demanding more pay: "Usted can hablar till you morir but no get mas pagar." The man seemed to understand.

There was one truss bridge erected on this road over the San Juan River; the abutments built by the Government, the bridge, 130 ft. long, furnished and erected by contract. In building the abutments of this bridge, as many large stones as possible were embedded in the concrete, thereby reducing the cost per cubic meter considerably. Care was taken to see that the stones were clean and thoroughly wetted before they were put in place. The cement cost $4.15 per barrel at the site; sand was obtained from the river bed; broken stone was hauled from the quarry 1.5 kilometers distant; this concrete cost $9.50 per cubic meter.

The steel truss bridges were in accord with the standard designs of the Department of Public Works, and were all purchased in the United States; the steel cost f. o. b. Havana $75 per ton of 2,000 lbs. It was shipped by rail from Havana, and, in some cases from the nearest point on the railway, had to be hauled on wagons 20 kilometers and more. The price paid for erection was $30 per ton. This included furnishing and placing the false work, removing it after the bridge was erected, painting the superstructure two coats of paint, and putting in place the flooring, paint and lumber for flooring being furnished by the Government. The bridge flooring delivered at the site cost from $48 to $60 per 1,000 ft., B. M.

On all this bridge steel, though it was imported for the Government the Treasury authorities exacted the payment of the duty. As this was material for use on the roads, and as the amount paid for duty was part of its cost to the contractor, under the contract the amount paid for duty was duly repaid them, plus their 10½ per cent. This matter was explained at length orally and in writing to the officials, but they declined to change their ruling, and required the duty to be paid to the Treasury Department, and a few days later the Department of Public Works had to pay back to the contractor the sum paid for duty, plus 10½ per cent.

It was found in Cuba that work on these roads was most economically performed when arrangements or agreements could be made to have it done by piecework. This was true of the grading, quarrying, hauling, stone crushing, laying telford, spreading macadam, rolling, making, and placing concrete; work under all the above heads was done on one or more of the roads by this system. The native workmen organized themselves into gangs under a foreman, or "Capitaz," of their own choosing, and would take the jobs of grading, etc., by the cubic meter, and practically invariably by this system the work was done more cheaply than by day labor.

The grading on all these roads varied from solid rock, through cemented gravel, stiff clay, sandy clay, to pure sand. When paying for grading by piecework, the price paid depended upon the nature of the material, and was rarely agreed upon in advance; as a rule, the engineer fixed this price fortnightly, after the work was done; a careful record was kept of the number of men working in each gang, of the amount of material moved, the hours worked, upon which no restriction was placed, and a note as to energy with which the work was prosecuted. When the work was satisfactory, as a rule the price per cubic meter agreed upon was such as to give the men a little more than they would have earned by day labor. It was interesting to note how keenly some of them watched and checked the engineer's measurements and calculations.

The stone quarried would be piled so that it could be measured; the quarry men would utilize stumps to swell the cubic contents of their piles, and would leave domed or arched-shaped vacancies therein, if they were not watched, sometimes spending more time on such devices than it would have taken to quarry and pile the stone which would have filled such spaces. But, as a rule, they were fairly honest, and, in their way, hard workers when the amount they earned depended thus upon their own exertions.

American cement was used entirely in making concrete. There is a cement-making plant at Havana, but the price of its product was but a few cents less per barrel than for well-known brands of cement made in the United States, while the quality of the Cuban article was not so good. American cement delivered at points on the railroad about 200 kilometers from Havana cost, on an average, about $3.75 per barrel; to this had to be added the cost of hauling to the site of the work, often a long distance from the railroad. Another item which added largely to the cost of concrete was the unexpected difficulty in procuring sand at inland localities. Very little sand was found in the beds of the streams, and that which was found was poor in quality, and frequently had to be hauled several kilometers; crusher dust was used when it was available.

Concrete varied in cost from about $9 per cubic meter in the abutment of the San Juan bridge, where sand was near at hand, and where many large stones were used in the mass, to about $22 per cubic meter when placed in small quantities in culverts, etc., in places where the materials had to be hauled long distances.

The itemized cost of the 1 : 3 : 5 concrete in the abutments for the Guama bridge, on the outskirts of the town of Pinar del Rio, was as follows:

	Per cu. meter.
Cement	$3.65
Sand	0.21
Small stone	0.88
Large stone	0.13
Reinforcement	0.16
Materials for framing	1.53
Excavation	0.86
Labor for framing	0.97
Labor mixing and placing	2.19
Total cost per cubic meter	$10.58

The labor cost of making macadam road 5 meters wide, exclusive of grading and of cost of material, per meter of length, was about as follows:

	Per lin. meter.
Boxing and laying shoulders of large stone	$0.225
Spreading macadam	0.075
Spreading binder	0.033
Sprinkling	0.030
Rolling	0.367
Total	$0.73

Kilometer posts marking distances along the highways had formerly been of cut stone, costing $10 each at the quarry; for these there were substituted posts made of concrete, of simple design, costing $4.88 in place.

It may be interesting to give some of the average prices of materials in Cuba, for comparison with prices in the United States:

Alcohol, per liter	$ 0.40
Bran, ton of 2,000 lbs	40.00
Corn, ton of 2,000 lbs	36.20
Hay, ton of 2,000 lbs	40.00
Oats, ton of 2,000 lbs	69.25
Cement, per barrel	3.75
Coal, bituminous, per ton of 2,000 lbs	6.85
Lumber, per 1,000 ft. B. M.	50.00
Oil, illuminating, per gal	0.36
Oil, machine, per gal	0.43
Dynamite, per ton of 2,000 lbs	412.65

The prices above are for materials delivered at the railroad stations nearest the work, and to them must be added the cost of hauling.

The total amount expended on all these four roads under American supervision was $1,628,000. Of this amount the truss bridges, whose aggregate length was 1,370 ft., with their piers and abutments, cost, finished, approximately, $100,000. The plant purchased for hired labor work cost about $50,000, and it was worth to the Government $40,000, after deducting a fair percentage for wear and tear. Of the Guane road, but about 12 kilometers were entirely finished, but all the remainder, 21 kilometers, was graded, and all the stone for this stretch had been quarried. Adding to the lengths of roads given above:

the 1 kilometer made in [illegible] Viñales, 2.5 kilometers metalled beyond the end of the Viñales-San Cayetano road, and 1 kilometer made into quarry at San Juan y Martinez, the aggregate length of road entirely finished was about 73 kilometers, and the actual net cost, deducting cost of bridges, and amount spent on incomplete road and value of plant, was about $1,275,000, or something over $17,000 per kilometer, a cost which is very high, compared with the cost of similar work in the United States, but which, for reasons given below, was as low as it could be kept, and not unreasonably great when all the existing conditions and difficulties are given due weight.

The cost plus a percentage form of contract was entered into for three of the roads above described, two of the contracts being made with Cubans, and one with an American firm doing business in Cuba. Under such a contract it is manifest that the greater the cost of the work, the greater is the contractor's gain. In other words, there is but little incentive for a contractor to do economical work, to institute and insist upon the many saving methods which can be and are employed when his profit depends entirely upon how cheaply he can do satisfactory work. Even if the contractor is honest and means to do economical work it is most difficult to get the best results from his subordinates, his foremen, and even from the ordinary laborers, all of whom are generally more devoted to the interests of the contractor than to those of the Government, and all of whom know that the contractor profits more if their work is done inefficiently and in the most costly manner. Securing economical work is immensely harder if the contractor himself is unscrupulous, and simply means to make all he can out of the job, and cares not all what is the cost to the Government.

There are hundreds of ways by which such a contractor can increase the cost of the work, in spite of the most rigorous inspection and requirements. This is particularly the case when the inspecting force is not thoroughly familiar with language used by the workmen. With all conditions favorable, a trustworthy contractor meaning to give the very best results for the money expended, the work of superintending and inspecting under such a contract is easy, but under adverse conditions no form of contract is known which will cause more annoyance, greater trouble, and give less satisfactory results.

The following is quoted from the report of the Provisional Governor for the year 1908: "The excessive cost of construction work in Cuba over that in the United States * * * may be attributed to several causes, the principal being [illegible] added cost of work and expensive delays; all feed, lumber, machinery, fuel, cement, etc., must be imported at large cost; delays due to being away [illegible] and beast are not as efficient in a tropical climate; inefficiency of labor, an ordinary man doing in Cuba half the work at nearly as high wages as the laborer in the United States; difficulty in obtaining trained mechanics and foremen at reasonable wages."

The conditions throughout the island, and especially in the western part where these four roads were built, placed the agriculturist who lived at any appreciable distance from the railroad or a seaport at a marked disadvantage. A portion of the benefit derived from the new roads may be gathered from the statements in the report of the Governor for 1908 that "The road from Pinar del Rio to Viñales and Esperanzo reduced the price of passenger transportation from $15 to $1.50, and the time of the trip from three days to three hours. The cost of transporting tobacco from the Viñales valley to Pinar del Rio, the nearest railway station, was reduced from $3 per hundredweight to $1 per hundredweight, and as the trip can be made in a few hours, instead of days, as heretofore, the danger of the tobacco being injured by exposure to sun and rain is reduced to the minimum."

Other roads cut transportation charges in half; in addition, by giving access, in many cases, to both the seacoast and railroads, there was a reduction in freight rates by common carriers. On many of the roads automobile 'bus lines were established and vigorously patronized.

Macadam roads in Cuba, as elsewhere, deteriorate, and demand constant care to keep them in proper condition. Several reasons operate in Cuba to make their maintenance costly; the stone available for road construction is limestone, which pulverizes under traffic and forms a very fine dust. Except in the towns, the roads are not sprinkled, and, during the long, dry season, much of the top dressing is blown away. The rains in the wet season are heavy, the ditches frequently clogged, and the subgrade becomes saturated so that the traffic then forms ruts and inequalities, which, if not repaired, rapidly grow worse. In spite of regulations governing traffic, it is practically impossible to keep the narrow-tired, heavily loaded "carretas" off the roads; these vehicles not infrequently bring upon the roadway a pressure of from 1,500 to 2,000 lbs. per inch width of tire, most [illegible] breaking it there, or even off the metal entirely, making ruts, which rapidly enlarge during the rains.

[illegible] the roads the Government has built road houses, in which are lodged usually two laborers, and where are kept the necessary tools for repairing the roads. There are also overseers, who usually have charge of some 20 to 30 kilometers of road; the overseer and the laborers are supposed to keep the road in repair, but their work is frequently poorly done. Grass grows readily on the strip of earth bordering the road metal on each side. If encouraged, and simply kept trimmed, this grass would assist in preventing erosion, but it was almost impossible to keep the laborers from cleaning this strip of grass with hoes and destroying the roots. The road overseers are paid $900 per year and furnished with quarters; the laborers, $360 per year, with quarters. The average cost of the houses built [illegible] each. At each of the laborers' houses there are kept one or more draft animals, with harness and carts and the necessary tools for the care and repair of the roads. A steam roller is also provided for use on the section under each overseer.

The interest charge on the first cost of the houses, animals, tools, etc., allowing a moderate percentage for deterioration, and adding the annual salaries of the employes, gives an aggregate cost for maintaining these roads of about $200 per kilometer per annum. To this must be added the most of materials, and the appropriation is further charged with a part of the salaries of the provisional engineering force and also of the Department of Public Works in Havana; how much these add to the cost is uncertain, but it is understood that the Department estimates the cost of the upkeep of these roads at not less than $400 per kilometer per annum.

When the American intervention ended in April, 1909, some of the roads then unfinished were under contracts which the succeeding Cuban Government was pledged to carry out. After such contracts are completed, whether or not the Cubans will continue this good work is problematical. No expenditure of public funds will bring a greater return and be of more benefit to the island, and it is certainly to be hoped that a portion of the yearly revenue may be devoted to continuing the construction of good roads.

STEAM AND ELECTRIC RAILWAY SECTION

Methods and Costs of Surfacing and Smoothing Track.

BY D. A. WAL[illegible]

A surfacing gang should never waste time waiting for passenger trains. The entire gang can be used to excellent advantage in cutting jack holes if the first raise is being delayed by a passenger train. If a train causes a delay during the second raise, the gang can be put to work dressing up. During any considerable raise in surfacing track in which the ties are not to be removed, time will be saved by using two good men to follow the jacks, spacing ties to chalk marks. Under no circumstances should one side alone of the track be raised and tamped, but both sides should be raised together with as many jacks under one rail as under the other. No two men tamp with the same degree of thoroughness. In order that the end of each rail at the joint shall have the same support, it is necessary that the heads of the joint ties be tamped by the same man.

SURFACING—GANG ORGAN[illegible]

I am indebted to W. L. Choate, Illinois Central R. R., for the careful trial of these gang organizations in actual work.

Stone, 3 ins.; 4 or 5 Ties R[illegible] per Rail A Foreman and 30 Men.—Four jacks should be used with 2 men to each jack. The jack men should put in the joint ties. Eight good men should be kept removing ties behind the jacks. The remainder of the gang should tamp up.

Stone, 3 ins.; No Tie Renewals. A Foreman and 30 Men.—[illegible] men to each jack. Two men should be put to spacing ties behind the jacks and the other 24 men can be put to tamping, 4 abreast.

Stone, 4 ins.; No. Tie Renewals. Foreman and 20 men.—Work 4 jacks with 2 men to each jack. Let 4 men catch up heads and 4 men the insides; 3 men can carry on the necessary gaging and spiking and 1 man can carry water, plug holes, etc. The 3 men spiking will not be able to keep right behind the surfacing with the gaging, but while the gang is engaged in smoothing up the first raise, the spikers will have a chance to get to the end of the surface with their work.

Stone, [illegible] and 10 Men.—Work 4 jacks with 2 men at each jack. The jack men put in the ties in each half rail length while the remaining 2 men are catching up the heads. The foreman can help in spiking where there are no more than 3 ties to put in to face. At the close of the day's work the foreman should tamp up the run-off; while 4 jack men spike the ties and tamp up the insides. The other men can tamp the heads.

Gravel, 4 ins.; Tie Renewals. Foreman and 25 Men.—Use 4 jacks with 2 men to each jack; 8 men to shuffle insides; 4 men to shuffle heads; 3 men to gage track, and 2 men to put in ties. When the jack men get further than 60 ft. ahead of the tampers, they should go back and assist in putting in ties, as it is impossible for 3 men to keep up with the surfacing. They can reach the end of the surface when the gang is put back to smoothing the first raise.

Gravel, 4 ins.; No Tie Renewals. A Foreman and 40 Men.—Work 4 jacks with 2 men to each jack. Pick out 6 good men to use as tie men, and let the jack men put in the joint ties. [illegible] in a gang of this size. The other 20 men can come up with the shuffling, inside and out.

[illegible]—[illegible] to each jack; 2 men spacing behind jacks and 1 man knocking out jack eyes and carrying water; [illegible] level board and helping shuffle. This surface

can be carried on for two days, when the gang should be put back to pick tamping the first raise with a 2 or 3-in. surface.

Raise 3 ins.; Tie Renewals. A foreman and 27 Men.—Work 4 jacks with 2 men to each jack. Use 1 spike puller; 4 men spiking; 2 men nipping; 11 men pick tamping; 1 man carrying water and plugging spike holes. Let 2 jack men pull out the ties to be renewed and the 2 opposite jack men slip in the new ties. The surfacing should be stopped about 1½ hours before quitting time, the track lined up and 20 men be taken back to dress up. In the meantime the spikers can be completing their work to the end of the surface.

SMOOTHING-GANG ORGANIZATION.

The smoothing up track, low places on the high rail should be pulled to the surface by eye and the low rail be brought to the level of the high rail with the level board.

Foreman and 6 Men.—Work 2 jacks with 1 man to each jack, and use the other 4 men tamping. The foreman can carry the level board and chalk mark the ties that need tamping. He can also help the jack men in tamping off bar-springs. After the track is lined, 5 men should dress up while the foreman and other men are gaging out rail kinks.

Foreman and 10 Men.—Work 2 jacks with 1 man to each jack. Let 1 man handle the level board and also assist the jack men in springing quarters with the nipping bar. Use 7 men tamping behind the jacks. The foreman will be kept busy watching the tamping, and when the tamping and lining for the day is done the foreman can gage out kinks while the track is being dressed up.

RECORDS OF WORK.

Foreman's wages are not included in the costs in the following records, except as shown. As the cost per mile of the foreman's wages is dependent on the number of laborers in the gang.

(1) In this work dirt surface track was stripped and stone ballast unloaded from Rodgers bottom dump ballast cars. The raising was done with a spotboard and four or five days later the second raise of a 3 or 4-in. surface was made with tamping picks. The record for 20 days—first raise 7 ins. in rock from stripped dirt track shovel tamped—was as follows:

Number of ft.	Number of Rails.	Hours Worked.	Ft per Man Per Day.
930	31	355	26
480	16	270	18
690	23	365	19
300	10	106	28
500	16	210	23
480	16	210	23
500	16	195	25
500	16	200	25
340	11	131	25
600	20	320	19
600	20	210	28
350	11	160	22
600	20	220	27
300	10	100	30
400	13	170	23
600	20	210	28
600	20	200	30
462	15	145	30
400	13	190	21
510	18	190	28
Average			25

Italian labor was employed at $1.25 per day with a foreman at $60 per month. The cost of surfacing was, therefore:

Surfacing 1 ft. of track	$ 0.05
Surfacing 100 ft. of track	5.00
Surfacing 1 mile of track	264.00

(2) This work consisted of surfacing track 4 ins. in rock on top of a 6-in. raise where ties had been renewed at the rate of about 7 per rail length. The work included spacing and gaging. The record for 7 days was as follows:

Number of Ft.	Number of Rails.	Hours Worked.	Ft. per Man per Day.
230	8	8	26
330	11	15	22
265	5½	9	18
265	5½	11	15
100	3	3	33
110	4	4	26
330	11	22	22
Average			

Negro labor at $1.25 per day and foreman at $60 per month were worked. The cost was, therefore:

Surfacing 1 ft. of track	$ 0.057
Surfacing 100 ft. of track	5.70
Surfacing 1 mile of track	301.00

(3) This work consisted of surfacing track 3 ins. in rock on top of a 7-in. raise where ties had been renewed at the rate of about 7 to the rail length. The record for 7 days was as follows:

Number of ft.	Number of Rails.	Hours Worked.	Ft per Man Per Day.
240	8	10	24
198	7	7½	26
230	8	20½	12
198	6	12	16
148	5	8.3	18
594	20	23	25
247	8	13	18
Average			20

Negro labor at $1.25 per day and foreman at $60 per month were worked. The cost, therefore, was:

Surfacing 1 ft. of track	$ 0.0625
Surfacing 100 ft. of track	6.25
Surfacing 1 mile of track	330.00

(4) On this work new rail had been laid on track which was in very poor surface. In order to keep the new rail in good condition, a 3-in. stone surface was necessary. Sufficient stone for the raise was taken from the shoulders of the ballast then in place. The surfacing was done immediately after rail renewal. The record for 8 days was as follows:

Number of Ft.	Number of Men.	Ft. per Man per Day.
265	12½	21.2
300	9½	31.5
900	35	28.5
660	31	21.3
581	25½	22.8
528	24½	21.1
550	25	22
460	15	30.6
Average		24.8

Negro labor at $1.25 per day and foreman at $60 per month were worked. The cost, therefore, was:

Surfacing 1 ft. of track	$ 0.0443
Surfacing 100 ft. of track	4.43
Surfacing 1 mile of track	234.00

(5) This work was the first raise of 7 ins. in screenings for stripped track, shovel tamped. The record was as follows:

Number of Ft.	Number of Hours	Ft. per Man per Day.
430	150	29
450	150	30
550	150	33
500	175	29
Average		30

Italian labor at $1.25 per day and foreman at $60 per month were employed. The cost, therefore, was:

Surfacing 1 ft. of track	$ 0.041
Surfacing 100 ft. of track	4.10
Surfacing 1 mile of track	216.50

(6) This work was the second raise of 3 ins. in screenings on a 7-in. raise track lined and dressed, pick tamped. The record was as follows:

Number of Ft.	Number of Hours.	Ft. per Man per Day.
600	40	150
200	20	100
200	20	100
Average		116

Italian labor at $1.25 per day and foreman at $60 per month were worked. The cost therefore, was:

Surfacing and lining 1 ft. of track	$ 0.0107
Surfacing and lining 100 ft. of track	1.07
Surfacing and lining 1 mile of track	56.00

(7) This work was the first raise of 7 ins. on cinders from dirt stripped track, shovel tamped. The record was as follows:

Number of Ft.	Number of Rails.	Hours Worked.	Ft. per Man per Day.
600	20	200	30
600	20	140	43
Average			36

Italian labor at $1.25 per day and foreman at $60 per month were worked. The cost was:

Surfacing 1 ft. of track	$ 0.034
Surfacing 100 ft. of track	3.40
Surfacing 1 mile of track	180.00

(8) These records were taken from work of three sections and one extra gang. The track was poorly ballasted with hand napped stone and was raised 4 ins. on gravel consisting of pebbles and non-cementing sand. The rail was laid with broken joints. Gravel was unloaded from bottom dump coal cars at a cost of 30 cts. per cu. yd. on the ground. These records were kept in order to determine the most economical method of making a raise of 4 ins. under these conditions. The track put up by Sec. No. 1 stood 1st. The track put up by Ex gang No. 1 stood 2d. The track put up by Sec. No. 2 stood 3d. The track put up by Sec. No. 3 stood 4th. Negro labor at $1.10 per day and foreman at $50 per month were worked.

Section 1—Made one raise and pick-tamped the length of the tie except 14 ins. in the middle; raised track one day and dressed up on the following day. The record of 11 days' work was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
200	5½	36
150	3	33
300	8	38
150	4	37
160	4	40
180	5	36
280	9	31
280	8	35
200	6	33
200	5	40
250	7	36
Average		.36

With a gang of 6 men 1 mile is surfaced in 24 days at the following cost:

Labor at $1.10 per day	$161.60
Foreman at $50 per mo	38.40
Total	$200.00

The record for dressing was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
500	7	71
600	6	100
300	4	75
300	3	100
600	8	75
Average		.84

With a gang of 6 men 1 mile of track is dressed in 10 days at the following cost:

Labor at $1.10 per day	$68.70
Foreman at $50 per mo	16.00
Total	$84.70

Section 2.—Made one raise, pick-tamping heads of ties and shovel-tamping insides except 14 ins. at centers. The track surfaced on one day was dressed the next day. The record for surfacing was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
200	4	50
300	6	50
260	5½	47
300	6	50
200	4	50
270	5	54
240	6	40
230	6	38
260	5	52
360	7	51
240	6½	37
450	8½	53
360	7	51
430	9	47
330	7	47
100	2	50
350	7½	46
Average		48

With a gang of 6 men 1 mile is surfaced in 18 days at the following cost:

Laborers at $1.10 per day	$121.40
Foreman at $50 per mo	28.80
Total	$250.20

The record for dressing, working a gang of 7 men, was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
500	6½	77
900	9	100
700	7½	93
900	9	100
500	6½	77
700	7½	93
500	6	83
Average		89

With a gang of 7 men 1 mile was dressed in 8 days at the following cost:

Laborers at $1.10 per day	$64.90
Foreman at $50 per mo	12.80
Total	$77.70

Section 3.—The track surfaced by this gang was shovel tamped heads and inside. After an interval of 3 days the gang went back over the raised track and caught up low joints with picks and put up the track complete. The record for surfacing was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
200	6	66
330	3	110
300	4	75
270	3½	77

330	4	81
210	[illegible]	[illegible]
180	3	60
330	4	81
360	6½	55
450	7	64
Average		74

With a gang of 4½ men 1 mile was surfaced in 16 days at the following cost:

Labor at $1.10 per day	$73.20
Foreman at $50 per mo	25.60
Total	$98.80

The record of smoothing was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
250	4	60
350	6	58
250	4	62
360	5	72
250	5	50
250	3	83
225	5	45
420	8	53
420	8	53
400	7	57
Average		59½

With a gang of 5½ men 1 mile was smoothed in 16 days at the following cost:

Labor at $1.10 per day	$ 97.15
Foreman at $50 per mo	25.60
Total	$122.75

In dressing, the foreman sent 3 men back to work alone; the record was as follows:

Number of Ft.	Number of Days.	Ft. per Man per Day.
150	2	75
240	2	120
360	3	120
240	3	80
450	3	150
450	3	150
600	4	250
600	5	120
Average		133

This gang of 3 men dressed 1 mile in 15 days at a cost of $43.30 per mile.

Extra Gang—This gang made a 5-in. raise shovel tamped ties on first raise and after 3 or 4 days went back over the work picking up low places with the pick. The gang made an average of 70 ft. per man per day on the first raise. With a gang of 25 men 1 mile of track was raised in 3 days at the following cost for two rates of wages:

Labor at $1.25 per day	$ 95.00
Foreman at $75 per mo	7.50
Total	$102.50
Labor at $1.10 per day	$ 83.60
Foreman at $50 per mo	4.80
Total	$ 88.40

A gang of 17 men averaged 100 ft. per man per day smoothing up first raise, smoothing up 1 mile in 3 days at the following costs for two rates of wages:

Labor at $1.25 per day	$65.00
Foreman at $75 per mo	7.50
Total	$72.50
Labor at $1.10 per day	$57.20
Foreman at $50 per mo	4.80
Total	$62.00

A gang of 10 men dressed an average of 55 ft. per man per day or at a rate of 1 mile in 10 days. The work was slow on account of uneven distribution of ballast unloaded from bottom dump coal cars. The cost of dressing 1 mile with labor at $1.25 and foreman at $75 was $119.85. With labor at $1.10 and foreman at $50, the cost was $105.40 per mile.

The surfacing done by these four gangs consumed more time than a 4-in. rise in gravel on account of using a good portion of the stone in the track in tamping with gravel. A comparison of the work of the four gangs is given in Table I.

TABLE I.

Gang.	Surfacing. Foreman.	Surfacing. Labor.	Smoothing. Foreman.	Smoothing. Labor.	Dressing. Foreman.	Dressing. Labor.	Total. Foreman.	Total. Labor.	Grand Total
1	$38.40	$161.60	$.....	$.....	$16.00	$ 66.70	[illegible]	[illegible]	$282.70
2	28.20	121.40	.....	.....	12.80	64.90	[illegible]	[illegible]	227.30
3	25.60	73.20	25.60	97.15	.....	43.30	[illegible]	[illegible]	264.55
Extra	7.50	95.00	7.50	65.00	.....	119.85	[illegible]	[illegible]	294.85
*Extra	4.80	83.60	4.80	57.20	.....	105.40	[illegible]	[illegible]	255.80

*Extra gang laborers at $1.10 per day and foreman at $50 per month.

(9) The following records were secured from the work performed by section gangs. By running surface is meant the work done in bringing track to an easy riding surface by tamping up [illegible] attention being given to the general surface as far as appearances go. Surfacing refers to the raising of the track out of face to a uniform grade line. Smoothing up refers to the picking up of low [illegible] the general level. Negro labor at $1.10 per day and foreman at $50 per month were worked.

Record 1.—Covers 18 days, during which an average of 66 ft. per man per day was the length of surface run in slag ballast.

No. Ft	No. Days.	Ft.-Man-Day.
510	6.5	[illegible]
780	[illegible]	92
[illegible]	[illegible]	[illegible]
660	[illegible]	[illegible]
1100	20.5	[illegible]
165	2.5	[illegible]
450	8.5	[illegible]
240	3.5	[illegible]
300	4	[illegible]
5075	70.5	[illegible]
600	12	[illegible]
400	8	[illegible]
300	4.5	[illegible]
105	[illegible]	52
400	5	[illegible]
210	[illegible]	[illegible]
300	[illegible]	[illegible]
135	3	[illegible]
Average		[illegible]

The cost was:

Running surface 1 ft. of track	$ 0.016
Running surface 100 ft. of track	1.66
Running surface 1 mile of track	88.00

Record 2.—Covers 31 days running surface in rock ballast, during which an average of 55 ft. per man per day was run.

No. Ft.	No. Days.	Ft.-Man-Day.
280	8	35
405	5	81
300	10	30
480	6.5	73
250	4.5	55
200	3	66
200	3	66
150	[illegible]	[illegible]
180	3	60
120	[illegible]	[illegible]
180	5.5	[illegible]
150	4.5	33
670	15.5	43
670	17.5	38
560	12.5	[illegible]
500	13	39
150	4	38
540	8.5	63
450	7.5	60
760	24	32
300	4	75
930	13	71
430	5	86
300	4	75
330	4	75
200	10.5	31
400	6	33
180	5.5	72
120	3	60
100	4	30
	1.5	66
Average		55

The cost was:

Running surface 1 ft. of track	$ 0.02
Running surface 100 ft. of track	2.00
Running surface 1 mile of track	105.00

Record 3.—Covers 12 days running surface in gravel ballast, during which an average of 87 ft. per man per day was made.

No. Ft.	No. Days.	Ft.-Man-Day.
300	3.5	86
180	3	60
720	[illegible]	[illegible]
120	[illegible]	120
840	9.5	88
630	[illegible]	[illegible]
820	10	[illegible]
390	5	[illegible]
660	[illegible]	[illegible]
570	[illegible]	95
630	[illegible]	105
580	[illegible]	[illegible]
Average		[illegible]

The cost was:

Running surface 1 ft. of track	$ 0.013
Running surface 100 ft. of track	1.26
Running surface 1 mile of track	66.50

Record 4.—Covers 20 days smoothing up in slag ballast, during which an average of 116 ft. per man per [illegible]

[illegible]

Average [illegible]

The cost was:

Smoothing 1 ft. of track [illegible]

Smoothing 100 ft. of track [illegible]

Smoothing 1 mile of track [illegible]

Record 5.—Covers [illegible] days smoothing up in rock ballast, during which an average of [illegible] ft. per man per day was smoothed.

No. Ft.	No. Days.	Ft.-Man-Day.
[illegible]	[illegible]	[illegible]
960	8.5	113
[illegible]	[illegible]	[illegible]
3750	18.5	225
[illegible]	[illegible]	[illegible]
430	7.5	51
[illegible]	[illegible]	[illegible]
Average		[illegible]

The cost was:

Smoothing 1 ft. of track...... [illegible]

Smoothing 100 ft. of track [illegible]

Smoothing 1 mile of track [illegible]

(10) This [illegible] lines in Louisiana working "Cadian" labor at $1.75 per day and foreman at $75 per month. The dirt was a good solid black loam. The shoulders of the grade were skinned off to a slope of 1 in. to 1 ft. outward from the ends of the ties by a plow constructed on the order of a dirt spreading machine. The dirt was cast [illegible] edges [illegible] dirt, however, was insufficient for the raise, and

the remainder was secured by shoveling up from the berm to the shoulder after having been loosened by plows. The embankment averaged 4 ft. in height. The record was as follows:

No. Men.	No. Rails	Raise, Ins	Time, Raise, hours	Time, Fill., hours.	Time, Dress., hours	Total Time, hours
23	16	[illegible]	6	3	1	10
24	16	4	6	3	1	10
20	14	4	6	3	1	10
23	16	3	[illegible]	4	1	10
20	16	[illegible]	6	3	1	10
20	14	[illegible]	[illegible]	4	1	10
17	16	3	5	4	1	10
27	17	4	5	4	1	10
25	20	2	[illegible]	3	1	10
26	20	3	6	3	1	10
24	15	4	6	3	1	10
27	13	7	5	4	1	10
28	[illegible]	3	6	3	1	10
27	14	6	[illegible]	4	1	10
24	15	[illegible]	6	3	1	10
24	19	6	6	3	1	10
21	19	6	6	3	1	10
21	14	5	6	3	1	10

The average for a 4.1 in. raise was 22.7 ft. per man per day. The cost was as follows:

Item.	Per 100 ft.	Per Mile.
Raise	$4.35	$229.80
Fill in	2.56	135.60
Dress	0.77	40.60
Totals	$7.68	$406.00

The Economy of Handling Railway Scrap and Other Materials By Mechanical Means.

At the last convention of the Railway Storekeepers' Association two papers on handling materials by mechanical appliances and giving some costs were read by Mr. N. A. Mears of the Lake Shore & Michigan Southern Ry., and Mr. J. F. Slaughter of the Missouri, Kansas & Texas Ry. The following are Mr. Mears' cost figures:

The expense of operating a magnet varies with the size as far as the electricity is concerned, but the labor cost for both the crane and the magnet is from $5 to $10 per day, and sometimes less.

The saving by the use of the magnet is really quite a figure, although it is usually figured as compared to hand work, and not considered with the crane as a necessary feature. In rough figures, the crane and magnet save from $15 to $50 per day, according to how fast they are operated and the material handled. On the following items the saving shows what can be accomplished:

Loading locomotive tires	Per Ton.
By hand	$0.17
By crane	.08
By crane magnet	.04
Loading heavy cast	**Per Ton.**
By hand	Almost Impossible.
By crane	.20
By crane and magnet	.03

You will note that on these items the magnet reduces the cost of handling over the crane cost, particularly on account of the necessity for a good hold on the heavier items when handled by chains or hooks.

Mr. Slaughter presents the following comparison between locomotive crane and hand work:

First, in unloading piling and lumber from open cars, I find it costs $6 per car to handle by hand where cars must be moved by hand back and forth to properly assort them on ways of their respective lengths. This same work can be done with a crane for $1.40 per car, or a saving of $4.60.

Car and engine bolsters cost to handle by hand $5 per carload of seventy-five; these can be handled by locomotive crane for 75 cts., or a saving of $4.25.

One hundred 4¼x8 axles—by hand $5.50, by crane $1.50, saving of $4. Mounted wheels to axles—by hand 75 cts. per car, by crane 17 cts., saving 58 cts. These are only a few instances for which the crane can be used, but it is not necessary for me to enumerate further.

I also find in handling scrap that the cost by hand for an average of 100 cars is $7 per car; with the crane it is $2.83, or a difference of $4.37 in favor of the latter.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Precarious Expedients in Engineering Practice.*

In presenting this paper for the Society's consideration, the observation may be made that it is not, in the strict sense of the term, a scientific paper. It would seem, however, that if engineers had no thoughts or aspirations in regard to their profession, other than those applying to technical details, that profession, and the Society which represents it, would fall short of the standards which inspire workers in other fields. In the many scientific papers which are continually being presented, attention is directed to methods and formulas by which one may build safely and efficiently. With these two watchwords of the Engineering Profession—"Safety" and "Efficiency"—is it not necessary to class the additional word, "Honesty?" In the engineering profession, as in other professions, ordinary intentional dishonesty sooner or later brings its own punishment. It is not to such self-evident facts that the writer would draw attention.

There is another kind of dishonesty to which one may, without premeditation, be made accessory, which is known to every engineer and architect, yet very rarely discussed. Possibly this is because some may believe it is the result of the present method of financing large construction work, others that it is caused by undue competition among contractors; and there are a few who pessimistically declare that it is simply a part of the ever-increasing laxity of moral standards in all fields of industry. Whatever the cause, the writer's object is to expose the facts relating to the use of certain precarious expedients, and to hint at a possible remedy. It is hoped that the presentation of this paper to the Society, and not to the public press, will demonstrate that it is not intended as a "muck-raking" article. The evil lies within the circle of knowledge of professional men, by whose efforts alone it can be eradicated.

Let it be assumed that some large piece of work—a public library, a railroad terminal, a hospital, a power-house, or a municipal pumping station—is to be constructed. As either an engineer or an architect may be engaged to take supreme charge of the design and construction, he will be referred to herein as the "designer." The "designer" then, having received his appointment, proceeds with the preparation of his plans. Now, if he be an architect, his specialty will take form in the artistic embellishment and utilitarian arrangement of his design. Rarely will he have, either from his own knowledge or from that of his office force, the qualifications necessary to the economic design of all the other factors such as structural comment of plumbing, and the like. To be sure, some of his assistants, or even he himself, may be able to do one or two of these things as well as specialists, but seldom all of them. If a structural engineer is the "designer," then that feature of the work, and perhaps one or two others, will receive the fullest emphasis to the possible detriment of the architectural or mechanical side.

Now, occasionally, the "designer" calls to his assistance specialists in each of the departments with which he (or his office force) is unfamiliar. Their fees are usually higher in proportion than that which the "designer" himself is to receive, and must be paid out of his own pocket. Also he or some of his assistants soon acquire that "little learning" which is "a dangerous thing," and begin to believe themselves capable of doing the specialist's work on future occasions. These two reasons militate against this solution of the problem.

Next in order comes the method which the writer believes is used in the majority of cases, where the work involves a number of radically different specialties. The "designer" prepares his plans and specifications, in complete form as far as his knowledge carries him, tentatively on the points where that knowledge is lacking. Then, whether it be the problem of reinforced concrete design, or heating, or lighting, or what not, he allows some of the contractors, who have been importuning his office with this very object, to examine his tentative plans and make suggestions for increasing their efficiency and practicability. Of course, there is opportunity here for the ordinary, intentional dishonesty heretofore referred to, such as the insertion in plans and specifications of some particular quarry, or the like. However, it is assumed that the "designer" is not intentionally dishonest, and that he will listen to no suggestions of this kind.

In accepting the services of these contractors, he expressly stipulates he is thereby placed under no obligation to them and that he accepts or rejects their recommendations as to changes in the design with precisely the same freedom that he would had he called in consulting experts. The difference consists in the fact that he had not had to pay over a large proportion of his fee.

According to the usual custom, the "designer" receives half his total fee upon completion of the working plans and specifications. This is almost always exhausted by his office expenses up to this point. His profits lie in what is left of the second half of the fee, after deducting his expenses for superintending the actual construction. Should the work not be built, for any reason whatsoever, the "designer" would not receive his second half of his fee. Small wonder, then, that he is reluctant to pay out of his own pocket for specialists, at a time when the ultimate financial outcome to himself is still in doubt.

Returning, now, to the contractors, it is found that in the case of work being planned for private individuals or corporations, they have frequently secured from the owner letters of introduction to the "designer," which cannot be ignored; but, in most cases, those kind-hearted gentlemen, the contractors, carry their competitive methods right up to the point of trying to excel each other in doing the greatest amount of work for nothing. They are ready to furnish samples of brick, stone and mosaic, working models of hardware and plumbing devices, cartoons of ornamental terra-cotta, designs of reinforced concrete and ironwork, layouts of heating lines or electric wiring, or to pass upon and revise the "designer's" embryonic drawings and specifications on any of these subjects.

Do not let it be forgotten that the "designer" intends to be absolutely honest. He warns these contractors, from whom, on one point or the other, he has accepted advice or assistance, that he will not permit the introduction of exclusively controlled devices, and that the general contract is to be given to the lowest bidder, irrespective of all else. If a municipal job, bids will be advertised for; if a private one, the list of contractors invited to bid will be long enough to render favoritism impossible. Does this discourage the contractor who is giving time and thought, which means money, to the details of his own specialty on the general plans in the "designer's" office? Not in the least; he works hard, constantly changing his lay-out, in whatever line it may be, to suit the general scheme as it evolves from the "designer's" mind. Furthermore, his work and his recommendations are honestly rendered, and about as efficiently as that of the high priced specialist whom the "designer" might have engaged. Also, the contractor who is allowed to render this assistance never leaves out anything, nor—and this should be well noted—does he call attention to anything superfluous that may exist in the tentative lay-out prepared by the "designer."

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*A paper by John Hawkesworth in Transactions American Society of Civil Engineers, Vol. LXVII, p. 32.

Now pass to the time subsequent to the receipt of bids from the general contractors. These bids, which are in each case the aggregation of lowest prices received by the general contractor from various sub-contractors, added to his estimate for that portion of the work which he will do himself, are honestly rendered. The contract for bridge, or library, or power-house, or whatever it may be, is usually awarded to the lowest responsible bidder, who then becomes the general contractor.

For the proper execution and construction of the work, it is usually found necessary to insert in the specification that the general contractor's selection of sub-contractors shall be subject to the approval of the "designer," and, in some cases of the owner also. The general contractor presents his list of "subs," and on this list are almost certain to be found some of the very men who rendered aid, in one way or another, to the "designer." If for no other reason, they are on the list because their estimates to the general contractor were the lowest which he had received. Though he be the most honest man in the world, the "designer" cannot help giving his consent to the employment of these sub-contractors, for two legitimate reasons: First, he is reasonably sure of their ability to perform their particular work satisfactorily, or he would have had nothing to do with them in the first place. Secondly, their intimate prior knowledge of the plans and specifications renders it likely that they know the requirements of the job. Another reason is the fact that sometimes the owner may indicate his desire to have these very sub-contractors approved, unless the "designer" can offer definite reasons why they should not be.

As a digression in the effort to ascertain why the owner, whether corporate or municipal, should favor not only the approval of certain sub-contractors, but even urge the "designer" to obtain their co-operation when the plans are being prepared, a single example of each class, taken from actual occurrences, will be given:

A certain large corporation, an insurance company, was erecting a building of enormous size. The structural steel design was a difficult problem, but one well within the "designer's" power. Nevertheless, the president of the company insisted that a certain structural iron contractor should have his engineers check the design. The general contract was awarded, and the list of "subs" was presented to the "designer" for approval. On this list were two structural iron firms, one an independent firm, the other the direct agent of "the trust." The general contractor had noted that the "independent" bid was the lower. The president of the insurance company sent for the "designer" and made him admit that each firm could do the work equally well. Also, it was obvious that, since the general contract was let for a lump sum, the relative cost of the iron work bids did not enter into the discussion. The "designer" was directed to approve the iron firm which made the higher estimate, because that firm, having an estimate knowledge of the plans, showed from its figures that the work could not be done honestly for the price quoted by the independent firm." The "designer" gave his approval, as directed. Of course, the trust behind the higher bidder was financially affiliated with the insurance company, and it is interesting to note that the net cost of the successful firm executing the ironwork was quite a little lower than the bid of the independent. In that case, the general contractor simply paid a rebate unwillingly to the owner, but [illegible] unfair transaction.

An example of the second class, having to do with municipal ownership, may be cited with equal ease. In many cities, appropriations for public buildings, bridges, and the like, are requested by the superintendent or commissioner having jurisdiction over the department which requires them. Assume that the request is passed upon favorably by a superior board, and goes to a body, such as a Board of Aldermen, for final ratification. This final deciding power, say, has not the right to alter the amount of the appropriation, or the purpose for which it is requested, but it has the privilege of withholding its approval as long as it wishes. If such approval is unreasonably delayed, it may be assumed that the superintendent or commissioner, anxious to gain credit for his administration by carrying out the much-needed work, if for no other reason, seeks to ascertain the cause of delay. He knows a man, who, holding no official position, nevertheless is cognizant of everything in this line. This man suggests that, if the appropriation can be passed, a certain "designer," whom he names, should be appointed. The superintendent or commissioner readily agrees. The "designer" knows nothing of all this, nor is he expected to. His first information comes from the man of no official position, who tells him he has been suggested as "designer" of this great public work.

Now as all governing bodies, whether boards of aldermen or not, have a guiding spirit, it may be assumed that the unofficial man obtains the ear of the guiding spirit. The appropriation is quickly passed, and the superintendent or commissioner, free and untrammeled, appoints the "designer" to prepare the plans. The course of events thenceforth is the same as that previously described, and, when the list of subcontractors comes in, after the general contract has been let to the lowest bidder, the man of no official position is on the spot. Not being connected with the municipality, there is no legal reason why he should not be a stockholder, or on the payroll, of some of these sub-contractors who appear on the list. The "designer" not only knows that he owes his appointment to this man, but he may also have a vague suspicion that the work would never have been proceeded with, but for his efforts. What could be more natural than that, confronted with the names of two sub-contractors of equally good standing, the designer should give his approval to the one suggested by his influential friend?

Should the "designer" feel reluctant about acquiesing in this matter, though after all it does not benefit him directly in a financial sense, he adopts the following expedient. He gives his approval to two sub-contractors, one of which is the favored firm. The general contractor thereupon beats each down to the bottom price, and then takes steps to find out which is the favored firm by the powers above the "designer." This one he takes care to employ, irrespective of the cost; neither does he fail to emphasize the fact, for it is "bread upon the waters." Discrimination cannot, it is true, be shown in the award of the general contract for municipal structures, but the right to reject all bids is reserved. By this means, the unpopular or unpolitic general contractor can always be frozen out when his bid happens to be the lowest for the entire work, and he wishes to remain popular, even if it costs a few extra dollars in sub-contracts.

Up to this point, all that has been said shows clearly, or else the purpose of this paper has failed, that the situation of the "designer" is not of his own creation, being forced on him by circumstances, and that he does not profit directly to the extent of a dollar thereby. Also, it should be distinctly remembered, he has done nothing necessarily prejudicial to the safety or efficient construction of the work he has designed.

Somebody, however, must be making an undue or unfair profit. Why do the sub-contractors, and their financial backers, or their silent partner, "the man who holds no official position," do so many kind acts for apparently nothing, or at least for the ordinary contractor's profit only?

It is, of course, reasonable to infer that prior familiarity with the plans of the proposed work gives these sub-contractors a certain advantage in making up their estimates. Having had plenty of time to prepare an accurate statement of cost, they can naturally give a closer figure than their competitors who have, perhaps, had only a few hours to examine the plans and specifications on file in the office of the general contractor; but this advantage is not by any means the only one.

In the description of the preparations of plans and specifications, particular mention was made of the fact that nothing superfluous in design or requirements of construction is ever stricken out. When the opportunity offers, or when the subject happens to be one on which the "designer" is not even fairly well informed, the sub-contractor, in his advisory capacity, can easily insert needless re- [illegible] Should that subject be, for example, heating [illegible] may be shown, which only an expert in this specialty could with certainty declare needless; or, in the case of the specifications, many requirements as to elaborate testing, or extensive submission of expensive samples, may be inserted, the enforcement of which requirements may or may not be considered [illegible] eventually.

Let it now be assumed that the general contract has been awarded, that the sub-contractors, among whom are the favored ones, have been approved, and that the work has been started. Sooner or later the "designer" is informed that certain changes may be made in the plans, or certain requirements of the specifications waived, without detriment to the work. The "designer," being still conscientious, investigates these statements, even calls in other contractors for their advice, and finds that requests to omit certain things are entirely reasonable. As to the elaborate requirements for testing, samples, and the like they too are unnecessary, if responsible parties are doing the work. Who could be considered more responsible than those who assisted in the design? The requests for their omission or curtailment is granted more or less rapidly.

At this point it may be remarked that there are two kinds of specifications, the loosely worded, "blanket" kind, and the one filled with elaborate and detailed requirements as to tests, samples, and so on, both of which offer every opportunity for this kind of discrimination. The first class, the loosely-worded one, clear only on the one point that all power is vested in the "designer," can be ininterpreted so that the cost of the entire work or any part thereof, may turn out to be anywhere from one-half the estimated amount to twice that figure. As for the other class of specifications, an impartial examination of the multiplicity of petty, often unnecessary though always costly, requirements, will show that if enforced down to the last detail, the work could not be performed for twice the contract price. That all will not be enforced is, of course, discounted in the contractor's bid; but only the sub-contractor who is on intimate terms with the designer," and who has assisted in preparing the lay-out, can be reasonably sure of the omission of [illegible] petty and harassing stipulations, as far as his particular work is concerned.

Specifications of this latter class are notoriously frequent. Although they assist his scheme materially, it is not the politic sub-contractor who is responsible for them. They are the result of over-weening vanity on the part of the "designer," who desires t[illegible] therein every requisite and every [illegible] condition that he has ever read [illegible] about, and whose method of making each [illegible]cification better and more complete than the last is to keep adding voluminou[illegible]ments, without ever weeding out t[illegible] and obsolete clauses evolved during the earlier years of his practice.

Returning now to these requests for omissions. It has been assumed that the "designer" is an honest man. He may, and often does, demand an allowance from the sub-contractor when the request entails, not only rigid enforcement of the technical clauses of his specifications, but the actual omission of material and work as well. Then the sub-contractor goes to the general contractor and lays the case before him. The latter knows the "pull" possessed by the sub-contractor with the owner, and is glad to assist. The two go over the plans and specifications together in great detail. Now, it is rare indeed that, in the case of a large piece of construction work, something essential, either in design or specifications has not been inadvertently omitted by the "designer." In the writer's opinion, there has never yet been executed a large contract where there was not something installed, or some work done, which the general contractor could not have legally evaded on the ground that it was not shown or required.

It is to provide against these errors of omission, so certain to occur, that some designers have adopted the "blanket" clause. This is frequently found in the following form:

"Should any items be omitted in the drawings and mentioned in the specifications, or shown on the drawings and not mentioned in the specifications, or neither shown nor mentioned in either the drawings or specifications, but reasonably to be implied, and, in the opinion of the "designer," necessary to the complete and satisfactory execution or operation of the work or works, it shall be understood as expressed in both, and shall be carried out as it so expressed, and as directed by the 'designer,' to correspond in all respects with the remainder of the work and works."

Now, it is indeed fortunate for the general contractor that the courts do not interpret such a clause as conveying to the "designer" the all-supreme powers that it appears to. Nevertheless, it furnishes a basis for tedious litigation, on which the contractor desires to spend neither his time nor his money. The result is usually a compromise.

Having located the items "neither shown nor mentioned," the general contractor goes to the "designer" and makes a counter demand for extra payment. The "designer" is then in a quandary. He knows that if he endeavors to enforce his blanket clause, and if the amount involved is sufficiently large, the contractor will fight it. This involves legal expenses and delay in the execution of the work, either of which causes would bring down the wrath of the owners upon the head of the "designer." Neither is he willing, in most cases, to give in entirely, admit his error, and transmit to the owner, with his approval, the contractor's request for an extra payment. To do so would not only render him subject to the accusation of incompetency, and of having prepared an incomplete design, but also, especially in the case of public work, it might be impossible to obtain an additional appropriation.

Thus the "designer" also is ready for compromise. This is offered by the general contractor, who agrees to do the necessary extra work without charge, if the "designer" will agree to the omission, without allowance therefor, of the unnecessary details, as requested by the particular sub-contractor heretofore mentioned. Here, again, the "designer," if particularly desiring to be honest to the end, may require a statement showing that the value of the work added is equal to that of work omitted. Of course, this is rarely the case, but the statement is always so rendered. The contractor is a better authority than the "designer" on the detailed cost of fractional parts of his work, and the "designer" can do nothing but accept his word for the accuracy of the statement.

This completes the chain. The industrious sub-contractors have not only secured their contracts against all competitors, by knowing how to bid a little lower, but they are actually making a considerably larger percentage of profit than their competitors would have made, even at the higher prices.

There is nothing actually illegal in all this, and engineers and architects of the highest ethical standards are constantly being forced into just such situations. The resultant tendency toward discrimination and the unfair application of specifications cannot help but lower the standards of professional integrity. Graft and dishonest practice are only the next step downward. Such words lose their justly repelling force when the actions which they symbolize become our next-door neighbors. The taint of this corruption is spreading, not only among engineers and architects who are in the position of the "designer," but its baleful influence must of necessity cast its spell over the young engineers employed by many contracting firms, who are thus brought into contact with "the system," and who find their splendid ideals of the old-time engineering standards trailing in the wake of conscienceless competition.

Even though the writer may have succeeded in showing clearly the existence of this unfortunate condition of affairs and its importance to the engineering profession, the purpose of this paper would be but half accomplished were there not a possible remedy to be suggested.

When paid on a commission or lump-sum basis, the "designer's" fee is not always sufficient to insure a reasonable profit, over and above his office and running expenses, commensurate with the long years of technical training and experience in subordinate capacities considered so necessary as preparation, before he is entrusted with important work. Bearing in mind those unfruitful years, from a financial point of view, it has become customary for the "designer" to reduce his expenses, and to the same degree increase his profits, by inserting in the contract a clause requiring the contractor to pay the salary of the inspector or inspectors, employed by the "designer," in immediate supervision of the actual construction. These inspectors, however, are directly responsible to the "designer," and are subject only to his authority.

The first step, therefore, is to insure, by agreement between the owner and the "designer," that the fee or charge for professional services shall be properly commensurate, not only with the gross cost of the proposed construction, but also with the difficulties involved.

Secondly, it should be arranged that this charge should be paid in succesive installments, in such proportion that four-fifths, and not one-half, of the total amount, should be paid upon completion of working drawings and specifications. This, for reasons heretofore noted, corresponds more closely to the expenses of the "designer" up to this point in the work

Thirdly, there should be a prior agreement between client and "designer" as to what specialists—such as heating, electrical, or sanitary engineers—are to be employed (if their employment is necessary) and what fees are to be paid to each. Their fees may come out of the "designer's" own charges, if need be, but the amount should always be predetermined in his agreement with the owner.

Next in importance comes the question of payment of the field inspectors during construction. It has been seen that this has been required of the contractor, who, of course, figures on the cost thereof in his estimate for the work. Hence the owner pays for it just as surely as though he signed the weekly salary check himself.

It is the writer's opinion that, in the case of men not so honest as the "designer" has been assumed to be, this system is a very fertile field for graft. The "designer" having the absolute right to appoint the inspector and fix his salary, from nothing at all up to the amount specified in the contract, may, by striking a medium between these two figures, save a considerable sum to the general contractor. This saving, or rebate, which really comes out of the owner's pocket, may be applied to various purposes, such as off-setting the contractor's claims for extras due to mistakes or omissions in the design, or to the more frankly grafting one of thereby obtaining the favor of a contractor influential enough to throw more work in the "designer's" way.

All this temptation could be eliminated by having the inspector paid directly by the owner, instead of indirectly, as at present. The salary could be fixed by the prior agreement between owner and "designer," and the selection of the individual could be made subject to the approval of both.

The inspector should also be subject to discharge by either owner or "designer," and his duties should consist in rendering daily reports, in duplicate, to both, showing first, the exact progress of the work to date, and secondly, describing in detail any and all variations from the requirements of plans and specifications. This inspector should not be given power to condemn work. His reports, coming daily under the eyes of the engineer inspectors in the regular employ of the "designer," would enable them to perform judicially all the condemnation necessary by letter, or an occasional visit to the work. The field inspector, however, being constantly on the job, may with propriety warn the contractor when incorrect or improper work is being done, and announce his intention of reporting the same. The contractor must then decide whether or not to persist in the face of such a warning.

Then it is essential that all allowances for work omitted, and all extras for additional work done, should be settled by one of the two following methods: First, as far as possible, the deduction of the extra should be computed on the basis of "unit prices," to be named by the contractor in his bid. Second, when the first is not possible, such amount should be decided by arbitration between the "designer," the general contractor and a third party aceptable to both. The valuation should be based on actual cost sheets of the work involved, to which should be added, or from which should be subtracted, a certain fixed percentage representing the contractor's profit. This percentage should be fixed and be a component part of the contract when it is signed. No extra work should be accepted gratis from the contractor. If such did occur, it would immediately come to the owner's attention through the duplicate reports of the field inspector, and should indicate to him that some kind of reciprocal favoritism was in progress between contractor and "designer."

By the adoption of these safeguards, it would seem that, not only intentional dishonest graft could be prevented, but also the more subtle kind with which the "designer," though profiting nothing directly thereby, is continually being entangled. The remedy here pointed out is not intended to produce a check on the ambition of the "designer," nor does it imply presumptive suspicion of his honesty. On the contrary, it is a true safeguard against a combination of circumstances which would place him in a position to say the least, unenviable.

There is a secondary advantage to the profession as a whole, namely, that under the protection here outlined, the work of the "designer" may be judged on its own merits. No longer may it be inferred that the mistakes and omissions of the young "designer" are necessarily the natural result of his inexperience. No longer will the apparent flawlessness of the work of the older "designer" be ascribed to his more mature knowledge, when he shall have become no more amenable to the wily subterfuges of the contractor's system, which, to its own advantage, conceals mistakes. The client or owner will obtain the work for which he has paid. The "designer" without pull or political affiliations, will be on the same basis as the one whose finer sensibilities have become blunted through intimate relations with scheming contractors.

After all, when engineers have written and talked over the technical details of their work, have commented upon and discussed this or that theory of design or method of construction, does there not remain something even more important in the consideration of those high ideals which should underlie all else in the profession? It is, of course, important that engineers should be true to their work, and to those standards of knowledge and efficiency set by those who have gone before, but is it not equally vital that they should be true to themselves?

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

A Conference of Mayors.

This is the age of conferences. We have had a conference of city officials to standardize street paving and a conference of governors on the conservation of natural resources, and now comes a conference of mayors on the essentials of municipal health. This latest conference of mayors and other important municipal officials of second and third class cities in New York state was held at Schenectady early this month. It was attended by 34 mayors and eight other cities were represented by officials other than mayors. Out of a possible total of 48 cities, 42 were represented at the conference. It was the sense of the conference that public health work should occupy a much greater place in municipal work. The conference was so successful that it was decided to have annual conferences of mayors, the next one to be held at Poughkeepsie, N. Y., in 1911.

The Doings of the Week.

Two large municipal bond issues for improvement work have been voted the past week. On July 22 the city of Cleveland, O., voted to issue $2,000,000 worth of bonds for the abolishment of grade crossings. Kansas City was the other municipality to vote a large bond issue for improvement work.——One of the most ambitious road building schemes ever advocated in any state is now under consideration by the State Highway Commission of Colorado. It is proposed to construct a boulevard around the state with connecting roads to all interior points of interest. The cost will be borne almost entirely by the counties through which the boulevard will pass.——The Public Service Commission of New York City has begun advertising for bids for the construction of the tri-borough subway system in New York. The contract includes the Broadway-Lafayette loop and the two branches of the 4th Ave. subway, running to Coney Island and Fort Hamilton.——The city of New York has just awarded a large contract for the completion of the outlet sewer in White Plains Road in the Borough of the Bronx. This contract was secured by F. V. Smith, 125th St. and Lexington Ave., at $621,000.——The principal railroad construction contract of the week appears to have been the one for constructing the 275 mile line of the Arizona, Mexico & Gulf of California Ry., from Silverbell, Ariz., to Port Lobos on the Gulf of California. This contract was secured by Charles J. Lantry, Kansas City, Mo., and Edward J. Scott, of St. Louis, Mo. Among the other railroad contracts let recently may be noted the following: E. A. Wickham & Co., Council Bluffs, Ia., for 50 miles of work on the Chicago, Milwaukee & Puget Sound Ry. near Lewistown, Mont.; The Arnold Co., 181 La Salle St., Chicago, Ill., for shop and yard improvements at Shreveport, La., for the Kansas City Southern Ry., the work amounting to about $500,000; the McDowell Construction Co., Knoxville, Tenn., for filling involving about 100,000 cu. yds. of excavation on the line of the Athens & Tellico R. R., from Athens to Tellico, Tenn.; W. H. Denison, Lubbock, Tex., for grading and tracklaying for the projected 40-mile line of the Crosbyton-South Plains R. R. from Crosbyton, Tex., to South Plains; A. DeMayo, 1 Haskell Bldg., Ashtabula, O., for constructing the line between Alliance, O., and Akron, O., for the A. & A. Short Line Ry. Co.; Maney Brothers & Co., Oklahoma City, Okla., and St. Louis, Mo., for constructing the 15-mile extension of the Pacific & Idaho Northern Ry., from Evergreen to Meadows Valley, Idaho.——A fair sized railroad construction contract is now being advertised by the Cullman Coal & Coke Co., of Cullman, Ala. This contract, bids for which are to be opened at Cullman on Aug. 1, calls for various work in connection with the construction of the line.——The State Superintendent of Public Works of New York State is reported to have awarded Contract No. 62 for constructing 14 miles of the Barge Canal to I. M. Ludington Sons Co., of Rochester, N. Y. The itemized bid of this contractor for the work will be found elsewhere in this issue.

Barge Canal Excavators and Conveyors.

The construction of the New York State Barge Canal has offered a broad field to contractors and manufacturers for the design of special types of excavators and conveyors. As the work is spread over a length of more than 400 miles, a wide variety of material must of necessity be excavated, and this has led to the use of a varied assortment of excavators; in many cases each machine has been somewhat changed from the standard pattern in order to meet particular conditions. The steam shovel, of course, is in general use as are various types of revolving machines with long beam and scraper bucket. A new kind of excavator, the tower scraper, was evolved for work on the canal. This scraper consists of a simple frame tower and a hoisting engine mounted upon the same base, which operate a scraper bucket, the carrying cable running to a fastening that slides on a cable anchored at the farther side of the cut. This machine is used largely in diking. By making its tower tall enough its range of operations may be extended across a width of several hundred feet. Dredging machines are also used on the work and on one contract in particular, three types of dredges are used: the dipper, the ladder, and the suction. Hydraulic dredges are also in use in other contracts. In the use of apparatus for conveying excavated material to embankment or spoil field much ingenuity has been exercised. On one contract just west of Lockport, for instance, the contractors are using the following kinds of conveyors: The usual locomotive and train outfit; a set of guyed derricks swinging their booms from prism to spoil; locomotive cranes working in pairs; an inclined track with tipple at the top and mounted on a traveling vase, carrying its cars from canal to bank; a cableway with traveling towers adjustable as to distance betw [illegible] boom excavator, which can be loading and discharging at the same time. In addition there is a large cantilever crane, extending from the tow path to the spoil bank behind the berme. Some of these machines can be used for excavating as well as conveying. These types are of [illegible] sections of the canal, though generally not in so great a variety on any other one contract. Near Rochester the largest single machine on the line of the canal [illegible] This is a bridge excavator and conveyor. The trusses of the bridge, 428 ft. long end to end, are supported on [illegible] towers 90 ft high. Suspended from a track on the lower chord, run the [illegible] and 12 [illegible] the cantilever extensions. At another place on the canal there is what is called an aerial carrier. Two or three cableways can be operated with this, a single mast and one hoisting engine. Belt conveyors are also used in connection with the ladder dredges, for delivering the excavated material both to scows and upon the banks.

The Canadian Railway Commission.

Now that [illegible] has been [illegible] the United States and Canada looking to the international control of the railway systems [illegible] countries it may be of interest to note briefly the work of the Canadian Railway Commission. The Railway Commission of Canada came into being about five years ago and during its five years of life it has settled more disputes at less cost than were adjusted in a whole half century immediately before. According to the Canadian railway act, the commission has greater powers at its command than any other administrative body in Canada. Its jurisdiction reaches from Sydney, Cape Breton, to Dawson City in the Yukon. It has more than 200 corporations under its control, more than half of them railways, the remainder being telegraph, telephone, or express companies operated in connection with the railways. It deals with 500 distinct industries, and the public today is making 6,000 requests annually for its services. During the fiscal year from March, 1908, to March, 1909, the commission issued 2,249 orders and disposed of 2,742 other applications without the necessity of a hearing. Not a single mile of new railway can be operated by any railway corporation without the approval of the commission. Whenever one of the railways sends out a branch line across the prairie, as soon as the rails are laid and the track properly ballasted, the engineer or some other competent official must give notice to the commission that such road is sufficiently ready for traffic, and thereupon he requests the board to authorize its opening. An expert inspecting engineer is commissioned to make a thorough examination, and if his report is satisfactory the road may be opened.

A Definition of Engineering.

[illegible] neering is that given in [illegible] bodied in the application of the Institution of Civil Engineers of Great Britain for a charter. It describes the profession of an engineer as "the art of directing the great sources of power in nature for the use and convenience of man." Tredgold then went on to specify some of the branches of the profession and concluded with the prediction that the extent of the profession was limited only by the progress of science and that its scope and utility would be increased with every discovery in philosophy and its resources with every invention in the mechanical or chemical arts. The definition was formulated at the time when the minds of engineers were principally occupied with the new discoveries relating to power, such as the steam engine, the steam boat and the steam locomotive. Hence the [illegible] A year or so Mr. Henry G. Stott in his address as President of the American Institute of Electrical Engineers, proposed the following as an improvement of Tredgold's definition: "Engineering is the art of organizing and directing men, and of controlling the forces and materials of nature for the benefit of the human race." Another definition of engineering was given last year by Professor G. F. Swain in an address at the Worcester Polytechnic Institute. Professor Swain's definition was as follows: "Engineering is the science and art of applying, economically, the laws, forces and materials of nature for the use, convenience or enjoyment of man."

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Citizens of Centerville have taken out incorporation papers for the Birmingham, Selma & Pensacola R. R. Co. and are in conference with citizens of Selma regarding the building of the line to that place.

Bids will be received by the Cullman Coal & Coke Co., at its general office in Cullman, Ala., on Aug. 1, for the completion of the following work on the railroad of the company: One—61,164 cu. yds. of earthwork, 42,156 cu. yds. of loose rock, 5,950 cu. yds of solid rock. Two—Delivery of 65,184 ft. B. M. trestle timbers, erecting 862,809 ft. B. M. trestle construction, delivery of 65,184 ft. B. M. trestle timbers and erecting 24 trestles containing 862,809 ft. B. M. Three—Hauling and placing 1,348 ft. of double strength sewer pipe culvert; average haul, two miles. Four—Finishing subgrade on 18 miles of track. Five—Furnishing posts and erecting 36 miles standard railroad fence. Six—Delivery of 35,514 first-class cross ties on right of way, delivery of 4,214 seconds on right of way. Specifications, maps, profiles and general plans are on file in the company's office, and may be examined after July 28. Bids will be opened on Aug. 1, and forwarded to Holland for examination and approval.

The Vance Contracting Co. is reported to have been awarded the contract at about $80,000 for grading through Norwood for the change in the location of the tracks of the Birmingham Belt Line at Birmingham.

Proposition has been made to the citizens of Demopolis for the construction of a railroad through that place. Right of way and a bonus of $20,000 are asked. The plan proposes the building of a road from Birmingham to Scranton, Miss. M. P. Hillyer, New York City, is interested. A. R. Smith, Demopolis, is President of the Business League of that city.

Arizona.

The contract for constructing the projected line of the Arizona, Mexico & Gulf of California Ry. from Silverbell, Ariz., to Port Lobas on the Gulf of California, 275 miles, has been let to Charles J. Lantry, Kansas City, Mo., and Edward J. Scott, of St. Louis, Mo. B. P. Cheney, Boston, Mass., is President of the road. The contract for the road includes a large pier and wharf at Port Lobas, 225 miles north of Guaymas, on the Gulf of California. It is understood that the construction work will progress inward from the coast and that material will be forwarded to Port Lobas by ship. Work is to be commenced at once and it is estimated that the contract will amount to about $7,000,000. Branches and extensions to Tucson, Phoenix and the extensive mining interests south and east of Globe, Arizona, are proposed.

California.

The Northern Electric Ry Co., Alaska Commercial Bldg., San Francisco, has secured right of way and has decided to extend its line from Maryville to Colusa.

Preliminary surveys have been started for the Hanford-Summit Lake Ry., of which John B. Rogers is General Manager. It is expected that the surveys will be completed by Aug. 1.

We are advised that it is the intention of the Nevada-California-Oregon Ry. at the present time to extend its line at once from Alturas to Lakeview, Oregon. The contract has been let to the Hall Construction Co. of Los Angeles. At the present time, however, the extension of the line to Klamath Falls has not been considered.

According to a statement at Alturas of a right of way agent of the Southern Pacific, as soon as the deeds for the right of way are filed for record, construction work on the branch from Klamath Falls, Ore., to Alturas will be commenced and the road will be in operation in 22 months. The road will not end at Alturas, but will be extended to Reno, Nevada. Surveyors are now engaged in locating and correcting the route which has been recently surveyed down the Pitt river to establish a permanent line. The Modoc portion of this line will run for a distance of over 60 miles through Modoc County and will follow the Pitt River from Lookout south to Bieber, Lassen County.

Surveys and negotiations on right of way for the Sacramento & Sierra Ry. have been practically completed. Grading work on the line between Sacramento and Orangeville is now underway although no attempt has been made to rush the road to completion, pending the settlement of the right of way. The principal traffic of the road will consist of the lumber industries which will follow in El Dorado County. It is said that steam power will be used exclusively on the high grades through the mountains, and for the more level tracks electric or gasoline power will be used.

The Atchison, Topeka & Santa Fe Ry. (Coast Lines) is to expend $500,000 in improvements at San Diego. These will include a new depot, plans for which are now being prepared.

The Board of Works of San Francisco has granted the United Railroads Co. permission to reconstruct its abandoned tracks in Presidio Ave. between Jackson and California Sts.

The Utah Construction Co., Ogden, Utah, which is building the Los Angeles Short Line northward into Inyo, has secured the contract for the extension of the line 10 miles north of Owenyo. The work of broad-gaging the old narrow gage road is to begin immediately. Some seven grading camps of the Utah Construction Company have been established between Owenyo and Laws, where about 60 of the 100 miles are to be so graded. Orders have been issued to S. McLean, sub-contractor, to continue with the work of grading from Owens River, where the camp has geen located, to Owenyo and then north to Laws.

The Northern Electric Ry. Co. has made public plans for extensive shops and suburban business additions in West Sacramento, and a new terminal on the west side of the Sacramento River at the Yolo end of the bridge.

Colorado.

The Grand Junction & Grand Valley R. R., the first interurban electric railway through the fruit belt was formally placed in operation on July 14. The road extends from Grand Junction to Fruita and is 16 miles long. The offices of this company are at Fruita, Colo., and the officers are as follows: Thomas E. Curtin, President; Charles MacNeill, Vice-President; E. A. Sunderlin, Vice-President and General Manager, and Orson Adams, Secretary-Treasurer.

Plans are under consideration at Greeley for the construction of a street car line to Evans and the construction of a pleasure resort at Bartels reservoir near the latter place. As proposed the line will take a route along the section line, past the Evans cemetery and come into Evans from the west, connecting with the Denver, Laramie & Northwestern railroad near its depot.

Final locations are underway for the new Harriman line from Defiance, N. Mex., to Durango, Colo. The money for the construction of this line is understood to have been raised and work may be started soon after the final surveys are completed. The line will be built for the Arizona Eastern R. R., a company incorporated some months ago to consolidate a number of Harriman lines and to build the Durango extension. Epes Randolph, Tucson, Ariz., is General Manager, Arizona Eastern R. R.

The Utah Construction Co., of Ogden, which has the contract for constructing the double track lines from Walsenburg to Pueblo, for the Denver & Rio Grande and the Colorado & Southern Rys., as noted in the issue of July 13, has established an office at Pueblo, Colo., from which point matters in connection with this work will be handled. We are advised that the company expects to subcontract a considerable portion of the work, and have representatives at Pueblo looking after this sub-letting. The contract includes the excavation of 1,250,000 cu. yds. of earth, 370,000 cu. yds. of loose rock, 500,000 cu. yds. of solid rock, also 3,100,000 cu. yds. of borrow, 5,000,000 cu. yds. of overhaul and 50,000 cu. yds. of concrete for bridges and culverts.

Georgia.

The Savannah & Southwestern R. R. Co. has been chartered with a capital stock of $1,000,000 and proposes a road to start at Savannah and run in a southwesterly direction to Fort Gaines. The new road will touch the following counties: Chatham, Bryan, Liberty, Tatnall, Toombs, Montgomery, Telfair, Ben Hill, Irwin, Turner, Worth, Dougherty, Calhoun and Clay. The road, when completed, will be 275 miles in length. The incorporators are: F. R. Durham, E. M. Frank, both of Savannah; W. T. Kichlighter, of Bryan; C. S. Grice, G. R. Thaggard, of Tatnall; Warnedd and Anderson of Reidsville, Ga., are the attorneys for the petitioneres.

According to a statement of Capt. L. Johnson, of St. Mary's, Ga., President and General Manager of the St. Mary's & Kingsland R. R., arrangements are pending for the commencement of work on an extension from Kingsland to Waycross. The distance between Waycross and Kingsland is 47 miles. The railroad now has 11 miles of line in operation.

Idaho.

The Commercial Club of Rexburg, Idaho, has endorsed a project for building an electric road that will encircle a large farming area in that section. The proposed road will be 40 miles long, and would pass through Rexburg, Salem, Sugar City, Teton, Wilford and St. Anthony, along the Elgin bench to Park, Egin, Plain Hibbard, Burton and back to Rexburg. The proposition made by a Mr. Sewell of New York is to form a company capitalized at $1,000,000, with $700,000 paid up stock. Tremont County business men and farmers are to subscribe $100,000, 15 per cent to be paid down, 35 per cent when construction begins, and 50 per cent when completed.

It has not been decided yet when contracts will be let for the construction of the Bear Lake branch of the Oregon Short Line R. R. This branch will be 9½ miles long and will extend from Montpelier west five miles to Ovid and south 4½ miles to Paris, Idaho. Surveys for this branch were made in November, 1908. Wm. Ashton, Salt Lake City, Utah, is Chief Engineer.

The Pacific & Idaho Northern Ry., E. M. Heigho, President, Weiser, Idaho, has awarded the contract for an 18-mile extension from Evergreen to Meadows. The material for the extension is reported to have been ordered.

The contract for the construction of a 15 mile extension of the Pacific & Idaho Northern Ry. from Evergreen to Meadows Valley, Idaho, has been let to Maney Brothers & Co., Oklahoma City, Okla., and St. Louis, Mo. The contract includes 55,000 cu. yds. of earth excavation, 60,000 cu. yds. [illegible] ation, 220,000 cu. yds. of embankment, 1,100 lin. ft. of wood trestle and 7,200 lin. ft. of piling. Lee Highley, Weiser, Idaho, is Chief Engineer of the Pacific & Idaho Northern Ry.

Illinois.

The stockholders of the Tri-Cities & Northeastern Interurban Co. at the recent annual meeting at Port Byron reelected the old officers. The directors of the road are now deciding on the route for the proposed interurban line, for which several surveys have been made by Wallace Treichler, Rock Island, Ill.

The Peoria Southern Ry. Co., of which H. E. Chubbuck, Peoria, of the Illinois Traction System, is President, has made surveys as far as Pekin for its projected line to that place from Peoria. It is understood that the new road, if built, may secure the privilege of crossing the river on the bridge of the Peoria Terminal railway in exchange for privileges on Peoria streets. The new road will be a branch of the Illinois Traction System.

Ground was broken at Rochester on July 13 for the extension of the Springfield Clear Lake & Rochester Interurban from Rochester to Pawnee. J. E. Mellick, Springfield, Ill., is President.

The Iowa Central Ry. is planning to build additional sidetracks and switches west of Peoria.

The Budd Construction Co. of Summit has been incorporated with a capital stock of $25,000 and will engage in a general contracting and construction business. The incorporators are Isaac D. Budd, Cyrus W. Hoyt and Alfred J. Parker.

The Chicago, Peoria & St. Louis Ry., W. A. O'Brien, Chief Engineer Maintenance of Way, Springfield, is to lay a track around "Dow Hill," near Alton, in order that the line to St. Louis may be shortened. The new track will avoid a grade near Alton over which freight trains require a pusher.

We are advised that the following contract work is now being done for the Elgin, Joliet & Eastern Ry., of which Arthur Montzheimer, Joliet, Ill., is Chief Engineer: Newkirk & Powers Construction Co., of Joliet, is putting in about 18,000 yds. of concrete, both plain and reinforced, in rebuilding various bridges along the line of the road, including viaduct at Jackson St., Joliet, and considerable improvements at the shops, both at Joliet and Waukegan. Cook & Lund Engineering & Construction Co., of Chicago, has a contract for construction of a 17-stall reinforced concrete engine house at East Joliet, Ill. Wm. P. Carmichael Co., of Chicago, has the contract for the construction of a 15-stall reinforced concrete round house, including boiler room 39 by 61 ft. and blower house, 26 by 30 ft. Wm. P. Carmichael Co. is also constructing a reinforced concrete store and oil house, 43 by 21 ft. at Waukegan, Ill. Jones Bros., of Columbus, O., have contract for grading second track from Frankfort to Matteson. There are about 45,000 yds. in this work. John Benson of Lemont, Ill., has contract for grading yard at East Joliet on account of the construction of the new yard, the work consisting of about 19,000 yds. Steel work for the various bridges along the line, including Jackson St. viaduct and two 80-ft. turn tables, one for Waukegan and one for Joliet, will be furnished by the American Bridge Co. Jones Bros. also have contract for putting in the substructure for a 86½-ft. bascule bridge over ship canal near Whiting, Ind. The concrete yardage amounts to 1,200.

Advices from Harrisburg state that capital has been raised to get title to the road bed and all property of the Galation, Harrisburg & Southeastern R. R., which was partly constructed several years ago, with the idea of completing the road. C. F. Knowlton is interested.

The bonds have all been sold and right of way secured for the extension of the Rock Island Southern Interurban Ry. into Alexis. Grading is to be commenced soon.

Indiana.

Commissioners of St. Joseph County have been inspecting right of way now being secured by the Fort Wayne & Chicago Electric Ry. Co., preparatory to granting that company a franchise for a line to connect Bremen, Ind., with South Bend.

The Chicago & Toledo Transportation Co. has made surveys and will, it is said, soon extend its lines from Elkhart to South Bend. H. E. Bucklin, Elkhart, Ind., is interested.

A. M. Shattuck, Clinton, is grading for a switch to the new Jackson Hill mine south of Clinton.

The County Commissioners at South Bend have granted a franchise to Omar Neff, of Milford, Ind., to build an electric railway from Bremen to Mishawaka. The franchise provides that work on the new road must be started by July 1 next. Cars must be in operation by Jan. 1, 1913. The line will enter Mishawaka via Union St., passing onto private right-of-way at the south city limits. From that point it will proceed by a direct route to the Marshall county line and from that point to the town of Bremen. The road will pass through Woodland in Madison township.

Iowa.

The Lehigh Portland Cement Co. will build a short spur line from its plant to the Iowa Central main line north of Mason City.

The Des Moines City Ry. Co. has presented a proposition to the City Commissioners of Des Moines whereby it proposes to abondon its present line on Jefferson St. from 6th to 9th, where the city is going to repave, and extend its line out 6th from Jefferson to connect up with the rails that are now laid across the 6th Ave. bridge.

The Chicago & Alton R. R. is securing land at Ottumwa on which to erect a new round house.

The Commissioners of Cerro Gordo County have granted permission to the Mason City & Clear Lake Ry. Co. of Mason City to construct an electric railroad along and upon the highway extending north from the city limits of Mason City, to the highway running west on the half section line of Section 33, all in Lime Creek Township, thence west on highway one mile.

J. M. Coe and associates who are planning to make a large amusement resort of Crystal Lake, near South Sioux City, Neb., will probably ask the City Council of Sioux City, Ia., for a special franchise for an electric street car line from the combination bridge to 4th and Pierce Sts. According to present plans a direct line from Sioux City to Crystal Lake will be established. Riley Howard, Orchard, Neb., who recently purchased the Crystal Lake & Homer Electric Ry., is interested.

The Phee Construction Co. of Chicago, Ill., has started work on the construction of the substructure of the West 7th St. viaduct at Des Moines, which is to be built for the Des Moines Union Ry. and three other railroads. Three gangs were placed at work. Under the terms of the contract, which amounts to about $50,000, the Phee Co. must complete its portion of the work in 90 days time. The viaduct when completed will represent an outlay of approximately $200,000. A large part of the work called for in the contract is concrete work. For the foundations for the steel piers, bases of concrete, 12 ft. sq. will be put in. For some of these it will be necessary to excavate to a depth of 16 ft. Where Plum St. intersects West 7th St. the present grade of Plum St. will be lowered 5 ft., so that high wagons which want to pass beneath the viaduct along that highway can do so. A. L. Morgan, Engineer of the Des Moines Union Ry., will be in charge for the railroads.

The Chicago, Milwaukee & St. Paul Ry. will resume work shortly on laying new steel on the Sioux City-Manilla line. A small amount of steel was received in early spring, and invoices have been received for more of it that has been delayed because mills were behind in their orders. This is expected to arrive shortly, and when it does the final orders probably will be received to put men on the work. New 90-lb. steel will be laid, and the road bed will be rock ballasted [illegible] summer, according to present plans, and the remainder will be put down in the winter months. About 10 miles were laid just out [illegible] will be north of that, and the remaining 60 [illegible] miles of track already relayed will have to be ballasted along with the rest of the stretch. Gravel probably will be hauled from the pits of the company at Fairview, S. Dak.

The citizens of Rockwell City are raising a bonus of $5,000 for the electrifying of Fort Dodge, Des Moines & Southern into the city from Fort Dodge Junction, 26 miles southeast. It is believed that the work of electrifying the road will be completed by Nov. 1

It is said that over $300,000 of stock of the proposed Red Oak & Northwestern Interurban Ry. have been sold. An additional $300,000 of stock will be sold before construction work is started, but this, it is believed, will be accomplished so that work can be started this fall. George C. Bolleau, Red Oak, Ia., is Secretary.

The Iowa City, Ottumwa & Southwestern R. R., which projects a 70-mile line from Iowa City, through Wellman, Keota, Ollie, Farson and Ottumwa, has completed preliminary sur- [illegible] construction purposes. We are advised that construction contract will probably be let within 90 days. W. L. Kettlewell, Iowa City, Ia., is Chief Engineer and Frank Tanner, Iowa City, is General Manager.

The Charles City & Western Ry. of Charles City, has asked an amendment of the franchise granted it by that city so that it can tunnel under Mack and Est Sts. for a distance of 227 ft. to secure an egress from the city.

Kansas.

The Missouri Pacific opened passenger train service last week on the new Kiowa, Hardtner & Pacific Ry. in Kansas. This road is an extension of the Missouri Pacific from Kiowa to Hartdner, Kan., a distance of about twelve miles.

The Manhattan City & Interurban Ry. Co., W. R. West, President, Manhattan, Kan., is considering extending its line to Junction City, and has been making surveys on the military reservation at Fort Riley in order to apply to the War Department for a right of way.

The Garden City, Gulf & Northern R. R., W. H. Cost, Chief Engineer, Garden City, Kan., has started grading work on the extension north of Scott. This is the first of the operations in effecting a connection with the Union Pacific R. R. at Oakley, a distance of 58 miles from Scott. Grading will be pushed rapidly and the laying of rails will follow in a short time. Several cars of steel are expected in a few days. The company expects to complete this stretch of track by Dec. 31, 1910.

The Chicago Great Western R. R. will, it is reported, within the next year, start work on new tracks between Kansas City and Leavenworth. These will be used in connection with the Missouri Pacific as a double track for both lines.

The Kansas & Southeastern R. R. of Pratt, has started permanent surveys for its line from that city.

Kentucky.

The Monday Construction Co., which has just opened offices in the Empire Bldg., Knoxville, Tenn., has the contract for the masonry work on a 3-mile extension of the Lexington & Eastern R. R. near Lexington, Ky. The Monday Construction Co. is building a num- [illegible] one of the arches extending out into the K[illegible]tucky river a distance of some 140 ft.

Surveys have been started for the Glasgow & Hodgenville electric line and it is stated that the road will be in operation within nine months. Surveys were started at Glasgow and at Green River.

Louisiana.

The New Orleans, Natalbany & Natchez R. R. [illegible] mond, La., has completed its survey from Kentwood to Baton Rouge. The road is now built to Grangerville, over half of the distance from Kentwood to Baton Rouge, and it is said construction of the balance of the way into Baton Rouge is to be rushed.

The Kansas City Southern Ry. Co. has awarded to the Arnold Co., 181 LaSalle St., Chicago, Ill., the contract to build shop and yard improvements at Shreveport for which the directors have voted an appropriation of $500,000.

The New Orleans Great Northern R. R. and the St. Louis & San Francisco R. R. are reported to be considering the construction of a bridge across Lake Pontchartrain from Goose Point to a point on the lake shore, near Little Woods, and from there the building of a line into New Orleans, to connect with the tracks of the Terminal Co. It is stated that the probabilities are in favor of the new line into New Orleans being built from Slidell, the new track being built to the east of that town and crossing the Rigolets about six or seven miles east of the north shore and passing through the marsh near Chef Menteur and Michaud to a junction with the belt line tracks. This route would mean the building of 32 miles of track, including the bridge, with one draw, over the Rigolets.

Maryland.

Plans are now under way to go ahead with the construction of the Washington, Sandy Spring & Ellicott City Electric Ry., the right of way for which was secured a number of years ago. It will tap a section of Montgomery and Howard counties and will extend from Washington, D. C., to a point beyond Patapsco. Harry Phillips, Washington, D. C., is the Engineer.

The United Railways & Electric Co., Continental Trust Bldg., Baltimore, has been granted a franchise by the Highways Commission of Baltimore County to extend its line from Monument St. and Loney's lane to Monument St. and 8th St.

Massachusetts.

A special commission consisting of Arthur Lord of Plymouth, Prof. George F. Swain of Boston and Fred Joy of Winchester, has begun to hold preliminary hearings on the methods for abolishing grade crossings on the Boston & Maine R. R. in the northern part of the city of Worcester. The plans prepared by City Engineer Frederick A. McClure of Worcester, provide that all streets except Otis and Harlow Sts. and North Ave. shall pass under the railroad tracks and that the tracks shall cross on concrete arch bridges, leaving a headroom of 16 ft. All of the hearings are to be held in Worcester. The first hearing will be held in the City Hall on Sept. 20.

The Hampden R. R. Co. has been organized with a capital stock of $1,000,000, to construct a line to be operated by steam or electric power between Springfield and Bondville on the Massachusetts Central division of the Boston & Maine, with a spur to Holyoke. The directors named in the article of association are: Ralph D. Gillett, H. W. Ely and Archie D. Robinson of Westfield, Arthur W. Eaton of Pittsfield, Joseph A. Skinner of Holyoke, H. H. Bowman and F. T. Ley of Springfield.

Michigan.

The Grand Rapids Terminal Belt Ry. Co., of Grand Rapids, is acquiring right of way for its proposed lines in Wyoming Township. It is said that the company has now acquired a continuous right of way connecting the Lake Shore and Michigan Southern, the Grand Rapids and Indiana, the Grand Trunk and the Pere Marquette. The company contemplates constructing a connecting link for all these roads around the south and east portions of the city. It is said that building operations will not begin for some time.

Minnesota.

The Minneapolis, St. Paul & Sault Ste Marie Ry. has put an additional track-laying machine on the west end of the Plummer-Moose Lake line, which will work east from Plummer towards Bemidji until about 35 miles of track are laid. Another track-laying machine is working out northwestward from Moose Lake.

Richard Evans, who is building the grade for the Soo line from Cass Lake to Bemidji, is completing his contract and now has only some finishing touches to put onto the grade when he will have the 14 miles ready for the track-laying machine. He has had four steam shovels on the job most of the time since last spring and has rushed the grading as rapidly as possible.

Peter Nelson of Minneapolis has finished his grading operations on the western end of the Coo's Plummer-Moose lake line. Mr. Nelson had a large contract in the vicinity of the Leech Lake dam. He also took a contract to grade some six miles of right of way in the town of Gonvik, Clearwater County, extending westward 6 miles from Silver Creek. Mr. Nelson has been given a contract to grade 8½ miles on the old Wisconsin Central line, in Wisconsin, from Silon to Glenwood, Wis.

All of the Soo contractors have received notice that they will be granted a 60-day extention in which to complete their work along the line between Cass Lake and Plummer. The Soo is now laying about a mile of track per day on the new line.

Mississippi.

The stockholders of the Mississippi Western Construction Co. held a meeting at Jackson, Miss., on July 27, to take steps for the financing of the projected Mississippi River Western R. R. The company was organized some months ago.

Surveys for the route for the Newton Northwestern R. R., projected between Newton, Miss., and Carthage, in Leake County, for which a charter was granted some time since, has been started. The company has engaged J. A. Kauffman, first vice president and general manager of the J. A. Kauffman Co., engineers and contractors, steam and electric railroad buiders, of Dayton, O., to do this work.

Missouri.

The Nashville, Chattanooga & St. Louis Ry., Hunter McDonald, Chief Engineer, Nashville, Tenn., is reported to have practically completed arrangements to enter St. Louis over its own rails. It is proposed to construct a bridge across the Ohio river at Paducah, crossing to Metropolis, Ill., and thence over a practically new constructed road to enter St. Louis.

The property of the St. Louis, Montesano & Southern Ry., an electric railway running from St. Louis to Mt. Pleasant, Mo., has been bought at a receiver's sale by John O'Laughlin, an insurance broker, of St. Louis, Mo., acting for a syndicate. It is said that the company will be reorganized and the line completed. The company has franchises and right of ways for 63 miles of track, beginning at Broadway and Davis St. in St. Louis, and running through St. Louis, Jefferson and St. Francois counties. About 30 miles of track have been laid and the rest of the line surveyed. Several residents of the southern part of St. Louis County will be interested in the company when it is reorganized, it is said.

The Metropolitan Street Ry. Co., of Kansas City, Mo., is stated to have accepted the ordinances for the extension of the Roanoke and Brooklyn car lines. Parties along Roanoke St. are to have the grading done for that extension.

The Missouri Pacific Ry. has completed plans for an addition to the company's machine shops in the East Bottoms at Kansas City. The company will spend $250,000 for this improvement which will nearly double the size and capacity of this institution.

According to statement at Montgomery of R. E. Race, Vice-President and Manager of the Central West Construction Co., and Chairman of the Board of the St. Louis, St. Charles & Northern Traction Co., the route of the projected line will run from a point near Delmar Garden, St. Louis, through Creve Coeur, St. Charles, St. Peter's, St. Paul, Chain of Rocks, Troy, Olney, Marling, Middletown, Ladonia, Mexico, Paris, and points northwest, the first division extending from Delmar to Laddonia. The road crosses Cuivre river several times.

The Missouri, Kansas & Texas R. R. is said to be about to let contracts for the extension of its line to connect with the Union Depot terminals at Joplin, Mo. The new track will be 2¾ miles long and will leave the old line at a point some distance west of Chitwood. It will circle through the north part of Joplin along Joplin Creek, coming into the Union depot limits at a point about 50 ft. west of the North Main St. viaduct. The line will cost something like $250,000 owing to the heavy cuts and fills to be made. At one point a fill 135 ft. above the bottom of the ravine will be required. Several trestle bridges will also have to be built.

St. Louis Items.

BY A. B. KOENIG.

Ransom & Cook, Ottawa, Kans., have 20,000 yds. of wheeler work on the Santa Fe R. R. in Missouri to let. They would like to have about a 15 or 20 team outfit on this job.

The Hoosac Construction Co., 5400 Arsenal St., St. Louis, Mo., want a 10 or 12 team outfit to put on 40,000 to 60,000 yds. of wheeler work that they have to let in the western part of the city.

The Board of Public Improvements let the contract for the sewer in the Dale Ave. joint sewer district to Hoffman & Hogan, contractors, whose bid was $85,000. The contract for the Ellendale sewer also was let. The lucky bidders were the Clark-Ansbro Co., who signed the contract for $27,125.75, beating the next highest bidder, E. J. Welsh, by 75 cts.

Ed. Oberby came in from J. H. Haliburton's work in Indiana for a bunch of colored skinners and went back happy.

Cameron, McManus & Joyce were awarded the contract for building the new dyke in Kansas City, Mo., the other day. They have quite a lot of work to sub-let on this job. Address them 916 Union Ave., Kansas City, Mo.

Hummer Kahl returned from the north and informs us that quite a few jobs in the north are shutting down. The south is looking for this labor if there is any of it idle, for there is quite a scarcity of labor in the neighborhood of St. Louis.

R. T. Grover, Warrensburg, Mo., has 88,000 yds. of light team work to let at that point.

J. H. McFarlin, General Manager of the Springfield & Jacksonville Electric Line, was in town the other day looking for outfits to put on this work. McFarlin says he has several nice pieces left on this line, which he will let to contractors to suit their outfits. Jacksonville, Ill., is headquarters.

Wm. Hughes spent a day in town last week and returned to his work on the Big Four R. R. near Evansville, Ind.

H. H. Heiser, who formerly was in the labor business in Denver, is now associated with the Contractors' Supply & Equipment Co., 339 Century Bldg., Denver, Colo.

On account of the scarcity of labor in the south A. B. Koenig has decided to close his Labor Agency in Ft. Smith temporarily.

R. H. McWilliams has moved his headquarters from Mattoon, Ill., to the Steger Bldg. in Chicago, where he and his brother will be located in the future under the firm of G. A. and R. H. McWilliams. They just secured a contract of 1,155,000 yds. of dredge work in Mississippi. They also have 20,000 yds. of nice scraper work to let on the Illinois river near Kampsville, Ill. This work is to be finished by Dec. 1st and they are offering attractive prices for same.

The Board of Public Improvements here on July 22nd awarded contracts for the improvement of 6½ miles of streets at a cost of $373,000. The streets to be improved and the cost follow: Rosalie St., Carter Ave., Fair Ave., asphalt, Trinidad Asphalt Manufacturing Co., $4,260.25; Newcomb Pl., Walton Ave. east 285 ft., asphalt, Trinidad Asphalt Manufacturing Co., $2,017; Newcomb Pl., Marcus Ave. west 272 ft., asphalt, Trinidad Asphalt

Manufacturing Co., $1,540.31; Cote Brilliante Ave., Kingshighway Blvd., Union Blvd., asphalt, Trinidad Asphalt Manufacturing Co., $14,750.89; McLaren Ave., Broadway, Church Rd., brick, John B. Turner, $6,566.35; Slattery St., Montgomery St. north 225 ft., brick, Wm. H. Redemeyer, $2,420.98; Keokuk St., Missouri Ave., Broadway, brick, Ruecking Construction Co., $5,057.84; Ohio Ave., Miami St., Cherokee St., brick, Wm. R. Bush Construction Co., $11,830.95; Hereford St., Bischoff Ave., Northrup, brick, Webb-Kunze Construction Co., $15,170.27; Elliott Ave., University St., Hebert St., brick, Skrainka Construction Co., $10,515.25; Glasgow Ave., Dodier St., Parnell St., brick, John McMahon, $25,076.51; Forest Ave., Manchester Ave., Plateau Ave., brick, Skrainka Construction Co., $19,576.08; Pennsylvania Ave., Miami St., Potomac St., brick, Wm. R. Bush Construction Co., $4,913.65; Louisiana Ave., Eiler St., Neosho St., brick, Ruecking Construction Co., $23,635.55; Nineteenth st., North Market St., St. Louis Ave., brick, Wm. R. Redemeyer, $13,282.14; Eighth St., Biddle St., Cass Ave., brick, Wm. R. Bush Construction Co., $11,465.70; Tenth St., Biddle St., Cass Ave., brick, Wm. R. Bush Construction Co., $11,300.50; Eleventh St., Biddle St., Cass Ave., brick, Wm. R. Bush Construction Co., $9,463.90; Biddle St., Broadway, Seventh St., brick, Skrainka Construction Company, $4,870; Thirteenth St., Franklin Ave., Biddle St., brick, Skrainka Construction Co., $10,410.98; Seventh St., Biddle St., Cass Ave., brick, Wm. R. Bush Construction Co., $10,895.20; Grand, Kingshighway, Kingshighway southwest, Bates St., telford; G. Eyermann & Bro., $24,972; Grand Ave., Bates St., Neosho St., telford, Ruecking Construction , Co., $30,322.63; Habsburger Ave., Salzburger Ave., Gravois Ave., telford, Harry F. Heman, $4,525.80; North Market St, Kingshighway Blvd., Union Blvd., bitulithic, Granite Bituminous Paving Company, $23,293.30; Mississippi Ave., Geyer Ave., Lafayette Ave., bitulithic, Granite Bituminous Paving Co., $8,122.44; Kingshighway southeast, Compton Ave., Grand Kingshighway, grading and planting trees and shrubbery, Harry F. Heman, $9,623.47.

Montana.

E. A. Wickham & Co., Council Bluffs, Ia., has secured the contract for 50 miles of work on the Chicago, Milwaukee & Puget Sound Ry. near Lewiston, Mont.

White Brothers, 325 First National Bank Bldg., Missoula, Mont., have their contract for constructing the Big Blackfoot Ry. from Bonners Landing to a point 10 miles east of Ovando, practically covered and are not subletting any more work just at present. The contract covers approximately 40 miles and includes some very fine team work, on which about the highest prices in the country are being paid. The sub-contractors on the work are Mike Tobin, Al Walker and J. C. Johnson, all of Ovando, Mont., and Headman & Lund of Clearwater, Mont.

Good progress is being made with the construction of the Big Blackfoot Ry. from Bonner at the junction of the Chicago, Milwaukee & Puget Sound Ry., to the crossing of Clearwater river. Clifton Applegate & Co., Bonner, Mont., have the contract, the work including 400,000 cu. yds. of earth excavation, 300,000 cu. yds. of rock excavation, one 250-ft. Howe truss bridge with pile approaches; one 300-ft. steel girder bridge and 8 or 10 pile bridges crossing small streams The Bates & Rogers Construction Co., 355 Dearborn St., Chicago, Ill., has the contract for the concrete work for the piers of the bridges. The sub contractors for the grading work are as follows: White Bros., Missoula, Mont.; J. G. Dinwiddie, Warden, Wash.; Headman & Lund, W. R. Hill and L. P. Anderson. There are also a number of station men at work on the line. The Clifton Applegate contract covers about 35 miles of work. About half of this is good team work; the balance is rock work and steam shovel work. The contract for the construction of the balance of the line of the Big Blackfoot Ry. for the crossing of Clearwater river to end of line, 25 miles, is held by White Bros., Missoula, Mont., and this 25 miles is team work.

Advices from Lewistown state that the extension of the Montana R. R. (Chicago, Milwaukee & Puget Sound) from that city to a point a little over three miles from Kendall will not stop there, as was supposed would be the case, but instead will run on northward several miles until Deer Creek is reached when it will branch, one line going to Christina, in the Dog Creek country, and the other continuing eastward to Roy and the Box Elder country.

Advices from Butte, Mont., state that the Davis-Daly Copper Co., W. M. Bacon, Manager, has made surveys for the grade of the proposed railroad from the Colorado mine to the company's ore bins on the Hesperous lode, on the Northern Pacific tracks. It is estimated that it will require about three weeks to build the spur.

Nebraska.

An ordinance is before the City Council of Lincoln to grant the Omaha, Lincoln & Western R. R. Co. a franchise in that city.

Stock subscriptions for the proposed Norfolk-Newman Grove Interurban Ry. are being secured, and it is believed that the road will be built. W. R. Martin, Norfolk, Neb., is interested.

New Jersey.

The Thompson-Smith Co., Oradell, N. J., has been incorporated with a capital stock of $25,000 and proposes to build railways, houses, turnpikes, etc. The incorporators are: Gilbert O. Smith, Oradell, N. J.; Edward W. Selvage, No. 1011 Chestnut St., Philadelphia, Pa.; Harry N. Selvage, No. 116 Nassau St., New York City; Caddell Smith, No. 54 S. Arlington Ave., East Orange, N. J.

The High Pressure Construction & Supply Co. of Millville, N. J., has been incorporated with a capital stock of $100,000 and proposes to build railroads, water, gas and electric works. The incorporators are: S. J. Franklin, Walter Owen and Alfred Brandriff, Jr., all of Millville.

New York.

The Public Service Commission of New York City began advertising for bids on July 25 for the construction of the tri-borough subway system in New York. The advertisements will run seven or eight weeks, and the bids will be opened either Sept. 13 or 20. The contract includes the Broadway-Lafayette loop and the two branches of the 4th Ave. subway, running to Coney Island and Fort Hamilton.

The village authorities of East Syracuse have notified the Syracuse Rapid Transit Ry. Co. that an extension of time will not be granted on the franchise for double tracking Manlius St. The franchise expires next October.

The project for the construction of an electric railway to connect Geneva and Newark has been revived and the owners of the Geneva, Phelps & Newark Electric Ry. have been endeavoring to interest the Beebe syndicate of Syracuse in the project. The Geneva, Phelps & Newark was organized and promoted about six years ago for the construction of a 12-mile line between Geneva and Newark, touching Phelps. Franchises and rights of way were secured and a line surveyed but the financial aid was not forthcoming and the proposition was dropped.

North Dakota.

Grading work on the Great Northern Ry. line is so well along that it is believed the entire grade will be finished this fall. Out of Fargo over 20 miles of grade is already completed and it is reported that at Surrey, the west end of the line, the work of laying ties and rails will commence about Aug. 1.

Over 200 teams are now working on the grading work from Jamestown on the Midland Continental R. R. J. T. Adams, Columbus, O., is the general contractor.

The Devils Lake & Northern R. R. (Farmers' Grain & Shipping Co.'s R. R.) will probably not have construction work started until next year on its extension from Hansboro, N. Dak., to Killarney, Canada. Jos. M. Kelly, Devils Lake, N. Dak., is President. The company at present is operating 66 miles of standard gage line.

It is said that the Powers Lake branch of the Great Northern road being built out from Stanley, will not be built any farther than [illegible] the lake to Stanley for shipment below.

Ohio.

The Baltimore & Ohio Southwestern R. R., A. M. Thompson, Chief Engineer, Baltimore, Md., is to double track its line from Cozoddale to Midland, a distance of 14 miles. The work will cost about $200,000.

The Columbus, Mt. Vernon & Mansfield Traction Co., incorporated July 13, is said to contemplate the taking over of the present Columbus, New Albany & Johnstown Traction Co. line and the continuation of its lines to Johnstown, Mt. Vernon and Mansfield. The new company was incorporated by J. W. Lehman, J. M. Adams, David Lehman, Thomas W. Varley and George W. Rhoads, of Columbus. According to the incorporation papers of the new road the new route will be from Taylor and Atcherson Sts., Columbus, through Franklin, Licking and Knox counties to Mt. Vernon and then through Richland County to Mansfield.

The Terminal Warehouse Co. of Cleveland is to have work started next month on the $1,500,000 freight station it proposes erecting at Ontario St. and Howe Ave., Cleveland, The four buildings of the station will cover 2½ acres. The company some time ago obtained the right by ordinance from city council to construct tunnels under Ontario St. and under Canal Road. The Ontario St. tunnel will carry tracks through "Vinegar Hill" to the basement of the wholesale stores from the Wheeling & Lake Erie terminal. Tracks from the B. & O. R. R. will enter the buildings from a tunnel under Canal Road. Plans for the station were made by Frank L. Packard, Architect, Columbus, O. Among those interested in the company are J. H. Fuller of the Stowe-Fuller Co.; F. C. Caine, of the National Fireproofing Co.; and W. D. Guilbert, President of the Capitol Trust Co. at Columbus.

A. DeMayo & Co., 1 Haskell Bldg., Ashtabula, O., have been awarded the contract for constructing the line between Alliance and Akron for the A. & A. Short Line Ry. Co., of which L. C. Marble, 1005 Schofield Bldg., Cleveland, O., is Chief Engineer.

The Hocking Valley Ry., J. A. Stocker, Assistant Engineer of Construction, Columbus, is improving the belt railway at Pomeroy, which it purchased last fall. The company has bought quite a tract of land and will extend the line and put in a number of switches to take care of the output of several coal mines which are now being opened just outside Pomeroy.

It is reported at Cincinnati that the management of the Baltimore & Ohio R. R. will soon announce that the Baltimore & Ohio Southwestern R. R. will be extended from Cincinnati to Portsmouth, O. It is reported that the new line will parallel the Ohio River between Portsmouth and Cincinnati, connecting at the former place with the branch of the B. & O. S. W. which runs south from the main line into Portsmouth from Hamden, O.

The Cleveland, Cincinnati, Chicago & St. Louis Ry. has authorized the construction of a sidetrack to the proposed new plant of the General Motors Co. at Clyde. The work will cost about $30,000.

The Bluffton, Geneva & Celina Traction Co is reported to have determined upon the route for the proposed extension from Geneva, the present terminus to Celina. It is said that the route will go through New Corydon. This route would require the construction of 12 bridges, while the route through Wabash, O., would require 28 bridges.

Oklahoma.

The Red River Ry. Co. of Oklahoma City has filed amended articles of incorporation with the secretary of state, changing its name to the Red River & Gulf Ry. Co. It proposes to build from Oklahoma City south to the Red river, at or near the town of Grady in Love county, 150 miles, and from Oklahoma City southwest through Oklahoma, Canadian, Grady, Caddo, Kiowa, Comanche, Tillman, Greer and Jackson counties to a point on the Red river at or near Lincoln in Jackson County, 145 miles.

The Oklahoma Central Ry., F. C. Hand, Chief Engineer, Purcell, Okla., will, according to advices, in the near future, construct terminals of its own in Chickasha and discontinue the use of the depot and yards of the Rock Island at that point.

The Southland Construction Co. of Muskogee has been incorporated with a capital stock of $10,000, the incorporators being J. M. Jemison, T. J. Murphy and Guy Nelson, all of Denison, Tex.

A state charter has been granted the Dallas Ry. Co. of Oklahoma, capitalized at $50,000. It is proposed to construct a railroad line from the Arkansas line across the Poteau River from Fort Smith to Wilburton in Latimer county, Oklahoma, a distance of 60 miles. The estimated cost of the line is $18,000 to $20,000 per mile. Among the incorporators are M. C. Burke, a railroad contractor of Fort Smith, Ark.; R. S. Willis and R. C. Alexander, Rogers, Ark.; J. E. Reynolds and M. W. Murray, Arkoma, Okla.; John Vaughan, Fort Smith.

The Fairview & Oklahoma City Ry. Co. has been chartered with a capital stock of $100,000 and proposes to build a line from Fairview to Rush, 4½ miles. The incorporators and officers are as follows: O. E. Snyder of Oklahoma City, President; H. A. Noah, Secretary; M. M. Fulkerson, Treasurer, both of Alva; W. D. Bowling, H. A. Bower, H. Clay Willis, all of Fairview, Vice-Presidents; W. B. Noble, Alva, and S. B. Moore, Oklahoma City.

Citizens of Billings are raising funds to aid in the financing of extensions of the Osage & Western Ry. As soon as the bonus is raised it is said work will be started on the extension from Billings to Enid westward and to Pawhuska on the east.

Grading for the Cherryvale, Oklahoma & Texas R. R. has been completed to Wann, Okla., and work has been started grading toward Nowata. J. H. Brewster, Independence, Kan., President of the Continental Construction Co., which has the contract for building the road, is now making a trip through Missouri, Arkansas, Louisiana and Texas for the purpose of buying ties, bridge materials and piling.

Oregon.

Surveys have been completed for the projected line of the Albany & Interurban Ry. Co. As proposed the line will be 85 miles long and will be constructed via Sanderson's bridge, up through the forks of the Santiam to Sweet Home. From there it will extend across the foothills to Holly and thence down through the Calapooia valley, reaching Albany again via Brownsville. It will describe almost a complete circle. The enterprise is financed by Albany, Ore., parties and the officers of the company, all of whom are from that city, are as follows: P. A. Young, President; J. M. Hawkins, Vice-President and General Manager; George H. Crowell, Secretary; A. C. Schmitt, treasurer.

It is reported in Klamath Falls that the reason for the temporary delay of work on the Oregon Trunk R. R., toward Klamath, near the north end of the county, is as follows: It is stated that in making the roadbed through the lava country of the Deschutes canyon large fissures in the earth have been discovered and the temporary stopping of the work on the contracts already let is due to these. Some of these fissures in the earth are said to be large enough to bury a house, and over these the building of a solid and safe roadbed is declared to be very difficult. For this reason a large force of surveyors have been sent to the field to make a new survey with a view to try and avoid crossing these as much as possible. When this new survey is finished the road will be rushed.

The Chamber of Commerce of Klamath Falls has appointed a committee to take up the matter of the right of way of the proposed railway between Klamath Falls and Merrill. The line will be an extension of the Oregon, California & Nevada R. R. now built to Alturas, Cal., and which it is proposed to extend through to Klamath Falls.

J. F. Mounce, who some time ago secured a franchise from the City Council of Eugene to build a steam railroad over certain streets of the city, which he proposes to build from Eugene west to the mouth of the Siuslaw river, is reported to have assigned and transferred the franchise to Ole Halverson, a wealthy farmer living near Eugene. A survey for the road for a distance of about 20 miles west of Eugene has been made and part of the right of way secured.

The City Council of Eugene is considering applications on the Portland, Eugene & Eastern Ry. and the Oregon Electric Ry. for a franchise over 5th St. The latter road desires to enter Eugene over 5th St., and proposes to extend its line from Salem. The Lane County Asset Co. already has a franchise on 5th St.

It is stated here in Portland that there is no truth in the reports that the contractors engaged in building the Oregon Trunk Line on the Deschutes R. R. have adopted a policy of retrenchment and are laying off men. On the contrary, it is said, the contractors could use many more men. On the Oregon Trunk Line there are something like 4,500 men at work, while on the Deschutes R. R., Twohy Bros., the general contractors, have over 2,500 men at work. It is further said that arrangements are going forward for getting grading started on the second section of the Oregon Trunk between Madras and Bend. Camps are being scattered along the proposed right of way at frequent intervals, and this stretch of line will be made ready for the rails within a few months.

The Oregon Eastern Ry., a Harriman line, is planning to build an extension 50 miles westward from Vale. Work will probably not be started before next spring.

Lewis A. Hicks & Co., of San Francisco and Portland, Ore., have been awarded the contract for erecting a warehouse, 1,000 ft. long and two stories high, at Portland for the Oregon Railway & Navigation Co. The contract price was about $135,000.

The Oregon Railway & Navigation Co. is now securing right of way deeds for the Stanfield-Coyotte cutoff, which will shorten the distance from Pendleton to Portland by about eight miles. It is reported that grading work will me started before the middle of next month.

The Oregon Electric Ry. Co., Portland, Ore., has purchased blocks 101, 102 and 103 between Clay and Montgomery Sts., at Portland, adjoining the present terminals, and will build new freight terminals.

The Oregon Electric Ry. Co. has bought land at McMinnville for terminal yards and depot grounds.

Pennsylvania.

The Pennsylvania R. R. is said to be tentatively considering building a subway into Pittsburg from its terminal on Liberty Ave. in the down-town district, to East Liberty, for the purpose of bringing trains into the city and also to establish a local and suburban passenger service in competition with the surface trolley lines. The plan proposes the electrifying of the Pennsylvania lines completely in and about the city and then running all passenger trains coming into Pittsburg with electricity after they reach the suburbs.

Construction work on the Western Maryland extension is well along at the Connellsville end. Wilkey & Rush have their camp on the W. A. Rieber farm opposite the borough of Confluence and are now engaged in making a long fill near the Yough river. The Nay Construction Co., which has the contract for bridge and concrete work on this section, has its headquarters at Harnedsville on the banks of the Casselman river and is now crushing rock for the concrete work. For the eight mile or more sections above Harnedsville there is not anything doing until the tunnel at Pinkerton is reached. Here work has been commenced at both sides of the tunnel. At Markleton a new survey is being made and this is retarding work in this section. All along the sidings of the B. & O. in the vicinity of Markleton and Pinkerton machinery of all kinds are filled up and ready for use. About two miles above Meyersdale near Keystone, a large force of men are employed at all kinds of construction work. The Somerset Construction Co. has a large force of men at work with all kinds of machinery. In the vicinity of Big Savage Mountains where the largest tunnel on the line will be cut through the mountains progress has been made, a steam shovel is at work and a large force of drillers on hand.

Contractors have submitted bids for the construction of the new line of the West Penn. Rys. Co. from Leiseuring No. 3 to Uniontown. Work will be started at the Connellsville end. J. L. Fritsch, Connellsville, Pa., is Chief Engineer.

People in the townships along the proposed line of the Ephrata & Lebanon Street Ry. Co. have subscribed for over $50,000 of stock. The City Council of Lebanon has also extended the time for constructing the road in the city for 15 months to 24 months. The line will connect Ephrata and Lebanon.

Work is to be started at once on the new round house and other buildings to be erected for the Bessemer & Lake Erie R. R. H. T. Porter, Chief Engineer, Greenville. The work will cost about $107,000 and will include a new road house, machine shops and steam heating and washout plant. The roundhouse will be of reinforced concrete and will contain 17 stalls. A building 70x129 ft. will be used as an air brake room and machine shop for work in connection with the round house.

The Scranton Ry. Co. of Scranton is reported to be planning to extend its lines from Mt. Cobb on the Moosic Lake road to Lake Ariel by way of the old gravity route. The extension will require seven miles of track.

The Midland Pennsylvania R. R. Co. has completed surveys for its projected 44-mile line from Millersburg to Ashland, Pa., and has awarded the construction contract to the Pinkerton Construction Co. Dodge & Day, Philadelphia, Pa., are the engineers, and W. E. Harrington, The St. James, Philadelphia, Pa., is the President.

South Dakota.

The Rapid City, Black Hills & Western R. R., at present operating 35 miles of line, is said to be planning to build an extension into Wyoming as far as Sundance, touching Cold Springs and Canon Springs. W. E. Moore, Rapid City, S. Dak., is General Manager.

Tennessee.

The Knoxville, Sevierville & Eastern R. R., W. A. Seymour, Chief Engineer, Knoxville, Tenn., is to have work started this season on a 15-mile extension from Sevierville, Tenn.

The Nashville Ry. & Light Co. of Nashville has been granted the right to construct a double track on West End Ave. from Centennial Park to the corporation limits of Nashville.

The Ococe Construction Co. of Polk County has been chartered with a capital stock of $100,000, the incorporators being Henry C. Beck, J. D. Alsup, R. L. Wescott and Henry Crumbliss, Jr.

The Clarksdale, Covington & Collierville Interurban Ry. Co., which has completed its line to Lakeview, has an ordinance before the city council of Memphis for a franchise to secure an entrance to that city. The franchise gives a right of way for 9½ miles of track in Memphis.

Arrangements are well along for the construction of the Harriman, Knoxville & Eastern R. R., and it is believed at Harriman that active work will be started in September. The road is to be extended into North Carolina.

The McDowell Construction Co. has been awarded a contract amounting to about $50,000 for filling in trestles and rebuilding the line of the Athens & Tellico Ry. from Athens, Tenn. A contract for a 2-mile extension on the line in Athens was to have been let on

July 23. This road was recently purchased by the Louisville & Nashville R. R.

The Tennessee Traction Co., of which George M. Bushnell, Memphis, is Chief Engineer, has completed preliminary surveys for its projected line from Memphis to Jackson, Tenn., and is now securing right of way. As proposed the line will be 75 miles long.

Texas.

The Gulf, Colorado & Santa Fe Ry. has received at Bolivar a consignment of 8,000 ties from Mexico, which are to be distributed over the company's system to various parts of the country, where the different woods will be given tests. Among the ties are mahogany, ebony, native cedar and various other woods, the shipment, it being stated, being in the form of a test or experiment.

Surveys have been started under the direction of Engineer P. G. Burns, for the line of the recently chartered Stamford & Eastern R. R. The road is to extend from Stamford east to the coal fields.

Advices from Austin quote J. T. Priest, representative of the new company which lately was voted a franchise by the people of Austin to build a car line across the Colorado river, as stating that grading for the line into South Austin will be begun at once.

Surveys for the Corpus Christi and Del Rio R. R., of which J. H. Collins is Chief Engineer, have been completed to Del Rio.

Construction work on the new Stone & Webster interurban line from Galveston to Houston is well along and materials for the road are arriving at Houston. Ballasting materials for the road are piling up and the last of the order of 120,000 ties is being delivered. The Louisiana Red Cypress Lumber Co. received the bulk of this order, this company getting an order for 100,000 ties. The remaining 20,000 are heart pine and are being delivered by Pickering & Co. of Louisiana. Rail amounting to 5,700 tons has been ordered from the Pennsylvania Steel Co., and it is understood that the first shipment has either been made or about to be. This will arrive by way of Texas City and will help fill up the material yards at Texas City Junction.

The Brownwood Southwestern Ry. Co. has completed surveys and has secured the capital for the construction of its projected 30-mile line from Brownwood to Rockwood. We are advised that the company will itself construct the line. R. A. Love, Brownwood, Tex., is President.

The Pecos Valley Southern Ry. now has 25 miles of line in operation and 30 miles of finished grade. It is expected that the entire line of the 45-mile section will be completed by Oct. 1. The contract for the first 45-mile section of this road was let about March 1. L. W. Anderson, Pecos, Tex., is Chief Engineer.

Work is to be started at once on three small center buildings at the yards of the International & Great Northern R. R. at Taylor. The three new buildings are to cost about $15,000, and to be used for the following purposes: One for a power house, another for a sand dryer and the third for bath rooms and closets.

W. H. Denison, Lubbock, Tex., has been awarded the contract for grading and tracklaying for the projected 40-mile line of the Crosbyton-South Plains R. R. from Crosbyton to South Plains. John A. Knox, Crosbyton, Tex., is Chief Engineer.

Utah.

The Utah Light & Ry. Co., L. L. Dayton, Engineer, Salt Lake City, will at once make surveys to Draper.

Preliminary surveys have been made and maps drawn of the projected route of the Iron Mountain, St. George & Grand Canyon R. R. The line leaves the Salt Lake Route at Thermo and runs to Cedar City via Enoch. From Cedar it goes to Kanarra and at a point a few miles east of New Harmony it branches. The Kingman branch is projected to run through the following places: Belleview, Silver Reef, Leeds, Harrisburg, Washington, Middleton, St. George, where it makes a turn up Santa Clara creek to a point near Santa Clara and then makes another turn to the southwest, effecting an easy grade in crossing the Beaver Dam mountains, thence to Littlefield, Bunkerville, St. Thomas. The Colorado river is crossed at Stone Ferry, a few miles west of Rioville. Then the line runs due south to Kingman, Ariz., where it connects with the Santa Fe. Returning to the point of divergence near New Harmony, the other line runs southeast through Virgin, Canaan Spring, Short Creek and east to Pipe Springs and Mangum Springs in Arizona. Between Pipe Springs and Mangum Springs the third branch runs to the rim of the Grand Canyon of the Colorado in Arizona, at a point about 50 miles south of Kanab.

Surveys are now underway for a proposed railroad from Cedar Creek to Huntington in Emery County.

The San Pedro, Los Angeles & Salt Lake R. R., E. G. Tilton, Chief Engineer, Los Angeles, is reported to have five engineering parties in the field at various points in Meadow Valley making surveys for a high line to preclude the possibilities of washouts. The new line would involve the construction of about 60 miles of track and would cost about $5,000,000.

Virginia.

The Richmond & Chesapeake Bay Ry. Co., Wm. Northrop, General Manager, Richmond, Va., has completed the work of surveying routes between Ashland and Fredericksburg, where connection is made with the line from Ashland to Richmond, and from Fredericksburg to Washington, D. C. Two lines have been surveyed from Fredericksburg to Washington—one by way of Manassas and Fairfax Courthouse, and the other following closely the line of the Richmond, Fredericksburg & Potomac R. R., and the Washington Southern R. R. The company will determine which of these lines it will use in constructing the railroad.

The question of building a railroad from Fredericksburg through the Northern Neck to the Chesapeake Bay has been again revived, and a meeting of the citizens of Richmond and Westmoreland counties has been held to confer with the representatives of capitalists and the railroad interests to consider plans looking to the construction of a line. A meeting of citizens of Northumberland and Lancaster counties to consider the same subject was held July 18 at Lancaster Courthouse.

Plans have been completed and applications made to the city authorities of Norfolk for a building permit for the proposed $1,000,000 union station to be constructed in that city by the Norfolk Terminal Co., of which L. E. Johnson, Norfolk, Va., of the Norfolk & Western Ry., is President. The main station, or office building, eight stories and one mezzanine, is to be 51 by 200 ft. and 123 ft. high. The waiting room and annex is to be a building 53.6 ft. by 140 ft. and the power, baggage and express building is to be 35 by 330 ft. Reed & Stem, Chicago, Ill., and St. Paul, Minn., are the architects.

The Laurel Fork & Mendota R. R. Co. has been chartered with a capital stock of $5,000, and proposes to construct a railroad about 45 miles in length to run through the counties of Washington and Smyth, in Southwest Virginia. The officers of the company are: V. B. Robertson of Abingdon, President; Alexander Stuart, of Abingdon, Secretary and Treasurer; C. E. Bolling of Richmond; E. G. Leigh, Jr., of Richmond; C. D. Langhorne, of Mirador, Va.; John Thompson Brown of Brierfield, Va.; and John C. Dabney, of Lynchburg, incorporators.

Officials of the Chesapeake Western Ry. with F. J. Kilpatrick, a railroad contractor, have been over a proposed extension of the road. The Chesapeake Western Ry. now has 38 miles of line in operation from Elkton to Stokesville and is said to be planning to extend the line 40 miles to Deerfield toward the west. C. B. Williamson, Harrisburg, Va., is Superintendent.

Washington.

Engineers of the city of Seattle have begun surveys for a railroad to be built at a cost of about $100,000 and which will be used in carrying out timber cut from the shores of [illegible] neer, of Seattle.

[illegible] ern Pacific railroads have been in conference with City Engineer Doolittle, in North Yakima, to consider the question of building a subway at either Yakima Ave. or Chestnut St. under the tracks of both railroads.

The Oregon & Washington Ry. has placed on the market a portion of the right of way it purchased for its proposed line between Tenino and Lakeview. This property is no longer needed by the road since it has made arrangements to enter the city over the Northern Pacific's new Point Defiance line.

The Grays Harbor line of the Chicago, Milwaukee & Puget Sound and the Oregon & Washington R. R., on which the last steel was laid some weeks ago, will be turned over to the operating department about Aug. 1.

The Seattle, Renton & Southern Ry. Co. of Seattle, Wash., has asked the city council of that city for a franchise on Stewart St., between Third and Fifth Aves., and has asked that the rights on Westlake Ave. between Pike and Fifth Ave. be eliminated from the original franchise. A portion of Stewart St. is already occupied by the company's temporary tracks.

West Virginia.

The Virginian Ry., H. Fernstrom, Chief Engineer, Norfolk, Va., has issued bonds to build a branch line from Harpers by way of Berkeley and Mount Hope to Paintville, connecting at that point with the main line.

The Norfolk & Western Ry., Chas. S. Churchill, Chief Engineer, Roanoke, Va., has construction work under way in West Virginia on 17 miles of second track. This work is being pushed as rapidly as possible. Included in the work are four tunnels.

The Mingo Ry. Co. of Charleston, W. Va., has been chartered and proposes to build a line from Lenore, on Pigeon Creek on the Tug Fork of the Big Sandy river, to the mouth of Gilbert's creek, on the Guyandotte river. The capital stock is $50,000. The incorporators are Simon P. Richmond, V. L. Black, L. G. Summerfield, Angus W. McDonald and George S. Couch, Jr., all of Charleston, W. Va.

Application has been made to the Commissioners of Hampshire County at Romney, W. Va., by J. V. Cowgill and R. P. Monroe for a franchise for an electric railway in Hampshire County to run over the county road and Northwestern turnpike from Romney, via Augusta, Pleasant Dale, Hanging Rock and Capon Bridge, to the Virginia boundary line on the way to Winchester, Va., a distance of 35 or 40 miles.

Wisconsin.

The State Railroad Commission held a final hearing at Superior, Wis., on July 26, regarding the projected line to or proposed ore dock at Superior for the Soo R. R.

The State Railroad Commission is holding a hearing at Milwaukee today, July 27, regarding the action brought by the city ag[illegible] the Chicago & Northwestern and the Ch[illegible] Milwaukee & St. Paul Ry. Cos. to force [illegible] ishment of the dangerous grade crossin[illegible] the heart of the manufacturing district of [illegible] city. According to tentative plans of the city the grade of six streets will remain the [illegible] 3.6 ft. L. J. Klug, Assistant City Eng[illegible] is in charge of the plans.

[illegible] LaCrosse & Southeastern R. R. [illegible] LaCrosse, is interested.

Canada.

[illegible] into an arrangement with the Canadian Northern R. R. by which the construction of the branch to the Okanagan will be commenced next year and pushed to completion. A preliminary survey of the route proposed for the Okanagan branch is reported to have been made by railwav surveyors last year. Generally the route will, it is said, follow the old stage route between Kamloops and Okanagan, traversing the Grand Prairie district, Campbell Creek and the Upper Salmon River valley.

It is asserted that the Grand Trunk Ry. is likely in the near future to build or acquire a line connecting Winnipeg with Chicago. Of course the plans of the Grand Trunk are in anticipation of the removal of the duty upon wheat and the negotiation of a liberal reciprocity treaty between the United States and Canada under which the Grand Trunk hopes to carry into Canada large quantities of American factory goods in exchange for an American market for the Canadian wheat it expects to bring across the border.

The route by which the Grand Trunk Pacific Ry. will enter Regina, Sask., has been given out. The plans show that the Regina-Yorkton branch will strike the city at the northeastern limits, skirting the northern boundary to the extreme west. There it will turn south, and passing between governmen house and the exhibition grounds, will proceed to southern limits where it will turn east stopping at the junction of Albert St. and 16th Ave., where a passenger depot and large hotel will be located. The line to the international boundary which will link up the G. T. P. with the Hill system will connect with the above line at a point near the southwestern limits of the city, while the proposed line to run west from that city will connect at the northwestern limits. The freight yards and sheds will, if the present plans are carried out, be situated west of Albert St. near the exhibition grounds and adjacent to the C. P. R. main line, while the extensive shops which the company will locate at this point will be placed north of the city limits.

The Grand Trunk Ry. Co. is to commence work soon on the depression of its tracks between Bathurst St. and Sunnyside at Toronto, Ont. The city is to bear one-third of the cost of depressing the tracks, and the Grand Trunk Ry. Co. is to bear the other two-thirds. The city's third of the cost applies only to two tracks, not to four tracks, which it is proposed to construct. The Grand Trunk Ry. Co. will have to bear the whole expense of the proposed additional two tracks. Engineer E. L. Cousins will have charge of the city's end of the undertaking.

Mr. John B. McRae, Consulting Engineer, of Ottawa, Ont., and Mr. Hector A. Dion, Assistant Engineer, have gone to Moose Jaw, Sask., where they will supervise the construction of the new electric street railway in that city. The franchise for the new road was secured by a number of Ottawa men headed by A. A. Dion of the Ottawa Electric Company, and Newton J. Ker, City Engineer, and extends for twenty years. The road will extend for six miles and it is intended to have three miles in operation this fall.

The contract for the construction of the first section of the Canadian Northern Pacific Ry. from New Westminster easterly for a distance of 57 miles, has been let to the Northern Construction Co., of Winnipeg, Man.

Mexico.

Azan & Clark, Engineers, Pachuca, Mexico, are preparing plans for the railroad now being surveyed between Pachuca and Real del Monte. The surveys are to be continued to El Chico, thus connecting the three most important mining camps in the state of Hidalgo. The board of directors consisting of Jacinto Pimentel, Jose L. Requena and Rafael M. Arozarena, accompanied by general manager T. Brandenburg, have made a visit over the proposed line.

Work is to commence shortly on the construction of the railway to Metzitlan, a concession for which has been granted to Richard Honey. Engineer F. F. Zschiedrich of Pachuca will have charge of the work. He was formerly employed on the Pachuca-Zimapan road now under construction by the same concessionaire. Connection will be made at Apulco or Tortugas and will also connect with Zacualtipan, where Mr. Honey owns some valuable rolling mills and foundry.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

Arthur S. Bent, 717 Central Bldg., Los Angeles, Cal., has the contact for adding 15 ft. to the height of the Sweetwater Dam near San Diego, and for reinforcing the old structure sufficiently to carry the added load and pressure. The contract includes 2,000 cu. yds. earth excavation, 5,000 cu. yds. rock excavation and 20,000 cu, yds. of concrete masonry.

Colorado.

The Rio Grande Reservoir & Ditch Co., 420 Symes Bldg., Denver, Colo., opened bids July 2 for furnishing material and the construction of a storage reservoir at Santa Maria Lake, Mineral County. Beisel & Glenn, 502 Railroad Bldg., Denver, Colo., were the low bidders. We are advised that the question of whether a contract will be let at all this season is yet undecided; should it be decided to let a contract it will be awarded to Beisel & Glenn. The work will consist mainly of a 48-in. diameter continuous wood stave pipe 8,000 ft. long, a concrete lined canal 8,000 ft. long; a hydraulic fill, or earth dam containing 265,00 cu. yds., outlet tunnel 600 ft. long, outlet canal 3,000 ft. long, spillway, diversion dam, valve chamber, valves, etc.

The Grand Valley Irrigation District of Grand Junction is to hold an election in Aug. 1 to vote on bonding for $425,000. The proposed bond issue involves the purchase of the old Wilcox canal by the property owners of the irrigation district and the work of repair and enlargement will begin at once.

Work on the impounding dam for the Mt. Pisgah reservoir of the Park Center Land & Water Co., 12 miles northwest of Cripple Creek is so well along, that it is believed that it will be completed by Aug. 15. The dam is of earth construction and will be 66 ft. high, 225 ft. in length and 288 ft. in width at the base. In addition to a concrete core running down to the bedrock, which is in some places 18 feet below the channel of the creek, the entire upper surface of the dam is protected by a 6-in. coating of concrete, held in place by a system of steel netting. At the top of the dam there will be a stone spillway, 10 ft. deep and 50 ft. wide. The Empire Construction Co., Denver, Colo., is the contractor for the dam. H. N. Nickerson, Greeley, Colo., is contractor for the concrete work.

Iowa.

✣Bids are asked by Neal Jones, City Clerk, Des Moines, Ia., for river improvement for flood protection, including the excavation of new channels in the Des Moines and Raccoon Rivers, estimated to involve 650,000 cu. yds. Official advertisement will be found elsewhere in this issue.

The City Council of Des Moines has voted to build a canal or cutoff for the Coon River in South Des Moines to do away with loss from floods.

Commissioners of Webster County, at Fort Dodge, have awarded the contracts as follows for the construction of Drain No. 116: Lehigh Clay Products Co., at $1,911, for furnishing tile on line of ditch; J. F. Parrish, at $1,750, for laying tile.

Bids were opened July 20 at the office of the County Auditor at Northwood, Ia., for work on Drainage District No. 13 of Worth County. The contract for the open work was let to McKillip & Lyford, Northwood, Ia., at $15,625. The contract for the tile was let to J. H. Scriver, Mason City, Ia., at $7,228. The work includes 143,060 cu. yds. of earth excavation, 10,372 ft. of 10-in. tile. 4,400 ft. of 12-in., 1,200 ft. of 14-in., 2,000 ft. of 15-in., 2,484 ft. of 8-in., 66 ft. of 6-in. tile.

Chapman Bros. are now working two dredges in their contract for constructing 14½ miles of ditches in District No. 12 near Wapello. Their new dredge boat, costing about $10,000, was placed at work last week.

City Engineer Gaynor of Sioux City, Ia., has completed plans for a conduit for the drainage of Perry Creek in Sioux City. It is estimated that the conduit will cost about $50,000.

Kansas.

✣Bids are asked by W. H. Daniels, President, Kaw Valley Drainage Board, Kansas City, Kan., until 2 p. m., Aug. 22, for the construction of 62,400 cu. yds. of levee work; 50,000 sq. yds. of revetment paving and other work along the bank of the Kansas River on the left side from Mattoon Creek to Fifth St. bridge.

Louisiana.

✣Bids will be received until August 15, 11 a. m., by Maj. Burgess, U. S. Engineer, 3338 St. Charles Ave., New Orleans, La., for the construction of about 257,000 cu. yds. of earthwork in the lower Tensas Levee district.

✣Bids are asked by Capt. Robert Ralston, U. S. Engineer, 3338 St. Charles Ave., New Orleans, La., for furnishing about 7,500 tons of rock for Albemarle Bend.

Minnesota.

The La Crosse Dredging Co. of La Crosse, Wis., will commence work about Aug. 1 on the work of dredging Lake Winona and filling in of land in the vicinity of Winona on the lake proposition.

Commissioners of Chippewa County, at Montevideo, have awarded the contract for constructing County Ditch No. 13 to Verkle Bros. & Erdahl.

Mississippi.

Bids were opened July 21 at the U. S. Engineer's Office, Vicksburg, Miss., for about 800,000 cu. yds. of levee work at the Albemarle and for work in the Arkansas and upper Tensas levee districts. The bidders on the different work were: Lorance Bros., Leonard & Co., Memphis; O. A. Gibson, Natchez; W. T. and E. M. Lorance, Rosedale; Lawrence Brothers, Baton Rouge; H. F. Garbish, Vicksburg; Jno. G. Sessions, Fitlers; W. C. Mullen, Vicksburg; Shields & Miller, Greenville; Riche & Stansell, Memphis; Clarke & Parker, Natchez; Clarke, Bobbett & Co., Vicksburg; Donovan & Daly, Lake Providence; Helgason Bros., Vicksburg.

A meeting of planters of Washington County is to be held at Leland on Aug. 5th for the purpose of organizing a drainage district to reclaim the swamp and overflowed lands lying between the east bend of Deer Creek and the Sunflower County line, and the west bend of Sunflower River, extending to the Sharkey County line, the north line of the proposed territory being the line of township 18, ranges 6, 7 and 8. More than 50,000 acres of land are included in this territory.

Missouri.

Cameron, McManus & Joyce, 17 South 7th St., Keokuk, Ia., have been awarded a con-

Items marked thus ✣ indicate work now open for bids.

tract July 19th, by the North Kansas City Levee District, for constructing levee in Clay County, Missouri, along North Harbor line of Missouri River, opposite Kansas City, for protection of 3,000 acres of land. The approximate quantity is 550,000 yds., all team work. Cameron, McManus & Joyce have opened an office at Harlem, Mo., for this work.

The city of Kansas City has voted a bond issue of $75,000 for improving levees.

Montana.

Advices from Helena state that at the middle of July about 800 men were employed on the Holter and Hauserlake dams of the United Missouri River Power Co. and that concreting is underway on both projects. Caissons were then being built at Hauserlake and were shortly to be sunk, it being the intention to complete the foundation by the pneumatic process.

Nebraska.

The Commissioners of Dodge County at Fremont, Neb., have been petitioned to establish extensive ditches in the west end of the county.

Louisiana.

John Riess, 903 Hibernia Bank Bldg., New Orleans, La., has been awarded the contract, at $2.25 per ton, for furnishing 10,000 tons of rock for Reid-Bedford Bend, La., for the U. S. Government. The rock is to be delivered on U. S. barges at Vicksburg, Miss. Bids were opened at New Orleans on July 22.

New York.

WORK ON CONTRACT NO. 21, N. Y. STATE BARGE CANAL.

Work on this contract was started June 6, 1910, and about 1 per cent of the total work required was done during the first month. The contractors, Lane Bros. & Co., of Alta Vista, Va., have been busy establishing a camp just southwest of Rochester, N. Y., but have, at the same time, made a good showing in the amount of earth moved during their first month on the ground. The first monthly estimate was 27,636 cu. yds. The work is on the "land line" of the new canal, which means that part which diverges from the old canal. It is about 2½ miles long. The material, indicated by the borings taken, is about 40 per cent rock, and the excavation was bid in at 48½ cts. a yd., including both rock and earth, there being no classification. The remaining 60 per cent of the material to be excavated consists of loam, sand, gravel, and large pockets of clay. The cut will run from 38 ft. in depth to 63 ft. The borings indicate that the strata of rock has a summit at about the center of the contract, which is within 16 ft. of the surface and on this account the work in this vicinity will be unundertaken with starting points at both ends in order to facilitate the drainage. The entire plant will consist of three steam shovel outfits, with cars and locomotives of standard gage. Two of the shovels are now at work. These two shovels are Atlantic No. 1, 70 tons with 2½-yd. dippers. They are to be used in the soft material and a Marion shovel model 100, of 118 tons, will be used for the rock work. This shovel is equipped with a shallow 4-yd. clipper, which is to be operated by a steel encased, wooden boom and dipper arm. The cars used consist of about 50, 6-yd. side dump cars, and two trains of 5 cars each, of Kilbourne Jacobs air dump cars of 16 yds. capacity. The air dump cars are of the latest type and are a feature of the car equipment. They are equipped with air brakes and air dumping apparatus and may be dumped by a man at each car or may be dumped from the locomotive, singly or by the entire train. Each car contains a storage pressure cylinder which has sufficient capacity for dumping the car six times, after the engine is cut off. By way of experiment, a train of these cars, after dumping, were left in that position over night and were easily righted to loading position the following morning by the pressure still contained in the cylinders on each car. These big cars are intended particularly for the rock work and for long hauls. The locomotives will consist of eight Porter, of 22 tons weight, and two American, 40 ton locomotives for the large air dump cars. All of the rolling stock is of standard gage, which is of great advantage, especially in moving steam shovels from one part of the job to another. The work during the 21 days of June consisted of 30 shifts of 8 hours each. One 70-ton shovel worked 21 of these shifts and the other 9 shifts. The 30 shifts excavated 27,636 cu. yds. Considering that all the material was first in new dump and that the track was being continually raised on the dump, so as not to begin widening it until the ultimate heighth of the dump was reached, the showing made is very good. After the heighth of the dump is once reached the work will be continued by simply shifting track. Mr. T. Y. Conway is Superintendent of the work with Mr. C. B. Nye and Mr. J. W. Hardman as assistants. The state of New York is represented by Mr. T. W. Barralby, Division Engineer of the Western Division, with Mr. Thos. J. Morrison as Resident Engineer and Mr. H. J. Hemstreet in charge of Contract 21.

The I. M. Ludington Sons Co., Powers Bldg., Rochester, N. Y., was the only bidder July 19 for contract No. 62 for work on the New York State Barge Canal. The contract calls for the improvement of the canal from the west line of Monroe County to the east end of Contract No. 9 at Eagle Harbor and covers a length of 14.15 miles. The total bid was about 9.2 per cent above the engineer's estimate. The bid of the Ludington Sons Co. was as follows:

Quantities.	Items.	Unit bid
14.15	Miles cofferdams, pumping bailing and draining per mile	$[illegible]
....	Clearing, lump sum	6,000.00
1,625,000	Cu. yds. excavation	[illegible]
160	M. ft. B. M. sheeting and bracing	[illegible]
2,000	Lin. ft. round timber bracing	.20
11,960	Sq. ft. channeling	.90
718,200	Cu. yds. forming embankment	.21
37,900	Cu. yds. lining	1.50
30,000	Cu. yds. puddle	2.00
64	M. ft. B. M. sawed lumber (yellow pine or Douglas fir)	50.00
8,000	Lin. ft. foundation piles	.35
25	M. ft. B. M. wooden sheet piling	50.00
45,120	Cu. yds. second class concrete	7.50
4,444	Cu. yds. third class concrete	7.00
4,160	Cu. yds. reinforced concretet	12.00
29	Cu. yds. first-class masonry coping	30.00
5,125	Cu. yds. rubble masonry	4.00
1,476	Cu. yds. dry retaining wall, including coping	2.50
101,100	Cu. yds. wash wall	2.00
8,890	Sq. yds. second class stone paving	1.50
14,300	Sq. yds. third class stone paving	1.25
200	Sq. yds. cobblestone paving	1.25
550	Cu. yds. second class rip-rap	2.75
21	Cu. yds. thirl class rip-rap	2.50
1,704.000	Lbs. cast iron culvert pipe and specials	[illegible]
450	Lin. ft. 8-in. vitrified pipe, laid	.20
450	Lin. ft. trenching and backfilling for 8-in. vitrified pipe	1.50
2,403,300	Lbs. structural steel	.05
443,000	Lbs. metal reinforcement	.03½
19,100	Lbs. iron castings, plain	.03½
270	Lbs. expanded metal	.05
560	Sq. ft. Portland cement sidewalks	.25
30	Sq. yds. relaying sidewalks	.50
120	Sq. yds. brick pavement	3.00
3,224	Sq. yds. wooden pavement, 2¾-in.	2.75
1,302	Sq. yds. wooden pavement, 3¾-in.	3.00
13,005	Lin. ft. wooden fence	.20
85	Lin. ft. wrought iron pipe railing	[illegible]
1,580	Lin. ft. lattice railing	1.75
5,400	Lin. ft. repointing old masonry	.05
840	Lin. ft. drilling bolt holes in old masonry	[illegible]
7	waste gates, 24x24-in., complete in place, each	225.00
7	waste gates, 36x36-in., complete in place, each	325.00
465,000	Lbs. metal in guard gates	.05½
100,000	Lbs. machinery for lift bridge	.12
3	Electrical equipment, each	2,000.00
3	Operator's [illegible]	[illegible]
2	Pumps, each	450.00
172,900	Sq. ft. tarfelt water proofing	.05
	For removing old bridge superstructures	[illegible]
	For [illegible] lump sum	15,400.00
	For maintaining highway traffic, lump sum	8,400.00
68	Buildings to be removed	50.00
	Total	$2,348,436.00

Ohio.

The Kaps-Brehm Co., Cincinnati, O., have 7,000 cu. yds. of wheel work at Hamilton, O., to sub-let.

A. J. Brehm, Dayton and McLean Aves., Cincinnati, O., wants teams to haul dirt away from steam shovel. He will furnish dump wagons and will pay $5 per day.

The Murray Stone Co., 914 Williamson Bldg., Cleveland, O., wants a contractor to move about 25,000 yds., using the company's complete steam shovel equipment.

South Dakota.

✣Bids will be received by C. S. Evans, County Auditor, Clark, S. Dak., until 2 p. m., Sept. 6, for the construction of Drainage Ditch No. 6, involving about 800,000 cu. yds. of excavation and also for furnishing of culverts as contained in specifications. The work is situated in southern Clark County, principally in Lake and Hague townships, and will be an open ditch. Bids will be received for the entire work or sections: Section No. 1, and laterals No. 1 to 8 are in Lake; Section No. 2 involving 555,000 cu. yds. of material is about 2 miles long, average depth 34 ft. and 6 ft. wide at the bottom; Section 3 includes deepening and widening the natural course involving about 70,000 cu. yds.

Commissioners of Lincoln County, at Canton, S. Dak., have awarded the contract for constructing ditch No. 14 to W. R. Shipman.

Tennessee.

✣Bids are asked until noon, August 8, by Maj. M. L. Walker, U. S. Engineer, Room 20 Custom House, Memphis, Tenn., for about 1,650,000 cu. yds. of levee work in First and Second Districts of the Mississippi River Commission.

Texas.

Roach & Stansell, Memphis, Tenn., have been making good progress with the levee being constructed along the Brazos river opposite Bryan on the Burleson County side. At the middle of July it had been completed from Brewers hill, the northern end, to the Jones bridge, a distance of some twelve miles. At the bridge there was a gap about a mile in length and the other contractors have several miles more completed. The entire 27 miles is contracted to be completed by Oct. 1.

Utah.

Board of Public Works, Salt Lake City, Utah, has awarded the contract for the construction of the city dredge to be used in cleaning and straightening the channel of the Jordan River, to Silver Bros. Iron Works Co. for $7,885, a figure about $2,000 above the estimate of the City Engineer.

Washington.

The Commissioners of King County at Seattle are to be petitioned to form the Cedar River Improvement District. The improvement contemplates the dredging and widening of the Cedar River, and will practically put Renton on the water front when the Lake Washington canal is completed.

The Commissioners of Thurston County at Olympia have been petitioned to form two drainage districts. The upper district will drain Black River swamp from Black Lake to Little Rock. The work will reclaim about 1,100 acres of land. The river will have to be deepened and cleared wherever needed. Most of the ditching is to be done near Little Rock, where it is planned to lower the level of the river about 3 ft. There will be about 16,000 yards of excavation on the up-river job, according to County Engineer T. D. Young.

Mexico.

The Hydraulic Commission of the Mexican Government in searching for data has discovered in the archives of the government a valuable book of parchment which is devoted to the drainage and waterways of the republic. It was issued in 1748 by order of the viceroy, Juan Francisco Huemez y Horcasitas. The information it contains is of historical value, giving the decrees for public roads, descrip- [illegible] drainage of the valley of [illegible]

MISCELLANEOUS CONSTRUCTIONS

California.

The city of Sacramento may vote in September on issuing $75,000 of bonds for proposed improvements to the Sacramento river, to include widening and deepening it.

The U. S. Engineer Department will call for bids soon for the work at Los Angeles harbor for which appropriations were made in the recent River and Harbor Bill. Three different projects will be advertised. One is the building of breakwater to close the gap of 1,800 ft. between the shore and the place where the present stone work begins; another is dredging the channel from the turning basin to the outer harbor to a depth of 30 ft. and the third is the dredging of 20-ft. channels in the east and west basins. Lieut. Charles T. Leeds, Los Angeles, is U. S. District Engineer.

The Valley Contracting Co., Oroville, Cal., has been awarded a contract for furnishing six cars of crushed rock a day for use on the construction of the concrete dam of the Great Western Power Co. of San Francisco. Work has already been started.

Colorado.

Bids were opened July 18 by the city of Boulder, Colo., for the construction of a rubble concrete masonry dam at Albion Lake reservoir. All bids were rejected by the City Council and the work will be done by the city. The dam is to be 60 ft. high and the work includes 1,000 cu. yds. earth excavation, 2,000 cu. yds. rock excavation, and 13,000 cu. yds. rubble concrete masonry. The city expects to install the plant this season and finish the dam next season. Fred R. Dungan is City Engineer of Boulder.

District of Columbia.

✣Capt. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., will receive bids until August 2, for furnishing under Canal Circular 597, carbon tool steel, dredge chain, attachment plugs and rubber boots.

✣Bids will be received until 10:30 a. m., August 19, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under canal circular 598 the following: Steel castings, manganese steel bushings, steel, iron, brass condenser tubes, cast iron pipe, sluice gate valves, pumps, etc.

✣Bids will be received until September 15, by William Crozier, Chief of Ordnance, U. S. Army, Washington, D. C., for furnishing electrical apparatus for two 14-in. gun turrets, model 1909.

✣Bids are asked by William Crozier, Chief of Ordnance, U. S. Army, Washington, D. C., until September 20, for furnishing two 14-in. gun turrets, model 1909.

✣Bids will be received until September 8, by the War Department, Office of William Crozier, Chief of Ordnance, U. S. Army, Washington, D. C., for furnishing armor for two 14-in. gun turrets, model 1909, including barbettes and gun shields.

✣The War Deprtment will receive bids at the office of William Crozier, Chief of Ordnance, U. S. Army, Washington, D. C., for furnishing 16 sets steel forgings and 4 extra breech block forgings for 4.7-inch gun, model 1906, and 12 sets steel forgings and 3 extra breech block forgings for 3-inch field gun, model 1905.

Florida.

✣Bids are asked until noon, August 15, by Board of Public Works, Key West, Fla., for furnishing two standard Scotch stationary boilers and one condenser, delivered on the dock at Key West. William R. Porter is Chairman of the Board.

A building permit has been issued by the Building Commissioners of Jacksonville, Fla., for the erection of a new pier and terminals for the Clyde Steamship Co., at a cost of $500,000. The structure will be erected by W. P. Richardson & Co., of Jacksonville.

Illinois.

✣Board of Trustees of the Village of Evergreen Park, Ill., will receive bids until 8 p. m., August 6, for installing poles, wires and globes for all that is necessary for about 22 lamps in the village, which is situated on the Grand Trunk R. R. and Chicago Terminal Transfer R. R., fourteen miles from Chicago.

Bids as follows were received July 11 by the city of Streator for the erection of a retaining wall at the site of the new bridge over the river: Philip Schlachter, Jr., reinforced concrete wall, $1,965; masonry wall, $2,234. E. D. Roberts, reinforced concrete wall, $2,147; masonry wall, $2,800.

Indiana.

Concrete work for the dam for the new water supply system of the Indiana university was started on July 15. The dam is being constructed across the mouth of a ravine in the new university farm 2½ miles from Bloomington and will flood seven or eight acres to a depth of 20 ft. Besides this lake there is being constructed a reservoir to have a capacity of 150,000 gals. It is to be constructed entirely of concrete and will measure 24 by 72 ft. A roof will be built over it and an 8-in. iron pipe line will connect with the lake, from whence the water supply will be drawn by gasoline pumps. The proposed reservoir will be more than 100 ft. above the level of the Indiana campus. The work is in charge of Prof. A. L. Foley, Bloomington.

Michigan.

W. E. Williams, Bay City, has been awarded the contract for sinking a new shaft for the Genessee Coal Mining Co., of Flint. The work will be started at once.

Bids were opened July 6 by the Board of Public Works of Sturgis, Mich., for constructing a power house and dam on the St. Joseph river for the municipal hydro-electric plant. The contract was let to the Olsen Construction Co., 414 Gilbert Blk., Grand Rapids, Mich. The work includes a 36 by 50 ft. power house, drop tubes, tail race, multiple arch reinforced concrete spillway, 300 ft. long, 22 ft. high. The work includes 1,000 cu. yds. earth excavation, 24,000 cu. yds. embankment, 2,600 cu. yds. concrete, 300 lin. ft. piling, 500 sq. ft. sheet piling and 40 tons reinforcing metal. J. S. Flanders is Manager for the city.

Minnesota.

J. W. Shuman, Corn Exchange, Minneapolis, Minn,, has been awarded the contract at $4,569 for material, machinery, etc., for changes to the electric light plant of the village of Pelican Rapids, Minn. Bids were opened July 18.

Missouri.

The Continental Power Development Co., W. E. Bradford, Secretary, Versailles, Mo., has had surveys and estimates made for a hydro electric development on the Niangue river near Nonsuch.

The city of Kansas City has voted a $100,000 bond issue for an incinerating plant.

Nebraska.

✣Board of Directors, Kimball Irrigation District, Kimball, Neb., will receive bids until noon, August 12, for the construction of canals, storage reservoirs and irrigation works, comprising the Oliver reservoir and two main distributing canals, together with all necessary conduits, flumes and all other appurtenances, according to the plans and specifications thereof now on file at the office of board. Also for bids separate and apart from all other bids hereinbefore mentioned for the construction of the Bushnell reservoir according to the plans and specifications now on file at the office of said board.

New York.

The following bids for materials and labor for furnishing and installing electric lighting fixtures in the Metropolitan Museum of Arts, New York, were received July 21 by the Park Board of that city. Black & Boyd Mfg. Co., 23 East 22nd St., New York, $34,300; The Enos Co., 16th St. and 7th Ave., New York, $26,418; Sterling Bronze Co., 107 West 25th St., New York, $37,588.

The owners of Maple Beach Park, Albany, N. Y., are to expend $200,000 to $300,000 for improvements. Work is to be started at the close of the amusement season. William Brookheim, Albany, is President and John J. Carlin is Manager.

The Board of Control and Supply of Albany, N. Y., has awarded the contract for erecting a steel fence about the Bleecker reservoir to Robert T. Wilke at $6,363.

Pennsylvania.

✣Bids are asked by Herbert Deakyne, Maj., U. S. Engineer, 815 Witherspoon Bldg., Philadelphia, Pa., until noon, August 10, for constructing steel twin-screw suction hopper dredge for Southwest pass, Mississippi River.

Texas.

E. R. Schurtz of Alamagorda, N. Mex., who was recently granted a franchise to lay pipe and install a plant for a gas furnishing company in Taylor, is now in Pittsburg, Pa., selecting machinery for installation in his prospective Taylor plant. Mr. Schurtz will come to Taylor to reside, and will personally conduct the business. He expects to install the machinery within three months.

Virginia.

Alsop & Pierce, Newport News, Va., have been awarded the contract for constructing a wharf and bulkhead along the water front at the mouth of Gillie's creek for the city of Richmond. The contract price was $24,000.

Washington.

A contract has been awarded to P. M. Coyne and J. H. Coyne, of Port Townsend, for grading and moving earth for filling the lagoon at the Port Townsend quarantine station.

The Commission in charge of the improvements of the Puyallup river have awarded contracts for jetty work to L. G. Palmer, Seattle and F. W. Morse, Puyallup. Contract for jetty and other bank protection on the Stuck river near Sumner was let to S. H. Williams. The commission will expend another $7,000 soon on the upper Stuck valley, where more breakwaters and jetties are needed. Capt. Archibald O. Powell, the commission's engineer, will supervise the work.

West Virginia.

Capt. F. P. Reese of Bellington, W. Va., is reported to be at the head of a movement to organize a corporation in the East with $4,000,000 capital for the purpose of damming the Buckhannon River. The plan is said to be to dam the Buckhannon River, backing the water a distance of 15 miles. This would give a store of water sufficient to supply several large cities.

Wisconsin.

✣Village Clerk, of Brownstown, Wis., will receive bids until p. m., August 17, for furnishing and installing a 25 h. p. gasoline engine, belt connected to an 18½ k. w. generator, furnishing and erecting pole line for the electric lighting system. C. B. Stewart, 408 Wisconsin Bldg., Madison, Wis., is Consulting Engineer. Official advertisement will be found elsewhere in this issue.

Items marked thus ✣ indicate work now open for bids.

Canada.

✣Bids will be received until noon, July 27, for the erection of a municipal telephone system for Blyth, Ont. Plans and specifications are on file at the office of A. Elder, Secy., or at the office of George J. Beattie, 109 Victoria, Toronto, Ont.

The Ontario Power Co. on July 20 completed its new $500,000 pipe line at Niagara Falls, work on which was started five months ago. The pipe is 1⅛ miles in length, the inside diameter being 18 ft. All efforts will now be turned to the completion of the power house.

The citizens of [illegible] voted to give a bonus of $350,000 to London capitalists who will erect a steel ship-building plant and floating dry dock in Sydney. The provincial government has already offered an additional subsidy of $100,000.

A new steel dredge for the use of the Harbor Commission of Montreal was launched July 20 at the yards of the Polson Iron Works at Toronto. The keel of the dredge was laid seven weeks ago. The vessel, which is built entirely of steel, has a length of 104 ft., a breadth of 36 ft. and a depth of 10 ft. 9 in. from keel to deck. The boiler will be installed by the builders, but the [illegible] the present boat, which will be known as dredge No. 5. She will have a dredging capacity of about 3,000 cu. yds. a day by the dipper system.

Two parties of Government engineers are at present on the work of surveying the Saskatchewan river. When the Cadette and [illegible] parties will proceed eastward towards The Pas. It is expected that the whole length of the river will be thoroughly surveyed before winter, and after the freeze up soundings of the depths of the water will be taken through the ice.

BRIDGES AND BUILDINGS

California.

✣Bids will be received until 3 p. m., Sept. 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the painting, etc., of the United States Post Office, Court House, etc., at San Francisco, Cal.

The Board of Supervisors at Willows, Cal., have decided to build a bridge over Walker Creek, 2 miles east of that place. The structure will be 75 ft. long and will take the place of the one recently wrecked by the traction engine.

The Finance Committee of the Board of Supervisors, San Francisco, Cal., have recommended the appropriation of $20,000 toward the construction of the Mission St. viaduct. This amount is to be taken from the $135,000 to be raised by special tax levy.

Secretary of War, Washington, D. C., has signed the permit of the United States War Department granting the Northern Electric Co. and the Vallejo & Northern Co. privilege to construct a swing draw railway, vehicle and foot bridge across the Sacramento River at the foot of M St., San Francisco, Cal. The project was mentioned in our last issue.

San Diego County Board of Supervisors at San Diego, Cal., have under consideration the matter of constructing a new bridge over the San Dequito River on the new highway to Escondido by way of Poway from Bernardo. The present structure, which has been examined by the County Surveyor, is stated to be unfit for traffic. The cost of building a new bridge would be, it is estimated, about $7,000.

The following bids were received by the Board of County Supervisors at San Diego, Cal., for the construction of the San Luis Rey River bridge; Mercereau Construction Company, $13,150; Young Construction Company, $19,850; Charles Steffgen, $13,491; Standard Iron Works, $16,870; Knight & Hyde, $18,445; Chas. W. Corderley, $16,995; E. B. Schockley, $16,750. The Securities Construction Company bid $12,800 on general specifications and $17,992 on an all steel bridge. The Young Construction Company proposes to build an all concrete bridge. The specifications, however, call for a combination wood and steel or an all steel structure, the span to be 612 ft. It is planned to have the work completed by the winter.

Connecticut.

✣Bids will be received until noon, August 10, by the Saybrook and Lyme Connecticut River & Bridge Commission at their office, Saybrook, Conn., for the construction of the superstructure for a highway bridge to be built across the Connecticut River between the towns of Old Saybrook and Old Lyme, Conn. The work includes: 8 deck riveted spans about 159 ft., 2 deck riveted spans of 122 ft., 1 deck Scherzer rolling lift draw in two wings; total length of [illegible] W. Bush is Chief Engineer.

Delaware.

Levy Court of Dover, Del., considered the bids for the construction of Martin's Bridge and Squaggam bridge, which ranged from $5,000 to $7,500 too high and therefore no contract for the work was let.

As an agreement has finally been reached between the Street Commission of Wilmington, Del., and the Atlantic Coast line whereby the expense of constructing a viaduct over the tracks at Sixth St. will be divided. City Engineer Humphrey has been instructed to advertise for bids on the work.

Florida.

✣Bids will be received until 9:30 a. m., July 29, by the Board of County Commissioners, Jacksonville, Fla., for furnishing material and labor for the construction of two concrete bridges. Gail L. Barnard is County Engineer.

✣Bids are asked until 11 a. m., Sept. 6, by R. E. Hall, Secretary, Board of Public Instruction, Dade County, Miami, Fla., for the erection of a public school building at Miami, Fla.

Georgia.

Advices from Griffin, Ga., state that a special county election will be held August 23 to vote on issuing bonds amounting to $50,000 for the construction of bridges and roads.

The Department of Public Works of Columbus, Ga., has awarded the contract for constructing a concrete-steel arch bridge (Melan system) over the Chattahoochee River at Dillingham St. to B. H. Hardaway, Columbus, Ga., on a cost plus a fixed sum basis. The work includes the bridge complete with a fill at each end. Bids were opened July 18.

Illinois.

✣City Council of Mendota, Ill., will receive bids until 8 p. m., August 1, for the construction of three concrete bridges in accordance with plans and specifications on file at the office of George Holland, City Clerk.

Advices from Aledo, Ill., state that the contract for the construction of a new steel bridge across the Edwards River west of the Lutz mill has been let to G. C. McIntyre for $1,974. The structure as specified will be 100 ft. long with 18 ft. trestles.

Advices from LaSalle, Ill., state that the Canal Commissioners have awarded a contract for the construction of a new steel bridge 74 ft. long and 20 ft. wide over the Illinois & Michigan Canal at Utica, Ill. It is said that the necessary amount for the structure will be taken from the $20,000 bridge fund recently provided by an act of the Legislature.

Work has been started under supervision of W. A. O'Brien, Chief Engineer Maintenance of Way, Chicago, Peoria & St. Louis Ry., Springfield, Ill., on the construction of the proposed steel bridge over the Sargamon River near Kilbourne. The structure when completed will cost, it is estimated, about $23,000.

Bonds amounting to $250,000 for the construction of the proposed bridge at Peoria, Ill., have been placed by the city and Ira G. Hedrick, Kansas City, Mo., has been selected to prepare plans for the new structure

Indiana.

✣The [illegible], Pike County, will receive bids until 1 p. m., August 5, at Winslow, Ind., for the construction of an eight room school house. Warrick Coleman is Trustee.

✣Bids are asked by the Hancock and Shelby County Commissioners, at Shelbyville, Ind., until 2 p. m., August 3, for the construction of a bridge on Hancock-Shelby County line. G. B. Huntington is Auditor of Shelby County.

✣Bids will be received until 10 a. m., August 4, by Commissioners of Laporte County at Laporte, Ind., for the construction of several bridges. Charles H. Miller is County Auditor.

✣Commissioners of Orange County are asking bids to be received until 11 a. m., August 2, for the constructon of a bridge at Johnson's Ford. A. B. Ham, Paoli, Ind., is Auditor of the county.

✣The Morgan County Commissioners, Martinsville, Ind., will receive bids until 2 p. m., August 2, for the construction of three bridges. B. E. Thornburgh is Auditor of the county.

An engineering corps of the Indianapolis & Cincinnati Traction Co. has been making surveys in the vicinity of Fairland for the construction of a concrete crossing at the Big Four tracks to take the place of the present wood and steel structure, which will soon be razed.

At a recent meeting of the County Council at Indianapolis, Ind., the Commissioners requested an appropriation of $30,000 for the construction of a steel and concrete bridge on West Washington St. over Little Eagle Creek

According to reports from Fort Wayne, Ind., Edgar A. Tennis, the director of the Interurban Railroad between Fort Wayne and Bryan, O., has ordered the construction of five new bridges along the route.

Iowa.

✣[illegible] Fort Dodge, Ia., until 5 p. m., August 22, instead of 7:30 p. m., August 27, as noted in our last issue, for the construction of the South Third St. viaduct. According to plans the total length of the structure including the viaduct proper will be 823 ft. Each bid must [illegible] W. L. Tank is City Clerk

✣[illegible] ceive bids until 10 a. m., August 1 [illegible] River at its intersection with Walnut St.

[illegible] walk, for the county. Bids [illegible] opened at Forest City, Ia. [illegible]

South Third Ave. in Marshalltown, Ia., and it is expected that further steps will be taken soon.

Information received from Des Moines, Ia., states that vigorous steps are being taken toward the construction of another new bridge at that place. The southsiders are reported to be behind the movement which is for a new structure over the Raccoon River.

Advices from Orange, Ia., state that preparations are being made for the construction of a new cement bridge to replace the old wooden structure on the Alton and Orange City road, between the Te Grotenhuis and Dykstra places.

The Board of Supervisors of Ida County at Ida Grove, Ia., have let the contract to the Marsh Engineering Co., Des Moines, Ia., for the construction of a concrete arch bridge across the Odebolt River at Ida Grove. The structure will be about 61 ft. long and is the first of its kind to be constructed in that county.

Kentucky.

Owing to the trouble the Jefferson County Court at Louisville, Ky., is having in selecting a commissioner to take up the matter of constructing the proposed bridge at West Point, Ky., over the Salt River, it is believed that the project will be postponed until next year.

Maryland.

✣Bids will be received until 11 a. m., August 3, by Board of Awards, Baltimore, Md., for the construction of a concrete steel bridge across Stone Run, Wyman Park. A certified check for $2,000 must be filed with each bid.

Massachusetts.

✣Bids are asked by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., August 25, for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Marlboro, Mass.

Minnesota.

At a meeting of the County Commissioners at Brainerd, Minn., the contract for the construction of the proposed bridge over Buffalo Creek was awarded to the Security Bridge Company for $1,790.

Mississippi.

City Council of Vicksburg, Miss., has voted to buy at once the Switzer property for $22,500, thus removing the last obstacle confronting the proposition to build the proposed bridge at the Cherry St. railway crossing, mentioned in our last issue. The work as planned is estimated to cost about $50,000.

Missouri.

The Nodaway County Court at Maryville, Mo., has recently let contracts for the erection of 45 bridges, the total cost of which amounted to $14,898.

The Canton Bridge Co., contractors for the construction of the new Sac River bridge near the Valley Mill dam, three miles northeast of Springfield, Mo., have begun work. According to the plans the structure will be 32 ft. wide with steel I-beam and concrete floor.

According to a report made by Daniel Bontecou, Special Engineer, Board of Commissioners of Wyandotte County, Mo., the reconstruction of four bridges over the Kaw River will necessitate an expenditure of $464,028. The proposed work included in the report is as follows: The James St. bridge will consist of three spans instead of two. The two 237-ft. spans will remain, a pier will replace the present east abutment and a span 281 feet will be placed at the east end of the bridge. The entire structure will be raised four feet and eight inches. Cost of reconstruction, $151,828; the Central Ave. 3-span bridge to be replaced by a new structure, the central span of which will be 343 ft. 6 in. long. At either end smaller spans each 197 ft. long are recommended. Present piers to be replaced by new ones. This bridge is not to be raised. Cost of reconstruction, $142,000; Fifth St. bridge approach on the north end to be taken out and a span 250 ft. long to replace it. The three 200-ft. spans to remain and a 136-ft. span on the south end will carry the wagon road across the tracks of the Atchison, Topeka & Santa Fe Railroad. A raise of eight feet recommended. Cost of reconstruction, $82,200; the Twelfth St. bridge, removal of the 234-ft. approach at the north end and replacing of it with a steel span of that length. Cost of reconstruction, $88,000.

At a special meeting of the St. Louis, Mo., City Council a bill was passed providing for the construction of a viaduct over Compton Ave. between Chouteau and Manchester Aves. by the Terminal Railroad Association, the Missouri Pacific, the Wabash and the Frisco Railroad Companies. Bills will now be placed for the widening of Compton Ave. and the raising of Chouteau Ave. Plans for the viaduct, which will be 2,200 ft. in length, are to be submitted to the City Council for approval within four months.

The proposition recently voted on by the citizens of Kansas City, Mo., to issue bonds amounting to $200,000 for the extension of bridges was carried.

Nebraska.

The Otis Elevator Co. has been awarded a contract at $3,500 for installing two electric freight elevators in the U. S. storehouse at Omaha, Neb. Bids were opened June 11.

Wm. Bellamy, Omaha, Neb., was awarded the contract at $4,249 for installing a steam heating plant in the U. S. storehouse at Omaha. Bids were opened June 10.

New Jersey.

✣Board of Chosen Freeholders, Passaic county, will receive bids at Paterson, N. J., until 2 p. m., July 27, for the construction of a reinforced concrete arch bridge over the Wanaque river at Pompton Lakes, on the Paterson and Hamburg turnpike near McDavitts. Plans are on file at the office of the County Engineer. F. G. Sloan is Chairman of the Board.

Committee of the Board of Freeholders at Elizabeth, N. J., awarded the contract for the construction of four new bridges on the road leading to Rahway from Four Bridges, to William T. Kirk Co., Plainfield, N. J., for $3,486.

Residents of the Second and Fourth Wards of Trenton, N. J., have filed a petition with the Board of Freeholders for the construction of a bridge across the water power at the foot of River Drive Avenue.

New Mexico.

✣Bids are asked by Board of County Commissioners of Rio Arriba County, New Mexico, at Tierra Amarilla, until 4 p. m., August 15, for the construction of a court house to be built at Tierra Amarilla, N. Mex. The architects are I. H. & W. M. Rapp Co. at Santa Fe, N. Mex. and Trinidad, Colo.

Advices from Albuquerque, N. Mex., state that the Territorial Engineer, Vernon L. Sullivan, has approved plans for the construction of the new bridge across the Red River at Maxwell City. The structure will have two 90 ft. steel spans, will rest on concrete piers and is estimated to cost $5,000.

New York.

✣Bids will be received by F. A. McNeel, Secy. State Armory Commission, Albany, N. Y., until noon, August 3, for installing electric light wires and fixtures in State Arsenal, 7th Ave. and 35th St., New York City.

✣Bids are asked by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., August 3, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Olean, N. Y.

✣Bids are asked by the Commissioner of Immigration, Ellis Island, N. Y. H., until 2:30 p. m., July 29, for the necessary labor and material for the installation of an elevator in the tower of the main building, Ellis Island. William Williams is the Commissioner.

At a meeting of the Board of Street Commissioners of the village of Canandaigua, N. Y., it was decided to erect a concrete bridge over the outlet at the northeastern corner of the lake on Lake St. According to the plans presented and accepted, the structure will be 20 ft. reinforced concrete span and will replace an old iron bridge. The work which is estimated to cost about $2,000, will be done in connection with the paving work.

Plans and specifications, according to reports from Rochester, N. Y., have been completed by Assistant City Engineer, John F. Skinner, for the new Central Avenue bridge. The structure will be 500 ft. long, and 66 ft. wide with 42 ft. roadway and walks on either side and will rest on 10 piers. The cost of the improvement is estimated at $160,000. Bids will be advertised at once it is said.

Committee of Clyde, N. Y., have taken up the matter with the Attorney General at Albany, N. Y., of constructing a bridge over the barge canal at that village.

The Mayor of Dunkirk, N. Y., has vetoed the act of the council awarding the contract for the construction of the concrete bridge over Hyde Creek on Ermine St. to P. B. Colgan, at $1,362. He recommends that the council do the work under municipal control or readvertise for bids.

Town Boards of Chenango and Fenton, N. Y., have decided to award the contract for the construction of the new bridge to replace the one destroyed by high water to the Owego Concrete Bridge Co. for $19,000. According to the plans the structure will be of reinforced concrete consisting of five arches.

North Carolina.

✣Bids will be received until noon, August 16, by C. R. Humphreys, City Engineer, for the construction of the superstructure of a steel highway bridge at the crossing of 6th St. over the Atlantic Coast line tracks at Wilmington, N. C. The structure will be 142 ft. long.

North Dakota.

All bids received July 20 by E. M. Atterberry, County Auditor, Williston, N. Dak., for the construction of six county bridges were rejected.

Ohio.

✣Bids are asked by Board of County Commissioners, Toledo, O., until 10 a. m., August 16, for the necessary labor and material for the construction of abutment and repair of approach to bridge on County Road No. 332 over Swan Creek at the end of Salsbury Stone Road southwest one-quarter section 27, town 2, U. S. R., Monclova township, Res. No. 234, in accordance with plans and specifications now on file at the office of the county auditor.

✣Bids will be received by F. W. Toan, County Auditor, Bowling Green, O., for furnishing the necessary labor and material for the construction of the substructure and superstructure of a bridge about 80 rods south of the northeast corner of Section 36, Bloom township, Wood County, O. The structure will be 34 ft. long with 16 ft. roadway.

✣The County Commissioners will receive bids at Akron, O., until 11 a. m., August 1, for the repair of the canal and river bridge at Peninsula, O. Certified check for $200 must accompany each bid. Charles L. Wirth is Clerk.

✣Board of County Commissioners will receive bids until 10 a. m., August 2, at Toledo, O., for the necessary labor and material for the construction complete and ready for travel of the substructure and superstructure of a bridge on Division St. over Ten Mile creek in the village of Sylvana, Ohio, in accordance with plans and specifications now on file at the office of the County Auditor.

✣Bids will be received by the Board of Commissioners, Allen County, at Lima, O., until noon, August 2, for the necessary labor and material for the construction of a bridge over Hog creek in Bath township, known as the Fetter Quarry bridge. Bids must be sub-

Items marked thus ✣ indicate work now open for bids.

mitted separately for the sub and superstructures. C. R. Phillips is Clerk of the Board.

The Wyankook McGormley Co., Toledo, O., has been awarded the contract for constructing the superstructure of two bridges over the Miami and Erie canal at Defiance, O. The contract price was $1,495 each. Bids were opened July 18 at Defiance.

F. J. P. Brackett, Glendale, O., has been awarded the contract for the construction of a concrete bridge in Anderson township. The contract price was $1,396 and bids were received until July 8 by the County Commissioners at Cincinnati.

The contract for the construction of the new viaduct at Akron, O., has been awarded to the Akron Storage & Contracting Co., for $21,971.

Commissioners and D. Y. Geddes, Engineer of Muskingum County, O., have inspected the proposed site for the construction of the 32-ft. bridge in Meigs township at a point known as Oil City and have decided to do the work.

Boards of Commissioners of Marion and Morrow Counties, O., have announced their intention to construct an iron bridge over East Fork of the Whetstone river near Wilson's residence in Tully township on the county line.

Council of Hubbard, O., has appointed a committee to take up the matter of rebuilding the bridge on East Park Ave.

Although the County Commissioners turned down the petition of Pemberville, O., advices from Bowling Green state that the town is not to drop the proposition of constructing a new bridge across the West Branch in Wood County.

Advices from Columbus, O., state that the Commissioners of Franklin County have awarded the contract for the construction of bridge over Grant Run in Jackson township for $5,500.

All bids received by the Erie County Commissioners at Sandusky, O., for the construction of the proposed $60,000 lift bridge over the Huron river at Huron, have been rejected because they did not come within the estimates of the cost based upon the plans prepared by the Scherzer Lift Bridge Co., of Chicago, Ill. The work will be readvertised in the near future.

Oklahoma.

Advices from Lawton, Okla., state that a company has been formed to construct a bridge across the Red river near Burkburnett. The new structure will be the only wagon bridge in that vicinity for Oklahoma-Texas interstate traffic.

The contract for the construction of the proposed new bridge over the North Canadian river by The Oklahoma Railway, the county and Park Board of Oklahoma City, Okla., has been let to the Topeka Bridge Co., Topeka, Kan., for $56,000. According to the plans the structure will be 67 ft. wide, with 16 ft. roadway, sidewalks on either side, and two car tracks, being built entirely of steel and concrete. Work, it is said, will be started at once.

Oregon.

The Raymond Concrete Pile Co., of New York and Chicago has been awarded the contract for the Raymond pile foundations of a building to be erected for the Cudahy Packing Co. at Portland, Ore.

Pennsylvania.

✣Bids are asked by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., August 29, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Bradford, Pa.

✣Sealed proposals will be received by the commissioners of Clinton County, Pa., at their office at Lock Haven, Pa., until 1 p. m., August 12, for the construction of a steel span bridge with a Kreodone block floor and concrete substructure also, for a steel span bridge with a concrete floor and concrete substructure over Sinnemahoning Creek at Keating in East Keating township. Official advertisement will be found elsewhere in this issue.

✣Bids are asked until noon, August 9, by the Commissioners of Blair County, Pa., at Hollidaysburg, Pa., for the necessary labor and material for the construction of the following bridges: Reinforced concrete arch bridge over Brush Run near Bald Hill, on line between Frankstown Township and Blair Township 32'-0"; rise 8'-0"; width of roadway 18'-0"; parapet walls 4'-0" high; and necessary wing walls. Reinforced concrete arch bridge over Laurel Run at Reightown, in Antis Township, skew span 55'-0"; skew angle 64 degrees; right angle span 49'-5¼"; rise 8'-0"; width of roadway 16'-0"; parapet walls 4'-0" high; and necessary wing walls. Reinforced concrete arch bridge over Bald Eagle Creek, near the Paper Mill at Tyrone, skew span 79'9¾"; skew angle 70 degrees; right angle span 75'-0"; rise 11'-0"; width of roadway 30'-0"; width of sidewalk 6'-0"; parapet walls 4'-0"; and necessary wing walls. Concrete abutments and necessary wing walls for steel beam bridge over Brush Run at Hart's Brick Yard, in Frankstown Township, skew span 28'-0"; width of abutments 14'-6"; top of foundation to bridge seat, 1'-3"; foundation 4'-0" deep; creosoted wood block floor. Concrete abutments and reinforced wing walls for steel truss bridge over Clover Creek at Homer Hewitt's farm, in Huston Township, width of abutments 18'-0"; span 39'-0"; bridge seat 6'-8" above foundation; width of bridge seat 1'-9"; foundation 5'-0" deep; creosoted wood block floor.

The common council of Scranton, Pa., has passed an ordinance authorizing the Delaware & Hudson R. R. Co. to change the course of the Lackawanna River at Mulberry St. as the first step toward the construction of the viaduct.

Advices from Carlisle, Pa., state that the County Commissioners, in accordance with the request of the citizens of Shippensburg, made about a year ago, have agreed to contribute $500 toward the construction of a bridge in that place on King St.

A conference has been held at Ashley, Pa., at which the question of constructing a bridge on the Mountain Road at Hazleton was discussed. Those who were present at the meeting are as follows: Ashley Council, Borough Attorney C. E. Keck, General Counsel George R. Bedford and President Alvin Markle of the Wilkes-Barre and Hazleton Railway, members of the streets and highways committee of the Wilkes-Barre Board of Trade, General Manager C. F. Huber of the Lehigh and Wilkes-Barre Coal Company, and a committee representing the Glen Summit colony.

The contract for the construction of the 5-span concrete arch bridge over the Swatara Creek near Hummelstown on the Hummelstown-Hoernerstown road has been awarded to the Ferro-Concrete Co., Harrisburg, Pa., at $17,495. According to the plans the structure will be 310 ft. long and 20 ft. wide.

Advices from Carlisle, Pa., state that the Supervisors of Middlesex township have awarded the contract for the new bridge at Middlesex to the Ferro-Concrete Construction Co., Harrisburg, Pa., for $1,692. The structure as planned will span the Letort Spring to replace the old one washed away about 10 years ago, and the old piers will be used.

Tennessee.

It is reported in Chattanooga, Tenn., that the Queen & Crescent railroad is planning the construction of a new drawbridge over the Tennessee River about three miles north of that city. The work, according to an announcement, said to have been made by Curtis Dougherty, Engineer Maintenance of Way, Cincinnati, O., will cost $1,000,000.

Texas.

✣Bids will be received until noon, August 10, by T. M. Wilson, Mart, Tex., for the construction of a school building in that city. William Drago, 715 Hennan Bldg., New Orleans, La., is Architect.

The Commissioners of Parker County, Texas, at Weatherford, have awarded the contract to J. J. Johnson of that city for the construction [illegible] tures are to have a 50 ft. span each with 50 ft. approach and the fourth is to have a 60 ft. [illegible]

The contract for the construction of the new union depot in Wichita Falls, Tex., has been awarded to the Texas Construction Co., Fort Worth, Tex., for $100,000. The new depot will be used by the Fort Worth & Denver, Wichita Falls & Oklahoma, Wichita Valley, Wichita Falls & Northwestern, Wichita Falls and Southern and Missouri, Kansas and Texas Railroads.

Plans have been completed by Consulting Engineer F. L. Dormant of Houston for the construction of the proposed San Jacinto St. bridge over the Houston Ship Canal connecting the north and south sides of Houston, Texas. The structure will be 70 ft. long and will be built entirely of concrete.

Virginia.

✣City Engineer of Alexandria, Va., will receive bids until noon, August 4, for the erection of steel cells and the alterations of the jail.

Washington.

The American Pile Driving Co., Everett, Wash., has been awarded the construction of an additional 220 ft. steel span to the U. S. bridge at Deming, the work including concrete piles, approaches and pier protection. The contract also includes removing the present piers, furnishing and building the span and constructing concrete piers 32 ft. in height reinforced with iron. The contract price was $13,474 and bids were opened July 8 at Bellingham.

According to reports from Aberdeen, Wash., the Oregon & Washington R. R. has staked out a right of way in South Aberdeen and it is believed that the company is considering the construction of a bridge across the Chehalis River at a point near the Hulbert mills. This plan would bring the north approach in the vicinity of the Lindstrom ship building yards.

Commercial Club of Pasco, Wash., is to take up with the club of Kennewick, the matter of constructing a wagon bridge across the Columbia River between the Twin Cities.

Wisconsin.

A contract has been let to J. Young & Brother, Oconto, Wis., for the reconstruction of the railroad bridge across the Menominee River just above the mill at Niagara, Wis. The old crib piers will be replaced by concrete ones and one new span will be installed, the other one to be replaced later.

The town board of Raymond, Racine County, Wis., has voted $1,200 toward the construction of a bridge across the Root River and has asked the county board at Racine, Wis., to provide the balance of the amount necessary for a $2,400 structure.

At a meeting of the Racine County Board, Racine, Wis., a petition was presented from the town board of Norway asking that the county appropriate $600 toward the new bridge at that place, over Goose Creek, for which the citizens recently voted $1,000.

Canada.

✣Bids are asked by Barber & Young, Toronto, Engineers, until noon, July 27, for the construction of a steel superstructure, 55 ft. clear span and concrete substructure for a bridge over the Black River between the counties of York and Ontario, Lot 31, East Gwillinbury.

The Board of Control of Winnipeg, Man., has awarded contracts for the erecti[illegible] as follows: Piers, Wm. Newman & [illegible] nipeg, at $54,720; erection of st[illegible]

[illegible] contracts for its new $250,000 central heating and lighting plant at Toronto. L. K. C[illegible] [illegible] contract for the power house and the connect-

Items marked thus ✣ indicate work now open for bids.

ing tunnels and will also supply some of the machinery. The contract for boilers was let to Babcock & Wilcox and the contract for the heating mains was secured by W. J. McGuire, Ltd., Toronto.

Wm. Mills, Sault Ste. Marie, Ont., has been awarded a contract at $800 for constructing five section houses for the Algoma Central & Hudson Bay R. R.

Mexico.

Plans have been adopted by the Mexican Railway, which runs between Mexico City and Vera Cruz, for improvements involving an expenditure of more than $2,000,000. Included in the proposed work will be the construction of a bridge across the Metlac Barranca which will be one of the longest and highest in the world. It will eliminate two tunnels, reduce the grade and save about four miles of trackage.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received by Lieut. Edwin F. Barlow, Constructing Quartermaster, Fort Morgan, Ala., until 1:30 p. m., August 5, for the construction of brick paved road and cement walks around the barracks, mess hall and lavatory at Fort Morgan, Ala.

Advices from Birmingham, Ala., state that the Board of Revenue has granted the petition of the committee representing the district of Jefferson County around Yolande and Johns and will start work immediately on a macadam road connecting the two cities.

The street committee of the City Council of Oakland, Cal., at the last meeting adopted the following resolutions authorizing the city engineer to establish grades in annexed district and on Delaware St. and prepare plans to grade, curb and macadamize Broadway to Ocean View drive. Of intention to widen Claremont Ave. between Martin and Forest Sts., to change grades on Brooklyn Ave. between Hanover Ave. and Wesley Ave; to change grades on Brooklyn Ave. from Chicago Ave. westerly; directing city engineer to prepare plans to grade, curb and macadamize Fifty-fifth St. from Vicente street to Telegraph Ave.; adopting plans for improving portion of Lawton Ave. between College Ave. and Broadway; of intention to improve portion of Lawton Ave. between College Ave. and Broadway; adopting plans for the improvement of Claremont Ave. and College Ave. from Florio St. to the northern boundary line of the city; of intention to improve Claremont Ave. and College Ave. from Florio St. to the northern boundary line of the city.

The contract for improving the Upper Stockton Road with an oiled macadam roadway from 31st and P Sts. to the State Fair grounds was recently awarded Clark & Henery, at $29,955 by the Board of County Supervisors, Sacramento, Cal. The company also has the contract for the work on the Riverside Road from the city limits three miles south for $22,977.

Advices from Los Angeles, Cal., state that Board of Supervisors have awarded the contract for the pavement of Compton Ave. between Compton and Watts to F. F. Prendergast, at $12,372, which was $300 in excess of the County Engineer's estimate. The Highway Commission has decided to construct the short stretch of Long Beach Blvd. between the city limits of Long Beach and Willows with its own forces.

The contract for the improvement of G. St. between Sixth St. and 20th in Sacramento, Cal., has been relet to Joseph Lawrence and the work will be started at once.

Advices from San Bernardino state that prominent citizens are making efforts to have the Boards of County Supervisors construct an automobile highway from San Bernardino and Redlands to the beach resorts of Orange County. It is said that the Riverside board proposes to put the road from Corona to the Orange county line, which is near Prado, in first-class condition, if the supervisors of Orange county will do likewise from the line down to Yorba. The distance from Corona to Yorba is about 15 miles. Culverts are needed in some places. In others a little filling in will be necessary. The point where the road follows the base of the hill near the line, is considered dangerous, and it is proposed to widen the grade and cut out some of the points that obscure the view of the grade and make sharp turns necessary.

Board of Supervisors, Sacramento, Cal., have ordered plans and specifications for the improvement of the 12th St. road from the B. St. levee to the American River bridge. It is proposed to construct an oiled macadam roadway.

The City Council of San Diego, Cal., has recommended the paving of more than half the streets extending north and south in the district bounded by B. H. First streets and the water front. A petition was also granted providing for the construction of pavement on two east and west streets in the district F and E, between Fourth St. and Arctic St.

The Piedmont Construction Co., of Oakland, Cal., has been awarded a contract at $96,698, for constructing several miles of oiled macadam pavement for the city of Benicia.

Colorado.

Advices from Colorado Springs, Colo., state that the County Commissioners have taken steps to induce the commissioners of Fremont County to start work on the improvement of the state highway at their end, including about 10 miles of roadway.

Bids were opened July 16 by Charles W. Comstock, State Engineer, Denver, Colo., for the construction and improvement of the wagon road from Rocky Ford to Fowler in Otero County, the low bidders for the work being W. H. Holdworth and L. C. Swink.

Florida.

✣Board of Public Works is asking for bids to be received until noon, August 10, for the construction of concrete sidewalks in Pensacola, Fla., the work including 525,000 sq. ft. of walks. L. Earle Thornton is City Engineer. T. A. Jennings is Chairman of the Board.

Georgia.

✣Bids are asked until 8 p. m., August 5, by J. H. Hicks, Mayor, Clarksville, Ga., for furnishing all necessary labor and material for the construction of approximately 6,000 lin. ft. of curb and gutter, 8,000 sq. yds of macadam pavement and 9,000 sq. yds. of brick or concrete side walk. H. S. Jaudon, P. O. Box No. 111, Gainsville, Ga., is Engineer.

The following street paving bids were received by the City Clerk, Atlanta, Ga., and referred to the Street Committee, July 18: For Marietta, between Tabernacle Place and North Ave., with wood blocks: By the Nichols Construction Co., $2.68 per sq. yd.; by Thornton & Mayson, $2.62; by the West Construction Co., $2.59. For Forsythe St., between Marietta and Luckie, with wood blocks: By Thornton & Mayson, $2.66; by the West Construction Co., $2.59. For DeKalb Ave., between Mayson and Moreland Ave, macadam asphalt: by the Nichols Construction Co., $1.25; by the West Construction Co., $1.29.

Board of County Commissioners at Atlanta, Ga., have been petitioned by property owners in Inman Park to repair Euclid Ave. from Elizabeth St. to Moreland Ave., a distance of 8 or 10 blocks.

Idaho.

The City Council of Twin Falls, Idaho, has decided to omit from the recently declared paving district, East and West Main St., and North Shoshone St., and has ordered the paving of the territory about the depot and the block between the parallel streets in the first district and will complete the paving on Second St. South to the railway right of way, with bitulithic paving material.

Illinois.

✣Advices from Oregon, Ill., state that the Commissioners of Highways, Rockvale, Ill., will receive bids until August 4, for constructing a macadam road in said Town, upon the following route, viz: the public highway leading from Oregon to Byron, along the West side of Rock River from the South line of the Town of Rockvale to the Mud Creek Bridge. Said road is to be divided into three sections and the same will be let publicly to the lowest responsible bidder, by sections, at the hour of One o'clock, p. m., at the office of J. C. Seyster, in the City of Oregon, in said County.

✣Bids are asked until 1 p. m., July 30, by J. B. Mathis, Secretary of the Road Committee, Ullin, Ill., for the dirt work on the road from Cache Bridge at Ullin to the foot of the hill near Calloway place. The work will include about 3,930 cu. yds. or dirt.

✣Bids will be received by the Commissioners of Highways of the Town of Farm Ridge, Ill., until 2 p. m., July 30, for the construction of a gravel road beginning at the end of gravel on west line of section 10 and extending westward ½ mile to the center of section 9. C. W. Peterson is Town Clerk.

Street and Alley Committee of the Springfield, Ill., City Council, took favorable action on an order providing for the paving of Canedy St., from Walnut to Fourth Sts. The plans provide for boulevarding, having a strip of grass in the center of the street.

At a recent meeting of the Commissioners of Highways of the Town of Emma at Maunie, Ill., all bids received for the construction of five miles of rock roads were rejected on account of their being too high.

The Town Board of Pekin, Ill., has awarded two contracts for the construction of pavement, one to Janesen & Zoeller, Pekin, at $42,324 for paving Park Ave. with mineral rubber and the other to the Illinois Cement Construction Co., Springfield, Ill., at $4,500 for paving 3d St., and 3d St. Place with brick with asphalt filler.

Residents of Richmond Ave., Peoria, Ill., have asked the board of Local Improvements to pave that street from Knoxville Ave. to North St., the roadway being 33 ft. wide. The matter was referred to the City Engineer with a request for an estimate of the probable cost.

The Lincoln Park Board, Chicago, Ill., voted at a recent meeting to join with the city authorities in paving the Sheridan Road from Evanston Ave to Devon Ave. with creosoted wood blocks. The Park Board has jurisdiction from Evanston Ave. to Foster Ave., while the city has authority north of Foster Ave.

According to the report of Attorney Dan R. Burke, of the Board of Local Improvements, Joliet, Ill., the Hickory St. paving job will not be delayed further and all will be in readiness to let the contracts in August. The cost of the work, according to the estimate of the City Engineer, is $28,383.

The contract for paving Gilbert Ave., in the village of Downer Grove, Ill., has been let to A. E. Rutledge, Rockford, Ill. Bids for the work were opened July 19. The work includes: 2,400 cu. ft. of earth excavation for roadways and curb; 200 cu. yds. of earth excavation for parkways; 2,475 lin. ft. of combined concrete curb and gutter curb; 3,350

Items marked thus ✣ indicate work now open for bids.

sq. yds. of vitrified paving brick [illegible] lin. ft. of 10-in. tile drain [illegible] let set to grade and line of curb [illegible] water inlet adjusted to line and grade of curb; 5 sewer manhole covers adjusted to the grade of finished street. The same contractor was also awarded the contract for paving Grove St., this work including 2,950 sq. yds. vitrified brick pavement.

At a recent meeting of the Board of Local Improvements of the City of Peoria, Ill., the proposition to pave with brick the five alleys running from Jackson St. to Bryan Ave., between Glendale Ave. and Adams St. was taken up. A hearing has also been held on the proposed paving of Adams St. with creosoted wood blocks from Hamilton St. to Bridge.

Board of Local Improvements of East St. Louis, Ill., has awarded the following contracts to Walter Coonan for street improvement work: Parsons Ave., at $5,891; Converse Ave., at $22,326.

Indiana.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., August 1, for the improvement of 19th St., from the east curb line of Rural St., to the east curb line of Parker Ave., north side to the west curb line of Parker Ave., south side by grading and paving the sidewalks.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., August 1, for the improvement of 29th St., from east property line of Talbott Ave., to west property line of Central Ave., by grading and paving the roadway.

✣Bids will be received at Decatur, Ind., by the Commissioners of Adams County, until 10 a. m., August 4, for the construction of a macadam road in Monroe township. H. S. Michaud is County Auditor.

✣Commissioners of Tipton County, at Tipton, Ind., will receive bids until 10 a. m., August 6, for the construction of five stone roads. J. F. Barlow is Auditor of the County.

✣The Davies County Commissioners will receive bids until 10 a. m., August 6, at Washington, Ind., for the graveling of a road. Thomas Nugent is the Auditor of the County.

✣Bids are asked until noon, August 8, by the Commissioners of Porter County, at Valparaiso, Ind., for the construction of gravel roads in Center township. Stephen P. Corboy is County Auditor.

A petition has been filed in the office of the County Auditor at Rushville, Ind., asking for the draining, grading and paving with crushed stone of a certain highway in Anderson township known as the James A. Brown et al. highway and the matter will be taken up for consideration at the next meeting of the board of County Commissioners.

Town Engineer of LaFayette, Ind., has prepared plans for the improvement of the Riverside road from the bridge across the road at Lake Erie R. R. to the north line of the West Side water works property at Happy Hollow. The work under contemplation includes the construction of a 30 ft. roadway of crushed stone.

Plans have been prepared by Harry H. Thompson, City Engineer, Logansport, Ind., for the construction of pavement on Broadway from Seventh to Twelfth St. and work will be advertised at once.

A petition has been filed with the Board of Public Works of Indianapolis, Ind., for the paving of the street car tracks in East Washington St. from Gale St. to Wallace St. The work will probably not be taken up until the street settles as a sewer was recently constructed there.

The Board of Public Works of Indianapolis has awarded the contract for paving Sherman Drive St. with asphalt to the Marion County Construction Co., Indianapolis. Bids were opened June 20.

Bids were opened July 6 by the Board of Public Works of Indianapolis, Ind., for street improvement work, contracts being let as follows: Wm. H. Hall, Indianapolis, for cement walks on Washington St.; Indianapolis Bitu-Mass. Co., Indianapolis, for bitumass, on 36th St.; Henry Pothast, Indianapolis, for cement walks on Denny St.; M. Sapirie, Indianapolis, for cement walks on Addison St.

Iowa.

✣City Council of Hampton, Ia., will receive bids until 8 p. m., August 1, for street paving to be constructed of Portland cement concrete laid in two courses. The lower course is to be five inches as a foundation, and the upper, two inches, as a wearing surface. The curb is also to be of cement. The estimate of the work places the figures at 19,030 sq. yds. of concrete paving, 9,384 lin. ft. of curbing, 2,800 cu. yds. of extra grading, 7,600 pounds of cast iron gutter plates, 150 lin. ft. of false curbing, together with the necessary grading in connection with the work.

✣City Council of Villisca, Ia., will receive bids until August 3, for the curbing, and paving to be done on Third Ave., about the city square and the important side streets abutting thereto. Portland cement will be used for the work.

✣Bids will be received by A. W. Casady, City Clerk, Council Bluffs, Ia., until 5 p. m., August 1, for paving with vitrified blocks on concrete foundation 4-in. thick the following streets: Harrison St., south side of Hyde Ave. to Fleming Ave.; Damon St. from north line of Clinton St. to Hill St.; Knepper St. from First St. to Damon St.; Bloomer St. from Damon St. to Stutsman St.; Platner St. from First St. to Stutsman St.; Logan St. from Harmony St. to north line of Prospect St.; Ross. St. from Oakland Ave. to Scott St.; Mill St. from east line of Scott St. to Eighth St.; Scott St. from Washington Ave. to Mill St.; Little Curtis St. from Washington Ave. to Mill St.; Sixteenth Ave. from Sixth St. to Eighth St.; North Sixth St. from Washington Ave. to Mill St.; Third St. from Thirteenth Ave to south line of Sixteenth Ave.; Sixteenth Ave from east line of High St. to Main St.

✣Bids will be asked until 9 a. m., August 1, by the City Council of Des Moines, Ia., for paving with sheet asphalt consisting of 1-in. binder course with 2-in. wearing surface upon a 6-in concrete foundation, West Eight St. from the south line of Mulberry St. to the north curb line of Cherry St. The work will include 1,510 sq. yds. of pavement. Neal Jones is City Clerk.

✣Bids are asked by the Des Moines, Ia., City Council until 9 a. m., August 3, for the construction of sheet asphalt pavement with 1-in. binder course and ½-in. wearing surface and 5-in. Portland cement concrete foundation on 23d St. from Forest Ave to South line of Lots 1 and 32 Williamston Place. The contract will include about 371 sq. yds. of pavement.

The Sidewalk and Bridge Committee of the City Council of Waterloo, Ia., has awarded the contract for the construction of sidewalks on the Fifth St. bridge, to M. J. Rieff for $1,045.

City of Des Moines, Ia., has decided to condemn the strip of ground 20 ft. wide and nearly a mile in length down the center of Polk Blvd., which was reserved for the exclusive control of the Des Moines City Ry. Co., when the street was dedicated to the city by the late Jefferson Polk. This action was taken upon the advice of the legal department in order that pavement could be constructed as per the wishes of the abutting property owners on the street.

Residents of Prospect Hill are urging the City Council, of Burlington, Ia., to pave the big fill which has been thrown across the ravine just south of South St., with concrete.

Property owners have petitioned the City Council of Fort Dodge, Ia., to curb, gutter and pave with asphalt. 16th St., from Central Ave. to Fifth Ave. south and First Ave. from 15th to 17th St. and Second Ave. from 18th to 20th St. The matter was referred to the paving committee and an investigation will be made.

The Mayor of Marshalltown, Ia., has picked out the following streets to be paved with concrete this season, the work aggregating 18 blocks: Seventh St., Main to Jerome; Second St., Main to Lin[illegible] Third St. [illegible] Church; Seventh St., Main to Church; Eighth [illegible] State St., Sixth to Seventh.

The contract for paving Thirtieth St. from [illegible] awarded by the City Council of Des Moines, Ia., to the Bryant-McLaughlin Co., at $2.15 per sq. yd.

Advices from Des Moines, Ia., state that the City Council has awarded to the J. W. Turner Improvement Co., the contract for the paving with brick of East Walker St., from Sixth to Pennsylvania Ave. The contract price was $2 per sq. yd.

A contract has been awarded the Miracle Construction Co., by the City Council of Des Moines, Ia., for the construction of curb on 24th St. from Forest to College at $.36 8-10 per lin, ft.

Kansas.

Advices from Kansas City, Kan., state that the County Commissioners have announced that work will be started at once repairing 52 miles of rock road in Wyandotte County. All new culverts will be constructed of concrete.

The Board of Commissioners of Kansas City, Kan., have passed a resolution providing that Eighth st., from Ohio Ave. to Tenney Ave. in the city, be paved with No. 1 paving brick for a width of 26 ft. on a 4-in. concrete foundation.

Kentucky.

The Fiscal Court of Christian County at Hopkinsville, Ky., has awarded a contract to E. C. Outlaw, at $2,600 per mile for the construction of a pike from Herndon to Lafayette, a distance of 7½ miles. Citizens of Hopkinsville and people along the route have contributed $9,000 toward the cost of the work. Operations will be commenced at both ends of the road at once.

Maine.

✣Capt. Joseph F. Gohn, Constructing Quartermaster, 655 Congress St., Portland, Me., will receive bids until 10 a. m., August 15, for the construction of a service road, grading, etc., at Fort McKinley, Me.

Maryland.

✣Highway Commissioners of Baltimore County, Baltimore, Md., will receive bids until noon, August 4, for the improvement of Lawrence Ave., from Altamont Ave. to Paradise Ave., a distance of 1,500 ft. Henry G. Shirley is Baltimore County Roads Engineer.

The County Highway Commission at Towson, Md., has awarded the contract for the improvement of Hillsdale Road to P. Flanigan & Sons, Baltimore, Md., at $9,000. The contract prices were as follows: 5,600 cu. yds. excavation at 47½ cts.; 6,600 sq. yds. macadam at 65 cts.; 40 cu. yds. plain concrete at $8; 60 cu. yds. reinforced concrete at $12. Bids were opened July 14.

Michigan.

Preparations are being made, according to advices from Northville, Mich., for the construction of a line of good roads around that city including the roads from Farmington to Northville and Waterford to Northville. A combination of crushed stone and macadam will be used for the roadway.

The city of Crystal Falls, Mich., has awarded the contract for paving Superior Ave. to Patrick McDonnell, Duluth, Minn., at $2.37 per sq. yd.

Minnesota.

✣Bids [illegible] 29, by the Village Clerk, John H. Carlson, [illegible] ing of Central Ave. with tar m[illegible] lithic, Donnellite, concrete, creosoted blocks or sandstone blocks. Duluth Engineering Co., 614 Palladio Bldg., Duluth, Minn., have plans and specifications on file at their office.

The Board of Public Works, St. Paul, Minn., has awarded the contract for paving the alley in Crocus Hill with vitrified brick to

P. J. Ryan for $1,983, which was below the Engineer's estimate.

The Board of Public Works, St. Paul, Minn., on July 14 awarded the contract for grading Berry Ave. from Bayard St. to University Ave. to Keough Bros. for $2,543. Bids were submitted by five other firms.

Motorists of Morrison County, Minn., according to advices from Little Falls, have organized a club for the purpose of improving the main roads in the county and have secured the co-operation of the Board of Commissioners who have appropriated $300 for the work to be done this season.

The County Commissioners at Fairmont, Minn., have awarded the contract for constructing State Road No. 1 from Station 133 to Station 187 to Frank Benschoter at $1,600.

Mississippi.

✣Bids will be received until 8 p. m., August 2, by Board of Aldermen and Mayor of Gulfport, Miss., for furnishing necessary labor and material for the construction of 13,000 sq. yds. of cement sidewalks. N. D. Goodwin is City Clerk and H. D. Shaw is City Engineer. A certified check for $500 must be filed with each bid.

According to information received from Jackson, Miss., the Board of Supervisors are to ask bids soon for $200,000 of bonds for the construction of a system of good roads leading into that city. A conference has been asked with the Bureau of Public Roads, United States Department of Agriculture experts after which plans and specifications will be prepared. The work is estimated to cost $2,500 per mile.

Missouri.

In order to induce factories to locate at Kansas City, Mo., the Board of Public Works is to send resolutions to the council recommending the paving of streets and the construction of a big storm sewer in the factory district of Centropolis.

Property owners have formed the Second Ward Improvement Club in Springfield, Mo., to take up matter of paving State St., Mt. Vernon and South Campbell Sts. and the Councilmen were ordered to bring the matter up in Council meeting. It was also decided to improve West Elm St. from Grant to Evans, Market St. from Walnut to State, Main from Walnut to Phillips, Grant from Walnut to Phillips and New St. from Walnut to Evans St. The kind of pavement to be used on the latter streets will be taken up at the next meeting.

The proposition to issue bonds amounting to $50,000 for the construction of a street paving plant in Kansas City, Mo., was carried, at the recent election.

At a recent election held in Kansas City, Mo., to vote on issuing bonds for the improvement of parks and boulevards to the amount of $650,000 the proposition was defeated.

Court of Jackson County, Mo., at Independence, Mo., has been petitioned to construct a gravel road from the County Farm towards Blue Springs. The road forms a connection between the Independence and Lee's Summit Rock road and the rock road from Blue Springs running south and the Court will inspect it as soon as possible.

Nebraska.

✣Bids will be received at the office of City Clerk, Norfolk, Nebr., until 5 p. m., August 8, for paving in Paving District No. 1, including Norfolk Ave. from the bridge over the river east of First St. to the west line of Seventh St. The pavement is to be 68 ft. wide. Official advertisement will be found elsewhere in this issue.

New Hampshire.

✣Bids will be received by H. C. Hill, State Engineer, Concord, N. H., until 1 p. m., August 5, for the construction of 10,000 ft. of trap rock road in Somersworth, N. H.

✣State Engineer H. C. Hill will receive bids for the construction of gravel road in Lee, N. H., estimated to cost $1,300, at Concord, N. H., until 1 p. m., August 5.

The contract for constructing a native stone road in Littletown, N. H., estimated to cost $5,000, has been let to Fred E. Ellis, Melrose, Mass. Bids were opened July 15 by H. C. Hill, State Engineer, Concord, N. H.

New Jersey.

✣Bids are asked until 10:30 a. m., August 10, by the Road Committee of the Board of Chosen Freeholders, Salem County, Salem, N. J., for grading and placing gravel surface on the Elmer Borough Road 1.78 miles in Borough of Elmer, Salem County, N. J. Harry P. Gray is Director.

✣Bids will be received by the County Board of Freeholders at Camden, N. J., until 11 a. m., August 10, for the construction of an amiesite road 14 ft. wide, 85-100 mile long, known as Chapel Ave., at Merchantville, N. J. J. J. Albertson is County Engineer.

Advices from Trenton, N. J., state that the contract for the construction of a stone road from the Glen Gardner R. R. station to the tuberculosis institution has been let to the Bushkill Quarry & Construction Co., for $11,923.

New York.

✣Village Clerk, Frank Dinsmore, of Bronxville, N. Y., will received bids until 8 p. m., August 1, for necessary labor and material for the grading and paving of the following streets: (a) Tanglewylde Ave. from Midland Ave. to Garden Ave.; (b) Garden Ave. from Tanglewylde Ave. to Underhill Ave.; (c) Underhill Ave. from Garden Ave. to Pondfield Road; (d) Tanglewylde Ave. from Garden Ave. to Pondfield Road.

✣Bids will be received at the office of Alfred E. Steers, President of the Borough of Brooklyn, New York City, for furnishing labor and material for seven street improvement contracts, the largest being Contrat No. 1, as follows: For regulating and repaving with granite, Class B, on a concrete foundation the roadway of Clinton St., From Hamilton Ave. to Lorraine St., together with all work incidental thereto, including: 3,620 sq. yds. of granite pavement, Class B, with tar and gravel joints (one-year maintenance); 20 sq. yds. old stone pavement, to be relaid; 625 cu. yds. of concrete for pavement foundation; 1,510 lin. ft. of new curbstone, set in concrete; 225 lin. ft. of old curbstone, reset in concrete; 1,146 sq. ft. of new granite bridgestones; 72 sq. ft. of old bridgestones, relaid. The time allowed for the completion of the work and the full performance of the contract is thirty (30) working days. The amount of security required is Five Thousand Dollars ($5,000.)

At an election recently held at Herkimer, N. Y., the proposition to raise $12,000 for the paving of German St. was carried.

Common Council of Dunkirk, N. Y., has awarded the contracts to the H. P. Burgard Co. for the construction of paving of West Fourth St. at $16,637 and for the construction of pavement on Swan St., at $15,995. On Swan St. there are to be concrete curbs and gutters, while on Fourth, as much of the present stone curbing as is in first-class condition will be reset and the necessary amount of new curb installed. The gutter on this street is to be brick, 18 ins. wide.

The following contracts have been awarded for the construction of street paving by the board of Contract and Supply, Rochester, N. Y.: Spruce St. brick pavement, Whitmore, Rauber & Vicinus, $14,975; Northview terrace grading and sewer, John Petrossi Company, $2,885.75; Ericsson St. trap rock pavement, Whitmore, Rauber & Vicinus, $2,940.75; Earl St. brick pavement, H. N. Cowles, $12,569.

The contract for paving with asphalt blocks on a concrete base on Vyse St., bids for which were opened July 7, by the President of Bronx Borough, New York city, has been let to the Hastings Pavement Co., 25 Broadway, New York, at $16,402.

The Village Trustees of Lyons, N. Y., have awarded a contract for street work to Miller & Hegeman, Rochester, N. Y. The work consists of laying a brick pavement on Canal St. from Geneva St. to Phelps St., together with a cement curb and gutter, macadamizing Spencer St. the entire length and putting in a cement curb with cement gutter, and macadamizing, curbing and putting in a cement gutter on Broad St. from Flat Iron building to the intersection of Jackson St.

The Board of Contract and Supply of Albany, N. Y., has awarded the contract for improving Morris St. between Main Ave. and West Lawrence St. to T. H. Dumary, Albany, N. Y., at $7,740.

North Carolina.

Advices from Yanceyville, N. C., state that S. G. Woods, the contractor, is making preparations for an immediate start on the work of constructing the Caswell County macadam road between Danville, Va., and Yanceyville. It is expected to have the road completed to the state line by October.

Ohio.

✣Bids are asked until noon, August 5, by the Board of County Commissioners, Cincinnati. O., for the improvement of extension of Struble road from Pippin road to Hamilton pike in Colerain and Springfield townships. Fred Dreihs is Clerk of the Board.

✣Bids are asked by the Board of County Commissioners of Hamilton County at Cincinnati, O., until noon, July 29, for the construction of improvements under Specifications No. 85, on the Cleves and Dugan Gap road from Cleves to Dugan Gap in Miami township.

Martin P. Connelly, Youngstown, O., has been awarded the contract for the construction of a brick pavement on Bridge St. for the village of Struthers, O. Bids were opened July 20.

Bonds will be sold at 2 p. m., August 15, by City Auditor of Youngstown, O., for the grading of Shehy St. between Wilson Ave. and Edgewood St.

The contract for grading and paving 1½ miles of public road in Fairfield township, Columbiana County, O., has been awarded to Harding & Knisely, New Philadelphia, O. It is stipulated that the road be paved with high grade paving brick, with concrete curb and base and that the brick after being laid be firmly cemented.

Bids for the construction of pavement on Washington, Franklin and Neil Sts. have been received by the Director of Public Service, Sandusky, O., from the following firms: Andrews Asphalt Company, Peters Bros. Company, A. G. O'Donnell, W. S. Pace, Ohio Paving Company, Asphalt Block Company, M. J. Hannon and Warren Bros. As soon as the above bids are tabulated blanks will be opened at the City Engineer's office for the signatures of the property owners indicating the kind of material they prefer.

Advices from Wooster, O., state that L. Wildeson, Orroville, has been awarded the contract at $12,650 for the paving of one mile of road south from the corporation line of Creston to the church. As specified the road will have a concrete foundation.

The County Commissioners at Dayton, O., awarded the contract for the construction of the Cincinnati pike from Main St. to Calvary Cemetery, a distance of 1 mile, to Frank Teian whose bid was $11,580, just $2 less than that of Gephart & Kline.

At the request of the residents in the vicinity of the Franklin County Children's Home the County Commissioners at Columbus, O., decided to take action to eliminate the dangerous curve in the Shepard Road at the Matheny bridge over Alum Creek.

Commissioners of Mahoning County, Ohio, after viewing Mahoning Ave., part of which has been paved recently by Stark and Mahoning County, decided to inform the city of Alliance and the County of Stark that the matter of completing the work is up to them.

The following bids have been received by the City of Delaware, O., for the construction of pavement on North Sandusky St. and as soon as the kind of material can be decided upon the contract will be awarded: W. H.

Ringwald & Sons, Chillicothe, Trimble Block, $29,235.86; Lambert Bros. & Wirt, of Delaware, Big Four Block, $29,855.52; Wm. E. McHugh, of Springfield, Trimble Bolck, $29,587.03; Fishbaugh & Karch, Celina, Wassail or Trimble Block, $33,103.37; E. H. Eckert, Toledo, O., Westrumite asphalt, $34,340.

City Council of Upper Sandusky, O., according to advices from that place has sold paving bonds amounting to $16,000.

Oregon.

Plans and specifications have been adopted by the city council of Corvallis, Ore., for the paving of the following streets including about 30 blocks: Washington from Second to the Union Station, Jefferson from Second to 10th, Monroe to 9th, and Third from the Mary's River bridge to Van Buren. All the streets will be paved 32 ft. in width, except that portion of Third between Adams and Van Buren. This will be widened to 52 ft.

At a meeting recently held by the Killingsworth Avenue Improvement Club, of Portland, Ore., it was announced that Killingsworth Ave. will be paved some time this summer.

The Executive Board of Portland, Ore., on July 15 let the following contracts: The improvement of Kerby, between Prescott and Ainsworth Sts., was let to the Oregon Hassam Paving Company for $40,664. Improvements on East 27th and several cross streets were let to the Warren Construction Company for $70,014. East Tenth, between Halsey and Thompson Sts., is to be improved by the Oregon Hassam Paving Company, and their bid was for East Ninth, between Thompson and Halsey Sts., the improvement was let to the Oregon Hassam Paving Company at a bid of $14,263. The largest improvement considered was that of East Sixtieth and other streets. The Pacific Bridge Company bid $116,533, while the Warren Construction Company offered a bid of $114,597.

Pennsylvania.

✣Bids are asked until 4 p. m., August 4, by McBridge Sur. & Eng. Co., Ltd., 709 Fitzsimmons Bldg., Pittsburg, Pa., Engineers of Emsworth, Pa., for curbing and laying cement sidewalks on Beaver ave. from the west line of John W. Stauffer's property to the Ben Avon borough line. The work will include the following approximate quantities: 9,350 lin. ft. of stone curb; 45,300 sq. ft. of cement sidewalk.

✣Board of Public Works, Reading, Pa., will receive bids until 2 p. m., August 3, for the construction of 25,000 sq. yds. of vitrified block paving also for 3,500 sq. yds. of granite block paving. E. E. B. Hedden is Assistant City Engineer.

According to information received from Emaus, Pa., the residents of that borough are agitating the construction of a pavement on a number of the streets, and a great many of the property owners have expressed their willingness to bear part of the expense.

The Council of Shenandoah, Pa., has awarded the contract for paving West Coal St. from Main to West St. and South White St. from Centre to Oak St. to, John A. Leffler, Hazleton, Pa., for $2.19 per sq. yd. The material used will be Porter brick.

The Wilkesbarre, Pa., township commissioners have awarded the contract to W. L. Hutchins, Wyoming, Pa, at $31,677 for laying a macadam road from Northampton St. at the Central Railroad crossing at the Empire to the Central tracks at Laurel Run borough, a distance of 3,400 ft. The completion of this work will mean a paved highway from the city of Wilkesbarre to the borough line of Laurel Run, where the famous start on the Giant's Despair Hill Climb is located.

South Carolina.

The Bureau of Yards and Docks, Navy Department, Washington, has awarded the contract for gravel paving work at the Navy Yard, Charleston, S. C., to the Simons-Mayrant Co., 16 Broad St., Charleston, at $1,771 for item 1, 58 cts. for item 2 and 58 cts. for item 3. Bids were opened July 9.

South Dakota.

Board of City Commissioners, Sioux Falls, S. Dak., have been petitioned to lay sidewalks on the north side of 22d St. from Phillips Ave. to Walts Ave. five ft. from the lot line. The same was referred to the Commissioner of Streets and Public Property.

Tennessee.

Advices from Memphis, Tenn., state that the contract for the construction of 23 miles of turnpike has been let for $17,250. Work will be started at once on the new roadways which will have a uniform width between 30 and 40 ft. and will connect stretches already laid out, thus making a continuous road by which one can go out north Second St. and make a circuit of the county returning by Riverside Park and the Speedway.

Texas.

✣Bids will be received by R. L. Williford, County Judge, Fairfield, Texas, until 4 p. m., August 15, for the construction of a system of county roads for District No. 1.

✣Bids are asked until noon, August 9, for paving West Montgomery Road with gravel and shell or shell only. John B. Ash, Houston, Tex., is County Auditor.

✣Bids will be received until Noon, August 11, by John B. Ashe, County Auditor, Houston, Tex., for the paving of Scott St. road.

At a recently held election the citizens of Colorado, Texas, voted to issue bonds to the amount of $30,000 for the improvement of roads in a district nine miles square with Colorado as the center. It is believed that the district will be extended later.

Commissioners of Travis County, Austin, Tex., have awarded to A. M. Clopton, at $2.500 a contract for the construction of one mile of graveled road between the Stessy gate and a point one mile northeast on the Austin and Lockhart road. The work is to be completed within 90 days.

Property owners on Live Oak St. between Cantegral and Mungar, Dallas, Texas, have filed a petition with the Street Commissioner for the paving with permanent materials that portion of the street, excepting the section between Peak and Annex, which was recently macadamized.

The Texas Grading Co., 114 Travis St., Houston, Tex., has been awarded a contract at $60,000 for constructing macadam and brick pavement for the city of Longview, Tex.

Utah.

The contract for repairing streets in Salt Lake City, Utah, during 1910, was awarded to P. J. Moran. His bid for the work was as follows: Excavation, cubic yard, $0.80; concrete foundation, cubic yard, $9.35; pavement, exclusive of foundation, square yard, $1.87; pavement grouted, square yard, $1.95; pavement, not grouted, square yard, $1.80.

Virginia.

A mass meeting was recently held in Wise County, at Wise, Va., and it was decided to petition the Judge of the Circuit Court for a special election to vote on the proposition of issuing bonds amounting to $700,000 for the construction of public highway in that county.

Washington.

City Council of Walla Walla, Wash., has awarded the contract to the Pacific Paving Co. for paving improvement District No. 60 for $44,806. The work includes the construction of a gravel and concrete base, one inch binder and two-inch wearing surface on Birch street from Second to Palouse; and Poplar street from East to Alder street.

Contracts for street improvements amounting to $105,000 have been awarded by the Board of Public Works, Spokane, Wash. The improvement work, engineer's estimate and contractor are as follows: Paving Manito Blvd. from Manito place to Thirty-third Ave., engineer's estimate, $57,000, Spokane Asphalt Macadam Paving Co., $55,110, maintenance, $3,500, material, granitoid; curbing, grading, parking and sidewalking, Thirty-second Ave. from Perry to Arthur St., engineer's estimate, $6,500, Thomas Malony, $6,456; grading, curbing, parking, sidewalking and paving Indiana Ave., Division to Madison St., engineer's estimate, $43,000, Inland Empire Hassam Paving Co., $43,960, maintenance, $112 50. The maintenance covers a period of five years. The contract for grading, curbing, parking and sidewalking of Denver St. from Celesta to Newark Ave. was not let and will not be readvertised for bids, as the engineer's estimate is $3,600 and the only bid received was for $5,500.

The City Council of Chehalis, Wash., has awarded the contract for the construction of pavement on a number of city streets for $91,100. The streets to be paved are as follows: Pacific Ave. from Park to Main, 36 ft. wide, and Cascade from Prindle to Market, Main St. from Market to Railroad, 36 ft. wide, Market from Park to Main, 40 ft. wide, Folsom from State to Louisiana, 24 ft. wide, West to State, 36 ft. wide and State from West to Folsom, 30 ft. wide. The work includes 25,763 sq. yds. of pavement.

Property owners on Tenth St., Vancouver, Wash., have decided to request the city council to have that street paved from the garrison to the depot instead of from the military reserve to Main St.

City Council of Seattle, Wash., has awarded the contract for paving the district between James and Madison Sts. and Sixth to Ninth Aves. for $72,961. Plans have been accepted for the regrade of Fifth Ave. and Fifth Ave. south from Main to Marion Sts. The cross roads, according to the plans, will be regraded between Fourth and Sixth Aves.

At a meeting of the Mason County Board of Supervisors at Shelton, Wash., it was decided to construct a country road known as the south shore road from Union City to Clifton, at the extreme head of the Hood Canal, connecting with the road from Clifton to Bremerton, a distance of 15½ miles. The cost of the work is estimated at $10,000.

Commissioners of King County, Seattle, Wash., have awarded the following contracts for road work: Construction of 1,100 ft. on road east from Orillia, to J. T. Krumm, at $2,495; construction of 1,968 ft. of road between Newcastle and the coal mine to Pearl Gay, at $2,000; planking of sandy stretch of road on the Ravenna-Bothell road, to H. L. Hillman, at $200; for the contract for clearing, grubbing and constructing a 16-ft. road from Enumclaw, 7,961 ft., George Banderet and W. P. Zindork submitted identical bids of $13,500 and it was decided to draw straws for the work.

At a meeting of the Commissioners of Chehalis County at Montesano, Wash., it was decided to have a survey made at once for the construction of a road from Copalis Crossing to Aloha, a distance of 9 miles connecting with the state road from Seattle and Tacoma to the open beach at Pacific.

Wisconsin.

✣Village Recorder of Janesville, Wis., will receive bids until 7:30 p. m., July 28, for furnishing the material, excavating trenches, furnishing and placing necessary hydrants and laying about 8,878 ft. of 4-in. water main and connecting the same with the water work now in force.

Canada.

✣Bids will be received by K. S. MacDonnell, Engineer town of Collingwood, Ont., until noon July 30, for the construction of approximately 3,636 sq. yds. of street paving either brick or bituminous on concrete foundation.

The Common Council of St. John, Can., received the following bids for the construction of [illegible] Mfg. Co., $12,676; McDonald & [illegible] 920; W[illegible] A. R. C. Clarke, $11,250. Mr. Clarke s[illegible] an alternative bid for Apposite paving which amounted to $11,380. The Board of Works recommended letting the contract to the latter for the construction of Apposite paving.

Items marked thus ✣ indicate work now open for bids.

WATER-WORKS AND SEWERAGE

Alabama.

✣City Clerk of Gadsden, Ala., will receive bids until August 4 for the construction of a new water works plant in that city.

Arkansas.

Questions as to the legality of the sewer bonds issued by Newport, Ark., have been settled by the Chancery Court and bids for the work will soon be advertised.

Plans and specifications have been prepared for the construction of 8 miles of sanitary sewer in Brinkley, Ark., and are now on file at the office of the city clerk.

The City Council of Helena, Ark., has taken action toward the purchase of the city water works system before August 11, 1911.

California.

Street Committee of the Oakland, Cal., City Council has adopted the following resolutions authorizing the Board of Public Works to construct sewers in the crossing of Eighth and Castro streets; to connect side sewers in Jefferson, Grove and Castro streets south of Fourteenth street; to construct sewers in the crossing of Eighth and Grove streets; the city engineer to prepare plans for sewering the crossings of Thirteenth, Fourteenth and Nineteenth streets with Alice street and for paving portion of Ninth street west of Webster.

Reports from San Francisco, Cal., are to the effect that the contract for the construction of the sewer in Kentucky St. has been awarded to the Federal Construction Company for $34,600.

The Board of Trustees, Willow, Cal., has instructed the City Engineer to prepare estimates of the cost of constructing sewers in all the outlying districts of the city. A resolution was then passed to call a special election to vote on the proposition of bonding the city to provide funds for the work.

City of San Francisco, Cal., has let two contracts for the construction of sewers; the first to the Keystone Construction Co. at $130,260 for the Powell-Bay-Market Sts. Section of the auxiliary system; and the second to The Metropolis Construction Co., at $23,181 for the sewer on Fourth and Kentucky Sts., from Channel St. south.

The City Trustees of Vallejo, Cal., have approved submitting a proposition to the people for bonding to the amount of $75,000 to construct a new city hall and branch county jail, building a new reservoir on Heming hill; also for repairing the old reservoir and laying water main to South Vallejo at a cost of $90,000.

Colorado.

Surveys have been started at Colorado Springs, Colo., by the City Engineer preparatory to the construction of two large reservoirs to be built on the north slope of Pike's Peak to extend the municipal water system.

Connecticut.

City Engineer F. L. Ford, of Hartford, Conn., submitted to the council his third annual report including under sewers proposed for 1910 the following to be constructed during this season: In Albany Ave. from Baltimore St. westerly 182 ft. In Allen place from the terminus of the existing sewer westerly to Summit St. In Cabot St. between Homestead Ave. and Albany Ave. In the rear of Fairfield Ave. from New Britain Ave. southerly to the top of the hill. In Hillside Ave. from New Britain Ave to White St. In Hillside Ave. from Harbison Ave. to Hamilton St. In Holcomb St. between Blue Hills Ave. and Ridgefield St. In Homestead Ave. and across private lands to Albany Ave., comprising the third section of the Homestead Ave. intercepting sewer. In Homestead Ave. between Cabot St. and Sterling St. In New Britain Ave. between Newington Ave. and Mountain St. In Park St. between John St. and Hudson St. Across private lands from Sisson Ave. to Farmington Ave. at Tremont St. In Washington and School Sts. from the present terminus in School St. to near Brownell Ave. In White St. from Hillside Ave. easterly and westerly.

Bids were opened July 6, by the town of Putnam, Conn., for sewer contract No. 1, the contract being let to P. Suzio Co., New Britain, Conn., at the following bid:

Item.	Cut.	Quantity.	Price
24"	$5\frac{1}{2}$	330	$ 1.25
18"	8	240	1.40
15"	10	1,350	1.00
10"	$7\frac{1}{2}$	710	.78
8"	$7\frac{1}{2}$	210	[illegible]
Rock			4.00
Manholes			34.00
Total			$3,119

Chandler & Palmer, Norwich, Conn., are the Engineers.

District of Columbia.

✣Commissioners of District of Columbia, Washington, D. C., will receive bids until 2 p. m., July 27, for furnishing cast iron water pipe. Specifications can be obtained from Chief Clerk, Engineer Department, Room 427 District Bldg., Washington, D. C.

✣Bids will be received by the Commissioners of District of Columbia, Washington, D. C., until 2 p. m., July 27, for furnishing cast iron water pipe specials. Specifications can be obtained from the Chief Clerk, Engineer Department, District Bldg., Washington, D. C.

Florida.

At a recent meeting of the City Council of Ocala, Fla., a resolution was carried providing that the Light and Water Committee take up the matter immediately of ascertaining the cost of installing a new water plant. A. E. Boardman, Treasurer of the Ocala Water Co., offers to sell their plant for $100,000 but no action will be taken until a comparison of the cost of the new plant is made.

Georgia.

City Council of Savannah, Ga., has instructed Consulting Engineer Jaudon to prepare estimates of the cost of changing a number of fire hydrants on York St., West Broad St., and Oglethorpe Ave., to larger and more modern apparatus and also an estimate of the cost of laying an 8-in. water main on York St. to replace the present 4-in. main, between Drayton and Barnard Sts.

The Water Board of Atlanta, Ga., has awarded the contract for constructing two coagulating basins, an intake tower and an overflow tower to the Nichols Contracting Co., at $28,478.

Idaho.

Plans have been prepared for construction of the proposed sewer system in Pocatello, Idaho, by the City Engineer and a meeting was recently held by the Council to make final arrangements for the matter. Bonds amounting to $164,788, were recently issued for the improvement.

Bids were opened July 11 by the City of Sandpoint, Idaho, for constructing a sewer system, the contract being let to A. Burns, Empire State Bldg., Spokane, Wash., at $37,800. The work includes the following: One screen house, 2,000 lin. ft. 16-in. wood stave pipe outfall, 800 lin. ft. 30-in. reinforced concrete pipe sewer, 4,280 lin. ft. 18-in. vitrified pipe sewer, 2,267 lin. ft. 15-in. vitrified pipe sewer, 2,085 lin. ft. 12-in. vitrified pipe sewer, 898 lin. ft. 10-in. vitrified pipe sewer, 4,477 lin. ft. 8-in. vitrified pipe sewer.

Illinois.

A hearing was held July 18 at Princeton, Ill., on the proposed South End sewer improvement. The work is estimated to include the following approximate quantities: 5,780 ft. of 15-in. sewer complete with house junctions, $13,005; 2,710 ft. of 12-in. sewer, complete with house junctions, $2,168; 1,300 ft. of 10-in. sewer, complete with house junctions, $936; 20,730 ft. of 8-in. sewer, complete with house junctions, $11,401.50; 1,500 ft. of 6-in. house drain extensions, including elbows in deep trenches, $375; 110 manholes complete with covers, $3,080; 11 flush tanks, complete with syphons and pipe connections, $770; for lawful costs and expenses attending the proceedings for making said improvements and the cost of making and collecting the assessment therefor, $1,864.50.

Advices from Joliet, Ill., state that the property owners on Jackson St. between Eastern Ave. and Franklin St. have petitioned the city council for the construction of a sewer and water main in that district.

City Council of Mendota, Ill., has instructed the Sewer Committee to investigate the matter of sewer extension at the north end and report concerning it at the next meeting.

Sewer Committee of the Paris, Ill., City Council has awarded to A. L. Simons, at $1,669.60, the contract for the construction of a sewer in Wabash Ave. from Newton to Jackson Sts.

An ordinance has been passed by the city council of Streator, Ill., appropriating an additional $3,000 for the construction of the sewer on the Crawford property in that city.

A petition is being circulated in Catlin, Ill., for the proposed new sewer which is planned to run from the Jones branch, a little stream north of the village to the south corporation line. According to the profile of the same it is to be a 15-in. sewer with manholes at all the prominent street corners and will be about a mile in length. The estimated cost of the improvement is somewhere between $4,000 and $5,000.

Advices from Dundee, Ill., state that the village board of West Dundee is making preliminary plans for the installation of a sewer system.

The Board of Public Works of Alton, Ill., has awarded the contract to John Strubel for the construction of a sewer in Logan St.

At a recent meeting of the city council of Rockford, Ill., a petition was presented from property owners calling for a sewer proposition on the special assessment plan which aims to drain the entire northeastern section of the city from the river to Highland.

Citizens have petitioned the city of Paris to install a filtering or settling apparatus at the water works plant and the Council will take up the matter at the next meeting. It is supposed that the work will require the general remodeling of the plant and will necessitate an expenditure of not less than $25,000.

On the recommendation of the Water Committee the City Council of Rockford, Ill., has decided to call a special election soon for the purpose of permitting the tax payers to pass on the proposition of bonding the city for $200,000 in order to bring the water supply system up to date.

A resolution has been adopted by the City Council of Springfield, Ill., providing that the Mayor, the Superintendent of Water Works and the Water Works committee select an expert hydraulic engineer to determine the improvements needed to the present water works system, in order to make it adequate.

Indiana.

✣Bids are asked by the Board of Public Works, Indianapolis, Ind., until 10 a. m., July 27, for the construction of a local sewer in the alley between Spruce and Evison Sts., from Orange St. to first alley south of Prospect St.

✣Board of Public Works, Indianapolis, Ind., are asking bids until 10 a. m., July 27, for the construction of local sewer in the alley east of Evison St., from Orange St. to first alley south of Prospect St.

Board of Trustees, Bloomfield, Ind., on the petition of a large number of citizens, has

Items marked thus ✣ indicate work now open for bids.

ordered a sewer line to be established on Mechanic St., between Seminary and Lewis Sts. The survey has already been completed and the work will be started at an early date.

The Town Board of LaFayette, Ind., has investigated the proposed route of the sewer through the bottom lands to the Wabash River on the south side and the matter will be taken up at the next meeting.

City of Waterloo, Ind., is considering the extension of the main sewer from McBridge Machine shops to the creek. The Cement Tile Co has made a proposition to furnish the necessary tile.

At the next meeting of the City Council of Columbus, Ind., it has been decided by property owners to present a petition calling for the construction of a sewer from Washington St. to Home Ave., in 16th St. The construction of such a sewer would be a means for draining the whole north end of the city.

The Sheehan Construction Co., Indianapolis, Ind., has been awerded a contract for constructing a local sewer in Beecher St., Indianapolis. Bids for this were opened July 11.

The Board of Public Works of Fort Wayne has awarded a contract to Derkheimer & Co., for constructing two miles of 12-in., 15-in., 18-in., and 24-in. vitrified clay pipe sewer. Bids were opened July 14.

Board of Public Works of Indianapolis, Ind., has awarded a contract to Wm. Bassert & Co., Indianapolis, for constructing a sewer in Cottage Ave. Bids for this were opened June 24.

Iowa.

✣Clerk of Sioux City, Ia., will receive bids until 9 a. m., July 30, for the construction of 800 ft. of 4-ft. x 5-ft. x 8-in. tunnel and placing 800 ft. of 16-in. cast iron suction pipe. Bids will be received for both brick and concrete. K. C. Gaynor is City Engineer.

✣Bids will be received by G. J. Gittingek, City Clerk, Chariton, Ia., until 1:30 p. m., August 1, for the construction of a water main extending two blocks north on Grand St. from the present main at the intersection of Grand St. and Park Ave.

✣Bids will be received until August 10, by the County Commissioners at Harlan, Ia., for the establishment of the first public drainage ditch. It will begin near the town of Defiance and run southeast about five miles with two miles of laterals.

A special election was held at Essex, Ia., July 18, to vote on the proposition of installing a sewer system at that place. As planned the main sewer will be from the river to J. Taverner's corner, consisting of a 12-in. pipe. The cost of the work is estimated at $3,500.

Council of Muscatine, Ia., has instructed the City Recorder to publish a notice of intention of the sewerage improvements to be made on West Hill. The work will include the construction of a new sewer in Lucas to Logan St., across Logan to Climer, and then over to Eighth. An alley extension through the Geiss addition, making connections with the trunk sewer, is also to be included in the proposed new district.

Advices from Sigourney, Ia., state that the Council has decided to install a sewerage system for that city and that an engineer will be employed at once to make plans and prepare estimates.

City Council of Sioux City, Ia., has decided, according to an announcement made by G. B. Healy, to install a large well with a daily capacity of 1,500,000 gals. in the eastern part of the city. The new well, which will be about 300 ft. deep and 15 ins. in diameter will cost, it is estimated, about $7,000.

City Council of Stuart, Ia., has before it the question of erecting a new water tank and tower to replace the old one, which is rapidly giving out. The work will call for an expenditure of about $6,000, it is said.

The proposition to issue bonds amounting to $5,000 for the water works system at Tabor, Ia., was carried July 8. The work will include the drilling of new wells and piping the water into the main conduit.

Water Trustees of Waterloo, Ia., have ordered the installation of water mains on the following streets: Newell from Fourth to Madison; on Ankeny from Quincy to Adams; on Randall from Sunnyside to Murphy; on Conger from Broadway to Fairview. Mains were ordered, conditional upon sewer being placed, upon the following streets: On Fowler from Mobile to Linden; on Edwards from Broadway to the Illinois Central belt.

Iowa.

✣City Clerk William Shardlow, Cherokee, Ia., will receive bids until 8 p. m., August 2, for sinking deep well at pumping station. Bids desired on 6-in., 8-in. and 10-in. well.

Kansas.

A resolution has been presented to the city commissioners of Topeka, Kan., creating a sewer district for the extension of the sewer at the intersection of Lincoln St. and Willow Ave. along Willow Ave. to Lane St. thence south to Fifth St. and from there east to Lincoln St.

Advices from Pittsburg, Kan., state that the proposition recently voted on to bond the city for the sum of $300,000 was carried July 12. An effort was recently made by the city officials to secure a private plant but no agreement could be reached.

J. W. Kelso, Iola, Kan., has been awarded the contract at $53,242, for installing a sewer system for the city of Herington, Kan. Bids were opened July 15. The work includes mains, submains, septic tank and laterals.

The City Council of Herington, Kan., on July 20 awarded the contract for constructing about eight miles of sewer and a septic tank to J. W. Kelso, Iola, Kan., at $43,242. Bids were opened July 15.

Kentucky.

✣The Louisville, Ky., Commissioners of Sewerage will receive bids until noon, August 5, at 605 Equitable Bldg., for the construction of Section "A" Western Interceptor, Contract 72, the work including the following approximate quantities: 3,239 ft. of reinforced concrete sewer, diameter 5 ft., including about 3,239 ft. of earth excavation, average cut about 19.1 ft.; about 1,450 cu. yds. of concrete, and about 67,000 lbs. of steel. J. B. F. Breed is Chief Engineer of the Commission. H. P. Eddy, 14 Beacon St., Boston, Mass., is Consulting Engineer.

Water Board of Henderson, Ky., is planning the construction of a new reservoir to have a capacity of about 6,000,000 gals. or double the capacity of the present one.

Louisiana.

Advices from Lake Charles, La., state that a proposition was recently voted on at that place to issue bonds amounting to $160,000 for the purpose of installing a sewerage system in District No. 1 embracing parts of wards 2, 3 and 4.

Maryland.

Engineers of Baltimore, Md., have completed surveys for the proposed sewerage system for the town of Centerville, Md., and plans for the proposed work are now being drawn up. Bids will be advertised as soon as the latter are completed.

A movement has been started in Williamsport, Md., looking to the establishment of a water works system for that place. At a recent meeting held at the Washington County Bank, the matter was thoroughly discussed and it was decided to employ an engineer to prepare estimates of the cost of such a project.

The Fidelity Engineering & Constructing Co., 53 Gunther Bldg., Baltimore, Md., has been awarded the contract for constructing a sewage disposal at the state rifle range at Glenburne, Md., for the Maryland National Guard. The work to be done is the building of a hydrolithic tank 26 ft. 3 in. by 14 ft. 3 in. 6 ft. deep, to be fitted with four flushing siphons each leading to a separate sand filter bed 34 ft. by 44 ft. and 4 ft. deep. It is proposed at this time to build the hydrolithic tank and two of the sand filters.

Massachusetts.

✣The Metropolitan Water and Sewerage Board, 1 Ashburton Place, Boston, Mass., will receive bids until 2.30 p. m., August 1, for laying 3,080 ft. of 36-in. cast iron water pipe and [illegible] ft. of [illegible] water pipe in Chelsea, Mass. Dexter Brackett is Chief Engineer of Water Works.

The M. McManus Contracting Co., 411 Wood St., Philadelphia, Pa., has been awarded the contract by the Bureau of Yards and Docks for [illegible] at the Navy Yard, Boston, Mass. The contract price was $2,673 and bids were opened July 9.

Maine.

✣Bids will be received by Capt. Joseph F. Gohn, Constructing Quartermaster, Portland, Me., until 10 a. m., August [illegible], for the construction of one brick fire station, plans 98-G., at Fort Williams, Me., including plumbing, electric wiring and fixtures; also for the construction of an ice house at Fort McKinley, Me.

Arrangements have been completed by the City Council of Auburn, Me., for completing the Goff Hill sewer. The bill passed by the body orders the Public Works Commission to build 325 ft. of sewer on Hampshire St. from Goss St. to Gamage Ave.; 1,250 ft. on Gamage Ave. to Shepley St.; 1,816 ft. on Shepley St. to Lake; 480 ft. on Lake to Fern St., and 175 ft. on Fern St. At Goss St. the sewer will connect with the Hampshire St. sewer which runs into the Androscoggin.

Michigan.

The city of Munising, Mich., has awarded a contract to Thos. E. Wooley, LaCrosse, Wis., at about $18,000, for constructing sewers to include 6,834 ft. of 8 in. to 24 in. vitrified pipe, 1,985 ft., 2½x3 ft. and 3x3½ ft. concrete sewers, 2 bulkheads, 19 manholes, 19 catch basins and 1 lamp hole. Bids were opened July 7.

The City Council of Grand Rapids, Mich., has adopted the resolution providing that all public sewers depositing sewage into the old river bed be extended to the main channel of the Muskegon River, the work to be done under the supervision of the Sewer Committee

The Board of Public Works, Saginaw, Mich., has approved a long list of sewers reported by the committee as necessary of construction during the ensuing year and referred it to the Council. There are 13 streets included on the east side and 8 on the west side and the costs are $10,615 and $10,275 respectively. Plans were also approved and sent to the council for the construction of a sewer in Mackinaw St., estimated to cost $25,350 and a sewer in Bay St. between Alexander and Hancock Sts., to cost $675.

City Council of Crystal Falls, Mich., has taken up the matter of extending the system of water works along Marquette Ave. and at the lower end of Superior Ave.

Minnesota.

City Council of Rochester, Minn., in accordance with petitions received from property owners, has had plans and specifications prepared for the construction of sewers in State, North Main and Oakwood Sts.

The Board of Public Works, St. Paul, Minn., has awarded the contract for the construction of a sewer on Scheffer St., from 7th St. to Chatsworth St. to John Lind for $4,300, which is $186 above the Engineer's estimate.

The Winslow Cummings Co., Chisholm, Minn., at $14,462, was the low bidder July 22 for constructing two reinforced concrete settling basins for the city of Chisholm, Minn.

F. H. Gray, Fergus Falls, Minn., has been awarded a contract at $364 for constructing a sewer for the city of Fergus Falls. Bids were opened July [illegible]

Missouri.

The proposition to issue bonds amounting to $1,000,000 for the water works system in Kansas City, Mo., was carried at the recent

Items marked thus ✣ indicate work now open for bids.

election. A bond issue of $25,000 for the sewers was also carried.

City Engineer Lawler of St. Joseph, Mo., after an inspection of the lower Blacksnake sewer reports that the portion between the foot of Dewey Ave and Third St., a distance of 5 blocks, is badly in need of repairs. The cost of the necessary work is estimated at $15,000.

Advices from St. Louis, Mo., state that the city council of Edwardsville, Ill., has authorized the right of way for a central outler sewer and condemnation proceedings will be commenced shortly against the property owners. As planned the new sewer will run through the Steam Mill branch, which has been an open sewer for many years.

The town of Windsor, Mo., at a recent election voted to issue bonds amounting to $55,000 for the installation of a water works and sewerage system.

Advices from St. Louis, Mo., state that Maplewood will soon call a special election to vote on the franchise for furnishing water to that suburb. The franchise, which has been approved by the city council and accepted by the water company, is to run 20 years unless Maplewood is annexed to St. Louis, in which event it lapses in 15 years.

Montana.

✣State Board of Examiners, Helena, Mont., will receive bids until 3 p. m., August 8, for the erection and completion of certain improvements at the State Reform School, Miles City, Mont. The work is as follows: First—A water system of the Kewanee or similar type, to consist of two 6 ft. by 26 ft. Kewanee plain pneumatic tanks, with all necessary appliances to complete system. Second—Two fire hydrants, with necessary pipe connections and fire hose. Third—One brick kitchen and bakery building 40 ft. 1 in. long by 22 ft. 3 in. wide. Plans and specifications may be seen at the office of the president of said Reform School at Miles City, Montana, or at the office of the State Board of Examiners, at Helena, Mont., Copies of the specifications for the water system may be had on application to either of said offices. A. N. Yoder is Secretary of the Board.

Bids were received by the City Council of Missoula, Mont., for the construction of the proposed sanitary sewer system from the following firms: James Kennedy Construction Company of Salt Lake, R. M. Bartson & Co. of Butte, J. H. Fifer of Spokane, G. A. Haggatt of Fargo, North Dakota, and S. Koglund, Nordstrom & Co. of Butte. The city attorney was instructed to pass on the legality of the bids and report at the next meeting.

City Council of Billings, Mont., has decided to construct a sewer east in the alley between Minnesota Ave. and First Ave. south from 24th St. to the Drainage ditch, thus creating a special improvement district. The railroad which will be benefited by this work will pay $1,720 toward the cost of the work.

Nebraska.

✣City Clerk, J. C. Gay, Orleans, Nebr., will ask for bids until 7 p. m., August 5, for necessary labor and material for the construction of a system of water works including: Brick pumping station, steel stand pipe 12 ft. in diameter by 80 ft. high, with concrete foundation, 1-25 h. p. gasoline engine with foundation, pipe connections and belt; system of approximately 3 miles of 8, 6 and 4-in. water mains, with hydrants and valves. (The water supply will be developed by the city ready for belt attachment from gasoline engine.) A certified check for $500 made payable to the order of J. C. Gay, City Clerk, will be required with each bid. C. F. Sturtevant, Holdredge, Nebr., is Consulting Engineer.

The York Water Co., of York, Nebr., has offered its plant to the city for $52,500 and the Council is seriously considering calling an election to vote on the proposition of installing a new system. As mentioned in our last issue the city offered $50,000 for the plant.

Committee is circulating a petition in Decatur, Nebr., asking the town board to call an election to vote on issuing bonds amounting to $15,000, the sum thought necessary for the installation of a water works plant.

A proposition has been placed before the South Omaha, Nebr., residents by Theodore Jacobson, representative of Boston, Mass., capitalists; who proposes to install a water works system for that section of the city. He plans to build a standpipe reservoir at 42d and W Sts. or in that vicinity and pump water from the Platte River, a distance of 15 miles.

New Jersey.

✣Bids are asked until 8 p. m., August 3, by Water and Sewer Committee of City Council, Ventnor City, N. J., for the construction of a sewage disposal plant. W. I. Risley is City Engineer.

✣Bids are asked until 8 p. m., August 10, by S. G. Willets, Clerk, Madison, N. J., for the construction of 12 miles of sewers from 9 to 18 in. in diameter with manholes, flush tanks and other appurtenances and a small sewage ejector station. A certified check for $3,000 must accompany each bid.

NOTICE TO CONTRACTORS.

Miles City, Mont.

Sealed proposals will be received at the office of the City Clerk of Miles City, Mont., up to three (3) o'clock p. m. of Monday, the 22d day of August, 1910, for furnishing certain materials and constructing extensions and improvements to the water works, electric lighting and sewer systems for said city; separate bids being entertained as follows:

1. For furnishing all materials and constructing main and outfall sewers, sewage pumping and disposal plants. Certified check, $5,000.
2. For furnishing certain materials and constructing intake and reinforced concrete settling basins, filter chambers, etc. Certified check, $2,000.00.
3. For hauling and laying cast iron pipe and setting hydrants and valves. Certified check, $500.00.
4. For furnishing materials and constructing power house. Ceertified check $500.00.
5. For furnishing f. o. b. cars, Miles City, Mont., all cast iron pipe and fittings. Certified check, $2,000.00.
6. For furnishing f. o. b. cars, Miles City, Mont., all hydrants and valves. Certified check, $500.00.
7. For furnishing and erecting steel tower and tank of 200,000 gals. capacity, all at an elevation of not less than 100 ft., and furnishing and erecting a steel chimney and breeching; chimney to be 72 ins. in diameter and 100 ft. high. Certified check, $1,000.00.
8. For furnishing all equipment and installing a mechanical filter plant of 4 units, each having a capacity of 500,000 gals. per day. Certified check, $1,000.00.
9. For furnishing all pumping machinery, consisting of six (6) turbine and centrifugal type, motor driven units. Also two (2) steam driven air compressors. Certified check, $1,000.00.
10. For furnishing f. o. b. cars, Miles City, Mont., and supervising the erection of one (1) fully equipped air lift system for sewage pumping. Certified check, $200.00.
11. For furnishing f. o. b. cars, Miles City, Mont., one 250 K.W. 60 cycle, 3-phase, 2,300 volt generator; one 50 h. p. motor and two 15 K.W. exciters. Certified check, $200.00.
12. For furnishing and supervising erection of at Miles City, Mont., one 300 h. p. Corliss engine. Certified check, $200.00.
13. For furnishing f. o. b. cars, Miles City, Mont., all power station switchboard equipment. Certified check, $100.00.
14. For furnishing two (2) three-phase armatures for General Electric 120 K.W. single phase generators now in use in lighting plant. No check.

All of the above material and work to be furnished and constructed in accordance with the plans and specifications on file at the office of the City Clerk, and at the office of the Engineers, where bidders will have ample opportunity to consult them.

Any one desiring a set of plans for personal use in submitting a bid may obtain the same by application to the Engineers, and payments as follows to cover the cost of the prints:

Section 1	$10.00
Section 2	10.00
Sections 3, 4 and 8, each	2.00
Sections 5, 6, 7, 9, 10, 11, 12, 13 and 14, no charge.	

Complete set of all plans, $15.00.

Specifications covering Sections 10, 11, 12 and 13 will be obtained by addressing Superintendent of Water and Light, Miles City, Mont.

The city reserves the right to reject any and all bids.

All payments will be made in cash.

GEO. W. FARR, Mayor.
J. E. FARNUM, City Clerk.
BURNS & McDONNELL, Engineers,
Scarritt Bldg., Kansas City, Mo.

ADVERTISEMENT.

Houston, Texas, July 7, 1910.

Plans and specifications are invited for the heating and ventilating system of the Houston City, Auditorium.

Contractors submitting bids are required to submit their own layout with complete specifications.

It is proposed to heat the Auditorium proper by the Plenum System, and the offices by direct radiation. The outside temperature to be taken at 10 degrees above zero and inside air to be heated to 70 degrees. Seating capacity of Auditorium 7,000, and each seat to be provided with 2,400 cubic feet of air per hour. Change of air to be every 20 minutes, and air to be washed.

The Contractor is to guarantee that the apparatus when completed in accordance with his specifications and plans will be of ample capacity to evenly maintain a temperature of 70 degrees F., when the outside temperature is at 10 degrees above zero, and that the apparatus throughout will have a free and rapid circulation when in operation.

Bids, plans and specifications to be addressed to Dan C. Smith, Jr., City Secretary and controller of the City of Houston. Bids, etc., to be received until Aug. 1, 12 M., or noon.

Plans of Auditorium can be seen at the offices of Mauran & Russell, architects, St. Louis, and at the office of F. L. Dormant, Consulting Engineer, Houston, Texas.

A certified check of the bidder on any bank in Houston, Texas, payable to the order of H. B. Rice, Mayor, for 5 per cent of the bid will be required to be deposited with each bid, plans and specifications.

Bidders must examine the building before submitting their bids. The successful bidder will be required to give bond and comply with the City Charter respecting contracts and to execute the usual form of contract as prepared by the City Attorney.

The right is reserved to reject any or all bids, plans and specifications or to accept any bid considered advantageous to the City of Houston, Texas.

H. B. RICE, Mayor.

(Proposal Advertisements Continued on Page 49.)

Items marked thus ✣ indicate work now open for bids.

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HALBERT P. GILLETTE . . . . . . } EDITORS
CHAS. S. HILL . . . . }
C T. MURRAY . . . . }
H. P. KIRKLAND . . . . }
MYRON C. CLARK . . . . PUBLISHER
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Organization in Street Cleaning.

The qualifications required of a superintendent of street cleaning and the duties of his office are presented briefly on another page of this issue. This discussion is worthy of careful attention throughout, but we [illegible] the part of greatest [illegible] is the ten paragraphs in which the author presents his theories on organization. Here are summarized three of the most important laws of management engineering: First, the divorcing of planning from performance, second the increasing of reward with increased performance and third the keeping of regular unit cost reports. Once these rules are grasped by officials in charge of street cleaning and put honestly into force street cleaning, instead of being one of the most unsatisfactorily performed tasks in American city housekeeping, will become one of the best performed tasks. We commend Mr. Fetherston's remarks on organization not only to street cleaning officials, but to contractors; the laws there enumerated apply to construction work of all kinds.

Panama Canal Excavation Increased 7,000,000 Cu. Yds., But the Cost Will Be the Same.

An increase of over 7,000,000 cu. yds. is made by the latest figures of the Panama Canal engineers in the amount of excavation in the Central Division, which is substantially the Culebra Cut. About a fifth of this increase is because of changes in dimensions, but the great bulk is allowance made for slides. In 1909 such slides required the excavation of 884,530 cu. yds. and in 1910 the amount was 2,649,563 cu. yds. These amounts are closely 7 per cent and 18 per cent of the total Central Division excavation for the two years named. In the new estimate a total of 34,896,483 cu. yds. is named as the remaining yardage to be removed from the Central Division, and 18 per cent of this is 6,280,000 cu. yds., which is not far from the amount allowed for slides in the new estimate. While we are not particularly concerned with these specific amounts the statement which prefaces their publication in the *Canal Record* attracts notice: "It is believed that they will not affect either the time of completion of this part of the work or its cost." The explanation is that the excavation is being done much faster and cheaper than was anticipated when the final cost estimate of October, 1908, was made. As we have a lively recollection of the disdain with which some of our engineering contemporaries, who have strenuously upheld the policy of day labor work at Panama, greeted our criticism of the estimate of 1908 as based on extravagant excavation costs, this explanation interests us. It would appear now that the estimated unit costs of 1908 were enough too high at least to provide for 7,000,000 cu. yds. extra excavation and still be within the total estimated cost.

Competition as a Means of Promoting Efficiency.

Efficiency is promoted by competition. Any man having sap works best and plays hardest where a rival is in the field, be the stake money, fame or the favor of a maid. It is a common and a perfectly logical thing to make use of this fact in engineering production. Pitting man against man or gang against gang promotes efficiency by introducing into every day tasks the elements of rivalry and reward for victory. There is no gainsaying the truth of this. It is not true, however, that it is enough merely to bring about rivalry. The competition must be wisely directed or it may result in more evil than good.

We are led to make the above statements by the story of an engineer who had to take over a construction work on which the pitting of [illegible] gang against gang even to the extreme of working on racial and religious prejudices had been made a star feature of the management. The engineer found a very pretty mess on his hands. Rivalry had run wild. It had become in the minds of the men and to a very great degree in the minds of their foreman the vital thing that the "Irish" had beaten the "Dagos" or vice versa, rather than that a good 24 hours progress had been made. Trickery had developed. Mike's gang felt elated when it could leave the work in such shape that Giuseppe's gang which followed must spent so much time in clearing the way that its output fell short of that of its rival. The gossip of the bunk house was not of records and output, but of the fulness and snap of Giuseppe's maledictions and in speculation on the probable nature of his "come back." The trouble was overcome only by discharging half of the men and reading the riot act to the other half. Naturally the engineer disparages competition.

Doubtless the case is an extreme one, but also one not at all improbable of occurrence. It illustrates the important point that the introduction of competition in engineering production, while [illegible] for good, [illegible] strong for evil. In shoveling earth into wagons or in unloading rails from cars as mentioned elsewhere in this issue, pitting gang agains gang in competition is a simple matter, but in, say tunnel work, where the effective work of one shift depends on the honest and efficient performance of its task by the preceding shift there must be stern and wise direction of competition or its value ceases. Conditions will determine the best manner of this direction; its necessity is the point we make here. It may frequently be the part of wisdom to eliminate all tendency to rivalry. Because this happens we may not condemn all rivalry at all times. Just as certainly as there are cases where its wisdom is doubtful, so are there cases where it is a powerfully effective means for increasing performance.

The Appraised Value of the Railways In Five States and the Probable Cost of Reproducing All Railways in America.

The failure to provide for an appraisal of American railways is probably the most serious defect of the Interstate Commerce Bill just passed by Congress. Such an appraisal is certain to be made by all the states acting individually, unless the Federal government shall soon enter upon the task.

It will doubtless surprise even those who are conversant with railway matters to hear that the mileage of more than twenty per cent of all steam railways in the United States has been appraised, or is now being appraised, by the railroad or tax commissions of individual states. The following is a list of the states that have taken this action, and the respective railway mileage as given in the 1907 report of the Interstate Commerce Commission:

Michigan	[illegible]
Minnesota	[illegible]
Nebraska	5,865
New Jersey	[illegible]
Texas	[illegible]
Washington	[illegible]
Wisconsin	[illegible]
Total	[illegible]

With the exception of Nebraska and New Jersey the appraisal of this mileage has been completed. The total railway mileage in the United States in 1907 was 229,951.

Many other states, particularly in the west, would have begun similar appraisals before this had it not been hoped that the Federal government would soon come to a realization of the importance of ascertaining what the physical property of the railways is worth. This hope has been buoyed by the frequent recommendations in the reports of the Interstate Commerce Commission itself, giving [illegible] problems.

[illegible] the first to come before that commission under the Hepburn law, has served to impress the Commission more forcibly than ever the necessity of an appraisal of all the railways. The Northern Pacific and Great Northern railways offered in evidence what purported [illegible]

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reproducing their respective railway systems, and upon this evidence they tried to prove that their freight rates not only were not excessive, but that they were so low as scarcely to yield a legal rate of interest on the cost of reproducing the physical property.

It has been argued by members of Congress in recent debates that the enormous cost of a general railway appraisal should be considered, and that the Interstate Commerce Commission would have power anyway to make an appraisal, if one were needed, in any particular rate case. This argument will crumble under its own weight when it is generally realized that an appraisal of every mile of railway in the country can be made for less than three million dollars. It will be soon apparent also that even if the cost were many times three millions, it would prove a wise investment of public money, if only to secure prompt decisions in rate cases like that of Spokane, just mentioned. The new railway law will soon result in hundreds of important rate cases, in nearly every one of which the shippers will contend that the railways are seeking to make profits on watered stock, while the railways will contend that if present prices of materials, land and labor be applied to their physical property it will be found that the annual returns upon this cost of reproduction are less than in any other large business.

Based upon the experience in five states that have made appraisals, it may be safely predicted that $10 per mile of railway roadbed, or less than 2 cts. per $100 of railway property, will cover the cost of a general appraisal, if properly managed. The cost to individual states is greater than it would be if all the railways were appraised at one time, due to the higher percentage of overhead charges for management of the appraisal, as well as to the higher cost of appraising the rolling stock. As it now stands, each state must appraise all the rolling stock of all the railways that enter the state, for in no other way is it practicable to prorate the cost of rolling stock. This is no small part of the expense of an appraisal.

While the time required for an appraisal is so great as to make it almost prohibitive if undertaken solely to establish facts in one rate investigation—as in the Spokane rate case—it is surprisingly small when viewed as an undertaking upon which untold future decisions will rest. In each of the several states above enumerated it has taken 12 to 24 months to make the appraisals, and it need take no longer to appraise all states together than to appraise a single state by itself, the time element being merely a function of the number of engineers and clerks employed to make the appraisal. With an efficient organization it should not be difficult to appraise every mile of railway in the United States within 18 months after the preliminary conferences between the commission and the engineers selected to manage the different divisions.

Much speculation has found its way into print as to the actual cost of the average mile of railway in America. In a recent magazine article of the sensational sort, it was stated that $15,000 a mile would build and equip the average railway, which is now capitalized at more than four times this sum. Other writers have carelessly supposed that the "book costs" reported by the railways to the Interstate Commerce Commission could be used as a guide. Such "book costs" are usually meaningless when used as criteria of the actual amounts of cash expended in construction.

The funded debt of the railways unquestionably represents the minimum probable cost that should be assigned to them, and that is $36,300 per mile of roadbed. However, the total funded debt and stock outstanding amount to $67,500 per mile. Hence between these limits lies the cost of building and equipping the average road.

Using the latest reports at hand, we have compiled the following tabulation of the cost of reproduction (new) of the railways already appraised in five states.

State.	Miles of roadbed.	Cost per mile.	Total.
Michigan	7,813	$26,138	$ 204,191,091
Wisconsin	7,090	34.624	244,128,868
Minnesota	7,596	54,204	411,735,195
Washington	3,006	64,600	194,057,240
Total	25,705	$41,030	$1,054,582,394
Texas	12,373	$17,198	$ 212,790,854
Grand total ..	38.078	$33,290	$1.267,373,248

The most recent figures for Michigan are not at hand, but those given will serve the present purpose, which is to show roughly, what the probable average cost of reproduction of all the railways in America is. It will be seen that the average for four states is $41,030 a mile, and that for five states it is $33,290; but the fifth state, Texas, contains such a large mileage of exceedingly cheap class of railway construction as not to be as typical as the average of the other four states. Moreover, there are reasons for believing that the appraised values of the Texas railways are altogether too low.

The Interstate Commerce Commission's report for 1906 shows that the total outstanding stock and bonds not owned by railway companies themselves aggregate only $45,600 per mile of roadbed. This, it will be seen, is only 10 per cent more than the average cost of reproducing new each of the 25,705 miles of railway in four fairly typical states. There is, therefore, no such great over capitalization of railways as is popularly believed. Indeed, when the land values of railways in the more thickly settled east come to be appraised, it may develop that there is very little if any over capitalization, if we confine the capital to the securities in the hands of the public, and do not include railway securities owned by other railways.

As just intimated, present values of right-of-way and station lands are enormously higher than they were when originally purchased by the railways. An extreme case, but one illustrating the point, is found in the land values of the Great Northern and the Northern Pacific Railways in the state of Washington. Only a trifle more than $6,000,000 were paid for land now appraised at $50,000,000. The growth of terminal land values in cities like Seattle, Tacoma and Spokane accounts largely for this great increase—an increase that amounts to nearly $20,000 a mile when distributed over the total mileage of these two railways in Washington.

The results of the appraisal now being made in New Jersey will be particularly interesting because New Jersey is the first eastern state that has undertaken to ascertain the cost of reproducing the entire railway property within its borders. In spite of the fact that New Jersey contains no terminals equal in value to those in New York or Pennsylvania we believe that the average cost of reproducing the New Jersey railways will reach such an astonishing high figure that most of the present railway opposition to railway appraisals will vanish. We very much doubt whether the highest railway officials themselves appreciate the great increment in railway land values that have occurred in the last generation, particularly in towns and cities.

CONCRETE AND REINFORCED CONCRETE SECTION

Combined Unit and Monolithic Method of Constructing a Reinforced Concrete Factory Building.

The plant of the National Casket Co., at Asheville, N. C., comprised three separate buildings, a mill building, power house and dry kiln. The mill building is a one-story factory 80x280 ft., with a monitor 40x240 ft. The dry kiln is 80x137 ft. In connection with the dry kiln are two transfer platforms, one between the mill and kiln buildings, 39x80 ft., and the other at the north end of the kiln building, 36x80 ft. The power house is a one-story building 47x100 ft. All buildings are constructed of reinforced and plain concrete and brick as follows: The reinforced concrete was mixed in approximate proportions of 1:2:4 and the plain concrete 1:3:6.

Mill Building.—The foundation walls are of plain concrete. The columns, beams, girders and roof slabs of structural concrete. The columns, the cross and the main girders are of monolithic construction. The columns are spaced 20 ft. The cross and intermediate beams are spaced 5 ft. on centers. The intermediate beams are of unit construction. A brick curb surrounds the lean-to. This is backed with a concrete gutter to which the flashing is secured. The conductors lead down inside of the building and through the foundation walls below the floor line. The entire building has a 3-in. finished concrete floor.

Kiln Building.—The foundation walls are of plain concrete. Five longitudinal 13-in. brick walls 20 ft. divide the building into four kilns. The concrete roof is of unit construction consisting of concrete beams, and slabs resting on top of the beams which are supported by the brick walls.

Power House.—This building is of monolithic construction except the roof slabs, which were cast on the ground and placed.

Construction Plant.—The layout of the construction plant was as follows: Two separately operated mixing plants were used, one for monolithic work being located between the mill building and dry kiln and the other for the separately molded members situated at the slab yard south of the mill building. Cement, sand and stone for the main mixing plant were delivered on the railroad siding and unloaded alongside the track.

Power for the main plant was furnished by a boiler located west of the dry kiln along the siding where fuel could be conveniently unloaded. A No. 2 Ransome mixer was used at this plant. The sand and stone were shoveled into 1 yd. industrial type cars divided by a partition to correspond to the proper volume of aggregate. Portable track was laid along the material pile and the cars, after being loaded, were run to the foot of an incline track leading to the charging platform. A cable operated by a hoisting engine was then attached and the material hauled to the charging platform and dumped into the hopper. A stock of cement was kept on the charging platform and one man attended to the charging. Four men were used in loading the aggregates. Water was supplied from a tank located above the mixing platform. Close to the mixer was an elevator used to hoist the concrete, which was delivered for the monolithic superstructure in two-wheeled buggies.

The power house was poured first, with one setting of forms. A runway led from the elevator to this building at an elevation slightly above that of the roof. Only a small amount of concrete was placed in a column at a time and well puddled. Pear shaped rammers being used for this purpose. All columns were poured to the elevation of the bottom of the brackets, then allowed to settle and shrink 24 hours. The girders and beams were then poured.

After about a week the side forms were removed, except under the girders which were left supported by posts for at least three weeks.

In constructing the mill building one main runway extended from the elevator to the south end of the building. This runway had two decks, one at the elevation of the top of the monitor and the other at the elevation of the roof of the lean-to. Work was begun at the south end of the lean-to and monitor. One setting of forms covered about four bays and all forms on columns and sides of beams were removed after three or four days. Bulkheads were placed for joints in the middle of the beams.

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*From "Notes on Concrete Construction," by Robert A. Cummings. Proceedings of the Engineers' Society of Western Pennsylvania, Vol. 26, No. 5, p. 159.

The runway had a slight grade from the elevator to lessen the labor of wheeling full buggies but not enough to interfere with the return of the empties.

Near the north end of the building is an elevator pit approximately 20 ft. square and 13½ ft. deep. Two cylinder pits extended 7 ft. deeper. All the walls, floors and cylinders are plain concrete, the floor being an inverted arch to resist hydrostatic pressure.

On account of the rather low elevation of the site and the adjacent river, considerable water was encountered in the elevator pit in the form of seepage and springs. In order to make the pit water-proof special precautions were necessary.

When the excavation was completed, the lower part being in rock, three springs were found in one pit and two in the other. In order to relieve the pressure while concreting, the water was taken care of by steam siphons in the following manner: The springs in each pit were drained to one low spot by small gutters which were filled with coarse broken stone and covered with empty paper bags to prevent the concrete from closing up the drains. A steam siphon was then placed at the low point and concreting begun. Two of the springs were well up on the side of the pit, but as the concrete level was raised more stone was placed alongside of the pit allowing the spring water to flow down to the siphon. The jets were concreted in and were pumped for several days until the concrete had a good set. The pipe was then unscrewed above the concrete and a cap put on, thus sealing the foundation.

The floor of the mill building was filled with earth to within about 6 ins. of the final floor level, 1-yd. industrial cars and portable track being used for the filling. The fill was wet down and well tamped and 3 ins. of sand placed on top as a bed for the concrete floor. The concrete floor was divided into 10x10 ft. squares, each requiring about 1 cu. yd. of material.

Most of the floor was laid in freezing weather so that it was necessary to heat the building. Two brick salamanders, one on each side of the building, were fired continuously, coke being used as fuel. In extreme weather fires were kept burning in metal wheelbarrows, which were easily shifted as required. A temperature between 30 and 35° above the concrete and a cap put on, thus work.

The Cummings System of steel reinforcement was used exclusively. All steel was shipped in shop-made units tagged and ready to be placed in the forms with the exception of the column reinforcement, which was shipped knocked down. All the steel was unloaded at the south end of the mill building near the slab yard and protected by a 50x54 ft. shed.

The girder, beam and slab units were tagged with a letter and number corresponding to that on the drawings to insure the proper location of steel. This was also a great aid in checking the steel received.

As soon as the forms were completed and cleaned the steel was quickly placed by common labor under the supervision of the steel foreman, no work being delayed on account of placing the steel.

Each unit was provided with Cummings patent chairs to hold the reinforcement off of the forms, thus insuring the correct position of the steel in the beams and slabs.

As soon as all the unit slabs were lined up and grouted along the outer edge of the roof, a brick curb was laid in cement mortar and a concrete gutter was laid against the brick and sloped to the conductor heads. On completion of the grouting of slabs and placing of the curb and gutter, the standard 3-ply tar and stone chip roofing was laid.

Separately Molded Members. The cross beams in the monitor roof and the beams in the dry kiln and all roof slabs for the three buildings were separately molded on the ground and erected.

For this purpose a slab yard was laid out just south of the mill building. The yard was approximately parallel to the railroad siding and about 40 ft. distant. The overall dimensions were 190x90 ft. On each side of the yard there were three longitudinal rows of slabs 5 ft. 6 ins. wide, the middle being taken up with a row of beams about 20 ft. wide.

The longtitudinal alleys were 5 ft. wide. A little to the north of the middle was a transverse alley 6 ft. wide, which divided the yard into two sections. At the end of this alley, near the track, was the concrete mixing plant, tool house, cement and steel sheds. Industrial track was laid throughout the length of all the alleys and provided with turntable crossings and switches.

A Ransome mixer was used here, power being furnished from a boiler located directly opposite on the other side of the siding. A small portable saw mill was also located across the railroad siding and driven by a steam engine.

The mixer was set up so as to discharge into cars at an elevation of about 3 ft. above the track. A charging platform was built around the hopper and an incline constructed running about 50 ft. to the south and alongside of the material which was unloaded from the siding. Nearest the mixer was the sand pile about 40 ft. long and the stone pile extended 80 ft. further along the track.

For depositing the concrete small cars were used. They were hexagonal, 3 ft. across and 6 ins. deep with a trough 10 ins. long on each side and closed by small stops, which were removed when depositing and the material pulled out with hoes.

The yard was nearly level so that a small amount of grading was necessary. For the first slabs made 3x6 ft., concrete bottoms approximately 2 ins. thick were laid on sand. Later these were found unnecessary and the first slabs made were laid on sand leveled off, a layer of paper placed on it and the first slab cast on this paper.

The forms were made of 2¾-in. stock, 3 ins. wide. A frame was made the size of the slabs, the inside being beveled so that the side of the slab with the larger area was on top. When the form was removed and put together again, the lower side, being of smaller area, allowed it to be placed on top of the slabs already case.

The sides of the forms were longer than required, to allow the forms being used for a few of the longer slabs. The forms were held together by rods across each end with nuts which could be loosened for removal of forms. All forms were greased to facilitate removal.

The number of forms used was sufficient for a maximum day's run, and the procedure was as follows: For the first pour, after covering the bottoms with paper, the forms were bolted together and placed on the bottoms. The steel slab units were then placed near each slab form. This was a short operation as all steel was in units and marked for placing.

The concrete, transported in the cars mentioned above, was raked into the forms, tamped and leveled off. The steel was then embedded in the top of slab as cast, and the surface slightly troweled. It will be noted that the slabs are cast upside down.

On the following days the removing and replacing of forms and the depositing of concrete were continuous and simultaneous operations. After one day's set, the forms could readily be removed by loosening bolts. Paper was then placed between the slabs to break the bond. This being done, the steel unit was placed near by, ready for the slab, and the concrete gang followed with their work.

The beams were cast in the slab yard, the molding being done simultaneously with the roof slabs. The beams averaged 9x18 in. x20 ft.

Six lines of 4x4 in. sills were laid parallel to and between the industrial tracks to support the bottoms of the beam forms, which were laid at right angles to the four by fours. The forms were made for alternate beams and so placed that on the molding of alternate beams and the removal of forms, the intervening space was just the required width of a beam. The bottom and end forms were then set between the beams already cast and the sides of the latter whitewashed for use as the sides of the forms. Another set of beams was then molded.

The bond between the adjacent beams was slight on account of the whitewashed sides, most of them separating on the driving of a wedge at the ends and along the top. In a few cases, however, it was necessary to jack up one end slightly to break them apart.

On removal the first set of forms, the sides and ends were at once reset, additional planks being necessary only for the bottoms.

As soon as the forms were ready the steel units were placed. The reinforcement for each beam was a shop fabricated unit delivered ready for placing and tagged to designate the proper beam. Two men carried the steel from the stock shed nearby and placed it in the form. Thus the placing of steel for all beams occupied but a few minutes.

The reinforcement was held off the bottom forms by Cummings Chairs, the proper fireproofing of the steel being thus insured without the use of loose hangers.

Concrete cars were run along each end of the beams and the material pulled out into the beams with hoes. It was then well rammed and troweled smooth along the top.

After the slabs and beams had had a set of about three weeks, the erection was begun. This was handled by the slab yard crew, two extra crews, under sub-foremen being added later on in the work.

The power house superstructure being the first poured, the slab yard program was so arranged that the slabs for this building were the first ready for erection.

Several schemes were tried out for moving and erecting the slabs. At first a heavy plank runway was laid extending from the yard up an incline into the mill and across to the power house. A low truck with wide wheels was built to hold from three to six slabs, which were taken by hand from the piles and placed on the trucks. The truck was then hauled by the hoisting engine cable along the runway to the power house where they were unloaded and piled twelve high at different locations in the building ready for placing.

After several experiments, the method of handling slabs finally adopted was as follows: For loading slabs a gantry was erected 7 ft. high and long enough to span a pile of slabs and the adjacent track. A small track was attached to the top of the gantry along which traveled a sheave with rigging to carry the slab. This slab rigging consisted of a 5-in. triple block and line, to which were fastened four long hooks. To load a slab the traveler was placed over the slab pile, two of the hooks placed at each end of the slab which was clear of the pile and the traveler moved along until over the car and the slab lowered. The gantry was light enough to be easily moved by hand from one pile to another as required. Trucks and narrow gage track were used for moving the slabs and beams.

For unloading a double block attached to the beams of the building and a line with hooks were used, the slabs being hoisted clear of the trucks, swung over the pile and lowered. In piling the slabs, spacing strips were placed under each end.

The best way to erect the slabs was found to be as follows: A gantry was erected consisting of two A-frames [illegible] braced together and supporting a cross piece to which was attached a double block. The A-frames were about 8 ft. wide at the base. This gantry was placed across the beams of the building which were 5 ft. on centers and the slabs were hoisted up between the beams inside of the frame, swung into position and lowered.

A horse was used for the hoisting, the snatch line passing through a single block on the ground and a double block at the top of the frame. One man on the ground fastened the line around the slab and two men on the roof released and set the slab. They were set approximately when first placed and later were lined up and grouted. The grouting was placed in the groove between the beveled edges of the slabs and slightly troweled.

The lower edges of all slabs were pointed with mortar. For this work traveling platforms were constructed and run on two lines of portable track. Three or four men worked on each platform about 200 sq. ft. of slabs being pointed at each position of the traveler. One traveler was used for the lean-to in the mill building and another constructed for the high work on the monitor roof.

The same method was used for moving and erecting slabs on all buildings. The dry kiln slabs were taken through the mill building on the portable track. Switches and curved track were used in moving slabs to all buildings so they could be distributed to the different locations approximately beneath their final positions on the roof.

The moving and erection of beams was more difficult, each beam weighing 1¾ tons. The method adopted was as follows: The loading of beams was done with a beam gantry. Two towers were constructed about 15 ft. high and 5 ft. across the base and mounted on the trucks of industrial cars. One track with a tower was placed on the track running along each end of the beams. A 30-ft. I-beam spanned the row of beams and connected the towers moving along the tracks. From the middle of the I-beam a 2-ton triplex block was suspended, to which was fastened a bridle made out of two planks, 2 in. x10 in., on edge, spaced 2 in. apart and bolted together. This was hung by means of a ⅝-in. chain from each end to a 3x½-in. ring, which engaged the chain of the triplex block. The chains and tongs used to lift the beams were suspended from each end of the bridle so that the force applied was at each end and at right angles to the beam.

The first operation was to remove the bottom forms. To do this the gantry was placed directly over the beam and the bridle lowered. A large pair of tongs made out of ⅜x3 in. wrought iron and suspended from each end of the bridle, gripped the beam and raised it a few inches, the tongs being round pointed to avoid cutting into the concrete. The bottom form could then be easily removed. The beam was again lowered onto the 4x4 in. stringers and a chain placed around each end. It was then raised by the triplex block clear of the other beams, swung through 90° or parallel to the tracks, and the gantry moved forward until the beam was over the moving-carriage, when it was lowered onto the carriage supports. Two men were used in loading beams.

The carriage used for moving beams was constructed as follows: The bodies of two industrial cars were removed and wooden turntables mounted on the trucks. Two ordinary T-rails were laid parallel, on top of the turntables, with about 12 ins. clear space and secured at each end. Two stirrups were hung on the T-rails about 18 ft. apart to carry the beam.

The carriage track extended to the near end of the row of beams and was parallel to and midway between the other two tracks on which the gantry traveled.

A horse was used to pull the beams to their respective positions ready for placing. The snatch line was long enough to reach from the mill building to the place of loading so the horse could remain on the earth floor of the mill, this part of the work being done before the concrete floor was laid.

The dry kiln beams were first erected, all being taken up through the mill and into each division of the kiln as required.

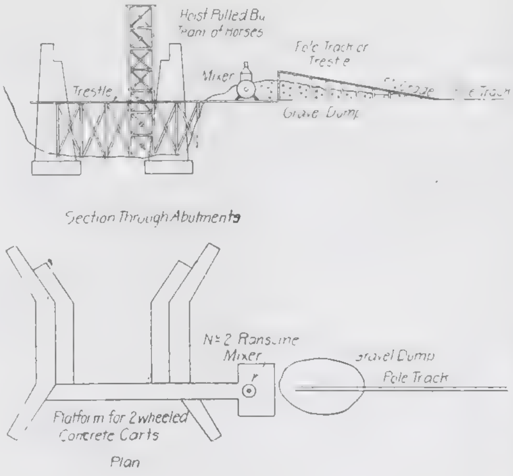
A 35-ft. gin pole was used for hoisting the beams, the hoist line being operated from an engine. A bridle similar to that used on the gantry was used to hoist the beams into position. This pole was first erected in each kiln slightly ahead of the position to be occupied by the first beam. The carriage was then run to the required position near the pole, the bridle chains attached and the beam hoisted into place. As each was set in position the pole was skidded along about 6 ft. on a plank to the required position for the next beam. The beams in each kiln were thus placed with but one erection of the pole.

The erection of the beams in the mill building was more difficult on account of the monolithic beams at each column, which necessitated the partial lowering of the gin pole for each bay. Thus only three beams could be erected for each erection of the gin pole. The pole was more easily guyed in this building, however, the lines being attached to the monolithic work.

The Speaker takes pleasure in acknowledging the courtesy of the Executive Committee and officers of the National Casket Co. for the privilege of presenting a description of this part of their Asheville plant. The plant was designed throughout in monolithic concrete by the well known firm, W. G. Wilkins Company, Engineers and Architects.

Cost of Constructing Concrete Abutments for a Railway Bridge.

The following costs relate to the construction of two wing wall abutments on the Transcontinental Ry., at Machent Pouce, County Montmaguy, Quebec. The accompanying sketch indicates the lay-out of the construction plant. The abutments contain 2,480 cu. yds. of concrete in which rubble stone are embedded. There are 720 cu. yds. of stone or practically 30 per cent of the volume. The gravel was obtained from a pit which was opened up for this work and was hauled 1,600 ft. on a pole line track and stored in a pile behind the mixer. The pit had to be stripped from overlying earth, and this work was done by men and wheelbarrows. The rubble stone were obtained from the bed of the stream, piled on the bank and hauled 1,000 ft. on pole line to a storage pile. From the mixer, the concrete was hauled in two-wheel carts on runways on trestle as indicated; about 500 cu. yds. of stone and concrete were handled by hoist operated by horses. The figures given have been computed from data furnished us by R. M. Thompson, the engineer in charge of the work.



Sketch Showing Layout for Building Concrete Abutments.

The total amount of gravel was 1,160 cu. yds., or 1 cu. yd. per cubic yard of plain concrete. The cost of obtaining this gravel was as follows:

Item.	Total.	Per Cu. Yd.
Looking for gravel	$ 82.19	$0.047
1,600 ft. pole track at 11 cts.	252.10	0.143
Stripping top soil	257.20	0.146
Loading cars	497.82	0.283
Hauling 1,600 pole track car	336.90	0.191
171 ft. trestle at $1	171.26	0.097
Total	$1,597.47	$0.907

The cost of gravel apportioned to the total 2,480 cu. yds. of rubble concrete was, from these figures, $0.644 per cu. yd. of concrete in place.

The cost of trestles and scaffolding was as follows:

Trestle No. 2 (399 Lin. Ft.):	Total.	Per M. Ft.
21,500 ft. B. M., labor only	$305.60	$14.23
2,856 ft. B. M., 2-in. plank	33.07	12.00
Total	$338.67	

This gives a cost of 77 cts. per lin. ft. of trestle laid down:

Trestle No. 3 (114 Lin. Ft.):	Total.	Per M. Ft.
4,238 ft. B. M., labor only	$51.40	$12.13
2,000 ft. B. M. 2-in. planking	24.00	12.00
Total	$75.40	

This gives a cost of 45 cts. per lin. ft. of trestle laid down.

Trestle No. 3A (22 Lin. Ft.):	Total.	Per M. Ft.
1,608 ft. B. M., labor only	$74.90	$11.77
1,472 ft. B. M. 2-in. planking	17.64	12.00
Total	$92.54	

This gives a cost of 77 cts. per lin. ft. of trestle laid down:

Trestles 4 and 4A (136 Lin. Ft.):	Total.	Per M. Ft.
6,362 ft. B. M., labor only	$ 74.90	$11.77
2,396 ft. 2-in. planking	28.80	12.00
Total	$103.70	

This gives a cost of 55 cts. per lin. ft. of trestle laid down. Summarizing the cost of trestling and adding the cost of scaffolding we have:

Trestle 2	$338.67
Trestle 3	75.40
Trestle 3A	92.54
Trestles 4 and 4A	103.70
Total trestles	$610.31
Scaffolding	43.83
Total trestle and scaffolding	$654.14

The cost of trestling and scaffolding for 2,480 cu. yds. of concrete was, therefore, 26.4 cts. per cu. yd.

The cost of mixing and placing the concrete was as follows:

Item.	Total.	Per Cu. Yd.
Cement	$3,784.00	$1.53
Cement cartage		0.65
Cement shed		0.10
Hauling 2,062 bags at 6.1 cts.	132.40	0.053
Wheeling shed to mixer	61.40	0.024
Loading and wheeling gravel to mixer	193.02	0.077
Foreman on concrete	135.13	0.054
Engineer on mixer	124.74	0.050
Man at hopper	48.00	0.019
Man discharging mixer	61.07	0.024
Wheeling concrete to bridge	166.77	0.067
Helping to tip carts	33.95	0.013
Spreading concrete	196.40	0.079
Total		$2.74

The cost of getting timber and setting up the mixer was as follows:

Item.	Total.	Per Cu. Yd.
Cutting 30 cords at $1.95	$ 58.67	$0.023
Carting 30 cords at $4.55	135.60	0.054
Setting up mixer	146.11	0.059
Total	$340.38	$0.136

The cost of collecting, hauling and placing 720 cu. yds. of rubble stone was as follows:

Item.	Total.	Per cu. yd. stone.	Per cu. yd. concrete.
Cutting bush (½ acre)	$ 30.62	$0.043	$0.012
1,000 ft. pole track at 13½ cts.	135.10	0.190	0.055
Collecting and putting on bank	360.00	0.500	0.145
Loading onto stone boats	215.60	0.299	0.087
Hauling on pole track	175.00	0.243	0.070
Carrying from pile to wall	233.64	0.324	0.094
Total	$1,149.96	$1.599	$0.463

Some 500 cu. yds. of concrete and stone were placed by means of a hoist as before stated. The cost was as follows:

Cost of Hoist:	Total.	Per cu. yd.
Labor constructing	$137.82	.....
Timber	60.75	....
Total	$198.57	$0.395

Cost of Hoisting 500 cu. yds.:		
Labor and team	$47.85	$0.095
Grand total	$246.42	$0.490

The cost of forms including materials and erection was as follows for 2,480 cu. yds. of concrete:

Item.	Total.	Per cu. yd.
Carting 38,000 ft. B. M. at $2.17 per M.	$ 82.45	$0.033
38,000 ft. B. M. timber at $11 per M.	418.00	0.169
Labor	584.55	0.230
Taking down forms and clearing up	213.28	0.086
	$1,298.28	$0.518

The following miscellaneous items of cost complete the work:

Sundries	$136.49	$0.050
Tools and plant	252.07	0.101
Total	$388.56	$0.151

Summarizing the above items of cost we have the following unit costs for 2,480 cu. yds. of rubble concrete in the abutments:

Item.	Per cu. yd.
Gravel	[illegible]
Trestles and scaffolding	[illegible]
Mixing and placing	[illegible]
Setting up mixer	[illegible]
Rubble stone in place	[illegible]
Hoist	[illegible]
Forms	0.518
Miscellaneous	0.151
Total	$5.216

Cost of an 8x8-Ft. Concrete Box Culvert.

The culvert was built by day labor and replaced an old wooden bridge, the foundations of which had been washed out. The culvert was an 8x8 ft. concrete box with parapet and wing walls and contained 132.6 cu. yds. of concrete. Its length was 33 ft. exclusive of wings. The parapet walls were 12 ins. thick with a 12-in. curb on one side and a 4-ft. walk on the other side, making the width of roadway 26 ft. The roadway slab was 12 ins. thick, reinforced with ¾-in. Havemeyer bars on 8-in. centers. A 1:2:4 concrete was used. The waterway was paved with concrete. The cost was as follows:

	Labor.	Material.	Total.
Removing old bridge and [illegible]	[illegible]	[illegible]	[illegible]
Cost of shed, tools, rubber boots	[illegible]	[illegible]	[illegible]
For excavation and cofferdam	[illegible]		[illegible]
Erecting concrete forms and platforms	113.87	146.34	260.21
Cost of all concrete except pavement of waterway	[illegible]	[illegible]	[illegible]
Paving waterway with concrete	[illegible]	[illegible]	[illegible]
Removing forms	20.75		20.75
Plastering face of concrete	[illegible]	[illegible]	[illegible]
Embankment filling	[illegible]		[illegible]
Watchman	[illegible]		[illegible]
Hauling tools and material		34.75	34.75
Totals	[illegible]	[illegible]	[illegible]

These figures give a total cost per cubic yard of $11.64. They are taken from the report for 1910 of B. T. Fendall, City Engineer, Baltimore, Md.

EARTH AND ROCK SECTION

Two Months Record of Steam Operated 3 5-8-In. Percussion Drill in Quarrying for Crushed Stone.

This record is for two months' work at the crushed stone quarries of the Webster Stone Co., Fitzhugh, Okla., and is furnished us by the manager, Mr. W. H. Webster. The quarry has three different qualities of stone. The top 5 ft. is rather loose stratified rock, which is very hard; the next 20 ft. is of a shell formation and is not so hard, and the bottom 20 ft. is a silicious limestone having more or less free silica mixed with the lime, and is quite hard and solid, but not very hard to drill as the stone is very compact. The face of the quarry ranges from 44 to 46 ft. high.

View of Crushed Stone Quarry Operated by Steam Percussion Drills, Fitzhugh, Oklahoma.

Two sizes of Wood drills* are used. One is a 2¾-in. drill made for drilling 12 ft., but here another 4 ft. has been added making 16 ft. of steel which the drill handles easily. This drill has been in use since 1903, 7 years, and the expense of maintenance has not been to exceed $15 for the 7 years. The other drill is a 3⅝-in. Wood drill. This drill has been in use 60 days, with no maintenance expense. It drills up to 20 ft. Extra large steels are used, the starter and up to 6 ft. being 2 ins., from 6 to 12 ft., 1⅞ ins., from 12 to 16 ft., 1½ ins., and from 16 to 20 ft., 1⅜ ins. These large steels are found to be an advantage in shaping the bits and also in wearing qualities; giving more steel to work on prevents the steel from crystallizing under the constant pounding.

The power used to run this 3⅝-in. drill is steam furnished by a 10-h.p. traction engine, which is moved along with the drill and kept as close as possible to reduce condensation. Steam can be carried as far as 150 ft. from the boiler, but the best results are had at not to exceed 30 ft.

The machinery is handled by 3 men; 1 fireman, 1 driller and 1 helper. The practice is to drill the top 5 ft. and blast it off to prevent spalls from falling into the deeper holes. The balance of the face is drilled in two drillings of 20 ft. to each bench. The holes are spaced 12 to 15 ft. from the quarry face and 10 ft. apart. The holes are started 3½ ins. in diameter and decrease ⅛ in. in diameter for each 2 ft. lengths of bit. The holes are pumped with a long pipe pump made in the blacksmith shop from 1¼-in. black iron pipe with a steel ball valve at the bottom. Best results are obtained with this pump by using a steam blower.

With the 2¾-in. drill from 40 to 90 ft. of hole are drilled per 10-hour day, the average is 70 ft. The record of the 3⅝-in-drill for May and June, 1910, is given in Table I. In May the drill was in operation 93½ hours and drilled 515 ft. in an average of 55.08 ft. per 15-hour day, at an average cost of 11.57 cts. per foot. In June the drill worked 130 hours and drilled 599 ft., or an average of 46 1/13 ft. per 10 hours at an average cost of 11.83 cts. per foot.

TABLE I. DAILY REPORT FOR MAY AND JUNE, 1910, FOR 3⅝-IN. WOOD DRILL.

May			June		
Date.	No. ft.	No. hrs	Date.	No. ft.	No. hrs.
6	34	5	1	73	10
7	64	8	2	44	10
10	50	9	3	40	10
11	30	8	7	50	10
12	41	10	8	40	10
13	40	8	9	24	7
17	30	6	10	54	10
18	42	10	11	44	10
19	17	5	13	22	5
20	10	1	14	18	5
26	36	7	15	52	10
27	56	8½	16	52	10
31	65	8	17	18	5
			29	24	8
	515	93½	30	44	10
				599	130

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*Wood Drill Works, Paterson, N. J.

A Record of Blast Hole Drilling with a Well Drilling Machine.

The following record of 43 consecutive days' work of a well drilling machine in drilling blast holes for quarry work has been furnished us by the Lewisburg Stone Co. of Lewisburg, Ohio. The rock drilled is medium hard but full of seams for the topmost 10 ft., then comes 5 ft. of hard cap rock below which is very hard blue limestone. The holes range in depth from 22 to 30 ft. and are 5 ins. in diameter. The machine used is a No. 2 G Clipper, made by the Loomis Machine Co. of Tiffin, Ohio. It is a 10-hp. gasoline machine. The drill is operated by two men, a driller at 20 cts per hour and a helper at 17½ cts. per hour. The gasoline costs on an average 10 cts. per hour, and oil is estimated to cost 10 cts. per day. This gives a cost of operation per 10-hour day as follows:

1 drill runner at $2.	$2.00
1 helper at $1.75	1.75
Gasoline	1.00
Oil	0.10
Total	$4 85

The record for the 43 days' work was as follows:

1910.	Hours.	Feet.	Ft. per hour.
May 21	10	71½	7.15
May 23	8½	36	4.24
May 24	10	54	5.40
May 25	10	58	5.80
May 26	10	40	4.00
May 27	10	60	6.00
May 28	8½	51	6.00
May 31	7	43	6.14
June 1	10	51	5.10
June 2	8	43	5.37
June 4	6	25	4.16
June 6	10	50	5.00
June 7	10	43	4.30
June 8	10	51	5.10
June 10	7	25	3.57
June 13	10	66	6.60
June 14	10	40	4.00
June 15	7	24	3.43
June 16	10	46	4.60
June 17	10	56	5.60
June 18	10	40	4.00
June 20	10	40	4.00
June 21	10	46	4.60
June 22	10	48	4.80
June 23*	10	10	1.00
June 24	10	65	6.50
June 25	10	45	4.50
June 27	8	30	3.75
June 28	10	34	3.40
June 29	10	41	4.10
June 30	10	25	2.50
July 1	10	51	5.10
July 2	9	36	4.00
July 5	10	50	5.00
July 6	10	32	3.20
July 7	10	55	5.50
July 8	10	36	3.60
July 9	5	16	3.20
July 11	10	66	6.60
July 12	9	50	5.55
July 13	10	43½	4.35
July 14	10	56	5.60
July 15	10	37	3.70
43 days.	403	1,886	4.68

*Delayed 8 hours on account of gasoline engine.

The cost of 403 hours' work at the rules given would be about as follows:

1 drill man (403 × 20 cts.)	$ 80.60
1 helper (403 × 17½ cts.)	70.53
Gasoline (403 × 10 cts.)	40.30
Oil (43 × 10 cts.)	4.30
Total	$195.73

The cost per ft of hole drilled was then $195.73 ÷ 1886 ft.=10.37 cts.

A Device for Making Subsurface Tests of the Bearing Power of Soils with Some Examples of Operation.

The accompanying illustrations show an apparatus by means of which the bearing power of soil, at any ordinary foundation depth below the surface previous to excavation and preliminary to design of foundations, may be tested. Briefly described a 16-in. pipe, made in sections of convenient length which may be coupled together with outside screwed sleeves, is sunk to the required depth by means of water jet and pile hammer. Inside of this shell, which is dredged out clean, is inserted a 10-in. pipe having the lower end closed by a 14-in. ribbed cast iron disk as shown by one of the drawings of Fig. 1. The inner pipe and disk is rotated a few times to secure an even bearing at the bottom and at the top of the 16-in. shell is centered by fillers which leave it free to move up and down but not to tip. The 10-in. pipe extends several feet above the top of the shell, and around it is clamped a timber platform, also supported by guys from a flanged collar or spider at the pipe top. This platform carries the weights which make up the test load. Figures 1 and 2 illustrate the construction and loading. As the load is applied or at such times afterward as may be determined the settlement of the 10-in. pipe is measured by an engineer's level sighting on a mark placed on the pipe and referenced to a permanent bench mark conveniently located.

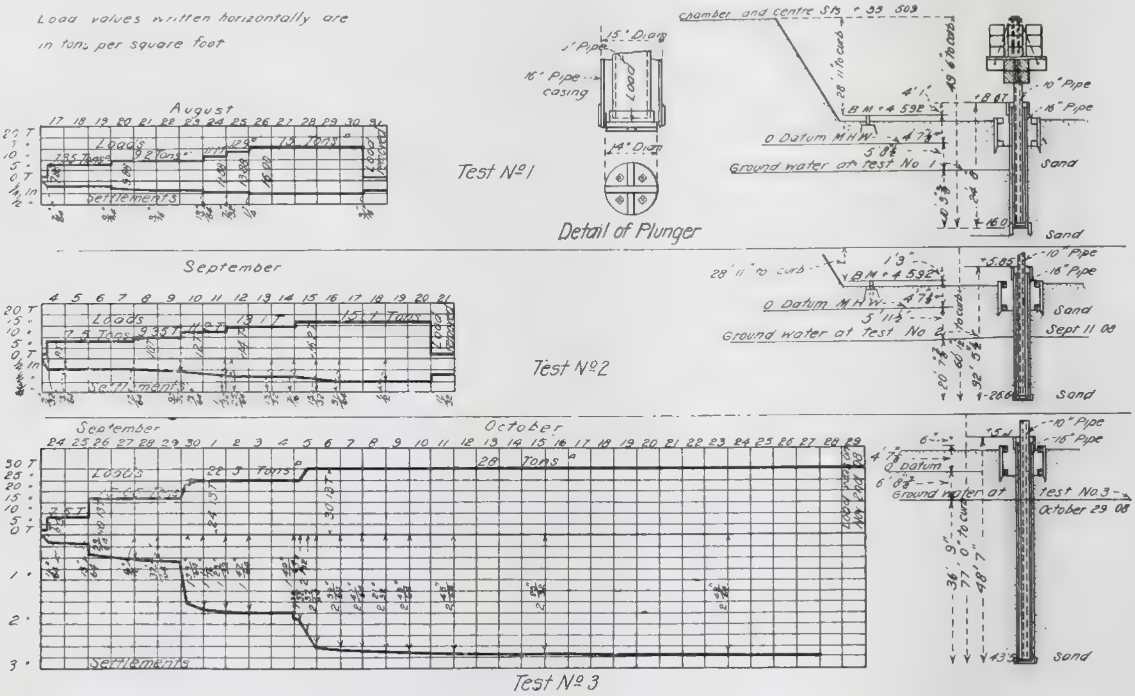

Fig. 1.—Diagrams Showing Methods and Results of Subsurface Soil Tests, New York Municipal Building.

Two recent examples of the use of this apparatus will explain best perhaps the methods and results. In preparing for the foundation work for the new 25-story municipal building in New York, three tests were made at different depths as indicated by Fig. 1. In the first test the shell was sunk to a depth of some 49½ ft. below the curb. Its lower end had one of the coupling sleeves screwed partly on to act as a shoe or cutting edge in sinking. Since the inside of this sleeve for the portion not embracing the shell was roughened by threads it was feared that an arching effect might be had on the sand inside the shell, thus giving it a fictitious bearing power. Accordingly the shell was pulled and the sleeve at the bottom was screwed up until the bottom edges of shell and sleeve were flush. The shell was then sunk again to a depth of 60 ft. below the curb and a second test made. After its completion the shell was driven to a depth of 77 ft. for the third test. The diagrams of Fig. 1 show the relation of settlement to load for each test. In round figures the settlements were as follows:

15 tons per sq. ft.	½ in.
22½ tons per sq. ft.	1 49-64 in.
28 tons per sq. ft.	2 49-64 in.

It was concluded that these results indicated a bearing power under gradually applied loads of 20 tons per square foot. Incidentally it will be observed the depth of ground water was determined by direct measurement in each test.

The second example was a test to determine the bearing power of a sand stratum on which it was proposed to rest caissons supporting a 9-story warehouse near the water front in New York. The shell was sunk through 5 ft. of fill, 4 ft. of timber crib and rip rap, 3 ft. of river mud and 14½ ft. of course sand to a depth of 35½ ft. below the curb. The sinking was done by a 1,062-lb. steam hammer and a 1-in. pipe, ¾-in. nozzle water jet working under 100-lbs. pressure. In going through the cribwork and rip rap difficulty was had and dynamite had to be used to remove the obstructions. In this case after dredging out the shell the plunger pipe and disk were sunk below the shell bottom some 9 ins. by water jet. The log of the tests was in brief as follows:

Date.	Load, tons.	Settlement, ins.
March 21	2	0
March 21	4	3/32
March 21	6	3/16
March 21	8	15/32
March 22	8	19/32
March 23	8	19/32
March 24	8	20/32
March 24	12	1 3/32
March 25	12	1⅛
March 26	12	1¼
March 29	12	1¼
March 30-31	12	1 9/32
March 31	16	1 20/32
April 1	16	1 23/32
April 2	16	1 26/32
April 4	16	1 28/32
April 4	20	2 10/32
April 5	20	2 18/32
April 6	20	2 20/32
April 7	20	2 22/32
April 7	24	3 1/32
April 8	24	3 8/32
April 9	24	3 9/32
April 10	24	3 10/32
April 12	24	3 10/32
April 12	28	3 11/32
April 13	28	3 15/32

We have given the results in some detail as they are not without interest in showing the behavior of sand under load.

The tests described were conducted by the O'Rourke Engineering Construction Co., of New York, the apparatus used being the invention of Mr. John F. O'Rourke., M. Am. Soc. C. E., to whom we are indebted for the above information.

Record of Gravel Ballasting, Using Hopper Bottom Coal Cars on a 75 Mile Haul.

BY D. A. WALLACE

This record of ballasting is worthy of preserving because it is a record of work performed efficiently under extremely difficult conditions. It was suddenly decided to ballast 32 miles of track with 32,000 cu. yds. of gravel taken from a pit 75 miles along the line of road from the unloading point. Because of the unavailability of ballast cars at this time, hopper bottom coal cars were used for the gravel service.

The gravel pit was situated along the bed of a creek which ordinarily ran under ground at the pit, but during a rain the steep tributary water sheds caused the creek to rise and flow along the surface of its course. A quality of clean gravel and sand was left in the pit when the creek subsided. A spur one mile long connected the pit with a main line side track 21 miles west of Nashville. The track ballasted extended from Mile Post No. 33, east of Nashville, to Mile Post No. 75, giving a total haul for the ballast of 54 to 96 miles. Owing to the low face of 6 ft. which the shovel worked, only about 750 cu. yds., or 25 cars, of gravel were loaded daily. The contractor loaded the gravel and placed the loaded cars on the main line side track for $0.145 per cu. yd.

Terminal conditions in Nashville required more switching facilities, but the requirements were not sufficient to warrant an additional crew for an entire 12 hours. It was, therefore, arranged that an additional night crew should handle the additional switching and move the 25 cars of ballast, which had been loaded on the previous day, from the pit siding to Nashville. A charge of $10, covering wages of the yard crew, coal, proportion of repairs, etc., while engaged in this service, was made against the Road Department by the Transportation Department, for this service.

The grade from the pit to Nashville permitted the handling of [illegible] the train. Between 6 and 7 a. m., two trains were started out of Nashville for the unloading points. The first train made a long haul of 60 or 75 miles to the unloading point, reducing to 9 or 10 cars for a 2.5 per cent grade 40 miles east of Nashville.

The second ballast train made the short haul of 40 or 50 miles to the unloading point, and in addition to its own train, unloaded the cars set out by the first train.

In the course of the day's work, five passenger and three regular freight trains were met by both ballast trains. The Track Supervisor and the Chief Dispatcher worked closely together in arranging unloading points, so that there was a minimum of delay to the ballast or revenue trains.

The majority of the coal cars in the ballast service had floors sloping from the ends down to the middle to two doors worked by a chain and ratchet movement by a wrench from the outside of the car. Owing to the wet condition of the gravel, and the flat slope of the car floors, it was necessary to shovel and sometimes pick out the most of the car load. Frequently, the engine was cut off and bumped against the train. This operation, which was not the best treatment for cars, still helped considerably in loosening up the gravel so that it would run out. One tie was placed across the rails in front of the rear trucks of the car being unloaded to sweep off the gravel. Since one tie so placed would not sweep the gravel off level with the rails, after the ballast was unloaded the entire train was backed over the ballast with 3 ties placed edge to edge up against the leading trucks. This last sweeping cleaned the track level with the rails.

From 10 to 30 minutes were consumed in unloading the coal cars where it took from 3 to 10 minutes for the Rodger ballast cars for the same gravel. The great variation in time was due mostly to the condition of the gravel, whether wet or dry. Only occasional difficulty was experienced in handling the coal car doors.

Passenger trains were not delayed and freight trains seldom more than 30 minutes by the ballast trains. Track Supervisor generally accompanied one of the trains and a Track Apprentice the other. Records of delays, running and unloading time were kept of both trains and worked up into unit costs at

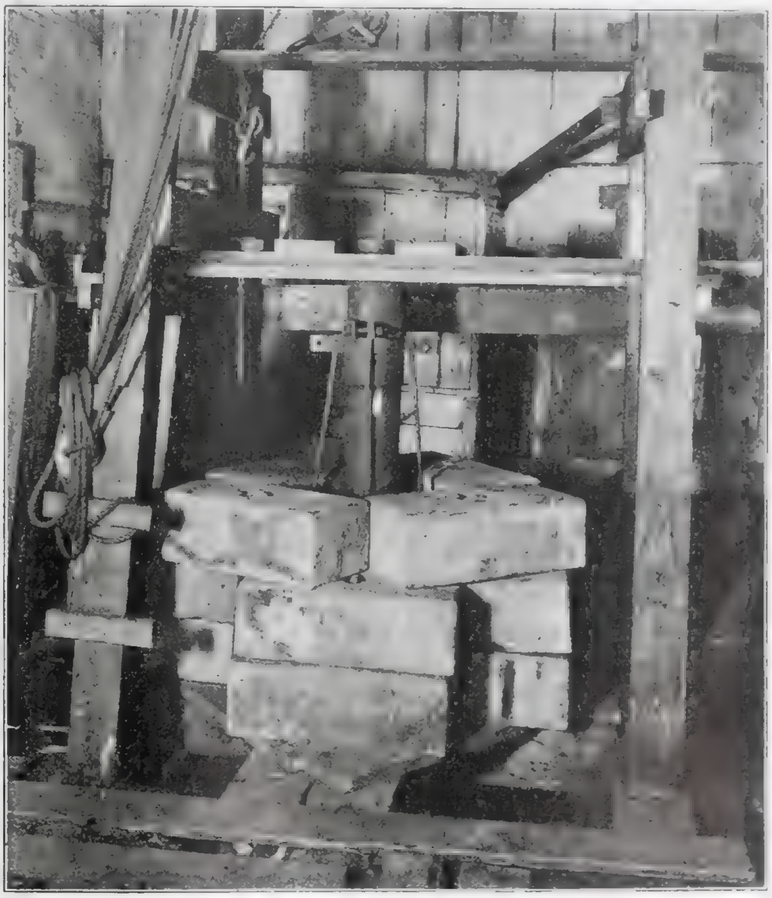

Fig. 2.—View Showing Top of Subsurface Soil Testing Device With Load in Place.

RECORD OF UNLOADING GRAVEL WITH UNIT COSTS

Date	[illegible]	Leave Nash.	Arr. U. P.	Lv. U. P.	Arr. Nash.	Delays	No. cars.	No. cu. yds.	No. men.	No. foremen	Time unloading	Time each class car	Cost of train	Cost of labor	Total cost	Cost cu. yds. [illegible] unloading	Cost cu. yds. of haul.	Cost cu. yds. of delays.	Net cost per cu. yd.	No. miles hauled	Section No.	Mile	Distance moved
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

night. The accompanying table shows the method of keeping track of the work performed, delays, and all information necessary to a complete understanding of the work. In addition to this information an itemized record was kept of the delays of each train crew.

Train and enginemen giving unsatisfactory service to the Road Department were at once returned to revenue service.

In the tabulation, the time given in columns headed "Arr. U. P." and "Lv. U. P." are the times that the train arrived to unload and the time the unloading was completed. "Delays" consisted of all time not consumed by the ballast train in running from Nashville to the point of unloading and return and the time consumed in unloading. For instance, if, while unloading, it became necessary to run in to meet a train, the total time that the ballast train was away from the unloading point was figured as delay. The distance in column headed "Mile" is the distance from Nashville to the unloading point. "No of miles hauled" shows the distance from Nashville to the unloading point plus 21 miles, the distance of the pit from Nashville.

Owing to the frequent rains, making it difficult to take accurate cross sections of the pit, the yardage of cars was measured at the unloading point. Diagrams were furnished the men showing the number of yards in each class of car when the load averaged certain distances from the top of the car. It was found that the average shrinkage for a 75-mile haul was about 2 cu. yds. per car.

Train expenses figured as follows:

1 conductor for 12 hours	$ 3.80
2 brakemen for 12 hours	4.60
1 engineman for 12 hours	4.50
1 fireman for 12 hours	2.40
Total wages for 12 hours	$15.30
10 tons coal for 12 hours	12.50
Water, oil, etc., for 12 hours	1.00
Total expense for 12 hours	$28.80

Section labor was paid $1.10 per day and foremen $50 per mo. Overtime for train crew began 12 hours and 20 minutes from time train was called for and was figured as follows:

Section labor was paid $1.10 per day and foremen $50 per month.

1 conductor, per hour	$0.316
2 brakemen, per hour	0.382
1 engineman, per hour	0.45
1 flueman, per hour	0.24
Coal, etc., per hour	0.11
Total expense of train for overtime	$1.50

The unit costs of the entire work were:

Loading, per cu. yd	$0.145
Hauling and unloading, per cu. yd	0.108
Surfacing	0.25
Total cost under track, per cu. yd	$0.503

ROADS AND STREETS SECTION

The Training and Duties of a Street Superintendent.*

The duties of a street superintendent vary with the laws and customs of different cities, and as it is not the purpose of this Conference to discuss street maintenance, pavement repairs and the like, this paper will consider only such duties of a street superintendent as apply to the cleaning of streets, the collection and disposal of wastes and related sanitary work.

To dogmatize on the training required for an efficient municipal cleaning official at this time would be presumptuous on the part of the writer in view of the unsatisfactory status of the subject, but a statement of the duties, responsibilities and requisites for success in this branch of municipal sanitation may indicate to some extent, at least, the kind of training needed.

The head of a street cleaning department deals with two different types of forces: first, human or animal energy, and second, mechanical appliances; thus a street superintendent should understand the art of directing the work of men and machines.

In the old days, leadership depended upon personal magnetism, or the right of might. Today industrial conditions and the advances in scientific training have changed this situation to a considerable extent. Laws based upon scientific observations have been deduced concerning the management of large manufacturing establishments and these discoveries are raising the art of managing men to a scientific basis. It may be contended, of course, that leaders are born, not made, and that the art of management is not essentially scientific, but it will be remembered that psychology is conceded to be a science and broadly speaking the management of men is really nothing more than applied psychology. Thus if this analysis is correct our street superintendents should be trained in applied psychology.

But municipal cleaning work involves more than the management of men and machines. It presumes a knowledge of the fundamental principles of sanitary engineering without which a street cleaning superintendent is apt to be at a loss in carrying on the duties of his office.

Municipal cleaning is primarily sanitary work; cost, though of the greatest importance, should be a secondary consideration.

Statistics show that about 36 per cent of all deaths are due to preventable causes. It is interesting to note the progress made in decreasing the death rate of the city of London from about 80 persons per thousand between 1700 and 1800 to about 20 persons per thousand between 1880 and 1890, and about 16 per thousand in 1900. A portion of this reduction was undoubtedly due to the improvement in hygienic conditions and without doubt a portion was due to better sanitation on the part of the municipality.

The object of street cleaning is to obviate the cause or prevent the spread of communicable diseases, among which consumption, diarrhea and typhoid fever are partially at least within the province of municipal cleaning.

Flies breed in filth as a rule and carry about on their legs all sorts of germs, some of which are harmless, while others undoubtedly cause illness, disease and death. There has been a great awakening to this fact all over the country within the last year and the war against the house fly while yet in its infancy is none the less making great progress. Municipal cleaning is peculiarly interested in this factor because flies breed in solid filth such as horse manure, garbage and other organic materials, hence one of the chief duties of the street cleaning division is to promptly remove and rapidly dispose of all solid organic city wastes, thus in time tending to do its part in eliminating the house fly as a carrier of infection.

Today a superintendent of streets must know the sanitary requirements of his office and the means whereby health may be promoted and the spread of infection controlled. Thus a course in sanitary science should form part of the training of a street cleaning superintendent.

Organization.—In the management of men responsibility for work assigned is essential. Every man in an organization should know his duties and either through hope of reward or fear of punishment, each individual should perform the work assigned in the best possible manner. Responsibility should be definite and readily fixed, so that the stockholders of our city corporations may easily place the blame for inefficiency or the praise for good work where it properly belongs.

The highest efficiency in organization is most likely to be attained if the superintendent or head of the division arranges his subordinates in two divisions: (1) A Planning or Efficiency Section, (2) a Performing or Work Division. In small municipalities the superintendent may combine both functions, but it is much better, particularly in large street cleaning departments, to have one or more competent engineers or properly trained men with no routine duties, to advise the superintendent or commissioner and to provide for him efficiency standards and economical methods of performing work. The Efficiency Division acts as the pacemaker for the organization, setting up practical ideals for the department and the individual employes of the force. Lack of definite working ideals causes most of the inefficiency in municipal departments. A superintendent of streets must have ideals and standards for the attainment of the greatest measure of success in his work and he should either be an engineer or have engineering advisers attached to his Planning Division.

Efficiency in organization depends to a considerable degree upon two factors insofar as employes are concerned: (1) Hope of reward or (2) fear of punishment. Discipline may be secured by punishing infractions of the rules of the service and efficiency or good work should be rewarded by proportionate increases in wages. The Planning Division of an organization should determine the limiting wage rates for various kinds of duties and the amounts to be paid for various percentages of efficiency in these classes of work. This means that a record must be kept of the products of each individual, gang or unit of the street cleaning force, or better still, standards should be predetermined and wages should be paid in accordance with attainments as shown by efficiency records.

It is necessary for efficiency, that cost records be maintained so that actual work performed may be compared with the standards set by the Planning or Efficiency Branch of the organization. It should be the duty of the head of a department to systematize his work, keep cost records and show how results are checked by diagrams readily comprehended by his employers—the public.

For the benefit of the department as well as the taxpayers who take an interest in city affairs (this interest is usually very keen around election time), it is desirable that cost records be made in graphic form, so that the progress of efficiency may be shown year by year.

There are some classes of work in street cleaning the cost of which fluctuates in such a way as to be beyond control of the most efficient department. Snow removal work is not only particularly trying to the street cleaning organization but likewise varies in cost, due to weather conditions or attendant circumstances. Nevertheless, even here it is desirable to show results by comparative records.

The three main divisions of street cleaning are those concerned with the cleaning of streets proper, the collection and removal of household and street refuse, including ashes, garbage, rubbish and street sweepings and their sanitary disposal.

Cost keeping and resulting graphic records involve measurements of the performances of both men and machines. This is work which an engineer is best qualified to handle properly. Efficiency as indicated by cost records must not be considered as simply showing the relation between the past and present figures. In its broad and true sense, efficiency should be simply denoted as an ideal condition reduced to a practical form so that it may be measurable ultimately in dollars and cents. The percentage of efficiency attained in any work measures the results secured when compared with the ideal standard, and in sanitary work particularly comparison in costs can only be made on a proper basis when the results attained are equally sanitary in effect. Thus the training of a street superintendent should include the study of work cost records, their analysis and use in securing greater efficiency.

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*Abstract of a paper by J. T. Fetherston, Superintendent of Street Cleaning, Richmond Borough, New York City, read before the New England Conference on Street Cleaning held in Providence, R. I., June 29, 1910.

Street Cleaning.—The cleaning of a street would seem to be an easy problem, but in practice it is difficult to maintain clean streets because many of our citizens have no regard for the public hallways of the city household. Colonel Waring, the father of efficient street cleaning, once said that his aim was not to clean dirty streets but to maintain clean streets. Preventable litter is usually in evidence in most cities and an unjust burden is thus placed upon the taxpayers mainly through the carelessness or ignorance of the people who consider the street to be a proper dumping ground for all sorts of waste. This condition is not peculiar to any city but is a more or less general affliction throughout the world.

Clean streets mean clean people. The city is nothing more than a great household and if the unwritten rules of conduct which apply in well-regulated homes were actively practiced on the public thoroughfares, great benefits would be conferred upon the community resulting in the promotion of health, comfort and happiness.

One of the most constant sources of public expense is the removal of preventable litter in the form of newspapers, paper bags, fruit skins and the like from public thoroughfares. Yet four out of six people will pass the street cans placed in most cities for the reception of waste and without the least compunction throw newspapers on the roadway, banana peels on the sidewalk and miscellaneous litter on the pavement. This not only violates all rules of order but apparently is even countenanced by the mass of our people.

Private refuse cans on the street and sidewalk are generally nuisances. An overflowing garbage can opposite the entrance to a store is a common sight in most cities, and it does not require any large stretch of the imagination to picture the flight of a fly from the garbage can to the food exposed on the counter. Most city ordiances require that refuse receptacles shall not be overfilled, but this provision of the law is usually ignored and it is a common sight, particularly in the crowded districts of our large cities, to see the curb adorned with art objects in the form of battered tins, dilapidated barrels, boxes, coal scuttles and other refuse receptacles. The prevalence of this condition shows the need of training our citizens in the duties and obligations which they owe to the municipality in which they live.

Besides the old standard method of cleaning by hand broom and machine broom, there has been of late a demand for more efficient street cleaning work, particularly with the object of eliminating the fine street dust which cannot be removed by the broom alone. Thus hose flushing in summer is desirable particularly in crowded districts, where dust and germs may cause respiratory diseases.

The methods of flushing streets vary in different places. Some cities pin their faith to hand flushing, others use machines, throwing water from tanks under pressure, while the latest method of street washing consists in the use of a horse-drawn squeegee, whereby water spread upon the pavement is followed by a rotating rubber broom, the object being to lubricate by water, scrape away the street dirt and push it toward the gutter where it can be gathered into heaps and removed.

Efficiency in street cleaning requires that the different kinds of pavement refuse be promptly removed and rapidly disposed of in order that infection emanating from the street materials may be avoided. This involves training and experience in the handling of men, machines and methods.

Refuse Collection.—When one considers the amount of waste material taken away from our municipalities, it is surprising to find that each individual is directly or indirectly responsible for the accumulation of about 1,470 lbs. of waste material per annum. Careful statistics in New York City show that in each year the average inhabitant is responsible for the production of about 181 lbs. of garbage, 936 lbs. of ashes, 95 lbs. of rubbish and 260 lbs. of street sweepings, making a total of 1,470 lbs. of refuse or about ten times the weight of the average man. Where millions of people congregate the amount of waste to be handled is simply enormous and efficiency in refuse disposal is much more of a technical engineering problem than most other subjects connected with municipal cleaning. There is no cure-all in this matter of waste disposal any more than there are patent medicines adapted to meet all kinds of ills, and a local study of the question is the only safe and sane way to meet the situation and solve the problem. Thus the training of a superintendent should include a study of the character, amount, variations, chemical constituents and the different means for the sanitary and economical collection and disposal of refuse.

Horse-drawn vehicles are practically the only kind used in this country for the collection of city wastes, though abroad motor vehicles have been tried for this purpose, and their use will probably increase. The steel-bodied garbage and ash cart of the kind used in New York is water tight, self-dumping, holds about 1½ cu. yds. level full, and is well adapted for the removal of garbage where hauls are reasonably short. When ashes and other dusty wastes are carried, however, the steel cart is not particularly satisfactory in controlling the dust arising when loading and improvements by the Planning Division of a municipal department are much to be desired in this regard. Wooden vehicles are not satisfactory as a rule for transporting organic materials, and most advanced cleaning divisions use steel carts or wagons for this purpose.

In warm weather, it is desirable that garbage be removed each day if possible, in order that fermentation and decomposition may not progress too far before final treatment is undertaken.

Where long hauls from the collection section to the place of disposal are the rule, a wagon of large capacity will be found economical and advantageous, particularly if the materials are mixed together. A bottom dump wagon of large capacity provided with canvas curtains for the purpose of controlling the flow of dust when emptying cans into the wagon is suitable and economical.

In Great Britain as a rule, contrary to general American practice, waste materials are not separated by the householder and all classes of refuse are thrown together into one can or dust bin for removal to destructors where the materials are burned.

The more efficient collection of refuse requires attention in most cities as present methods are usually crude and unsatisfactory. This is a practical matter needing attention in the training of a street superintendent.

Supplementary Reports on the 1907 and 1908 Dust Prevention and Road Preservation Experimental Work of the U. S. Office of Public Roads.

In 1998 the U. S. Office of Public Roads in co-operation with various municipalities conducted a number of experiments in dust prevention and road preservation. The work included experiments with asphaltic preparations, tar preparations and residual oil at Newton, Mass., the construction of four sand clay roads in Kansas, and the construction of an earth-asphalt road at Independence, Kan. This experimental work was described in the May 26, 1909, issue of ENGINEERING-CONTRACTING. Supplementary reports on these experimental roads and on experimental roads constructed in previous years are given in a circular issued recently by the U. S. Office of Public Roads, and from this circular we have taken the matter that follows.

Asphaltic Preparations, Tar Preparations, [illegible]

[illegible] made with an asphaltic preparation, one with a residual oil, two with a refined water-gas tar, and one with a molasses-oil-lime mixture. This work consisted in resurfacing an old macadam road according to the mixing method, using the various materials as binders. The sections were last inspected July 22, 1909, about eleven months after being laid.

At the time of inspection there was considerable difference in the appearance of the sections treated under experiments Nos. 1, 2, 3, 4, 5, 6 and 7, with asphaltic preparation. Section No. 1, in which a mineral aggregate containing practically no fine material smaller than ¼ in. in diameter had been used, had raveled in places and had been patched with a refined coal tar under the direction of the Street Commissioner of Newton. Section No. 2, in which a mineral aggregate containing more fine material had been used, was in better condition, but had been patched in a number of weak places with the coal-tar preparation above mentioned. Section No. 3, in which the mineral aggregate held a still greater amount of material smaller than ¼ in. in diameter, was in much better condition and only one patch had been required. Section No. 4, which had been constructed in a manner similar to No. 3, except that instead of stone screenings a light coat of tarred sand had been employed as a surface dressing, had not required patching, but the surface was in rather poor condition. In all of the first four experiments only 0.54 gal. of asphaltic preparation per square yard had been used. In Experiments Nos. 5 and 6 a flush coat of bitumen had been applied in addition to this. The asphaltic preparation was used for this purpose in No. 5 and a refined coal tar in No. 6. These two sections, together with No. 7, in which 0.71 gal. per square yard of the asphaltic preparation had been used, were in first-class condition when inspected.

Section No. 8, bound with a residual oil, was just beginning to pick up under traffic and the oil showed a lack of adhesiveness.

Sections Nos. 9 and 10, in which a refined water-gas tar was employed as a binder, were both in excellent condition; No. 10 indeed appeared better than any of the other sections. In No. 9, 0.81 gal. per square yard of the water-gas tar was consumed and the surface was coated with stone screenings, while in No. 10 an application of sand mixed with a refined coal tar was used as a surface dressing.

The molasses-oil-lime work at the time of the inspection, July 22, 1909, was in very good condition, except at a rather sharp curve where the surface had just started to pick up under traffic.

Earth-Asphalt Road at Independence, Kan.—The road was constructed in 1908. On Feb. 19, 1910, the road was inspected, and, while the conditions for making an intelligent inspection were unfavorable, since the road was frozen and partially covered with snow, the following results were reported:

The appearance of the road in general was similar to that of other dirt roads in the near vicinity, except that it did not show the deep ruts noticeable on the latter, although the traffic over both is similar. This shows that during the winter the mud had not been as deep as on the ordinary dirt roads. The only attention that it has received since being built is that it was dragged once in February, 1909.

For the length of two blocks the road has a grade of nearly 5 per cent and had previously washed badly, but now shows but little, if any, effects of last year's rains. F[illegible] dents along the road state that during r[illegible] weather the road is quite muddy [illegible] that there is no deep mud and tha[illegible] [illegible] a little soft under heavy l[illegible]

[illegible] asphalt mixed with the earth renders it [illegible] well as a binder to prevent the w[illegible] spread upon and mixed with earth satisfactorily unless the earth is previously heated; that such a road is practically dustless save for dirt that may be carried upon it; and that, to prevent its being muddy just after a rain, 2 to 3 ins. of from ¾-in. to 2-in. stone should be worked into the top.

Sand-Clay Roads in Kansas.—These roads were constructed in 1908 with a view to determine the suitability of sand-clay construction to meet varying conditons encountered in the Middle West.

In the experiment at Garden City a local gypsum-clay was mixed with the natural sandy soil. The road was inspected one year after completion and was found to be as hard and firm as macadam. The people living in the vicinity of this work were so well pleased with the results that during the past year 7 miles more of sand-clay road were constructed at their instigation.

In the work at Dodge City a clay silt obtained from an old irrigation ditch was mixed with a sandy soil similar to that encountered at Garden City. When inspected one year after completion the road was in excellent condition. Although previously but little used, it has been converted into one of the most heavily traveled roads leading into Dodge City. Land values along this road have increased, and farmers who were formerly considering the advisability of selling their farms and going where the roads were better are now well satisfied to remain.

In the experiment at Bucklin the general plan of construction was identical with that used at Dodge City, except that a buckshot-clay was mixed with the sandy soil. When inspected a year later the road, while not smooth, had not rutted. The inspection was made after a heavy rain, during which the road had softened to such an extent that the surface picked up under traffic. This indicated merely an insufficiency of sand on the surface and the trouble was easily remedied.

In the experiment at Ford a short section of sandy road, forming the south approach to a bridge crossing the Arkansas River, was graded and a sedimentary clay added. The work was done under very unfavorable conditions, which made it impossible to mix the sand and clay in an altogether satisfactory manner. When inspected one year after completion the surface was covered with about 1 in. of mud, showing that more sand was needed; otherwise the road was in good condition.

Experiments at Wayland, Mass.—These experiments* were made in 1907 with crude tar, tar preparations and oil emulsions. By 1909 the entire road need to be treated again, and during that year a surface application of tar was made with an English spraying machine, under the supervision of the Massachusetts State Highway Commission. This road is subjected to such heavy mixed traffic that annual surface treatments will probably be required in order to keep it in good condition.

Kentucky Rock Asphalt at Wayland.—The experiment was made in 1907 and an inspection was made in January, 1909. This road was again inspected during the latter part of May, 1909, and the following report made. A heavy rain had been falling for some hours before the inspection was made, and there was more or less soft, sticky mud on the roads adjoining the experimental road. The surface of the rock asphalt was clean, smooth, and compact, with no ruts, and had much the same appearance as a first-class asphalt city street. The thin surface course of rock asphalt has worn down in a few spots to the crushed stone, but the individual crushed stones were tightly bound together and not a single loose stone was found.

Experiments at Jackson, Tenn.—This was one of the earliest pieces of experimental work on dust prevention and road preservation undertaken by the U. S. Office of Public Roads. The experiments* were made in 1905, tars and oils being used. When last inspected, on Dec. 2, 1909, the following results were reported:

An inspection made Dec. 2, 1909, of the streets of Jackson, Tenn., which were treated with coke-oven tar, shows that where a second application of tar was applied one year after the first the surface was smooth and even, and that there was only an occasional break at intervals, of about 20 ft., with the exception of a strip averaging about 20 ft. wide down the center of the street where traffic is heaviest and droppings from unimproved streets accumulate. Very little trace of tar could be found in this center strip.

On the streets which were treated with only one coat of tar the deterioration is much more apparent. In the center of the streets no trace of tar can be found, and on the sides, for a distance of about 25 ft. from the gutters, patches of tar coating, varying in size from 6 ins. to 6 ft. in diameter could be seen at intervals of a few feet. The short section which was spiked up and where the tar was incorporated in the macadam showed that the crown has almost entirely disappeared, owing to a softening of the binder during the summer months. Detritus accumulates on this section to such an extent that, from a casual inspection, no tar could be noticed. When a part of the section was cut out, however, the tar could be plainly seen in the voids between the particles of stone.

It might be added that the streets have been badly neglected since treatment. A third application of tar, applied last summer, would have made these roads almost as good as they were after the first application, and even yet it is not too late to save the city hundreds of dollars.

As to the oil experiment, no trace of oil was found on the city streets which had been treated. On the section of country road treated with residual oil a strip about 3 ft. wide on either side of wheel tracks showed distinct traces of oil, which was still beneficial in preventing side washes.

Experimental Work in 1909 of the U. S. Office of Public Roads in Dust Prevention at Road Preservation.

During the summer of 1909 the U. S. office of Public Roads conducted a number of experiments in dust prevention and road preservation. These experiments are described in a circular issued recently by the U. S. Office of Public Roads and the matter that follows has been taken from that circular.

EXPERIMENTS WITH WASTE SULPHITE LIQUORS.

These experiments were conducted at Washington, D. C., six experiments being made.

Experiment No. 1.—Special Preparation.—In this experiment a concentrated waste sulphite liquor preparation was employed in the surface treatment of a macadam driveway for the purpose of determining its road-binding and dust-laying properties. The road selected for treatment is located in the Agricultural Department grounds, Washington, D. C., and connects 13th and 14th Sts. It is built of trap rock with a soft limestone binder and, although subjected to only a moderate amount of light traffic, becomes quite dusty in dry weather.

The preparation was furnished free of charge by the manufacturers in 60-gal. barrels. It proved to be a dense sticky liquid, miscible with water, and having a specific gravity of from 1.267 to 1.270 at 25° C. Its binding value is dependent upon the presence of so-called calcium-magnesium-ligno-sulphonate, which is produced in the manufacture of wood-pulp according to the sulphite process.

Application was made by means of an ordinary 300-gal. sprinkling cart, and a mixture of equal parts of the preparation and water employed. The roadway was sprinkled three times with this mixture at the rate of 0.54 gal. per sq. yd. The preparation itself was, therefore, applied at the rate of 0.27 gal. per sq. yd. The section treated was 615 ft. in length and 16 ft. in width giving a total of 1,093 sq. yds. The mixture was fairly well absorbed by the road, but a small amount was lost by drainage to the gutters. This application was made on March 17. Until the middle of May the results obtained from this treatment were quite satisfactory; the dust was successfully laid and the road surface well bound. Rains seemed to wash out the material much less than might have been expected. About May 15 the road showed signs of becoming dusty and was watered for a number of times. On June 1 another treatment with the sulphite liquor preparation in a 20 per cent dilution was given for a width of 12 ft. in the center of the road. This application was made at the rate of 0.366 gal. of solution or 0.073 gal. of the preparation per sq. yd., and 820 sq. yds. were thus covered. The cost of this experiment, is given in Table I, and the loan cost of experiments 2, 3, 4 and 5 is given in Table II. While no charge was made for this material, it is figured at a minimum cost of 12 cts. per gal., delivered at the road.

Experiment No. 2.—Crude Waste Sulphite Liquor.—The road treated in this experiment and in the three following is a branch of that described under experiment No. 1, and runs nearly parallel to 14th St. It does not, however, receive quite as much travel as the former. A crude waste sulphite liquor obtained from a pulp and paper company was applied at the rate of 0.5 gal. per sq. yd. As only one barrel of this material was available for use, it was sprinkled upon the road by means of common garden watering pots and "broomed" into the road surface. Application was made for a width of 12 ft., and 90 sq. yds. of surface adjoining the first section were treated. The material was readily absorbed by the road, but did not appear to be as satisfactory a binder as the first preparation.

Experiment No. 3.—Crude Waste Sulphite Liquor.—This experiment was made in the same manner as experiment No. 2, with a sulphite liquor of 1.049 specific gravity (25° C.), obtained from another pulp and paper company. The rate of application was 0.5 gal. per sq. yd., and 90 sq. yds. of roadway, adjoining Section 2, were treated. This material was even more readily absorbed than that described in Experiment No. 2, and seemed to produce a less satisfactory surface condition.

Experiment No. 4.—Concentrated Waste Sulphite Liquor.—In this experiment a concentrated liquor of 1.220 specific gravity (25° C.), obtained from a third pulp and paper company, was applied in the same manner as described in Experiment No. 2. The liquor was, however, diluted with an equal volume of water, and the mixture thus produced was applied at the rate of 0.44 gal. per sq. yd. Twenty-two hundredths of a gal. of the original liquor were therefore consumed per sq, yd. A section of 114 sq. yds., adjoining Section 3, was treated with this material, and the appearance of the road after treatment was quite similar to that produced by the use of the first preparation.

Experiment No. 5.—Concentrated Waste Sulphite Liquor.—This experiment was identical with experiment No. 4, except that the material was used in full strength. A section of 45 sq. yds. was thus treated, and ½ gal. of the liquor was applied per sq. yd. It was not readily absorbed by the road, but after being "broomed" in produced a well-bonded surface.

Cost Data.—While the cost data can not be accurately figured, owing to the fact that no charge was made for material and that a number of engineer students took part in the work, Tables I and II are an approximation of the cost of eight-hour labor for the various experiments.

TABLE 1—COST OF LABOR IN EXPERIMENT NO. 1 AT WASHINGTON, D. C.

Two laborers for bailing liquor, ⅜ day, at $2	$1.50
One sprinkling cart, ⅜ day, at $5	1.88
Total	$3.38
Cost of labor per square yard (1,093 sq. yds. total), first application	.0031
Approximate cost of material per square yard, first application	.0324
Total	$ .0355

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*Engineering-Contracting, May 26, 1909.

*Engineering-Contracting, May 20, 1907, and May 26, 1909.

Two laborers for bailing liquor, 1/16 day, at $2	.25
One sprinkling cart, 3/16 day, at $5	.94
Total	$1.19
Cost of labor per square yard, second application	.0011
Approximate cost of material per square yard, second application	.0088
Total	$ .0099
Total cost per square yard	.0454

TABLE II—COST OF LABOR IN EXPERIMENTS NOS. 2, 3, 4 AND 5 AT WASHINGTON, D. C.

Four laborers, 2/8 day, at $2	$2.00
One foreman, 2/8 day, at $3	.75
Total	$2.75
Cost per square yard (339 sq. yds. total)	.0081

Summary of Experiments Conducted at Washington, D. C.—The use of crude waste sulphite liquors as described under experiments Nos. 2 and 3 proved but little more effective than water so far as laying the dust was concerned. For the first six weeks experiments Nos. 4 and 5 were satisfactory as Experiment No. 1, but owing to lack of material it was impossible to make a second application. With the exception of No. 1 all of these experiments were made upon such short stretches of road that no very definite conclusions could be drawn, but all indications point to the fact that the application of a solution of about 1.13 specific gravity at the rate of approximately 0.5 gal. per sq. yd. is fully as effective as the more concentrated material. The second application described under Experiment No. 1 laid the dust satisfactorily for a period of six weeks, after which the road slowly reverted to its original condition, although the excellent binding value of the material was apparent for some time later. From these experiments it would seem that crude waste sulphite liquor in single applications has but little value for road treatment, but that the concentrated material may be classed as a temporary or semipermanent dust preventive and road binder. It is possible, however, that, if crude liquor were applied daily as in ordinary water sprinkling, its use would prove economical in localities where it is produced, and that the base would concentrate in the road and eventually become a valuable binder.

EXPERIMENTS WITH SLAG AND LIME, SLAG AND WASTE SULPHITE LIQUOR PREPARATION, AND SLAG AND TAR

During the summer of 1909 the Office of Public Roads, in cooperation with the Carnegie Steel Co., conducted a series of experiments at Youngstown, O., to determine the best method of utilizing slag for road construction.

In the reduction of iron ores, the iron as it melts settles to the bottom of the furnace, while the impurities unite with the fluxing material to form what is known as blast-furnace slag. While the iron varies little in composition, the slag is by no means as uniform, owing to variations in the ore and flux. This slag is usually drawn off in a molten condition into large ladles holding about 140 tons each. Sometimes it is run into a large vat of water to form what is known as granulated slag, a fine, crisp, glassy product, which is often used as a substitute for sand in concrete mixtures. Sometimes the slag is partially cooled in the ladle. When this is turned out and exposed to the air, or when a stream of water is thrown upon the cake, it rapidly breaks down into a fine dust of crystalline structure. As a rule the cars are hauled along a track to the edge of a bluff, where the ladles are dumped, allowing the slag to run out in thin layers to cool. The surface of the slag bank soon solidifies, but, where the product is poured from several large furnaces, the banks formed remain warm for a long time. It is generally believed that a slag bank should be allowed to season for at least two years before the slag is used.

It is evident that slag, even in the same bank, may vary greatly in composition, in hardness, and in structure. Where slag is deposited in large banks, it is most easily excavated by means of a steam shovel which starts at the bottom and plows up through the material, breaking up and, at the same time, mixing the different layers. One-third of the slag obtained in this manner at Youngstown was found to pass a ¾-in. screen. Of the coarser material about one-third was less than 1½ ins. in greatest diameter, while only a very small per cent was over 3½ ins.

Most of the iron produced in the blast furnaces is converted into steel by various processes. In one process the crude metal is further purified in what is known as open-hearth furnaces. Here again a flux is used which rises to the surface of the molten mass as slag. This slag is run into small cars and formed into cakes about 6 ft. square by 18 in. deep. When cold, these cakes are taken to a "skull-cracker" and broken up in order to separate the large amount of scrap iron which is always present. The utilization of this slag has been very limited, although it possesses many desirable properties, such as extreme hardness, toughness, and, frequently, excellent cementing properties. In the separation process a small amount breaks up into pieces less than ¼ in. in size, usually with a large per cent of "man size" remaining.

A number of other slags are also formed in different processes of manufacturing steel, but usually in smaller quantities.

In the experiments at Youngstown the blast-furnace slag was taken from a bank that had aged for about two years and the material of which came from six furnaces of the same type. A steam shovel was used to load the slag from the bank into large gondola cars and these cars were drawn to a gravity screen, where the slag was dumped into a chute and passed over the screen to separate it into proper sizes. At first a 3½-in. screen was used. The finer screenings fell into one car, while the coarser fell into another. The latter material, as a rule, was very soft and crumbly, and was discarded, while the former was reserved until an amount sufficient for the work was obtained. As the slag could be passed over only one screen at a time, this proved to be a costly operation. The screened slag eventually obtained was quite uniform in character. After it had been properly sized, it was taken by rail to a siding about 1½ miles from the road upon which it was to be used. Here it was loaded into wagons and hauled to the road.

The road improved was located just outside the city limits on Belle Vista Ave., running south from Mahoning Ave., for a distance of 2,754 ft. The soil was a gravelly clay, sticky when wet and dusty when dry. The road was level for only 100 ft., while the contour elsewhere was rolling. The maximum grade was 4.5 per cent. This road is used by the farmers in hauling their produce to town and sustains also a heavy automobile and a light carriage traffic. As the county of Mahoning did all the grading before the Office of Public Roads commenced work, no cost data were kept for this item. Grading was done by contract at a cost of 22 cts. per cu. yd. for excavation. The total cost of excavation for the entire road, including the cost of retaining walls, amounted to over $2,000.

Experiment No. 1, Section No. 1.—Blast-Furnace Slag Macadam.—Section No. 1 was constructed as in regular macadam work. The first course consisted of blast-furnace slag ranging from 3½ in. to 1½ in. in diameter, laid loose to a depth of 9 in. and rolled until firm. This material was laid for a distance of about 100 ft. on a part of the second section by mistake, and after it had been rolled a considerable amount of material was hauled over it. Though each teamster drove in the same track, only very small ruts were formed—an indication that the coarse slag was firmly keyed together The second course was laid 4 in. deep at the center and 2½ in. at the side, with the same kind of material, varying from ¾ in. to 1½ ins. in size. This was rolled until smooth, but it did not become absolutely firm until the top course of screenings ranging from ⅜ in. to dust had been applied. After spreading the screenings and rolling slightly in order to fill the voids as completely as possible with the fine material, water was applied in the usual way, by means of a sprinkler, and the rolling was continued. In a very short time the water began to run off the surface, which then became quite solid. As the road dried out, however, the surface became crumbly and required additional rolling and sprinkling. When the work was completed, about the middle of August, this section was in good condition except for one or two small places. From the behavior of this material indications point to the advisability of sprinkling the surface every day for about ten days in order to develop the full binding value of the slag screenings.

The cost data for all of the Youngstown experiments are given in Table IV.

Experiment No. 2, Section No. 5.—Blast-Furnace Slag.—This experiment was made at the suggestion of the Carnegie Steel Co., who wished to ascertain if the cost of construction could be lowered without producing bad results. The first course of Section No. 5 was composed of ¾-in. to 3¼-in. slag, laid 12 in. deep at the center and 9 in. at the side. Owing to the great range in sizes and the method of screening, there was considerable lack of uniformity between different loads of the material. Since this course was thick, it required more rolling than the other first courses. The road consisting of this single course was finished in the same manner as described under Experiment No. 1, after slag screenings running from ⅜ in. to dust had been applied. The surface was well bonded when inspected at the beginning of last fall.

Experiment No. 3, Section No. 6.—Blast-Furnace Slag.—The first course of Section No. 6 was laid 9 ins. deep with slag varying in size from 3¾ ins. to dust. This material like that employed for Experiment No. 2, was lacking in uniformity. The second course, 6 ins. deep at the center and 4 ins. at the side, was composed of 3½-in. to ¾-in. material. Each course was well rolled, and the section was finished in the same manner as in Experiment No. 2 and with similar results.

Experiment No. 4, Section No. 7.—Blast-Furnace and Open-Hearth Slag.—Section No. 7 was constructed in the same manner as Section No. 6, except that fine open-hearth slag screenings ranging in size from ¼-in. to dust were used in place of the blast-furnace slag screenings. When puddled this material set very quickly and produced a firm surface. The open-hearth slag was prepared by crushing the slag left at the "skull-cracker" after the "man-size" blocks had been removed. Care was taken to prevent iron from entering the jaws of the crusher. After leaving the crusher, it was placed in a dry roll mill, where it was ground to fine screenings, a large percentage of which became dust. This material was taken to the road and spread about 1½ ins. deep. The addition of free lime, as described under Experiment No. 5, was not considered necessary, as these slags when finely powdered frequently have high binding properties, owing to the presence of free lime and silicate minerals which when moistened produce a true hydraulic set.

Experiment No. 5, Section No. 2.—Blast-Furnace Slag and Lime.—Section No. 2 was constructed in the same way as Section No. 1, except that 5 per cent of powdered quicklime was mixed with the slag screenings, from ⅜ in. in size to dust. This addition was made to hasten and increase the bond of the road surface by the chemical action of the caustic lime, when freshly slaked, on the mineral constituents of the slag dust. In mixing the two, the fine slag was measured out on a mixing board and the 5 per cent of lime spread on the top. This was turned twice and then loaded on wheelbarrows or shoveled directly upon the road. The slag had been dumped, in separate loads, on one side of the road, and, as the screenings were spread, the mixing board was moved ahead about 30 ft. at a time. Upon being sprinkled and rolled, the surface bonded very quickly and became solid. It did not become crumbly or "calk up" under traffic as did Section No. 1. It was observed that better results were obtained from the use of very fine screenings than from coarser material.

Experiment No. 6, Section No. 3.—Blast-

Furnace Slag and Waste Sulphite Liquor Preparation.—Section No. 3 was constructed in the same manner as Section No. 1, except that a concentrated waste sulphite liquor preparation of 1.273 specific gravity, similar to that used in the experiments at Washington, D. C., was mixed with water and used to puddle the surface. The sprinkler, after having been filled with water, was conducted over Sections Nos. 1 and 2 and enough water sprinkled on these sections to leave space in the tank for the desired amount of the sulphite liquor. After this material had been poured into the sprinkler, a hoe was used to mix the two together thoroughly. The mixture was then applied to the road and, as the solution tended to run toward the gutters, care was taken that the center should receive the heaviest treatment. At first one part of the liquor to seven parts of water was used, and this produced a very thin solution, which pentrated several inches into the wearing surface. As the voids were gradually filled, it became necessary to add more of the liquor to each tank of water to decrease the rate of flow in order that the liquid might not run off the road. The last mixture used was composed of one part of water to one part of the liquor and only one-half of a tankful was applied at a time. This treatment was repeated from day to day as the surface absorbed the material. It was found necessary to roll the road shortly after sprinkling, because otherwise the surface soon became so sticky that it would pick up under the wheels of the roller. After about 1 gal. of the sulphite liquor had been applied to the sq. yd., a very smooth surface was produced which did not "calk up" under traffic. A few days later the surface was found to be badly cracked and blistered for a depth of ⅛ in., but the material below was solid. The section was sprinkled with water and well rolled again, leaving the road in good shape, but not as smooth as it was before.

Experiment No. 7, Section No. 4.—Blast-Furnace Slag and Refined Coke-Oven Tar.—In Section No. 4 the first course was laid in exactly the same manner as described for Section No. 1. The second course was laid 4 ins. deep and consisted of a mixture of three parts of slag from 1½ in. to ¾ in. in diameter to one part of slag varying from ⅜ in. to dust, with about 6 per cent of tar. The slag was heated in a large pan until dry and warm to the hand. One-half of the pan was used for heating each size of material. The coarse slag was first shoveled into a gauge placed upon the mixing board and the finer slag was placed on top. After the two had been turned twice, the tar, which had been heated in a 2-barrel pot, was poured over the slag and the whole was well mixed. The mixture was then shoveled into wheelbarrows and carried to the point at which it was spread upon the road. The mixture was rather dry and, after rolling, it was found necessary to flush the surface with tar. Two large sprinkling cans were used for this purpose, after the holes in the nozzles had been enlarged. About ¼ gal. of tar was applied to the sq, yd., making a total of about 1½ gal. A thin coat of slag (⅜ in. to dust) was now spread over the surface and rolled in to fill all voids and to take up any surplus tar.

This tar was obtained from a by-product coke-oven plant at Sharon, Pa., where it was also refined by distilling off about 17 per cent of the lighter oils and water. Its characteristics are shown in Table III. When last inspected, at the beginning of fall, this section was in excellent condition.

TABLE III.—ANALYSIS OF REFINED COKE-OVEN TAR (VISCOUS).

Specific gravity 25°/25° C.		1.217
Float test at 32° C. (time)		1′ 25″
Per cent of free carbon (insoluble in CS_2, air temperature)		13.11
Distillation:	Pct. by volume.	Pct. by weight.
Water	0.0	0.0
First light oils to 110° C.	.0	.0
Second light oils 110°-170° C.	*3.8	3.2
Dead oils 170°-270° C.	†26.6	23.4
Pitch residue	‡69.6	73.4
	100.0	100.0

*Distillate practically solid when cold. †Distillate showed about one-third its volume precipitated solids when cold. ‡Pitch residue, hard, brittle, fairly lustrous.

EXPERIMENTS WITH TAR, OIL, ARTIFICIAL ASPHALT PREPARATIONS, BRICK, CEMENT, AND SLAG.

The experiments at Ithaca, N. Y., were conducted by the Office of Public Roads in co-operation with Cornell University for the purpose of ascertaining the relative value of different road binders applied in a number of ways under given conditions. According to previous arrangements, the university furnished all stone, machinery, and necessary labor; various manufacturers donated the bitumens, brick, cement, and slag; and the Office of Public Roads paid freight charges on all donated material and furnished a supervision of the work. When so desired the manufacturers had a representative present during the application of their material.

In the experiments where bitumens were employed as binders an attempt was made to try out all materials according to two methods of construction, known as the penetration method and the mixing method. Work was begun so late in the summer, however, that it was found impossible to finish it before winter. It was thought best, therefore, to stop work in December and wait until spring to complete the experiments.

With the exception of the brickwork no section was selected in advance for any given product, but each material was used in the order of its arrival at Ithaca upon the first section available. The brick was purposely laid on that section of road subject to the heaviest traffic. The sections mentioned in the following descriptions run east from the west extremity of the road. The road selected for these experiments is known as the Forest Home drive, and, beginning at Central Ave. just west of Sibley College, runs east to the city limits, 3,000 ft. Arrangements were made to use as much of the State Road No. 681, running from Ithaca to Dryden, as experiments required. This state road is a continuation of the one originally selected for the experiments. During 1909, about 3,900 ft. of roadway were laid.

The road is subjected to a rather heavy automobile traffic and a considerable amount of country traffic the year around. That part lying between Central Ave. and the bridge (about 800 ft.) is subject to a large amount of heavy hauling. During the winter months the frosts are very heavy and the road is generally covered with snow.

From Station 0 at the west end to Station 8+50 the road passes over a well-formed foundation of gravel. Street-car tracks cross the road from East Ave. at Station 6+15 and these run parallel to the road as far as Station 7+50. Here a 6 per cent grade extends to Station 9+50. From Station 8+50 to Station 12 the old road had been cut to reduce grades and exposed a layer of clay-bearing quicksand, which disappeared at Station 13. At this place the earth was excavated to a depth of about 4½ ft. and refilled with shale shuck. This filling, when well rolled, gave a very fair foundation. A 5-in. tile was placed at the bottom of this excavation, next to the hill, on the south side of the road running to Station 6+75, for the purpose of draining the subgrade and preventing seepage from the sidehill. For the same purpose a 5-in. tile was placed on the south side of the road from Station 12 to Station 15+50. This foundation held up well when the road was completed. From Station 15 to Station 22 the subgrade was excellent. That part from Station 15 to Station 20 lies so that the sun strikes it throughout the day. At Station 22 quicksand was again encountered on the right side of the road looking east. This sand gradually extended into the road, underlying its entire width, from Station 25+50 to Station 29. A 5-in. tile was placed on the road next to the hill running from Station 27 to Station 21, and, in like manner, a 4-in. tile from Station 27 to Station 30. As the quicksand was not as bad as on the first hill, the university had previously constructed an ordinary macadam road at this place depending upon the tile and additional 4 ins. of stone to make the road firm. As the road was being completed, however, it was noticed that the foundation waved somewhat under the roller. When finished the road appeared quite firm and, if the tiles are kept open, the foundation should continue to improve. All tile for this work was covered with either shale shuck or ashes. The road lying between Stations 30 and 39 passes over an old roadbed where the subgrade is very solid. Most of the road runs along the bank of Beebe Lake and is about 20 ft. above the water.

The labor employed was unskilled and consisted of the regular campus force, together with a few extra men. Common labor was figured at $1.50 per 9-hour day, foremen at $3, and double teams at $3.50. The stone used was a hard blue limestone, costing 65 cents per ton f. o. b. cars at the shipping point about 60 miles away. Freight on this stone amounted to 50 cts. per ton. The cost of constructing the experimental sections described below is of course excessive, owing to the shortness of the sections and the constant rearrangement of labor which was made necessary by the variety of work. The crude machinery and heating apparatus which had to be used also added greatly to the cost.

TABLE IV—MATERIALS AND COST DATA OF EXPERIMENTS AT YOUNGSTOWN, O.

Description.			Quantities.						Cost data (cents per square yard).						Total cost.	
Experiment No.	Section No.	Binder.	Length of section (ft.)	Area section (square yards).	No. 1 slag (cubic yds. per square yd).	No. 2 slag (cubic yds per square yd).	No. 3 slag (cubic yds per square yd).	Binder per square yard.	Slag on siding.	Hauling and laying slag.	Binder.	Applying binder.	Rolling and sprinkling.	Miscellaneous.	Cents per square yard.	Entire section.
1.	1.	Slag screenings	[illegible]	777	0.250	0.090	0.042	.....	18.95	20.15	.....	.....	7.42	....	46.52	$361.46
2.	5.	Slag screenings	300	456	.292	....	.042	.....	16.60	17.60	.....	.....	9.14	....	43.34	197.63
3.	6.	Slag screenings	[illegible]	506	.250	.139	.042	....	21.41	22.75	.....	.....	7.80	....	51.96	262.92
4.	7.	Open-hearth slag screenings	[illegible]	506	.250	.139	.042	....	21.41	22.75	.....	.....	6.05	....	50.21	254.06
5.	2.	Slag screenings and lime	500	777	.250	.090	.042	*4.5	18.95	20.15	0.83	2.46	5.79	....	48.31	374.35
6.	3.	Slag screenings and sulphite liquor	[illegible]	777	.250	.090	.042	† .901	18.95	20.15	13.88	.95	7.38	....	61.31	476.38
7.	4.	Refined coke-oven tar	[illegible]	456	.250	.090	.022	†1.545	17.97	19.10	13.49	12.72	4.17	1.00	68.45	312.13

*Pounds. †Gallons.

The road was 16 ft. wide and had 3 ft. shoulders on each side. When the Office took charge of the work the first course of stone for a distance of 3,000 ft. had been laid by the university. This course was composed of crushed stone, ranging from 1½ to 3½ ins., placed 4 in. deep when loose. After rolling, a sand filler was applied, until all voids were filled, and the road was again well rolled. A ¾-in. crown was adopted for all of the bitumen work. The bitumens were heated in a 10-bbl. tank fitted with a fire box and mounted on wheels. Scrap wood was used for fuel. The bitumens were fed into the tank through a manhole in the top and, when heated, were drawn off through a spigot placed just over the fire box at the rear of the wagon. Owing to this arrangement the entire contents of the tank had to be brought to the desired temperature before drawing off. If any attempt was made to feed in fresh material during application, the cold bitumen, by settling on the bottom, would clog the valve. Two 2-bbl. iron soap kettles were also used for heating the bitumen while the large tank was being recharged, but in spite of this the work was often delayed for lack of hot material. When the bitumen was sufficiently soft to flow, the barrels were rolled on skids to the top of the tank, the head knocked in, and the material drained into the tank. As there was only sufficient room to drain one barrel into the tank at a time, this operation consumed a great deal of time. Two flat ⅛-in. steel stone heaters, each having a heating surface of 80 sq. ft., and a semicylindrical section of an old boiler were employed for heating the stone when required. The two former were used for heating coarse stone and the latter for screenings.

A portable concrete batch mixer of the old McKelvey type was used in mixing both the bitumen and the cement concrete. It was driven by a gasoline engine connected by a chain drive. In the bituminous mixtures segregation of the various sizes of stone occurred to some extent while the concrete was being discharged, as the coarse stone came out first, while the finer material stuck to the sides of the discharge funnel, without, however, completely clogging it. Wheelbarrows loaded as nearly alike as possible each time were used in proportioning and transporting the mineral aggregate from the heaters or storage pile to the mixer. An old 12-ton steam roller was used in the greater part of the work, but was later replaced by a new 10-ton roller.

Experiment No. 1, Section No. 1.—Refined Coal Tar—Penetration Method.—The section treated in this experiment was 300 ft. long and began at Station 0. The wearing course of stone, which ranged in sizes from 1½ in. to ½ in. in its largest dimensions, was laid 4 ins. deep when loose. As this stone contained considerable fine material and was damp when laid, a steel harrow was used to stir it until dry and to work all dust to the bottom. This proved to be a very satisfactory method and left a fairly even surface of coarse stone on top, which was then rolled until firm. The binder used in this experiment was a coal tar, having the properties shown in Table V.

TABLE V. ANALYSES REFINED COAL TARS

	H[illegible]		Light. b	
Specific gravity 25°/25° C	1.248		[illegible]	
Float test at 32° C (time)	[illegible]		1′ 5″	
Per cent of free carbon (insoluble in CS₂ air temperature)	23.95		[illegible]	
	Pct. by volume.	Pct. by weight.	Pct. by volume.	Pct. by weight.
Distillation:				
Water	[illegible]	.0	0.0	0.0
First light oils to 110° C	[illegible]	[illegible]	.2	[illegible]
Second light oils 110°-170° C	[illegible]	[illegible]	e3.2	[illegible]
Dead oils, 170°-270° C	[illegible]	[illegible]	f29.6	25.1
Pitch residue	[illegible]	[illegible]	g67.0	[illegible]
	100.0	99.9	100.0	99.8

a Extremely viscous. b Viscous fluid, sticky. c Distillate [illegible] precipitated solids when cold. d Distillate showed about [illegible] solids when cold. e Distillate showed about two-fifths its [illegible] f Distillate showed about four-fifths its volume precipitated [illegible] brittle, slightly lustrous.

This material was very viscous and flowed slowly from the barrel when cold. In order to facilitate handling it was found advisable to warm the tar for some time before attempting to load the heating tank by placing the barrels near [illegible] in a small portable furnace. The tar was finally heated in the tank to between 250° and 280° F., and then drawn off into coal scuttles fitted with strips of metal which were riveted across their spouts, so as to give an opening 4½ ins. across and ½ in. wide. The hot tar was then poured upon the prepared road surface at the rate of approximately 1½ gals. per sq. yd. The surface was given a light coat of screenings (½ in. to dust) and then rolled; and more screenings were applied from time to time until the surface became firm. The road was allowed to remain in this condition for about two weeks, after which the surplus screenings were swept from the surface with rattan hand brooms. A lighter tar than that previously used was then heated, poured upon the surface, and "broomed" in. The properties of this tar, which was applied at the rate of approximately ½ gal. per sq. yd., are also given in Table V. Screenings were again applied in sufficient quantity to fill all surface voids and take up the surplus tar. This made the surface smooth and solid when rolled.

Experiment No. 2, Section No. 2.—Refined Coal Tar—Mixing Method.—Section No. 2 adjoins Section No. 1 and extends east for a distance of 300 ft. In this experiment crushed stone ranging in size from 1½ ins. to ½ in. was laid to a depth of 1½ in. on the foundation course and rolled until firm. Crushed stone heated in the manner previously described was proportioned as follows: Six parts, by weight, of from 1½ to ½ in. stone to one part from ½ in. to dust. These two sizes of stone were measured in wheelbarrows and carried to the mixer. The coarse stone was first dumped into the mixer and about 6 per cent, by weight, of hot tar added. After the mixer had made two turns, the screenings were dumped in and mixing continued until the stone had become thoroughly covered with tar. The mixture was dumped upon a platform where it was shoveled into wheelbarrows, taken to the road, and spread to a depth of 2½ ins. The mineral aggregate as laid was not entirely satisfactory, owing to the segregation that took place upon being discharged from the mixer, and to the fact that the stone furnished for this work was not uniform. Part of the larger size consisted entirely of stone 1½ ins. in size, while part contained much fine material. The tar used on this section was the same as the heavy product described under Experiment No. 1.

This course was well rolled after a light coat of stone chips ½ to ¼ in. in size was spread over the surface to keep the tar from sticking to the roller wheels. While rolling, more chips were added as required. When thoroughly rolled, the surface was painted with about ½ gal. of tar to the sq. yd. Enough stone chips were then added to take up all surplus tar and fill the voids. This section, when finished, presented a smooth, firm surface. In about two months, however, one spot showed signs of raveling. Four small patches were made at this place by cutting out the defective surface and refilling with hot stone. Tar was then poured over the new stone and the surface well tamped. Sections 1 and 2 were opened to traffic shortly after [illegible].

Experiment No. 3, Section No. 4.—Artificial Oil Asphalt—Mixing Method.—Section No. 4 extends from Station 9+25 to Station 12. The wearing course was mixed in the same manner as in Experiment No. 2, except that an artificial oil asphalt, heated to between 250° and 300° F., was used in place of the tar. Upon examination this material showed properties given in Table VI.

TABLE VI. ANALYSIS OF ARTIFICIAL OIL ASPHALT* USED IN EXPERIMENT NO. 3.

Specific gravity 25°/25° C.	0.996
Melting point °C (cube method)	[illegible]
Float test at 50° C. (time)	[illegible] 44″
Penetration (No. 2 N, 5 seconds, 100 grams, 25° C.)	82°
Per cent of loss at 163° C., 5 hours (50 grams)	1.97
Penetration of residue (as above)	[illegible]°
Per cent of total bitumen insoluble in 86° paraffin naphtha	23.96
Per cent of fixed carbon	8.42
Per cent of bitumen soluble in CS₂, air temperature (total bitumen)	99.69
Organic matter insoluble	.11
Inorganic matter	.20
	100.00

*Dense, semi-solid

This product was shipped in sheet-iron drums, holding about 56 gals. each. In handling it was found convenient to cut the ends of the drums free and also to cut a seam down the side. The drums were then rolled upon two small iron rails over a fire. In this manner a thin layer of melted oil was formed next to the metal and this permitted the casing to be easily removed. The cakes of asphalt were then cut up by means of a wire and thrown into the tank heater. After coming from the mixer, the coated stone was shoveled into dump wagons and hauled 500 ft. to the road, where it was dumped upon a board and shoveled into place. Owing to this method of handling, a much more uniform mixture was obtained than in Experiment No. 2. It was found that the course of bitumen-coated stone could be rolled before adding stone chips. This section did not require a paint coat of bitumen and was completed by rolling in stone chips as in the first two sections, in order to produce a finished surface.

Experiment No. 4, Section No. 12.—Artificial Oil Asphalt—Mixing Method.—Section No. 12 is a part of the state road No. 681. The foundation course of crushed limestone running from 2 to 4 ins. in size was laid 5⅜ ins. loose and rolled solid after a sand filler had been added. The course of bitumen-covered stone was laid directly upon this foundation in the same manner as described in Experiment No. 2, and an artificial asphalt showing the characteristics given in Table VII. was employed as a binder.

TABLE VII. ANALYSIS OF ARTIFICIAL OIL ASPHALT* USED IN EXPERIMENT NO. 4.

Specific gravity 25°/25° C.	0.964
Float test at 100° C. (time)	1′ 27″
Melting point °C (cube method)	[illegible]
Penetration (No. 2 N, 5 seconds, 100 grams, 25° C.)	[illegible]
Per cent of loss at 163° C., 5 hours (50 grams)	[illegible]
Float test on residue at 100° C. (time)	1′ 29″
Per cent of total bitumen insoluble in 86° paraffin naphtha	22.0
Per cent of fixed carbon	8.60
Per cent of bitumen soluble in CS₂, air temperature (total bitumen)	[illegible]
Organic matter insoluble	.12
Inorganic matter	.14

*Dense, semi-solid.

Owing to cold, damp weather this work was very much handicapped. The oil-asphalt was shipped in 42-gal. barrels which had been coated inside with whitewash. This made it possible to strip the staves from the material so that it could be readily cut up by means of a wire. This course did not bond well and had to be painted in order to obtain a satisfactory surface. About 1½ gals. of asphalt were used to the sq. yd.

Experiment No. 5, Section No. 5.—Refined Semiasphaltic Oil—Penetration Method.—The surface of section No. 5 was constructed in [illegible] a rather fluid semiasphaltic oil, having the properties given in Table VIII was used.

TABLE VIII—ANALYSIS OF REFINED SEMI-ASPHALTIC OIL.*

Specific gravity 25°/25° C.	0.955
Float test at 32° C. (time)	58"
Flash point °C. (open cup)	119°
Burning point °C. (open cup)	155°
Per cent of loss at 163° C., 5 hours (20 grams)	13.4
Float test on residue† at 35° C. (time)	3' 27"
Per cent of total bitumen insoluble in 86° paraffin naphtha	14.99
Per cent of fixed carbon	6.35
Per cent of bitumen soluble in CS_2, air temperature (total bitumen)	99.82
Organic matter insoluble	.11
Inorganic matter insoluble	.07
	100.00

*Viscous, slightly sticky.
†Character of residue, slightly fluid, somewhat sticky.

This material was heated to between 210° and 240° F. It could be easily handled and run from the barrels into the tank-wagon without trouble. Application was made at the rate of about 1½ gals. to the sq. yd. It was found unnecessary to paint this course, since the oil worked to the surface under the action of the roller after applying the stone chips. The section was in good condition on Dec. 2.

Experiment No. 6, Section No. 6.—Semi-solid Refined Semiasphaltic Oil—Penetration Method.—Section No. 6 was built in the same manner as Section No. 5, except that a different semiasphaltic oil was used. The results of the examination of this material are given in Table IX under No. 1.

TABLE IX—ANALYSES OF SEMI-SOLID REFINED SEMI-ASPHALTIC OILS.*

	No. 1.	No. 2.
Specific gravity 25°/25° C.	0.985	0.989
Float test 65° C. (time)	1' 54"	1' 56"
Melting point °C (cube method)	....	39°
Penetration (No. 2 N, 5 seconds, 100 grams, 25° C.)	247°	196°
Per cent of loss at 163° C., 5 hrs. (20 grams)	0.00	0.04
Penetration of residue (as above)	160°	142°
Per cent of total bitumen insoluble in 86° paraffin naphtha	17.41	20.02
Per cent of fixed carbon	11.20	11.53
Per cent of bitumen soluble in CS_2, air temperature (total bitumen)	99.86	99.77
Organic matter insoluble	.09	.05
Inorganic matter	.05	.18
	100.00	100.00

*Semi-solid, sticky.

In this case it was found impossible to pour the oil from the wooden barrels, and it was therefore necessary to knock off all hoops and throw the barrels, with their contents into the small heating kettles. The oil was then heated to about 350° F. and the staves were used as fuel as they floated to the top. The surface of this section was not painted. Stone chips were applied and rolled in, making a smooth, firm surface, which was in good condition when last inspected.

The manufacturers had shipped two products, one to be used according to the penetration method and the other according to the mixing method. Owing to great similarity in the markings on the barrels, and to the fact that there was hardly a perceptible difference in the appearance of the materials themselves, over 200 ft. of the section were laid with the product intended for the mixing method before the mistake was called to the attention of the engineer in charge by the agent of the company. The remaining 90 ft. were laid with the material intended for the penetration method described in the analysis as No. 2. When last inspected there was no apparent difference in the results obtained from the two products.

Experiment No. 7, Section No. 8.—Refined Water-Gas Tar; Penetration Method.—Seceion No. 8 was constructed in the same manner as Section No. 6, except that refined water-gas tar was used instead of the oil. Both the tank-wagon and the two kettles were used in heating this material, which was first warmed in the barrels, as described in Experiment No. 1, and then poured into the kettles or tank and raised to a temperature of 275° C. The characteristics of this material are shown in Table 10.

The tar-coated course, after stone chips had been applied, rolled down into good condition. On part of this section more tar was applied than had been intended, during the unavoidable absence of the engineer in charge. Owing to the excess of tar the surface did not require a paint coat; in fact, a large amount of stone screenings was found necessary to take up the surplus tar.

TABLE X—ANALYSIS OF REFINED WATER-GAS TAR.*

Specific gravity 25°/25° C.	1.158
Float test at 32° C. (time)	5' 10"
Per cent of free carbon (insoluble in CS_2, air temperature)	1.15

Distillation:	Pct. by volume.	Pct. by weight.
Water	0.0	0.0
First light oils to 110° C.	.4	.3
Second light oils 110°-170° C.	.7	.5
Dead oils 170°-270° C.	†33.2	29.1
Pitch residue	‡65.7	69.4
	100.0	99.3

*Viscous, sticky. †Distillate showed a trace of precipitated solids when cold. ‡Pitch residue hard, brittle, and lustrous.

Experiment No. 8, Section No. 9.—Refined Semiasphaltic Oil; Penetration Method.—On Section No. 9 a viscous semiasphaltic oil (see Table 11) was used, according to the same method as described in experiment No. 5. This oil was applied at the rate of 2 gal. per sq. yd., at the request of the manufacturers' agent, who was present at the time. The oil sweated to the surface upon rolling, and it will undoubtedly be necessary to apply stone screenings from time to time until all excess of oil is taken up. The section was left in good condition on Dec. 2.

TABLE XI.—ANALYSIS OF REFINED SEMI-ASPHALTIC OIL.*

Specific gravity 25°/25° C.	0.993
Float test at 32° C. (time)	2' 20"
Flash point, °C., open cup	234°
Burning point, °C., open cup	298°
Per cent of loss at 163°, 5 hours (20 grams)†	.90
Float test on residue at 35° C. (time)	4' 35"
Per cent of total bitumen insoluble in 86° paraffin naphtha	12.70
Per cent of fixed carbon	9.45
Per cent of bitumen soluble in CS_2, air temperature (total bitumen)	99.65
Organic matter insoluble	.26
Inorganic matter	.09
	100.00

*Viscous, fairly sticky. †Character of residue, dull and granular.

Experiment No. 9.—Section No. 10.—Refined Water-Gas Tar and Slag; Penetration Method.—Section No. 10 was only 100 ft. in length. The top 4 ins. were composed of open-hearth slag, crushed and screened to between ¾ in. and 3 ins. in the largest dimensions, and then rolled until firm. About 1 in. of from ¾ to ½ in. crushed slag was then spread evenly over the surface and rolled down. A heavy refined water-gas tar, showing the following properties, was poured over this course in the usual manner.

TABLE XII.—ANALYSIS OF HEAVY REFINED WATER-GAS.*

Specific gravity 25°/25° C.	1.167
Float test at 32° C. (time)	22' 11"
Per cent of free carbon (insoluble in CS_2, air temperature)	2.09

Distillation:	Pct. by volume.	Pct. by weight.
Water	0.0	0.0
First light oils to 110° C.	0.5	0.4
Second light oils 110°-170° C.	3.0	2.5
Dead oils 170°-270° C.	†29.0	25.2
Pitch residue	‡67.5	71.2
	100.00	99.3

*Very viscous, sticky. †Distillate showed about one-tenth its volume precipitated solids when cold. ‡Pitch residue, hard, brittle, and lustrous.

This tar was of such consistency that it had to be handled in the same manner as described for the semiasphaltic oil in Experiment No. 6. Fine slag, from ¼ in. to dust in size, was rolled into the tarred surface and made a smooth, firm road. After this section had been completed, mud was found coming through the surface in one place where the foundation was soft. About 2 sq. yds. of the surface were, therefore, taken out and the mud removed and replaced with good gravelly soil well tamped. Slag was then applied and more tar added, after which the patch was tamped solid.

Experiment No. 10, Section No. 7.—Kentucky Rock Asphalt.—The stone for Section No. 7 was laid to the same depth as in Section No. 1. The bonding material in this case was Kentucky rock asphalt, obtained from the same source as that used in the experiment at Bowling Green. Ky., which was reported in Circular 89 of the U. S. Office of Public Roads. Upon analysis this material showed the characteristics given in Table XIII.

TABLE XIII.—ANALYSIS OF KENTUCKY ROCK ASPHALT.

Per cent soluble in CS_2, air temperature (total bitumen)	6.73
Per cent of mineral matter	93.27
Per cent retained on 10-mesh sieve	1.0
Per cent passing 10, retained on 20 mesh.	3.0
Per cent passing 20, retained on 30 mesh.	5.5
Per cent passing 30, retained on 50 mesh.	43.0
Per cent passing 50, retained on 80 mesh.	35.0
Per cent passing 80, retained on 100 mesh	4.5
Per cent passing 100, retained on 200 mesh	4.5
Per cent passing 200 mesh	3.5
	100.00
Extracted bitumen:	
Specific gravity 25°/25° C.	1.027
Per cent of loss at 163°, 5 hours (20 grams)*	5.41
Per cent of mineral matter	1.76
Per cent of bitumen insoluble in 86° paraffin naphtha	18.10
Per cent of fixed carbon	10.83

*Residue semi-solid, soft, sticky.

The product was shipped in an open car. When shoveled into the wagons it was found necessary first to use picks to loosen up the material. Before spreading, the upper course of stone was rolled until firm and then the asphalt was shoveled from a dumping board into place to a depth of 1½ ins. over the east half of the section. On the west half ½ in. was first applied. A harrow was then passed over the material for a few times in order to work it into the stone, after which the course was rolled once to smooth up the surface. The rock asphalt was then applied to a depth of 1 in. more on the west end and the whole surface rolled. During a cold spell of ten days it was found impossible to finish this surface satisfactory, since it tended to crack under the roller. When weather became warmer, however, it was finished off in good condition. When rolling it was found necessary to cover the roller wheels with dust in order to prevent the asphalt from picking up. On Dec. 1 the road was in excellent condition and showed no signs of calking, as it had the first week after laying. No difference could be seen between the two halves of this section.

Experiment No. 11, Section No. 11.—Open-Hearth Slag.—Section No. 11 was constructed in the same manner as Section No. 10, except that no bituminous material was employed; slag screenings from ¾ in. in size to dust were used for a binder, as in ordinary macadam work. Owing to its hardness and the lack of very fine material or slag powder and to the rather soft subgrade, it was found impossible to obtain a good bond. The fine slag was composed mainly of gritty, sand-like particles, which would not pulverize under the roller and produce the very fine dust necessary to give satisfactory results. This would indicate that a certain proportion of the open-hearth slag screenings should consist of finely ground material in order to bind well. For the purpose of accelerating the binding properties of the slag through chemical reaction, as described in the Youngstown experiments with blast-furnace slag, unslaked lime was spread over the surface and rolled in. The surface was well watered, but did not show up as well as the slag work at Youngstown.

Experiments No. 12, Sections Nos. 15 and 14.—(a) Cement Concrete; (b) Bituminous-Surfaced Cement Concrete.—(a) The foundation of Section No. 15 was laid 4 ins. deep and consisted of crushed limestone from 2 to 4 ins. in size. The wearing course was composed of concrete made of one part Portland cement, two parts sand and five parts stone. The results of the examination of this cement are shown in Table XIV.

TABLE XIV.—EXAMINATION OF PORTLAND CEMENT.

Specific gravity	3.122
Per cent of magnesia (MgO)	3.30
Per cent of sulphuric anhydride (SO_3)	1.55
Fineness:	
Per cent retained on 100 mesh	4.8
Per cent retained on 200 mesh	17.8
Time of setting:	
Initial setting	2 hours 40 minutes
Final setting	6 hours 30 minutes
Tensile strength:	
Neat, 24 hours in moist air (pounds per square inch)	258
Neat, 7 days (1 day, moist air; 6 days, water) (pounds per square inch)	528
Neat, 28 days (1 day, moist air, 27 days, water) (pounds per square inch)	728
1 cement: 3 sand; *7 days as above (pounds per square inch)	186
1 cement: 3 sand; 28 days as above (pounds per square inch)	275

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*Standard Ottawa sand used.

Constancy of volume:	
Pat in air 28 days	Sound
Pat in water 28 days	Sound
Pat over boiling water, 4 hours	Sound

The sand used was a fine, clean product, the best that could be obtained in the immediate vicinity. The stone was of the same kind as used throughout these experiments, coming in two sizes, one ranging from 1¼ to 2¼ ins., and the other from ½ to 1¼ ins. Two boxes, one holding 6 cu. ft. and the other 1 cu. ft., were used to determine the proportions in which these two sizes could be mixed with the lowest percentage of voids. Six cubic feet of the two materials were measured out in varying proportions, mixed on a mixing board, and shoveled into the larger box, where the depth of stone was measured by a rule placed in one corner of the box before the stone was shoveled in. The mixed stone was leveled without reference to its depth before a reading was made. The following results were obtained from different trial mixtures (Table XV):

No. mixture.	1¼-in. to 2¼-in. stone. Cu. ft.	½-in. to 1¼-in. stone. Cu. ft.	Depth in inches.
1	3	3	15.75
2	4	2	15.5
3	3½	2½	15.25
4	4	2	15.5
5	2½	3½	15.5
6	6	0	16.25
7	3¾	2¼	15
8	3¾	2¼	15

This shows for the mixtures tried that 3¾ parts of the 1½-in. stone to 2¼ parts of the ¾-in. stone gave the lowest percentage of voids. By taking 18 shovelfuls of material to a wheelbarrow load, the proportions worked out roughly to two wheelbarrows of the covered stone, containing 15 shovelfuls each, to one barrow load containing 18 shovelfuls of the finer stone. These proportions were followed as nearly as possible—carrying out the work. The concrete was mixed in the mechanical mixer, hauled 300 ft. in a dump wagon and dumped upon a mixing board, from which it was shoveled into place and raked with steel hand rakes to conform to the desired crown of the road. At first the concrete was made rather dry, but as it was found that the voids were not being properly filled, more water was added, and the mixture was then raked and tamped until the mortar flushed to the surface. After this the surface was rolled until fairly smooth with a concrete roller 2½ ft. long by 18 ins. in diameter. The finished surface, while somewhat rough, was uniform, except where the mixture was made too dry. Cold weather made it necessary to cover the concrete with leaves immediately after it was rolled. The whole operation, from the time the concrete went into the mixer until it was covered up, averaged about 40 minutes.

(*b*) The first 30 ft. of Section No. 14 were coated with the artificial oil asphalt described in Experiment No. 4. This material was applied hot at the rate of 1 gal. per square yard and was covered with stone chips. The bitumen did not adhere very well to the cold, damp surface. After the concrete was laid the road was kept closed for about 15 days, and on Dec. 2 the entire road was in good shape, except in one place, where a retaining wall should be placed.

Experiment No. 13, Section No. 13.—Ash-Cement-Concrete Section.—The foundation course of Section No. 13 was constructed in the same manner as Section No. 12. At the request of Cornell University a concrete composed of six parts of ashes from the college heating plant, two parts of sand and one part of cement was prepared and laid in the manner previously described in Experiment No. 12. This section was rolled with the small hand concrete roller until water flushed to the top. Upon setting the road became hard and appeared quite satisfactory.

Experiment No. 14, Section No. 3.—Brick—Section No. 3 extends from the inside of the west rail of the street-car track, crossing the road to station 9 + 25, a total of 526 sq. yds. in all. After the grading had been completed, a foundation course was laid in the same manner as described for Sections Nos. 1 and 2, except that the voids were well filled with screenings from ¼ in. in size to dust, instead of with sand. Where the car tracks cross the road, the foundation was prepared by removing all the earth between the cross-ties and refilling with concrete to the top of the ties. Upon this a 2-in. sand cushion was laid and the bricks were placed upon this. A cement curbing 4 ins. wide by 20 ins. deep was placed on the south side of this section, while on the north side, owing to a greater amount of traffic, a curbing 6 ins. wide by 20 ins. deep was laid.

TABLE XVI.—ANALYSIS OF BITUMINOUS FILLER.*

†Surface of residue somewhat drawn.

Specific gravity 25°/25° C.	0.980
Melting point ° C. (cube method)	108°
Penetration (No. 2 N, 5 seconds, 100 grams, 25° C.)	54°
Per cent of loss at 163 C., 5 hours (20 grams)†	1.15
Penetration of residue (as above)	48°
Per cent of bitumen insoluble in 86° paraffin naphtha	26.88
Per cent of fixed carbon	8.36
Per cent of bitumen soluble in CS_2, air temperature (total bitumen)	99.83
Organic matter insoluble	.09
Inorganic matter	.08

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*Dense, rubbery.

After the curbing had thoroughly set, a form reaching 5¾ ins. below the top of the curb at the side of the road and 1¾ ins. below at the center was pulled over the section, and all uneven places were filled with stone or cut off, until a uniform crown of ½ in. to the foot had been obtained. Next to the curbing was then placed a board 1 in. wide and 6 ins. deep, which, upon the completion of the road, was withdrawn. This space was then filled with a bituminous filler (see Table XVI.) to within 1 in. of the top. The remaining space was filled with sand. A 2-in. course of sand was spread over the foundation and, after this had been dragged with a wooden form to conform to the road surface, it was compacted with the light hand roller in order to obtain a uniform cushion for the brick. The roller was started at the sides, moved longitudinally to the center, and then rolled at right angles to the length of the road, after which it was rolled at an agle of 45° in both directions. This produced a firm but slightly uneven surface, which was made smooth by a light coat of screened sand. The whole surface was finally struck off to produce a sand cushion 2 ins. in depth. Upon this the brick, which had been furnished by six different manufacturers, was laid with unskilled labor at right angles to the center line of the road. The brick surface was then rolled with a 2-ton tandem roller, made from a self-propelled lawn mower and carrying the greater part of the weight on the front roller. The roller was started next to the curb and gradually worked toward the center of the road, and in like manner from the other side. This operation was repeated twice, after which the road was rolled twice in both directions at an angle of 45° to its length. This process was repeated three times until the brick had become firmly set.

TABLE XVIII.—ITEMS OF COST.

Experiment No. 10, Section No. 7—Kentucky Rock Asphalt.	
Length of section (ft.)	[illegible]
Area of section (sq. yds.)	[illegible]
No. 2 stone, cu. yds. per sq. yd.	.211
Rock asphalt, cu. yds. per sq. yd.	.041
Cost of No. 2 stone on siding, per sq. yd. (cts.)	[illegible]
Cost of hauling and laying stone, per sq. yd. (cts.)	1.42
Cost of rock asphalt, per sq. yd. (cts.)	31.08
Cost of hauling rock asphalt, per sq. yd. (cts.)	4.71
Cost of spreading rock asphalt, per sq. yd. (cts.)	[illegible]
Cost of rolling, per sq. yd. (cts.)	[illegible]
Cost of freight on rock asphalt, per sq. yd. (cts.)	[illegible]
Total cost, per sq. yd. (cts.)	83.04
Total cost of entire section	$ [illegible]
Experiment No. 11, Section No. 11—Slag.	
Length of section (ft.)	200
Area of section (sq. yds.)	355
No. 2 size stone, cu. yds. per sq. yd.	0.139
Screenings, cu. yds. per sq. yd.	[illegible]
Lime, lbs., per sq. yd.	[illegible]
Cost of No. 2 slag, at siding, per sq. yd. (cts.)	[illegible]
Cost of slag screenings, at siding, per sq. yd. (cts.)	[illegible]
Cost of hauling and laying slag, per sq. yd. (cts.)	[illegible]
Cost of lime on road, per sq. yd. (cts.)	2.26
Cost of rolling, per sq. yd. (cts.)	2.79
Cost of sprinkling, per sq. yd. (cts.)	1.00
Total cost, per sq. yd. (cts.)	49.56
Total cost of entire section	$ 175.94
Experiment No. 14, Section No. 3—Brick.	
Length of section (ft.)	[illegible]
Area of section (sq. yds.)	526
Length of curbing (ft.)	590
Sand cushion, cu. yds. per sq. yd.	0.056
Average number of bricks per sq. yd.	40
Cost of curbing, per running foot	$1.00
Cost of bituminous filler, per running foot (cts.)	.75
Cost of sand cushion per sq. yd. (cts.)	4.08
Cost of hauling and laying brick (cts.)	20.81
Cost of brick, per sq. yd. (cts.)	55.52
Cost of freight on brick, per sq. yd. (cts.)	40.20
Cost of cement filler, per sq. yd. (cts.)	8.53
Cost of rolling brick, per sq. yd. (cts.)	1.53
Miscellaneous expenses, per sq. yd. (cts.)	7.56
Cost of curbing, per sq. yd. of road (cts.)	112.50
Cost of bituminous filler per sq. yd. of road (cts.)	4.23
Total cost of road, per sq. yd. (cts.)	254.96
Total cost of entire section	$1,341.09

Wooden boxes about 30 ins. wide, 14 ins. deep and 4 ft. long on top, with ends sloping into the bottom at an angle of 45°, were now obtained. These boxes were set on legs of unequal length; the shortest was about 8 ins. in length, and the longest, on the corner diagonally opposite, about 18 ins. Into one of these boxes was placed about ⅔ bu. of a mixture of equal parts of sand and cement. Water was then added until the resulting mortar flowed readily. Two men stood at the high end of the boxes with mortar-hoes and kept the mixture in [illegible]

TABLE XVII.—BRICK TESTS.

Brick No.	Rattler test. Per cent of loss. Average of [illegible]	Cross-breaking test. Modulus of rupture. Pounds per square inch. Average of 10 tests.	Crushing test. Pounds per square inch. Average [illegible]	[illegible] One-half hour.	[illegible]	Forty-[illegible]
[illegible]		*2,464		0.16		
[illegible]	14.88	1,738	[illegible]	.30		
[illegible]	15.14	2,183	[illegible]	[illegible]		[illegible]
[illegible]	14.28	1,700	4,890	.31	.58	1.15
Rat[illegible]	17.20	1,669	5,610			

*Average of [illegible] tests.

while a man stood on the lower side with a scoop, shoveling the grout upon the brick by dropping it suddenly from the shovel, but without throwing it. Three men with brooms and squeegees immediately work the grout into the joints between the brick. After the brick had been covered for a distance of about 20 ft., this treatment was repeated. In about three-fourths of an hour a final coat of three parts of cement to two parts of sand, made considerably thicker than before, was applied. The surface was then squeegeed, so that a thin layer of cement was left over the surface of the brick, and the joints were well filled. Owing to damp weather, it was unnecessary to cover the brick with sand to keep the filler moist. The road was closed to traffic for ten days, and not even the street cars were allowed to pass during that time.

On account of unskilled labor and the slow methods used in constructing the curb, the cost was exceedingly high for this kind of work. The cost of brick per square yard is averaged from the cost of each kind of brick, in connection with the area covered by each or the number used. The first 83 ft. of roadway running from the car track were laid with brick costing $12.75 per thousand f. o. b. cars at the point of manufacture. The cost of the brick for the adjoining 70 ft. was $12.25 per thousand and for the three different kinds of brick used on three 51-ft. sections $14, $17.50 and $13.75 per thousand, respectively, f. o. b. cars at the point of manufacture. The rail bricks were figured at $20 per thousand f, o. b. cars at the point of manufacture. They were laid only on the inner side of the outer rail, and did not add very materially to the average cost per square yard. The results of tests made upon these bricks are shown in Table XVII. It should be noted that these tests are not complete owing to an insufficient number of bricks being left over from the work.

All of the sections were in excellent condition when last inspected on Dec. 2, so that it is impossible to draw definite conclusions as to the relative merits of the different materials at the present time. Data on the work at Ithaca, N. Y., are given in Tables XVIII, XIX, XX and XXI.

An Inexpensive Pocket Compass.

Engineers and contractors have frequent use for a pocket compass of convenient size and sightly appearance, and at the same time of a good degree of accuracy. The accompanying cut illustrates such a compass which has been placed on the market by Iszard-Warren Co., Inc., of Philadelphia, Pa. The cases of these compasses are made of a non-tarnishing white metal. The graduated dials are also made of metal and have the north indicated by a red N. The needle which is 1¼ ins. long is the American form of wire balanced bar needle with jewel bearing. The compass is claimed by the makers who have supplied large numbers to the Engineer Corps U. S. A. to be fully 50 per cent better than foreign compasses, selling at double the price. The compass is sold for $1.50.

Pocket Compass.

Bureau of Mines.— The Bureau of Mines, of the Department of the Interior, which has just been established, in accordance with the law of May 16 last, will devote itself first and principally to the investigation of mine accidents, a work which has heretofore been carried on under the Geological Survey. For this purpose and for the investigation of fuels, Congress appropriated $410,000, and the total appropriation for the Bureau is $502,200. In general, the Bureau will continue the work of the Technologic Branch of the Geological Survey, and the work will be done largely by the same men heretofore engaged in the work. Many of the problems before the Bureau will have to wait, however, until Congress makes further appropriations. The director of the Bureau is George O. Smith. Bulletins on analyses of coal and other subjects will be issued by the Bureau before long. The directors' office is at Washington, but the Bureau includes the testing station at Pittsburg, and rescue stations will be established at a number of points in the coal regions.

TABLE XIX.—COST DATA OF EXPERIMENTS AT ITHACA, N. Y., BY PENETRATION METHOD.

Description.			Quantity of material.						Cost data per square yard, in cents.										Total cost.	
Experiment No.	Section No.	Binder.	Length of section (ft.).	Area of section (sq. yds.).	No. 2 stone (cu. yds. per sq. yd.).	Screenings (cu. yds. per sq. yd.).	Binder, first application (gals. per sq. yd.).	Binder, second application (gals. per sq. yd.).	No. 2 stone at siding	Screenings at siding.	Hauling and laying stone.	Binder.	Hauling binder.	Heating and applying binder.	Rolling.	Miscellaneous.	Freight on binder.	Square yard (cents).	Entire section.
1	1	Refined coal tar	300	620	0.111	0.022	1.46	0.56	14.55	2.91	5.27	12.41	2.84	2.02	0.92	1.00	4.00	45.92	$284.70
5	5	Refined semiasphaltic oil	300	533	.111	.022	1.50	....	14.55	2.91	5.27	17.25	2.92	1.50	.92	1.00	3.00	49.32	262.88
6	6	Semisolid refined semiasphaltic oil	300	533	.111	.022	1.64	....	14.55	2.91	5.27	11.48	3.19	1.64	.92	1.00	2.36	43.32	230.90
7	8	Refined water-gas tar	300	533	.111	.022	1.88	....	14.55	2.91	5.27	13.16	3.65	1.88	.92	1.00	3.61	46.95	250.24
8	9	Refined semiasphaltic oil	300	533	.111	.022	2.06	....	14.55	2.91	5.27	14.42	4.01	2.06	.92	1.00	7.16	52.30	278.76
9	10	Refined water-gas tar (slag)	100	178	.138	.022	1.47	....	30.28	4.83	8.40	10.29	2.86	1.47	.92	1.00	2.82	62.87	111.91

TABLE XX.—COST DATA OF EXPERIMENTS AT ITHACA, N. Y., BY MIXING METHOD.

Description.			Quantity of material.							Cost data per square yard, in cents.											Total cost.	
Experiment No.	Section No.	Binder.	Length of section (ft.)	Area of section (sq. yds.)	No. 2 stone (cu. yds. per sq. yd.).	Mixed stone (cu. yds. per sq. yd.).	Screenings (cu. yds. per sq. yd.).	Binder in mixture (gals. per sq. yd.).	Binder used in paint coat (gals. per sq. yd.).	No. 2 stone at siding	Screenings at siding	Hauling and laying stone	Binder.	Hauling binder	Preparing and laying mixture.	Heating and applying paint coat.	Rolling.	Miscellaneous.	Freight on binder.	Square yds. (cts.).	Entire section.
2	2	Refined coal tar	300	622	0.042	0.069	0.022	0.92	0.44	14.55	2.91	5.27	11.56	2.65	10.32	0.44	0.92	4.52	2.88	56.02	$348.44
3	4	Artificial oil asphalt	275	489	.042	.069	.022	.92	....	14.55	2.91	5.27	9.28	1.79	10.32	....	.92	4.52	9.06	58.62	286.65
4	12	Artificial oil asphalt	260	463	....	.069	.022	.92	.98	9.09	2.91	3.29	14.25	3.70	18.59	.98	.92	4.52	2.64	60.89	281.92

TABLE XXI.—COST DATA OF EXPERIMENT AT ITHACA, N. Y., ON CONCRETE PAVING.

Description.			Quantity of material.						Cost data per square yard, in cents.										Total cost.	
Experiment No.	Section No.	Binder.	Length of section (ft.)	Area of section (sq. yds.)	Coarse aggregate (cu. yds. per sq. yd.)	Sand (cu. yds. per sq. yd.)	Cement (cu. yds. per sq. yd.)	Bitumen (gals. per sq. yd.)	Coarse aggregate at mixer.	Sand at mixer.	Cement at mixer.	Mixing and laying concrete	Bitumen.	Hauling bitumen.	Heating and applying bitumen.	Screenings on road.	Freight on bitumen.	Miscellaneous.	Square yds. (cts.).	Entire section.
12a	15	Cement concrete	500	889	0.140	0.052	0.026	...	23.10	3.91	29.30	17.28	...	...	...	...	...	1.18	74.77	$664.70
12b	14	Bitumen coated, cement concrete	30	[illegible]	.140	.052	.026	0.84	23.10	3.91	29.30	17.28	6.30	1.64	0.84	1.00	1.17	1.18	85.72	45.43
13	13	Ash cement concrete	35	62	.138	.045	.017	...	4.27	3.38	19.42	20.16	...	...	...	...	...	1.18	48.41	30.01

WATER-WORKS AND SEWERS SECTION

Some Structural Details of the River Des Pere's Foul Water Sewer at St. Louis, Mo.

The sewer described is planned to follow closely the River des Peres from the mouth on the Mississippi River through the city of St. Louis a total distance of something over 7½ miles. Work has been begun on two sections of this sewer—Section 1 extending from the mouth 6,505.38 ft. and Section 2 continuing 25,619.21 ft. farther—aggregating 32,124.59 ft., or something over 6 miles. The sewer will be of brick throughout, but there will be nine variations in design of cross-section seven of which will come within Section 1. Two types of cross-section only are planned: (1) Circular brick sewer and (2) a 9x9-ft. section with semicircular roof on 4-ft. side walls and circular invert. The accompanying drawings show certain of the cross-sections and some of the special structures.

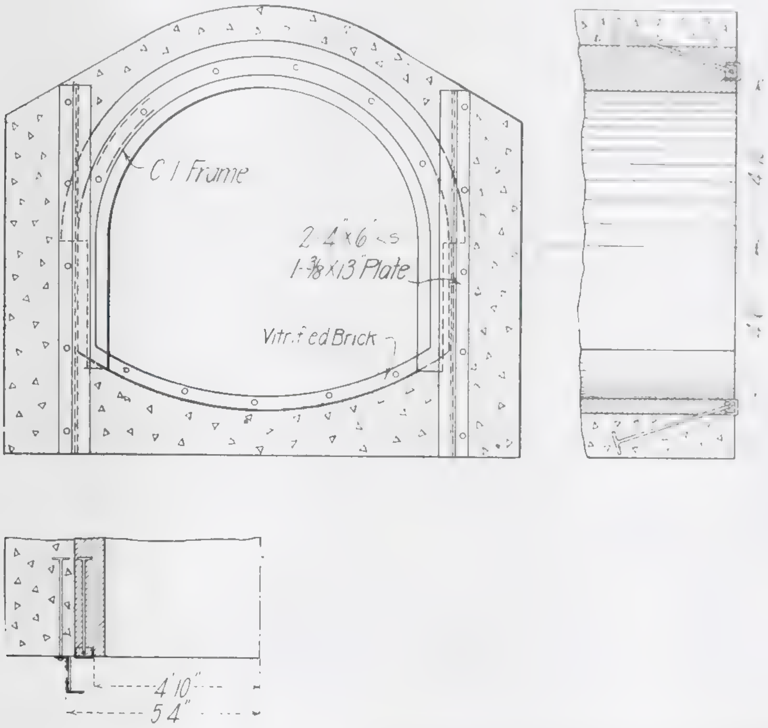

Fig. 1.—End Elevation of Outlet for 9x9-ft. Sewer Showing Provision for Emergency Gate.

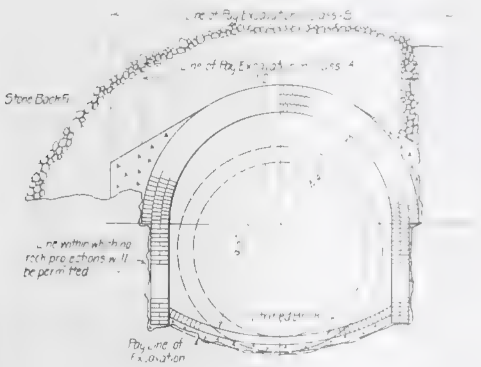

Fig. 2.—Sewer Section With Rock Cut Below Springing Line.

The following tabulation gives the sizes and the length of each size:

Size, ft.	Length, ft.
9x9	1,164.00
9 (circular)	1,440.00
9x9	3,901.38
7 (circular)	16,962.30
6 (circular)	8,656.91
Total	32,124.59

Section 1 of the work under contract comprises all the 9x9-ft. sewer and the 9-ft. circular sewer. It consists of six divisions. Division 1 comprises the outfall structure 34 ft. long, the end of which is shown by Fig. 1. This outfall structure is of concrete lined with brick and founded on bed rock. As will be noted from the drawing provision is made by means of a cast iron face ring and vertical steel guides for closing the opening by a sliding gate.

Following the outfall structure is Division 2, 155 ft. long, for which the sections shown by Figs. 2 and 3 have been designed. Figure 2 shows the section provided where the rock cut extends above the springing line; it also shows the stone backfill required. The section shown by Fig. 3 is provided for cases where the rock cut lies below the springing line; the arch ring is backed with concrete. In connection with this division there will be a rectangular shaft located over its junction with the outfall structure. This shaft is intended for use in cleaning out the sewer and is provided with a ladder. Its dimensions inside the concrete lining are 3½x9 ft. Figure 4 shows the detail of the reinforced concrete slab cover for this shaft.

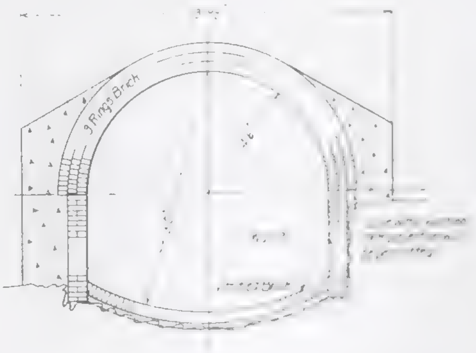

Fig. 3.—Sewer Section With Rock Cut Above Springing Line.

Divisions 3 and 5 will be tunnel constructions in rock and Fig. 5 shows the section of masonry adopted. The aggregate length of these two divisions will be 2,135 ft. long. The special structures on these two divisions include a tumbling basin of the construction [illegible] the construction shown by Fig. 7. Division 4 will consist of 4-ring circular brick sewer and Division 6 will have the cross section shown by Fig. 2. On this division there will be constructed the gate shaft, gate and gate mechanism shown by Fig. 8. Figure 9 shows the standard manhole constructions.

All the sewer on Section 2 is circular brick sewer 6 ft. and 7 ft. in diameter. Two types of construction will be employed designated as plain sewer and reinforced sewer. Altogether there will be some 3,140 ft. of the total 16,962 ft. of 7-ft. sewer which will be reinforced and of the 8,657 ft. of 6-ft. sewer, 1,050 ft. will be reinforced. Briefly the two constructions are as follows: Plain sewer, three rings of brick with the inner ring up to springing lines of vitrified and the remainder of common brick. Reinforced sewer, lower half three rings of brick with the inner ring vitrified brick; upper half two rings of common brick and the outer 4 ins. of concrete; reinforcement a single layer of wire fabric around the sewer outside of the two inner rings of brick. The specifications for reinforcement are in abstract as follows:

The longitudinal wires or strands in the roll placed perpendicular to the [illegible] shall have a net cross-sectional area of not less than 0.13 sq. ins. per foot width of roll. The wire shall have an ultimate strength of 50,000 to 66,000 lbs. per sq. in., and an elastic limit of not less than 50 per cent of the ultimate strength. The fabric is to be laid with the length of the roll in a peripheral direction with not less than 1 ft. lap. The reinforcement shall gird the two inner brick rings in one length of fabric. When the two brick rings for the upper half are closed the two ends of the fabric are to be brought together over them, lapped and laced and the 4-in. concrete cover placed.

The specifications for the brick work in general are as follows:

Mortar for Brickwork.—Mortar shall be made of 1 part Portland cement and 3 parts sand by measurement, each to be of the quality hereinbefore specified. The cement and sand shall be thoroughly mixed dry in proper boxes, and such quantity of clean water afterwards added as will produce a stiff mortar of the consistency [illegible] thoroughly worked with proper tools. All mortar shall be made fresh for the work in hand, and any mortar which has begun to set shall not be used.

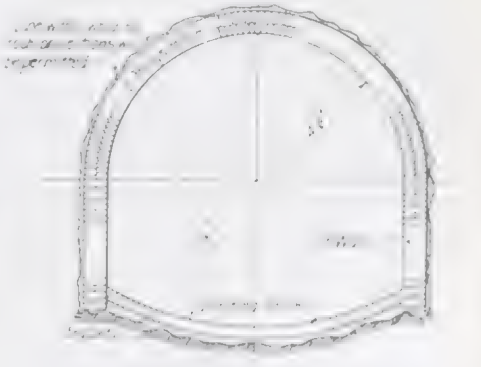

Fig. 5.—Sewer Section In Tunnel.

Common Brick.—All common brick shall be of uniform texture and hard-burned entirely through. One edge face of each brick shall be such that if the brick is laid on a horizontal plane on that face no portion thereof shall be more than ⅛ in. from the horizontal plane. Each shipment of between 12,000 and 20,000 brick shall be sampled. Each sample shall be subjected to cross-breaking and crushing tests under the following three conditions: (1) After having been thoroughly dried. (2) After having been immersed in water for 24 hours. (3) After having been subjected to 20 freezings, alternating with 20 thawings.

The following figures fix minimum and average values to be met by the brick after the above treatment:

	Modulus of rupture. Lbs. per sq. in.		Crushing strength. Lbs. per sq. in.	
(1) Dried	325	400	2,500	3,000
(2) Wet	225	275	2,000	2,500
(3) Frozen and thawed.	225	275	2,000	2,500

The absorption of the brick after immersion in water for 24 hours shall not exceed 15 per cent of the weight of the dry brick. All the brick rejected under the provisions of the above test and those culled on account of irregularities shall be removed immediately from the work.

Vitrified Brick.—All vitrified brick shall be uniform in size and be not less than 8x4x2 ins., nor more than 10x4½x3 ins. in length, width or thickness, respectively. The edges may be rounded to a radius not greater than ¼ in. The brick shall be free from lime or other impurities, uniformly vitrified and annealed, and shall have one edge face such that if the brick is laid on a horizontal plane on that face no portion thereof shall be more than ⅛ in. from the horizontal plane. The Sewer Commissioner shall be allowed to sample the brick intended for use on the work herein specified, either at the kiln or on the work. Each sample so taken shall be submitted to an abrasion test and shall not show a loss of more than 20 per cent. The test shall be made according to the method adopted as standard by the National Brick Manufacturers' Association, in 1901, with all subsequent amendments thereto.

Common Brick Masonry.—All brick masonry shall be made of brick and mortar, of the quality hereinbefore specified, and laid in a careful and workmanlike manner. The bricks shall be clean and thoroughly wetted before being laid. In building brick masonry, none but careful and skillful bricklayers shall be employed. Every brick shall have full mortar joints on the bottom, sides and ends, which, for each brick, shall be formed at one operation by placing sufficient mortar on the bed and forcing the brick into it. On the intrados, or inside, of every row of bricks, the joints shall not be more than ¼ in. The bricks shall be laid normal to the tangent of the circle. Every brick on the inside of the sewer shall be laid even and smooth by line and be true to the form given in each case. All bricks in each course shall be stretchers, breaking joints with those in adjoining courses. The exterior surfaces of brick arches shall be plastered with a coating of mortar not less than ⅜ in. thick.

Vitrified Brick Masonry.—The invert of sewer shall be lined with one course of vitrified brick. Bricklaying shall be started at the center line of the invert and laid to a line each way from the center, and all joints shall be broken, giving a lap of at least 2½ ins. Whole bricks shall be used excepting where bats are needed to break joints.

The work described is being done after the designs and under the direction of Mr. R. H. Fardwell, Commissioner of Sewers, St. Louis, Mo.

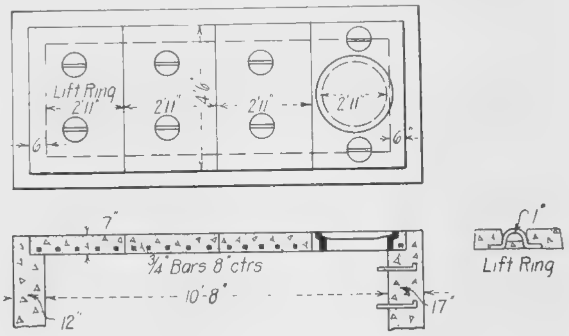

Fig. 4.—Reinforced Concrete Cover for Clean-Out Shaft.

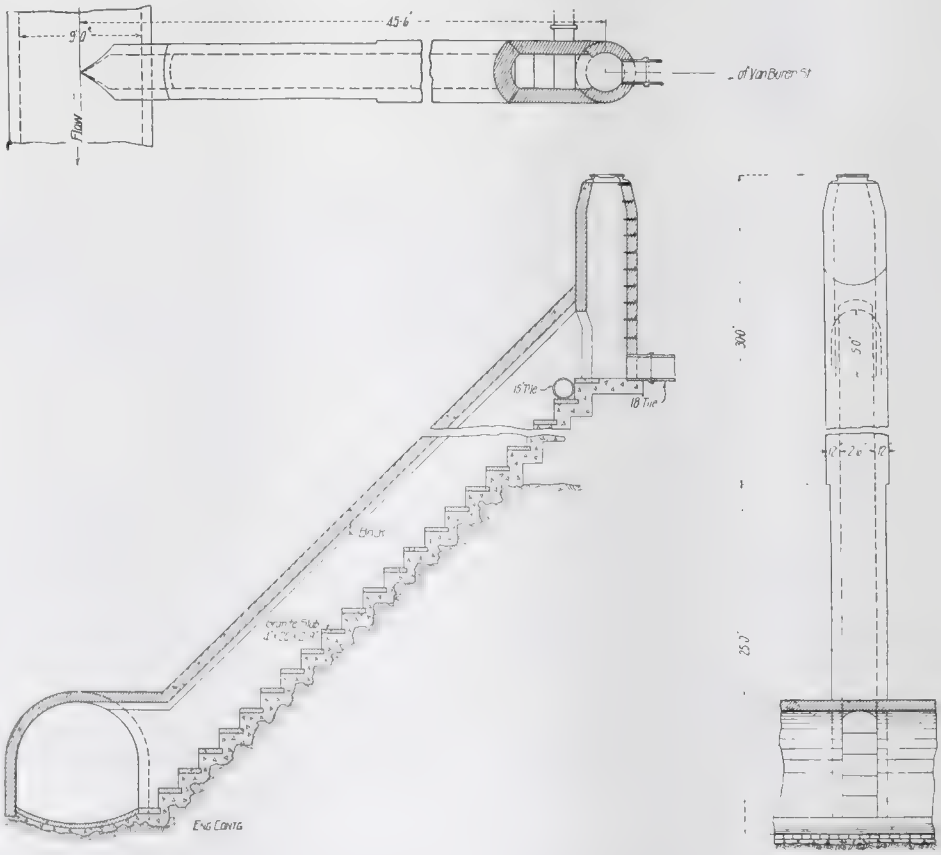

Fig. 6.—Details of Tumbling Basin.

Availibility of Underground Waters for Manufacturing Purposes: Methods of Securing Such Waters with Some Costs.*

Other conditions remaining approximately equal, no large manufacturing concern can compete successfully with others of its kind, unless a large amount of good water is available at a reasonable price. If located on a large river or lake where soft water can be pumped under low head to all parts of the plant, water conditions may become ideal, the expense remaining at its minimum.

Manufacturing districts are constantly increasing and demanding larger quantities of surface water. City supplies have to be resorted to in a greater degree than formerly and the annual expense for water may amount to several thousand dollars. Confronted by such conditions the mill operator often decides to look for an underground supply. It is our purpose to furnish certain preliminary data that may have been and may be used in such connection.

Underground waters are usually harder than those found on the surface. This has always been to their disadvantage for boiler use and generally for technical use as well. However, many wells driven in granite and related rocks afford very soft water. Aside from the disadvantage of hardness, well waters usually possess many advantages. They are free from mud and suspended vegetable matter and are usually uniform in quality and are safer for drinking purposes. For moderate depths, well waters are cooler than surface waters on the average throughout the year, and of still greater importance, their temperature is remarkably uniform. The annual cost of pumping from a good well is low especially with a large boiler plant.

Water from expensive wells may be useless for any purpose. Calcium, magnesium, sodium and iron salts and hydrogen sulphide are all disadvantgeous to the manufacturer. If heavily charged minerally the well is usually discarded.

It is not always necessary to drill a very deep well to get a considerable quantity of water. Many manufacturing concerns with which we are acquainted are getting ample supply of very good water from depths varying between 60 and 500 ft. It has been our experience that wells of less depth than the minimum mentioned are liable to surface contamination. In any event the preparation in connection with drilling a deep well should include a report by a competent economic geologist who must be familiar with existing strata as they are usually found in the locality and must acquaint himself with well records or other information that will be useful in connection with the proposed enterprise. The drilling of a well must be taken up with a thorough understanding that the matter is a business venture with a possible total loss of capital employed.

If a favorable report from the disinterested man is made the question of the kind of well to be drilled, its location on the property and related preliminary matter must be taken up with a practical well drilling concern.

Four general types of well drilling are as follows: (1) Bit; (2) diamond drill; (3) steel shot; (4) jet.

The anticipated strata will in large measure fix the type to be selected. This is largely a matter to be left with the well driller. It should be remembered that the larger the diameter the greater the reservoir for water in case of emergency.

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*A paper by W. M. Booth, Syracuse, N. Y., presented to the American Institute of Chemical Engineers, June, 1910.

Having begun drilling operations a contract should be made with a competent chemist who should test the water found both in reference to quality and quantity while a record should be made of the exact depth under the surface at which the vein occurs. It is of great scientific advantage to retain a record of any well. This can be done by the chemist or by the geologist if samples of the broken rock or other material are saved in small bottles.

If the water in quantity or quality is found to be insufficient the casing should be driven by these points and other sources looked for at a greater depth in a new drill hole in other parts of the property. When a sufficient supply has been obtained this should be analyzed from a chemical and sanitary standpoint. In the meantime the driller should not remove his tools. If the quality of the water is sufficient for use its quantity must then be ascertained. If near the surface or containing sand a centrifugal pump may be employed, while if the distance to the water is considerable an air lift may be used temporarily at least. Should the water be found either insufficient or of bad quality, the casing should be driven by this point and further investigations made.

Underground water formerly considered useless for boiler purposes is now successfully treated chemically. If a public supply costs 7 cts. per 1,000 gals., moderately hard well water can be treated and furnished less expensively including depreciation of plant.

While the quality of surface water may vary from hour to hour, underground waters are usually very constant and are thus ideal for softening processes. With the same chemical supply for months and with large variations in the quantity of water used from a well 130 ft. deep at Canajoharie, N. Y., the softened water has contained the following amount of calcium and magnesium oxides:

	Parts per Million.			
	Sept.,	Sept.,	Oct..	May,
Raw.	10, '09.	30,' 09.	10, '09.	25, '10.
CaO 141.........	13	17.4	19	10.4
MgO 27.........	17	9.4	16	14.5

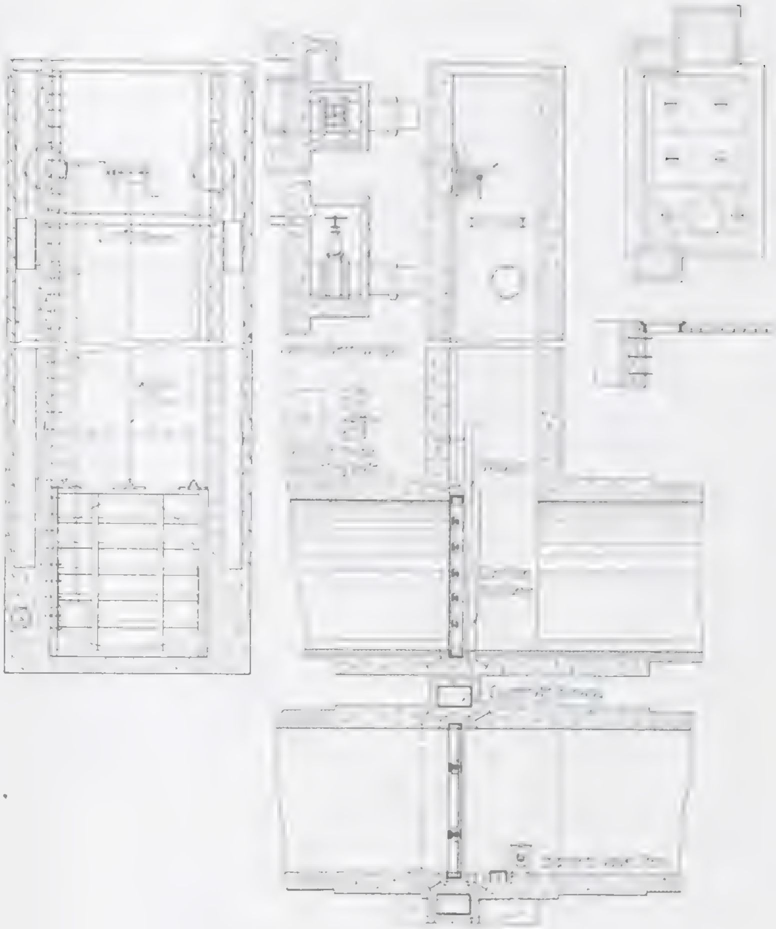

Fig. 8.—Details of Gate Shaft and Gate Construction.

The cost of softening this water is 1.2 cts. per 1,000 gals. We present the analysis of a very hard water applied to domestic use.

	Grains per gal.
Calcium carbonates	12.86
Carbonate of magnesium....................	.00
[illegible]	[illegible]
Magnesium sulphate	38.60

The cost of softening this water is 19 cts. per 1,000 gals.

Water containing above 10 grains of lime and magnesium carbonates and 40 grains of gypsum is about the limit for the lime soda softening process when the water is used in boilers.

Cost of Drilling.—In this particular we have the following from a prominent well drilling concern:

[illegible] offhand that will be more than approximate cost of drilling wells. The character of the formation, the size and depth of the hole, skill of operators, cost of labor and fuel, etc., all enter into the problem. Current contract prices for this work vary from 75 cents to $20.00 per foot. A fair average for shallow wells (up to say 400 feet deep), including casing when needed, would perhaps be about $1.50 per foot for a hole not exceeding [illegible] 2,000 feet deep and an 8-in. hole the cost would probably run from $2.00 to $5.00 per foot. Above 2,000 feet from $5.00 up. These prices contemplate average conditions. When exceptionally hard rock or deep pockets of quicksand are to be entered, the expense would be increased and the rapidity of the work would be decreased. As an illustration of the effect of varying conditions, we have records of 6 inches per hour in hard granite and 20 feet per hour in soft formations made by the same machine, and both considered satisfactory progress under the conditions confronted.

[illegible] gallons of water 50 vertical feet during 10 hours requires a theoretical consumption of 2.25 HP., pumped by steam this is increased to about 6.3 HP. If power can be furnished at $50 per horsepower year of 312 days, the annual cost of raising this water will be $315 or about $1 per day.

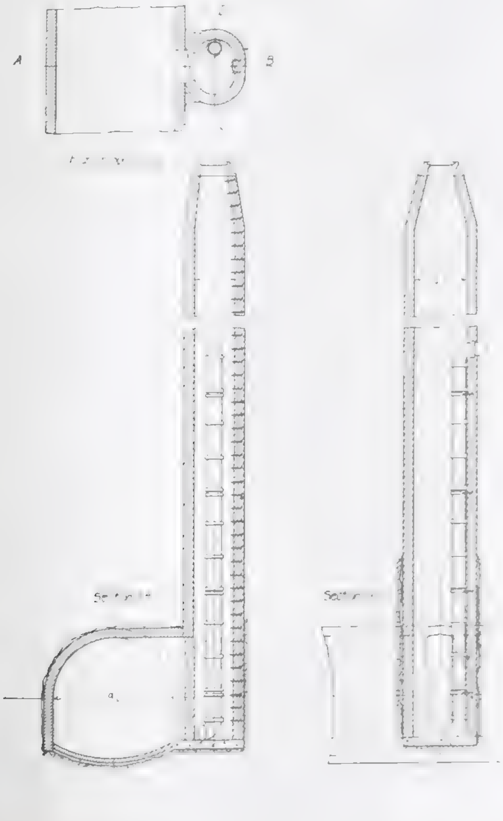

Fig. 7.—Details of Drop Manhole.

Some Costs of Small Sewer Work by Day Labor in Baltimore, Md.

The following data on the cost of small sewer jobs have been rearranged from the Annual Report for 1909 of B. T. Fendall, City Engineer, Baltimore, Md. The construction was done by the department under the direction of Mr. Newton M. Gray, Assistant City Engineer. The records are of interest among other reasons because they include all expenses incidental to the work, such as restoring pavement and sidewalks, making changes in adjacent underground structures, and maintaining plant.

Eastern Ave. Sewer.—This sewer was 1,939.3 ft. long of double strength terra cotta pipe of the following dimensions:

Size, inches.	Length, feet.
24	333.78
33	400.89
36	1,204.63
Total	1,939.30

The appurtenant work included 9 inlets connected to 8 manholes, built to the surface of the street and to 1 manhole covered over with a cement slab 6 ft. below the street surface, and 2 manholes, with openings for inlet connections, built to the surface of the street. There were placed one 18-in. pipe connection with a manhole and one 24-in. pipe connection for a future lateral.

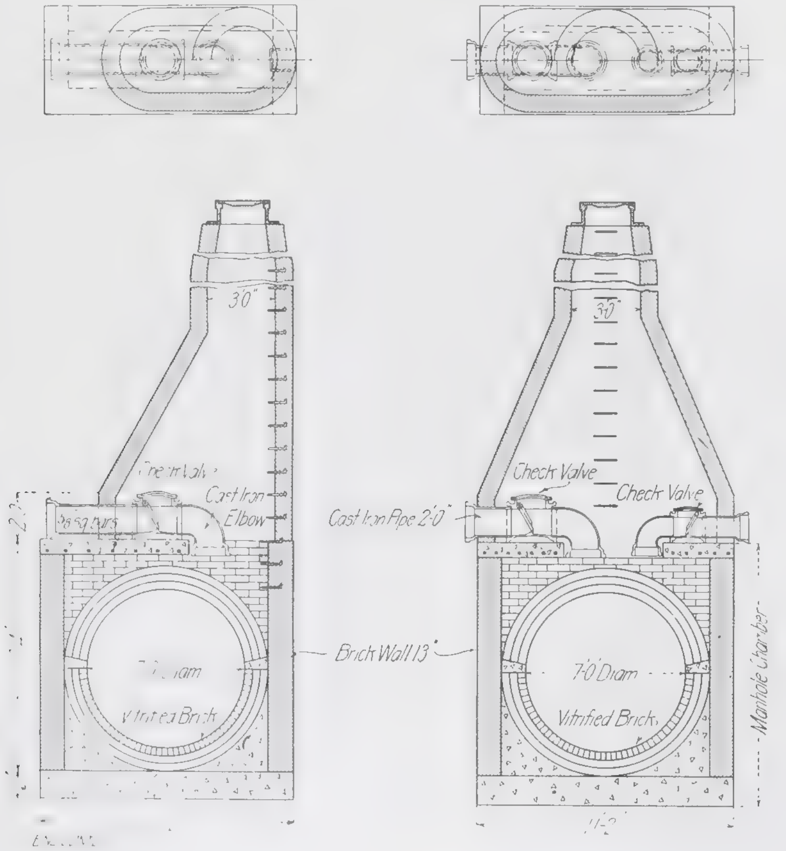

Fig. 9.—Details of Manholes for Brick Sewers.

A length of 650 ft. of trenching had to be done in the line of one track of a street railway with all traffic diverted to the other track. A Carson overhead cable system was used in the excavation of 513 ft. of trench from 13 to 16.7 ft. deep. The remaining trench averaged 10 ft. in depth. As the material trenched was all filled in material and since large gas and water mains paralleled the sewer the trench had to be closely timbered its entire length. All the sheeting was left in place which increased the cost of excavation. The lumber used in that part of the work done by machine cost 35 cts. per cu. yd. of excavation, while the average cost of lumber distributed over the entire length of sewer was 22 cts. per cu. yd. of excavation.

Work was begun March 15 and completed Sept. 18, 1909, and the cost was as follows:

2,928.8 cu. yds. hand exc., inc. timb. and backfill, at $1.1937	$ 3,496.23
1,624 cu. yds. mach. exc., inc. timb. and backfill, at $1.459	2,370.15
1,186.25 lin. ft. 36-in. pipe at $2.7294	3,237.85
395 lin. ft. 33-in. pipe at $2.4132	953.23
326 lin. ft. 24-in. pipe at $0.8526	277.95
Laying 1,204.63 ft. 36-in. pipe at $0.3579	431.21
Laying 400.89 ft. 33-in. pipe at $0.3246	130.13
Laying 333.78 ft. 24-in. pipe at $0.2388	79.72
Inlets, manholes, etc	2,498.57
Foreman	632.00
Watchman	126.96
Assistance in survey	2.50
Digging test holes	14.16
Inspection steam boiler	5.00
Cons. and maint. drains and dams	80.31
Receiving and inspecting pipe	22.18
Pumping	21.99
Hauling 36-in. pipe on sewer	20.95
Digging pits for anchorage cables	20.20
Erecting and dismantling cableway	161.11
Cutting opening in arch of receiving sewer	33.91
Removing old stone culvert on line	6.67
Removing dams and cleaning sewer	12.04
Labor moving machinery to yard	9.76
Hauling cableway from and to yard	84.00
Sending to yard for tools, etc	27.51
Riprapping cobblestone pavement over trench	67.18
Blacksmithing done at yard	12.39
Resurfacing street railway track	21.05
Removing electric light poles	15.17
Laying water service pipe	2.92
Hardware, oils, etc	88.38
Engine supplies	3.06
Repairing water supply pipe	15.70
Lumber for repairs	2.80
Total	$14,987.94

In the total given by the report there are charged to this sewer some $82.72 for materials purchased and not used. As these materials were hauled to the sewer department yards for use on future work we have not included them in the cost. Dividing the total length of 1,939.3 ft. of sewer into the total cost we get a cost of $7.73 per lin. ft.

Race St. Sewer and Laterals.—An open section of 141.5 ft. of the Race St. sewer was covered with reinforced concrete slabs 12 ins. thick and 11 ft. span after repairing the old rubble side walls and raising them 2 ft. by concrete walls on top. To this sewer there were constructed a 36-in. pipe lateral 306.44 ft. long, a 36-in. pipe lateral 347.11 ft. long and a 24-in. pipe 187.36 ft. further, and a 24-in. pipe lateral 143 ft. long. There were 7 inlets constructed. Work was begun May 11 and finished Oct. 26, 1909. The cost of the work was as follows:

662 cu. yds. exc., inc. timb. and backfill, at $1.254	$ 830.17
597.5 lin. ft. 36-in. pipe at $2.7244	1,627.83
349 lin. ft. 24-in. pipe at $0.8526	297.56
52 lin. ft. 20-in. pipe at $0.5978	31.09
16 lin. ft. 15-in. pipe at $0.32826	5.25
Laying 615.97 ft. 36-in. pipe at $0.34646	213.42
Laying 330.36 ft. 24-in. pipe at $0.1843	60.89
Tearing out in places and rebuilding stone side walls:	
Labor	113.73
Material	48.38
52.4 cu. yds. concrete sidewalk at $3.1465	164.88
70.2 cu. yds. concrete slabs at $10.0292	704.05
Inlets, etc.	1,063.54
Foreman	347.50
Watchman	202.00
Assistance on survey	3.33
Digging test holes	10.00
Making forms:	
Labor	129.20
Materials	154.86
Removing old wooden bridge	43.55
Moving tools to job	3.54
Constructing cofferdam	13.34
Rebuilding temporarily one-half wooden bridge	8.33
Filling in alongside concrete slab covers	25.84
Cleaning gasoline engine and mixer	18.25
Receiving and inspecting pipe	5.08
Pumping	10.83
Laying water supply pipe	6.67
Blacksmithing at yard	9.34
Repairing 137.65 sq. ft. am. pavt. at 14½ cts.	19.96
Rubber boots	26.61
Hardware	31.13
Coal, oil and gasoline	17.56
Hauling	56.00
Repairs to gasoline engine	15.63
Raising meters and tapping water mains	44.34
Clay	0.75
5 lin. ft. 36-in. pipe broken	13.62
5 lin. ft. 36-in. pipe taken from other work	4.09
Total	$6,382.14

In the report a total of $151.37 for materials purchased but not used is charged against the work. This amount is not included in the above total.

Monroe St. Sewer.—This work involved the construction of 1,059.72 ft. of pipe sewer divided as follows:

Size, inches.	Length, feet.
15	130.61
18	226.57
24	370.35
30	332.19
Total	1,059.72

There were six inlets and two 15-in. connections built. The cost of the work was as follows:

1,112 cu. yds. exc., inc. timb. and backfill, at $1.0814	$1,202.54
320 lin. ft. 30-in. pipe at $1.8914	605.25
358 lin. ft. 24-in. pipe at $0.85258	305.22
210 lin. ft. 18-in. pipe at $0.4263	89.53
126 lin. ft. 15-in. pipe at $0.32828	41.37
Laying 328.19 ft. 30-in. pipe at $0.30917	101.47
Laying 364.15 ft. 24-in. pipe at $0.17522	63.81
Laying 212.39 ft. 18-in. pipe at $0.13498	28.67
Laying 126.61 ft. 15-in. pipe at $0.11965	15.15
Inlets, etc.	1,090.91
Foreman	280.00
Watchman	19.34
Building Shelter Houses:	
Labor	6.67
Lumber	32.28
Digging test holes	20.42
Receiving and inspecting pipe	2.08
Cleaning mixer at yard	1.67
Sending to yard for tools	3.75
Moving shelter house and tools	6.76
Hardware	46.76
Blacksmithing at yard	3.78
Gum boots	14.22
Hauling	30.25
Repairing water supply pipe	2.27
Riprapping cobblestones over trench	84.95
6,165 sq. ft. paving at $0.05104	314.72
Labor on old inlets	30.33
Total	$4,444.17

In the report a total of $72.89 for material purchased but not used was charged to the work. This amount is not included in the above figures.

Hollins St. Sewer.—This work consisted of extending an 18-in. pipe sewer 232 lin. ft. and constructing 1 manhole and 1 inlet. The cost was as follows:

129 cu. yds. exc., inc. timb. and backfill, at $0.644	$ 83.08
224 lin. ft. 18-in. pipe at $0.4262	95.49
Laying 232 ft. 18-in. pipe at $0.15163	35.18
Inlet and manholes	176.87
Foreman	50.00
Watchman	3.17
Oil and sharpening tools	2.76
1,370 sq. ft. repaving at $0.04489	61.50

2 lin. ft. 18 in. pipe broken	[illegible]
6 lin. ft. 18-in. pipe brought from other work	2.56
Total	[illegible]

This gives a cost per lin. ft. of completed sewer including manhole and inlet of $2.19.

Seventh St. Sewer.—This work included 220.80 ft. of 15-in. pipe and 169.84 ft. of 18-in. pipe sewer, 3 inlets and 2 manholes. The excavation was loose rotten rock. The work cost as follows:

177 cu. yds. exc., inc. timb. and backfill, at $1.3577	$ 240.32
149 lin. ft. 18-in. pipe at $0.4279	63.76
248 lin. ft. 15-in. pipe at $0.3283	81.42
Laying 156.5 ft. 18-in. pipe at $0.16408	25.68
Laying 213.83 ft. 15-in. pipe at $0.11509	24.61
Inlets and manholes	439.60
Foreman	108.00
Watchman	5.83
Assistance on survey	0.42
Digging test holes	5.00
Receiving and inspecting pipe	1.67
Repairing cement walk	9.96
Restoring brick walk	8.10
Hardware, oil, etc	1.52
Repairing bitulithic pavement	447.64
Hauling	2.50
2 ft. 15-in. pipe broken	0.66
2 ft. 15-in. pipe brought from other work	0.66
8 ft. 18-in. pipe brought from other work	3.41
Total	$1,468.36

This gives an average cost for the two sizes of sewer of $3.76 per lin. ft.

Lateral Sewer in Slingluff Ave.—This sewer consists of a 15-in. pipe for a distance of 23.5 ft., and of an 18-in. pipe for a distance of 168 ft.; a total length of 403.5 ft.

One inlet and two side inlets and also three manholes were constructed on the line of the sewer. The covers of the two side inlets were made of sand and cement, reinforced—the smaller one with expanded metal and the larger one with ⅞-in. round steel rods. Work was commenced Oct. 19 and completed Dec. 16, 1909. The cost of the work was as follows:

Exc., inc. timb., backfill, etc., 209 cu. yds., at $1.1152	$ 233.09
166 lin. ft. 18-in. pipe at $0.4262	70.76
248 lin. ft. 15-in. pipe at $0.3283	81.42
Laying 164 lin. ft. 18-in. pipe at $0.15835	25.97
Laying 227.3 lin. ft. 15-in. pipe at $0.10545	23.97
Inlets, connecting chambers and manholes	381.19
Foreman	140.00
Watchman	9.08
Assistance on survey	.41
Digging test holes	1.67
Repairing cement walks	15.85
Repairing bitulithic pavement (contract)	24.42
Sharpening tools, etc	.91
Oil, etc.	1.52
Hauling	7.50
Total cost of work	$1,017.76

Drains at University Parkway and Wickford Road.—These drains, consist of a 36-in. terra-cotta pipe and a 3-ft. x 2½-ft. concrete sewer, 27 ft. long. The work involved the construction of one inlet at the west end of the 36-in. pipe. Work was commenced on Aug. 17 and completed Sept. 28, 1909. The cost was as follows:

Exc., incl. timb. and backfill, 537 cu. yds. at $0.85	$ 456.45
490 lin. ft. 36-in. pipe at $2.7244	1,334.95
Laying pipe, including cement, sand, etc., 498.5 lin. ft., at $0.3845	191.67
Engineering	324.78
Foreman	167.00
Inlets, connecting chambers and manholes	213.58
Forms for 3x2½-ft. concrete sewer, 27 lin. ft.	80.00
Concrete [illegible] at $4.967	[illegible]
Hardware, lumber, hauling, etc.	76.16
Incidentals [illegible] etc.	[illegible]
Total cost of work	$3,074.92

Sewer in Clifton Park.—This sewer consists of a 4x4-ft. concrete section, 105 ft. long, with vitrified brick invert joining the existing 6-ft. stone arch culvert under Washington St.—508 ft. of 36-in. pipe, 196.5 ft. of 30-in pipe, 237.5 ft. of 27-in. pipe and 376 ft. of 24-in. pipe, which, with connections, have a total length of 1,433 ft. Connection is made at the west end of this sewer with the 20-in. pipe sewer. Manholes, with openings on either side for future lateral connections, were built at the junctions of the 36-in and 30-in., the 30-in. and 27-in., and the 27-in. and 24-in. pipes. A brick shaft, with a drop of 8 ft., was built on the line of the 24-in. pipe. An inlet of special design was built at the junction of the 4x4-ft. concrete section with the 36-in. pipe. Work was commenced Sept. 28, and, with exception of a few minor details, completed Dec. 27, 1909. The cost was as follows:

Exc., inc. timb. and backfill, 961.65 cu. yds., at [illegible]	$ [illegible]
497½ lin. ft. 36-in. pipe, at $2.7244	1,355.39
192½ lin. ft. 30-in. pipe, at $1.8914	364.09
232½ lin. ft. 27-in. pipe, at $1.4308	332.66
376 lin. ft. 24-in. pipe, at $0.8526	320.58
Laying 36-in. pipe, inc. cement, sand, etc., 508 lin. ft. at $0.24	121.92
Laying 30-in. pipe, inc. cement, sand, etc., 196½ lin. ft. at $0.22	43.23
Laying 27-in. pipe, inc. cement, sand, etc., 237½ lin. ft. at $0.21	49.88
Laying 24-in. pipe, inc. cement, sand, etc., 376 lin. ft. at $0.21	78.96
4-ft. × 4-ft. concrete sewer, 105 lin. ft. = 64 cu. yds., at $6.96	445.44
Vitrified brick invert in concrete section, 47 sq. yds., at $2.48	116.56
Building and setting forms for concrete section—material and labor	173.98
Inlets, manholes and connection chambers, material and labor	444.90
Building dams, temporary ditching and pumping	100.15
Foreman	342.00
Engineering	[illegible]
Hardware, tools and hauling	87.58
Material on hand Dec. 27, 1909—terra cotta drain pipe, cement, brick, drip stone, etc.	124.09
Incidentals—watching, moving tools, cleaning up, etc	126.16
Cost of work to Dec. 27, 1909	$5,666.91

Sewer in Cedar Ave.—This sewer, consisting of a 20-in. double-strength terra-cotta pipe, extends in the east sidewalk of Cedar Ave., from Bey St. to Viaduct Ave., and thence in Viaduct Ave. to the north abutment of the viaduct over Stony Run. The sewer there turns to the east, and through the wing wall of the abutment, where it enters a brick shaft, and is then carried down the steep slope at this point by a series of three shafts, with pipe connections between them, the total drop being 38 ft. in a length of 30 ft. to a point just under the tracks of the Maryland and Pennsylvania R. R., from which point it continues by a straight line and grade to the nearest point on Stony Run; total length, 1,130 ft.

The excavation in which the shafts are built is in the rock slope just adjoining the railroad, making this portion of the work expensive and slow. A branch line, consisting of a 15-in. double-strength terra-cotta pipe, 140 ft. long, was laid to catch the drainage [illegible] at the north side of the park property. Inlets were constructed at the north end of the 15-in. pipe described above on the east and west sides of Cedar Ave., near the intersection of Viaduct Ave., and an inlet connection on the east side of Viaduct Ave. just north of the viaduct. Work was begun Oct. 16, 1909, and is finished with the exception of two of the brick shafts referred to and the outfall pipe from the railroad to Stony Run. The costs has been as follows:

[illegible]	[illegible]
[illegible] including timbering, explosives, etc., [illegible]	[illegible]
[illegible]	[illegible]
144 lin. ft. [illegible]	[illegible]
[illegible]	[illegible]
Laying [illegible] sand, etc., 930 lin. ft. at $0.22	204.60
Laying [illegible] sand, etc., 138 lin. ft. at $0.16	22.08
[illegible] material	[illegible]
[illegible]	[illegible]
Inlets, manholes, connection chambers and shafts	832.93
Foreman	326.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] shanty, clearing railroad track, testing pipe, dressing tools and hauling	54.00
Value of material—cast-iron pipe, cement, sand, brick, terra cotta pipe and castings—on hand Jan. 1, 1910	219.63
Total cost of work	$4,028.60

Pipe in Alley.—This sewer, consisting of a 12-in. terra-cotta pipe, connects with the existing 15-in. pipe sewer and extends in the alley for a distance of 189 ft. One manhole and three inlets with 12-in. pipe connections were constructed along the line of this sewer; also, seventeen 6-in. x12-in. Y-connections were made with it for the purpose of connecting up the waste-water pipes and rain-spouts from the abutting properties, which formerly emptied on the surface of the alley. Work was commenced June 22 and completed July 22, 1909. The cost was as follows:

[illegible] brick, inlet and manhole castings, hard[illegible]	[illegible]
Labor, including brick masonry, pipe laying, excavating, refilling, etc	270.04
Engineering expenses	38.71
Water department—changing location of water pipes	14.81
Total cost of work	$470.79

[illegible] consisting of a 20-in. terra-cotta pipe, extends westerly in Canton Ave. for a distance of 400 ft. A brick chamber, 5 ft. long, with a manhole, was built at the end of the 20-in. pipe sewer, with a 12-in. pipe connection for the inlet built at the southwest corner and an 18-in. pipe connection for the two inlets built at the northwest corner of Luzerne [illegible] and finished Oct. 16, 1909. The cost was as [illegible]

Labor, including excavation, pipe laying, brick masonry, refilling, etc	$ 929.89
[illegible]	[illegible]
[illegible]	[illegible]
Hardware, hauling, etc	15.73
[illegible]	[illegible]
[illegible]	[illegible]

GENERAL ARTICLES AND CLASSIFIED ITEMS

The Necessity for Standardizing Contracts of the City of New York.

One of your members, with whom I was associated in the early years of Consolidation under the first charter of Greater New York, has suggested that notes from the viewpoint of a municipal engineer on the broad subject of No. 10 of your program, relating to "standardizing specifications for public works and improvements," might be of interest.

Looking at the broad proposition in which we are interested, we can, I believe, safely assume that a sane and safe contract should [illegible]

(1) That a clear definition of all work and materials to be furnished by the bidder be carried consistently throughout the invitation to bidders, the form of contract, the bond and [illegible]

[illegible] price contract a clear distinction between all [illegible] to be paid for as classified under unit item bids and such uncertain and contingent work of miscellaneous nature as is to be supplied by the bidder without direct compensation, being carried or floated over the other item prices. To illustrate, sheeting and excavation in a sewer trench where a price is taken only for a sewer complete per linear foot, including all incidentals, is in the second class, i. e., items not directly bid for.

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*A paper by R. Walter [illegible], Engineer of Public Works, Borough of Brooklyn, read before the National Association of Comptrollers and Accounting Officers.

(3) That provision be made by which extra work, unknown as to character or extent at the time a contract is made, may be ordered and paid for under such stipulations and reasonable control as may be just to both parties. This applies especially to public works of magnitude, where subsurface conditions and extent of foundation have not been fully exploited. In street work, or work of a simple character, the provision for such extras may be omitted.

(4) That the contract should embody a clearly expressed provision for a uniform and fair valuation of all classes of work and materials to be paid for in partial or monthly payments, so as to protect the city from unbalanced bids and the necessity for financing a contractor to an unfair extent during the progress of the work where he has so adjusted his bid as to call for a large allowance on the first items of work to be done.

(5) That a determination of the most favorable bid cannot be made on a unit price contract by taking only the gross sum without comparison of the prices of all the items, and figuring interest thereon, as compared with the interest to be carried by the city on the monthly allowances called for by payments of a balanced bid. In public works of magnitude, extending over several years, this question of the extent to which the city shall finance contractors is of great importance.

(6) That aside from this feature, unbalanced bids may operate to the disadvantage of the city in the event of variation in quantities anticipated and given in the engineer's preliminary estimate. The basis for this axiom in The City of New York may perhaps be given in the case of Nelson vs. The Mayor, where unbalanced bids and subsequent increases in quantities bid for at high prices and omissions in quantities bid for at low prices constituted in the decision of the courts sufficient evidence of collusion and rendered the contract void.

(7) Where alternate methods of construction or substitution of materials are allowed under the contract, and where only one price has been established for each general classification of such work and material, the option in every case for the selection of the satisfactory alternate method of construction or character of material to be substituted must be vested directly with the bidder, not only in the interest of economy, as better competition is so invited, but because otherwise we have "a specification which does not specify," affording a broad opportunity for the annulment of the contract by a taxpayer's action, as in the well-known bridge case of Gage vs. The Mayor, City of New York.

As financial officers of great cities and institutions, your association may be especially interested in an administration bill recently approved by the Board of Estimate as a step toward some of the ideal conditions which I have crudely summarized under these seven headings. This administration bill revising the charter provides that in every contract there may be inserted a provision defining what is "additional" work and what is "extra" work, questions which have led to much confusion throughout the city. The difference between these terms is defined by stating that the work performed under a contract based upon estimated quantities and payable at unit prices in excess of such estimated quantities shall be deemed additional work, and that work done in connection with a contract and not specifically covered thereby, which is not additional work as herein defined, shall be deemed extra work. To meet extreme conditions under the old form of bidding the bill provides that, if additional work be required for completing the contract to an extent in excess of 5 per centum as provided of the estimated quantity of said item bid upon or should extra work be required for the completing of the contract, the work in question may be done under a supplemental contract entered into without public letting by the Board of Estimate and Apportionment acting on behalf of the city after the receipt and filling of an itemized report from the head of the department stating the reasons therefor and the estimated costs thereof.

The bill also provides a standard of procedure in the use of Percentage Unit Bidding, presented by the writer to the Board of Estimate in 1905 but subsequently used only in the Borough of Brooklyn. This provision reads as follows:

> In contracts for work and materials, however, where bids are invited according to the percentage unit bid plan where the borough president or head of department has established a fair and reasonable unit value for each class of work and materials required and the contractor has bid a certain single percentage applying to all such unit items of the contract and provided that such additional work and materials be actually required to properly complete the general work specified and that such work be ordered in advance in writing by the borough president or head of department and a copy of said order be immediately filed with the comptroller of the City of New York, the work and materials may be increased.

I invite your attention to this plan of bidding, which is largely used abroad as an excellent plan where the engineer is able to balance values for the unit items advertised, and as a specialist on the work it is believed that he generally can balance these values and certainly can be trusted to do so better than the average bidder for city works. Even under an ideal condition, when no variation in quantities is shown in the final certificate of acceptance issued by the engineer, Percentage Unit Bidding has this important function: It has served to definitely establish in advance of the receipt of proposals a basis on which the contractor is to be financed by the city during the progress of construction, because the engineer's estimate, both of quantity and unit value, has been known and published as the 100 per cent basis on which the single percentages submitted by each bidder is applied throughout the progress payments and on final acceptance of the work. Furthermore, in the event of variation in quantities, as in change in foundations and increase or decrease in quantities of shoring and bracing of a trench, or for many other reasons constantly causing changes in quantities, both the city and the contractor are protected to the extent of the engineer's ability to apportion his profit uniformly over the items which may have been varied as to quantity up to the time of the completion of the works.

The bill also provides that interest at the rate of 4½ per cent shall be paid on any estimate properly verified and recorded in the Department of Finance more than thirty days, and that on large assessable improvement contracts, exceeding a quarter of a million dollars, the contractor may receive 90 per cent of the amounts earned, instead of only 70 per cent, after such time as the retained percentage equals $75,000.

It is hoped that these provisions of the administration bill may soon be incorporated in all important departmental city contracts and that the strong trend toward standardization will extend also to the great commissions and boards of the city of New York where the works about to be undertaken will amount to several hundred millions of dollars.

And speaking even more informally, I would say that nothing illustrates plentitude in the popular mind better than the full barrel. The American city as a rule has a full treasury barrel. The financial officer may be at the controlling faucet, directed when to open and shut off by the charter, by the legal officer and the engineer, but the time-worn barrel, filled by the annual increment of millions from taxation, is leaking at many seams. Much caulking of these leaks can be done by the legal and engineering experts if they could be made to work intelligently together until the treasury be safeguarded against legal and engineering leaks and open opportunity for those infrequent frauds which occur. Most costly to the city, however, are the leaks due to inefficiency and lack of co-operation of city officials entrusted with the task of laying out public works and preparing these forms of contracts and specifications, and the efficiency of the financial officer would be greatly increased and his duties simplified and litigation avoided if proper contracts only were advertised, telling the bidders exactly what they were to do, providing clear means for getting it done, and for paying promptly for it when it is done.

A great deal can be done by you gentlemen if you have control over the legal officers of your municipalities to such an extent that they and the engineer will work together, and I do not think that they should use the scissors on the old forms and patch up new contracts for new sorts of work. They should approach this thing and go into exactly what is to be done and describe clearly, concisely and very carefully all the points. Now, on the one point of abandoned asphalt maintenance in New York city, the trouble is that in the old form of contract (also in use today), the contractor was required to make repairs within forty-eight hours of the service of a certain notice by the head of the department stating that such asphalt pavement surfaces were worn and defective. Now, just a change of a few words would have put the burden of continual maintenance squarely on the contractors, where it belonged in all honor and fairness, and the city would not be put to the trouble of showing why the notices were not served in all cases. I have detailed knowledge of very many cases where the city has been trimmed in the aggregate millions of dollars both through the looseness of the contract forms and the laxity of interpretation of the contracts. The corporation counsel has also given the authorities many kinds of opinions based on the same form of contract, and I speak knowingly and of specific cases. In one case he has told a department to go on with additional work, to the amount of a 30 per cent increase over the contract amount, where he has been told that the price for this particular item of the work was two and a half times what it was worth; in another case, on precisely the same form of contract, the department had stated that, while the price was one-third too high, the work was imperative and was already done, but the corporation counsel determined that the work could not be paid for and that the contractor must sue. We have accumulated a remarkable assortment of opinions of the corporation counsel showing such vagaries of the legal mind, and the debits of the city written off on such account have been enormous, and these incompetent opinions should be charged up to the individuals who wrote them, and right here in New York we should hereafter be able to stop these great leaks in the city treasury by a competent analysis of city contract forms by able corporation lawyers and experienced engineer officers of the city, and standardize all legal and engineering terms, and be hereafter able to successfully resist a very great proportion of contract litigation as now attempted against the city, and proceed with the municipal business on a carefully established and rational basis throughout.

The "approval as to form" of New York city contracts required by the charter, as given for many years, has been a farce and the interpretation of the contracts most confusing, and it would seem that the authorities of other cities might take a lesson and standardize the working forces as a first step toward standardizing the contracts.

Methods and Cost of Loading Rail from Roadbed to Cars.

BY D. A. WALLACE.

(1) The rail was lying on the shoulder of the grade, just as it had been thrown out from the track and disconnected. One pair of angle bars was fastened to each rail by two bolts. Two men with lining bars kept the rails straightened out on the flat car as they were loaded. The train was followed by two men who picked up any loose scrap that might have been left behind. A work train and a gang of 40 men were used; the

labor was negro, at $1.25 per day, and foreman at $60 per month. A total of 429 rails was loaded in 3 hrs. 2 mins. at the following cost:

Train service	$25.00
Labor	20.00
Foreman	0.66
Total	$45.66

This gives in round figures a cost of 10 cts. per rail loaded. The work was costly, due to the fact that the banks were very narrow, permitting the rail in many instances to slip down to the bottom of the fill. The work was also hindered by a growth of high weeds.

(2) The rail was disconnected with angle bars lying alongside. One man loaded the angle bars and scrap bolts on the rear car; 2 men with lining bars kept the rail straightened on the flat car as it was being loaded; 11 men loaded the rail on one side of the car until half the load was placed, then the train was backed up while the other side of the car was loaded. The rail was 56-lb. rail left lying along the shoulder; 6 flat cars with a capacity of 100 rails each were loaded. A total of 800 rails was loaded at the following cost:

Train service	$25.00
Labor	20.00
Total	$45.00

This gives a cost of 5.6 cts. per rail or of $19.71 per mile of track. This same crew loaded and unloaded 400 rails with the same shipment. In unloading the rail two greased rails were used as skids. Six men were on the car to start the rails, and 8 men were on the ground to straighten them up in piles. The cost of the work was 11.3 cts. per rail or $39.77 per mile of track.

(3) The rails were lying on the shoulder of the grade, disconnected, as taken from the track. A force of 22 men, 18 per rail, and 4 on the car, loaded 160 58-lb. rails in 2 hrs. 45 mins. Negro labor at $1.20 per day and foreman at $60 per month were worked. The cost was as follows

Train service	$5.53
Labor	5.12
Total	$10.65

This gives a cost of 6.6 cts. per rail or of $20.25 per mile of track.

(4) A gang of 24 men loaded rails into end of gondola car from pile 15 ft. from the track; 16 men to a rail and 8 men on the car. A total of 100 rails were loaded in 1 hour 40 mins. or 1 rail per minute. Negro labor at $1.25 per day and foreman at $60 per month were worked. It cost to load the 100 rails $5.30 or 5.3 cts. per rail.

Methods and Costs of Tracklaying with a Harris Tracklaying Machine.

BY D. A. WALLACE.

The work was done by contract in June, 1907, on the Frisco line in Louisiana. The record is a poor one, due to faulty working organization. The average day's work was 6,000 ft., full teed, bolted and spiked. Work was greatly delayed on account of poor handling of material in material yard. A 35-mile run was necessary for the night crew to bring the angle bars and spikes to the front for the next day's work.

The outfit equipped for each half-day's work consisted of a pioneer car, 5 flat cars loaded with 300 ties each and 2 flat cars loaded with 90 rails each.

Two train crews were used. The day crew came on duty at 6 a. m. and was released at 6 p. m. by the night crew, which had had supper when the day crew returned with the gang from the front. The night crew then ran to Eunice, 15 miles, filled up the tank car, left flat cars spotted for loading ties and rails and ran to Opelousas, 20 miles further, for angle bars and spikes, returning to camp with train made up for first half-day's work at 6 a. m. The day crew returned to camp at 12 noon for dinner, getting back to the front at 1 p. m. During the noon hour the night crew switched out the empty tie and rail cars and picked up the loaded tie and rail cars ready for the afternoon's tracklaying. Lining gang handled the back switch work. An improvement in the Bridle rods used can save sufficient time to permit an increase of 1,000 ft. per day of track laid. In other words the cost per mile of track would be reduced to $166.

The force itemized in the following table was needed to lay 6,000 ft. of track. This force may be reduced to 90 men by wolf bolting and spiking the track, the track work being done on days when there is delay to the material. The gang required was as follows:

Item	Per day
1 general foreman at $150 per mo	
1 timekeeper at $75 per mo	
1 commissary clerk at $90 per mo	
Total	$10.50
Front Gang	
1 straw boss at $2.25	$2.25
1 rope man at $1.75	1.75
1 chain and puddle man at $1.75	1.75
18 men (9 on a side) at $2	36.00
1 spike puller at $2	2.00
1 bolt puller at $2	2.00
23 men. Total	$45.75
Machine Gang.	
1 foreman and board at $3	$3.00
1 rail feeder at $2	2.00
1 angle bar man at $2	2.00
2 rail pullers at $2	4.00
4 tie buggy men at $2	8.00
6 laborers (3 on side) at $2	12.00
15 men. Total	$31.00
Ground Gang.	
1 foreman and board at $3	$3.00
1 bolt puller at $1.75	1.75
1 spike puller at $1.75	1.75
2 bridle rod men at $1.75	3.50
2 wrench men at $1.75	3.50
2 jack men at $2	4.00
8 tie spacers at $1.75	14.00
6 gage men at $1.75	10.50
1 maul man at $1.75	1.75
1 bar man at $1.75	1.75
16 spikers at $2	32.00
8 nippers at $1.75	14.00
2 water boys at $1.50	3.00
51 men. Total	$94.50
Lining Gang:	
1 foreman and board at $3	$3.00
8 liners at $1.75	14.00
1 water boy at $1.50	1.50
Night Loading Gang:	
12 laborers at $1.75	$21.00
Camp Help:	
1 head cook at $100 per mo	$3.30
1 second cook at $35 per mo	1.15
1 flunkey at $30 per mo	1.00
3 flunkeys at $25 per mo	2.50
1 yard man at $40 per mo	1.35
1 camp woman at $40 per mo	1.35
8 Total	$10.65
Train Crew:	
2 engineers and board at $100 per mo	$6.70
2 firemen and board at $60 per mo	4.00
1 conductor and board at $100 per mo	3.30
2 brakemen at $60	4.00
7 men. Total	$18.00
Miscellaneous Expenses.	
1 pioneer car, rent $25 per mile	$23.40
Rent, equipment, coal, waste	10.00

Summarizing, we have the following:

Item.	Per day
Pioneer car	$23.40
Gen. foreman, timekeeper and clerk	10.50
Front gang	45.75
Machine gang	31.00
Ground gang	94.50
Lining gang	18.50
Night loading gang	21.00
Camp help	10.65
Train crew	18.00
Equipment, coal, etc	10.00
Total	$283.30

To be deducted from this total are the following amounts:

Item.	Per day
Receipts from board	$50.00
Commissary profits	12.00
Total	$62.00
Net daily expenses (283.30—$62)	$221.30

The contractor received $275 per mile for tracklaying, or for 6,000 ft. of track laid per day, $312 [illegible] net daily expense of $221.30 the cost per mile of track laid was closely $200.

No matter what explosive is used in blasting, maximum results can only be attained by always having the explosive in a thorough- [illegible] the strongest and highest grade detonator that can be secured.

LETTERS TO EDITORS.

Formula for a Waterproofing Paint for Concrete.

Sirs: [illegible] commonly known as the Cunningham formula, [illegible] however, I think, misused in this instance, for [illegible] coats of paint, but under some conditions it can [illegible] crude tar should be impressed on any one who is to make a paint of this kind, as all crude [illegible] like uniform results are to be obtained.

L. F. S.

New York, [illegible]

Time for Removing Forms in Concrete Sewer Work.

Sirs: I was much interested in the matter on page [illegible] of your [illegible] issue of Engineering-Contracting on "When safe to remove forms from concrete." In [illegible] I have on with our new system of [illegible] concrete monolithic pipe in sizes from 2 ft. to 5 ft., we remove the forms the next morning on base laid in advance of work. We have met no trouble or damage in moving forms as we build back fill as fast as [illegible]. Your issue of Nov. 10, 1909, explains our method of sewer construction.

Respectfully,

JOSEPH HICKSON.

Mt. Gilead, Ohio, [illegible]

Errors in Public Land Surveys.

Sirs: I was quite interested in the editorial on [illegible] Surveys to be Abandoned," to learn that the author of the article considered 50 or 150 ft. as a great error in public land surveys. The limit that the writer discovered in checking of some old surveys of the public land in Minnesota was [illegible] common and 50 or 100 ft. quite close.

Yours truly,

N. F. HOPKINS

Pittsburg, [illegible]

Construction of Levees on Permeable Soil.

Sirs: Can you give me any data or refer me to any book showing the efficiency of earthen embankments or levees built upon 2 ft. of loamy soil underlaid by sand and gravel? Do you know of any levees built upon such ground where there is liable to be underseepage to a greater [illegible] be about 6 ft. high with 4 or 6 ft. top and side [illegible] required to hold water within a floodway to a depth of 4 ft. for a period of several days.

Very sincerely yours,

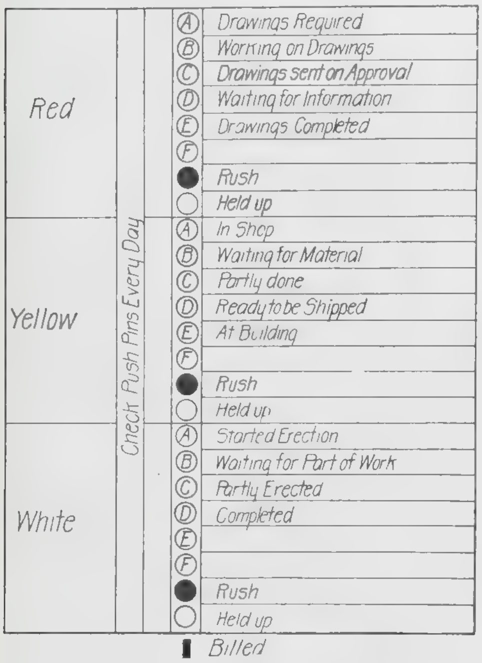
Osgood, Iowa, July 26, 1910. O. G. B.

[illegible] Editors.)

Progress Charts for Drafting Work.

Sirs: In your issue of July 20, 1910, appears an article written by J. D. [illegible] for Recording Progress [illegible] reader will observe, explains itself. This system, of course, can be adapted to almost any class of business, provided that minor changes in the number and color of the push-pins and their meaning are made. As the reader will observe, the chart is laid out to cover a term of three months, which time was found adequate to complete the orders of the particular line of business in which I was interested.

It is quite evident that this chart is a great saver of time inasmuch as no writing has to be done in the way of transmitting notes to the different department heads. It also gives the manager a clear view of all the operations which have been performed on the different contracts, and by the different departments and shows him the true conditions of every branch of his business up to date.


Check Push Pins Every Day

Red	Ⓐ	Drawings Required
	Ⓑ	Working on Drawings
	Ⓒ	Drawings sent on Approval
	Ⓓ	Waiting for Information
	Ⓔ	Drawings Completed
	Ⓕ	
	●	Rush
	○	Held up
Yellow	Ⓐ	In Shop
	Ⓑ	Waiting for Material
	Ⓒ	Partly done
	Ⓓ	Ready to be Shipped
	Ⓔ	At Building
	Ⓕ	
	●	Rush
	○	Held up
White	Ⓐ	Started Erection
	Ⓑ	Waiting for Part of Work
	Ⓒ	Partly Erected
	Ⓓ	Completed
	Ⓔ	
	Ⓕ	
	●	Rush
	○	Held up
	▮	Billed

Hoping this will be of interest to your readers, I beg to remain THEODORE AHLBORN.

Chicago, July 21, 1910.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Railway Engineering and Maintenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H. Warder, Monadnock Block, Chicago, Ill.

Personals.

Mr. Charles Mullen of New York City has been appointed Superintendent of Street Construction for the city of Milwaukee, Wis.

Mr. F. W. Alexander has been appointed Division Engineer of the Canadian Pacific Ry., with headquarters at Calgary, Alberta, succeeding T. Martin, promoted.

Mr. Fulton Race has resigned his position as Division Engineer in the Porto Rico Irrigation Service and has taken charge of engineering work for Central Aguine, Porto Rico.

Mr. William P. Eigenmann, a contractor for river and road work, of Rockport, Ind., has been nominated as the Republican candidate for the State Senate in the district composed of Vanderburg, Warrick and Spencer Counties, Indiana.

Mr. H. B. Kirkpatrick, Assoc. M. Am. Soc. C. E., has resigned his position as Chief of the Irrigation Division, Bureau of Public Works, Government of the Philippine Islands, and has returned to the United States, where he will engage in general hydraulic engineering work.

Mr. T. Martin, Assistant Division Engineer of the Canadian Pacific, at Calgary, Alberta, has been appointed a division engineer of the new Saskatchewan division, with office at Moose Jaw, Sask. Mr. H. B. Sims, resident engineer at Moose Jaw, has been appointed an assistant division engineer.

Mr. H. A. Strauss, Vice-President and Chief Engineer of the Falkenau Electrical Construction Co. of Chicago, Ill., has been appointed Consulting Engineer by the Davis & Weber Counties Canal Company, of Utah, to undertake the design of the hydro-electric development of the Davis and Weber Counties Canal.

Cornelius H. Ackerman. formerly associated with the late John Evans in the construction of portions of the New Ontario & Western R. R. and the South Pennsylvania R. R., died early this month at the home of his son in Binghamton, N. Y. Mr. Acherman entered the contracting business in 1870 and became Vice-President of the Crary Construction Co., of Binghampton, N. Y., which held extensive contracts for construction work on the New York, Ontario & Western and the Lake Shore & Michigan Southern Rys.

Col. August Forsberg, for several years City Engineer of Lynchburg, Va., died July 15 at his home in that city. He had been an invalid for four or five years. Col. Forsberg was for some time employed on government work at Baltimore, going from there to Columbia, S. C., where he was one of the architects of the capitol. He was thus engaged when the Civil War began, and he went into the Confederate Army with a commission, rising to the rank of colonel. He commanded the Forty-second Regiment, Virginia Infantry, and was twice wounded.

John Denison Evarts Duncan, for the last six years managing engineer of the New York office of Sanderson & Porter, engineers and contractors, died July 13 at Ann Arbor, Mich., at the home of his mother.

Mr. Duncan was born at Union Falls, Clinton County, N. Y., in July, 1871, and, with his parents, moved to Ann Arbor, Mich., in 1879, where he lived until the completion of his technical education. He entered the University of Michigan in 1889 and was graduated from the School of Engineering in 1893, receiving the degree of Bachelor of Science in Mechanical Engineering. The following year was spent in post graduate work at Cornell University, from which he received the Master's Degree in Mechanical Engineering in 1894. From 1894 to 1896 Mr. Duncan was employed by the Terre Haute Street Railway Co., Terre Haute, Ind., and the Stanley Electric Manufacturing Co., of Pittsfield, Mass. With the latter company he was associated with Mr. Stanley and Mr. Chesney in their extensive experimental work connected with the solving of the early high tension problems which were first studied and worked out at their factory. On leaving the Stanley Electric Manufacturing Co., Mr. Duncan successively held engineering positions in New York with the Metropolitan Street Railway Co.; Western Electric Co.; New York Telephone Co.; Westinghouse, Church, Kerr & Co.; and Consolidated Railway Electric Lighting & Equipment Co. On his return from a trip to Alaska on engineering work connected with a mining enterprise, Mr. Duncan entered the employ of Sanderson & Porter, 52 William Street, New York City. While directing the engineering work of this firm, Mr. Duncan had been in responsible charge of the design and execution of many large and diversified engineering projects. When taken ill Mr. Duncan was returning from a business trip of investigation and inspection made in the far west where he had gone to examine electrical properties for which his firm is acting as consulting and constructing engineers.

Catalogs Worth Having .

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Ceresit.—Paper, 3¼x6½ ins., 16 pp. Ceresit Waterproofing Co., Chicago, Ill.

A booklet containing a description of this waterproofing material with illustrations and directions for using it.

Ripley Combination Pile.—Paper, 5¾x8½ ins., 12 pp. The Robbins-Ripley Co. 48 Church St., New York.

A catalog illustrating uses and tests of a concrete covered timber pile designed especially for use in pier or dock work, in waters infested with teredo or other marine borers.

Anti-Hydro.—Paper, 5x8 ins., 8 pp. American Diamond Blast Co., 48 Church St., New York.

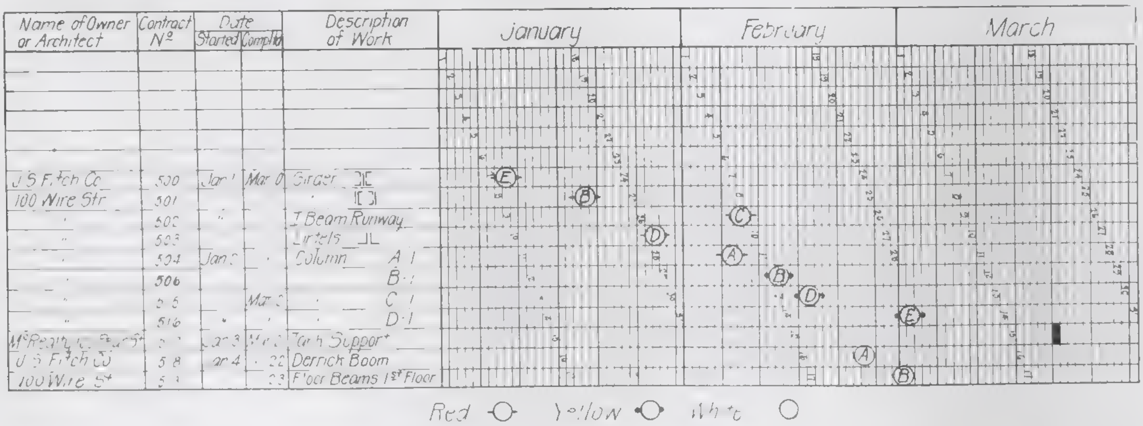
A pamphlet describing and giving directions for using this colorless cement water proofing material.

Comp Duct.—Paper, 7x10 ins., 32 pp. H. B. Camp Co., Commercial National Bank Building, Chicago.

A catalog of vitrified salt glazed conduit for electrical subways. It is illustrated with scale drawings of various sections. Tables of costs of laying conduits are given and also sample specifications and contracts for underground conduit systems.

Metal Tube Hose.—Paper, 6x9 ins., 24 pp., MulConroy Co., Inc., Philadelphia, Pa.

This is catalog No. 22 showing metal steam hose, rock drill hose, pneumatic, water, air, suction hose, couplings, rubber boots and shoes. Price lists adopted May 1, 1910, are included.



Name of Owner or Architect	Contract Nº	Date Started	Date Compl'td	Description of Work
J S Fitch Co	500	Jan 1	Mar 0	Girder
100 Wire Str	501			
"	502	"		I Beam Runway
"	503			Lintels
"	504	Jan 3	"	Column A 1
"	506			B 1
"	5 5		Mar 3	" C 1
"	516	"	"	" D 1
McReady [illegible]	[illegible]	Jan 3	[illegible]	Arch Support
U S Fitch Co	5 8	Jan 4	" 22	Derrick Boom
100 Wire St	[illegible]		23	Floor Beams 1st Floor

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

The new Pennsylvania R. R. terminal at New York City was formally opened Aug. 1. It will not be thrown open to public use, however, until Sept. 8. One feature of the terminal opening was the unveiling of the bronze statue of the late President Alex. J. Cassatt of the Pennsylvania system.—Chicago is now connected with St. Louis and other Mississippi River ports by a continuous water course, deep enough for barges and other vessels of light draft. The connecting link between the drainage canal and the old Illinois and Michigan canal at Lockport was formally thrown open July 25. It is estimated that the link will afford a channel with at least 5 ft. of water.—Bids are now being asked by the New York State Superintendent of Public Works, at Albany, N. Y., for two large barge canal contracts. These are contract No. 27A and contract No. 67. The first contract calls for work in the Champlain Canal, Sec. 2, for a length of 4.76 miles. The other contract calls for work on Sec. 10 of the Erie Canal and includes the construction of the canal prism with two locks and all other structures at Lockport, N. Y. Bids are to be opened Aug. 23.—Bids are now being asked for a large piece of excavating work in the Northern District of Tamaulipa, Mexico. This work is for the opening of a canal about 63 miles long and calls for the moving of about 9,000,000 cu. yds. of earth. The work is to be done for La Compania Agricola La Santina, San Bernardo No. 3, Mexico City, Mexico.—Bids are now being asked at the U. S. Engineer's office, Detroit, Mich., for canal construction, etc., at Sault Ste. Marie. This contract, bids for which are to be opened Aug. 30, includes 62,700 cu. yds. dredging and 290,000 cu. yds. dry work, 36,600 sq. yds. channeling, 22,000 cu. yds. concrete, etc.—Among the larger city and county contracts let recently are the following: Rogers Bros., Albion, Pa., at $174,868, for constructing a bridge over the Allegheny River at Oil City, Pa.; James Kennedy Construction Co., Salt Lake City, Utah, at $200,000, for constructing a sanitary sewer system for the city of Missoula, Mont.; Good Roads Construction Co., Memphis, Tenn., at $92,785 for constructing 23 miles of gravel roads for the city of Tupela, Miss.; Metropolitan Construction Co., Kansas City, Mo., for 200,000 sq. yds. of asphalt pavement for the city of Fort Worth, Tex.—Quite a number of railroad construction contracts were let during the past week. Among these may be mentioned the following: C. W. Merritt, Pensacola, Fla., for grading the Pensacola, Mobile & New Orleans R. R. from Loxley, Ala., to Mobile Bay; Railroad Contractor Kuhn, Omaha, Neb., for grading and bridge work for the proposed interurban line from Des Moines to Adel, Ia.; J. A. McGuire for constructing a railroad from Pincher Creek station to Pincher Creek, Alberta, and then through the valley to Cardston; P. Perrigo, Eganville, Ont., sub-contract for 10 miles of grading for the Grand Trunk R. R. in Quebec; P. Furlong, Egansville, Ont., and Jas. Hicks, Perth, Ont., for building trestles and laying steel for 80 miles of line for the Algoma Central; R. M. Dudley, Chihuahua, Mexico, for constructing a 24 kilometer branch line for the Mexico Northwestern Ry.; Furtwangler & Smith, Birmingham, Ala., for constructing a line of railroad in Birmingham for the Illinois Central; J. W. Wright, Union Springs, Ala., for a 3-mile mine spur for the Central of Georgia Ry.; Roach & Stansell, Memphis, Tenn., for constructing 50 miles of line west from Mertzon, Tex., for the Kansas City, Mexico & Orient Ry.; Bell, Sims & Blackford, City of Mexico, for the reconstruction of 60 kilometers of track for the National Railways of Mexico.

Involuntary Heroes.

Some years ago on one of the compressed air tunnel works being carried on in New York City a "blow out" carried one of the "sand hogs" into the opening and shot him up through the bed of the East River. The newspapers made much of this occurrance and the involuntary hero reaped a rich reward—for a time—of "free suds" in the water front saloons. Our more serious contemporary, the *Canal Record,* now matches this tale of the metropolitan press with a story of a man "washed through 269 ft. of pipe." We give the accident in the words of our American C. Z. contemporary:

> Juan Antolin, a Spanish laborer, aged 38 years, was washed through 269 ft. of 30 in. drain pipe at Gatun Dam on the afternoon of July 4, and is recovering from the bruises he sustained. He was one of a gang at work on a floating platform keeping debris from the hydraulic fill in the west section of the dam, from being carried into the drain pipe and clogging it. He fell from the platform and although his fellow workers tried to rescue him, was carried head first into the pipe. A minute later he was washed out of the discharge end of the pipe into the old West Diversion channel, whence he swam and was dragged ashore.

The date of the story is to be taken into consideration.

The Engineer as a Business Man.

A few years ago it was generally believed that the man of scientific training could not be a good business man. It was thought that he lacked the business acumen and administrative ability needed for executive positions. Happily this belief, insofar at least as engineers are concerned, has changed, in a measure, as is shown by the no small number of the members of that profession who now head important enterprises or hold administrative positions of trust and responsibility. It is nevertheless true, however, that there are many engineers who are ignorant of business methods and who, as a result, become merely employes of business men, lawyers and financiers. In an address delivered last year at Worcester Polytechnic Institute, Mr. G. R. Swain, Professor of Civil Engineering at Harvard University, discussed this matter of the relation of engineering to business and we quote from his address as follows: "I have spoken of the relations of engineering to science. Let me add a few words regarding its relation to business. The engineer must be very largely a business man. Engineering is business to a very large degree. The divine is not a business man; his work does not require it, and the fact is often painfully evident when he abandons his proper sphere,—that of endeavoring to keep men upon a high plane morally and to imbue them with high ideals,—and attempts to apply moral principles to business questions. The physician is not a business man; of all the learned professions his is the most scientific. The lawyer, however, deals constantly with business affairs and like the engineer, should be not only imbued with the scientific spirit but should be possessed of business acumen. The engineer deals not simply with the design of engineering works, but with their execution and their commercial value. His usefulness will be much hampered unless he can intelligently advise not only concerning their design, but as to whether they should be designed at all, and where, and also as to their execution. He must know how to draw up a contract; how to deal with men; how to smooth difficulties; how to arbitrate differences of opinion, and, in many cases, how to manage large financial transactions. Engineering is applied science, and its application is directed, in ninety-nine cases out of a hundred, to just one thing—*to making money for somebody.* No quality will be found of greater value to the engineer than commercial acumen. The young man who looks upon engineering *purely* as a science, or as the art of applying science, independent of business principles will very likely remain a drudge all his life, directed by men of far less scientific ability, but of greater business acumen."

Building Statistics.

Two pretty good indications of improved financial conditions are strikes and building permits. Strikes and threats of strikes have been frequent the past few months. As to building permits, statistics issued recently by the U. S. Geological Survey show that the estimated cost (based on building permits) of building operations last year was 10 per cent more than the cost in 1906, the high record year. These statistics show that the cost of building operations in 51 cities that reported to the U. S. Geological Survey was $[illegible] in 1907, $[illegible] in 1908, and $771,937,564 in 1909. The estimated cost of building operations in these cities in 1906 was $700,000,000. The Geological Survey last year for the first time made an attempt to collect statistics of the building operations by character of buildings and also by additions, alterations and repairs to each class of buildings. Reports were obtained from 128 cities showing that 264,536 permits had been issued in 1909 for building work estimated to cost $903,385,954. Of this amount new buildings were responsible for 90.3 per cent, and additions, alterations and repairs for 9.7 per cent. Of the cost of new buildings 73.24 per cent was for fire-resisting buildings and 26.76 per cent for wooden buildings. In the 128 cities 96,193 permits were issued for new wooden buildings, representing $218,293,619, or 24.16 per cent of the total: for alterations, additions and repairs in wooden buildings 69,275 permits were issued, representing $30,161,600. The largest number of new wooden buildings, 7,355, was erected in Seattle; while Los Angeles was next with 5,284 wooden buildings. Chicago was the leading city in cost of wooden buildings with a total of $13,532,880, San Francisco was second with a total cost of $12,257,683 and Seattle third at $[illegible]. In the construction of new fire-resisting buildings New York was first in new brick buildings with a total of $151,[illegible]. Brooklyn [illegible] of $51,747,760 and Chicago third with a total of $[illegible]. [illegible] Chicago led with a total of $15,985,300. New York [illegible] Chicago led with a total of $9,894,800, Seattl[illegible] Philadelphia third at $2,014,300. As to miscellaneous fire-resisting buildings, which includes steel skeleton structures, New York led with a total of $12,863,100; Newark was second at $3,323,000 and Houston third at $2,154,000. Of the 128 cities reporting 79 erected new concrete buildings, the total number erected being 1,791. The average cost in 1909 for the new buildings was as follows: Wooden buildings, $2,-269; brick buildings, $9,522; stone buildings, $11,679; concrete buildings, $17,100; miscellaneous fire-resisting buildings, $63,890.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Henry C. Allen, city engineer of Anniston, Ala., has been making surveys for an extension of the short line railway of the Bass foundry and machine works of Rock Run which it is now operating between Spring Garden and Rock Run.

C. W. Merritt, Pensacola, Fla., has been awarded the contract for grading the Pensacola, Mobile and New Orleans R. R. from Loxley, Ala., to Mobile bay, thus completing all grading this side of Mobile bay. The contractor, who has done much of the other grading, expects to have all of the grading work done by Dec. 15.

The Illinois Central R. R. has awarded a contract to Furtwangler & Smith of Birmingham, Ala., for the construction of a line of railroad in Birmingham paralleling the Southern Railway from 10th Ave. north to a connection with the Birmingham Belt Railway near 22nd Ave. In the contract there is approximately 63,000 cu. yds. of excavation, 16,000 cu. yds. embankment and 450 cu. yds. of concrete retaining walls. The excavation will have to be done with steam shovel. M. B. Morgan, Birmingham, will be the engineer in charge of the work, which will be started at once.

J. W. Wright, Union Springs, Ala., has the contract for building a 3-mile spur for the Central of Georgia Ry. from the Henry Ellen branch to coal mines. The spur runs through rough country.

Ernest Lamar, Selma, has applied to the city council of Selma, for right of way and terminal facilities for the projected railroad from Selma up the Cahoba Valley to the Birmingham District. Good progress has been made with the promotion work for this railroad and it is believed construction work will be started this fall.

The Furtwangler & Smith Construction Co. has been incorporated with a capital stock of $5,000 fully paid in. The company will do a general contracting and construction business, with offices in Birmingham. The officers are: A. S. Furtwangler, President; P. F. Smith, Vice-President and General Manager; Eugene Fies, Treasurer and H. C. Poyntz, Secretary.

Arkansas.

Engineers for the Fort Smith, St. Louis & Chicago R. R. who have been located at Harrison have about completed there work for the projected line, and it is said that construction work may be started this year.

The Thornton & Alexandria R. R., J. H. Beland, general manager, Thornton, Ark., is to at once award a contract for building a 3½ mile spur line from Newton to Tinsman on the Rock Island.

Grading work on the Central Arkansas & Eastern R. R. being built between Stuttgart, England, and Hazen has been resumed. Work was started several weeks ago, but the incessant rains caused the contractors to put their teams on pasture and quit active operations until the weather was more favorable. One hundred teams will be used when work is resumed.

An engineering corps of the Memphis, Dallas & Gulf R. R., H. C. McCluerd, chief engineer, Nashville, Ark., has been making final surveys out of Murfreesboro to Graysonia and thence to Arkadelphia.

The Missouri Pacific Railway Co. on July 15, asked for bids on the filling of a number of trestles between McGehee and Ferguson, Ark., on its Arkansas City division. The contract will embrace about 600,000 cu. yds. of filling and the contractor will be required to furnish his own steam shovels, locomotives and cars. M. L. Byers, St. Louis, Chief Engineer of Maintenance of Way, will be in charge of the work. At this writing no award of contract has been made.

Ball & Peters, Little Rock, Ark., have about completed their contract for double track work between the White River and Diaz on the main line of the Iron Mountains. Ball & Peters also have the contract for the eight miles of track south from Poplar Bluff. They are working two outfits there and expect to complete the entire contract in October.

California.

An agreement has been made between the Pacific Electric Co. and the Los Angeles Dock & Terminal Co., by which the former obtained a right of way from the latter for a nominal sum around the inner harbor to Long Beach.

The Southern Pacific has completed permanent surveys from Wadsworth, Nev., west through Honey Lake Valley to Bieber, Lassen County, Cal.

Final surveys for the Porterville Northeastern R. R. have been started from Springville. Contractors have been over the line preparatory to bidding on the construction work.

The Hall Construction Co., 129 North Los Angeles st., Los Angeles, Cal., has the contract for extending the Nevada-California-Oregon R. R. from Alturas, Cal., through Pitt River Canyon to Davis Creek, Cal. The work is located in Modoc County and all sub-contracts have been let. The contract includes 75,000 cu. yds. of earth excavation and 100,000 cu. yds. of rock excavation. Tom Sagris, Salt Lake City, Utah, is a sub-contractor on the work.

The Robbins-Ripley Co., Engineers and Contractors, 50 Church St., New York, have completed plans for a large water terminal at Port Lobos, Mexico, for the Arizona, Mexico & Gulf of California R. R. The terminal consists of a pier 500 ft. long, which is to be partially shedded and so located that there will be sufficient depth of water for the largest ocean vessels, with an approach of 2,500 ft. long, leading into the shore. The Ripley combination piling is to be used throughout the entire structure, this type of piling having been successfully used in a large dock constructed at Port au Prince, Hayti. It is expected that the construction work on the pier and approach will be started at once. The Arizona, Mexico & Gulf of California R. R., is a new line contract for which was let a short time ago to Charles J. Lantry of Kansas City, Mo., and E. J. Scott of St. Louis, Mo., as noted in our last issue. The road will have 225 miles of main track from Port Lobos to a point not yet announced, on the Arizona Southern railroad, which is owned by the Imperial Copper Company, together with a possible 50-mile branch to Tucson. The Arizona, Mexico & Gulf of California is an idea of Frank M. Murphy, president of the Development Co. of America, which has built several railroads in Arizona within the past few years. B. P. Cheney, Boston, Mass., is president of the railroad company.

Advices from Los Angeles state that Robert C. Gillis, President of the Los Angeles-Pacific Railway Co., is now in New York completing financial arrangements for the construction of the double track subway electric road to Santa Monica, Ocean Park and Venice and the construction of a terminal and office building on Hill St., Los Angeles, between 4th and 5th. It is said here in Los Angeles that Mr. Gillis' trip is to complete details of the bond issue for $20,000,000 voted by the company in January, and that upon his return definite announcement can be made of the exact date on which work will be started upon the subway and also on the terminal building.

Colorado.

W. H. Wattis, general manager of the Utah Construction Co., with general offices at Ogden, Utah, has transferred his headquarters to Pueblo, where he will have charge of the contract for constructing the double tracking of the Colorado & Southern and the Denver & Rio Grande between Walsenburg and Pueblo and on the Denver & Rio Grande between Goodnight and Swallows.

Final stakes are reported to have been set along the proposed Union Pacific cut-off from Fort Morgan to Denver.

Plans are reported to have been completed for the construction of a new railroad from Denver to Omaha. The road, which is to be known as the Denver & Omaha Short Line, was projected several years ago and constructed from Denver as far as Scranton, Colo. It has since been operated under the name of the Denver Eastern R. R. and has 17 miles of narrow gage line. According to the surveys, the new line will run 250 miles directly east, passing twelve miles north of Lenora, Kan., where a Missouri Pacific line ends, and then bend north, passing through Hastings, Neb., where a Chicago & Northwestern spur ends, and into Omaha, a total distance of about 500 miles. It is estimated that the construction will cost about $20,000 a mile. The New York offices of the Colorado Eastern R. R. are at 15 Wall street, and Henry T. Rogers is president. W. M. Porter, Denver, Colo., is chief engineer.

The Central City & Pactolus Ry. Co. has been incorporated and proposes to build a line beginning at Pactolus, near the mouth of South Beaver creek on the Moffat road, running across Clear creek, 2½ miles north of Black Hawk, and thence to Central City. There will be a branch line from Central to Russell Gulch and from Central to Black Hawk. The incorporators are: Thomas E. Watters, John McDonough, Fletcher H. Gray, David J. Davies and Percy S. Morris, all of Denver.

Representatives of eastern bankers and financial interests have been inspecting in Laramie, Hahns Peak & Pacific Ry., and the country along the line, and definite announcement has been made that the line will be extended to Steamboat Springs. Other extensions may be made as the result of the inspection trip.

The MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., have a contract for building about 25 miles of railroad from Hudson to Greeley, Colo., from the Chicago, Burlington & Quincy Ry. The contract is said to amount to about $850,000.

Connecticut.

The Connecticut Co., controlling the street railway system at Hartford, Conn., is to at once begin double tracking on Broad St., from Capitol Ave. to New Britain Ave. The work will take about two months to complete. Warren P. Bristol, Hartford, is local manager.

Georgia.

The Wrightsville, Adrian & Lyons Ry., now under construction from Lyons to Brunswick, is having surveys made for the section from Wrightsville to Milledgeville. The line is already in operation from Wrightsville to Lyons.

Tilden Holtzendorf and associates of New York City are promoting the construction of a high speed trunk line railway from Jacksonville to Atlanta, Ga., and beyond. The route as proposed will be from Jacksonville to Homerville, Willacoochee, Ocilla, Fitzgerald, Abbeville, Hawkinsville to Macon and thence to Atlanta via shortest route. The promoters are said to have all right of ways and terminal facilities right up to Hawk[illegible] will, even as far as Perry.

Work on the construction of the projected line of the Middle Georgia Interurban Ry. Co. is to be started soon. The company was recently authorized by the State Railroad Commission to issue $100,000 of stocks and $50,000 of bonds. The first work will be done on the Indian Springs end of the line and the road will be built into Jackson and from here to Griffin. It is the intention of the promoters to extend it to Monticello and Social Circle to the east, thus forming connection at Griffin with the proposed interurban line from Atlanta to Macon and with the Central and Southern, and at Monticello with the Central and at Social Circle with the Georgia road. Capt. W. F. Smith, Flovilla, Ga., is the promoter.

Idaho.

The Spokane, Wallace & Interstate Ry. Co., W. J. Hall, secretary, Wallace, Idaho, is ready to begin construction work on an electric line from Wallace to Spokane as soon as the government accedes to the request for right of way rights over the land in contest between the state and settlers. It is expected that the government will render a decision in the matter early this month.

Illinois.

The city council of Galesburg has granted the Peoria & Galesburg Interurban Ry. Co. a nine months' extension in which to begin work in Galesburg. The company has been having some trouble in securing an entrance to Peoria, but now has a new plan for getting into that city. According to this plan the line will skirt the city limits and come into town on Krause Avenue, striking the Peoria Terminal Railway between Division Street and Western Avenue and utilizing the Terminal tracks up town. It is said that when an entrance is secured to Peoria the company will have no difficulty in securing the money to build the line. This is the road being promoted by Smith T. Atwood.

The Illinois Traction Co. has work under way on improvements to its properties in Decatur, which will involve the expenditure of nearly $200,000. These improvements include the following: Gas holder, $30,000; Marietta street car line extension, $25,000; Eldorado street car line extension, $20,000; electrical equipment at Cerro Gordo street plant, $50,000; gas making machinery at Wood street plant, $20,000; gas main extensions, $30,000; steam main extensions, $15,000. M. L. Harry, Decatur, is general manager.

F. M. Zimmerman, Aurora, Ill., is promoting a project for building an interurban line from Morris to Yorkville. As proposed a local company will be organized to build and operate the road. A rough estimate of the cost of the proposed road is as follows: Right of way 3 rods wide, 6 acres to the mile at $150 per acre, $900; grading 4,000 yards to the mile at 15 cents per yard, $600; fencing, $100; culverts and drains, $100; road crossings, planks and cattle guards, $100; ties, $1,500; rails and fittings, $3,600; track laying, $500; siding, every three miles, $100; telephone line, $100; total cost of track per mile, $7,600; twenty miles of track, total cost, $152,000; three motor cars, $12,000 each, $36,000; freight or flat cars, $5,000; depots, buildings and platforms, $3,000; organization, surveys, engineering, etc., $2,000. Total cost, $108,000.

The Northwestern Indiana Traction Co. has begun work at Chicago Heights on the construction of the final connecting link of interurban railway between Joliet and Gary. The grading between Chicago Heights and Dyer will be pushed rapidly to completion. From Dyer the track will run to Hammond. At present there are tracks from Hammond to Gary. The track from the Heights to Hammond is expected to be in condition for use inside of four months.

The Valley Park, St. Louis & Eastern Ry. Co. has been chartered with a capital stock of $100,000 and proposes to construct and operate a railroad through southern and central Illinois counties. As projected the line is to start on the Mississippi river opposite St. Louis and run to a point on the Indiana line in Iroquois county and will traverse the following counties: St. Clair, Madison, Bond, Jersey, Calhoun, Clinton, Washington, Jefferson, Marion, Fayette, Effingham, Mourtrie, Douglas, Champaign, Ford, Monroe and Randolph. The incorporators are William C. Plass, Ormond B. Plass, both of St. Louis; Charles Neustadt, John H. Suess of East St. Louis and Henry Schrader of Belleville.

The Sterling-Moline Traction Co. has been organized at Sterling, with a capital stock of $1,500,000 and proposes to build an electric interurban railroad from Princeton, Ill., to Sterling and from Sterling to Moline. Preliminary work on the project will begin in two weeks, it is said. Among those interested are Joseph Wright and A. G. Van Petten.

Construction work has been started on the new round house of the Chicago & Alton R. R. in Bloomington. The round house will cost about $350,000 and is part of the proposed $1,000,000 improvements to be made in Bloomington by the railroad. Westinghouse, Church, Kerr & Co., New York, have the general contract for the buildings. W. J. Taggart is supervising construction engineer for the contractors and is now located at Bloomington.

An ordinance has been before the City Council of St. Charles to grant a franchise to O. J. Martin to build five miles of street railway through the streets of the city. The road, if built, would connect with the proposed railway between St. Charles and Alton, which would be built through Portage des Sioux, 14 miles north of St. Charles.

The Engineering Department of the Big Four Ry. has completed plans for a new coaling and water supply plant at Mackinaw, to be erected near the bridge across the Mackinaw. The plans call for a coaling station, with hoisting elevators and other improved appliances for the quick handling of fuel, and a pumping plant to supply locomotives with water.

The Eastern Illinois Ry. Co., which proposes the construction of a 15-mile electric railway from West Hammond to Harvey, Riverdale and the city limits of Chicago, has filed a first mortgage to secure a bond issue on $5,000,000. Of this sum $400,000 is to be used for construction and equipment and $4,600,000 is to be held in reserve for construction and other purposes. The route of the road has not been definitely decided upon, but as soon as this detail is completed construction work will be started. T. E. Mitten, President of the Chicago City Rys., is President of the new company. A. L. Druin, 125 Monroe St., Chicago, Ill., is the Engineer.

The Big Four is planning to build a new round house at Mattoon, Ill.

Indiana.

The Muncie & Portland Traction Co., G. A. Ball, secretary, Muncie, is stated to have decided to extend its line from its eastern terminal in Portland to Celina, Ohio, where connection will be made with the Western Ohio.

The Southern Indiana R. R. Co., a Walsh property, is to be reorganized and it is said that the present bond holders will bid in the road at the sale ordered by the Federal Court. As soon as the road is sold, it is believed that extensive improvements will be made for the betterment of the service. M. J. Carpenter, Grand Central Station, Chicago, Ill., is receiver.

Iowa.

A new proposition has been submitted to the business men of Waterloo by Attorney H. R. Mosnat, Belle Plaine, Ida., providing for a double tracked interurban system from Waterloo to Keokuk, and two branches, one extending from Belle Plaine to Grinnell and the other running northeastward through Keystone, Vinton and Independence to Elkader, the county seat of Clayton county. From Waterloo to Keokuk the distance is 175 miles.

Contracts for the grading and bridge work for the proposed interurban line from Des Moines to Adel have been let to Railroad Contractor Kuhn of Omaha, Neb. This line will be 29 miles long and Flynn Brothers, Des Moines, Ia., are chief promoters.

The Minneapolis & St. Louis R. R., W. D. Taylor, chief engineer, Chicago, Ill., is expending $100,000 for improvements at Fort [illegible] the yards at that city.

Preliminary surveys are said to be over half completed for a line for the Chicago Great Western Ry., L. C. Fritch, chief engineer, Chicago, Ill., from Des Moines to Clarion. The object of the surveys is said to be to se- [illegible] City.

The Union Pacific has set aside $267,000 for improvements at its terminal yards at Council Bluffs. These will include a 25 engine round house, freight car repair yards and two new ice houses.

The Commercial Club of Magnolia, Ia., has employed F. W. Cherry, a civil engineer, of Princeton, Ill., to examine and report on the most feasible route from Magnolia to run an electric or railroad line to connect with one of the trunk line roads running through Harrison county.

J. F. Porter, of Davenport, President of the Tri-City Railway & Light Co., A. C. Weeden, construction superintendent, and Attorney Joe R. Lane have been over the proposed route of the Muscatine & Davenport interurban line investigating the various routes. They went over the territory between Buffalo and Blue Grass, with a view of determining the respective advantages of the different routes. Both Blue Grass and Buffalo want the line and it is desired to get the line between those two towns. A line to run from Davenport to Buffalo, then to Blue Grass, and from there westerly and southwesterly to Muscatine is being considered, as the residents in this territory are anxious to get the interurban.

The General Construction Co. of Davenport, Ia., has shipped an outfit to Muscatine for work on its grading contract for the extension of the Muscatine North & South R. R. to Burlington, Ia.

Kansas.

The city council of St. Paul, Kan., has granted an extension of the franchise of the Southern Kansas Electric Ry. Co. which proposes to build a line from Iola to Pittsburg by way of Chanute, Erie, St. Paul and Girard. Prospects are now said to be good for financing the project. F. V. Crouch, Iola, Kan., is president.

The grade for the new Kinsley-Turon Air Line Ry. has been completed to a point about nine miles out of Turon. The grading outfits are working west from Turon to Kinsley. T. S. Hann, Kinsley, Kan., is a director.

The Atchison, Topeka & Santa Fe Ry. is reported to have engineers in the field running a line from Dodge City, Kan., to Springer, N. Mex., with a view to avoiding the use of the Raton Pass line for heavy freight.

The Winnipeg, Salina & Gulf Ry. Co., with headquarters at Salina and with a capital of $100,000, has been granted a charter. The company proposes to build a line from Winnipeg, Canada, to the gulf. In Kansas it will run through the counties of Republic, Washington, Clay, Cloud, Ottawa, Saline, Ellsworth, McPherson, Rice, Barton, Reno, Stafford, Pratt, Barber and Comanche. This will be a north and south road. Another line will run from Kansas City, through Wyandotte, Leavenworth, Jefferson, Shawnee, Wabaunsee, Morris, Marion and Dickinson.

[illegible] Co. was chartered on July 29 and proposes to [illegible] Central Kansas connecting the Midland Val- [illegible] has headquarters at Wichita, and has a [illegible] City and run through Sumner, Cowley, [illegible] wick, Harvey and McPherson counties. [illegible] chiefly Wichita men, among th[illegible] Edwards, former Secretary o[illegible] Ingersoll of Philadelphia is the Eastern [illegible] struction Co. of Wichita with $[illegible] has practically the same incorporators as the railroad company.

Kentucky.

An extensive railroad terminal is planned for Louisville, Ky., according to information current in railroad circles in that city. It is said that behind the issuance of a mortgage of $10,000,000 for the nominal purpose of improving and rebuilding the Kentucky & Indiana bridge across the Ohio River is a plan for railroad and freight terminal improvements extending from 34th street and the river in a belt around the western part of the city. The roads behind the plan are the Southern, the Baltimore & Ohio and the Monon, which control the Kentucky & Indiana Bridge Co. Of the $10,000,000 it is proposed to use only $2,000,000 for the new bridge; the other $8,000,000 is to go for terminal improvements.

The Louisville & Eastern R. R. of Louisville is said to be planning to begin a survey of two routes to Eminence. It is proposed to build a branch line from Eminence to connect with the main line between Shelbyville and Simpsonville. One of the routes will leave the main line near Scott's Station, will follow Bullskin creek to Fox Run creek; thence along that creek to the Hornsky farm, where it will take up the old Cumberland & Ohio roadbed into Eminence. The other route is to start at or near Simpsonville, thence along Bullskin and Fox Run creeks and into Eminence as in the first route.

Louisiana.

Rails, cross ties, etc., for the construction of the proposed Lake Arthur, Jennings & Northern R. R. have been received at Lake Arthur. The proposed line starts at Lake Arthur, passing through Jennings, Elton and connecting with the trunk lines at Alexandria. As noted in our July 20 issue the Jennings Construction Co. has been formed to construct this road. E. P. Fox, Jennings, La., is general manager.

It is reported at Hammond that grading work will commence along the line of the Baton Rouge, Hammond & Eastern Railroad within the next few days, preparatory to double-tracking the line between Baton Rouge and Hammond.

Maine.

The Aroostook Valley R. R. Co., Presque Isle, Me., has preliminary surveys under way for an extension of its electric railway through the towns of Woodland and Perham as far as Madawaska lake, a distance of about nineteen miles. Residents in the towns along the route are very much in favor of the extension and possibly may undertake to do the grading to secure it.

The citizens of Canaan, Me., have begun plans for an electric line to run from Hinckley. There is a distance of only about five miles to be built and the lay of the land is excellent for this line. Canaan has six water powers or more which could develop sufficient power for such a line.

Maryland.

Your correspondent has bumped up against hard rock once or twice in his life, but on a recent trip to the Allen & Allen contract on the B. & O. cut at Havre de Grace, Md., he saw some rock that would make many a man scratch his head and leave a happy home for life. They have had four drills working night and day in front of one shovel, and even this was not enough to keep the shovel going. The rock wears away the hardest steel tempered as good as any man can temper it. Springs are so numerous the pit men have to work in water up to their knees. Shovel runners have come from all over to try their hand at digging, only to give it up after a month or so of hard work. Mr. Allen has been forced to take charge of the shovel himself, just to keep the job moving. Coal has to be hauled a mile or more over hills and through woods to get it anywhere near the work. As your correspondent gazes upon Mr. Allen running the shovel with his spectacles on the top of his head, tears in his eyes, and his jaws closed tight, he couldn't help but hope that they would come out all right in the end. And no doubt they will, as everything comes to him who sticks, and Mr. Allen has never been known as a quitter.

The Western Maryland R. R., H. R. Pratt, Chief Engineer, Baltimore, Md., has bought 10 acres of land in the southern part of Baltimore on the Patapsco River and proposes to construct a yard there.

The Baltimore & Ohio Southwestern, a freight branch of the Baltimore & Ohio, extending from Linden to Georgetown, D. C., was opened for business July 27. The road has been in course of construction for more than two years, and considerable work is yet to be done, including the erection of a proper terminal in Georgetown.

Massachusetts.

The New York, New Haven & Hartford R. R., Edw. Gagel, chief engineer, New Haven, Conn., has started surveys for the tunnel under Fall River, and a new bridge at Slade's Ferry. Material changes in the plans for double tracking the Warren and Bristol branch between Warren and Fall River have announced the revision of the original layout calling for five double track bridges and two additional miles of second track. These changes will give Providence a double track to Fall River instead of a single track on the bridges at Warren, the Kickemult river and from Cole's river to South Swansea, and it is said that double tracking the whole distance was ordered to correspond with the tunnel and bridge improvements in Fall River recently approved by the Massachusetts Legislature. The five bridges not included in the first plan are at Barrington river, Warren river, Kickemult river, Cole's and Lees. Work on the second track is now in progress near Long lane crossing or Touisset road, where the steam shovel is cutting through an 18-foot embankment.

Minnesota.

Foley, Welch & Stewart, St. Paul, Minn., general contractors for the Canadian Northern Ry. line to be constructed from Virginia, Minn., to Duluth, Minn., have sublet some 60 miles of the 75 miles of the work in contracts ranging from five to ten miles. E. M. Olson & Co., contractors of Duluth, have been awarded the contract for building section houses along the line, which, until the completion of the road will be utilized by the engineers in charge of construction. The engineers on construction are already at their places and camps are being erected at Smithville. The work is divided into two divisions, each in charge of a divisional engineer, the divisions being subdivided each into four sections with a resident engineer in charge of each section, while there will be two bridge engineers to superintend the third of a mile of steel bridges which will be necessary as well as wooden trestles. The line will cost about $35,000 a mile, and there will be 500 ft. of rock tunnel at Short Line Park. H. T. Hazen, Duluth, Minn., is chief engineer.

Some difficulty has been encountered in the construction of the new Duluth, Missabe & Northern R. R., cutoff at Silica, about 20 miles south of Hibbing. The numerous swamps over which the road is being built are proving exceedingly troublesome. On one stretch between Hibbing and Alice there is a long muskeg strip that must be crossed and several months have been required to obtain a solid formation for the grading. At that point the embankment is about 60 feet high, and hundreds of loads of ballast have been dumped there to maintain a level roadbed.

It is still reported here at Duluth, that the Great Northern Ry. is planning to extend its line from Virginia to Winnipeg, to compete with the Canadian lines for business in that territory.

Duluth and the Ranges.

BY PETER E. MEAGHER.

Mr. F. C. Peabody, General Superintendent for Dale & Baumgardner, was a caller at this office recently. They are working five steam shovels on the Soo line, and expect to be very busy for some time.

J. A. Higgins of Higgins & McDonald, railroad contractors, was a visitor here a few days ago. They are at present working on the Soo Line, but are in the market for some good work

J. A. McNaughton, Labor Agent from St. Louis, Mo., has been spending his vacation of a couple of weeks in Duluth, and has been in to see us every day. Mack is a very good fellow and is well posted.

J. R. Morris has been appointed General Superintendent for the stripping contracts of MacArthur Brothers Co. in this vicinity. Mr. Arthur Mitchell, the former General Superintendent, resigned recently.

Thomas C. Walsh of the Johnson-Carey Co. has been spending the past week in Duluth. They have a contract amounting to 350,000 yds. of solid rock on the extension of the Duluth, Winnipeg & Pacific R. R. into Duluth. He is quite busy at the present time sub-letting this work to contractors, and also building camps, and getting his organization in shape. They also have a steam shovel job on the Soo Line in Wisconsin, and on the Northwestern Ry. in Wisconsin near Milwaukee.

John C. Greenway, General Superintendent for the Oliver Iron Mining Co. in the Coleraine district, has resigned his position, and has accepted a position of General Manager of a large copper company in Bisbee, Arizona. Mr. Greenway was very popular in this territory, and has the well wishes of a great many people here for his success in his new venture.

Charles Ross, President of the International Brotherhood of Steam Shovel and Dredge Men, and also representative of the Atlantic Equipment Co., manufacturer of Atlantic Shovels, spent a day with us here recently. He reported business very good, and said he felt very good, and he certainly looked the part.

The writer had an interview recently with Mr. H. T. Hazen, Chief Engineer for the Duluth, Winnipeg & Pacific Ry. Co., which of course is a branch line of the Canadian Northern Ry. Co. Mr. Hazen said that the C. N. Ry. had 800 miles of construction work under way at the present time, and that they intended to rush this work to completion as fast as possible.

C. R. McLain, contractor, came in to see us recently. He said that he had been awarded two nice concrete contracts by the Duluth & Iron Range Ry. Co. and the City of Duluth.

C. G. Borchert, representing the Arthur Koppel Co., manufacturers of dump cars, spent a few days in the city recently.

Charles Fairbairn, General Manager of the Republic Iron & Steel Co., Pittsburg, Pa., was in the city recently and spent about a week looking over their iron mines in this vicinity. They are working a great many men, and getting out a large amount of ore.

Greer Thompson, General Superintendent for the Drake & Stratton Co., stripping contractors, was a caller at this office recently. They have some very large stripping contracts on the Iron Range, and are working both night and day shifts on the same.

F. C. Simer, Civil Engineer, who is in charge of 46 miles of construction work on the Canadian Northern Ry. out of Duluth, came in to see us the other day. They have their engineering parties in the field, and are going ahead with this work as rapidly as possible.

Mr. E. P. Galvin, representing the Du Pont Powder Co., came in to see us a few days ago looking up contractors in the market for explosives.

F. C. Bowman, contractor, came in to see us and said he was in the market for some work. He certainly came to the right place.

O. W. Olson, rock contractor, was a caller and reported that he had secured a very nice contract.

Andrew Perrin, of the contracting firm of Carl Hall & Co., was a visitor with us several times recently. They have some work on the Duluth & Iron Range R. R. at the present time, and are in the market for a new contract.

P. C. Pastoret of the Pastoret-Lawrence Co. came up from his large sewer contract at Rice Lake, Wis., and spent a couple of days here this week. He said their work in various towns in this vicinity was in excellent shape.

Arthur Mitchell, former General Superintendent for the MacArthur Brothers Co. in this territory, was a visitor the other day and said he contemplated going into the contracting business, and was looking for a contract.

C. J. A. Morris of Morris & Shepard, General Contractors, St. Paul, Minn., was a visitor with us last week and reported all his contracts in excellent condition.

F. D. Beal, General Superintendent for the Brown Hoisting Machinery Co., which has a contract for the steel work on a large coal dock here at Duluth, which is being built under the supervision of C. J. A. Morris, was a visitor here today and said they were getting along very nicely with their contract.

Contractors and others when in this vicinity are cordially invited to make the Labor and Equipment offices of Peter E. Meagher, 409 West Michigan St., Duluth, Minn., their headquarters.

Mississippi.

A charter has been granted for an electric railway to connect McComb and Summit and to extend from the latter place to Godbold Wells.

The Hixon, Sumpter & Northwestern R. R. chartered some time ago has organized at Meridian and has elected the following officers: John Alexander, president; F. J. Hughes, secretary and manager. The board of directors consist of the above and George C. Hixon, J. M. Hixon and T. E. Breckingham. The road will run from Meridian across Kemper county to a point in Alabama, and will open up a big section of timber lands.

The Illinois Central R. R. last week awarded two contracts for gravel pit excavations. One contract for the excavation of 60,000 cu. yds. of material at Greenville, Miss., was let to Jake Baxter of Baton Rouge, La., and the other contract for the excavation of a like amount of gravel at Isola, Miss., was let to Sam Calloway of Chicago. The material is to be dug with steam shovel furnished by the contractors and loaded on cars furnished by the railroad company. The contractors must guarantee to load at least 1,200 cu. yds. per day, if required to do so by the engineers in charge. A. S. Baldwin, Chicago, is Chief Engineer of the I. C. R. R.

Missouri.

The Supreme Court of Missouri has rendered a decision which gives the Manufacturers' Railway Co. of St. Louis permission to lay tracks on Second Street from Poplar to Potomac Streets at St. Louis, a distance of 2½ miles.

The Edgewater Terminal Co. will shortly commence laying railroad tracks on the fill along the river front from Kansas City, Kan., to Kansas City, Mo. The fill is just north of the Intercity viaduct at Kansas City, and has been created by the pumping of sand from the Missouri river. A separate company, the Federal Construction Co., has been making the fill. Part of the Edgewater company's plan is a bridge across the Kaw river at its mouth. It is supposed that the Missouri Pacific is back of the Edgewater Co.

Grading work is well under way on the St. Joseph-Savannah Interurban line and it is expected that the line will be completed by Aug. 15. Two forces of graders are now working out of Savannah in the direction of St. Joseph and one of the gangs has reached a point nearly two miles south of the Andrew county line. Material for the high bridge over Dillon creek is on the ground and work will be rushed. The Flick Construction Co., Chicago, Ill., has the general contract.

Preliminary surveys are being made by Albert Bunn, C. E., Kansas City, Mo., for a proposed electric railway from Butler to Rockville. The road will open one of the largest coal fields in the state and the money necessary for its construction and equipment is said to have been assured.

The United Rys. Co., of St. Louis, Mo., is considering extending the Tower Grove line through Arloe, Gratiot and Lindenwood, a distance of three miles.

The North Missouri Central R. R. Co. has been reorganized and M. M. Stevens, East St. Louis, Ill., has been elected President. The company is said to be planning to have construction work started soon and is reported to have opened negotiations with the Gray Construction [illegible] the work.

St. Louis Items.

[illegible]

G. L. Cary, 321 Old Mason street, Memphis, Tenn., will have 50 teams idle by Aug. 15,

M. F. Peoples, General Superintendent of the Covington & Southwestern R. R. at Kingdon, Ind., writes us that he has a job for a 10 or 15 team outfit there by day or contract work.

The City Council in special meeting last Friday afternoon passed the Compton avenue grade-crossing bill providing for the construction of a viaduct over Compton avenue between Chouteau and Manchester avenues by the Terminal Railroad Association, the Missouri Pacific, the Wabash and the Frisco Railroad companies. The bill passed provides that the steel viaduct 2,200 feet long is to be completed by July 1, 1911. Plans are to be submitted for the city's approval within four months after passage of the bill and work is to begin within six months thereafter.

Keating Bros. have their outfit still at Mt. Carmel and expect to be there for the next three months.

The long-looked-for permit to build the new union station was issued by Building Inspector Newton to Murch Bros.' Construction Co. for the Union Station Co. at Memphis, Tenn., on July 29. The permit provides for erection of a three-story depot building at Second street and Calhoun avenue, at a cost of $600.

Mr. Walsh, Jr., and the Hummer Kahl came to town the other day for some more labor to be added on to their Big Four work in Southern Indiana.

Street Commissioner Travilla recommended to the Board of Public Improvements that the asphalt pavement on Tower Grove avenue, between Old Manchester road and Manchester avenue, be resurfaced by the company which did the original work five years ago. The company is the Parker Washington Co. of West Virginia, and Travilla's recommendation was to the effect that the company be required to complete the work in thirty days. A committee appointed by the President of the Board of Public Improvements to investigate the matter reported that they would notify the company to do the work within thirty days.

R. L. Cheshire, 62 South Front street, Memphis, Tenn., has 100,000 cu. yds. of good work near Arkansas City, Ark., also 90,000 of county road work near Memphis, Tenn.

Labor still continues to be a scarce article in this neighborhood. Not half enough of it to supply the demand, and with the government starting up on river improvement work in this territory next week is not going to help matters any.

The caisson for pier No. 3 of the Municipal bridge was launched last week by the contractors. Pier No. 3 is the easterly river pier, there being four piers in all, one located on each shore and two in the stream. The count starts with the pier located on the Missouri shore. Brenneke & Fry, resident engineers for the bridge, supervised the launching. The caisson for pier No. 3 was put together on twin pontoons moored near the Illinois shore. These pontoons are makeshift flat boats, and they are fastened together with timbers and bolts. On these the caisson was constructed. The timbers connecting the pontoons were unbolted, a hole was cut in the bottom of each pontoon, and as the pontoons sank the caisson was left afloat without jar or shock. The sunken pontoons were then hauled away by the engines which operate the derricks. The caisson is now firmly moored to piles near the Illinois shore. It has not yet been towed to the place where it is to be located because the contractors are not yet ready to start sinking it. The sinking will not start until the eastern shore pier, pier No. 4, reaches bed rock. In the meantime the caisson will remain moored close to the eastern shore. Anchor piles have been driven at the spot where the caisson will be placed, but as the current is swift there the caisson will be kept in quiet water [illegible] of water and will be sunk in 25 ft. of water. It is 39x90 ft. and 15 ft. high. Pier No. 4 is now within 12 in. of the rock bottom on which it will ultimately rest. It is now deeper down below water than the deepest of the Eads bridge piers. The pressure of the air in the working chamber of the caisson, which keeps the water out of the caisson, is now so great that the workmen can work in it only an hour at a time. About 115 workmen, called "sanghogs" coloquially, are on the job. They work only four hours at a time. The work, despite the easy hours, is dangerous. A number of them have been taken with slight touches of the "bends," and one workman, who worked longer hours than usual, was taken to the hospital with severe attack of this ailment. Although the pier No. 4 caisson is within a foot of bed rock, the end of the work is not near, because a stratum of water-worn boulders, immediately overlying the bed rock, has been encountered. These boulders must be broken up and hoisted to the surface. They are of limestone, red granite and gray granite. The granite boulders evidently have been washed down from the headwaters of the river. The contractors have taken out altogether about 100 cu. yds. of boulders. Some of them are a cubic yard in volume.

Montana.

The Chicago, Milwaukee & Puget Sound Ry. has been making surveys for its line through Great Falls, Mont.

Representatives of the Chicago, Milwaukee & Puget Sound Ry. line recently completed a reconnaissance trip of the country between Kalispell and Libby, and this has given rise to the rumor that that road was figuring on building a branch in that section. Cracker barrel talk even goes so far as to state that a line will be run from Martinsdale, Meagher county, on the main line of the road, over the Cadotte pass, into the Flathead valley, to Libby and through the Kootenai pass to Spokane.

The directors of the Chicago, Burlington & Quincy R. R. have filed a resolution with the Secretary of State at Helena providing for the building of an extension from Scribner, Carbon county, to the Northern Pacific line at Fromberg at an estimated cost of $1,000,000. The resolution also directs the tearing up of the line between Toluca and Scribner, 79 miles. The new extension is only 30 miles long.

The Gallatin Valley Electric Ry. Co., Chas. B. Anderson, General Manager, Butte, Mont., is reported to be running preliminary lines for an extension toward Three Forks. As proposed the extension will leave the present road at the Bozeman hot springs and proceed down the West Gallatin for a few miles. From this point on the route will be pushed forward to Three Forks.

Engineers have been going over the ground in Billings, Mont., making estimates for an electric street railway. Franchise for this railway was graned on June 20 to John A. Connolly of Muskogee, Okla.

Nevada.

The Nevada Northern Ry., L. G. Cannon, general manager, East Ely, Nev., is considering a branch line 14 miles in length for the purpose of hauling lead-silver ore from the property of the Nevada Mines Company, at Ward. Engineers of the road are now checking up the preliminary survey recently made by the Nevada United Co. The proposed line will connect with the ore line of the Nevada Northern on the east side of Steptoe valley, and will have an easy grade, exceeding 1 per cent in only one place, where it will be about 1½ per cent for a short distance.

New York.

The city council of Auburn has gran[illegible] Auburn & Syracuse Electric R. R. Co., T. H. Mather, chief engineer, Syracuse, N. Y., a franchise to double track in East Genesee Street, Auburn, between its present tracks and the city line, thereby insuring the early construction of the cut-off between Skaneateles and Auburn. The double tracking of Genesee Street will enable the trolley people to make a direct entrance into Auburn. The roadbed west of Skaneateles will be rebuilt over a private right of way and the railroad double tracked, eliminating the many heavy grades and inconveniences of the present single tracked route along the highway. The work of double tracking in Genesee Street, Auburn, will be started immediately and that of building the cut-off some time early next year. The new route over the private right of way will shorten the distance between Skaneateles and Auburn by more than two miles. The work calls for a large expenditure and will be one of the most important bits of construction work undertaken by the street railway interests during the next year.

A committee composed of Frederick W. Rowe, who is the president of the Manhattan Bridge Three-Cent Line; Wm. A. Harmon, the real estate operator; William C. Demarest, who is associated with Mayor Gaynor in the control of the Biegler estate, and Henry Roth, a large builder, representing large real estate interests in the southeastern portion of Brooklyn, has made an offer to the Public Service Commission of New York City proposing to operate a system of subways and elevated roads which had heretofore been proposed should be built by assessment on the holders of property benefited. The road planned embraces the subway under the Eastern Parkway with a line south to Nostrand Avenue, Sheepshead Bay; also a line south to Utica Avenue to Jamaica Bay, and a line easterly through Livonia Avenue through the Brownsville and East New York section. It is proposed to build these four lines by assessment, and the committee proposes in addition that the city should build a mile of four track subways down Flatbush Avenue from Atlantic Avenue, the terminus of the present Interborough subway, to Eastern Parkway. The committee now offers to form a corporation to operate the system if it is constructed.

The Erie R. R. is to have work started shortly on improvements at Jamestown, N. Y., involving an expenditure of about $70,000. These include the building of an addition to the freight station on Chandler Street, the laying of three new tracks from Buffalo Street to Falconer and the laying of a new main track from the bridge across the Chadakoin river near the boatlanding west almost to Celoron.

The Solvay Process Co., Syracuse, N. Y., is building a railroad connecting its recently acquired limestone quarries near James with the track of the Delaware, Lackawanna & Western R. R.. The Solvay Company has been given authority to construct a viaduct over the tracks of the Syracuse & Suburban Ry. near Jamesville.

The Lehigh Valley R. R. will probably survey a route for a proposed extension from Camden to Watertown. The Chamber of Commerce of Watertown has been advocating the extension for some time.

The Village Trustees of Solvay have applied to the Public Service Commission, Second District, for an order requiring the Syracuse Rapid Transit Railway Co. to extend its double tracks from Bridge St. to the present westerly terminus of the line of street railway.

The State Public Service Commission, Second District, will resume hearings in September on the second application of the Buffalo, Rochester & Eastern R. R. Co. for permission to build a double track railroad between Buffalo and Troy. The company estimates the cost of the road at $85,000,000, and claims to be able to get the necessary amount for its construction if the Public Service Commission grants it a certificate. The first application of the company met with considerable opposition from the other railroads. The Buffalo, Rochester & Eastern is nominally capitalized at $3,500,000, all subscribed for, 10 per cent of which, as required by law, is paid in. Much more than $350,000 has been spent by the company in making the surveys for the road and presenting its case at Albany. The officers and directors are: R. D. Gillet, president, and A. D. Robinson, Secretary, of Westfield, Mass.; A. W. Eaton, Treasurer, of Pittsfield; Joseph Skinner of Holyoke, Franklin Weston of Dalton, Henry H. Bomann and Fred T. Ley of Springfield, and James H. Caldwell of Troy, N. Y.

North Dakota.

Engineers of the Great Northern Ry. have placed the stakes for the line of the road through Ryder, N. Dak., and it is believed there that the company intends to build its Fargo-Williston line this fall. The right-of-way has already been purchased from Williston to the Berthold reservation, west of Ryder. The company has filed the deeds for the right-of-way through Mountrail county.

Ohio.

The Lake Erie, Bowling Green & Napoleon Ry. Co., E. H. McKnight, general manager, Bowling Green, has made a proposition to extend the line from Woodville to Elmore, if the people of the latter place would subscribe for $25,000 of bonds and obtain the right of way.

The city engineer of Hamilton is preparing plans for an underground crossing at South Hamilton to do away with a grade crossing on the Cincinnati, Hamilton & Dayton Ry.

Work has been commenced by the Northwest System of the Pennsylvania R. R. Co. between Rochester, Pa., and Cleveland. The improvement will represent an expenditure of over $500,000, together with additional double tracking.

The Chamber of Commerce of East Hamilton is working to secure a street car service for East Hamilton and the Ohio Electric Ry. Co., Cincinnati, O., has agreed to build the extension if property owners' consents are secured. As proposed the line is to begin on the Grand Boulevard at Hamilton, where the present line ends, go to Shuler Ave., north of Shuler Ave. and connect with the East High St. line at the foot of the infirmary hill.

The Fairport, Painesville & Eastern R. R. Co., of Fairport, has been incorporated with a capital stock of $7,500. Stanley Newell is one of the incorporators. The Lake Shore & Michigan Southern R. R. is said to be behind the project.

Oklahoma.

Advices from Miami state that the contract for the construction of an electric interurban line from Joplin, Mo., to Miami has been let to the Clark Marshall Construction Co., and that material for the work has been ordered and part of it shipped. The railroad now in operation between Miami and Hattenville has been taken over by the new company. The first track will be laid by way of Spring City to Joplin. After the line is completed the company expects to extend it to Bartlesville. The right of way necessary between Miami and Joplin has been secured and that between Miami and Bartlesville has been promised, together with substantial bonuses from several towns along the proposed route. James F. Gallagher, Joplin, Mo., is interested.

Oregon.

Judge Twohy, of Twohy Bros., railroad contractors, of Spokane, Wash., has purchased 840 acres of land near Grants Pass, the consideration being $30,000. It is believed in Grants Pass that the purchase indicates that the Southern Pacific is contemplating the construction of a railroad to Crescent City.

Advices from Astoria, Ore., state that the Western Cooperage Co. has a force of about 100 men at work clearing the right of way for the first 12 miles of the Astoria Southern R. R., to be built up the Youngs and Clatskanie rivers into the Nehalem Valley, and is anxious to secure additional help. An excellent grade has been found for the proposed line, and it is said the maximum does not exceed 1 per cent. George Wilson, of Portland, who has been awarded the contract to grade the first 12 miles of roadbed, has also started work.

Location surveys have been completed for a railroad along the coast from Siletz Bay to Yaquina Bay. Preliminary surveys were made about two years ago. The Spalding Lumber Co., Falls City, Ore., is believed to be interested.

A charter was issued July 29 to the Missouri, Oklahoma & Gulf R. R. Co. of Muskogee, with $2,000,000 capital. The old company was chartered as the Missouri, Oklahoma & Gulf Ry. Co. and the re-chartering is understood to be incidental to the extension of the present line south from the Oklahoma-Texas line to the Gulf, and not from Wagoner, Ok., to Kansas City. The directors are: William Kenefick, Fred Ruark and Arthur Miller of Kansas City; W. H. Dewar, E. R. Jones and W. N. Patterson of Muskogee; J. S. Keefe of Chicago, Ill.

Pennsylvania.

The Carter Construction Co., Chicago, Ill., which has the general contract for the Western Maryland R. R. extension, has begun work in the big tunnel near Sand Patch. The tunnel is to be 3,000 feet long. The Carter Co. is doing the work between Meyersdale and Cumberland, the rest of the work having been let to sub-contractors, all of whom are making good time. All of the contractors are reported to be handicapped by the scarcity of labor.

A new syndicate composed entirely of citizens of Philadelphia has been formed to underwrite the reorganization and extension of the Philadelphia & Western R. R. Co. The new extension through Norristown to a connection with the Lehigh Valley Transit Co. will make the Philadelphia & Western the terminal section for more than 200 miles of electric railway line, and the present Philadelphia & Western line will become a part of an important through line of travel. Jno. Davey, Upper Darby, Pa., is chief engineer.

A charter has been granted to the Norristown Transit Co. to build a line four miles long in Norristown on Swede, Airy and Markley streets to the borough line and return by the Old Swede Road. This road will be part of the Philadelphia & Western extension to connect with the Lehigh Valley Transit lines near North Wales. The company is capitalized at $25,000 and the incorporators are Charles E. Ingersoll, president; Penllyn McAllister, George H. Frazier, Edward B. Smith, Gerald Holsman and H. S. Farquhar, Norristown.

The Philadelphia Rapid Transit Co. is about to ask for a franchise to extend its line from Chester Ave., Yeadon, to the 69th St. terminal, Philadelphia. It is said that the proposed route is along Church lane, Yeadon, to Fernwood, to Cardington, in Upper Darbytownship, thence to the terminal. This same line is to connect with the Philadelphia Rapid Transit lines in Darby to 69th St., which would give a direct line from Chester or Media to 69th St.

The City Council of Harrisburg has authorized the Central Pennsylvania Traction Co. to extend its line in Second St., Harrisburg, from Seneca to Division St.

The Clarion & East Brady Electric Ry. Co., which projects a 31-mile line to cost over $1,000,000, is reported to have secured the necessary capital, and it is said that construction work will be started Sept. 1 and that the road will be in operation by July 1 next. E. G. Patterson, Pittsburg, Pa., will superintendent the construction work.

Preliminary surveys have been completed between Mount Lebanon and Bridgeville for the projected line of the Pittsburg, Steubenville & Wheeling Ry. Almost all the right-of-way has been secured, and it is believed that construction work on that section of the line will be started this month. As projected the route of proposed line is from the intersection of the Beechview and West Liberty lines in Washington Ave, Mount Lebanon, along the Bower Hill road to Bridgeville. From Bridgeville the line will extend along Millers Run through the large territory of the Pittsburg Coal Co. to Cecil. From this point a branch line will be run to Canonsburg, connecting with the Pittsburg & Washington Line and affording the people of the surrounding district easy access to the county seat of Washington County. From Cecil the main line will pass through Midway, Bulger and Racoon to Burgettstown, then in a northerly direction to Florence and Paris, and then south through Holiday's Cove, where the new plant of the Pope Tin Company is situated, to Steubenville. From this point the cars will be operated over the Steubenville Line to Wheeling, thus connecting the three cities. F. W. Ritchey, who had charge of the work from Zelienople to New Castle on the Harmony Line, will be in charge of field operation, and James Bryan, who built the Mount Washington tunnel and the Harmony Line, will be the consulting engineer and contractor. Among those interested in the company are: W. E. Hildebrand, Pittsburg; A. H. Kerr, Burgettstown; J. Winfield Reed, Burgettstown; D. G. Banford, Midway; C. W. Behney, Cecil First National Bank, and A. Wagner, Cecil; John N. Haney, Bridgeville; H. J. Wilcox, Bridgeville.

The Wilmington & Philadelphia Traction Co. of Wilmington, Del., is considering extending its Washington St. line at Wilmington out Concord Ave. from 22nd at Washington Sts.

The Philadelphia Rapid Transit Co., Philadelphia, is said to be planning to ask for a franchise to extend its line from Chester Ave., in Yeadon, to 69th St., Philadelphia. The route as proposed is along Church Lane, Yeadon, to Fernwood, to Cardington, in Upper Darby Township, and thence to the terminal. This same line is to connect with the Rapid Transit lines in Darby, thereby giving direct communication with Chester, Media and the many towns in that section.

Tennessee.

Advices from Mt. Pleasant, Tenn., state that work on the extension of the Middle Tennessee Ry., from Water Valley to Mt. Pleasant is to begin soon. Contractors are reported to have been figuring on the grading at the Water Valley end.

The Lake View Traction Co., expect to have its interurban line from Memphis to Lake View, Miss., in operation about Oct. 1. The stretch is 12 miles and when finished this will be the first interurban line to be operated in the state of Tennessee. M. J. Roach, of Memphis, has the contract for the grading and track laying of the line and states that his forces will have done all of their work by Sept. 1.

Texas.

The Gulf, Texas & Western Ry., Ben. B. Cain, general manager, Dallas, Tex., has begun surveys for an extension from Seymour to Paducah.

The engineering corps of the Southern Pacific Ry. engaged in surveying an extension from Gallup, N. Mex., has reached Farmington, N. Mex.

Construction work is being rushed on the extension of the Cotton Belt from Galesville to Hamilton, with the object of having the road completed so as to handle crops this fall. The bridge builders are close behind the grading gangs and ties are now being rushed to the front. John Scott and J. W. Thompson, St. Louis, Mo., have the general contract for the extension.

Sam Bush of Memphis has just about finished his 150,000-yd. contract at Gatesville, Tex., and is now looking for more work. He has a 40-team outfit.

The Kansas City, Mexico & Orient R. R. on July 19 entered into a contract with Roach & Stansell, of Memphis, Tenn., for the construction of 50 miles of road from Mertzon, Tex., west. There will be approximately 600,000 cu. yds. of excavation in the contract, half of which quantity will be rock. W. W. Colpitts, Kansas City, Mo., is Chief Engineer of the Orient. The contractors will do the work with their own forces, requiring no sub-contractors. This makes the third contract which the Orient road has awarded to Roach & Stansell this year.

The Berrendo Irrigated Farms Co., owners of the electric light plant at Roswell, N. Mex., will in the near future, it is said, put in a modern electric street car system in that city. It is proposed to run out of the Berrendo Irrigated farms, Roswell Country Club, Lea Lake Club, Hagerman orchards and farms at South Springs, five miles south of Roswell, the Haynes amusement park and natatorium, across North Springs river, on Union avenue, Roswell fair grounds, St. Mary's hospital, on South Hill, New Mexico Military Institute and other places. It is [illegible] company finds the local electric car system a profitable investment that it will later consider the advisability of installing an interurban line connecting Carlsbad and Roswell and all intermediate points.

The first consignment of 3,000 tons of steel of the total order of 5,700 tons for the Stone & Webster interurban line now being constructed from Galveston to Houston left Sparrows Point, Maryland, July 26, destined for delivery at Texas City. It is believed that the track material will arrive about Aug. 6. Bolts, spikes and plates are included in the shipment. By the time this material arrives the roadbed in many places will be ready for track laying. About half of the embankment work has been completed and another 40 days will see the completion of the contracts. Dickinson bayou bridge has been finished and July 25 a gang started driving piling for the structure over Clear Creek. This will be 600 ft. in length and like the Dickinson bayou structure will be built of creosoted material. The power station will be started at Clear Creek within the next 60 days, although plans have not definitely been decided upon. Two units will be installed, probably a 500 and 1,000 kilowatt, although other power units may be decided upon.

The Rio Grande R. R., a narrow gage line in operation between Point Isabel and Brownsville, has been sold at a receiver's sale to William E. Guy of St. Louis, Mo.

Harty & Ford, 307 Scanlon Bldg., Houston, are said to have 50,000 yds. of fine railroad work near Houston to sublet.

Clarence Moore, Navasota, Tex., has been calling for bids for clearing 75 acres of land in Brazos Bottom.

O. E. Metcalfe, County Surveyor, San Marcos, has been making preliminary surveys for a street railway system for San Marcos. Franchise for the system was granted some time ago.

Good progress is being made with the construction of the Lometa extension of the Santa Fe, about 100 miles from Lometa, on the Lampasas branch, in a westerly direction to Eden. The grading of this extension was divided into three sections and three contractors given a section each. Grading over the entire 100 miles is going forward rapidly and tracklaying has been commenced west of Brady. Already six miles of track have been laid on that portion of the new line from San Saba in the direction of Melvin. The Santa Fe is building the extension and furnishing all the material and the contractors furnished the men and teams for the grading.

The St. Louis, Brownsville & Mexico Ry. is making arrangements for the construction of a portion of the line from Kingsville to San Antonio. The contracts for the first 25 miles extending from Kingsville to Alice—where it will cross the San Antonio—and Aransas Pass and the Mexican line, will probably be awarded during the fall.

Camps have been established about six miles north of Weatherford for the grading work for the Chicago, Weatherford & Brazos Valley R. R., and work has been started in both directions from the camp. L. M. Kirkes, who has been working on the Santa Fe's Texas cut-off, has moved his outfit to Weatherford and will have charge of the work. Mitchell & Pigg, promoters of the line, have also brought in a construction outfit from west Texas.

Over half the grade for the DeLeon-Rising Star extension of the Texas Central R. R. has been completed and track laying will soon be started. The extension is 41 miles long. A meeting of the stockholders of this road, which is now controlled by the Missouri, Kansas & Texas Ry., will be held at Waco on Sept. 22 to arrange for a loan of $20,000,000, the money to be used for extensions, betterments and general improvement.

The Nueces River Valley Ry., Lee Frisby, General Manager, Beeville, is reported to be about to establish permanent surveys for its projected line from Beeville to Eagle Pass. The general offices and shops will be in Beeville.

Surveys [illegible] by Will S. Clarke, C. E., to locate a route between Jacksboro and Oran, 18 miles, for the proposed Jacksboro & Southern R. R.

Utah.

Engineers of the Denver, Northwestern & Pacific Ry., H. A. Summer, chief engineer, Denver, Colo., are reported to be locating a line through Provo Canyon. It is believed that the engineers are surveying a possible route for the new railroad into Utah, down Provo Canyon, with the purpose of determining which of the three proposed routes, the one down Hobble creek, Springville, the one through Park City or the Provo route, will be the most feasible.

The Oregon Short Line R. R. is planning several extensions for its yards at Brigham City.

Something of a tracklaying record seems to have been made on the San Pedro, Los Angeles & Salt Lake R. R., three miles east of Caliente, when a gang of 63 men, under the direction of Fred M. Bigelow, supervisor of bridges and buildings, laid 2,700 ft. of track on a 10-degree curve, every foot of it in a trestle 15 ft. high, in four hours. It is claimed that every timber in this trestle was measured and cut as the work progressed.

Virginia.

The Richmond, Fredericksburg & Potomac R. R., W. H. White, president, Richmond, Va., has completed plans and arrangements for eliminating four grade crossings on the belt line in Hearn county by the construction of four bridges, at a cost that will exceed $100,000.

The Langborne & Ballard Co., of Lynchburg, Va., has been incorporated with a maximum capital stock of $175,000, and proposes to build railroads and other public work. The incorporators are: C. D. Langhorne, president, Greenwood; E. K. Langhorne, vice-president, Manteno; J. D. Ballard, manager, Bedford City; F. E. Herring, secretary, Greenwood, Va.

Washington.

The Little River Logging Co., W. F. Delabarre, trustee, Port Angeles, is constructing a standard gage logging road from the water front at Port Angeles to the southern limits of the city and beyond.

Nichols & Handley, Tacoma, Wash., have the contract for clearing the right of way for the Northern Pacific joint line by way of Old Town, the bay shore and the Narrows. They will commence work at once, moving off the buildings on the right of way.

Practically all right-of-way has been secured for an electric line from Chehalis to Randle. This is to be part of an electric system extending from eastern Lewis county through Chehalis and Centralia to Grays Harbor. It is said that the project is backed by New York capitalists, having $3,000,000 to put into the enterprise. The proposed route goes through Forest, Ethel, Salkum, Silver Creek, Mossyrock, Riffe and on to Randle. C. Lewis and W. H. Allen, of Chehalis, are interested in the project, and the latter has done considerable engineering work for it.

West Virginia.

The Baltimore & Ohio R. R. is stated to have a corps of engineers at work at Tunnelton preparing plans for a new tunnel at that place. It is said that the old tunnel will be used for passenger service and that a new double track tunnel, 30 ft. lower and 80 ft. to the right of the old one, will be constructed. It is estimated that the new tunnel will cost about $2,000,000.

The Sunshine Coal & Coke Co., of West Virginia, has been chartered with a capital [illegible] incorporators are Francis Rocks, J. E. [illegible], T. J. Lynch, J. R. Topham and W. J. St[illegible] all of Uniontown, Pa.

Carpenter & Boxley, Roanoke, Va., have a contract with the Norfolk & Western R. R., for a change in the line of the road at Huger, W. Va., which includes the driving of two double-track tunnels, one single-track tunnel, and also for raising the grade and lining an old single track tunnel, all of which will cost approximately $400,000. A contract has also been let for 3½ miles of double track near Glen Alum, W. Va.

The Coal & Coke Ry., A. M. Smith, General Manager, Elkins, W. Va., is stated to be making a survey for a line which will connect the Coal & Coke with the M. & K. R. R. at Morgantown, and will run over the latter road as far as Trowbridge and then run down Cheat River to the junction of the Monongahela and Cheat Rivers at Port Marion. It is reported that the new line is to be built by the Coal & Coke R. R. and that the M. & K. will have an interest in it.

Wisconsin.

Officials of the proposed Chicago & Wisconsin Valley Ry. have asked a franchise from the city of Madison, Wis., for the projected electric railway from Madison to Stevens Point, Wis. Permission to build the line has also been asked from the State Railroad Commission. Practically all right of way has been obtained and necessary capital secured. The line will be about 130 miles long and will cost about $26,000 per mile.

The Minneapolis, St. Paul & Sault Ste. Marie R. R. has applied to the State Railroad Commission for a certificate to build a line connecting its main line below South Superior with the property on Pokegama bay, on which the old Mitchell-McClure log unloading trestles were located. The line which the Soo would build leaves the main line at about what would be 75th street, Superior, and follows the route of the oredock line until it is within the city limits. Then the line runs in northwesterly direction across section 4 and 5 to the terminal on the waterfront.

The Twin City & Lake Superior Ry. Co., L. N. Loomis, President, 440 Railway Bldg., Minneapolis, Minn., is to locate its terminal at Superior, Wis., at 21st St. and Logan Ave. Survey for this has just been completed. This company projects a 129 mile line from St. Paul and Minneapolis.

Joseph Ellis, of Janesville, resident engineer of the Cincinnati Construction Co., which plans to construct an electric railway between Janesville and Madison, has filed with the city clerk of Edgerton a certified check for $5,000 in lieu of the bond that was demanded by the council at the time of the passage of the franchise. This increases the life of the franchise and similar checks will be filed in Janesville and Stoughton when the time arrives. According to the Edgerton franchise actual construction work must begin within 30 days after the filing of the bond or check.

The State Railroad Commission has granted a certificate of necessity to the Fox River Valley Electric Co., which purposes building an interurban line which will eventually extend from Appleton and points on the east shore of Lake Winnebago to Milwaukee.

Canada.

As noted in our last issue the route by which the Grand Trunk Pacific Ry. will enter Regina, Sask., has been given out. The city Council of that city is now considering a proposition of the Canadian Northern for joint passenger facilities with the G. T. P., and to make Regina the chief divisional point for their systems in Saskatchewan, with large shops and freight terminals. The Canadian Northern has already expended upwards of $300,000 on property for terminals at Regina and the company proposes the early expenditure of at least double that amount, for the establishment of the necessary equipment of its divisional point there.

Advices from Seattle, Wash., quote Jean Wolkenstein, President of the British Columbia & Alaska R. R. Co., as stating that company proposed to build 800 miles of railway traversing the valley between the east and west ranges of British Columbia and extending from Vancouver to the northern British Columbia line. The line, as projected, will extend from Vancouver via Lytton and Fort George and thence north. The company also is contemplating a line into Skagway by way of Telegraph Creek and is now securing the right of way. Surveying parties are now in the field.

J. A. McGuire is stated to have been awarded the contract for constructing a railroad from Pincher Creek Station to Pincher Creek, Alberta, and thence through the valley to Cardston.

An American Company, believed to be backed by the J. J. Hill interests, is having surveys made for a line to run from the American boundary to Fort McMurray in the far North. The idea is to have this as a feeder for a fourth transcontinental road, which will be built across Canada to the north of existing lines. It is said that the company will build 100 miles of line before asking the government for the subsidy of $13,000 a mile granted to all railroad companies in Alberta.

P. Perrigo, Eganville, Ont., has taken a subcontract for grading 10 miles of roadbed for the Grand Trunk R. R. in Quebec.

P. Furlong, Eganville, Ont., and Jas. Hicks, Perth, Ont., are reported to have been awarded the contract for building the trestles and laying the steel for 80 miles of line for the Algomen Central.

Construction work was commenced July 25 on the line of railway by which the Canadian Northern Ry. contemplates tapping its coal areas on the Brazeau River, from Stettler, Alberta, east of Lacombe. The surveys for the line have all been completed and 70 miles of the road are to be finished this year. The line will cross the C. & E. near Lacombe, and continue northwest into the Brazeau coal fields. It is the intention to have the line completed and in operation by the fall of next year. The line will be continued through the Brazeau fields to connect with the main line of the railway, at some point west of the McLeod river.

According to a statement of C. C. Van Arsdol, Chief Engineer of the Pacific Coast end of the Grand Trunk Pacific Ry., 240 miles at that end will be completed by next summer. According to Mr. Van Arsdol, rapid progress is being made from the Prince Rupert end of the road, in spite of the fact that not enough labor is procurable to carry on the work as fast as is desired by the engineers in charge. One hundred miles of grade have been completed, and the steel laid. Contractors and outfits are spread over the entire road for 140 miles farther into the mountains, and are rushing the construction as fast as possible. The construction of this end of the road is particularly heavy, owing to the fact that from within a very few miles of the coast terminal, the road runs east through a mountainous country, that is taking all the skill of engineers to conquer. Steel is following up the grade as fast as it is completed, and when the 240 miles have been finished early next summer east of Prince Rupert, the road will be ready for operation of work trains for that distance.

Good progress is being made with the construction of the Canada & Gulf Terminal Ry. Hugh Doheny has the contract for this work, his superintendent of construction being J. R. Cassidy, late superintendent at Harvey Junction for McDonald & O'Brien, contractors on the Grand Trunk Pacific. Mr. Cassidy is located at Little Metis, Que.

Mexico.

Construction work on the branch line of the Mexico Northwestern Ry. from San Antonio station on the main line running from Chihuahua to Minaca and Madera to Cusihuiriachic is to be commenced at once and pushed through to completion. It is estimated that this branch line which will be about 24 kilometers long can be finished and traffic inaugurated over it within five months at the outside after construction work is started. R. M. Dudley, Chihuahua, who is building the Terrazas Madera line, will also build Cusihuiriachic branch. The company has asked the department of communications to accept the 20 kilometers of track from Terrazas to the new lumber town of Pearson and as soon as this is done, train service on the El Paso division, now running from the border city of Juarez opposite El Paso, Texas, to Nueva Casas Grandes will be extended to Pearson. This extension of the service will probably take place some time next month. The track is laid for 30 kilometers south from Pearson toward Madera and for about 18 kilometers from Madera northward toward Pearson. Contractor Dudley has grading outfits over the intervening distance and the work is being pushed as rapidly as practicable. By the middle of next year it is expected that this line which will be about 116 miles long, will be completed and the El Paso and Chihuahua divisions will be connected.

Bell, Sims & Blackford, City of Mexico, have been awarded the contract for the reconstruction of 60 kilometers of track of the National Railways of Mexico between Acambaro and Uruapam. The National Railways Company has commenced the reconstruction of 160 kilometers of track from Acambaro south toward Patzcuaro, and the contract just let calls for the building of two sections of 30 kilometers each, one from Acambaro to Andocutin and the other from Morelia to the vicinity of Coapa, all in the state of Michoacan. The remaining 100 kilometers will be reconstructed by the National Railways and the work will consist largely of re-grading the roadbed to accommodate a standard gage track. The sections awarded by contract are really new lines through the roughest parts of the road. The heaviest work will be encountered just south of Acambaro. There will be no tunnelling but the masonry will amount to 1,500,000 cubic meters. Bell, Sims & Blackford will have offices in Morelia during the next eight months in order that they may be near their contract. The contract price for the work will amount to nearly $1,000,000, U. S. currency. H. M. Taylor, Buenavista Station, City of Mexico, is Director of Construction for the National Railways of Mexico.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

Bids were opened July 26 at the office of the County Clerk at Osceola, Ark., for constructing 75 miles of drainage canal, requiring the moving of 3,170,000 cu. yds. of material. The contract was let to Kochtitzky & Crumpacker, Cape Girardeau, Mo., at 7.34 cts. per cu. yd. W. E. Ayres, Memphis, Tenn., is Chief Engineer of the District.

California.

Preliminary steps have been taken to raise the levee at Nicolaus and for a distance five miles north it is proposed to add 5 ft. to the height of the present levee. E. Von Geldern, Yuba City, Cal., is engineer.

The Sweetwater Water Co., B. P. Cheney, Los Angeles, President, has decided to increase the height of the Sweetwater dam 15 ft. The work will cost in the neighborhood of $200,000.

Colorado.

Advices from Moline state that the board of directors of the Cottonwood Reservoir Co., together with Mr. Hillery, civil engineer, of Collbran, have been making surveys at Cottonwood reservoir with the view of raising the Cottonwood dam 5 ft. higher.

The McDowell Construction Co., Lamar, Colo., was awarded a contract on July 27 for the construction of the outlet, conduit, tunnel, and gates of Bradford Lake, or Reservoir No. 1, by the Pueblo Rocky Ford Irrigation Co. of Pueblo, Colo. Under the terms of this contract this work is to commence by Aug. 4 and is to be completed by Jan. 1, 1911. The work consists of 160,000 cu. yds. of excavation, the construction of a 400 ft. tunnel, 5x7 ft., lined with concrete throughout, the construction of a lined shaft or well for operating outlet valves, 40 ft. in depth, the shaft being 6x8 ft.

Florida.

The Furst-Clarke Construction Co., of Baltimore, Md., which has the contract to cut the canals in the Everglades, has started the dredge Caloosahatchee to cutting the main south canal out of Lake Okeechobee southward. It is estimated that for a distance of 20 or more miles south of the lake the progress will be very rapid, as the material to be excavated consists of nothing but muck.

The Commandant of the U. S. Naval Station at Key West, Fla., has received orders to proceed with the construction of the quay wall for which $137,767.22 was appropriated under the general deficiency act approved June 25, 1910. This quay wall was previously authorized, plans and specifications were prepared and proposals were invited from contractors, when by the passage of the sundry civil appropriation bill, approved March 3, 1909, the appropriation became no longer available and the terms of this bill had to be turned into the treasury. The bids of the contractors were therefore not considered and efforts were made to have the money reappropriated.

Illinois.

✣Bids will be received at the office of J. J. Corcoran, Acting Clerk of the Sanitary District of Chicago, Room 1500, American Trust Bldg., Chicago, Ill., until noon, Aug. 10, for the construction of reinforced concrete ditch outfalls on the north shore channel. Each bid must be accompanied by a certified check for $300, payable to the order of the clerk.

Bids were opened July 20 at the office of Charles W. Brown, Engineer, Jacksonville, Ill., for work on the Meredosia Lake drained levee district, the contract being awarded on July 27 to M. J. O'Meara & Son, Cullom, Ill. The work includes 149,199 cu. yds. ditch work and 75,076 cu. yds. levee work.

Bids were opened July 23 by the Drainage Commissioners at Atkinson, Ill., for the construction of two small levees and a highway grade and for cleaning out portions of open ditches in Union District No. 1. As no satisfactory bids were received the letting was continued for three weeks. H. E. Reeves, Atkinson, Ill., is Engineer.

Indiana.

✣Bids will be received until 2 p. m., Aug. 13, by Drainage Commissioner, of Henry County at Surveyor's office in Newcastle, Ind., for the construction of a drain. Charles E. Byrkett is Commissioner.

Kansas.

The County Commissioners of Shawnee County, Topeka, are planning to go ahead with the construction of the South Side Dike at Topeka. It is proposed to build the dike as far as possible [illegible] excavation under the new span on the south end of the Milan bridge and then to build a concrete dike from the end of the earth dike west to the limit recommended by the county engineer, F. B. Simms [illegible] er.

Louisiana.

✣Bids will be asked by Capt. R. R. Ralston, U. S. Engineer, St. Charles Ave., New Orleans, La., until 11 a. m., Aug. 9, for the construction of about 26,000 cu. yds. of earth work in the Lake Borgne Levee District.

Michigan.

✣Bids are asked until 3 p. m., Aug. 30, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for canal construction, etc., at Sault Ste. Marie, Mich.

The work includes: Excavation, dredging, navigation canal, 47,700 cu. yds.; dry work, navigation canal, 275,000 cu. yds.; dry work, head race and forebay of water power canal, 15,000 cu. yds.; dredging, head race and forebay, 15,000 cu. yds.; channeling, 36,600 sq. yds.; crib framing and placing, timber, 154,000 cu. yds.; crib filling, 13,000 cu. yds.; construction and removal of west cofferdam, head race and forebay; construction of new north dike, 1,900 lin. ft.; concrete (exclusive of cement), 22,000 cu. yds.; cement, 27,500 bbls.; vitrified paving brick, 15,000.

Missouri.

R. H. and G. A. McWilliams, 1600 Steger Bldg., Chicago, Ill., have been awarded the contract for constructing a drainage ditch for Livingston County, bids for which were opened July 28 at Chillicothe, Mo., by Thomas Hurst, County Engineer. The contract price was $36,500 and the work includes the construction of a dredge ditch with eight steel highway bridges of 40 ft. spans, 14 farm crossings and 16 water gates in Drainage District No. 13. The ditch will be 51,800 ft. in length and will include 208,766 cu. yds. of excavation. The ditch will be 12 ft. wide at the bottom and 7 ft. deep.

Mississippi.

C. W. Hunter, Memphis, Tenn., at $1.75 per cord, was the only bidder for furnishing the Mississippi River Commission, Third District, with about 30,000 cords of willow brush and poles. Bids were opened July 21 at Vicksburg, Miss.

T. S. Shields of Greenville, Miss., has finished his contract for construction of a levee on White River and has his outfit laid up at Memphis, Tenn., for the time being.

Bids were opened July 21 at the office of the U. S. Engineer, Vicksburg, Miss., for a considerable amount of levee work, the bids received being as follows: (1) standing for Lawrence Bros., Leonard & Co., Memphis, Tenn.; (2) for O. A. Gibson, Natchez, Miss.; (3) for W. T. & E. M. Lawrence & Co., Rosedale, Miss.; (4) for Linnan Bros., Baton Rouge, La.; (5) for H. F. Garbish, Vicksburg, Miss.; (6) for Jno. G. Sessions, Fitler, Miss.; (7) for W. C. Mullen, Vicksburg, Miss.; (8) for Shields & Miller, Greenville, Miss.; (9) for Roach & Stansell, Memphis, Tenn.; (10) Clark & Parker, Natchez, Miss.; (11) Clark Babbitt & Co., Vicksburg, Miss.; (12) J. B. Lewis, Lake Village, Ark.; (13) Donoven & Daley, Lake Providence, La.; (14) Helgason Bros., Vicksburg, Miss.

[illegible] the U. S. Engineer's Office at Vicksburg, Miss., [illegible] Commission, Third District: C. C. Hutchmacher & Co., Grand Tower, Ill., $2.49 per cu. yd. for 10,000 cu. yds. delivered on contractor's barges between mouth of White River, Ark., and Greenville, Miss., and between Greenville and Albemarle Bend, Miss.; Oscar F. Barnett, Cincinnati, O., $2.40 per cu. yd., for 10,000 cu. yds. delivered on contractor's barges between White River and Greenville, and $2.65 per cu. yd. on barges between Greenville and Albemarle Bend. For 20,000 cu. yds. delivered on U. S. barges at Vicksburg, John Riess, New Orleans, La., bid $2.23 per cu. yd., and Jas. B. Miles, Jr., Helena, Ark., bid $1.75 per cu. yd. for a like amount for delivery f. o. b. at Helena, Ark. For 20,000 cu. yds. delivered on the bank the following bids were received: At Vicksburg, John Riess, New Orleans, La., $1.98; Richard M. Murphy, New Orleans, La., $2.60; and at Greenville, F. W. Katterjohn Construction Co., Paducah, Ky., $2.26 and $2.00.

New York.

✣Bids will be received until noon, Aug. 23, by the Superintendent of Public Works, F. C. Stevens, Albany, N. Y., for the following contracts: No. 27 A, Champlain Canal, Sec. 2; Contract No. 67, Erie Canal, Sec. 10; Contract 79, Oswego Canal, Sec. 11.

Ohio.

Boyd & Lyons, Dayton, O., are working some 20 teams on their contract for the construction of the levee on the east side of Miami river from the Trenton bridge to Middletown, a distance of nearly two miles, and are said to be seeking more teams in order to finish the work within the contract time of 150 days.

Oregon.

Work has been resumed by the government and bridge contractors on the Celilo Canal. Winters, Caughren & Smith, Seattle, Wash., have the contract for about 14,000 ft. of the canal and it is expected that this portion of the work will be completed by next May. The government will build 5½ miles of the canal and has about 500 laborers at work. Major James F. McIndoe, U. S. Engineer, Portland, Ore., has charge for the government.

Utah.

The Provo Reservoir Co. has secured a loan of $50,000 to be used for construction purposes.

Vermont.

✣City Clerk of Barre, Vt., will receive bids until 7 p. m., Aug. 11, for the excavation of a new river channel, buildings walls at the sides, ripraping the bottom, refilling the old river bed, building about 500 lin. ft. of culvert and other work incidental thereto. Each bid must be accompanied by a certified check for $500. James Mutch is Mayor.

Mexico.

The Balses Power & Irrigation Co., which is [illegible] New York City, is reported to have secured $200,000 capital for developing its Mexican concession in the Balses District. Lic Francisco, Alfaro, City of Mexico, s[illegible] cession from the government

Station.	Miles below Cairo.		Cu. yds.	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	(13.)	(14.)
Lower Yazoo Levee District, in Mississippi:																	
4733-4760	568	New levee	[illegible]	[illegible]								.23			.19		
4760-4777	568	New levee	110,000	.269								.225					
4777-4795	568	New levee	110,000	[illegible]								.225		.19			
4795-4812	568	New levee	[illegible]	.249								.215			.18		
4812-4838	569	New levee	110,000	.239								[illegible]		.199			
4838-4862	569	New levee	110,000	.35													
4862-4884 +74	569	New levee	110,000	.38													
Upper Tensas Levee District, in Arkansas:																	
920-942 Ark. R.		New levee	[illegible]														
942-965 Ark. R.		New levee	[illegible]														
Upper Tensas Levee District, in Louisiana:																	
1865-1985	548	Enlargement	[illegible]		[illegible]	.319	$0.35						$0.27				
2805-2860	576	Enlargement	50,000		.17	.1725	.1599										
3070-3160	579	Enlargement	90,000		.23	[illegible]	.1999		.219								

Items marked thus ✣ [illegible] now open for bids.

MISCELLANEOUS CONSTRUCTIONS

California.

The following bids were received by the city of Oakland for constructing the Livingston St. pier: H. Gould, $127,219; Mercer-Fraser Company, $135,000; Healey-Tibbets Construction Company, $119,982; Thompson Bridge Company, $125,000; same company (alternate design), $112,900; Pacific Construction Co., $145,300; Metropolis Construction Company, $129,775; Burrell Bridge & Construction Company, $131,300; Colton Brothers & Company, $119,790. The pier will be 125 feet wide and 300 feet long, and will be of reinforced concrete.

The Abbot Kinney Co. is considering building a pier at the foot of Mildred Ave., Venice.

The Stanley Construction Co., San Francisco, Cal., has been awarded the contract by the Sacramento Valley Irrigation Co. of Willows, for constructing concrete culverts under Willows and Walker Creeks for the Glenn Canal.

Steps are being taken at Long Beach for the building of a series of docks encircling the bay. The estimated cost is about $500,000. S. J. Abrams, Long Beach, is interested.

District of Columbia.

✣Bids will be received by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until August 3, for furnishing the following repair parts for 19-yard Oliver dump cars: 300 gaskets, cylinder, as per drawing, Fl-465, gaskets to be of best quality, suitable for use on cylinders operating under 70-pound air pressure, and 150 leathers, piston packing.

Florida.

✣Bids will be received by Capt. George R. Spaulding, U. S. Engineer, Jacksonville, Fla., until Noon, August 24, for dredging and removing rock in Biscayne Bay, Fla.

Illinois.

✣Bids will be received by Maj. Thomas H. Rees, U. S. Engineer, Chicago, Ill., until 10 a. m., August 8, for dredging and rock excavation in the Chicago River, Ill.

Kansas.

✣Bids will be received until August 10 by the Constructing Quartermaster, Fort Riley, Kan., for furnishing miscellaneous pipe fittings, plumbers' supplies, etc.

The Kansas Gas & Electric Co. has secured a site between 3rd St. and the Arkansas River at Wichita, Kan., for its new $575,000 plant.

✣Bids will be received by the Constructing Quartermaster, Fort Riley, Kan., until August 9, for furnishing 1 Armstrong hand machine, 48 tap plugs, 230 boiler tubes, 12 grate rests, 12 arc liners, 9 baffle plates, 12 coal guards, 72 drilled rivets, 72 cotter pins, 39 grate wedges, 72 drill rivets, 50 lbs. of sheet packing, 18 radiator valves, 36 air valves, 12 doors for heater, parts for Model heater, 500 fire brick, 250 manganese pipe coverings, 3 vertical tanks, 2 tobasco heaters, etc.

Louisiana.

The following bids were received July 26 by the Board of Port Commissioners of New Orleans, La., for roofing for the Branch M. King, the Eighth-Harmony, Sixth St., Third St. and Soraparu St. wharf-sheds: New Orleans Roofing & Metal Works—Ready-to-lay roofing, $3.04 a yard; built-up roofing, $3.24 a yard. Philip Carey Co.—Ready-to-lay roofing, $3.45 a yard. A. J. Nelson Manufacturing Co.—Built up roofing, $2.65 a yard. A. H. White Co.—Ready-to-lay roofing, $2.75 a yard; built-up roofing, $3.03 a yard. Kracke & Flanders—Built-up roofing $3.24 a yard. Atkinson & Blake—Ready-to-lay roofing, $2.45 and $2.77 a yard; built-up roofing, $2.95 a yard. Warren Ehret Company—Built-up roofing, $3.75 a yard. Bacarisse Roofing Co.—Ready-to-lay roofing, $4.15, $3.82, $2.27, $2.45, $2.75 and $2.86 a yard; built-up roofing $3.09 a yard.

Maine.

✣Lieut. Col. George A. Zinn, U. S. Engineer, 537 Congress St., Portland, Me., will receive bids until Noon, August 22, for dredging in Stockton Harbor, Me.

Massachusetts.

✣Board of Harbor and Land Commissioners, 131 State House, Boston, Mass., will receive bids until 2 p. m., Sept. 2, for the construction of a stone pier or wharf to be known as Pier No. 6, South Boston. It will be 1,200 ft. long and 300 ft. wide, the solid filling to be enclosed by a granite sea-wall, 41 ft. high and 2,700 ft. long; also the filling of a street 100 ft. wide and about 850 ft. long, the outer face to be enclosed by a granite sea-wall about 645 ft. long on a pile foundation. The quantities of material to be furnished and work to be done are substantially as follows: Dredging, 414,600 cu. yds.; filling with dredged material, 274,600 cu. yds.; gravel to be furnished, 94,000 cu. yds.; riprap and stone back-ballast, 40,200 cu. yds.; spruce piles, 1,295 piles; concrete, 730 cu. yds.; stone masonry below low water, 45,750 cu. yds.; stone masonry above low water, 14,100 cu. yds.; bulkhead, 95 lin. ft.; fenders on face of wall, 2,700 lin. ft.

Michigan.

W. C. Cornwell, of Saginaw, and a number of wealthy Chicago business men have purchased 400 acres of land near Clare and will build a summer resort. They will dam the waters of Beebe lake and raise a section of it to an altitude of 70 ft.

Minnesota.

O. H. Case & Son, Civil Engineers of Fountain, Minn., are preparing plans for a water power plant for the village of Preston, Minn. G. A. Love is Mayor.

New Jersey.

The city council of Trenton, N. J., has voted a bond issue of $50,000 to the Dock Committee with which to acquire lands and develop wharf facilities for the city along the Delaware River front.

Eugene Boehm, Atlantic City, N. J., at $3.-342, was low bidder July 25, at the office of the U. S. Engineer, Wilmington, Del., for removing the wreck of the steamship Oakdene, lying sunk in the Atlantic Ocean off the coast of Virginia.

New York.

✣Bids will be received by Wendall L. Simpson, Commissary Purchasing Officer, Panama R. R., 24 State St., New York City, until August 5, for furnishing under circular P-298 elbows, tees, valves, packing, nuts, iron steel, screws, tacks, handles, hose, nuts, rivets, files, nails, pipe wire, wrenches, etc.

✣Commissioner of Docks, Calvin Tompkins, Department of Docks and Ferries, Pier "A" Foot of Battery Place, North River Borough of Manhattan, New York City, will receive bids until Noon, August 8, for furnishing and delivering about 25,000 cu. yds. of riprap stone in place.

✣Bids will be received by Calvin Tompkins, Commissioner of Docks, Department of Docks and Ferries, Manhattan, New York City, until Noon, August 8, for furnishing all labor and material required for dredging about 200,000 cu. yds. in the North River, Borough of Manhattan.

✣Bids will be received until Noon, August 20, by Col. W. H. Black, U. S. Engineer, 710 Army Bldg., New York, N. Y., for dredging and removing ledge and broken rock in Larchmont Harbor, N. Y.

John F. Fitzpatrick & Sons, Plattsburg, N. Y., have been awarded the contract for constructing the West Brook dam for the city of Plattsburgh. The contract price was $24,417. Bids were opened July 22.

The Herbert Engineering Co., Easton, Pa., has been awarded the contract at $6,095 for constructing a concrete dam for the city of Batavia. The dam will contain 600 cu. yds. of concrete. Bids were opened July 23.

The New York Dock Ry. of New York City, incorporated last May with a capital stock of $500,000, has applied to the Public Service Commission of New York City for permission to lease and operate the railroad properties of the New York Dock Co., which heretofore have been operated by the dock company in connection with its large warehouse business in Brooklyn. It is said that the railway company will seek subsequently to extend the existing railway system and make it more effective as a freight handler along the Brooklyn waterfront. John B. Summerfield, New York City, is President.

Calvin Tomkins, Commissioner of Docks and Ferries of New York City, has designated a committee of engineers from his department to confer with engineers in the Brooklyn Navy Yard on a plan to have the city build a drydock to the Brooklyn water front. The proposed drydock will be at least 1,000 feet long, and a rental would be charged to each vessel using it.

Ohio.

Dredging work for the new shipyard site at Ashtabula is well along. The Two Rivers Dredge & Dock Co. has a dredge on the work, and Greiling Bros., Green Bay, Wis., also have placed a dredge on the job. Bids are soon to be asked for the beginning of the work on the new outer harbor there. The first work will be the completion of the west breakwater and the removal of a part of the old east breakwater. The west breakwater will be further extended toward the shore and continued out into the lake for 1,700 feet. After that the new east breakwater extension will be undertaken. This will extend eastward 1,800 ft. and shoreward 2,700 ft. The entire new outer harbor when completed will cost $1,285,-529.

Tennessee.

✣Bids will be received until Noon, August 10, by M. L. Walker, Major, U. S. Engineers, Room 20, Custom House, Memphis, Tenn., for furnishing riprap stone and spalls.

Texas.

The construction of a large dam across Mexico Creek, two miles east of Baird, is proposed by officials of the Texas & Pacific. W. D. Boydstun, Baird, is interested.

Utah.

The Johnson Iron Works, Ltd., Julia and Delta sts., New Orleans, La., has been awarded a contract at $39,000 for the construction of a steel hull, stern wheel tow boat for the U. S. Engineer's Office. Bids were opened at New Orleans on July 28.

Plans are to be prepared for a large hydro-electric development for the Davis & Weber Counties Canals in Utah. This canal is one of the most important irrigation systems in the state of Utah. It is 17 miles long and carries a maximum of 750 sec. ft. of water, serving at present more than 500 fruit orchards and farms in the counties indicated by its name. This canal is diverted from the Weber River at the mouth of the Weber Canyon. The canal is carried from here along the side of a stretch of hills overlooking the Uintah Valley. At a certain point on this canal, four miles from the mouth of the Canyon, there exists a sheer drop of 220 ft. to the valley below. This head will be utilized in conjunction with a hydro-electric power station in the valley, the discharge to be returned to the Weber river. The maximum power available is, approximately, 15,000 H.P. The initial installation will be designed to develop about 6,000 H.P. H. A. Strauss, Vice President and Chief Engi-

Items marked thus ✣ indicate work now open for bids.

neer of the Falkenau Electrical Construction Co., Chicago, Ill., is Consulting Engineer for the work.

Washington.

The city of Olympia, Wash., is reported to be calling for bids for constructing a large fill at the head of the bay north of Third St., known as the Carlyon reclamation project. This fill comprises about 19 blocks and is designed to provide a large tract of waterfront land for cheap factory sites. The estimates of City Engineer Van Epps call for a fill of 561,165 cu. yds. of dirt to be dredged from the channel, and bulkheading all the way around, the estimated cost being $102,297.20.

The City of Tacoma proposes to construct a city dock and market on the water front between 11th and 15th Sts. The city is reported to have invited sketch plans for the structures, these plans to be submitted to W. C. Raleigh, City Engineer, by Aug. 10. A prize of $150 is to be given for the plans that are considered the best.

Wisconsin.

✣Bids will be received at the Forest Products Laboratory, Madison, Wis., until 2 p. m., [illegible] sary for installing on Forest Service foundations, electrical equipment for driving a 500 hp. ground wood pulp grinder in the Forest Service Ground Wood Laboratory.

Canada.

✣Tenders will be received until Noon, Sept. 1, by P. G. Keyes, Secretary, Department of Interior, Ottawa, Ont., for furnishing iron posts for use on the survey of Dominion lands to be delivered as follows: 15,000 to Winnipeg; 10,000 to Prince Albert; 12,000 to Edmonton.

BRIDGES AND BUILDINGS

California.

L. M. Scott, San Jose, Cal., has been awarded the contract at $4,380 for constructing a concrete bridge over Guadaloupe Creek on the Alameda road for the county three miles from San Jose. Bids for the work were opened July 25.

Advices from Hollister, Cal., state that the County Commissioners have decided to construct a new steel bridge across the Salinas River near Metz station at a cost of $33,000.

According to an announcement reported to have been made by President Ripley, the Santa Fe Ry. is planning the construction of a new bridge on its San Diego branch over the Santa Ana River in California, to cost approximately $125,000. According to the proposed plans the bridge will consist of 11 90-ft. steel girders and will rest on large concrete piers and abutments.

At a special meeting of the Marysville, Cal., City Council the following bids were opened for the construction of new floor on the approach to the Feather River bridge: Marders & Beere, Marysville, $6,975; Pacific Construction Company, $7,130; Western Bridge and Construction Company, Sacramento, $5,290; Ed. Malley, San Francisco, $5,700. The awarding of the contract is pending the agreement of the County Supervisors to bear one-half the expense.

Information from San Francisco, Cal., is to the effect that the Supervisors have authorized the Board of Public Works to contract for the completion of the southern section of the Mission viaduct; also the second section of the distribution system of the auxiliary water system.

Commissioners of Napa County, Napa, Cal., have decided to construct two stone bridges on the Browns Valley road.

The contract for the Walker Creek bridge in Willows, Cal., mentioned in our last issue, has been awarded by the Board of Supervisors to Bid Williams of Willows for $1,875.

District of Columbia.

✣Bids are asked by Walter H. L. Pettus, Constructing Quartermaster, Walter Reed General Hospital, Takoma Park, Washington, D. C., until noon, August 17, for the construction, etc., of one army nurse corps home and one mortuary at the Walter Reed General Hospital, Takoma Park, D. C.

✣Bids will be received until noon, August 5, by W. M. Hays, Secy. U. S. Department of Agriculture, Washington, D. C., for extending and improving the steam heating system in the buildings of the weather bureau, 24th and M. sts., northwest, Washington, D. C.

✣Department of Interior, Frank Pierce, Washington, D. C., Acting Secretary, will receive bids until 2 p. m., August 8, for the installation of a vacuum heating system for the Pension Office building, Washington, D. C.

Florida.

✣Bids will be received about the middle of August by the County Superintendent of Education, Fort Myers, Fla., for the erection at Fort Myers of a school building.

At the July meeting of the Hillsborough County Commissioners at Tampa, Fla., the construction of a new steel bridge across the Palm River at South Tampa was ordered. The bridge will be a modern structure and is estimated to cost $9,000.

Georgia.

✣Bids will be received until 10 a. m., August 17, by R. V. LaDow, Superintendent of Prisons, Department of Justice, Washington. D. C., for furnishing and delivering at the United States penitentiary at Atlanta, Ga., conduit, outlet boxes, etc., for electric light, telephone and clock outlets for the hospital building.

Illinois.

✣Bids will be received by F. M. DeLapp, Town Clerk, of South Ottawa, P. O. Ottawa, Ill., until 1 p. m., August 5, for the construction of a bridge over Covel Creek on the boundary line between section 36, town of South Ottawa and Section 31, town of Fall River.

Commissioners of Vermilion County, Danville, Ill., have awarded the contract to the Paris Bridge Co., for the construction of two steel bridges, one located on Salt Creek near Catlin, for $8,500, and the other in the city of Danville for $2,000.

Town Council of Rockdale, suburb of Joliet, Ill., at a recent meeting started a movement toward the construction of a new bridge over the Illinois & Michigan Canal at Midland Ave. Right of way has been donated and a committee appointed to take the matter up with the canal commissioners.

Upon investigation the highway commissioners and officials of the Joliet & Southern Traction Co. found that a large amount of work will be necessary in order to operate cars over the Jackson street viaduct, which is now under construction in Joliet, Ill. The work necessary will include the construction of a big fill and extensive grading at the east approach and the Spring Creek bridge east of the new structure will also have to be reinforced.

The Cass County Board at Virginia, Ill., is preparing to let a contract for the construction of seven concrete bridges and culverts. Plans and specifications were prepared for the work under direction of the State Highway Engineer.

The contract for the construction of the new bridge over the North Fork of the Sangamon River on the Mt. Auburn Road leading out of Illiopolis, Ill., to Christian County has been let to Frank R. Miller, Springfield, Ill. His bid was as follows: 160 ft. span, tubes one end and concrete the other, $6,399; 140 ft. span on four tubes, wood floor, $6,300; 160 ft. span, concrete at both ends, $6,500; 140 ft. span, concrete at both ends, wood floor, $5,500.

Indiana.

✣Board of Hospital Trustees, Central, Ind., will receive bids until 10 a. m., August 3, for the necessary labor and material for the construction of a new upholsterers' department: also for repair of store building and power house

✣Commissioners of Marion County, Ind., will receive bids at Indianapolis, until 10 a. m., August 6, for the following work: Culvert 100 ft. south of the N. E. corner of the S. E. ¼, of Section 26-15-2, Decatur town-, ship; Culvert on road N. E. ¼, of the S. E. ¼, of Section 11-14-2, Decatur township; Culvert on road in S. E. ¼, of the S. E. ¼, of Section 11-14-2, 1,000 ft. north of the south line of Section 11-14-2, Decatur township; Culvert on the German Free Gravel Road, 2,100 ft. west of the southeast corner of Section 14-15-4, Franklin township; Culvert on the German Free Gravel Road, 1,700 ft. west of the southeast corner of Section 13-15-4, Franklin township; Culvert over Bean Creek on township road running north and south through center of the S. E. ¼, of Section 16-15-4, Center township; Culvert on west line S. E. ¼, of Section 16, twenty (20) ft. north of the south line of Section 16-17-5, Lawrence township; Repairs to Indianapolis & Cumberland Free Gravel Road, on west line of Section 6-15-5, Warren township. Albert Sahm, Auditor.

✣The Benton County Commissioners will receive bids until 1 p. m., August 8, at Fowler, Ind., for the construction of a bridge over Mud Pine Creek at Chase. Lemuel Shipman is County Auditor.

✣Trustees of Eagle township, Boone County, Ind., will receive bids at Zionsville, Ind., until noon, August 11, for the construction of an 8-room schoolhouse. Plans and specifications are on file at the office of Lavten Allen, 44 Lombard Bldg., Indianapolis, Ind., architect. H. H. Avery is trustee.

Contract has been let to Fitz-Simmons-Connell Co., Chicago, $3,950, for theconstruction of the temporary bridge over the Grand Calumet River at Hohman St., Hammond, Ind.

Iowa.

Board of County Supervisors at Ottumwa. Ia., have let contracts for the construction of bridges to the Ottumwa Bridge Co., Ottumwa, Ia. One on the county line in Washington township where Jefferson and Wapello counties meet. The last named bridge is one of 24 foot steel beam span, 14 feet wide, and was awarded for $1,064. The other bridges were of the following dimensions and will cost as follows:

Item No. 1.—60 feet long with steel cost of $980. Total cost of $2,830.

Item No. 2.—70 feet long with 30 foot apron; steel cost, $1,865. Total cost, $3,195.

[illegible] apron; steel cost, $1,250. Total cost, $2,155.

Plans for the construction of the proposed Le Claire St. viaduct in Davenport, Ia., have been filed in the office of the city engineer by the Chicago, Rock Island & Pacific Ry. engineers. According to the present drawings, the new structure will reach from Iowa St. to the middle of the block between LeClaire and Fardman Sts.

[illegible] three weeks.

Kansas.

✣[illegible] Superintendent of Prisons, Department of [illegible] United States Penitentiary, Leavenworth, Kan., conduit outlet boxes, etc., for the elec-

Items marked thus ✣ indicate work now open for bids.

tric light, telephone and clock outlets, Hospital building.

At a joint meeting of the commissioners of Douglas and Jefferson counties, Kansas, at Lawrence, the contract for the reconstruction of the Perry-Lecompton bridge was let to the Missouri Valley Bridge Co., for $7,990. Work on the bridge will start soon as material for the false work can be gotten on the ground, and the spans will be rebuilt throughout. damaged and missing pieces being supplied.

Bids were opened July 25 by the County Commissioners at Minneapolis, Kan., for constructing four bridges. The contracts for Buckeye Bridge Nos. 1 and 2 and Morton bridge No. 1 was let to the Kansas City Bridge Co., Kansas City, Mo., at $4,010. The contract for Garfield Bridge No. 1 was not let. H. A. Brownlee, Minneapolis, Kan., is County Clerk.

Kentucky.

According to advices from Louisville, Ky., the County of Jefferson has selected Charles F. Taylor as commissioner, and steps are now being taken at locating a site for the proposed new bridge over the Salt River at West Point. The project was mentioned in our last issue.

Michigan.

The township board of Holland, Mich., has decided to replace the old Scholten bridge on the main road between Zeeland and Holland with a new steel structure, estimated to cost about $7,000.

Maryland.

✣Bids are asked until 11 a. m., August 10, by Board of Awards, Baltimore, Md., for the necessary labor and material for the construction of the sub and superstructure of the proposed Poplar Grove st. bridge.

✣Bids will be received by the Board of Awards, Baltimore, Md., until 11 a. m., August 17, for furnishing the following items for the Bayview Asylum: (1) furnishing materials and labor for the construction of a power house; (2) furnishing and installing engines, generators, switchboard and electric wiring; (3) for boilers, piping, in power house and piping on the grounds; (4) for the water supply system, including water storage tank, pumps, etc.

The States Road Commission has awarded the contract for the construction of a reinforced concrete bridge near Belair, Md., to David E. Evans & Co., for $14,000.

At a meeting in Baltimore, Md., Harbor Engineer Lackey and Capt. F. H. Wagner, decided the revised plans satisfactory for the construction of the new bridge across Jones Falls at Pratt st. The structure is to be of concrete with 95 ft. clear span, and will have a width of 120 ft., corresponding with that of Pratt street. The roadway will be paved. The cost of the work is estimated at $90,000.

Minnesota.

✣Bids will be received until August 15, at 10 a. m., by the Village Board of Randolph, Minn., and the county commissioners for the construction of a highway bridge across Chub Creek in Randolph. The structure will have a 60-ft. pony truss span with 16-ft. clear roadway on concrete abutments with pile foundations or on I-beam abutments.

✣Bids will be received until 10 a. m. August 15, by the commissioners of Goodhue and Dakota Counties and Boards of towns, Stanton and Randolph at the latter place, for the construction of a 160-ft. bridge over the Cannon River on the new highway leading south from the Village of Randolph. The structure will have a 16-ft. clear roadway and will rest on two concrete abutments.

Bids were recently opened at Rochester, Minn., for the construction of the Winona Ave. bridge and the contract was awarded J. P. Chase, of Chatfield, Minn.

Commercial Club of St. Paul, Minn., at a recent meeting passed strong resolutions against the issuance of bonds for the erection of the proposed bridge over the Mississippi River. Owing to the erection of the new union depot and the proposed change in the channel of the river, the committee of public affairs thought it impracticable at the present time.

Missouri.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a steam heating and ventilating apparatus, etc., for the United States Postoffice building at St. Louis, Mo., until 3 p. m., August 26.

The County Court at Independence, Mo., has awarded the contract for the construction of three bridges as follows: A 30-ft. bridge, two and one-half miles northeast of Lone Jack, to the Canton Bridge Company, at $725. Abutments to J. C. Brown, at $822.50. A 30-ft. bridge southeast of Hickman's Mill, to the A. M. Blodgett Construction Company, at $695. A 36-ft. bridge one-half mile southeast of Buckner, to the Canton Bridge Company, at $955. Abutments to Jones & Phillips of Buckner for $599. All of the bridges are to be completed within ninety days.

Montana.

Commissioners of Cascade County let the contract at Great Falls, Mont., recently for the construction of 18 steel bridges from 15 to 30 ft. long to the Midland Bridge Co., Kansas City, Mo., for $18,600.

Committee of the City Council of Missoula, Mont., has recommended the postponement of bids for the proposed bridge across the Rattlesnake Creek at Vine street until Deymour H. Knight, concrete bridge expert from Spokane, Wash., can prepare plans for his type of a bridge.

Advices from Fort Benton, Mont., state that the Board of County Commissioners have awarded the contract for the construction of two bridges over Milk River about 6 and 8 miles from Chinook to O. E. Peppard, Missoula, Mont., for about $9,000 each. The structures are to be of steel.

Nebraska.

Citizens Committee of Schuyler, Neb., have succeeded in raising $10,000, the amount pledged toward the construction of the Platte River bridge.

Bids will be received until 3 p. m., Sept. 19, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, and electric conduits and wiring, of the U. S. Post Office at Plattsmouth, Nebr.

New Jersey.

Committee has recommended to the Board of County Supervisors, Elizabeth, N. J., that a new bridge be constructed on Normandy st., Cranford.

New York.

✣Bids will be received until 11 a. m., August 10, by A. E. Steers, President of the Borough of Brooklyn, New York City, for the following contracts: No. 1. For furnishing all the labor and materials required for repairs and alterations to steam boilers and piping in the Municipal Building, Hall of Records, Kings County Court House and Borough Hall. No. 2. For furnishing all the labor and materials required for waterproof flooring in the Brooklyn Disciplinary Training School, as per specifications. No. 3. For furnishing all the labor and materials required for repairs and alterations to plumbing and steam fixtures in the Brooklyn Disciplinary Training School. No. 4. For furnishing all the labor and materials required for repairs and alterations to carpentry, etc., at Brooklyn Disciplinary Training School.

✣Bids will be received until 2 p. m., August 4, by Kingsley L. Martin, Commissioner of Bridges, Department of Bridges, Nos. 13-21 Park Row, New York City, for replacing floor beams, stringers, etc., on the steel superstructure of the Manhattan bridge over the East River, between the boroughs of Manhattan and Brooklyn.

✣Bids will be received until 2 p. m., August 4, by Kinsley L. Martin, Commissioner of Bridges, 13-21 Park Row, New York City, for removing the Madison Ave. temporary bridge over the Harlem River and the approaches thereto.

✣Board of Contract & Supply, Rochester, N. Y., will receive bids until 10 a. m., August 3, for the construction of a reinforced concrete arch bridge across the Genesee River at Central Ave., together with other work incidental thereto. F. X. Pifer is secretary of the board.

The Turner Construction Co., New York City, has been awarded the contract for a reinforced concrete factory building for the Alling & Cory Co., Rochester, N. Y. Building to be erected in Buffalo, N. Y. It is to be L shape, 153 ft. by 65 ft., with a wing 117 ft. by 53 ft. Both of the buildings are 6 stories and basement in height and are figured for 300-lb. floor loads. Work will be undertaken at once.

The Turner Construction Co., New York City, has been awarded the contract for a reinforced concrete factory building for the Bush Terminal Co., of Brooklyn. Building is 440 ft. by 230 ft. in plan, 8 stories in height. William Higginson, architect. Work will be undertaken at once.

The contract for placing Raymond piles in the foundations of the Waters School, West Wilson & North Campbell Aves., Chicago, Ill., has been awarded to the Raymond Concrete Pile Co. of New York and Chicago; A. F. Hussander, Acting Architect, Chicago Board of Education.

North Dakota.

✣Morton County Commissioners will receive bids until 10 a. m., August 18, at Mandan, N. Dak., for the construction of a county bridge in township 137, range 80. The structure is to consist of an 80 ft. steel span on tubes with 32 ft. approach at one end and 16 ft. approach at the other and concrete backings and wings; also for two 16-ft. Eyebeam bridges on concrete foundations, and two 40-ft. two-truss span bridges on steel pile foundations with concrete backings and wings, and one 50-ft. low-truss span bridge on steel pile foundation with concrete backing and wings, and one 26-ft. Eyebeam bridge on steel piles with concrete backing and wings. All bridges to have 16 ft. clear roadway. H. H. Harmon is county auditor.

Ohio.

✣Bids will be received until noon, August 19, at Cincinnati, O., by the Board of County Commissioners for the construction under specification No. 94, of a concrete bridge on Duckcreek road near Henry Cordes' place, in Columbia township. Fred Dreihs is clerk of the board.

✣Bids will be received until 11 a. m., August 10, by Board of County Commissioners, Cleveland, O., for the construction bridge per report No. 2679, Jetties, Chagrin River at Gates Mills Bridge, Mayfield township. Plans and specifications are on file at the office of the County Engineer, City Hall Bldg. John F. Goldenbogen is clerk of the board.

✣Bids are asked by the Board of County Commissioners at Huron, O., for furnishing all materials and labor necessary for the construction complete of the substructure and superstructure of a highway bascule bridge and approaches over the Huron River at Van Rensselaer street. Plans and specifications for the work are on file at the office of John Deist, county auditor. A certified check for $1,200, payable to the order of the Board of County Commissioners must be filed with each bid.

The County Commissioners at Akron, O., have awarded the contract for the superstructure of the proposed Fourth Street bridge to C. B. France, Akron, O., at $1,516, and the superstructure to the Burger Iron Co., Akron, O., for $1,375. The other bidders on the work were Central Concrete & Construction Co., Home Engineering Co., of Canton, O., E. C. Hovey, Akron, O., and Thomas McGuire, Akron, O.

The Commissioners of Butler County, Hamilton, O., have received the following bids for the construction of the steel concrete bridge over Elk Creek in Madison township, estimated to cost $6,305, and have referred same to the engineer for tabulation: Frank Bone, $6,200; D. E. Snider, $1,241; William Fogarty, $1,279; Oregonia Bridge Company of Lebanon, $4,950; Cranford Bridge Company, of Cincinnati, $5,895; Central States Bridge Company, of Indianapolis, Ind., three bids on different plans, $4,400, $4,590, $4,690; Wynkoop-McGormley Bridge Company of Toledo, bridge, $4,940; Capital Construction Company, foundation and bridge, $5,850.

The Director of Public Service, Youngstown, O., received the following bids for the construction of the new concrete arch bridge at Andrews Hollow on Elm street: Charles H Connell, $27,205; Turner & Olson, $32,950, Rood & Scott, $38,580; James McCarren, $34,960; Chambers & Heasley, $34,395; Louis Adovasio, $27,785; Youngstown Sales Company, $35,760; Carpenter & Fleming, $30,767; S. H. DeGroot, $29,170.

The Branchland Bridge Co., Branchland, O. has been incorporated with a capital stock of $20,000 and proposes the construction of toll bridges and to transport passengers. The incorporators are L. R. Via, A. M. Parsons, E. W. Leete, Rufus Sweitzer, Huntington and W. E. Beardsley, Clarksburg, O.

Advices from Cincinnati, O., state that the County Commissioners on July 19 awarded the contract for the construction of bridges across Banklick Creek and De Coursey Creek to the Carolina Engineering Co., Burlington, N. C., for $13,450.

The contract for sand blasting the High and Main street bridge in Hamilton, O., has been awarded to the Bracket Bridge Co., Cincinnati, O., for $2,695. The work will be started at once.

Plans of Engineer Dillon for the construction of the new bridge over the Miami and Erie Canal at Grand Boulevard, Hamilton, O., are now under consideration by the County Commissioners. The structure will be either a hoist bridge, vertical hoist, roller lift or bascule, and will be operated by electricity. According to specifications, the roadway will be paved with wood block and will have cement sidewalk. The estimated cost of the improvement is $14,206.

Preparations are being made for the construction of a new bridge at Francis street over the Auglaize River in Defiance, O., to replace the old one taken out by the ice last winter. The new bridge will be of heavy structural steel and will rest on concrete pier and abutments. The work is estimated to cost $24,000.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 P. M., Sept. 7, for the steel furniture for vaults in the U. S. Post Office, Custom House and Court House, Cleveland, O

Oklahoma.

A contract has been let to the Kansas City Bridge Co., at $10,000 for the construction of a large steel bridge across the Salt Fork River north of Cherokee, Okla. Work will be commenced on the structure, which will be one of the largest in the state, at once.

A company has been formed at Grandfield, Okla., for the purpose of constructing a wagon toll bridge over Red River. The structure is to be 4,000 ft. long, resting on piles. J. G. Hardin, G. W. Wigham and W. G. Webb, all of Wichita Falls, Tex., are members of the company.

Oregon.

Court of Union County, at La Grande, Ore., has ordered the construction of a number of new bridges to be erected this year as follows: Across the Grand Ronde River at Cove, over the big ditch between La Grande and Imbler, over Willow Creek, near Imbler, and the wooden span which gave away across the Grand Ronde east of Elgin will be replaced with an 80-ft. steel span. In addition to this the bridge over Wallowa River is being raised three feet.

Pennsylvania.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Sept. 13, for the construction, including plumbing, gas piping, [illegible] and wiring, [illegible] Pa.

Richard Walsh, 5922 Tacony street, Philadelphia, Pa., has been awarded the contract, at $15,000, for [illegible] substructure for the city of Philadelphia, bids for which were opened July 20. The work includes concrete abutments and column piers, grading and paving.

The County Commissioners at Franklin, Pa., have awarded the contract for the construction of the new bridge across the Allegheny River at Oil City to Rogers Bros., Albion, Pa., for $171,868.

Judge Ferris, according to the latest reports from Wilkesbarre, Pa., has granted a preemptory mandamus against the commissioners of Luzerne County compelling them to erect the structure over the river at Plymouth regardless of the costs in excess of that fixed by the viewers.

Advices from Harrisburg, Pa., state that Governor Stuart, has approved the charter of the McKeesport & Mifflin Bridge Co., which proposes to construct a bridge over the Monongahela River at McKeesport, Pa. The company, which is formed of business men of the latter city, is capitalized at $3,000.

A meeting of the City Council and County Commissioners was recently held at York, Pa., to consider plans relative to the reinforcement with concrete the condemned College Avenue structure, or the erection of a new bridge on the same site.

Bids for the construction of the bridge on the line of N street, made necessary by the construction of the sewage disposal plant at Torresdale, Philadelphia, Pa., have been received by the Pennsylvania Railroad as follows: John McMenamy, $46,500; Cramp & Co., $45,778, both agreeing to complete the work in eight months; American Paving & Construction Company, $52,700, nine months; Thomas F. Reilly, $44,000, six months; McNichol Paving & Construction Company, $48,109, 12 months, and Richard Walsh, $39,757, seven months.

The business element of Pittsburg, Pa., is backing the project for the construction of another bridge across the Monongahela River. The plans considered tentatively are to build a double-decker bridge—the lower portion of the bridge to run from Sixth avenue and Forbes street in the city proper and terminate on grade at Third and Carson streets on the South Side. Such a construction would relieve the congestion on the Smithfield street bridge and on Smithfield street itself. It would obviate the necessity of widening the Smithfield street bridge, as now contemplated.

Judge Garmon, Wilkesbarre, Pa., has handed down an order to the County Commissioners from the Grand Jury favoring the construction of a surface bridge across the river at Nanticoke, to cost $149,276. The matter will be taken up at once.

It is believed that the committee recently appointed by the Common Council of Harrisburg, Pa., will recommend the construction of a new bridge at the crossing of 18th street and the Philadelphia & Reading railroad.

A preliminary meeting was recently held at Coatesville, Pa., to take up the matter regarding the construction of a bridge across the flat on Main street.

The following bids were received by the Commissioners of Luzerne County, Wilkesbarre, Pa., for the construction of a concrete floor covered with asphalt and car tracks on the Berwick-Nescopeck Inter-county bridge: C. H. Reimard, Bloomsburg, Pa., concrete floor and roadway, $12,338.40; asphalt wearing surface, $9,894.73; painting floor surface with two coats graphite paint, $1,635.21; railroad track, $2,800.00; total, $26,668.40. Check for $1,333.42, claimed to be filed with bid, forwarded to Columbia County Commissioners. John P. Fooley, Wilkes-Barre: Concrete floor and roadway, $12,920.00; asphalt wearing surface, $11,486.00; painting floor system with two coats [illegible] track, $3,000.00; total, $28,890.00.

South Dakota.

✣[illegible] cation, Kimball, S. Dak., until 8 p. m., August [illegible] grade school building.

Tennessee.

✣Bids will be received until noon, August 10, by Judge George T. Weakley, chairman Dyer County Court, Dyersburg, Tenn., for the erection and completion of two-story and basement brick courthouse. Brinton Davis is architect.

The City Commission of Memphis, Tenn., on July 26, awarded the following contracts: Reinforced concrete culvert on Waldren blvd., to F. D. Harvey of Memphis, for $2,270; reinforced concrete culvert on Cooper st., to Clarke Construction Co. of Memphis, for $1,257; reinforced concrete culvert on Lathan st., to F. D. Harvey of Memphis, for $834; reinforced concrete culvert on Chelsea st., to F. D. Harvey of Memphis, for $3,268; reinforced concrete culvert on Monroe av., to Lindsay Brothers of Memphis, for $762.

Texas.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Sept. 6, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Postoffice at San Marcos, Tex.

✣Bids will be received until 3 p. m., Sept. 9, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring of the U. S. Post Office and Custom House at Port Arthur, Texas.

The contract for furnishing seats for the auditorium building of Houston, Tex., has been awarded to the American Seating Co. of Chicago, Ill., on a bid of approximately $10,800 for 6,259 seats. Folding opera chairs of the stationary kind are to be used in the two galleries, while first-class banquet seats will be placed on the orchestra floor, banquet hall and boxes. These will be of the movable variety. The seats will all be colored a light green.

The City Commissioners of Houston, Tex., have awarded the contract for the construction of the eight-room annex to the Fannin school to W. E. Woodruff of Houston, at $29,988. The contract for heating apparatus and plumbing in the new building was awarded to the Keithly Co., Houston.

A proposition to build a viaduct over Oak street railroad crossing was submitted to the city of Texarkana, Tex., by the Texas & Pacific, Cotton Belt and Kansas City Southern Rys., July 18. The plans call for a steel viaduct with a 20-ft. carriage driveway and concrete sidewalks on each side, and will cost about $100,000. This matter has been agitated for some time, as a number of switches and main lines at Oak street make crossing very dangerous.

Virginia.

✣Bids will be received until 10 a. m., Aug. 29, by Captain Ernest R. Tilton, Fort Monroe, Va., for the construction of an addition to enlisted men's artillery school, Fort Monroe, Va., including extension to boiler room for coal bins and installation of ash hoist.

✣Bids will be received until 1:30 August 19, [illegible] Home, Va., for furnishing and installing the following: Body ironer and repairs to extra [illegible] floors, library building and main laundry; for repairs to plumbing, main laundry, general mess hall and barracks company F, and labor and material for furnishing and installing voltage regulator in power house.

Washington.

✣[illegible] 24, by Constructing Quartermaster, Fort George Wright, Wash., for the construction, [illegible] fixtures for electric lighting of 1 two-story brick annex to post hospital Fort George Wright, Wash.

Residents in the vicinity of Hangman Creek, Spokane, Wash., have filed a protest with the mayor against the construction of a fill and state that a concrete bridge should be constructed for crossing.

The contract for the construction of the Stevens Creek bridge in Chehalis county has been awarded to W. G. Hiatt, Arlington, Wash., for $1,949 by the State Highway Commission.

Wisconsin.

✣Bids will be received until 2 p. m., August 15, by town boards of Lake and Grover and county board at the office of Marinette county auditor, Marinette, Wis., for the construction of a steel bridge on the section line between sections 23 and 24, 25 and 26 of the town 31, range 21, and on the dividing line of the Peshtigo river between the towns of Grove and Lake. J. A. Tiedjens is chairman of the town of Grover and Levi Sanborn is chairman of the town of Lake.

County Commissioners at La Crosse, Wis., have awarded the contract for the construction of a new steel bridge across the river at Union Mills in the town of Farmington, to the La Crosse Steel & Bridge Co.

The contract for the construction of the bridge across the Duck Creek in the town of Howard, Wis., has been awarded to John Roberts and the Illinois Bridge Co., for $2,600. The latter company will construct the superstructure.

Canada.

✣Bids are asked by Curry & Sparling, 90 Yonge St., Toronto, Ont., until noon, Aug. 10, for the erection of a fireproof building in Melinda St., Toronto.

✣Bids are asked until noon, Aug. 15, at the office of Darling & Pearson, 2 Leader Lane, Toronto, Ont., for all the various trades required in the erection and completion of buildings for the Out Patient Department and the Emergency Hospital in connection with the General Hospital.

✣Bids are asked by R. C. Dessrochers, Assistant Secretary Department Public Works, Ottawa, Ont., until 4 p. m., Aug. 22, for the construction of a Post Office building at Battleford. Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Joseph Greenfield, resident architect, Winnipeg, Man., at the Dominion Lands Office, Battleford, and at Ottawa.

✣Bids are asked by R. C. Dessrochers, Assistant Secretary Department of Public Works, Ottawa, Ont., until 4 p. m., Aug. 15, for the erection of a public building at Souris, Man. Plans, specifications and form of contract can be seen and forms of tender obtained at this Department, on application to Joseph Greenfield, resident architect, Public Works Department, Post Office Building, Winnipeg, Man., and at the Post Office, Souris, Man.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be opened 3 p. m., August 8, by R. W. Lisenby, Clerk, Dotham, Ala., for the construction of approximately 12 miles of sidewalk and curb and guttering. Plans and specifications are now on file at the office of the city clerk. S. C. Stallings is Engineer.

✣City Engineer, Maury Nicholson, Birmingham, Ala., will receive bids until 11 a. m., August 17, for the construction of approximately 128,000 sq. yds. street paving. The material will be brick, granitoid, bitulithic, asphalt or Kentucky rock asphalt.

Information received from Selma, Ala., states that W. S. Keller, County Engineer, has completed surveys for the construction of the proposed county road between that city and Burnsville. Right of way has already been secured and contract for the work will be let soon. The new road will give Selma an excellent turnpike to Autaugaville in Autaga County.

Contracts will soon be let, it is said, by the county commissioners of Morgan County, Ala., at Decatur, for the construction of several additional miles of turnpike as follows: One turnpike to commence at Decatur and run southwest on the Decatur and Danville road for a distance of five miles across the mountains. Another will run from Falkville, one and a half miles. And still another is to commence at Bartee's gin, on the Tennessee River, and continue for three miles on the Lacy Springs road. And a fourth will cover a distance of about 14 miles on road No. 2. This latter road is badly in need of a turnpike, owing to the fact that it is one of the most popular county roads in the east end of the county.

California.

✣All bids received July 18, by the Napa County Board of Supervisors, Napa, Cal., for macadamizing of Sections a, c and d of the Browns Valley Road commencing about a mile west of Napa were rejected and the work has been readvertised, bids to be received until August 9.

✣Henry F. Vogt, Secretary of the Park Commission of Oakland, Cal., will receive bids until 2 p. m., August 4, for furnishing the necessary labor and materials for the construction of an asphalt roadway in Lakeside Park for the Park Department in the city of Oakland.

Advices from San Jose, Cal., state that the Board of County Supervisors has passed a resolution providing for the construction of a mountain drive, extending from the Gage Canal along the Box Springs Road to the intersection with the Santa Fe R. R. in the Fourth Supervisorial district. The road bed will be constructed of oiled macadam and will be 16 ft. wide with a 3-ft. gravel shoulder on each side. The work is estimated to cost $30,000.

The Board of Supervisors of Plumas County has awarded the contract for the construction of 5 miles of road to E. M. Green, Clio, Cal., for $4,995. This is their first action since their decision to cooperate with Sierra County Supervisors in building the Mohawk Valley road.

Advices from San Francisco, Cal., state that a committee including members of the Finance and Public Utilities Committees, Board of Supervisors, City Engineer Manson and Public Works Commissioners after a trip of inspection decided upon the Cliff House as the terminus for the proposed Geary St. road at the Beach.

In view of improving the county roads the Board of Supervisors of El Dorado County, Cal., are making an inspection of the public highways.

Colorado.

The Commissioners of Otero County, at La Junta, have awarded a contract to L. C. Swink for work on the Santa Fe trail east of Rocky Ford. The contract calls for 77,000 cu. yds. of excavation, the contract price being 11½ cts. per cu. yd.

The Larimer County Commissioners at Fort Collins, Colo., have decided to call for bids for the construction of a scenic highway from that city to Estes Park, to shorten the distance between the two places 5 miles. This project has been advocated for some time by the people in that vicinity.

County Commissioners, according to advices from Florence, Colo., are planning to grade a new road one mile southwest of Penrose, along sectional lines to connect with the Pueblo road seven miles east. This new stretch of road will also connect with cross section roads to Portland, Concrete, Beaver Creek and Penrose. During the past two years the commissioners of this county have spent large sums of money on roadways in this end of Fremont county, especially in the Beaver Park section. When the work now outlined is completed it will afford not only good roadways for the people of that section of Fremont county but of Pueblo and El Paso counties as well.

Connecticut.

✣Bids will be received until 5 p. m., August 9, by Benjamin E. Kelley, Borough Clerk, Greenwich, Conn., for paving Putnam Ave., from the Eastern boundary of the borough to its western boundary. Proposals will be received for brick, wood block or bitulithic.

Georgia.

The Road Commissioners of Knox County have awarded the contract to J. B. McTye for the construction of the sample road on the Rutledge pike adjacent to the exposition grounds for 1 per cent the cost as profit. The feature of this road construction will be the fact that one-half of the street, sectionally, will be built of asphaltum, and the other of tar or tarvia. The work will be done under the supervision of J. M. Eldridge, Atlanta, a government engineer.

Florida.

✣Bids are asked by J. P. Jones, Clerk of Perry, Fla., Council, until Noon, August 25, for the grading and paving of three to five miles of streets in the town of Perry.

Commissioners of Dade County at their last meeting in Miami, Fla., awarded the contract for the extension of Twelfth St. to the Orange Glade District, to Walter Waldin and work has already been commenced.

Idaho.

Committee of the Commercial Club of Twin Falls, Idaho, and the Automobile Club have made arrangements for the construction of 16 miles of good roads. The county is to pay one-third the cost of the work.

Illinois.

✣Bids will be received by the Board of Local Improvements of the city of Mt. Carmel, Ill., until 3 p. m., August 4, for the construction of 10,800 sq. yds. brick pavement, concrete foundation and concrete curb. Guy W. Courter is Engineer. Official advertisement will be found elsewhere in this issue.

✣Bids will be received about August 15 by Nokomis, Ill., for the construction of 20 blocks of vitrified brick paving. Walter R. McCaslin is Engineer.

Contract has been let by the Board of Local Improvements, Chicago, Ill., for adjusting sewer manholes and catch-basins, constructing and connecting catch-basin inlets, constructing new catch-basins complete, grading and paving with creosoted wooden blocks on 1 in. of sand and 8 ins. of Portland cement concrete, joints filled with coal tar, surface dressed with ¼ in. of sand, the roadway of La Salle St. from the south line of Madison street to the north line of Jackson street.

The Board of Local Improvements, Peoria, Ill., has decided that Adams St. from Hamilton to Bridge will be paved with creosote wood block and that Perry Ave. will be resurfaced from curb to curb with asphalt, excluding the central boulevard.

Board of Local Improvements, Quincy, Ill., has ordered the paving of the following streets in that city: Twelfth St. from Broadway to Maine, Fourteenth St. from Broadway to Maine, York St. from Tenth to Twelfth. Brick is the material under consideration for the improvement.

Items marked thus ✣ indicate work now open for bids.

The contract for the paving of East and West Main St., in Marion, Ill., has been awarded by the Board of Local Improvements to Valentine Wolf, for $45,759 and work will be commenced immediately. The other bidders on the West Main St. job were William Lough & Son, $28,559.59, Hoffman & Townsend, $28,707.84, George A. Peters, $27,761.65, Curdie & Manfine, $29,244.53, and those on the East Main St. job were: Hoffman & Townsend, $18,885.04, Curdie & Manfine, $18,982.72.

Board of Local Improvements, Chicago, Ill., opened bids July 26 for the paving of Johnston Ave. with asphalt from North California Ave. to North Kedzie Blvd. and it was discovered that the lowest bids were but 30 cents different. The American Asphalt Co. bid $18,134.80 and R. F. Conway Co., bid $18,135.10. For paving Elston Ave. with granite blocks between West Division street and West North avenue, the Parker-Washington Co. submitted the lowest bid, $28,839.20, while the John A. McGarry Co. submitted the lowest for paving West Twelfth street with brick between Talman avenue and South Fortieth avenue.

Indiana.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., August 17, for the improvement of the first alley east of Capitol Ave., from the north property line of McLean Place to the south property line of 22d St. by grading and paving the roadway.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Aug. 17, for the improvement of the first alley north of New York St. from the east property line of East St. to the west property line of Liberty St. by grading and paving the roadway.

✣Bids will be received until 10 a. m., August 17, by Board of Public Works, Indianapolis, Ind., for the improvement of Laurel St. from the south sidewalk line of Lexington Ave. to the north curb line of Prospect St. by grading and paving the sidewalks.

✣Board of Public Works. Indianapolis, Ind., until 10 a. m., August 17, for the improvement of the first alley north of St. Joseph St. from the west property line of Delaware St. to the east property line of Pennsylvania St. by grading and paving the roadway.

✣Bids will be received until 10 a. m., Auguse 17, by the Board of Public Works, Indianapolis, Ind., for the improvement of Thirty-sixth St. to the west curb line of Central Ave. from the west curb line of Pennsylvania St. by grading and paving the sidewalks.

✣Commissioners of Madison County, Ind., will receive bids at Anderson, Ind., until 10 a. m., August 16, for the construction of a gravel road in Jackson township. William T. Richard is County Auditor.

✣City Council of Wabash, Ind., will receive bids until 6 p. m., August 8, for the improvement of Stitt St. with sidewalks and macadam and tarvia pavement. William L. Agan is City Clerk.

✣Board of County Commissioners will receive bids until Noon, August 3, at Peru, Ind., for the construction of nine gravel roads in Jefferson, Pine Creek, Richland and Perry townships. Charles Griswold is Auditor of Miami County.

Bids were opened July 18 by the Board of Works of Indianapolis for street improvement work, contracts being let as follows: Cement walks on Temple Ave., Wm. H. Hall, Indianapolis, Ind.; cement walks on Washington Blvd., John Arnold, Indianapolis, Ind.; bitu-moss pavement on Thirty-sixth St., Indianapolis Bitu-Moss Co., Indianapolis, Ind.

The Board of Works of Indianapolis, Ind., opened bids July 22 for street improvement work, the following contracts being let: Resurfacing with brick on Meridian St., L. J. Cooper, Indianapolis; resurfacing with brick on Georgia St., Marion County Construction Co., Indianapolis.

Bids were opened July 8 by the Board of Works of Indianapolis, Ind., for street improvement work, contracts being let as follows: Brick paving on Dayly St., American Construction Co., Indianapolis; brick resurfacing of Maryland St., L. J. Cooper, Indianapolis; brick resurfacing on Maryland St. from Virginia Ave., L. J. Cooper, Indianapolis.

Board of Public Works has ordered the construction of a main sewer along Seventh St. from Division St to Ingle St. in Evansville, Ind.

Board of Public Works of Evansville, Ind., has designated brick as the material for the improvement of Governor Ave., from Lincoln Ave. to Louisiana St.

The County Commissioners with whom the petition for the improvement of East Wysor St. with brick paving from Walnut to the Whitely bridge has been filed have announced that the matter is now entirely up to the city council of Muncie, Ind.

Advices from Richmond, Ind., state that the contract for the improvement of the National Road from a point in West Richmond to the boundary line of Center township, distance of about 3 miles, has been let to John F. Cronin & Co., of that city for $52,000.

Property owners on Main St., Bicknell, Ind., have been notified by the Town Clerk that it is proposed to pave that street from Sycamore St. to a point 100 ft. south of Ried St. The work will include about 10 blocks of pavement. E. C. Williamson, Vincennes, Ind., is Engineer.

Iowa.

✣City Council of Clinton, Ia., will receive bids until August 9 for the following paving work: 8,330 sq. yds. creosoted wood block pavement on a 5-in. base and a 1-in. sand cushion; 2,040 lin. ft. concrete curbing; 440 lin. ft. concrete underpinning curb; 13 new style catch-basins; 640 lin. ft. 10-in. catch-basin pipe; 3 manholes topped out and provided with new style castings. W. E. Hayes is City Clerk. R. C. Hart is City Engineer.

✣City Council will receive bids until August 8 for the construction of two sections of pavement in Knoxville, Ia.

Council of Osceola, Ia., has awarded a contract to William Horrabin, Iowa City, Ia., for the construction of 13,000 sq. yds. of paving and 8,000 lin. ft. of cement curbing. The bid on the latter was 52 cts. and the paving was let at $2.10½.

City Council of Clinton, Ia., have ordered the construction of pavement on Main St. in Lyons from Sixth St. to the bridge. Creosote wood blocks have been recommended for the work.

The contract for paving A Ave. west between Market and B Sts. and South Third St. between Third Ave. and Rock Island Ave. was awarded by the City Council of Oskaloosa, Ia., to Magden & Sheeley, Des Moines, Ia., for $1.73 per sq. yd.

The contract for the construction of asphalt pavement in Des Moines, Ia., on Thirty-first St. from Grand Ave. to Center St. was let to McLaughlin-Bryant Co., at $2 and the pavement of Ingersoll Ave. from 28th to 42d St. was let to the same company for $2.15.

Property owners on Grande Ave., Cedar Rapids, Ia., have been notified by the City Council to make water, gas and sewer connections preparatory to the construction of pavement on that thoroughfare.

City Council of Marshalltown, Ia., has passed a resolution for the construction of brick block pavement and single concrete curb on the following streets and alleys: West Nevada St. from the end of present pavement to east side of First St.; Market St. from west line of First Ave. to east line of Second Ave.; South Third Ave. from south line of Nevada St. to main line of Chicago & Northwestern railway; alley from north line Main St. to south line of State St. in block 12, original town of Marshall; alley from west line of Third Ave. to the east line of alley intersection in block 12, original town of Marshall; alley from west line of Third Ave. to east line of alley intersection in block 2, Anson's second addition; alley from south line of alley intersection in block 2, Anson's second addition, south to the present pavement in the block; alley from east line Second Ave. to west line of Third Ave. in block 13, original town of Marshall; alley from south line of Main St. to north line of [illegible] original town of Marshall; Second St. from north line of Main St. to south line of State St. and from the north line of State St. to south line of Grant St., and from north line of Grant St. to south line of Lincoln St.

The Chariton, Ia., City Council has ordered the paving of Main St.

A petition is being circulated in Greenfield, Ia., for the paving of the square including a half block on each street leading to and from.

Residents on Superior St., Mason City, Ia., are agitating the construction of pavement on the south end of Rawlin St. as the mud is carried from that thoroughfare to the first street making it nearly impassable.

Kansas.

Advices from Hutchison, Kan., state that the road running north from the western salt plant through the frog pond is to be improved for a distance of ½ mile. The Reno Township Board and the City Commissioners will bear the expense.

Kentucky.

✣Board of Public Works, Paducah, Ky. will receive bids until 3:30 p. m., August 23, for the following work: Contract "A" (approximate quantities), granite curbing, 16,500 lin. ft.; concrete gutter, 16,800 lin. ft.; concrete walks, 34,000 sq. ft.; concrete driveways, 4,000 sq. ft.; cast iron drain pipe, 500 lin. ft.; sewer (10-in. to 24-in. pipe), 650 lin. ft. Contract "B" (approximate quantities), granite curbing, 1,370 lin. ft.; concrete gutter, 1,395 lin. ft.; concrete walks, [illegible] sq. ft.; concrete driveways, 300 sq. ft.; sewer (10-in. to 12-in.), 565 lin. ft. Contract "C" (approximate quantities), granite curbing, 6,150 lin. ft.; concrete gutter, 6,300 lin. ft.; concrete walks, 31,300 sq. ft.; concrete driveways, 930 sq. ft.; cast iron drain pipe, 500 lin. ft. Contract "D" (approximate quantities), granite curbing, 700 lin. ft.; concrete gutter, 700 lin. ft.; concrete walks, 3,600 sq. ft.; concrete driveways, 160 sq. ft. Contract "E" (reinforced retaining wall), (approximate quantities), [illegible] cu. yds.

The Board of Public Works, Louisville Ky., has awarded the Barber Asphalt Co. contracts for constructing pavement on the following streets: Virginia Ave., Beach to Thirty-second St., $1.82 per sq. yd.; Euclid Ave., Eighteenth St. to Twenty-first St., $1.82 per sq. yd.; Twenty-ninth St., Kentucky to Greenwood, $1.90 per sq. yd.; Brook, A to Lee, $1.80 per sq. yd.; Twenty-second St., Date to Oak, seven blocks, each $1.80 per sq. yd.; Woodland, Beach to Thirty-second St., two blocks, each $1.95 per sq. yd.

Louisiana.

✣Bids are asked by the City of Crowley, La., until August 16, for constructing street crossings on 28 streets.

The City Council of Crowley, La., on July 26 awarded the contract for 5 miles of cement walks on 28 streets to Dejersey & Bernard, of Jennings, La., at 12.45 cts. per sq. ft. There were three bids opened, the highest being 15.50 cts. The crossing contract was not let, as only one bid was put in for this work, and it will be readvertised and [illegible]

It is planned by the Police Jury of Iberia Parish and the town councils of New Iberia, La., and Jeanerette to construct a model highway between those places. The cost of the work is estimated at $3,000 per mile or $36,000 for the entire distance. It is also proposed to build a similar road from New Iberia to Avery's island (the salt mines) and to Loreauville on the north.

Maryland.

✣Bids [illegible] Quartermaster, Fort Howard, Md., until 10:30 a. m., August 15, for constructing a macadam

Items marked thus ✣ indicate work now open for bids.

road, macadam resurfacing roads, constructing concrete walks and cross walks.

✣Road Engineer, Baltimore County, will receive bids until August 4 at Towson, Md., for the improvement of Lawrence Ave., from Altamont to Paradise Ave., a distance of 1,500 ft. Each bid must be accompanied by a certified check for $200.

Massachusetts.

Bids were opened July 21, by the Commissioners of Middlesex County, at Haverhill, Mass., for constructing three miles of macadam road, the contract being let to Richard F. Hudson, 19 Whittier St., Melrose, Mass. Bids were compared on the basis of quantities in section from Martin's to Lake St. (about 1 mile): 950 cu. yds. earth excavation, at 50 cts., $475: 100 cu. yds. borrow $1, $100; 9,000 sq. yds. surfacing at 2 cts., $180; 2,100 tons broken stone in place, $1.55, $3,255; 160 ft. 8-in. pipe, 50 cts., $80; 200 ft. fencing, 40 cts., $80; 5 catch basins, $40, $200; 5 cu. yds. concrete, $10, $50; removing watering trough, $25; total $4,445 for 1 mile, or about $13,335 for the whole job.

The contract for the construction of brick block pavement on Dudley St., Boston, Mass., between Warren and Magazine Sts., has been awarded to James Doherty for $25,552, which was $2,000 below the next lowest bidder.

The contract for the paving of Geneva Ave. from Bowdoin to Park St., in Ward 20, Boston, Mass., has been awarded to Contractor Timilty for $23,567. The other bidders for the work included James Doherty, $23,727.80; C. W. Dolloff & Co., $23,865.90; Joseph B. O'Rourke & Co., $24,678.20; F. S. & A. D. Gore Corporation, $25,206.10, and Coleman Brothers, $25,809.50.

Michigan.

✣Bids will be received until 5 p. m., August 8, by Arthur Ryall, City Clerk, South Haven, Mich., for the macadamizing of Broadway from Phoenix St. to Green St. The work includes about 10,000 sq. yds.

At a recent meeting the Council of Muskegon, Mich., decided upon the improvement of Seventh St. and Park Ave. from Houston Ave. to Laketon Ave with crushed stone 6-in. deep and 12 ft. wide. The cost of the work is estimated between $1,400 and $1,500.

All bids received July 19, by the Common Council of Escanaba, Mich., for the construction of the improvement on Hartnett Ave. were rejected. Among the bidders were Delta Contracting Co., 34½ cts. per yd., and Solid Rock Paving and Construction Co., 33 cts. per yd.

Minnesota.

✣Bids will be received by H. P. Edwards, County Auditor, Fairmont, Minn., until 11:30 a. m., August 15, for the construction of Section 5 of the State Road No. 1 from station 186 plus 98 ft. to 239 plus 8 ft., being from the north quarter corner of section 15 to the west quarter corner of said section 15, one mile, all in Rolling Green township.

City Council of Bemidji, Minn., has decided to pave Third St. with cement from Minnesota to Bemidji Ave., with the exception of the square crossings. The contract for the work will be let at once to a local firm and it is expected that work will be commenced immediately.

The Board of County Commissioners, Fairmont, Minn., have awarded the contract for the construction of gravel roadway on State Road No. 1 to W. G. Brown and F. C. Gould for 85 cts. per yd.

Committee including W. M. Knight, R. J. Upton and C. B. Waddell of the board of commissioners, Hennepin County, Minn., have made an inspection trip preparatory to beginning a series of road improvements.

Missouri.

✣Bids will be received by the County Court at Kansas City, Mo., until August 12, for grading and macadamizing the road from Levasy south to Mecklin church. The cost of the work, according to the estimate of the Engineer, is $43,110. This work will be part of the general plan projected by the County Court several years ago to build a north and south road just inside the eastern part of the county from Levasy south to Lone Jack.

Bids were opened July 18 by the City of Cape Girardeau, Mo., for paving Broadway with brick, the contract being let to Hawley & Duoneld, Cape Girardeau, at $19,629. The work includes excavation, 1,260 cu. yds.; creosoted wood block paving, 1,392 sq. yds.; vitrified brick paving, 6,168 sq. yds.; curbing, 771 lin. ft. The same contractors were also awarded the contract at $3,623, for grading, curbing and guttering and macadamizing with asphaltum binder on Whittier St.

The Troy and Auburn Gravel Road Co. will receive bids until noon, August 16, 1910, for the construction of 14 miles of gravel road in Lincoln County, Mo. For plans and specifications write H. F. Childers, Secretary, Troy, Mo.

Nebraska.

The petition of the property owners on Sixteenth St. has been granted and the City Council of Omaha, Neb., has ordered the construction of wood block pavement on that thoroughfare from Farnam St. south to the north end of the viaduct.

At a recent election held in Omaha, Neb., it was voted to lay asphalt pavement in the district from Dodge to Underwood and from Forty-eighth to Fifty-second Sts. The Board of Trustees will later take up the matter of letting the contract.

North Carolina.

A mass meeting was recently held at Winston-Salem, N. C., by citizens and plans were discussed for the construction of a turnpike from that city to Pinehurst traversing five counties and connecting at the latter place with the national highway.

New Hampshire.

✣Bids will be received until 1 p. m., August 12, by H. C. Hill, State Engineer, Concord, N. H., for the construction of a gravel road in London estimated to cost $1,100.

✣State Engineer, H. C. Hill, Concord, N. H., will receive bids until 1 p. m., August 12, for the construction of a gravel road in Lyme estimated to cost $20,000.

New Jersey.

✣Bids will be received by the constructing quartermaster, Fort Dupont, Delaware City, Del., until 11 a. m., August 25, for the construction of an oyster shell road from Harrisonville, N. J., to Fort Mott, N. J.

New York.

✣Bids will be received until 2 p. m., August 16, by Capt. M. G. Spinks, Constructing Quartermaster, Fort Totten, N. Y., for the construction of approximately 713 sq. ft. concrete walk, 32 ft. concrete steps and 629 sq. yds. of macadam road at Fort Totten.

✣Bids are to be received until 2 p. m., August 8, by George McAneny, President of the Borough of Manhattan, New York City, for 19 street improvement contracts, the largest one being No. 11, as follows: For regulating and repaving with sheet asphalt pavement on a concrete foundation the roadway of Long Acre Square, from the south side of Forty-third St. to the north side of Forty-seventh St.; Broadway, from the north side of Forty-second St. to the south side of Forty-third St., and Seventh Ave., from the north side of Forty-second St. to the south side of Forty-third St. Engineer's estimate of amount of work to be done: 12,600 sq. yds. of asphalt pavement, including binder course, except the railroad area; 4,930 sq. yds. of asphalt pavement, including binder course, in the railroad area; 3,030 cu. yds. of Portland cement concrete; 1,880 lin. ft. of new bluestone curbstone, furnished and set; 180 lin. ft. of old bluestone curbstone, redressed, rejointed and reset; 23 noiseless heads and covers, complete, for sewer manholes, furnished and set; 39 noiseless heads and covers, complete, for water manholes, furnished and set. The time allowed for doing and completing the above work will be sixty (60) working days. The amount of security required will be $12,000.

✣Bids will be received until Noon, August 9, by George Cromwell, President of the Borough of Richmond, New York City, for eight repaving contracts, the largest being No. 7, as follows: For furnishing all the labor and materials required for regulating and repaving with vitrified brick pavement on a concrete foundation the roadway of Morningstar Road, from Sherman Ave. to Prospect St., and the gutters of Union Ave., from Richmond Terrace to the S. I. R. T. Ry.; South Ave., from Richmond Terrace to the S. I. R. T. Ry.; Nicholas Ave., from Richmond Terrace to Innis St.; Ann St., from Richmond Ave. to Avenue B; Avenue B, from Ann St. to south end of street; Church St., from Richmond Ave. to Broadway, and James St., from Sharpe Ave., to a point 125 ft. east of Elm St., together with all work incidental thereto. The Engineer's estimate of the quantity and quality of the material and the nature and extent, as near as possible, of the work required is as follows: 8,400 sq. yds. of vitrified brick pavement, including sand bed, and laid with cement grout joints, with one (1) year maintenance; 1,850 cu. yds. of concrete foundation; 1 cu. yd. of reinforced concrete, in place; 3,900 lin. ft. of new 4-in. by 16-in. bluestone curbstone, furnished and set; 11,200 lin. ft. of old curbstone, redressed, rejointed and reset; 10,000 sq. ft. of old sidewalk, relaid; 20 sq. ft. of new flagstone, furnished and laid; 20 sq. ft. of old flagstone, recut and relaid; 10 sq. ft. of new 4-in. bluestone dripstone, furnished and set; 450 lin. ft. of new 5-in. by 16-in. bluestone curbstone, furnished and set; 150 lin. ft. of roof leader outlets, relaid. The time for the completion of the work and the full performance of the contract is seventy (70) days. The amount of security required is Twelve Thousand Dollars ($12,000).

✣Bids will be received until 11 a. m., August 10, by Alfred E. Steers, Borough of Brooklyn, President, for four contracts for the construction of sidewalks, the largest being No. 3, as follows: For regulating, grading, curbing and laying sidewalks on Schaeffer St., from Knickerbocker Ave. to the county line, together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 890 lin. ft. of new curbstone, set in concrete; 1,390 cu. yds. of earth excavation; 30 cu. yds. of earth filling, not to be bid for; 50 cu. yds. of concrete, not to be bid for; 4,020 sq. ft. of cement sidewalk. The amount of security required is Seven Hundred Dollars ($700).

City of Buffalo, N. Y., has let contract for repaving South Division St., between Lord and Smith Sts., to the German Rock Asphalt Co., for $2,376. The paving of Broadway between Washington and Ellicott Sts., has also been ordered. The dressed Medina Sandstone has been recommended.

Advices from Schenectady, N. Y., state that J. C. Connors, of that city has been awarded the contract for the paving of the streets in Kinderhook village at 10½ cts. per sq. ft. The work calls for an expenditure of $10,000.

A proposition has been made to the village of Seneca Falls, N. Y., by the State Highway Department to pave with either 16 ft. of macadam or 10 ft. of brick, any of the streets traversed by Route No. 6, providing the village paves the remainder of the thoroughfares.

The following contracts have been let by the Board of Contract, Rochester, N. Y., for street improvements: Brinker St., asphalt, Rochester Vulcanite Paving Co., $2,106; Vann St., asphalt, Julius Friedrich Co., $1,990; Smith St., Medina block pavement, H. N. Cowles, $9,260; Davis St., brick pavement, Hagaman, Miller & Hagaman, $9,971; Weaver St., brick pavement, Julius Friedrich Co., $18,308; Marsh St., sewer, walks and grading, Julius Friedrich & Co., $2,476.75; Alameda St., walks, John J. Regan, $966.25; Marie St., walk, Henry Schoenfeldt, $358.25; Park View, walks, Wm. Margrander, $324.75; Magnolia St., brick and asphalt pavement. Rochester Vulcanite Pavement Co., $27,277.

Ohio.

✣Bids will be received until [illegible], August 12, by R. G. Ruslee, Clerk of Johnstown, O., for the construction of approximately 15,000 sq. yds. of paving and 8,000 lin. ft. of curbing.

✣City Clerk of Delphos, O., will receive bids until August 8, for the construction of about 20,000 yds. of vitrified brick or asphalt block paving on West Third, West Fifth and Scott Sts.

✣Bids are asked by Oscar Kosche, Clerk of the Village of Oakley, O., until Noon, August 9, for the necessary labor and material for the improvement of Brotherton Road from Martha Ave. to west line of Lot No. 45, by constructing a sewer therein. Each bid must be accompanied by a certified check for $50, payable to the village.

City Council has received a number of bids for paving Johnson St., in Upper Sandusky, O., and a committee has been appointed to investigate a certain brand of brick before the contract is let. P. Drake & Sons, Marion, submitted the lowest bid.

City Council of Wauseion, O., have been petitioned to take up the matter of improving East Birch St., which is at the present time in very bad condition. Engineer in charge has been ordered to submit an estimate of the cost.

An ordinance has been passed by the Council of Mansfield, O., providing for the improvement of West Third St., from Mulberry to Sycamore by recadamizing the roadway and finishing with oil, also providing for bonds amounting to $1,600 to defray the cost of the same.

Commissioners of Hamilton County at Cincinnati, O., have awarded the contract for the construction of 25 miles of county roads to D. M. Hanna, for $200 per mile.

Plans and estimates have been submitted by C. H. Wells, Engineer, to Service Director Taylor, Newark, O., for the following street improvement: Paving Locust St., from Stanberry to the B. & O. Ry. tracks, 36 ft. wide, $3,618; Seventh St., from West Main St. to Locust St., $4,303; Granville St., from Elevenh to Sixteenth St., with macadam and curbing, $15,353.

Advices from Springfield, O., state that the Board of Control is contemplating the letting of contracts within the next two months for the paving of West Main St., East High St. and College Ave.

Advices from Portsmouth, O., state that the contract for the construction of Section 8 of the Rock Ford Road was awarded to W. B. Smith at $2 per yd. and Sections 11 and 12 were awarded to Andrew Haggerty, Otway, for $3.60 and $3.70 per yd., respectively.

Board of Aldermen, Cincinnati, O., have passed a resolution directing the resurfacing of Madison Ave. from Seventh to Eleventh St.

Board of City Council of Bellevue, O., received bids for the reconstruction of Fairfield Ave. with vitrified brick and for the extension of the culvert over Taylor Mill Creek. They were referred to the City Engineer for computation.

Information from Dayton, O., states that the County Commissioners at a session July 15 adopted a resolution which provides for the macadamizing of the Covington pike from the corporation line to the Studebaker Road, a distance of about half a mile. The cost of the work is estimated at $3,000.

Contract has been awarded Garrigan Bros., by the County Commissioners at Toledo, O., for macadamizing Hill Ave., for a distance of 8 miles through Adams township, at $57,622. The other bidders were Russell & Jennison, the France Paving Co., and the Ohio Paving Co. The road is to be improved with tar bound macadam.

Oklahoma.

✣Bids will be received until August 6, by City Clerk of El Reno, Okla., for grading, curbing, guttering and paving Bickford Ave. in Hickox Addition.

✣City Clerk of El Reno, Okla., will receive bids until August 3, for the improvement of Rock Island Ave. Plans are on file at the office of the City Clerk.

A resolution has been passed by the Council of Oklahoma City, Okla., providing for the pavement of Walnut Ave. from the north line of Ninth St. to the south line of Thirteenth St., and also to do the necessary grading, to construct manholes and catch-basins, to put in inlet pipes, lateral storm sewers, curbs and reset curbs. Bob Parman is City Clerk.

The Oklahoma City, Okla., Council has passed a resolution providing for the construction of pavement on Seventh St. from the west line of Stonewall Ave. to the east line of Lottie Ave. The work to include the necessary grading, construction of manholes and catch-basins, inlet pipes, lateral storm sewers, curbs and reset curbs.

Oregon.

Property owners have petitioned the City Council of Medford, Ore to pave West Tenth St., from Fir to Oakdale, Mistletoe from Seventh to Tenth, and D St. from Eighth to Twelfth Sts.

City Council of Cottage Grove, Ore., has awarded the contract for the construction of bitulithic pavement on Main St. from the railroad track west to the Coast Fork of the Willamette River, through the business portion of town to the Warren Construction Co. at $2.35 per sq. yd. The contractors will purchase their crushed rock from the city for $1.50 per cu. yd. and will pay the municipality $5.00 per day for the use of the steam roller.

Bitulithic pavement has been adopted by the City Council of Klamath Falls, Ore., as the proper material for covering the streets of that city and the contract for paving the same has been awarded to the Warren Construction Co., Portland, Ore., at $2.25 per sq. yd.

Council of Rosebury, Ore., has granted the petitions of the property owners for the construction of pavement on Pitzer, Ella, Court and Fowler Sts., comprising about 5 blocks and estimated to cost $8,000.

Advices from Coquille, Ore., state that Coos County Commissioners are planning the construction of good roads estimated to cost $200,000.

Pennsylvania.

✣Bids will be received until 2 p. m., August 17, by State Highway Department, Harrisburg, Pa., for the construction of 15,000 ft. of road extending from the city of Monongahela to Union township line at Mingo Creek in Carroll township in Washington county. Joseph W. Hunter is State Highway Commissioner.

An ordinance has been passed by the Council of Brownsville, Pa., providing for the paving of Broadway in that place, from the present terminus of pavement to Market St.

At a meeting of the Borough Council of Butler, Pa., it was decided to pave 300 ft. of Mercer St. with brick, and that the roadway be 20 ft. wide.

Residents of Montgomery, Pa., are considering the construction of paving on Main St. and at the last meeting of the Borough Council a committee was appointed to investigate the cost and methods of the improvement.

An ordinance has been introduced into the Select Council, Scranton, Pa., providing for the grading of Upper Powderly road from the intersection of Sand and Pearl Sts. to the southerly line of the property of the Patrick Burke estate. The measure provides for the establishment of a 20 ft. roadway with a 5 ft. walk on each side.

The County Commissioners at Washington, Pa., have given notice of the proposition to lay before the August grand jury for its approval or disapproval the improvement and reconstruction of the following roads: Commencing at the borough line of West Alexander in a southerly direction to the intersection of the Ridge road near the lands of Himmegar brothers, a distance of 26,020 ft. A certain section of the Shaw line road, lead- [illegible] Midway state road, near the Shaw mines, beginning at a point on the improved road at the northern end of the Midway state road, near the Shaw mine, a distance of 16,120 ft. [illegible] the Taylorstown road near the county bridge on the L. M. Crothers estate, in Buffalo township, to the "S" bridge on the National pike, a distance of 8,128.2 ft. A certain section of the Beallsville Zollarsville road, in Deemston borough, beginning at the borough line of Beallsville, thence in a southerly direction to the old Thompson mill, a distance [illegible]

South Carolina.

[illegible] gusta, Ga., have been awarded the contract at $81,336, for paving work for the city of Greenville, S. C., bids for which were opened Jul [illegible] vitrified brick pavement (Mack brick) and about $9,000 worth of curb, drains, etc.

Tennessee.

✣Bids will be received until August [illegible] City Council of Memphis, Tenn., for the construction of paving on Madison Ave., and Cooper Ave. to the speedway. The contract will include about 8,000 sq. yds. of asphalt.

The City Commission of Memphis, Tenn., on July 26 awarded the following contracts Improving Muller Pl., to H. P. Streicher & Co., of Toledo, O., for same price as other work now being done by this company; improving Edith Ave., to Roper & McTighe, of Memphis, at the same price as other work now being done by them, tar macadam pavement; improving Latham St., to Roper & McTighe, of Memphis, for $21,819.20, tar macadam pavement; improving Waldran Blvd., to E. W. Jordon Construction Co., of Memphis, for $21,695, tar macadam pavement; improving Cooper Ave., to H. P. Streicher & Co., of Toledo, O., for $42,763, asphalt pavement; improving Cleveland St., to E. J. Wetterstrom, of Chicago, Ill., for $3,096, resurfacing with tar macadam; improving Cleveland St., to Tennessee Roads Co., of Memphis, for $9,505, tar macadam; improving Monroe Ave., to H. B. Streicher & Co., of Toledo, O., for $2,580, tar macadam; improving Anderson Ave., to H. B. Streicher & Co., of Toledo, O., for $3,850, tar macadam; improving Diana St., to H. P. Streicher & Co., of Toledo, O., for $2,482, tar macadam; improving Wisconsin Ave., to Roach & Manigan, of Memphis, for $8,828.39, tar macadam; improving Chelsea Ave., to E. J. Wetterstrom, of Chicago, Ill., for $27,170, concrete paving.

The County Court Commission of Shelby County, Tennessee, has awarded a contract to R. L. Cheshire, of Memphis, for the grading of almost 10 miles of roads in Hatchie River bottoms. There will be about 200,000 cu. yds. in the contract, and .1692 cts. per cu. yd. was the price bid.

The County Court at Memphis, Tenn., has been asked to take steps toward the improvement of Poplar Ave. and the Old State Line road.

Street Commissioner Love, of Memphis, Tenn., recently stated that the city had determined to reduce the amount of street work which had been outlined in the early part of the season and he said that but little new work would be advertised until early next spring. This action on Commissioner Love's part is largely caused by the fact that so many streets are at present torn up that he deems it advisable to allow contractors to go ahead and complete all work they now have on hand before beginning any new streets. The City of Memphis has done much street work in the past two years; in fact, the whole street system has been practically rebuilt.

The city of Tupelo, Miss., recently awarded contract to the Good Roads Construction Co., of M[illegible] The other bids were as follows: W. J. Cumberford, New Orleans, La., $111,480; Worth[illegible]

Items marked thus ✣ indicate work now open for bids.

$107,800; L. E. Oldham, Oxford, Miss., $116,172; Finley Construction Co., St. Louis, Mo., $116,578; J. W. Prescott, Memphis, Tenn., $123,845; Newell Brothers, Birmingham, Ala., $124,820; Andrew E. Perry, Montgomery, Ala., $134,000.

Texas.

✣Bids are asked until 10 a. m., Aug. 11, by John B. Ashe, County Auditor, Houston, Tex., for building sidewalks around the new court house at Houston.

The Metropolitan Construction Co. with headquarters in Kansas City, Mo., has been awarded the contract for 200,000 sq. yds. of asphalt pavement at Fort Worth, Tex. W. J. Hennessey is local manager for the Metropolitan Company at Fort Worth, and will be in charge of the operations there.

Advices from Smithville, Texas, state that at a special meeting of the Ten Thousand Club a good roads movement was inaugurated that in connection with the work of the county commissioners, will insure first-class roads in the territory surrounding that town. A fund will be raised by the business men, a certain amount being donated for six months to carry on the work.

The Commercial Club of Orange, Tex., recently held a meeting to discuss the matter of starting work on the Transcalcasieu road. It is expected that the committee in charge of securing funds for the work will soon report.

Utah.

J. W. Jensen, of the State Road Commission recently made arrangements with P. N. Pierce, Box Elder Road Commissioner, to start work immediately on the improvement of the state road from Hot Springs to Brigham City; he has also asked on behalf of the State Commission that the county levy a special tax of 5 mills on all property lying adjacent to the road, which will make a sum in the neighborhood of $10,000 for the work.

According to advices from Rexburg, Utah, the contract for paving sidewalks on Main St. was awarded to W. H. Wheelright, the lowest bidder, at 14½ cts. per sq. ft.

Virginia.

✣Bids will be received by Capt. H. L. Pettus, Depot Quartermaster, Washington, D. C., until 11 a. m., August 8, for the construction of concrete sidewalk, etc., at Winchester, Va., National Cemetery.

Washington.

The Anderson Construction Co., Seattle, Wash., has been awarded the contract for the construction of brick pavement on A St., between Front and Second Sts., and on Second St. between A and B Sts., North Yakima, Wash. Work will be commenced at once and will be finished in about 100 days.

Board of County Commissioners, according to advices from Seattle, Wash., have appropriated $12,000 for the grading of the trunk line between Seattle and Renton from 57th Ave. to Ryan St. on the southern limits of the city, a distance of 1 mile. This is the last link of the Rainier Blvd., for which the State, County and City have contributed.

The Board of Commissioners, Whatcom County, has ordered the improvement of the Guid Meridian Road for a distance of 4 miles from the city limits of Bellingham, Wash., and the Water front road commencing at the north end of the state aid road No. 6 and running north to the city limits of Bellingham. The work which will include crushed gravel surfacing, is estimated to cost about $17,000.

The Washington State Highway Board at Olympia, Wash., has awarded the contracts for the improvements of state roads as follows: Road No. 2581 in Island County, by County Commissioners for $686.

Wisconsin.

The Committee of County Roads at Medford, Wis., after rejecting the first set of bids received awarded the contract to the second lowest bidder of the second set, J. A. Babbitt, at $12,980, for the construction of a country road west of that city.

City Council of Marinette, Wis., has awarded John Magnuson, of that city, the contract for paving six city blocks for $8,563.

WATER-WORKS AND SEWERAGE

Arkansas.

General Manager J. M. Parker of the Arkansas, Louisiana & Gulf Railroad, Hamburg, Ark., has donated a site east of the tracks for the installation of a waterworks plant, and work will be commenced at once.

California.

Representative of the Pacific Gas & Electric Co. has met with gratifying success in obtaining signers for water in Davis, Cal., and it is expected that the company will soon start work on the installation of a system.

A resolution of intention was adopted by the City Council of Alameda, Cal., July 15, for the installation of a sewer in Pearl street from Eagle to Harrison avenues.

Board of trustees are to receive bids at once for the construction of a municipal sewer system in Colton, Cal., consisting of sewers, laterals, flush tanks and manholes.

Plans and specifications have been submitted to the city trustees by county surveyor for the new water and sewer system, which is proposed to be installed in Corning, Cal. The cost of the work is estimated at $70,000.

Plan of action contemplated in providing the sewer system for Los Gatos, Cal., has been outlined by President George W. Turner. He recommends that the city engineer prepare plans and surveys for the work and then call an election to vote bonds for the project.

Colorado.

✣Bids will be received until 2 p. m., August 12, F. N. Newell, Director, U. S. Reclamation Service, Washington, D. C., for furnishing approximately 5,224 ft. of 26-in. and 36-in. pipe for siphons on the Uncompahgre Valley project, Colorado.

A meeting has been held by the Commercial Club, at which committees on schemes for providing Pueblo, Colo., with better water supply reported.

Connecticut.

At a recent meeting of the East Hartford, Conn., fire commissioners a map was submitted showing the layout of lots on Judson place, through which Walter H. Judson, of Willow Brook, wishes water service extended. The extension of the Hillstown pipe line, which is under construction, will be about 6 miles in length.

Board of Aldermen of Willimantic, Conn., have passed resolutions for the extension of the Main street sewer through Windham street to Mansfield street, estimated to cost $3,500, and for the extension of the water service in Mansfield street northerly from the present terminus 400 ft. and in Hewitt street to Summit street, a distance of 370 ft. The estimated cost is $2,000.

Georgia.

City Council of Lafayette, Ga., has awarded the contract for the installation of a water and light plant to McCrary & Co., Atlanta, Ga., and work will be commenced immediately.

City of Augusta, Ga., has signed a 20-year contract with the Anniston Water Supply Co. Under the terms of the contract the company is to extend mains to the Fifth Ward. The matter will be taken up immediately.

City Council of Albany, Ga., has awarded the contract for the installation of 11,000 ft. of water main to R. C. Eatman. Work is to be started at once and pushed to early completion.

Idaho.

The Cottonwood Water Co., Cottonwood, Idaho, has awarded the contract for the laying of three and one-fourth miles of steel pipe from the new source of water supply on Cottonwood Butte to the city reservoir, to Chas. Norlin, Lewiston, Idaho, for $1,900.

Illinois.

✣Bids are asked by the Department of Public Works, Chicago, Ill., until 11 a. m., August 5, for furnishing all materials and labor for the construction of a brick sewer from the existing 73d street sewer to the Stony Island avenue pumping station. B. J. Mullaney is commissioner of public works.

✣Board of Local Improvements of Chicago, Ill., will receive bids until 11 a. m., August 3, for the construction of a system of brick and tile sewers as follows: Warrant 38263—Brick and tile pipe sewer, with manholes and catch-basins in a system of streets as follows: South Central Park avenue from West 59th place to West 65th st.; South Spaulding Av. from West 59th St. to West 61st st.; South Sawyer av. from West 59th st. to West 61st st.; West 59th place from South Spaulding av. to South Hamlin av.; West 60th place from South Spaulding av. to South Hamlin av., and each of the streets, to-wit: West 60th st., West 61st., West 61st place, West 62d st., West 62d place, West 63d st., West 63d place, West 64th st., West 64th place and West 65th st., from South Kedzie av. to South Hamlin av. According to plans and specifications for said improvement on file in the office of the Board of Local Improvements.

✣Department of Public Works, Chicago, Ill., will receive bids until 11 a. m., August 3, for furnishing and delivering sewer brick and common brick during the period ending December 31, 1910, estimated as follows: 90,000 by team in lots of about 20,000 at the city yard at Chicago Avenue bridge; 90,000 by team in lots of about 20,000 at the city yard at 69th and Peoria streets; 410,000 by team in lots of 1,000 each inside the territory bounded as follows: On the north by the north line of North av.; on the west by the city limits; on the south by the south line of 63d st.; on the east by Lake Michigan, north of the south line of 48th st.; on the east by Cottage Grove av., south of the south line of 48th st.; 140,000 by team in lots of 1,000 each, north of the territory described above; 85,000 by team in lots of 1,000 each, south of the territory described above; 20,000 f. o. b. cars at Yard A, Avers and Wabansia avs. (unloaded by city); 20,000 by team in lots of 1,000 each at the city pumping stations and shops within the above-described territory.

The Kennecott Co., Chicago Heights, Ill., has been awarded the contract at $5,260 for material and labor for a 300,000-gal. steel standpipe, 25 ft. in diameter and 80 ft. high for the town of Waynesboro, Va. Bids were opened July 8.

Advices from Alton, Ill., state that East Alton has voted to install a water system, and bids for the construction will be at once made public.

At the recent election held in Toulon, Ill., the citizens voted in favor of the waterworks proposition.

Special election is soon to be held in Kewanee, Ill., to vote on the question of issuing $60,000 of bonds for the equipment of the new water works plant.

Commissioners of LaGrange, Ill., have awarded J. J. Ryan the contract for the extension of the water mains in that village.

The DuPage Water Co. has been incorpo-

Items marked thus ✣ indicate work now open for bids.

rated with a capital stock of $10,000 and proposes to operate a system of water works in DuPage county, Ill. The incorporators are Charles C. Hamilton, G. W. Fenning and E. M. Hammond.

City Council of Plainfield, Ill., is making arrangements for the construction of a sewer system in that town. W. Halloch, Aurora, Ill., will make the necessary surveys.

A motion was carried at the last meeting of the Kankakee, Ill., city council to extend the sewer ordered from Chicago avenue, along the river bank on to Emery street to serve the newly acquired second subdivision.

Board of Local Improvements, Danville, Ill., has decided to build a sanitary sewer in the northeast part of the city. It will be located in the territory south of the Big Four and east of the Wabash railroads, with the main line extending down Collett st. and joining the big Main st. sewer at Stony Creek. Laterals will extend eastward through several alleys.

Indiana.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., August 15, for the construction of a local sewer in and along McPherson St. from 30th St. to Sunderland Ave.

✣Bids will be received until 10 a. m., August 15, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along Bellefontaine st. from 30th st. to Sunderland av.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., August 15, for the construction of a local sewer in and along Parkway from north property line of 18th st. to center of 30th st.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., August 15, for the construction of a local sewer in and along alley north of Lincoln st. from second alley west of Leonard st. to a point 977 ft. west.

✣Bids will be received until 10 a. m., August 15, by the Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along Euclid avenue from Michigan st. to a point 1,130 ft. north.

A petition has been placed on file by the City Council of Michigan City, Ind., for the construction of a sewer in Buffalo st. from 10th to Ripley.

Town Board of Lafayette, Ind., has instructed the town engineer to prepare plans and specifications for the construction of a sewer on the south side along a new route, abandoning the route through the bottom lands north of the Lake Erie R. R. embankment.

Iowa.

✣Town Clerk William E. Gamble, Mount Vernon, Ia., will receive bids until 7 p. m., August 8, for furnishing all materials and labor necessary for the construction of a reinforced concrete reservoir according to plans and specifications prepared by Fremont Turner of Des Moines, Ia.

R. C. De la Hunt, Cedar Rapids, Ia., has been awarded the contract for constructing two pipe sewers for the city of Oelwein, Ia., bids for which were opened July 21. The contract price was as follows: 2,231 ft. 6 in. salt glazed clay pipe sewer at 70 cts., and 4,292 ft. 8 in. salt glazed clay pipe sewer, at 75 cts., four manholes at $35 each and sewer combined manholes and flush tanks at $80 each.

John D. Shaw, Davenport, Ia., has been awarded the contract for sinking an artesian well for the waterworks company at Clinton, Ia.

The City Council of Tabor, Ia., is now taking steps toward securing data on the installation of a sewer system in that place.

At an election recently held in Carson, Ia., the proposition to issue bonds for the installation of a waterworks system was defeated by a narrow margin. It is planned to submit the question again in a few months.

City Council of Pella, Ia., has sold bonds amounting to $60,000 to provide funds for the installation of the waterworks system. The contract for building the plant calls for its completion during this summer. The supply will be obtained from the Des Moines river.

The Council of Pella, Ia., has awarded the contracts for the installation of the sewerage and disposal plant to H. J. Cathroe, Omaha, Neb., and W. D. Yeager, Cedar Rapids, Ia., respectively.

Martin Conroy Co., Des Moines, Ia., has been awarded the contract by the city council of Newton, Ia., for the construction of 25,000 ft. of sewers. His bid was 96.4 cents per lin. ft. for sewer pipe, $1.60 for 8-in. iron pipe and $9 per cu. yd. for concrete work where required. The contract calls for 23,400 ft. of 8-in. pipe and 1,600 ft. of 10-in. pipe.

City Council of Albia, Ia., has decided on the route of the proposed sewer according to the plans of Engineer Hall, as follows: Commencing at the manhole at the intersection 6th avenue east, thence east on 4th avenue east to the center of South 5th street, thence north on South 5th street to the center of 2d Ave., thence west on 2d Ave. to the alley between 2d and 3d sts.

The election to vote on the proposition to construct a sewer system in Essex, Ia., mentioned in our last issue, resulted in favor of the improvement.

The City Council of Des Moines, Ia., received two bids for the construction of the sewer in Maple st., as follows: T. J. Casselberry, $1.33 per foot; John A. Jones, $1.87½ per lin. ft.

Lewis & Leeder, Sioux City, Ia., were awarded the contract for 800 ft. of concrete suction tunnel and laying 16-in. suction pipe for the city of Sioux City. The contract price was $15.75 per lin. ft. K. C. Gaynor is City Engineer.

Kentucky.

At a recent meeting of the Council of Owensboro, Ky., the mayor was authorized to advertise for bids for the installation of a water-softening plant, but the matter has been delayed pending an appropriation of the amount necessary for the improvement.

The fiscal court of Campbell county, Ky., has voted to accept the proposition of the city of Newport to cede to the county what is known as the Waterworks road, leading from that city to the highlands. An appropriation of $5,000 has been recommended by the committee for necessary improvements to the roadway.

Board of Public Works, Louisville, Ky., have decided it necessary to reconstruct the sewer on Preston st., from the river to Main st., as all attempts to repair the hole in the old sewer have failed.

Maine.

Only one bid was received for the construction of the Chestnut st. sewer in Portland, Me. This was from Forgione & Romano, whose figures were $2,870. The contract for the work was not let.

Maryland.

✣Board of Awards, Baltimore, Md., will receive bids until 11 a. m., August 10, for furnishing and erecting pumping station for pipe line system on South st., near Pratt st. J. Barry Mahool is president of the board.

Minnesota.

Special election was held August 2 in Willmar, Minn., to vote on amending the city charter to provide for the improvement of the system of sewerage in that city. The step is recommended by John M. Rains, the health officer.

Council of Crookstown, Minn., has received petitions for the extension of water mains in Hunter st. to Bertha st., and in Bertha st. to S. Ash st.; in Cowing st. from the present terminus to Bertha st.; in South Main st., Seventh av. S., and in other streets intersecting with S. Main st. The matter has been referred to the city attorney.

City Council has referred a resolution for $1,300 to provide funds for the construction of a sewer in Scheffer st., from 7th to Chatsworth St. to the committee on streets, St. Paul, Minn.

City Council of Rochester, Minn., has been petitioned to construct two new sewers, one commencing at the center of 8th and running 200 ft. north to the north line of 9th st. the other on Fifth av. from Oak st. to the sewer on Liberty st. Both petitions were referred to the sewer committee.

C. M. Anderson, Preston, Minn., is figuring on putting in about 2,000 ft. of sanitary sewers, and plans for the work are being prepared by O. H. Case & Son, Fountain, Minn.

City Council of Duluth, Minn., has passed a resolution authorizing the construction of the proposed Woodland sanitary trunk sewer at an estimated cost of $138,352. The course of the sewer according to plans of the Board of Public Works, will be as follows: In Abbotsford Ave., extending from Fairmont St. to St. Andrews St., thence in St. Andrews St. to [illegible] St. Marie St., and thence to Lake Superior.

Village Council of Long Prairie, Minn., upon the recommendation of the citizens, is taking the matter of constructing a sewer system into consideration. It is proposed to get a plan of the entire village decide upon the right depth for every pipe and then to construct the main sewer pipe down Main St. to Walnut St., then north to the river.

Missouri.

Property owners have petitioned the Board of Public Works, St. Joseph, Mo., for the construction of a sewer from 29th and Faraon Sts. to the alley north of Faraon, west in alley to alley running parallel with 28th St. and north to Clay St. An ordinance for the work will be recommended.

The St. Louis, Mo., Board of Public Improvements has awarded the contract for the construction of the Dale av. sewer to Hoffman-Hogan Construction Co., for $75,157 and the Ellendale sewer to Clarke & Ansbro for $27,125. Hoffman-Hogan Construction Company's bid was $10,000 below the estimate.

Montana.

The contract for the construction of proposed sanitary sewer system in Missoula, Mont., mentioned in our last issue, was awarded to the James Kennedy Construction Co., Salt Lake City and Fargo, N. Dak., for $199,000.

The City of Missoula, Mont., has awarded the contract for constructing a sanitary sewer system to James Kennedy Construction Co., Salt Lake City, Utah, at $193,000. Bids for this work were opened July. The work includes the following approximate quantities: Total length, 40,746 ft.; excavation and refill, solid rock, 940 cu. yds.; excavation and refill, loose rock, 4,700 cu. yds.; excavation and refill, earth 88,250 cu. yds.; 1,160 cu. yds. of embankment to be rebuilt; pipe and incidentals, such as manholes, flush tanks, conduits, bulkheads, bridges and lumber.

Nebraska.

Residents of North Fremont, Neb., are to bring before the city council at the next meeting the matter of constructing a sewer main in 17th St. from Nye Ave. east.

New Jersey.

B. F. Sweeten & Son, Camden, N. J., have been awarded the contract for constructing sewers and a sewage disposal plant for the borough of Haddon Heights, N. J. The work includes 36,000 ft. of 8-in. to 12-in. vitrified pipe sewers, masonry sewage tanks, masonry coke-filled filters, etc. Bids were opened July 19.

The township committee of Cranford, N. J., has decided to call a special election to vote on the question of appropriating [illegible] to de- [illegible]

The Shark River W[illegible] Asbury, N. J., offering to [illegible] water main to that place to [illegible] of water.

Borough Council of Verona, N. J., pass[illegible] a resolution to lay 4,000 ft. of water mains. [illegible]

Items marked thus ✣ indicate work now open for bids.

lows: Malvern Pl., 700 ft.; Hillside Ave., 1,600 ft.; Afterglow Ave., 150 ft.; Hillcrest Ter., 850 ft.; Fairview Ave., 150 ft., and Montrose Ave., 100 ft. Bids for the work will be advertised at once by the clerk.

Borough Engineer J. L. Bauer, of Roselle, N. J., has prepared two sets of plans for the construction of the proposed sewer in the Lorraine section, both starting from a point in Drake and Third Aves., one going south through private property to Rahway Ave., and the other to Linden road and the Gregory property and thence to Rahway Ave.

Advices from Newark, N. J., state that Pasquale Mauriello, Orange, N. J., was the lowest bidder for the construction of sewers in Millburn township. His bid was $7,121 for the construction of 9,300 ft. of sewers. All bids were taken under advisement.

The Jersey City, N. J., Board of Finance has concurred in the Street and Water Board's award of the contract for the construction of the Logan Ave. sewer to O'Reilly Bros., for $3,379.

Advices from New Brunswick, N. J., state that the Mayor of Highland Park will take up with an expert on sewage disposal, the matter of installing a plant at the Park.

The Cold Spring Water Co. of West New York, N. J., has been incorporated with a capital stock of $100,000 and proposes the operation of water works, etc.; real estate, etc. The incorporators are Alphonse Thourot, W. New York, N. J.; Edward C. Thourot, North Bergen, N. J.; Joseph Syfel, Union, N. J.

New York.

✣Bids will be received until 11 a. m., Aug. 10, by Alfred E. Steers, President of the Borough of Brooklyn, for the following contracts: (1) For furnishing all the labor and material required for repairing sewer in Frost St. between Graham Ave. and Humboldt St. The amount of security required is $1,000. (2) For furnishing all the labor and material for repairing sewer in Richardson St. between Herbert St. and Humboldt St. $1,000 security will be required.

✣Bids will be received by Alfred Steers, President of Borough of Brooklyn, New York City, until 11 a. m., Aug. 10, for nineteen sewer construction contracts, the largest being No. 1 as follows: For furnishing all the labor and material required for constructing sewer in E. 94th St., between the summit north of Clarkson St. and the summit north of Lenox road; and an outlet sewer in Clarkson St., between E. 94th and E. 98th Sts.; and a tributary sewer in Clarkson St., between E. 92nd and E. 94th Sts.

✣Bids will be received until 4 p. m., August 3, by Board of Contract and Supply, Binghamton, N. Y., for the construction of a sewer in Alice St., commencing at a manhole to be built in the Court St. sewer; thence north in the center of Alice St. for a distance of 391 ft. Plans and specifications are now on file at the office of S. W. Murray, City Clerk.

The Turner Construction Co., New York City, has been awarded the contract for constructing a reinforced concrete reservoir for the Jacob Dold Packing Co., Buffalo, N. Y. This will be 68 ft. x 40 ft. and is designed to carry a 3-story building to be constructed later. The work will be undertaken at once.

At a special election held in Silver Springs, N. Y., the tax payers voted to build a pumping station for the water works and to raise $6,000 for the installation of a lighting plant.

Commissioner Ralph Tubby of the Roslyn, L. I., water district, has reported to the Board of Trade that plans and specifications prepared by W. E. Sexton on lines laid down by the state water commissioners, have been approved. The estimated cost of the work is $108,000.

City Council of Buffalo, N. Y., has appropriated $8,000 for the laying of a 16-in. water main in Elmwood Ave.

The State Water Supply Commission at a recent meeting in New York City discussed plans for the delivery to the five boroughs of New York City 500,000,000 gals. of water daily from the Catskill source of supply. It is proposed to construct a deep tunnel under Manhattan Island and the East River to Brooklyn, where the water will be diverted by surface pipe lines to Queens and across the Narrows to Richmond. It is estimated that the proposed distributing system will cost $25,000,000. The commission reserved decision upon the plans.

The Belleville Water Supply Co., of Belleville, N. Y., has been incorporated with a capital stock of $5,000 and proposes the construction and operation of a system of water works. Charles M. Horner, Hartley D. Scanland and Eben W. Clark are the incorporators.

Board of Water Commissioners, Livonia, N. Y., have awarded the contract for the new pumping plant and the work necessary for the change in the system from the present one which is pumping water from Conesus Lake to the Nickerson Springs in that village, to Danz-Whitcomb Co. of Rochester, N. Y., for $2,415.

The Board of Public Works of Fulton, N. Y., has awarded the contract for the construction of the laterals to the west side sewer system to Swift & Hookway for $16,353. Work will be commenced at once and it is expected that the sewers will be completed by Dec. 1.

The Board of Contract, Rochester, N. Y., has awarded the following contracts: Chamberlain St. sewer, Henry Schoenfeldt, $352.50; laying water pipe in group 242, Ripton & Murphy, $5,062.40; laying water pipe in group 244, Nicola Desiderio, $3,239.50; laying water pipe in group 243, Nicola Desiderio, $2,642.

Otto Pfaff, Mayor of Oneida, N. Y., has appointed a committee to investigate the complaints of the residents of Durhamville about the nuisance caused by the sewage from the city draining into the Oneida Creek. It is expected that it will be necessary to install some type of disposal plant.

William B. Dye, President of the Village of Albion, N. Y., has appointed a Sewer Commission to make plans and estimates of the cost of constructing a sewer system for that place. The work is to include the construction of a disposal plant.

The Board of Contract and Supply, of Rochester, N. Y., has awarded the contract for the construction of the Norton St. sewer to H. N. Cowles for $2,013.

The residents of the South Seventh St. from Division to Fay and those on Fay St. from South Seventh to South First St., Fulton, N. Y., have petitioned the Board of Works for the construction of a sewer in those sections and the matter has been referred to the city engineer.

Consulting Sanitary Engineer, G. L. Robinson, New York city, who has been assisting John A. Giles, City Engineer, Binghamton, N. Y., in the preparation of plans for the proposed disposal plant is to recommend a choice of the two sites for the plant now under consideration.

The Board of Contract and Supply, Utica, N. Y., at the last meeting awarded the contract for the construction of a sewer in Prospect St. from Ottillia to Genesee Sts., to John R. Baxter, Jr., for $441. The board also received resolutions providing for sidewalks on Osborne St., sewer in Osborne St. and pavement on Elm St.

At a recent meeting of the Water and Sewer Board of Rome, N. Y., a petition for the installation of 90 ft. of sewer and water mains in the alley in the rear of Thalman property at Washington and Thomas Sts. and also one for the construction of 900 ft. of water and sewer mains in Turin Road above Linden St. were granted. The matter of extending the system to the southern part of the city was also discussed.

A special election was held July 19, by the city of Silver Springs, N. Y., to vote on the proposition of installing a pumping station and in connection therewith an electric lighting plant. It is estimated the two propositions call for an appropriation of about $19,000.

Patrick F. Brennan, 244 Mt. Hope Place, New York city, was awarded the contract, at $43,132, for constructing sewers in Drainage St. and other streets in the Bronx, bids for which were opened July 14. This work includes the following: 91 lin. ft. of 18-in. cast iron pipe sewer; 190 lin. ft. of pipe sewer, 18-in.; 1,000 lin. ft. of pipe sewer, 15-in.; 4,570 lin. ft. of pipe sewer, 12-in.; 488 spurs; 61 manholes; 13 receiving basins; 5,960 cu. yds. of rock excavation; 15 cu. yds. of Class "B" concrete; 30,000 ft. (B. M.) of timber; 100 lin. ft. of 12-in. drain pipe.

The President of Bronx Borough, New York city, has awarded the contract for completing the outlet sewer in White Plains Road, bids for which were opened July 14, to F. V. Smith, 125th St., and Lexington Ave., at $621,000. The work includes the following: 18 lin. ft. of pipe sewer, 30-in.; 192 lin. ft. of pipe sewer, 24-in.; 237 lin. ft. of pipe sewer, 18-in.; 92 lin. ft. of pipe sewer, 15-in.; 435 lin. ft. of pipe sewer, 12-in.; 1,340 spurs for house connections; 103 manholes, complete; 108,000 cu. yds. of excavation of all kinds; 35 cu. yds. of brick masonry; 32,500 cu. yds. of Class "A" concrete; 6,500 cu. yds. of Class "B" concrete; 4,500 cu. yds. of Class "D" concrete; 5,200 cu. yds. of broken stone; 882,000 ft. (B. M.) of timber, for foundations and sheeting left in place; 100,400 lin. ft. of piles; 3,050,000 pounds of steel bars, for reinforcing concrete (3-8 inch to 1¼ inch); 261,000 pounds of structural steel; 6,600 sq. ft. of wire netting, 2-in. by 2-in. mesh, No. 14 gage; 1,000 lin. ft. of 12-in. to 24-in. drain pipe; 3,400 lin. ft. of 6-in. pipe, as risers for house connections, including the surrounding and supporting Class "C" concrete; 330 lin. ft. of wrought iron fence; 90 sq. yds. of vitrified brick pavement.

The village of Pike, N. Y., has awarded a contract to Gray & Miller, Hornell, N. Y., at $6,200 for constructing the water works system. Bids were opened July 11. The work includes hauling and laying about 8,913 ft. of 4-in. cast iron pipe; about 930 ft. of 6-in. cast iron pipe; about 1,835 ft. of 8-in. cast iron pipe; about 5,160 ft. of 8-in. wood pipe; hauling and setting hydrants, valves, valve-boxes, specials, etc.; constructing concrete reservoir, spring house, overflow pipe and ditch pipe line about 128 ft. long from spring house to reservoir, according to plans and specifications. The village will furnish the pipe, hydrants, valves, valve boxes and specials. T. H. Culver is Village President.

North Carolina.

Board of Water Commissioners of Charlotte, N. C., are at present considering the matter of improving the water shed from which the city gets its water supply.

North Dakota.

City Commissioners of Mandan, N. Dak., are now taking up the matter of installing a water works system. Plans are being investigated and it is proposed to construct a series of settling tanks on the high hills northeast of the city where an abundant supply can be obtained and good pressure is assured.

The city of Washburn, N. Dak., has warded the contract for constructing water works to C. H. Porritt, Fargo, N. Dak., at $17,782. The work includes two settling basins, engines and water mains. Bids were opened July 18.

Ohio.

✣Bids are asked by H. H. Canfield, Clerk of the Village of Cleveland Heights, O., at his office 309 Beckman Bldg., Cleveland, O., or at the town hall, until noon, Aug. 9, for furnishing the material and labor necessary for the improvement of Maple Brow drive from Helsey Ave. to the north line of Quincy Heights allotment by constructing a water main therein, according to the plans and specifications on file at the office of said clerk at the town hall, and at the office of The F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, O.

✣Bids will be received until noon, Aug. 9, by H. H. Canfield, Clerk of the Village of Cleveland Heights, O., at his office, 309 Beckman Bldg., Cleveland, O., or at the town hall, for furnishing the material and labor necessary for the improvement of Cedar road from the east line of Coventry road to the east line of Lee road by laying a 10-in. water main therein, according to the plans and specifications on file at the office of said clerk at the town hall and at the office of the F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, O.

✣H. H. Canfield, Village Clerk of Cleveland Heights, O., will receive bids until noon, Aug. 9, at the town hall or at his office, 309 Beckman Bldg., Cleveland, O., for furnishing the material and labor necessary for the improvement of Quincy Ave. from Maple Brow drive to East boulevard by constructing a water main therein, according to the plans and specifications on file at the office of said clerk at the town hall, and at the office of F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, O.

✣Village Clerk H. H. Canfield, Cleveland Heights, Cleveland, O., will receive bids until noon, Aug. 9, at the town hall or at his office, 309 Beckman Bldg., Cleveland, O., for furnishing the material and labor necessary for the improvement of Quincy sewer district No. 4 by constructing sewers therein, according to the plans and specifications on file at the office of said clerk at the town hall, and at the office of The F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, O.

A proposition has been submitted the City of Urbana, O., by James Westwater & Co., Columbus, O., to duplicate the present water works plant in that city for $126,000 or to construct a plant according to plans and specifications of S. Wyer, M. E., for $153,500.

City Council of Hamilton, O., has passed resolutions of necessity providing for the construction of sanitary sewers in South C. St., from Main to Millikin Sts., Hanover St. from East Ave. to the Canal, and 11th St. from Ludlow to John St.

Contract has been awarded William Hynes, by the Board of Control, Youngstown, O., for the construction of the sewer in Watt St. and Andrew O'Horo for the Edgewood St. sewer.

Property owners on DaKota St., Ashtabula, O., have presented a petition to the City Council asking for the construction of a sewer in that thoroughfare. The matter was referred to the Sewers and Drains Committee.

City Council of Youngstown, O., has passed resolutions to construct sewers in Albert St. between State and McGuffey Sts., and in Commerce St. from Walnut St. to Champion St., and in Champion St., from Commerce St. to Federal St.

It has been resolved by the City Council of Zanesville, O., that it is necessary to construct a brick and pipe sewer in Pine St. from Woodruff alley north to the north side of lot 20 in South Zanesville addition to the city of Zanesville, thence across the north side of lots 20 and 21 through the unplatted land to the Muskigum River.

At a recent meeting of the Youngstown, O., City Council the question of installing a sewer in Second St. west of Market St. was favorably commented upon and recommended. The sewer committee will at once take up the matter with the property owners.

Plans and specifications are being prepared by John W. Lowe, Director of Service, Circleville, O., for the proposed new sanitary sewers. Surveys are also under way.

A resolution has been adopted by the City Council of Canton, O., instructing the City Engineer to prepare plans and estimates for the establishment of a sanitary sewer system in the south and southwest sections of the city. The principal thoroughfares affected are South Market St., Henry Ave., Stark Ave., Hammond St., Clark Ave., Garfield Ave., Greenfield Ave., Harrison Ave., Lewis Ave., Vine St. and Maiden lane.

City Council of Wellston, O., has been petitioned by the residents of West Broadway for an extension of the main sewer as far as Minnesota Ave., in order that it can be tapped for sanitary purposes.

According to advices from Van Wert, O., surveys are now under way preparatory to constructing an extension to the city water main on East Third St. to be 650 ft. long and an extension on South Walnut St. to be 700 ft. in length.

Board of Control, Dayton, O., has let the following contracts for the additional water supply equipment: For lumber, W. C. Ely, at $2,744; for pump house, Requarth Co., at $495; pumping Unite, Dravo Doyle, Cleveland, O., at $675. It has been decided to do the excavation work with the city's workmen.

Twelve bids were received by the Director of Public Service, Dayton, O., for the construction and furnishing of a temporary pumping station on the Mad River levee above the water works. Those who submitted proposals for the work, cost of which will not exceed $20,000 are as follows: Larkin Brothers, T. J. Backus Co., Platt Iron Works, John B. Rausch, F. A. Requarth, Miami Lumber and Veneer Co., W. C. Ely, C. H. Hosier, all of Dayton; R. D. Wood, Philadelphia; Drake & Doyle, Cleveland; Harvey C. Harbell, Loveland, and Lawrence Machine Co., Lawrence, Mass.

The village of Lakewood, O., has awarded the contract for constructing a sewer main in Donald Ave. to A. J. Galvin, 457 Lenox Bldg., Cleveland, O., at $3,020. Bids for this work were opened July 18.

O. C. Borreson, 4734 Carthage Place, St. Bernard, O. (P. O. Elmwood Place, O.) has been awarded the contract at $2,578 for constructing a storm water sewer for the village of St. Bernard. Bids were opened July 19.

The Director of Public Service of Youngstown, O., has awarded the contract on sewering and grading Edgewood St., to Anthony O'Hare, Youngstown, O., at $1,130.

City auditor of Youngstown, O., will sell bonds on August 15 at 2 p. m., for the construction of sewers in Lawrence St., between Center and Acorn; Gibson St. between Poland Ave. and Williamson Ave.; Garlick St. between West Chalmers Ave. and Tremont St.; Buckeye St. between Hillman St. and Garlick St.

Oklahoma.

Plans and specifications have been prepared for the installation of a water works system at Foss, Okla. The cost of the work which is to be superintended by W. H. Kennedy, is estimated at $25,000.

Oregon.

The Council Committee on Mountain Water of Salem, Ore., have investigated the cost of the installation of a new water works system and have reported to the city that it would be much cheaper to purchase the present plant. The matter will be submitted to the residents of Salem, Aug. 15, in order that they may vote.

Property owners on Alder St., Medford, Ore., have petitioned the city council for the installation of a water main and sewer in that street north of Fir.

A bond issue of $40,000 is being planned by the City Council of Albany, Ore., to provide funds for the extension of the city's sewer system. The new work will be located in the eastern part of the city, which is the only part lacking proper drainage.

The American Light & Water Co., Kansas City, Mo., has been awarded the contract at $63,940, for the installation of a water works and sewer system at Vale, Ore. The construction work will consist of the putting in of a complete water system, five miles of sanitary sewers, throughout the city, a 20 h. p. gasoline engine and pumping plant and big 1,000,000 gallon reservoir. Later a gravity system will be put in, with a flow line of 12 miles to the Willow Springs. The bid on the line by the American Water & Light Co. was $46,940. The pumping system will undoubtedly be completed first but will be used as an auxiliary plant when the gravity system is completed.

An ordinance was passed at a recent meeting of the Salem, Oregon, City Council amending the city charter in such a manner as to enable the Council to purchase the water works system now the property of the Salem [illegible] election will be held August 15 to vote on the proposition.

Pennsylvania.

The Uniontown Construction Co., Uniontown, Pa., has been awarded a contract at $28,132 for constructing sewers for the Bor[illegible]

Citizens Water Committee of Coatesville, Pa., has recommended to the council the installation of an artesian water system, but the latter body is inclined toward an additional gravity supply from Brandywine.

Bids have been opened by the Director of Public Works, Philadelphia, Pa., for the construction of the sewage disposal plant at Torresdale, which is estimated will cost $150,000. Among the bidders were: Edwin H. Vare, Edward Fay & Son, David MacMahon, Costello & Co., the Keystone State Construction Co., Robert Wiggins, Lombard & Perna, the Otto Gas Engine Works and the D'Olier Engineering Co.

The proposition to borrow $110,000 for the construction of a sanitary sewage disposal system for the central portion of Lebanon, Pa., is to be submitted to the voters at another election.

The towns of Charleroi, North Charleroi, Monessen and Donora, Pa., are considering plans for the construction of a sewage plant for the four places.

It is believed that the Committee on the Market St. Sewer, Harrisburg, Pa., is considering appropriating about $6,000 from the Thirteenth Ward Sewer Fund, for the work which includes the extension of the 30-in. sewer from 15th St. on Market all the way into the junction of the Evergreen and Market St. sewers.

Council of South Fork, Pa., has voted to make an extension to the present sewer system of that borough on Lake, Maple, Portage and Highway Sts., Fourth Alley and in Rockville, the whole aggregating about 8,000 ft.

The City of Hazleton, Pa., is making preparations for the [illegible] sewer system in that place. According to the plans a disposal plant will be included and none of the sewage will empty into fresh water streams. A bond issue will be made to defray the cost of the improvement.

The State Board of Health has granted the City of Carbondale, Pa., the right to sewer all city streets upon condition that within 60 days the city shall secure a consulting engineer to prepare plans, and locations, also style of sewage disposal plant that they may adopt. The mayor suggested the passing of a resolution authorizing the city engineer to secure the services of a consulting engineer and proceed with the work at once.

The Summit Hill Water Co., of Leighton, Pa., has awarded a contract to Andrew Brelson for placing a concrete bottom in its reservoir and raising the sides 2 ft.

Residents of Clifton Heights, Pa., are discussing the matter of installing a municipal water works system for that place.

Rhode Island.

✣Board of Sewer Commissioners, Woonsocket, R. I., will receive bids until 2 p. m., August 4, for the construction of about 3,600 ft. of 8-in. sanitary sewer and appurtenances, and about 660 ft. of surface water drain, part 18-in. pipe and part concrete. Frank H. Mills is City Engineer.

South Carolina.

At a recent election at Charleston, S. C., it was voted to reject the proposition of the Charleston Light [illegible]

South Dakota.

✣City Council of Mellette, S Dak., until August 8, for the construction and material necessary for laying a 4-in. water main on Main St. from Second to Fifth Ave., a distance of about 1,200 ft. H. O. Hendrickson is City Auditor.

The Brookings Construction Co. has been awarded the construction contract for the lateral sewers in Huron, S. Dak [illegible]

Items marked thus ✣ indicate work now open for bids.

City Commissioners have adopted the new plans for the proposed west side sewer district at Sioux Falls, S. Dak.

Bids were opened July 20, by the Contracting Quartermaster, Fort Meade, S. Dak., for the construction of a concrete dam in connection with the water supply system, the following bids being received: Bartlett & Co., Deadwood, S. Dak.—Earth excavation, 90 cts. cu. yd.; rock excavation, $3.50 cu. yd.; rip rap, $3.00 cu. yd.; 16" C. I. pipe with valves, $17.50 lin. ft.; 12" C. I. pipe with valves, $17.50 lin. ft.; 4" vit. pipe, 75 cts. lin. ft.; concrete in place, $9.75 cu. yd.; approximate bid, $68,000. Grams & Schummer, Sturgis, S. Dak.—Earth excavation, $1.00 cu. yd.; rock excavation, $4.00 cu. yd.; concrete in place, $10.00 cu. yd.; lump sum bid, $71,960. Bartlett & Kling, Cedar Rapids, Ia.—Earth excavation, 45 cts. cu. yd.; rock excavation, $2.00 cu. yd.: rip rap, $2.00 cu. yd.; 16" C. I. pipe with valves, $15,00 lin. ft.; 12" C. I. pipe with valves, $12.50 lin. ft.; 4" vit. pipe, 75 cts. lin. ft.; concrete in place, $7.80 cu. yd.; approximate bid, $54,000.

Tennessee.

Bids were opened July 27 by the city of Union City, Tenn., for labor and material for constructing a sewer system. The contract was let to Sullivan & Long, Bessemer, Ala., at $35,000.

H. S. Bosler has been awarded the contract for the construction of the pumping station for the cross town sewer, Chattanooga, Tenn., which will be located at the terminus of the drain. Work will be started at once.

Texas.

✣Bids are asked until 10 a. m., Aug. 11 by John B. Ashe, County Auditor, Houston, Tex, for boring an 8-in. well for the new court house at Houston.

✣Bids will be received until 2 p. m., August 22, by Capt. P. Whitworth, Constructing Quartermaster, Fort Crockett, Galveston, Texas, for the construction of a sanitary sewer system and sewage pumping plant at that post.

Washington.

✣Bids will be received by the constructing quartermaster, Fort George Wright, Wash., until 11 a. m., August 22, for sinking one 10-in. tubular deep well at this post.

Utah.

Commissioners of Webber County, Utah, have allowed Lewis Zitsman to withdraw his bid for laying water mains and constructing sprinkling tanks to be used for street sprinkling between Ogden and the Davis County line. The Wheelwright Construction Co., the next lowest bidder, was then awarded the contract.

City Engineer submitted to the City Council at the last meeting the estimate showing the cost of the sewer extension north of the Ogden River bridge in Ogden, Utah, to be approximately $40,000 and the communication was forwarded to the Sewer Committee. Plans were also submitted for the construction of the proposed conduit on 22d St. and Wall Ave., with the information that the railroad would bear half the expense.

Canada.

✣Bids are asked until 11 a. m., Aug. 25, by M. Peterson, Secretary Board of Control, Winnipeg, Man., for the supply of machinery capable of boring or drilling holes in the limestone rock from the bottom or top of the City Water Works Wells, which are 15 ft. in diameter and from 60 to 100 ft. deep.

Residents of Birch av., Balmy Beach, Ont., have made arrangements to have the water system extended to that section of the city in the near future.

The village of Swift Current, Sask., has awarded the contract for furnishing 49 6-in. hydrants, gate valves, etc., to the Canadian Fairbanks Co., Winnipeg, Man. Bids were opened July 12.

Washington.

The Maple Cooperative Water Co., College Place, Wash., has been incorporated with a capital stock of $10,000. The incorporators are J. W. Isaac, H. O. Rowley, W. R. Wright, Willis Ford and J. H. Flower.

The contract for the construction of the Swantown fill box sewer in Olympia, Wash., has been awarded to Henry Mallory, for $18,218. The sewer is to be constructed on Chestnut St. from the south line of the government waterway to Ninth St. on Ninth St. from Chestnut St. to Plum St. and on Plum St. from Ninth to Union St. It is to be built of pilings and lumber and is to be 6x10 ft. on the inside.

TRADE NOTES.

Mr. J. H. Cook has resigned as President and Treasurer of the G. & M. Manufacturing Co., 26 Cortlandt St., New York, and Mr. Frederick B. Cook succeeds him as President. Mr. J. H. Cook remains a director of the company.

The Orenstein-Arthur Koppel Co., manufacturers of portable and industrial railways and steel cars, paid a dividend for the year 1909 of 13 per cent of their capital of $6,500,000. The surplus fund of this company amounts to $1,800,000.

The Wood Drill Works of Paterson, N. J., manufacturers of the "Wood" brand hose coupling for steam and air hose, have been awarded order No. 23767 by the Isthmian Canal Commission. The couplings were given a thorough test on the canal. The order consisted of 2,100 "Wood" brand hose couplings.

Arrangements have been made by the C. W. Hunt Company, New York, builders of coal handling, conveying and hoisting machinery, that its business on the Pacific Coast will be handled by the San Francisco Bridge Co., with offices at 865 Monadnock Bldg., San Francisco. The company has just completed a naval coaling station in San Francisco bay for the government.

The Mine & Smelter Supply Co., of 42 Broadway, New York, maintaining offices and warehouses at Denver, El Paso, Salt Lake City and Mexico City, have taken over the agency for the entire western territory of the United States of the well known line of pumps made by the Epping-Carpenter Co., Pittsburg, and the well known line of compressors made by the Burry Compressor Co., Erie, Pa.

The Edgar Allen American Manganese Steel Co., recently organized in Chicago, has purchased the Chicago Heights works of the American Brake Shoe & Foundry Co. and the New Castle (Del.) plant of the Tropenas Steel Co., and the manganese business of both the above mentioned companies, also the manganese steel business heretofore conducted in the United States of America by Edgar Allen & Co., Ltd., Imperial Steel Works, Sheffield, England, will be carried on by the newly formed company.

The Wagner Electric Mfg. Co., of St. Louis, Mo., has removed its Charlotte, S. C., office to the Woodward building, Birmingham, Ala. The office will be in charge of Mr. J. F. Jones. The Birmingham office will cover that part of Tennessee east of the Tennessee River and all of the states of Mississippi, Alabama, Georgia and Florida. North and South Carolina, which have heretofore been handled from the Charlotte office, will now be handled from the Philadelphia office, which is located in the Real Estate Trust building, in charge of Mr. John Mustard.

The Jeffrey Manufacturing Co., with main office and works at Columbus, O., is changing the location of its Denver office from 1711 Tremont place, and after Aug. 1st will occupy a suite of rooms in the First National Bank building. This company, besides maintaining a large selling force in over a dozen of the leading cities of this country, also maintains a corps of engineers at its branch offices situated in the following cities: Chicago, St. Louis, Denver, Montreal, Pittsburg, Charleston, W. Va., Boston, New York and Birmingham. There are also nearly 100 Jeffrey agencies in additional cities in this country and abroad.

Allis-Chalmers Co., Milwaukee, Wis., recently sold a turbine for a particularly interesting installation to the Standard American Dredging Co. of San Francisco. This company is one of the largest dredging concerns in the United States and has many boats on the Pacific Coast and on the Gulf. The turbine, which is a standard 500 K.W., 2,300 volt, 3-phase, 60-cycle, 3,600 R.P.M. machine, will be installed on one of its largest dredges and will furnish power for driving a 500 H.P. motor direct connected to the dredge pump. The alternator will receive exciting current from a 15 K.W. Allis-Chalmers generator direct connected to an American Blower Company's engine. Steam will be supplied at 175 pounds pressure and 100° F. superheat and the entire installation will represent the most modern design of power plant.

NOTICE TO CONTRACTORS.

Miles City, Mont.

Sealed proposals will be received at the office of the City Clerk of Miles City, Mont., up to three (3) o'clock p. m. of Monday, the 22d day of August, 1910, for furnishing certain materials and constructing extensions and improvements to the water works, electric lighting and sewer systems for said city; separate bids being entertained as follows:

1. For furnishing all materials and constructing main and outfall sewers, sewage pumping and disposal plants. Certified check, $5,000.
2. For furnishing certain materials and constructing intake and reinforced concrete settling basins, filter chambers, etc. Certified check, $2,000.00.
3. For hauling and laying cast iron pipe and setting hydrants and valves. Certified check, $500.00.
4. For furnishing materials and constructing power house. Ceertified check, $500.00.
5. For furnishing f. o. b. cars, Miles City, Mont., all cast iron pipe and fittings. Certified check, $2,000.00.
6. For furnishing f. o. b. cars, Miles City, Mont., all hydrants and valves. Certified check, $500.00.
7. For furnishing and erecting steel tower and tank of 200,000 gals. capacity, all at an elevation of not less than 100 ft., and furnishing and erecting a steel chimney and breeching; chimney to be 72 ins. in diameter and 100 ft. high. Certified check, $1,000.00.
8. For furnishing all equipment and installing a mechanical filter plant of 4 units, each having a capacity of 500,000 gals. per day. Certified check, $1,000.00.
9. For furnishing all pumping machinery, consisting of six (6) turbine and centrifugal type, motor driven units. Also two (2) steam driven air compressors. Certified check, $1,000.00.
10. For furnishing f. o. b. cars, Miles City, Mont., and supervising the erection of one (1) fully equipped air lift system for sewage pumping. Certified check, $200.00.
11. For furnishing f. o. b. cars, Miles City, Mont., one 250 K.W. 60 cycle, 3-phase, 2,300 volt generator; one 50 h. p. motor and two 15 K.W. exciters. Certified check, $200.00.
12. For furnishing and supervising erection of at Miles City, Mont., one 300 h. p. Corliss engine. Certified check, $200.00.
13. For furnishing f. o. b. cars, Miles City, Mont., all power station switchboard equipment. Certified check, $100.00.
14. For furnishing two (2) three-phase armatures for General Electric 120 K.W. single phase generators now in use in lighting plant. No check.

All of the above material and work to be furnished and constructed in accordance with the plans and specifications on file at the office of the City Clerk, and at the office of the Engineers, where bidders will have ample opportunity to consult them.

Any one desiring a set of plans for personal use in submitting a bid may obtain the same by application to the Engineers, and payments as follows to cover the cost of the prints:

Section 1	$10.00
Section 2	10.00
Sections 3, 4 and 8, each	2.00
Sections 5, 6, 7, 9, 10, 11, 12, 13 and 14.	no charge.

Complete set of all plans, $15.00.

Specifications covering Sections 10, 11, 12 and 13 will be obtained by addressing Superintendent of Water and Light, Miles City, Mont.

The city reserves the right to reject any and all bids.

All payments will be made in cash.

GEO. W. FARR, Mayor.
J. E. FARNUM, City Clerk.
BURNS & McDONNELL, Engineers,
Scarritt Bldg., Kansas City, Mo.

(Proposal Advertisements Continued on Page 63.)

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Increased Wages and Decreased Output.

It is common knowledge that the cost of construction work has increased materially in five years. Wages are higher, stock, forage and provisions cost more, the prices of many construction materials are greater. While, just as stated, these facts are common knowledge, we believe that both engineers and contractors will read with interest the specific evidence from employers and labor agents which is published on another page of this issue. There is general agreement by our correspondents that costs of work have increased all the way from 25 to 50 per cent as compared with five years ago.

The disturbing feature of this record of evidence is not, however, that prices are higher, but that labor is less efficient than formerly. There is general agreement on this point and neither skilled or unskilled labor escapes the charge. Broadly a workman can be got to do now scarcely two-thirds the amount of work that he did five years ago. Add this decrease in efficiency to the increase in wages and prices during the same period and a [illegible] the construction work done today as compared with the construction work done half a decade ago. Wherein lies the cause for this decrease in efficiency? Is it that work is so much more plentiful as some assert, or is it due to labor unionism, as others hint; or are workmen generally less competent or managers less efficient? None of these reasons is wholly convincing, some of them are not true. There is before us as we write the twenty-third annual report of the commissioner of labor containing a most elaborate account of workmen's insurance and benefit funds. We would suggest that here is another matter for the commissioner's study, the causes which have led to decreasing efficiency with increasing wages.

Whatever its cause the fact remains, which is the vital thing, and there is no clear reason why it will not continue. This at least is the attitude, we believe, that employers of construction labor must assume. To deal with the new conditions the contractor has got to study means of reducing manual labor and methods of more scientific management. Labor saving machinery and tools must take the place of men to the utmost practicable degree.

Men, however, will always count high in construction work, no matter how many or what labor saving machines are used and the nub of the problem is better management of men. It is obvious that the old rule of "drive 'em" no longer holds good. There must be an incentive greater than the regular daily wage or fear of the boss. The condition is no longer a case of what the contractor wills to do; it is a case of what he must do. If it be a new condition it must be met by new methods. The method that promises most is a modification of the time-honored wage system of paying men, the introduction of some sort of bonus system whereby a man will receive payment in proportion to the work done.

City Bureau of Public Efficiency for Chicago.

For something over a year an investigation has been going on to determine the efficiency of the various departments, particularly those having charge of construction and maintenance work, of the city government of Chicago. This investigation has been conducted by a commission of five members known as the Chicago Commission on City Expenditures. This commission is soon to go out of existence with a record of work which has stirred the depths of public works department methods in Chicago more thoroughly perhaps than any other occurrence of a decade. To itemize the records of inefficiency and waste disclosed by the investigations made seems unnecessary, but the broad result coming from them, an awakened public interest, is deserving of comment. The actual existence of this result is most specifically evidenced, perhaps, by the creation by the City Club of a Bureau of Public Efficiency, consisting of nine men to continue the work of the Chicago Commission on City Expenditures. The purpose of this body is announced to be:

(1) To scrutinize the systems of accounting in the eight local governments of Chicago.

(2) To examine the methods of purchasing materials and supplies and letting and executing construction contracts in these bodies.

(3) To examine the payrolls of these local governing bodies with a view of determining [illegible]

(4) To make constructive suggestions for improvements in the directions indicated under 1, 2 and 3, and to co-operate with public officials in the installation of these improved methods.

(5) To furnish the public with exact information regarding public revenues and expenditures and thereby promote efficiency and economy in the public service.

The possibilities for usefulness of this commission or committee, are large. In a measure it will work at a disadvantage as compared with the legally authorized commission which it succeeds or with the permanent finance commission, having espionage over Boston's city government. It cannot, as these other commissions were able, exercise power, to question public officials and to secure evidence. These are losses, but not such great ones that they can not be discounted by earnest and energetic work in securing specific facts and giving them the widest publicity. We would urge these two points.

The work of the original Boston Finance Commission drew its power from the specific facts on costs which were secured. The conclusions of the commission, sound as they were, and its discussions of influences and policies, able as they were, were as nothing in force compared with the specific records of outputs and costs made by the investigating engineers. Within the narrower limits of its labors, this is also true of the work of the Chicago Commission on City Expenditures. We believe this distinction so vital to success that it demands emphasis. The complete age census of Boston's sewer department laborers, showing that 13 per cent of them were men from 60 to 79 years old, was more effective than any general statement that many of the men were too old for active hard work. In a similar way, the exact computation of cost of "holidays" and "sick leave" showing it to be 8 per cent of the total pay roll, was more impressive than any general statement. So with the Chicago commissions report on the maintenance and repair work of the city's bridge department, it was the repetition of specific figures of successive costs, here a job of painting, there a piece of crib work, elsewhere a bit of electrician's work, that drove home the facts of carelessness and inefficiency. It is this character of work that the new commission can do if it will. We believe that it is the character of work which will count highest.

The strong tendency of civic reform commissions is to dissipate their ammunition in volley firing when pot shots at the enemy alone are effective. It is not the occasional misappropriation of thousands that wastes our city funds, but the thousand cases of inefficient and misdirected work. To get these requires sharpshooting and not volley firing. The very effective attack of the Boston Finance Commission along these lines proves the fact. It was not a general accusation of inefficiency and waste that worried the Boston heads of departments, but the citation in detail of case after case of excessive cost and poor work, backed by proofs which could not be answered. When the fact was presented to the shop keeper, the clerk and the wage earner, that Boston sewer officials were paying $9 per thousand for brick work which was being done for $2 a thousand by private persons, he understood it, and when case after case of similar figures was brought to his notice he understood that he was witnessing a general condition. No broadside accusation of graft, incompetence and carelessness in handling the city's sewer funds could have impressed him so forcibly.

It may seem that we are tediously insistent on the importance of specific, detailed records of work, but we believe that it is their lack that has made the work of civic reform commissions generally futile. No minuteness of data will count for much, however, unless their collection is followed by effective pub- [illegible] the hands of the few that do not need the information is not effective publication. The findings, like the bulletins of a health department, [illegible] zens, prominent and commonplac[illegible] will be quite as much efficient [illegible] for this task as for collecting the infor[illegible] tion.

[illegible] has among its members [illegible] member is Prof. C. E. [illegible] money there is warrant in [illegible] lent work.

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CONCRETE AND REINFORCED CONCRETE SECTION

Some Details of the Siphon Lock at Oswego, New York, Barge Canal.

The ordinary canal lock is filled and emptied by means of culverts in walls and floor controlled by gates. Most of the locks of the New York State Barge Canal are of this ordinary type, but at Oswego, N. Y., a siphon lock has been constructed and is described in the July *Barge Canal Bulletin* as follows:

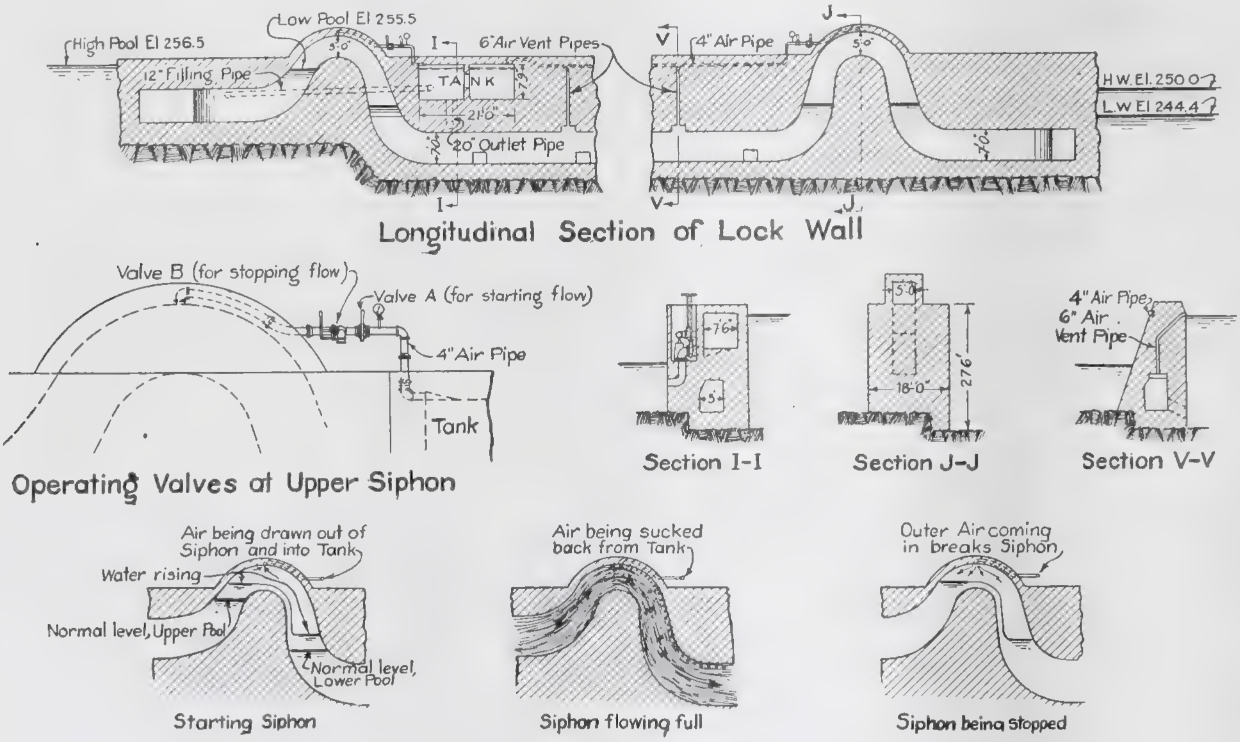
With a lock of the siphon type the general design of the culverts is similar to that of a lock of ordinary type, except that at the upper and lower ends the culverts are curved up so as to make necks, which rise a little way above the highest water-level and which at the same time are shut off from all communication with the outer air, except through the operating pipes. These necks are shown on the accompanying drawing. While the lock chamber is filled and emptied by water operating under the action of gravity, the flow is modified by siphonic action. All the water flowing into or out of the chamber runs uphill and over the crests of the siphon, lifting itself over the top of the lock walls before it begins to run down into the lower levels of the culverts.

The first lock of this type was completed about 1896, on a canal in northern Germany, and was designed by Professor Hotopp of Hanover. As its operation proved to be simple and successful, the remaining six locks on this canal were also made of the siphon type and others have been built here and there in Germany since that time. The chief advantages which they possess are those of simple and cheap operation and maintenance, as there is no complication with machinery or motors, and no large culvert valves to be operated under water, but all the movements are made by the direct action of the head of water on the air pipes and are controlled by hand valves, all parts being easily accessible and simple in design. The head of water, moreover, not only supplies the motive power, but automatically renews it during each operation. Deterioration of steel work under water by rusting is also eliminated, and in the case of the lock at Oswego it was found that the siphon type was the more economical as compared with the design which would have been used for a lock of ordinary type at the same site.

Looking again at the drawing, it will be noticed that at the upper end of the wall there is a space marked "Tank." This is a space (7½ ft. wide, 7¾ ft. high and 21 ft. long, with a center partition) built in the wall and communicating by means of pipes with the upper and lower levels and with each siphon in the same wall. One of these tanks is provided at the upper end of each lock wall and each one is entirely shut off from communication with the outer air, except through the pipes and through a manhole with an air-tight cover. One pipe, 12 ins. in diameter, is used to fill the tank; another pipe, 20 ins. in diameter, is used to empty it, and the remaining two pipes, each 4 ins. in diameter, are connected with the siphons and used for the operation of the lock. The cubic contents of the tank are nearly half as much again as the contents of one of the siphons, measuring from low pool levels.

The operating power for filling or emptying the chamber is obtained as follows: The 12-in. pipe for filling the tank is first opened, the 20-in. emptying pipe of course being close. The water from the upper pool then rushes into the tank, the air escaping through the valve marked *B*. This necessitates, of course, that the valve marked *A* should be open also. During this operation the neck of the siphon is temporarily in communication with the outer air, but as there is no drawing tendency of the air, the level of the water in the siphon does not change. The air escapes through the pipe with considerable force, and the tank is filled in about 4 minutes from the time of beginning to open the 12-in. valve. This valve, together with the controlling valves *A* and *B*, is then closed, and it must be seen, of course, that the corresponding valve *A* at the lower end of the lock is also closed, thus cutting off communication between the tank and both its siphons. On opening the 20-in. outlet valve there is produced in the tank the effect of a body of suspended water tending to escape into the lower pool. As the tank is now shut off from all communication with the outer air, the water remains suspended by its weight and thus produces the vacuum necessary for operation. For the convenience of the operator a vacuum gage is placed at each siphon, so that he can tell how much operating power is available. During the filling of the tank the needle of the gage stands at zero, but as soon as the filling is completed and the opening of the 20-in. valve begun, the needle begins to move slowly upwards, stopping finally at the difference in head between the upper and lower pools. This, as is usual with vacuum gages, is indicated in inches and corresponds to the difference in height which would be produced in a column of mercury by the head between the pools. Thus a head of 8 or 9 ft., which will be the average head under which the lock will be operated, would be indicated by a reading of about 7 to 8 ins. on the dials. The pressure per square inch as compared with that used for steam engines is light, and a head of 8 ft. would produce a pressure of only about 3½ lbs. per sq. in., or about 500 lbs. per sq. ft. Applying this, however, to the number of square feet of the water-surface in the tank, the figures become more noteworthy, as under the head just mentioned, the pull of the tank would lift a weight of some 37 tons. Under a head of 12 ft., which would be the maximum possible, the weight could be increased to 55 tons.

With the tank filled and the outlet valve open, everything is ready to start the flow of water. This takes place as follows: Suppose it is desired to fill the lock. The valve *A* stands closed and the valve *B*, which communicates with the outer air, must also be closed, if it has been open. Valve *A* is then opened and the air in the siphon rushes into thet vacuum in the tank displacing part of the water in the latter and permitting it to escape into the river through the 20-in. outlet. Reference to the drawing will show the manner in which the water rises in the siphon. After it has reached the crest, it of course begins to flow over into the culvert below. The tank continues to draw out the air, and as soon as the water in the siphon has risen to about one-third of the height between the crest and the crown (equal in this instance



Details of Siphon Lock at Oswego, New York Barge Canal.

to a little less than 2 ft.), part of the air begins to be carried out through the culvert. It is a natural principle of siphons of this type that when the water has risen to this height, the water will begin to carry out the remaining air and the siphon will thereafter fill itself automatically, provided the air bubbles can find an escape through some outlet. All the foregoing action takes place rapidly, and under an 8-ft. head the siphon begins to prime itself in from 30 to 40 seconds. At this time the needle of the gage, which recedes several inches as soon as valve *A* is opened, begins to climb again, and the siphon at the same moment reverses the action of the tank, so that instead of the air being drawn into the tank, the siphon begins to draw it back from the tank and to carry it out into the culvert. A certain amount of water from the river flows up into the tank at the same time through the 20-in. outlet pipe and supplies the place of the air, so that in a few minutes after valve *A* has been opened the original vacuum is restored in the tank. The movement still continues, however, and only stops when the tank and the pipes have all been drawn full of water, at which time the needle usually registers 3 or 4 ins. more of vacuum than at the time of starting. Some experiments were made with a float gage in the tank to ascertain the rise and fall of the water, and it appeared that when the reversing action began, the operating head of water in the tank was nearly 2 ft. in excess of the head in the siphon. It would have been expected, therefore, that the tank would have continued to draw air out of the siphon until this head was neutralized but in point of fact the draft of the siphon was so strong that it not only overcame this difference, but commenced at once to draw up the water into the tank, filling it again completely.

The air which is carried out by the water escapes partly in small bubbles through the culvert ports, but chiefly through the air vents in the walls, shown on the drawing. At first there is a discharge of mingled air and water, which is thrown a few feet from the lock wall, but as the flow through the siphon increases, the jets also increase until they occasionally blow a cloud of spray 50 or 60 ft. If this discharge should at some time cause inconvenience to boats, it will probably be remedied by cutting recesses in the walls and bolting baffle plates in front of the pipes. Practically all the discharge of air takes place through the up-stream vents and the culvert ports and only a small portion reaches the lower vents.

With both siphons in use the lock chamber can be filled in 4½ to 5 minutes, and as the water reaches the final level there is noticed the "surge" usual with lock chambers of this size. This means that the columns of flowing water continue to run a few seconds after the level in the chamber has reached that outside, so that the chamber level still continues to rise slightly and in so doing starts open the lock gates. With lock gates operated by hand this feature is often of much assistance to the lock-tenders in commencing to open the gates.

When the chamber is filled and prior to starting the lower siphon, valve *A* must be closed, and valve *B*, which admits the air to the upper siphon, must be opened, thus allowing the water in the neck to fall below the level of the crest. Unless this is done, any difference of level in the lock chamber caused by commencing to empty it would start the water in the neck of the siphon running again, and it would be impossible to empty the chamber without thus stopping the flow.

In order to empty the lock the same process is used as for filling it. In case the valve *B* at the lower siphon was not left open during the filling of the chamber, so that the air in the siphon could find an escape as the water rose, it must be opened for a few seconds and then be closed again before starting to empty the chamber, as otherwise there would be an excess of air inside, which would go far to neutralize the vacuum in the tank. The lower siphons are less rapid than the upper ones in starting, as the air has to travel to the tank through some 250 ft. of pipe in each wall and around several bends. Moreover, the air which the water begins to carry out after the siphon has started to prime itself does not appear to escape as readily as at the upper end, as it has a less direct route to travel before it can get free. Tests showed that the operation takes from three-quarters to a minute longer, the first discharge of air appearing at the culvert outlet in from 1½ to 1¾ minutes. The vacuum gage, however, indicates that the flow of air from the siphon to the tank reverses in about 45 seconds. As the outflow increases, the amount of air carried in the water continues to increase, and the discharge for a minute or two is a compound of air-bubbles and water, changing gradually until all the air has been discharged. The vacuum gage in a manner similar to that described for the upper siphon commences to register a steadily increasing pull until, when the discharge is in full play, it sometimes reaches as high as 13 to 14 ins., or nearly double that at the commencement of the operation. After the flow has stopped, the needle gradually settles back to the original figure indicated. The emptying of the lock, using both siphons, takes 5½ to 6 minutes.

It will be seen from the foregoing description that once the tanks have been made ready for work the operating power is self-renewing, so that, were there no leakage of air into the tanks, lockages could be conducted at any time and by merely manipulating the 4-in. air valves. While tests for leakage have not yet been concluded, the experience obtained thus far seems to indicate that the tank will retain a sufficient vacuum for 2 or 3 hours after the last lockage. However, in order to avoid having to refill the tank when traffic is very infrequent, the plan has been adopted of closing the 20-in. outlet valve, thus holding the water in the tank. On opening the valve again the apparatus is at once ready for use.

Formulas for the Design of Gravity Retaining Walls.*

The following discussion is presented, not in order to add anything new to the already voluminous literature on this subject, but in the hope of presenting easily applied formulæ for the use of those engineers who prefer to base their design on formulæ derived from some one of the common theories of earth pressure rather than to obtain dimensions from purely empirical ones.

If *A B C D* (Fig. 1) represents the vertical section of a masonry retaining wall without surcharge, the following forces are considered as acting:

1. The weight of the wall, *W*. This is a vertical force and its point of application is the center of gravity of the section.

2. The weight, *W'*, of the triangular prism of earth, *B D E*. This is a vertical force, whose point of application is the center of gravity of the triangular section.

3. The force *P*, representing the lateral pressure due to the earth backing. This is assumed to be a horizontal force, acting against the vertical plane *B E*, whose point of application is one-third of the height of the wall above the base.

These are the assumptions on which the design of the lock walls of the Gatun locks at Panama were based. They are also used by Turneaure, and Maurer, "Principles of Reinforced Concrete Construction," edition 1909, p. 372, and are believed to be fairly representative of modern engineering practice.

Some engineers consider also the force of the earth friction acting downward along the plane *B E*. (See letter by Mr. Chas. Worthington on "The Design of Retaining Walls," *Engineering News*, Nov. 16, 1905, pp. 519-521.) The intensity of this force is equal to $P \times$ the coefficient of the internal friction of the earth backing. It is neglected in the discussion which follows and, since the force adds to the stability of the wall, this neglect is on the side of safety.

The thrust due to the pressure of the earth backing can not be exactly determined either in direction, intensity, or point of application, and it is the uncertainty in the determination of this force which has led many engineers to discard all theories and rely simply on empirical formulæ based on experienced and existing designs.

Many formulæ have been deduced by eminent engineers for determining its intensity, and many theories proposed as to its direction and point of application.

Among the best known of the formulæ are those of Coulomb, Rankine, Weyrauch, and Poncelet. (See Baker, "Treatise on Masonry Construction," edition 1909, pages 493 and 494.)

Rankine's formula was used in the design of the Gatun lock walls and seems to be the one in most general use. For a wall without surcharge it is,

$$P = \frac{w'h^2}{2}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)$$

where P = total horizontal pressure of earth backing in pounds.
h = height of wall in feet;
w' = weight of earth backing per cu. ft.
ϕ = angle of repose of earth—that is, angle between the natural slope and the horizontal.

Coulomb's formula is

$$P = \frac{w'h^2}{2}\tan^2\left(45^\circ - \frac{\phi}{2}\right)$$

which is identical with Rankine's formula above, since

$$\tan\left(45^\circ - \frac{\phi}{2}\right) = \sqrt{\frac{1-\sin\phi}{1+\sin\phi}}$$

Baker gives the following experimental method of determining ϕ:

Thoroughly pulverize a mass of earth so as to destroy all cohesion between its particles; and then slowly pour it vertically upon a horizontal surface, thus forming a cone. The angle of the sides of this cone with the horizontal is ϕ, the angle of repose or the angle of natural slope.

Sometimes the earth pressure is taken as equivalent to the pressure of a fluid having an assumed weight per cubic foot. In this case, if w'' represents the weight of the fluid per cubic foot,

$$P = \tfrac{1}{2}\, w''\, h^2.$$

The following deductions are independent of the method of determining P, and the designer may select whatever formula he prefers.

Referring to Fig. 1, the following conditions for stability should be fulfilled:

1. The resultant of the forces *W, W'*, and *P* should not pierce the base outside the middle third—that is, there must be no tension at the heel, *B*.

2. The total unit pressure at *A* should not exceed the allowable unit pressure of the masonry in the wall or of the foundation. The allowable unit pressure in the masonry is usually much greater than the pressure developed. If the unit pressure developed exceeds the allowable unit pressure on the foundation bed, a spread footing should be used to decrease the developed toe pressure or the allowable unit pressure should be increased by driving piles or otherwise.

3. To prevent sliding, the friction developed along the base *AB* due to the forces *W* and *W'* should be greater than the force *P*.

Assuming that the resultant pressure due to the weight of the wall *W*, the weight of the earth *W'*, and the pressure *P*, intersects the base at the edge of the middle third nearest *A*, according to the first condition above, the moment of the resultant about this point must be zero. That is, the sums of the moments of its components must be zero. Or

$$Pl'' = Wl + W'l'$$

where l, l' and l'' are the lever arms of the forces *W*, *W'* and *P*, respectively, about the edge of the middle third nearest the toe of the wall.

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*A paper by Lieut. W. H. Rose, Corps of Engineers, U. S. A., in "Professional Memoirs," Corps of Engineers, U. S. A., July-Sept., 1910.

Referring to Fig. 2, the lever arm of P is $\frac{h}{3}$ since the point of application of P was assumed to be one-third of the height of the wall above the base.

Hence $l'' = \frac{h}{3}$, and moment of force P about edge of middle third is $\frac{Ph}{3}$

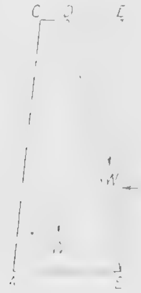

Fig. 1.

To find l and l' refer to Fig. 2.
Let $a = CD$ = width top of wall.
$b = AB$ = width base of wall.
$h = EA$ = height of wall.
Θ = angle EAC = angle of batter front face.
O be center of gravity of trapezoid $ABCD$.
O' be center of gravity of triangle BDF.
OQ and SR be perpendicular to AB.
MN be line joining middle points of AB and CD.

The centers of gravity, O and O', lie on MN and BT, respectively.

$$l = \frac{b}{6} - QN,$$

$$QN = \sqrt{ON^2 - OQ^2}$$

$$\text{but } ON = \frac{MN}{3}\;\frac{2a+b}{a+b}$$

$$\text{and } OQ = \frac{h}{3}\;\frac{2a+b}{a+b} \text{ (Trautwine).}$$

$$\text{and } MN = EP = \sqrt{h^2 + AP^2}.$$

$$\text{But } AP = \frac{b}{2} - PN = \frac{b}{2} - EM = \frac{b}{2} - \frac{a}{2} - h\tan\theta, \text{ whence}$$

$$l = \frac{b}{6} - \left(\frac{2a+b}{3(a+b)}\right)\left(\frac{b}{2} - \frac{a}{2} - h\tan\theta\right)$$

If w = weight of masonry per cubic foot, then for a section of wall one foot long

$$W = \frac{wh\,(a+b)}{2}$$

and moment of force W about edge of middle third is

$$Wl = \frac{wh\,(a+b)}{2}\left[\frac{b}{6} - \left(\frac{2a+b}{3(a+b)}\right)\left(\frac{b}{2} - \frac{a}{2} - h\tan\theta\right)\right]$$

Also,

$$l' = \frac{2b}{3} - RB$$

$$RB = SF = \frac{2}{3}\,\frac{DF}{3} = \frac{DF}{3},$$

but $DF = b - ED = b - a - h\tan\theta$
whence

$$l' = \frac{2b}{3} - \frac{b-a-h\tan\theta}{3} = \frac{b+a+h\tan\theta}{3}.$$

If w' = weight of earth backing per cubic foot, then for a section of wall one foot long

$$W' = \frac{w' \times DF \times h}{2} = \frac{w'h(b-a-h\tan\theta)}{2}$$

and moment of force W' about edge of middle third is

$$W'l' = \frac{w'h}{6}(b+a+h\tan\theta)(b-a-h\tan\theta)$$

Substituting in the moment equation, $Pl'' = Wl + W'l'$, the values of l'', Wl, and $W'l'$ found above, we have

$$\frac{Ph}{3} = \frac{wh\,(a+b)}{2}\left[\frac{b}{6} - \left(\frac{(2a+b)}{3(a+b)}\right)\left(\frac{b}{2} - \frac{a}{2} - h\tan\theta\right)\right]$$
$$+ \frac{w'h}{6}(b+a+h\tan\theta)(b-a-h\tan\theta).$$

from which

$$P = \frac{w}{2}(a^2 + 2ah\tan\theta + bh\tan\theta)$$
$$+ \frac{w'}{2}(b^2 - a^2 - 2ah\tan\theta - h^2\tan^2\theta)$$

whence

$$b = -\frac{wh\tan\theta}{2w'} + \sqrt{\frac{2P - a^2(w-w')}{w'} - \frac{2ah(w-w')\tan\theta}{w'} + \frac{w^2h^2\tan^2\theta}{4w'^2} + h^2\tan^2\theta} \quad \text{(A)}$$

This is the general equation of the retaining wall without surcharge, under the assumptions made.

If the front face is vertical, as in the ordinary lock wall, $\tan\Theta = 0$ and

$$b = \sqrt{\frac{2P - a^2(w-w')}{w'}} \quad \text{(B)}$$

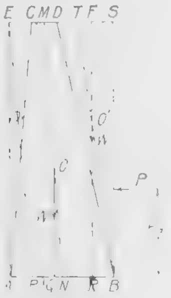

Fig. 2.

From equations (A) or (B) if P, w w', a, h and Θ are known, the thickness of the base, b, of the wall can be found and with this value of b, under the assumptions made, the resultant of the forces will pierce the base at the forward edge of the middle third. This fulfills the first condition of stability.

The maximum pressure on the toe of the wall at A is given by the equation

$$P_1 = \frac{W+W'}{b} + \frac{6(W+W')d}{b^2}$$

where P' = maximum pressure per square foot at A,

d = distance of center of pressure from center of base in feet.

W and W'' = weights of masonry and earth, as before, for one foot length of wall.

b = length of base in feet.

When the center of pressure is at the edge of the middle third nearest A,

$$d = \frac{b}{6} \text{ and } P_1 = \frac{2(W+W')}{b}.$$

From this equation we can determine whether or not the second condition for stability is fulfilled.

The force of the friction along the base AB is equal to $F = (W+W')f$ where f is the coefficient of friction of the masonry on the material upon which it rests. If $f(W+W')$ is greater than P the wall is safe against sliding and the third condition of stablitiy is fulfilled. For the type of wall under discussion the friction developed is usually ample to insure stability against sliding.

SURCHARGED WALLS.

For a wall carrying a surcharge at an angle θ with the horizontal, Rankine's formula for the horizontal earth pressure is

$$P = \frac{\frac{1}{2}w'h^2\cos^2\varphi}{\cos\delta\left(1 + \sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\delta)}{\cos\delta}}\right)^2} \quad \text{(c)}$$

and if $\delta = \varphi$, the angle of repose, the assumption usually made,

$$P = \tfrac{1}{2}w'h^2\cos\varphi \quad \text{(D)}$$

The resisting moment is increased by the moment of the weight of the small triangular

BT be line joining B with middle point of DF.

EP be parallel to MN.

The centers of gravity, O and O', lie on MN and BT, respectively.

prism l m n, see Fig. 3. For unit length of wall this weight is

$$W'' = \frac{w'}{2}(b-a-h\tan\theta)^2\tan\delta$$

Its lever arm about the forward edge of the middle third is the same as that of the prism m n s, viz.:

$$\frac{b+a+h\tan\Theta}{3}$$

Its moment is

$$\frac{w'\tan\delta}{6}(b-a-h\tan\theta)^2(b+a+h\tan\theta).$$

The moment equation then is,

$$\frac{Ph}{3} = \frac{wh(a+b)}{2}\left[\frac{b}{6} - \left(\frac{2a+b}{3(a+b)}\right)\left(\frac{b}{2} - \frac{a}{2} - h\tan\theta\right)\right]$$
$$+ \frac{w'h}{6}(b+a+h\tan\theta)(b-a-h\tan\theta) + \frac{w'\tan\delta}{6}$$
$$(b-a-h\tan\theta)^2(b+a+h\tan\theta) \text{ or } P = \frac{w}{2}(a^2 +$$
$$2ah\tan\theta + bh\tan\theta) + \frac{w'}{2}(b^2 - a^2 - 2ah\tan\theta -$$
$$h^2\tan^2\theta) + \frac{w'\tan\delta}{2h}(b-a-h\tan\theta)^2(b+a+$$
$$h\tan\theta) \quad \text{(E)}$$

This is the general equation for the surcharged retaining wall under the assumptions made.

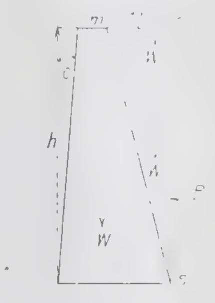

Fig. 3.

If the front face is vertical, $\tan\Theta = 0$ and

$$P = \frac{wa^2}{2} + \frac{w'(b^2-a^2)}{2} + \frac{w'\tan\delta}{2h}(b-a)^2(b+a) \quad \text{(F)}$$

It will be noted that equations (E) and (F) are cubics, considering b as the unknown quantity. They may be readily solved by successive approximations, substituting for b, in the last term of the second member, approximate values. For the first approximation, for the type of walls shown in the figures, b may be taken as $.47h$ for the wall with battered face and $.49h$ for the wall with vertical face. See examples 3 and 4.

The unit pressure at the toe will be

$$\frac{2(W+W''+W''')}{b}$$

The force resisting sliding will be $f(W+W'+W'')$.

Example No. 1: No surcharge. Face batter 1/12.

Assume h = 32 = height of wall in feet.
a = 2 = width of top in feet.
w = 140 = weight of masonry per cu. ft.
w' = 100 = weight of earth backing per cu. ft.
$\phi = 41° 49.'$ sin $\Phi = ⅔$ = angle of repose of earth.
tan Θ = 1/12 = batter of front face.
From Rankine's formula,

$$P = \frac{w'\ h^2}{2}\left(\frac{1-\sin\delta}{1+\sin\delta}\right)$$

P = 10,240 pounds.

b = 12.6 feet = width of base. $\left(\frac{b}{h} = .394\right)$

$$P_1 = \frac{2\,(W+W')}{b} = \frac{2\,(32{,}700+12{,}600)}{12.6} =$$

7,200 lbs. per square foot.

This is a very low value so far as the allowable stresses in the masonry are concerned. It would be within the limits of safety for almost all soils excepting soft clay or quicksand.

Friction on base $= f(W+W')$.

Assume base of wall rests directly upon a dry sand bed and that the coefficient of friction of masonry on sand is .45.

Then F = 20,420 lbs., which is practically twice the intensity of P, the force tending to produce sliding.

Example No. 2: No surcharge. Vertical face.

If the same values of h, a, w, w' and ϕ be taken, but the condition be imposed that the wall shall have a vertical face, we have,

P = 10,240 pounds.

b = 14.25 feet. $\left(\frac{b}{h} = .445\right)$

P_1 = 7,900 lbs. per sq. ft.
F = 25,200 lbs.

It will be noted that the base must be considerably wider in the second case than in the first. In the wall with a face batter of 12 on 1 the weight per foot length is 32,700 lbs., while for the vertical face wall the weight per foot length is 36,400 lbs., showing that a considerable saving can be effected by using the battered type.

Example No. 3: Wall surcharged at angle of repose. Face bater 1/12.

Assume h = 32.
a = 2.
w = 140.
w' = 100.
$\phi = \delta = 41° 49'$.
tan Θ = 1/12.

Then from equation (D), $P = ½\ w'h^2 \cos\phi$ = 17,060 lbs.

From equation (E), (substituting $.47h$= 15 feet for b in the last term of the second member).

b = 15.1 feet. $\left(\frac{b}{h} = .472\right)$

W = 32,700.
W' = 12,680.
W'' = 4,780.
P_1 = pressure at toe = 6,680 lbs. per sq. ft.
If f = .45.
F = 22,600 lbs.

Example No. 4: Wall surcharged at angle of repose. Vertical face. Same assumptions as above but vertical face.

P = 17,060 lbs.

b = 15.7 feet. $\left(\frac{b}{h} = .491\right)$

W = 39,650 lbs.
W' = 21,920 lbs.
W'' = 6,140 lbs.
P_1 = 8,640 lbs. per sq. ft.
F = 30,470 lbs.

EARTH AND ROCK SECTION

Working Costs of Gold Dredging in California.*

In California, dredging companies determine yardage handled by bank measurement ahead of the dredge. When dredges are working in swift running rivers, as in some foreign countries, it is difficult to determine the yardage handled with the same degree of accuracy that can be computed from careful bank measurement; the method generally employed in such cases is to count the number of buckets dumping within a stated time, making some allowance for buckets only partly filled. Should too large a yardage be figured, it is obvious that the estimated cost per cubic yard will be proportionately too low. Working costs cannot be fairly used in comparison unless uniform methods of determining them are employed, and also unless operating conditions are somewhat similar. Ground in the same locality often varies to such an extent that dredges similar in construction, design and bucket capacity, and operated under the same management, show at times considerable difference in cost per cubic yard. Nearly all dredging companies operating in California keep careful daily records, though on the dredges owned by individuals the practice of keeping exhaustive records of yardage handled and the segregating of items of working cost is not always followed. It may also be said that in some cases working cost is in a great measure a matter of bookkeeping.

The table opposite, showing the operating cost per cubic yard for dredges of different capacity, working in California, has been compiled from records of various dredging com-

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*A paper by Charles Janin and W. B. Winston in the "Mining and Scientific Press" for July 30, 1910.

WORKING COSTS OF GOLD DREDGING IN CALIFORNIA.

						Operating expenses, in cts. per cu. yd							
Capacity of buckets, cu. ft.	Time in commission.	Working period for figures given.	Actual w'rk'g time; hours during working period[1]	Yardage handled.	Average depth of gravel, ft.	Labor and material.	Electric power.	Water.	Repairs.	General.	Taxes and insurance.	Total expense.	Remarks.
3	5 yr. 9 mo.	1 yr.	2,809	173,655	27.0	2.77	0.90	0.14	4.15	0.78	0.49	9.23	Difficult digging.[7]
3		1 yr.	7,216	458,852	26.9	2.03	0.69	....	3.28	0.63	0.37	7.00	Working under favorable conditions.
3½	7 yr.	1 yr.	.....	395,316	35.0	2.83	1.53	0.228	1.74	1.32	....	7.67	
3½	6 yr. 6 mo.	1 yr.	7,344	461,882	35.0	2.85	1.48	0.195	1.71	1.07	....	7.32	Compact gravel land subject to overflow.
4	9 yr.	1 yr.	7,057	484,387	20.6	1.83	0.89	0.31	2.58	0.65	0.26	6.52	Remodeled dredge, uneven bedrock, in places shallow
5	6 yr.	1 yr.	.....	481,184	25.0	3.28	1.46	0.39	2.97	1.52	....	9.55	Difficult ground, in places cemented gravel
5	2 yr. 5 mo.	1 yr.	.....	635,146	27.0	3.14	1.45	....	2.40	1.28	0.41	8.70	Difficult ground.
5	2 yr.	1 yr.	....	582,891	30.0	3.28	2.02	0.32	2.59	1.37	1.00	9.60	Difficult digging.
5	5 yr. 6 mo.	1 yr.	7,344	615,009	25.0	3.06	1.42	0.29	3.06	1.14	....	8.98	Difficult digging.
5	4 yr. 6 mo.	1 yr.	.....	812,355	36.0	2.30[2]	1.08	....	2.95	....	0.35	6.65	Med. grav., considerable clay, much brush on top soil
5	3 yr. 5 mo.	1 yr.	6,798	1,148,480	25.5	0.88	0.52	0.05	1.77	0.25	0.35	3.80	Loose gravel, heavy overburden of sandy loam.
5	2 yr. 5 mo.	1 yr	6,790	1,148,802	29.9	0.82	0.49	0.03	1.89	0.25	0.16	3.64	Loose gravel, heavy overburden of sandy loam.
5	4 yr. 7 mo.	1 yr.	6,644	599,614	38.5	1.77	0.92	0.25	4.03[3]	0.47	0.23	7.67	Difficult digging, working against 20-ft. bank.
7	9 mo. 10 days.	1 yr.	5,088	838,885	35.0	1.19	0.69	....	1.22	0.26	0.17	3.53	Difficult digging, gravel coarse, partly cemented.[8]
7	1 yr.	1 yr.	6,313	1,114,605	27.6	1.21	0.62	0.03	1.81	0.29	0.11	4.07	Compact gravel.
7	3 yr. 9 mo.	1 yr.	6,390	1,033,694	26.5	1.08	0.64	0.14	2.69[4]	0.34	0.20	5.09	Compact gravel, heavy digging.
7	2 yr. 9 mo.	1 yr.	6,917	1,017,167	28.1	1.10	0.65	0.15	2.19[5]	0.28	0.14	4.51	Compact gravel, heavy digging.
7	3 yr.	1 yr.	6,352	935,322	33.4	1.26	0.85	0.06	3.06	0.31	0.34	5.88	Compact gravel.
7	3 yr.	1 yr.	6,700	1,194,146	27.5	1.05	0.58	....	2.78	0.32	0.37	5.10	Compact gravel.
7½	2 yr. 11 mo.	2 yr. 11 mo.	13,464	3,458,229	27.9	0.27	0.41	....	1.50	0.24	0.24	4.42[6]	Medium compact bench gravel.
7½	9 mo. 6 days.	9 mo. 6 days	7,582	944,879	28.9	0.95	0.58	....	1.30	0.27	0.39	3.55	Medium compact gravel with heavy [illegible]
7½	2 yr. 6 mo.	1 yr.	6,402	1,369,844	70.2	0.99	0.77	....	1.95	0.45	...	4.16	Medium gravel overlain with [illegible]
7½	2 yr. 6 mo.	1 yr.	6,900	1,281,351	67.8	1.09	0.98	....	2.01	0.45	....	4.53	Medium gravel overlain with hydraulic tailing.
8	6 mo.	6 mo.	3,162	583,927	42.5	1.69	0.59	....	1.14	0.28	0.22	3.92	Light gravel, dredge working [illegible]
8	4 mo. 8 days.	4 mo. 8 days.	2,369	626,624	24.0	Segregated costs not given.						2.47	
9	5 mo.	5 mo.	.....	580,310	51.0	Segregated costs not given.						4.98	Cem. grav., dif. dig., 20-ft. bank above water-level.
13½	8 mo.	8 mo.	4,478	1,803,201	19.0	1.02	0.47	....	0.66	0.12	0.03	2.30	Fine gravel, easy digging

[1] Total possible time in year's work, 8,784 hours.
[2] Including general expense, management, etc.
[3] Heavy repair cost due to new tumbler, conveyor belt, repairs to digging ladders, screens, etc.
[4] Replacing tumbler shafts, conveyor belt, and new screen included in repairs.
[5] New steel spud and screen in repairs.
[6] Depreciation charges included in total expense.
[7] A 7-ft. dredge is now working this ground at a profit.
[8] This dredge successfully replaced an open-connected bucket dredge which could not handle ground at a profit.

panies, with the endeavor to arrive at the total operating cost per cubic yard with some degree of accuracy. The buckets in use in California vary in capacity from 3 to 13½ cu. ft. and will probably soon be made 15 cu. ft. Dredge operators in California prefer the close connected bucket line to the open-connected type, and the use of digging spuds, to head-lines. In practice the close-connected bucket line dumps at the rate of from 18 to 22 buckets per minute, while the open-connected line averages from 12 to 14 buckets per minute. On some of the older boats where the bucket line has been changed from open to close connected buckets, it is claimed that the yardage handled has been nearly doubled and the expenses per cubic yard decreased.

A Portable Drilling Outfit for Street Work and Light Contract Excavation.*

The city of Gloucester, Mass., located on the southeast end of Cape Ann, is for the most part built on a solid granite formation. Large areas are covered with boulders, deposited during the glacial period. Many of these boulders are ten ft. or more in diameter, and some even as large as twenty feet through. These conditions have rendered the building of streets and laying of water mains difficult and costly; solid rock, or ground filled with these large boulders, being constantly encountered.

Until recently, the City of Gloucester has carried on this work by hand drilling, and later by means of steam tripod drills of the Sullivan UB pattern, operated by portable boilers. Both methods, however, have been found expensive and slow. After studying the conditions thoroughly, the present street commissioners decided that the work could be done more rapidly and at lower cost if compressed air were available

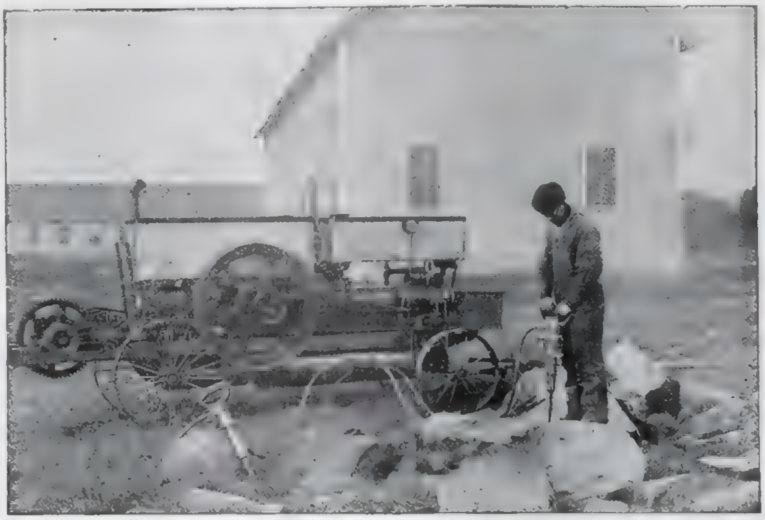
Accordingly, in March of this year, they purchased an outfit, consisting of a Sullivan air compressor geared to a gasoline engine, and the whole mounted on wheels. The compressor operates two hammer drills, of the Sullivan Class DB-15 and DB-19 types, respectively. The first of these drills puts in holes up to three feet in depth, and weighs 20 pounds. The size DB-19 puts in holes five feet in depth, and weighs 35 pounds. This outfit has been in operation now for the past three months, working steadily, practically every day, with the exception of Sundays and holidays, and has given entire satisfaction in the points desired. It has proved well adapted for such work as widening out streets, excavating trenches for water and sewer pipes, and trimming off curves. The drills are so easily handled that holes may be put in at any point or at any angle desired. When boulders project into the street, it is a simple matter to drill a hole and blow off the projection with a little powder.

In the intervals of street work, the outfit is frequently hauled to the city trap rock quarry, where it is used for excavating stone for the crusher, to be used later on the roads.

In some parts of the town, where trenches have been excavated for water mains, disintegrated granite of a very springy nature was encountered, similar to loose shale. Progress in this rock was particularly unsatisfactory with the steam drills, and in fact pick and shovel has ordinarily been the method of excavation. The hammer drills were found very well adapted for this work, and on one occasion, nine holes, five feet deep, have been drilled and the rock blown out in three hours' work. This task would have required at least two days if done by hand. Much of this ground was wet and in some cases the water stood an inch or more in depth over the rock. The rock was so well broken up by blasting, as to pass, with the exception of only a few pieces, through a one-inch ring. It was easily removed by shovel, and made excellent macadam for the streets. In ordinary trench work the rock is broken into pieces from two to three feet in diameter and removed by means of a light wooden tripod, mounted across the trench.

Still another class of work is found in extension of the streets in the suburbs. In the thinly settled parts of the city, the fields are covered with the glacial deposits of boulders. By using hose in 50-foot lengths on the drills, these boulders can be drilled for a distance of 100 feet at each shift of the compressor.

The Air Compressor.—The air compressor is a standard Sullivan WG-3 single stage machine, with air cylinder 8x10 inches, compressing 96 cu. ft. of free air per minute at 165 revolutions to 80 to 100 pounds pressure. This is sufficient to operate three hammer drills, although only two, one large and one small are now in operation. The illustration shows the outfit in use, and the illustration on this page shows the other side of the outfit. The compressor is geared to a 15-HP. gasoline engine, and both are mounted on a substantial steel truck with heavy broad-tired wheels. The entire outfit weighs about 8,000 lbs. As will be noted from the illustration, it includes a gasoline tank, cooling tanks of a special design for the engine and compressor, and an air receiver attached beneath the frame of the truck for the compressor. The outfit carries a day's supply of gasoline and it is only necessary to add one bucket of water every other day to the cooling supply.



Portable Drilling Outfit, Sullivan Machinery Co., Chicago, Ill.

At the rear end of the outfit is a hoisting attachment, driven by gearing from the engine, which has been found very convenient in removing boulders and rock fragments from the sewer trenches, and from the line of streets.

Hammer Drills.—The hammer drills are of standard pattern, using hollow steel with hexagonal shanks, fitting a hexagonal bushing at the nose of the drill cylinder. A double grip handle is furnished, and the operator uses this handle to rotate the steel. When the operator pushes the handle against the cylinder the throttle opens, and the drill operates until pressure is released, when it automatically stops running. By a special arrangement of ports, it is possible to turn any desired proportion of the exhaust air into the hollow steel, thus keeping the hole free from dust or sludge, under all conditions, and securing greater capacity and speed than would otherwise be possible.

The valve and piston motion in these tools is so arranged as to provide a cushioning effect on the back stroke, which reduces the vibration of the tool to a very low point, and does away with much of the jar and fatigue usually experienced with hammer drills.

The DB-19 tool employs 1-in. steel, the starters having a gauge of 1¼ ins., and the 5-ft. finishing steel a gauge of 1¼ ins. Seven-eighth-inch steel is used on the DB-15 drill, the starter being sharpened to 1⅜-in. gage, and the last or 3-ft. being 1⅛-in. gage.

Records of Work.—Records kept on the classes of work described above show that the hammer drills are doing about three times as much work as the tripod drills formerly accomplished. The cost of operation for the drills and compressor is about one-third less than that of the steam drills and boilers. Some of the performance records of the hammer drills are worthy of note. In 16 hours' time, the DB-15 drill put in 47 ft. in 25 holes, ranging from 19 to 36 ins. deep, and the DB-19 drilled 19 ft. or 5 holes running from 32 to 60 ins. in depth. This includes loading, shooting and all details, and further the drills were not operated at the same time. Holes 5 ft. deep have been drilled frequently in 30 minutes, and the best time noted for a hole of this depth is 20 minutes. This drilling was done in very hard dark green bastard granite.

Thanks are due Mr. George E. Merchant, street commissioner, and Mr. Nicholas F. Sleep, Superintendent of Streets, for information furnished the writer in preparing this article.

Another instance of the convenience of these portable air compressors and drill outfits is furnished by the Keystone State Construction Company of Yonkers, New York, which is building a reservoir for the Board of Water Supply of New York city.

The ground is heavily covered with boulders, which it is necessary to remove from the basin, and the contractors are breaking these up as removed, for use in concrete. Until recently this work was done by hand at a cost of $1.50 per man per day. As each man is able to drill about five feet of block hole per day, this shows a cost of 30 cts. a foot for drilling.

The contractor has recently installed a Sullivan portable compressor outfit of the size and type described in the above article; together with three Sullivan DB-15 hammer drills. These tools are drilling an average of 50 ft. each per day. The cost of operation is estimated as follows:

3 drill operators at $3.50 per day	$10.50
Compressor attendant	3.50
Gasoline, per day, 15 gals. at 20 cts.	3.00
Interest, renewals, wear and tear	6.00
Total cost per day	$23.00

$23.00 divided by 150 gives a cost of 15½ cts. per foot of hole, which means a saving of 14½ cts. per foot over hand work, or $21.75 per day. The saving at this rate will rapidly pay for the equipment and of course secures greater speed.

There are hundreds of places throughout the country where an outfit of this kind might be used to advantage, on account of its compactness, portability, and economy of operation.

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*An article by Samuel Seaver, Claremont, N. H., in "Mine and Quarry" for July, 1910

Increased Cost of Construction Due to Increased Wages and Decreased Efficiency.

One of the criticisms urged against the U. S. Reclamation Service is the great discrepancy between estimated costs and actual costs of important works. In explanation of this discrepancy Director F. H. Newell of the Service presented, some weeks ago, a statement charging it to increased wages, prices of materials and supplies and decreased efficiency of labor. His statement in full is as follows:

Any comparison of the original estimates with the expenditure is necessarily [illegible] from the fact that the larger projects at least were outlined and begun in accordance with the information then at hand. They were subsequently modified from time to time, both as to size and character of construction, in accordance with developments. The original plans were made with a knowledge that such modifications must take place, and all construction was undertaken with this in view, care being exercised to design and build in such way that extension can be made without notable difficulty.

The alternative method, which theoretically might have been applied, was to delay construction until all of the vested rights, legal and physical conditions, had been completely determined, and then make plans so complete that no further modification would be necessary. This while possible, would have involved delays extending through years. Many of the matters were so interrelated that it would be necessary to have one condition solved (involving a delay of months or years) before the next could be taken up. Such a course was evidently out of the question, in view of the impatience of all persons interested to have construction begun immediately, leaving for the future the determination of questions which could best be solved as construction proceeded.

The increased cost of reclamation works above the figures originally assumed is due mainly to the rapid change in industrial conditions during the past five or six years. Since the reclamation projects were investigated there has been a general advance in the cost of materials and equipment, especially horses and mules, which are so largely necessary on construction work in the west, and of subsistence supplies for men and animals. There has been a similar advance in the cost of labor, and a marked decrease in its efficiency.

The president of the Northern Pacific Railway states that the average cost of work prosecuted by that company since 1905 has been found by careful estimate to average about 60 per cent above the cost for the five years preceding that date.

Mr. Andrew J. Wiley, civil engineer, Boise, Idaho, who has probably the widest experience with irrigation work under private enterprise and the provisions of the Carey Act during the last ten years, states that his experience indicates the average cost since 1905 to be about 75 per cent more than the cost for the five years preceding that date.

This testimony is borne out by the experience of all those engaged in construction work in the west, as well, also, as in a less degree in other regions.

For example, the South Side Twin Falls project was estimated to cost $1,500,000 and actually cost $3,500,000. The American Falls canal system, estimated to cost $350,000, really cost $886,000. The project of the Canyon Canal Co., estimated to cost $225,000, actually cost $650,000.

One of the great irrigation systems of Canada was originally estimated to cost less than $5 per acre. It has to date cost between $12 and $13 per acre, and a recent examination justifies the opinion that this sum must be increased by about 60 per cent to make the system thoroughly satisfactory and efficient.

The Panama Canal was undertaken in 1903 by the United States after surveys and construction work had been in progress developing conditions for a generation. After two years of American experience, in 1905 a board of thirteen consulting engineers, the foremost in the world, spent many month examining all existing data, making plans for the future, and estimating the cost in the light of all the accumulated information. [illegible] of canal was [illegible] of which were estimated to cost $140,000,000. The experience [illegible] shown that these engineering features will cost $283,000,000 of which [illegible] by changes in [illegible] and the remainder, or nearly 60 per cent, of the increase over the estimate of 1905 is to be attributed to the higher unit cost of the different items of the work. The board of consulting engineers of 1909 reported that this difference was caused mainly "by the higher prices for plant, supplies and labor which have prevailed in the United States since the estimate of 1905 was made."

The most important element in this increase in cost was in the item of labor. Not only did the actual price for common labor advance from 20 to 50 per cent, reaching as high as $3 per day in some regions, but the efficiency fell off in a much greater proportion. These influences were not felt on established business enterprises, where labor of average intelligence and sobriety was steadily employed, but on construction work, where employment was necessarily limited to the construction season, it was usually impossible, owing to the scarcity of labor, to secure any except the floating, or "hobo," element, and these men, never very efficient, and conscious that they could pick up a job at any place and any time, would not exert themselves and would only remain long enough to get a few dollars ahead, and then, if the weather were disagreeable or the foreman not sufficiently polite, they would quit and necessitate shipping in additional men. It became necessary on all large work to ship common labor from the centers of population, as Chicago and Omaha. These laborers were hired under contract to work at a certain rate and have their railroad fare deducted. To avoid this deduction from future wages, they would, whenever possible, desert before reaching the point of labor or quit soon after. Thus all heavy work of a temporary character was kept under constant expense—shipping in laborers, paying them high wages, and receiving little benefit.

In a less degree costs were affected by the increased price of materials and equipment. Good mules, which could be purchased for about $150 each in 1903, advanced until similar mules demanded the price of $250 each in 1908. Cement, which in 1904 at one of the principal western factories was selling at $1.10 per barrel advanced to $2.05 per barrel for the same brand at the same place in 1907. This is fairly representative of the advance in cement throughout the west, and sometimes it was impossible to obtain bids at all. Lumber and steel not only materially advanced, but it was at times impossible to obtain them when needed and work was delayed and expense increased in consequence. The congestion in freights in 1906 and 1907 was also a prolific source of increased cost.

Earthwork on the earlier projects, as the Hondo and Minidoka, was let from 9 to 14 cts. per cu. yd. in 1904 and 1905. Such work has nearly doubled in price, very little of it being done under 20 cts. since 1905. Owing to the varying local conditions, it is somewhat difficult to make comparisons of different jobs of this kind, but one case occurred in which work was let, after competitive bidding, in 1905, and the contractor attempting to carry it out found the prices impossible and gave it up before accomplishing anything, though the prices were standard for dates previous to 1905.

The following table shows the contrast between the bids of 1905 and those of 1906, upon which the work was actually done:

EARTHWORK PRICES BID IN 1905 AND 1906.

	Earth.	Hard-pan.	Loose rock.	Solid rock.
Division 2:				
Callahan Bros. (June 1, 1905)........	[illegible]	[illegible]	[illegible]	$0.65
Freeman (May 12, 1906)........	.22	.32	.60	1.50
Division 3:				
Callahan Bros. (June 1, 1905)........	.129	.30	.30	.65
Newman & Hoy (July 26, 1906)...	[illegible]	[illegible]	.60	1.50
Division 4:				
Callahan Bros. (June 1, 1905)........	.12	.30	.30	.65
Delaney (April 13, 1906)........	.18	.25	.45	1.50

[illegible] cement and steel [illegible] west from $4 to $12 per cu. yd., depending on local conditions. The following [illegible] types of conditions [illegible] respective dates:

Williston project, August 30, 1906: The only bid received was $13 per cubic yard.

Bulford-Trenton project, March 5, 1907 $11.50.

Sun River project, April 3, 1907: The only bid received was $27.50 per cubic yard.

Belle Fourche project, April 10, 1907: The only bid received was $19.50.

Belle Fourche project, June 10, 1907: Schedule 1, $13.50, $16, $17; schedule 2, $16, $16.50, $18.

North Platte project, June 2, 1907: Canal structures, $16.50.

Shoshone project, August 23, 1906: Canal structures, $15, plus 3 cts. per pound for placing reinforcing steel.

These conditions culminated in 1906, and continued until October, 1907. The panic of that month caused a reaction which, however, was short lived. The following table of expenditures shows that about two-thirds of the money so far expended by the Reclamation Service was spent in 1906, 1907 and 1908, the years most affected by high prices. It is worthy of note that the value of the land reclaimed advanced in similar ratio:

1903	$[illegible]
1904	[illegible]
1905	5,109,538
1906	[illegible]
1907	13,817,635
1908	[illegible]

In a letter from Mr. L. C. Hill he states:

Since work was begun on the Salt River project, Arizona, the cost of feed has increased nearly 50 per cent. Wages have increased from 20 to 50 per cent, and practically all material which we have used has increased from 10 to 75 per cent, with the exception of cement, which cost us considerably less than it did at first, and possibly steel. In addition to the increase in wages, like all other people operating in the southwestern or middle west country, we are troubled by the inefficiency of the laborers. On account of the large amount of work now going on at all places over the country they have no trouble in getting a job, and if the foreman remonstrates with them for the way they are working, they tell him "To —— with the job," and go and get their time.

After seven years of work here, during which time by far the greatest percentage of work done has been by force account, we have succeeded in getting by elimination a high class of foremen, loyal to the service, and capable of doing the work and getting lots of work out of the men, but even with their best efforts and experience we are unable to do now as much work per each dollar of expenditure as we were able to do several years ago, when jobs were hard to get and wages were less.

It costs for a poorer class of provisions more money by 25 or 50 per cent than it did in 1903, 1904 and 1905. In most of the camps it is almost impossible to operate mess houses for the price received, and unless the mess houses are large they are invariably run behind. This was not true several years ago; we lived better, and money was made on each one of the messes. This condition is not confined to the operations of the Reclamation Service in the southwest. In conversations with contractors of wide experience it is found that they are meeting the same conditions, and in many cases their past experiment has been a real detriment in estimating cost of work. The cost of all work now being carried on, with but few exceptions covering some such classes, will aggregate from 25 to 60 per cent more than would be some six or seven years ago.

Mr. Charles H. Swigart states that he has been handling labor in public work in the state of Washington and vicinity since 1900 and can give the following specific instances of the advance in the price of labor and the cost of materials since 1900 in this part of the northwest.

In 1901 he handled about 500,000 cu. yds. of excavation by force account for the Great Northern Ry. Co. The work was steam-shovel work and handled in standard-gage cars. There were employed from 100 to 250 laborers during the greater portion of the time, and the wages paid ranged from $1.25 to $1.50 per day of ten hours for common labor. No. 1 common lumber, such as is generally used in construction work, cost from $7.50 to $8.50 per M. b. m. at that time.

From 1902 to 1905 Mr. Swigart handled contract work for Grant, Smith & Co., in Idaho and Western Montana, employing a great many laborers—from 300 to 800 on different pieces of work. In [illegible] $1.75 during the summer for common labor and $1.50 during the winter. In 1903 they paid $2 during the summer and $1.50 during the winter. In 1904 a general wage of $2 was paid during the summer, with two months at $2.25. During the winter $1.75 was paid for common labor. In 1905, $2 was paid during the summer, with a short time at $2.25, and during the winter $1.75. This shows the increase in labor up to that time.

The same firm of contractors during the winter of 1909-10 paid $2.25 for labor and during last summer paid $2.50 to $2.75. One of the firm, during the spring of 1910, expressed the opinion that labor conditions would be worse during the summer of 1910 than they had been during last summer. The wages stated above were all for ten-hour-day work, and for what is called white labor. All the time up to 1907 Italians, Greeks, Bulgarians and Austrians could be had for from 25 to 50 cts. per day less than the so-called white labor—Scandinavians or native Americans—these men wishing to board themselves and being willing to work for a less wage if they were accorded this privilege. During 1907 and since that time, however, it has been necessary to pay these men as much as any other laborers and still allow them to board themselves.

From 1902 to 1904, steam-shovel engineers were paid $110 per month and board, or $125 without board. These same men since 1905 have commanded from $150 to $175 without board.

From 1902 to 1904 form carpenters were paid from $2.75 to $3 per day for putting up forms on concrete work. Since 1906 this same class of labor has received from $3.50 to $4 per day.

From 1902 to 1905, blacksmiths were paid from $2.75 to $3 per day. From 1906 to the present time blacksmiths have had from $3.50 to $4 per day.

From 1901 to 1905, teamsters handling two-horse teams had from $50 to $55 per month. Now the same class of labor gets $65 per month.

In 1904 the contractors above named purchased a number of horses weighing from 1,200 upward at $100 to $125 per horse. During the winter of 1908 and 1909 many horses of the same class were bought at what was believed to be a low price, ranging from $160 to $180 per animal.

Lumber which in 1901 and 1902 was purchased for $7.50 or $8 per thousand, now costs from $11 to $12 per thousand at the Puget Sound mills.

During all this time—that is, while the wage of common labor was increasing—the efficiency of this labor was decreasing. The most efficient labor since 1901 was during the winter of 1902-1903, when $1.50 was paid per day for ten hours for common labor. The least efficient was during last season, when it was necessary to pay from $2 to $2.40 per day of eight hours for the same class of labor. This recrease in efficiency is estimated to be at least one-third; that is, it takes one-third more men to do the same work at the present time and at the present wage than it did to do the same work during 1901 to 1903 at the wages prevailing at that time. This is mainly due to the fact that there is more work at the present time than there are laborers to do the work; that is, the demand for labor is so great that the average floating laborer knows that he can get a job whenever he wants it, therefore, he is independent and will work only as he pleases and when he pleases, while during a period of low wages the demand for labor is not so great and the laborer hesitates before quitting a job for a trivial reason.

During the winters of 1902-3 and 1903-4 many laborers of the class known as "hobo," who had been working at different times for the contractors with whom I was at that time, worked for three or four months, or during practically the entire winter season, without laying off at all. These same laborers, during the summers of 1904, 1905 and 1906, when the demand for labor was greater and they had no trouble in getting work, would not work more than from seven to ten days without laying off and going to the nearest town to spend the money they had earned. This is the general experience of employers of this kind of labor, and in the Northwest the labor employed on large public work, such as the Reclamation Service is engaged in, is either the class known as hobo laborers or the foreign laborers, such as Italians, Greeks, Roumanians, Austrians, Bulgarians, etc., the Scandinavian laborer being generally classed with the hobo laborers and making up a large proportion of the floating laborers on public work.

As labor enters into such work and makes the larger part of the cost it is easily seen why estimates made during 1904 and 1905, based on the experience of engineers during years prior to that time, are not at all applicable to present conditions, and if used must be increased from 50 to 75 per cent to take care of the increase in cost of labor and material.

A few specific examples of the increased costs are to be noted in connection with the work of the Reclamation Service in South Dakota. At the time the construction of the Belle Fourche project, South Dakota, was begun work was started on a power plant located about seven miles from Belle Fourche, on the Red Water River. This plant is now owned by what is known as the Consolidated Power Co. and has been completed. It was estimated that this work would cost about $150,000, but mostly on account of the high price of labor and supplies, the same having been built during the years 1905 to 1907, the actual cost of the plant was $350,000. The owners of the plant were forced to back up a contractor in order to keep the work going, and put in extra money. Most of this work was excavation in earth and rock.

Attention is also called to the fact that the cost of the work being done during the years of 1905 to 1907 increased so much that nearly all the railroads of the west stopped construction work during that period, finishing up the work that they had contracted for and refused to let any new work. During the last two years, 1908 and 1909, prices have become more settled, and the railroads are now resuming construction. A statement was made by an official of the Chicago & Northwestern R. R. during 1906 to the effect that they could not afford to do any extension work, and that all construction work had been postponed indefinitely.

When work was started on the reclamation projects it was supposed that laborers could be transported from centers of population to the different reclamation projects in parties of ten or more at half rate. This plan was in operation during the first year or more of active construction, but upon the passage of the railroad rate act by Congress this privilege was canceled, and since that time it has been necessary to pay full fare for all laborers transported. This has added considerable to the cost.

During the year 1905 the Reclamation Service advertised the first contract on the Belle Fourche project, and received seventeen bids on this work. After 1906 it was never possible to get more than two or three bids on any work, and many times no bid at all was received. The bids that were received were always high in comparison with what work had been done theretofore. On the bid for the excavation of the Inlet Canal, on which there was about 800,000 yards of dirt to be moved, eight or ten bidders wanted to do the work at from 12 to 14 cts. per yard. This work when finished cost nearly 25 cts. per yard. While many bidders were anxious to get this work at from 12 to 14 cts. per yard, one year later, when advertised for work on the North and South canals, the bids ran from 16 to 22 cts. per yard, and the contractors did not make any money at these prices.

The work for the concrete diversion dam in the Belle Fourche River was let for $5.95 per cu. yd. in 1905. In 1906 bids were received at from $6.80 to $7.80 per cu. yd. After this year no bids could be secured for concrete at less than $13.50 per cu. yd., the same running from that price up to $18 per cu. yd.

The matter of forage is an important item on a project where much team work is being done. When the Belle Fourche project was begun oats could be purchased, delivered at the works, at from 80 cts. to $1.10 per hundred. Since 1906, on the average, it has been necessary to pay $1.50 per hundred up to as high as $2 per hundred, and to haul the oats from the farmer's bin. Hay has increased proportionately, from $5 to $8 per ton to $10 and $12 per ton.

Supplementing the above statement, we have several letters from large contractors and others familiar with labor conditions which we print in substance as follows:

Sirs: The increase of wages, in a general way, amounts to about 25 per cent. It has taken place in the ranks of both skilled and unskilled labor. We find that the price of mules has increased about 50 per cent and that the cost of hay and grain at present is about 20 per cent over that of five years ago. As to the efficiency of labor, we are of the opinion that the results as now obtained are not equal to those secured five years ago.

Yours truly,
GEO. W. JACKSON, INC.

Chicago, Ill., June 25, 1910.

Sirs: In our work we are paying for unskilled labor an average of about one-third more than in 1905, and perhaps about 25 per cent more for skilled labor. This applies in both of the foregoing instances to non-union labor. The efficiency per man I believe to be not more than 75 per cent of what it was five years ago, brought about by the fact that there is not the apparent interest taken in the work that there was five years ago, and also by the fact that labor is becoming more and more made up of men from Southern Europe instead of from Northern Europe. Stock is more expensive to buy. I should say at least 33⅓ per cent higher than in 1905. Grain and hay will average at least that much higher also. It costs about 30 per cent more to board men than it did five years ago. To sum the whole thing up I believe that the increase in wages and decrease in efficiency of labor makes it cost for labor practically 50 per cent more to do work now than it did in 1905.

CONTRACTOR.

Chicago, Ill., June 17, 1910.

Sirs: The contractors of the South and Southwest have been fortunate in being able to draw from the negro race for men to do common laboring. In the past five years wages paid the negro have not advanced a penny, while the service gotten out of them has been up to the standard of 1905. The negro will always be a negro. He will always consider only the money he has on Saturday night to gamble. Whether large or small, it does not matter, just so he has enough to enter a crap game. He will win or lose. If he has a large sum, it will go as quickly as a smaller amount, for it is usually all staked at the start. He can win almost as quickly with a small stake as with a larger amount.

The negro is always subject to the white man, and we are obtaining the same amount of work from him, with a good foreman, that we did years ago. In 1905 we paid $1.50 for teamsters, $1.75 for wheeler holders, and $2.00 for dumpers, per day, and we are paying exactly the same wages to-day.

So different is negro labor from the common white labor, the "hobo class," and so much more valuable to us, that we are shipping negroes to our various divisions in Texas, Illinois and Missouri, places where the white man has always held sway. I find, from our payrolls, that white labor is about 20 per cent higher to-day than it was five years ago, and our records show that their usefulness has decreased to an almost corresponding percentage. Skilled labor, such as foremen, steam shovel engineers, trackmen, locomotive engineers, rock drillers, etc., are drawing in wages almost 30 per cent more than formerly, while daily their services are becoming less valuable. The men are growing more independent and hard to handle, caused, in a large measure, we believe, by the labor unions.

Mules to-day cost 40 per cent more than in 1905. In the latter year we paid $250 per head. We cannot buy the same mule to-day for less than $350. Incidentally, let me add, the high price of mules is forcing the contractor all over the country to realize more clearly the need and economy of using machinery on contract work wherever possible, and it will be only a question of a few years before mules and horses will have been relegated to the past.

Grain, we find, has increased 37 per cent more to-day than in 1905. On looking up our invoices of five years ago, I find that oats then cost us 35 cts. per bushel. To-day we are paying 48 cts. In 1905 we paid $16 per ton for hay; the last car we bought cost us $22 per ton.

It costs 35 per cent more to feed the men now than it did in 1905. In that year, all our camps showed a profit in feeding the men at $3.50 per week. At the same figure to-day they are losing money. Meat has advanced 50 per cent, canned goods 40 per cent, etc., and, taking all in all, records show that it costs 35 per cent more to run our cook tables.

A journal like yours can do much good by calling attention to the increased cost of living and operating expenses, and warning contractors of this country that they are to-day taking work at figures that are much too low. I think you will find, upon investigation, that the price for contract work has not advanced in the same ratio as the price of operating and living.

Yours very truly,

CONTRACTOR.

Memphis, Tenn., July 19, 1910.

Sirs: The wages of railroad laborers in this part of the country are no higher than they were five years ago. They are, however, a little higher than they were a couple of years ago, during the panic when every road was reducing forces and cutting down expenses. Labor is not as efficient at present as it was years ago, principally on account of the large amount of construction work going on in this country and there not being enough labor here to do it, which makes labor indifferent, knowing that if they are discharged they will have no trouble in getting another job. Stock, forage and provisions, as everyone knows, has gone up the last few years. However, boarding contractors have not raised the price of feeding men, which remains the same in this neighborhood as it has been for thirty-five years, from $3.50 to $4.00 per week for board and lodging.

Yours truly,

A. F. KOENIG.

St. Louis, Mo., June 21, 1910.

Sirs: Wages in this locality have increased about 20 per cent in the last five years, and the price of stock, forage, provisions, etc., has increased, I should say, at least 30 per cent. Regarding the decrease in efficiency of the laborers, cannot give an exact opinion of that. The laborers that we have in this section of the country seem to be just as good as ever, and the getting of good results from them seems to be a matter of proper handling of them by the contractors and their foremen.

Very truly yours,

PETER E. MEAGHER.

Duluth, Minn., June 24, 1910.

Sirs: In bridge, railroad, river and harbor construction work, my experience has been that in the last five years cost of labor has increased from $1.50 for common labor in the early spring months to $2 early spring months at present time; summer and fall from $2 to $2.50 at the present time. Owing to the scarcity of skilled labor one-half of the force nowadays is receiving wages for work that only the other half can do properly. There is a greater scarcity in all labor other than common labor, which is not evidenced by the number of skilled laborers working, but by the fact that only a small percentage of the skilled labor really knows its business. The keep of men has increased from practically $4 camp charge to $6 camp charge per week.

[illegible] to-day, compared with five years ago, what are classed as skilled laborers have had their ranks so increased by supposedly skilled labor that men have been able to get high wages and not able to return for value received. This has caused extravagance and lack of knowledge of the real worth of things; consequently the cost of everything has naturally gone up. I believe that $6 a day for team and driver is not more to-day than $4 five years ago.

Yours very truly,

JAMES O. HEYWORTH.

Chicago, Ill., June 25, 1910.

Sirs: In our line we use practically no skilled labor. Our employes are all negroes, and the wage with us is exactly the same as it was ten years ago and has been during that period. We pay for levee camp skinners, muckers and such common labor as is used in moving dirt with teams $1.00 per day and board, some camps are paying $1.25, and at times we pay $1.15 per day and board, but this is the same as has been paid since I have known the business. The "inefficiency" of our labor is about the same year in and year out. We work our men from 6 a. m. until 7:30 p. m., with one hour for noon, attempting to make up in hours the inefficiency of our labor.

The cost of boarding men has advanced continually and probably is 25 per cent higher now than five years ago. The cost of feed for teams is about double that of five years ago. The price for work has advanced but very little and is too low now for money making. Competition has been strong and contractors bid too close on work in our section and therefore no one is making much money in our line.

Yours truly,

HARTY & FORD.

Houston, Tex., Aug. 3, 1910.

ROADS AND STREETS SECTION

Some Costs of Street Paving Work at Baltimore, Md.

The work of repairing and maintaining streets in Baltimore, Md., is done by the Division of Street Repairs and Maintenance. The work of this division in 1909 comprised the repair and maintenance of all streets, roads and alleys in the city, except those under a contractor's guarantee for maintenance, unless the contractor building such a guarantee, neglected to obey the Department of Public Improvement's order to make repairs when necessary; the laying of new flag and vitrified block crossings; the construction and maintenance of all waterways under street intersections; the laying of improved paving under special ordinance, when the ordinance does not specifically, state that such work shall be done by contract, the repaving over trenches opened by various corporations and individuals, including all city departments; the maintnance and supervision of the city property yards, together with the construction and maintenance of all fencing on street fills and bridges, approaches and the readjustment of street and intersections where the sewerage commission has constructed storm water inlets. The work of the Division of Street Repair and Maintenance is under direction of R. K. Compton, assistant city engineer. In the annual report for 1909 of Mr. B. T. Fendell, City Engineer, much data on the work of this division are given and from that report we have taken the matter that follows:

Table 1 shows the maintenance cost of various types of pavements in 1909. The table does not include streets under guarantee. In the table the item "street asphalt" includes inspection, both on work and at plant, also slag block at vitrified block gutters. Under the amount of cobble is included all street intersections readjusted where the sewerage commission has constructed storm water inlets. The table includes both labor and material, together with the setting and resetting of curb and gutters. Table II shows the comparative unit costs in 1907, 1908, 1909, for materials at various classes of street work.

The principal work done in 1909 up to Divisions in the repairs of streets paved with asphalt blocks, was the repaving of St. Paul street, from Chase to Biddle streets, with this type of pavement. The asphalt block paving in this section was removed and about three-quarters of the blocks hauled to Preston and Eutaw streets to make necessary repairs at that point; and the remainder hauled to Mt. Royal ave. and St. Paul st. and to Mt. Royal and North ave. The same base was excavated and new 3x5x12-in. asphalt blocks laid on a 6-in. concrete base, with an inch screened sand cushion. The joints were thoroughly grouted with a mixture of one part of cement and two parts of screened sand. As it is necessary to haul dirt excavated further each year, this has added considerable to the cost of the work; the haul on this work being 1.4 miles. The cost of dressing curb and hauling asphalt blocks is separated from the cost of paving proper. The following will show the itemized cost:

	Total.	sq. yd.
Cement, 895 bags at 31 cts.	$ 277.45	$0.191
Paving sand, 121 cu. yds., at 68 cts.	82.28	.056
Concrete gravel, 229.3 cu. yds., at $1.30	298.09	.205
Screened sand, 68 cu. yds., at 70 cts.	47.60	.033
Asphalt blocks, 3x5x12 in., 29,500 blocks, at 6½ cts.	1,917.50	1.321
Labor, for 1,451.7 sq. yds., including grading	1,060.17	.730
Total	$3,683.09	$2.536
Dressing, 670 lin. ft. curb, at $0.108		$ 72.17
Hauling old asphalt block		82.09
Total		$154.26

Table III shows the comparative cost of asphalt block paving and repairing in 1907, 1908 and 1909, and Table IV shows the comparative cost of new asphalt block pavement on concrete base for the same years.

One of the most interesting pieces of work undertaken by the Division last year was the improvement of Charles St. and St. Paul St. and Merrymans Lane Boulevard. The intersection of the above-named streets was in very bad shape, owing to the heavy automobile traffic at this point, and it was, therefore, decided to resurface it with gabbro crushed stone. As an experiment, the crushed stone on the entire south half of this intersection was poured with Fairfield refined asphalt cement, while a small area on the north half was poured with Fairfield anti-dust. After the No. 2 stone had been rolled, the above named materials were poured after having been heated to the proper temperature; then followed a covering of ¾-in. stone, and the entire surface thoroughly rolled with a 12-ton roller. The Fairfield asphalt cement was heated to a temperature of 325° F., while the anti-dust was heated to a temperature of 190° F.

The area was 849 sq. yds. and the average depth was 8 ins.

The itemized cost of the work on the South half was as follows:

	Total.	Per sq. yd.
Labor, for heating and pouring cement	$ 41.02	$0.048
Labor, for rolling	[illegible]	[illegible]
Labor, for watchman on roller and work	34.40	.040
Labor, for "picking up" road and spreading stone	86.10	.101
"Fairfield" cement, 10 tons	199.08	.234
Crushed stone, "Gabbro," 215 cu. yds.	440.79	.519
Oil, 11½ gals.	.86	..
Coal, ¼ ton	[illegible]	....
Hauling cement and boiler	15.73	.018
Total	[illegible]	$1.006

During this work a bad rainy spell occurred which accounts for the excessive time for the watchman. The cost of the north half of the roads which involved 163 sq. yds. of pavement, was as follows:

Labor, for preparing roadway, spreading stone heating and pouring cement.	$ 78.12
Crushed stone	51.28
Hauling	.94
Total	$131.34

The cost per square yard was therefore $0.806. The Anti-Dust used on this section was furnished without cost, except for hauling from the station. The amount used was 1,589 lbs., or 3 bbls. One of the most important pieces of macadam resurfacing undertaken by the Division during the year was on Charles St., from St. Paul St. and Merryman's Lane Boulevard to the northern city limits. The old roadbed had worn down to the original base, which in some instances contained stones 12 in. square and 6 in. deep and in some places the earth shoulders were 12 in. below the roadbed. The old stones were spiked off and napped by hand to about No. 1 size and thoroughly rolled. From 4 in. to 6 in. of gabbro was then added and thoroughly rolled to a finished surface. Earth shoulders were constructed by hauling suitable material from the repair gangs, and ditches were opened on each side of the road to provide drainage. The macadam drive is 23 ft. wide and the earth shoulders 17 ft. wide each, making a total width from gutter to gutter of 57 ft. Work was commenced on July 1 and completed Sept. 11, the itemized cost being as follows:

	Total	Per sq. yd. macadam
Preparing sub-grade, including spiking, rolling and napping 1,322 cu. yds. stone	$ 687.44	$0.086
Constructing shoulders and side ditches, including the hauling of 318 cu. yds. refuse	539.00	.068
Spreading, sprinkling and rolling macadam, 7,934 sq. yds. (thickness 5 in.), at 50 cts.	3,967.00	.500
Ditching and laying 15 ft. of 15-in. T. C. pipe	12.60	.002
Guard fence, 269 lin. ft.	45.73	.006
Watchman (nights and Sundays)	88.21	.011
Total	$5,339.98	$0.673

As the total length improved was 3,070 lin. ft., the cost per mile was $9,182.

Where granolithic gutters along streets paved with sheet asphalt are badly worn, it is the practice to remove them and replace them with vitrified block gutters, 18 in. wide, laid on a 6-in. concrete base. An itemized statement of work of this kind on Calvert St. is as follows:

	Total.	Per sq. yd.
Vitrified block, 6,726 at $26.40	$177.57	$1.176
Concrete gravel, 17.4 cu. yds., at $1.20	20.88	.138
Paving sand, 11.8 cu. yds., at 68 cts.	8.03	.005
Screened sand, 4.9 cu. yds., at 80 cts.	3.92	.002
Cement, 83 bags at 31 cts.	25.73	.170
Labor, for 906 lin. ft., or 151 sq. yds.	216.33	1.432
Total	$452.46	$3.025

A summary of the cost of new vitrified block gutters laid in 1909 on streets paved with street asphalt is as follows:

	Per Lin. Ft.	Per. Sq. Yd.
Vitrified block paving, 18-in. wide	$0.36	$2.17
Setting and dressing curb	.03	.20
Grading and hauling	.11	.66
Total	$0.50	$3.03

During 1909 the Division of Street Repairs and Maintenance constructed 239 footway crossings, itemized as follows: Vitrified block crossings on sand or dust, 209; vitrified block crossings on concrete, 11; old flag crossings, 17; new flag crossings, 2. Vitrified bricks were laid where traffic was light, and flagstones where traffic was heavy. Most of the flag was hauled from streets improved with new paving material and were rejointed and redressed. The Clymer and Mack brands of brick were used for the brick crossings. A summary of the footway crossing work is as follows:

	Sq. Yds.
New flagstone footways	36.2
Cobble repaving	49.4
Cost per sq. yd., including cobble repaving	$4.60
Old flagstone footways	235.2
Cobble repaving	288.9
Cost per sq.yd., including cobble repaving	$2.29
Brick footways	2,367.6
Cobble repaving	2,415.7
Cost per sq. yd., including cobble repaving	$1.81

Table V shows the comparative cost of vitrified brick footway crossings in 1906, 1907, 1908 and 1909.

One of the largest pieces of brick paving work undertaken by the Division last year was on Payson St., from Edmondson Ave. to Lanvale St. The work was commenced June 10 and was completed Aug. 4. This street was formerly partly paved with vitrified brick on sand bed, and cobble, both in bad condition; a portion was also unpaved. It was renewed throughout with new vitrified blocks on a 6-in. gravel concrete base, with stone-dust cushion and joints filled with Portland cement grout. The best of the old bricks removed were used in the alley intersections, between the curb and building line. The curbs were renewed where necessary, or redressed and reset. The Clymer block was used. A statement of the expenditures on this work is as follows:

Labor, as per roll	$3,976.88
Paving sand, 442.8 cu. yds.	464.94
Screened sand, 36 cu. yds.	42.84
Concrete gravel, 619.7 cu. yds.	867.58
Cement, 2,600 bags	821.98
Curb (4½ in.) 178 lin. ft.	112.14
Stone dust, 144.83 cu. yds.	173.79
Vitrified blocks, 155,228 blocks	3,415.02
Lumber, 96 feet, 1x12	2.16
Advertising	30.20
Gasoline, 15 gallons	1.43
Block filler, 2,000 pounds	20.00
Hose, 150 feet	24.00
Maryland Geo. Survey for brick tests.	72.50
Hauling vitrified blocks	364.28
Total	$10,389.74

The itemized cost of the work, including labor and material was as shown below:

Vitrified block paving, 3,768.1 sq. yds., at $1.43	$5,388.38
Vitrified block repaving, 159.5 sq. yds., at 40c	63.80
Concrete base (6-in.) gravel, 3,898.1 sq. yds., at $0.683	2,663.42
Curb reset and redressed, 1,061 lin. ft., at $0.225	239.32
Curb set (4½ in.), 178 lin. ft., at 78c	138.84
Gutter relaid, 31 lin. ft., at $0.074	2.29
Cobble repaved, 138 sq. yds., at $0.561	77.77
Ashphalt block repaved, 17.1 sq. yds., at $0.604	10.33
Grading, 1,800 cu. yds., at $0.961	1,730.79
Hauling, 290 perches of cobble from work, at $0.153	44.60
Advertising	30.20
Total	$10,389.74

Another piece of work undertaken by the Division was the paving of Ostend St. from Race St. to Leadenhall St. with vitrified blocks on concrete base. Bids for this work were asked, but none were received, so the city engineer was directed to have the work done by day labor. The cost of the work is lower than the cost of any similar work in the city heretofore done by contract.

The filling and construction of concrete curb on this street was done by the Division of Bridges and New Paving and was then turned over to the Division of Street Repairs and Maintenance for the paving. The vitrified block paving extends from the east curb line of Leadenhall St. to the west curb line of Race St. and includes the area in and between the United Railways Co.'s tracks, which together with the 2 ft. strips on either side was charged to the Railways Co. The Clymer block was used on a screened sand cushion, 6 in. gravel concrete base and cement filler. The vitrified blocks paving was commenced on Oct. 12 and completed on Nov. 10. In addition to the above, the intersection of Leadenhall St. and the North and West approaches thereto were repaved, as were also the intersection of Race St. Vitrified block crossings were laid where necessary in the cobble paving and the roadway on the south approach at Leadenhall St. was shaped up. The cost of the work was as follows:

TABLE II.—COMPARATIVE UNIT COSTS.

	1907.	1908.	1909.
Asphalt blocks, 3x5x12 and 4x4x12 ins.	$0.06¼	$0.06½	$0.06½
Asphalt blocks, 4x5x12 ins.	0.06¾	0.07	0.07
Vitrified paving blocks, per 1,000, f. o. b.	20.50	25.00	22.00
Cobblestone, per perch	1.96	1.84	2.02
Standard gutters, per lin. ft.	0.35	0.34	0.32
Hammer-dressed gutters, per lin. ft.	0.30	0.28	0.27
4½-in. curbstone, per lin. ft.	0.65	0.63	0.63
Flagstone, per sq. ft.	0.30	0.34	0.35
Paving sand, per cu. yd.	0.85	0.762	0.844
Screened sand, per cu. yd.	0.996	0.91	0.924
Laying cobblestone, per sq. ft., labor	0.030	0.035	0.035
Laying belgian block, on sand base, per sq. ft., labor	0.044	0.040	0.039
Laying belgian block, on concrete base, including heating and pouring filler and gravel, per sq. yd., labor	....	0.32	0.39
Resetting flagstone, per sq. ft., labor	0.09	0.09	0.09
Redressing flagstone, per sq. ft., labor	.....	0.07	0.05
Resetting gutter-stone, per lin. ft., labor	0.035	0.035	0.035
Renewing 4½-in. curbstone, per lin. ft., labor	0.11	0.14	0.14
Resetting old 4½-in. curbstone, per lin. ft., labor	0.08	0.11	0.11
Dressing old 4½-in. curbstone, per lin. ft., labor	.....	0.05	0.10
Resurfacing macadam, per sq. ft., labor	0.01	0.01	0.01
Repairing with old asphalt block on sand base, per sq. ft., labor	0.044	0.041	0.043
Repairing with new asphalt block on sand base, per sq. ft., labor	0.025	0.024	0.028
Paving new asphalt block, on concrete base, including grading and concreting, per sq. ft., labor	0.072	0.062	0.081
Repairing old vitrified block on sand base, per sq. ft., labor	0.044	0.042	0.041
Paving new vitrified block, on concrete base, including grading and concreting, per sq. ft., labor	0.105	0.105	0.12
Paving new vitrified block, on concrete base, grading not included, per sq. ft., labor	.....	.....	.043
Concrete base, not including grading, per sq. ft., labor	0.018	0.016	0.016
Grouting new vitrified block, per sq. ft., labor	.	0.002	0.002
Laying new vitrified block, on sand base, per sq. ft., labor	..	0.02	0.02
Paving new asphalt block, on concrete base, grading not included, per sq. ft., labor	....	.....	0.035

TABLE I—COST OF MAINTENANCE OF VARIOUS KINDS OF PAVEMENTS IN 1909.

This table does not include streets under guarantee.

Character of Work.	Total area in city, sq. yds.	Area repaired in 1909, sq. yds.	Total, in 1909.	Cost per sq. yd. per year for total area	Per cent of total area repaired.	Cost per sq. yd. for area repaired.
Asphalt block	284,988	16,067	$ 15,969.69	$0.0560	5.64	$0.9939
Belgian block (sand bed)	863,388	40,450	21,700.31	0.0251	4.69	0.5365
Cobble stone	4,924,797	237,503	139,467.57	0.0283	4.82	0.5872
Macadam (ordinary)	615,105	53,214	32,051.96	0.0521	8.65	0.6023
Sheet asphalt	218,090	16,566	22,370.54	0.1026	7.60	1.3503
Vitrified block	117,784	1,798	1,154.30	0.0098	1.53	0.6420
Cobble base on roads	....	28,304	7,093.03	......	....	0.2506
Mosaic block	25,770	483	220.28	0.0086	1.87	0.4561
Wood block	1,500	.....	....	......	....	......

Labor, as per pay roll ..	.$2,014.05
Vitrified paving block, [illegible]	. 1,040.98
Paving sand, 556.8 cu. yds	478.64
Hammer-dressed gutters, 1,014 ft. 6 [illegible]	[illegible]
Cement, 709 bags.......	[illegible]
Cabblestone, 107.34 perches	. 214.68
Concrete gravel, 163.2 cu. [illegible]	. 212.16
Regular curb (4½-in.), 269 [illegible]	[illegible]
Steel curb bars, 1,000 ft.............	150.00
Advertising for proposals	70.86
Freight on 100 steel curb [illegible]	[illegible]
Hauling, 83 ft. curb................	6.64
Screened sand, 6 cu. yds.	[illegible]
Gasoline, 30 gal.......	. 2.85
Repairing concrete mixer	4.70
Total	$4,881.24

The following statements show the cost, including labor and material of the city's portion of vitrified block paving:

Vitrified blocks, 39,487 block .	$ [illegible]
Cement, 689 bags.....	[illegible]
Gravel, 163.2 cu. yds... . .	.212.16
Screened sand, 37.2 cu. yds..	29.76
Paving sand, 81 cu. yds .. .	[illegible]
Labor, for 971.48 sq. yds ..	[illegible]
Gasoline	2.85
Repairs to concrete mixer	4.70
Grading	169.13
Total	$2,058.59
Vitrified block paving, per sq. yd..........	$1.38
Concrete, per sq. yd.	.57
Cost (not including grading) .	$1.95

The cost of cobble paving, etc., was as follows:

Neew cobble paving, 596.3 sq. yds., at $0.675	$ 402.53
Old cobble paving, 3,064.4 sq. yds., at $0.413	1,266.58
Headers reset, 79 lin. ft., at $0.183.....	14.46
New gutters set, 1,014 ft. 6 in., at $0.305.	309.45
Old gutters reset, 519.4 lin. ft., at $0.035.	18.18
New curb set, 269.08 lin. ft., at 78c......	209.88
Old curb reset, 847.9 lin. ft., at $0.139...	118.12
Concrete gutter relaid, 70 lin. ft., at $0.035	2.45
Vitrified brick footways laid, 102.3 sq. yds., at $1.309..............	133.95
Labor, repairing roadway......	68.40
Labor, grading 138.0 cu. yds., at $0.419..	57.79
	$2,601.79
Advertising for proposals................	$ 70.86

TABLE III.—COMPARATIVE COST OF ASPHALT BLOCK PAVING AND REPAIRING.

Designation.	1907.	1908.	1909.
Sq. yds. paved, new work	9,453.90	8,840.60	5,795.30
Expended for labor, new work	$ 2,134.95	$ 1,936.56	$ 1,455.54
Expended for material, new work	13,575.26	13,577.31	8,286.85
Cost of labor per sq. yd., new work	.23	.22	.25
Cost of material per sq. yd., new work	1.43	1.54	1.45
Total cost per sq. yd., new work	1.66	1.76	1.70
Sq. yds. repaved, repairs	8,892.20	20,046.80	10,271.70
Expended for labor, repairs	3,569.22	7,459.64	3,984.44
Expended for material, repairs	438.57	1,673.59	1,395.75
Cost of labor per sq. yd., repairs	.40	.37	.39
Cost of material per sq. yd., repairs	.05	.08	.13
Total cost per sq. yd., repairs	.45	.45	.52

The cost of the United Railways and Electric Company's portion of vitrified block paving was as follows:

Steel curb bars, 1,000 ft................	150.00
Total	$2,822.65
Total cost to the city....	$4,881.24
Vitrified blocks, 38,652 blocks	$ [illegible]
Cement, 706 bags	[illegible]
Gravel, 174.3 cu. yds....................	226.59
Screened sand, 40.5 cu. yds............	32.40
Paving sand, 66.9 cu. yds..............	60.21
Labor, for 939.52 sq. yds..............	395.30
Total (at $1.93 per sq. yd.)	$1,811.97

A bill for above amount, plus 10 per cent. was rendered the company.

TABLE IV.—COMPARATIVE COST OF NEW ASPHALT BLOCK PAVEMENT ON CONCRETE BASE.

Designation.	1907.	1908.	1909.
Sq. yds. paved, new work	97.20	710.90	1,451.70
Expended for labor, new work	$ [illegible]	$ [illegible]	$1,060.17
Expended for material, new work	79.61	1,305.33	2,622.92
Cost of labor per sq. yd., new work	.65	.56	.73
Cost of material per sq. yd., new work	1.80	1.84	1.80
Total cost per sq. yd., new work	2.45	2.40	2.53

TABLE V.—COMPARATIVE COST OF VITRIFIED BRICK FOOTWAY CROSSINGS.

	[illegible]	1907.	[illegible]	1909.
Square yards [illegible]	[illegible]	1,490.70	[illegible]	2,367.60
Expended for labor	$1,217.76	[illegible]	$1,550.58	$1,950.71
Cost of [illegible]	.72	.83	[illegible]	[illegible]
Cost of [illegible]	1.16	1.02	1.16	[illegible]
Cost of lab[illegible]	1.88	[illegible]	[illegible]	1.81
Contract price [illegible] and M[illegible] [illegible] in [illegible]	[illegible]	[illegible]	25.00	[illegible]

Street Cleaning Methods.

A conference of no small importance from a sanitary point of view was held at Providence, R. I., on June 29, under the auspices of the Bureau of Social Research of Providence. This conference was called for the consideration of street cleaning problems and some 38 New England cities were represented by officials. Several papers of particular interest to sanitary engineers were presented before the conference. In our last issue we gave an abstract of one of the most important of these papers. This was the paper by Mr. J. T. Fetherson on the training of a street superintendent. [illegible] was the one presented by Mr. George A. Soper, Consulting Engineer, 17 Battery Pl., New York City. Mr. Soper's paper in part follows:

Concerning the correct principles of scavenging, little is generally known. Although every citizen is a competent critic of the results, few are willing to make a sufficient study of the problem to understand its difficulties, much less devise the practical measures of improvement required.

Efficiency in operation is less in scavenging than in most other sanitary undertakings, but with time it may be increased. A constant effort should be made to improve upon the methods employed, to keep accurate account of the ways in which the money is spent and to accomplish the results which the citizens expect. A system of scientific scavenging carried on according to this principle deserves adequate financial support and, with proper management, sufficient money can usually be obtained for it.

In seeking appropriations, mistake is often made in asking help of politicians. Political influence is nowhere more pernicious than in the operations of a street cleaning department. For every favor conferred, a political boss requires a suitable return, the result being that many street cleaning departments are today overburdened with men who cannot get a living except by pension. Occupants of prisons and poor houses should not be put to work to clean streets. The work is demoralizing to them and, what is more important, they are demoralizing to the work. The men should be young, strong and capable not only of doing a fair day's work, but of taking a personal interest and pride in it. There is no reason why a sweeper should not take as much pride in the cleanness of the pavement assigned him as a good sailor takes in the order of his ship. There is nothing disgraceful about scavenging except the inefficient manner in which it is sometimes done.

To keep a city clean it is essential that the scavenger should receive adequate co-operation from the public. No man, nor body of men, can maintain clean streets if the public does not wish them to be clean and is not willing to help keep them so. The scavenger should keep faith with the public by collecting the refuse according to an announced schedule. The receptacles should be handled with due regard to their destructibility and with proper respect to the convenience of the householder.

Whenever possible, the same authority should collect the wastes which is required to dispose of them. Proper disposition can only be made of wastes which are of the composition for which provision has been made at the disposal place, and the persons who do the collecting and so come in contact with the householders, are alone able to see that the proper composition is maintained. Proper composition here refers to the three classes of ingredients into which household refuse is often divided: First, kitchen refuse; second, ashes, glass and metals, and third, readily inflammable matters, such as paper, wood and cloth. Sometimes the three are collected and disposed of in mixed condition, sometimes separately. Whatever system is adopted, it is important that the system should be adhered to by every householder. Choice of a system depends chiefly upon the method of final disposal best suited to the city.

As to the apparatus to be employed for collection, many details need to be considered when devising a system of scavenging which do not require to be discussed here, such as the proper size, form and material for the collecting carts, brooms, shovels and other apparatus.

The familiar rotary sweeper, known as the horse broom, is a standard apparatus, and is widely used in Europe and America, especially where there is much surface to be cleaned and the pavement is irregular. It should always be preceded by sprinkling carts and followed by men with hand brooms to sweep the throw of the rotary brooms into piles. These piles must be shoveled into carts and carried away as soon as possible, or the material which has been collected will soon become scattered again.

The so-called patrol system, by which men with an equipment of shovel, broom and receptacle mounted on some form of hand cart, patrol the streets to collect small masses of coarse refuse before it is broken up and scattered about is another procedure which may be termed standard.

Street flushing with water, with and without the aid of foot laborers provided with brooms and rubber squeegees, is a method of cleaning pavements which has claimed a large amount of attention in recent years. There is much to be said in favor of the cleanness possible with flushing, but good results without an extravagant waste of water, not to mention possible injury to pavements and sewers are not so readily obtained as a casual observer might suppose. This kind of work calls for careful and intelligent labor, especially where the pavements are not good and smooth.

In America, as in Europe, inventors have devised machines to take the place of hand labor in cleaning streets and it would seem that there was a good field for the exercise of ingenuity in this direction. Machines successfully sweep and water and squeegee pavements and there are flushing machines and dust-collecting machines which are receiving strong endorsement. We should seek to employ all truly economical apparatus whenever the amount of work is sufficiently great to warrant the cost of it, but the merits of mechanical appliances should not bind us to the limitations which all machines possess. No machine can wholly take the place of intelligent hand labor. So far as my observation goes, the efficiency of any mechanical street cleaning apparatus depends largely upon the care and skill with which it is used.

The subject of machinery suggests the use of motors and here, too, there is a promising field for inventors. Several European cities use motors for propelling the carts necessary to remove household and street refuse, and street washing machines have been propelled in this way. According to my best information, the economy of motors over horses lies chiefly in running them long hours, as day and night, for example.

It is regrettable to say that a standard cart for street cleaning has not yet been agreed upon. Nothing more certainly shows the incompleteness with which the apparatus used in scavenging has been developed than this. Most cars are too high, too small and too heavy. The ideal cart is of metal, low-bodied, water tight, covered, easy-running and light.

The best European designs are far ahead of American practice.

There are a number of ways to dispose of garbage and other household refuse after it is collected, all of which may be followed in a sanitary and satisfactory manner with proper attention to details.

Mixed refuse may be dumped upon low-lying land. This is usually considered an unsanitary proceeding, but if the dumps are well chosen the material leveled as rapidly as it is dumped and promptly covered with soil, there is little sanitary objection to it. To minimize the chance that foul odors will be produced the amount of kitchen refuse should be small.

The kitchen refuse may be dug into the ground. In this case it is desirable for reasons of economy that the putrescible elements should be put in separate receptacles at the household and collected independently from the rest. The putrescible material may then be dumped upon a field and plowed under. This method takes a large amount of land, but is sanitary and not unduly expensive where suitable ground can be obtained. Kitchen waste, variously termed swill and garbage, can be utilized by feeding it to hogs. This method is very commonly employed by professional scavengers. It can be carried on in a sanitary manner and, although objections may be raised against it, these can be largely overcome. Kitchen refuse can be turned into compost. Composting is commonly practiced in European cities. Every farmer composts stable refuse when he makes manure. It is essentially a rotting process. The garbage to be composted is piled in heaps about 3 ft. high, from 6 to 10 ft. wide and about 30 ft. long. It is thoroughly wetted and allowed time to rot. Eventually the piles are opened up and the material employed as fertilizer. Garbage composts should be located as far as practicable from houses and highroads.

In none of the foregoing methods of finally disposing of household refuse is there any prospect of profit. Methods of disposal which promise a return are generally misleading and foredoomed. The object to be kept constantly in mind in this connection is to have the material disposed of promptly, thoroughly, finally and with as little offense as possible. The question of economy or return from the utilization of municipal wastes should be a secondary consideration. At the present stage of sanitary science, it is impracticable to secure a substantial return from the disposal of municipal wastes.

Bituminous Roads—Mixed and Poured.*

While the writer is commercially interested in a special form of bituminous pavement and road construction known as "Bitulithic" in its application to city streets and "Warrenite" in its application to country roads in the United States and Canada, and laid in Great Britain and the continent in a modified form known as "Quarrite," he hopes to accomplish an unprejudiced discussion of this subject.

In the year 1909 the New York *Herald* and Atlanta, (Ga.) *Journal* offered premiums of $1,000 for the best; $500 for the second and $250 for the third best section of country road between New York City and Atlanta, Ga., one of the Southern of the United States of America, covering a distance by air line of about 750 miles. The first premium was awarded to Mercer County in the State of New Jersey, of which Frank I. Eppele is County Engineer. In an excellent paper on the subject of "Future Highway Improvement" published in a current paving journal, Mr. Eppele says:

> I think the statement can be made that already the problem has been solved in part and that road engineers have practically agreed that the principles of construction which provide for the broken stone or other road metal used to sustain the wear, and some bituminous product applied in conjunction with same, possessing in a high degree the necessary binding and dust preventive qualities, will be the basis for adoption of a method for future highway construction. If this be true, I think we can logically conclude that a majority of road engineers will favor a method of construction that insures a perfect coating of bituminous binder to every particle of road metal being used, and before same is spread upon the highway, to one that provides for the application of a binder to the surface of the material after same has been spread upon the work either by a method of pouring, sprinkling or spraying, and then depending upon the penetration qualities of the binder to give a uniform and perfect condition of coated work. Were it not for the question of cost involved, I am sure that a form of construction involving the use of a mechanically coated material, for at least the top course, or wearing surface of a road, would be adopted; but even taking into consideration this question of first cost, would not this increase be more than balanced by the condition of the roadway together with the wearing and other improved qualities of the same after construction?

From an article in the same publication we extract the following:

> It is safe to say that a grouted road is not as satisfactory and long lived as a mixed road. As the desirability of accurate proportions in a bituminous macadam is great the batch mixer will probably prove most satisfactory. The best results in Massachusetts have been obtained with broken trap rock 2½ ins. to ½ in. in size having 40 per cent or less voids. If this percentage of voids is lessened by more small particles in the aggregate, say from 2½ in. to ¾ in., still better results obtain. I believe that when a softer rock is used the slight crush which takes place during the construction draws in more bitumen and produces a denser pavement. Experiments have shown that bituminous surfaces having the voids filled with bitumen and trap pea stone are to be preferred in every case.
>
> A mixture of 2½-in. to ½-in. trap stone with 40 per cent ½-in. sand well mixed dry and then coated with bitumen should prove to be a very permanent road matrix.

The question naturally arises:

> If a mineral aggregate varying from 2½ in. to ½ in. having 40 per cent or less voids is good, and if running the fineness of the stone down to ¼ in. is better, and if the voids are filled with sand, the mixture is still better, why should not the "ne plus ultra" be provided by going a little farther in the scaling down process as to sizes and using scientifically determined and accurately proportioned mineral aggregate down to the finest obtainable (impalpable powder) in which mixture the voids can be reduced as low as 10 per cent and all the voids thoroughly filled?

Pouring or penetration methods have the following advantages:

(a) Very little investment in plant.

(b) The cheapest possible method of application. The following are the disadvantages of the pouring methods:

(a) After the stone is rolled the portions of the surface of many of the individual stones are in such contact with each other and many of the voids are so small that the bitumen cannot penetrate into many of the spaces and consequently cannot thoroughly coat the particles of stone. This objection rapidly increases as the minimum size of the stone used and the voids decrease.

(b) If the bitumen used is not hard enough and of a character sufficiently cementitious to bind the particles of stone together the road will gradually ravel if subjected to even a moderate traffic.

(c) Unless enough bitumen is used to thoroughly fill the voids to the greatest extent practicable the particles of aggregate are not even approximately bound together and satisfaction is only temporary.

(d) If the voids are filled with bitumen as much as practicable then the roadway has a surplus of bitumen or rather it is not properly distributed through the mass and the free and nearly pure bitumen in the large voids oozes to the surface under traffic during hot weather, making a sticky unstable and undesirable surface which ruts and rolls badly under traffic.

Very good examples of the two last mentioned disadvantages and inherent weakness of construction are found on sections of Huntington Ave., in Boston, Mass., which were laid under the most approved penetration methods during the summer of 1909. From the east side of Gainsboro St. to the east side of Bryant St. the spaces between the stones were filled very full with bituminous binder. To facilitate and make more thorough the filling of the voids the precaution was taken, after rolling the stone, of heating it with a large gasoline flame confined under a sheet iron hood resting on the surface of the rolled stone. The apparatus used was that known in the asphalt paving business as "surface repair heater." Between east side of Bryant St. and east side of Ruggles St. less bitumen was used and consequently the voids less thoroughly filled. In both sections bituminous cements were used of a grade of hardness which required heating to a temperature of about 275° F. to liquify and consequently cementitious and of the "true binder" class as distinguished from liquid oils and tars often called "binders" although in the writer's judgment more properly classed as "dust layers." Both sections presented a fine appearance during the Summer and Fall of 1909 and the Spring of 1910 and the intervening Winter except that in spots in both sections where the bitumen had not penetrated well into the surface; ravelling began in the early Spring. At this writing (June 13, 1910) on the section in which the voids in the stone were least filled the bitumen has disappeared from over one-third of the surface and we have on such portions practically a macadam road (as if no bitumen had been used) which is already ravelling and promises at an early date to require entire resurfacing. This section of the street shows great irregularity in amount of bitumen used, as there are many places from 2 ft. to 10 ft. in length where there is an excess of bitumen which has been pumped by traffic to the surface and now is much too rich, showing deep calk marks and an unstable surface. On the section where the greater quantity of bitumen was used the surface is now so very soft that automobile and other vehicle wheels and horses' hoofs press into the nearly pure bitumen and unstable mineral aggregate at the surface to a depth of over ½ an inch and the surface presents a very sticky and undesirable condition. In describing the rutting and marking of vehicle wheels and horses' hoofs, reference is made to moving horses and vehicles in the center of the roadway and not to the still greater marking from standing vehicles and horses near the gutter.

The mixing methods are of two general classes as to hardness of bitumen known as "cold process" and "hot process" and two classes as to method of mixing known as "hand mixing" and "machine mixing" which will be treated in the order named.

The "cold process," meaning the use of a mixture of stone and bitumen of such a character that the ingredients can be mixed and laid without artificial heat that is at the temperature of the air. This necessitates the use of bitumen of a character which is liquid when cold and, as above referred to, in connection with "penetration methods" is necessarily deficient in cementing strength unless the bitumen is made liquid by the use of a volatile temporary liquifier which will evaporate soon after the roadway surface is laid. The "cold process" is also necessarily subject to the weakness that the moisture has not been evaporated from the aggregate before adding the bitumen which seems to be bad practice, to say the least.

In the writer's judgment, other things being equal, the "hot process" gives the best results but is necessarily more expensive both on account of the more or less expensive plant required to heat and mix the ingredients, and also the greater amount of labor required to heat and roll the much tougher, denser and harder surface mixture. The "hot process" has the great advantage of providing a surface which is "set" hard as soon as compressed and chilled to the temperature of the air.

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*A paper by George C. Warren, President, Warren Brothers Co., Boston, Mass. Written by request for presentation at International Road Congress, Brussels, Belgium, July 31 to Aug. 7, 1910.

Hand mixtures have the following advantages over machine mixtures:

(a) Comparatively little expense of plant installation on account of which it is applicable for use on roadways of less area than practicable by machine methods.

(b) No cost of fuel and consequent saving.

(c) Some writers say machine mixing labor is less than hand mixing, but taking all items of cost, including plant installation and delivery of materials to and from the mixing plant, and labor, mixing and laying into consideration, the writer believes as a rule the reverse is the real condition.

The disadvantages of the hand mixing processes are:

(a) Manifestly less thorough mixing and less accurate proportioning and uniform distribution of ingredients and consequently greater variableness of results than with a properly constructed mixing and heating plant.

(b) Because of greater ease in hand mixing a marked tendency toward use of a softer bitumen.

(c) Impracticability of getting a thorough mixture without more power than can be executed by hand mixing if the combination of ingredients are as dense as they should be to produce the best results.

Machine mixing methods may be sub-divided into several classes, as follows:

(1st) Mixing without accurately proportioning or heating ingredients for which ordinary concrete mixers either of the "continuous" or "batch" types will answer. This method has the advantage of least expense in plant and labor which, in the writer's judgment, is very much more than counterbalanced by the disadvantages of using bitumen of a grade so soft as to be liquid at normal temperature and of less accuracy and uniformity of results.

(2nd) Mixing by heating without accurately proportioning the ingredients which in the writer's judgment is better than the last named method but still inherently defective.

(3rd) Using a well planned mixing and heating machine specially constructed for the purpose, which will produce the following essentials to a maximum degree of success:

(a) Uniformity and accuracy of proportioning of ingredients both as to varying sizes of mineral aggregate and amount of bitumen.

(b) Sufficient heat in the ingredients when mixed and laid in the work to evaporate moisture and permit the use of bitumen hard enough to furnish a "true binder."

(c) When compressed in the work a solid dense voidless, dry bituminous concrete wearing surface which will to the greatest possible extent prevent penetration of moisture (the enemy of all road surfaces) and withstand the troublesome automobile and other traffic without shifting or presenting undesirably soft surfaces.

A word here on the subject of proportioning of mineral aggregates in bituminous wearing surfaces may not be out of place. The writer believes from his wide experience and observation as well as from theoretical reasoning that the following are necessary essentials to the best construction:

(1st) That the sizes of stone or mixture of stone and sand composing the mineral aggregate of the wearing surface shall be scientifically and accurately proportioned varying from the coarsest size permitted by the thickness of the surface (at least ½ in. less than the depth of compressed surface desired) down to an impalpable powder, each size to be proportioned as to reduce the voids to the greatest practicable extent, which in practical work can be as low as 10 per cent to 15 per cent of the volume. To practically produce this result a mixing plant designed to proportion and control the sizes of the aggregates is essential.

(2nd) That sufficient bitumen shall be used to thoroughly fill the remaining voids and evenly but thoroughly coat every particle of aggregate, large and small, with a thin coating of bituminous cement of a grade which when cool [illegible] a high degree of cementing strength and solid construction of bituminous concrete which (as is practically possible) when thoroughly compressed on the road foundation has the density and within about 5 per cent of the specific gravity of solid rock of the character used in the wearing surface. This difference in specific gravity represents the difference between the specific gravity of the stone (say 2.8) and the bitumen (say 1.0 - 1.25) used in the construction and not voids or lack of density or stability in the compressed bituminous concrete wearing surface.

Notes on Road and Street Work.

Oak Joint Filler and Sectional Oak Blocks—During 1909 the City Engineer's Department of Baltimore, Md., experimented with a new method for the betterment of old granite block pavement. This method was invented and patented by Mr. Edward Alcott. It consists in driving white oak keys or wedges between the blocks at each course. This key is intended for use as a joint filler in repaving old belgian block streets where the blocks have become so worn and rounded on the edges as to require redressing. The primary object of the key is to render redressing unnecessary; its further object is to hold the blocks so rigidly in position as to cause the traffic to gradually wear down the tops to a fairly uniform surface. The designer further claims that when properly laid it renders the pavement waterproof. This key is made in various sizes from 2 ins. to 4 ins., and creates a saving in the number of granite blocks per square yard; the amount saved depending of course upon the size of the key used. The results obtained from the use of the key, according to the annual report for 1909 of Mr. B. T. Fendall, City Engineer, from which this note has been taken, were as follows: (a) A general tightening of all the blocks, preventing any motion. (b) A better foothold for horses, the old blocks having worn very smooth. (c) By preventing the blocks from moving, the rounded top is worn down and brought back to its normal flat surface. So far the device appears to be a good one, but it has not been in use a sufficient length of time to determine, with certainty, whether its further use is desirable. A sectional oak paving block also designed by Mr. Alcott, was likewise described in Mr. Fendall's report. This block was used in laying a small section of pavement. This is an untreated block 9 ins. long, 3 ins. wide and 3½ ins. deep. It is ordinarily made in five sections, clamped together. Its designer claims that it is absolutely non-slippery in all weathers except frost and ice. Under an agreement with Mr. Alcott, 183.4 sq. yds. of this material were laid on the east side of Calvert Street in front of the News building, and 60.5 sq. yds. were laid on the north side of Fayette street, extending westwardly from the west curb of Calvert street. The blocks were dipped in hot tar before laying, and after laying they were grouted with a mixture of cement and sand. The area paved was then covered with small screened gravel. The total area paved is 243.9 sq. yds., for which Mr. Alcott is to be paid $2.00 per square yard, if in the judgment of the City Engineer the work is a success.

Cost of Maintaining Street Asphalt Pavements at Baltimore, Md.—The accompanying table (Table I) shows the cost of maintaining sheet asphalt pavements at Baltimore, Md., from expiration of guarantee to Dec. 31, 1909. The statement does not include any pavements under guarantee for 1909. The matter is taken from the annual report of Mr. B. T. Fendall, City Engineer.

Cost of Maintaining Asphalt Block Pavement at Baltimore, Md.—The accompanying table (Table II) shows the cost of maintaining streets at Baltimore, Md., paved with asphalt blocks, from the expiration of guarantee to Dec. 31, 1909. The table does not include any pavements under guarantee. The table is taken from the annual report for 1909 of Mr. B. T. Fendall, City Engineer.

Methods of Repairing Macadam Road and Preventing Dust.—The following method of repairing a macadam road so as to give a smooth surface and do away with the dust nuisance was given by M. J. Siddalls, Borough Surveyor of Livingston, England, in a paper read at the recent annual meeting of the Institution of Municipal and County Engineers. The roaad to be repaired should be well scarified, the old material taken away, and if good sifted for reuse. The new material, which should form a coat 4 in. thick, should be laid down in two layers. After the first layer is put down sufficient tarred chippings should be spread to fill the interstices, and lightly rolled, the next layer should then be spread and tarred chippings put on as before, using no more of the chippings than is absolutely necessary. The whole should be then well rolled and a coating of tar put on by a tar-spreader. The road should then be left to itself for a day to enable the tar to sink into the road. The final rolling should then be given, until perfectly solid, a light coat of tar run over the surafce, and hard grit or chippings lightly sprinkled thereon, which the traffic will soon put into its proper place. Such a road as this can be made at a

TABLE I.—COST OF MAINTAINING SHEET ASPHALT PAVEMENTS FROM EXPIRATION OF GUARANTEE TO DEC. 31, 1909.

Street.	Completed.	Guaranteed years.	Lineal feet.	Area in sq. yds.	Original cost.	Cost per sq. yd.	Cost of repairs to Dec. 31, 1909.	Cost of repairs per sq. yd. per year.	Years.
*Belair Market, Forrest St.	10—25—1884	2	1,687	6,426	$17,671.50	$2.75	......	......	[illegible]
City Hall	1885	[illegible]	959	3,462	6,404.70	1.85	$8,591.84	$0.1127	[illegible]
Hollins Market	9—12—1885	2	1,040	3,842	10,565.50	2.75	5,741.47	0.0677	[illegible]
Cross St. Market	9—26—1885	2	1,050	3,282	9,025.50	2.75	7,681.81	0.1204	22
Lafayette Market	9— 2—1890	2	1,145	5,245	14,423.75	2.75	6,117.51	[illegible]	17
Camden St.	6— 4—1891	2	342	1,502	4,130.50	2.75	8,247.07	0.3431	[illegible]
Hollins St.	8—13—1891	2	853	3,857	10,606.75	2.75	4,558.38	0.0737	16
Montgomery St.	6— 6—1891	[illegible]	[illegible]	740	2,035.00	2.75	1,644.35	0.1387	16
Sharp St.	9— 9—1891	2	345	1,149	3,159.75	2.75	3,719.21	0.2025	16
Hanover Market	5— 5—1891	2	401	1,736	4,772.30	2.75			
Hanover Market	11—17—1892	2	564	1,814	4,989.38	2.75	4,431.73	0.1627	[illegible]
Richmond Market	11— 7—1891	2	733	2,665	4,328.75	2.75			
Richmond Market	8—26—1893	2	559	1,576	4,334.00	2.75	[illegible]	0.0713	[illegible]
Calvert St.	6— 2—1892	2	1,690	7,620	20,574.00	2.70			
Calvert St.	9—30—1893	2	374	1,510	4,077.00	2.70	11,577.73	[illegible]	[illegible]
Mulberry St.	7— 6—1892	2	1,171	3,605	9,733.50	2.70	1,273.17	0.0235	
Broadway	12—16—[illegible]	[illegible]	7,230	51,739	139,695.30	2.70	67,305.48	0.1866	
Fayette St., Lexington St.	12—10—1892	2	658	1,747	4,716.90	2.70	11,227.48	0.1280	
Baltimore St.	9— 9—1893	2	4,540	20,860	56,322.00	2.70	23,391.22	0.0500	14
Lexington St.	9—16—1893	2	732	5,085	13,729.50	2.70	1,105.64	0.1550	
Chase St.	11—11—1893	2	5,030	22,495	60,736.50	2.70	[illegible]	0.0257	
Front St.	12—16—1893	2	1,400	4,285	11,569.50	2.70	9,447.00	0.1578	
Broadway	11—[illegible]—1896	5	2,404	15,365	30,678.50	2.02	8,353.47	0.0680	
Mt. Royal Ave.	10—31—1898	5	.....	18,603.5	39,124.67	1.52	[illegible]	0.0065	
Fulton Ave.	12—15—1898	5	.....	11,424.4	30,628.10	1.54	1,817.58	0.2650	[illegible]
St. Paul St.	11—19—1902	5	2,465.5	6,016	[illegible]		385.20	0.0320	[illegible]
St. Paul St.	12—30—1901	5	2,403	5,453	26,090.29	2.18	581.95	0.0356	3

*Belair Market, Forrest St., from Orleans St. to Hillen St., all sheet asphalt removed, now laid with vitrified blocks.

TABLE II. COST OF MAINTAINING STREETS PAVED WITH ASPHALT BLOCKS FROM EXPIRATION OF GUARANTEE TO DEC. 31, 1909.

Street	Completed.	Guaranteed, years.	Lineal feet.	Area in sq. yds.	Original cost.	Cost per sq. yd.	Cost of repairs to Dec. 31, 1909.	Cost of repairs per sq. yd. per year.	Years.
Charles St	1881	.	1,285	6,862	$17,155.00	$2.50	$20,273.81	$0.1053	28
Calhoun St.	4—13—1883	2	460	1,945	4,862.50	2.50	4,681.60	0.0964	25
Eutaw Pl.	7—26—1883	2	4,640	22,857	57,198.50	2.50	42,656.73	0.0779	24
Cathedral St.	4—12—1884	2	280	1,191	2,977.50	2.50	8,317.99	0.2912	24
Washington Pl.	5—10—1884	2	470	4,303	10,575.50	2.50	886.69	0.0082	24
Mt. Vernon Pl	6—11—1884	2	355	1,898	4,745.00	2.50	284.70	0.0065	23
Monument St	6—4—1885	2	581	2,585	6,462.50	2.50	1,869.70	0.0328	22
Eastern Market	7—22—1886	2	910	3,653	9,132.50	2.50	4,018.64	0.0524	21
Fulton Ave.	8—22—1887	2	2,500	9,269.07	23,174.25	2.50			
Fulton Ave.	6—1—1888	2	2,700	21,688	54,170.00	2.50	75,127.38	0.1277	19
Lafayette Ave.	10—23—1892	2	5,990	24,835.75	62,089.38	2.50			
Lafayette Ave.	12—2—1893	2	1,952	8,003.30	20,008.48	2.50	39,377.17	0.0857	14
*Lexington St.	5—20—1893	2	5,893	25,083.92	62,703.29	2.50	41,765.77	0.1343	14
Saratoga St.	8—8—1893	2	3,966	16,152	40,380.35	2.50	10,083.37	0.0446	14
Eutaw St.	9—13—1893	2	1,979	9,001.33	22,528.33	2.50	9,330.40	0.0743	14
St Paul St.	11—4—1893	2	6,630	16,120.13	40,300.50	2.50	11,530.47	0.0510	14
McCulloh St.	6—1—1894	2	1,778	7,358.57	18,646.43	2.50	895.78	0.0093	13
Pearl St.	10—9—1896	5	1,287	4,510.94	9,518.08	2.11	4,428.71	0.1227	8
Mt. Royal Ave.	10—9—1896	5	1,626	11,546.74	28,835.94	2.034	4,304.51	0.0466	8
McCulloh St	12—5—1896	5	882	4,070.87	8,233.16	2.02	231.25	0.0070	8
Patterson Ave.	11—7—1897	5	2,542	11,264.80	25,345.80	2.25	426.75	0.0054	7
Grant St.	7—30—1898	5	.....	266†	650.00	2.44	....	......	7
Bank Lane	9— . 1901	5	...	806	2,469.13	2.00	129.28	0.0534	3
North Ave.	12—23—1902	5	4,097	27,928.66	72,487.97	2.42	105.23	0.0019	2
Twenty-fifth St	10—26—1901	5	347	2,326.7	5,973.95	....	12.19	0.0017	3
Warren Ave.	7—25—1903	5	1,394	7,774	18,715.69	2.27	48.93	0.0063	1
Ashland Ave.	9—9—1903	5	728	3,510	9,601.31	2.35	34.20	0.0097	1

*On Lexington St., between Pearl and Arch Sts., there was 1,115 sq. yds. of vitrified paving block laid in 1906, and between Calhoun and Stricker Sts. there was 1,728.2 sq. yds. of vitrified paving block laid in 1901, taking the place of asphalt blocks completely worn out

†No repairs necessary.

cost of not more than 10 per cent above that of the ordinary wet method of rolling, and if treated in subsequent years with a thin coat of tar will prove nearly dustless, and will last quite as long again as a road made under the usual conditions. Mr. Sliddalls also discussed dust prevention as follows: With regard to the prevention of dust on old road surfaces many substances have been tried, but up to the present none have proved more effective and economical than tarring. To obtain the best results, however, several very necessary precautions must be taken. The tar must be well heated so as to drive off all moisture. No doubt properly distilled tar is best for the purpose, but it is not always procurable in country districts. The tar is best spread by a machine, as less tar is used, and it is spread more evenly than by hand, bearing in mind that a thick coat of tar is not required, being wasteful and needless, and causing a black pasty mud to be formed by the attrition of surface under heavy traffic, and horse droppings, dust blown from fields, etc. There are excellent machines for this purpose on the market varying in price from the ordinary spreader with brush at about £45 for the 160 gallons—a most useful size—to £80 or £90 for the machine with pump worked by the travel of the machine to deliver the tar by pressure. Two machines, if possible, should be used so that the men's time may be more profitably employed, one machine being at work while the tar is being heated in the other. For this purpose neighboring surveyors may usefully combine forces and so save expenditure. It is useless commencing this work before the end of May or the beginning of June, at all events in this district, as everything depends upon suitable conditions. The work can only be properly done on dry, hot days. If possible one-half of the road should be tarred at a time, the traffic kept off until the tar is quite dry, then a small quantity of dry, sharp grit sprinkled on the surface before the traffic is put on the road. It is absolutely essential, before the tar is applied, that all dust be carefully removed from the surface, hollows filled in with tar chippings well rolled in, and if necessary, the road must be washed the day previously and allowed to become thoroughly dry. It must also be borne in mind that the best results cannot be obtained on a road nearly worn out nor on a road much overshadowed by trees, nor must it be expected that the tarring will last under the heavy traffic for more than one season, although the author has found that on sides of the road the tar is practically as good the second year as the first. With laborer's wages at 3¾d. (7½ cts.) and foreman 6d. per hour, horse and man 6s. per day, and tar at 2d. per gallon, the usual prices in the West, the cost of the work varies from 7d. to 1d. per square yard, including cleansing for the first year, the cost in subsequent years being somewhat less as the cost of cleansing is not so high. This works out from £30 ($150) to £45 ($225) per mile for a road 20 ft. in width.

STEAM AND ELECTRIC RAILWAY SECTION

Methods and Costs of Unloading, Spacing and Renewing Ties.

BY D. A. WALLACE.

UNLOADING TIES.

(1) Ties were unloaded from work train while running, with negro labor at $1.10 per day and foreman at $50 per month. Work train cost $25 per day. Six men unloaded 250 ties from a coal car in 30 mins. at the following cost

Train service, 30 mins.	$1.04
Labor, 30 mins.	0.45
Total	$1.49

This gives a cost per tie of 0.6 ct.

Thirteen men unloaded 970 ties from 3 box cars in 2 hours. Four men per car were worked with one to follow. The cost was as follows:

Train service, 2 hrs.	$ 6.24
Labor, 2 hrs.	5.35
Total	$11.59

This gives a cost per tie of 1.2 ct. It will be seen that it cost twice as much to unload from box cars as from coal cars.

(2) Work train unloaded 9 cars of ties on a run of 106 miles, picking up section gangs and unloading in spots. Cars were coal cars and train was called at 6:15 a. m. and tied up at 6:15 p. m. Negro labor at $1.10 per day and foreman at $50 per month were employed. The expense per day was as follows:

Work train, including coal, oil, etc.	$28.80
Labor	4.40
Foremen	1.00
Total	$34.20

The train was in service 12 hours as follows:

	Hrs.	Mins.	Frac. of day.
Delays	3	35	0.300
Unloading time	2	13	0.184
Running time	6	12	0.516
Total	12	00	1.00

The cost of unloading per tie was, therefore, as follows:

Delays	0.48 ct.
Unloading time	0.29 ct.
Running time	0.83 ct.
Total	1.60 cts.

The actual unloading cost per car is given in Table I.

TABLE I.

No. of ties.	No. of men.	Time in mins.	Train cost.	4-man cost	Labor cost.	Total cost.	Cost per tie.
150	1	10	$0.340	$0.027	$0.072	$0.439	$0.0028
250	5	18	0.612	0.048	0.162	0.822	0.0030
200	3	12	0.408	0.032	0.064	0.504	0.0025
100	5	10	0.340	0.027	0.090	0.457	0.0047
300	4	14	0.476	0.037	0.101	0.617	0.0020
300	4	15	0.510	0.040	0.108	0.658	0.0020
300	3	23	0.782	0.062	0.124	0.968	0.0030
300	4	18	0.612	0.048	0.129	0.790	0.0026
300	8	13	0.442	0.035	0.187	0.664	0.0022
2,100		133	$4.523	$0.357	$1.038	$5.919	$0.0028*

*Average.

TIE RENEWALS.

When track is being surfaced out of face in two raises the renewal of ties during the first raise consumes too much time and should be done during the second raise. The following gang organizations were employed in the work for which the records are given.

Good Surface; Foreman and 4 Men, Not more than 2 Ties to Be Removed at a Place.—Foreman will loosen up the spikes on 4 ties on each side of the tie that is to be removed; 2 men can be used in thoroughly cleaning the ballast from around the tie that is to be removed; the other 2 men should each have a jack to raise the rail, so as to let the tie come out easily, without disturbing the general surface. The 4 men should then slip in the new ties, working in pairs. The foreman should drive the spikes home as soon as possible in order to keep the track safe, and should dress up the track.

Foreman and 6 Men; Smoothing Track; 7 or 8 Ties per Rail Length.—Gang as follows: 2 men with jacks, 2 men with claw bars, 2 men pulling ties out of track. Where 3 or 4 ties together come out the foreman should put in the middle tie and spike it to keep the track safe. When about 20 ties are removed the gang should go back and full-tie the track, care being taken not to disturb ties that are not to be taken out of the track, even if it is necessary to loosen up the spikes on 3 or 4 ties on each side of the tie to be removed. Spikes should not be pulled all the way out, and ties left in track should not be raised more than ¼ in. Only 20 ties should be removed at a time before new ties are put in, for the reason that the gang may be picked up by a work train or called away suddenly for some reason and the work be left in bad shape for the regular trains. As the new ties are being put in place the gang can smooth up.

The following are records of tie renewals:

(1) An average of 4 ties per rail renewed during a 7-in. raise in rock ballast, with Italian labor at $1.25 per day and foreman at $60 per month. The ties were 7x9 ins. x 8½ ft.

No. of ties.	No. of days.	Ties per man per day.
19	1½	12
95	8	12
20	1	20
72	10	7
16	1	16
15	[illegible]	[illegible]
30	5	6
16	1½	10
15	0.9	16
63	[illegible]	12
24	2½	10
45	4	11
40	4	10
15	1	[illegible]
70	6	11
30	2	15
47	4	[illegible]
45	4½	10
25	2	[illegible]
60	4	15
55	2.9	[illegible]
35	3	11
Average		11

The cost of renewing 1 tie was $0.104

(2) Ties put in during a 3-in. raise in rock ballast by section gangs, with negro labor at $1.10 per day and foreman at $50 per month. Ties were 6x8 ins. x 8 ft. The record was as follows:

No. of ties.	No. of days.	Ties per man per day.
50	4	12½
35	2	17½
23	1½	[illegible]
118	6	19½
87	7	12½
33	2½	[illegible]
42	3½	12
85	7	12.1
90	8	[illegible]
[illegible]	6	[illegible]
Average		14

The cost of renewing 1 tie was $0.08.

(3) Ties renewed in rock ballast during a 2-in. raise by section gangs working negroes at $1.10 per day and foreman at $50 per month. The ties were 6x8 ins. x 8 ft.

No. of ties.	No. of days.	Ties per man per day.
80	5	16
80	5	16
113	10	11.3
71	7	10.1
35	2	17.5
12	1	12
23	1½	15.3
51	4	12.7
30	2	15
80	5	16
140	10	14
40	2½	16
130	11	11.8
46	4	11.5
74	5	14.8
65	6½	10
75	7	10.7
12	1	12
27	2½	10.1
Average		13.3

The cost of renewing 1 tie was $0.082.

(4) Ties renewed during a 7-in. raise in rock screenings, working Italians at $1.25 per day and foreman at $60 per month. Ties were 7x9 ins. x 8½ ft. The record was as follows:

No. of ties.	No. of days.	Ties per man per day.
115	10	11
55	5	11
70	6	11
80	6	13
85	6	14
50	3	16
Average		12.7

The cost of renewing 1 tie was $0.098.

(5) Ties renewed in 2-in. slag by section gangs working white labor at $1.10 per day and foreman at $50 per month. Ties 6x8 ins. x 8 ft. The record was as follows:

No. of ties.	No. of days.	Ties per man per day.
98	5½	17.9
26	2	13
44	4	11
51	5	10.2
12	1	12
30	2	15
Average		13.1

The cost of renewing 1 tie was $0.083.

(6) Ties renewed in 2-in. surface gravel working white labor at $1.10 per day and foreman at $50 per month. Ties 6x8 ins. x 8 ft. The record was as follows:

No. of ties.	No. of days.	Ties per man per day.
78	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
64	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	6	[illegible]
22	2	11
Average		[illegible]

The cost of renewing 1 tie was $0.08.

(7) Ties renewed during rock smoothing, working negroes at $1.10 per day and foreman at $50 per month. [illegible] The record was as follows:

No. of ties.	No. of days.	Ties per man per day.
95	7	13.6
30	2	15
11	1	11
30	3	10
39	[illegible]	7.8
60	[illegible]	[illegible]
87	[illegible]	[illegible]
89	[illegible]	[illegible]
45	4	11.2
37	4	9
Average		[illegible]

The cost of renewing 1 tie was $0.088.

SPACING TIES.

The spacing of ties in rock ballast in the following record was a good average of the work done on several miles. The ties were special following the first raise and just before the ballast for the second raise was unloaded. The tie spacing in stripped track was done just before the unloading of the ballast for the first raise. Negro labor at $1.10 per day and foreman at $50 per month were worked. The record is as follows:

No. ft. track.	No. days worked.	Kind of ballast.	Feet per man per day.
430	15	Rock	28½
495	12	Rock	40
430	9½	Stripped	45
365	6	Stripped	60½
330	5	Stripped	66

One man spaced 6 joints per day in rock ballasted track, no raise, and rail laid broken jointed.

Methods and Cost of Unloading Railway Rails.

BY [illegible] A. WALLACE.

There are many contrivances in general use for rail unloading. The best of the different methods is perhaps the use of an ordinary push car fitted with a rail bent to an inverted V shape. This rail is fastened to the push car at an angle of 45° with the horizontal and the push car is attached to the rail car with the point of the V-rail forward. Four ropes are rigged with a clamp at one end and a hook at the other end. As the rail train moves slowly ahead the hook end of a rope is caught into the bolt hole in a rail on the car and the clamp at the other end of the rope is dropped over the head of the track rail, causing a rail to be dragged from the car and deflected to the outside of the track by the V-rail on the push car. In practice 2 rails are unloaded at once, one on each side, and with 4 ropes the operation is continuous, one pair of ropes being detached and carried forward as the other pair is pulling 2 rails from the car.

By this method 11 men are required to unload the rail without stopping the train; 1 man is placed on the car with a lining bar to keep the rails free; 1 man on the ground follows the work and straightens out an occasional rail lying in a dangerous position; 8 men, 2 to each rope, do the unloading, and 1 man on the push car fastens the hooks into the bolt holes. The man on the push car stands directly within the "point" of the V-rail. A quiet, cool-headed man is required for this position, for a mistake in fastening the ropes would very likely result seriously for him.

The serious objection to this method of unloading is that when one car has been unloaded it is necessary either to leave it on the main line or to sidetrack it. If it be left on the main line the push car must be car[illegible] it to the next rail car.

[illegible] is smooth, there is no objection to unloading from the sides of the car, provided, of course, that both ends of the rails are released together.

[illegible] rails:

(1) The 70-lb., 33-ft. rail was unloaded [illegible] section gangs which had no experience in handling new rail. Two rails were dropped at a place, then the train moved ahead one rail length and the operation repeated. One man followed the train to straighten out an occasional rail which lay too close to the track; the remainder of the gang unloaded the rails by hand with the assistance of 2 men at each end of the car with lining bars. This was the method, when unloading from gondola cars.

Rail unloaded from flat cars was rolled off the sides, using lining bars and shovels. Two men at each end had lining bars and the remainder had shovels. As soon as the bar men had started the rail they were assisted by the shovelers, one bar man at each end always using his bar as a skid, keeping the rail up from the floor, thus giving leverage to the shovel men. One man followed the train to straighten out rails lying in a dangerous position.

Negro labor at $1.10 per day was employed, with foreman at $50 per month. The work train cost $25 per day. The cars unloaded were as follows:

	Rails.
Gondola car	84
Gondola car	84
Gondola car	113
Flat car	113
Total	[illegible]

The time required for unloading was 3 hrs. 50 mins., and the cost was as follows:

18 men at $1.10 per day	$[illegible]
2 foremen at $50 per month	[illegible]
Work train	25.00
Total	$[illegible]

This gives a cost of 8.7 cts. per rail and of $27.84 per mile of track.

(2) In the record which follows no charge was made against the Road Department by the Transportation Department for roadway work performed by revenue trains other than overtime made by trains doing the work and in this case the revenue business was light and no overtime was made. The cars unloaded were:

	Rails.
One gondola car	84
One gondola car	113
One flat car	113
Total	310

The working time was 1 hr. 30 mins. and the cost was as follows:

13 men	$2.14
4 foremen	0.96
Total	$3.10

This gives a cost of 1 ct. per rail and of $3.20 per mile of track.

(3) In the following record a comparison is made between the time of unloading gondola and flat cars. The time of unloading the gondola cars was as follows

1 car	113 rails	1 hr. 0 mins.
1 car	113 rails	1 hr. 0 mins.
1 car	84 rails	2 hrs. 14 mins.
3 cars	310 rails	4 hrs. 14 mins.

The time for unloading 5 flat cars was:

1 car	141 rails	35 mins.
1 car	114 rails	[illegible]
1 car	78 rails	[illegible]
1 car	73 rails	[illegible]
1 car	76 rails	25 mins
5 cars	482 rails	2 hrs. 10 mins.
Grand total unloading time		6 hrs. 24 mins.
Delays		[illegible]

In comparison the time per rail and per mile of track was as follows:

1 car 113 rails......1 hr. 0 mins.

Item.	Gondola.	Flat.
1 rail, time required	.81 min.	.27 min.
1 mile, time req'd.	4 hrs. 20 mins.	1 hr. 25 mins.

Therefore it costs three times as much to unload rails from a gondola car as it does from a flat car.

Where rail was unloaded from flat cars it was customary for half of the gang to unload from one side and half to unload from the other. This was a very good method, as there was always a rivalry between the two gangs, each to unload its half first so that the few bottom rails in the center of the car would be left for the slower gang to unload. The cost of unloading the eight cars, 792 rails, was as follows: The wages for labor were $1.10 per day and for foreman $50 per month, but as the work was done on Sunday time-and-a-half was paid the men. The cost was therefore:

17 men at $1.65 per day	$28.05
4 foremen at $50 per month	6.66
Work train	25.00
Total	$59.71

This gives a cost of 7.5 cts. per rail and of $24 per mile of track.

Summarizing the costs of records 1, 2 and 3, given above, we have:

(1)	394 rails unloaded at	$34.43
(2)	310 rails unloaded at	3.10
(3)	792 rails unloaded at	59.71
	1,496 rails unloaded at	$97.24

This gives a cost of 6.5 cts. per rail and of $20.80 per mile of track.

(4) Generally rails are piled on a car in layers. In each layer the rails are placed alternately head up and head down, the head of one rail being always overlapped by the base of the adjacent rail. In this case the rails were loaded loosely on a flat car, with just enough straightening around to put them parallel with the sides of the car. In unloading these rails no difficulty was experienced in loosening up a rail such as is oftentimes the case when rails are piled tightly in layers.

Negro labor at $1.10 per day and foreman at $50 per month were worked. A gang of 10 men unloaded 90 85-lb. rails in 45 mins. The cost of the work was as follows:

Train service	$1.56
Labor	1.05
Total for 90 rails	$2.61

This gives a cost of 2.9 cts. per rail or of $9.30 per mile of track.

GENERAL ARTICLES AND CLASSIFIED ITEMS

A Novel Construction of Tunnel Intake.*

This paper is a description of the condenser supply systems of the two power stations of the Union Electric Light & Power Co., situated on the west bank of the Mississippi River at St. Louis. These stations are known respectively as the Ashley St. and Lewis St. Stations. The former has a capacity of 50,000kw., 38,000 in steam-turbine units and 12,000 in engine-driven units. The second station has generating equipment of 7,500-kw. capacity, 6,000 in steam-turbine units and 1,500 in engine-driven units. The primary reason for locating these power stations on the river bank was to have an abundance of condenser water available at the minimum cost. The two systems to be described herein are especially worth study because of their location and the source from which the water is taken. The Mississippi River, in its muddy water, carries all manner of refuse and it varies in stage from 2 ft. below zero to 38 ft. above. This river is no respecter of seasons, and any time may find it at any stage, from the lowest to the highest.

Ashley Street Station.—This station is so situated that its east wall is directly at the water's edge, and the problem presented, in providing an intake for its circulating system, was to have one through which water could be taken at all stages of the river, and which could be constructed at a cost commensurate with the size of the station and the work to be performed.

The design of the building structure provided for a sea-wall running parallel to the east wall of the boiler room, the boiler room being on the east side of the building and the engine room on the west side, and extending throughout the length of the building. This sea-wall is on a line with the river shore and is surrounded by water, except at very low stages of the river. It presented a very desirable location for an intake, as this could be built in and made a part of the wall, without requiring separate and additional construction; the only difficulty being to get it placed low enough to insure a flow of sufficient water at all times. It is at the northeast corner of this sea-wall that the intake is located, and it consists of two wells adjacent to each other, the general arrangement and construction being shown in Fig. 1. Each well is an open section in the wall 6 ft. wide x 7 ft. high, the north well being 20 ft. long and the south 14½ ft. long. The openings to the river are through gateways 4 ft. wide x 7 ft. high. The floor of each well is 58 ft. below the top of the sea-wall, and the wells can be approached from the top through metal shafts 3x5 ft. in section.

All elevations are referred to a datum point arbitrarily taken at 100 ft. below the city directrix, which is a station point for all local measurements, having an elevation 412.73 ft. above the sea-level and fixed by a mark on a curb-stone in Market street.

What is known as the zero stage of the river was a low-water reading made in 1863 which showed an elevation of 33.71 ft. below the city directrix, and is the point on which all river-stage readings are based. This elevation referred to the datum point for Ashley Street Station is 66.3 ft., which reading is the basis for all river-stage measurements in connection with the work about this station. The floor of the intake wells is 9.26 ft. below the zero stage of the river; the openings of the circulating suction pipes in the intake wells have an elevation of 5.27 ft. below the zero stage of the river, and are the lowest possible point at which water can be taken.

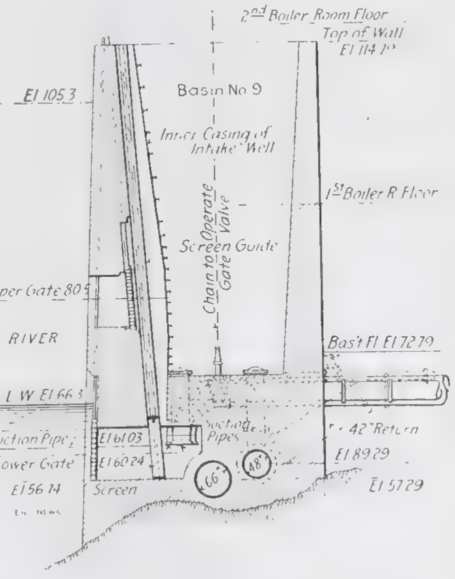

Fig. 1.—Section of Intake Wells.

In addition to the opening to the wells, already referred to, there are two other gateways of the same size 20 ft. higher up on the wall, which feed the wells through the metal shafts and were intended to be used for high stages of the river. The gateways are protected on the outside by bars of 6-in. I-beams, concreted on both sides between the flanges, the ends imbedded in the face of the well on 7-in. centers with the flange of the beams facing out. These are a guard against any large substance that might be drawn in from the river. Next to the bars are heavy cast-iron gates, operated by 2-in. square rods extending to the top of the wall, which are for closing the gateways in case it is necessary to shut off the water and get into the wells.

As a protection against small refuse in the water, and there is an abundance of it, there are, on the inside of each lower opening, two wire screens of 1-in. mesh. These screens are hoisted to the surface for cleaning, one screen always being in position. Several hundred yards north of the power station is a city dump where the refuse from stables, produce commission houses, etc., is dumped into the river, and much of this is drawn into the intake, lodges on the screens and makes it necessary at times to clean them very frequently. This refuse passing through the pumps would soon plug up the condenser tubes, and while the mesh of the screns is not small enough to stop everything, yet they are very effective in minimizing the trouble we would have if the refuse had a free passageway to the pumps. The hoisting of the screens is done by a wire rope operated by counter-weights and an electric motor driving a hoisting sheave through a worm-gear and clutch.

The suction pipes to the pumps are five in number, each 30 ins. in diameter, three entering the north well and two the south, in the manner shown on Fig. 1. The lowest stage of the river of which there is any record, was —2.6 ft. on January 2, 1900, and the lowest stage in our experience was on January 12, 1909, when the point reached was —1.6 ft.

The river along the sea-wall has filled in considerably, and at a stage of 2 ft. above the shore extends about 50 ft. out from the wall. A small channel was left to the intake openings, but for the lower stages of river the passage was found not large enough for flow of sufficient water, and it was necessary to dredge in front of the intake out into deep water. This was done in October, 1908, and we now have a clear channel, 14 ft. below the zero stage of the river, extending 60 ft. out into deep water, there being a deep pool in front of the station, varying in width from 25 ft., at the wall, to 60 ft. at the outer end. This provides a large open course for the flow of water even at the lowest stages known. The channel is extremely valuable in the winter season when the river is full of ice. Shore ice tends to ground and thus to shut off the water, but, with the channel so deep, the ice forms a solid bridge across, leaving a free open passageway. Soundings are frequently made directly in front of the intake during low-water periods so as to insure against any possible obstruction to the flow of water.

The sea-wall is built of concrete reinforced with steel frames tied to the main building wall. This work was done back of a steel cofferdam, but, on account of the varying stage of the river, it was impossible to keep the dam tight, and that portion of the wall containing the intake wells was constructed by means of a caisson, the well chambers being constructed within the caisson. While the construction of these wells was incidental with the construction of the sea-wall, an independent structure would have had to be built equally as substantial to withstand high-water levels and provide adequate means for handling screens, so that the cost for an independent structure would probably have been more than for this portion of the wall.

The intake was designed to provide condenser water for an ultimate station load of 35,000 kw., and this condition was fulfilled very easily. Since the building of the station, many improvements have been effected and with the generally increased efficiency the intake will safely pass water for twice this capacity. The five 30-in. suction pipes lead to a common suction header, to which the circulating pumps are connected. There are five engine-driven, centrifugal pumps, two with 45-in. discharge and three with 30-in. discharge, having a maximum pumping capacity of 165,000,000 gals. per day. The well chambers have no capacity whatever, and they simply serve as a junction box between the intake gateways and the suction pipes of the pumps.

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*From a paper by John Hunter, Chief Engineer, Union Electric Light & Power Co., St. Louis, Mo., before the National Electric Light Association. The illustrations are reproduced from "Engineering News."

Readings are frequently made of the water level in the wells and of the river, the difference showing the head of flow through the gates. This head is an indication of the condition of the bars on the outside of the gateways, which become clogged with refuse. For cleaning the bars, a by-pass pipe from the main discharge header of the circulating system opens into the wells. When the head of flow indicates a choking of the bars of either well the suction valves to this well are closed and the by-pass valve opened, allowing the discharge water to flow outward through the gate, washing away whatever is in front of the bars. This scheme for cleaning the gates is very effective, as indicated by the working level of the water in the well after the flushing has been done. These by-pass connections are also used in the winter time to clear the wells from ice, the warm discharge water being allowed to pass into the wells in just sufficient amount to break down whatever ice forms.

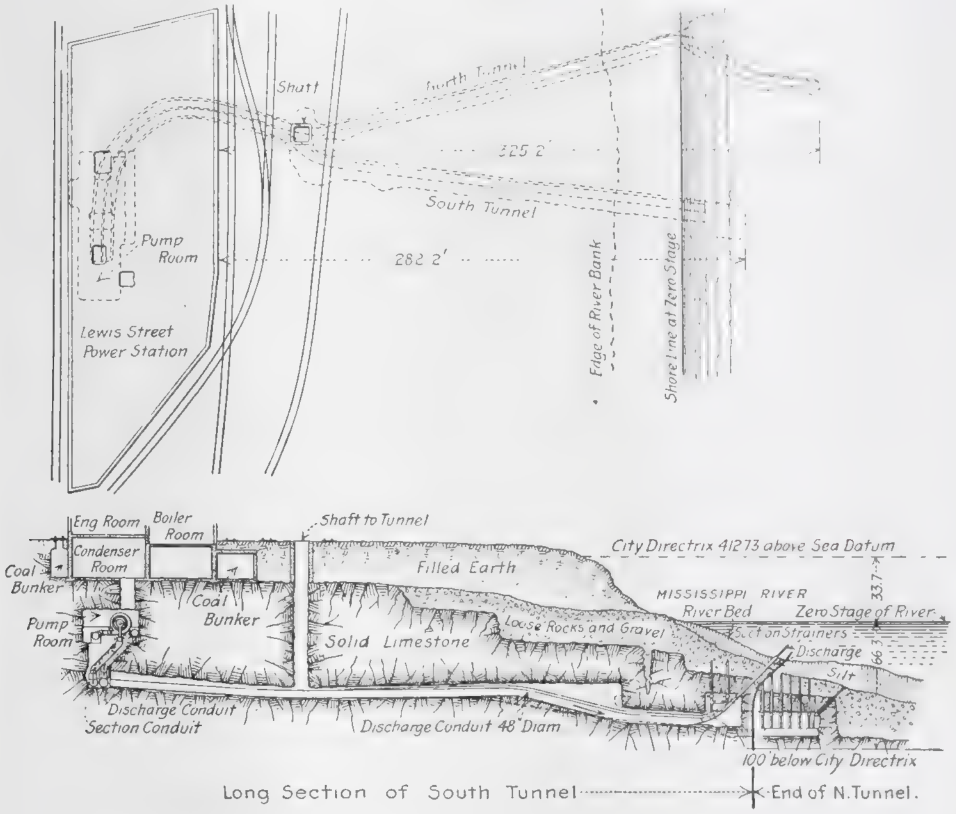


Fig. 2.—Plan and Section of Intake Tunnels.

The flow of water through the wells is sufficient to keep them free of all sediment, and on several inspections they were found perfectly clean. While there are two openings to each well, it has been found desirable to use only the bottom opening at all stages of the river, for to allow water to flow through the upper gate reduces the flow through the bottom gate, so that it quickly fills up with silt and sand. As a further protection to the intake from refuse in the water, a wall of interlocking steel piling was constructed around the openings, extending out from the north corner of the fall 15 ft. and then south about 30 ft. so that the water must flow backward into the wells. This wall has added very much to the safe operation of intake, especially during the winter when the river is full of ice.

Lewis Street Station.—An entirely different problem was presented in providing an intake for the Lewis Street Station. This station is located in the city block directly north of that occupied by Ashley Street Station; it sits on the west side of the railroad tracks that run along the levee, and is about 300 ft. from the water's edge. Along the river shore at this point there is an underlying bed of solid limestone, at a depth varying from 10 to 15 ft. below the ground surface at the west building line to from 30 to 40 ft. at the edge of the bank. This station was erected in 1901. The early operation was conducted on a comparatively small scale, and as the requirements for condenser water were not very great an effort was made to reach the river by a surface pipe line. This was not successful, for after being constructed it was displeasing to the harbor authorities and had to be removed. A later effort was made to get a river connection by constructing an underground conduit along the surface of the rock. Considerable time and money were spent on this venture, but the job had to be abandoned on account of the nature of the soil and the various obstructions encountered. It was finally decided that the work that was being avoided, that of tunneling through the solid rock, was the only practical way of getting a proper connection to the river. This was a big undertaking for a plant of this size, but the need of a condensing system was becoming greater every day and the work of driving a tunnel through the solid rock to beneath the river to get a connection for water was undertaken. Surveys were carefully made of the condition of the rock as far out into the river as it was deemed desirable to locate the intake, in order to determine the proper depth for the tunnel. In erecting the station its ultimate capacity had in a measure been predetermined, and the furnishing of ample water for such capacity was the basis for fixing the size of the tunnel and its conduits.

The construction of the tunnel was started by sinking a shaft through the earth and solid rock at a point about 50 ft. east of the station building, and then excavating through the rock from this point, west toward the station and east to the river. Much care had to be exercised in driving the tunnel toward the river, as deep fissures extended into the rock at several points, and to strike one of these meant to flood the job. Precaution was taken by drilling small test holes 15 to 20 ft. into the rock ahead, and this proved a very valuable safeguard, as the course of the tunnel had to be changed from that previously determined, sloping to a lower elevation so as not to run into open water before the required distance into the river had been reached. The condition governing the distance the intake should extend into the river was the low stage of the river.

The tunnel shaft has a cross section 10x10 ft. and it is sunk to a depth of 90 ft. below the ground surface. There are two tunnels to the river, both beginning at the shaft, one extending slightly toward the north, which is for the suction water, the other slightly toward south for the discharge. A single tunnel leads west from the shaft to beneath the station building, connecting with the pump room and containing both the suction and the discharge conduits. Each tunnel has a general cross section 9x9 ft. The suction tunnel extends 275 ft. from the shaft, which is 75 ft. beyond the shore line at low water. The discharge tunnel runs 232 ft. out from the shaft. Both take a downward slope, and at the extreme outer ends are 60 ft. apart, as shown in Fig. 2. The top of the north or suction tunnel at its outer end has an elevation of 47.3 ft. below the surface of the river at low water. The rock at this point is 8 ft. thick. There is a layer of loose rock, sand and mud about 19 ft. deep, leaving 20 ft. of open water. The discharge tunnel ends in a big room, which had to be provided for the installation of the large tubes it contains. Its top is 38.3 ft. below low water, with about the same thickness of solid rock and loose rock and sand above as has the north tunnel.

The suction conduit in the north tunnel is 48 ins. in diameter and is constructed of reinforced concrete. The south tunnel has two conduits, one 48 ins. in diameter, of reinforced concrete, similar to that in the north tunnel, and which is the discharge conduit. The other is of 18-in. iron pipe, originally constructed as a temporary suction conduit, has been continued in this service and has since been encased in concrete.

The means of getting water from the river into the suction conduits is through strainer tubes, one end connecting with the conduit, the other extending through the solid rock into the sand and mud above. The suction tubes are of 6-in. standard pipe, and that portion extending beyond the face of the solid rock is 8 ft. long and perforated with 7/16-in. holes on 1-in. centers, the outer end being closed. The placing of these tubes was accomplished by drilling 8½-in. holes into the solid rock to a depth of 4 ft. Into these holes pieces of 7-in. pipe, with flange and valve on one end, were inserted and made fast by grouting in with cement. With the 7-in. sleeves and valves securely in place the drilling of the rock was continued to within a fraction of an inch of the surface. The 6-in. strainers were then inserted into the openings and forced through the film of stone left on the surface of the rock and into the gravel, sand and mud above. The strainers were pushed into place by means of pushing rods and a hydraulic jack, and to guard against their being pushed beyond the edge of the solid rock the distance was accurately predetermined and the tubes were left extending 6 ins. within the rock to keep them from washing away. The placing of these strainers was a very delicate part of the work and required considerable precaution, but it was accomplished without an accident of any kind. There are 18 such strainers in the north tunnel and four of them in the south.

The connection between the discharge conduit in the south tunnel and the river was made in practically the same way as that of the suction strainers just referred to, but the discharge tubes are larger and fewer in number and extend further into the river. There are three of these tubes, each 18 ins. in diameter and 27 ft. long, made up in two sections with inside coupling. The placing of such large tubes was a considerably more difficult operation than the placing of the 6-in. strainers, but it was accomplished with as much success. Short holes, 24 ins. in diameter, were first drilled into the solid rock. Into these holes specially constructed cast-iron sleeves, with flange and 20-in. gate valve on one end, were placed and secured with concrete grouting. With the sleeves and valves securely in place the drilling was continued, but in this case light blasts were used for removing the rock. As a further precaution against a flood of water, while pushing the large pipes into the river, a stuffing box was arranged below the valve, so that when the pipes were inserted into the cast-iron tubes they could be carefully packed, and any water breaking through into the drilled holes could not flow back into the tunnel. It took considerable pressure to force the large pipes into place—at times almost equal to the crushing strength of the pipes. They were not pushed as close to the edge of the solid rock as the 6-in. strainers, the inner end of the pipes remaining within the cast-iron sleeve to give them a bearing, and also to make the connections more water-tight, as the holes in the rock through which they passed were not very regular.

A test was made on a section of the 48-in. reinforced-concrete conduits, which test showed they would be perfectly tight up to 50 lbs. pressure and that they would not burst at 150 lbs.

The operation of the system was started by using the temporary 18-in. suction pipe. The three discharge connections to the river had been completed first, and into two of these, strainers made of 14-in. pipe 21 ft. long were inserted, connecting to the temporary suction pipe and extending about 10 ft. into the clear water. The early experience with these strainers was very discouraging, owing to the immense amount of sand, mud and refuse that came through, and it was on this account that the regular intake strainers were made of smaller diameter and shorter so as not to extend into the open water, the idea being that the water filtering through the mud and sand would be much clearer and free from refuse. After the installation of the permanent suction tubes one of the larger strainers was abandoned, but the other was kept in service, as the smaller tubes did not admit the quantity of water that was anticipated.

It was found, after the system was in operation for a short time, that the flow of water decreased very rapidly, caused by mud and refuse clogging up the strainers. To overcome this, air connections were run to the strainers for blowing them out, the connection to the 14-in. strainer being fitted up with an electrically-operated valve controlled from the circulating-pump room. The small strainers are blown out singly by hand operation. To flush out the big strainer the circulating pump is slowed down, thus allowing the water to flow back, and the air valve opened at the same time, allowing the air to blow through the strainer for a few seconds. The scheme works very successfully, and keeps the strainers from choking up.

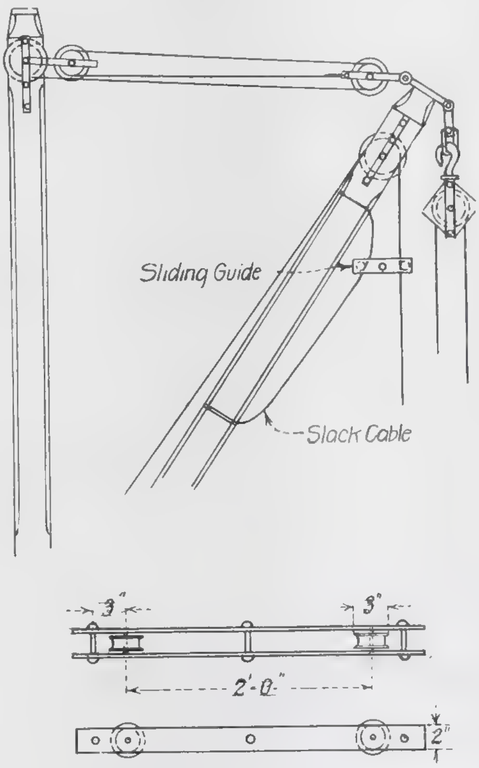
As this intake system is now being operated, water is received in the 48-in. suction conduit in the north tunnel, through 18 6-in. strainers, and in the 18-in. suction conduit in the south tunnel, through one 14-in. strainer and four 6-in. strainers. The discharge of the system is through the 48-in. conduit in the south tunnel, which is connected to the river through an 18-in. tube. The system, including all excavation, conduit and pipe work and all expense in connection therewith, was completed at a cost of $80,000.

Stephen M. Hoye, president of the New Jersey & Staten Island Railroad Company, announces that plans are being prepared for a tunnel across the narrows of New York bay, between Staten Island and Long Island. Mr. Hoye says that the tunnel can be made in a year at a cost of $6,000,000, and he is thinking of having a road wide enough for both railway tracks and carriages. The length of such a tunnel would be about two miles.

Method of Keeping Fall Block on a Derrick from Twisting and Swinging.

A simple method of keeping the fall block on a derrick from twisting is used by the Cullen-Friestedt Co. of Chicago on their contract on the New York Barge Canal at Buffalo.

As shown by the accompanying sketch a cable is fastened along the boom with about 2 ft. of slack. One end of the cable is fastened as close as possible to the sheave near the end of the boom, and the other end of the cable is fastened about 10 or 15 ft. from the base of the boom. Two flat pieces of iron about ¼x2 ins. x 2 ft. are fastened together with two sheaves between them, one sheave at each end, as shown in the sketch. This is then put on the derrick with the slack cable and the fall line passing between the sheaves, as shown in the operation of the derrick. This guide slides up and down on the cables. When the boom is being lowered the guide slides up. Besides preventing the twisting of the blocks it also serves, to some extent, in preventing the load from swinging.



Derrick Arranged to Prevent Twisting of Fall Block.

A Convenient Method for Carrying Working Drawings.

It is always necessary to have working drawings at hand on any engineering work, but the size of the prints makes it inconvenient to carry them around on the job, and often little details are not attended to on the moment because the drawings are "in the office."

Mr. G. D. Holmes, Chief Engineer Syracuse Intercepting Sewer Board, has adopted a method by which a complete set of drawings for each division, or each contract, is made up in book form (6x8-in.) size, and is available for carrying in the coat pocket.

The tracings on all the work are of a standard size and the lettering on the tracings are made somewhat large for being photographed. Plenty of dimensions are shown on all drawings to avoid all necessity of scaling.

The tracings are hung in the window and photographed and the negative is used for reproducing any number of prints.

The prints are punched on the edge, to receive the button fasteners which hold them together in the desired sets. A pliable cloth and paper cover of a size slightly larger than the prints is used for a protection and binding. This method makes it possible to carry a complete set of prints on the work at all times, and at the same time is a great saving in the wear of the original tracing, and the cost is much less than for producing the large sized prints.

A Record of Cableway Efficiency.

A letter of endorsement recently given by a high official of the Isthmian Canal Commission to the operator who had charge of the eight Lidgerwood Cableways used in building the Gatun Locks during the preceding eleven months contains incidentally a remarkable record of efficiency of the cableways. This passage reads as follows: "These cableways so far as delays from breakage or repairs were concerned, while working 12½ hours per day, have been kept up to an efficiency of 99 per cent." That is to say, that during this whole period only one per cent of time was lost on account of making repairs. The cableways referred to are eight of the thirteen cableways designed and built by the Lidgerwood Mfg. Co. for the Isthmian Canal Commission. The other five are used for handling the broken stone and sand for the concrete, taking it from barges and delivering it to the storage yards some 600 ft. away on the average. The total to be handled will be 2,000,000 cu. yds. of broken stone and 1,000,000 cu. yds. of sand. The eight cableways for building the locks are used for placing the concrete and reinforcement and also for handling forms. They are traveling cableways of 800 foot span, operated electrically. They are handling on every working day more than 3,000 cu. yds. of concrete. Up to June 4th there had been placed in the Gatun Locks and its auxiliary plant 437,461½ cu. yds. of concrete. The amount placed in the five days from May 31st to June 4th inclusive was 16,809 yds., an average of 3,361 cu. yds. per day.

The Relation of Depreciation to Gross Earnings.

In a recent paper on depreciation of public service plants, Leonard Metcalf, engineer, of Boston, makes a comparison of the effect of depreciation charges upon annual income in the case of gas and electric companies as contrasted with water works companies. Assuming for the sake of illustration a gravity plant the annual depreciation upon which might be figured at 1 per cent of cost, and comparing this with an electric or gas property upon which the annual depreciation amounts to 5 per cent, let us see briefly, says Mr. Metcalf what these depreciation items mean to these corporations in reduction of annual income, for it will be found that the effect upon income is not at all in the ratio of the relative amounts of depreciation, based upon the cost of the two plans. Attention is particularly called to this fact because it has sometimes been assumed that the amount of depreciation upon water works property is much less significant than that upon electric and gas properties and is, in a general way, commensurate with the rate of depreciation upon the first cost of the property, one-fifth more or less as shown above. But such is not the case.

The reason for this difference lies in the relative amount or gross annual earnings of these two classes of quasi public corporations based upon the value of the property. In the water works plant the gross annual income will be likely to lie between 10 and 15 per cent of its plant value. Thus in a property valued at $100,000 the gross annual income might be from $10,000 to $15,000. Let us say, $12,000. The depreciation upon this plant based upon the reproduction cost of the plant would be something less than $1,000. We may assume, therefore, that the annual depreciation will amount approximately to one-twelfth of the gross annual income.

In the case of the electric or gas property, on the other hand, the gross annual income will exceed 30 or even 40 per cent of the value of the property. Assuming a gross annual income of $40,000 upon an electric plant valued at $100,000, the assumed annual depreciation of something less than $5,000 would amount to ⅛, more or less, of the gross income. It appears therefore that under the assumed conditions the amount of the annual depreciation in the two classes of plants compared is not in the ratio of 1 to 5 (corresponding to its percentage of cost of plant) but in the ratio of 1/12 to ⅛, that is two-thirds instead of one-fifth. Whatever the exact figures may be, enough has been said to show clearly that adequate provision must be made in the earnings of rates to maintain the integrity of investment in the plant.

Sharpening and Tempering the Miner's Tools.*

There is no time lost in sharpening tools well. But good time is lost when a workman uses dull picks or drills, because there is extra call on his energy, and he is even then unable to accomplish as much as he should.

The greatest single item of expense in mining is drilling, and it behooves a man to see that his employes are provided with tools whereby they can do this work to the best possible advantage. And not only must one see that well-sharpened tools are provided, but that employes use them. More than once I have sent an employe, found working with dull tools, to the shop after sharp ones.

The proper sharpening and tempering of the tools is of such great importance that every person furnishing employment to miners should know from practical experience, just how to do it, not that he may make that his business, but that he may be able to show a blacksmith who doesn't happen to be as skilled as he should be (and somehow it seems easy to get that kind) just how the work should be done. Again, there are times when, search as he may, a mine operator cannot easily find a good blacksmith; and, if the boss is able to take a turn at the forge himself for a few days, he may save the mine from the necessity of closing down. Men soon learn when the boss is independent of their whims and caprices, and are careful not to give him a chance to exercise his skill and show them that when necessary he can dispense with their services.

A cutting tool should be so shaped that it will do good execution, also it should be sharp and, more important still, it should be properly tempered. In sharpening, the skilled worker aims to heat his steel gradually, so that all parts may have time to arrive at the same temperature, which, in an ordinary fire, ranges from 1500 to 2700 degrees F. As the steel is heated, it assumes a dark red color, as it becomes hotter it is cherry-red; still hotter, it becomes yellow; hotter still, it reaches what is called a "white heat." The heat should never be beyond the yellow, except for welding, and, as a general rule, when steel has become cherry-red, it should be taken from the fire. In exceptional instances it may be allowed to become yellow, but one should be very careful not to overheat, as by so doing the small amount of carbon in the steel which gives it its tempering quality, may be burned out, thus rendering the steel valueless.

In sharpening drill bits, the blacksmith handles his steel quickly and, giving the bit a few blows on one side, turns it over and gives it a few on the other. He does all his hammering in one way, and after he has once flattened the bit he is careful not to attempt to hammer it back to a square or a round, as that would spoil it. The steel is shaped when hot and hammered until nearly cold. Steel is improved by hard work on the anvil, having no fibres to be separated by hammering . In this respect it differs from iron. The rule in working iron is "strike while the iron is hot," and to that rule should be added, "Do not strike when it is not hot," as the fibres of iron are easily separated, causing the iron to split, if it is hammered when cold. Steel expands under the influence of heat, and hammering it as it cools makes it more compact. The blows must not be heavy. The lighter the blows in working steel the tougher it will be.

There are two ways of tempering drills. Many plunge it hot from the forge. While the tempering cannot be quite so well done, this method has its advantages, but to temper successfully in this way one must be a good judge of color. As the drills are sharpened they are allowed to cool. They are then reheated in the forge, as short a distance from the point as possible, to a dark cherry-red and plunged in water, the drill being moved about as it cools. The drill will be hard in proportion to the degree of heat to which it has been raised before cooling—the hotter, the harder and more brittle. The object, of course, is to retain the highest degree of hardness simultaneous with a valuable degree of toughness. The tempering quality of steel is due to the pressure of ¾ to 1¼ per cent of carbon. This carbon is thought to be dissolved by heat, and to be held in place by cooling. A bright red to the steel indicates a temperature approaching 1000 degrees F., a dark or black red shows approximately 900 degrees F. If drills chip and break, it shows that they were plunged at too high a heat, and the remedy is obvious. One prominent authority says: "Heat to a dark cherry-red and cool in a very strong brine made with warm, soft water. Do not draw the temper. The drill will look white, but be hard and tough."

Some temper all their drills with a draw temper, and in reality this is the only way to get the temper of a bit exactly as it should be. On being taken out of the water the point is rubbed on a sand board. The color will be gray. In a short time it will exhibit a yellowish or straw color. The books say that the bit should be replunged on this color, but my experience has been with very hard rock and bits tempered on straw color will break in drilling such rock, as if they were made of glass. Do not plunge for the second time on straw color, but wait until the color is darker, what is called copper color, and that color very pronounced. If, in taking the bit from the first plunge, the color flows to the point rapidly it has not been sufficiently cooled. The best temper is secured where the color changes slowly, the copper tinge coming evenly over the whole face of the bit, not when it is driven rapidly to the point by the darker colors.

The novice may not fin dthese directions easy to follow, perhaps. Tempering is something he must learn by experience. In other words, he is in the position of the Irishman with new boots, who remarked that he "didn't believe he would be able to get them on until he had worn them a few times." By experience only, by using his intelligence and observing results can a man hope to become skilled. If in tempering one gets the bits too hard or too soft, and he understands why, he is enabled to make an intelligent change the next time he does the work.

I quote a few suggestions from practical authorities:

"The drill should be heated to a cherry red, then plunged in cold water, to which a handful of salt is added. Make the drill bright. Draw to a light-straw color."

"Quench in water with the cold chill off."

"In order to lessen the risk of cracking during the quenching, pour oil over the water to the thickness of a card."

"Rub a piece of soap over point of drills before heating, as no scale is then formed and they come out clean after quenching."

"Heat the tool after it has been sharpened, taking care not to heat it above a dull cherry-red."

"Harden at the lowest heat that the particular kind of steel will take, in clean water at about 60 degrees."

"Heat the steel at a low red heat, so as not to raise a scale. Dip in a brine of clear salt and water [illegible] water."

"Good work may be done with either coal or charcoal as fuel. Coal containing much sulphur is inferior to charcoal."

The point of a pick should be [illegible] sharp. Some blacksmiths make the point a quarter of an inch across, and with a 45-degree bevel, like the point of a framing chisel. Good work cannot be done with such a tool. A well-shaped point is one which slopes back at least 3 ins. before it is 1 in. thick. In hard ground the point must be sharp so it will enter narrow crevices. In soft ground one cannot get hold of enough ground with a thick-pointed tool to pay for the effort expended in trying to get it loose.

One authority gives the following rule for tempering a pick: "Heat in the flame of the fire, using great care. When a very dull red heat, cool in rain water with the chill taken off. Let down to a blue or, if it should be too brittle, a little lower." Another authority says: "Leave heat enough in the tool to run the temper down to a required hardness, which is shown by the pigeon-blue color."

My experience in late years has been with all-steel picks and I find they will not stand tempering on the blue. I heat to a dark red, give two or three swirls in the cooling bath, and let the blue run entirely off the point before replunging.

Hardies and chisels for cutting iron I temper as I would a pick, stopping the flow on the blue.

Moils are tempered the same as drills.

Gads are not used as much as they should be, largely because so few blacksmiths know how to make them. As they are most frequently made they would only need sharpening to make splendid moils for cutting hitches in soft rock. The point of a gad should be wider one way than the other, being really somewhat wedge-shaped, and it should slope back 4 ins. where the steel is 1 in. or more in diameter. Such a tool must be tempered soft, so it will bend rather than break. Heat to a dark red and let the blue pass off the point. If too brittle when thus tempered, try the gad without dipping in the tub. Where the atmosphere is such that a gad will cool quickly, it will sometimes be sufficiently hard to stand work better than when tempered.

For uniformity of results in tempering, one needs as little variation in the light as possible. Preferably the light should enter a shop from the north side. Steel looks hotter in the dark than in the bright sunlight, and one must govern his work accordingly.

The Dike from Gatun to Mindi.

In past rainy seasons when the Chagres River was in flood the water spread over the flat land at Gatun and found its way to the sea through the French canal, the Mindi River, and by overflowing the flats, in addition to the main stream which is carried off by the river channel proper out past Fort San Lorenzo. A fill of 550,000 cubic yards was made in the French canal and the dredged channel of the American canal during the floods of last November, and the heavy current that set in prevented the free use of the French canal by the material barges carrying rock, sand, and cement to the locks at Gatun.

To prevent a recurrence of last season's experience, and to protect the American canal for all time against fills from this source, a dike has been built from the north or downstream toe of Gatun dam, practically parallel with the American canal, to a hill at Mindi. Thus the water that flows through the spillway will be confined to the section west of the dike and will flow out to sea by way of San Lorenzo. The dumping of material was begun five months ago and the dike is now practically finished. It is one and one-half miles long and extends from the hill in the center of the dam, known as Spillway Hill, to one of the Mindi hills. The top at the dam is 25 feet above sea level; at Mindi, 21 feet above, and [illegible] is 20 feet.

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*An article by Matt. W. Alderson, in "Mining World," Aug. 6, 1910.

About 150,000 cubic yards of miscellaneous spoil, principally from the lock site at Gatun, were dumped during the construction, which was carried on by running a track through the swamp and jungle and raising it as the dump increased in height.

The west or river side of the dike has been covered with clay which will act as waterproofing. The ridge of rock and earth which forms the dike runs through as tangled a piece of swampy jungle as will be found on the Isthmus, rich in plant and insect life and made noisy, when a human being disturbs the place, by the chattering of monkeys and the screeching of paroquets. At the point where the dike crosses the old river channel it was broadened into a substantial dam of rock and earth.

Twenty-five feet above sea level was made the controlling height, because it is not believed that the water will rise above that point even in the highest flood. In the historic flood of 1879 a record of 23 feet above sea level was made at Gatun, but this may not be accurate because the recording was not systematic. In November, 1909, 22 feet were recorded at Gatun. Since the water has been confined in the lake at about 10 feet above sea level and forced to flow through the spillway of the dam, none of the old records are infallible as a guide to future floods. The surface of the stream running through the spillway at low water is about 14 feet above sea level. It is believed, however, that the dike is higher than the water is likely to rise north of the dam. In order that it may be raised higher, in case the water should go above 20 feet during the construction of the canal, the track will be left on the dike so that spoil can be dumped there at any time.

In a paper read before the Central Railway Club, at Buffalo, on May 3, Mr. Frederick Darlington stated that estimates recently prepared for the electrification of about 100 miles of single-track railroad, with about 25 miles of side tracks and with heavy grades to be climbed and very heavy and frequent trains to be handled, show the total cost of direct-current transmission and distribution apparatus, including sub-stations, to be $2,381,000, and for single-phase alternating current with transformer stations $1,011,000. This was figured for 1,500 volts on a third rail for direct current and 11,000 volts on an overhead trolley for single-phase current. The difference in cost of the two distribution systems is $1,370,000. However, the single-phase locomotives for the same railroad, would be more costly than direct-current locomotives by about $374,500, but this amount is only about one-quarter of the difference in the cost of the transmission and distribltion appliances.

In connection with an investigation of the cost of mill buildings, Charles T. Main, mill engineer and architect, of Boston, has established some interesting relations between the size of a building and its cost. He shows that there is an immediate decrease in cost as the width is increased, due to the fact that the cost of the walls and outside foundation, which is an important item of cost, relative to the total cost, is decreased as the width increases. For example, supposing a 3-story building is desired with 30,000 sq. ft. on each floor. If the building were 600x50 ft. its cost would be about 99 cts. a sq. ft. If the building were 400x75 ft., its cost would be about 87 cts. a sq. ft. If the building were 300x100 ft., its cost would be about 83 cts. a sq. ft. If the building were 240x125 ft., its cost would be about 80 cts. a sq. ft. Of course the exact figures as to cost will vary year by year and with the locality, but the relative values will remain practically constant. The minimum cost per square foot is reached with a 4-story building. A 3-story building costs a trifle more than a 4-story. A 1-story building is the most expensive.

Personals.

Mr. W. M. Vigal has been appointed Terminal Engineer, in charge of construction at Tampico, Mex., for the National Railways of Mexico.

Mr. Mortimer D. Metcalf, of New York City, has been appointed Deputy State Architect of New York, succeeding Mr. Frank Oliver, resigned.

Mr. D. A. McLean, a contractor on the Grand Trunk Pacific Ry., Regina to Griffin branch, was found dead early this month in a slough near Cedoux. It is thought he committed suicide.

Mr. A. H. Graham, Engineer in charge of the $2,000,000 improvements being made at Grafton, W. Va., and vicinity by the Baltimore & Ohio Ry., was badly injured early this month and is now in the City Hospital at Grafton suffering from a fractured skull.

Mr. William Van Vleck Lidgerwood, representative of the Lidgerwood Manufacturing Co. at London, England, died July 27 in that city after an illness of several months. Mr. Lidgerwood was 78 years old and a brother of the late John H. Lidgerwood, treasurer of the Lidgerwood Manufacturing Co. of New York City.

Mr. John C. Sheridan has resigned his position as Chief Engineer for the Department of Highways in Brooklyn, N. Y., and will become Chief Engineer and General Manager for the Cranford Contracting Co. of Brooklyn, N. Y. Mr. Sheridan's resignation will take effect on Sept. 1. Mr. Sheridan entered the department ten years ago.

General Oliver, Acting Secretary of War, has appointed the following board of engineers charged with the responsibility of raising the battleship Maine in Havana harbor and removing the bodies which may be recovered to Arlington National Cemetery: Col. William M. Black, Lieut.-Col. Mason M. Patrick and Capt. Harley B. Ferguson.

Mr. E. T. Archer, of Archer, Rollins & Co., Consulting Engineers, of Kansas City, Mo., has severed his connection with that firm and opened an office as a consulting engineer at 426-27 Beals Bldg., Kansas City, Mo. Mr. W. B. Rollins and Mr. H. C. Westover, of the firm of Archer, Rollins & Co., have formed a new firm to be known as Rollins & Westover, Consulting Engineers, with offices at 534-35 Beals Bldg., Kansas City, Mo.

The U. S. Civil Service Commission, Washington, D. C., will hold an examination on Aug. 24-25, 1910, to secure eligibles from which to make certification to fill a vacancy in the position of marine engine draftsman, $1,800 per annum, Office of the Chief of Engineers, War Department, and vacancies requiring similar qualifications as they may occur, unless it shall be decided in the interest of the service to fill the vacancy by reinstatement, transfer or promotion.

Mr. S. P. Cobb, Associate Eingineer of the Rochester Railway & Light Co., of Rochester, N. Y., and Secretary of the Rochester Engineering Society; Mr. A. E. Hibner and Mr. John N. French, also connected with the engineering department of the railway, have resigned their positions. Mr. Cobb will take charge of the gas department of the Albany Southern R. R. and will have his headquarters in Albany. The company operates a trolley line and controls gas plants in Hudson and Rensselaer. Mr. Hibner and Mr. French will inauguratee a department of consulting engineers with the Toronto Electric Light Co., with headquarters in Toronto, Ont.

Arthur J. Wolfe, of 159 North Nineteenth Street, Columbus, O., has been appointed chief engineer of the Scioto Valley Traction Company, vice Mr. Julian Griggs, resigned. Mr. Wolfe has been with the traction company since its organization and located the tracks when the line was built down the Scioto Valley. Later, when the road was extended to Chillicothe, he was made resident engineer at Kingston, and following that was made assistant engineer, which position he has held for four or five years. His new position gives him charge of engineering work for the entire road from Lancaster to Chillicothe. His headquarters will be in Columbus.

Mr. R. N. Begien, formerly Division Engineer at Philadelphia for the Baltimore & Ohio R. R., recently made assistant to the chief engineer, has been honored by being presented with a handsome gold watch by his former assistants and associates on the Philadelphia division as a token of the good will and kind regard they have for him. The watch was especially imported, and is said to be without a duplicate in this country. Before coming with the Baltimore & Ohio R. R. Mr. Begien was connected with the B. F. Sturtevant Company, of Boston; saw service in the United States Navy, and was in charge of surveys in Nicaragua for both the United States Nacaraguan and Isthmian Canal Commissions. He has been associated with the District Electrical Engineer, of Washington, D. C., and was engaged on the construction of the Quito and Quayaquil Railroad, in Ecuador, South America. In 1903 Mr. Begien came with the Baltimore & Ohio R. R. Co. as assistant engineer in the construction department. Until 1908 he was engaged in developing certain projected improvements as well as taking part in the construction of the new union terminal at Washington, D. C. Until recently made assistant to the chief engineer, he was stationed at Philadelphia as division engineer of the Philadelphia division of the Baltimore & Ohio R. R. Co.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Battery Charging Rheostats.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

The battery charging rheostats described and illustrated in this booklet are designed to meet every ordinary requirement of battery charging service. To meet unusual conditions we are prepared to design and build special apparatus, but it is believed that the standard constructions here shown will be found suitable for most classes of automobile charging and storage battery service.

Hoisting and Conveying Machinery.—C. W. Hunt Co., New York, N. Y.

This catalog is intended to briefly describe the various types of machinery which we build. The descriptions are only outlines, and fuller information either by catalogs or by correspondence will be given upon inquiry. Illustrations of various plants are given on the last pages of this book, showing varied applications of our machinery. They are useful for the suggestions they offer in helping to solve important questions that are likely to arise when seeking some method to reduce the cost of manufacture or to increase the output of the works.

Steel Derricks and Drilling Machines.—Carnegie Steel Co., Pittsburg, Pa.

This is a first-class technical article on steel well drilling derricks, with useful illustrations. Any person interested in this class of structure, either from the structural engineering or well drilling point of view, should secure a copy.

Friction Clutches. — The Hill Clutch Co., Cleveland, O.

This pamphlet explains the uses and advantages of friction clutches and illustrates and describes a great variety of clutches of the make named. Tables of sizes are given; also a great variety of tables useful to the mechanical engineer.

Wilson Flare Light.—United States Marine Signal Co., New York, N. Y.

The Wilson flare light is a powerful, automatic, portable light produced by acetylene gas, the candle power of which varies from 1,000 to 8,000, according to the size of the apparatus. It is especially designed for use in connection with all kinds of outdoor construction work, also in mines and tunnels. To contractors and railway companies particularly it is an exceedingly useful apparatus. For all open air purposes where a powerful portable light is required the apparatus will be invaluable. It is intended to replace oil lights, which are much more costly, as well as being very troublesome and inefficient.

Raymond Concrete Piles.—Raymond Concrete Pile Co., New York and Chicago.

This volume is a useful technical publication, being a treatise on concrete piles of the type named. The subject is discussed under the following headings: The Development of the Concrete Pile; The Most Widely Used Type of Concrete Pile; Local Conditions Determine Type of Pile to be Used; The Method of Making and Placing Raymond Piles; The Shell; The Core; Assembling the Shell; Placing the Shell; Filling the Shell; Reinforcing the Pile; Standard Sizes; The Basis of the Superiority of the Raymond Pile; The Function of the Shell; The Importance of Protecting the Setting Concrete Against Distortion; Speed in Placement; Inspecting the Pile Before Completion; Testing the Carrying Capacity; The Advantage of the Tapering Shape; Comparative Tests of Piles of Varying Tapers; The Economy of Tapering Piles; Where Straight Piles are Preferable; How Straight Piles Increase the Cost of Foundations; The Economy of Concrete Piling; Why Concrete Piling is Superior to Wood Piling; The Disadvantages of Wood Piling; The Basis of Comparison Between Wood and Concrete Piling; The Difficulty of Establishing Standard Prices of Concrete Piles; The Reason for the Greater Carrying Capacity of Concrete Piles; Concrete Piles Independent of Permanent Water Line; The Cause of Decay of Wood Piling; Importance of Constant Saturation of Wood Piling; Conditions that Menace Constant Saturation; Influence of Water-Line Upon Cost of Piling; Saving in Time Effected Through the Use of Concrete Piles; The Advantages of Concrete Piles Over Spread Foundations; Some Illustrations of the Initial Economy of Raymond Piles; U. S. Naval Academy, Annapolis; Reinforced Concrete Conduits; Specifications for Raymond Piles; Concrete Docks, Bulkheads and Similar Structures; The New Atlantic City Boardwalk; The Missouri River Revetment; The New Baltimore Docks; The Advantages of Concrete Docks and Bulkheads; The American Tobacco Company's Bulkheads; The International Harvester Company's Bulkhead; The Maryland Steel Company's Ore Dock; Some Users of Raymond Piles.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week. The principal government contract let recently appears to be the one for extending the Dry Dock No. 3 at the navy yard, Norfolk, Va. William L. Miller, 19 Milk St., Boston, Mass., secured the contract at $553,788.—The National Railways of Mexico has just placed an order for 15,000 tons of 85-lb. steel rails in Belgium. The principal feature of interest in this item is the report (unconfirmed) that an American company offered to supply the rails at $26.50 per ton.—Preliminary estimates of the Canadian government engineers set the cost of deepening the Saskatchewan River to make navigation possible between Edmonton, Alta., and Winnipeg, Man., a distance of 1,500 miles, at $15,000,000. It is said that the project may be undertaken next year.—The second dam of the Canadian government's Ottawa River storage system has been finished by the contractors and turned over to the engineers. This dam is situated at one end of one of the outlets of Lake Kipewa, lying about 9 miles east of the Ottawa and discharging into it at a point about 300 miles up stream from the capital. The entire storage scheme calls for 45 dams located throughout an area of 45,000 square miles, controlling all the important lake expansions and feeders of the upper reaches of the Ottawa River and regulating the flow of the Ottawa for 600 miles from its course.—Several fair sized ditch and levee contracts were let during the past week. Among these may be noted the following: The Canal Construction Co., 188 Madison St., Chicago, Ill., at $61,941, for constructing the Garretson drainage ditch in Woodbury County, Ia.; Hearin & Ryan, New Orleans, La., at $50,868, for constructing 334,000 cu. yds. of levee work in the Lower Tensas Levee District; Lowrance Bros. & Co., Memphis, Tenn., at 20.4 cts. per cu. yd., for 226,000 cu. yds. of levee work in the Upper Yazoo Levee District.—Two large electric railway propositions seemed to have about reached the final stage of promotion work. These are the Chicago & Wisconsin Valley R. R. and the St. Louis & Kansas City Electric Ry. Co. The latter company is reported to have placed a $15,000,000 bond issue in France and the prospects are said to be good for the commencement of construction work this fall. The road will cost about $12,000,000. The Chicago & Wisconsin Valley R. R. is also said to be planning to have construction work on the first section started this fall. This road is to be 130 miles long and will extend from Madison, Wis., to Stevens Point, Wis. It will cost about $3,387,600, and is to be built by the Western Indiana Construction Co., 6 Sherman St., Chicago, Ill.—Among the railroad construction contracts let recently are the following: C. L. Merritt, Pensacola, for the last ten miles of the Pensacola, Mobile & New Orleans Ry., the work being located north of Daphne, Ala.; Claibourne, Johnston & Co., Baltimore, Md., for the construction of four spur tracks for the Western Maryland R. R. from Thomas, W. Va., to the mines of the Davis Coal & Coke Co.; John L. O'Connor, Knoxville, Tenn., for constructing a two-mile terminal spur at Athens, Tenn., for the Athens & Tellico R. R.; J. N. Gillis & Son, Brewton, Ala., for extending the line of the Mississippi Eastern R. R. northeast into the timber belt; Foley, Welch & Stewart, St. Paul, Minn., for 26 miles of track to be built for the Canadian Pacific Ry. between Carmangay and Aldersyde, Alberta; C. E. Deakin, Montreal, Que., for the $1,000,000 station and office extension of the Canadian Pacific Windsor St. station at Montreal, Que.—Bids [illegible] being asked by the city of New Orleans for the construction of the large reinforced concrete sea wall at the west end of the city, mentioned some time ago in this paper. The sea wall is to be about 2,700 ft. long and 14 ft. high and will rest on a pile foundation. Bids are to be opened Sept. 19. Bids will be received at the same time for filling in with earth for the bed of Lake Pontchartrain, this work including 400,000 cu. yds. of earth. W. J. Hardee is city engineer of New Orleans, La.

Why the Cook Left. The cook of a construction camp is a personage of no small importance. Upon him devolves the task of preparing the food for many hungry men, and much depends on whether he does his work well or badly. If he does his work well he is the most popular person about the camp; but if he falls down on his job he—but read below what happened to a cook of this kind in a railway grading camp in Texas. This cook quit after the week's work and the contractor refused to pay him for what he had done. The cook brought suit to recover a week's pay and when the case was brought to trial he gave the following version of why he threw up his job: "I went out to the camp on Monday and began work the next day. I didn't have any trouble Tuesday, except that some of the men wanted to know if I hadn't made a mistake and given them dish water in place of coffee. I hadn't made no mistake. The next day everything was all right until after supper and then three or four of the men came round and asked me if I wasn't going to take a vacation soon. Thursday I gave them a fine bunch of grub, but after supper a big teamster came to the cook tent and hit me several times. He said he had broken a tooth on a button which was in his pie. Six or seven other men also took a hand and they shook me up considerable. They told me to beat it while my wind was good. The next morning when I got up I found that some one had stolen my pants. I had another pair though. I didn't have no trouble that day, but in the evening a lot of men pulled me out of my bunk, threw a lot of water on men and told me to get out. Saturday I gave them pie three times and baked some raised biscuits. After supper some of the men got mad at something and grabbed me and tied me on a wheeled scraper. They put a bushel basket on my head and a lot of them pulled me all around the camp. Then they started the scraper down the hill with me on it. Down I went into the creek and got all wet. I got mad then and quit."

The March of Progress. When on Nov. 4, 1825, the first boat traveling along the Erie Canal reached New York it was thought that the final perfection in canal construction had been reached. But 85 years brings many changes even in the construction of canals. Perhaps no better illustration of this march of progress or clearer contrast between the old and new can be given than by comparing the lock tender of the original Erie Canal with his brother of the present Barge Canal. The old time lock tender might have been seen with his back against a great balance-beam and his feet braced against a cleated pathway, straining every muscle to close one of the gates, then running across a bridge over the lock to close the opposite gate, next running to the other end of the lock and out upon the gates to [illegible] and raise the [illegible] lever, and after the boat had been raised or lowered—repeating the operation all of which had to be performed by main strength at each lockage and [illegible] cargo, had been locked through. On the new Barge Canal the lock-tender, at his operating stand near one of the hollow quoins, will throw successive switches, first to open the buffer-beam and gates for the incoming vessel, then to draw into the lock by means of a capstan the boat, or perhaps, a pair of traveling tandem or a fleet of flour, with their loads of 3,000 tons or more to the pair or fleet. Another switch will open the valves for filling or emptying the lock, both gates and valves being controlled from either side of the lock without crossing over, and all of these operations will be performed by electrically-driven machinery, the power being generated in a near-by power house, where the head of water created at the lock will be utilized.

The Commission Form of Government. The commission form of city government which was brought into being several years ago at Galveston, Tex., to meet the chaotic conditions prevailing as the result of the tidal wave that swept away the greater part of the city, seems to have gained a firm foothold in this country. Over 70 municipalities now have some form of commission government, the latest additions to the list being Muskogee, Okla., and Columbia, S. C. The citizens of Birmingham, Ala., have voted 8 to 1 in favor of the plan, and two other Alabama cities, Mobile and Montgomery, now have the matter under advisement. In the south, possibly because of the absence of an opposition party, the movement seems to be making its greatest headway. The citizens of three cities in Tennessee—Chattanooga, Knoxville and Nashville—are now agitating the adoption of such a system, and a vigorous campaign for the new form of city government is being carried on at Pensacola, Fla. The citizens of Richmond, Va., Asheville, N. C., and Charleston, S. C., are also taking steps to do away with the present form of municipal government in these cities. Tentative discussion of the matter is also being carried on at Baltimore, Md.

Please Remit. The Surveyor states that the Ogmore and Garw Council, England, has received the following claim. "I beg to send my claim to you. You know very well what for When I owe you money, you are sending very sharp letters to me. Understand it is my turn now. You know alright that you have put a manole and a long string of pipes in my garden. A bominabul stink from that there manole, and you think I've no claime agin you. You pay up, and very quick. Now I want £15, 'cos I am going on my holidays. I know I owe you £3. You take it out, and send me £13, and I will be off next week.

Church & McCoy Co., St. Paul, Minn., has started work on its contract for tunneling under the Spokane River for about a quarter of a mile west of the upper falls in the business district of Spokane for the Washington Power Co. Four water wheels of 1,000 kilowatt capacity will be installed to generate 53,500 hp.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Louisville and Nashville R. R. and the Nashville, Chattanooga & St. Louis R. R. have notified the City Engineer of Gadsden, Ala., that they were ready to proceed with the work of changing the grades of their roadbeds where this is necessary to have them conform to the grades of the streets that are being paved. The Nashville, Chattanooga & St. Louis R. R. will raise its tracks where they cross 4th st. and the Louisville & Nashville will change the grade of its roadbed from the river bridge to 6th st. When this work is done the paving of North 4th st. will proceed and the Alabama City, Gadsden & Attalla Ry. Co. will be able to lay its tracks and bring its North Gadsden cars into the city.

The grading and the chief part of the bridging on the first 30 miles of the Pensacola, Mobile & New Orleans Ry., are about ready for the ties and steel. No track, however, will be laid before Oct. 1. There are no obstacles in the way of getting 40 miles of this line in operation very soon after Jan. 1, 1911. The contract for the entire line of this road, approximately 50 miles, is held by Henry McLaughlin, Pensacola, Fla. He recently sublet to C. W. Merritt of Pensacola, Fla., the greater part of the last section of ten miles. This latter work is about 3 miles north of Daphne.

New 80-lb. rails are being shipped to Sheffield, Ala., for replacing the lighter rails now in use on the Southern Ry., from the junction with the Southern and Northern Alabama Ry., 2 miles east of Sheffield to a point below Tuscumbia. Work will be started, it is said, as soon as the material is at hand.

The Tuscaloosa Mineral R. R. has been incorporated with a capital stock of $25,000, of which $4,562 has been paid in. The company proposes to construct, maintain and operate a railroad from Tuscaloosa to Florence through the counties of Jefferson, Walker, Etowah, Tuscaloosa, St. Clair and Lauderdale. The incorporators are: F. G. Blair of Tuscaloosa; F. M. Moody, H. B. Foster, P. D. Brown, E. B. Nuzum and A. S. Vandergraff, of Tuscaloosa.

The Louisville & Nashville R. R., J. E. Willoughby, Engineer of Construction, Louisville, Ky., has surveys under way and is securing right of way for double tracking its line north of Black Creek into Decatur, Ala.

The Birmingham, Demopolis & Scranton R. R. Co. has been incorporated and proposes to build a railroad from Pascagoula, Miss., to Birmingham, Ala. The promoters for the most part are citizens of Demopolis, Ala.

Arizona.

The Twin Buttes R. R. has been formally taken over by the Tuscon & Nogales R. R. Co. The deed of conveyance gives to the Tucson & Nogales R. R. Co. the Twin Buttes railroad and its appurtenances beginning at its point of physical connection with the Southern Pacific Railroad and extending to Engineer Station 974, a distance of 17.9 miles.

Surveys have been completed by the engineers of the El Paso & Southwestern R. R. for the proposed line from Benson, Ariz., to Florence, and location surveys are soon to be made.

Arkansas.

The citizens of Pine Bluff, Ark., have succeeded in raising over $70,000 of the $100,000 required to secure the building of the Memphis, Dallas & Gulf R. R. extension to that city.

Officers of the Marianna & Southwestern R. R. Co. on Aug. 4, met eastern and northern capitalists to discuss further financiering of the road so that it may be extended from its present terminus at Big Creek, Ark., through Marianna to a connection with the Missouri & North Arkansas R. R. at Obery, and thence later through Pine Bluff to a connection with the Rock Island between Fordyce and Hope, Ark. It is estimated that the line, which is now doing a logging business from Big Creek to Heth, will cost, when extended to Obery, $450,000. The officers of the company are J. T. Robertson, Marianna, Ark., President, and H. F. Roleson, Marianna, Vice-President, and Attorney W. R. Mann of Marianna, is promoting the road, as is P. C. Allen of Memphis.

The Hot Springs Street Ry. Co., H. E. Martin, General Manager, Hot Springs, Ark., proposes to extend its street car line for a distance of seven blocks to South Hot Springs.

The Arkansas State Board of Railroad Incorporators has granted an 18-month extension of the charter of the Arkansas Belt Railroad Company, which proposes the construction of a line from Rush through Yellville to Stone, a distance of 40 miles in Marion County. The road, which will be constructed through a mountainous country, will cost between $30,000 and $50,000 per mile. The company is capitalized at $1,500,000 and is now completing necessary negotiations preparatory to starting active construction work as soon as possible. The officers are Dr. H. Wells, President; W. E. Layton, Secretary, both of Yellville, and Frank Pace, Attorney, Little Rock.

The State Board of Railroad Incorporation of Arkansas has granted a petition of the McCrory & Beedeville Southern Ry. Co. for the right to extend that railroad two miles to Jelks, making a direct connection between McCrory and Jelks, a distance of 16 miles. The officers are: C. Haily, President; R. B. Keating, Secretary and Treasurer; E. L. Hamilton, Vice President and General Manager.

Surveys will be started Sept. 1 for the line of the recently organized St. Louis, Fort Smith & Dallas R. R., though no construction work will be attempted until after January 1, 1911. M. C. Burke, Fort Smith, Ark., states that the route will be from that city to Wilburton and will be eventually extended to connect Dallas and St. Louis by a direct line.

The Indiana & Arkansas Lumber and Manufacturing Co., which recently purchased a large body of timber near Mariana, Ark., has employed J. T. Edwards, C. E., Marianna, Ark., to make a survey for the construction of a short railroad about 5 miles in length to the holdings. It is planned to lay 40-lb. steel on the road and it will be necessary to construct a bridge over the L'Anguille river, which flows between Marianna and the other terminus of the proposed line.

Advices from Jasper, Ark., state that the survey of the Fort Smith, St. Louis and Chicago R. R. south to Jasper, has been completed. The next survey will be made from Jasper to Harrison, a distance of 18 miles. It is said there will be four tunnels on the line, but that the grade of 1½ per cent has been maintained the entire distance. The grade from Harrison to the Newton county line will minimize the cost below that which was expected.

California.

The Senate of Haiti has ratified the railroad and plantation contracts submitted by an American syndicate of which James P. McDonald of New York is the head. The railroad concession by the government permits the construction of a railroad in Haiti and an interest in the banana trade and other fruit interests. The contracts provide for the extension and consolidation of the concessions previously granted to the National Railroad Co. of Haiti. The company will issue bonds, the interest and principal of which will be guaranteed by the Republic of Haiti. The railroad will connect the interior of the country with four seaports and will run through the Artibonite River valley.

The Oakland & Antioch Ry. Co. of Oakland which now has grading well under way in its projected road between the points named has placed orders for 60,000 ties. Some of the rails for the line have already arrived and orders have been placed for cars.

The Yreka R. R., which operates eight miles of line from Montague on the Southern Pacific to Yreka, is said to be planning to extend its line into Scott Valley. The motive power of this road is gasoline cars. H. L. Walther, Yreka, Cal., is General Manager.

Farey & Jeffries, Engineers, Monteca, Cal., have been employed by the San Joaquin Electric Co. to start surveys and grading from Stockton to Modesto.

The Porterville Northeastern Ry. Co. filed its articles of incorporation at Visalia, Tulare County, Cal., on July 25. The company is organized with a capital stock of $300,000, of which $18,500 has been subscribed. The incorporators are F. U. Nofziger, A. M. Coburn and G. W. Zartman. The purpose of the company is to build a steam road from Porterville to Springville, a distance of about 16 miles, in Tulare County, Cal., connecting with the Southern Pacific R. R. at Porterville. C. S. Freeland is Chief Engineer, with headquarters at Porterville.

Surveyors of the Humboldt & Eastern R. R., headed by J. N. Lentell, have started work on the proposed line, easterly through Wildwood to Good's Mountain Pass on the Trinity-Shasta County divide. The pass, which has also been taken into consideration by the Southern Pacific surveyors, is the lowest gap in the Trinity-Shasta County divide and it looks as though there is liable to be a struggle to obtain possession of it.

Advices from San Bernardino, Cal., state that the residents of the Palo Verde country are strong in the belief that the Sante Fe is planning to soon construct a line from Calzona on the Parker cutoff, south along the west bank of the Colorado river, through the above districts and then on south across the Imperial valley to connect with the Spreckles road now building east from San Diego. It is said that a complete line of railroad stakes can be traced over this route, and the fact that the line starts from the Santa Fe and that Spreckles and the Santa Fe have always worked together in the past leads the residents of the Palo Verde country to believe that the Santa Fe is getting ready to commence operations in the very near future. A line built on this route would mean the tapping of a rich mining country, also the providing of an outlet for one of the richest agricultural sections in the entire southwest.

Citizens of Burbank and Crescenta are raising bonuses to induce the Glendale & Eagle Rock Ry., E. D. Goode, Manager, Glendale, Cal., to extend its line to those places.

The Western Pacific Ry. Co. has purchased a large area at Sacramento, Cal., and has broken ground for the construction of an immense shop and general mechanical plant at that point. The work will be completed and the shops in operation within a year.

Surveys and negotiations for rights of way for the proposed line of the Sacramento & Sierra Ry. Co. have been practically finished by the engineering crew and the attorneys. Construction work, it is said, will be pushed as far as Rattlesnake Bar this year and rushed to completion next season.

A crew of surveyors of the Southern Pacific, under the lead of Chief Engineer Cooper, is now located in Little Valley, near Dixie Valley, 45 miles north of Susanville, Cal. This party has made a permanent survey for Wadsworth, Nev., northwest through Pyramid Lake Indian reservation, thence intersecting the Western Pacific R. R. between Smoke Creek and Doyle, thence west near Amadee and through Honey Lake Valley to Dixie Valley.

The directors of the Vallejo Northern R. R. Co., at a meeting at Vallejo, voted to increase the capital stock of the company and it is believed work will be started soon on the new electric railway between Vallejo and Sacramento.

Orders are stated to have been issued by the officials of the Southern Pacific to have work started this month on double tracking the main line between Los Angeles and Colton. The work later is to be continued to Redlands Junction and thence to Beaumont, either on the present line or by continuing the Crafton line through the Yucalpa valley to Beaumont.

Colorado.

The Chicago, Burlington & Quincy R. R. has secured the entire right of way for its line to connect Groves and Greeley.

Good progress has been made in the promotion work for the proposed interurban electric line from Montrose to Delta, 29 miles, and it is now believed that the project will be financed by Montrose parties. It is proposed to run the new line on the west side of the Uncompahgre river, along Spring creek and California mesa and through Shavano and Coal Creek valley. I. N. Pepper, Montrose, Colo., is interested.

A new company—the Denver & Colorado Springs Electric Ry. Co.—has secured all rights of way between Denver and Pueblo for an electric railway and it is said that active work will be started this year.

The Denver & Intermountain R. R., F. L. Butler, General Manager, Denver, has applied to the City Council of Golden, Colo., for the right to construct a line across certain streets of the city and along the creek bottom to the new metallurgical plant of the School of Mines and to the Rubey clay mines. It is also planned to construct a line to the Parfet mines at the southern edge of the city and a line to the Coors brewery.

The Idaho Northern R. R. is running a recognizance survey through Long Valley from the south to a point three miles north and east of Rosebury, Idaho. One line has already been completed, but the crew is working on another in order to locate a better route if possible.

The Colorado Midland Ry., F. F. Mallon, Chief Engineer, Colorado City, Colo, is said to be planning to build a branch from Wellington, Colo, to Cheyenne, Wyo.

Georgia.

The Georgia Southern & Florida Ry., W. C. Shaw, Jr., Chief Engineer, Macon, Ga., is to expend $80,000 for improvements along the line between Macon and Jacksonville, Fla. Of this amount $37,600 will be for passing tracks and $45,300 for constructing water stations with stand pipes.

Redmon & Co. of New York are reported to have taken over the holdings of the E. H. Harriman estate in the stocks and bonds of the Augusta-Aiken Ry. & Electric Co. and allied properties. The purchase price is stated to be $2,700,000. The new owners are said to intend to begin immediately the extension of the road from Augusta westward to Atlanta and from Aiken northward to Columbia. The completion of the project will give a continuous line between the capitals of South Carolina and Georgia, a total distance of 280 miles. Jno. H. Adams, Augusta, Ga., is Chief Engineer.

The promoters of the Jacksonville and Atlanta Short Line R. R. are reported to have submitted a proposition to the Macon Chamber of Commerce stating that arrangements have been made for the construction of the line as far as Hawkinsville. Should the proper offers be made for terminals and right of way it is stated the road will be brought by way of Fort Valley to Macon.

Illinois.

The City Council of Peoria has granted a franchise giving the proposed Peoria & Galesburg Interurban entrance into Peoria on South Washington st. from the west line of Krause ave. to Cherry st. The franchise is similar in its provisions to the ordinance already granted the company from Cherry st. to Hamilton over the Peoria Ry. Terminal tracks. It is now believed that the interurban company of which Smith Attwood is President, will go ahead with its plans for building its line between Peoria and Galesburg.

Tracklaying on the Cairo & Thebes R. R. has been pushed steadily forward and it is believed that the track gang will reach Beech Ridge by Aug. 15. The construction gang will than be taken to Fayville and will work both ways, towards Cairo and towards Thebes.

The Eastern Illinois Ry., Co., mentioned in our last issue, has completed surveys and has secured the capital for the construction of its projected electric railway. The projected length of this line is 11 miles and it is to extend from Hammond, Ind., through Harvey, Ill., and Riverdale. T. E. Mitten, Chicago, Ill., is President. A. L. Drum & Co., 624 American Trust Bldg., Chicago, Ill., are the consulting engineers.

James Newkirk, contractor in charge of the Rock Island elevation work in Joliet, Ill., is making preparations for resuming work and is quoted as stating that trains will be running over the new right of way by December.

Illinois Central R. R. has had surveys made for the construction of the proposed subway for Second South St. in Champaign, Ill., and work will be started at once and completed according to contract by Nov. 1. **Action was delayed** owing to the inability of **the city officials to** decide just what was wanted.

The Chicago & Northwestern R. R. in order to secure gravel for the construction of the roadbed for the proposed Hawarden cutoff, to be completed this fall, have purchased gravel pits near Hawarden, Ia. Some unexpected work is required on the new line because of improvements on the Great Northern Railroad which parallels it for a distance of several miles. When the latter road raised the grade of its roadbed, the Northwestern found itself obliged to do likewise, and for this purpose it has bought a number of farming tracts in 40-acre pieces to get dirt with which to raise the grade.

Grading work is reported to have been started on the 12-mile Wauconda & Palantine section of the Waukegan, Rockford & Elgin Traction Co. This first section will connect Wauconda at Palantine and will pass through Lake Corners, Junction Corners and Lake Zurich. Robert D. Wynn, Waukegan, Ill., is the promoter of the company, which has its headquarters at the Palantine Bank, Palantine, Ill.

The Chicago, Milwaukee & Gary Ry., I. W. Troxel, Chief Engineer, Chicago, is making surveys of its right of way from Aurora to Joliet. The company expects to have its tracks laid from Aurora to Joliet by next summer, when its lease with the E., J. & E. expires. It is stated that the company has decided not to build from Rockford to Milwaukee this year, but will extend its line next year. The route is now from Rockford through Kirkland, DeKalb, Aurora and Joliet to Momence. The link between Joliet and Aurora will give the C., M. & G. its own right of way over the entire distance.

The Alton & Southern R. R. Co. has been incorporated with a capital stock of $10,000 and proposes to operate a belt railway in East St. Louis, Ill.

Formal announcement has been made of the plan on which the Walsh railroads, the Chicago Southern and the Southern Indiana, are to be reorganized. A new company, to be known probably as the Chicago, Terre Haute & Bedford Ry., will be formed to acquire the railway, the equipment and other property of the two Walsh lines and the other companies owned or controlled by them. The new company will also acquire the Bedford Belt Ry., subject to its existing liens. The new company will have an authorized issue of $20,000,000 of first and refunding mortgage bonds, of which only $2,500,000 will be sold for the present; an issue of $6,500,000 of income bonds and an issue of $5,500,000 of common stock. In the reorganization all of the income bonds and all of the common stock will be issued. The proceeds of the $2,500,000 of refunding bonds to be sold will be used to pay off the receivers' certificates against the properties and the past due interest on their bond obligations, to settle other claims and to provide for the purchase of the Bedford Belt. The total of this cash requirement is $2,339,157.

Advices from Joliet, Ill., county seat of Will County, state that the Chicago & Alton on July 26 filed at the recorder's office an $18,000,000 mortgage. The mortgage covers a bond issue about to be made by the company for the purpose of improving the roadbed and equipment. It is said the mortgage will be recorded in the various counties of every state in which the road runs.

It has been announced by Arthur Montzheimer, Chief Engineer, Elgin, Joliet & Eastern R. R., Joliet, Ill., that there is no immediate prospect of any extensive double-tracking on the road between Joliet and Waukegan.

The St. Louis Southern Ry. Co. has been incorporated with a capital stock of $25,000, and principal office at East St. Louis, Ill., and proposes to construct a line from East St. Louis to Cairo, through the counties of St. Clair, Monroe, Randolph, Jackson, Union and Alexander. The incorporators and first board of directors are Henry G. Offenbacher, T. W. Stoddard and George O. Rogers of St. Louis; Whitney Galbreath of Chester; C. H. Bayless, J. H. Hohl, Frank C. Smith, A. C. Mann of East St. Louis.

A company, to be known as the Springfield & Central Illinois Traction Co. is to be formed for the purpose of building an electric railway from Springfield through Pawnee, Morrisonville, Hillsboro, Coffeen, Greenville, Carlyle and Centralia. Branch lines will be run to Vandalia, from Coffeen, and on to the southeast, passing through Kinmundy, Flora and Mount Carmel, on the Wabash river. Another line to the west will connect Greenville with Alhambra, Edwardsville and East St. Louis. The estimated cost is $3,000,000, and it is said that surveys will be started soon. Isaac A. Smith, C. E., National Bank of Commerce Bldg., St. Louis, Mo., is interested.

Indiana.

The St. Joseph Valley Traction Co. has been given the right to cross the Lake Shore & Michigan Southern Ry. right of way in Bristol, thus removing the chief obstacle to the construction of the line between Bristol and Middlebury. It is intended to complete the line between these places this year, and most of the right of way has been secured. L. T. Owen, Lagrange, Ind., is Chief Engineer.

Good progress is being made with the extension of the Evansville & Rockport traction line, being built from Rockport to Grandview, and cars are expected to be running on the extension some time this fall. It is probable the residents of Troy, Tell City and Cannelton will be asked soon to vote a tax for the extension of the road to those towns.

The Northwestern Indiana Traction Co. started work the last of July on the construction of the final connecting link of interurban railway between Joliet and Gary. The grading between Chicago Heights and Dyer was begun and will be pushed rapidly to completion. From Dyer the track will run to Hammond. At present there are tracks from Hammond to Gary. The track from the Heights to Hammond is expected to be in condition for use inside of four months.

Officials of the syndicate controlling the Terre Haute, Indianapolis & Eastern Traction system, Robert I. Todd, General Manager, Indianapolis, have made a second trip over the two proposed extensions of the Indianapolis and Danville lines to Amo, closing a 7-mile link to the main line from Terre Haute, and opening up a new line 55 miles long from Rockville to a junction with the Indianapolis line at Danville.

Iowa.

E. E. Pastor, Corydon, Ia., has started work upon a plan for the building of a river interurban railway through the southern tier of counties in Iowa.

The South Dakota Interurban Ry. Co. has started securing franchise in the cities along the right of way of its projected line from Sioux City, Ia., to Chamberlain, S. Dak., by way of Bijou Hills, S. D. Surveys between the last two places are to be started Sept. 1. About 50 miles of right of way has been secured. W. E. Miller, Iowa Bldg., Sioux City, Ia., is President.

The Commercial club of Sioux City is taking steps to secure subscriptions of $25,000 to aid the Sioux City & Spirit Lake Interurban Ry. Co. Efforts are being made to raise $75,000 and of this amount $40,000 has already been secured. The present assets of the company are as follows: Maps and profiles of survey from Sioux City to Spirit Lake, both via Perry creek and via Floyd valley. Transit and level notes of the line. Right of way maps and schedules for both surveys. Profiles and tracings of line from Third and Water sts., Sioux City, to city limits, and the same of all the towns along the line and Arnolds Park. Blue prints of railway yards in all towns and Sioux City. Twenty-five year franchises for street and interurban railways in Le Mars, Granville, Primghar, Hartley and Spirit Lake. Guarantees for depot sites, stock yards and right of way in all these places. Deeds and contracts to deeds for 60 miles, of right of way and guarantees for 22 additional miles. Fred Davis, Commercial club, Sioux City, Ia., is Secretary.

The Des Moines City Ry Co. of Des Moines has announced that its street railway tracks, which are to be connected up with those on the 6th ave. bridge will be extended north to Corning ave. and thence east on that street to connect up with the belt line tracks.

Engineers under the direction of County Surveyor Tyfor of Northwood, Ia., are now making surveys for the projected line of the recently incorporated Forest City, Mason City & Fertile R. R. Co.

Engineers said to be in the employ of the Chicago Great Western R. R. were working in the vicinity of Nevada, Ia., last week and have surveyed the line from a point just north of Shipley directly north to a point a half mile west of the town of Roland on the Story City branch of the Iowa Central. This line will miss Nevada by about three miles. The line parallels the St. Paul & Des Moines railroad between Shipley and Cambridge. This is believed to be part of the surveys for a connecting line between Des Moines and Clarion.

The City Council of Muscatine, Ia., has adopted a resolution by which the Citizens' Railway & Light Co. was ordered to practically rebuild its entire line within the limits of brick paving in Muscatine. The company was ordered to commence work at once on the laying of the 70-lb. rails on a number of the principal streets.

Track laying on the new Chicago & Northwestern cutoff from Wren, Ia., to Hawarden, is under way and will probably be completed this month. The new branch is 30 miles long and will cost about $1,500,000. Nearly a year was spent in grading the right of way. J. A. S. Redfield, formerly division engineer of the Northwestern railroad in Sioux City, is superintending the work of the cutoff.

Kansas.

The stockholders of the Missouri, Kansas & Texas R. R. have authorized an increase of the bonded indebtedness of the company not to exceed $125,000,000 outstanding at any one time. The bonds are to bear interest at 5 per cent from April 1 this year. They are to be issued at such times and for such purposes as the directors may determine.

The incorporators of the Winnipeg, Salina & Gulf Ry., mentioned in our last issue are as follows: H. Leone Miller, M. J. Quinn, H. J. Nesmith, C. H. Wyatt, T. R. Quinn, T. B. W. Seitz, Otto Peterson, J. Vaughan and B. F. Brown, all of Salina, Kan.

John A. Keeran, secretary of the Gulf & Northwestern R. R., who is at present in Tribune, Kan., securing right of way for the project, states that the necessary land has been secured north of Sharo Springs and that it is expected that active construction work will be commenced early this fall.

Kentucky.

The Wasioto & Black Mountain Ry., now under construction, from Wasioto, in Bell county, to Harlan and up Poor Fork, will be completed to Harlan, Ky., Nov. 1, according to an announcement of G. W. Callahan, President of the Callahan Construction Co. which has the general contract. Twenty-three firms, which have sub-contracts, are doing the grade work, and 2,000 men are employed. On account of rainy weather in June and the early part of July the contractors received a setback in their work, but now the construction is going ahead with a jump and the road will be completed on contract time.

A company has recently been organized in Somerset, Ky., to construct a new railroad to run from Corbin, in Whitley County, through a portion of Laurel, Pulaski to Somerset and then on to the Cumberland river at the point where Fishing Creek empties in, a distance of 45 miles, and eventually through to Glasgow to intersect the Illinois Central. This would penetrate some of the finest coal fields to be found anywhere in the state, as there are a number of veins in the various counties which range from 24 inches to 5 or 6 ft., and which are undeveloped because it is now too far from any railroad. The section is also well timbered, there being thousand of dollars' worth of timber along the route. The representative of the eastern capitalists, who has been in Somerset for two weeks, has returned to Philadelphia, but is ready to begin the financing of the road just as soon as the organization gets things in a little better shape. It is stated that this road will be completed within less than two years.

Louisiana.

The Shreveport Traction Co., L. M. Levinson, General Manager, Shreveport, La., is considering double tracking the West End or Fair Grounds Line from Park Ave. to the fair grounds at Shreveport.

J. C. Ables, Oak Grove, La., is making good progress with the construction work on the Frank Janes Lumber R. R., from Terry to Janesville, La., a distance of six miles. Rails will be laid and the road will be ready for operation Sept. 15. Preparations are being made to purchase two locomotives, six flat cars, four box cars and two passenger cars.

Maryland.

The contract for the construction of four spur tracks for the Western Maryland R. R., has been let to Claibourne, Johnston & Co., Baltimore, Md. The tracks which are to be completed within four months according to the terms of the contract, will lead into the mines of the Davis Coal & Coke Co., from Thomas, W. Va.

The Baltimore & Ohio R. R. has started work on the erection of the bridge carrying Hamburg St. over its tracks in South Baltimore, Md. This marks the beginning of the work on the grade crossings in South Baltimore, which will take several years. The ordinance, which requires the railroad to eliminate all grade crossings in South Baltimore, requires that it shall begin work before Aug. 16, 1910. There will be four bridges, which will carry Lee, Hamburg, Cross and Stockholm Sts. over the tracks.

The Vang Construction Co., of Cumberland, Md., has been incorporated with a paid-up capital of $5,000. The incorporators and directors are George Vang, president and general manager; John G. Shearer, secretary and treasurer, and Robert H. Shearer, all of Cumberland. The company will do general construction work and now has a contract on the Western Maryland extension, near Mount Savage, that will run about $90,000.

Michigan.

Surveyors for the proposed railroad from Cedar Creek to Huntington, Mich., are now in the field and prospects for the construction of the line within the next few weeks are very bright.

The Detroit & Mackinac Ry. is now making surveys for a 13-mile extension from Posen, Mich., to Rogers City, Mich. It has not been definitely decided as to whether this line will be built. If it is to be built, however, the company will do the work. H. S. Waterman, East Tawas, Mich., is Chief Engineer.

It is estimated that the Grand Rapids & Indiana Ry. will, this season, spend about $150,000 for terminal improvements, in Grand Rapids, Mich. About two miles of the road through the congested district is to be double tracked. The freight house is to be extended 240x60 ft. A new freight house is to be built at Fuller station, 150x30 ft. An eight-stall 160x90-ft. addition is to be made to the roundhouse for the locomotives. A new water plant is to be installed at the south yards with a tank of 100,000 gallons capacity. The passenger coach yards are to be enlarged to provide for 55 additional cars. A wheel house 60x140 ft. is to be built in connection with the shops. Some of this work has already been completed and rapid progress is being made on the others, with the view to having everything done before the season closes.

Watertown township has voted to grant a franchise to the Detroit, Lansing & Grand Rapids Ry. The granting of this franchise gives the railway a route from Lansing to Portland direct, and the possibilities are that an arrangement may be reached with the Michigan United Railways, providing for the use of its tracks through the city of Lansing, and a portion of the line from Lansing to St. Johns, probably as far as to some point in the township of Dewitt, turning west from that point to Portland through the townships of Dewitt, Watertown and Eagle. The engineers of the railway have completed their survey from Brighton to Lansing and from Brighton east through South Lyon and Northville to Plymouth, and they are now working on the last lap of the east half of the line from Plymouth to Detroit.

Minnesota.

The Duluth & Iron Range R. R., W. A. Clark, Chief Engineer, Duluth, Minn., has about completed plans for extending its spur track, at present running as far as Spring mine on the east Mesaba. The extension will be about ten miles long and will tap the timber limits held by the Oliver Iron Mining Co. in that district. It will also give access to the timber limits of the Twohy-Killorin Co.

The Twin City & Lake Superior Ry. Co., which projects a 138-mile electric railway northeasterly from Minneapolis and St. Paul, through Grantsburg, Wis., now has 50 miles of roadbed graded and 80 miles cleared and graded. H. L. Laughlin, Minneapolis Minn., is Chief Engineer, and L. N. Loomis, Minneapolis, Minn., is President.

The Canadian Pacific Ry. Engineers have made surveys along the international boundary from Windgate east to Gretna, a distance of 40 miles. The line will cross the Pembina River north of Elkwood, going east and will indicate that the aim of the company is to eventually connect with the Winnipeg-St. Paul Soo line at Emerson, thus giving a direct connection for the border business with the twin cities.

Information received from Hibbing, Minn., states that a crew of railroad construction men are busy laying tracks from the Oliver Iron Mining Company's new shops to the Missabe railroad, a distance of about 5 miles.

Active work has been started clearing the right of way for the Duluth, Winnipeg & Pacific out of Duluth, Minn., by Johnson & Carey Construction Co., St. Paul, Minn., preparatory to starting the construction of 10 miles of the roadbed for which they have the contract. In the building of the line into the city proper the work will be largely of a steel bridge construction, and this will be let to the bridge builders. So far the bids have not been called for, although it will be done in the near future.

Mississippi.

The incorporators of the company which propose to build an electric railway from Summit to McComb and from Summit to

Godbold Wells, as mentioned in our last issue, are as follows: Clem V. Ratcliff, Ted Blackman and V. Simmons, all of Summit, Miss. The line is to be built both for the accommodation of the residents of Summit and McComb, which are only three miles apart, and to develop Godbold Wells as a health and pleasure resort. The company will be capitalized at $40,000, and the charter grants the right to do an interurban business, with privileges in certain streets of the city of McComb and town of Summit.

The Meridian Light & Ry. Co. of Meridian, Miss., has filed an amendment to its charter increasing its capital stock to $5,000,000.

The Mississippi Eastern R. R. has let a contract to J. N. Gillis & Son of Brewton, Ala., to extend the line northeast into the timber belt. The road is owned by the Mississippi Lumber Co., of Quitman, Miss.

Missouri.

A court decision has been rendered upholding the ordinance passed by the Municipal Assembly of St. Louis to abolish grade crossings. The decree dismisses the suits of the American Tobacco Co., the Missouri Pacific the Carondelet & Oak Hill and the St. Louis & San Francisco Rys. to prevent the lowering of tracks at Tower Grove station, and orders the work to begin at once.

Advices from New Madrid, Mo., state that E. S. McCarty, builder and former president of the St. Louis, Kennett & Southern R. R., and builder of the St. Louis & Memphis Ry., is promoting a railroad to extend north and south of New Madrid. It is stated that the road is already financed by capitalists of Southeast Missouri, mostly of New Madrid City. It is also said that construction work will begin as soon as the surveys are completed. It is planned to operate the line by steam for freight and by gasoline motors for passenger service.

Among the building permits recently issued in Kansas City, Mo., is that for the construction of a $136,000 machine shop for the Missouri Pacific Ry.

D. C. Nevin, Kansas City, Mo., president of the St. Louis & Kansas City Electric Ry. Co., has returned from Paris, where, it is said, he placed a $15,000,000 bond issue for the building of the road. It is stated construction will begin about Oct. 1. The road is to cost about $12,000,000.

A surveying corps is now in the field going over the proposed route of the Bates County interurban electric line, which when completed, will connect the cities of Butler, Rich Hill and Rockville. Several surveys will probably be made before the route is decided upon. Afbert Bunn, Kansas City, Mo., is interested.

According to the report of the Kansas City Terminal Ry. Co., to the city of Kansas City, the sum of $12,587,845.09 already has been spent on the proposed Union passenger station and freight terminals. The complete statement follows:

Real estate	$ 7,570,594.32
Purchase of constructed road (K. C. Belt Ry.)	3,517,899.46
Grading	8,689.80
Track construction	1,906.89
Miscellaneous construction	1,230.10
Station buildings (plans)	55,673.35
Locomotives and equipment	298,310.23
Engineering	68,272.12
Law expenses	57,984.77
Taxes	62,562.97
Interest	758,065.81
Organization	102,509.89
Other general expenditures	84,145.38
Total	$12,587,845.09

H. L. Harmon, president of the company, states that he is farther ahead in his preparation of details for the beginning of active work of construction than is required by his contract with the city.

Montana.

A. H. Hogeland, Chief Engineer of the Great Northern Ry., was in Lewiston, Mont., preparatory to going over the survey of the new line in the McDonald creek and Grass Range countries. He [illegible] Right of Way Agent Smith.

The Galatin Valley Ry., now under construction, is [illegible] line from Buckley's ranch, about six miles straight south of Central Park, to Belgrade on the main line of the Northern Pacific. This branch would be about five miles long and would run due east. E. C. Van Netta, Bozeman, Mont., is Chief Engineer.

Construction crews of the Great Northern R. R. have completed the Great Falls-Augusta, Mont., extension of the line comprising 50 miles of track. The line bisects the Fort Shaw unit of the Sun River reclamation project, embracing 16,000 acres and will open up the new towns of Sun River, Fort Shaw, Simms and Augusta, Mont.

Board of Directors of the Chicago, Burlington & Quincy has filed with the Montana Secretary of State a resolution authorizing the construction of an extension of its line from Scribner Carbon county to Northern Pacific line at Fromberg, the cost estimated to be about $1,000,000. The resolution also includes instructions to tear up the line between Toluca and Scribner a distance of 79 miles.

Anderson Brothers, Rockford, Ill., have gone to Lewiston, Mont., where they have a contract for a year's work grading on the St. Paul road.

Nebraska.

The roundhouse and machine shops of the Chicago & Northwestern R. R., at Chardon, Neb., were destroyed by fire on Aug. 2, with a reported loss of $400,000.

New Mexico.

The Rio Tinto Mining Co. of Cleveland, O., which has acquired the properties of the Savanna Copper Co. in the Pinos Altos district, Grant county, N. Mex., will build a narrow gage railroad to the holdings.

The recently incorporated Rock Island, Texico, Farwell & Gulf Ry. Co. has made preliminary surveys and has secured $150,000 of capital for the construction of the first 40 miles of line. The company is now ready to let construction contracts on this section. The total projected length of this road is 280 miles. It is to form a Rock Island connection via Texico route to the Texas & Pacific Ry., M. J. Healy, Texico, N. Mex., is President and W. B. Wynn, Texico, N. Mex., is Chief Engineer.

New York.

Advices from Geneva state that surveys have been completed for the first five miles of the new electric railway which is to extend from Geneva to Port Gibson. The line is practically that of the proposed Geneva & Newark road, which was surveyed several years ago, and it is said that this road has been transferred to the syndicate headed by C. D. Beebe, Syracuse, and that it is to be completed by these interests immediately.

The Long Island R. R., J. R. Savage, Chief Engineer, Jamaica, N. Y., has had work started on its terminal yards and station. The improvement at Jamaica is to cost more than $3,000,000. The station is to be ready for occupancy by December. In connection with the improvements at Jamaica a new freight yard is being laid out at Richmond Hill.

Arthur E. Stillwell, President of the Kansas City, Mexico & Orient Ry. Co., who has been abroad for about two months arrived in New York on Aug. 1. In an interview he made the following statement regarding prospects of financing railroad work abroad: "Financial conditions are favorable, but there is uncertainty about the condition in the United States, from the English standpoint, which is diverting millions of European money to South America, when it should come here were conditions in the United States stable from the English point of view. However, what we need is to give the railroads in the United States decent paying rates. If that were the case the railroads would start in immediately upon an expenditure of $500,000,000 in improvements. That would create a far greater [illegible] country ever has known before.

The United Traction Co., 598 Broadway, [illegible] lines to the Arbor Hill section of that city. Three years ago the United Traction Co. secured from the [illegible] a railway line from its tracks on Clinton Ave. to Livingston Ave., and thence to Watervliet Ave.

Engineers are now making surveys for the construction of a branch line of the Rochester, Syracuse & Eastern Ry., from Geneva, N. Y., to Port Bigson, through Oak Corners, Phelp Clifton Springs and to a connection with the main line of the road.

The New York Central Lines in behalf of itself and other lines centering in Buffalo, N. W., has applied to the Public Service Commission, Second District, for permission to make certain connections and extensions which if allowed will be followed by an expenditure of $750,000 on improvements in the freight yards being established at Gardenville. The plan is to build a branch to serve as a trunk line 2½ miles long, connecting with the West Shore, Lehigh Valley, Erie and Lackawanna, as a result of which most of the freight that now has to be taken into Buffalo will be handled at Gardenville.

The Auburn & Syracuse Electric R. R. Co., will construct 4,000 ft. of track on East Genesee St., Auburn, N. Y. The work will be done by the company forces. Thos H. Mather, Syracuse, N. W., is Chief Engineer.

The State Public Service Commission has granted the Coney Island & Brooklyn R. R. Co., J. E. Babcock, Chief Engineer, De Kalb and Franklin Aves., Brooklyn, N. Y., permission to issue $489,539 in 4 per cent bonds. The greater part of the proceeds from the bond sale are to be used for the entire reconstruction of the company's tracks on Coney Island Ave., from the Park Circle to Coney Island. The bond issue originally asked was for $462,000. But as the bonds are to be sold around 80 the net proceeds to the company from the sale of the $489,539 issue authorized will be only $391,630. Outside of a few small expenditures the money is to be used in shifting the tracks of the railroad on Coney Island avenue to the middle of the street. The tracks are now laid along the western side of the avenue, close to the side walk, but during the last administration the company was ordered by the city to lay its tracks in the center of the street.

North Carolina.

Paul Chatham, Charlotte, N. C., has been granted a franchise to operate a street railway in Charlotte. It is proposed to build an electric line out to a large suburban tract which is to be developed by Chatham and others. It is also believed that the franchise is to be used in bringing into the city the interurban road being built by the Southern Power Co. to Charlotte, N. C. The Southern Power Co. is building an interurban line from Anderson to Greenville, S. C., to be extended to Spartanburg, and eventually, it is stated, on to Charlotte and Greensboro, and probably to Dunham.

The construction of a railroad from Elizabeth City, N. C., to Weeksville, N. C., is under consideration. D. G. Wilson, Weeksville, N. C., is interested.

It was definitely determined at a recent meeting of the Roanoke, Va., business men and delegates from Mt. Airy, N. C., to extend the proposed Roanoke & Bent Mountain R. R. through Patrick and Carroll Counties to Mt. Airy, the county seat of Surry County, N. C. It was decided to change the name of the road to the Roanoke & Mt. Airy Southern. Its length will be about one hundred miles. From Roanoke it will pass through several miles of Roanoke county, entirely through Floyd, Patrick and Carroll, into Surrey county, N. C., to Mt. Airy, where it will connect with a road now building from that point to Statesville. With the completion of these two lines the distance between Roanoke and Statesville will be materially reduced. The Mt. Airy delegates also pledged to subscribe 40 per cent of the necessary funds for the work.

Ohio.

Construction will probably not be started this year on the extension of the present Columbus, Albany & Johnstown Traction Co. by the Columbus, Mt. Vernon & Mansfield Traction Co., which has taken over the former road. As planned this road will be rebuilt to Johnstown, thence to Mt. Vernon and then to Mansfield, where it will connect with the lines of the Cleveland, Southwestern & Columbus.

The Lake Erie, Bowling Green & Napoleon Ry. Co., E. H. McKnight, General Manager, Bowling Green, O., is planning to extend its electric railway to Elmore on the east and to Grand Rapids on the northwest.

The city of Cleveland a short time ago voted a $2,000,000 bond issue for grade crossing work. The funds for this work, however, will probably not be available before November. The Lake Shore & Michigan Southern Ry. has already started to work up its plans for the Madison Ave. and Lake Ave. N. W. crossings, and these improvements can be started without delay as soon as the city funds are available. A group of the Pennsylvania series of crossings on the East Side will be taken first of all along the Pennsylvania road. It is probable that the work will be started at Cedar Ave. S. E. and continued northward to St. Clair Ave. N. E. If there are any funds left over the St. Clair group will be taken next.

Surveys have been started by John W. Riegle and assistants, Findlay, O., for the proposed extension of the Western Ohio Ry., from Minister to Loramie, the latter place having never been touched by trolley or steam lines.

According to an announcement reported to have been made by F. Brandon, Lebanon, O., Vice President of the Dayton, Lebanon & Cincinnati Terminal Co., the company will not only permit the construction of the proposed east levee for the new channel of the Miami River south of Washington St., Dayton, O., on land owned by the company, but will assist in paying part of the cost. When plans for the work have been completed they will be submitted to the city engineer for his approval.

Oklahoma.

The Rapid Transit Interurban Co., incorporated under the laws of the Territory of Oklahoma, with a capital stock of $2,500,000 to build an electric interurban railroad from Muskogee to Chickasha, and from Guthrie to Sulphur, crossing at Tecumseh, has secured from the city of Tecumseh a franchise and from the county commissioners of Pottawatomie County permission to cross all public roads and highways. The preliminary work of constructing the line from Tecumseh to Sulphur will be commenced at once and will be speedily pushed on the part where franchise and permission has been secured.

The Osage & Western R. R., which proposed the construction of a line from Vinita west to Enid, Okla., has grading well under way, the work being completed within 26 miles of the latter city. Arrangements have been made for the use of the Rock Island line between Enid and Billings, and the first section will be completed from Billings to Tonkawa, as the first installment of the $50,000 bonus of Enid will be paid at that time.

Oregon.

The Astoria & Columbia River R. R., T. H. Croswell, Chief Engineer, Portland, Ore., has detailed surveys underway for the proposed cutoff at Tongue Point. The cutoff is to start at the commencement of the big curve a short distance west of the John Day river and run through the bluff several hundred feet south of the present track. It will then follow the short line back of the Hammond Lumber Co.'s mill and continuing along on solid ground to a point about 200 feet west of the Astoria Box Co.'s plant, where it will connect with the existing trestle. The main object in making the change is to do away with the heavy curve at Tongue Point, as well as with a long stretch of trestle that is expensive to keep in repair. A cut is to be made through the bluff at the point and the earth secured there will be utilized to fill in the grounds at the depot.

The contractors have turned over to the operating department of the Oregon Short Line R. R. 57 miles of the new road being built north, down the west bank of the Snake river from Huntington.

The citizens of Ashland have voted to grant John R. Allen a franchise in that city for an electric railway.

The Great Southern R. R., J. G. Heimrich, General Manager, now operating 30 miles of line from The Dalles to Dufur, is said to be having surveys made for an extension into Central Oregon.

The Coos Bay Traction Co., recently incorporated with a capital stock of $1,000,000, has announced its intention of building a line from Marshfield to Roseburg. It is said that a $5,000,000 bond issue of the company will be guaranteed by the Marine Trust & Savings Co. of San Francisco. It is understood that it is a part of a plan to build an electric line to Florence and Coos Bay and on to Roseburg and also from Marshfield to Bandon, down through Curry county and across to Grant's Pass. George F. Averill, Marshfield, Ore., is President.

The Oregon Trunk Line, John F. Stevens, President, Portland, Ore., is said to be about ready to let a contract for another section of its line through Klamath County toward Klamath Falls. The contract has already been let for the construction of this grade from the Klamath Indian reserve line north 40 miles. It is believed that the road is to come from Crescent down through the Big Marsh country to Agency Bay, near the Klamath Indian Agency. The line is then to proceed around this bay to the mouth of Williamson River on the east side. From there soundings are now being made across the lake for the line to cross to the west side and strike land again about Eagle Ridge Tavern. From that place it will have a straight course down the west side to the head of Link River and down the river to the proposed depot site on the west side of the city.

Pennsylvania.

The Buffalo & Lake Erie Traction Co. has applied to the City Council of Erie, Pa., for the right to double track East 6th st. and East 12th st. out to the General Electric Co.'s grounds in order better to handle the traffic that promises to result from the growth of the city subsequent to the coming of the shop to Erie.

The City Council of Philadelphia has passed an ordinance authorizing the Chester & Philadelphia Ry. Co. to lay track to construct a line of surface street railway from its terminus at Bow creek to 92nd st. in the 40th ward, connecting with the Philadelphia Rapid Transit Co.

The Susquehanna, Bloomsburg & Berwick R. R., J. H. Cochran, President, Williamsport, Pa., has made a survey for a two-mile extension of its steam railroad to Bloomsburg.

A company has been organized at Ellwood City, Pa., by W. J. Coursin, H. L. Tuckert, J. W. Humphrey, R. A. Todd and Fred Johnson, for the purpose of building a street railway from Park City to Ellwood City.

The Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., has purchased the Inter Works R. R. The line is seven miles long, connecting the towns in which the company's plants are located.

Rhode Island.

Officials of the New York, New Haven & Hartford R. R. have approved plans for double tracking the old road bed of the Boston & Providence from the tunnel bridge in East Providence, R. I., to East Junction on the main line. The work is said to include the widening and strengthening of bridges and the abolishment of a grade crossing in Rumford.

City Council Committee of Providence, R. I., is shortly to take up with the New York, New Haven & Hartford R. R. the matter of abolishing the railroad crossings in the 8th Ward in Providence.

South Carolina.

The Atlantic Coast Line R. R. is to establish new freight yards at Bennettsville, S. C., which will have two miles of track and will accommodate 1,500 cars.

Officials of the Carolina, Clinchfield & Ohio Ry. have been requested to meet with the representatives of Charleston, Columbia and Spartanburg and other interested points at a meeting in the city of Spartanburg at some early date, to discuss the proposed extension to Charleston.

South Dakota.

The Chicago & Northwestern Ry. has completed tracklaying on its new extension between Gettysburg and Blunt, and the work of laying side tracks and building stations at the several new towns established on the extension is expected to be completed by Sept. 1.

Tennessee.

The Chattanooga Railway & Light Co. of Chattanooga, Tenn., has filed an amendment to its charter, authorizing extension of tracks on a number of streets in Chattanooga.

The Memphis Street Ry Co., T. H. Tutwiler, President and General Manager, Memphis, Tenn., has given out the route by its cross city street car line at Memphis, and has announced that work will be started at once. The route is as follows: Beginning at Railroad ave. and Bellevue boulevard, north on Bellevue to Linden ave., which will be opened eastward near the new high school; thence east on Linden to Cleveland st., which will be opened to Union ave. and continunig north to Poplar ave.

The Chattanooga Southern R. R., Chas. Hicks, General Manager, Chattanooga, Tenn., is understood to have completed arrangements with the Rome & Northern R. R. providing for the construction of a connection between the two roads and giving the Chattanooga Southern connections to Rome, Ga. The Chattanooga Southern is to build an extension from Rome to the connection with the Seaboard Air Line, making a short and direct line between Chattanooga and Atlanta.

The Middle Tennessee R. R., mentioned in our last issue, is reported to have let grading contracts for its extension from Water Valley to Mt. Pleasant. The new branch will tap the Leatherwood branch of the Middle Tennessee about six miles from Leatherwood, and will be run from there through to Mt. Pleasant, traversing a fertile country and one rich in phosphate deposits. John White, Franklin, Tenn., is Chief Engineer.

The Overton County R. R., now operating 20 miles of standard gage line, is reported to be planning to build an extension into Kentucky. W. W. Yeatman, Livingston, Tenn., is General Superintendent and George L. Wilkins, 1007 Marquette Bldg., Chicago, Ill., is President.

John L. O'Connor, Knoxville, Tenn., has been awarded the contract for constructing a 2-mile terminal spur at Athens, Tenn., for the Athens & Tellico R. R.

Texas.

The Belton & Temple Traction Co. of Temple, Tex., now operating 14.3 miles of line between the two cities named, is to improve its line and extend it to Waco. Local systems of street railways are also to be built in Temple and Belton. The property of this company was recently purchased at receiver's sale by a syndicate of Pennsylvania men who own the bonds.

Surveys are under way for the projected interurban line from Dallas to Palestine and it is believed that construction will be undertaken shortly. Advices from Dallas state that J. V. Watkins, President of the Trinity Valley Traction Co., is at the head of the new enterprise.

The Texarkansas Gas & Electric Co., W. L. Wood, jr., Manager, Texarkana, has had surveys made for a 1½ miles extension of its Rose Hill street car line at Texarkana. Necessary material for the extension is said to have been purchased.

The Texas Traction Co., 300 Commerce St., Dallas, Tex., has authorized the construction of a local line in Sherman, running out to West Hill, and also of a local line in McKinney, route not determined. The Sherman line is to be completed by April 30, 1911, and the McKinney line by July 1, 1911.

The people of Falfurrias are raising a bonus to secure the building of a branch line of the Brownsville Ry. to that city. The branch is to extend from Kingsville or Sarita to Falfurrias and on to a point west of Falfurrias. Surveys have been made over the proposed new route.

The Pecos Valley Southern R. R. has completed its line to Saragosa, 28 miles, and has inaugurated train service. W. L. Carwile, Dallas, Tex., is President of this road.

Advices from Kingsville state that contracts have been let at that city for building a belt road through the cane district in the vicinity of Brownsville. Some 12 miles of road will be required to complete the circuit from Blalock spur, 4 miles north of Brownsville on the line of the St. Louis, Brownsville & Mexico southwest through the heavy cane producing plantations, doubling back to Brownsville. The Brownsville main line will supply the connecting link of the circuit between Brownsville and Blalock.

The Mitchell-Pigg Construction Co. of Weatherford, Tex., has been incorporated with a capital stock of $100,000, the incorporators being H. L. Mitchell, R. W. Miller and J. W. Pigg. The company has the contract and has work under way on the Chicago, Weatherford & Brazas Valley R. R., noted in our last issue.

A proposition has been made the Young Men's Industrial Club of Mexia, Tex., to build a line of railroad from Waco east through Mart, Mexia and Fairfield.

Col. L. D. Ross, of New York City, who is associated with Col. I. D. Polk of Beaumont, in promoting the electric railway between Beaumont and Port Arthur, is now in that city. It is believed definite announcement as to the plans will be made in the near future.

Receiver Sam W. Brown of the Bartlett & Florence R. R., has appointed James C. Collins to operate the road from Bartlett to Jarrell under the terms of the receivership proceedings set forth by Judge Charles H. Wilcox. A partial inventory shows the road to be worth about $115,000 and indebtedness amounting to $90,000. Receiver Brown will sell the road under direction of the court.

The Rio Grande & Eagle Pass Ry., R. W. Davis Chief Engineer, Laredo, Tex., is considering extending its line down the valley of the Rio Grande from Laredo to Sam Fordyce, where it will connect with the St. Louis, Brownsville and Mexico. The distance traversed will be about 125 miles, and the territory opened up is among the most valuable for irrigation and grazing purposes in the state. The road at present runs from Laredo to Minerva, a distance of 29 miles.

Preliminary surveys have been made for a projected 80-mile railroad from Austin, Tex., to Fredericksburg, Tex., and it is hoped to take up the matter of construction work by Oct. 1. The company to operate the line has not been chartered nor has a chief engineer been selected. W. S. McGregor, Temple, Tex., is interested.

According to advices from San Antonio, Tex., nearly all the surveys have been made and right of way secured for the construction of the proposed San Antonio, Rio Grande & Tampico R. R., and it is expected that trains will be operating over considerable distance by next fall.

Preliminary surveys for the Texas North & South Ry. have been completed from Fredericksburg to Mason. Surveys between Fredericksburg and Boerne have also been completed. It is believed that permanent surveys will be started soon and all engineering work finished by Nov. 1. F. W. Steber, Fredericksburg, Tex., is Engineer.

The International & Great Northern Ry. has made a second application to the State Railroad Commission for a revaluation of its property, so as to provide a basis for its proposed reorganization and bond issue. The commission refused to grant the former application. The present valuation runs to $24,193,386, and it is desired to increase this to at least $31,642,506. Of this amount $5,973,947 is alleged to be in betterments from January, 1895, to June 30, 1910; $434,406 is alleged to be omitted betterments [illegible] of old road from January, 1895, to June 30, 1909; $533,098 added freight on betterments, 10 per cent of total cost prior to 1906 of $5,335,098 added freight on betterments, 10 per cent of total cost prior to 1906 of $5,335,098, and $507,255 in average stock of material on hand for the past five years.

Grading work on the Brownwood Southwestern R. R. will probably be started by Sept. 1. Contractors have been over the line with a view to bidding on the work. Col. R. A. Love, Brownwood, Tex., is the promoter.

A preliminary valuation of the San Antonio, Rio Grande & Tampico Ry. on the proposed line from San Antonio to San Jose, thence south 85 miles to a point midway between the Nueces and Frio Rivers, near the LaSalle and McMullen county line, a total distance of 90.5 miles, has been completed by R. D. Parker, Engineer of the State Railroad Commission. He estimates the cost of the proposed line at $1,688,361.23, an average of $18,655.80 a mile. He figures that the estimate of the railway officials in their application for a preliminary valuation for the purpose of issuing bonds is correct in that estimate that $77,500 has already been spent. The estimates call for an eight-tenths maximum grade, 70-lb. steel for the line gravel ballast, concrete culverts and steel bridges across the Medina, Atacosa and San Miguel Rivers. Mr. Parker calls attention to the fact that terminals in San Antonio will prove very expensive, and upon this basis makes his calculations. With $90,000 in stock already issued, $1,598,000 remains under the valuation for the issuance of bonds.

City Council of Corpus Christi, Tex., is considering granting a street railway franchise to H. H. Read and associates.

Utah.

The construction of an electric railway from Nephi to Payson is proposed and steps are also being taken to continue the line to the county seat of Juab county. George Whitmore, Nephi, Utah, is interested.

The Ogden Rapid Transit Co., Ogden, Utah, which is now building a line from Five Points to Brigham City, is said to intend to extend the line to Logan.

The Emigration Canyon R. R., LeGrand Young, Jr., Chief Engineer, Salt Lake City, Utah, is considering extending its interurban line from a convenient point on the East Bench down 21st East and eventually to Holliday.

Virginia.

Parties who are developing the sulphur mines near Knight's Branch in Spotsylvania county Va., are contemplating building a railroad to extend from the sulphur mines, in Louisa county, to the mines near Knight's Branch. If the rairoad is built it will be extended by Spotsyvalania to Fredericksburg.

The Richmond, Fredericksburg & Potomac R. R. Co. has started work on the rebuilding of the belt line railway from Acca to the High Bridge over the James River. The line is to be double tracked and the grade crossings on all streets and highways leading out of Richmond, Va., intersected by the Belt Line will either be tunneled or a trestle will be erected over the road. The property necessary for this improvement was acquired several years ago by the railroad company as the officers fully realized the fact that at no distant date the double track would be necessary.

Washington.

Winston Bros. & McDougall will probably complete their portion of the work in double tracking the main line of the Northern Pacific to Portland by Nov. 1.

Plans have been prepared by Alexander Stewart, Seattle, Wash., Assistant Chief Engineer of the Great Northern Ry., for the reconstruction of a part of the main line of that road west of Wellington, in the Cascades. The construction of a new tunnel at a lower level than the present tunnel is included in the plans. The work the Great Northern now has under way at Wellington and west of that point will be completed by Dec. 1 and will cost nearly $1,500,000.

It has been reported that papers have been signed making preliminary arrangements for the construction of a railroad from Cove, Ore., to Walla Walla, Wash. The project is said to be subsidiary to the Northern Pacific. George Alexander, Boston, Mass., is consulting engineer.

West Virginia.

Permanent surveys are now being made for the Sisterville & Middlebourne R. R. which projects a line between the places named.

Curtis, Shumway & Deane have started grading at Fairmont, W. Va., for the construction of the railroad which will connect the mines of the Four States Co. on Teverbaugh with the M. R. division of the B. & O. at Worthington. The contract calls for several miles of railroad and a viaduct which will be modern in every particular. Much of the bridge material has arrived and the derrick to handle this has been erected on the railroad side of the river.

The Morgantown & Kingwood R. R., now operating 48 miles of standard gage road, has increased its capital stock from $200,000 to $2,000,000. It is believed that this increase was made for the purpose of building an extension. J. K. Monroe, Kingwood, W. Va., is Chief Engineer.

Wisconsin.

The city of Ironwood has taken favorable action on the light and street car franchise in that city and as a result it is said that A. E. Appleyard, Ashland, Wis., will at once go ahead with the developments of the water power at Copper Falls near Mellen. Power will be transmitted both to Ironwood and Ashland as needed. It is said the proposition will involve the expenditure of $1,000,000.

The Engineering Department of the Minneapolis, St. Paul & Sault Ste. Marie R. R. is to prepare plans shortly for a subway under its tracks at Belknap st., Superior, Wis.

Plans for the construction of the Chicago & Wisconsin Valley R. R. are taking final shape and it is believed that active work will be started this fall. The road is to be built from Madison to Stevens Point and will be about 130 miles long. The estimated cost is $3,387,600. The road will be built in three sections: From Janesville to Madison, from Madison into Stevens Point to Merrill. The section from Madison to Stevens Point is to be in operation by July 30, 1912. The road will be equipped with electricity and gasoline locomotives. The Western Indiana Construction Co., 6 Sherman st., Chicago, Ill., will construct the line.

Advices from Duluth, Minn., are to the effect that the Minneapolis, St. Paul & Sault Ste. Marie R. R. has applied for a certificate entitling it to build a branch line from a point south on its main line below South Superior in section 10-48-14 to the government dock line on the point between Little and Big Pokegama Rivers and Bays.

J. M. Hassett & Co., Pittsburg, Pa., have completed over 9½ miles of their contract for reconstructing the 16½ miles of line on the old Wisconsin Central right of way from Howard station to the village of Colfax. They began work May 10 and their contract is to be finished Nov. 1. They have two camps, one at Howard and are working a crew of 200 men. Their equipment consists of four steam shovels, six 16-ton Vulcan dinky engines and 100 dump cars, three pile drivers besides horses, wagons, camp paraphernalia and tools of every description. The new roadbed penetrates a hilly and undulating country and follows a survey that the old company often wished to utilize but never went to the expense of putting in shape. Hassett & Co.'s contract calls for $200,000 for grading this 16½ miles and extras on the contract will amount to about $50,000. These figures will not include laying the tracks or any of the railroad equipment. The tracks will be laid on the grading by about Nov. 20 and will be at the start a second class track.

Canada.

The people of St. Catherines, Ont., were to have voted July 29 on a bylaw granting a franchise to the Buffalo, Niagara & Toronto Ry. Co. The company, however, withdrew the bylaw on the ground that the unsettled state of the bond market would make it unwise for them to undertake construction at this time. It was proposed to build an electric railway between St. Catherines and Niagara-on-the-Lake, and to eventually extend the line to Buffalo and Toronto.

The Deputy Ministers of Railways at Ottawa gave a hearing on Aug. 9 on the application of the Canadian Northern Ry. for approval of a route map from Stewartwyn, in the province of Alberta. The proposed line crosses the Calgary & Black Falls and runs westerly from there to Rocky Mountains and practically parallels the line of the Alberta Central Ry. Co. to the Rocky Mountain House.

The Canadian Northern Ry. has applied to the Dominion Government for a charter for a railway to run from Edmonton to Bear River, on the Portland Canal, which is part of the British Alaska boundary. The proposed route would give the Canadian Northern shorter haul to tidewater than the Grand Trunk Pacific to Prince Rupert.

Advices from Stewart, B. C., state that the Canadian Northern Ry., which recently applied for a charter for a railroad from Edmonton, Alta., to Stewart, is now considering the construction of another railroad from Stewart branching through Portland City up the Salmon River through 20 miles of Alaskan territory into Britsh Columbia.

A syndicate headed by R. T. Shillington, member of Parliament for the Porcupine District, is reported to have been granted a charter to build a line from the T. & N. O. Ry. to the Porcupine District.

Construction work is to be started this month on the Hudson Bay & Pacific Ry. The survey for the road is now out over 100 miles and the road is surveyed ready for construction work for a distance of 85 miles. The engineering headquarters of the road are at Prince Albert, Sask.

The Montreal & Southern Counties Ry. Co., W. B. Powell, General Manager Montreal, Que., is to start work shortly on an extension to the Richelieu River, connecting Montreal and St. Lambert with Chambly Basin, Chambly Canton and the village of Richelieu, and intervening parishes. Later on the railway is to be extended to Granby. The company has also secured a long lease from the Central Vermont Ry., from Montreal to Waterloo, and will electrify about nine miles of the track.

The contract for 26 miles of track to be constructed by the Canadian Pacific Ry. between Carmangay and Aldersyde has been let to the Foley, Welch & Stewart Co., St. Paul, Minn. The total distance of the new short cut to Calgary from Lethbridge is 56 miles, but 30 miles of this have already been built. Work on the line will be completed about Oct. 15. Work will be started at once.

The Grand Trunk Pacific has laid out extensive yards at Edson, Alta., for the accommodation of its general railway traffic. Five miles of sidings will be built at once, but the yards as laid out provide room for twenty-six miles.

C. E. Deakin, Montreal, Que., is reported to have been awarded the contract of the C. P. R. Windsor St. station and office extension at Montreal, which will represent an expenditure of $1,000,000.

Advices from Ottawa state that according to advices from all along the line the scarcity of labor on the National Transcontinental Ry. is becoming more and more serious. This scarcity of men is impeding construction. The relaxation of the immigration restrictions helped somewhat, but not enough to cope with the situation.

The contractors on the coal fields extension of the Grand Trunk Pacific have started to cut out the right of way from Edson. This branch, which is to be about 70 miles in length, will cross the Yellowhead Pass Coal Co.'s line and the Pacific Coast Pass Coal Co.'s lines and unless labor difficulties so troublesome in the west are greater than anticipated, the grade should be ready before the winter closes in. On the Battleford branch of the Grand Trunk Pacific the contractors are seriously hampered by lack of labor, but track laying is expected to begin on the grade by the middle of next month. On the Prince Albert branch the same conditions prevail, but it is likely that about 90 miles of the grade will be ready for steel before the winter. Ballasting cannot be continued after the frost sets in, so the work is being rushed with all possible speed. On the Regina portion good progress is being made between Melville and the southern limit, about 100 miles south of Regina. Farther than that there is nothing but tentative surveying. All the contracts have been let for the work from Melville to the southern limit, and it is intended to connect with the main line through Brandon.

Plans for a line connecting Montreal with the Transcontinental Railway by way of Joliette, Que., have been filed at the Railway Commission at Ottawa, Ont., by the Joliette & Lake Manan Ry. Co. The line is to start from Joliette and run to Weynoutachene on the Transcontinental. The general route as far as Lake Manan has been approved and a location made for ten miles of the way filed. Above the lake the line has not yet been located.

Mexico.

The National Railways of Mexico is stated to have placed an order for 15,000 tons of steel rails with Belgian mills and it is expected that this will be almost immediately followed by other orders with European mills for several thousand tons additional. Of late practically all the steel used on the National railways has been the output of Monterey mills, but those founderies are now piled up with orders, practically all of which are for that system.

The legislature of the state of Chihuahua, Mexico, has appropriated 400,000 pesos for the building of a railroad from Montclova, in the state of Coahuila, to Chihuahua. The distance is about 700 kilometers and the entire cost will be 2,000,000 pesos.

Engineers on the Vera Cruz, Tabasco & Campeche Ry. Co. will complete surveys by the end of August on the two optional routes given the company in the concession for the construction of 750 kilometers of line between Santa Lucrecia and the city of Campeche. Two routes are now under construction, the southern, keeping close to the foothills, and the northern, taking the main line through some of the larger cities between Santa Lucrecia and the City of Campeche, such as San Juan, Bautista. The southern route will, it is said, be more easy and less expensive for construction of track It is believed that construction work on the road can be rushed as the line will cross more than half a dozen large streams, and materials for the road can be taken up these rivers and delivered at no less than six points in the interior. Thus, at least, eight points construction work can begin at the same time. David Coe, City of Mexico, is the Engineer.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

Richard C. Tumelty, City Engineer, Stockton, Cal., has submitted a plan to the Council of that city for constructing a canal to serve as an outfall sewer. The plan provides for purchasing a right of way through the Boggs tract, located southwest of the city. The right of way will be 500 ft. wide and 2,453 ft. long. A canal 300 ft. wide would be dug, extending from Mormon Channel at Harrison St. to the San Joaquin river. This will leave the city 100 ft. on each side for wharf space. The cost of dredging is estimated at $65,000, and the right of way can be purchased, it is said for about $150 an acre, or approximately $22,500, making the total cost $87,500.

The Mill Creek Reservoir Co. has been incorporated with a capital stock of $20,000 and proposes the building of irrigation ditches and reservoirs. The stockholders are: W. H. Van Leuven of Redlands, N. B. Hinkley, M. L. Frink and J. M. Cole of Bryn Mawr and J. H. Strait of Redlands.

Advices from Pasadena state that the North Pasadena Land & Water Co. is making plans to locate a new reservoir at Millard's canyon. The location will be above the point where the Millard pipe line trail hits the canyon bottom. The plan is to erect a submerged dam similar to that at Devil's Gate, but smaller. This will be sunk at a point a few hundred feet below where the water of the canyon goes under ground.

Colorado.

The Pueblo-Rocky Ford Irrigation Co., 601 North Main St., Pueblo, Colo., is reported to have let a contract for 800 ft. of tunneling at the outlet of Bradford lake, near Walsenburg.

Plats have been filed in the county clerk's office at Montrose, Colo., by W. D. Gould, James Gould and E. S. Gould, showing the plans of a proposed reservoir and ditch project soon to be built in the vicinity of Crystal creek, near Montrose. The reservoir will be formed by a dam 58 feet high and will contain 56,407,000 cu. ft. of water. The ditch will be about 11 miles in length, with a carrying capacity of 300 ft. The estimated cost is $35,000. Work was started surveying Sept. 9, 1909.

The city of Boulder, Colo., has retained W. H. Hamm of Boulder, who has been foreman for the MacArthur Bros. Co. in the construction of the dam at Barker Meadows, to superintentend the construction work of the dam to be erected by the city at Camp Albion. The dam is to be built by day labor and will require 13,000 cu. yds. of rubble masonry. The work was mentioned in our July 27 issue.

Advices from Durango state that farmers of the Florida Mesa irrigation district have voted $1,060,000 in bonds to construct ditches and reservoirs for the irrigation of 5,000 acres of land. Work on the project will commence at an early date.

Iowa.

✣Bids are asked by A. Tansen, county auditor, Harlan, Ia., until 10 a. m., Aug. 10, for the construction of the Nishna Botna river drainage ditch No. 1, the work approximating 378,407 yds. of excavation.

The commissioners of Page county will give a hearing Aug. 19 at the court house at Clarinda on a petition for the establishment of a drainage district and the straightening of the Nodaway river.

The supervisors of Woodbury County, at Sioux City, Ia., have awarded the contract for the construction of the Garretson drainage ditch to the Canal Construction Co., 188 Madison St., Chicago, Ill., at $61,941. Construction work is to be started Oct. 1 and is to be completed by Nov. 1, 1911. The ditch will be 10 miles long with approximately 24 miles of laterals, there being 16 of these. The ditch will be from 18 to 22 ft. in width, while the laterals will range from 4 to 12 ft. in width.

Petitions have been circulated for the establishment of Ditch No. 10 in Winnebago county. The county commissioners will give a hearing on the petition on Sept. 15 at the court house at Forest City, Ia.

Kansas.

Preliminary surveys have been completed by Bert C. Wells, City Engineer of Wichita, Kan., for an extension of the present city drainage canal to the Big Arkansas river. The work will cost about $40,000 and can be done by a steam dredge. Bids for the work are to be asked soon.

The City Engineer of Hutchinson, Kan., has been making plans for the new head gates and dam which it is proposed to build at Cow Creek near the junction of the drainage canal. Bids for the work will be asked at once.

Louisiana.

The Lafourche Levee Board, W. J. McCune, Secretary, New Orleans, La., has been allotted $20,000 from the levee funds of the Board of State Engineers.

L. M. Soniat has submitted a proposition to Mayor Weill and the Board of Aldermen of White Castle, La., for the drainage of the city and vicinity.

Hearin & Ryan, Baton Rouge, La., have been awarded the contract for constructing the Melwood, Myrtle Gray and Waterproof levee in the Lower Tensas Levee District. The contract includes 334,000 cu. yds. earthwork and the contract price was $50,868. Bids were opened Aug. 1 at the U. S. Engineers' office at New Orleans, La.

Missouri.

The Bois Brule Bottom Drainage District of Perry County, Missouri, is to call for bids soon for ditch work estimated to cost about $85,000. The work will include a main ditch at 9 laterals and will require over 546,000 cu. yds. of excavation. Joel Dunn, Fordyce, Ill., is the Engineer.

North Dakota.

✣Bids are asked by J. H. Fraine, Grafton, N. Dak., until 2 p. m., Aug. 15, for the construction of County Drain No. 35. Certified check for $200 required with bid. Plats can be seen at the office of Charles Edwards, Drayton, N. Dak.

Ohio.

✣Bids will be received by the County Auditor, C. E. Russell, Urbana, O., until Sept. 1 at 10 a. m., for the construction of 185,186 cu. yds. of dredge work. Plans are on file at the office of C. E. Russell or James Swisher, County Surveyor.

The city of Dayton, O., proposes to build a levee for the channel of the Miami river south of Washington St. F. J. Cellarius is City Engineer of Dayton.

South Dakota.

The construction of a large irrigation system east of Rapid City, S. Dak., which will involve the expenditure of about $2,000,000, is under consideration. S. H. Lea, state engineer, Pierre, S. Dak., is working on the project.

Tennessee.

Lowrance Bros. & Leonard, of Memphis, Tenn., were the low bidders, Aug. 1, on 224,000 yds. of new levee at Sun Flower Landing, Miss., and were awarded the contract at 20.4 cts. per cu. yd. The letting was held under the direction of Major M. L. Walker, Corps of Engineers, United States Army, of the Third District.

Texas.

Drainage District No. 2 of Galveston County has voted to issue $45,000 bonds for the construction of a drainage system.

Maps of the various levee districts where surveys have been made have been completed by Capt. Arthur Stiles, Austin, State Levee and Drainage Commission. The maps were made in the U. S. geological survey and will show the exact location of each district where it is contemplated to build levees.

The Texas Building Co., 510 F. & M. Bank Bldg., Fort Worth, Tex., has been advertising for subcontractors for 1,000,000 yds. of levee work; 7 ft. to 14 ft. work, 3-to-1 slope, outfits from 10 teams up, 6 to 8 months' work.

The Navigation Commissioners of the Beaumont Navigation District of Jefferson county have decided to at once advertise for sale the bond issue of $[illegible] voted by the people of Jefferson county for the purpose of aiding in securing deep water in the Sabine-Neches canal. The Commissioners of the district are J. E. Broussard and J. Frank Keith of Beaumont. James F. Weed, Beaumont, is the Engineer.

The Chamber of Commerce of Beaumont, Tex., has appointed a committee to take steps to make Jefferson a drainage district under the state law and to vote bonds for drainage improvements.

Utah.

The Davis & Weber Counties Canal Co. of Ogden, Utah, is to expend about $250,000 for concreting the canal from the mouth of Weber canyon to the first branch line at the sand ridge. The company has already completed the concreting of the canal 1½ mile in length, which has proved so successful that it has been decided to concrete the entire work. The Gillis Construction Co., Salt Lake City, Utah, has the contract. A large hydro-electric development is also proposed for this canal, as was noted in our last issue.

The State Board of Land Commissioners has decided to lend $50,000 of its funds to the Union Reservoir Company of Utah and Wasatch Counties for the completion of an irrigation project which will water lands in both counties. The company is a consolidation of the Provo Reservoir Company, the Sego Irrigation Company, the Timpanogas Irrigation Company and the Wasatch Irrigation Company, which companies own a number of water rights and canals. The project calls for the building of a number of reservoirs and canals to irrigate lands in Wasatch County and on the Provo bench.

Wisconsin.

The Johnson Dredging Co., according to advices from Madison, Wis., has been awarded the contract for filling the low land of the 300-acre tract of the Fairhaven Land Company near Winnequah. The contract price is reported to be $30,000.

Canada.

D. B. Campbell, Strathroy, Ont., has been awarded the contract at $5,939, for constructing municipal drain No. 3 for the Township of Minto, Ont. The drain will be about 35,300 ft. long, and bids for constructing it were opened July 27.

MISCELLANEOUS CONSTRUCTIONS

Alabama.

✣Bids will be received until 11 a. m., Sept. 7, by Maj. H. Jervey, U. S. Engineer, Mobile, Ala., for the construction of a lock and dam No. 17 and lock tender's house, Black Warrior River, Ala.

The city of Mobile has awarded the contract for dredging the river along the city wharves to the Home Dredging Co., Mobile, Ala., at 21 cts. per cu. yd. The contract calls for the removal of about 100,000 cu. yds. of dirt.

California.

✣Bids are asked until 11 a. m., Sept. 8, by Capt. W. P. Stokey, U. S. Engineer, 723 Central Bldg., Los Angeles, Cal., for dredging at San Diego Harbor, California. The work includes dredging channel 600 ft. wide and 30 ft. deep through outer bar, and a channel 400 ft. wide and 30 ft. deep through middle ground just inside harbor entrance. The estimated quantity to be removed is 460,000 cu. yds.

✣Bids will be received until 11 a. m., August 10, by the Board of Public Works, Oakland, Cal., for the necessary labor and material for the construction of a concrete quay wall along Oakland Harbor between Myrtle St. and Clay St.

✣Park Commissioners of Oakland, Cal., will receive bids until 2 p. m., Aug. 25, for the necessary labor and material for the construction of a fountain in Lakeside Park. Henry F. Vogt is Secretary of the Commission.

✣Bids will be received by the Board of Public Work, Oakland, Cal., until 11 a. m., Aug. 10, for furnishing the necessary labor and material for the construction of a concrete quaywall along Oakland Harbor, between Myrtle St. and Clay St. Walter B. Fawcett is Secretary.

Cotton Bros. Co., Oakland, Cal., is stated to have been awarded a contract at $119,790 for constructing a reinforced concrete pier 125 ft. wide and 300 ft. long for this city.

The city council of Los Angeles is to appropriate $100,000 for improving the water front at Wilmington.

The city trustees of Ocean Park, Cal., have been petitioned to call an election to vote bonds to the value of $60,000 for the construction of a municipal pier. It is proposed to build the pier into the sea 1,600 ft. from the foot of Mildred avenue, two blocks south of the Windward avenue pier. It would be 40 ft. in width and the piling would be wood with concrete casings.

The Ocean Park Amusement Co., of Ocean Park, Cal., has awarded the contract for building a concrete pier at the foot of Pier Ave. to D. A. Corbaley & Co., according to an announcement made by A. R. Fraser, president of the company. The bid of the contractors was $175,000. There will be 280,000 sq. ft. of floor space on the pier, which will join the present pier near the auditorium. Plans for the improvement are being prepared by Eager & Eager, architects of Los Angeles. It will require 634 concrete piles reinforced with steel and 20 to 26 ins. in diameter to support the pier, which will be 1,000 ft. in length.

Advices from Oreville state that W. E. Oddie, President of the Crescent Hill Gold Mines Co., operating near Quincy, has awarded a contract for driving a 200-ft. tunnel to S. P. Maxwell; William Jones and C. P. Mosely. The tunnel will be driven for the purpose of carrying the waters of the middle fork of the Feather River at a point known as Horseshoe Bend, near the line between Butte and Plumas counties. The tunnel will drain 1,380 ft. of the river bed and make possible the mining of the gravel.

Bids were opened July 20, by the city of Visalia, Cal., Morve L. Weaver, City Engineer, for the improvement of Mill Creek, the work including the construction of 3,371 lin. ft. of reinforced concrete conduit. The following bids were received: J. McNair Paving Co., San Diego, Cal., $70,382; Continental Fireproofing Co., San Francisco, $872,738; M. C. Couchot, San Francisco, $86,512; Coutra Costa Construction Co., San Francisco, $72,435; Oscar Parlier, Tulane, Cal., $8,610 for bridge section only; J. Doyle, San Jose, Cal., $74,286; Concrete Pipe & Construction Co., Porterville, Cal., $84,-

806; Western Bridge & Construction Co., Sacramento, $79,060; W. J. O'Brien, Reedley and Stockton, $80,430; R. Keatinge & Sons, San Francisco, $66,512; Engineering Contracting Co., Exeter, Cal., $82,497.

District of Columbia.

✣Bids will be received by Capt. F. C. Boggs, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., August 29, for furnishing under Canal Circular 599, deformed steel bars, memorandum books, calendar tags, rubber bands, etc.

✣Bids will be received until August 10 by general purchasing officer, Capt. F. C. Boggs, Isthmian Canal Commission, Washington, D. C., for the furnishing of 600 ft. of suction hose, 2½ ins., in 12 12-ft. lengths.

✣Capt. F. C. Boggs, general purchasing officer, Isthmian Canal Commission, Washington, D. C., will receive bids until August 10 for furnishing 50,000 fire brick No. 1 packed in boxes.

✣Bids are asked by R. V. LaDow, superintendent of prisons, Department of Justice, Washington, D. C., until 10 a. m., August 24, for furnishing and delivering at the United States penitentiary, Atlanta, Ga., 10,000 barrels of Portland cement.

✣Bids will be asked by Chief of Ordnance, U. S. Army, Washington, D. C., until August 12, for furnishing two sets of steel forgings for 6-in. guns, model 1908.

✣Sealed bids will be received at the office of the Chief of Ordnance, U. S. Army, Washington, D. C., until August 12, for furnishing 800 10-in. cast iron shells, model 1907.

✣Bids will be received until August 12 by Chief of Ordnance, U. S. Army, Washington, D. C., for furnishing two sets of steel forgings for 14-in. gun, model 1910, and one jacket forging.

Florida.

✣Bids are being asked until noon, Sept. 6, as noted in our last issue, by Capt. Geo. R. Spalding, U. S. Engineer, Jacksonville, Fla., for dredging in Hillsboro Bay, Fla. The work proposes the dredging of the Sections C and D of the channel beginning at the entrance in Tampa Bay. The channel is to be dredged 150 feet wide and to a least depth of 24 ft. at mean low water. It is also proposed to dredge the turning basin and extend the same to the harbor line on the northeasterly side. This dredging will also be done to a least depth of 24 ft., at mean low water except where rock is encountered.

The material is believed to consist mostly of sand and mud. In dredging the 20-ft. channel a rather compact bed of shell was encountered in the vicinity of beacons Nos. 1 and 5, in section C. The borings indicate no rock except in a portion of the turning basin and in its vicinity. The removal of rock will not be required under this contract, but the overlying soft material which it is practicable to remove by the ordinary methods used for dredging soft material will be included in the work. It is estimated that the amounts of material to be removed from each section will be as follows: Section C, 1,300,000 cu. yds.; Section D and turning basin, 1,200,000 cu. yds.

As noted in our last issue, bids are asked by Capt. Geo. R. Spalding, U. S. Engineer, Jacksonville, Fla., until noon Aug. 24, for dredging and removal of rock from Biscayne Bay, Fla. The work to be done will be to widen the present channel, and the portions to be excavated under the existing contract, to such an extent as the funds available with the prices bid will admit. The sum of about $75,000 is available for this work. It is proposed to work on the south side of the existing channel. A depth of 18 ft. at mean low water will be attained at the inner end of the channel. This will increase at a uniform rate to a depth of 20 ft. at the seaward end of the channel. The rock disclosed during the present contract is a soft coral limestone, somewhat too hard to be excavated by an ordinary dipper dredge without first being broken by blasting or otherwise. This is overlaid in places with the usual sea beach sand.

Idaho.

Advices from Wallace state that Jack Orwell has begun work ona 500-ft. tunnel contract at the Snowstorm Extension property, near Mullan.

Illinois.

✣Bids will be received until 11 a. m., August 30 by commissioners of the Neredosia Lake Drainage and Levee District at the office of C. W. Brown, Jacksonville, Ill., for delivery and installation in the district in the west part of Morgan County, Ill., of one simple condensing 4-valve engine, capable of developing 114 h. p.; one 72-in. horizontal tubular boiler, 18 ft. in length; one single suction 24-in. Volute pump, with a capacity of 15,000 gals. per minute; one surface condenser with not less than 400 sq. ft. of condensing surface, together with suction and discharge pipe and other necessary auxiliaries.

✣Bids will be received by William Carroll, city electrician, Chicago, Ill., for furnishing paper insulated, lead incased and rubber covered lead incased fire alarm cable in the following amounts: 21,000 ft., 15 pair, No. 19 B. & S. G., dry core, paper insulated, lead incased; 5,000 ft., 5 pair, No. 19 B. & S. G., dry core, paper insulated, lead incased; 3,000 ft., 19 conductor, rubber covered, lead incased. Proposals must be made out upon blanks furnished by the city electrician, inclosed in sealed envelopes, be addressed to him, and indorsed "Proposals for Fire Alarm Cable."

Permission has been granted William Fahrney to construct two 50-ft. piers into Lake Michigan in the rear of his home, Sheridan road and Granville Ave., Chicago, Ill.

Indiana.

The Indiana & Michigan Electric Co., F. P. Ohmer, chief engineer, South Bend, Ind., is said to be planning to increase the height of its Elkhart dam.

The owners of the Bristol Power Co. of Bristol, Ind., are reported to be planning to erect a new power plant.

Iowa.

✣Bids will be received by the City of What Cheer, Ia., for the street lighting contract. The present one will expire in November. W. I. Meade is Mayor.

City council of Mason City, Ia., is considering the building of a dam across Lime river for the purpose of storing water so that in times of drought the river can be flushed and sewage carried away.

Louisiana.

✣City Comptroller Charles R. Kennedy, New Orleans, La., will receive bids until 11 a. m., Sept. 19, for the construction of a reinforced concrete sea wall on pile foundation, said wall to be about 2,700 ft. long and 14 ft. high, in the bed of Lake Pontchartrain at West End. Bids will be received at the same time for filling in with earth dredged from the bed of the lake the area between the said sea wall and the lake shore, embracing approximately 400,000 cu. yds. of earth. Official advertisement of this work will be found elsewhere in this issue.

Maine.

✣Bids will be received until noon, Sept. 2, by Lieut. Col. George A. Zinn, U. S. Engineer, 537 Congress St., Portland, Me., until noon, Sept. 2, for the construction of a breakwater near Bar Harbor, Me.

Bids are being asked until noon, Aug. 22, by Lieut. Col. Geo. A. Zinn, U. S. engineer, 537 Congress St., Portland, Me., as noted in our last issue, for dredging in Stockton Harbor, Me. The work to be done under this contract consists of dredging a channel about 300 ft. wide and about 3,600 ft. long, in Stockton Harbor, Maine. The material to be removed is believed to be mud, with no boulders or other coarse material. The amount of material to be removed is estimated to be 285,000 cu. yds. measured in scows. The area to be covered is about 25 acres. The cut to required grade ranges from zero to about 7 ft., and the average cut to required grade is about 5.1 ft.

Massachusetts.

✣Bids will be received until noon, August 22, by Col. F. V. Abbot, U. S. Engineer, Boston, Mass.,, for removing the wreck of barge Harbeson Hickman in Plymouth Harbor, Mass.

Michigan.

Special committee appointed by the mayor of Saginaw, Mich., has taken up the matter of excavating the dock lines of the city. The proposed extension as recommended by City Engineer R. W. Roberts is a 600-ft. channel from the Bristol St. bridge to the Johnson St. bridge and a gradual widening from that superstructure until 700 ft. is reached at the Pere Marquette bridge or a short distance below it. It is probable that a consulting engineer will be secured to report on the improvement.

Plans have been completed by T. W. Orbison, Appleton, Wis., for a new dam on the Escanaba River two miles above Escanabe, Mich. This will give the Escanaba Traction Co. 4,200 hp. A large pulp mill will be built.

Minnesota.

The U. S. Department of the Interior has approved the application of the Minnesota Canal & Power Company for a license or permit to use the public lands in the Birch Lake drainage basin, Duluth Land District, Minn., under the provisions of the act of Congress of Feb. 15, 1901. The project of the company involves the development of a minimum of more than 30,000 h. p. in the immediate vicinity of Duluth.

Nebraska.

Surveys have been completed for the proposed power canal site near Niobrara, Neb. It is proposed to build a dam about seven miles up the Niobrara river. The canal will be about 6½ miles long, and the development will cost something like $1,000,000. C. A. Nippell, Niobrara, Neb., has been making the surveys.

New York.

The city of Poughkeepsie, N. Y., is considering the construction of a municipal wharf. John C. Welch is acting mayor.

Ohio.

Jones Bros., Macon, Ga., at Knoxville, Tenn., have awarded a subcontract to Sloan Allen, Anniston, Ala., for the construction of a dam and canal at Middletown, O.

Oregon.

C. L. Huston, Astoria, Ore., has begun work on his contract for the construction of a jetty on the south side of the bay entrance at Nehalem. A rock quarry has been opened near Garibaldi for the work. About $50,000 has been appropriated for the construction of the jetty.

An ordinance has been before the City Council of Portland, Ore., appropriating $15,000 for the erection of a public concrete double-deck dock at the foot of Stark St. The city engineer was instructed to prepare plans and specifications for the dock.

The citizens of Marshfield, Ore., will vote at the fall election on appropriating $50,000 for the purpose of buying dock sites. Henry Sengstacken, Marshfield, is secretary of the Commission of the Port of Coos Bay, which is back of the plan.

Texas.

The Gulf Refining Co., Port Arthur, Tex., is planning to dredge Taylor's bayou from its intersection with the Port Arthur ship canal northward to the sharp turn at the end of the Kansas City Southern lumber dock, and along part of the frontage of this company's property further north. Between these two parts of the bayou it is intended to dredge across the land of the Texas & New Orleans Ry. It is proposed to dredge a channel throughout this distance of about 100 ft. in width at the bottom and to construct a turning basin in front of the company's property on the bayou. All dredging is to be done to a depth of 26 ft. below mean low tide. The company intends also to build a dock of considerable length along the above turning basin.

L. Bryan & Co., 4th floor Chronicle Bldg., Houston, Tex., have been asking bids on the building of about 8 miles of wire fence near the city of Houston.

Virginia.

✣Bids will be received until noon, August 29, by Lieut. Col. Mason M. Patrick, U. S. Engineer, Room 2, Custom House, Norfolk, Va., for dredging Appomattox River, Va.

✣Maj. Charles S. Bromwell, U. S. Engineer, Milwaukee, Wis., will receive bids until 3 p. m., Sept. 1, for the dredging of Port Washington Harbor, Wisconsin.

W. L. Miller, contractor for the extension of No. 3 drydock at the Navy Yard at Norfolk, Va., has begun operations and expects to have the dock completed in 15 months. Between 400 and 500 workmen will be employed in day and night shifts, and there will be practically no suspension, except on Sundays. M. M. Cannon, who will be in charge of the work, states that he will employ negro labor in preference to Italians who were largely employed by the Rodgers Co. in the construction of the present dock. The dock will have a length of 750 ft., which is 200 ft. greater than its present length. Its present width is sufficient to admit the largest vessels which have as yet been designed for the navy.

Canada.

The second dam of the Canadian Government's Ottawa river storage system has been finished by the contractors and turned over to the engineers. This dam is situated at one end of one of the outlets of Lake Kipawa, lying about 9 miles east of the Ottawa and discharging into it at a point about 300 miles upstream from the capital. The storage capacity of the lake is 2,788,000,000 ft., and the rate of discharge into the Ottawa is nearly 14,000 cu. ft. per second maximum flow. .The height of this dam is 27 ft. The entire storage scheme calls for 45 dams located throughout an area of 45,000 square miles, controlling all the important lake expansions and feeders of the upper reaches of the Ottawa river, and regulating the flow of the Ottawa for 600 miles from its course.

The engineers of the Canadian Government estimate the cost of deepening the Saskatchewan river to make navigation possible between Edmonton, Alberta and Winnipeg at $15,000,000 for a distance of 1,500 miles. This cost is exclusive of locks at Grand Rapids, the entrance of the river to Lake Winnipeg. The project will probably be undertaken next year.

BRIDGES AND BUILDINGS

Alabama.

Railroads centering at Birmingham, Ala., have agreed upon plans to submit to the city council for the construction of the 28th St. viaduct. The cost of the structure according to the most conservative estimate is about $1,000,000.

G. B. Bingham, Constructing Quartermaster at Fort Screven, Ga., has awarded a contract to . Blair of Montgomery, Ala., for the construction of one double set of non-commissioned officers' quarters and to Morgan Van Blossom for plumbing the same. Bids were opened July 28.

California.

The Board of County Supervisors, Oroville, Cal., have decided upon bridge improvements estimated to cost about $5,000 including the construction of a new bridge over Little Chico Creek and the filling in of the long bridge west of Chico.

The Board of Santa Clara County Supervisors at a recent meeting held at San Jose, Cal., awarded the contract for the construction of the reinforced concrete bridge over Guadalupe Creek at the Almaden Road to L. M. Scott for $4,380. The bid of James Casley on the work was $5,498.

Advices from San Diego, Cal., state that plans have been completed by City Engineer E. M. Capps for the construction of a steel suspension foot bridge over a deep canyon on Spruce St., between Front and Brant Sts. The total length will be 450 ft. and will resemble in style the old Brooklyn bridge. The span from tower to tower will be 300 ft. in length, with the approach at each end about 75 ft., making the total length of the bridge 450 ft. The height of the towers will be approximately 35 ft. over all, 25 ft. above the floor of the bridge and 10 ft. below.

Colorado.

All bids for the construction of the Bijou bridge were rejected by the county commissioners at Fort Morgan, Colo.. because they were too far above the estimate. New specifications will be prepared and bids asked on a less expensive structure.

Committee composed of John Evans, Colorado State Auditor; Roady Kenehan, C. P. Allen and City Engineer of Denver, Colo., recently inspected the site of the proposed extension of the Larimer St. viaduct over West Colfax Ave. to ascertain the feasibility of extending the viaduct to the intersection of Colfax Ave. and Boulevard F. The state has appropriated $50,000 of the necessary amount, $700,000, for the work and the railroads will also bear a portion of the expense.

District of Columbia.

✣Bids will be received until 11 a. m., Sept. 6, by H. L. Pettus, Quartermaster, U. S. Army, Washington, D. C., for reconstructing superintendent's lodge, etc., at the Mesico City National Cemetery.

✣Bids will be received by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m., August 27, for the extension to building No. 32, Navy Yard, Boston, Mass.

✣Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until 11 a. m., August 20, for the addition to garage at Naval Medical School Hospital, Washington, D. C. R. C. Hollyday is Chief of the Bureau.

✣Bids are asked until 2 p. m., Sept. 1, by District Commissioners, Washington, D. C., for furnishing one straight double 85-gal. tank chemical engine for use in the fire department of the District of Columbia.

✣District Commissioners, Washington, D. C., will receive bids until 2 p. m., August 10, for furnishing 700 more or less metal lockers to be used at the Central High School.

✣District Commissioners, Washington, D. C., will receive bids until 2 p. m., August 12, for wiring, equipping with gas, air, water and electricity, etc., in the physics laboratories in the Western High School.

✣Commissioner of Indian Affairs, Department of Interior, Washington, D. C., will receive bids until 2 p. m., August 23, for the necessary labor and material for the erection of a heating and lighting system for the Grey Nun's Department of the Fort Totten School, North Dakota.

Georgia.

✣Sealed proposals will be received until 10 a. m., August 26, by R. L. LaDow, Superintendent of Prisons, Department of Justice, Washington, D. C., for furnishing and delivering to the United States Penitentiary at Atlanta, Ga., copper work for two guard towers of the inclosing wall at that institution.

✣R. V. LaDow, Superintendent of Prisons, Department of Justice, Washington, D. C., will receive bids until 10 a. m., August 30, for furnishing and delivering at the United States penitentiary Atlanta, Ga., plumbing fixtures for the hospital building.

✣Bids will be received by R. V. LaDow, Supt. of Prisons, Department of Justice, Washington, D. C., until 10 a. m., August 23, for furnishing and delivering at the United States penitentiary Atlanta, Ga., enameled brick to be used for facing the inner walls of the main cell wings.

Idaho.

✣Bids will be received by the Board of County Commissioners, at Sand Point, Idaho, for the construction of a bridge in road district No. 21 . Ignatz Weil is Clerk of the Board.

Illinois.

✣Bids will be received by W. L. Kelley, Treasurer, Danville Branch of the N. H. D. V. S., Danville, Ill., until 10 a. m., Aug. 17, for furnishing labor and material necessary, etc., for steam tunnels and equipment at the home.

A contract has been awarded to H. S. Wetherell, at $4,850, for removing the present bridge from Main St. and placing it at Harrison St. and to construct a new bridge with concrete floor and walks on each side on Main St. in Algonquin, Ill. The other bidders on the work were Continental Bridge Co., $5,600 and Illinois Bridge Co., $7,040, the latter including a concrete arch.

The contract for the construction of the retaining wall on the new Vermillion River bridge at Streator, Ill., was awarded to E. D. Roberts, for $2,147. The work will be done with reinforced concrete.

Information received from Rockford, Ill., states that the Board of Aldermen has condemned the Winnebago St. viaduct over the Chicago, Burlington & Quincy and the Illinois Central Railroads in Rockford, Ill. Action will soon be taken toward the construction of a new viaduct to take its place.

Town Clerk White, Earlville, Ill., has received and placed on file plans for the construction of a new bridge over four mile creek or Stuphen's run south of that city.

Indiana.

✣Commissioners of Hancock and Madison Counties will receive bids at Anderson, Ind. until 10 a. m., Aug. 16, for the construction of two joint county bridges. W. T. Richards is Auditor of Madison County.

✣Bids will be received until 2 p. m., Aug 20, by the Commissioners of Rush County at Rushville, Ind., for the construction of a 55-ft. concrete arch in Washington township. J. M. Stone is Auditor of the county.

✣Bids will be received until 2 p. m., Aug. 20, by the Commissioners of Rush County, Rushville, Ind., for the driving east and west piling under piers at Malcolm ford, Big Flatrock River. J. M. Stone is Auditor of the county.

✣Board of Trustees, Eagle Township, Boone County, at Zionsville, Ind., will receive bids until noon, Aug. 25, for the construction of an 8-room school house. Plans and specifications are on file at the office of Layten Allen, 44 Lombard Bldg., Indianapolis, Ind. H. H. Avery is Trustee.

✣Bids will be received at Peru, Ind., until 2 p. m., Sept. 7, by the Miami County Commissioners, for the gas and electric fixtures for new court house.

✣Commissioners of Shelby County, Ind., will receive bids until 10 a. m., Aug. 29, at Shelbyville, Ind., for the construction of four bridges. G. B. Huntington is Auditor of the county.

Items marked thus ✣ indicate work now open for bids.

✣Commissioners of Noble County will receive bids until 2 p. m., Aug. 22, at Albion, Ind., for the construction and repair of a number of bridges. John W. Earle is County Auditor.

T. H. Koontz has been awarded a contract by the county commissioners at Bluffton, Ind., for the repairs at the Wells County Infirmary for $6,600. Bids were opened Aug. 1.

The commissioners of Jackson County at Brownstown, Ind., have awarded contracts for the construction of seven bridges in the county as follows: Vincennes Bridge Co., Vincennes, Ind., for $325; Chris. Moirtz, Seymour, Ind., for $775; James DeGalyer, Seymour, Ind., for $430. Bids were opened Aug. 2.

Benton County Commissioners at Fowler, Ind., have awarded a contract to J. D. Adams & Co., of Indianapolis, Ind., for the construction of six bridges in Pine township for the sum of $2,400. Bids were opened Aug. 1.

The city of Corydon, Ind., has awarded a contract to the Vincennes Bridge Co., of Vincennes, Ind., for repairing a bridge. The work includes steel joists, steel hub rail and new floor. Bids were opened Aug. 2.

The commissioners of Hendricks county at Danville, Ind., have awarded contracts to the following for the construction of seven bridges: National Concrete Co., Indianapolis; Ira H. Martin, Danville; Gill & Stokes, North Salem, Ind.; and C. W. Hornady, Plainfield, Ind. Bids were opened Aug. 2.

Plans have been approved by the County Commissioners, New Castle, Ind., for the construction of the proposed new flat rock bridge. An appropriation of $1,250 has been provided for the work.

Information received from Logansport, Ind., states the Commissioners of Knox and Daviess Counties, Ind., have adopted the plans of J. S. Spiker of Vincennes for the proposed bridge across the White River. According to the drawings the structure will be 440 ft. long and is estimated to cost $17,557.

Iowa.

The Phee Construction Co., which is building the new Seventh St. viaduct, Des Moines, Ia., has contracted with the Oak Park Sand Co. for 5,000 yds. of sand necessary for the work.

City Council of Shenandoah, Ia., has ordered the construction of a cement bridge over a creek in that town. It will be 40 ft. in width and 14 ft. long. The cost of the work is estimated at $1,400.

Commissioners of Poweshiek and Iowa Counties at a recent meeting held at Victor, decided to construct a new cement and steel bridge over the creek on the county line road. The structure will be 20 ft. wide and will be 42 ft. long.

Kansas.

✣Bids will be received until 10 a. m., Aug. 30, by R. V. LaDow, Supt. of Prisons, Dept. of Justice, Washington, D. C., for furnishing and delivering at the United States penitentiary at Leavenworth, Kan., plumbing fixtures for the hospital building.

County Clerk J. W. Niehaus at Leavenworth, Kan., received bids Aug. 1 for the construction of two concrete culverts. A. Shoniski of Baschor Lear Co., of Kansas City received the contract for constructing one culvert for $310.

The Chicago, Burlington & Quincy R. R., according to a report said to be official, will spend about $56,000 for the construction of new bridges on its line. The work will include two structures on the Kansas City line near East Leavenworth, Kan.

Louisiana.

✣Bids will be received until noon, Sept. 14, by Favrot & Livaudais, Ltd., Architects, 839 Gravier St., New Orleans, La., for the alterations to the two-story court house at Thibodaux, La.

Maine.

Commissioners of Somerset County, Me., have awarded the contract for the superstructure of the proposed new steel bridge across the Kennebec River between Embden and Solon about a mile below the village of Solon, to the Penn. Bridge Co., Beaver Falls, and the substructure to J. L. Parkin & Son, Fairfield, Me.

Maryland.

The State Roads Commission, Baltimore, Md., has awarded the contract for the construction of either a Luten or a ferro concrete bridge in connection with some projected road work.

The Board of Awards, Baltimore, acting on the recommendation of the Commissioner for opening streets has rejected all bids submitted for the building the Seventh St. bridge over the tracks of the western Maryland R. R. at Walbrook. Bids for the structure, which is to be 90 ft. long and 66 ft. wide and of steel encased in concrete, are as follows: Raymond Cement and Pile Co., $34,386; Baltimore Bridge Co., $34,671; Lauer & Harper, $37,007.

Commissioners of Frederick County, Md., have decided to construct a steel bridge across the Monocacy River at Biggs Ford near Walkersville.

Massachusetts.

✣Bids will be received until 3 p. m., Sept. 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Beverly, Mass.

✣James Knox Taylor, Supervising Architect, Treasurey Department, Washington, D. C., will receive bids until 3 p. m., Sept. 14, for the construction complete including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Webster, Mass.

Michigan.

✣Bids will be received until noon, August 15, by H. A. Osborn, Director St. Marie, Mich., for the construction of a school house in District No. 9.

Minnesota.

The contract for the construction of the concrete dock for the Lutzen Lumber, Tie & Post Co., at the mouth of the Poplar River in Cook County, Minn., has been awarded to George Laughlin, Superior, Wis.

Mississippi.

The Board of Supervisors at Bay St. Louis, Miss., has awarded a contract to Jett Bros. of Mobile, Ala., for the construction of a new brick courthouse in that city for $24,989.

Missouri.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Sept. 22, for the construction complete, including plumbing, gas piping heating apparatus, electric conduits and wiring of the United States Post Office at Clinton, Mo.

✣Bids will be received until 3 p. m., Sept. 12, by James Knox Taylor, Supervising Architect, Treasury Department, Washington D. C., for the construction complete including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Lexington, Mo.

The contract for the construction of the high bridge over Dillon Creek has been awarded to the H. A. Klepper Co., Kansas City, Mo. The structure will be along the line of the St. Joseph-Savannah interurban line and will be 540 ft. long and will be about 100 ft. above the bed of the stream.

The contract for the construction of a steel bridge 5½ miles southwest of Columbia, Mo., has been awarded by the County Court to the Missouri Bridge and Iron Co., of St. Louis, for $1,496.

Montana.

Advices from Billings, Mont., state that the contract has been awarded to the Security Bridge Co., at $28,500 for the construction of the first bridge across the Big Horn River. The structure will be of the three-span variety, each span having a length of 165 ft. On one end will be a fill, and at the other an approach 82 ft. long. Ten thousand dollars of the cost will be liquidated by Yellowstone county, an equal amount by the government, and $8,500 will be paid by Rosebud county.

Nebraska.

✣Bids will be received by George Morris, Clerk of Richardson County, Falls City, Nebr., until 9 A. M., August 13, for the necessary labor and material for the construction of all the steel bridges that may be ordered during the ensuing year of 40 to 100 ft. in length and steel tubes 24 to 36 in. in diameter.

The contract for the construction of two new bridges one across the south fork of the Republican at Culbertson and the other across the Frenchman River between sections 9 and 10 in township 4, range 33, has been let to the Empire Bridge Co., Falls City, Nebr. The first structure will be of steel, 160 ft. long consisting of two 60 ft. spans and two 20 ft. spans and the roadway will be 16 ft. wide. The contract price was $2,900. The other bridge will be 171 ft. long of wood and let for $1,100.

New Jersey.

Committee of the Board of Freeholders, according to advices received from Hackensack, N. J., received the following bids for the construction of the steel and concrete bridge across Jay St., Tenafly, N. J.: Caeser Campanini, $1,235; Herbert Howland, $2,400; George M. Brewster Construction Co., $2,100; and L. H. Card & Son, $2,234.

In connection with road known as the Ocean Boulevard planned by the State Roads Commission of New Jersey it has been found necessary to construct four bridges.

The board of chosen freeholders of Passaic county at Paterson, N. J., has awarded a contract to the Abbott Bridge & Construction Co., of New York, N. Y., for the construction of an arch structure over the Wauague River at Compton, N. J., for $7,800.

New York.

✣Bids will be received by the Board of Contract & Supply, Albany, N. Y., until 3 p. m., Sept. 6, for furnishing necessary labor and material for the erection and completion of a new truck house at the southeast corner of Marshall St. and Delaware Ave. in Albany, N. Y.

✣Bids will be received until 2 p. m., August 11, by Commissioner of Bridges 12-21 Park Row, New York City, for constructing stairways and ladders in the main towers of the Williamsburg bridge.

✣Bids will be received by J. K. Paulding, Acting President, Belleview and Allied Hospitals, Department of New York City, 26th St. and 1st Av., New York City, for labor and materials required for furnishing and installing electric and gas lighting fixtures in the Pathological department and male dormitory of the New Bellevue Hospital on 1st Ave. and bounded by 26th and 29th Sts.

✣Bids will be received until August 16, at 10 A. M., by Department of Health of the city of New York, for furnishing and delivering plumbing materials and fixtures, fittings and vitrified pipe to be used in the construction and equipment of various buildings now erected or proposed for erection upon the grounds of the tuberculosis sanitarium at Otisville, Orange County, N. Y.

Perry, N. Y., has awarded a contract to Laidlaw-Dunn-Goulon Co., of Cincinnati, O., for furnishing 2,000,000-gal. cross-compound crank and fly wheel engine. Bids were opened July 28.

The Empire Bridge Co., which has the contract for the construction of a large railroad bridge in Mexico for the National R. R. has shipped the entire steel work from its works at Elmira, N. Y., being the largest shipment billed from that place.

The department of public works of Oswego, N. Y., will probably let a contract Aug. 16, to the United Bridge Co., for the construction of a joint city and county bridge at Oswego. Bonds will be sold about Aug. 10, and the contract will then be let. The United Bridge Co. bid $94,700 on the work. Bids were opened Aug 2

A contract has been awarded to Phillips & Trumbull at $21,750, for the construction of the proposed bridge over East Canada Creek at East Creek (in St. Johnsville, N. Y.) . The structure will be of steel and concrete with three arches, each 80 ft. long and a 28 ft. roadway.

Borings have been completed by Engineers appointed by the Interstate Bridge Committee, on the two proposed sites for the Hudson River bridge. As the cost of the viaduct will probably control the selection of the site, it is believed that the New York end of the structure will be located at 179th St., for it would be at least $4,000,000 cheaper than any other site under consideration. This location would bring the New Jersey end above Fort Lee, which it is said would not be convenient for the residents of New Jersey.

North Carolina.

The Carolina Concrete Co., of Greensboro, N. C., has been awarded a contract by the city of Greensville, S. C., for the necessary labor and material for the construction of a reinforced concrete bridge for the city of Greenville, S. C. H. S. Jaudon Engineering Co., Savannah, Ga., are the engineers. Bids were opened July 20.

North Dakota.

✣Board of County Commissioners at Williston, N. Dak., will receive bids until 10 a. m., Sept. 7, for the construction of the following bridges: One 30-ft. span, 16-ft. roadway, 9-ft. abutments, over Cow Creek, near section line between Sections 13 and 18, Township 156, ranges 100 and 101. One 30-ft. span, 16-ft. roadway, 8-ft. abutments, over Sand Creek, 2½ miles northwest of Angie. One 20-ft. span, 16-ft. roadway, 6-ft. abutments, over Spring Creek, 3 miles north of Williston. One 25-ft. span, 16-ft. roadway, 8-ft. abutments, over Painted Wood Creek, between sections 21 and 27, township 154, range 102, and grade on east side of bridge approximately 1,300 yds. of earth. One 20-ft. span, 16-ft. roadway, 8-ft. abutments, over Painted Wood Creek, 2 miles south of Todd. One 20-ft. span, 16-ft. roadway, 12-ft. abutments, over Coal Bank Creek, 2½ miles north of Buford. One 25-ft. span, 16-ft. roadway, 8-ft. abutments, over Sand Creek, between sections 15 and 22, township 54, range 101, as per plans and specifications on file with the county auditor. The county furnishes all steel and floorings for the above bridges at the court house yard at Williston.

Ohio.

✣Board of County Commissioners will receive bids at the court house, Toledo, O., until 10 a. m., Aug. 16, for furnishing labor and material for the construction and building of abutment and repair of approach to bridge on County Road No. 332 over Swan Creek. Charles J. Sanzenbacher is Auditor of Lucas County.

Plans are being drawn at the office of the County Engineer, Dayton, O., for the construction of a 29-ft. concrete bridge on the Focht road, four miles west of Germantown. The structure will replace the old structure recently destroyed by a traction engine.

Director of Public Service Sundmaker, upon the recommendation of City Solicitor Ballard, Cincinnati, O., has awarded the contract for the construction of the reinforced concrete bridge over the west fork of Mill Creek at Powers St., to the Kirschner Construction Co., for $5,745.

Advices from Cleveland, O., state that the Pennsylvania Railroad Officials have reached an agreement with the Board of County Commissioners by which they agree to pay $80,000 toward the cost of the construction of the proposed 1,200-ft. bridge over the track on Dunham Road in Bedford Township. The entire cost of the work is $120,000. The Wheeling & Lake Erie R. R. will pay $10,000 of the amount.

The County Commissioners at Akron, O., have awarded a contract to the Home ,Engineering & Contracting Co., of Canton, O., for the repair of the canal and river bridge at Peninsula, O., for $1,688. Bids for the work were opened Aug. 1.

County Board of Commissioners, Canton, O., has rejected all bids for the construction of the Roush bridge in Plain Township. The lowest bid was that of Peter Schisler, $1,040, $42 above the estimate.

The county commissioners at Toledo, O., have awarded a contract to the Home Engineering & Construction Co., of Canton, O., for the construction of a bridge over Ten Mile Creek for $4,199. The contract for the substructure was awarded to John Weckerly Whitehouse for $4.90 per cu. yd. Bids were opened Aug. 2.

The Capitol Construction Co., of Columbus, O., has been awarded a contract by the county commissioners at Lima, O., for the construction of the Terter bridge in Bath township for $2,592. Bids were opened Aug. 2.

Oklahoma.

Information received from Muskogee, Okla,. stated that the County of Muskogee has voted to issue $100,000 for the construction of bridges which it is believed will make possible the extension of good roads heretofore prevented.

Oregon.

The Brooklyn Improvement Club, Portland, Ore., is agitating the matter of constructing a bridge over the Willamette River, with the east approach at Ellsworth St. Efforts will be made to put the question before the voters.

Soundings for the piers of the Broadway bridge, in Portland, Ore., have been completed by Engineer Weidman. An excellent foundation has been found at a depth of 120 ft. No further action will be taken at present.

Pennsylvania.

✣Board of Commissioners of York County will receive bids at the court house in York, Pa., until 11 a. m., Aug. 25, for the removal of the present College Ave. bridge and the erection of an entire new one of various necessary spans and approaches with reinforced concrete or for the alteration, repair and improvement of the present one. William H. Strine is Clerk of the Commissioners.

The Luzerne County Judge, Wilkesbarre, Pa., has approved the report of the viewers and has ordered the construction of a bridge over the river at Wapwallopen. This is the third new bridge to be approved by the court, within a month, and viewers have been appointed for a fourth river structure. The bridge projects recently approved are those crossing the river from Plymouth to Breslau, from Nanticoke to West Nanticoke and from Wapwallopen to Salem Township, while the movement for a bridge between Wyoming and Port Griffith has been referred to viewers.

Commissioners of Somerset County, Pa., have awarded the contracts for the construction and repair of the following bridges: Wrought iron bridge, 30 ft. in length with concrete roadway, over Glade run, on the road leading from Rockwood to New Centerville; also three 6-ft. culvert bridges; awarded to Frank Bicchieri, for $549. Iron bridge with concrete roadway over Quemahoning creek, in the town of Belmont, in Jenner Township, 30 ft. in length and 14 ft. wide; superstructure, Nelson-Merydith Co., $540; foundation, Frank Bicchieri, $574 per cu. yd. Iron bridge with 14-ft. concrete roadway, over Juniata Creek, in New Baltimore, in Allegheny Township, 40 ft. in length; superstructure, Nelson-Merydith Co., $720; foundation, Jefferson Landis, $7.40 per cu. yd. Steel beam bridge, with 14-ft. concrete roadway, over Fallen Timber run, in Hooverville, 26 ft. in length; superstructure, Nelson-Merydith Co., $440; foundation, William Eschrick, $6.25 per cu. yd. Iron bridge over Wells Creek at Williams station, with concrete 14-ft. roadway, 95 ft. in length; superstructure, Nelson-Merydith Co., $1,260; foundation, Frank Bicchieri, $4.90 per cu. yd. Repairs to covered wooden bridge over Stone Creek, near Glessner's Mills, on road leading from the Shanksville and Stoyestown station road, 80 ft. in length; R. G. Hostetler, $950. Repairs to covered wooden superstructure bridge over Casselman River near Harnedsville, between Addison and Lower Turkeyfoot Townships, 150 ft. in length; William H. Stoddard, $975.

Soundings have been made for the construction of the proposed new Philadelphia & Reading R. R. bridge over the Delaware River at Yardley, Pa., and solid rock has been located at an average depth of 8 ft. The plans call for 14 spans across the river, but an additional span will be probably employed in order to better accommodate the lines of the river and the New Jersey water power canal, making 15 spans in all, each of which will be a graceful arch. Active construction work will be started early this fall. The project, it is said, will require an expenditure of at least $500,000.

Tennessee.

At a mass meeting recently held at Edgefield, Tenn., arrangements were discussed for the construction of the new bridge between Hermitage and Edgefield Junction on the proposed road. The matter is to be placed before the county court.

Texas.

✣Bids will be received by J. A. Bellar, Secretary School Board, Falfurrias, Tex., until noon, Sept. 6, for the erection of a 2-story and basement brick school building at Falfurrias, Tex. Alfred Giles, San Antonio, Tex., is Architect.

✣Bids will be received until 2 P. M., August 31, by Alfred Hampton, Inspector, Immigration Service, Galveston, Tex., for furnishing all the labor and materials necessary for the construction of the United States immigration station on Pelican Island, Galveston, Harbor.

Bids for the installation of a heating and ventilating system in the Houston, Tex., auditorium were rejected. Bids were opened Aug. 1. Dan C. Smith, Jr., city secretary.

Virginia.

The Norfolk County Board of Supervisors received the following bids for the construction of the proposed Tanner Creek bridge on a line with Reservoir Ave.: V. M. Johns, $2,533; E. E. Cross & Son, $2,500, not including abutments; Cates Machine & Bridge Co., Burlington, N. C., $4,500 for steel bridge. According to the specifications the bridge will be 315 ft. long, 18 ft. wide with four piles to the bent not to exceed 45 ft. in length. At the same meeting instructions were given the Road Engineer to inspect all county bridges and make a complete report.

Washington.

✣Bids will be received until 11 a. m., Aug. 20, by Capt. E. C. Long Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of an oil house at Fort Casey, Wash.

✣Bids will be received at Tacoma, Wash., by the County Auditor, until August 22, for the construction of a bridge across the Pilchuck River at Silvana.

At a joint meeting of the North End Improvement Clubs, Seattle, Wash., a resolution was passed asking the City Council to build Stone Ave. bridge. A committee was appointed to arrange the details.

The general contract for the construction of the new $50,000 addition to the Northern Pacific Beneficial Association hospital on McKinley Hill, Tacoma, Wash., has been let to J. Rounds & Co. of Seattle, Wash., for $33,000, the sub contracts will consume the remainder of the appropriation.

The contracts for the construction of the Whipple Creek and Elmer Martin Bridges were awarded by the County Commissioners, Vancouver, Wash., to T. D. Owens for $2,160 and $1,460 respectively.

Councilman Frank P. Mullen is advocating the construction of an overhead foot bridge between First Ave. and the water front. Plans for the project, which are to be submitted to the city council, call for a 12-ft. bridge on the south side of University St., connecting with the existing sidewalk along the north side of the Arlington Hotel, running directly over Post St., Western Ave. and Railroad Ave. to the dock line, similar in construction to the viaduct on Marion St., over which approximately half the patrons of steamships and ferries pass each day. The work is estimated to cost about $5,000.

Articles of incorporation have been filed with the Secretary of State, Olympia, Wash., for the Nisqually Bridge Co., Sherlock, Wash., with a capital stock of $5,000. The incorporators are A. L. Brown, W. H. Bennett, John Hachmann, Peter Gritzer, Frank Mounts. The new organization proposes to construct a new bridge over the Nisqually River near the Northern Pacific R. R. bridge to replace the one recently destroyed by floods.

West Virginia.

✣Bids will be received until August 13, by W. Guy Tetrick, Clerk of Harrison County, Clarksburg, W. Va., for the following bridge work: First—A bridge across Indian Run, in Ten-Mile District, Harrison County, West Virginia, same to be a twenty-foot span with a sixteen-ft. roadway, to be constructed entirely of concrete. Second—A bridge across Simpson Creek at the mouth of Beards Run, in Simpson District, Harrison County, West Virginia, same to be a forty-foot span (forty-three feet in the extreme), with a sixteen-foot roadway, for which bids will be received for both a low truss and an entire concrete bridge. Both bridges to be constructed in accordance with the plans and specifications on file in the office of the Clerk of the County Court.

Wisconsin.

Advices from DePere, Wis., state that the City Council has condemned the viaduct over the railroad tracks at Winnebago St. Although nothing definite has been done as yet toward the construction of a new bridge, it is believed that concrete will be used.

City Council of Milwaukee, Wis., will take up the matter at once of constructing fenders for the concrete abutments on several bridges, estimates are as follows: State St. bridge, $2,639; Cherry St. bridge, $1,500.

Canada.

The contract for the substructure of the proposed bridge over the Saskatchewan River connecting Edmonton, Alta and Strathcona has been let by the Canadian Pacific Ry. to John Gunn & Sons, Winnipeg, Man.

The contract for the construction of the proposed bridge over the River de Lilse on the Military Road north of Alexandria, Ont., has been awarded to Marpaw & McDonald, St. Andrews, Ont., for $2,066. The estimate of the engineer was $2,480.

The city of New Hambury, Ont., has awarded the following contracts for electrical equipment; bids opened July 18: Packard Electric Co., Ltd., St. Catharines, Ont., for distributing transformers, $1,014; Canada Westinghouse Co., for storkling apparatus, $1,327; Canada Westinghouse Co., for protective apparatus, $562.

Contracts have been awarded at Toronto, Ont., for the construction of a 55-ft. clear span pony truss steel bridge to Jesse Winger, Edgeley, Ont., for $1,528, abutments, and to Jas. Vance, New Hambury, for $1,093, superstructure. The bids on steel have been rejected.

The city of Saskatoon, Sask., has awarded a contract to Robb Engineering Co., of Amherst, N. S., for furnishing the city with one 250-hp. water tube boiler for $4,246. Bids were opened July 25.

John Gunn & Sons of Winnipeg, Man., have been awarded a contract by the city of Edmonton, Alta., for the construction of a substructure high level bridge over N. Saskatchewan River.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣ City Treasurer of Montgomery, Ala., Robert Tait, will receive bids until noon, Aug. 15 for the paving of roadway of South Hull St. Extension from the south side of Felder Ave. to the City Limits with clay gravel. Plans and specifications are on file at the office of the City Engineer.

The board of revenue at Birmingham, Ala., is working on plans for the construction of several new roads over the county. The present plans include a three and a half-mile road from Johns to Yolande, to cost $4,000. The road, it is said, will be partly dirt and partly macadam. It is also planned to build a four-mile road from Brookside to Mineral Springs at a cost of $2,000. A one-mile stretch on the Lewisburg road is also being planned. About $12,000 is available for this work.

J. T. Robertson appeared before the county board of revenue at Montgomery, Ala., and asked that a road from Stanford's store, two miles west of LeGrand and then to Red Level, a distance of about three miles, be graded and gravelled.

California.

The county of Contra Costa held an election Aug. 2 to vote on the issuance of bonds for the construction of 125 miles of permanent highways.

Property owners on Ninth St., in the city of San Diego have filed a petition with the city clerk asking the common council to pave 12 blocks on that street between B and N Streets.

Property owners in San Diego have filed a petition in the office of the city clerk asking for the paving of Eighth St., from the south line of City park to the north line of K St., excepting the intersections at C. D. and H Sts. The distance covered by the proposed improvement is one mile.

The board of trustees of Porterville, Cal., has ordered Putnam Ave., from the East property line of Division St., to the west property line of Grevilla St., graded and paved with asphalt pavement on an asphalt concrete foundation.

The University of California, Berkeley, has awarded contracts to the Contra Costa Construction Co., involving an expenditure of $33,100, for the construction of a number of new roads and avenues through the campus grounds. One of the new avenues contemplated in the plan will start from the northeast corner of California Hall and extend westerly to the tennis courts. From the tennis court the avenue will extend north of the new library building, intersecting the street near North Hall. Another avenue will be extended from east of the Philosophy building to the west steps of the Hearst Mining building.

The Box Springs grade at Riverside, Cal., is to be converted into a mountain road. The board of supervisors passed a resolution declaring that the public convenience and necessity demanded that the grade road be improved with a rock foundation 16 ft. in width. The cost will approximate $30,000.

The City Trustees of Visalia have awarded a contract to Worswick Street Paving Co. for the recapping of the present pavement and the laying of several additional blocks of new pavement.

City Council of San Diego has passed resolutions of intention to pave 2d St. from the north line of H St. to the north line of B, and B St. from the east line of 15th to the west line of 25th St.

City of Escondido, Cal., has awarded a contract to Denney & Granville for grading and paving with decomposed granite Grand Ave., from the west line of Juniper St. to the west line of Nutmeg St. The contract price was $6,400.

Colorado.

J. A. Osner was the only bidder for the work on the state boulevard which will run from Denver to Colorado Springs. The bid being as follows: Team and drivers, $4.50; laborers, $2; tools, $4; on a basis of eight-hour day. The contract will probably be awarded. Two bids were received by the state engineer for work on the Larimer county road from Fort Collins to Loveland as follows: Ward A. Tucker—Rock, per yd., $1, and earth, $.30; James Ross—$.90 on rock, and $.25 on earth.

The state highway commission will probably build a first class automobile road between Delta and Grand Junction. The commissioners of Delta county have asked the commission to appropriate $500 to put the road in shape, and have agreed if this is done, Delta county will put up $1,000, making a total of $1,500 to be spent on improvements from Delta county line to Delta.

City Council of Colorado Springs, Colo., has passed an ordinance, providing for the paving of the down-town streets of Colorado Springs, the laying of an adequate sewer system and the changing of curb lines to suit the various conditions in different localities.

District of Columbia.

✣Bids will be received until 2 p. m., August 15, by District Commissioners, Washington, D. C., for grading and improving suburban streets and avenues in the district of Columbia. D. C. Cuno is Commissioner.

Extensive improvements in West Potomac Park, Washington, D. C., are contemplated, for which purpose $100,000 is asked by Col. Cosby. This sum is wanted for grading and macadamizing the roads.

Florida.

It is stated that the Jacksonville Automobile club of Jacksonville, Fla., is back of a movement for the construction of a two-mile speedway on the outskirts of the city. The track, it is said, will be one of the largest in the country and will be built circular.

Idaho.

The board of public works of Boise, Ida., has awarded contracts for the construction of 60 blocks of asphalt paving and 30 blocks of concrete paving as follows: To the Coast Construction Co., of Tacoma, Wash., for the construction of 14 blocks of concrete pavement at $41,759; Jacob Gustafson of Boise for the construction of 16 blocks of concrete pavement for $49,257; the Pacific Construction Co., of Portland, Ore., for the construction of 60 blocks of asphalt pavement for $223,124. The contractors will begin work at once.

Illinois.

✣Bids will be received until 2 p. m., August 20, by the Commissioners of the Highways in Sycamore, Ill., for the construction of washed gravel roads to be located between the easterly corporate limits of the city of Sycamore and the township line between Sycamore and Cortland townships. John Carlstrom, Charles A. Swanson and C. E. Marshall are Commissioners.

✣Bids will be received by Fred W. Stinnett, Town Clerk, Fire Proof Bldg., Carmi, Ill., until 2 p. m., August 20, for the construction of one gravel or rock road in the towns 3 miles in length. All bids must be accompa-

Items marked thus ✣ indicate work now open for bids.

nied by a certified check payable to the Commissioners of Highways, for $100. J. A. Hubele, Henry Null and Jacob Maurer are the Commissioners.

✣The Chicago Department of Public Works will receive bids until 11 a. m., August 10, for furnishing and delivering at the various ward yards in the city approximately 5,000 sq. yds. of cedar paving blocks. B. J. Mullaney is Commissioner of Public Works.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., for the construction of 22 street improvement contracts. C. A. V. Standish is Secretary of the Board.

✣Town clerk of Carmi, Ill., will receive bids until 2 p. m., August 20, for the construction of one gravel or rock road in the town of Carmi 3 miles in length. Fred W. Stinnett is Clerk.

✣Board of Local Improvements of Peoria, Ill., will receive bids until August 15, for paving the roadway of Meyer Ave. from the intersection of Pecan to Lincoln Ave. with brick pavement 30 ft. wide. The work includes the following approximate quantities: 920 cu. yds. excavation, 30 lin. ft. stone protection (4 in. x 14 in.), 1,646 lin. ft. cinder foundation under cement curb (6 in. x 12 in.), 1,646 lin. ft. Standard No. 1 cement curb, 2,743 sq. yds. concrete foundation (5 in.), 2,743 sq. yds. sand cushion (2 in.), 2,743 sq. yds. brick pavement, 2,743 sq. yds. sand filler (½ in.). Work must be completed by October 15th next.

The city council of East St. Louis, Ill., is considering boulevarding State St., at an estimated cost of $227,000. The plan is to move the street car tracks to the center of State St., formerly known as the Belleville rock road, and make a roadway on either side with granitoid sidewalks, shade trees, etc. The measure has been referred to the Ordinance Committee, and if adopted the result will be a boulevard from the old city limits at 38th St., to the present city limits at Edgemont, 89th St., Belleville has promised to take up the work from that point.

The contract for the paving with brick of 13th St., in East Moline, Ill., from the bluff road to the Marseilles plant, a distance of about three-fourths of a mile, was awarded by the East Moline board of local improvements to the Northwestern Construction Co., of Davenport, Ia., for $15,279.

City Engineer Danely of Champaign, Ill., is preparing the plans for a pavement on Washington St., Urbana, from Market St., to Busey Ave., and thence north to Green St. In the center of the street a park will be constructed 10 ft. wide, with openings at street intersections. The pavement will be from 30 ft. to 36 ft. in width. The improvement will cost about $27,000. The contract will probably be let in September.

City Council of Joliet, Ill., has directed the Board of Local Improvements to prepare ordinances for walks on 2d Ave., Mississippi Ave. and Cass St. About four miles of concrete walks will be required.

Indiana.

✣Bids will be received until 2 p. m., August 26, by Commissioners of Vermillion County at Newport, Ind., for the construction of a gravel road in Eugene township. H. T. Payne is Auditor of the county.

✣Jennings County Commissioners at Vernon, Ind., will receive bids until 11 a. m. Sept. 5, for the construction of two pike roads in Campbell township. T. L. Campbell is auditor of county.

✣Bids will be received at Williamsport, Ind. until 1 p. m., Sept. 5, by the Commissioners of Warren County for the construction of gravel roads in Pine and Steuben townships. Robert L. Winks is Auditor of the County.

✣Bids will be received at Marion, Ind., until Sept. 5, by Commissioners for the construction of a macadam road in Franklin township. A. C. Stout is Auditor.

✣Bids will be received by the Commissioners of Tipton County at Tipton, Ind., until 10 a. m., Sept. 5, for the construction of a gravel road in Cicero township. J. F. Barlow is Auditor of Tipton County.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., Aug. 15, for the improvement of Haugh St. from the West property line of Walnut St. to the east property line of Calvelage St. by grading and paving the sidewalks.

✣Bids will be received until 10 a. m., August 15, by Board of Public Improvements, Indianapolis, Ind., for the improvement of New Jersey St. from the north property line of 30th St. to the south property line of 32nd St. by grading and paving the roadway.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., August 15, for the improvement of New Jersey St. from the north line of 28th St. to the south property line of 30 St. by grading and paving the roadway.

✣Bids will be received until 10 a. m., August 15, by Board of Public Works, Indianapolis, Ind., for the improvement of Osage St. from the north property line of Osage St. from the north property line of New York St. by grading and paving the roadway.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., August 15, for the improvement of Linwood Ave. from the south property line of New York St. to the south property line of Michigan St. by grading and paving the roadway.

The city council of Warsaw has let a contract for the paving of three miles of pavement to J. J. Kelleher & Co., of Frankfort, specifying Indiana block.

A joint session of the commissioners of Marion and Hamilton counties was recently held in Noblesville to decide whether or not a county line road will be built between the two counties.

The city of Marion, Ind., has awarded a contract to William Yates for the paving of Second St., from Boots to Race Sts., with Metropolitan block, and tar filler. Mr. Yates' bid for the work was $5.76 per lin. ft.

The Kelleher Co., Frankfort, Ind., has been awarded the contract for paving portions of 11 streets at Warsaw, Ind.

Board of Public Works of Marion, Ind., has awarded a contract to William Yates for the paving of 2d St., from Boots to Race St., with metropolitan block, the contract providing that tar filler be used. The contract price was fixed at $5.76 per lin. ft.

The County Commissioners at Marion, Ind., have awarded the contract for the construction of the Phillips Road to Mackey & Drucke at $8,197. The other bids on this road were as follows: Modlin Brothers, $9,300; Alexander & Crosby, $8,610; Charles Nelson, $8,660; William Small, $8,767; Wheat, Siske & Ruple, $9,449; Dillard Artis, $10,095; Drucke & Williams, $9,500; Mahoney & Allen, $9,697; William Yates, $9,400. The contract for the Sherron Road was let to Wheat, Siske & Ruple at $6,545.

The commissioners of Hendricks County at Danville, Ind., have awarded a contract to Evan Bray of Noblesville, Ind., for the construction of roads in Union and Washington townships. Bids were opened Aug. 3.

The commissioners of Wells County at Bluffton, Ind., have awarded a contract for the construction of three roads of macadam to Abe Hesher. Bids were opened Aug. 1.

The Board of County Commissioners at Vincennes, Ind., has awarded a contract to John Hunchler of that city for the construction of a gravel road in Knox County for $1,150. Bids were opened Aug. 2.

The Commissioners of Wabash County at Wabash, Ind., have awarded a contract to Geo. Sunell of Laketon, Ind., for the construction of a road in Paw Paw Township. Bids were opened Aug. 2.

The Commissioners of Washington County at Salem, Ind., have awarded a contract to Bert Chartaen of Campbellsbury, Ind., for the construction of the Bee Line gravel road in Washington Township for $11,754. Bids were opened Aug. 1.

The County Commissioners at Decatur, Ind., have awarded a contract to Martin Miller of that city for the construction of a stone road in Monroe Township. Bids were opened August 4.

The contract for the Sheron road, two miles in extent, in Franklin Township, was awarded by the Commissioners at Marion, Ind., to Wheat Sisk & Ruple of Portland for $6,545. The Phillips road in Franklin Township, three miles long, was awarded Alexander & Crosby of Indianapolis, Ind., for $8,610.

Iowa.

The Iowa City, Ia., city council has acted favorably upon a resolution providing for the construction of bitulithic pavement on the following streets: Bloomington, between Capitol and Clinton; Dubuque, between Jefferson and Bloomington; Linn, between Market and Jefferson; Dodge, between College and Burlington; Jefferson, between Capitol and Clinton; Jefferson, between Clinton and Dubuque; Burlington, between Dubuque and Johnson; Linn, between Court and College; Linn, between College and Iowa Avenue; Dubuque, between Bloomington and point east of Park Bridge; Dubuque, between Bloomington and Market; Evans, between Iowa Avenue and Market; Market, between Evans and east end of paving on Market.

M. Ford has been awarded a contract by the city of Cedar Rapids, for paving Grand Ave., from 10th to 21st Sts. for $19,838. The bid being $1.64 per sq. yd. for paving and $.42 per cu. yd. for grading. The Concrete Construction Co., was awarded the contract for the curbing at $1,224.

The city council of Creston, Ia., has passed a resolution providing for the paving of North Walnut St., from Summit to Jefferson Sts.

Centerville, Ia., has awarded a contract for the construction of 5,000 sq. yds. of brick pavement to McGuire & Stanton Construction Co., of Leavenworth, Kans., at $2.12, also combined curb and gutter at $.70 per lin. ft.

Property owners on Brady St., between Front St. and Fifth St., have drawn up a petition asking the city council of Davenport to pave that street with asphalt instead of creosoted blocks.

The city council of Decorah, Ia., has decided to construct cement sidewalks on the north side of Helvly St., on the west side of Grove St., and on the north side of Jefferson St.

Contracts for paving work at Davenport, Ia., have been let as follows: Paving the alley between East River and Federal Sts., Switz St. and Tremont Ave., Hydraulic Construction Co., at 45 cts. a cu. yd. for excavating and $1.72 per sq. yd. for paving. The same firm received the paving contract, for work on Case St. from Federal St. to Cambria St., at excavating 45 cts., paving $1.69, and curbing 35 cts. per lin. ft. Paving Brown St. between 6th and 7th, Independent Construction Co., excavating 45 cts., curbing 38 cts., paving $1.73. Paving Western Ave. between 6th and 7th, Independent Construction Co., excavating 45 cts., curbing 38 cts., paving $1.73 sq. yd.

Bids as follows were received Aug. 1, by the city of Burlington, Ia., for paving on South Main St.: Young & Buescher, curbing, 52 cts.; concrete, $1.48; brick, $2.06. Fred. W. Guenther, curbing, 48 cts.; concrete, $1.63½; brick, $1.85. Bernard Bros. & Mercer, curbing, 45 cts.; concrete, $1.85: brick, $1.80. George Peterson, curbing, 57 cts.; concrete, $1.62; brick, $1.50. The paving material will be concrete with a foot of brick pavement on each side of the street railway track.

The Bryant-McLaughlin Asphalt Paving Co., of Des Moines, Ia., has been awarded a contract by that city for the construction of about 1,510 sq. yds. of asphalt pavement for $2.05 per sq. yd. The paving will be laid on 8th St., from Mulberry to Cherry. Bids were opened Aug. 3.

The Bryant-McLaughlin Asphalt Co., of Des Moines, Ia., has been awarded the contract by the city of Des Moines, Ia., for the construction of about 3,871 sq. yds. of paving on 23d St., from Forest Ave. to the south line of lots 1 and 32 of Williamson Place. The contract was awarded at $2.05 per sq. yd. Bids were opened Aug. 3.

The following bids were received Aug. 3, by the city of Vellisca, Ia., for vitrified brick paving on concrete base with concrete curb; Theo. S. Delay, Engineer, Creston, Ia.: Hamilton & Schwartz, Shenandoah, Ia., 37 cts. curb, $1.97 paving, 40 cts. excess grading, 2 cts. overhaul grading; Conrou & Wright, Harlan, Ia., 40 cts. curb, $2.05 paving, 40 cts. excess grading, 2 cts. overhaul grading; O'Farrel Construction Co., Dubuque, Ia., 49 cts. curb, $2.09 paving, 45 cts. excess grading, 10 cts. overhaul grading; M. Ford, Cedar Rapids, Ia., 49 cts. curb, $1.97 paving, 38 cts. excess grading, 1½ cts. overhaul grading.

Kansas.

The city of Wichita, Kan., has awarded contracts for the construction of 21 blocks of new pavement on Cleveland Ave., from Douglas Ave. to 13th St., and Victor place from Hillside to Rutan and Cliffton Ave. The contracts were awarded as follows: Warner-Quinlan Paving Co., at $1.98 per sq. yd., for paving Victor place; Kansas Bitulithic Co., at $2.15 per sq. yd., for paving Cleveland Ave. A petition signed by some property owners of N. Main St., between Ninth and 13th Sts., was received by the city commissioners asking for new pavement.

Kentucky.

The city of Bellevue, Ky., has awarded a contract to E. J. Knepfle for $30,080 for the construction of pavement on Fairchild Ave.

Maryland.

✣Bids will be received by the Board of Awards, Baltimore, Md., until 11 a. m., August 17, for the grading, curbing and paving with sheet asphalt, asphalt block, vitrified block or bitulithic Park Terrace from Park Ave., to Robert St. B. T. Fendall is City Engineer.

The state road commission at Baltimore, Md., has agreed upon a portion of the proposed Baltimore to Annapolis boulevard. The commission adopted the tentative route from Annapolis to Boone station and work upon this will begin as soon as specifications can be drawn and bids received. A survey is to be made of the portion between Boone station and Glenburnie for the purpose of determining the topography of the country in that locality.

The state road commission at Baltimore, Md., has awarded a contract to the Monroe Paving Co., for paving the Liberty road within the city limits with sheet asphalt for $114,064.

P. Flanigan & Sons have been awarded a contract by the state road commission at Baltimore, Md., for paving with pitch macadam the Liberty road from the city limits to Bucks lane. This firm was also awarded the contract for paving the Harford road with vitrified brick from North Ave., to the city limits for $146,294. The section from Atlantic Ave., to the city limits will be done by Warren Bros. for $106,452.

George M. French has been awarded a contract by the state road commission of Baltimore, Md., for improving the road from Elkton to Singerly, in Cecil county for $21,884. The distance is 2.35 miles.

Contracts for improving the Harford, Belair and Liberty roads were awarded by the State Roads Commission at Baltimore. Vitrified brick was selected for the Harford, sheet asphalt for the Liberty and pitch macadam for the Belair. Contracts were awarded as follows:

Garrison Avenue—Sheet asphalt from Walbrook Junction to Buck's lane, 1½ miles, to the Monroe Paving Co., $114,063.

Liberty Road (continuation of Garrison Ave. from Buck's lane for one mile into Baltimore county)—Pitch macadam, to P. Flanigan & Sons; $13,165.

Harford Road—Vitrified brick for section from North Ave. to Atlantic Ave. to P. Flanigan & Sons, $146,293. Continuation of same road over Herring run to Warren Bros., $106,178 for same material and a further charge of either $60,752 or $39,950, according to the nature of the bridge selected to span Herring run.

Belair Road—Pitch macadam to E. P. Lindsay, $58,461 for 3 41-100 miles of road from the city limits.

Cecil County—Trap rock road from Elkton to Singerly, to E. M. Fresch, $21,183, on condition of adjustment of some charges.

Massachusetts.

Contracts were awarded by the Highway Commission at Boston, Mass., for the construction of about three and one-quarter miles of road in the town of Holliston. Of the total 9,800 ft. is to be gravel road with oiled surface paid for by the state and 7,300 ft. is to be macadam road paid for by the town of Holliston. The contract was awarded to C. E. Horne of Millbury, who bid $8,304 for the town work and $7,782 for the state work.

Michigan.

The city of Niles, Mich., has contracted with C. H. Defrees of South Bend, Mich., to lay two miles of street pavements this year. The greater portion of the pavement will consist of brick.

Minnesota.

✣Bids will be received by the Board of County until 2 p. m., August 18, at the Monterey Hotel, Monterey, Minn., for the grading of State Road No. 2, through sections 1, 2, 3, and 4 in Elm Creek Township. H. P. Edwards, Fairmont, Minn., is County Auditor.

Mississippi.

The county board of supervisors, Hazlehurst, Miss., have been petitioned by the electors in Hazlehurst district to be allowed to come under charter 149 of the laws of 1910, which gives the power of each district to issue bonds for the purpose of building roads. It is proposed that an issue of $75,000 will be sufficient to build the roads in this district.

The board of supervisors of Tallahatchie county, Charleston, will at its August meeting, sell a $50,000 bond issue, the proceeds of which will be used in construction of modern highways in the fourth and fifth districts.

Bids opened at Gulfport, Miss., for the construction of 13,000 sq. yds. of cement sidewalks on Aug. 2, have been rejected on account of defect in legal proceedings. The work includes 300 sq. yds. of cement driveway, 1,000 cu. yds. of grading and 500 ft. of terra cotta pipe. H. D. Shaw is City Engineer.

Missouri.

✣Bids will be received by the Board of Public Improvements, St. Louis, Mo., until August 15, for the improvement of streets as follows: Asphalt—Rolla place, from Ashland to 835 ft. south; Newstead, from Hunt to Manchester; Sarpy, from Vandeventer (formerly Manchester) to Hawk; Arlington, from North Market to St. Louis, and Adelaide from Conde to 590 ft. east. Bitulithic—Arsenal, from Morgan Ford to King's Highway; Portis, from Scanlan to Arsenal; Bent, from Humphrey to Hartford; Semple, from North Market to St. Louis and Union from St. Louis to Natural Bridge road. Wood blocks—McPherson, from King's Highway to Union; Gay, from Twelfth to Thirteenth; and Twelfth from Franklin to Tyler and from Tyler to Hebert. Telford—Waldemar Ave. from Forest Ave. to McCausland. Brick—Pacific, from Chouteau to Papin; Arsenal, from King's Highway to Woods; Minnesota, from Meramec to Gasconade; Twenty-first, from Bremen to Penrose and from Branch to Salisbury; McRee, from Spring to Tower Grove; Lemp, from Utah to Wyoming; Bulwer, from Grand to Prairie; Victoria, from Billon to Tamm; Crittenden, from Nebraska to Pennsylvania; Duncan, from Boyle to Newstead; Alaska, from Itaska to Osceola; Compton, from Winnebago to Miami; Bertha, from Hodiamont to the western city limits; Idaho, from Bates to Itaska; Juniata, from Ohio to Gravois; Alabama, from Fillmore to Bates; Twenty-third, from Hebert to Palm; Maiden Lane, from Twenty-fifth to Jefferson; Natural Bridge road, from Spring to Fair and from Spring to Grand; St. Louis, from Union to Belt; Greer, from Union to 449 ft. west; Minnesota, from Osage to Keokuk; Glasgow, from Cass to St. Louis, and Twentieth, from Washington to O'Fallon, from O'Fallon to Cass, from Cass to Branch and from Branch to Salisbury.

A petition will soon be presented to the county court at Springfield, Mo., for the formation of a special road district of the county along the Division St. road, between the city limits of Springfield and the Taylor township line. County Highway Engineer Fred J. Marshall will soon submit an estimate on the work.

Montana.

The Miracle Tripp Concrete Co., of Missoula, Mont., has been awarded a contract by A. B. Shattuck, Constructing Quartermaster at Fort Missoula, Mont., for the construction of concrete sidewalks and curbs. Bids were opened July 30.

Nebraska.

The contract for grading 36th St., from Q to Harrison, at South Omaha, Neb., has been let to Condon & Griffith, at 13.9 cts. per cu. yd.

New Hampshire.

✣Bids will be received until 1 p. m., August 19, by H. C. Hill, State Engineer, Concord, N. H., for the construction of 6,900 ft. of road in Madison. The work includes grading and surfacing.

New Mexico.

At a recent meeting of the county commissioners held at Deming, N. M., $1,500 was appropriated towards building the road out of Deming north across the bridge and on to the hard road which goes up the Mimbres. The county has the promise of assistance of the territorial good roads commission.

New York.

✣Bids will be received by the Park Board, Department of Parks, Arsenal Bldg., New York City, until 3 p. m., August 11, for furnishing, delivering and distributing in place 20,000 gals. crude oil mixture having asphaltic base for parks, Borough of Bronx.

✣Bids will be received by Alfred E. Steers, President of the Borough of Brooklyn, New York City, N. Y., until 11 a. m., August 17, for 39 street improvement contracts, the largest being No. 38 as follows: For regulating and repaving with asphalt block pavement on the present pavement as foundation, the roadway of Ocean Ave., from Parkside Ave. to Dorchester Road, together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 25,410 sq. yds. asphalt block pavement, including mortar bed, outside railroad area (five years' maintenance); 60 sq. yds. asphalt block pavement, including mortar bed, within railroad area (no maintenance). The time allowed for the completion of the work and the full performance of the contract is seventy-five (75) working days. The amount of security required is $15,000.

✣Bids will be received until 3 p. m., August 11, by the Park Board, Department of Parks, Arsenal Bldg., New York City, for regulating, grading and paving with asphalt pavement on a concrete base the roadway of west traffic road of ocean parkway, from 18th Ave. to King's Highway, Borough of Brooklyn, together with all the works incidental thereto.

✣Bids will be received until 3 p. m., August 11, by Park Board, Department of Parks, Arsenal Bldg., New York City, N. Y., for regulating, grading and paving with asphalt pavement on a concrete foundation the roadway of Parkside Ave., from Flatbush Ave. to Park Circle, Borough of Brooklyn, together with all the work incidental thereto.

The State Highway Commission at Albany, N. Y., received the following bids for state road work on Aug. 1: Highway No. 872, Portville Village Cattaraugus Co., 0.65 mi. (bids held); Highway No. 5061, Williamsville Village, Erie County, 1.08 mi., awarded to Mulderry Bros., Albany, N. Y., $32,980; Highway No. 868, Dolgeville Village, Herkimer County, 2.06 mi., awarded to Cooper Snell Co., Little Falls, $37,777, subject to right-of-way; Highway No. 869, Middleville Village, Herkimer County, .069 mi., awarded to Newport Construction Co., Newport, $7,100, subject to right-of-way; Highway No. 870, Herkimer

Village, Herkimer County, 1.99 mi., awarded to Warren Bros. Co., Boston, Mass., $49,445.44; Highway No. 5069, Poland Village-Cold Brook Village, Herkimer County, 2.04 mi., awarded to Dale Engineering Co., Utica, N. Y., $19,949.44, subject to right-of-way; Highway No. 867, Dansville Village, Livingston County, 1.09 mi., awarded to Schroader Hicks Construction Co., Rochester, N. Y., $10,654; Highway No. 5,070, Clyde-Savannah-Part 1, Wayne County, 0.62 mi., awarded to Lawler Bros. Construction Co., New York City, $18,477.50; Repair Contract 66, Road No. 88, Transit, Section 1, Towns of Amherst-Clarence, awarded to F. L. Cohen, Buffalo, N. Y., $28,450; Repair Contract 87, Road No. 94, Monroe Ave., Monroe County, towns of Brighton and Pittsford, all bids rejected; Repair Contract No. 64, Road No. 86, Big Tree, towns of Aurora-Wales, Erie County (bids held); Highway No. 86-R, Big Tree, towns of Aurora-Wales, Erie County, 4 miles (bids held).

The board of contract and supply of Schenectady has awarded a contract to the Schenectady Contracting Co., for the paving of South Ferry St., and a contract to L. E. Regan for the construction of new sidewalks in Watt St., and to Thomas R. Crane for new sidewalks in Raymond St.

The Endicott-Johnson Co., of Lestershire has awarded a contract to F. E. Whittemore of that city for the construction of curbs and gutters of cement about the factory. The work will be done on Arch St., Corliss Ave. and Willow St.

At the recent meeting of the National Good Roads Congress held at Niagara Falls a resolution was introduced at the suggestion of Congressman William Sulzer, presiding officer of the convention, urging the construction of a state scenic highway from New York City to Niagara Falls. The delegates indorsed the idea.

The following contracts were awarded by the President of the Borough of Queens, New York, for improvements in the several wards in the borough: Regulating and grading in Monson St. from Fulton to Franklin St., First Ward, Astoria Contracting Co., $2,745. Regulating, grading and laying sidewalks in Academy St. from Jane St. to Wilbur Ave., First Ward, Astoria Contracting Co., $1,649.25. Paving with asphalt blocks Elm St. from Hopkins Ave. to Sherman St., First Ward, Barber Asphalt Contracting Co., $3,352.50. Regulating and laying sidewalks and curbing in Payntar Ave., from Vernon Ave. to Sunswick St., First Ward, Astoria Contracting Co., $16,972. Regulating and grading in Ely Ave. from near Harris Ave. to Payntar Ave., First Ward, Joseph A. Boyce, $194.70. Regulating and grading Lawrence St. from Walcott Ave. to Winthrop Ave., First Ward, Peace Bros., $5,945. Regulating and laying sidewalks in Eighteenth Ave. from Jackson Ave. to Grand Ave., First Ward, Peace Bros., $17,897.50. Regulating and laying sidewalks in North First St. from Bergen Ave. to Grand St., Fourth Ward, Henry J. Mullen, $423. Regulating, grading and paving with asphalt blocks Newtown Ave. from Flushing Ave. to Grand Ave. First Ward, Barber Asphalt Contracting Co., $43,448.70. Regulating and laying sidewalks in Fourth Ave. from Flushing Ave. to Walcott Ave., First Ward, Peace Bros., $21,258.70. Regulating and laying sidewalks in Fourth Ave. from Flushing Ave. to Walcott Ave., First Ward, Peace Bros., $21,258.70. Regulating and laying sidewalks in Seventeenth Ave. from Flushing Ave. to Grand Ave., First Ward, Astoria Contracting Co., $10,037.50. Curbing and laying sidewalks in Seventeenth Ave. from Jackson Ave. to Grand Ave., First Ward, Peace Bros., $10,620. Regulating and laying sidewalks in Ely Ave. from Jamaica Ave. to Broadway, Joseph A. Boyce, $5,308.70. Regulating and laying sidewalks in Fourteenth Ave. from Newtown road to Grand Ave., First Ward, Astoria Contracting Co., $6,316. Regulating and laying sidewalks in Fifth Ave. from Broadway to Flushing Ave., First Ward, Joseph A. Boyce, $24,821.

A committee has been appointed at Seneca Falls, N. Y., consisting of Norman J. Gould, Fred L. Story, Louis H. Hood, Dr. Frederick W. Lester, and Murray G. Hoskins, to settle upon the most feasible manner in which to pave Cayuga St

Ohio.

✣Bids will be received by the County Commissioners at Toledo, O., until 10 a. m. August 17, for the construction of macadam pavement on the Point Place Road. A certified check for $500 must be filed with each bid. Charles Sanzenbacher is Auditor.

✣Bids will be received by the County Auditor, Charles J. Sanzenbacher, Toledo, O.; until 10 a. m., August 17, for furnishing labor and material necessary for the construction of the Point Place macadamized road. Samples of the material used must be furnished by each bidder and a certified check for $500.

✣Board of Lucas County Commissioners will receive bids at the office of Charles J. Sanzenbacher, County Recorder, Toledo, O., until 10 a. m., August 19, for the necessary labor and material for the construction of a macadam road on Lewis Ave., from Sylvania Ave. to the north line of west Toledo addition, Washington township.

✣Bids will be received by the County Commissioners at the office of the County Auditor, Toledo, O., until 10 a. m., August 22, for the necessary labor and material for the construction of a macadam country road in Waterville township. A certified check and samples of the materials must accompany each bid. Charles J. Sanzenbacher is Auditor of Lucas County.

✣Bids will be received until August 12, by William Mahoney, City Clerk, Springfield, O., for the construction of storm sewer in west Main St.

✣Bids will be received until noon, August 15, by the Director of Public Service, Youngstown, O., for furnishing the necessary labor and material for the construction of sewers in McKinnie St., between Glenwood Ave. and Edwards St. W. H. McMiller is Clerk of the Director.

✣Commissioners of Franklin County will receive bids at Columbus, O., until 2 p. m., August 12, for the necessary labor and materials for macadamizing the Hilliard and Dublin Road as follows: Section No. 1, from Wyandotte Grove to the south corporation line of Dublin, a distance of 21,563 ft.; Section No. 2, from the north corporation line of Hilliard northerly to the Hayden Run Pike, thence eastwardly to the west end of the Hayden Run Bridge, a distance of 21,800 ft.; Section No. 3, the Britton Road, from the road running north from Hilliard to the Dublin Pike, a distance of 14,846 ft. John Scott is Clerk of the Board.

William H. Vogt of Massillon, O., has been awarded a contract by the Commissioners of Stark County, Canton, O., for the construction of the Beach City and Wilmet Road for $41,299. Bids were opened Aug. 5.

O. E. Robinson, Hamilton Pike, Cincinnati, O., has been awarded a contract for the construction of the Miles Road No. 66 in Hamilton County for $4,287. Bids were opened July 22nd.

The Lockland (P. O. Cincinnati, O.) Council has passed an ordinance to improve Wayne Ave., from Mills to Wyoming Ave., with brick. The Hartwell council will probably improve its portion of this thoroughfare with brick or other material, and make a good substantial roadbed to junction with the Carthage pike.

The firm of Lee & Griggs of Millersburg has been awarded the contract for the paving of the new Millersburg road. Columbus, by State Highway Commissioner James C. Wonders and the county commissioners of Holmes county for $11,543. Another contract was awarded to Harding & Kinseley of New Philadelphia for a brick road for $18,349. Frank Tejan was awarded the contract for the construction of a tar treated macadam road at Dayton to the cemeteries for $11,580.

The city of Steubenville, O., has awarded [illegible] West Market St., from Liberty St., to Steel Ave., with Ligoner stone block for $19,958. Petitions were received by the board of control from residents on North St., between Third and Lake Erie Ave., also on Pennsylvania Ave., from Belleview Boulevard to McDowell Ave., asking for paving.

The board of Richland County Commissioners at Mansfield, O., has let the contract for building 2.32 miles of state pike on the Plymouth and Shelby road to Carroll & Gruber for $18,167.

The City Council of Steubenville, O., has passed a resolution declaring it necessary to improve the roadway from Wellesley Ave., to Franklin Ave., by grading and curbing the same. John J. Dillon is President of the council.

The City Council of Delaware, O., has awarded a contract to Lamber Bros. & Wirt for the paving of North Sandusky St., on Big Four block and cement filler, for $29,856.

The City Council of Alliance, O., has passed resolutions providing for the paving of South Arch Ave., between the old corporation line and State St., and West Harrison St., between Union and Garfield Ave.

The City Council of Marion, O., has adopted a resolution providing for the paving of Vine St., from Center St., to the south line of the right of way of the C. C. C. & St. L. Ry.

A resolution has been introduced in the city council of Marion, O., providing for the improvement of Mark St., from Prospect to State St., and the first alley west of State St., from Mark St., south to the first alley by paving with tar macadam.

At a recent meeting of the Highway Commissioners held at Napoleon, the contract for the construction of a number of roads was let as follows: Road No. 78, Flatrock Township, material and construction, C. S. Witham at $5,500. Road No. 94, Liberty Township, material Tecumseh Gravel Co., $650, construction to Fred Albrink, $600. Road No. 88, material and construction, Whitehouse Stone Co., $3,000, C. W. Ryan, $3,000 and Ramus & Clark, $6,047.70. Road No. 91, Joint Fulton and Henry Counties, material and constructiton, Whitehouse Stone Co., $3,500; The Groetscheus Stone Co., $12,891 and Geo. W. Cody, $13,553.93. Road No. 97, Richfield Township, construction, $800, to Wm. Hines. Road No. 88, Napoleon Township, construction, C. W. Ryan, $3,000. Road No. 87, Harrison Township, Conway & Harper, construction, $1,600.

The Board of Control of Steubenville, O., has awarded the contract for paving, curbing, etc., on Prospect Ave. to Floto Bros. Construction Co. for $14,411. Barclay Ave. paving contract was awarded H. M. Bates. Cement sidewalk on McDowell Ave. contract let to Steubenville Stone Co.

Oklahoma.

Wyatt S. Hawkins, State Highway Engineer, and a field party are engaged in making a reconnaissance survey for a state highway between McAlester and Claremore. The line that will probably be followed runs through the extreme western end of Muskogee County and across the Arkansas River somewhere between Haskell and Coweta. The highway will be constructed by the state.

State Highway Engineer W. S. Hawkins has reported to the governor at Oklahoma City his first preliminary survey of state highway No. 1, extending from McAlester north on the township line through Indianola, Council Hill, Boynton, Haskell and Coweta to Claremore. The engineer reports the road entirely feasible. It is said that this highway can be built at the rate of one mile a day by the 500 prisoners that can be placed upon the construction at once. The highway engineer is at present located at Claremore.

The City Council of Oklahoma City has decided that it is necessary to pave Seventh Ave., from the west line of Stonewall Ave., to the east line of Lottie Ave.

Items marked thus ✣ indicate work now open for bids.

Pennsylvania.

✣Bids will be received by the State Highway Department, Harrisburg, Pa., until 2 p. m., Aug. 10, for the construction of 5,030 ft. of road extending from the Corapolis and Cornot Road eastwardly in Moon Township. Joseph W. Hunter is State Highway Commissioner.

✣Highway Commissioner Caldwell, Harrisburg, Pa., will receive bids until noon, August 16, for the construction of 75,000 sq. yds. of pavement located on the streets as follows: Boyd St., Second to Wallace; Boyd St., Wallace to Seventh; Currant St., Herr to south side Basin alley; Calder St., Sixth to Seventh; Front St., Herr to Maclay; Fifth St., Reily to Maclay; Harris St., Front to Third; Harris St., Fourth to Seventh; Hamilton St., Front to Seventh; Sayford St., Sixth to Seventh; Wallace St., Verbeke to Reily; Chestnut St., Thirteenth to Summit; Chestnut St., Fifteenth to Sixteenth; Chestnut St., Seventeenth to Eighteenth; Cameron St., State to Herr; Eighteenth St., Market to Derry; Evergreen St., Market to Derry; Fifteenth St., State to Verbeke; Helena alley, State to North; Herr St., East line Pennsylvania Railroad to Cameron; Kittatinny St., Crescent to Derry; North St., Fifteenth to Sixteenth; State St., Canal to Tenth.

✣The Pennsylvania State Highway Department, Harrisburg, Pa., will receive bids until 2 p. m., August 17, for the construction of a road from Carroll Township line in a northwesterly direction to a point in Union Township, a distance of 1,369 ft. Joseph W. Hunter is Highway Commissioner.

The city of Altoona, Pa., has voted a municipal loan of $260,000 for city improvements, of which $100,000 is for street paving, $75,000 for resurfacing worn-out paved streets, $25,000 to cover part of the cost of the new bridge over the Pennsylvania R. R. tracks, and $60,000 for sewer extensions.

The city of New Castle, Pa., has awarded a contract to Burns Bros., for the paving of Moravia St., for $14,358. The other bids were as follows: Woods & Golder, $17,678; J. H. and M. E. Miller, $15,952; New Castle Contracting Co., $15,664.

The City Council of Erie, Pa., has awarded a contract to William Simpson for the paving of 22nd St., from Peach to Chestnut with asphalt at $1.23 per sq. yd.

The City Council of Richfield has decided to create paving districts so as to have paved sidewalks for two blocks east and west from Main St., on the north side of each street from Fourth North to Fourth South. On Center St., the paved walk will reach to the depot and the paving on Main St. will be extended to Fourth South St. In all these there will be 5 ft., the whole costing approximately $15,000.

Nay Aug Park, Scranton, Pa., is to be paved with tarvia-x along past the Cleland greenhouse.

The ordinance providing for the repaving of Arch St., with wood blocks between Front and 21st Sts., and for the laying of Belgian blocks between Delaware Ave., and Front St., on the same thoroughfare in Philadelphia has been signed by the mayor. The city has also contracted with the Filbert Construction Co., for the repairing of streets involving an expenditure of $150,000.

The City Council of Waynesburg, Pa., has awarded a contract for the paving of some 2,000 ft. of streets. The sections to be paved include Church St., between High and Green; 180 ft. on Lincoln St., and a portion of High St., extending from West St., to the west borough line known as the West Town hill. The contract was awarded to Frederick Robinson of Waynesburg for $13,000.

The Pennsylvania State Highway Department has awarded the contract for the building of the State Road to Guthsville to Geo. H. Hardner of Allentown, Pa. The road will be a 7,000-ft. extension of the Walberts Pike, from Walberts through Guthsville to the North Whitehall Township line near Siegersville.

Tennessee.

The City Commissioners of Memphis, Tenn., have awarded the following contracts for the improvement of streets: Improving Latham St. from Iowa Ave. to the Speedway, tar macadam paving; Roper & McTighe, $21,819.20. Improving Waldran Blvd. from Poplar Ave. to the Speedway, tar macadam paving, E. W. Jordan Contracting Co., $21,695. Improving Cooper Ave., from Madison to Central Aves., asphalt paving; H. P. Streicher & Co., $42,763. Improving Cleveland St. from Peabody to Harvard Aves,. resurfacing with tar macadam; E. J. Wetterstrom, $3,096.80. Improving Cleveland St. from Peabody Ave. to Poplar Ave., tar macadam; Tennessee Road Co., $9,505.12. Improving Monroe Ave., from Diana to Cooper, tar macadam; H. B. Streicher & Co., $2,580. Improving Anderson St. from Harbert to Central, tar macadam; H. B. Streicher & Co., $3,850. Improving Diana St. from Peabody to Vinton Aves., tar macadam; H. P. Streicher & Co., $2,482. Improving Wisconsin Ave., from Kansas St. to Riverside Blvd., tar macadam; Roach & Manigan, $8,828.39. Improving Chelsea Ave., from Fourth to the city limits, concrete paving; E. J. Wetterstrom, $27,170.

Texas.

✣Bids will be received by George C. Baker, Jr., County Judge, Richmond, Tex., until noon, Aug. 15, for the construction of a system of county roads for District No. 1 of Fort Bend County. Tolman Engineering Co. is the consulting and constructing Civil engineer, Houston, Tex.

The Williamson County Commissioners' Court, Georgetown, Tex., has awarded the contract to the Texas Building Co., for the building of $150,000 worth of macadamized public highways in the fourth commissioners' precinct, Taylor, Tex. The precinct a few months since voted a $200,000 bond issue, and the bonds have been approved by the state department and sold.

The citizens in precinct No. 1, Beeville, Tex., have voted the issuance of bonds in the amount of $100,000 for the construction of good roads.

Utah.

✣Kenneth P. Williams, Constructing Quartermaster, Fort Douglas, Utah, will receive bids until 10 a. m., August 26, for the necessary labor and material for the construction of roads, catch basins, concrete sidewalks, grading and drains complete at the fort.

Virginia.

Citizens of Portsmouth, Va., have petitioned the Norfolk County Board of Supervisors for the opening of a road in Western Branch district. The proposed road is to begin at a point on the Key road where the old Deep Creek thoroughfare crosses and extending to a point on Glasgow St., near Florida Ave. The viewers have recommended that the road be opened.

Steps toward straightening the highway from the Tanner's Creek cross road in Portsmouth, to Ocean View, were taken by the Board of Supervisors of Norfolk County when a report of viewers, recommending the straightening plan, was presented and adopted. An application was filed with the board asking that Portsmouth Ave., Ocean View, be made a public road.

Washington.

The Board of County Commissioners at Bristol has declared an emergency to exist for the construction of a difficult quarter-mile of road work on the Bristol cut-off, and has placed its supervision in the hands of Commissioner William Morginson and County Engineer George W. Borden. The road is a short cut to White Salmon and the Columbia River and will be built mostly by subscription. It winds around and down the hills with an altitude of 1,500 to 1,800 ft.

Charles Lindbery, County Engineer, Bellingham, Wash., has announced that preliminary work on the construction of a road from Thurston's place to Glacier, about a mile and a half, will soon be started. The entire right-of-way has finally been secured.

The City Council of Walla Walla, Wash., has authorized the construction of about ½ mile of asphalt on East Alder St.

West Virginia.

City Engineer Cook of Wheeling, W. Va., has prepared estimates of the cost of opening the Top Mill road and placing it in first-class condition. The Pennsylvania R. R. Co. has set aside $30,000 as the maximum cost of the improvement. The company will carry its own and the city's cost of the road.

Wisconsin.

✣Bids will be received until 2 p. m., Aug. 10, by County Clerk, Superior, Wis., for the following road improvement: For ditching on the east side of the road and for graveling the roadway from the north line of Section 22; southerly to the east and west center line of said section 22, town 46, range 12; also for ditching on east side of road and brushing and graveling roadway from 150 ft. north of the culvert near the north eighth line of section 26 to about 30 rods south of the south line of said section 26, town 46, range 12, and brushing and turnpiking road from last named point to 60 or 70 rods south of township line between towns 45 and 46 to connect with road already graded; also for brushing and turnpiking road from the corner of section 1-2-11-12 south to the quarter post between sections 13 and 14, township 45, range 12. C. J. Morisset is Commissioner of Highways.

Charles F. Haworth of Milwaukee has been awarded a contract by the West Allis City Council for the grading of Stutley I. Henderson's extension of Henderson park.

Canada.

✣Bids will be received until noon, August 18, by Frank Chappel, Town Engineer, Oshawa, Canada, for the construction of 4,000 lin. ft. of first-class heavy macadam pavement, 43 ft. wide on King St. and Simcoe St. and 2,500 ft. of light macadam, 32 ft. wide, on Simcoe St.

✣Bids will be received by W. F. Heal, City Clerk, Moose Jaw, Sask., until 8:30 p. m., August 15, for the necessary labor and material for the construction of approximately 63,000 sq. ft. of concrete walk, 9,000 lin. ft. of combined curb and gutter, 6,000 sq. ft. concrete crossings and 6 miles of wooden walks. J. M. Wison is City Engineer.

WATER-WORKS AND SEWERAGE

Alabama.

✣Bids will be received until noon, August 31, by Mayor and City Council of Opelika, Ala., for furnishing labor and material for the installation of a water works and electric lighting system. J. B. McCrary Co., 13-11-15 Empire Bldg., engineer. L. F. Dickson is Mayor.

The time for letting contracts for the construction of approximately 6½ miles of pipe sewers and appurtenances in Attalla, Ala., was postponed from July 26 to a later date. Plans for this work are on file with William Hill, Engineer, Gadsden, Ala. L. S. Gray is town clerk.

Items marked thus ✣ indicate work now open for bids.

Arizona.

The city of Phoenix, Ariz., recently voted to issue bonds in the amount of $400,000 for the purpose of installing a sewer system. Lloyd B. Christy is Mayor and Frank Thomas is City Recorder.

California.

✣Bids will be received by the City Clerk, Pleasanton, Cal., until August 15, for the construction of an entirely new sewer system. P. A. Haviland is engineer in charge.

Colorado.

Preliminary steps have been taken by the city council of Golden, Colo., for the establishment of sanitary sewer district No. 2, which comprises that part of the city lying north of Clear Creek. Engineer W. F. Allison has submitted an estimate in which he places the cost at $27.30 for each lot 50x140.

A number of hydraulic engineers of Denver, Colo., have recommended the construction of a concrete conduit from the mountains into Denver to supply the city with water, should it become necessary to build a water system, at a cost of not to exceed $10,500 a mile.

Connecticut.

✣Bids will be received until 4 p. m., August 18, by G. Allen Hawkins, chairman, Highway Committee, Putnam, Conn., for Sewer Contract No. 2, including about 5,000 ft. of 20 to 30 in. sewer. George W. Perry, Putnam, and Chandler & Palmer, Norwich, Conn., are negineers.

Georgia.

The city of Atlanta, Ga., has awarded a contract to the Nichols Contracting Co., of that city, for the construction of two coagulating basins, overflow tower and intake tower at the water works. The work will be of reinforced concrete construction and will cost $28,478.

The General Contracting Co., Candler Bldg., Atlanta, Ga., has been awarded a contract by the city of Gadsden, Ala., for the construction of a water works plant. The work includes a pumping station, filter plant, settling basin and pipe line. Bids were opened Aug. 4.

Illinois.

✣Bids will be received by the Special Park Commission, 501, 200 Randolph St., Chicago, Ill., for furnishing all labor and material necessary for the construction of a drainage and water supply system at the municipal play ground on Hamlin Ave. and 16th St.

✣Department of Public Works, Chicago, Ill., will receive bids unitl 11 a. m., August 15, for furnishing and delivering to the various city pipe yards cast iron valve basin and fire cistern covers during the period ending December 31, 1910, as follows: 1,600 complete covers (curbs and lids), 200 extra lids.

✣Bids will be received until 11 a. m., August 15, by the Board of Local Improvements, Chicago, Ill., for furnishing and delivering to the city of Chicago at the water works shops, South Ashland Ave., 250 tons of hydrant and stop valve castings. B. J. Mullaney is Commissioner of Public Works.

✣Bids will be received by the Department of Public Works, Chicago, Ill., until 11 a. m., August 17, for furnishing and delivering at the 68th St. pumping station and erecting place three 350 h. p. water tube boilers.

✣Sealed bids will be received until 2 p. m., Aug. 26, at the office of Judge H. V. Teel, Rushville, Ill., for furnishing and installing one tandem compound four-valve engine, 280 hp., also one 36-in. centrifugal pump, two 7-in. boilers and the necessary auxiliaries. The estimated cost of the work is $16,000. C. W. Brown, Jacksonville, Ill., is Engineer. The machinery is to be installed for the Crane Creek Drainage and Levee District at a point about 6 miles south of Beardstown, and Schuyler County.

✣Bids will be received until 2 p. m., Aug. 15, by The Cook County Board of Commissioners, Chicago, Ill., for furnishing labor and material for drilling wells at the Oak Forest Infirmary in accordance with the plans of Holabird & Roche, Architects. William McLaren is Superintendent of Public Service.

✣Bids will be received by the Board of Local Improvements, Evanston, Ill., at the office of the Commissioner of Public Works, until 8 p. m., Aug. 11, for the construction of a system of sewers with settling tanks, in 8 streets in Germania Addition. Joseph E. Paden is President of the Board.

The Board of Local Improvements of De Kalb, Ill., will soon choose a site for the proposed sewage disposal plant. The board has several sites in sight and one will be picked immediately so that work can be started.

Employes of the engineering department of the Big Four R. R. have completed plans for a new coaling and water supply plant at Mackinaw, to be erected near the bridge across the Mackinaw. The plans call for an up-to-date coaling station, with hoisting elevators and other improved appliances for the quick handling of fuel, and a pumping plant to supply locomotives with water.

The city of Steger, Ill., has awarded a contract to Earl Pikens of Kankakee, Ill., for the laying of water mains in connection with the new water system. The contract was awarded for about $30,000.

Plans and specifications are being prepared by Alvord & Burdick of Chicago, Ill., for the construction of a $40,000 reinforced concrete reservoir at Baton Rouge for the Baton Rouge Water Co.

Board of Trustees of Glencoe, Ill., have been petitioned to make improvements costing $10,000. These will consist of extensions to the village's sewerage system, and the laying of a practically new system of water mains.

Indiana.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., Aug. 19, for the construction of a local sewer with appurtenances in and along alley between Spruce St. and Evison St., from Orange St. to the first alley south of Prospect St.

✣Bids will be received until 10 a. m., Aug. 19 by the Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along the alley east of Olive St. from the first alley north of Swift St. to Prospect St.

✣Bids will be received by Board of Public Works, Indianapolis, Ind., until 10 a. m., Aug. 19, for the construction of a local sewer with appurtenances in and along alley east of Evison St. from Orange St. to the first alley south of Prospect St.

The Board of Public Works of Vincennes, Ind., has passed resolutions recommending to the city council the appropriation of $100,000 to build the main trunk lines, reduction plant and pumping stations for a sewer system.

An offer to buy, instead of lease, the Brightwood waterworks has been made to the Board of Public Works of Indianapolis by the Indianapolis Water Co.

City Engineer Roberts of Terre Haute, Ind., has recommended the extension of the sewer system over the following territory: From 13th St. and 8th Ave. east to 14th Ct.; north on 14th St. to Plum St.; east on Plum St. to 23rd St.

Iowa.

✣Bids will be received until 6 p. m., Aug. 10, by City Clerk, Shenandoah, Ia., for the following improvements Iowa St. from its intersection with Sheridan Ave. to its intersection with Valley Ave. with 12 in. vitrified sewer pipe. Valley Ave. from its intersection with Iowa St. to its intersection with Sycamore St. with 12-in. vitrified sewer pipe. Sycamore St. from its intersection with Valley Ave. to its intersection with Wabash Ave. with 12 in. vitrified sewer pipe. Wabash Ave. from its intersection with Sycamore St. to its intersection with Broad St. with 12-in. vitrified sewer pipe. Sheridan Ave. from its intersection with Center St. to its intersection with South Webster St. with 10-in. vitrified sewer pipe. South Webster St. from its intersection with Sheridan Ave. to its intersection with East Thomas Ave. with 10-in. vitrified sewer pipe. East Thomas Ave. from its intersection with South Webster St. to its intersection with Staple court with 10-in. vitrified sewer pipe.

✣Bids will be received until 7:30 p. m., August 23, by City Clerk J. H. Clark, Indianola, Ia., for the construction of sanitary sewers complete as follows: 6,447 ft. 10-in. standard vitrified sewer pipe, 12,087 ft. 8-in. standard vitrified sewer pipe, 1,258 ft. 6-in. standard vitrified sewer pipe, 33 common manholes, 13 drop manholes, 9 flush tank siphons set in manholes, 800 house connections, 328 manhole steps, ½x10-in. round iron. A. H. Gilliland is city engineer.

The city of Chariton, Ia., has awarded a contract to O. S. Smith of Indianola, Ia., for the construction of the water main extending two blocks north on Grand St., from the present main at the intersection of Grand St., and Park Ave., for $900. The work includes furnishing and laying 845 ft. of 6-in. pipe, setting one old hydrant and furnishing and setting one new hydrant, and refilling ditch. Bids were opened Aug. 1.

The City Council of Oelwein, Ia., has awarded a contract to R. C. De La Hunt for sewer extensions on West Charles St., Seventh Ave., W. First Ave., S. Second St., S. North Frederick St., to Eighth Ave., First Ave., E. to Eighth Ave., Second St., E. and other points for $5,400. The work includes about 7,535 ft. of sewer.

The city of Pella, Ia., has sold bonds in the amount of $60,000 for the installation of a waterworks system. The construction work will be started immediately.

The citizens of Essex have voted in favor of the proposition of installing a sewer system.

The City Council of Oelwein, Ia., has awarded a contract for the construction of a complete sewer system in that city to Dearborn & Jackson of Cedar Rapids for $29,996. The other bids received are Des Moines Bridge & Iron Works, $39,913; Independent Construction Co., Davenport, 36,591; Lytle Construction Co., Sioux City, $35,828; Cook Construction Co., Des Moines, $35,598; Thomas Carey & Son, $35,434; Cedar Rapids Construction Co., $33,888; Frazee & Danforth, Rochester, Minn., $33,621; J. W. Turner Imp. Co., Des Moines, $32,646; M. A. Camery & Co., Harlan, Ia., $30,756.

Kansas.

The contract for placing concrete piles in connection with the Riverside Park dam at Wichita, Kan., has been awarded to the Raymond Concrete Pile Co., of New York and Chicago. The Freeborn Engineering & Construction Co. are the general contractors.

Louisiana.

The city council of Lincolnville has under consideration a petition for a sanitary sewer in that city. The sewer will empty into Hawkeye sewer at Moehn's brewery and will follow the course of Mount Pleasant St., to Moore St.

The town council of Hammond has employed an engineer to make a preliminary survey of the town for the purpose of forming an estimate of the cost of the system of sewerage which it is proposed to put in. I W. Sylvester, Consulting Engineer of the city of Alexandria, has the work in charge.

Lewis & Leeder of Sioux City have been awarded a contract by that city for the construction of an 800-ft. by 4 ft. by 8 ft. by 8-in. suction tunnel for $15.75. The work includes the construction of tunnel and laying 16-in. suction main. Bids were opened July 30.

Maryland.

✣Bids will be received by the Board of Awards, Baltimore, Md., for the following until 11 a. m., Aug. 17: First, furnishing materials and the erection complete of power house. Second, for furnishing and installing engines, generators, switchboard and electric wiring. Third, for boilers, piping in

Items marked thus ✣ indicate work now open for bids.

power house and piping on the grounds. Fourth, for the water supply system, including water storage tank, pumps, etc., the above to be furnished for the Bayview Asylum.

Water Engineer Quick of Baltimore has begun work on the plans for the 20,000,000 gal. reservoir to be built in the valley of the Gunpowder River out of the $5,000,000 loan. Bids for the work will probably be advertised for some time during the coming winter.

Plans are being prepared by Alfred M. Quick, Water Engineer of Baltimore, Md., for the construction of a filtration plant at Montebello at a cost of $1,500,000.

Michigan.

✣Bids will be received until 2 p. m., Sept. 1, by Board of Water Commissioners, Manistee, Mich., for furnishing and constructing complete ready for use a 12-in. cast iron pipe river crossing. T. J. Elton is secretary. John W. Alvord and Charles B. Burdick, 1212 Hartford Bldg., Chicago, Ill., are engineers. Official advertisement of the work is to be found elsewhere in this issue.

The common council of Sandusky, Mich., has decided to submit to the voters the proposition to bond for $34,000 for sewers, waterworks and electric lights.

Minnesota.

✣Bids will be received until noon, August 17, by E. J. Casey, Village Recorder, Chisholm, Minn., for furnishing necessary labor and material for the construction of two concrete reinforced settling basins and appurtenances. Daniel W. Mead, Madison, Wis., is consulting engineer.

The city council of Crookston, Minn., has awarded a contract for the construction of the Sampson addition sewer and North Front Sts., sewer to P. McDonnell of Duluth.

H. F. Bosworth of Ada has been awarded a contract by the city of Bemidji, Minn., to lay about 2,840 ft. of new sewer through the larger portion of the city. The pipe to be used in the sewer will be 8-in. The contract was awarded for $1.05 per ft.

P. M. McDonnell has been awarded a contract by the city of Crookston, Minn., for the construction of sewers for $4,847. The work includes sewers in Stuart Ave. and Hubbard St., Woodland Ave. and N. Front St. Bids were opened July 12.

Missouri.

City Engineer Harry G. Horton of Springfield, Mo., has completed the estimate of the cost of constructing a sewer in district No. 16 of section No. 4, embracing all property in the Sixth ward from Boonville to Campbell Sts., and from Center to Pine Sts. The total length of the sewer is 1,739 ft., comprising an area of 559,107 sq. ft., and the total cost is estimated at $1,989.

The Board of Public Improvements of St. Louis, Mo., has authorized the construction of sections 4 and 5 of Harlem Creek, estimated to cost $12,500 and $110,000, and Glaise Creek No. 4, estimated at $55,000. The city now has about 14 miles of sewer under contract as follows:

Name of sewer.	Cost.	Length in feet.
Baden public sewer..........	$280,157.15	4,700
River des Peres, foul water, first section	310,533.05	6,500
Same, second section........	604,518.85	25,619
South Harlem, joint sewer, first section	247,777.50	6,549
Same, second section.........	236,919.89	8,093
Glaise Creek, joint sewer.....	161,616.25	5,839
Dale Ave. public sewer.......	75,157.41	5,985
Ellendale public sewer.......	27,127.75	12,407

Montana.

A. B. Shattuck, Constructing Quartermaster at Fort Missoula, Mont., has awarded a contract to P. A. Harrington of that place for the construction of a reinforced concrete pumping station supply and installation of all boilers, steam pumps, valves, etc. Bids were opened July 30.

J. P. Grady of Missoula, Mont., has been awarded a contract by A. B. Shattuck, Constructing Quartermaster at Fort Missoula, Mont., for the construction of a water distributing system and sewer system. Bids were opened July 30.

Nebraska.

✣City Clerk of the city of Cozad, Neb., will receive bids until 6 p. m., Sept. 2, for the construction of a system of water works. Hershey S. Welch, North Platte, Neb., is engineer. Official advertisement of this work will be found elsewhere in this issue.

The city council of Fremont, Neb., has granted a petition for an extension of the sewer mains from Nye Ave., to Platte Ave., on 17th and thence southward to connect with the 14th St. main.

City Council of Fremont, Neb., has passed an ordinance ordering a sewer main to be laid on 17th St. from Nye Ave. east to Platte, thence on Platte south to connect with the 14th St. main.

The Intermountain Br. & Construction Co. of Tecumseh, Neb., has been awarded a contract by the city of Horton, Kan., for the construction of a purification plant, main sewer and 23 laterals for $34,081. Bids were opened Aug. 2.

New Jersey.

The Street and Water Commission of Jersey City, N. J., will construct new water mains in the Hamilton Park section of the city at a cost of $8,000.

L. H. Henry of 10 Windsor Ave., Atlantic City, N. J., has been awarded a contract by the city of Atlantic City for the construction of a sewage disposal works at $18,663. The work includes two concrete tanks for disinfection of sewage, one tank 102 ft. by 48 ft. by 10 ft., including storage tank; second tank is to be 52 ft. by 10 ft. by 10 ft. Bids were opened Aug. 3.

New York.

The Board of Contract of Utica, N. Y., has approved the plans and specifications of City Engineer Cogley for the construction of a vitrified pipe sewer in Oscar St., from the West Shore R. R. to Bleecker St.

W. G. Stone, Utica, N. Y., has finished the plans for the Yorkville sewer and they have been submitted to the village board for approval. There will be about three and a half miles of this system, and it is hoped to complete the main part, a distance of about two miles, by autumn. The pipes to be laid vary from 8 to 10 ins in diameter and will, when completed, give the village a complete sewer system.

The citizens of Silver Springs, N. Y., have voted the issuance of bonds in the sum of $14,000 for a new well and pumping station.

Ohio.

✣Bids will be received until 1 p. m., August 15, Lisbon, O., for the construction of a storm water sewer on the Wellsville and East Liverpool road near the Wellsville corporation line in the township of St. Clair.

✣Director of Public Service, Youngstown, O., will receive bids until noon, Aug. 15, for furnishing the necessary labor and material for the sewering of Japan St. between Poland Ave. and Homewood St. Plans and specifications are on file at the office of the City Engineer. W. H. McMillen is Clerk of the Director.

✣Bids will be received by the Director of Public Service, Youngstown, O., until noon, Aug. 15, for furnishing the necessary labor and material for the sewering and paving of Caroline St. between Belmont Ave. and Fifth Ave. W. H. McMillen is Clerk of the Director of Public Service.

P. Drake & Sons of Marion have been awarded the contract for the construction of the Campbell St. sewer in Delaware, O. The contract price being $1,961.

The city of Youngstown has awarded the contract for constructing sewers in sewer district No. 1, of district No. 3 to William Lehmann of Cleveland, O., for $21,768. The work will cover 11 streets in the district.

The village of Utica, O., has retained S. S. Wyer, Consulting Engineer, Columbus, O., to prepare plans and specifications for a new waterworks system. The work will include a 300,000-gal. reinforced concrete reservoir; two deep well pumps; two drilled wells, and two brick, stone and concrete pump houses.

Chief Engineer M. J. Bahin of Springfield, O., has estimated the cost of constructing sanitary sewers in Clifton and Fremont Aves., Rose, Rice and Catherine Sts., at $5,093.

Oklahoma.

The city of Muskogee, Okla., will probably employ Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., to prepare plans and supervise the construction of a sewage disposal plant and also the proposed enlarged water plant for the city. A thorough investigation to determine whether it is advisable to dispose of the sanitary sewage of the city by the construction of a big main trunk intercepting sewer to carry all of the sewage of the city to the Arkansas River, or to construct a modern disposal plant to some point outside the corporation south or southeast of the city will be made.

Oregon.

The Vale City Council has awarded a contract to the American Light & Water Co., of Kansas City, Mo., for the construction of a water and sewer system in the city. Work will start when the material arrives the latter part of August. The system is to be completed within four months and will cost $63,490. The council has reserved the right to decide within 60 days whether to install a pumping plant or a gravity system. The city has bonded for $75,000.

Following bids were received July 27, by the City Council of Pendleton, Ore., for the extension of the West Pendleton sewer: G. H. Sutherland Co., Walla Walla, Wash., $16,100; F. R. Mendenhall, Spokane, Wash., $17,422.

Pennsylvania.

✣Bids will be received until noon, Aug. 10, by the Building Committee of the Pennsylvania Reform School, Morganza, Pa., for furnishing labor and material necessary for the extension of the existing main sewer and for the construction of a sewer purification plant to be located on land owned by said Reform school. W. F. Penn is Superintendent.

The supervisors of Carbondale Township, at Carbondale, awarded a contract to James Harrigan for the construction of concrete culverts and concrete tile drains along Gordon Ave., from the city line to the line of the borough of Mayfield in preparation for the county road.

The New Holland borough council has taken steps for the erection of a water system. An ordinance is being drawn up by the solicitor providing for a loan of $30,000 for the purpose, and this will be voted upon at the next election.

Charles F. Mebus, of the engineering firm of Albright & Mebus of Philadelphia, has been engaged by the city of Chambersburg to superintend the construction of a complete sewer system. Plans and specifications have been prepared.

The Highway Committee of Allentown councils has instructed City Engineer Wierbach to call a special meeting of the committee, with the mayor and other city officers, in order to draft an ordinance to submit to the people the question of borrowing $1,000,000 for house sewerage.

The Fayette St. Sewer Co., of Mercersburg, has been organized with H. Geo. A. Stouffer as secretary. This company proposes putting in a 6-in. sewer pipe to run from the head of the avenue and will go out the alley between the Smith and McAtee properties, crossing Main St., and following the alley to Fayette St., thence down Fayette St., its entire length and will empty in the Oregon St. sewer or continue on out to the run. The contract has been awarded to the Frank Hafer Co., Chambersburg.

B. E. Briggs, City Engineer, Erie, Pa., has reported that a sewer system could be installed in the 6th ward for $10,500.

Items marked thus ✣ indicate work now open for bids.

South Dakota.

✣Bids will be received until 8 p. m., August 16, by Board of Commissioners, Canton, S. Dak., for the construction of a sewer in Fourth St. from Broadway to Dakota St. Carl Tank is Mayor and George Hokenstad is Auditor.

✣Bids will be received by the City Commissioners, Huron, S. Dak., until 8 p. m., August 15, for the construction of sewers and appurtenances, including 860 lin. ft. of 18-in. sewer, 4,000 lin. ft. of 8-in. sewer. S. S. Oviatt is City Auditor.

✣Bids will be received by the Sioux Falls, S. Dak., City Commissioners until 9 a. m., Sept. 6, for the construction of approximately 66,000 ft. of sewers varying in sizes from 8 to 36 in. Lewis Larson is County Auditor. A certified check for $10,000 must be filed with each bid.

A petition has been circulated in Morristown, S. D., asking that a special election be called for the purpose of voting $10,000 bonds for municipal water works system.

The business men of Hartford have inaugurated a movement for the construction of a municipal waterworks system, to replace a system which was destroyed by an explosion about two years ago.

Constructing Quartermaster R. L. Casmichael, Fort Moultrie, S. C., has awarded a contract to Simons-Maysant Co., Charleston, S. C., for the construction of three concrete reservoirs for fire purposes for $6,627. Bids for this work were opened July 29.

Texas.

Abilene, Tex., has voted the issuance of bonds in the sum of $7,000 for improvements to the waterworks system.

The LaPryor Water & Light Co., of La Pryor, Zavala County, Texas, has been incorporated with a capital stock of $8,000 and proposes the installation and operation of a system in that city. The incorporators are G. W. Baxter, D. A. Harrison and R. L. Couser.

Bonds amounting to $42,548 have been sold for the proposed sewer system in Amarillo, Tex., and all preliminary work completed by E. L. Dalton, Engineer, Dallas, Tex.

City Council of McKinney, Tex., has ordered the construction of additional sewers and preliminary work will probably be taken up at once.

The Water Commission of the City of Temple, Texas, at a meeting held July 13, have decided upon improvements to the water system as follows: The eight-inch mains now between the city and the Leon river pumping station, which have been replaced by an eighteen-inch main, will be taken up and relaid in a belt on the north of the city, following closely the city limits. The eight-inch main will be connected with a six-inch supply main that will run lateral to the main feed pipe, supplying a large territory heretofore inadequately furnished with water.

The San Antonio Water Supply Co., San Antonio, Texas, has placed an order for $50,000 of water pipe necessary for the immediate extension of its system.

City Commission of Dallas, Tex., was petitioned at the last meeting by J. B. Wilson to improve the sewerage conditions on Elm St., where he proposes the construction of a new 12-story building.

Virginia.

✣Bids will be received by City Clerk W. L. Craft, Norfolk, Va., for the construction of a storm drain in Randolph St. from Church Ave. to the Campbell Ave. drain. F. L. Biggoney is City Engineer.

West Virginia.

The City Council of Romney, W. Va., has appointed a committee to engage an engineer to investigate the water system. The system will be improved at an estimated cost of $30,000.

The city of Keyser, W. Va., has voted the issuance of bonds in the sum of $30,000 for waterworks improvements. The work will include the [illegible] reservoir.

A town meeting has been held in Romney, W. Va., to devise ways and means for securing a more adequate water supply for the town. The present system is now in bad condition, being honeycombed with rust.

An election was held July 25 by the Town Council of Keyser, W. Va., to vote on a bond issue of $30,000 for the construction of a subsidary reservoir of $26,000,000 gals. capacity for the town water supply.

Washington.

The city of Tacoma, Wash., is to call for bids at once for the construction of the first unit of the city's $2,000,000 Green River gravity system. The first unit comprises the intake, settling basin, drain, tunnels Nos. 1 and 2, and river crossing. It is estimated to cost $62,500, the estimate being segregated as follows: Intake, $5,000; settling basin, $5,000; drain, $5,000; tunnel No. 1, $34,000; tunnel No. 2, $5,000; river crossing, $6,000. Nicholas Lawson, Tacoma, is Commissioner of Light and Water.

Special meeting of the Cheney, Wash., City Council was recently held and a committee appointed to investigate the condition of the pipe line from Fish Lake to the city and report as to the necessity of extending the intake farther out in the lake.

As the result of the Springston Lumber Co. fire, the Water Department of Spokane, Wash., has recommended the following extensions to the water works system estimated to cost $100,000: A 12-in. instead of a 6-in. main on Montgomery Ave. from Division to Hamilton St.; an 8-in. main on Buckeye Ave. from Division to Standard St., thence on Standard to Grace Ave. and thence east on Grace Ave. to Cincinnati; an 8-in. main Grace, Nevada to Columbus, thence south of Columbus, Grace to the S. F. & N. tracks; a 12-in. main south on Hamilton, Baldwin to Olive Ave.; an 8-in. main on Cataldo Ave., Hamilton to Columbus St., south on Columbus to Springfield, west on Springfield to Dakota, north on Dakota to Cataldo and east on Cataldo to Hamilton.

City Council of Tacoma, Wash., has been petitioned to construct a sanitary sewer on Sheridan Ave. and M. St. The matter was referred to the Commissioner of Public Works.

A resolution requesting that the City Council of Spokane, Wash., pass the ordinance now before it providing for a sewer on 17th Ave., was adopted by the Altamont Improvement Association recently.

City Council of Pomeroy, Wash., has under consideration the installation of a complete sewerage system.

Advices from Tacoma, Wash., state that although repairs have been recently made, the Commissioners of Light and Water are of the opinion that new reservoirs will soon have to be constructed to take the place of those on Hood and Alaska Sts.

Owing to complications concerning the ownership of water rights near Ashford, Wash., the Board of County Commissioners at a recent hearing held at Tacoma, Wash., refused to grant Samuel Estes a franchise to lay water pipes along a portion of the Mount Tacoma Canyon road and in the town of Ashford.

The City Council of Colfax, Wash., is considering the proposition of Henry M. Richards, President of the Washington Water Power Co., to furnish light at less than the past cost, to remodel the entire plant and system, and to pump water from the lower reservoir, when completed to the upper one at one-half the cost now required to run the pump now in operation at Elberton.

The Adrian Power & Water Co. has been incorporated with headquarters at Adrian, Wash., and a capital stock of $75,000. E. P. Coleman, H. Lessing and H. W. Mangold are the incorporators.

Wisconsin.

✣Bids will be received until 2 p. m., July 29, by Street Assessment Committee, Kenosha, Wis., for furnishing all labor and material necessary for the construction of 900 ft. of 18-in. pipe sewer in Washington St., on [illegible] ft. of 12-in pipe sewer, 6 manholes, etc.

✣Board of Public Works, Oshkosh, Wis., will receive bids until 10 a. m., August 15, for the construction of a sewer in Minnesota St. between 16th St. and 17th St. J. E. Mallery, H. Wunderlich and E. S. Ostertag are members of the board.

✣Bids will be received until noon, Aug. 15, by L. F. Fish, City Clerk, West Allis, Wis., for the necessary labor and material for the construction and laying of sewers, manholes, connections, fittings, etc., including the following approximate quantities: 3,338 ft. 18-in. pipe; 1,034 ft. 15-in. pipe; 4,240 ft. 12-in. pipe; 9,634 ft. 10-in. pipe; 6,234 ft. 8-in. pipe, and about 92 manholes. Said sewers are distributed in about thirty different streets or parts of streets. Between 4,000 and 5,000 ft. of the above sewer work is to be let in one contract and the remainder in a separate contract. Bids are asked per lin. ft. for each size of pipe, including all manholes and fittings. Work to be completed by Nov. 15, 1910.

✣Bids will be received until 10:30 a. m., Aug. 11, by the Department of Public Works, Milwaukee, Wis., for the necessary labor and material for the construction of house drains and water service connections on the following named streets in Milwaukee: In 18th ward, Kenwood Blvd., from Oakland Ave. to Downer Ave., Frederick Ave., from the south line of Gross Park to Kenwood Blvd., in 21st ward, Brattle St. from North Pierce St. to Humboldt Ave. H. E. Briggs is Commissioner of Public Works.

Citizens of Merrill, Wis., are agitating the matter of erecting a municipal waterworks plant upon the expiration of the present water contract.

The water commissioners of Eau Claire, Wis., after months of consideration have decided to take immediate steps toward the construction of a large water reservoir of a capacity between 400,000 or 500,000 gals.

At a recent meeting of the city council of Stoughton, Wis., three sewerage districts were formed. The first will comprise practically all east of the river, the second west of the river as far north as Prospect av., and the third takes the territory north of that avenue.

The Board of Public Works, of Waupaca, Wis., according to advices received from that place, is making preliminary plans for the letting of the contract for the construction of sewer system and septic tank.

At an election recently held in Evansville, Wis., the proposition to issue bonds for the construction of a sewer system, was carried.

Wm. Schiebel, Watertown, Wis., has been awarded the contract at $1,200 for constructing 1,519 ft. 8-in. vitrified pipe sewer, one manhole, two automatic flush tanks and one ordinary flush tank for the city of Watertown. Bids were opened July 16.

City of Beloit, Wis., has ordered the Beloit Water, Gas & Electric Co. to extend the water main on Vernon Ave. west from the present main 425 ft. The matter is now before the State Rate Commission.

Contracts for a pumping station and ten additional drive wells 130 ft. deep for the city of Wausau, Wis., bids for which were opened July 20, have been let as follows: Ten wells, Mr. Paterson, Madison, Wis., to drive the wells, and the Crane Co., Chicago, to furnish the pipe; four 150 HP. boilers, Murray Iron Works, Burlington, Ia.; boiler to be erected by Wausau Iron Works, Station Building, Miller & Krause, Wausau, Wis.

Wyoming.

The city of Cheyenne, Wyo., will probably award a contract to Doyle & Schwartz of that city for the construction of 14 ft., 16 ft. and 20 ft. cast iron water mains. The work includes approximately 7,450 ft. of 14-in. cast iron pipe, 6,400 ft. of 16-in. cast iron pipe and 37,474 ft. of 20-in. cast iron pipe. Bids were opened Aug. 1.

At a special election recently held in Buffalo, Wyo., the citizens voted in favor of issuing bonds amounting to $50,000 for the construction of a system of sewers.

Bids were opened July 15 by the City of Wheatland, Wyo., J. C. Hadsall, Wheatland, Consulting Engineer, for labor and materials for municipal water, light and sewer systems, the contract let to P. O. Brien, Denver, Colo. The itemized bids received on the work were as follows: (1) standing for P. O'Brien, Denver, Colo; (2) American Light & Water Co., Kansas City, Mo.; (3) Katz, Craig & Co., Omaha, Nebr.; (4) T. S. Sheppard, Denver, Colo.; (5) W. G. Garrard, Sheridan, Wyo.; (6) E. Jaeger, Rich Hill, Mo.

	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)
10-in. pipe	$ 1.74	$ 1.87	$ 1.85	$ 2.00	$ 2.10	$ 2.25
8-in. pipe	1.37	1.45	1.48	1.53	1.66	1.75
6-in. pipe	.98	1.10	1.00	1.00	1.10	1.25
4-in pipe	.70	.69	.75	.72	.80	.90
5-in. hydrants	65.00	70.00	6.??	75.00	70.00	75.00
4-in. hydrants	60.00	70.00	66.00	68.00	65.00	70.00
10-in. valve	42.00	40.00	45.00	41.00	47.50	50.00
8-in. valve	38.50	38.00	37.00	37.00	40.00	40.00
6-in. valve	30.00	27.70	32.00	27.50	35.00	30.00
4-in. valve	18.00	19.20	20.00	17.00	22.50	20.00
Tank	8,000	8,250	8,250	8,200	9,000	8,750
Pumps	3,500	4,000	4,000	3,800	3,950	4,500
House	3,100	3,400	3,300	2,760	3,290	3,400
Power	12,000	13,300	12,500	12,760	11,500	13,125
Sewer System:						
10-in. pipe	0.74½	.70	.82	.83	.77½	.90
8-in. pipe	0.62½	.61	.66	.65	.70	.72½
6-in. pipe	0.54	.57	.58	.54½	.60	.65
4-in. pipe	...	...	...	...	...	...
Manhole	48.00	55.00	50.00	63.00	45.00	41.00
Lamphole	6.00	7.50	13.00	7.00	9.00	10.00
Total	$62,418	$66,973	$66,157	$66,056	$68,199	$73,206

Canada.

✣Bids will be received by Barber & Young, York township engineers, 57 Adelaide St. E., Toronto, Can., for the following work: 982 ft. vitrified pipe sewer on Spadina Road northerly from the city limits, 592 ft. vitrified pipe sewer on Walmer Road northerly from city limits, 986 ft. granolithic sidewalk on Markham St. northerly from the city limits.

✣City Clerk W. F. Heal, Moose Jaw, Sask., will receive bids until 8:30 p. m., August 15, for supplying materials and labor for the construction of 3,286 lin. ft. of 6-in. and 700 lin. ft. of 12-in. cast iron water main. J. M. Wilson is city engineer.

The town of Swift Current, Sask., has awarded a contract to Blackmer & Post Pipe Co., of St. Louis, Mo., for furnishing and delivering f. o. b. Swift Current sewer tile as follows: 18,700 ft. 7-in. salt glazed standard vitrified tile pipe; 4,250 ft. 10-in. salt glazed standard vitrified tile pipe; 3,450 ft. 12-in. salt glazed standard vitrified tile pipe; 3,150 ft. 15-in. salt glazed standard vitrified tile pipe; 500 ft., 4-in. salt glazed standard vitrified tile pipe; 100 ft. 6-in. salt glazed standard vitrified tile pipe; 695 4-in. off 7-in. salt glazed standard vitrified tile pipe, Y junction; 95 4-in. off 10-in. salt glazed standard vitrified tile pipe, Y junction; 70 4-in. off 12-in. salt glazed standard vitrified tile pipe, Y junction; 20 6-in. off 12-in. salt glazed standard vitrified tile pipe, Y junction; 300 4-in. ⅛th bends; 20 6-in. ⅛th bends.

The Board of Control of Toronto, Ont., has accepted the bid of the Orpen Co., Ltd., for the construction of Section No. 6 of the high level interception sewer. The contract was awarded for $23.07 per ft.

The board of control of Toronto, Ont., has awarded a contract to the Orpen Co. of that city for the construction of a reinforced concrete pipe sewer, 1,340 ft. in length, for $23.07. Bids were opened July 26.

TRADE NOTES.

Mr. T. Evans, for many years Purchasing Agent for the Cananea Copper Co., has been appointed Local Manager of the Mine & Smelter Supply Co.'s branch office at Denver, Colo.

The Kilbourne & Jacobs Mfg. Co., of Columbus, O., recently secured an order for 500 cars for the Illinois Tunnel Co. of Chicago, Ill. These cars are to be used for conveying freight, and are to be drawn by electric locomotives. They are small, double-truck gondolas, having a capacity of 15,000 lbs. They are of all-steel construction, equipped with Andrews small size side frames and bolsters.

Mr. William J. A. Bailey, who recently returned from a successful trip around the world representing a number of American manufacturers, is now preparing another business tour. He expects to leave this country early in the fall and will be gone about a year, visiting the leading commercial centers of the world. Mr. Bailey markets his lines in conjunction with permanent sales offices in the different countries, so that this trip would no doubt be of interest to manufacturers seeking foreign trade. His address is 32 Broadway, New York City.

Among the recent sales made by the Cyclone Drill Co. of Orrville, O., are the following: Nine blast hole drills for John B. Carter Co. for various contracts in Maryland and Pennsylvania; four prospecting machines for Jacobs & Davies for testing foundations for the large government dam on Tennessee River, near Chattanooga, Tenn.; blast hole drill for Empire Limestone Co., Buffalo, N. Y.; blast hole drill for Shore Line Stone Co., Monroe, Mich.; blast hole drill for Barr-Clay Co., Streator, Ill.; blast hole drill for France Slag Co., Toledo, O., together with a number of water well drills and prospecting outfits for various concerns. The company is stated to now have more orders on its books than at any time in the history of their business.

ADVERTISEMENT.

Sealed bids will be received by the Board of Water Commissioners of the City of Manistee, Mich., at the City Hall, up to 2 o'clock p. m., September 1, 1910, for furnishing and constructing complete, ready for use, a 12-in. cast iron pipe river crossing.

Plans and specifications may be examined at the City Hall, or at the office of the Engineers.

The right is reserved to reject any or all bids, to waive any informality in any bid, and to accept any considered advantage to the City of Manistee.

JOHN SEYMOUR, President,
Board of Water Commissioners.
T. J. ELTON, Secretary.
JOHN W. ALVORD,
CHAS. B. BURDICK,
Engineers,
1212 Hartford Bldg., Chicago, Ill.

NOTICE TO SEWER CONTRACTORS.

Sioux Falls, S. D., August 3, 1910.

Sealed proposals marked "Bids for Sewers" will be received by the Board of Commissioners of the City of Sioux Falls, S. D., at the office of the City Auditor of said city, up to 9 o'clock a. m. of Tuesday, September 6, 1910, for the construction of approximately 66,000 feet of sewers varying in size from 8-inch to 36-inch.

Plans and specifications may be seen at the office of the City Engineer or at the office of L. P. Wolff, Consulting Engineer, St. Paul, Minn.

All proposals must be on blank forms furnished by the City Engineer and must be accompanied by a certified check in the sum of $10,000 made payable to the City Treasurer of the City of Sioux Falls, S. D.

The Board of Commissioners reserves the right to reject any and all bids.

LEWIS LARSON,
City Auditor.

(Proposal Advertisements Continued on Page 53.)

Importance of Cost Keeping

Whether his work be inspecting, surveying, drafting, or in charge of constructing, the engineer should record both the cost of the work he himself is doing and the cost of all work that comes under his observation. His ability not only to estimate future work but to reduce its cost depends upon his detailed knowledge of costs. Cost keeping, therefore, should be studied by every engineer. "Cost Keeping and Management Engineering," by Halbert P. Gillette and Richard T. Dana, has met with universally favorable reviews from the engineering press, and cannot fail to be a great aid to every engineer and contractor. The book is 6x9 inches, 360 pages, and its price is $3.50 net, postpaid.

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A Notable Article on Rock Tunneling.

General accounts of tunnel work are as plentiful as bees in June, but it is rare that a record appears in such detail as that published in another part of this issue. The value of this record lies in its detail, its minute presentation of difficulties and of the methods of solving them. This fact is apparent in the portion of the article which we publish this week and will be still more apparent in the concluding portion which will appear in our next issue. In viewing the work as a whole there are several features which stand out so prominently as to deserve special mention.

First of all, from the constructor's point of view, the designing engineer's work is to be commended because of the shape of cross-section adopted. This was such that a practically rectang[illegible] sible. There w[illegible] the periphery, th[illegible] flat a curve that for excavation purposes it could be considered a straight line: The great advantage of such a section lies, of course, in its reduction of overbreakage, which increases the cost both because of the excess material removed [illegible] rial which has to be put back in its place. Another advantage of this section lies in its flat floor. There are few more troublesome tasks in rock tunnel work than that of breaking out a dished floor, the practical tunnel man is always between the devil of trimming down and the deep sea of overbreakage. To complicate matters are the difficulties of track work on a curved bottom and, of course, the greater cost of a shaped lining. It is impossible to state in dollars and cents just how much was saved in cost by the sensible cross-section adopted, but we have the contractor's assurance that his blessings went out to the engineer for it many times during his troublesome two years' work

Among the difficulties of the work, water came first. For nearly 2,000 ft. of the lake tunnel the excavation cut a gash through a nearly horizontal water-bearing seam, so that two seepage edges, one in each side of the tunnel, were exposed. In the land tunnel the circumstances were almost as bad. Grouting was the remedy, and tunnel men will draw new faith in the use of this material from the experience at Buffalo. While generally the fear of the tunnel man in subaqueous rock tunneling is of vertical seams which connect with the stream bed above, it is plain from the tunnel work at Buffalo that horizontal strata present dangers of their own particular kind. A vertical seam, when once got in hand, is soon passed, but a horizontal seam furnishes a fresh accesion of trouble for every foot of tunnel opened.

It will be noted too that the horizontal stratification of the rock in the Buffalo tunnels was fruitful in drilling troubles. With rock layers varying from 2 to 6 ft. thick and of varying degrees of hardness, drilling became a problem. Putting in horizontal holes resulted in blowing out neatly a succession of horizontal slices, leaving shelves between the holes. To solve this difficulty inclined holes were necessary, and here came another difficulty. The possible inclination was not great and in passing from a soft to a hard stratum the drills went off line and blocked or jammed. This made the use or iron or "shot" frequently necessary. It is interesting to note at this point that best results were got from pieces of cast iron and that next came ordinary cold pressed ¾-in. hexagon nuts.

In the land tunnel work a unique difficulty was encountered in the shape of sulphurous gases. These gases appeared in certain seams and pockets of rock only, and their effect was felt chiefly on the eyes of the men. Frequently men would go blind for several days and laying off because of sore eyes was so common that at times a double force had to be employed to keep enough able men on hand to fill the gangs. Analysis of the water which came out of the seams emitting gas showed that it contained almost pure sulphur. Naturally the effect of this water on pumps and piping was vicious and pipe leaks and pump troubles added to the complications.

At this point it may be noted that ventilation was a considerable source of trouble throughout the land tunnel work in particular. Prostrations from smoke and gas resulting from blasts were frequent. One remedy for this was in the use of time fuses, by which the number of trips into the heading to fire the several rounds was reduced from four to two. The main resort, however, was to provide a ventilating system which in some respects was rather novel. At intervals along the tunnel 8-in. holes were drilled and cased using ordinary well drilling methods. These holes were connected up at the surface with blowers piped both to exhaust from the tunnel or to force air into it, and after blasts they were operated first in exhaust to draw the smoke away from the immediate heading and then reversed so as to blow air into the tunnel and force the smoke out of the shafts.

Considering the difficulties encountered in the Buffalo tunnels, the records made were very good. The record of the final 6 months on the lake tunnel was particularly good. In a measure at least this favorable showing can, we think, be credited to the system of bonuses and penalties by which the payment of the men was regulated. The bonus system was first applied only to the drill runners, helpers and heading foremen and was based on the linear foot of advance. The average week's work was set at 55 ft., and for every foot beyond this the foreman was given a bonus of 50 cts., the runners a bonus of 30 cts. and the helpers a bonus of 20 cts. When the three drill shift plan of work was adopted the bonus system was extended. In the new bonus scheme all the men were taken in, including muck foremen at 30 cts. and muckers at 10 cts. per foot. Motor men, lock tenders, switchmen, cage men and top men, electricians, pipe fitters, etc., were all included. The concrete men were paid a bonus on all over 66 ft. progress per week. It was found desirable to give the motor men a bonus on both concrete and on excavation progress, or else they would favor one gang at the expense of the other. To prevent one shift from leaving the work in such shape as to delay the next shift a penalty plan was introduced. This penalty was 1 ft., 6 in., and 3 ins. for delays of 1 hour, 30 minutes and 15 minutes, respectively, taken off the progress of the gang causing the delay and added to the progress of the gang delayed. It was found that this penalty scheme quickened things up wonderfully and when it was well established the delays would not average 30 minutes a month.

A record for speed of construction has been established in the erection of the Manufacturers' Home building, Vancouver. The structure was put up from the water's edge to a height of 103 ft. in 118 days. There are about 14,500 sq. ft. of floor area per floor. The floors are designed to carry a live load of 175 lbs. per sq. ft., the concrete slabs being carried on shallow concrete beams and girders, which are in turn carried by hexagonal columns heavily reinforced to cut down their sizes to a minimum. The entire floors were finished as the work progressed from floor to floor and were immediately covered with lake sand to protect them from being marred. The building piers rest on clusters of piles; the largest columns in the basement are 28-in. hexagons; the smallest columns in the last story 10-in. square

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CONCRETE AND REINFORCED CONCRETE SECTION

Fill Dams with Hollow Core Walls.

BY FRANK B. GILBRETH

The salient features of a fill dam as a type are, its range of adaptability, the utilization of available materials and the ease and economy of construction. Any new features which add to the advantages of this important class of dams are worthy of consideration.

The center core-wall type of fill dam is the one in most general favor due in part to the ease and economy of construction, notwithstanding the fact that the weight of the reservoir fill is partly lost through submergence. Solid center core-walls have been constructed of generous dimensions which were expected to provide ample provision against leakage and regardless of this fact, leakage too frequently does occur.

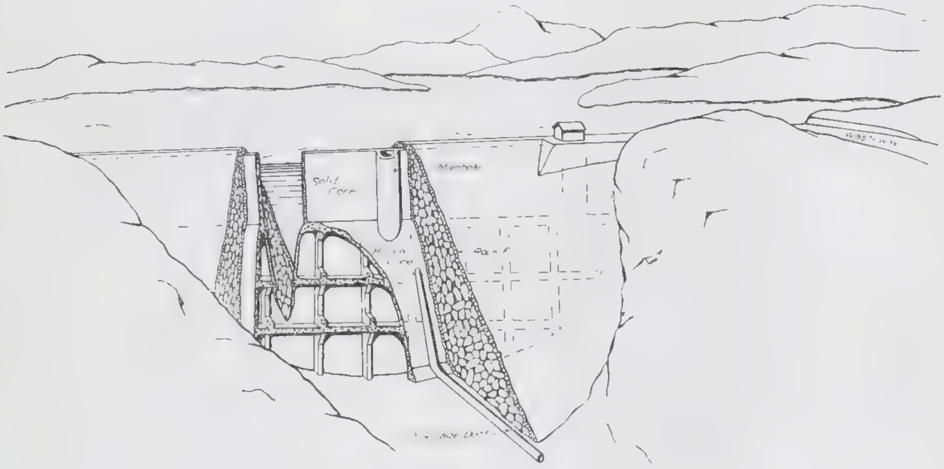
In localities where the run-off for water supply is scarce or intermittent, any leakage through a reservoir dam, however small, is a serious one in loss of revenue. When leakage does occur through a solid core fill dam, the location of the leak cannot be definitely determined for the position of the fill which covers the core of the dam makes that part of the dam inaccessible and the means for repair are slight and an expense which at the time is too great to warrant immediate attention.

To meet this condition and to provide access to the vital portion of the dam there is designed a type, the Hollow Core Fill Dam, wherein the core is made hollow, that is, of two walls cross-braced with division walls with means for access to the interior of the core thus formed. This hollow feature permits of an inspection of the interior of the core and to the seal of the core along the foundation. By this method of construction the conditions of the interior of the structure is always known and any defect can be definitely located, and if leakage does occur at the seals or through the core wall, repair of the defect is possible. The hollow feature can be constructed to any part of the height of the core wall making the upper portion of the core solid and the lower portion hollow, thereby allowing access to that portion of the dam which is subjected to the greatest pressures, and resulting in a combined solid and hollow core-wall.

The small extra cost of hollow construction of the core is offset by the advantages of making the critical part of the dam open to inspection and repair and in addition thereto it has an increased strength and stability of core, due to the enlarged shape and greater base. The enlarged section of the core also reduces the amount of necessary fill without sacrificing any features of design, due to the resultant of force on the sloping reservoir face falling more within the base of the core.

The rear wall of the core is constructed to receive the rock pressure only which is transmitted to the reservoir wall which in turn is designed for both strength and impermeability. The division walls crossing between the core walls are arranged so as to divide the interior into compartments which are provided with separate drainage to conduct any leakage away from the core and lower fill, and thereby avoid flooding of the interior of the core.

The increased size and shape of the hollow core is a feature in the strength of the dam for the materials are placed where they serve to the best of advantage as to the practicability of the entire structure.



Fill Dam With Hollow Concrete Core Wall.

In localities where the country is extremely arid the torrential run-off has been phenomenal and a present condition is not a criterion of possible conditions. Wasteways become blocked and even with open bays and the counteracting effect of the reservoir above, with water near the high water level, a cloud burst or the failure from a reservoir above places all computations of possible discharge as nothing and any feature which adds to the strength and safety of this class of dams is to be desired. A dam is a structure which should be built for the life of the reservoir and scarcely any dam is constructed which does not have a community interest below it and this interest should be granted all the protection possible against disaster from failure of the dam.

In localities where the water supply is abundant the question of leakage, while not one of direct revenue, is one that should be avoided. In a reservoir fill dam a continual leakage is a detriment and in this type of dam only a bottle tight condition should be considered. Permissible leakages due to hydrostatic pressures do not apply to this class of dams.

Fill dams have a wider range of application than any other type, being suited as an adjunct to a constructed overflow type, or where the foundations will not permit of a structure of great weight; where the materials of construction at hand are not suited to another type of dam; where the site is remote from transportation and when the feature of economy of construction is all important. These features make the fill dam more universal in application than any other type of dam and the hollow core fill dam increases the practicability of this important class of structures.

The Design of Footings of Reinforced Concrete.

BY FRANK H. CARTER.*

The introduction of reinforced concrete has somewhat changed the design of footings, as the following discussion will show. Because of the ease with which steel may be varied in its distribution through the bottom of reinforced concrete footing new assumptions or methods of computation are naturally suggested in designing such footings.

It is no longer desirable or perhaps even permissible to take moments about the edge of the column base and to design the footing as a cantilever, a custom formerly quite common among some engineers for footings with I-beam grillage.

By taking moments about the center of the footings, assuming an even distribution over the whole base, the following expression is easily derived for maximum moment at the center of the footing:

$$M_b = \frac{W}{2}\left(a + \frac{b}{2}\right)^2$$

$$W' = W\left(\frac{2a+b}{2}\right) = W\left(\frac{2a}{b} + 1\right)$$

$$M_b = \frac{W}{2}\left(\frac{2a+b}{2}\right)^2 - W\left(\frac{2a}{b} + 1\right)\left(\frac{b}{2}\right)\left(\frac{b}{4}\right)$$

$$= \frac{W}{2}\left(\frac{4a^2+4ab+b^2}{4}\right) - W\left(\frac{2a+b}{b}\right)$$

$$= \frac{W}{8}(4a^2+4ab+b^2) - \frac{W}{8}(4a^2-2ab) - (2ab-b^2)$$

$$= \frac{W}{4}(2a^2+ab)$$

$$= \frac{Wa}{2}\left(a + \frac{b}{2}\right) = \frac{Wa^2}{2}\left(1 + \frac{b}{2a}\right)$$

Assuming again an even distribution over the whole of the footing also that the lines of division between what may be termed the two "principal beams" on the bottom of the footing are the main diagonals of the rectangle or square comprising the outline of the footing, the following expression is deduced:

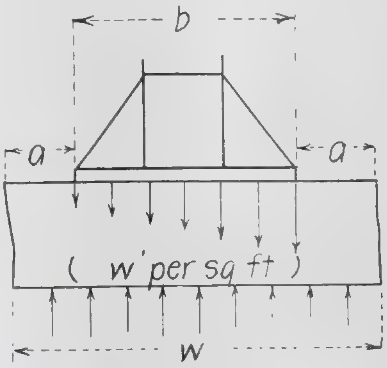


Fig. 1.

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*147 Magazine street, Cambridge, Mass.

$$M = \frac{W}{8}(4a^2 + 2ab) + Wx^2\left(\text{[illegible]}\right)$$

$$= \frac{W}{24}(12a^2 - 6ab - 16x^2 \text{[illegible]})$$

$$= \frac{W}{12}(8x - 6a - 6ab + 3 \text{[illegible]})$$

Where W = load in lbs per sq ft on the bottom of the footing, a = projection beyond column base, and b = width of column base.

The "principal beams" of the footing, reinforced from A to A and from B to B, each of a width equal to one side of the column base according to the second assumption must carry the "load" on the bottom between the main diagonal of the rectangle enclosing the outline of the [illegible] and the [illegible] principal beam [illegible]

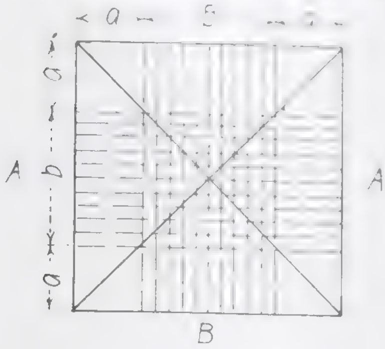


Fig. 2.

[illegible] nearest principal beam, and the moment in that part may be computed as though each part were a cantilever with the half load.

The greatest shear is of course at the perimeter of the column base and is the load per sq. ft. on the bottom of the footing times the area on the part of the footing projecting beyond the edges of the column base. Provision for the shearing stresses may be made by reinforcing with bent rods or stirrups or a combination of the two. Particular attention must be paid to the high bond stresses on the perimeters of the reinforcing rods and in some cases more rods will have to be added. Deformed bars or bars with some form of mechanical bond are generally required in footings on account of these excessive bond stresses.

EARTH AND ROCK SECTION

Construction Methods and Organization in Constructing the Buffalo Water Works Tunnel.

Plans developed in 1906 for the improvement of the water supply of Buffalo, N. Y., involved the construction of a rock tunnel 6,600 ft. long, under Lake Erie and from its shore end a land tunnel 4,300 ft. long connecting with the present city pumping station. Subsidiary works were an intake at the outer end of the lake tunnel and a pumping station at its shore end. This article describes and illustrates the tunnel construction. All the work was done by contract by the Buffalo Dredging Co., Buffalo, N. Y., with C. H. Hollingsworth, superintendent, who has furnished the matter from which this article has been prepared.

General Structural Features.

The old pumping station of the Buffalo water-works was located on the east bank of the Niagara River at the end of a short intake tunnel extending out under the river. This old intake is to be abandoned, but the pumping station is retained and is connected with the new pumping station by the land tunnel mentioned above. Shaft 1 is located at the old pumping station, Shaft 3 is located at the new pumping station and Shaft 2 midway between the two stations. From Shaft 3 the lake tunnel extends out to the new intake crib.

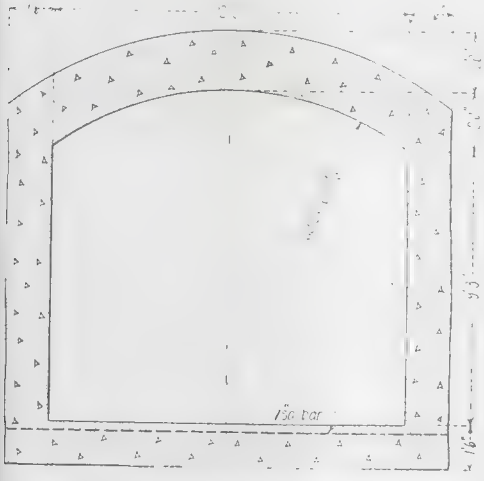


Fig. 1—Cross Section of Lake Tunnel, Buffalo Water-Works.

The section of the land tunnel is shown by Fig. 1 and that of the lake tunnel by Fig. 2. The reinforcement of the floor lining is to be noted. Both tunnels are through rock; a limestone in nearly horizontal layers, some soft and others very hard, interspersed with frequent thin strata of flint This horizontal stratification of the rock caused some trouble in drilling and blasting as will be described later. In addition the rock carried water in places and in other places developed very troublesome sulphurous gases. For the most part driving and lining had to be done under compressed air.

Shaft 3 and Lake Tunnel.

Nearly the entire length of the lake tunnel and some 1,976.8 ft. of the land tunnel were driven from Shaft 3. The shaft sinking and lake tunnel work only are described under this heading.

SHAFT 3.

This main shaft was located in what at the time of beginning it was Lake Erie, being in about 7 ft. of water and 400 ft. from the shore. As shown by Fig. 3, the new pumping plant was to be located between it and the shore line and the whole area for about 1,200 ft. along the water front and to 150 ft. beyond the shaft was to be filled to a height of about 6 ft. above water level with spoil from the tunnels. A concrete retaining wall, ran along the lake side of the area and this was built in 1907. The site of the pumping station was partly excavated and the material used to make a road from the shore to near the shaft. A timber crib 32 ft. square of 12x12-in. timbers, was partly constructed and floated to the site of the shaft and there finished and sunk by weights at the corners. The interior of the crib was then excavated with an orange peel bucket operated from a derrick boat until the crib had settled to within about 2 ft. of rock, where it struck hard gravel. The crib was then pumped out and braced inside with diagonals spaced 2 ft. vertically, making the interior octagonal in shape, with 12 ft. sides. Short pieces of 6-in. sheet piling were driven inside through the gravel to rock, the gravel was excavated and a strip of waling was run around inside the sheet piling at rock surface.

When the rock was cleaned off it was found to be nearly level and a test hole was started. This hole developed the fact that there was a water seam about 1 ft. below the surface from which the water spouted up through the hole nearly as high as the lake surface. It was decided to try to plug this seam by grouting; four holes were drilled around the shaft area and 2-in. pipes with valves were put in. As the covering of the seam was light the pipes were carried above lake level and the crib was allowed to fill with water. A pump was connected to each pipe and grout was pumped in and allowed to set for 2 days, and at the end of this time a drill hole showed the seam to be closed. When excavation was begun 1½ ins. of solid cement was found to fill the seam. Two other seams were met and closed by grout; when the bottom was reached at a depth of 70 ft.—24 ft. in sand and 46 ft. in seamy rock—a 30-gal. per minute pump handled all the water.

The shaft was designed to be 14x13 ft. outside with a 12-in. concrete lining, but in order to have plenty of room it was excavated 17x16 ft. In sinking the drillers worked one shift and the muckers worked the next shift. The arrangement of drill holes used is shown by Fig. 4. The procedure was as follows: The first night the drill gang, consisting of 1 foreman, 4 runners, 4 helpers and 1 nipper, drilled the 10 cut holes and a relieving hole at each end and if there was time one or two side holes were drilled. In the morning they loaded and fired the cut and at 7 a. m. the muckers started. As the cut did not make as much muck as the side round there was time in this shift to load and fire any side holes that had been drilled and to muck out this material also. The second night the drill gang drilled the 12 side holes and fired them in the morning. To drill the side round a rough staging of timbers and planks had to be laid over the cut since all drills were tripod mounted. By using 10-ft. steel the cuts and sides round usually squared up a depth of about 8 ft., making a daily average of 4 ft. The 46 ft. of rock came out in exactly 2 weeks outside of the time taken to grout the three water seams. The muck was hoisted in buckets and dumped around outside the crib. At about 6 ft. above the bottom of the shaft a 17x20x12 ft. pump chamber was excavated on each side.

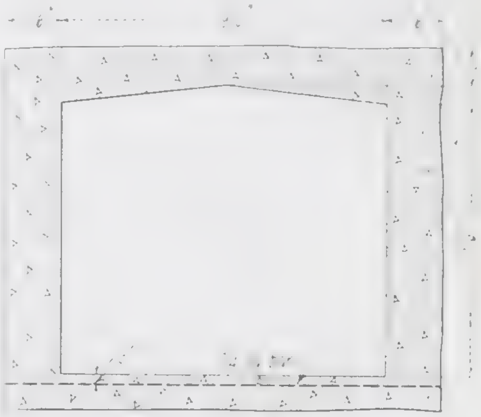


Fig. 2—Cross Section of Land Tunnel, Buffalo Water-Works.

As soon as the shaft was bottomed work was begun north on the land tunnel heading and south on the lake tunnel heading, but water being struck as described further on excavation was stopped to install bulkheads and air locks and a shaft pumping plant and a shaft hoisting plant.

[illegible]

The heading for the lake tunnel was carried 350 ft. without air when a slab fell from the roof disclosing a 2-in. water seam, and work was stopped to install compressed air and the shaft plant as just mentioned. A bulkhead of concrete 5 ft. thick was built and provided with a 6½x20 ft. material lock, a 3½x15-ft. emergency lock and pipes for various services. When the compressed air was turned on it escaped so freely that pressure could not be secured or maintained.

Water Troubles.—The water seam just mentioned appeared first about 1 ft. above the roof grade and reached horizontally across the tunnel. This seam dipped about 1 ft. in 100 ft., and as the excavation proceeded it was cut through leaving an exposed edge on each side of the tunnel ranging from ¾ to 1 in. wide. As the plant was not ready for putting in the concrete lining, by which means the seams could be closed up close behind the excavation, it was decided to drive a bottom heading below the grade of the seam until the concreting plant could be installed. This bottom heading was made 7 ft. high and 15 ft. wide and was extended about 500 ft., until its roof reached to within about 1 ft. of the seam. Work was then stopped and from the upper corners of the heading holes were drilled upward piercing the seam. These holes were spaced about 30 ft. apart along the heading and each was fitted with a short piece of 2-in. pipe provided with a stop cock. A grout pump was connected with each pipe in turn and grout was pumped into the seam until it was closed; a 1:2 cement and sand grout was used except where the seam was very thin and here neat cement grout was used. Meantime additional compressors and the concreting plant had been installed and work had been begun concreting the lining. The heading gang was then taken back to the starting point of the bottom heading and put to breaking down the upper half of the tunnel.

Timber platforms or stages were used in taking out the top heading; there were two of these and each was built in two sections. The stages consisted of 12x12-in. side sills carrying 12x12-in. posts 2 ft. apart which supported 12x12-in. wall plates. Across these wall plates there was laid a flooring of 12x12-in. timbers. The total height of the stage was such that a space of 6 to 12 ins. was left between its top and the roof of the bottom heading. This space or clearance was so small that when the rock was shot down its drop was not great enough to injure the platform, and yet it was sufficient to avoid danger from the shock of the blast, which would have destroyed timber placed close against the rock. Three 8-hour shifts of drillers were worked, shifting from one stage to the other while by means of the two sections of each stage the muck gang could shift the working platforms ahead as fast as necessary. It may be noticed that when the upper half of the tunnel section was taken down the seam was found completely closed by the grout.

Excavation continued as described and without incident until the top section had been removed as far as the end of the previously driven bottom heading, then a new series of water troubles developed. First an attempt was made to take out a top heading shallow enough to keep its floor some 2 ft. above the seam, after which holes could be drilled in the bench which would pierce the seam and permit it to be grouted. In blasting, however, the rock would break or crack down to the seam and this left so many openings that grouting was impracticable. The next plan was to drill long holes in from the face and "looking down" enough to pierce the seam well ahead. Two such holes were drilled, one on each side of the heading and each about 15 ft. long, and when grouted they would permit two or three shots to be made without trouble. Then the operation had to be repeated. This was slow work and as the dip of the seam carried it lower down it was hard to reach with the grout holes more than 8 to 10 ft. ahead of the face. Also it developed that the grouting did not close permanently the seams and water came into the tunnel between the heading and the concrete lining. About this time several feet of the widest seam became exposed and as an experiment a hole was run horizontally directly into the seam, and was grouted. To the surprise of all it closed the seam completely. Thereafter this operation was repeated as fast as the seam was exposed until at a distance of 1,800 ft. from Shaft 3 the seam dipped below the tunnel floor; the remainder of the tunnel with 23 to 25 lbs. of air pressure was entirely dry. If the pressure dropped, however, leaks from small seams appeared.

With the beginning of the dry tunneling a fixed plan of excavation and concreting could be and was developed. Before describing this plan a word should be said regarding the rock encountered. At about 1,000 ft. from Shaft 3 the rock ran from a firm, hard but good drilling limestone into a belt of black flint about 18 ft. thick, running with a slight dip toward the intake, and on top of this was found an extremely hard limestone in strata from 6 to 18 ins. thick interspersed with strata of the black flint. This flint was so hard that it would readily cut glass.

Drilling Methods.—The general method of excavation was to drive a full width (15 ft.) top heading 9 ft. high and then remove the remainder of the section as bench. Numerous different arrangements of holes were tried but the arrangement finally adopted was that shown by Figs. 5 and 6. It would have been easier in drilling the heading to have employed two side rounds instead of one as shown, or else to drill reliever holes between the cut and side rounds, but while the advance might have been slightly more per shot, the disadvantages were considered numerous, including the use of more powder with the consequent additional amount of smoke, the greater time taken to fire the heading and the much greater time taken to drill the hea

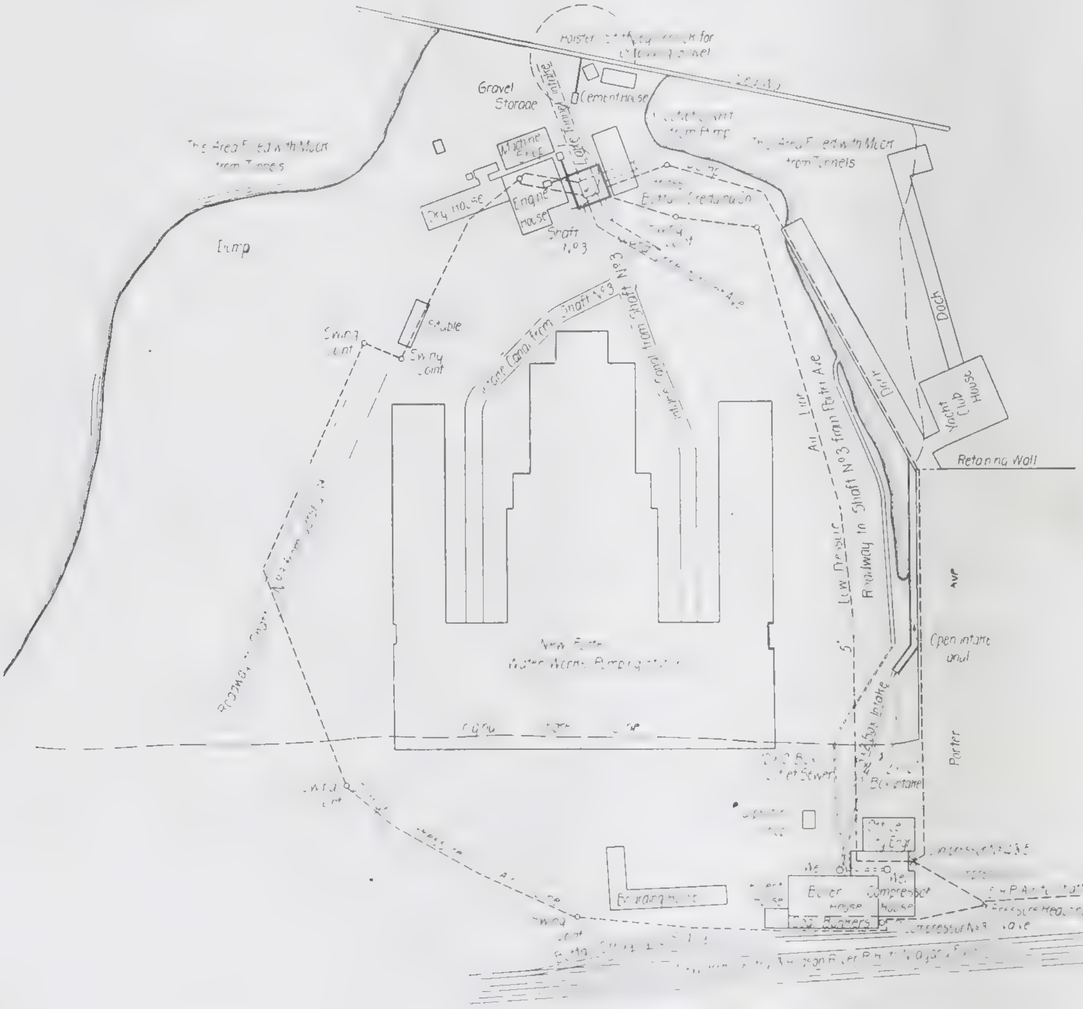


Fig. 3—General Lay-Out Plan at Shaft 3, Buffalo Water-Works Tunnel.

ing. The last two reasons were important as it was desired to have one drilling shift complete the sitting up, drilling and firing one round in its day of 8 hours. With the heading drilled as illustrated it was necessary to place the holes very carefully and several alleged heading foremen came to grief, some of them getting as little as 2½ ft. advance with one round of 8-ft. holes. The general average, however, with 8-ft. holes, which were actually 7 to 7½ ft. deep, was from 5 to 6½ ft. in the very hard rock and from 6 ft. up in the limestone.

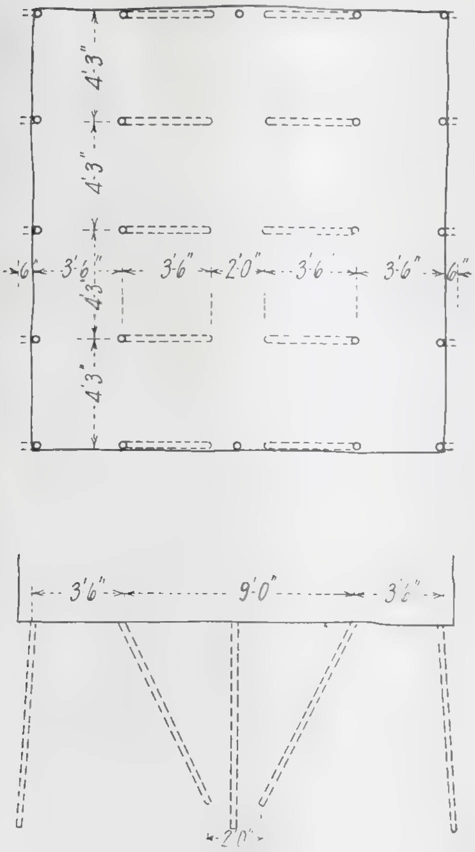


Fig. 4—Plan and Section of Drill Hole Arrangement in Sinking Shaft 3.

The bench was taken out with two rows of four holes across the tunnel with the rows about 3 ft. apart. These holes were usually drilled a foot or more below the floor of the tunnel.

Organization and procedure in the drilling work may be summarized as follows: Before putting on air two 10-hour shifts were worked and good progress was made with the drilling but the mucking ran behind. At first after air pressure was turned on, three 8-hour shifts were worked but the third drilling shift did little more than get in the other's way. Later two 8-hour full shifts and one 8-hour split shift were used in drilling with three shifts of muckers. With this last arrangement the procedure was about as follows:

The day shift of drillers consisting of 1 foreman, 4 runners and 4 helpers in the heading and of 1 runner and 1 helper on the bench, went on at 8 a. m., finding the heading all mucked out. This shift set up its columns, drilled its round of holes and usually fired its first shot about 3:45 p. m. The day drill and muck gangs then went out and at 4 p. m. the split drill gang and the 4 o'clock muck gang came on. The split drill gang consisted of 2 runners and 2 helpers, and they and the heading foreman finished firing the holes drilled by the day shift. After an interval of 10 to 15 minutes after the last shot the split drill gang and 4 o'clock muck gang went into the heading; the drill gang worked until 8 p. m., and it was their task to have the heading cleaned for setting up the drills by that time and to see that the muckers brought in the columns, foot blocks and machines ready to set up. At 8 p. m. the night drill gang came on, set up, drilled a round and fired the first shot by 4 a. m., when it went out and the split gang came on, finished firing and cleaned up for the day drill gang, working 4 hours or until 8 a. m. The 4 o'clock mucking gang worked till 12 midnight, when the night mucking gang came on, worked till 4 a. m., then went to lunch, while the split drill gang was firing, and returned to finish the shift quitting at 8 a. m. This system was operated from September, 1908, to October, 1909, without once failing to drill a round and begin shooting on the same shift. The orders were to get in a round and start shooting, may be a 6-ft. round, may be an 8-ft. round, but finish and shoot anyway. The chief trouble was in firing. With ordinary explosives the procedure was as follows:

The entire heading and bench were loaded and the cut and first round on the bench were fired first. The other exploder wires had been tucked into the holes. If the cut did not come clean, which it usually did not when put in properly, the bottoms of the cut holes were reloaded and fired with the second round on the bench. Then the men went back the third time and mucked out the bottom side round holes and fired the side round. Finally they went back and connected up the dry holes. All shooting was done with a special shooting circuit of two No. 14 copper weather-proof wires carried on the opposite side of the tunnel from the lighting circuit and running from a point about 50 ft. back of the bench to a switch box in the concreted tunnel. This box was kept locked and a flexible connection was run across the tunnel to a plug in the lighting circuit. The flexible connection was low, being only 3 to 3½ ft. above the floor, and, of course, was usually disconnected and coiled around the shooting box. Because of the connection being across tunnel and so low it was impossible to leave it in without noticing it and the passing of cars continually between firing periods ensured the connections being kept broken. In addition the switch had to be open to permit the locking of the box. The shooting box was kept 500 to 750 ft. back from the working face and at the end of the shooting line there was a coil of 250 ft. of the double line, which was uncoiled day by day as the heading progressed until the whole 250 ft. were run out, when the box was moved ahead another 250 ft.

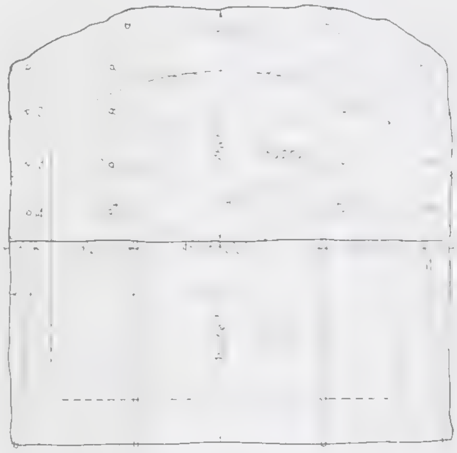


Fig. 5—Elevation of Drill Hole Arrangement in Driving Lake Tunnel.

As indicated, it required four shots to finish firing the heading and the time required was from 1 to 1½ hours, according to the amount of mucking to be done. The two rounds on the bench could be shot at the same time, but the results were bad. It was concluded to try electrical time exploders and a small lot of what are known as first delay action exploders was purchased. They worked well and an order was placed for a large number of first and second delay action exploders. When these came several trial shots were made in the heading and good results obtained, but the trouble was that unless the cut came clear the first time a poor shot resulted. On the other hand, when the cut holes came close together in the bottom the cut came clean, but left too much ground for the side round to break. Finally the following plan was adopted and used from about May, 1909, to the completion of the work.

On the bench the first round was loaded with ordinary exploders and the second with first delay exploders, which, while the current went to them at the same time detonated about 1/10 to 1/20 second later than the ordinary exploders. The cut holes in the heading were loaded with ordinary exploders, the side round with first delay exploders and the dry holes with the second delay exploders. The cut and bench holes were fired first, then the men went back and reloaded the bottoms of the cut holes with ordinary exploders and connected up these and the side round and dry holes and fired them altogether. This method cut down the firing time from 1 to 1½ hours to from 20 to 30 minutes, and the results were as good if not better and there were fewer missed holes. The time exploders acted very uniformly and in the second shot the three detonations could be heard distinctly in one, two, three order. All exploders were tested on top and poor ones were discarded. No. 30 Du Pont exploders were adopted after trying various other kinds.

In the matter of powder various experiments were also made. At first 60 per cent Forcite and a small amount of 60 per cent Keystone were used; during the final 2½ years Forcite alone was used. The amount used from time to time was varied and it was found that the best charge for what were nominally 8-ft. holes was 8 sticks or approximately 6 lbs. With less than this amount the breaking power was too low and with more the charge came too near the collar of the hole and the explosive lost its force there before the powder at the bottom could properly exert itself. As 8 sticks per hole and 26 holes made 208 sticks to handle it was arranged to get the sticks 16 ins. instead of 8 ins. long. This reduced the number of pieces to be handled just one-half and it also reduced the amount of paper which according to powder men makes smoke; with 8-in. sticks there were 14 wads of paper separating the sticks and with 16-in. sticks there were only 6 wads. The 16-in. sticks were made 1½ ins. in diameter. A trial was made of 90 per cent gelatine powder, but it did no better than the 60 per cent, the same quantity was required and it cost about 40 per cent more.

In November, 1909, a change was made from two full shifts and a split shift of drillers to three full shifts and this arrangement was continued until the tunnel was holed through in March, 1910. In the three-

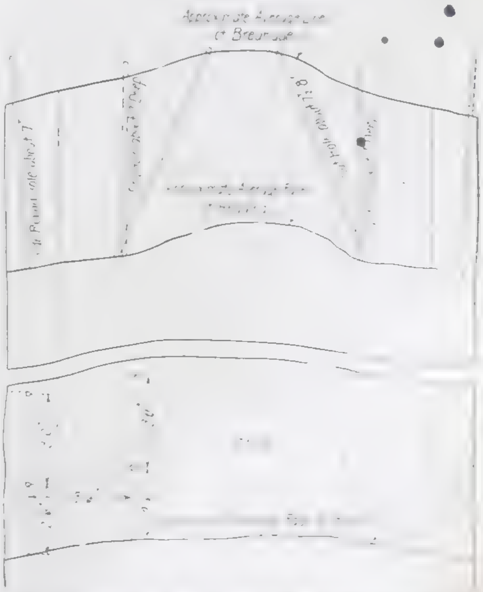


Fig. 6—Plan of Drill Hole Arrangement in Driving Lake Tunnel.

shift plan, the heading gang consisted of 1 foreman, 4 runners in heading, 2 runners on bench, 6 helpers and 1 nipper. The 8 heading men mucked out the heading working 4 at a time, then while the runners set up the columns the helpers went back and picked out their steel, got their hose, wrenches, valves, etc. Then all hands set up the machines. The bench men cleared off for one hole each and then set up and started drilling, leaving the other holes to be cleared off by the muckers. Occasionally one of the bench men would have to go back and drill two or three trimming holes ahead of the concrete forms, but this was not required more than about once in 300 ft., on an average. The bottom had never to be redrilled nor the roof except at a few points near the haunches where Little Jap drills were used.

The nipper's business was to get an empty car on top, get his steel from the blacksmith shop, and load it on the car and see that it got in as close to the heading as possible, where the helpers could get at it. He also took in in the morning enough oil for the day and some blank nuts for use as shot. He usually got back on top about 10 a. m., bringing his torches up with him, made up his tamping and powder in a building apart from the main magazine, stopping to take coffee to the men at noon. About 1:30 p. m. he loaded his powder and tamping onto the powder car, which was a water-proof, insulated tool box mounted on rubber springs on the underframe of a car, and took the load into the heading and unloaded it on the side of the tunnel opposite to the light wires, putting the powder boxes below and the boxes of tamping on top. The runners and helpers took the powder from the pile into the heading.

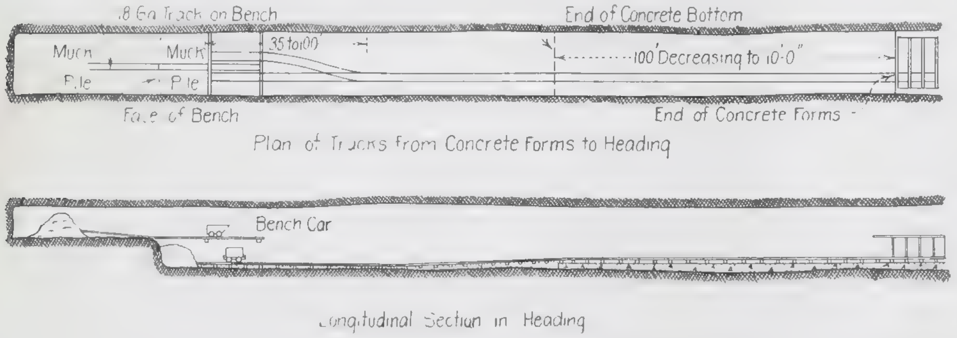


Fig. 7—Arrangement of Tracks in Heading.

In the heading as soon as a runner finished his holes he and his helper took the drill and arm off the column and dropped them on top of the muck pile. When both men on one side were down they pulled down the column and dug up the foot block. If the columns were all down before 3 p. m. the men waited until that time and then started blowing out the holes, after which the light lines were pulled out and the holes were loaded. No holes in the heading and on the bench, only the holes on the far side from the light wires were loaded until these wires had been pulled back over the bench. The runners always loaded the holes and one and the same helper always strung the lead wires from the end of the permanent shooting wires into the heading. By the time the loading was finished the gang had cleared the heading and all hands went back for the first shot. As only one trip back into the smoke was required, the foreman took the two top runners and helpers one day, the two bottom runners and helpers the next day, and the bench men the next day. In going back the foreman took two short loading sticks, one man restrung the lead wires, one took the powder, one the tamping and one carried two shovels. As the air had been turned on before leaving the heading for the first shot only 3 to 5 minutes elapsed before getting back for the second shot. After firing the second shot one man took the surplus powder on top to the nipper after having removed the exploders.

Not belonging to the heading gang, but working largely with it, were a pipefitter and an electrician. The pipefitter at the beginning of the shift replaced the 3-in. main air line which had been removed in order to shoot. This usually consisted of an 18 to 20-ft. length with a ball and socket joint on each end and of a 50-ft. length. The ball and socket joints allowed considerable leeway in getting onto the bench, and the hose ran up over the muck pile into the heading. Next the pipefitter looked after his water line which was 2-in. pipe to the end of the concrete lining, 1-in. pipe from there to the bench, and a 1-in. hose terminating in a short length of ¾-in. hose, with a ⅜-in. jet pipe, into the heading. The water was supplied by a pump at the shaft and one jet furnished enough water for all four drills, as the rock was hard and slow cutting. The pipefitter also gave the concrete gang a water connection and an air connection for operating the hoists; kept the blow pipe extended behind the bench; looked after blow pipe connections back along the tunnel; kept at least two extra drills, extra chuck bolts, valves, etc., in near the heading and took care of all throttle valves which were turned over to him after the drills were down. At the end of the shift he disconnected the water and air lines. On the end of the air line he placed a 3-in. sleeve bushed down and ending in a 1-in. nipple. This was done so that the blow-off could be left wide open in going back for the first shot and not run the air pressure down. With the full 3-in. pipe it was found difficult to open the valve large enough to give a good force of air into the heading and not so wide that the pressure would run down.

The electrician was the first man into the heading, taking one mucker to help him put up the light wires. These wires were hung on spikes driven into seams or on wooden plugs in shallow drilled holes. These temporary light wires were about 500 ft. long, running back to the switch box inside the concrete lining. A short section of wire with two clusters of three 32-c.p. lights was hung to each column; other clusters in three or four places gave light to the muckers and two more clusters gave light to the concrete gang. After the round was drilled the electrician pulled out the various clusters, coiled up the wires and with the help of a mucker took them back to a safe distance, tied up the coils and covered them up. Between these various duties the electrician strung permanent wire, trimmed arc lamps on top, and looked after various electrical repairs.

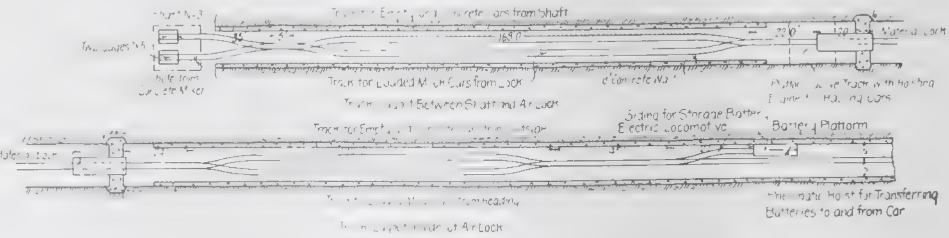

Track for Loaded Muck Cars from Lock
169.0
22.0
12.0
Siding for Storage Battery Electric Locomotive
Battery Platform
Pneumatic Hoist for Transferring Batteries to and from Car

Fig. 8—General Arrangement of Transportation Tracks in Tunnel.

The time of a drilling gang, taking the day shift as an example, was distributed about as follows:

8:00 to 8:05 a. m., getting into heading.
8:05 to 8:15 a. m., blowing smoke.
8:15 to 9:15 a. m., mucking out heading.
9:15 to 10:30 a. m., setting up machines.
10:30 to 3:00 p. m., drilling 18 7-ft. holes.
3:00 to 3:30 p. m., blowing out and loading holes.
3:30 to 3:55 p. m., firing.
3:55 to 4:00 p. m., blowing out smoke.

Before closing this account of the drilling methods it will be of interest to note the results of some pressure tests made on the compressed air mains. These tests were made just previous to starting the three full drilling shifts in November, 1909. At this time the working force was 4,300 ft. from the shaft. A 5-in. air main ran 2,500 ft. from the compressor house to the shaft, a 4-in. main ran down the shaft and a 3-in. main ran from shaft bottom to the working face. A gage was attached to the main at the compressor house, another to the 4-in. main at the shaft bottom and a third to the end of the 3-in. line, where the hose to the drills connected. The gages were adjusted to read alike and readings were taken simultaneously at minute intervals for an hour. At the compressor house the gage registered uniformly 130 lbs. That at the bottom of the shaft registered a pressure ranging from 126 to 128 lbs. The gage at the heading showed 50 lbs., with 6 drills and a concrete hoist running and 70 lbs. with only 2 drills running. The loss in pressure between shaft and heading, 4,300 ft., thus was from 33½ to 51½ lbs., which showed conclusively that the 3-in. main was too small. This main was consequently changed to 5-in. main to as far as the concrete work and from there 3-in. main was continued to the heading terminating in 50 ft. of 3-in. wire wound hose having a 7-branch manifold. In addition to the loss caused by the too small pipe there was a large amount of leakage at the joints which were the regulation screw couplings and spuds. A special quick action coupling with a rubber gasket was substituted with the result of both eliminating the leakage and of reducing the time of coupling up from 5 to 10 minutes to ½ minute.

Mucking Methods.—The only features which favored fast mucking were that the rock broke off from practically smooth horizontal seams making good shoveling and the shape of the tunnel which admitted of working the maximum number of men abreast. At the start before the air locks were put in, the men mucked into Steubner buckets set on flat cars and at the shaft hoisted by derrick and dumped alongside and lowered. The haul in the tunnel was short, only 400 ft., and the return of the buckets from the top was quick. The buckets were low and large at the top and so easy to shovel into and the limestone broke coarse. Exceedingly good mucking records were, therefore, made. After the air was put on a special V-shaped car designed to pass the locks was used; this car was made by the Atlas Car & Foundry Co., of Cleveland, O.

The muck below the bench was shoveled directly into the cars while that from the heading was wheeled out on overhead runways and dumped into the cars. The sketches of Fig. 7 indicate the arrangement. The runways first used were 4x16-in. plank placed on 6x6-in. cross timbers whose ends were supported by "ladders" set against the tunnel sides. These ladders consisted of two 4x6-in. side pieces connected across by cap and sill and bored every 8 ins. so that movable rungs of 1-in. bolts could be inserted as desired; by shifting the rungs up or down the cross timbers were kept at one level, whether the ladder stood on a high or low spot of the floor. Two rungs were provided for each ladder and they were 1-in. bolts with nuts, the end of the cross timber rested on one bolt and was wedged down from the other. Some jacks were used to wedge the timbers against the tunnel sides and so prevent lateral movement. The runway was over the axis of the tunnel so that the barrows could be dumped into the car on either side. This wheelbarrow method worked well but was slow, since a barrow held only 2 cu. ft. and 2 men were required to a barrow, and a car was substituted.

The runway was replaced by a portable track on which ran a ½ cu. yd. rotary dump car of 18-ins. gage. The track consisted of 12-ft. sections of 35-lb. rails held together by three crossplates riveted to the bottom of the rails; the cross timbers were spaced 12 ft. c. to c. and the track sections were bolted directly to them. This trackway reached back into the heading and extended far enough out over the end of the bench to cover two muck cars set end to end on the track below. The small cars were operated by hand, a run plank being laid between rails and the heading end being raised 8 or 10 ins., so as to give a down grade for the load. The cars were easily shoveled into and two car loads filled a muck car, and while the muckers had to wait for the small car to be dumped each time the trip seldom took over 30 to 45 seconds when, as was usual, the bench was kept within 30 to 40 ft. of the heading face. With the wheelbarrows it took from about 9 a. m. to 2 p. m. to clear out the heading; with the car arrangement the work was finished by 12 m. or 1 p. m.

The muck gang on the basis of two shots per day consisted of a foreman and 10 or 11 men; on the basis of three shots per day it consisted of 14 men. On first going in, which for the day shift was about 8:15 a. m., one man went with the electrician and one with the pipe fitter until they were done putting in piping and lights. The remainder of the gang in the meantime cleared off the switch and tracks, loading the muck into cars as they cleaned up. About 8:45 four men started placing the staging for the heading car track, and by the time this was done the track would be cleared so that a train of 3 cars could be backed in and mucking the heading begun. It usually took from 15 to 30 minutes to put up the staging. Whenever the heading foreman was ready the entire muck gang went back and brought up the columns, arms, drills and manifold hose. This was found quicker than to send part of the men back, with the whole gang with the muck boss to lead them the whole outfit could be loaded in about 2 minutes, while if 4 or 5 men were sent back alone they would take an hour. The heading machines, when brought up, were put on the muck pile and the bench machines set one side out of the way of the muckers. The usual arrangement was to work 7 men in the heading and 1 man on the car with 5 men shoveling below and 1 man on the track cleaning up. At 3 p. m. all mucking was stopped and the staging and track were taken out, while the holes were being blown out. Then the columns, machines, arms, and manifold were carried back, the drills loaded onto a car, and finally all blocking and tools loaded and pushed back and at 3:30 the gang started for the heading.

For some 300 ft., toward the end of the work the heading was driven first and the bench left until the heading had been holed through. To muck this heading the muck track was carried on an incline up to the heading level and a 50-ft. switch track laid. Empty cars were run in until the siding was filled and were taken off one at a time, loaded and run back onto the switch until it was full of loaded cars, when a train was made up and started for the shaft. As soon as the heading was holed through, the four heading drills were put at work on the bench drilling it completely, but shooting it only as fast as the muckers could handle the spoil.

Transportation Methods.—The chief problem with the muck was getting it from the heading to the shaft and on top and 99 per cent of the lost time in mucking was in transportation. When about 1,000 ft. from the shaft a 3½-ton storage battery electric locomotive was installed to handle cars between the air lock and the heading. Except that it was too light and had to be strengthened and a new and heavier motor put in this locomotive worked well. This installation provided only temporary relief, and early in 1908 a comprehensive plan for handling the muck from heading to dump was worked out. This plan is illustrated by Fig. 8 and in parts also by Figs. 7 and 9.

At the shaft, leading from two cages are two tracks running into a short length of single track from which diverge double tracks leading to within about 40 ft. of the air lock where they converge into a single track through the lock. This arrangement gave some 200 ft. of double track between the shaft and the air lock. All muck coming through the lock was run on one track and all empties and cars of concrete went toward the lock on the other track. To handle these cars between lock and shaft a double drum hoisting engine was mounted on a platform above the track near the lock. From one drum the cable run directly down, turned to the shaft, from the other drum a cable run down tunnel well above the floor to the shaft and then down to a snatch block at floor line and back along the floor to the lock. Each cable was provided with a hook and with the two cables a track in either direction was possible.

Inside the air lock the single track coming through the dock terminated in a switch which led to a 150-ft. stretch of double track. This double track converged into a single track which led to a second stretch of double track 110 ft. long diverted from 100 to 400 ft. back of the concrete forms. This last stretch of double track was moved ahead every month. It converged into a single track which ran to the concrete incline. In the heading the single track switched into two tracks as shown by Fig. 7. Figure 9 shows the branch to the concrete incline. The switch in the heading and the track to the concrete incline were moved ahead each week. The two stretches of double track provided two storage sidings. The method of transportation was as follows:

The storage battery locomotive worked between the heading and the nearest storage siding taking in always three empties and bringing out three loads. In addition it handled concrete from the storage siding to the concrete incline setting in usually two cars at a time. The muck cars were made up into 6, 9 or 12-car trains at the storage siding, and a 5-ton, 30 hp. electric trolley locomotive hauled these trains to the storage siding at the lock, then switched over to the other track and pushed empties and concrete cars back to the second storage siding. A double trolley system was used both because it did away with rail bonding and because it reduced the danger of stray currents. A 500-volt direct current was supplied.

The first trolley locomotive had two 13 hp. motors, running either in series or in multiple as required. It also had a gathering reel with 500 ft. of wire by which in emergency it could be run beyond the trolley line to the heading. With motors running in multiple it had a capacity of 12 loaded muck cars weighing 2½ tons each or 30 tons altogether. The second locomotive bought in 1909 also had a normal capacity of 12 cars, but could haul 15 to 18 cars and did haul as many as 22 cars on one trip. As a usual thing it was found better to haul 9 to 12 car trains and make fast trips than to wait for 15 to 18 cars since the cars had to be locked out by threes and 9 to 12 cars could be locked through and the same number of empties locked back between trips, but a larger number could not and congestion resulted.

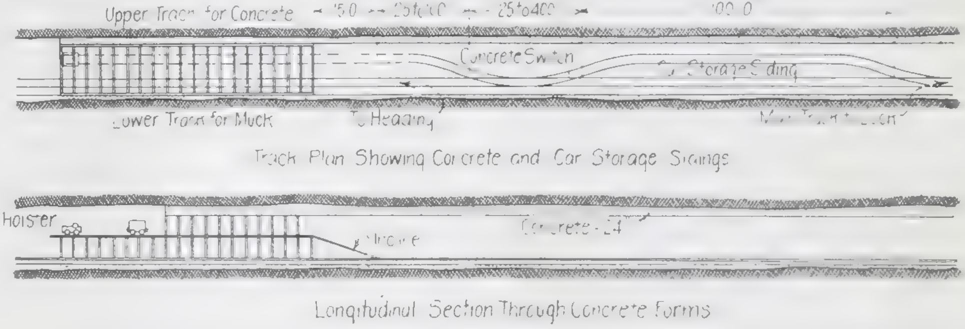
The storage battery locomotive ran 8 hours without charging. Two batteries were provided one being charged while the other was in use. The charging siding with overhead hoist to handle the batteries is indicated in Fig. 8.

On top, the hauling to the dump was done with mules. This worked well while the haul was short, but when it got to be 1,000 to 1,500 ft. the method was too slow. Some 85 cars on the average had to be handled and the number sometimes ran as high as 97 cars, all of which practically had to be handled in 7 hours, since it was fully an hour after this shift begun before the first cars came to the surface.

Concrete Lining Methods.—The concrete lining after the first 500 ft. from the shaft was carried along at about the same rate as the excavation. The mode of procedure was as follows:

On Sunday the concreting gang cleaned out all loose material in the bottom down to subgrade and for the length of tunnel that would be concreted the following six days. The track from the heading was then blocked up and the concreting of the bottom was begun. All concrete, except a small amount mentioned later, was mixed in a Hains mixer located in the shaft. At the top of the mixer there was a storage floor holding about 100 bags of cement and from which a door opened into one of the cage wells so that cement could be received from the top by way of the cage. Above the storage platform in the shaft there was a gravel bin with its top below the shaft top so that it could be filled by dumping from small cars running to a gravel storage pile on the deck near th shaft tops. All concrete was made fron Niagara River gravel which contained th necessary proportion of sand. The concret proportions were 1¼ bbls. of cement to 1 cu. yd. of gravel.

Before installing the Hains mixer a short length of tunnel was concreted from a mixer on top, but trouble was had in getting the proper consistency and moreover there were so many delays in getting the concrete to the work that initial set often took place befor the concrete could be got into the forms Therefore when the Hains mixer was installed [illegible]



Track Plan Showing Concrete and Car Storage Sidings

Longitudinal Section Through Concrete Forms

Fig. 9—Arrangement of Tracks at Concrete Forms.

terials dry and add the water only after the mixture was at the forms. This method also enabled the consistency of the mixture to be regulated to suit the conditions.

The bottom concrete was laid 18 ins. thick; a thickness of 13 to 14 ins. was deposited and the reinforcing rods were placed, then the covering concrete was deposited and smoothed off. Steel forms were used in placing the wall and roof concrete. These forms were of the Jackson type* consisting of channel and I-beam ribs, carrying channel lagging. Figure 10 shows one of the ribs. In this work the side walls were constructed first and then the roof arch so that at first only that portion of the ribs below the wooden blocks was erected. Five of these frames were erected 3 ft. apart making a section of side-wall forms 15 ft. long. The procedure was as follows: The angle sills 15 ft. long were first laid and braced apart at the ends and center by the 4x6-in. ties. Next the side posts were erected and the I-beam cross-struts were placed. Each row of side posts was then connected at the top by light angles running longitudinally of the tunnel. A bulkhead of boards was built to close the forward end openings between forms and walls. The channel lagging pieces, 12x16 ins. in size, were then placed one at a time from the bottom up. For the first 4 ft. in height of the walls the concrete was handled from the floor level; above this height an elevated platform laid on the I-beam cross-struts was employed. This platform was got at as follows:

At a point back of the forms a switch was placed from the main track. This switch was moved up close to the forms every Sunday and its forward end terminated in an incline leading to the elevated platform. This incline was made of 60-lb. T-rails having their lower ends beveled to fit onto the track rails and their upper ends hinged to a 6-ft. section of track resting on the upper deck, and connecting with a track along the deck. At the forward end of the deck track a small hoisting engine was mounted on a car chained to the first I-beam cross brace. Steel shoveling plates were laid on the upper deck. Concrete cars were hauled up the incline by cable from the hoisting engine and dumped on the shoveling plates. They were then lowered down the incline and sent forward to the heading for muck. After the dry concrete was dumped onto the shoveling plate it was wetted down and shoveled into the wall forms.

In concreting the arch the two end ribs were erected first and all the lagging placed after which the concrete was shoveled in over the end and tamped back. The next rib was then erected and the lagging placed and so on till the full section of arch was concreted.

The forms were taken down in 15-ft. sections as follows: First, all bolts in the arch rib were removed and the wooden packing blocks at the ends were knocked out, leaving the ends of the arch ribs free to drop 3 ins. Next the center post was knocked to one side enough to clear the crown joint and this freed one-half of the arch rib. By knocking the center post the other way the second half of the arch rib was freed as well as the center post. The lagging stuck to the concrete and when all the arch ribs were down this was loosened and taken down. The next step was to disconnect the hinged track from the deck track and load it and the incline on a car which was run under from behind. Next the deck beams were removed and finally the side posts, sills, side lagging, etc. When the side posts had been erected ahead as before described the car carrying the incline was pushed ahead and the incline track connected up again.

About the only trouble experienced with the forms was that they slightly over-run at the top so that about every 300 to 400 ft., one of the rib frames had to be plumbed up again and a set of ¾-in. wooden lagging sawed to fit between the plumbed rib and the inclined rib behind. The "over-run" seldom amounted to over ½ to ¾-in. per 100 ft.

The concrete gang consisted of 2 men on the mixer and a foreman and 6 or 7 men in the tunnel. When concreting the lower lift of the side walls one man placed the lagging and the other men shoveled. Two car trains of concrete were brought in and dumped on shoveling boards where it was wet down and then shoveled into the forms. When concreting from the deck the foreman or one of the men ran the hoisting engine, one man stayed on the bottom to hook and unhook the cars and the other men wet down and shoveled. The concrete gang erected the arch ribs and lagging, but the rib frames for the side walls were erected by an extra gang consisting of a foreman and 6 men working only one shift and also looking after track work, cleaning up, etc. Two men were kept dressing down and plastering up the surface after the forms were removed. The concrete figured 88 cu. ft. per lin. ft. of lining, but it over-ran about 20 per cent; the length of tunnel lined per week ran from 75 to 100 ft.

Progress.—Practically 6,350 ft. of the lake tunnel was excavated from Shaft 3, the remaining 250 ft. or so being driven from the intake end as will be described later. The schedule of progress by months was as follows:

Date.	Excavation Lin. ft.	Lining Lin. ft.
Jan., 1907	12	.....
Feb., 1908	117.4	.....
March, 1908	231.2	.....
April, 1908 (1)	60.2	.....
May, 1908	281.4	.....
June, 1908	174	.....
July, 1908 (2)	......	253
Aug., 1908	13	331
Sept., 1908	217.8	.....
Oct., 1908 (3)	96.6	142.5
Nov., 1908	192.25	186
Dec., 1908	208.4	201
Jan., 1909	227.3	217
Feb., 1909	243.6	211.5
March, 1909	282.6	256
April, 1909	292.65	319
May, 1909	231.9	272
June, 1909	275.5	325
July, 1909	288.7	285
Aug., 1909	238.9	178.2
Sept., 1909	268.4	296
Oct., 1909	285.5	305
Nov., 1909	307	318
Dec., 1909	358.3	341
Jan., 1910	367.1	314
Feb., 1910	257.3	259
March, 1910	390.7	327
April, 1910 (4)	343.8	253
May, 1910	.....	461
June, 1910 (5)	....	197

(1) Installing air locks April 1 to April 15. (2) Battern heading driven from April 13 to June 17; enlarged to full section from June 17 to Aug. 31. (3) Taking up battern from Oct. 8 to Oct. 28, no progress in heading. (4) Heading holed through May 1. (5) Concreting finished June 19, 1910.

The progress from a point 300 ft. from the shaft to a point about 1,600 ft. from it was very slow, owing to the necessity of timbering part of the work and to water troubles; also the heading was stopped for two months in 1908 while the lining was brought up to the face. On these accounts it was difficult to keep up a proper organization. The average monthly progress from Sept. 1, 1908, to Nov. 1, 1909, during which time two drilling shifts were worked, was 239.3 ft. The total number of working days in that period was 365; the lost time amounted to 62½ days and the total days worked were 302½. The advance per 24-hour day worked was 11.1 ft., or 5½ ft. per shot. The greatest monthly advance during this period was in April, 1909, and was 292.6 ft. in 26 working days, or 11.2 ft. per day. The greatest advance in one week was 71.1 ft. for the week ending July 18, 1909, in 6 working days, or 11.85 ft. per day. After starting the three drill shifts per day on Nov. 1, 1909, the total progress to May 1, 1910, 6 months, or 156 working days, was 2,124.3 ft., or 14.6 ft. per day. The greatest monthly advance was in March, 1910, when 390.7 ft. were made in 26 days, or 15 ft. per day. The greatest weekly advance was for the week ending Feb. 20, 1910, when 96.2 ft. were made in 6 days, or an average of 16.03 per day.

Intake Crib and Heading.—Note was made above that a portion of the lake tunnel was driven from the intake end. The work at this point was of particular interest, as it had to be done far from shore and often during high seas.

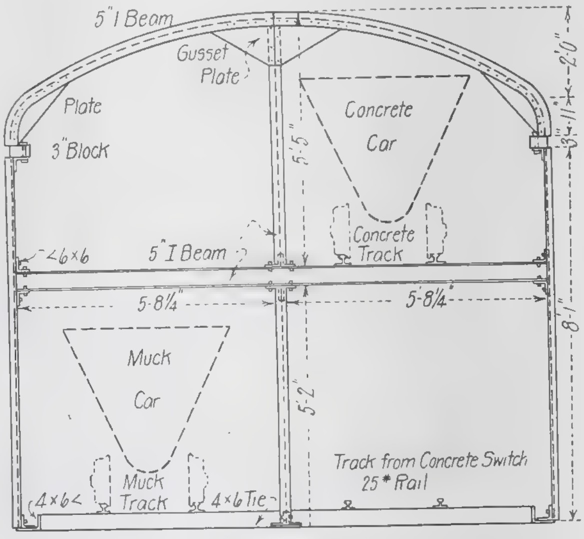


Fig. 10—Details of Jackson Forms for Concrete Lining.

The intake crib consists, first, of two concentric steel rings made up of ¾-in. steel plates riveted together and resting on a ring of concrete about 6 ft. thick, placed on the rock bottom. The top of the steel reaches a point about 3 ft. above water level. The space between the rings is filled with mass concrete even with the top of the steel shell and on top of this are placed concrete blocks carrying the outside up to 25.23 ft. above lake level and the inside 13.23 ft. above lake level. The outside shell is 110 ft. in diameter and the inner shell is 70 ft. in diameter, leaving 20 ft. between the shells. The two rings are connected by 12 stiffening bulkheads and 12 ports, each 6 ft. square and closed on the inner end by sluice gates, run through from outside to inside to admit water. The entire crib is covered by a brick and steel building, which covers the gate operating mechanism, provides quarters for the men, etc., and on top is a small light for guidance of ships.

The steel shell of the crib was constructed on shore. In constructing the crib, timber bottoms were built in eight of the twelve pockets in order to float it while being towed to position. In the spring of 1908 the site of the crib was dredged down to solid rock and this was carefully cleaned by the dredge and examined by divers. Concrete was then deposited in a ring, the outside of which was about 120 ft. in diameter and the inside 60 ft. This concrete was about 6 ft. deep and after it had set measurements and soundings were taken and at a dozen or more points a bucket of concrete would be deposited, which a diver carefully leveled off to a given grade, which was slightly above the general level of the concrete. All concrete was deposited under water, using a bottom dump bucket, which was lowered first to the bottom, then raised just enough to clear the doors and then dumped. A piece of canvas was used to cover the bucket on top, one side being fast to the bucket. This prevented wash from the water rushing in as the bucket dumped. All concrete was mixed on a floating plant, including one mixer and a gravel scow. The mixer boat was a schooner eqiupped with a 75 h. p. boiler aft, two stiff leg derricks amidships and on opposite sides, and a 1 cu. yd. cubical mixer forward, above which was a storage bin for gravel. There were also two hoisting engines to operate the derricks. One derrick fitted with a 2 cu. yd. clam shell bucket kept the mixer supplied with gravel and the second derrick handled the concrete as it came from the mixer.

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*Geo. W. Jackson, Inc., Chicago, Ill.

When the foundation was completed the caisson itself was launched and towed by five tugs to its proper position, making the trip of about 4 miles in about 5 hours. When the crib was in proper position valves were opened and it sank until it rested on the foundation previously prepared. Concreting was immediately started in the pockets in which there were no bottoms and later on, when the timber bottoms had been removed, in the others. Concreting was carried on in two 8-hour shifts, starting at 6 a. m. and working until 10 p. m. After the concrete had reached the top of the steel shell, forms were erected and it was completed, including the coping course, with the exception of a gap left on the side next to the landing crib, in which were to be located steps, entrance door, etc. Work was then shut down until the spring of 1909, when work was started on the shaft.

The first step was to construct accommodations for the men and get plant out to the crib. Roughly about one-half of the top of the crib was covered with a building for the accommodation of the men. The outer side of this building set on the coping course of the outside crib wall, while the inner side of the building rested on 6x6-in. posts, the bottoms of which set on the top of concrete of the main crib. The building was about 250 ft. long and 18 ft. wide and was divided into five compartments, dormitory for the laborers, dining room for laborers, kitchen, dining room for mechanics, foremen, etc., and dormitory for mechanics and foremen. Later on the space under the building was inclosed and used as additional sleeping quarters for the laborers. Next to the men's quarters was the electric light plant, consisting of one 11 k. w. 100 volt General Electric Company generator, belt driven by a 25 h. p. Rice automatic engine. Next to that was located a stiff leg derrick with a 55-ft. boom, operated by a double drum hoisting engine. This derrick was set with the mast resting on a framed timber bent about 15 ft. in towards the center of the crib from the inside of the 20-ft. wall, thus giving a length of about 35 ft. for one sill. The other sill was about 40 ft. long. Directly across the crib from the men's quarters were two locomotive type boilers, one 75 h. p. and the other 150 h. p. These boilers were set side by side on top of the crib and alongside them on the inner edge of the crib wall was a gallows frame from which was hung by cables a 14x20x19x15-in. Worthington duplex tandem compound pump. This pump was used to pump out the interior of the crib and was not again needed. Near the boilers were located a boiler feed pump and a 7½x7½x6-in. Snow pump to provide water supply for the boarding house, fire purposes, etc. Between the boiler fronts and the opening in the wall for the landing crib was a coal bin. When the shaft was down and the headings started one Ingersoll straight line air compressor, 1,300 cu. ft. capacity, was installed, being located across the crib wall, directly in the above mentioned opening. At the same time a blacksmith shop, pipe fitting shop, powder magazine and a coal storage bin were located down inside the crib around the mouth of the shaft.

The first work to be done was the pumping out of the interior of the crib and the caulking of any leaks in the crib, which were remarkably small. The area inside the crib was cleared off and the shaft, which was to be 13 ft. in diameter inside the concrete, or 15 ft. over all, was started. A 12-ft. test hole developed the fact that there was a water seam about 4 ft. below the rock surface. Four holes were drilled around the outside line of the shaft and the seam was then grouted. When the grout had set for two days work was commenced on the shaft sinking. This proved to be slow work, owing to several causes, the chief of which was the circular shape of the shaft and its small size; another was the fact of using steam for the drills instead of air, and still another was the number of water seams encountered and finally a scarcity of men. Steam was used from the large boiler at 100 lbs. pressure, as it was thought that in case of too much trouble with water the shaft would be sunk to its full depth and the headings turned, leaving the remainder of the work to be done from shaft 3 under air pressure. The scarcity of men was caused by the fact that they did not want to board out at the crib, which they had to do on account of uncertain landing in rough weather. During the shaft sinking all drill steel was sharpened on shore and this steel had frequently to be sent up from the tug to the crib piece by piece with a hand line, while the tug kept within 10 to 40 ft. of the crib. Provisions and small supplies were taken on to the crib in rough weather by swinging the derrick around and lowering the boom as far as possible. This allowed the hook to hang about 25 ft. away from the crib. The supplies were made fast to the hook with rope slings and then picked up with the derrick and swung in board. The men also went from tug to crib and vice versa in rough weather by means of the derrick. To do this the boom was set so that the hook hung about 15 ft. outboard and about 10 ft. above the crib. A rope about 20 ft. long was attached to the hook, pulled inboard and the men took hold of it, waited until the tug rose on a wave and swung out, sliding down the rope to the tug's deck as she descended into the trough of the sea. As can be readily seen there were very few men that cared to go ashore under these circumstances and in fact none was allowed to leave the crib except during calm weather, when the tug could lay alongside. However, as there were time keepers, master mechanic and others going back and forth, they often used this method. Coal was brought out every few days at first when the storage room was small, but later on enough would be brought Sundays to last at least a week. On one occasion it was impossible to land at the crib for five days and during some of that time the waves washed to the top of the crib, a distance of 25 ft. above water. Heavy supplies were brought out on a deck scow towed by the tug. A tug was kept for attending to the intake crib and a day and a night crew were kept on her. The tug usually left about 7:15 a. m. from the foot of Porter Ave. and kept going back and forth until about 6 p. m. Then if the weather was calm she laid at the crib or if stormy she laid at Porter Ave., and could be called from either place by blowing four blasts of the whistle at the opposite end of the run.

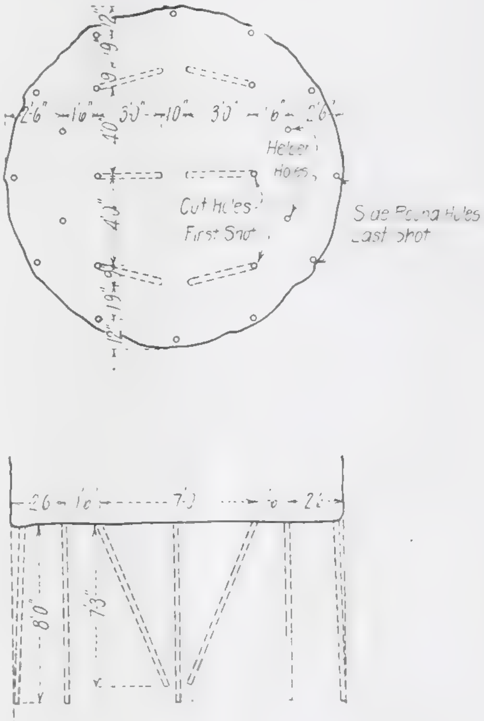

Fig 11—Arrangement of Drill Holes in Sinking Intake Shaft.

As previously mentioned, steam was used in sinking the shaft, but when tunnel grade had been reached, which was 39 ft. below the rock surface, it was found that very little water seeped in and an air compressor was installed in order to run the tunnel as far toward shore as possible before bad weather set in. One of the compressors from Porter Ave., an Ingersoll straight line machine, with 1,300 cu. ft. capacity, was moved out to the intake crib. It was run on to a scow at Porter Ave. and blocked up about 8 ft. above water level. When a very calm day came the scow was towed out to the crib, skids were placed from the blocking to the crib, which was about 13 ft. above water level, and the compressor hauled up by means of the hoisting engine which operated the derrick. As the rock in the center of the crib was low, all drainage ran down the shaft. To avoid this a timber curbing 32x36 ft. and 4 ft. high was built around the shaft by laying 12x12-in. timbers one on top of the other and drift bolting them together. The space between the bottom timber and the rock was grouted and the timbers held down by anchor bolts let into holes in the rock at each corner of the timber curbing both inside and outside and connected by a yoke passing over the timber. The space between this curbing and the crib was filled with broken rock except at one side where a space about 32x20 ft. was left for a pump well. This was floored over and a plank wall built on three sides of it, making a coal bunker in which about 150 tons of coal could be stored. A 10x8½x10-in. Blake pump was placed slightly to one side of the coal bin, with the suction running to the pump well underneath, and this served to take care of all leakage. A small 7½x7½x6-in. Buffalo pump at the bottom of the shaft served to handle all water running in through the rock. This latter pump discharged into the pump well above mentioned. Later on, however, a 10x8½x10-in. Blake pump was installed at the foot of the shaft and pumped directly over the top of the crib. After the shaft had reached its full depth the headings were turned and a sump the full size of the shaft and about 6 ft. deep was excavated.

It may be here explained that the contract calls for about 75 ft. of tunnel to be driven beyond the intake crib shaft, of which 36 ft. was to be lined and a timber bulkhead built. This was to provide for an extension of the tunnel at any future time. When the compressor had been installed work began in earnest. The rock in these headings was not so hard as that encountered from the Porter Ave. shaft, but as there was no air to prevent it the water came in through the numerous seams and gave trouble. Also gas of the same kind as is described later gave a lot of trouble. The 75-ft. section of tunnel beyond the intake shaft was excavated and when the heading toward Shaft 3 had advanced about 250 ft. a great deal of water began to come in through the numerous seams and as it was getting late in the season it was decided to clean up and concrete the shaft and a short section of the tunnel and then suspend work entirely at the intake.

One reason for this was that it would be almost impossible to keep up communication between the crib and shore regularly in the winter on [illegible] ther reason was that to handle the work properly the tunnel would have to be put under compressed air, which would necessitate a large plant, requiring in turn steady communication with shore for coal and other supplies. In addition to this all exacavated material had to be dumped overboard. In the summer when this material had piled up above water level a dredge was brought out and in a short time loaded all the material on scows to be dumped at the regular government dumping grounds. In winter it was impossible to get a dredge out through the ice.

After cleaning up the tunnel the first step toward concreting was to get a reserve store of gravel. This was done by piling gravel around the curbing of the shaft inside the crib. A small Hains concrete mixer fitted for use on a derrick was then secured and the concreting started. The forms used here were of wood and about 80 ft. of them were built. They consisted simply of 4x6-in. uprights every 2 ft., with 4x4-in. braces across about 4 ft. 6 ins. from the bottom and ribs made of 2-in. plank sawed to fit the curve of the arch. The lagging used for the sides was 1¼-in. dressed lumber in 12-ft. lengths. The same was used on the arch until a space about 4 ft. wide was left in the center. After that lagging in 4-ft. lengths was used, reaching two arch ribs. The manner of concreting differed from that used from Shaft 3, in the fact that the sides and roof were concreted first and the bottom placed last. In order to do this and at the same time make a bond between sides and bottom, a box 1 ft. high and 6 ins. deep was built along the bottom of the side wall forms. After these forms were removed this box left a groove along the entire bottom of the walls. When the floor concrete was placed it was tamped back into this groove. About 36 ft. was concreted beyond the intake shaft and about 100 ft. toward Porter Ave. was finished up. The shaft was next concreted. The form used for this was simply a drum 8 ft. high and 13 ft. outside diameter. In two opposite sides were two wedges about 8 ft. long, 6 ins. wide at the small end and 10 ins. wide at the top. When set up the bottom of these wedges were flush with the bottom of the drum. To draw the center the derrick was hooked on to lugs in the tops of these wedges and the wedges were pulled up two or three feet, allowing the two halves of the drum to fall together a few inches, the derrick was then hooked on to eye bolts in the top rib of the drum and the latter was drawn up about 8 ft., a prop put under it and the wedges driven tight. The two halves of the drum were held together with turn buckles, which were drawn tight after the wedges had been driven home. The concrete in the shaft was 1 ft. thick and after the top of the rock was reached a concrete wall around the shaft about 3 ft. thick and 10 ft. high was built. Then the entire space between this shaft wall and the inside of the crib was leveled up with stone from the tunnel and finished up with a 6-in. floor of concrete. The Hains mixer used was of the type usually used in connection with a derrick and consisted of four hoppers held together by chains. The bottom hopper had hand operated gates in the bottom, while the others had automatic gates, which closed when the hoppers rested together and opened as they were picked up.

After the shaft had been concreted a reinforced concrete bulkhead 3 ft. thick was built in the shaft about 8 ft. below the rock, as compressed air was being used at the Porter Ave. end of the work and it was intended to use compressed air to finish up after breaking through from Porter Ave. to the intake shaft. This bulkhead was tied into the concrete wall by means of 16 bolts 1 in. in diameter, let into holes drilled in the concrete. This work was completed about October 25, 1909, and all plant except derrick and hoisting engine and the 75 h. p. boiler was removed.

(To be concluded.)

Data now at hand indicate that the total gross earnings of the railways of the United States reporting to the Interstate Commerce Commission amounted, in the year ended June 30, last, to approximately $2,845,000,000, an increase of $350,000,000 or more.

Hammer Drills for Overhead Stoping and Raising in Gold Mines.[*]

The numerous advantages obtained by the recent substitution of hammer drills in place of hand labor and ordinary piston drills having now been sufficiently demonstrated by means of exhaustive trials and practical operation in stoping and raising at the Granite Gold Mines, British Columbia, I herewith append an account of my experience of their performance.

Overhand or back-stoping only is practiced at these mines, the reef consisting of hard quartz from 8 ins. to 5 ft. in width, containing 2 per cent to 10 per cent of sulphides of iron and arsenic, while the country rock is a dark close-grained granite. The vein underlies at angles varying from 35° to 50°.

Figures being available to show the cost of stoping as practiced in previous years at the mines, this paper is written with the object of a general comparison of results by the various methods employed, and in particular with regard to those obtained with the hammer drill. The drill found most efficient is the Waugh stoping hammer drill, a 2-in. cylinder, valve machine. The principal wearing parts are the piston hammer, costing $4, the chuck $3.50, tappet $2 and complete vales $10.

CONSTRUCTION AND OPERATION OF THE HAMMER DRILL.

A general description of the mechanism of the machine in question is as follows: The drill is 4 ft. in length, weighing 60 lbs.; its greatest outside diameter being at the barrel, 3¼ ins. The cylinder diameter is 2 ins. The automatic telescope air-pressure feed allows of an extension of 24 ins. The hammer is a piston the blow of which is regulated by the valve. The hammer strikes a tappet which in turn delivers the percussion to the end of the shank of the drill steel, which is held in alinement with the drill in a hardened steel chuck. Rotation of the machine, and consequently of the drill steel, is effected by means of the hand lever. With an air pressure of 60 lbs., 1,000 blows per min. are struck by the hammer, its stroke being 2½ ins.

In operation underground, a starter is first placed in the chuck and the hose coupled to its connection. The drill is then set up with the extension end on a rough block. As previously stated, the hammer drill is designed for the boring of uppers in overhand stoping and raising only. The block may be laid on broken ore or across the stope timbers at a convenient distance from the fact of the stope, and as the machine is so alined as to take the best advantage of the heads occurring in the ground to be broken. Air is now turned on, the extension piston automatically brings the bit forward into contact with the rock, percussion of the drill steel by the tappet commences, and when the rotating lever is operated by the machine man, pitching and subsequently drilling of the hole proceeds to the depth required.

Holes up to 4 ft. in depth are bored by these machines. The drill steel used is of light cruciform section in lengths of 18, 27, 36, 45 and 54 ins., allowing 9-in. changes for each bit. It has been found important to forge and harden the drill shanks with care, 1 in. square, where they fit in the chuck, as it is at the chuck that most wear and tear occurs with these machines. It has been suggested that with only slight wear of the chuck and of the shank of the drill steel, the alinement of the machine itself and the drill steel would not coincide, and in consequence there would be a tendency to "fichured" holes. Experience at the Granite Mine, however, has proved to me that the number of fichured holes is small, although the ground is "heady." Difficulty is experienced only when the drill bores into soft gouge which occasionally occurs on the hanging wall.

It has been found more satisfactory to avoid the boring of holes at an angle of less than 35° from the horizontal. At smaller angles the dust does not clear from the holes by gravity, and owing to the unsupported length of the machine and drill steel the leverage is sufficient to cause the drill steel to break, usually close to the chuck, and to wear the hole in the chuck itself unduly; moreover, considerable additional friction and consequent loss of boring efficiency is caused by the boring of flat holes. With a reef underlying at over 35°, as is the case with the Granite Mines, there is only occasional necessity for a low-pitched hole.

Machine men running the hammer-drills are instructed to attend carefully to the lubrication of their machine, which is essential owing to the somewhat delicate mechanism of the valves. Recently an automatic lubricator has been supplied combined with the air-connecting plug, which now ensures constant oiling of the machine for a full shift without replenishing the oil-chambers.

ADVANTAGES OF HAMMER DRILL OVER PISTON DRILL.

I now propose to deal with the advantages of the hammer drill over piston drills manifested in the tests underground, which led to the final adoption of the former at the mine for stoping and raising.

The lightness and general handiness of the 2-in. hammer drill, its weight being only 60 lbs., against the 125 lbs. of the 2-in. piston stoping drill, is a point in its favor.

There is a considerable saving of time in setting up. In a shift of eight hours, it can be safely estimated that the loss of boring time in setting up, changing steel and taking down a piston drill is two hours; with the hammer drills half an hour only per shift is sufficient, less time is lost in changing steel, there being no U-bolts, bars, or mountings to manipulate.

Inexperienced hand-labor miners can learn to run the hammer drills in a few shifts, a great advantatge in a country where good machine men are difficult to procure.

Greater drilling efficiency has been obtained. With the small 2-in., one-man piston drill, a shift's work comprising a total footage bored of between 25 and 30 ft. was considered satisfactory, whereas the hammer drills bore ten 4-ft. holes, or an aggregate of 40 ft. per shift. The bits of the drill steel are not dulled by the quick, light blows of the hammer drill to the extent which occurs with the heavier blows from the piston drill. Owing to the fact that the hammer drill is so compact and requires no bar or mountings, holes may be bored to take the greatest advantatge of slips in the ground in low stopes, and greater efficiency in breaking ground has resulted.

The construction of the hammer drill renders its adapatability most evident for carrying considerably lower stopes than with the piston drill, a great saving of cost in stoping narrow reefs, such as those of the Granite Mines.

I have been struck with the small quantity of fine dust made by the hammer drill in the stopes and rises. I account for this improvement over piston drills by the fact that there is no churning movement of the drill steel in the hole, as is the case with the piston drills, the bit of the drill steel being held continually in the bottom of the hole while boring. The air is exhausted back from the face of the stope and no air can escape at the chuck end of the machine. It may also be noticed that the hammer drills possess the advantage of producing coarser cuttings than the piston drill.

In air consumption I have found that with a receiver pressure of 80 lbs., there is only a slight advantage in practice in favor of the 2-in. hammer drill over the 2-in. piston drill.

REDUCTION OF COSTS.—Having related the advantages of the hammer drill over the piston drill, as proved by their successful operation for some months past at the Granite Mines, I now propose to deal with the reduction of costs in stoping effected by their use. A comparative statement of stoping costs under various methods is as follows:

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[*] A paper by H. G. Williams presented at a meeting of the British Institution of Mining and Metallurgy, April 21, 1910.

	Per ton.
Stoping by hand labor	$3.50
Stoping by 3¼-in. rock drill (two men)	2.90
Stoping by 2¼-in. rock drill (one man)	2.08
Stoping by 2-in. hammer drill	1.53

In the above statement no allowance is included for development charges, compressed air, or depreciation of plant generally. In reference to this point, however, it may be of interest to mention that the total costs, including all charges of mining transportation, milling and realization, etc., at the Granite Mines, have recently been reduced from $5.32 to $3.25 per ton, although the high cost of labor and supplies locally shows no diminution. The reduction is mainly attributable to the adoption of the hammer drills. It must be borne in mind, in considering the value of the above figures in comparison with costs at larger mines, that they refer to a mine equipped with a plant capable of crushing only 1,500 tons per month, and that the greater proportion of the stopes worked recently carry a reef with an average width of only 15 ins.

On account of the simplicity and small number of moving parts, the repairs and general upkeep of the hammer drills work out at approximately only $5 per month, which compares favorably with these charges in the case of the piston drills. Owing to its compact tube like design, the hammer drill withstands the invariably rough handling without the breakages so common with piston drills. The advantages in general handiness, increase in progress and consequent reduction of cost with the hammer drill are even more marked in raising than in stoping.

ROADS AND STREETS SECTION

The Physical and Chemical Characteristics of Bituminous Road Materials.*

BY PREVOST HUBBARD

Although in the past the examination of bituminous binders employed in road treatment and road construction has been sadly neglected, it is now generally admitted that such examinations are very necessary for the intelligent selection and use of these materials. Realization that many experiments have proved unsuccessful because the experimentor had no knowledge of the physical and chemical characteristics of the binder which he used has awakened considerable interest in the testing of bituminous road materials and a number of schemes for examination have recently been put forward by those who have to do with the construction and maintenance of roads under the most modern conditions. The old idea that an oil is simply an oil, and if it has produced good results in one locality should produce equally good results in another, has given place to the knowledge that great variations exist in their road building properties, and that not only will results depend upon the peculiar characteristics of a given oil, but that the method of application and local conditions to which it is subjected are most important factors to be considered. The same is, of course, true of tars and any other class of bituminous binders.

It is the purpose of the author in this paper to briefly consider the characteristics of the most common types of bituminous road materials, as indicated by the results obtained from their examination, according to methods employed by the U. S. Office of Public Roads. A description of these methods has been given in another paper presented to this congress by Mr. L. W. Page, entitled "The Testing of Road Materials in the United States," and it will, therefore, be unnecessary to here consider them in detail. It may be said, however, that for practical purposes, any scheme of examination should be as simple as possible and should not be too time-consuming. On the other hand, it should be comprehensive, and capable of supplying information which will be of value in determining the suitability of a material for use under given conditions. The above mentioned tests were selected with those points in mind and, as will be shown, much valuable information may be obtained from their application.

When making an examination a number of factors should be considered, which may often modify the method to some extent. Those of most importance are as follows:

(1) Purpose for which the material is to be used, i. e., as a dust preventive only, as a semi-permanent binder and dust preventive for surface treatment, or as a permanent binder in construction work.

(2) Character of the road to be treated, including the type of road (earth, gravel, or broken stone) and the characteristics of the road material.

(3) Desired method of application, i. e., whether the material is to be applied cold or hot and by means of a sprinkler, with or without pressure; by pouring from buckets; or as a proposed mixture with the road material. In the latter case, it is also desirable to know whether or not the road material itself is to be treated.

(4) Quantity and character of traffic.

(5) Climatic conditions.

When these facts are known, the examination becomes of more value than simply a means of identification. In any event, however, it serves the latter purpose, and even if an experimenter cannot interpret the results of an examination, he can use them as a guide in duplicating his work under a given set of conditions. Thus if in his work he has found that good results have been obtained from the use of a bitumen having a certain specific gravity, a certain penetration, a certain melting point, certain chemical characteristics, etc., he can be reasonably sure of duplicating these results with another lot of material showing the same characteristics.

Any one characteristic will not, of course, indicate the suitability of a bituminous binder for road purposes, and it is only by considering its collective characteristics that a satisfactory idea of its value for this purpose can be ascertained. This is particularly noticeable when comparing oils and tars. Thus for construction work an oil product having a specific gravity of 1.08 might be entirely satisfactory, while a tar having the same specific gravity could never be suitable for such work.

Because of the very great differences between oils and tars, somewhat different methods of examination are followed. A summary of the most important tests for each are given below:

OIL AND OIL PRODUCTS, INCLUDING FLUXED ASPHALTS.

(1) Specific gravity.
(2) Flash point.
(3) Melting point of solids.
(4) Penetration of semi-solids and solids.
(5) Volatilization at 163° C., 5 hours.
(6) Solubility in carbon bisulphide.
    a. Total bitumen.
    b. Organic matter insoluble.
    c. Inorganic matter.
(7) Bitumen insoluble in 86° naphtha.
(8) Fixed carbon.

TAR AND TAR PRODUCTS.

(1) Specific gravity.
(2) Melting point of solids.
(3) Free carbon.
(4) Results of distillation.
    a. Water.
    b. Light oils to 110° C.
    c. Second light oils 110°-170° C.
    d. Heavy oils 170°-270° C.
    e. Pitch.

Specify Gravity.—As shown above, the specific gravity determination is made upon both oils and tars. It is of value mainly as a means of identification, but when considered in connection with other tests is often of service in determining the suitability of the material for road purposes. As applied to oil and oil products, the specific gravity is a rough indication of the amount of heavy hydrocarbons which give body to the material. Crude petroleums vary in specific gravity from 0.73 to 0.98 and slightly higher, paraffine oils as a rule having the lowest specific gravity and asphaltic oils the highest. The former have practically no value for road work, while the latter constitute the most desirable type. Oils containing a semi-asphaltic base hold an intermediate position and will usually run higher in specific gravity than the paraffine oils and lower than the truly asphaltic oils. Solid native bitumens free from mineral matter, usually have a specific gravity of not over 1.04. If the specific gravity of an oil product or asphalt runs higher than this, the presence of mineral matter is indicated and in native asphalts the increase is almost directly proportional to the amount of mineral matter present, except when the material is very hard and brittle. Thus, a specific gravity of 1.40 indicates the presence of approximately 38 per cent mineral matter, while 1.30 indicates from 20 to 25 per cent mineral matter. This is, of course, only approximately true as the specific gravity of the asphalt is not only dependent upon the character and consistency of the bitumen itself, but also upon the specific gravity of the mineral matter which it holds. Any oil having a specific gravity of over 0.93 should be heated before application and no natural or residual oil having a specific gravity of less than 0.95 should be employed as a permanent binder. For construction work those lying between 0.98 and 1.00 are to be preferred. If a native asphalt containing mineral matter has been fluxed to suitable consistency for such work, the specific gravity may, of course, run considerably higher.

Crude coal tars vary in specific gravity from 1.10 to 1.22 and sometimes higher, while crude water gas tars lie between 1.00 and 1.10. In coal tars, the specific gravity is largely dependent upon the percentage of free carbon or soot which it contains, those of low specific gravity holding but little and those of high specific gravity holding a large amount of free carbon. Thus a crude tar having a specific gravity of less than 1.15 will usually show less than 12 per cent free carbon, while those running as high as 1.22 will have 30 per cent and over. As free carbon is detrimental to road work, tars of low specific gravity are as a rule to be preferred. Gas house tars in general are heavier than coke oven tars produced at low temperatures, as they carry a greater percentage of free carbon.

In refined tars specific gravity naturally increases with consistency, both because the lighter hydrocarbons and water have been removed and because the relative proportion of free carbon has been increased in the residue. In such products for a given consistency a low specific gravity is to be preferred to a high one. This is not true, however, when considering refined products of different consistencies, as in such cases while the percentage of free carbon might be the same, the most desirable product might show the highest specific gravity for the reasons mentioned above.

As a rule, crude tars having a specific gravity higher than 1.18 cannot be distilled to produce satisfactory road binders, unless previously mixed with a much lighter tar, preferably a water gas tar. No refined tars running lower than 1.16 should be used in construction work, and the same may be said of those running higher than 1.24. The lower limit is set from the standpoint of consistency, while the higher is based upon the free carbon contents. Any tar having a specific gravity greater than 1.15 should be heated before being applied. Those running under 1.15, which do not have to be heated before application, can be considered as dust layers and temporary binders only.

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*Paper by Prevost Hubbard, Assistant Chemist U. S. Office of Public Roads, presented at the Second International Road Congress at Brussels, July 28-Aug. 3, 1910.

Flash Point.—This determination is of little value other than as a quick means of differentiating between the heavy crude oils and cut back products, and the fluid residuums, although it also indicates the point to which a refined oil has been distilled. Crude oils have, of course a lower flash point than residual oils and among the crude oils themselves, those of a paraffine nature usually flash at a lower temperature than the asphaltic. The former may run as low as ordinary temperature, while the latter are sometimes as high as 135° C. Some crude asphaltic oils will, however, show quite as low flash point as the paraffine oils, so that no great dependence can be placed upon this difference in crude petroleums. The flash point of residual road oils commonly exceeds 200° C., while that of cut back products will vary greatly, according to the flash point of the flux and the percentage and character of the heavier residual product. Thus, in a certain instance when 90 per cent of a distillate having a flash point of 100° C. was mixed with 10 per cent of an oil asphalt having a flash point of 260° C., the flash point of the resulting mixture was raised to 143° C., and the addition of 600 per cent of the heavier product only increased this temperature by 5 degrees.

Great care should, of course, be taken when heating low flash point oils in an open kettle or tank that the oil does not catch fire. Such oils, however, rarely require heating before application, as they are usually quite fluid when cold.

Melting Point.—A determination of the melting point of solid bitumens is mainly of value as a means of identification and for control work on the part of manufacturers. Only the melting point of refined or artificial products is of interest from the standpoint of road work. These products may be classed as oil asphalts and tar pitches. The oil asphalts include oil pitches, blown oils, and solid native bitumens cut with fluid oil products to form asphaltic cements. Tar pitches include residual tars and cut back tar products which are solid when cold. These materials are of course only suitable for construction work. The melting point of a bitumen is directly related to its hardness and brittleness, but the relations are not the same for all classes. Thus, at normal temperature, a blown oil with a melting point of 50° C. is neither hard nor brittle, while a tar pitch is both. As the melting point rises, however, they both become harder and more brittle. For road work, the melting point of a tar pitch should rarely exceed 40° C., while that of a blown product may run as high as 65° C. and over, without fear of the material cracking in cold weather. Oil pitches and the asphaltic cements hold an intermediate position between these two. The climate under which a bitumen is to serve as a road binder could be considered in connection with its melting point, and this is particularly true of tar products. Thus in a cold climate where the winters are severe, it is preferable to employ a tar pitch having a melting point much lower than 40° C., in fact under very severe conditions, one that will melt as low as 20° C.

The desired method of application will also have to be taken into account. If the penetration or grouting method is to be followed, the melting point of a tar product should not exceed 25° C. and in a blown oil probably not be over 30° or 35° C., for the reason that if higher than this the material is apt to solidify too quickly upon coming in contact with the cold stone on the road, and will therefore not penetrate to any extent. When the mixing method is to be employed using hot stone, the melting point of the bitumen may be as high as climatic conditions will allow. Oil products for application in earth road construction should have a melting point considerably below normal temperature or otherwise it will be extremely difficult to mix them with the cold earth. If the earth can be heated, however, and mixed with the oil before application to the road, a product having a higher melting point is to be preferred.

Penetration.—The penetration determination, like the melting point determination, is a convenient one to employ for identification and control work. It serves to a great extent as a means for measuring the consistency of oil asphalts. While the test is made in exactly the same manner as in asphalt paving work, the standards for road purposes are somewhat different. No oil product should be employed in macadam construction with a penetration higher than 25.0 mm. when tested at 25° C. with a No. 2 needle for 5 seconds under a weight of 100 gms., unless it possesses the property of hardening considerably when subjected to the volatilization test. On the other hand, it is rarely necessary to require a penetration as high as that for asphaltic cement used in the topping of an asphalt pavement, for the reason that the upper course of a macadam has much greater inherent stability than the sand course of the asphalt pavement. A penetration of from 10.0 to 15.0 mm. is usually considered sufficient for road work. If a material having a much lower penetration is selected its susceptibility to temperature changes will have to be considered. Blown oils being but little affected by temperature changes may run as low as 4.0 mm. with little danger of becoming too hard in cold weather. They are, however, less ductile than the oil pitches and asphaltic cements of like consistency and somewhat less desirable for road work on this account.

In addition to the penetration of the original material that of the residue remaining from the volatilization test is often determined. The significance of this determination will be discussed under the volatilization test. Penetration determinations are seldom made upon tars, because their surface tension is so high that even approximately correct penetrations cannot be recorded and the presence of free carbon in varying quantities affects the results very considerably.

Volatilization.—This test is a purely arbitrary one, but when applied to road oils will often prove of considerable value. It consists in determining the loss in weight of 20 gms. of oil when subjected to a uniform temperature of 163° C. for 5 hours in a standard size dish. It is believed that the loss in weight thus produced is a fair comparative indication of loss by volatilization suffered by the material in the course of time when applied to the road, also that the character of the residue is similar to that eventually left in the road. A determination of the consistency of this residue should if possible be made, and particular attention paid as to whether it is of a greasy or sticky nature. The volatilization test is not a quantitative determination of any one class of volatile oils present in the original material, but only of its tendency to give up these volatile oils. If the material has a certain consistency which it is desired to maintain after application, it should show a low volatilization and should not be subject to hardening by oxidation or other causes. A determination of penetration of the residue as compared with that of the original material is of value in determining this fact. A material which must be soft and sometimes fluid on account of the desired method of application and character of the road treated, should very properly suffer high loss by volatilization in order that it may be capable of attaining proper consistency under service conditions. This is particularly true of oils that are to be applied during the construction of oiled earth roads, in which case loss of from 20 to 30 per cent is not uncommon. Fluid products that will not volatilize to any extent nor harden under this test are unfit for any sort of construction work and their use for this purpose can only result in failure. The great bulk of residual oils belongs to this class of materials. If the residue shows a penetration of over 25.0 mm. the material will never prove satisfactory, except in roads subjected to very light traffic. As a rule, it may be said that other things being equal, the suitability of an oil for use in the construction of roads increases as the penetration of its residue decreases. An oil showing a penetration of from 10.0 to 15.0 mm. should suffer but little loss by volatilization usually less than 1 per cent and the penetration of its residue should not be greatly lowered.

Fluid products to be used in the surface treatment of roads need not necessarily show a high loss by volatilization nor a great increase in the consistency of their residues, although the latter is a desirable property. They are mainly of value as dust preventives, and binders for the thin coat of fine material upon the road surface and cannot affect the character of the road proper unless applied in large quantities. If their residues are not of a sticky nature, they will, however, produce an undesirable surface condition in wet weather unless applied in very small quantities. In general all residues should be sticky or adhesive, as otherwise they will act more as lubricants than as road binders. A paraffine oil will produce a greasy residue, while an asphaltic oil will produce one that has considerable binding value. It is for this reason that the latter may be successfully employed in road work, while the former are worthless for this purpose.

In certain instances, determinations of the so called asphalt contents of oils have been made by driving off volatiles until the residue is of a certain consistency. To produce this residue it is often necessary to subject the bitumen to such high temperatures that chemical changes take place which would never occur under service conditions. For this reason the test is not a determination of the actual asphalt contents, but only of the ability of the oil to produce an asphaltic base of given consistency under the action of high temperatures. Such a test is therefore misleading and has resulted in much confusion among road engineers as to the relative binding value of oils. This matter has been discussed to some extent by the author in a previous paper, "Bituminous Road Materials," presented at the second annual Good Roads convention, Cleveland, O., Sept. 23, 1909, and it is therefore unnecessary to here consider it further.

Solubility in Carbon Bisulphide.—For practical purposes, all organic matter soluble in cold carbon bisulphide is considered as bitumen. Fluid oils are almost completely soluble in this material and also blown oils and oil pitches, unless they have been cracked to the point of producing free carbon. The solid native bitumens, with a few exceptions, are not so soluble, as they contain more or less mineral matter, together with organic matter of a non-bituminous nature. Thus petroleum and petroleum products are almost always soluble to the extent of at least 99.5 per cent, and contain less than 0.2 per cent mineral matter, while the native asphalts may show as low as 54 to 56 per cent bitumen. This is characteristic of Trinidad asphalt, an average sample of which will contain approximately 56 per cent soluble in carbon bisulphide, 7 per cent organic matter insoluble and 37 per cent mineral matter. Bermudez asphalt will show in the neighborhood of 95 per cent soluble in carbon bisulphide and 2.5 per cent each of organic matter insoluble and mineral matter. Gilsonite will more nearly coincide with the oils in this test, being an extremely pure solid native bitumen soluble in carbon bisulphide to the extent of from 99.4 to 99.6 per cent. The solubility of the bitumen itself is entirely independent of its character and consistency, so that the amount and character of insoluble material is of most interest in this test. This material is of no value from the standpoint of road work, but indicates whether an asphalt has been employed in the proportion of the binder, also whether a product has been distinctively distilled during its preparation, the determining factor in the former case being the amount of mineral matter present and the amount of organic material in the absence of mineral matter in the latter case. It is, of course, possible to adulterate a preparation so as to give misleading results, unless the analyist is familiar with the characteristics which the addition of various solid bitumens will produce in oils of various types.

Tars with the exception of those produced in blast furnaces contain only a small fraction of 1 per cent mineral matter. Practically all material insoluble in carbon bisulphide is therefore organic material, commonly known as free carbon. The relation of free carbon to the density of tars has already been discussed under the specific gravity determination, which, as has been shown, if taken in connection with the consistency of the tar, gives a good indication of the percentage of this constituent.

Any tar or tar product containing less than 4 per cent free carbon may almost without exception be considered as originating in the manufacture of carbonated water gas and is the product of the destructive distillation of oil. Water gas tars, or oil tars as they are often called, will usually contain less than this amount, even when refined to a specific gravity of 1.17, and crude water gas tar seldom exceeds 2 per cent free carbon. Most crude coke oven tars will carry from 4 to 10 per cent free carbons, unless they have been produced at very high temperatures, while the modern gas house coal tars rarely show less than 10 per cent and sometimes run as high as 30 per cent and over.

The effect of free carbon in tars from the standpoint of road treatment has been investigated by the author and reported in a previous publication.* The results of this investigation demonstrate the following facts:

(1) That in tars of the same consistency those of low carbon contents have a greater inherent binding strength than those of high carbon contents.

(2) That in tars whose bitumen contents are of the same consistency those of high carbon contents have a greater inherent binding strength than those of low carbon contents, but that the binding capacity of the former is lower.

(3) That in sand-tar mixtures containing a relatively large amount of high carbon tar, the carbon may act as a filler and add to the mechanical strength of the mineral aggregate, but that better results in this respect can be obtained by the use of a smaller quantity of low carbon tar of the same melting point, together with a mineral filler.

(4) That the waterproofing value of high carbon tars is in general less than that of low carbon tars.

(5) That free carbon retards the absorption of tars by porous surfaces.

(6) That when tar is exposed in comparatively thin films free carbon has little or no effect in retarding volatilization.

Applying these facts to the use of tar in road treatment, the following conclusions are logically deduced:

(1) In the treatment of old road surfaces a low carbon tar is to be greatly preferred to a high carbon tar.

(2) In ordinary bituminous road construction, both from the standpoint of efficiency and economy, a low carbon tar is to be preferred to a high carbon tar whose bitumen content is of the same consistency.

Bitumen Insoluble in 86 Paraffine Naphtha.—As applied to oils and oil products, this determination is of value as indicating the amount of body forming hydrocarbons which give mechanical stability to the material. No oils carrying less than 4 per cent naphtha insoluble bitumen will prove of service other than as dust preventives. Crude paraffine oils are almost entirely dissolved by this solvent, while the asphaltic oils contain very appreciable amounts of naphtha insoluble bitumen. Residual oils carry larger quantities than the crude oils from which they are produced and blown oils in particular show very high percentages of insoluble hydrocarbons, sometimes running as high as 25 or 30 per cent. In this type of oil the naphtha insoluble bitumen increases with the amount of blowing to which the oil has been subjected.

The solid native bitumens also run high in this respect, Trinidad and Bermudez asphalt showing 35 to 40 per cent insoluble bitumen and gilsonite as high as 45 per cent. Asphaltic cements containing appreciable quantities of these solid products will necessarily show relatively high percentages of bitumen insoluble in naphtha. While the binding value of asphaltic oils and cements is undoubtedly dependent upon the presence of the naphtha insoluble hydrocarbons, variations in the character of these hydrocarbons is not a marked influence upon the characteristics of the original material. This matter has at present received but little attention and just what such differences are and what effect they have is a matter for future study. Bitumens insoluble in naphtha are commonly known as asphaltives, while those soluble are called malthives. It should be understood, however, that both terms cover a multitude of hydrocarbons which vary greatly among themselves. The character of the naphtha soluble bitumen is of interest from the standpoint of road treatment, that which is sticky after the solvent has been evaporated indicating better road building qualities in the original material than that which is greasy.

Fixed Carbon.—The fixed carbon determination shows much the same thing as that for naphtha insoluble bitumen, as it serves as an indication of the mechanical stability of an oil. Paraffine oils show but little fixed carbon, while the asphaltic oils run higher and the asphalts still higher. The terms fixed carbon and free carbon should not be confused, as they have entirely different meanings. Free carbon always exists as such in the material, while fixed carbon is the coke resulting from its ignition of the bitumen in the absence of oxygen. Fixed carbon determinations are seldom made upon tars, as the presence of free carbon interferes with this test. Owing to a misconception as to what fixed carbon represents, specifications have sometimes been made limiting the percentage of this substance to a very low figure. Providing that free carbon is absent comparatively high percentages of fixed carbon are a rather desirable property in oils, for the reason before mentioned, especially if they are to be used in construction work. Native asphalts average from 12 to 14 per cent while the blown oils usually run higher. No asphaltic cement suitable for construction work according to the mixing method, will probably show less than 6 per cent fixed carbon, but too great reliance should not be placed upon this determination as it is not a very accurate one and is employed more as a means of identification and as a confirmation test for the naphtha insoluble material than for any other purpose.

Distillation.—The distillation test as applied to tars is a very valuable one, both for the purpose of ascertaining their road building properties and method of preparation if they are refined products. All crude tars contain water which of course appears in the first fraction to 110° C. In coal tars this water is ammoniacal, while in water gas tars it is not. No tar containing water should be employed as a permanent binder and even in temporary binders its presence is detrimental. Refined tars for use in road construction if of suitable original consistency for permanent work should not contain over 7 or 8 per cent by volume of distillate up to 170° C and this distillate together with that lying between 170° and 270° should, when cold, show but little precipitated naphthalene. The naphthalene contents of the last fraction will often differentiate the plain residue coal tar pitches from cut back products. In the former, this fraction will usually run from ¼ to ¾ solid naphthalene, while in the latter it will run much lower, owing to the fact that these oils have been separated from naphthalene before using the mas a flux. Naphthalene is an undesirable constituent of road tars as it gives the product a false consistency and volatilizes quite readily. It is usually found in coal tars to a greater extent than in water gas tars. In all tars to be used in road construction the total distillate to 270° C should not exceed 50 per cent by volume of the original material, or otherwise the product will be deficient in true binding base, especially if its free carbon is high. For surface treatment this distillate may run higher as the lighter oils are necessary to give the tar a proper degree of fluidity for application, especially if the application is to be made cold. In cold climates a high percentage of heavy oils lying between 170° C and 270° C is desirable as they reduce the brittleness of the material.

Tars which have been simply dehydrated carry as high as 10 to 18 per cent of light oils between 110° C and 170° C if produced from destructive distillation of coal. Dehydrated water gas tars will usually run much higher in this respect. These oils are of no value for road purposes, except when it is desired to use a product which will harden rapidly after application.

When a mixture of tar and oil products is suspected, the distillation test will often decide the matter very definitely. Petroleum and tar distillates obtained between two given temperatures will vary in specific gravity, the petroleum distillate being lighter than the tar distillate. If distillation is conducted carefully a separation of these two products will take place in the receiver forming two distinct layers of oil. This will not happen if either a pure tar or pure petroleum product is distilled. If desired, the separate distillates may be identified by suitable chemical means. Any naphthalene which may pass over and precipitate out of the distillate is almost conclusive evidence of the presence of tar. Both the tar and petroleum distillates have very characteristic odors, which may usually be distinguished even in a mixture of the two.

The foregoing discussion of the physical and chemical characteristics of bituminous road materials is presented by the author with the hope that it may prove of some assistance to road engineers who have occasion to employ such products. The effect of different properties upon the value of the material for road purposes has been studied by means of actual service tests conducted by the U. S. Office of Public Roads in many sections of the United States with various bituminous preparations which tests have been carefully correlated with laboratory examinations. The statements made are, therefore, based upon fact as well as upon theory and while in the future it may seem desirable to modify some of the limitations which have been given, such limitations would at present seem entirely justifiable in the light of our present knowledge of the subject.

In fact the author has in many instances broadened the limitations more than he deemed actually necessary, in order to avoid unjust criticism and the elimination of materials which might by any chance prove satisfactory for the character of work discussed.

Notes on Road and Street Work.

Cost of a "Rattler" Brick Testing Outfit.—For several years past the vitrified blocks used by the city engineer's department of Baltimore, Md., have been tested for abrasion by the Highways Division of the Maryland Geological Survey. Last year, however, the city decided to install a rattler at the city yard for the department's use. The rattler is the standard National Brick Manufacturers' Association machine, 28 ins. in diameter, 20 ins. long within heads. The barrel is a regular polygon of 14 sides and [illegible] It was manufactured by Olsen Bros., Philadelphia, Pa. T[illegible] h. p. Westinghouse Type A, single phase electric motor, making 1,710 revolutions per minute. The speed was geared down at the rattler end of the belt to produce 30 revolutions per minute. The speed in operation runs from 1,799 to 1,801 revolutions per hour and is very satisfactory in that respect. The first test of vtirified block with the outfit was made Aug. 31, 1909. The cost of the outfit and the expenditures during the year ending Dec. 31, 1909, were:

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*Proceedings of the American Society for Testing Materials, vol. ix, 1909.

One vitrified block rattler with belt	$192.50
One 5-H.P. motor	150.00
Cast steel shot	12.00
Freight and drayage	10.20
Building foundations and remodeling shed	53.32
One set scales	8.70
New cast-iron shot	10.20
One new pulley	5.20
One revolution counter	4.00
Electric installation	37.64
Electric Co.'s electric connection	3.73
Electric current	5.69
Total	$493.18

Water Absorption by Paving Materials.—Last year an examination was made for the city engineer's department of Baltimore, Md., of the absorption by water of certain paving materials. The blocks were carefully dried and weighed and after being immersed 48 hours the surface water was removed and they were again weighed. The results of these tests as given in the annual report for 1909 of B. T. Fendall, city engineer, are as follows:

Material.	Dimensions in inches.		Water absorb'd per cent.
Metropolitan vitrified block	9x	4x3.5	2.59
Clymer vitrified block	9.5x	4x3	2.80
Penn vitrified block	8.5x	4x3.5	3.61
Patton vitrified block	9x	4x3.25	6.74
Maxwell vitrified block	9x	4x3	2.32
Mack vitrified block	9x	4x3	2.62
Mack vitrified block	9x	4x3	2.45*
Lumber City vitrified block	8.5x	3.75x3.75	1.97*
Kushequa vitrified block	9.25x	4x3.25	1.52*
Pittsburg and Malvern vitrified block			1.02*
Toronto vitrified block	9.25x	3.75x3	1.25*
Clearfield vitrified block	9x	4x3.25	2.87*
Baltimore vitrified block	9x	4x3.25	2.24†
Baltimore vitrified block			2.49**
Yellow pine block	8x3.5	x3	4.05††
Medina sandstone block	10x4.25	x3.9	2.06
Asphalt block	12x	4x4	0.27
Vitrified sewer brick	8x	4x2.25	3.46
Granite paving block	12.5x	7x4	0.00
Arch sewer brick	8x	3.75x2.25	14.50
Sidewalk brick (No. 2)	8x	2.25x3.5	12.18

*Average of three blocks. †Before abrasion test; average of three blocks. **After abrasion test; average of three blocks. ††Creo-resinated (about four years old).

Bitu-Mass Pavement.—A combination earth and bituminous concrete pavement has been added recently to the pavements for which the city of Indianapolis, Ind., receives bids. This type is known as the bitu-mass pavement and the main clauses of the specifications under which it is laid at Indianapolis follow:

Foundation—The earth foundation or sub-grade will be brought to an even surface, parallel with the grade proposed for the pavement, by making the necessary excavation or embankment. Soft or spongy earth, or other material not affording a firm foundation, will be removed and the space refilled with dry earth, which shall be solidified by ramming or rolling. Any portion of the earth foundation not accessible to the roller shall be thoroughly compacted by ramming. When the rolling and ramming shall have been done, the surface of the earth foundation shall be true and smooth, and 5 ins. below the proposed finished surface of the pavement.

Excavated Material—The earth or other material excavated as hereinbefore described shall be placed in piles along the center or sides of the roadway thus excavated. This material shall contain approximately 50 per cent of mineral matter. By mineral mattter is meant gravel, broken stone, slag, etc. If, in its original state, it contains less than this percentage, sufficient gravel, stone or slag shall be mixed with it to bring the aggregate up to this amount.

Gravel—Any gravel to be used shall be clean pit or river gravel. The same shall be screened and any particles removed that measure above 1 in. in any direction.

Broken Stone—If broken stone is used, the same shall be a hard, sound and acceptable stone, and shall be a natural mixture of the various sizes as coming from the crusher, except that all stones above 1 in. shall be removed.

Pavement—The completed pavement shall be 5 ins. in thickness and shall be made as follows: The earth and mineral matter as above described shall, before being mixed with the bituminous cement, be passed through a rotary dryer and there subjected to direct heat for the purpose of expelling moisture, and for the further purpose of causing these ingredients to readily unite with the bituminous cement. Before being discharged from the dryer the earth and mineral matter shall be heated to a temperature of approximately 250°. The bituminous cement to be heated to approximately the same temperature.

Bituminous Cement—The bituminous cement used in this mixture shall be carefully prepared pitch, made from the highest grade of coal tar obtained in the manufacture of gas, in which no petroleum, water gas or other enricher is used, and refined by such process and apparatus as will accomplish uniformity of result and remove, as far as practicable, light oil, naphthalene and other matter susceptible to atmospheric influences. No pitch that has been cut back or softened by the use of light oils shall be used, and no cement shall be used which contains in excess of 38 per cent. of sooty matter or free carbon, or less than 24 per cent. of the same. No pitch made from water gas, coke oven or process tars shall be used.

Any cement that, after pouring on a blotter while heated to 250° F., and run out into a sheet, will crack when bent, after being plunged into water at a temperature of 45° F., shall be rejected. The ductility and consistency of the cement shall be as follows:

1. If a cylinder of the pure cement, at the temperature of 75° F., ½ in. in diameter and 1 in long, be held between the fingers of each hand and stretched, the same shall draw into a strand at least 3 ft. long without breaking.

2. The consistency or penetration of the cement shall be as follows: Take a metal cylinder 10 ins. long and 2 ins. in diameter, closed at one end, except a hole in the center of the bottom, into which a smaller metal cylinder, 1 in. long and ⅝-in. bore may be screwed, projecting into the larger cylinder ⅛ in., with a standard thermometer fastened on the inside of the larger cylinder. Fill the small cylinder with a plug of the cement and screw in place; hang the cylinder in an upright position and fill with water at a temperature of 78° F., and keep same at that temperature. If the water forces a hole through the cement in from 100 to 150 seconds, the consistency is suitable; otherwise, it shall not be used.

The bituminous cement shall at no time be heated to exceed 250° F. When the compounding of the mixture is taking place, the mixture shall be of the temperature of between 180 and 250° F.

The amount of the bituminous cement to be used is determined by the amount required to thoroughly coat each particle of the earth and mineral matter, and to fill the remaining voids in the mixture. After the formula is thus obtained, giving the exact amount by weight of the earth and mineral matter and the exact amount of cement for one batch, the same shall simultaneously be dumped into the mixer and the whole compound thoroughly agitated until all the particles are thoroughly covered, and the combination is a uniform bituminous concrete.

In this condition it shall be spread on the prepared foundation or sub-grade in two courses or layers, as follows: The first or lower course shall contain a slightly larger percentage of the cement than the second or upper course, and shall be at least 3 ins. in thickness after being thoroughly compressed by rolling with a steam roller weighing at least eight tons. The second or upper course shall then be spread on top of the lower course to such a depth that, after thorough compression with a steam roller weighing at least eight tons, the two courses shall have a thickness of 5 ins.

Street Cleaning in Vienna, Austria.—The work of street cleaning in Vienna is done at the expense of the city, as far as labor is concerned, and in part as to the furnishing of carts. Part of the work is hired out to contractors, who have to supply the requisite number of carts and horses for the removal of the refuse, as well as for the purpose of watering streets. The immediate management and supervision of the street cleaning in all the districts of the city save three are obligatory on the district councilmen. A special office for the entire supervision of the work has been taken into consideration, but has not yet been established. In consequence of the independence of each district there are some differences in the manner of carrying on the work. The laborers, mostly persons unfit for any other kind of work, are paid low wages. After the night sweeping the refuse is carted away in the early morning hours. For this work the municipality has at present 317 horses, 51 sweeping machines, 19 automatic watering carts, 25 watering carts, 110 dirt carts, 2 machines for removing slush, and 905 various carts for the removal of slush and for other purposes. These are stored in four large and two small depots, but the erection of a large depot is now underway. The municipality of Vienna cleans all thoroughfares and the sidewalks in front of vacant lots. The cleaning of the other sidewalks is obligatory on house owners, as is also the watering of the same, twice in dry weather, between 7 and 8 and 2 and 3 p. m. The house owners are also obliged to have the sidewalks cleared of snow and ice, though only to a breadth of 6 ft. 6 ins., and also to strew sand, etc., on them in case of slippery walking. In the first district, the city proper, the streets paved with granite and wood are cleaned nightly with sweeping machines, the preliminary sprinkling being done by patent automatic watering carts. In the remaining streets, the most important of which are also cleaned by machines at night, there are 11 groups of 3 sweeping machines each and 1 patent watering cart, each group having about 994,000 sq. ft. to clean. In the first district work begins at 11:30 and in the other districts at 10 p. m. In the first district the work of cleaning is finished at 6 a. m., but the market places and adjoining streets, which are occupied by the market people at night, are cleaned at a later hour. In the rest of the city the work of sweeping is finished at 5 a. m. For gathering refuse there are 15 groups, each with a foreman and 10 workmen, who begin working half an hour after the machines start and who are afterwards employed in collecting house refuse and otherwise. The sweeping machines, strongly built and durable, cost about $400 each. The asphalted streets are washed between 5 and 8 a. m. and are cleaned with rubber rakes. In the second district, the heavy traffic thoroughfares, for which the machines on hand are inadequate, are swept by hand at night. All other streets not swept by machines are swept in the daytime by brooms. On Sunday only a part of the workmen are employed, but they all receive full wages. The time of work in summer is from 6 a. m. until 6 p. m., with two pauses of a half hour each and one hour for dinner. For cleaning the streets there are employed on an average 63 overseers, 242 foremen, and 2,154 laborers. Night cleaning by means of machines will shortly be introduced for nearly all paved streets. The removal of the street and market refuse is done chiefly by the municipality, the rest by contractors. The carts have a loading capacity of 106 cu. ft., are of wood, and closed with covers. The refuse removed by the municipality is partially employed as manure, being mixed with the refuse from houses and partially deposited in sand pits. The refuse removed by the contractors becomes their property and is partially employed as manure. The employment of the street and market refuse collected by day for agricultural purposes, particularly the manuring of vineyards and sandy bottoms in the vicinity of Vienna, is now under discussion. The quantity of the street refuse, owing to the large area of the graveled streets, is considerable; about 9,888,480 cu. ft. annually are removed. For removal of the street slush and heavy refuse truck carts are employed. The formation of slush is largely due to local conditions, as principally chalk (lime) gravel of an inferior quality is used for the streets, other suitable stone not being found in the vicinity of Vienna. The cost of street cleaning for Vienna amounted in the estimate for 1909 to $1,157,700, according to a recent consular report from which the above notes have been taken.

Cyclopean Concrete at Gatun.

Rock dug out of Culebra Cut is being used in the concrete of Gatun Locks, adding weight to the massive gravity sections, acting as reinforcement, and reducing the cost of the lock construction. Only the hard rock from the dikes at Bas Obispo and Empire is used. Two plants have been established to get it ready, one of them on the north toe and one on the south toe of the Dam, both near the lock site.

The primary object of bringing the rock from Culebra Cut to Gatun, a distance of 23 miles, is to build the toes of Gatun Dam, and it therefore arrives at the Dam as miscellaneous spoil that must be sorted in order to get rock suitable for the concrete. Trains that are loaded at the dikes referred to are shifted to the points on either toe where the sorting plants have been established and are dumped, all the rock not used for concrete being allowed to lie where it is dumped as it forms part of the dam.

At the plant on the north toe of the Dam a locomotive crane operating an orange peel dredge bucket is used to pick up suitable boulders and place them on skips carried by narrow gauge cars. Boulders containing a cubic yard are frequently loaded in this way, but the usual run is smaller than that, although greater than one or two men could handle. From the sorting plant the rock is carried along the lock site on the industrial railway from the concrete mixing plant to the cableways; th e skips are picked up by the cables and delivered wherever desired in the lock site. It is the intention to increase the capacity of this plant by laying a standard gauge railway along the lock site parallel to the industrial railway, thus leaving the industrial line open to the exclusive use of the concrete trains. This plant supplied 6,808½ cu. yds. of large rock up to July 13, inclusive.

At the plant on the south toe the rock is sorted and loaded by hand, and in consequence only "man size" pieces ahe handled from this point. These pieces are loaded on skips and into buckets, and are carried over the narrow gauge railway, laid for handling the concrete from the auxiliary mixers, to the south forebay where the derricks erected there lift the skips or buckets over the forms. This plant had furnished 3,174 cu. yds. of large rock up to July 13, inclusive.

When both the plants are running at their capacity about 450 cu. yds. of large rock will be furnished each day to be embedded in the concrete, which will be about 15 per cent of the concrete placed.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Conservation of Water Powers.*

The conference of Governors, which assembled at the White House in May, 1908, in response to an invitation extended by President Roosevelt, focused the attention of the American people upon a subject which all recognize as one of fundamental national importance and one which appeals to the engineering profession with all the force which comes from special knowledge. True conservation of our natural resources means wise utilization of those resources without unnecessary waste. Such utilization of materials used in construction and of energy is the primary and essential business of the engineer. Since the days of Smeaton and of Watt, the engineer has been building the lighthouses of material prosperity and releasing and directing for the common welfare, those vast forces of nature imprisoned and overlooked for centuries, but now utilized on a scale which dwarfs the physical powers of man to insignificance.

During the last 25 years, a period practically coterminus with the life of this institute to date, the art of transmitting power by electricity has grown from a laboratory experiment into a development universally recognized as one of the great factors of industrial and commercial life.

The latest publication of the United States Geological Survey, relative to this subject, estimates the aggregate water powers of the United States at minimum flow to be 36,000,000, and the aggregate which presumably can be developed on the basis of six months' flow per annum at not less than 67,000,000 horsepower.

A very large proportion of the water powers hitherto unappropriated are either located upon Government lands or are dependent, wholly or in part, upon the run-off from government lands.

The regulations established by national and state governments which control or affect the further utilization of water powers, therefore, are of peculiar concern to the members of this institute. A bill endorsed by the administration is now before Congress which, if passed, will confer definitely upon the President and his executive assistants full authority in respect of withdrawal of public lands and unappropriated water powers. Probably the bill will pass, and if so we may expect that the question of governmental machinery and methods for handling practically this highly complex and vitally important subject will be raised in acute form.

If the views of the engineering profession are to be effective, either in moulding public opinion or in assisting the legislative and executive representatives of our people, by supplying facts essential to correct generalizations and deductions, it is important that those views be clearly stated at the right time and that apparent lack of agreement among those best qualified to measure the practical results of existing or proposed governmental regulations should not destroy their influence.

The present occasion seems opportune for the presentation of a brief and non-technical discussion of the practical bearing and effect of existing laws governing the appropriation of water powers located on public lands, which, as now construed and applied, are seriously retarding the utilization of these powers.

To those who realize the vast possibilities of a farsighted and thoroughly scientific development and utilization of our water power resources, particularly those of the Rocky Mountains and the Sierras, no subject can be more interesting. Present practice, whether ideal or faulty, is more likely to be modified than revolutionized, and now is the time for unprejudiced and candid discussion of the regulations now in force.

Relation of Forests and Stream Flow.—The Bureau of Forestry has established regulations governing the appropriation of water powers located on streams which drain watersheds included in whole or in part in Forest Reserves. Among these regulations is the imposition of a graduated rental, to be paid by the individual or corporation appropriating the water power and used by the government for forest purposes. This rental rests upon the assumption that the appropriator of the power will be benefited by the preservation of the forest, and this idea is accepted generally by engineers and by the public.

Mr. Gifford Pinchot, Chief Forester at the time when the present regulations were established, states his understanding of the physical facts upon which this charge is based in a document explaining the policy of the Forest Service, as follows:

"The national forests include the great mountain chains of the west. The rain and melting snow of these ranges feed the mountain streams. The forest cover on the steep slopes acts like a mighty sponge, absorbing the excess of rainfall in the wet season and giving it out to the thirsty lands in the dry season. It is for the express purpose of thus 'securing favorable conditions of water flows' (Acts, June 4, 1897) that Congress has authorized the creation of national forests and expends money for their administration and maintenance. Where the forest cover is destroyed by reckless lumbering and the fires which inevitably follow, the rains immediately run off the steep slopes as from the roof of a house, producing destructive floods in the valleys and leaving no store of water for the dry season. Therefore, when a power company puts its plant on national forest land, it gets from the government two things which it ought to pay for, viz.: (a) The use of lands of great value for power purposes, for the steep mountain sides give the fall which is essential for a power plant; (b) the guarantee of a steady flow of water as an incident to the land occupied by the plant. This steady flow is also essential to a power plant."

During the last two years the question of the actual or assumed effect of forests on the water-shed in regulating the run-off has been widely debated. That forest cover controls the run-off to a material extent has been vigorously asserted by engineers prominent in the government service and by many others, and, on the other hand, it has been seriously questioned by a number of our leading engineers, notably by Colonel Chittenden, in a paper read before the American Society of Civil Engineers, in March, 1909, and by Dr. Willis L. Moore, Chief of the United States Weather Bureau, in a report addressed to the Committee on Agriculture, of the House of Representatives in 1910, entitled "A Report on the Influence of Forests on Climate and on Floods."

I do not propose to enter into a detailed discussion of this complex subject at this time. Colonel Chittenden's paper and its discussion, as printed in the transactions of the American Society of Civil Engineers, have covered the subject perhaps substantially as well as it can be covered by applying inductive method to existing records.

The report of Dr. Moore and the article on "Floods," in Water Supply paper No. 234, prepared by the United States Geological Survey, also debated the subject at great length, the apparently radical difference of opinion between these two gentlemen being due apparently in large degree to the fact that Dr. Moore is considering total annual run-off, while Mr. Leighton is investigating the relation of "flood tendency" to precipitation.

As Dr. George F. Swain pointed out in a recent discussion of this subject at Boston, the difficulty in reaching an agreement along the lines adopted in the papers referred to results from the fact that all of these gentlemen are applying the inductive method of reasoning to a subject so complex and so varied as practically to preclude the possibility of general agreement in the inference drawn. The physical laws which govern the phenomena under discussion are all well known and to the scientist the deductive method of dealing with this subject is not only easier but is more convincing than the attempt to draw conclusions from incomplete records of precipitation and stream-flow where even approximate knowledge of the extent to which the surface of the watershed in question is forested, or plowed, or covered by vegetation other than forest, is not available.

Such reasoning unquestionably leads to the conclusion that the preservation of forests on the watershed does to a greater or less extent regulate and control not the aggregate annual run-off, but the rate at which that run-off varies during the year, and this idea is accepted generally by engineers and by the public. It is also accepted apparently by the majority of engineers who have discussed this subject in our various engineering publications, using the inductive method in drawing their conclusions.

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*Presidential Address of Mr L. B. Stillwell, before the American Institute of Electrical Engineers on June 28.

As the essential physical facts which bear directly upon forest control of run-off, and consequently upon the relation of forested water sheds and water power, the following as stated by Dr. Moore may be accepted probably without material error:

"(1). Precipitation controls forestation, but forestation has little or no effect upon precipitation. (2) Any local modification of temperature and humidity caused by the presence or absence of forest covering the buildings of villages and cities, etc., could not extend upward more than a few hundred feet, and in this stratum of air saturation rarely occurs, even during rainfall, whereas precipitation is the result of conditions that exist at such altitudes as not to be controlled or affected by the small thermal irregularities of the surface car. (3) During the period of accurate observations, the total annual precipitation has not increased or decreased to an extent worthy of consideration. (4) The total annual run-off of our rivers is not affected materially by any other factor than precipitation. (5) There is no adequate evidence to justify the conclusion that extreme floods in recent years attain higher stages than formerly."

Other conclusions stated by Dr. Moore in the report above referred to, the author is not prepared to accept, and as regards that forest control which is practically related to the commercial value of water powers, he believes the following to be a correct statement:

While the aggregate annual run-off of our rivers in general depends upon the total annual precipitation, the presence of forest cover on the watershed regulates the rate of run-off to an extent which in many cases materially affects the value of the water power, this regulation tending to equalize the flow and prolong it during the dry season.

With this understanding of the essential physical facts which are pertinent it is proposed in this paper (1) to discuss briefly certain provisions included in the present regulations of the Forest Service governing the appropriation of water powers dependent in whole or in part upon forest reserves, and (2) to suggest the outline of a plan which to the author appears preferable to that now in force.

The present form of permit provides a nominal charge (rental) for the land occupied by power house, dam, canals, penstocks, flumes, etc., the rate being "one dollar per acre and five dollars per mile for the land occupied by said works." It provides also that "the gross operation charge for any year shall be calculated by the forester upon the basis of the quantity of electric energy generated in such year at a maximum rate, which shall not exceed the following amounts per thousand kilowatt hours:

	Cents.
For the first year	2
For the second year	4
For the third year	6
For the fourth year	8
For the fifth year	10½
For the sixth to tenth years, inc.	12½
For the eleventh to fifteenth years, inc.	15
For the sixteenth to twentieth years, inc.	17½
For the twenty-first to twenty-fifth years, inclusive	20
For the twenty-sixth to thirtieth years, inc.	22½
For the thirty-first to thirty-fifth years, inc.	25
For the thirty-sixth to fortieth years, inc.	27½
For the forty-first to forty-fifth years, inc.	30
For the forty-sixth to fiftieth years, inc.	32½

The foregoing are maximum rates applicable only in cases where all the water utilized comes from the Forest Reserve and the entire head developed results from the topography of the forest. In all other cases, deductions are made as follows:

"From the gross operation charge for any year calculated as above.

"(a) A sum bearing approximately the same ratio to one-half of such gross operation charges as the area of unreserved land on the watershed as of the beginning of each year.

"(b) A sum bearing approximately the same ratio to one-half of such gross operation charge as the length of conduit outside the Forest Reserve bears to the total length of such conduit as of the beginning of each year.

"(c) A sum bearing approximately the same ratio to the balance remaining after said deductions 'a' and 'b' as the quantity of electric energy generated from water stored artificially by the permittee over and above what is generated by the natural flow, bears to all electric energy generated.

The sum remaining after all the aforesaid deductions have been made constitutes the net operation charge for such year."

The rationale of the deduction for water stored artificially by the permittee is obvious. That for the first two deductions described is stated in an informal explanatory document of the Forest Service, as follows:

"Since the two advantages furnished by the Government are the maintenance of a steady flow from the forested watershed, and the fall resulting from the topography of the forest, one-half of the conservation charge is calculated as based upon each of these advantages. Therefore:

"(a) If a part of the watershed which supplies the power plant is outside of the natural forest, the one-half of the conservation charge calculated upon the advantage resulting from the maintenance of the steady flow by the conservation of the forest cover is reduced proportionately, and (b) if a part of the fall which the permittee is to use in developing power is outside of the national forest, the one-half of the charge which is based upon the fall is reduced proportionately."

Imposed Rates as a Tax on the Power Enterprises.— The proposed conservation charge, at least during the early years of the contract, cannot be regarded reasonably as constituting any very serious financial burden imposed upon the individual or corporation developing the water power. If power be sold at an average price of one cent per kilowatt hour, the maximum conservation charge during the first five years of operation is equivalent to a tax of 0.61 per cent of gross receipts. During the next five-year period it is increased to 1.25 per cent of gross receipts, and it increases gradually from this figure to a maximum of 3.25 per cent of gross receipts, which rate applies during the last five years of the 50-year life of the contract. The average charge during the 50-year period is 2.086 per cent of gross receipts, if power be sold at the price assumed, viz.: one cent per kilowatt hour.

If power be sold at an average price of 0.5 cent per kilowatt hour the average conservation charge during the period of the lease becomes 4.172 per cent of gross receipts, and the maximum, which applies during the last five years of the lease, is 6.5 per cent of gross receipts.

It is a fair question, however, whether a more rational method, and one which in certain important respects would tend to produce better results, might not be devised. The plan in force obviously is open to several objections. Among these are:

(1) The imposition of a tax upon output means that the man who installs a highly efficient plant is called upon to pay a higher conservation charge than the man who wastes water by the installation of a cheap and inefficient plan. The effect of the conservation charge in influencing type of construction, and consequent effective utilization of the water, will probably be small, but unquestionably that influence is exerted in the wrong direction;

(2) The proposed method of charging imposes a heavier burden upon the man who sells his power at a low price than upon him who sells it at a high price. The tax, measured in percentage of gross receipts, is obviously twice as high in the case of the man who sells power at an average price of 5 cents per kw.-hour as it is in the case of a man who sells power at an average price of 1 cent per kw.-hour.

Both of these objections were pointed out in a paper read by Mr. F. G. Baum, before the American Institute of Electrical Engineers, at Atlantic City, N. J., in 1908, but the writer has not heard them referred to since, and they deserve careful consideration.

(3) Mr. Baum also calls attention to the fact that under the plan proposed by the Forest Service "the man who takes his power to a market, say 100 to 200 miles away, must pay to the Government for the losses incurred in doing so and pays more than the man who sells to the home market. The man who reaches out with his power is equalizing conditions, just as railroads equalize conditions by their transportation facilities."

The Italian law, recognizing this point, reduces the rental in the case of transmitted power. The basis of this reduction, as stated by M. Rene Tavernier, chief engineer, Department of Public Works, Republic of France, in his valuable article on "The Public Utility of Water Power and Their Government Regulation" (Water-Supply Paper No. 238), is as follows:

"For power transmitted by means of electricity to distances greater than 10 km. (about 8 miles) there is granted upon the annual rental of 3 francs per horsepower, a reduction calculated by multiplying the square of the distance expressed in kilometers by a fixed co-efficient of 0.001. In no case shall the rental be reduced to less than one-half of 1 franc per horsepower. "Under this formula the minimum reduction, that is to 0.50 franc, will be attained in transmission over 50 km. (about 31 miles)."

While the method of applying the "conservation charge" has been criticised in many quarters and while the objections above pointed out are valid, the method in force possesses undoubted advantage in the fact that it is definite and readily determined by reference to records which the permittee can easily keep. The charges, moreover, are adjusted to encourage development of the water powers by recognizing the fact that few, if any, can earn interest on the necessary investment from the start. In enterprises of this kind, the cost per unit of output generally decreases as the output increases. The forest service charge, recognizing this fact, is made small at the start and increases gradually. Except by reducing the average charge for the period, it would be difficult to devise a plan less onerous for the permittee.

(4) While the imposed charge could not be regarded as excessive, if the power developed were entirely, or even very largely, dependent upon the preservation of forest cover upon the watershed, it represents a high rate when

FIVE YEAR RUN-OFF TABLE.

River and Gauging Station.	Drainage area sq. miles.	Max. run-off sec. ft. per sq. mile.	Average run-off sec. ft. per sq. mile.	Min. run-off sec. ft. per sq. mile.	Minimum in per cent of: Maximum.	Minimum in per cent of: Average.
Kennebec—Waterville, Me.	4,380	17.5	1.96	.0388	.222	1.98
Merrimac—Franklin Junction, N. H.	1,460	16.93	1.998	.315	1.86	15.77
Connecticut—Holyoke, Mass.	8,144	14.12	1.623	.258	1.83	15.9
Susquehanna—Binghamton, N. Y.	2,400	19.62	2.044	.0187	.095	.916
Yadkin—Wilkesboro, N. C.	500	36.8	2.446	.43	1.17	17.6
Savannah—Augusta, Ga.	7,294	18.83	1.56	.198	1.05	12.7
Black Warrior—Near Cordova, Ala.	1,900	26.0	1.515	.01473	.0567	9.73
Feather—Oroville, Cal.	3,640	29.0	2.354	.33	1.14	14.0
Yakima—Near Yakima, Wash.	3,300	19.37	1.322	.1926	.995	14.56
Naches—Near North Yakima, Wash.	1,120	19.55	1.489	.0268	.137	1.8
Average		21.772	1.8311	.18226	.837	9.95

measured in comparison with the increase in commercial vale of the power, which, under ordinary conditions, is due to the forest. If, for illustration, it be assumed that under average conditions "forest control" adds 25 per cent to the value of the water power, a tax averaging 3.88 per cent of gross receipts is a tax of 19.4 per cent of the gross value contributed by the forest.

(5) The tax is imposed upon power from all "forest reserve lands," regardless of the actual condition of the forest upon which it is based. Obviously, therefore, a uniform tax must be very much heavier in some cases than in others, as compared with the benefit upon which it theoretically rests.

(6) It tends to retard utilization of water powers and stimulates the use of coal for power purposes—a result which is in direct contravention of the primary object of conservation.

(7) Something less than one-half the public domain is included within the limits of the forest reserve. To secure maximum revenue and to minimize the average retarding effect upon utilization of these water powers resulting from a system of rental, any charges which may be imposed by the Federal Government upon waterpower appropriation should apply to all public lands.

The author has expressed the opinion that the imposed charge would not be regarded as excessive if the power developed were entirely, or even very largely dependent upon the preservation of forest cover upon the watershed. In his judgment, however, that effect has been very greatly exaggerated by the majority of writers who have endeavored to instruct the public regarding the subject.

To sustain the announced theory of the Forest Service, it is evident that the value of the water power should be directly dependent upon forest control of the run-off. Obviously the statement that "the forest cover on the steep slopes acts like a giant sponge, absorbing the excess of rainfall in the wet season and giving it out to the thirsty lands in the dry season" and that the "power company which puts its plant on national forest land gets from the Government the guarantee of a steady flow of water" are highly figurative.

The extent to which forest cover and other surface conditions which tend to regulate runoff, succeed in equalizing stream flow, is illustrated in the above tabulated statement, showing in the case of ten fairly representative rivers of the Atlantic and Pacific slopes the maximum, average and minimum run-off in second feet per square mile for periods of five consecutive years and the minimum runoff expressed (a) in percentage of maximum run-off and (b) in percentage of average runoff.

Without attempting to discuss the complex conditions which determine the relations of maximum, average and minimum run-off, it is evident that in no case does existing forest cover or any other surface condition effectively equalize the flow.

As regards the relation of minimum to maximum run-off, the most favorable case, that of the Merrimac river, shows a minimum flow of 1.85% of the maximum, while for the ten rivers the minimum flow averaged is .837 of the maximum flow averaged. As regards the relation of minimum to average run-off, the most favorable case, the Yadkin, shows 17.6%, while the average of the ten rivers is 9.95%.

The effect of forest cover in adding to the commercial value of a water power, results from two facts, namely, first, the fact that an increase in minimum run-off reduces the necessary investment in auxiliary steam or other power plant; second, the fact that some portion of the flood waters, which otherwise would flow past the power plant, at a time when the water available exceeds the amount needed, is held back long enough to permit its commercial utilization. As regards the first of the two conditions referred to, if we assume that auxiliary steam power is used to insure a continuous supply equal to the average which a given head on each of these rivers is capable of developing, it will be seen that such auxiliary plants must be capable of producing power in an amount ranging from 82% to 98% of the water power. The difference, therefore, between the best and the worst case among these typical streams affects the cost of the auxiliary plant to the extent of 16% of the cost of a steam plant capable of developing the same output as the water power.

As regards the effect of forest cover upon the relative proportions of energy output from the water power and from the auxiliary steam plant, the conditions are so complex as to prevent profitable generalization. The holding back of a portion of the flood waters saves fuel and other operating costs of the auxiliary steam plant or reduces the artificial storage required. While it is evident that this effect, under the best conditions existing upon any of the watersheds, drained by the streams referred to in the table, is not such as to justify the theory that the forest is the principal factor affecting the value of the water power, the author would not be justified, from present knowledge, in attempting to fix its average effect upon that value.

The features of the present regulations which should be changed are as follows:

Permit Non-Transferable.—Clause 15 of the power agreement now in force reads as follows: "The permit here applied for shall be non-transferrable (U. S. Revised Statutes, Section 3737) and shall be subject to all prior valid claims which are not by law subject thereto."

The aim in view, of course, is to avoid monopoly, as a result of which an artificial price might be maintained higher than the average which would be fixed by competition of similar developments in the same market.

If effective, it is obvious that this requirement must retard development. The economic reasons which demand that water powers on the same stream should deliver their output to the same network of distributing circuits in many cases are material, and those which demand that the output of developments on different streams should be similarly combined are even more weighty. In the former cases, under certain conditions, as has been pointed out by Mr. W. S. Lee, in his paper before the American Institute of Electrical Engineers (Proceedings for April, 1910), the net output of a stream effective for commercial purposes may be considerably increased. In the latter case, owing to the fact that the relative run-off of neighboring watersheds sometimes varies widely during successive years, the reliability of the supply of power to the user is materially increased by combination. To put the matter another way, if combination be not permitted the aggregate investment in auxiliary steam plants or gas engine plants must be largley increased, which obviously is bad economy and means an increase in cost of power not only to the producer, but also to the user.

By electrically combining the output of a considerable number of water powers, interruptions of service, due to accidents to flumes, or to transmission circuits are decreased.

The clause, in my judgment, should be modified by permitting transfer, subject to approval by the government. The right of a state or municipality to fix charges, in the case of a public utility company selling its product within the limits of such state or municipality, has been established by decisions of the Supreme Court of the United States. The danger that American communities in general, knowing this fact, will submit for any great length of time to the imposition of rates that are really extortionate, is not comparable to the economic loss, which is certain to result from the imposition of conditions limiting the opportunity for profitable investment of capital. In this connection it is evident that even an assumed water-power monopoly of the largest conceivable size must sell its power at a cost lower than the cost of competing power produced by steam plants.

The established right of a state or municipality to fix rates at which power is sold is an absolute protection applicable by local governments best able to judge the conditions which determine what is an equitable charge.

Continuous Operation of Plant.—Clause 18 reads as follows:

"The permittee shall, except when prevented by the act of God or the public enemy, or by unavoidable accidents or contingencies, continuously operate for the generation of electric energy, the works to be constructed under the permit hereby applied for, in such manner as to generate after such generation begins, not less than the following percentages of full hydraulic capacity of the said works measured in kilowatt-hours; in the first year . . . . per cent; in the second year . . . . per cent; in the third year . . . . per cent; in the fourth year . . . . per cent; in the fifth year . . . . per cent; and in every year thereafter . . . . per cent."

The object in view is to prevent a power company increasing its prices by creating an artificial power famine and to secure full utilization of the available power. Some permits have specified that not less than twenty-five per cent of the full hydraulic capacity, measured in kilowatt hours, must be generated; others as much as seventy-five per cent, depending upon special circumstances supposed to govern the case.

In many cases this clause presents serious difficulty to the power company. In the majority of instances with which the writer has been personally familiar, it has been extremely difficult, if not impossible, to predict either maximum or minimum limits of the growth of power output. Circumstances may be conceived under which a power company, operating not only the plant covered by the permit, but also other plants might shut down the first named to produce temporarily an artificial scarcity of power, but the fact that this would seem an idle investment would make this a rare case. If it be necessary to retain such a clause, it should be accompanied by a provision permitting with the consent of the government, a reduction in the percentages originally fixed.

While discretionary power to make conditions upon which capital has been invested more onerous will retard or prevent development, the bestowal upon a Secretary of Agriculture or a Secretary of the Interior, of power to make those conditions less onerous involves no corresponding public risk, since that secretary would destroy himself politically who should grant such authorizations without proper cause. No power company can afford to invest capital under a contract which leaves it in the power of a government official to increase the burden of the enterprice within the term covered by the permit, but the government and the public can well afford to bestow upon a responsible official authority to reduce those burdens upon proper application and presentation of valid reasons.

Term of Permit.—Clause 20 of the permit in force reads as follows:

"The permit hereby applied for shall cease and be void, upon the expiration of fifty years from the date of approval hereof, but it may then be renewed in the discretion of the duly authorized officer or agent of the United States, and upon such conditions as he may in his discretion fix: Provided, that such officer or agent, in fixing such conditions shall consider the actual value at that time for power and all other purposes of the lines and rights of way within National Forests occupied and used under the permit hereby applied for and the actual value at that time of all improvements lawfully made by the permittee within National Forests under the permit hereby applied for, but neither the property of the permittee, if any, outside of National Forests, nor the permit, franchises, bonds, capital stock or other securities of the permittee shall be considered in fixing such conditions."

It will be noted that this clause contains no provision for taking care of the contracts which may be in force between the permittee (or his successor) and his customers at the expiration of the fifty-year period, nor does the author find any provision covering this point elsewhere in the power agreement. It is obvious that by its absence the value of the permit during the latter years of its life, is materially impaired. Power contracts are frequently, in fact generally, executed for periods of not less than five years and frequently for ten or even twenty years.

The contract agreement should include a clause guaranteeing for a period not less than five years subsequent to its termination, the fulfillment of contracts between the permittee and customers existing at that time.

The Permit Revocable Under the law as it now stands the Forest Service can grant to an individual or corporation seeking to develop water power from the Forest Reserves only a permit revocable by the Secretary of Agriculture in his discretion. The so-called "Second right of way" act is entitled "An Act relating to rights of way through certain park reserves and other public lands," and bestows authority in this matter upon the Secretary of the Interior. A later law, approved February 15, 1901, transferred to the Secretary of Agriculture responsibility for the execution of all laws relative to national forests.

No argument is necessary to demonstrate that a permit revocable in the discretion of the head of a department is not an adequate basis for financing an enterprise requiring investment of capital. This vital defect of the existing law today stands squarely in the path of legitimate and praiseworthy enterprise seeking to develop and utilize our many water powers from forest reserves now wasted. Every proper influence should be brought to bear by those interested in the true conservation of our national resources to secure a modification of the law removing this otherwise insuperable barrier.

An Alternative Plan.—The man who criticises adversely a plan which has been elaborated by others is not necessarily under obligation to suggest an alternative and, moreover in the judgment of the author, any plan which imposes a tax upon water power or fuel is at best of doubtful wisdom. Assuming, however, that upon careful consideration the American people should decide definitely and finally, to impose a tax upon natural resources of the public domain, to be used in conserving and developing those resources, it is perhaps not improver to suggest the outlines of a plan which from the standpoint of public policy appears preferable to that now in force. The essential features of the plan which he would suggest are the following:

(1) A tax imposed on all sources of power found upon public lands—a royalty on coal mined and a rental upon water power. The charge for water power to be based not upon an indefinite and disputed relation of forest covering and commercial value of the power, but upon the fact that the Government needs revenue to develop and conserve our natural resources, owns the power, and, as owner, possesses an unquestionable right to impose a charge for its use. The Federal Government is now selling coal lands on the public domain at prices which, on the average, approximate one-tenth of one cent per ton of the coal which it is estimated the property can commercially yield. If the coal be used to produce power under average conditions this tax is substantially equivalent to 5 cents per 1,000 kw.-hours as against an average rental of 20.86 cents per 1,000 kw.-hours now imposed in the case of water power. The theory of conservation unquestionably points to an increase in the price fixed for coal lands or a decrease in water power rental, or both. By adjusting the charges for coal and water power to approximate equality, as measured by their respective ability to produce power, the tendency of the present method to stimulate the use of coal for power purposes as against the use of water power—a tendency in direct contravention of the fundamental idea of conservation—will be avoided and the aggregate revenue ultimately available to the Federal Government for the purpos contemplated will be enormously increased.

The general features of the present contract agreement enforcd by the Forest Service as regards fifty-year limit of the period of appropriation should be preserved. The other restrictions now imposed should also be retained except that certain clauses should be modified to meet the practical objections which have been pointed out, in so far as mature consideration may determine the validity of those objections.

The proceeds of royalties upon the sale of coal land and forest products and mentals of water powers to be used to conserve our national resources by development under broad and systematic plans—to conserve forests, build dams, improve navigation and irrigate the arid lands.

(2) The charge imposed upon water powers to be based upon the amount of water appropriated and the effective head resulting from the topography of the Government lands concerned.

Under the present plan, it is necessary to measure the water used in order to fix the third deduction from the charge based upon output. The difficulty of measuring water, therefore, must be met and it is easy to fix the second feat appropriated as to fix the deduction allowed for artificial storage by a permittee.

Under this plan it would be to the interest of the permittee to install a plant of high efficiency and not a plant of low efficiency as the present method of charging suggests.

An important practical point in this connection is the fact that the estimate of competent Government engineers, discussed with and agreed to by the permittee would constitute a safer basis for the investor who may undertake to finance the enterprise than he now has in the data submitted for his consideration by the promoter.

(3) There is a third suggestion which perhaps may be worthy of consideration in view of the fact that conditions as regards cost of development and characteristics of the market for power differ so widely in various parts of the country. That suggestion is that the Government engineers of the department or bureaus concerned develop comprehensive preliminary plans for the development of water powers of a given watershed and that these water powers collectively or severally be leased to the highest bidder, th Government, of course, reserving the right to reject all bids.

Clearance and Grade Requirements for Carrying Highways Over or Under Railway Lines.*

The physical laws for grade separation are summed up in two:

1. The structure carrying the upper line of traffic must be sufficiently high above the lower traffic way to clear all objects passing on the latter;

2. The grade on either traffic way, approaching the crossing, must be practicable for the traffic thereon.

The maximum height of loaded vehicles and any objects thereon on city streets or country highways has been accepted as 14 ft. This height is also sufficient to clear regular street-railway traffic. While higher objects are moved along roads occasionally, it is properly not considered necessary to endanger the practicability of crossings under railways to accommodate them.

The vertical clearance, top of rail to bridge, required over railway tracks, is in most cases much higher than over highways, and this constitutes, in the great majority of cases, the insurmountable obstacle to grade separation. The highest fixed projection on an ordinary railway train is the locomotive smoke stack, and passenger cars project higher than the great bulk of freight cars; but some, comparatively extremely few, special freight cars are higher than either passenger cars or locomotive stacks. The extreme clearance requirement is for height, top of rail to running board, of highest car, height of brakeman added thereto, and a further allowance for contingencies, among which may be height of load of light material on an open car exceeding maximum box car height.

There are, at the present time, on the railways of standard gage in the United States, Canada and Mexico†, about 2,377,282 freight cars of all kinds. They classify as to height, rail to running board, as follows:

	Per cent.
Under 12 ft., including flat, gondola and tank cars	63.1
12 ft. to 13 ft.	23.4
13 ft. to 13 ft. 6 ins., inclusive	11.9
13 ft. 6 ins. to 14 ft., inclusive	0.65
Over 14 ft.	0.95

Limits of car dimensions are fixed by clearance outlines on the various railways. A composite clearance limit diagram for ninety railways, including all Canadian Trunk lines, has a height of 14 ft. 6 ins., limiting "over all" height of cars to this figure and practically limiting height of top of running board of freight cars to 14 ft. In the St. Clair tunnel, Grand Trunk Ry., the clearance height at width of 3 ft. is 14 ft. It is true than on many divisions or branches of the lines considered, the clearance is somewhat greater than shown in the composite diagram referred to, while on the other hand, it is less on a number of main lines, and on many branch lines.

The limit of grade, approaching crossings, can for railways be taken as between 0.5% and 1%. For city streets a grade of 5% is in most cases extreme and it should be so for main country highways. A preferable maximum grade for roads is 4%, and 3% is materially better. This works out as follows:

For 5% grade 20 × 2 = 40 ft. length of approaches for every vertical foot of clearance.
For 4% grade 25 × 2 = 50 ft. length of approaches for every vertical foot of clearance.
For 3% grade of 33 ft. 4 ins. × 2 = 66 ft. 8 ins. length of approaches for every vertical foot of clearance.

Any gain, by curtailment of vertical clearance requirement, or by change of railway grade, or by both, means corresponding shortening of road approaches, at the high ends. Such a gain of 1 ft. may greatly reduce the cost of a given grade separation, making it practicable when it would not otherwise be so. A vertical gain of 2 ft. would mean a very large addition to the number of practicable grade separations.

The extreme allowance that should be made for brakemen on a car must not exceed 7 ft.; 6 ft. 6 ins. will clear any brakeman unless he should be over 6 ft. tall, and 6-ft. brakemen are not common, to say the least. The necessity for brakemen on the tops of cars is becoming less and less, and has in many cases disappeared, rules and regulations of railway companies to the contrary notwithstanding. The air-brake is now universally used in train control.

The Pennsylvania R. R. makes it a rule to avoid all grade crossings on new work, and has within the last nine or ten years eliminated over 50 per cent of all its grade crossings on main lines. To do this clearance must be made as low as possible. Overhead bridges are as low as 16 ft. 6 ins. above the top of rail, while many are 18 ft. 6 ins. and less. Twenty-one ft., the standard for signal bridges, is recognized as the highest clearance for which there can be any need. In New York state many overhead bridges are only 18 ft. above the top of rail, and this is the case also in Massachusetts and in other states. The New York Central & Hudson River R. R. has asked for 16 ft. or 16½ ft. clearance for all overhead bridges within the electric zone, extending 16 miles from the Grand Central Station, in the City of New York.

It is submitted that with conditions as they are and more so with regard to the future, 20 ft. (13½ ft. for car and 6½ ft. for man), is a reasonable vertical clearance. It has been shown that 13½ ft. covers the height to running board of all but a very small percentage of freight cars now in use, and that cars higher than 14 ft. to running board, i. e., higher than 14 ft. 6 ins. "over all," or to top of brake rod, can only to a limited extent traverse beyond their home railways. That higher cars will be economical or practicable is as little probable as that the gage of railways will be widened or their entire

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From a paper by W. H. Breithaupt, M. Can. Soc. C. E., read before the Canadian Society of Civil Engineers, March 18, 1910.

†Official Railway Equipment Register.

structure changed. For a vertical clearance requirement greater than 21 ft. (14 ft. plus 7 ft.), there can, in any event, be no conceivable rational need.

In Massachusetts there is a special Grade Crossing Commission. The minimum clearance required by this Commission is in general 18 ft. Connecticut and Rhode Island also specify 18 ft. In New York the Public Service Commission requires 21 ft. clearance where practicable, many lower bridges are built throughout the state, some, as already stated, are as low as 16½ ft. New Hampshire, Ohio and Indiana require 21 ft. The only states requiring more are Illinois and Vermont, where 22 ft. is specified, but exception is made where this height is not practicable.

In Canada the Dominion Railway Act of 1904 specifies a minimum clearance of 22 ft. 6 ins., above rail level (allowed to mean base of rail) for bridges over railways, with no deviation except by leave of the Board of Railway Commissioners; and this board has hitherto not allowed a deviation in any case.

The Corrosion of Iron and Steel.*

The work of your committee during the past year has consisted in the care and supervision of the wire-fence panels at Pittsburgh and the official inspection of the steel panels at Atlantic City. A sufficient time has not yet elapsed to justify a report on the Pittsburgh wire tests, so that only the results obtained on the steel plates will be presented at this time.

A brief history of the Atlantic City steel test panels will make the results obtained more interesting to those members of the society who have not closely followed the work of the committee. Three years ago the suggestion was made in a paper presented before the seventh annual meeting of this society, that the various types of substances used as pigments in protective coatings might exert a stimulative or an inhibitive action on the rate and tendency to corrosion of the underlying metal. It was further suggested on theoretical grounds that slightly soluble chromates should exert a protective action when employed as pigments by maintaining the surface of iron in a passive condition in case water and oxygen penetrated the paint film. In view also of the well-known fact that alkalies inhibit while acids stimulate the corrosion of iron, it was suggested that the action of more or less pure pigments on iron in the presence of water should be thoroughly investigated. Two years ago this committee invited the cooperation of Committee D1 in the investigation and a special sub-committee representing the two main committees was appointed.

The methods and results of the water-pigment tests have previously been reported and published and need not be given in detail. Briefly, the method consisted in immersing samples of steel in water suspensions of the various pigments and blowing air through the containers for definite periods of time, the corrosion being measured by the loss in weight sustained by the test pieces. About 50 pigments, which are in more or less common use for painting steel, were secured and distributed among a number of the members of the committee, who agreed to carry out the work. Each investigator operated independently of the others, except that the same general method was followed; the time of exposure to the corroding action, however, varied in the different experiments. When the results were compared and anlyzed by the sub-committee, it was felt that the general agreement of the results obtained by the several investigators was striking and merited further and more systematic work. As a result of these tests the sub-committee tentatively divided the pigments into inhibitors, stimulators and indeterminates. The word indeterminate" was selected after considerable discussion, because the words "natural" or "inert" already possess a special meaning, as applied to paint technology. The committee takes this occasion to emphatically state that in adopting this tentative classification, the words "inhibitive" and "stimulative" as used by them up to the present time apply only to the results obtained in the water tests and no inference is justified that the results obtained have decided which class the pigment will fall into when made into a paint with the usual vehicles and used a protective coating on iron and steel. In order to make this point quite clear it has been agreed by the committee to qualify the classification so as to speak of the various materials tested as "water stimulative" or "water inhibitive."

As a result of the preliminary tests it seemed desirable to the committee that a systematic investigation of the same pigments should be made under service conditions. The Paint Manufacturers' Association of the United States offered to erect the series of steel panels at Atlantic City and place them under the supervision and control of this society.

The panels were erected in the autumn of 1908 and are now open to the inspection of members. The first official inspection was conducted by the special sub-committee on April 15, 1910. In order to carry out the inspection effectively a committee of seven inspectors was appointed, each member of which was requested to make an independent inspection and turn in the results to the chairman. The method of examination adopted was as follows: Each plate was given two separate marks graded upon a scale of 10, one mark was to signify the condition of the plate as far as corrosion effects were discernible, and the other was to grade as nearly as possible the present condition of the protective coating. In judging condition various factors were taken into account, such as chalking, checking, cracking, scaling and color. It was the unanimous opinion of the inspectors that so little difference existed in the duplicate panels on the different steels and fences that the careful report on one line of panels would answer for all up to the present time.

The results of the inspection are presented in Table 1, showing the values given by each inspector as well as the average, maximum, and minimum for each panel.

According to the original plan of the Atlantic City steel test panels the object in view was to determine whether the results obtained under service conditions bear any relation to the inhibition and stimulation effects obtained in the laboratory water tests which have been previously described and published. For the convenience of those members who are interested in a comparison of the results of the two tests, two additional tables are appended. Table 2 give in order all the simple pigments that attained an average of from 8 to 10 in the exposure tests on the steel panels. Table 3 gives in order the pigments which had the highest inhibitive effects in the water test.

It is the opinion of the committee that the panel tests have not yet progressed far enough to justify definite conclusions being drawn. It is not only possible, but probable, that in the course of time many of the plates that are at present in good condition will begin to fail and fall below others which now show slight deterioration. It is at once apparent, however, from an inspection of these tables that those pigments whose protective value depends upon the principle of chromate inhibition as well as those which produce basic reactions in water suspensions, have given a good account of themselves on the steel panels. In Table 2 out of 18 pigments [illegible] tests, there are but five exceptions to the above statement, represented by pigments Nos. 5, 12 14, 16 and 7 (No. 7, [illegible] almost be considered a water inhibitor, owing to its ZnO content, 50 per cent). All these pigments are claimed to be good excluders and do not depend upon solubility in water, and consequently on any inhibitive value for the protection provided. Beyond calling attention to this point the committee prefers to refrain from drawing conclusions at this time from the results of these tests.

The committee is unanimously of the opinion that up to the present time no differences are discernible in the duplicate protective coat-

TABLE I.—PIGMENTS USED AS PROTECTIVE COATINGS ON STEEL PLATES.

Pigment Number.	Name of Pigment.	Wt. of pigment in gal. of oil Pounds.	Specific grav. of paint as received.	Grams of paint to panel at 900 sq. ft. spreading rate.
1	Dutch Process White Lead	20.49	2.45	61
2	Quick Process White Lead	20.34	2.47	62
3	Zinc Oxide XX	16.68	2.12	59*
4	Sublimed White Lead	19.17	[illegible]	[illegible]
5	Sublimed Blue Lead	19.17	2.42	61
6	Lithophone	12.78	1.80	[illegible]
7	Zinc Lead White	13.26	1.96	49.4
9	American Orange Mineral	26.91	2.97	74.7
10	Red Lead	26.10	2.93	73.6
12	Bright Red Oxide	15.78	2.05	60**
14	Venetian Red	9.30	[illegible]	38
15	Metallic Brown	9.51	[illegible]	37.7
16	Natural Graphite	7.80	1.37	34.4
17	Artificial Graphite	6.63	1.22	30.8
19	Lampblack	1.82		
	Natural Barytes	8.32	[illegible]	40.2
20	Willow Charcoal	4.47	1.08	27
21	Gas Carbon Black	1.39		
	Natural Barytes	10.03	1.67	50.7†
24	French Yellow Ochre	8.82	1.46	37
27	Barytes Natural	13.38	[illegible]	[illegible]
28	Barytes Precipitated	12.69	[illegible]	[illegible]
29	Calcium Carbonate (Whiting)	8.22	[illegible]	[illegible]
30	Calcium Carbonate (Precipitated)	7.68	1.35	34
31	Calcium Carbonate (Gypsum)	6.99	1.25	31.4
32	China Clay (Kaolin)	8.01	1.34	34
33	Asbestine (Silicate of Magnesium)	8.25	1.38	34.7
34	American Vermilion (Chrome Scarlet)	20.49		[illegible]
36	Medium Chrome Yellow	17.64		[illegible]
39	Zinc Chromate	10.71	1.57	39.2
40	Zinc and Barium Chromate	10.35	1.58	40
41	Chrome Green, Blue Tone	13.32	1.94	49
44	Water Stimulative Prussian Blue	5.88		[illegible]
45	Water Inhibitive Prussian Blue	5.79	....	34.5§
48	Ultramarine Blue	7.20	1.29	32.5
49	Zinc and Lead Chromate	14.28	1.92	48.3
51	Magnetic Black Oxide	15.00	1.92	48.3
Composite Paints:				
111	Brown Made from pigments	10.72	1.30	32.7
222	Black that were inhibitive	10.86	1.30	32.8
333	White in the water	14.52		[illegible]
444	Green.. test	12.77	1.53	38.6
Composite Paints:				
555	Black Made from pigments	[illegible]		[illegible]
666	Brown that were stimulative	11.74	1.41	35.5
777	White in the water	[illegible]		[illegible]
888	Green test	14.57	1.75	44

*50.5 grams + 8.5 grams. Thick paste requiring 170 grams turpentine to thin 1000 grams to working consistency, thus raising [illegible] grams.

**51.5 + 8.5. 1000 grams paste required 166 grams turpentine.

†42 + 8.72. 1000 grams paste required 218 grams turpentine.

‡56 + 11.1. 1500 grams paste required 299 grams turpentine.

§29.5 + 5.0. Required 163 grams turpentine.

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*Report of Committee of the American Society for Testing Materials, presented June 30, by Dr. A. S. Cushman, Chairman.

ings applied to different types of steel or to surfaces prepared in different ways. As would be expected, however, the panels which faced the ocean and acted to some exent as a wind break to the other lines, show slightly advanced deterioration.

In addition to the single pigments which were common to both series of tests a number of composite paints were included. These composites were made up in part from pigments that had shown themselves as water stimulatives, and in part from water inhibitives. Both types, however, were to some extent reinforced with other pigments from the indeterminate class. Such results as have shown up so far can be judged by an inspection of the tables.

It was the consensus of opinion in the committee that the results of the inspection would be made more thorough by removing the paint films from one set of plates, so that the condition of the surface underneath the paint could be examined. As there are six duplicate panels for all of the single pigments, the committee felt that this could be afforded and consequently this action was voted and a subcommittee appointed to carry out the work. The results obtained are discussed in an appendix to this report.

The report of the special subcommittee, which had direct charge of the preparation, erection and painting of the steel test panels, follows. The report gives information necessary to the proper understanding of all the details of the tests, and is in the main self-explanatory. One or two points, however, require further explanation. In some cases the general method adopted for making up the paints with a standard quantity of oil did not yield a proper painting consistency, which, therefore, required that a certain amount of turpentine should be added. In the application of some of the black pigments special difficulties were encountered and in order to reduce these to a proper consistency they were used in combination with definite amounts of barytes. This was unfortunate, as it may completely destroy the comparative value of the tests as far as these black pigments are concerned. In view of the fact that none of the straight barytes panels, Nos. 27 and 28, escaped deterioration in the tests, it was manifestly unfair to the black pigments to mix them with this material. The results obtained on these particular panels should therefore be interpreted as applying only to the specific mixtures employed.

Report of Special Subcommittee in Charge of Painting and Erection of Steel Test Panels at Atlantic City.—All the pigments enumerated below are ground in quantities by weight shown in two-thirds of a gallon, by measure, of raw linseed oil, and one-third gallon of boiled linseed oil, without regard to consistency, as arranged.

The resulting material was put up in one quart friction top cans, the covers of which were stamped with the letter "P" and a number, as per key given. The labels read "Pigment No. 1," and so on. (See Table 1, p. 34.)

Preparation of Formulas.—The preparation of the formulas for the paints to be used in the field test involved the taking of the specific gravity of the various pigments, and when this was accomplished a definite formula for the grinding was decided upon so that the same amount by volume of each pigment would be used in the same quantity of oil. (Sp. Gr. of Pigment×3=lbs. Pigment to Gal. Oil.) It was decided to grind these pigments separately, in a mixture of two-thirds raw and one-third boiled linseed oil, no drier being included because of the unknown factor which would be introduced by the lead content of such drier. Besides, the pigments ground separately in oil, a series of composite paints was

TABLE II.—FIRST INSPECTION OF PAINTTEST STEEL PANELS, ATLANTIC CITY, N. J. APRIL 15, 1910.

Panel Paint.	Examined for.	Cushman.	Chapman.	Gardner.	Lyon.	Toch.	Voorhees.	Walker.	Average.	Maximum.	Minimum.
1 -White lead (Dutch process)	Cor.	8	9	9	9	7	9	10	8.7	10	7
	Con.	3	7	6	7	5	6	9	6.1	9	3
2—White lead (Quick process)	Cor.	8	9.5	9	10	7	9	10	8.9	10	7
	Con.	3	8	6	7	6	6	9	6.5	9	3
3—Zinc oxide	Cor.	3	3	4	5	0	2	2	3	5	0
	Con.	3	3	5	4	0	5	2	3	5	0
4—Sublimed white lead	Cor.	8	9.5	10	10	8	10	10	9.3	10	8
	Con.	2	8	9	9	10	7	9	7.7	10	2
5—Sublimed blue lead	Cor.	9	9.5	10	10	9	10	10	9.6	10	9
	Con.	1	8	9	10	10	6	9	7.5	10	1
6 -Lithopone	Cor.	3	6	5	6	3	2	2	4.1	6	2
	Con.	4	5	5	6	2	5	5	4.5	6	2
7 -Zinc lead white	Cor.	5	9	8	9	7	8	10	8	10	5
	Con.	7	8	8	9	8	8	9	7.7	9	7
9—Orange mineral (American)	Cor.	7	10	10	10	6	10	10	9	10	6
	Con.	6	9	9	10	6	9	10	8.4	10	6
10—Red lead	Cor.	6	10	10	10	6	9	10	8.7	10	6
	Con.	6	9	9	9	6	8	9	8	9	6
12—Bright red oxide	Cor.	8	10	9	10	8	10	10	9.3	10	8
	Con.	8	9	8	9	9	8	9	8.5	9	8
14—Venetian red	Cor.	6	9.5	5	6	6	9	9	7.2	9.5	5
	Con.	6	9	8	6	6	8	7	7.1	9	6
15—Metallic brown	Cor.	7	7	6	8	6	5	5	6.3	8	5
	Con.	5	8	7	8	6	7	7	6.8	8	5
16—Natural graphite	Cor.	8	10	8	10	8	10	10	9.1	10	8
	Con.	7	9.5	8	10	6	9	9	8.3	10	6
17—Artificial graphite	Cor.	5	8	7	9	7	6	8	7.1	9	5
	Con.	6	8	8	9	7	7	9	7.7	9	6
19—Lamp black	Cor.	7	8	6	9	7	5	8	7.1	9	5
	Con.	7	8	7	9	7	7	9	7.7	9	7
20 -Willow charcoal	Cor.	8	9.5	9	10	8	9	8	8.8	10	8
	Con.	8	9	9	9	8	8	9	8.5	9	8
21—Carbon black (gas)	Cor.	7	9.5	6	10	8	9	9	8.3	10	6
	Con.	7	9	8	10	7	8	9	8.3	10	7
24—Yellow ochre (French)	Cor.	6	7	5	10	5	3	3	5.8	10	3
	Con.	4	8	5	7	5	6	6	5.7	8	4
27—Barytes (natural)	Cor.	3	6	5	8	3	2	2	4.1	8	2
	Con.	3	7	6	8	5	6	4	5.1	8	3
28—Barytes (precipitated)	Cor.	3	5	5	7	5	2	2	4.1	7	2
	Con.	2	5	5	6	2	2	6	4	6	2
29—Calcium carbonate (whiting)	Cor.	0	0	0	1	0	0	0	.1	1	0
	Con.	0	0	0	0	0	0	0	0	0	0
30—Calcium carbonate (precipitated)	Cor.	0	0	0	0	0	0	0	0	0	0
	Con.	0	0	0	0	0	0	0	0	0	0
31—Calcium sulphate (gypsum)	Cor.	1	5	0	6	1	0	5	2.5	6	0
	Con.	1	4	2	6	1	0	5	2.7	6	0
32—China clay (kaolin)	Cor.	3	9.5	10	9	5	9	6	7.3	10	3
	Con.	2	8	8	8	5	5	6	6	8	2
33—Asbestine (silicate magnesium)	Cor.	3	9	10	9	5	8	7	7.3	10	3
	Con.	2	8	9	9	5	8	7	6.8	9	2
34—American vermilion (chrome scarlet)	Con.	10	10	10	10	9	10	—	9.1	10	5
	Con.	9	9	10	10	10	8	9	9.3	10	8
36—Medium chrome yellow	Cor.	6	8	6	8	5	9	7	7	9	5
	Con.	7	7	8	8	5	8	8	7.3	8	5
39—Zinc chromate	Cor.	8	10	10	10	8	10	10	9.4	10	8
	Con.	8	9	10	9	10	8	9	9	10	8
40—Zinc and barium chromate	Cor.	9	10	10	10	9	10	10	9.7	10	9
	Con.	8	9	10	10	9	8	9	9	10	8
41—Chrome green (blue tone)	Cor.	10	10	10	10	9	10	10	9.8	10	9
	Con.	9	9	10	10	9	8	9	9.1	10	8
44—Prussian blue (water stimulative)	Cor.	7	9.5	10	10	8	10	10	9.2	10	7
	Con.	8	9	10	9	8	8	10	8.8	10	8
45—Prussian blue (water inhibitive)	Cor.	8	9	10	10	7	10	8	8.8	10	7
	Con.	10	9	10	9	7	9	10	9.1	10	7
48—Ultramarine blue	Cor.	2	8	2	7	1	4	4	4	8	1
	Con.	0	6	2	5	1	4	4	3.1	6	0
49—Zinc and lead chromate	Cor.	9	10	10	10	8	10	10	9.5	10	8
	Con.	9	9	10	9	9	8	9	9	10	8
51—Magnetic black oxide	Cor.	9	10	9	10	9	10	10	9.5	10	9
	Con.	7	9	9	9	9	8	10	8.7	10	7
111—Brown (composite paint)	Cor.	5	9	10	9	9	10	8	8.5	10	5
	Con.	7	9	10	9	9	8	10	8.8	10	7
222—Black (composite paint)	Cor.	7	9.5	10	9	7	10	9	8.8	10	7
	Con.	4	9	9	4	7	6	7	6.5	9	4
333—White (composite paint)	Cor.	6	8	9	6	5	9	8	7.3	9	5
	Con.	6	9	9	8	5	6	7	7.1	9	5
444—Green (composite paint)	Cor.	5	8	9	9	5	9	9	7.7	9	5
	Con.	6	8	9	8	5	7	8	7.3	9	5
555—Black (composite paint)	Cor.	8	9.5	8	10	9	10	9	9.1	10	8
	Con.	9	9	8	9	9	8	9	8.7	9	8
666—Brown (composite paint)	Cor.	8	10	8	10	8	10	9	9	10	8
	Con.	8	9	8	9	8	8	9	8.4	9	8
777—White (composite paint)	Cor.	7	9.5	8	10	9	10	10	9.1	10	7
	Con.	4	9	8	8	9	7	9	7.7	9	4
888—Green (composite paint)	Cor.	8	10	8	10	10	10	10	9.4	10	8
	Con.	5	9	8	9	9	8	10	8.3	10	5
2000—1 coat zinc chromate, 1 coat iron oxide excluder	Cor.	9	10	10	9	5	10	6	8.4	10	5
	Con.	6	7	8	7	10	6	8	7.4	10	6
3000—1 coat red lead, 1 coat iron oxide excluder	Cor.	7	8	10	10	5	8	6	7.7	10	5
	Con.	6	7	7	7	5	6	8	6.5	8	5
4000—1 coat red lead	Cor.	7	9.5	10	10	8	9	6	8.5	10	6
	Con.	7	8	8	8	8	6	8	7.5	8	6
100—Straight carbon black paint with turps and dryer	Con.	4	9	7	10	7	10	8	7.8	10	4
	Con.	9	9	7	10	4	7	10	8	10	4
90—Straight lampblack paint with turps and dryer	Cor.	6	9.5	7	10	9	10	7	8.3	10	6
	Con.	8	[illegible]	7	10	6	8	9	8.1	10	6
5555—Coal tar paint over red lead	Cor.	7	5	0	5	0	8	4	4.3	8	0
	Con.	2	3	0	4	0	6	1	2.3	6	0
1000—Chrome resinate in oil, 1 coat	[illegible]	4	7		5	0	3	2	3	7	0
	Con.	5	5	-	5	0	3	3	3	5	0
1 plate—Boiled linseed oil, 3 coats linseed	Cor.	4	7	0	9	0	0	—	3.3	9	0
	Con.	3	6	0	8	0	0	-	2.8	8	0

TABLE III.—ANALYSIS OF AVERAGES.

Grade of Excellence from 8 to 10.
(Only pigments included which were common to both tests.)

No.	Pigment.	Average.
34	American vermillion (chrome scarlet)*	9.8
41	Chrome green (blue tone)	9.8
40	Zinc Barium chromate	9.7
5	Sublimed blue lead	9.6
4	Sublimed white lead	9.5
49	Zinc lead chromate	9.5
39	Zinc chromate	9.4
12	Bright red oxide	9.3
44	Prussian blue (water stimulative)	9.2
16	Natural graphite	9.1
9	Orange mineral (American)	9
36	Medium chrome yellow	9
2	White lead (quick process)	8.9
20	Willow charcoal	8.8
45	Prussian blue (water inhibitive)	8.8
1	White lead (Dutch process)	8.7
10	Red lead	8.7
7	Zinc lead white	8

*Average of 6, leaving out Walker's low value 5, which was evidently in error. This action was authorized by vote in committee.

made. These paints were made up in part mainly from the water inhibitive and in part from the water stimulative types of pigments. The composition of these special paints is given below.

Preparation of Plates.—Several hundred plates were obtained for the test and one-half the number were pickled in sulphuric acid, then neutralized with soda ash, thoroughly washed, and preserved from future oxidation in dry lime until needed for the test. The removal of the mill scale was complete in the case of the pickled plates, and a perfectly clean, neutral surface was obtained upon which to apply the paints.

Painting of Plates.—The painting of the plates was done under cover in a temporary building erected for the purpose. This was necessary in order to have uniform conditions for the application of each formula. A definite spreading rate of 900 sq. ft. to the gallon was used on the paints applied to the cleaned plates, while the paint applied to the black plates, i. e., those not pickled and having the ordinary black mill scale, had no definite spreading rate. The paint was applied under the constant supervision of the director of tests, by the painters representing the committee and the Master Painters' Association. Three-coat work was used throughout on the cleaned plates upon which the original fifty-one pigments were applied, but in some cases, on the black plates, where the special formulas were applied, two-coat work was used.

Details of Application.—After the specific gravity of the paint had been taken and the amount necessary for the application to each panel has been reckoned according to the spreading rate, a quart of paint was placed in a half-gallon enameled cup and stirred well to bring the mixture to thorough incorporation. A brush was thoroughly worked into the paint, and pot and all was placed upon the balance and the weight taken in grams, using the metric system throughout the test. The pot was then handed to the painter, who applied the paint to one plate. The number of grams applied to each panel was deducted from the counter balance, and when the pot, paint and brush exactly balanced, the panel was cross-brushed and laid out. The final weighing was then made to see that the counterbalance was maintained. The plates during the work were set upon a frame resting upon a bench, room being allowed beneath the plate for the painter to place his hands when lifting it after the brushing has been finished. The plate was then taken from the bench and slid into a specially prepared rack, so that the paint would dry in a horizontal position. Racks for several hundred of these plates were built and used during the test.

COMPOSITION OF SPECIAL FORMULÆ.

No. 111.

Pigment Formula		Paint Formula
60	Burnt Umber	22.50
20	Zn. and Ba. Chromates	7.50
20	Zinc lead	7.50
	Japan	3.40
	Raw Oil	59.10

No. 222.

Pigment Formula		Paint Formula
30	Bone Black	13.72
2	Prussian Blue	.92
10	XX Zinc	4.57
50	Silex	22.86
8	$CaCO_3$	3.66
	Japan	8.33
	Raw Oil	45.94

No. 333.

Pigment Formula		Paint Formula
35	Zinc Oxide	20.90
45	Zinc Lead	26.87
5	$CaCO_3$	2.98
15	Silex	8.95
	Japan	1.56
	Raw Oil	38.74

No. 444.

Pigment Formula		Paint Formula
60	XX Zinc	32.47
15	Zinc Chromate	8.30
3	Prussian Blue I	1.44
2	Calcium Carbonate	1.08
20	Silex	10.83
	Japan	2.22
	Raw Oil	43.66

No. 555.

Pigment Formula		Paint Formula
40	Lampblack	8.18
40	Nat. Graphite	8.18
20	Barytes	4.09
	Japan	8.33
	Raw Oil	71.22

No. 666.

Pigment Formula		Paint Formula
50	Red Oxide, 62a	22.94
5	Carbon Black	2.35
35	Barytes	15.30
10	Med. Chrome Yellow	5.88
	Japan	3.20
	Raw Oil	50.33

No. 777.

Pigment Formula		Paint Formula
60	Sublimed White Lead	44.80
20	Blanc Fixe	7.46
20	Gypsum	7.46
	Japan	1.60
	Raw Oil	38.68

No. 888.

Pigment Formula		Paint Formula
5	Chinese Blue S	4.32
35	Lemon Chro. Yellow	18.94
20	Sublimed White Lead	16.23
40	Barytes	21.35
	Japan	2.35
	Raw Oil	38.51

A sufficient length of time between the coats was allowed for the thorough drying of each pigment. Extreme care was used in painting the edges of the plates, for the reason that corrosion generally starts at this point of attack. Each pigment was applied in duplicate to each class of steel, so that when set upon the fence they could be placed in both an eastern and western exposure.

No reductions were made to any of the paints applied, except in one or two cases (see report), where the viscosity of the paint was so great that the possibility of brushing was precluded. A small amount of turpentine was added in these cases and the amount of paint to be applied to the panel proportionately increased so that when the turpentine evaporated the amount of paint originally intended would be left upon the plate.

Fences.—The fences upon which the steel plates were fastened after the painting are three in number, and each one is 125 ft. long and 5 ft. high. They are built of yellow pine studding, four by four, the posts being set 8 ft. apart and strongly counter-braced underneath the surface of the ground with two-by-fours. A strip of 2-in. batten is provided along the lower beam on either side of each fence as a resting place for the plates. The plates rest on two small pieces of rawhide fastened 18 in. apart on the battens, thus being raised a sufficient distance from the batten to prevent the accumulation of water at the bottom of the plates. The plates rest and back against the beams at top and bottom, and are fastened to these beams by metal buttons screwed into the wood between and lapping over an equal distance on two plates. Insulation of the buttons was obtained by the interposing of rubber strips between the plates and the button. The buttons were enameled and the screw heads painted and subsequently plugged with putty. This method of fastening the plates obviates the bad practice of drilling screw holes through the plates, which invariably starts a place of corrosion. Each plate has lettered upon its lower left-hand corner the number of the paint or pigment with which it is painted, and a numeral to show the class of steel used. Below each plate, in order to secure permanent identification, these same numbers are stamped in the wooden fence.

Brief Description of Pigments Used in Tests.

1—Dutch Process White Lead.—Made by the well-known old Dutch process of corrosion.

2—Quick Process White Lead.—Made by the quick process.

3—Zinc Oxide XX.—Made from sublimation of N. J. zinc ores.

4—Sublimed White Lead.—Sublimed from Missouri lead ores.

5—Sublimed Blue Lead.—Made by burning coarsely broken Galena mixed in a furnace with bituminous coal. The fumes arising from this complex mixture are streaked in appearance, white, blue and black. They are drawn from the furnace by suction fans, purified and collected by suction in a bag room. The material varies in composition considerably but its working properties are about constant. Its analysis will average about as follows: Lead sulphide, 50 per cent; lead oxide, 35; lead sulphide, 5; lead sulphite, 5; zinc oxide, 2; carbon, 3. Its color is due to the carbon and lead sulphide.

6—Lithopone. Manufactured by the double decomposition of zinc sulphate and barium pressed and furnaced, after which it is disintegrated while in its heated condition by plunging into water, where it is thoroughly washed and again filter-pressed. It is then dried and ground.

7—Zinc Lead White.—Analysis: 52.7 per cent lead sulphate; 47.2 zinc oxide. Made by sublimation of sphalerite and galena in the proper proportion, the fumes of which are oxidized and collected in bags.

9—Orange Mineral, American.—Made from white lead by the usual method.

10—Red Lead.—Made by submitting litharge to oxidation in reverberatory furnaces.

12—Bright Red Oxide.—Ninety-eight per cent of oxide of iron (copperas red).

14—Venetian Red.—Made by calcining a mixture of copperas and terra alba.

15—Metallic Brown—Made by roasting ore mined in Carbon County, Pennsylvania, for 72 hours at a cherry red heat, thus changing the iron from the carbonate to the sesquioxide. After the ore is roasted, it is simply ground and is then ready for mixing. Impurities consist of silica and alumina. Analysis of this product runs approximately: 45 per cent, iron; 45 per cent, silica (SiO_2); 10 per cent, alumina (Al_2O_3).

16—Natural Graphite.

17—Artificial Graphite.—Ninety per cent pure carbon. The ash contains carbide of silicon, small percentage of silica, iron and aluminum.

19—Lampblack.—Ninety-nine per cent pure carbon, 1 per cent ash and volatile matter. Passed U. S. Government specifications. Made from creosote and refuse oils.

20—Willow Charcoal.—From calcination of willow branches. Contains trace of potash.

21—Carbon Black.—From combustion of natural gas. Approximates 99 per cent carbon.

24—Ochre.—Hydrated silicate of iron and alumina.

27—Barytes.—Best grade of thoroughly washed, floated barytes. Analysis; Barium sulphate, 99.66 per cent; oxide of iron, 0.01; lime,

TABLE IV.—CHART OF FINDINGS OF MEMBERS OF COMMITTEES D1 AND A5, AMERICAN SOCIETY FOR TESTING MATERIALS, LOSS OF STEEL IN GRAMS IN TESTS CARRIED OUT ON PIGMENTS TO ASCERTAIN THEIR VALUE AS RUST INHIBITORS

	Pigment.	Gardner No. 1 [illegible] days	Cushman Nos. 1 and 2 10 days	Walker P. H. No. 2 7½ days	Cushman No. 2 10. days	Walker W. H. No. 1	Average
1	Zinc Cromate	.0050	.0300	.0094	.0130	.0396	.0194
2	Zinc and Barium Chromate	.0153	.0468	.0034	.0140	.0351	.0229
3	Zinc and Lead Chromate	.0094	.0277	.0153	.0085	.0620	.0246
4	Zinc Oxide	.1524	.0296	.1002	.0085	.0504	.0682
5	Zinc Lead White	.0842	.1712	.0515	.0856	.0156	.0876
6	Barium Chromate	.2333	.0101	.0429	.0094	.1932	.0978
7	Ultramarine Blue	.0247	.3185	.0137	.1865	.0496	.1186
9	Prussian Blue (Water Inhibitive)	.1438	.2267	.0448	.1130	.2671	.1591
10	Lithopone	.0160	.3791	.1274	.1792		.1754
12	Litharge	[illegible]	[illegible]	[illegible]	.1584		.2038
14	Quick Process White Lead	.2120	.3352	.1288	[illegible]		.2176
15	Calcium Sulphate	.3966	.2143	.1759	.1597		.2328
16	Metallic Brown	[illegible]	[illegible]	[illegible]	.1408	.1974	.2352
17	Orange Mineral French	.3950	.2724	.1495	.1467	.2526	.2432
19	Sublimed Blue Lead	.3177	.3425	.1001	.2365		.2492
20	Lemon Chrome Yellow	,2767	.4067	.1365	.1972		.2543
21	Orange Chrome Yellow	.2826	.4203	.1706	[illegible]	.2150	.2557
24	Venetian Red	.2682	.4756	.1955	.2375	.1564	.2666
27	Keystone Filler	.3560	.4651	.1366	.3349	.1481	.2881
28	Orange Mineral (American)	.4416	.4336	.1719	.2065		.2970
29	Umber	.1365	.5961	.1498	.3817		.3069
30	China Clay	.3493	.4770	.1248	.2445		[illegible]
31	Calcium Carbonate Precipitated	.3574	.4910	.1828	.2625	2616	.3111
32	Red Lead	.3112	.3555	.1495	.1717	.5767	.3117
33	Prussian Blue (Neutral)	.3584	.4463	.1218		.4173	.3171
34	Indian Red	.3546	.3739	.2617	.1905	.4334	.3228
36	Sublimed White Lead	.4176	.5856	.0982		.3116	[illegible]
39	Prussian Blue (Water Stimulative)	.5113	.4559	.2055	[illegible]	.5202	[illegible]
40	Mineral Black	.3050	.8018	.2017	.3529	.3353	[illegible]
41	Barytes	[illegible]	[illegible]	[illegible]	,3841	.5636	.4472
44	Artificial Graphite	.5262	.6337	,3723	.2789	.5095	.4641
45	Ochre	.4022	.8408	.2119	[illegible]		.4716
48	Precipitated Blanc Fixe	.5247	.8806	.3132	[illegible]	.5064	.5467
49	Lamp Black	[illegible]	[illegible]		.7096	.6257	.7294

0.02; magnesia, trace; silica, 0.22; moisture, 0.09; sulphuric acid, free trace.

28—Precipitated Blanc Fixe.—Made by the precipitation of barium chloride and sodium sulphate. May contain traces of sodium sulphate.

29—Calcium Carbonate (whiting).

30—Precipitated Calcium Carbonate.—Made by the precipitation of calcium chloride and sodium carbonate. May contain trace of alkali.

31.—Calcium Sulphate.—Natural.

32—China Clay.

33—Asbestin.—Silicate of magnesium.

34—American Vermilion.—Made by boiling white lead and chromate of soda and adding a small quantity of sulphuric acid in order to brighten the shade. This color is basic chromate of lead in large crystallized form. It is liable to contain free chromates, small quantities of white lead and sulphate of lead. Also small quantities of sulphate of soda.

36—Medium Chrome Yellow.—This is pure neutral chromate of lead made from nitrate of lead and chromate of soda. It is practically free from impurities and contains only very minute traces of lead salts and nitrate of soda.

39—Zinc Chromate.—This is manufactured from a zinc salt and bichromate of potash. Owing to its solubility, it is impossible to wash this perfectly, and it contains, therefore, usually a considerable amount of soluble matter, sulphate of potash, chromates and zinc oxide.

40—Zinc and Barium Chromate.—This was made by precipitating a mixture of zinc chloride and barium chloride by chromate of soda. The same remarks as under No. 39 are here in place. The product contains considerable soluble matter, consisting of zinc chloride, barium chloride, sodium chloride and chromates.

41—Chrome Green, Blue Shade.—This was made from nitrate of lead, bichromate of soda, and oil of vitroil, precipitated on white lead and Chinese blue. The resultant product contains beside chromate of lead, sulphate of lead, Chinese blue and white lead. It is liable to contain nitrate of lead salts and nitrate of soda.

44—Prussian Blue, Water Stimulative.—This is a Chinese blue made from prussiate of potash and copperas. It was oxidized with chloride of lime. The resulting product contains small quantities of chlorides.

45—Prussian Blue, Water Inhibitive.—This is a Prussian blue made from prussiate of potash and copperas. It was oxidized with bichromate of potash. It contains a certain amount of chromates to which its water inhibitive qualities are probably due.

48—Ultramarine Blue.—Made from silica, china clay, soda-ash, and sulphur, combined chemically by burning in pots in furnaces, the resulting product being ground, bolted, etc. Analysis of this product shows the presence of the above compounds.

49—Zinc and Lead Chromate.—This was made from zinc and lead acetates and chromate of soda. It contains small quantities of zinc and lead acetates and of chromates, also of acetate of soda.

51—Magnetic Oxide of Iron.—Not properly speaking a magnetic oxide. Made by neutralizing acid ferrous sulphate liquor with an alkali and blowing air through.

Lock Work at Miraflores.

Concrete operations in the upper lock at Miraflores were begun on May 30 with part of the auxiliary mixing plant formerly in use at the Pedro Miguel Locks. At present there are two ½-yard mixers and one ⅓-yard mixer in service. Three additional ½-yard mixers of the cube type have recently been ordered from the States, and two 2-yard mixers similar to those in use in the permanent construction plant at Pedro Miguel will be installed near the north end of the east storage trestle. These two mixers will be operated by electricity and will deliver into buckets, which will be hauled on cars to a track under the boom of the east berm crane, and the concrete will be placed by the latter in the east wall. The mixers will be so located in the trestle that cars of crushed rock and sand can be dumped directly into their hoppers.

The lock work at Miraflores now consists of drilling, blasting and excavating for the lateral culverts and the intermediate gate section, and the laying of concrete in the trenches already excavated and in the lock floor. The latter ranges in thickness from one foot, where the original bottom remains undisturbed, to five feet where holes have been caused by blasting. Raw material for the concrete is dumped into small storage piles in the lock and conveyed in wheelbarrows to the mixers, which are stationed alongside the culvert trenches to enable them to deliver directly on the near side, or into a chute for conveyance to the far side. The mixers, including the motive equipment, are set upon rollers, so that they can be moved forward and backward at will.

Excavation of the trenches and intermediate gate section is proceeding by means of two derricks and two locomotive cranes, the material being shoveled by hand into 2½-yard skips, thence dumped into cars and hauled away. At present the spoil is used in the construction of an embankment which will carry the new hydraulic pipe-line to the fill of the west dam.

It is proposed to continue the building of the floor and culvert section and to complete it in advance of the work on the walls. One of the berm cranes on the east bank, which will form a part of the permanent construction plant at this point, has been erected, and will be placed in service shortly, hoisting material into cars from the east head wall at the north end of the lock, where considerable excavation remains to be done.

The dumping of crushed rock and sand from the 500-foot west storage trestle was begun a few days ago, and dumping from the east trestle will probably be commenced this week. The storage capacity of the two trestles represents about one-fourth of the crushed rock and sand required in the construction of these locks.

The water that enters the lock chambers, or collects from rains, now flows into a large sump at the south end of the lock, from which it is expelled by two motor-driven pumps, one an 8-inch and the other a 12-inch. These took the place of two old French pumps formerly in service there.

LETTERS TO EDITOR.

Amount of Cement Required for Making Joints in Sewer Pipe.

Sirs: I would appreciate it very much if you can advise me how much cement is required to make a joint on the different sizes of terra cotta pipe, say up to 30 ins. diameter.

I would also like to know what the weight is of a cubic foot of cement of a mixture suitable for making joints in terra cotta pipe.

Thanking you in advance for this information,

Very truly yours,

G. McK.

Philadelphia, Pa., July 20, 1910.

(The amount of cement required will depend on the mixture used and on the nature of the joint, whether made "flush" or "overfilled," and whether standard or deep socket pipe is used. The amount in cubic yards of material required to lay 100 ft. of pipe in 2-ft. lengths is given in Gillette's "Handbook of Cost Data" for various mixtures and for both "flush" and "overfilled" joints for both standard and deep socket pipe. The tabulations are too long to be reprinted here.—Editors.)

States Which Have Laws Licensing Engineers.

Sirs: Being desirous of introducing a law into the coming Legislature licensing engineers and surveyors in this state, I am asking you if you will tell me what states have such laws, also where I could obtain copies of the same. As I am desirous of obtaining whatever information is available in this line, any suggestions will be thankfully received.

Thanking you in advance for your kind attention, and awaiting your reply, I am,

Very truly yours,

A. D. M.

Portland, Ore., July 26, 1910.

(There are laws governing the practice of engineering in the states of Wyoming, Louisiana and Florida. In addition the states of Idaho and South Dakota have laws governing the practice of land surveying. The published statutes of the states named contain these laws and it is possible that copies may be secured by addressing the Secretary of State. Our correspondent will find useful the committee report on Licensing Engineers which was presented a few weeks ago to the American Society of Civil Engineers and which was published in ENGINEERING-CONTRACTING for July 6, 1910.—Editors.)

Information Concerning Highway Commissions.

Sirs: We wish to get information regarding laws and regulations governing the making and maintenance of public highways of the various states. We wish to know from each state their specifications for new roads; laws regarding repairs and maintenance of roads, and duties of, and rules governing, the highway commissioners. Can you advise us how we may best obtain this information? Anything you can do to help us in this matter will be greatly appreciated.

Yours very truly,

THE AMERICAN BRASS CO.,

Library Department.

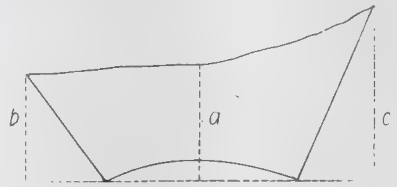
Aug 5, 1910.

(Our correspondent can probably secure best the information desired by addressing requests to the highway commissioners of the states that have such bodies. The following is a list from memory of the states which have highway commissions: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Virginia, Ohio, Illinois, Missouri, Michigan, Mississippi, Iowa, Washington and Utah. The commissions have offices at the state capitals.—Editors.)

Computing Area of Cross-Section and Yardages in Highway Work.

Sirs: As a matter of general interest I should be glad to see you discuss the question of estimates on county road work, giving the methods which prevail in different sections of the country, and comparing them in accuracy with the correct methods. To illustrate, in the accompanying sketch a, b and c are given, the width of the roadbed is 20 ft., the crown is 1 ft. and elliptical, the stopes are 1 on 1. What formula is commonly used in computing the area of the cross-section? If the crown be roof-shaped, instead of elliptical or circular, the following formula gives accurate results and is easy of application: $\frac{1}{2} [10 (b + 2a + c) + (a + 1) (b + c)]$.

If the roadbed be circular, there will have to be subtracted about 3.15 sq. ft. for each cross-section—the same amount being added for fills when the formula becomes: $\frac{1}{2} [10 (b + 2a + c) + 3\text{-}2 (a - 1) (b + c)]$.



The practice with some engineers is to disregard the 3.15 sq. ft. and compute the areas as if the roadbed were roof-shaped. What I wish to inquire is: what is general practice, particularly in the south? It makes quite a difference to the contractor and I hope to see a discussion of the matter in your excellent paper. Also I should like to know the methods used in compiling yardage, having the cross-sections given. The most accurate formula, I should think, would be the prismoidal formula, though practically, owing to the general convexity of the ground in cuts, it gives results too small, but, I think, not very much, and if an end section tapers to a point forming a pyramid, one-third the base by the altitude would be correct. Is it good practice to use one-half?

E. C. H.

Bristol, Tenn., Aug. 5, 1910.

(We are not able to give our correspondent specific information as to practice in the South and will refer the question to our readers. Generally both the prismoidal formula and the average end areas formula are used by road engineers, the latter being the one most commonly used. In Gillette's "Earthwork and Its Cost" there is given a method of employing average end areas formula with accuracy on practically all classes of earthwork, for if the cross-sections are taken close enough together the difference between the average end areas formula and the prismoidal formula becomes exceedingly slight. The rule referred to enables one to determine how close the sections should be taken. In computing the area of cross-sections such as is illustrated it is the practice of the writer to divide the section into four triangles; the bases of two of these triangles are the half widths of road bed and the common base of the other two is the center cut. From this area deduct the area of the segment formed by the crown of the road; this area is constant for any given width and crown. We shall be glad to hear from our readers on the subjects brought up by our correspondents.—Editors.)

Construction of Levees on Permeable Soil.

Sirs:—Answering the inquiry of "O. G. B." of Osgood, Iowa, published in your issue of Aug. 3, I herewith enclose copy of U. S. Government specifications for levees along the Mississippi river. On page 5, paragraph 38, under "Method of Construction of New Levees" may be found the most approved method of constructing levees on foundations of sandy or pervious soil. The muck ditch excavated along just on the river side of the center of the levee and refilled with a relatively non-pervious soil is depended upon to decrease the under seepage and prevent undermining. The depth and width of the muck ditch varies according to the character of the foundation and sub-soil, and according to the duration and head of water to be held.

Full information is not given in the inquiry, but I think in cases where the levee is small, as stated, that a muck ditch 6 or 8 ft. wide and of a depth sufficient to penetrate the sand and gravel into the sub-soil beneath would give satisfactory results. The muck ditch is in the nature of a puddle wall.

If the flood way mentioned is in the nature of an irrigation canal and it is important to conserve the water, and if the sand and gravel foundation is too thick and deep to be penetrated by a muck ditch, I should think that it might be more economical to puddle the base and walls of the canal, or sides of the levees.

Probably the best information as to this character of work can be obtained from the Chief Engineer of the U. S. Reclamation Service, Department of Interior, Washington, D. C.

Yours very truly,
HARRY N. PHARR.

Memphis, Tenn., Aug. 6, 1910.

[The paragraph of the U. S. Government specifications referred to by our correspondent is given below.—Editors.]

38. Method of Construction of New Levees.—The ground to be occupied by the levee must be cleared of logs, trash, brick, weeds, grass, leaves, and all other perishable or objectionable material to a distance of five feet outside the slope stakes. Next shall follow in the order indicated by the engineer in charge, or his designated agent, the thorough breaking of the surface to a depth of six (6) inches between the slope stakes, and the grubbing up and removal of all trees, stumps, and the larger roots, and also all buried logs, stumps or other perishable matter, over the same area, including a zone of five (5) feet wide outside the slope stakes. All of the matter so grubbed and excavated shall be conveyed to a distance outside the slope stakes of not less than five (5) feet. Such of this matter as shall remain undiscovered until the muck ditch is dug shall then, in like manner, be excavated and removed. After the satisfactory completion of the clearing, grubbing and surface breaking, and the removal from the ground of all debris, a muck ditch will be cut of such dimensions and in such location as the engineer in charge shall direct. After inspection and measurement the muck ditch must be filled in, if possible by scrapers, with approved material procured from without the base of the levee, and thoroughly tamped while being filled, by the teams passing over the material, to the satisfaction of the engineer in charge, or his designated agent. If it be impracticable to refill the ditch by scrapers, it will be done by men in the direct employ of the contractor, and under his immediate supervision, and the material will be tamped by mauls or by horses or mules passing over it as it is deposited in the ditch, to the satisfaction of the engineer in charge. In no case will the refilling be let to station men. The fill and side stakes shall then be set by the contractor. All of the foregoing work shall be completed for at least three hundred (300) feet in advance of the embankment. When this has been done, embankment construction shall be commenced; the first earth obtained from the borrow pits shall be placed on the land side of the center line of the levee; the embankment shall then be carried up to gross fill or height, as directed by the engineer in charge. Only clean earth, free from trash, roots, or other objectionable material, shall be placed in the levee. When so required stump holes must be tamped as the material is thrown in them, and for this an extra compensation, to be determined by the engineer in charge, will be allowed. When the embankment has been brought up to the proper height, it shall be dressed and planted with living tufts of Bermuda grass, not more than two (2) feet apart, well pressed into the earth and lightly covered with soil, to the satisfaction of the engineer in charge, or his designated agent. The contractor will cut down all trees, both great and small, to a distance of one hundred (100) feet from the base of the levee on both sides. The trees will be felled in such manner as not to fall on the levee.

Sirs: Answering the inquiry of O. G. B. about building levees 6 ft. high to hold 4 ft. head of water for several days:

If the loaming soil forming the surface stratum were 5 or 6 ft. thick, there would, in the writer's opinion, be no danger of undermining the levee by seepage unless the water should stand against it for several weeks or months.

A great many miles, if not all, of the levees along this part of the Mississippi River have sandy strata, and frequently sand strata under them, but there is usually a surface soil at least 5 ft. thick which is comparatively impermeable. These levees stand under a head of water for weeks, and while there is much seepage in some localities, it is not often that a well built levee gives cause for alarm. When it does, prompt measures are adopted to strengthen it.

If the sand and gravel stratum is not more than say 3 or 4 ft. deep, O. G. P. is advised to cut a narrow "muck ditch" through it, under the center line, and to refill this with the least permeable material at hand. If material is scarce, he would better use his top soil to fill the muck ditch and his sand and gravel to build the levee. If the sand preponderates, so that it fills completely all voids between the gravel, the seepage would be about the same as for sand, and if this is graded, the writer believes that a levee of this material 6 ft. high, 10 ft. crown and 3 to 1 slopes on both sides would stand against 4 ft. of water.

The muck ditch should be well tamped or puddled when refilled. Such a ditch, say 6 ft. deep, would do good even if it should not go through the permeable stratum.

It is probable that the levee would stand, without a muck ditch, if the base be made very wide—say 3 to 1 and 4 to 1 or 5 to 1 slopes. This depends upon the extent of the sand and gravel stratum and whether the voids in the gravel are well filled. There should be no excavation on the land side of the levee.

Respectfully,
A. L. DABNEY.
Asst. Chief Engineer Tallahatchie Drainage District.

Clarksdale, Miss., Aug. 7, 1910.

Sirs: Replying to your Iowa correspondent concerning small levees on sandy loam, in my opinion he has planned his levees too narrow on top. I would not use less than 8 ft. top width and slopes of 3:1, giving a good wide berm and wide shallow borrow pits on the outside, or river side. As soon as possible after construction get a grass started on the levee and in the borrow pits. White clover will start quicker than any grass that I know of, except Bermuda grass, and any person that will introduce that into our river bottoms should ornament the lower end of a rope.

My experience has been that the average soil in the river bottoms does not seep so very bad, unless you open up a pure sand pocket, and then a few overflows coming into your borrow pits and against your levees will deposit a sediment that will quickly lessen the seepage and with better result if your pits are shallow and dry out and the sun gets a good chance to bake the soil after each overflow.

To have two new levees that were built last fall that have had the water against them twice this season, once for four days and once for seven days, with no great amount of damage in either case. These levees are built up from the soil adjacent to the levee, which runs from gumbo to almost pure sand. The gumbo sections are 5 ft. wide on top with slopes of 2:1; the sand sections are 8 ft. wide on top with slopes of 3:1. With these two limits as a guide I varied my cross-section to fit the material as I found it. My minimum height was about 3 ft., maximum 12 and average about 6 ft. I consider that I was successful.

Yours respectfully,
W. L. HAZEN,
Engineer.

St. Joseph, Mo., Aug. 9, 1910.

Pavement Crowns.

Sirs: In a paper prepared on the above subject by the undersigned for the Convention of American Society of Municipal Improvements held in Little Rock, Ark., in November, 1909, which was published in most of the engineering papers* as well as the Proceedings of the Convention, the general rule was given, for monolithic pavements providing roughened or grainy surface, to provide crown ¼ in. per foot of width of roadway between tracks and that ⅓ of the fall be between crown and quarter and ⅔ between quarter and gutter. A rule in quite common practice is 1 in. crown in 5 or 6 ft. of width and ¼ of the fall between crown and gutter and ¾ between quarter and gutter. The paper gave variations for peculiar conditions such as steep grades, streets having railroad tracks or having curb on one side at a higher level than the other side of the street.

The effect if the rule suggested by the paper referred to as compared with flatter crowns in common practice is:

(a) To slightly raise the crown and consequently provide better flow of water to the gutter.

(b) To increase the ratio of fall from the center of the roadway to the "quarter" point thus overcoming the flat crowns holding water and causing deterioration which are so common in street pavements.

These were the cardinal principles the paper intended to bring out. In discussion following reading of the paper, it was criticized as not providing points between the quarter and gutter and between the quarter and crown. While these "mid-quarter" points are quite unnecessary unless the streets are wider than 40 ft. the criticism of the omission was well taken and the writer replied as it now appears with insufficient thought as follows:

"With reference to suggestion, that my rule did not provide for grades intermediate between the quarter and the curb, or between the quarter and the crown, I must admit that my paper was faulty in that respect. With streets, say 40 ft. wide, I believe my rule is sufficient and no intermediate points are necessary or advisable. If the streets were of unusual width, the rule I would follow would be to first find the crown, and then find the quarter and intermediate points by sighting across with a "T." If the street is of such width that you want intermediate stakes, make the same division between the quarter and the curb as between the quarter and the crown, that is let two-thirds of a total fall be in the half nearest the curb and one-third in the half nearest the crown."

Though private correspondence, Mr. G. B. Zahniser, C. E., of New Castle, Pa., kindly calls my attention to the fact (quite overlooked in my "off-hand" reply to the conditions above referred to) that this provides a "straight line from the crown mid-quarter point to the curb mid-quarter point." Mr. Zahniser agrees with the writer's cardinal rules above referred to, and as to mid-quarter points suggests the following rule, which the writer heartily endorses:

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*Engineering-Contracting, Nov. 10, 1909.

"First drop one-eighth the crown at the crown mid-quarter point.

"Second drop one-third the crown at the quarter point.

"Third drop five-eighths the crow at the curb mid-quarter point."

The writer's rule, thus modified by Mr. Zahniser, gives the following on a nearly flat street with roadway 80 ft. wide between gutters on streets having no tracks:

"Crown 20 ins. above gutter.

"First drop one-eighth of the crown at the crown mid-quarter point 2½ ins. below the crown.

"Second drop one-third the crown at the quarter point, 6⅔ ins. below the crown.

"Third drop five-eighths of the crown at the curb mid-quarter point, 12½ ins. below the crown."

Will you kindly give space for these important corrections and oblige.

Very truly yours,
GEO. E. WARREN.
Boston, Mass., Aug. 11, 1910.

Increase in Wages and Decrease in Efficiency of Labor.

Sirs: With reference to the cost of labor at the present time compared with 1905, and for particulars as to the efficiency of labor today as compared with the earlier date, and something as to the cost of boarding men and horses at the present time as compared with five years ago, we have made some investigation, but are not yet in position to give all the facts.

General comparison of rates paid five years ago to different classes of men, and the amounts paid them now on certain portions of our work which we have looked into, does not bear out the assertion in the article which you speak of that there has been great increase within the past five years. There has been generally an increase, but it seems mostly on our work to have been in the way of bonuses paid for continued and faithful service.

Taking work which this company is doing in the northern part of Minnesota stripping mines, comparing this year with 1905, there has been no increase in the actual wages paid dinkey engineers, blacksmiths and helpers, teamsters, cooks, powder men, shanty bosses and a few others. We are paying the same wages to a master mechanic now as at that time; an advance of 25 to 50 cts. per day for blacksmiths and about the same for blacksmith helpers; 25 cts. per day more for carpenters, car repairers and firemen; 10 to 20 cts. per day more for drillers; from 10 to 35 cts. per day more for brakemen; from 10 to 35 cts. per day more for labor; in some cases—25 cts. per day more for dump foremen; 10 to 35 cts. per day more for switchmen; 50 cts. more per day for oil men; 10 to 35 cts. per day more for pit men; wages of steam shovel engineers have gone up about 20 per cent and of cranesmen about 16 per cent.

It is a little difficult to be certain about this from our records, as there is a variation of rate paid sometimes, due to the real efficiency of men occupying the same position, or the same position so far as the payroll indicates it. As a matter of fact, on this work of which we speak there is paid something like 10 per cent in the way of bonuses to men who are particularly efficient, or who remain throughout the season and perform satisfactory service. This is a premium which we give for the purpose of retaining men throughout the season, as we consider that generally their efficiency and worth increases with the length of their service.

As to the general efficiency of labor as compared with five years ago, while it is pretty difficult to secure any basis of exact comparison, or determine upon percentage of decrease, it is the general observation that there has been, generally speaking, a decrease in the efficiency of labor during the time named. It would be difficult to assign a reason for this. It is doubtless due to many causes. It is the common observation and opinion in contract work that generally efficiency decreases with an abundance of work and with higher wages. To put it plainly, when there is an abundance of work and wages are higher men are scarce, and there are plenty of jobs. They are indifferent, or sometimes are inclined to be, and care little about retaining their jobs, for the reason that they can so easily and so quickly find others. When work is scarce and wages consequently lower, a man will do better work in order to hold his job, as he may not easily be able to secure another one.

Another reason may be that the character of common labor, particularly, has changed and is changing. The more ambitious, industrious, effect workers from the north of Europe have given way to those from the south who are less energetic, and man for man generally physically inferior. All this is a matter of general observation and conjecture. There is no data that we have to positively substantiate the statements made.

The price of all foodstuffs has generally advanced very materially in the past five years, and cost of boarding men consequently is greater, so that where men receive board as part of their compensation, they receive more, or the contractors at least pay more, although the stated rate per day or month may remain the same. The cost of horses and mules as well as their feed has also materially advanced.

Yours truly,
GENERAL CONTRACTORS.
Aug. 12, 1910.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Railway Engineering and Main-
American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York,. N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, .R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H. Warder, Monadnock Block, Chicago, Ill.

PERSONALS.

Mr. John Harvey of Hamilton, Ohio, has been elected city engineer of Oxford, Ohio.

Mr. C. G. Post of Belvidere, N. Y., is critically ill of typhoid fever at his home in that city.

Mr. H. A. Sumner has resigned his position as chief engineer of the Denver, Northwestern & Pacific R. R.

Mr. Charles A. Hammond, formerly resident engineer of the sewage disposal works of Mount Vernon, N. Y., has been made manager of the same.

Mr. C. A. Tupper, formerly Manager of the publication department of the Allis-Chalmers Co., has become Manager of the Reliance Engineering & Equipment Co., of Milwaukee, Wis.

Mr. Charles Sullivan of San Francisco, Cal., an engineer of the San Francisco Bridge Co., is now located in Honolulu, where his company is engaged on the construction of a dry dock for the United States Government at Peal Harbor.

Mr. F. I. Cabell, Engineer Maintenance of Way of the Chesapeake & Ohio R. R. at Richmond. Va., has been appointed also chief engineer maintenance of way of the Chesapeake & Ohio of Indiana, with office at Richmond Va.

Mr. Myron H. Lewis, Temple Court Building, Long Island City, N. Y., will undertake to represent at the New York Cement Show, at Madison Square Garden, New York City, Dec. 14 to 20, 1910, any intending exhibitors who will be unable to attend the show in person. Installation and removal of exhibit will be looked after and exhibits properly presented to the public.

Oswald F. Jordan, inventor of the Jordan spreader car, died early this month. Mr. Jordan was born in England in 1853 and was brought to this country when a child. He was roadmaster of the Michigan Central Ry. from 1881 to 1892, when he was appointed division superintendent, which latter position he held until his resignation in 1898. The O. F. Jordan Co. of Chicago was organized some years ago for handling his inventions, which included his air-operated spreader car, his bridge guard, consisting of three lines of rails laid between and parallel with the track rails, and a spring-rail frog.

The U. S. Civil Service Commission, Washington, D. C., will hold an examination on Sept. 14-15, 1910, to secure eligibles from which to make certification to fill vacancies in the position of civil engineer and superintendent of construction, $1,500 per annum each, in the Quartermaster's Department at Large, San Francisco, Cal., Fort Bayard, N. Mex., and Washington, D. C., and vacancies requiring similar qualifications as they may occur in any branch of the service, unless it shall be decided in the interest of the service to fill the vacancies by reinstatement, transfer or promotion.

Robert Moriarity, aged 21, of Ossining, N. Y., and Edward H. Lockert, 19 years old, of Hoboken, N. J., civil engineers employed by the express train near Hudson, N. Y., on Aug. 8. New York Central Railroad, were killed by an The two men stepped from a track to avoid an approaching train and walked directly in front of the express. Their bodies were hurled many feet, death being instantaneous. Thomas F. McQuade, a track foreman, working nearby, was struck by Moriarity's body and quite badly hurt.

Mr. T. H. Clarke, of the firm of Azan & Clarke, engineers and contractors, of Pachuca, Mexico, has accepted a position as manager of a large lumber company in the state of Mechoacan, Mexico.

Collapse of Cantilever Crane.—On Monday, August 1, the cantilever crane, working on contract 40, near Lockport, New York, collapsed. This machine is the property of the United Engineering & Construction Co. and cost $50,000. It is the only one of this type of machine at work on the Barge Canal. The accident was due to the breaking of the steel member which acted as a tie between the two short legs of the support which carries the weight of the bridge. When this break occurred, the legs, (which rested on car trucks) spread. The lower end of the cantilever, gradually sank to the ground. No one was injured. The break occurred at the time that the drag bucket was digging, which is the time of heaviest load on the machine. It is supposed that the broken member must have at some time or other been injured by being hit with the bucket. Repairs to the machine will put it in running order in about three weeks.

The Puebla & Pacific Ry. Co. has been formed in New York to build a railway between the city of Puebla and Laguna de Chacahua, on the Pacific coast. A concession for this line was granted on May 26 to A. B. Adams & Co. of New York City. The line, when in operation, will be an important one. It will touch rich coal fields owned by the Oaxaca Iron & Coal Company, of New York, a subsidiary company to the Puebla & Pacific. The contract provides that within six months from the date of the concession the company will commence a reconnoissance of the line, and that within eighteen months 50 kilometers of road must be finished, and an additional 50 kilometers each year, with the total system completed and in operation within a term of eight years. Lic Francisco Alfaro, City of Mexico, is interested.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week. A hearing was begun at New York City Aug. 16 in the proposed increase in freight rates aggregating, according to estimates made by the Interstate Commerce Commission, $500,000,000 annually in official classification territory—that part of the country north of the Ohio and Potomac and east of the Mississippi river. It is likely that the formal hearing of the evidence in the case will be postponed until Sept. 7.—A fire which started in the Belgian section of the international exposition at Brussels, Belgium, at 9 o'clock Aug 14, destroyed the Belgian and English exhibits and damaged all the other sections, including the American. The loss is estimated at $100,000,000. The fire is supposed to have been caused by the short circuiting of electric wires leading into the temporary postoffice in the Belgian building.—The Western Pacific R. R. will on Aug. 22 commence running through trains from Salt Lake City to San Francisco. The opening of this road will give the Gould system a continuous line from New York to San Francisco, over the Wabash, Missouri Pacific, Denver & Rio Grande and Western Pacific.—Reports received by the Continental & Commercial Bank of Chicago, Ill., from its correspondents indicate a total wheat crop of 657,000,000 bu., or 80,000,000 bu. less than last year; this, however, is about equal to a 10 years' average production. Corn promises a yield of 3,000,000,000 bu., or 225,000,000 bu. above the previous season and 25 per cent over a 10 years' average crop. The oats yield will exceed last year's excellent production with a total of 1,071,000,000 bu., 200,000,000 bu. over the 10-year average. Barley will equal last year's crop of 128,000,000 bu., and rye will exceed the previous season, being 31,500,000 bu., comparing with 30,000,000 bu. Cotton condition indicates a crop of 11,000,000 bales, or 700,000 bales above last year.—The New York State Superintendent of Public Works began advertising last week on two large barge canal contracts. These are contract No. 37, calling for the improvement of the Oswego Canal between Fulton and Oswego for a length of 9.72, and contract No. 50, for constructing a reservoir and dam on the West Canada Creek. The area of the reservoir inside the clearing line is about 6.1 square miles. Bids are to be opened Sept. 7 at Albany, N. Y.—The contract for a county road system for Grayson County, Texas, was awarded last week. The contract calls for 65 miles of 14 ft. wide road. The contract was let to McNervey Bros., Muskogee, Okla., at $250,000.—The Philadelphia & Reading Ry. is about to call for bids for a continuation of its track elevation work in Philadelphia, Pa. This work, which is estimated to cost about $4,000,000, will call for the elevation of the tracks between the Port Richmond wharves to Somerset St. This will about complete the company's work of track elevation in Philadelphia. —The Spring Valley Water Co., of San Francisco, Cal., is about to let contracts for the construction of its Calaveras dam. This dam is located about 30 miles from San Francisco. It is to have a reinforced concrete face with a backing of earth, sand and gravel. As projected the center height of the dam is something over 200 ft. with a crest length of about 800 ft.—Among the railroad construction contracts let recently were the following: Miller & Oltjen, McLaughlin, S. Dak.; subcontract for railroad grading west of Montevideo, Minn.; J. A. Perdue & Co., Pine Bluff, Ark., for 12 miles of new road from Silas, Ala., for the Tombigbee R. R.; McLean Contracting Co., Baltimore, Md., for retaining walls, bridge abutments, etc., for overhead crossings of the Baltimore & Ohio R. R. at Hanburg St., Baltimore, Md.; Hodges, Downey & Co., Birmingham, Ala., for placing 2,200,000 cu. yds. of dirt in fills in the Iron Mountain R. R. through Arkansas; C. M. Purdee, Rocky Ford, Ga. for grading 615 mile extension of the Savannah, Augusta & Northern R. R.; C. D. Smith & Co., Memphis, Tenn., for the 750,000 cu. yds. of excavation required for the new union station at Kansas City, Mo.

Road Work Extra-Ordinary. A widespread movement for good roads has developed of late in Iowa. One of the first results of this agitation was the improvement, under somewhat unusual conditions, of a practically continuous line of road over 300 miles long, extending across the State from Davenport on the Mississippi to Council Bluffs on the Missouri. Preliminary arrangements for the work were under way for some months, and on a given day 10,000 men began upon the road. This army of men, it is said, in one hour's time, working with teams, scrapers, graders, road drags and hand tools, put the road in good condition from river to river. This improvement of roads by concentrated effort of voluntary labor is no new thing. In fact, much of the earlier road building in the East was done in that manner. Practically the first road improvement work in the southern part of the State of New Jersey was undertaken by voluntary labor. This was 63 years ago, and the roads at that time were little more than beds of sand. The roads were so bad that one ton of hay was considered a good load for four horses, while 23 baskets of three pecks each constituted a full two-horse load. In 1847 a movement was started to improve some of the more important roads, particularly those leading to Philadelphia. The work was to be done by voluntary labor, and in the fall of that year, after the rush of the farming season was over, a large force of teams and laborers were collected on the road leading from Burlington to Camden. It is said that the working force, part of which came from a distance of eight miles on more, numbered about 500. It was intended to cut down some of the steeper hills and to cover the sandier portions of the road with gravel, clay or loam, according to the inclination or judgment of those who did the work. Very little was known about road making at that time; in fact, very few of the farmers had ever even seen a good gravel road. To be sure the citizens of Pennsylvania had started a movement to build stone roads 50 years before, but as there were no stone quarries in that section of New Jersey, the only recourse was to use the materials at hand. The volunteer forces assembled at East Camden, and a great discussion at once arose as to the best material to be used, some contending for clay and others advocating a stone quarry loam found in a hill near East Camden. The discussion became so warm that there was a division of forces, a part using clay from a pit near the Ellisburg and Marlton Junction and the others using the loam. This was probably the first sand-clay road ever constructed in this country. As everything connected with the movement was volunteered, everyone was boss. If a team driver refused to work in the line mapped out by the volunteer supervisor, there was no remedy; to fire him would merely mean the loss of his labor. Again, if the land owner of the abutting property objected to the cutting down of a hill, there was no legal redress and the hill remained. This method of road improvement was continued for two or three years, but owing to the lack of all legal authority, it was very ineffectual and unsatisfactory.

Licensing Architects in Louisiana. The State of Louisiana has recently enacted a law providing that all architects must register their names with the Clerk of the Civil District Court of the parish wherein they are practicing their profession. The act provides that all persons wishing to engage in the practice of architecture in the State, excepting those now practicing architecture, must apply to a board of architectural examiners for a certificate showing their fitness to practice their profession. They can obtain the right to practice by either showing a diploma from a recognized college of architecture, or by passing an examination in architectural engineering, architectural designing and architectural history. The applicant must be at least 21 years of age, and must possess a good moral character. The members of the Board of Examiners are to consist of five architects, all of whom must have practiced for at least ten years. It is provided that two members of the board may grant a temporary permit to practice, but they must report this to the next regular meeting of the board. The clerk of the court is entitled to a fee of $1 for the registration, and every year the architect must pay a fee of $5 to the board, and in case of his failure to do so his name will be taken off the roll of the clerk of the court, and he will not be permitted to practice, and should the fee be paid after January it will be $10, instead of $5. Every April the board is to publish a list of the registered architects, together with their residences, in a daily paper published in New Orleans. The members of the board are to be appointed by the Governor, and they are to be entitled to $5 a day, during the sessions of the board, and their traveling expenses. They are empowered to charge $10 for an examination, and in case the applicant fails they are entitled to retain $5 of this amount. The act further provides that the failure of anyone practicing architecture to comply with the provisions of the act shall subject him to a fine of not less than $25 and not more than $100, and he shall be imprisoned not less than 30 days nor more than 90 days for each offense.

Georgia State Highway Commission. Georgia is the latest State to take steps for the construction of improved highways. Last week its House of Representatives passed the bill providing for the establishment of a State Highway Commission and creating a State road fund from a special tax to be collected from owners of automobiles. The bill provides that the highway commission shall be composed of one commissioner, an assistant commissioner, the State geologist, the professor of civil engineering at the State university and the professor of engineering at the State Agricultural College at Dahlonega. The commissioner is to receive an annual salary of $3,000, and the assistant a salary of $1,800, The other members of the commission are to serve without salary, and are to act in an advisory capacity to the commissioner and his assistant. The commissioner is to have his office in the capitol at Atlanta, and he is to co-operate with county officials in the location and construction of roadways, the selection and testing of materials for road building and to aid them in various other ways which may become necessary in the process of improving the roads of the State. For the purpose of maintaining the commission and to meet the expense incident to the discharge of its duties a State road fund is to be established by levying an annual tax of $2 upon automobiles of two-passenger capacity and $4 upon automobiles of four-passenger capacity or more. When more than $10,000 is collected in this manner, the overplus is to be returned to the counties from which it was collected to be used in road improvement.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Louis Hart has made a proposition to the Business Men's Club of Gadsden, Ala., for the building of a car line to Noccalula Falls, on Lookout Mountain. It is proposed to build the line if $15,000 of stock subscriptions, are secured in Gadsden.

Surveys are to be started soon for a railroad from Salem to Bessemer, a distance of 78 miles. The road will be built primarily for coal carrying purposes. George H. Clark, C. E., Birmingham, Ala., is promoting the enterprise.

The Tombigbee R. R. has let the contract for the construction of 12 miles of new work from Silas, Ala., north, to J. A. Perdue & Co., Pine Bluff, Ark., who will be ready to start active operations about Aug. 20. The camp address of the contractors is Silas, Ala.

The Alabama Great Southern R. R. has resumed active construction work on the branch line to the new Horshoe plant at Gordon Heights from Bessemer, Ala.

A committee of five representatives of the commercial organizations of Mobile, Ala., has been appointed to confer with Henry McLaughlin, of Pensacola, Fla., who is building a railroad from Pensacola toward Mobile through Baldwin County, in an endeavor to secure his co-operation in the construction of the proposed Mobile-Baldwin County bridge. The improvement includes a driveway over a stretch of water 8½ miles long, with trolley lines and foot paths.

Arizona.

The Arizona Eastern R. R., L. H. Long, Assistant Chief Engineer, Tuscon, Ariz., has been making surveys for a branch from Meami to the Live Oak mine.

Arkansas.

The St. Louis & San Francisco R. R. Co. has advertised for bids on raising track at Four Mile Bayou, Ark., which work has been made a necessity by Maj. Walker, U. S. A. engineer, having decided to raise the government levee at this point, where the Frisco tracks cross the government dike.

Surveys have been completed for the construction of the Fort Smith, St. Louis & Chicago R. R. south to Jasper and the next survey taken up will be from that city to Harrison, Ark., a distance of 18 miles. It is said there will be four tunnels on the line but that the grade of 1½ per cent has been maintained the entire distance.

The St. Louis, Fort Smith & Dallas R. R. incorporated a short time ago under the laws of Oklahoma effected its formal organization at Fort Smith, Ark., on Aug. 10., with the election of the following officers: M. C. Burke, railroad contractor, of Fort Smith, President and General Manager; R. S. Wylie of Rogers, First Vice-President; M. J. E. Reynolds of Fort Smith, Second Vice-President; J. H. Vaughn of Fort Smith, Secretary; M. W. Murray of Fort Smith, Treasurer; R. C. Alexander of Rogers, Chief Engineer, and C. T. Kenney, General Superintendent. It is expected that work will be started soon on a line from Fort Sumter to Wilburton, Okla., which will eventually be extended to St. Louis and Dallas.

Residents of Mena, Ark., are advocating the construction of a new railroad between Mena and Hot Springs. The route of the proposed road is: Mena to Betheson Springs, to Consetil, up Mena Creek to Divide, to Missouri Falls, then down South Fork to Black Springs and into Hot Springs.

The Missouri Pacific Ry., E. F. Mitchell, Engineer of Construction, St. Louis, Mo., is reported to have made the final surveys for the construction of a line from Crane to Fort Smith.

Hodges, Downey & Co., Birmingham, Ala., have a contract to place 2,200,000 cu. yds. of excavation into fills on the Iron Mountain R. R. through Arkansas.

California.

The new line of the California Traction Co. in the Sacramento valley, from Sacramento to Stockton, was opened on Aug. 15. A merger for traffic purposes of the traction company and the Santa Fe, has been effected whereby the former will gain a new outlet to the bay and the latter an entrance into the Sacramento valley. Entrance of this section on the part of the Santa Fe has been opposed vigorously by the Southern Pacific.

Capitalists of Fresno have subscribed for $50,000 of bonds for the proposed interurban railroad for that city which is being promoted by F. S. Granger, of Fresno. It is said that this assures the construction of the line. The Hudson Counties Improvement Co. has the contract for building the line. The main line of the interurban road will run to Kingsburg. This part of the line is all ready for the graders and they will probably start work before Sept. 1. A branch line will be run to Sanger, leaving the main line about five miles south of Fresno. The people of Sanger subscribed $10,000 worth of the bonds and are assured the road. The Hudson Counties Co. will expend approximately $700,000 in the construction of these two lines.

Residents of Gridley have asked the Northern Electric Ry. Co., Chico, Cal., to extent its line two miles into the town.

The city of San Francisco now has about $500,000 in the treasury with which to begin construction of the Geary St. Electric Ry. M. Manson is City Engineer.

Agents of the Pacific Ry. Co., according to reports from Pomona, Cal., are making arrangements for the establishment of camps in that city for the men employed in making improvements there. Extension will be built on Fifth Ave., past Walker Dole tract to the city limits and will eventually be extended southeast to Chino and later through Corona to Riverside.

Construction work has been completed on the Fort Smith, Scranton & Eastern R. R. from Paris, Ark., in Logan County to Fort Smith, a distance of 16 miles and operation of it will be commenced at once. This road has been under construction for some time and it is expected that the territory through that part of Logan County near the Subiaco Abbey will thus be brought into communication with other sections and the coal fields in that section developed. L. P. Miles, Fort Smith, Ark., is promoter.

The Laton & Western R. R. Co. has filed its articles of incorporation and proposes to build a standard gage steam road about 20 miles long. Commencing at Laton, the road will extend northwesterly and westerly for five miles, thence south about three miles, west six miles and northwest for about six miles, terminating on what is known as the Johns ranch. Here the road will build its own terminus. The directors of the Laton & Western R. R., as designated in the articles of incorporation are William G. Kerchoff and A. C. Balch, of Los Angeles, and L. A. Nares, George P. Beveridge and Frank H. Short of Fresno. A large amount of preliminary work has already been done and it is stated that the work of construction would be started immediately and rushed to completion.

It is expected that permanent surveys of the Humboldt & Eastern R. R. will be completed and that rights of way secured by the beginning of the summer of 1911 and that active construction work will be started on the line early in 1912. The government has granted the company right to cut one billion ft. of timber and 40 government crusiers are now surveying the reserve for the purpose of estimating the timber so that the department may act intelligently on the petition of the promotion committee for the concession of three billion ft. of mature timber to be sold at a fair stumpage price, and to be removed in fifteen years by allowing four years for the construction of the railroad and eleven years after for the removal of the timber. E. E. Skinner, 318 Fifth St., Eureka, Cal., is Secretary.

Colorado.

The Denver & Rio Grande R. R. Co. has placed an order for 300,000 yellow pine ties, 90 per cent heart, or about 10,000,000 board feet of sawn ties. This order was distributed between four Texas concerns.

The Denver, Laramie & Northwestern R. R. now in operation between Denver and Greeley, will probably have its line completed and in operation to the base of the mountains, 45 miles northwest of Greeley, by Nov. 15. This will give the company about 100 miles of line. In Fish Creek canon, on the state line between Colorado and Wyoming, a gang of 150 men and teams are now at work driving Butte Royal tunnel, 400 ft. in length, and making the roadbed through the canon a distance of eight miles. The canon work is under contract with J. B. Orman, and is considered the heaviest that will be encountered in crossing the Continental divide. It will cost about $120,000.

The Denver & Rio Grande R. R., J. G. Gwyn, Chief Engineer, Denver, Colo., is planning a number of improvements for its line. These will include the building of concrete bridges, widening of dry gulches through which flood waters pass, straightening of the main line, reballasting of the roadbed between Pueblo and many points and raising of the tracks along some portions of the line.

Owing to the inability on the part of the promoters to successfully dispose of the necessary amount of bonds, construction work on the proposed line of the Denver & Gulf R. R. will be indefinitely postponed. The announcement that 51 miles would be completed at once has also been canceled on account of the general financial stringency. J. E. Swan, Lamar, Colo., is Secretary of the company.

A favorable report has been submitted Cosgriff Bros., by A. T. Young, Denver, Colo., the consulting engineer employed to investigate the conditions in the territory through which the projected railroad from Monte Vista, Colo. to Center will pass, and as soon as surveys are completed and right of way arrangements made, active construction work will be started.

Advices from Brush, Colo., state that a crew of Colorado & Eastern R. R. engineers are running a line east and west 10 miles from Brush, the first step toward the construction of the proposed shortline between Denver and Omaha, Neb.

Corps of surveyors running lines for the construction of the proposed railroad into Farmington, Colo., from the south are now located within 14 miles of that city on the San Juan River. It is expected that their part of the work will soon be completed.

Georgia.

A charter will be obtained shortly for the Jacksonville & Atlanta Short Line Ry. Co., which proposes the construction of a railroad from Jacksonville, Fla., to Atlanta. This company was temporarily organized at Fitzgerald, Ga., on March 4, 1910, the following being the temporary officers: B. B. Gray, President, Pinebloom, Ga.; T. B. Ragan, First Vice President, Hawkinsville, Ga.; M. W. Garbutt, Second Vice President, Fitzgerald, Ga.; Dr. C. A. Holtzendorff, Treasurer, Fitzgerald, Ga.; W. A. Heller, Secretary, New York City. The capital stock of the road is to be $2,500,000, and it is proposed to raise 20 per cent of this amount from the local towns and cities that the road will pass through. Macon is expected to subscribe liberally to this amount and also to furnish terminal facilities for freight and traffic, obtain right of ways from this city south bordering upon the river through Bibb county and a portion of Houston county to a point to be met bv the committee from Hawkinsville.

The Middle Georgia Interurban Ry. Co. which projects a 70-mile line from Griffin through Jackson, Indian Springs, Monticello and Social Circle, has made its surveys and has in part secured the capital for the construction of its line. We are advised that the company will build the road itself. L. W. Robert, Atlanta, Ga., is President and Chief Engineer. W. F. Smith, Flovilla, Ga., is also interested.

The Seaboard Air Line Ry. is to construct a reinforced concrete underpass on the extension of Ponce de Leon Ave. at Atlanta. Plans were made by Walker & Chase, Engineers, Atlanta, Ga., and bids for the work are reported to have already been taken.

Among the bills passed at the last session of the State Legislature of Georgia was one to change from two to three years the time within which new railroads may construct the first 15 miles of road.

The Savannah, Augusta & Northern R. R., E. M. Rice, Chief Engineer, Statesboro, Ga., is reported to have awarded a contract to C. M. Purdee, Rocky Ford, Ga., for grading 15 miles of line for an extension.

Illinois.

The Illinois Traction System, Champaign, Ill., has been granted a franchise by the Village Board of Chatham to construct a track through the village paralleling the Chicago & Alton tracks. The franchise was secured in order to do away with the curves in the village and to secure a straight track with room for a subpower station, which will be erected soon.

The Chicago Rys. Co., J. Z. Murphy, Chief Engineer, 444 North Clark St., Chicago, Ill., has completed plans for rebuilding the outlying lines on the north and west sides of Chicago and work will begin as soon as the union of those roads with the Chicago Rys. Co. is agreed upon and the necessary ordinance passed. The lines which the company is planning to begin rehabiliating as soon as the union ordinance is passed are: Milwaukee Ave., from Logan Sq. to Jefferson; Elston Ave., from West North Ave. to the terminus; West Madison St., from 40th Ave. to 60th Ave. Work on the main line may be started this month. Additional lines on which the reconstruction may begin this year are said to be: Evanston Ave., from Montrose Ave. to Devon Ave.; Belmont Ave., from Southport Ave. west to the north branch of the river.

The City Council of Mason has granted a franchise through that place to the Decatur & Southern Traction Co., thus removing the last obstacle to the construction of the line. It is now said that bids for construction work will be asked shortly.

The Paris Traction Co., F. L. Kidder, President, Paris, Ill., now operating four miles of line, has asked the City Council of Paris for a 50-year franchise, with a view to extending the line from that city to Chrisman. It is stated that the extension will be built as soon as right of way is secured.

The preliminary survey for the Sterling-Moline Traction Co.'s line has been completed between Sterling and Moline. Two preliminary surveys have been made between Sterling and Prophetstown, one going by the way of Galt and the other across the Avenue G bridge and on the south side of the river.

The Illinois Traction Co. is to apply for an interurban franchise at Paris on Washington St. Franchises have been obtained through Charleston, Ashmore and Kansas, and as soon as the Paris grant is made representatives of the corporation will begin obtaining the right of way through the country. Two routes are proposed, between Charleston and Paris, one from Kansas through Grandview to Paris, and the other parallel to the Big Four tracks, running about two miles north of Grandview.

The Sterling-Moline Traction Co., which proposes the construction of an electric railway between Sterling and Moline, has elected the following officers: President, W. E. Tuller, Morrison; Vice President, Charles Sturtevant, Erie; Secretary, Joseph Wright, Rock Falls; Treasurer, C. E. Windom, Sterling; General Manager, A. G. Van Patten, Sterling; General Attorney, R. A. Kidder, Sterling. The Northwestern Construction Co., Milwaukee, Wis., is reported to have the contract for constructing the road.

The first train passed over the new line of the Herrin-Metropolis extension of the Burlington to West Vienna on Aug. 10, making use of 18 miles of the Eastern Illinois line from Hudgens south, over which the new line has effected a traffic agreement until the tunnels are completed in Johnston County. It is expected that the rails will be laid into Metropolis by Sept. 1 and that the line will be in full operation by the last of that month.

Representatives of eastern capitalists have been over the proposed route of the Quincy & Terre Haute Traction Co. This company has been in the promotion stage for some time. Fred Tellbuesher, Quincy, Ill., is interested.

The Baltimore & Ohio Southwestern R. R. is to erect a 20-stall round house and several smaller buildings at Flora, Ill.

Indiana.

Advices from Fort Wayne state that J. A. Barry & Son, who are promoting a new interurban line to extend from Fort Wayne to Warsaw, are now ready to put the proposition up to financiers. The estimated cost of constructing and equipping the road, which will be 41 miles long, is $1,054,290. Of the estimated cost $352,586 is for roadbed, $382,274.74 is for track work, $127,874.98 for overhead work, $68,000 for substations, $23,899.20 for pavement, $3,900 for railroad crossings, $28,756.05 for engineering and superintendence, and $66,000 for equipment consisting of seven passenger cars, one freight car and one work car.

The Indianapolis & Northwestern Traction Co., A. L. Bowen, Chief Engineer, Lebanon, Ind., contemplates building a spur from its main line running around Cedar Lake to Crown Point. It is said that work will be commenced immediately on the project in conjunction with the constructiton work on the main line. The company is obtaining franchises in the towns and cities along the route.

The stockholders of the Fort Wayne & Springfield interurban line are reported to have taken a definite action at their meetitng early in August regarding the extending of the line southward.

Iowa.

A bonus of $5,000 is being raised in Rockwell City, Ia., to assist in electrifying the Newton and Northwestern R. R., which is controlled by the Fort Dodge, Des Moines & Southern R. R. J. L. Blake, Boone, Ia., is General Manager.

Albert Arntz has the contract for grading 1½ miles railroad near Atlanta, Ia.

An election was held at Wellman on Aug. 15 to vote on granting a franchise to the Iowa City & Southwestern Interurban Co. Iowa City has raised $100,000 for the line.

The Waterloo, Cedar Falls & Northern Ry. Co. has made surveys in part for its projected 30-mile extension from Waterloo to Cedar Falls, Dike and Grundy Center. We are advised that construction contracts will probably be let next spring. L. S. Cass, Waterloo, Ia., is President and T. E. Rust, Waterloo, Ia., is Chief Engineer.

A crew of Chicago & Great Western R. R. surveyors are running a line from a point just north of Shipley directiy north to a point a half mile west of the town of Roland on the Story City Branch of the Iowa Central, missing Nevada, Ia., by about 4 miles and paralleling the St. Paul & Des Moines R. R. between Shipley and Cambridge. It is rumored that the line is to be a connecting link between Des Moines and Clarion.

The street railway company at Waterloo has had a survey made for a proposed extension of the street car system down Jefferson St. from 4th St. to the site of the proposed Northern Iowa fair grounds.

Grading work on the extension of the Atlantic North & South R. R. from Atlantic to Villisca, was started early this month, and will be hurried along so that trains can be in operation by Jan. 1. The first grading work was started in Bear Grove Township.

The Iowa City-Ottumwa Interurban Ry. Co. is reported to have secured enough pledges of financial support to assure the construction of the line. Ottumwa has tentatively pledged $90,000 of its $100,000 allotment of stock. Frank Tanner, Iowa City, Ia., is Vice President.

Kansas.

Preliminary surveys are to be started next month for the projected line of the Wichita, McPherson & Gulf Ry., chartered recently as mentioned in our Aug. 3. issue. This will be an extension of the Midland Valley R. R., and the surveys will be made by the engineer of that company. C. Kaighn, Muskogee, Okla., is Engineer, Midland Valley R. R.

The Manhattan City & Interurban Ry. Co., W. R. West, President, Manhattan, Kan., has completed the survey for the proposed trolley line to Fort Riley and has made its estimates of the cost. The company will build the line if Manhattan City and Ogden Township will take a few thousand dollars' worth of bonds. Manhattan City will be asked for $20,000 worth of bonds for terminal facilities. The cost of the line is estimated at $150,000.

The Winnipeg, Salina & Gulf Ry. Co., which projects a 1,080-mile line from Omaha, Neb., to Oklahoma City, Okla., with branches from Salina, Kan., to Kansas City, Mo., and Alva, Okla. to Des Moines, N. Mex., has made surveys for 500 miles of its line. The capital for a portion of the line has been secured and we are advised that construction contracts will be let about Nov. 1, 1910. C. A. Slayton is Chief Engineer, and H. Leone Miller, Salina, Kan., is President.

The Wichita, McPherson & Gulf Ry. Co., noted in our Aug. 3 issue, effected its formal organization on Aug. 10. The Midland Construction Co., which proposes to build the Wichita, McPherson & Gulf Ry. from Arkansas City to McPherson, was also organized. The following men were elected officers: C. E. Ingersoll, Franklin Bank Bldg., Philadelphia, President; Frank C. Wood, of Wichita, Vice President; A. W. L'Feber, of Muskogee, Treasurer, and W. C. Edwards, of Wichita, Secretary. For the construction company the following officers were chosen: C. E. Ingersoll, of Philadelphia, President; J. W. McCloud, of Muskogee, Vice President; A. W. L'Feber of Muskogee, Treasurer, and W. C. Edward of Wichita, Secretary. The officers of the company are connected with the Midland Valley R. R.

Kentucky.

Dr. J. B. Jackson, President of the Commercial Club, of Hopkinsville, Ky., has been advised by Cecil Williams, of Somerset, Ky., that a railroad from Corbin to Somerset is to be built and the promoters desire to continue it to the Cumberland River and to connect with the Illinois Central there.

Lane Bros. Co., Alta Vista, Va., have been making good progress with their double track work on the Cheaspeake & Ohio and have advanced operations close to Fullerton, Ky., where extensive excavations are being made.

The Cincinnati, Hamilton & Dayton Ry., F. H. Alfred, Chief Engineer, Cincinnati, O., is reported to be contemplating the building of an extension to its system from Ashland, Ky., which is just across the Ohio River from the present southern terminal of that road at Ironton, to the southern border of Pike County, Ky. The route of the proposed extension is about 147 miles in length, and the estimated cost of the completed line is in the neighborhood of $14,000,000.

The Cane Valley R. R. Co. recently incorporated with a capital stock of $100,000, has secured practically all right of way for its proposed railroad from Cannell City to the mouth of Caney Creek. Residents of Morgan County, Ky., are back of the railroad. Judge Finley Fogg, West Liberty, Morgan County, Ky., is interested.

Louisiana.

It is believed here in New Orleans that the Southern Pacific will enter this city via Baton Rouge within a very short time. The crossing will be made, it is understood, at Baton Rouge from Port Allen and the Yazoo and Mississippi Valley tracks will be utilized running south into New Orleans. It is further reported that the old M. L. & T. line from Echo to Algiers has passed into the hands of the Frisco and that it will be used by that trunk line for its New Orleans entry.

The St. Louis, Iron Mountain & Southern Ry. (Missouri Pacific System) contemplates spending $2,000,000 in improvements on its lines in Louisiana in the near future. The St. Louis, Watkins & Gulf, which runs into Lake Charles, was recently purchased by the Iron Mountain, and it is contemplated improving the road into Alexandria.

Work will probably be resumed this fall or winter by the Frisco and the Southern, joint owners of the New Orleans terminal property at Chalmette, on the $3,000,000 slip in St. Bernard Parish.

The Louisiana Southern Ry., P. Campbell, General Manager, New Orleans, La., is considering extending its road from Belair to Bohemia, in the Parish of Plaquemines. This road is owned by the United Railway & Trading Co., which is composed of English capitalists.

The Louisiana & Northwest R. R. is securing land in Natchitoches, La., for its new depot and terminals. J. J. Nelson, Homer, La., is General Manager.

Maryland.

The Western Maryland Ry. is reported to have been looking into the matter of building a railroad across the Eastern Shore from a point opposite Kent Island, through Easton, Cambridge, Salisbury and Snow Hill to the seaboard in the vicinity of Chincoteague bay. It is also believed here in Baltimore that the Western Maryland is back of the recently revived project to bridge the Chesapeake, and that it has, in connection with the New York Central, a well defined idea of accomplishing this. It is stated that the contemplated bridge, if it is to be built by the interests mentioned, will span the bay from Kent Island to a point in Anne Arundel county on the south side of the Magothy River, connection to be made there with the Annapolis Short Line, which latter road crosses the Western Maryland at grade near Westport, about two miles from the tidewater terminals of the latter road at Port Covington.

The McLean Contracting Co., Baltimore, Md., has been awarded the contract by the Baltimore & Ohio R. R. for the retaining walls, bridge abutments, etc., for the overhead crossings of the Baltimore and Ohio tracks at Hamburg St. The contract includes the placing of more than 5,000 yds. of concrete. This is the first of the series of overhead and undergrade crossings to be constructed by the Baltimore & Ohio to eliminate the grade crossings of the tracks in the vicinity of Camden Station.

Fisher & Carozza, Baltimore, Md., are working on a sub contract near Garrett, Pa., for building three miles of the Western Maryland extension from Cumberland, Md., to Connellsville, Pa.

Massachusetts.

Officials of the New York, New Haven & Harford are contemplating alterations in the line of railroad known as the Huntington branch of the New Haven & Derby extension and the Newton branch of the Housatonic R. R. Co. It is proposed to alter the location of parts of the said line to an extent that will change the radius of the curves the width of its layout, and to add a number of main tracks from Newton easterly to Botsford station and to a point in Huntington, 625 ft. west of Shelton station. The work will necessitate the reconstruction of a number of bridges and road crossings.

Michigan.

Surveys are to be made by D. A. Brotherton, C. E., Escanaba, Mich., for an extension of the Escanaba & Gladsone Interurban line from Gladstone to Rapid River, touching Kipling and Masonville.

Tracklaying on the Lansing & Northwestern Electric Railway has been completed on the section from Lansing to Morrice, and the engineers are now laying out a line east from Morrice to parallel the Grand Trunk tracks to Durand. The construction work is said to have been handicapped by inability to get teams and men.

Minnesota.

Grinnell & Oltjen, of McLaughlin, S. Dak., have gone to Milan, Minn., where they will do the grading for the new roadbed down by the John Rud farm west of Montevideo.

Tracklaying on the Thief River Falls cutoff of the Soo is well along and will probably be completed by the end of the month unless delays occur at some of the streams that are to be bridged. At any rate the line will be ready for service by Oct. 1. The tracklaying machines, which are working from both ends of the line, are laying about three miles of track a day.

The City Council of East Grand Forks, Minn., has granted a franchise to the Grand Forks Transit Co., Thos. D. Campbell, General Manager, Grand Forks, N. Dak. Construction work on the extension is to be started this fall.

The Mississippi, Hill City & Western Ry., W. W. Rabey, General Manager, Hill City, Minn., is to construct the following sidetracks: 1,000 ft. at each of the following points: Split Hand Crossing, Rabey, Seaver, Brauer's Spur and 2,000 ft. at Hill City .

Duluth and the Ranges.

BY PETER E. MEAGHER.

Thomas Higgins of Higgins & McDonald, Contractors, came in to see us, and reported that he had taken a sub-contract for some solid rock work from Johnson-Carey Co. on the Duluth, Winnipeg & Pacific extension into Duluth, and would start work immediately.

Dennis Madden, General Superintendent for MacArthur Brothers Co., came up from Chicago last week and made a trip up to the mines to look over their two large stripping contracts they are working on in that location. He said that their work was getting along quite nicely.

Thomas C. Walsh of the Johnson-Carey Co., is spending a few days in our city, and drops in occasionally to see us. They are getting along very nicely with their rock work on the Duluth, Winnipeg & Pacific Ry., and have sub-let practically all of it; but, I understand that they have a small amount left.

H. J. Lanferman, President of the Empire Dynamite Co., of Chicago, spent a couple of days here with us recently looking over the field for explosives. This is Mr. Lanferman's second trip to this vicinity, and he was surprised at the amount of business that is being done up here, especially in the construction line.

Lew Barber of the J. H. Flick Construction Co., Chicago, spent a couple of days with us here recently. They had a small piece of railroad work to sub-let in Wisconsin, and he was up here to see the writer regarding subcontractors for the same. Mr. Barber said that their contracts in the various parts of the country were getting along very nicely.

C. J. A. Morris of Morris & Shepard, General Contractors of St. Paul, was up this week for a couple of days. He reported all their contracts in very nice condition.

P. W. Jones, the equipment man from Minneapolis, Minn., came in to see us last week. He reported business rather quiet in his line.

Richard Evans, railroad contractor, Minneapolis, Minn., has taken a sub-contract from Foley, Welch & Stewart on the Duluth, Winnipeg & Pacific extension, and is going to put three steam shovels to work on the same. He has already started to build his camp, and will rush work as fast as possible.

C. E. Jamieson, Contractor, has taken a subcontract from Foley, Welch & Stewart on the Duluth, Winnipeg & Pacific Ry. and has already started on the same.

Arthur Mitchell, contractor, left here last week to look over some railroad work which he is figuring on taking.

E. D. Packard, Chicago representative for the Marion Steam Shovel Co., came in to see us last week.

E. P. Galvin of the DuPont Powder Co. dropped in to see us the other day, of course, looking for contractors in the market for explosives.

C. A. Jacobson has taken a sub-contract of about eleven miles of work from Foley, Welch & Stewart on the Duluth, Winnipeg & Pacific Ry. extension into Duluth, and has already started on the same.

Mr. George W. Benton, General Manager of the Conneaut Shovel Co., Conneaut, O., spent a few days with us here recently and also on the Iron Range.

Franzen & Berglund, contractors, have taken a sub-contract from Foley, Welch & Stewart on the Duluth, Winnipeg & Pacific extension, and have already started on the same.

J. D. Kelvie, representing the N. Y. & N. J. Lubricant Co., manufacturers of high grade greases, spent a few days here recently, and left to make a trip over the range.

G. A. Jones, of Jones Brothers, contractors, Columbus, O., spent a couple of days with us here recently. He was up here on a trip of inspection of their work of stripping at Nashwauk, Minn.

T. J. Walsh, President of the North American Iron Mining Co., Duluth, Minn., when in our office the other day, reported that the Foundation Co. of New York, who have a contract for sinking a large concrete shaft for the mining company, are progressing very nicely on the same, and expect to have it completed in about 30 days.

J. E. Erickson, of Murphy Brothers & Erickson, contractors, came in to see us the other day and said that they had taken 15 miles of a sub-contract from Foley, Welch & Stewart on the new Duluth, Winnipeg & Pacific Ry. extension, and will start on the work immediately.

A. Johnson of Johnson, Rodgers & Curtiss, railroad contractors, was a caller at this office recently. He reported that his firm was just about finishing their contract of about 250,000 yds. on the Soo Line, and were in the market for some new work.

Mr. F. C. Peabody, General Superintendent for Dale & Bumgardner, Deerwood, Minn., spent a day with us here last week. He said they had shut down two or their steam shovels on their work on the Soo Line.

F. A. Watters, General Manager of the Pluto Powder Co. came up from Buffalo last week, and came in to see us. He said that business in his line was very good at the present time.

Contractors and others when in this vicinity, are invited to make the Labor Equipment Offices of Peter E. Meagher, 409 West Michigan, St., Duluth, Minn., their headquarters.

A. Kundson, General Superintendent for Peter Nelson, railroad contractor, was here with us a few days ago. He said they have finished their work on the Soo Line in Minnesota, and are moving their two steam shovels to some new work on the Soo Line in Wisconsin. He reported having a very successful season.

Mississippi.

The Batesville Southwestern R. R. Co., incorporated some months ago with a capital stock of $100,000 proposes to build a line running southwest from Batesville, Miss., a distance of some 28 miles, to Charleston, the county seat of Tallahatchie. At that point it would meet the loop line running north from Philipp to Charleston, and thus form a connection of the Illinois Central and Yazoo and Mississippi Valley, affording a direct route from Charleston and Tallahatchie county to Memphis and St. Louis, or points beyond. The board of directors is composed of Edward Mayes and J. C. Longstreet of Jackson, with A. E. Clift, T. E. Hill and John G. Jones, all of the Illinois Central R. R., associated with them. The officers are Jas. C. Longstreet, President; W. L. Park, Chicago, First Vice-President; R. J. Darnell, Second Vice-President; M. P. Blauvelt, Treasurer, and Burt a Beck, Secretary.

Missouri.

The Missouri & North Arkansas R. R., John Scullin, President, Security Bldg., St. Louis, Mo., now operating between Joplin, Mo., and Helena, Ark., is planning to secure an entrance to Kansas City. The first step in this direction will be the securing of right of way to Kansas City probably paralleling the Kansas City Southern tracks, and the immediate building of the extension. A little later, it is said, that building will start from the present Southern terminus and the line will be extended to Pensacola.

Traffic arrangements have been made between the Santa Fe and the Kansas City Southern whereby the Santa Fe will enter Joplin over the Kansas City Southern tracks. connecting with the Southern at Pittsburg, and will commence traffic as soon as the construction company finishes the contracts to fill in the lower end of the union depot site.

James D. Houseman, St. Louis, Mo., has applied to the County Court at St. Louis, for a franchise to establish a trolley line on the Gravois limits to the town of Sappington, passing the Weber nurseries, the town of Affton and the Grant farm. The application is practically a renewal of an application made a year ago and taken under advisement.

An ordinance has been before the City Council of Galena for the granting of a franchise to the Kansas-Oklahoma Electric Ry. Co. The company asked a franchise for the proposed new electric railroad connecting Galena with Baxter Springs, Columbus and Miami, Okla.

The St. Louis & Southeastern R. R. Co. applied for a charter on Aug. 10, but because the name conflicts with the St. Louis Southwestern, or Cotton Belt, the papers were returned with the suggestion that the title be changed. The proposed road is to be 75 miles in length and will connect Cape Girardeau with the Frisco R. R. in New Madrid County. It will run through Cape Girardeau, Scott and Mississippi counties. The capitalization is $700,000. The stockholders are A. B. Hunter, L. A. Lewis, W. H. Garanflo, Matt J. Conran, Murray Philips, Jr., D. R. Hunter, E. S. McCarty, David Mann, Lee Hunter, Thomas Gallivan and T. J. Brown.

Included in the building permits issued in Kansas City, Mo., was one for the construction of a new freight house on west side of Wyoming St., to cost $70,000. Concrete and steel will be used for the work.

C. D. Smith & Co., Memphis, Tenn., has been awarded the contract for the excavation work for the new Union Station at Kansas City, Mo., to be erected for the Kansas City Terminal Ry. Co., of which H. C. Harmon is President. This contract involves the moving of 750,000 cu. yds. of earth and is to completed by May 1, 1911. Three steam shovels will probably be used.

Montana.

Colonel James McNaught, formerly chief attorney for the Northern Pacific Ry., recently made a tour through the West, Gallatin canyon, with a view to looking into the possibilities of a trolley line by this route into the Yellowstone Park.

Nebraska.

It is stated that the promoters of the proposed Kearney-Beloit R. R. expect to be able to finance the proposition this fall. E. H. Neis, Kearney, Neb., is interested.

New Jersey.

The North Jersey Rapid Transit Co., Patterson, N. J., has been granted permission to lay its tracks over certain highways in Saddle River, Glen Rock and Ridgewood, in Bergen County.

An ordinance has been before the City Council of Morristown to grant the Morris County Traction Co., of Morristown, N. J., a franchise over certain streets. The company now has 40 miles of road in operation.

New York.

Petitions are being circulated at Albany, N. Y., asking the United Traction Co. to double track its Hamilton St. line from Lark to Philip.

The Public Service Commission has approved an application of the Second Avenue Railroad Co., Geo. W. Linch, Receiver, New York, for the electrification of its line from Chatham Square to Broadway through Worth St. at New York City. When the work, which will be started without delay, is completed, the terminus of the line will be at Broadway, as it was in the old days of horse cars and before the organization of the Metropolitan system.

The New York, Westchester & Boston Ry. Co., 22 William St., New York, has applied to the Public Service Commission, Second District, for authority to issue $5,000,000 par value, 50 year, five per cent first mortgage gold bonds. The purposes for which the proceeds of the bonds are to be used are the payment of $953,446.60 advanced by the City & County Contract Co. in connection with the construction of the branch line extending from Mount Vernon to White Plains, and for the general expenses of right of way and construction of this branch. It is figured that in addition to the amount already expended by the City & County Contract Co., there is needed to complete the building of the line, electrify it and provide equipment, $4,294,549.44.

The New York, Auburn & Lansing R. R., H. A. Clark, Chief Engineer, Ithaca, N. Y., is planning to electrify 30 miles of its present 39-mile standard gage steam line.

The Frontier Electric Ry. Co. of Niagara Falls, N. Y., has applied to the City Council of Tonawanda, N. Y., for right of way across several streets.

James S. Whipple, Forest, Fish and Game Commissioner, has petitioned the Public Service Commission to issue an order requiring the Brooklyn Cooperage Co., of Brooklyn, N. Y., to use oil for fuel upon its lines of railroad in the Adirondacks as a precaution against forest fires. The company owns several thousand acres of timber lands in St. Lawrence and Franklin counties, where it conducts lumbering operations.

It is reported at Hammondsport that work is to be started early next month on the construction of the Hornell-Branchport elevated road.

North Carolina.

Advices from Brevard, N. C., state that Transylvania County has voted $100,000 in bonds for the construction of the Greenville & Knoxville Railroad, thus assuring the extension of the line to its ultimate destination at Greenville.

Ohio.

It looks now as though construction work on the projected line of the Youngstown & Conneaut R. R. Co. would not be started before next year. The company has practically secured all right of way between Conneaut and Youngstown. The road if built, will be used primarily for ore carrying purposes and its construction will probably require the building of large ore docks. John H. Ruhlman, Youngstown, O., is President.

The Lake Erie, Bowling Green & Mapleton Ry. is considering building a 4-mile extension from Woodville to Elmore. Surveys have been made but the capital for construction has not been secured as yet. F. H. McKnight, Bowling Green, O., is Chief Engineer.

Oklahoma.

The Oklahoma Public Service & Interurban Lines has been granted a state charter. The corporation which intends to build and maintain steam and electric railroads in Oklahoma and Kansas, will have Stillwater as the headquarters and the center of radiating interurban lines. The lines proposed are from Stillwater to Morrison, Noble County, a distance of 14 miles north; from Stillwater to Perkins, Payne County, 10 miles; from Stillwater to Glencoe, Merrimac, Jennings and Sapulpa 79 miles; Stillwater to Coyle, Langston and Guthrie 45 miles. The total estimated cost of the proposed system is $6,000,000, and the company is capitalized at $100,000. The directors are: L. Brullard, New York; Harry C. Lytle, Brooklyn; Claude Powell, R. A. Sturgeon and Louis James Lampke, Stillwater; A. C. Lampke and George Washington Tucker, Jr., New York.

The Tulsa Street Ry. Co., Tulsa, Okla., is planning to have work started this fall on an extension line to West Tulsa, a distance of three miles, across the Arkansas River. A belt line, taking in West Tulsa and all local railway stations is also to be constructed soon.

Oregon.

Announcement has been made by John F. Stevens, Portland, Ore., President of the Oregon Trunk Ry., that the road will be extended across the Cascade Mountains to Medford, connecting with the partly built Pacific & Eastern, to reach that city. Both of these roads are controlled by the Hill interests.

Advices from Salme, Ore., state that the Corvallis & Alsea River R. R. is taking active steps toward repairing its line. New bridges are being built to replace unsafe structures and the road bed is also being improved.

Tracklaying was started early this month on the Natron-Klamoth Falls cut off of the Southern Pacific.

The Lane County Asset Co., of Eugene, Ore., which is projecting a railroad from Eugene to the coast, has completed a permanent survey as far west as Meadow, 30 miles from Eugene. A preliminary survey is now being made from there to Mapleton. An easy grade is said to have been found over the mountains and only one tunnel will be necessary.

Pennsylvania.

The Wilmington & West Chester Traction Co., chartered some months ago to build a line from Wilmington, Del., to West Chester, Pa., is reported to have about completed financial arrangements for building the line. Thomas F. O'Connell, West Chester, Pa., is President.

Erye-Shoemaker Co., Philadelphia, Pa., are making good progress with their work on the new line of the Baltimore & Ohio near Husband, about three miles west of Somerset. They are at present using three steam shovels and several gangs aggregating about 500 men are at work. Several miles of construction railroad have been installed and the work of grading is now being rushed to completion. In the immediate vicinity of Husband are some of the largest fills and deepest cuts which will be made along the new line. One cut is about 75 ft. in depth and a large portion of it will have to be cut through solid rock. This cut is about half a mile in length. A short distance west of this cut is a fill about a half a mile in length and at its highest part nearly 100 ft. above the ground. Trestle work has been erected here and earth from the cut is being used to make the fill. The Eyre-Shoemaker Co. has established temporary offices at Husband, where they also have their depot of supplies and commissary. It is the intention of the contractors to complete the line from Somerset to Husband, a distance of three miles, this fall, and if the weather permits to complete as much of the remaining part of the road between Husband and Acosta, a distance of 7 miles, as possible. It is probable that a considerable portion of the road will be in use by November.

The Pittsburg Rys. Co., F. Uhlenhart, Jr., Chief Engineer, Pittsburg, Pa., has made surveys for a loop from the Homeville division through Whitaker. Citizens of the borough are urging the company to put in the line and offering free franchises and rights of way.

The Buffalo, Rochester & Pittsburg Ry., E. F. Robinson, Chief Engineer, Rochester, N. Y., is said to be planning to extend its Yatesboro branch and build a large coal plant near Rural Valley to develop the Cowanshannock field. It is believed that the Yatesboro branch, from Echo in South Mahoning township, will be extended east to the Indiana branch. The company is completing a new slope near Rural Valley. The extension from Yatesboro would give a shorter and much easier haul for the Cowanshannock coal and develop the White Oaks Flats field.

E. B. Smith & Co., Philadelphia, are reported to have awarded the contract for the construction of the line which is to connect the Philadelphia & Western R. R. and the Lehigh Valley Transit Co.'s system. By this improvement the Lehigh Valley Transit Co. will obtain terminal at 69th and Market Sts., Philadelphia.

Councils Committee in Street Railways of Philadelphia is to give a hearing in the near future on the application of the Philadelphia & Suburban Elevated R. R. Co., for a franchise for a subway under Broad St. This company was chartered April 28, 1910, and proposes to construct a subway and elevated railway system in Philadelphia. The authorized capital stock is $1,000,000, of which $504,000 has been subscribed and $62,975 paid in. The names and residences of incorporators of the company are as follows: President, S. S. Neff, 38th and Chestnut Sts., Philadelphia; Vice-President, Caspar Wistar Haines, Cheltenham, Pa.; Treasurer, Coates Coleman, Swartmore, Pa.; Secretary, Frank T. Finch, Philadelphia.

The Pennsylvania R. R. is planning improvement to be made this year at New Brighton, Pa., which will involve the expenditure of $500,000.

The Baltimore & Ohio R. R., A. V. Thompson, Chief Engineer, Baltimore, Md., is planning extensive improvements for its lines in this state. These will include third tracks between Manila and Philson and between Sand Patch and Yoder. The Sand Patch tunnel is to be eliminated and a new double track tunnel over 2½ miles long, with improved ventilation facilities, is to be built on a revised line, securing a low grade freight line from the Somerset coal region. The tunnels at Everett, Rodemer, Murray and Hitchcock are to be made open cuts. A third track is to be built between Martinsburg and Orleans Road, which means a widening of bridges and culverts in that section. In order to care for the coal traffic new yards are being built at Grafton, a new third track is being constructed between Deer Park and Mountain Lake Park, while in order to accommodate a third track between Terra Alta and Grafton a new double track will be built to take the place of the present Kingwood tunnel.

Surveys have been started from Butler over the route of a proposed trolley line from Butler to Kittanning by way of East Brady, where connection will be made with the East Brady & Clarion Ry. Pittsburg and Philadelphia capitalists are said to have agreed to finance the Butler-Kittanning project.

Plans will be completed shortly and bids asked for the contract of elevating the Philadelphia & Reading Ry. tracks at Philadelphia between the Port of Richmond wharves and paralleling East Lehigh Ave. to the point where the road already submerges below street grade at Somerset St., a little east of Front. This will about complete the work of elevating the road to avoid grade crossings, and will entail an expenditure of approximately $4,000,000. The city and the Reading Ry. will equally share the expense. Wm. Hunter, Philadelphia, Pa., is Chief Engineer of the Philadelphia & Reading Ry.

The Committee on Corporations of the City Council of Pittsburg, Pa., is considering a proposition to build a subway or tunnel under Herron Hill. The plan is that the city establish a corporation which shall build the tunnel. The proposed tunnel would start near the intersection of Grant Boulevard and Seventh Ave. and emerge near the intersection of Craig St. and Center Ave. It will be built to accommodate four railroad tracks. The corporation would be known as "The City Subway Co." and the incorporators would be three business men, to be selected by the City Controller. The incorporators are to hold the stock as trustees for the city, and when the certificates of stock are issued to them they are to assign the certificates to the Mayor and Controller.

The Baltimore & Ohio R. R. Co. has some 150 men at work between Rand Station and Irwin Ave., and Mifflin St., Hays Borough, laying the double track which will be built between Glenwood and Washington, Pa. Work has also been started at Washington.

The New Jersey & Pennsylvania Traction Co. has secured options on land leading from upper Taylorsville, Pa., to lower Tayorsville, with a view, it is said, of building a branch of its road from Taylorsville proper to that part of the town which is nearer the river and about a quarter of a mile from the present trolley.

B. O'Connor, Connellsville, has begun work on the grading and masonry work for double-tracking 3,000 ft. of line at the Revere Works for the West Pennsylvania Rys. Co., of which J. L. Fritsch, Connellsville, is Chief Engineer.

South Carolina.

Contract has been signed by T. C. McNeely, representative of the syndicate and committee appointed by the town of Saluda, S. C., calling for the construction of a railroad to the court house from some point on a standard gage railroad. The promoters of the railroad have placed a bond of $50,000 to be forfeited unless the railroad is constructed by May 1, 1912.

Tennessee.

City Engineer J. H. Weatherford, of Memphis, Tenn., has served notice on the Illinais Central Railroad that work on the new subway which this road must build across Iowa Ave. must be begun at once. The railroad company requests a further delay, in order that the plans being worked out by Chief Engineer Baldwin may be brought to a high state of perfection. It is probable that Mr. Weatherford will allow them a two weeks' extension.

It is reported that the City of Memphis will soon require the N., C. & St. L. R. R. to construct a reinforced concrete culvert over its crossing at the Park Driveway. The work will require about 200,000 yds. of earth and gravel excavation, and about 60,000 cu. yds. of concrete masonry. The work will be done according to the plans of City Engineer Weatherford.

Texas.

The Stamford & Eastern Ry. Co., of Stamford, has been incorporated with a capital stock of $9,000, and proposes to construct a line of railway from Stamford in Jones County to some point at or near Graham, Young County, a distance of approximately fifty miles and traversing the counties of Haskell, Shackelford, Throckmorton and Stephens. The following are the incorporators: W. T. Andres, R. V. Colbert, F. B. Hastings, P. P. Berthelot, R. L. Penick, J. C. Bryan, B. E. Sparks, L. M. Buie, J. A. White, Charles Brewington, T. M. Richardson, all citizens of Jones county.

A preliminary survey for a street railway for San Marcos, Tex., has been made and according to this the total length of the line will be about five miles. The topographical survey has not been made except to determine that the proposed route contains no heavy grades and no bridges or trestles would be required. M. M. McFarland, of Uylade, has the building of this line under advisement. O. E. Metcalfe, County Surveyor, San Marcos, Tex., is the engineer.

Surveys are being made by Engineers of the Bessemer Steel Co., and the Santa Fe R. R., for the construction of a line from Longview to Daingerfield and Munz, Tex., to connect with the Munz railroad, operating to Texarkana. It is proposed by the steel company to develop the ore lands in Cass and Morris counties.

The Improvement League of East Dallas Heights, Dallas, Tex., has offered to raise $12,000 for an extension of the South Belt Line to Elm, connecting at Fitzhugh. The proposition has been submitted to E. T. Moore, Manager of the Dallas Street Ry.

Announcement has been made by Walter McGregor, Temple, promoter of the proposed railroad from Austin to Fredericksburg, Tex., that matters are progressing satisfactorily and that construction work will be started in a short time.

The Railroad Committee of Abilene, Tex., is making good progress in securing the right of way for the Abeline-Hamlin R. R., and will probably soon be able to turn over the deeds to the promoter, Morgan Jones, Abilene, President of the Abilene & Southern Ry.

According to reports the contract for the construction of the proposed railroad from the main line of the Santa Fe to the Elephant Butte damsite in Texas has been let. The reclamation service has a force of 50 men at work on the railroad right of way doing work preliminary to the construction of the line.

The Jacksboro Southern Ry. Co. has completed location surveys for a projected 19 mile line south from Jacksboro, Tex., to Oran, Tex. This is a new line and the company to build and operate it has not as yet been organized. W. S. Clark, Jacksboro, Tex., is Chief Engineer.

Thompson & Scott, St. Louis, have been making good progress with the construction of Stephenville North & South Texas R. R., from Hamilton to Gatesville. Tracklaying from the latter place has already been started. Engineers are now said to be in the field between Hamilton and Commanche and Stephenville and Thurber making a preliminary survey for the extension of the line to those points.

Utah.

It is reported that the officials of the San Pedro, Los Angeles & Salt Lake R. R. are considering the construction of 88 miles of line on solid rock, elevated many feet above the old track which was washed out by high-water last year. The improvement is said to be estimated to cost $12,000,000. The line has been repaired at its old level and the new movement is under consideration to avoid the possibility of another such catastrophe.

The Ogden & Northwestern R. R. Co., of Ogden, now operating 7 miles of electric railway, has secured right of way from the County Commissioners for the route around the hill north of Willard.

Virginia.

The Chesapeake & Ohio Ry., J. J. Ewing, Mechanical Engineer, Richmond, Va., is contemplating making extensive improvements to its railroad shops at Richmond, Va.

West Virginia.

The Tug River Construction Co., of Welch, W. Va., has been incorporated with a capital stock of $10,000 and proposes to construct railroads, coal and coke plants, bridges, etc. Capital, $10,000. The incorporators are: A. N. Harris, L. E. Woods, J. J. Stout, C. G. Seaton and H. G. Creek, all of Gary, W. Va.

The Western Maryland R. R. has work under way on the enlargement of its freight yards at West Virginia Central Junction on the West Virginia division of that road. The contract for the job was let some time ago, and it is most likely that the improvements will be completed and the new yards put in service within the next two or three months.

Work has been started on the construction of a new railroad from Old Fields to the Elk Pond. The road will touch the Hamshire Southern R. R. at Sycamore or McNeill Station and will be built within three-quarters of a mile of Williamsport, Grant County. The road is being built by the Twin Mountain Orchard Co., of which William Russell, Williamsport, W. Va., is Manager. and will be about 15 miles in length.

The Wellsburg, Bethany & Washington Traction Co., J. S. Liggett. Secretary, Wellsburg, W. Va., is considering extending its line from Bethany to Washington, Pa.

Wyoming.

The Sheridan Ry. & Light Co., which filed its certificate of incorporation last June, is taking definite steps for the construction of its proposed electric railway in Sheridan, Wyo. The principal office of the company is in the First National Bank Bldg., Sheridan, Wyo., and Fred H. Blume is the agent in charge. This is the road being promoted by Albert Emanuel and W. R. Sullivan. of Dayton, O.

Canada.

The first spike in the Alberta Central Ry. was driven Aug. 10 at Red Deer, Sask. This railway has a charter to build a line from Moose Jaw through Red Deer to the Brazeau River in the Rocky Mountains. It has also a charter to build from Saskatoon to Red Deer. This year the intention is to begin work on lines running east from Red Deer to a point where a junction is effected with the Grand Trunk Pacific, and also to begin a line west to the Brazeau River, where the coal mines will be tapped. Contracts for grading have been let, but no actual work has yet been done except a small portion on which the first ties were laid for the spiking ceremony. The Canadian Northern made application a few days ago to build a line to the Brazeau River and the plans of the Canadian Northern show that the road would cross the line of the Alberta Central nine times west of Red Deer.

The Deputy Minister of Railways and Canals gave a hearing Aug. 9 on the application for approval of the route of the Canadian Northern Ry's, Calgary and Edmonton branch to Brazeau River, through Red Deer. A portion of the line from Stewartwyn to the western boundary of range 25 was approved. From there on the Department of Railways asked that the company make inquiry as to the feasibility of locating a northern route via Lacombe to Rock Mountain House.

Steps are to be taken for the financing and building of the Niagara Falls, Welland & Dunnville Electric Railway .J. Carlton Gardner, C. E. Logan, Bldg., Queen St., Niagara Falls, Ont., is interested.

Advices from Winnipeg, Man., state that included in permits issued by the city for building is one authorizing the construction of new coach shops for the Canadian Pacific in the west yards, estimated to cost $42,000.

The first construction train passed over the Zenardi bridge on the Grand Trunk Pacific Prince Rupert line on August 8. Forty-three miles of the road were open at that date.

The Canadian Northern Ry. amended offer in connection with the Quebec & Lake St. John Ry. has been approved by the debenture bondholders in London, England.

The Canadian Northern Ry. has about completed the grading of its new line from Toronto. Both lines from the east and west are now graded about to the town limits of Cobourg, Ont. In the Colborne-Brighton district day and night gangs have been at work the past few weeks unloading rails, putting in switches, etc.

The Canadian Board of Railway Commissioners will hold a hearing at Vancouver, B. C., on Sept. 5, regarding the right of the Canadian Northern Ry. to build its line on a portion of the right-of-way of the Canadian Pacific Ry. on the shelving banks of the Fraser and Thompson River canyons. The Canadian Pacific Ry. has entered a general protest against the application of the Canadian Northern for approval of the route at two different points. The first is for a 7-mile section of the Thompson river and the other is for a 10-mile stretch on the Fraser.

Late advices regarding the work on the eastern section (District A) of the National Transcontinental Ry. state that early in August there remained only 40 miles of steel to be laid on the section. It is stated that contract No. 1 will be completed by Oct. 1st and contract No. 3 by Sept. 1st. The first four contracts out of Moncton were taken by the Grand Trunk Pacific and the sub-contractors are Messrs. Corbett and Floesch on No. 1 and the Toronto Construction Co. on No. 3. The 40 miles of steel yet to be laid are divided between two contractors and the roadbed is practically completed. The chief delay has been caused by the difficulty of getting the structural steel from the bridge companies. Most of the companies have orders booked ahead for two years and are having hard work to keep up with their orders. The same difficulty has also applied to getting the steel rails. As the work is nearing completion the estimates are falling off. The total for July was $342,949.73, and for August it will probably be $100,000 less. The total amount expended to date has been $10,027,478.75, not including steel rails or bridges. The estimates for July are divided as follows: Contract No. 1, $50,087.43; contract, No. 2, $26,033.13; contract No. 3, $34,153.15; contract No. 4, $139,686.44; contract No. 5, $49,791.91; contract No. 6, $43,197.67.

Plans have been submitted to the city officials of Winnipeg, Man., for the elevated structure of the Canadian Northern R. R., from a point where the tracks will leave the Assiniboine River bridge to another point, an eighth of a mile southeast. The structure will cross Main St. and Bell Ave., 14 ft. and 6 in. above the street level, thus permitting the street cars to pass beneath.

The Canadian Pacific Ry. has notified the city officials of Winnipeg of its willingness to construct a crossing over the company's lines at Saskatchewan Ave., near St. James Ave. The work will be done at once.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

The survey for the Beaver Bayou Drainage District, Phillips County, has been completed and the plans are now being prepared. The area of the district is 50,000 acres. Wellford White, Helen, Ark., is Secretary, Winters & Dove, Fort Smith, Ark., are the Engineers.

California.

The Madeline Irrigation Co. is making good progress with the construction of its irrigation ditch near Madeline, Lassen County. About 75,000 cu. yds. of earth was moved during July.

Surveys are under way near New Folsom for what is reported to be the site of a large reservoir for an irrigation project which will supply the Sacramento Valley with water. The reservoir is being surveyed principally on the Dalton place, which was purchased over a year ago in the name of Fred Kiesel and Charles Silva, capitalists of Sacramento, but the site as surveyed includes other land, some of which already has been purchased. Negotiations are in progress for the remainder. The plan is to store water in Carson Creek, which carries a large volume in winter but is dry in summer. Another large reservoir above Placerville is also a part of the plan, and will assure water during the summer months.

Colorado.

A. B. McFall, C. E., Florence, Colo., has completed estimates on the cost of the reservoir and canal for the Hardscramble Irrigation District, and places it at $782,000. The board of directors of the district have decided to call an election and let the owners of the land vote to issue or not to issue the bonds. The reservoir is to be at Babcock's Hole, and will hold 12,600 acre feet of water.

The Happy Home Reservoir & Canal Co., of Montrose, Colo., has been incorporated with a capital stock of $100,000, the incorporators being George I. Bergen, R. G. Trotter and H. W. Light.

Idaho.

The North Side Twin Falls Land & Water Co. has awarded contracts aggregating $500,000 to Donald Grant & Co. of Gooding, Idaho, and Conway & Wilhite for the construction of the Jerome Reserve Reservoir of the North Side Twin Falls tract, to be situated about six miles northeast of Jerome. The dam will contain about 1,200,000 cu. yds. of earth.

A map of the right of way of two reservoirs and the canal system to be constructed in Washington County near Cambridge and Council have been filed with the State Land Board at Boise, Idaho. This means the reclamation of 11,000 acres under the Carey act. The lands to be irrigated are across the Weiser River from the Mesa orchard.

Illinois.

Advices from Quincy, Ill., state that the Commissioners of the Sni Levee District have placed their new $25,000 dredge boat in operation. It has been decided to dredge the Sni as far down as Hamburg Bay, a distance of 58 miles. The levee commissioners are considering the matter of buying another dredge to commence work at the lower end of the Sni and continue its course upwards until the two dredges meet.

H. S. Green and J. J. Hurlbut, of Morrison, Ill., have purchased a 293 acre farm east of Lyndon, Ill. This is said to be the first move to secure water power right for the recently incorporated Sterling-Moline Traction Co. It is understood the object of the purchasers is to secure overflow rights preliminary to construction of a dam across Rock River at Lyndon. Other overflow rights along Rock River, to the extent of 600 acres, are said to be secured.

Iowa.

The Hamlin Construction Co., 806 Great Northern Bldg., Chicago. Ill., has been awarded the contract, at $23,000, for work in Drainage District No. 1 of Shelby County, Iowa. The work includes the straightening of 5½ miles of the Mishra Batua River, involving 340,000 cu. yds. of excavation; and about 1½ miles of laterals requiring about 20,000 cu. yds. of excavation. The bid on the main ditch was 5.7 cts. per cu. yd.; on the laterals the bid was 15 cts. per cu. yd. Bids were opened Aug. 10, at Harlan, Ia.

K. C. Gaynor, City Engineer of Sioux City, Ia., has prepared revised plans for the proposed Perry Creek conduit.

Kentucky.

The Third and Fourth Magisterial Districts of Louisville, Ky., have awarded the contract for the Mill Creek cutoff to Charles H. Dishman, of Henderson, Ky. The bidders and their estimates follows: Adams & Sullivan, $29,725; H. Bickel Co., $28,437; Charles H. Dishman, $25,300; J. H. Kahill, $34,218; E. E. Watts, $28,195.75; Ferry & Son, $71,301.50. The construction of the cutoff will take a large part of the $40,000 now in the treasury for the digging of the Mill Creek ditch in the scheme to drain the lowlands of the Third and Fourth Magisterial Districts, south and west of Louisville. The Mill Creek ditch will be about five miles long and the Cane Run ditch about seven miles long. The cutoff is only about a mile in length and is the connecting link between Mill Creek and Cane Run Creek. Some of the ground is high. It is estimated that 95,000 cu. yds. of earth must be removed in the digging of the cutoff. It will be under the supervision of S. F. Creceilus. Work will begin on the cutoff shortly. Other contracts will be let when funds are available.

Louisiana.

✣Bids will be received by Capt. Robert R. Ralston, U. S. Engineer, 3338 St. Charles Ave., New Orleans, La., until 11 a. m., Sept. 1, for constructing about 201,000 cu. yds. of earth work in the Pontchartrain levee district.

✣Bids will be received until Sept. 15, by Board of Commissioners, Iberia and St. Mary Drainage District, for drainage excavation canal work to the amount of 111,000 cu. yds. H. N. Pharr, Olivier, La., is Chairman Sub-Committee.

Pat N. Lyons, Nairn, La., has been awarded the contract for constructing 26,000 cu. yds. of levee in the Lake Borgue Levee District. Bids for this work were opened Aug. 9 at the office of the U. S. Engineer at New Orleans, La. The contract price was 16.99 cts. per cu. yd.

Nebraska.

✣Bids will be received by the Sanitary District No. 1, of Lancaster County, Nebr., at the room, 54 Brownell Block, Lincoln, Nebr., for the excavation of a new channel for Antelope creek from a point near 23d and Q sts., to a point near 23d and R sts. The work includes about 3,300 cu. yds. of clay. K. D. Cunningham is Secretary of the District.

New York.

✣Bids will be received until noon, Sept. 7, by F. C. Stevens, Superintendent of Public Works, Albany, N. Y., for the improvement of New York State Canals as follows: No. 22, Erie Canal, Sections 6 and 7—For constructing new highway bridges and raising existing highway bridges over the Erie Canal between Cold Spring and Free Bridge, within the limits of Contract No. 12. Sheets 1 to 23 inclusive. No. 37, Oswego Canal, Section 1—For improving the Oswego Canal between Fulton and Oswego. Length, 9.72 miles. Sheets 1 to 64 inclusive. No. 50, Erie Canal, Section 5—For constructing a reservoir and dam on the West Canada Creek, and performing all other work appertaining to the contract. Area of reservoir inside of clearing line, about 6.1 square miles. Sheets 1 to 31 inclusive.

Oklahoma.

The reclamation from destructive overflow of about 60,000 acres of bottom land lying in the valley of the Verdigres River in Wagoner County, Okla., is proposed. The plan proposes the straightening of the Channel of the river and the construction of levees. The work involves about ten miles of diversion canals and 50 miles of levees. The work will be done under the drainage laws of Oklahoma and it is expected that construction will be commenced early next spring. J. C. Barr Co., Joplin, Mo., are the engineers.

Oregon.

The U. S. Engineers at Portland, Ore., in charge of the construction of the Dalles-Alilo Canal have requested the War Department for authority to purchase a land dredge to facilitate the handling of material taken from the canal. About 500,000 cu. yds. of sand and gravel has to be taken from the canal at Big Eddy, and it is for this purpose that the land dredge is wanted. Under the present system steam shovels and a train of dump cars are used, and it is thought that if the dredge can be secured a large amount of time and expense can be saved to the government.

Advices from Vale, Ore., state that Fred J. Palmer, a financier of the Jordan Valley Country, is arranging an irrigation project in Jordan Valley with good prospects of success. The reservoir site is about 12 miles above the town on Jordan Creek. The project will cover about 50,000 acres of land.

Pennsylvania.

The Pennsylvania R. R., on account of the sharp angle the center of its new elevated line through Bristol will make with the Lehigh Coal & Navigation Canal will divert the course of the waterway to the eastward. As the waterway is at present, a bridge across it would be very long and placed with considerable difficulty. For this reason beginning at Jefferson Ave., the course will be changed from a straight line to an arc, which strikes the present course again at the Corona Leather Works.

Porto Rico.

Bids were opened July 25 at the office in the Porto Rico Irrigation Service, Guayama, P. R., for constructing the Carite Dam, the Toro Negra Dam and Dona Juana Canal for the irrigation system in Porto Rico. The only bidder on the Carite Dam and appurtenances was the T. L. Huston Constructing Co., the itemized bid of this firm being as follows:

Grubbing and clearing	7 acres.	$125.00
Excavation for Outlet culvert—class 1	880 C. M.	2.70
Class 2—(open cut)	500 C. M.	2.70
Class 3—(open cut)	2,000 C. M.	4.00
Concrete in outlet culvert	360 C. M.	38.00
Excavation for cutting off trenches	5,600 C. M.	.90
Class 2—(open cut)	2,300 C. M.	1.50
Class 3—(open cut)	300 C. M.	5.00
Back filling and puddling c. o. trenches	8,200 C. M.	2.00
Concrete in diaphragm	400 C. M.	42.00
Concrete in Spillway Linings	100 C. M.	34.00
Concrete in Spillway Weir.	40 C. M.	38.00
Hauling and placing reinforcing steel and iron work	20,000 lbs.	.10
Excavation for Spillway—		
Class 1—(open cut)	70,000 C. M.	.75
Class 2—(open cut)	70,000 C. M.	1.00
Class 3—(open cut)	30,000 C. M.	1.65
Total		$238,391

This bid was rejected.

The bids received for the Toro Negro Dam and appurtenances were as follows, (1) standing for the T. L. Huston Constructing Co., and (2) for Nereo Pirazzi (awarded contract):

Work or Material.	Quantity.	(1)	(2)
Grubbing and clearing	2 acres.	$200.00	$50.00
Exc. for outlet culvert Class 2	10 C. M.	4.70	2.00
Class 3 (open cut)	50 C. M.	5.00	2.80
Concrete in outlet culvert	40 C. M.	38.00	24.00
Exc. for cut-off trenches Class 2 open cut	100 C. M.	4.70	1.00
Class 3—(open cut)	50 C. M.	5.00	1.50
Back filling and puddling cut-off trench	150 C. M.	2.00	.40
Exc. for Spillway			
Class 1—(open cut)	10,000 C. M.	.95	.62
Class 2—(open cut)	5,000 C. M.	1.30	.94
Class 3—(open cut)	5,000 C. M.	1.95	1.22
Concrete in Spillway Linings	25 C. M.	34.00	20.00
Concrete in Spillway Weirs	30 C. M.	38.00	22.00
Hauling and placing reinforcing steel, etc.	6,000 lbs.	.15	.05
Total		$31,877	$19,915

The same contractors also bid on the construction of Dona Juana Canal and appurtenances, Nereo Pirazzi securing the contract. The bids received were as follows:

Open cut Excav.	2,000 C. M.	$ 1.30	$ .55
Tunnel Excavation	100 C. M.	23.50	16.50
Concrete in Tunneling.	50 C. M.	42.00	24.00
Concrete in Canaling.	600 C. M.	34.00	20.00
Concrete in Div. Dam.	5 C. M.	38.00	22.00
Hauling and placing steel, etc.	1,000 lbs.	.15	.04
Total		$27,790	$16,100

For furnishing reinforcing steel and reinforcing fabric the following bids were received, (1) standing for Behn Bros., (2) for Mullenhoff & Korber, San Juan, P. R., (awarded contract) and (3) for Merino & Co.:

	Quantity	(1)	(2)	(3)
¼-in. sq. bar equivalent	1,725 lbs.	.026	.0265	.0274
⅜-in. sq. bar equivalent	850 lbs.	.025	.025	.0229
½-in. sq. bar equivalent	185 lbs.	.0235	.0235	.0214
⅝-in. sq. bar equivalent	159,950 lbs.	.023	.0194	.0214
⅞-in. sq. bar equivalent	540 lbs.	.0225	.0225	.0214
1 3-16-in. sq. bar equivalent	1,360 lbs.	.0225	.0205	.0214
Steel reinforcing fabric	42,000 sq. ft.	.031	.0225	.0257
Totals		$5,094	$4,159	$4,614

No bids were received for furnishing 1,500 ft. of 12-in. hydraulic pipe.

South Dakota.

The Dakota Engineering Co., Mitchell, S. Dak., has made surveys for Drainage Districts Nos. 22, 23 and 24, Sanborn County, S. Dak. The work will consist of about 14 miles of open ditch from 3 to 8 ft. bottom width and the cleaning out and deepening of four miles of old dredge ditch, aggregating about 225,000 cu. yds.

Surveys have been made and bids will be asked in the near future for work in the Larsen Drainage District in Hanson County, S. Dak. The work will consist of about 38,500 ft. of drain tile varying in size from 5 in. to 24 in. The maximum cut is 12.5 ft., and average cut 6 ft. The Dakota Engineering Co., Mitchell, S. Dak., are the engineers.

Memphis, Tenn., and Vicinity.

(SPECIAL CORRESPONDENCE.)

Capt. Clarke S. Smith, U. S. A., has been appointed to succeed Maj. M. L. Walker in charge of First and Second Districts Mississippi River improvement, with headquarters in Memphis, the appointment being effective Sept. 15th. Maj. Walker has been promoted to Commander of the Post of Ft. Leavenworth, Kan.

Lowrance Brothers have taken R. L. Leonard into partnership with them, the firm being known as Lowrance Bros. & Co. They will do levee work exclusively.

Lacy Bros. & Co., of Arkansas City, have taken R. L. Cheshire into partnership on their new contract for levee work recently awarded by Maj. Walker.

Roach & Stansell, Memphis, who got the largest share of the Government levee letting in Memphis on the 8th, have about 1,000,000 yards of this excellent work to sub-let. It extends from Cresno, Mo., to a point 50 miles south of Memphis, on the Arkansas shore.

"Billy" Hayden, Chief Engineer of the Lake View Traction Co., says just as soon as he gets his power house finished at Lake View, Miss., he is going to begin running cars over his line. Billy is a comer in every sense of the work. Despite almost insurmountable obstacles, he has succeeded in building a line of interurban road from Memphis to Lake View, which is perhaps one of the best of its kind in the country. We wish you all sorts of luck, Bill!

Jim Davenport, one of the best that ever ran a level, is in town for a few days. Jim is now Resident Engineer for the Lake View Traction Co. When this line is finished Jim says he will ally himself with either the Government Engineering Corps at this place or accept a position with a very prominent railroad near Memphis.

G. C. Weathers was in town loading up on supplies for his large contract near Wilson, Ark. "G. C." says all is well on his line.

Jim Lewis, old time level builder, is now at Arkansas City, Ark. Jim came up for Maj. Walker's letting.

Items marked thus ✣ indicate work now open for bids.

On Aug. 10 Maj. M. L. Walker, U. S. A. Engineer, in charge of First and Second Mississippi River Improvement districts, awarded contracts for levee work as follows:

District.	Yardage.	Price.	Contractor.
Reelfoot Lake District......	[illegible] cu. yds.	.154	Roach & Stansell, Memphis.
Upper St. Francis District......	[illegible] cu. yds.	.1761	R. F. Clark & Co., Vicksburg
Upper St. Francis District......	85,000 cu. yds.	.179	Roach & Stansell, Memphis.
Upper St. Francis District......	94,000 cu. yds.	.16	Martin Jennings, Memphis.
Upper St. Francis District......	58,000 cu. yds.	.169	W. L. Mosby, Memphis.
Lower St. Francis District.....	903,207 cu. yds.	.179	Roach & Stansell, Memphis.
White River Levee District.....	114,285 cu. yds.	.29	Geo. R. Lacy, Arkansas City.
White River Levee District.....	100,000 cu. yds.	.264	Geo. R. Lacy, Arkansas City.

Roach & Stansell, Memphis, have been awarded contract for the construction of 80,000 cu. yds. of levee work in White River district by the United States Government. All of the new contract will be sub-let.

John W. Quarrells, Road Commissioner of Helena, Ark., is in the market for 200 cars of crushed lime stone. He desires a price made on the stone delivered f. o. b. cars, Helena.

P. McCadden was in for the big Government letting on the 8th and reports his large contract at Old Town, Ark., going ahead very rapidly.

J. T. Walsh, formerly vice-mayor, has gotten into the construction business, 'and reports his various outfits doing great work in Arkansas and Tennessee. J. T. will make a success in any line.

H. P. Streicher, of Toledo, O., who has made such a remarkable success at street work in Memphis, states he will soon be ready to put down his first batch of tar macadam in this city. Mr. Streicher was a big factor in inducing the Commission of Memphis to introduce tar macadam pavement, and many citizens are looking forward with interest to viewing the first streets completed. "Streich," as the big contractor is familiarly known to his many friends, never tackles anything without making of it a "Streiching" success.

"Big Ed" Manigan says he is about ready to begin work on paving South Third St. with brick from Union to Broadway. Ed will lay brick faster than many dogs trot.

Lowrance Brothers & Leonard, who were awarded 224,000 yards of new levee at Sunflower Landing, Miss., by Maj. M. L. Walker at Memphis last month, have made plans to start the large new loop at once. Bob Leonard will probably be personally in charge of operations on the new loop.

T. S. Shields, of Greenville, Miss., has sublet from P. McCadden a good bit of work at Old Tom Landing, Ark., 'and has moved his outfit on the contract and reports many yards of new levee already in place.

W. F. Stephenson, one of the old school levee contractors, has accepted a position with J. T. Walsh & Brother, Memphis, as General Superintendent. Bill is classed as one of the best at the trade, and his firm is to be congratulated in getting such an excellent man.

C. J. Lowrance has completed his contract at Peter's, Ark., for the St. Francis Levee Board. Quite a problem was met by Mr. Lowrance at this point when the hugh new levee which he had put in place, began to sink. Every night for about five months, the embankment would go down about a foot, and it finally became necessary to go back for fresh earth about three thousand feet. However, about two weeks ago, the levee came to grade, and is now pronounced as good as the strongest section on the whole line.

George Miller, the "Greenville Hustler," came to Memphis last week to be present at Maj. Walker's letting. George did not take any work away when he left, but went away full of pleasant memories of friendship with his old pals here. George is doing great work at Longwood, Miss.

Hugh McCarten's outfit at Cresco, Mo., is building a new loop of levee at that place for Roach & Stansell. The contract will be completed about Oct. 1st.

R. L. Cheshire is anxious to dispose of about 200,000 cu. yds. of county road work near this place. Bob wants to be ready for the big fall lettings in this section.

The Frisco R. R. has awarded contract for the construction of a spur track in East Memphis, connecting its line with that of the I. C. About 100,000 yds. of material will be excavated and the spur will be about one mile in length.

Jimmie Omberg, who has contract for the culvert and concrete foundation work on the new $3,000,000.00 Union Depot being built in this city, is meeting with some difficulty in taking care of the flood waters from the streets. Engineer Weatherford has given the contractor permission to use the city sewers for excess water, which has helped to expedite the work to a great extent.

Ben Talley, of Memphis, has sub-let 50,000 yds. from J. A. Omberg on the Union Station contract. Ben has Jock Short in charge of his work, and is making excellent progress.

The new 18-story Cotton Exchange building being built in Memphis by Oleson & Lesh, of Memphis and Chicago, is rapidly nearing completion, and if no serious delays are met with, the building should be ready for occupancy about Oct. 1st.

Maj. M. L. Walker, U. S. A., has been placed in charge of the light house department of the Mississippi River from St. Louis to New Orleans, and will construct two huge boats to add to his fleet of dredges and light house tenders. The boats will be built in Memphis.

John G. Sessions of Greenville, Miss., was in town for three or four days. John is looking for some more work.

McClavey Brothers are building a new loop at Rosedale, Miss.

Ryan Brothers are working for J. T. Walsh & Bro., on White River, in Arkansas.

Pres. Lowrance, of Lowrance Bros. & Co., was in the city last week. Pres. was bubbling over with good news of the various large contracts his firm has under construction. He expects big returns this season.

T. B. Jones, the big grain man, was on hand at Maj. Walker's letting, looking for new customers. Tom can win new ones as well as he can keep his old ones.

J. M. Sills, Dist. Eng. of the Frisco at Springfield, Mo., was in the city last Thursday.

D. J. Brumley, construction engineer of the Illinois Central R. R., reports that his road has no new work mapped out for the immediate future.

A meeting of the engineers and superintendents of the Frisco and Illinois Central roads was held in Memphis on the 10th, for the purpose of considering matters pertaining to contracts existing between these two roads. The Frisco was represented by M. C. Byers, chief engineer maintenance of way, and Superintendent Nixon, while D. J. Brumley and General Superintendent Cliff represented the Illinois Central.

The Helgason boys of Vicksburg, who have an outfit of 200 teams, were in the city last Monday. Things are booming in Vicksburg territory, according to the Helgasons.

Negro labor in this territory still continues plentiful, despite the fact of so much work going on. None of the contractors report any shortages of a serious nature. Last week Roach & Stansell were able to secure a carload of negroes here for their Texas work, while Lou McClavey was able on the same day to send a big gang up on his Illinois contract. Lowrance Bros. & Co., who have under way a large subdivision contract in the city, say they never have any trouble on the labor score. This is all very encouraging, considering the vast amount of new work which will he started in this section within the next sixty days.

Martin Jennings wore a happy smile when Maj. Walker told Martin he was successful in landing 94,000 yds. of choice levee work near Cresno, Mo. Martin will start moving his outfit on the work at once.

Lee Mosby will perhaps sub-let his 56,000 yd. contract at Cresno, Mo. Lee is moving much dirt at Reelfoot Lake, Tenn., where his own outfit is located.

General Superintendent Morris, of the Y. & M. V. R. R., who succeeded W. S. King, resigned, has won his way into the hearts of the Memphis people by his kindly nature and frank, open manner. Superintendent Morris is not in position just now, to state how much new work his road will have to let before the end of the year.

Texas.

The Drainage Commission of the Alvin Drainage District has signed final papers with the contractor, J. C. Kelso, Galveston, Tex., and he will start work at once.

W. L. Smither, owner of a large farm and pasture about four miles west of Riverside on the Trinity River, has a party of surveyors at work on a proposed levee to be built along the Walker County side of the river and extending from a point about three miles up the river. The first estimate of the cost places it at $10,000 per mile or $120,000 in all. The proposed levee will reclaim about 40,000 acres of river bottom land. It is proposed to issue bonds to raise money for the work, the bonds to be retired by a tax on those land owners who are benefited by the levee.

The Chamber of Commerce of Beaumont has appointed the following committee to take steps for securing drainage of lands in Jefferson County: W. F. Keith, Chairman; T. H. Langham, J. D. Wilkerson, George D. Anderson, Stuart R. Smith, Hal G. Land, N. N. Crary, John L. Keith, Robert Corley and W. W. Kyle. This committee will carefully canvass the situation with a view to determining the plan best suited to meet the demands and the approval of the people. If it is found that the proposed plan of bonding the entire county is feasible and that it will have the approval of the people, this will be undertaken; but if it is found that the creation of smaller districts is preferred by the people, the committee will vigorously prosecute efforts to form such districts. It is proposed to place the entire matter of promoting interest and establishing drainage in Jefferson county in the hands of this committee, which is empowered to add to its number by appointing representatives of various precincts and communities of the county.

MISCELLANEOUS CONSTRUCTIONS

Alabama.

J. G. Gingery, Ensley, Ala., has resigned his position as Master Mechanic at the blast furnaces and will have charge of the construction work at the dam of the impounding reservoir of the Tennessee Coal, Iron & Railroad Co.

Arkansas.

✣Bids will be received until 11:30 a. m., Sept. 10, by Maj. G. D. Deshon, Medical Corps Quartermaster, Hot Springs, Ark., for furnishing and installing one triplex motor driven pump and two motors—one A. C. and one D. C.

Items marked thus ✣ indicate work now open for bids.

California.

✣Bids are asked until 11 a. m., Sept. 8, by Capt. W. P. Stokey, U. S. Engineers, 723 Central Bldg., Los Angeles, Cal., for dredging at San Diego Harbor, Cal. The work to be done is to dredge in the ship channel across the Outer Bar at the entrance to San Diego Harbor, Cal., to a depth of 30 ft. at low water and 600 ft. wide; also to dredge on the middle ground inside the entrance to a depth of 30 ft. at low water over such area as the funds available will permit. The depth of cuts will vary from 1 ft. to about 10 ft. The amount of dredging will depend on the contract price, there being about $120,000 available for the work. The work will include the removal of all obstructions to navigation, including wreckage, lumber, piles, boulders, gravel, shells, or other material except solid rock, which may be found within the limits of the work as it progresses. The material to be dredged is supposed to consist of loose sand, with scattering fragments of shells.

✣Bids will be opened at 11 a. m., Sept. 10, by Capt. W. P. Stokey, U. S. Engineers, 723 Central Bldg., Los Angeles, Cal., for dredging at Los Angeles Harbor, Cal. The work to be done is to dredge in Los Angeles Harbor, Cal., in three divisions, "A," "B" and "C," which may be let in one or in different contracts as the United States may decide after receipt of bids. Work in Division "A" will be to deepen the channel at the entrance to the inner harbor to a depth of 30 ft. over a width of 200 ft. from Station "O" on the 30-ft. contour in the outer harbor to Station 56, which is 600 ft. northerly of the United States Coast and Geodetic Survey Station on Deadman's Island. It is estimated that there are 400,000 cu. yds. of material to be dredged in this division. Work in Division "B" will be to deepen the channel to 30 ft. over a width of 200 ft. from Station 56 to Station 88, which is near the lower end of the Salt Lake R. R. Co.'s wharf; thence to the full width between the wharves as far northward as the funds available will permit, there being about $115,000 available for work in Division "A" and about $70,000 for work in Division "B." Work in Division "C" will be to deepen to 20 ft. two channels extending from the turning basin, one to the easterly end of the east basin and the other to the northerly end of the west basin. The channels will be dredged to such widths, not exceeding 200 ft., as the funds will permit, there being about $92,000 available for work in each channel. It is estimated that there are 2,200,000 cu. yds. of material to be dredged in this division, but this quantity is approximate only. The work will include the removal of all obstructions to navigation, including wreckage, lumber piles, boulders, gravel, rock or other material which may be found within the limits of the work as it progresses.

The Spring Valley Water Co., of San Francisco, will let a contract for the construction of what is known as the Calaveras Dam, some 30 miles from San Francisco, and 12 miles from the railroad, and at an elevation of 560 ft. above tide. The company desires to let this work by contract at a fixed price per cu. yd., with classifications covering different materials in excavation and fill. The design of the dam is a re-inforced concrete face with a backing of earth, rock and gravel. As projected, the center height of the dam is something over 200 ft. with a crest length of about 800 ft. The necessary equipment would presumably include one or more steam shovels. Samuel Storrow, 906 Wright & Callender Bldg., Los Angeles, Cal., is Engineer.

The Finance Committee of the City Council of Oakland, Cal., has voted $12,000 for the work on the north side of the 12th st. dam, which is to be macadamized, graded and leveled.

Connecticut.

The construction department of the Safety Insulated Wire & Cable Co., 114 Liberty St., New York, N. Y., has been awarded a contract for laying electrical underground conduits for the city of New Britain, Conn., for approximately $14,050.

✣Lieut. Col. Harry Taylor, U. S. Engineer, New London, Conn., will receive bids until 3 p. m., Sept. 8, for delivering riprap stone in breakwater at New Haven, Conn., at Duck Island, Conn.

District of Columbia.

✣Bids will be received until 10:30 a. m., August 30, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under canal circular 600, Switch Stands, Switches, Steel Rail, Track Torpedoes, Bronze, Toe Calks, Bolts, Copper Gaskets, Grommets, Chaplets, Pipe and Fittings, Valves, Hose Couplings, Ball Cocks, Grease Cups, Water Gauges, Marine Lights, Twist Drills, Stocks and Dies, Locks, Hose, Wire, Mats, Refrigerators, Water Coolers, Kitchen Utensils, Dishes, Spoons, Aprons, Towels, Matches, Shipping Tags, Paper, Lumber, Etc.

✣Bids will be received by Lieut. Col. W. C. Langfitt, U. S. Engineer, 920 17th St. Northwest, Washington, D. C., for furnishing and placing riprap or cobblestones on the sea wall, Anacostia River, D. C., and for constructing and repairing jetties in Occoquan, Nomini and Urbana Creeks and Milford Haven, Va.

✣Bids will be received by Capt. A. S. Cowan, Signal Corps, U. S. A., Washington, D. C., until August 22, under proposal No. 475, for furnishing awls, hacksaw blades, bulbs, chisels, files, gimlets, gongs, handles, reamers, saws, screwdrivers, tacks, gasoline torches, rules, etc.

Florida.

✣Bids are asked until noon, Sept. 8, by Capt. George R. Spalding, U. S. Engineers, Jacksonville, Fla., for rock excavation in St. Johns River, Florida, opposite the city of Jacksonville. The work to be done will be to dredge to a clear depth of 24 ft. at mean low water the area included between the 24-ft. contour and the pierhead line along the left bank of the St. Johns River between the west side of Catherine street and Hogans Creek. The total estimated quantity of material to me removed to complete the work to be done is 44,000 cu. yds. place measurement and this amount will be used as a basis in canvassing bids. The area which it is proposed to dredge over is about 130 ft. wide at the upper end, gradually widening to 300 ft. at a point about 900 ft. below the upper end. At the latter point it suddenly narrows and has an average width of about 40 ft. for the remaining distance of 400 ft. For a distance of 400 ft. from the upper end the rock has already been broken in this area but may require further breaking. An additional portion of the area, about 5,000 sq. yds., has been dredged to a depth of 21 ft. and a further portion, about 4,000 sq. yds. in area, has been dredged to a depth of 19 ft. The depth over the entire area will average about 21 ft. at mean low water. The depth over the entire area will average about 21 ft. at mean low water. The mean range of tide is 0.8 ft. The rock is believed to consist of a moderately soft limestone with some clay and marl mingled with it.

✣Bids are asked until noon, Sept. 7, by Capt. Geo. R. Spalding, U. S. Engineer, Jacksonville, Fla., for furnishing material and raising and building training walls, dams and shore protection in St. Johns River, Florida. The work to be done includes the completion of the Mile Point Training Wall to a point about 6,000 ft. above Sherman Point, measured on the arc of a circle of 4,730 ft. radius; to build 3,800 ft. of Brunswick Island Dam, from Brunswick Island to the Island in the mouth of Clapboard Creek, lying just below Beacon No. 6; to build Shipyard Training Wall from the lower end of LeBaron Island, 2,350 ft. down river, towards Fulton and in a direction approximately parallel to Fulton cut; to revet the left bank of the River at the mouth of Clapboard Creek for a distance of 500 ft. downstream and 800 ft. upstream from Beacon No. 6; and to revet the river bank, at Isle of Content in the mouth of Browns Creek, for a distance of 500 ft. along the Island and 100 ft. upstream and 100 ft. downstream from the Island. The Mile Point Training Wall will be built up throughout the 6,000 ft. of wall to a height of mean low water, by depositing oyster shell in such a manner as to form a solid wall of shell, having a width of crest of about 10 ft. at mean low water, the side slopes to be those that the material naturally assumes. Upon this wall of shell, first class stone will be placed in such a manner as to build the wall up to a height of 5 ft. above mean low water. The Brunswick Island Dam will be constructed as follows: First, a brush fascine mattress, varying in width with the depth of water, will be sunk and ballasted immediately by a layer of second class stone, at least 1 ft. thick. Upon this foundation a solid wall of second class stone will be constructed to a height of mean low water, in such a manner that the crest at mean low water will be about 8 ft. wide. Upon this wall, first class stone will be placed so as to bring the wall to a height of 4 ft. above mean low water. Shipyard Training Wall will be constructed as follows: For the first 1,750 ft. below LeBaron Island, the construction will be entirely similar to that of the Brunswick Island Dam. For the remaining 600 ft. after the mattress is laid and ballasted, as described for the Brunswick Island Dam, a solid wall of oyster shell will be constructed on this foundation to a height of mean low water, in such a manner that the width of crest at mean low water will be about 8 ft. and the slope that which the material naturally assumes. Upon this wall first class stone will be placed to a height of 4 ft. above mean low water. It may be required to revet the shell wall along the channel side on both, the Mile Point Training Wall and Shipyard Training Wall with 1 ft. or more of second class stone. It is expected to do this revetment work only where wash makes it apparent to the contracting officer that it is necessary and the length of walls to be thus revetted cannot be stated. The bank protection required will be constructed as follows: First, a brush fascine mattress about 40 ft. wide, but varying somewhat according to the slope of the bank, will be laid so that the upper edge shall extend inshore about 7 ft. from the edge of the bank and the mattress turn at the edge of the bank and lie closely to the bank to the bed of the stream. At the toe of the mattress three extra fascines will be securely sewed into the mattress with wire, first two fascines close together and then one on top of these two so as to form stop for the stone covering. On the mattress so laid will be placed a layer of second class stone, 2 ft. thick, and this covering will be carried to the point of mean low water. Above this point the covering will be of first class stone and will be carried to a height of about 4 ft. above mean low water. The approximate quantities are as follows: Mattress, 24,100 sq. yds.; oyster shells, 53,600 cu. yds.; first class stone, 19,050 tons; second class stone, 14,500 cu. yds.

Georgia.

✣Col. Dan C. Kingman, U. S. Engineer, Savanah, Ga., will receive bids until noon, Sept. 8, for dredging in Club and Plantation Creeks, Ga.

Illinois.

✣Bids will be received until 2 p. m., Sept. 1, by Maj. Charles Keller, U. S. Engineer, Rock Island, Ill., for the repair of dams and shore protections between Clayton and Dubuque, Ia.; between Rock Island and Burlington, Ia., and Hannibal, Mo.; between Clarksville, Mo., and the Illinois River mouth.

The Great Lakes Dredge & Dock Co., Chicago, Ill., at $102,480, was the low bidder Aug. 8 for dredging and rock excavation in the Chicago River. Bids for the work were opened at the U. S. Engineer's Office at Chicago.

Massachusetts.

✣Bids will be received until noon, Sept. 1, by Department of Streets, Boston, Mass., for furnishing and delivering and erecting two steam turbine driven centrifugal pumps for the Calf Pasture pumping station.

✣Bids will be received by B. Leighton Beal, Secretary of the Boston Transit Commission, Boston, Mass., for the construction of Section 2, Beacon Hill tunnel, for the Cambridge connection including a three platform station located under a portion of the existing park street subway station and Boston Common.

Coleman Bros., 1 Marginal St., Chelsea, Mass., have been awarded a contract for the construction of an underground conduit system for electrical conductors at the navy yard, Boston, Mass., for $4,750. Bids were opened July 23.

Nebraska.

Burdette Boyers of Seward, Nebr., has been granted permission by the state engineer for an appropriation of water from the Blue River for the purpose of operating an electric power plant. He proposes to begin work immediately and to expend $60,000 to $80,000 for the construction of two dams and power plants to be operated together. It is his intention to supply electric power and light to the cities of Milford, Seward, Beaver Crossing and perhaps David City. Mr. Boyers now operates a flour mill at Seward. His plans call for the building of a dam 16 ft. high about 3½ miles below Milford on the Blue river and another dam 22 ft. high below the junction of the Blue and the West Blue

New York.

✣William Williams, Commissioner of Immigration, Ellis Island, N. Y. H., will receive bids until 2:30 p. m., August 18, for dredging in northeast channel entrance channel and ferry basin at the U. S. Immigration Station, Ellis Island, N. Y. H.

✣Bids will be received until noon, August 25, by R. M. Schofield, Depot Quartermaster, Army Bldg., New York City, for two locomotives.

✣Bids will be received by Wendel L. Simpson, Maj. U. S. Army, Commissary Purchasing Officer, Panama Railroad, 24 State St., New York City, for furnishing under Panama R. R. Circular P. 300: 200 carriage bolts, 200 flat head bolts, 500 bars round iron, 25 bars angle iron, 600 square head bolts, 500 spring cotters, 12 14-inch bastard files, 3,000 galvanized tinners' rivets, 100 pounds poultry netting, staples, 12 4-inch galvanized elbows, 24 galvanized bushings, 18 flanged unions, 200 feet ⅜-inch wrought iron pipe, 48 pairs loose pins, brass butts, 300 galvanized axle pulleys, 480 sheets emery cloth and 75 cross bronze screws.

✣Bids will be received until noon, August 22, by Commissioner of Docks, Department of Docks and Ferries, Borough of Manhattan, New York city, for furnishing all the labor and material for constructing under contract No. 1192, the exterior pier with appurtenances at the mouth of Whale Creek. Newton Creek, Borough of Brooklyn.

✣Bids will be received by the Commissioner of Docks, Department of Docks and Ferries, Borough of Manhattan, New York city, for the contract No. 1220, for furnishing all the labor and materials required for the preparing for and extending the pier at the foot of W. 134th St., North River in Borough of Manhattan, known as Pier 124, North River, and for furnishing and depositing cobble and riprap thereat.

✣Bids will be received by the Fire Commissioner, R. Waldo, Fire Department, 157 and 159 East 67th St., Borough of Manhattan, until 10:30 a. m.. August 24, for furnishing and delivering rubber tires for use at the repair shops in the Boroughs of Manhattan, the Bronx and Richmond and the Boroughs of Brooklyn and Queens.

A. W. Adams, Chaumont, N. Y., at 70 cts. per ton, was the only bidder, Aug. 8, for furnishing Capt. W. L. Guthrie, U. S. Engineers, Oswego, N. Y., with 75,000 tons riprap stone for use at Oswego Harbor.

Bids were opened Aug. 8 by the Department of Docks and Ferries, New York City, for furnishing in place 25,000 cu. yds. of riprap, O'Brien Bros., Inc., 54 Smith St., New York City, at 30 cts. per cu. yd., being the probable contractors.

R. G. Packard Co., 130 Pearl St., New York City, at 12 8-9 cts. per cu. yd., was the low bidder for dredging 200,000 cu. yds. of material for the North River, at New York City. Bids for this work were opened Aug. 8 by the Department of Docks and Ferries, New York City.

John and Joseph McSpirit, 118 Wayne St., Jersey City, N. J., have been awarded the contract at $3.25 per cu. yd., for removing from 12,000 to 24,000 cu. yds. of marl, gravel, rock, hardpan and the boulders from the Arthur Kill in New York and New Jersey for the U. S. Government. Bids for the work were opened July 22 at the office of the U. S. Engineer in New York City.

Oregon.

Petitions are being circulated in the city of Portland, Ore., calling for the taking of a vote at the November election on the question of securing municipal wharves. The measure, on which it is proposed to vote, provides for the issuance of $2,500,000 of bonds, for the improvement of the water and harbor front of the city of Portland, for the acquirement, construction, maintenance and operation of public docks, of lands for the same.

The St. Johns Shipbuilding Co. of Portland, Ore., has been awarded a contract by the Standard-American Dredging Co., of San Francisco, Cal., for the construction of the hull and house of a dredger to be used at Honolulu. The machinery is to be installed there. Work has been commenced and will be finished so that the craft can be towed to the scene of operations in the fall. It will have a length of 140 ft. and beam of 40 ft.

Pennsylvania.

✣Bids will be received by H. C. Newcomer, Lieut. Col. U. S. Engineers, Pittsburg, Pa., until noon, Sept. 8, for the construction of lock and dam No. 7 in the Ohio river at Midland, Pa.

Texas.

A bill has been introduced in the State Legislature authorizing Galveston county to build and own a combination roadway and bridge across Galveston bay to connect the island with the mainland. Under this act the roads of the county will be connected with this roadway and the county will issue bonds at a rate of interest not to exceed 6 per cent for its construction. In order that the ground upon which to build the causeway may be secured, the act carries provisions for the establishment of a three-mile limit, condemnation proceedings and securing a right of way and authorizes all corporations contracting for the right of way upon the structure to issue bonds therefor under the rules of the railroad commission. This is the first bill resulting from the action of Governor Campbell in recommending to the legislature the amendment of the acts of the last regular session providing for the construction of causeways by counties through the issuance of bonds, and describing the methods by which the grounds for the same shall be secured.

Vermont.

Joseph Long & Co., Leominster, Mass., has been awarded the contract at $43,280 for changing river bed and opening street at back of blocks on Main St., for the city of Barre, Vt. Bids for this work were opened Aug. 11. The contract includes 18,000 cu. yds. earth excavation, 3,000 cu. yds. rock excavation, 2,500 cu. yds. dry rubble masonry wall, 300 cu. yds. rubble wall laid in mortar, 1,300 cu. yds. riprap in bottom of channel, 900 cu. yds. of culvert work, 200 sq. yds. pavement, laying 400 ft. 24 in. sewer tile and 300 ft. 8 in. tile, and 30,000 cu. yds. refilling for old river bed. George A. Reed is City Engineer and will have charge of the work.

Virginia.

The City Council of Norfolk, Va., has directed the City Engineer to prepare plans and obtain an estimate for the construction of a wharf and warehouse at the western end of Main St. along the northern line of the prolongation of the street to the Port Warden's line.

Washington.

The Municipal Dock Committee of the City of Tacoma, Wash., is taking steps to secure a site on which to erect a municipal dock 1,500 ft. long and three stories high.

The City of Olympia, Wash., opened bids Aug. 17, for making the Carlyon fill. The improvement district contains an area of about 19 or 20 blocks north of Third street to the line midway between C and D streets, and between Water and Jefferson Sts. The tide lands will be filled to .5 ft. above city datum. The cost is estimated at $102,297.20.

West Virginia.

✣Bids will be received until noon, Sept. 8, by Lieut. Col. H. C. Newcomber, U. S. Engineer, Pittsburg, Pa., for constructing lock and dam No. 9 in the Ohio River at New Cumberland. W. Va.

Wisconsin.

✣Bids will be received until August 25 by City Clerk, Decatur, Wis., for surface condensing equipment for the Decatur Municipal Lighting plant. Complete information may be obtained from D. W. Mead, Consulting Engineer, Madison, Wis.

✣Bids will be received until noon, Sept. 12, by Maj. Charles S. Bromwell, U. S. Engineer, Milwaukee, Wis., for the building of reinforced concrete caissons and pile pier, removing old pier and dredging at Racine Harbor.

Preliminary work for the hydro-electric development, to be constructed at Prairie Du Sac, Wis., is under way. The work is under the direction of B. G. Walter of Madison, Wis., a civil engineer who several weeks ago superintended the work of surveying for the extension of the railroad to the dam site.

Canada.

The Board of Works of Toronto, Ont., has adopted a motion favoring the submitting of a by-law to raise $500,000 for the Ashbridge's Bay improvement. The work contemplated will provide needed harbor and docking facilities on the east side of Toronto Bay, and will convert the marsh into factory sites with the material removed in providing the required depth of water.

The Imperial Car, Shipbuilding & Drydock Co., Ltd., is now perfecting plans for the construction of a drydock and shipbuilding plant in North Vancouver. Aside from the drydock; the company will have a steel plant and car shops, where a new form of all-steel passenger coach will be built. Archibald Allison, Vancouver, B. C., is interested.

BRIDGES AND BUILDINGS

Arkansas.

The County Court of Chicot County, Ark., at Lake Village, has been awarded the contracts for the construction of two bent bridges of 150 ft. each at $2.20 per ft. and one pile bridge across Macon Lake about 300 ft. long for $3.75 per ft. Several companies have been requested to furnish estimates for the [illegible] bridge with concrete approaches to be erected across Big Yard Bayou on the Lake Village-Luna Road.

California.

✣Bids will be received until 11 a. m., August 22, by Board of Santa Clara County Supervisors at San Jose, Cal., for the construction of a reinforced concrete bridge over the gulch near the Tevis Place, on the Dougherty Road. Henry A. Pfister is Clerk.

✣Board of County Supervisors, Fresno, Cal., will receive bids until August 24, for the construction of the proposed bridge on the upper Kings River on Section 8-13-24. The plans call for a 410-ft. structure with floor surface width of 18 ft. of reinforced concrete. It will consist of one 150-ft. steel pan and two 70-ft. steel spans and three girders each 40 ft. each resting on five concrete abutments.

City Engineer E. M. Capps, San Diego, Cal., has completed designs for the construction of the proposed suspension foot bridge to cross a canon on Spruce St., between Front and Brant. The structure will be 450 ft. long and will be supported by two heavy chilled steel cables suspended from steel towers. The cost of the improvement will be equally divided between the property owners and the city.

A contract has been awarded to Charles W. Corbaley, Wilcox Bldg., Los Angeles, Cal., for the erection of a large bridge across the Santa Ana River between Orange and Anaheim, for the Santa Fe Ry. Co. The structure will be 1,200 ft. long and will rest on concrete piers and abutments.

A contract has just been entered into by Sacramento and Yolo Counties and the Northern Electric and the Vallejo-Northern Rys. for a bridge at M St., to be strictly modern in every detail and estimated to cost $380,000, of which amount Yolo County is to pay $53,333 and Sacramento County $106,666. The structure will be between Sacramento and Broderick and will accommodate railroad and wagon traffic and pedestrians.

Advices from Yreka, Calif., state that the contract for the construction of the Yreka Creek bridge has been awarded to Murray Elwell Co., at $3,100. The structure will be of steel with 60 ft. span, 16 ft. roadway with 7 ft. walk on each side. The abutments will be of concrete and rest on bedrock. Other bidders for the work were as follows: The Western Bridge Co., $3,240; Jenkins & Wells, $3,690; G. B. Saxton, $3,189; C. W. Swain, $3,310.

Colorado.

The Chicago, Burlington & Quincy R. R. is planning to do away with grade crossings on its new line from Greeley to Hudson, thus necessitating the construction of a viaduct over the Union Pacific tracks east of LaSalle, Colo.

Delaware.

✣Bids will be received by the Constructing Quartermaster, Fort Dupont, Delaware City, Del., until 11 a. m., Sept. 6, for constructing brick quartermaster's work shop and removing and enlarging frame ordnance shop at Fort Dupont.

The Levy Court at Georgetown, Del., has appropriated an additional $1,000 toward the erection of the bridge at Bethel, which will be the finest in the county when completed.

District of Columbia.

✣Bids will be received until August 25 by the Department of Interior, Washington, D. C., for the installation of a vacuum heating system in the Pension Office Building, and for the construction of a trench in connection therewith.

Florida.

✣Bids will be received until noon, Sept. 6, by William Hays, Acting Secretary, U. S. Department of Agriculture, Washington, D. C., for the completion of a reinforced concrete observatory building for the weather bureau, U. S. Department of Agriculture, Sand Key, Fla.

Georgia.

✣Bids will be received until 10 a. m., Sept. 7, by R. V. LaDow, Superintendent of Prisons, Department of Justice, Washington, D. C., for furnishing and delivering at the United States penitentiary at Atlanta, Ga., miscellaneous cast iron and steel work for the administration building and main east and west cell wings of the United States Penitentiary at Atlanta, Ga.

✣Bids will be received until 3 p. m., Sept. 15, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including plumbing, gas piping, heating apparatus, and electric conduits and wiring of the United States Post Office at Waycross, Ga.

At the last meeting of the County Commissioners at Rome, Ga., County Engineer Booz recommended the construction of new bridges over the Etowah River from Rome into South Rome and East Rome to take the place of the present steel structures which are now reported to be unsafe. The estimated cost of the work is in the neighborhood of $114,000.

Illinois.

Information has been received from Springfield to the effect that the contract for the construction of the proposed new concrete bridge over the Sangamon River, west of Oak Ridge cemetery and at the north of Walnut St., Springfield, Ill., has been awarded to Charles A. Weaver & Son, Clayton, for $7,205. Other bids for the structure were as follows: Carden Callahan Co., Chicago, $7,237.70; Joseph Klein, Freeburg, Ill., $7,652; Frank Fitzsimmons, Springfield, $10,382.50; Concrete Product & Material Co., Springfield, $7,667; Miller, Lawson & Egan, Springfield, $10,372.

Advices from Paris, Ill., state that the commissioners of Edgar Township have let the contract for the erection of a new steel bridge across Bruiletts Creek at Tiff Ford east of Horace. The new structure is to be 90 ft. in length with concrete abutments and a 16 ft. roadway. The cost of the structure is $3,774.

The State Highway Commissioner has furnished the Supervisor and Highway Commissioner of Godfrey Township, Ill., with plans and estimates for the construction of 10 concrete bridges to be erected over streams in that township. Half the cost, which is $5,000, will be borne by the county Board Committee.

Advices from Rock Island, Ill., state that bids will be received at once by the City for the construction of two new bridges over the Rock River in that place and also for repainting and repairing two other structures.

The contract for the construction of the proposed new bridge over Covel Creek between Fall River and South Ottawa Townships, Ill., was awarded to the Decatur Bridge Co., for $3,256. H. S. Wetherell, Chicago, Ill., bid $3,698 for the work. The new structure will be of steel.

A contract has been awarded Oscar Quinn, General Contractor of Marseilles, Ill., for the construction of a 16-ft. span concrete bridge in Rutland Township, for $825.

Indiana.

✣Commissioners of Marion County will receive bids at Indianapolis, Ind., until 10 a. m., August 25, for the following work: Culvert on Fall Creek and Mud creek gravel road in the northeast quarter of Section 2-16-4, Lawrence township. Culvert on Fall creek and Mud creek gravel road, in northwest quarter of Section 3-16-4, Lawrence township. Culvert on Fall creek and Mud creek gravel road, in northwest quarter of Section 31-17-5, Lawrence township. Culvert on Fall creek and Mud creek gravel road, in northwest quarter of section 30-17-5 Lawrence township. Culvert on highway running east and west on north line of the southwest quarter of Section 33-17-2. Pike township. Culvert on the Madison free gravel road, 1,000 feet north of the south line of the southwest quarter of Section 24-15-3, Center township. Two (2) culverts near the corner of Sections 10, 11, 14 and 15, 14, 2. Decatur township. Albert Sahm, Auditor.

✣County Commissioners will receive bids at Bloomfield, Ind., until Sept. 5, for remodeling heating plant in court house; new plant in jail. Plans with auditor or H. L. Bass, Architect, Indianapolis, Ind., P. M. Cook is Auditor.

A representative committee of Rockville, Ind., has taken up with the County Commissioners, the matter of constructing a new bridge across the Big Racoon River at Thorp Ford.

The bid of $1,220 by the Vincennes Bridge Co., for the construction of the proposed bridge across Billey Creek near Wesley Chapel has been taken under advisement by the County Commissioners at Brazil, Ind.

City Council of South Bend, Ind., has passed a resolution and will submit same to the County Commissioners at the next meeting providing for the construction of a new bridge across the St. Joseph River at St. Joseph St. The proposed structure will connect North and South St. Joseph Sts. and will be built to admit traction service.

The LaFayette Engineering Co., LaFayette, Ind., has been awarded a contract by the county commissioners at Fowler, Ind., for the construction of a bridge over Mud Pine at Chase, Ind., for $1,148. Bids were opened Aug. 8.

Iowa.

The County Commissioners have issued bridge bonds to the amount of $50,000 to defray the cost of bridge construction in Lee County, Ia.

The Board of County Supervisors at Clinton, Ia., are now considering the construction of a new bridge across Deep Creek, near Seth Collins and repairs on the Wapsipinnicon and other structures.

Kansas.

The Commissioners of Cowley County at a recent meeting at Winfield, Kan., decided to let the contract for the construction of the proposed new bridge across the Arkansas River 11 miles southwest of that city. The estimated cost of the work is $4,000, $1,400 of which has been raised by private subscription.

Advices from Dodge City, Kan., state that Board of County Commissioners and a bridge engineer have located sites in Ford and Bucklin Townships preparatory to the construction of two concrete bridges therein.

At the November election the county of Sedgwick, Kansas, will vote on erecting a new steel and concrete bridge across the river at 13th St., Wichita, Kan., estimated to cost $20,000. The structure as proposed will be 400 or 500 ft. long and will be 16 ft. wide.

Louisiana.

✣Bids will be received until noon, Sept. 14, for the alterations and additions to the 2-story brick court house at Thibodaux, La., according to plans and specifications and conditions for estimating which can be obtained at the office of Favrot & Livaudais, Ltd., Architects, No. 839 Gravier St., New Orleans, La.

Maine.

✣Bids will be received by the Van Buren St. Leonards International Bridge Commission at the office of State Commissioner of Highways, Augusta, Me., until noon, Sept. 9, for the necessary labor and material for the construction of a highway bridge over the St. Johns River between Van Buren, Me., and St. Leonards, N. B. The structure will be 762 ft. long between the backwalls and will include about 2,200 cu. yds. of masonry. E. E. Greenwood, Skowhegan, Me., is Engineer.

Maryland.

The Commissioners of Garrett County, Maryland, according to advices from Oakland, have decided to erect two wrought iron bridges both to span the north branch of the Potomac River one at the Dobbin and one at Wilson in the eastern end of the county, on the line of the Western Maryland R. R.

The Board of County Supervisors, according to advices from Frederick, Md., have awarded the contract for the construction of an iron bridge across the Monocacy River at Biggs Ford on the Walkersville-Emmitsburg

Items marked thus ✣ indicate work now open for bid.

pike to the York Bridge Co., York, Pa., for $5,595.

Massachusetts.

✣Department of Public Buildings, Boston, Mass., will receive bids until noon, August 22, for reconstructing the Curtis Hall Building.

Bids were opened by the Committee on Bridges for the construction of a new bridge across the Chicopee River at Three Rivers, Mass., and as the lowest was far in excess of the appropriation they decided to take the matter up at the next meeting. The bidders were as follows: W. N. Flynt Granite Co., of Monson, for all granite construction, $27,371; concrete, granite face, $23,300; John Donahue of Springfield, all granite, $28,500; concrete, granite face, $24,500; Daniel O'Connell's Sons of Holyoke, all granite, $30,800; concrete, granite face, $23,380.

The Park Board of Fall River, Mass., has taken the matter of constructing a bridge over the railroad at South Park into consideration. The railroad company has offered to pay one-half the cost of the bridge and approaches and the board has $15,000 available for the purpose. Work will be started on the structure, for which plans were made some time ago, as soon as a written agreement is drawn up.

Minnesota.

The contract for the construction of a new bridge across the slough half a mile east of Ash Creek, Minn., has been let by the Town Board to the Hewett Bridge Co., Minneapolis, Minn., the lowest bidders.

The contract for the construction of the new bridge at Norton's ford near Luverne, Minn., has been awarded by the township commissioners to P. N. Gillham, Luverne, Minn., at $4,000. The structure will be of concrete and steel with 80-ft. span and 50-ft. approaches. He was also awarded the contract for building a 20-ft. concrete bridge on the same road west of the large bridge.

Engineer of State Highways, George W. Cooley, after an inspection of bridges throughout Minnesoata announces that $50,000 a year is needed to keep bridges in good repair.

At an assembly meeting held recently in St. Paul, Minn., the proposition to construct a bridge across the Mississippi River at Minnesota St. was voted down and the matter will be postponed indefinitely.

Missouri.

✣Bids will be received at the office of George S. Miller, Highway Engineer, Nodaway County, Mo., at Marysville, until 2 p. m., Aug. 18, for the construction of 28 bridges in Grant, Green, Hughes, Independence, Lincoln, Polk, Union, White Cloud, Washington, Monroe, Hopkins and Union Townships.

City Council of St. Joseph, Mo., is to take up with the railroads, the matter of constructing a new viaduct on South Dixon St., from Olive to Monterey Sts. The cost of the structure as recommended by engineers, would be between $750,000 and $1,000,000.

William P. Carmichael Co., Fullerton Bldg., St. Louis, Mo., has been awarded the contract for the construction of a new reinforced concrete factory building for the Dalton Adding Machine Co., at Poplar Bluff, Mo. The building will be 45 ft. by 400 ft.; two stories in height, and will be of reinforced concrete skeleton with brick curtain walls.

A special election is to be held soon in Hannibal, Mo., to vote on issuing $20,000 of bonds for the construction of repairs to the number of bridges and culverts recently damaged by storms.

The Raymond Concrete Pile Co., of New York and Chicago, has been awarded the contract for placing 1,021 Raymond concrete piles in the foundations of the piers for the King's Highway viaduct at St. Louis, Mo.

Bids have been opened by the County Court at Carthage for the construction of six new bridges to be built in different parts of the county. The bidders were as follows: The Wichita Construction Co. of Wichita, Kans.; The Monarch Engineering Co., of Falls City, Neb.: The Massillon Bridge Co., of Massillon, O.; The Illinois Steel Bridge Co., of Jacksonville, Ill.; The Kansas City Bridge Co., of Kansas City; The Vincennes Bridge Co., of Vincennes, Ind.; The Empire Bridge Co., of Falls City, Neb.; The Western Bridge Co., of Harrisonville, Mo.; The Canton Bridge Co., of Canton, O.

Montana.

✣The Board of County Commissioners, Great Falls, Mont., will receive bids until Aug. 18, for grading of five approaches to steel bridges to be installed within a short time.

Nebraska.

Work has been started by Ralph A. Duff, Nebraska City, Nebr., and T. H. Pollock of Plattsmouth, on the construction of the proposed 3-span steel bridge across the Platte River at Oreapolis, a railroad crossing near Plattsmouth. The piling will be driven down 40 ft. and it is estimated that the cost of the structure will be in the neighborhood of $20,000.

The County Board of Supervisors, Kearney, Nebr., have been petitioned by W. F. Vest and 32 others to construct a bridge between Sections 3 and 4-11-16; the petition was referred to the committee of bridges.

The Standard Bridge Co., according to the announcement made in Omaha, Nebr., has been awarded the contract for the county bridge work during the ensuing year.

New Jersey.

Active steps are to be taken by the City Council to have the railroad replace the trestle at Amboy Ave., with a bridge as the present structure is an obstruction to traffic, in Elizabeth, N. J.

New York.

✣Bids will be received until 2:30 p. m., Aug. 23, by William Williams, Commissioner of Immigration, Ellis Island, N. Y. H., for the removal of buildings designated portable pavilions of temporary barracks at the U. S. Immigration station, Ellis Island, N. Y. H.

✣Bids will be received until 10:30 a. m., August 25, by R. Waldo, Fire Commissioner, 157-159 East 67th St., New York City, for furnishing all the labor and material necessary for repairs and replacements to building of engine company 138, located at 175 Norman Ave. Green point.

✣Bids will be received until 2 p. m., August 18, by Kingsley, L. Martin, Commissioner of Bridges, 1321 Park Row, New York City, for paving temporary roadways on the Manhattan and Brooklyn terminals or the Manhattan bridge over the East River between the boroughs of Brooklyn and Manhattan.

Whitmore, Rauber & Vicinus of South Ave., Rochester, N. Y., have been awarded a contract by the Board of Contract & Supply of Rochester, N. Y., for the construction of a reinforced concrete arch bridge across the Genesee River at Central Ave., togther with incidental thereto for $151,017. Bids were opened Aug. 10.

The following bids were received by the Commissioner of Works, John Smith, Oswego, N. Y., for the construction of the proposed new lower bridge: United States Construction Co., of Albany, $94,700 for the job complete, with a reduction of $3,000 if piers are not finished this year: Maximillian P. Andelfinger, Oswego, $103,000; Groton Bridge Co., $109,844, $1650 to be deducted if piers are not completed this fall. The cost of the construction of the new bridge will be apportioned as follows: The county will pay one-third, the Lackawanna R. R. Co., $2,500; the street railway company about $10,500, and the city the remainder.

At a recent election held at Carlton, N. Y., the proposition to construct two bridges over Oak Orchard Creek was voted down.

North Carolina.

✣Bids will be received by the Camden Ferry Co., Elizabeth City, N. C., for supplying labor and material for the construction of a Scherzer rolling lift highway bridge and wooden pile approaches to same across the Pasquotank River at Elizabeth City. The work will be let as follows: (1) A Scherzer Rolling Lift Bridge, having weight of approximately sixty-two tons of metal. (2) The wooden approaches to same, having a total length of 527 feet, with the necessary piling, fenders, etc. About 260 piles will be required, varying in length from 20 to 70 feet, possibly longer. John W. Hayes, Petersburg, Va., is Engineer.

North Dakota.

✣Bids will be received by the Board of County Commissioners, at Mandan, N. Dak., until 10 a. m., Aug. 18, for the construction of a county bridge in township 137, range 80, bridge to be 80 ft. steel span on tubes with 32 ft. approach at one end and 16 ft. at the other, and concrete backing and wings. H. H. Harmon is County Auditor.

Ohio.

✣Director of Public Service, Springfield, O., will receive bids until noon, August 20, for the necessary labor and material for repaving High St. about one mile; paving west Main St. about 1¼ mile; paving College Ave. about ¼ mile; for the construction of a bridge on East High St., estimated to cost about $18,000.

The village of Barberton, O., has awarded contracts for the construction of a viaduct over the Erie R. R. tracks at Cornell St., to Edward J. Landor of Canton, O., and the Capitol Construction Co., of Columbus, O. The former receiving the work of constructing abutments, wing walls and approaches for $44,027 and the latter for the steel construction and roadway for $7,345. Bids were opened Aug. 8.

Commissioners of Hamilton, O., have under consideration the matter of building a new bridge at the Grand Boulevard. No definite action has yet been taken but it is thought that the old foundation will be torn out and a new one built to take its place.

Plans and specifications have been prepared for the construction of the proposed new Fifth St. bridge in Zanesville, O., by Engineer J. A. Stewart, Cincinnati, O., and it is expected that after a thorough examination, bids for the work will be called.

State Board of Public Works has granted Board of County Commissioners permission to construct a temporary bridge over the canal at the temporary roadway to the Jewish cemetery and Calvary cemetery in Dayton, O.

The County Commissioners at Bowling Green, O., have awarded the contract for furnishing the necessary material and labor for the construction of the substructure of a bridge about 80 rods south of the northeast corner of Section 36, Bloom Township, Wood County, to B. L. Dennis of Dowling, O., and to the Home Engineering & Contracting Co., of Canton, O., for the superstructure of the same.

Petitions are being prepared and will be circulated for the construction of a bridge across the Maumee River a mile above Defiance, O.

The Advance Construction Co., 1244 Norwood Road, Cleveland, O., has been awarded a contract by the county commissioners at Cleveland for the construction of jetties as per report No. 2679, Jetties, Chagrin River at Gates Mills Bridge, Mayfield Township. Bids were opened Aug. 10.

The contract for the repair of the Taylor Creek culvert was awarded to John B. McLane for $6,810 by the city of Cincinnati, O.

County Commissioners have let the contract for repairing the large bridge over the Cuyahoga River and the canal at Peninsula, O., to the Home Engineering and Contracting Co., Canton, O., for $1,688.

A new bridge, according to information received from Jefferson, O., will be constructed across the Ashtabula Creek in Pier[illegible]t. O.

Commissioners of Allen County have let the contract for the construction of the new Fetter Stone Quarry bridge in Bath Township to the Capitol Construction Co., Columbus, O., for $2,592.

The Home Engineering & Construction Co., Canton, O., has been awarded the contract

Items marked thus ✣ indicate work now open for bids.

by the County Commissioners for the construction of the superstructure for a new steel bridge to be erected over Ten Mile Creek at Sylvania. The substructure for the same has been awarded John Weckerly, Whitehouse, at $4.90 per cu. yd.

The City Council of Cincinnati, O., has contracted with the Kirchner Construction Co., for the building of the Powers St. bridge across the west fork of Millcreek, at a cost of $5,245.

Oklahoma.

✤Bids will be received by the Board of County Commissioners, Tulsa, Okla., until Sept. 6, for sketches and estimates for a new County Court house and county jail to be erected on the site known as the Peryman Block in Tulsa, Okla.

Advices from Sapulpa, Okla., state that the county has awarded the contract for the construction of a bridge over the Cimaron River near Mannford, to the Massilon Bridge Co., for $25,000. The structure will be 600 ft. in length.

Oregon.

At a recent meeting of the Salem, Ore., City Council, the bridge committee reported favorably on plans and specifications for the proposed bridge over the creek at North Capitol Creek and a resolution was passed to call for bids on the work.

Pennsylvania.

✤Bids will be received until noon, Sept. 8, by James M. Norris, County Controller, Luzerne County, Wilkesbarre, Pa., for the necessary labor and material for the construction of parts of a bridge over the Susquehanna River between borough of Plymouth and the township of Hanover in the said County. Official advertisement of the work will be found elsewhere in this issue.

✤Bids will be received by the Commissioners of Beaver County at Beaver, Pa., until 10 a. m., Aug. 20, for the construction of a concrete bridge over Crow's Run near Wallace City in New Sewickley Township. Plans and specifications are now on file at the court house. Stanton F. Ewing is one of the Commissioners.

Advices from Altoona, Pa., state that the construction of the Johnston & Altoona Electric Ry will necessitate the installation of at least 12 concrete bridges to span streams and to avoid grade crossings.

City Council of Johnstown, Pa., has passed an ordinance appropriating $55,000 for the construction of new bridges to cross the Conemaugh and the Stony Creek. The first structure will connect Minersville and Cambria City and the latter the fourth and fifth wards. The county will now be called upon to appropriate its share of the cost.

Cramp & Co., Bridge Contractors, of Philadelphia, Pa., have completed their contract for the construction of the Broad St. bridge in Allentown, Pa. The new structure is of steel spanning the 100-ft. ravine through which flows the Monocacy Creek between West Bethlehem and Lehigh County and Bethlehem in Northampton County, and cost $120,000.

The contract for the construction of the new bridge between Sunbury, Pa., and Packer's Island has been awarded by the county and the Sunbury & Northumberland St. Car Co., to the York Bridge Co. The company's bid was $84,450 for a 4-span structure and $84,300 for a 6-span structure.

The Lehigh Valley R. R. Co. has released its property for the widening of the Hamilton St. bridge in the heart of Allentown, Pa. The improvement is estimated to cost $15,000 and will be borne by the railroads, the city and the county.

The Commissioners of Blair County at Hollidaysburg, Pa., have awarded the following contracts for the construction of bridges, bids opened Aug. 9: W. H. Herr, of Altoona, Pa.—Reinforced concrete arch bridge over Brush Run near Bald Hill, on line between Frankstown Township and Blair Township 32 ft.; rise 8 ft.; width of roadway 18 ft.; parapet walls 4 ft. high; and necessary wing walls, for $1,600. Reinforced concrete arch bridge over Laurel Run at Reightown, in Antis Township, skew span 55 ft.; skew angle 64 degrees; right angle span 49 ft. 5¼ ins.; rise 8 ft.; width of roadway 16 ft.; parapet walls 4 ft. high; and necessary wing walls, $1,950. Reinforced concrete arch bridge over Bald Eagle Creek, near the Paper Mill at Tyrone, skew span 79 ft. 9¾ ins.; skew angle 70 degrees; right angle span 75 ft.; rise 11 ft.; width of roadway 30 ft.; width of sidewalk 6 ft.; parapet walls 4 ft.; and necessary wing walls, for $8,300. Myers, Gable & Ritchey, Duncansville, Pa.—Concrete abutments and necessary wing walls for steel beam bridge over Brush Run at Hart's Brick yard, in Frankstown Township, skew span 28 ft.; width of abutments 14 ft. 6 ins.; top of foundation to bridge seat, 1 ft. 3 ins.; foundation 4 ft. deep; creosoted wood block floor. Concrete abutments and reinforced wing walls for steel truss bridge over Clover Creek at Homer Hewitt's farm, in Huston Township, width of abutments 18 ft.; span 39 ft.; bridge seat 6 ft. 8 ins. above foundation; width of bridge seat 1 ft. 9 ins.; foundation 5 ft. deep; creosoated wood block floor.

South Dakota.

✤Bids will be received until Aug. 20, at the office of the Dakota Wesleyan University, Mitchell, S. Dak., for the construction of a concrete foundation for a new science hall, 130x60 ft.

Tennessee.

✤Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Sept. 16, for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Harriman, Tenn.

Texas.

Petitions are being circulated and signed by property owners in Goliad County, Texas, and are to be presented to the Commissioners Court asking that bridges be built across the San Antonio River near Goliad and one on the Minnehuilla.

Virginia.

✤Bids are asked by Capt. E. R. Tilton, Constructing Quartermaster, Fort Monroe, Va., until 10 a. m., Sept. 9, for the construction of a band mess and ship building including plumbing, heating and electric wiring and fixtures.

Washington.

✤Bids will be received by Lieut. A. L. Sneed, Constructing Quartermaster, Fort George Wright, Wash., until 11 a. m., Aug. 20, for the following repairs, alterations and supplies for the hospital building No. 32 at this post, viz: Furnishing and installing wood frame window and door screens (full length for windows) on main building and west wing and on basement of entire building; furnishing and installing combined linen closets and lockers in two wardmasters' rooms, east wing; furnishing and installing work bench in laboratory; furnishing all material and constructing dark room in examination room, second floor, main building; furnishing and delivering at building 24 panes glass, best American double thick, 18x38 ins.

County Commissioners at a recent meeting held at Montesano, Wash., awarded the contract for the construction of a bridge across the Hoquiam River near London to A. W. Tweeden, Tacoma, Wash., for $2,498.

City Engineer D. P. Wheeler, Puyallup, Wash., has submitted plans and estimates for the construction of a bridge over the deep cut made by the Puyallup River into the banks of Meeker Junction. The structure as proposed will be 800 ft. long and is estimated to cost about $6,500.

Wisconsin.

✤Bids will be received until 10:30 a. m., Aug. 20, by Department of Public Works, for furnishing the city of Milwaukee two first size steam fire engine boilers for Ahren's engines.

✤Bids will be received by the Department of Public Works, until 10:30 a. m., Aug. 22, for installing a complete steam heating apparatus in fire engine house No. 4 located at No. 537 Third Ave. in the 11th Ward, Milwaukee, Wis.

✤Department of Public Works, Milwaukee, Wis., will receive bids until 10:30 a. m., Aug. 22, for installing a complete steam heating system in fire engine house No. 5 located at No. 339 Bartlett Ave. in the 18th Ward.

✤The Milwaukee Department of Public Works, will receive bids until 10:30 a. m., Aug. 22, for the installation of a complete steam heating system in the fire engine house No. 6 located at 247 St. Clair St. in the 17th Ward.

✤Bids will be received at an early date by the Citizens Water Works Co., Quincy, Ill., for the construction of a new pumping building. The cost of the work is estimated at $10,000. W. R. Gelston is Superintendent, Daniel W. Mead, Madison, Wis., is Consulting Engineer.

Wyoming.

Advices from Cheyenne, Wyo., state that the construction work will soon be started on the proposed new bridge across the Platte River south of Lingle. Property owners have offered to advance money for the purpose without interest. The cost of the structure is estimated at $18,000.

Canada.

✤Bids will be received by R. A. Fines, Sec'y-Treasurer, Darlingford, Man., until Aug. 22, for the construction of a 4-room brick school house. Frank Evans, Somerset Block, Winnipeg, Man., is Architect.

The Canadian Pacific R. R. has awarded the following contracts for the construction of a building in Montreal, Can.: For the completion of the new annex to their Windsor St. station, C. E. Deakin, at $1,000,000; for the structural steel work to the Dominion Bridge Co., at $250,000.

The contract for the construction of the substructure of the new bridge across the Pas over the Saskatchewan River in Canada to MacKenzie & Mann, Toronto, Ont., for $100,000. The contract for the superstructure was let several weeks ago to the Canada Foundry Co., Toronto.

ROADS, STREETS AND PAVEMENTS

Alabama.

The Dallas Court of County Commissioners at Selma, Ala., has ordered the building of the new road in the southern part of the county. The new road will be built from Richmond to Minter station on the Western Ry. of Alabama and will be about 5 miles in length. County Engineer W. S. Kellar will have charge of the building of the road and the work will be done by the county convicts.

California.

The right-of-way has been purchased from the Northwestern Pacific R. R. Co., by Mrs. Manlove, owner of the Hotel Bon Air, for the cut-off road from the foot of Wolfe's grade, Kentfield, to Escalle station. This new road will cut down the distance between San Rafael and Escalle's and Larkspur at least one mile.

County Surveyor Meek, Marysville, Cal., has made a report to the board of supervisors recommending that Hooper Lane, near Wheatland, be declared a public highway.

The Supervisors of Sutter County, Yuba City, Cal., have accepted the grant of land from the Eckert Wilbur tract which will enable the construction of county roads.

Connecticut.

Advices from Rockville state that surveyors have been at work establishing lines for the construction of a state road from the Manchester town line to the macadam road in Talcottville.

District of Columbia.

The Bureau of Supplies & Accounts, Navy Department, Washington, D. C., has awarded a contract to James Cape & Sons, of Racine, Wis., for constructing roads and walks under schedule 2610 at Naval Training Station, North Chicago, Ill., for $20,787. Bids were opened July 12.

Florida.

J. P. Branderon of Pensacola, Fla., has been awarded a contract by the city of Dothan, Ala., for the construction of about 12 miles of cement walks and the same amount of combination curb and gutter for $10.30 per sq. ft., and $.50 per lin. ft. respectively. S. C. Stallings, City Engineer. Bids were opened Aug. 8.

Georgia.

W. C. Pease, 307 Grant St., Ga., has been awarded a contract for the construction of roads and walks at Fort Morgan, Ala., for $5,740. Bids were opened Aug. 5.

Illinois.

✣Board of Local Improvements, Mattson, Ill., will receive bids until 1 p. m., Aug. 22, for the improvement of North 19th St., by paving with brick on a concrete foundation and cement fillers and constructing combined curb and gutter. The cost of the work is estimated at $13,145.

The contract for furnishing the gravel for the lower Hutton road near Westfield, Ill., has been awarded by the county commissioners at Marshall to W. F. Strader for $1.40 per yd. The contract calls for 1,000 yds.

The contract to pave East Court St. with sarco in Kankakee, Ill., has been awarded by the Board of Public Works to Hays Sons & Co., for about $1,800 less than the former bid. The contract was awarded for about $20,000.

An ordinance for the paving of Walnut Ave., from the National St. bridge to South State St., has been presented to the city council of Elgin, Ill. J. S. Robinson, division engineer for the Chicago & Northwestern R. R., and E. D. Howell, the local agent, appeared before the board and objected to the improvement on the grounds that the railroad would not be benefited by it.

The Board of Local Improvements of Robinson, Ill., has awarded a contract to Keegan Bros. of Brazil, Ind., for the paving of East Poplar St., King St., and North Jackson St.

Indiana.

✣Bids will be received until 10 a. m., August 24, by the Board of Public Works, Indianapolis, Ind., for the improvement of Pennsylvania St. from east property line of 38th st. running east to north property line of 40th St. by grading, paving and rolling the roadway.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., August 24, for the improvement of Pennsylvania St., from the south property line of 38th St., running east to the south curb line of 40th St., by grading and paving the sidewalks.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., August 17, for the improvement of Laurel St., from the south sidewalk line of Lexington Ave., to the north curb line of Prospect St., by grading and paving the sidewalks.

✣The Indianapolis, Ind., Board of Public Works will receive bids until 10 a. m., August 24, for the improvement of Washington Boulevard from the south property line of 36th St. to north property line of 40th St. by grading and paving the roadway.

✣Bids will be received until 2 p. m. August 26, by Commissioners of Vermillion County at Newport, Ind., for the construction of a road in Clinton Township, H. T. Payne is Auditor.

✣Bids will be received until 1 p. m., Sept. 5, by the Commissioners of Benton County, Fowler, Ind., for the construction of a stone road in York township. Lemuel Shipman is Auditor.

✣Bids will be received until 10 a. m., September 5, by the Commissioners of Adams County at Decatur, Ind., for the construction of a macadam road in Preble township. H. S. Michaud is Auditor.

✣Bids will be received until 2 p. m., Sept. 6, by Board of County Commissioners for the construction of a macadam road in Noble township and a macadam road on the dividing line of Orange and Anderson townships. Jesse M. Stone is Auditor of Rush County, at Rushville, Ind.

✣Bids will be received until 2 p. m., Sept. 6, by County Commissioners at Wabash, Ind., for the construction of a highway on the line between Noble and Waltz townships also gravel or macadam road in Chester township, Wabash County. J. P. Noftzger is Auditor.

✣Commissioners of Boone County at Lebanon, Ind., will receive bids until 1 p. m., Sept. 8, for the construction of a gravel road in Sugar Creek township. B. F. Herdrich is Auditor of the County.

The city of Wabash, Ind., has awarded a contract to Philip Hipskind & Sons for the improvement of Stitt St., with sidewalks and macadam and tarvia pavement for $.55 per lin. ft. for the former and $4 per lin. ft. for the latter. Bids were opened Aug. 8.

The county commissioners at Lafayette, Ind., have adopted specifications for the improvement of the Riverside road from Happy Hollow to the State Soldiers' home and bids will be advertised for at the September session of the board. Three plans were prepared by Everett B. Vawter, Engineer. The road will be of macadam.

Charles Hoesel, Winamac, Ind., has been awarded a contract by the commissioners of Pulaski County, Winamac, Ind., for the construction of the Chis. Peters et al. road between Tippecanoe and Hanim Townships, for $3,649. Bids were opened Aug. 2.

Arlantis Runyon of Valparaiso, Ind., has been awarded a contract by the Couny Commissioners at Valparaiso for the construction of 2.51 miles of road for $11,080. Bids were opened Aug. 8.

The County Commissioners at Valparaiso, Ind., have awarded a contract to Jake Ackerman of La Porte, Ind., for the construction of the H. M. Evans gravel road for $11,080. The road is 2.51 miles in length. Bids were opened Aug. 8.

The following bids were the lowest received at Frankfort, Ind., for the construction of 15 gravel roads throughout the county: Johnson road, W. E. Bolt, $3,145; Grice road, Frankfort Construction Co., $3,770; Smith road, Frankfort Construction Co., $5,280; Jacoby road, Frankfort Construction Co., $899; Gochenour road, G. M. Good, $2,113; Troxel road, C. C. Huffine, $1,255; King road, Davis & Booher, $3,456; Miller road, L. W. Seaman, $1,994; McClamroch road, Thos. Sparks, $7,664; Bottersall road, Davis & Booher, $4,687; Maish road, L. W. Seaman, $1,917; Dixon road, L. W. Seaman, $4,048; Wright road, E. Mitzenburg, $1,944; Barnett road, Frankfort Construction Co., $1,444; Pierce road, O. C. Davis, $3,246.

The Town Council of Markle, Ind., has approved the acceptance of the bid of L. A. Hutsell to construct the mile of model road to be known as the Rarick road on the township line near Markle. This road will be supervised by a government engineer.

Iowa.

Thos. Carey & Son of Clinton, Ia., has been awarded a contract in that city for the construction of creosoted wood block pavement for $22,146. The work includes 8,330 sy. yds. of wood block at $2.394 per sq. yd.; 2,040 lin, ft. of curb at 66c per ft.; 440 lin. ft. of underpaving at 20c per sq. yd.; 13 catch basins at $35 each; 640-ft. catch basin pipe at 45 cts. per ft., and 3 manhole tops at $9 each. Bids were opened Aug. 9.

Connonan & Co., of Muscatine, Ia., have been awarded a contract by the city of Knoxville, Ia., for the construction of 22 blocks of concrete pavement with combined curb and gutter, also two blocks of alley pavement for $1.50 per sq, yd. Bids were opened Aug. 8.

Proceedings for paving 4th Ave., from 34th to 55th Sts., in Davenport, Ia., have been started in court by City Attorney Ben. S. Bell. The city is determined to see the project through and hopes to secure the courts approval on the matter.

The following bids are the lowest received by the Board of Public Works of Davenport, Ia., for paving of several short stretches in the city: Hydraulic Concrete Construction Co., Davenport, Ia., alley between East River and Swits, Federal and Tremont Ave; excavation 45c, paving $1.72; Hydraulic Concrete Construction Co., Cast St., from Federal to Cambria; excavation 45c, paving $1.69, curbing 35c; Independent Construction Co., Davenport, Ia.; excavation 45c, paving $1.73, curbing 38c, Brown St., from 4th to alley north of 6th; Independent Construction Co., Western Ave.; excavation 45c, paving $1.73, curbing 38c; Independent Construction Co., Myrtle St., sewer, $1.08 per lin. ft.; and Pat Connelly, Spring St., sewer 80c per lin. ft.

The City Council of Marshalltown, Ia., has changed the specifications for brick paving to be done in this city from that of crushed stone base to gravel.

The Charlton City Council awarded the contract for the paving of all of North Grand St., also the street leading to the depot and the street one block east of McKelveen & Eickenberry's lumber yard and the block one block south of the postoffice to J. C. Blunk of Ottumwa, Ia., for $2.04 per sq. yd. for paving, 55 cts. for curbing and 45 cts. for excavating. Work on the contract will begin as soon as the material arrives and will be completed before winter.

The city council of Clinton, Ia., has instructed City Engineer Reuben C. Hart to make plans and an estimate of the cost of constructing pavement on Third Ave. The estimated cost of the work being $6,000. W. E. Hayes is City Clerk.

Kansas.

The Commissioners of Johnson County, Olathe, Kan., have been petitioned for the construction of a county road in section 13 to intersect with the Lexington and Indian Creek road. Jasper T. Kincaid is County Clerk.

Louisiana.

The Finance Committee of the City Council of New Orleans, La., has awarded the following contracts for paving and sewering in the city: Standard Paving & Construction Co., for the installation of subsurface drainage of Howard Ave., from South Peters St. to Camp for $20,292; C. Hyland & Co., for repaving the same for $10,602; Egan Bros., for paving DeSoto St., from Esplanade Ave., to Moss St., for $16,282; C. Hyland & Co., for re-embellishing Kennedy Place for $1,023; Barber Asphalt Co., for subsurface drainage for the DeSoto St., repaving for $22,857.

The police jury at Plaquemine, La., passed a resolution that it would contribute a sum not exceeding 25 cts. per lin. ft. for the establishment of gravel roads throughout the parish, on condition that the citizens in any particular part of the parish would contribute the balance. Following the provisions of this ordinance Joseph A. Grace, B. C. LeBlanc, A. H. Gay and the Wilberts' Plant-Grove Co., have decided to at once gravel the public road along the river from the lower end of the town to the Evergreen plantation, somewhat over two miles. Ross Murrell has also informed the jury that the citizens of his section of the ward would also gravel the public road extending from Bayou Goula Station to the town of Bayou Goula, a distance of slightly over a mile.

Lake Charles, La., automobile owners and others interested have raised a fund exceeding $500 for the improvement of the public road between this city and Grand Lake, a distance of 15 miles.

Maryland.

City Engineer B. T. Fendall of Baltimore, Md., has announced intention of calling for bids to resurface cobblestone streets with sheet asphalt.

Massachusetts.

Arthur M. Robinson of North Adams has prepared a bill which he will have introduced into the next Legislature for the construction of a state road over Hoosac mountain connecting the city of North Adams with Hoosac Tunnel village on the Deerfield River near the east portal of the Hoosac tunnel. The bill proposes to appropriate $100,000 for the state road. The route proposed forms part of the trunk line across the state from Boston.

Chairman C. D. Fisher of the County Commissioners of Middlesex County, Lowell, Mass., together with J. B. Kearns and A. A. Langill, have awarded the contract for the new road as voted at the recent special town meeting of Holliston, to C. E. Horne of Millbury for $8,305, to be completed by Nov. 1. At the same time the same contractor was awarded the contract for 9,800 ft. of gravel road, with oiled surface, to be paid for by the state and which will join the town's macadam road at Pine St. The contract price is $7,783.

A petition is being signed in Dighton, Mass., asking the selectmen to call a special meeting to consider the question of an appropriation for a macadam road from Berkley bridge to the First Congregational church. The town recently appropriated $5,000 for making macadam at the north end.

Warren Bros. of Boston, Mass., have been awarded a contract by the city of Boston for the paving between rails of crane track for $.17½ per sq. ft. Bids were opened July 23.

Michigan.

The Ionia and Berlin Bellevue association has been organized for the purpose of improving 5 miles of Bellevue road from Ionia south to Tremayne's Corners. The officers of the association are A. P. Loomis, President; Jay Hardwood, Secretary, and an executive committee from Orange, Berlin Township and Ionia City. The improvement will cost $7,500.

Minnesota.

A majority of Dayton Ave. property owners of St. Paul, Minn., owning about 6,000 ft. of frontage, have thus far petitioned for an asphalt pavement on that street. Others, owning about 2,000 ft. frontage, who favor creosoted block pavement, have asked for more time in which to strengthen their petition for the more expensive material. According to estimates, the block pavement will cost $5 a front ft., while the cost of the asphalt will be $4.20.

Missouri.

The County Court at Independence, Mo., may build a new rock road from Lee's Summit one and one-half miles south to the Rock Island depot. The court has directed the county highway engineer to prepare plans and specifications.

E. M. Clendening, General Secretary of the Commercial Club of Kansas City, Mo., has been informed by Curtis Hill, state highway engineer, that he will aid in the construction of a good dragged road over the old Santa Fe trail and the Boon's Lick road.

The Southwest Boulevard Improvement Association of Kansas City, Mo., has decided to co-operate with the Broadway Improvement Association in working for the lowering of the grade on Broadway between 14th and 17th Sts. A resolution also was adopted favoring the proposition of a viaduct across the Kansas City Terminal tracks at Broadway to connect with the Penn Valley traffic way. A committee of the club was appointed to further the scheme for the extension of the boulevard from Baltimore Ave. to 18th St., to connect with the proposed widening of 18th St.

The County Court, in session at St. Joseph, Mo., has awarded contracts for grading country roads as follows: The Drysdale road, to Rush Bros., at $0.14 a cu. yd. This road leads off the Rochester road, northeast of the city. Arnoldsville road, to E. P. Olson, at $0.24½. The Arnoldsville road is northeast of Dearborn, and south of Agency. The hill road to DeKalb, beginning at the Croy hill, to T. A. Davis at $0.11. The Brown-Waller road, a half-mile north and a mile west of Faucett, leading to the Sparta road, to S. S. Duncan, at $0.20.

Montana.

James M. & Will J. Moore of Bozeman, Mont., have been awarded the contract for constructing the wagon road from Taylor's Ford to Yellowstone, Mont., for $8,155. The work includes about 36½ miles of road through the mountains most of the way, 61 bridges and culverts from 3 ft. to 100 ft. spans. Bids were opened Aug. 1 by W. E. Brandenburg, County Clerk, Bozeman, Mont.

Nebraska.

The Katz-Craig Construction Co., of Omaha, Neb., has been awarded a contract by the city of Norfolk, Neb., for the grading and paving of Norfolk Ave., from the bridge over the river east of 1st St., to the west line of Seventh St. at a width of 68 ft., with brick. The contract was awarded at $2.10 per sq. yd. Bids were opened Aug. 9.

The City Council of Omaha, Neb., has passed a resolution accepting the petition of the property owners of South 16th St., for the paving of that street with creosote wood blocks.

New Hampshire.

State Engineer H. C. Hill, Concord, N. H., has awarded a contract to M. N. Layn of Dover, N. H., for the construction of a gravel road in Lee, N. H., at about $1,300. The work includes grading and surfacing. Bids were opened Aug. 5.

Bids were received by State Engineer H. C. Hill at Concord, N. H., on Aug. 5 for the construction of 10,000 ft. of trap rock road in Somersworth, N. H. All bids being rejected.

New Mexico.

Territorial Engineer Vernon L. Sullivan has announced that the survey of the good roads commission from Las Vegas to Mora, N. M., has been completed. The distance of the road as proposed under this survey will be exactly 31 miles and will avoid all low places, being entirely over the mesas and along the top of divides. Two other surveys will be made of routes so as to make sure that the best route will be selected.

New York.

✣Separate bids will be received by the Department of Public Works, Buffalo, N. Y., until 11 a. m., Aug. 18, for the following work: A separate proposal must be made for the work and supplies included in each descriptive paragraph following: For paving Kentucky street, 28 ft. wide, from the south curb line of Mackinaw St. to the northwest curb line of St. Clair St., except from the north curb line of O'Connell Ave. to the south line of the Erie R. R. and except the crossing of South St. with each kind of pavement for laying of which specifications have been filed by the Commissioner of Public Works. For paving Vincennes St., 26 ft. wide, from the north curb line of South St. to the Erie Ry. lands with each kind of pavement for laying, of which specifications have been filed by the Commissioner of Public Works. For paving Tennessee St., 28 ft. wide, from the south curb line of Mackinaw St. to the north curb line of Republic St. and 26 ft. wide from the Erie R. R. lands to the north curb line of South St., except the crossing of O'Connell Ave., with each kind of pavement for laying, of which specifications have been filed by the Commissioner of Public Works. For repaving Eagle St., 40 ft. wide, from the east curb line of Main St. to the west curb line of Washington St., except the space occupied by the street railway tracks and 2 ft. outside the same with each kind of pavement for laying of which specifications have been filed by the Commissioner of Public Works. For paving Grant St. 2 ft. wider on each side of the present pavement from the northwest curb line of Hampshire St. to the south curb line of Delavan Ave., except the crossings of West Ferry and Breckenridge Sts. and Lafayette Ave. with each kind of pavement for laying, of which specifications have been filed by the Commissioner of Public Works.

✣Bids will be received until 11 a. m., August 24, by Alfred E. Steers, president of the Borough of Brooklyn, for three contracts as follows: (1) for restoring and repaving with asphalt on a concrete foundation the roadway of Raymond St. from Dekalb Ave. to 50 ft. north of Johnson St. together with all work incidental thereto. (2) For fencing vacant lots on the east side of Amboy St., between Sutter and Pitkin Avs., and on various other streets in the Borough of Brooklyn. (3) For grading lots on the north side of 54th St., between 8th and 9th Avs., known as Lots Nos. 64, 66, and 68, Block 5665, Section 17.

✣Bids will be received until 2 p. m., August 18, by Kingsley L. Martin, Commissioner of Bridges, 13-21 Park Row, New York City, for laying and relaying water and gas mains and grading and paving the streets adjacent to the municipal building.

✣Bids will be received until 3 p. m., August 18, by Park Board, Arsenal Bldg., New York City, for furnishing all the labor and materials for reconstructing the roadway of the Bronx and Pelham Parkway, including surfacing with asphaltic earth mixture from its junction with the eastern boulevard to the crossing of the said parkway over the tracks of the N. Y., N. H. & H. Ry., Harlem River branch in the borough of The Bronx, in the city of New York.

✣Bids will be received until 3 p. m., August 18 by Park Board, Department of Parks, New York City, for the construction of rock asphalt mastic where directed on the walks of Central Park and other parks in New York City.

North Carolina.

Work on the improvement of the Hickory Nut Gap road will begin this month and will be pushed forward as rapidly as possible. The road forms part of the Charlotte-Knoxville highway. The road lies in Buncombe County. Joseph Hyde Pratt of Asheville, N. C., is interested.

Ohio.

✣Bids will be received until noon, Aug. 26, by the Board of County Commissioners, Cincinnati, O., for the improvement of the Harrison and New Haven road from Harrison Pike to the Miami River bridge at New Baltimore, in Harrison and Crosby Townships. Stanley Struble is President of the Board.

✣Bids will be received until noon, Sept. 12, by Nelson J. Brewer, Clerk of the Village of Euclid, O., for the necessary labor and material for the construction of brick pavement, grading and draining Lawnview Ave. from the north curb line of Euclid Ave., to the south line of Superior Blvd.

Vogt & Son of Massillon, O., has been awarded a contract by the County Commissioners of Stark County at Canton, for the construction of a brick roadway between Beach City and Wilmot, a distance of 2.54 miles, for $41,298. Bids were opened Aug. 5.

Chas. A. Wright of Cleveland, O., was low bidder for the construction of Broadway Road No. 4. Mr. Wright's bid being $8,836. The contract has not been awarded. Bids were opened Aug. 10 by Frank R. Lander, County Surveyor, Cleveland, O.

The city of Delphos, O., has awarded contracts to T. J. Mulligan of Lima, O., and the Asphalt Block Paving Co., of Toledo, O., for the construction of 20,000 sq. yds. of

Items marked thus ✣ indicate work now open for bids.

brick and asphalt pavement in the city. Bids were opened Aug. 8.

The County Commissioners at Dayton, O., have awarded a contract to K. E. Kunkle for the improvement of the Dayton and Xenia pike for $14,758.

The bids for building two and six-tenths miles of improved road in Vinton County, O., were opened at the Auditor's office in McArthur on Aug 4 and the contract awarded to Juniper & Nixon of Nelsonville for $12,100.

The Board of County Commissioners of Hamilton County at Cincinnati, O., has awarded a contract to William F. Garretson of 409 Tusculum Ave., Cincinnati, for the construction of improvements under Specifications No. 85, on the Cleves and Dugan Gap road from Cleves to Dugan Gap in Miami Township for $45,437. Bids were opened July 29.

The Board of County Commissioners at Cincinnati, O., have awarded a contract to R. E. Cash of 115 Ehrman Ave., Cincinnati, for the extension of Struble road from Pippin road to Hamilton pike in Colerain and Springfield Townships for $3,670.

The Paving Committee of the City Council of Columbus, O., has agreed to recommend the ordinance providing for the paving of North High St., from 5th Ave., to Doddridge St., to the city council. The distance is 2½ miles, and the ordinance provides for brick pavement. The cost will be close to $90,000.

The new Hospital Commissioners of Cincinnati, O., have rejected all bids for the construction of the macadam roads at the hospital grounds, and ordered the work readvertised. The lowest bid was $5,517, against the engineer's estimate of $3,390. The contract for the cement walks was awarded to William F. Rabel for $1,242.

The Board of Control of Cincinnati, O., has formally passed upon Director Sundamaker's recommendation for the paving of Findlay St., from Dalton to McLean Ave., with granitoid, the material to be tried in Cincinnati for the first time. The Rudolph Blome Co., of Chicago, Ill., was awarded the contract for $6,492.

An ordinance has been introduced in the City Council of Newark, O., to improve Cedar St. from the cemetery north to the corporation line by paving and curbing. The ordinance calls for the use of either brick or water bound macadam.

Property owners on Seventh St., between Locust and Granville Sts., in the city of Newark, O., have asked that the street be improved by sewerage and paving.

The residents of West Miller Ave., in Akron, O., have petitioned the City Council to pass an ordinance over the mayor's veto for the paving of that street for a distnace of two blocks.

The Council Committee on Public Improvements of Toledo, O., has approved the following ordinances: For the opening, extending and widening of Delaware Ave., east of Cherry St.; for the opening and extending of Delence St.; for the repaving of St. Clair St., Cherry to Monroe.

The City Engineer of Tiffin, O., has been instructed to prepare plans and an estimate of the cost of the proposed Charlotte St., improvement between Washington and Monroe.

Engineer Dillon of Butler County, Hamilton, O., has completed the estimate on the Venice road improvement and it has been submitted to the state highway commission for approval. As soon as the plans and estimate are approved bids will be asked for the improvement.

City Engineer F. E. Weaver of Hamilton, O., has presented to the City Council an estimate of the cost of paving South B St., and 4th St., from Main St. to a few ft. south of Millikin St., and from Maple Ave. to the Mill St. alley respectively. The estimates and plans being as follows: South B St.—Limestone curb and gutter—Asphalt, 1½ in. top, $22,588; vitrified brick, $21,125; sheet asphalt, 2 in. top, $23,563; creosoted block, $27,643. Cement curb and gutter—Asphalt, 1½ in. top, $21,549; vitrified brick, $20,166; sheet asphalt, 2 in. top, $22,471; creosoted block, $26,159. Fourth St.—Limestone curb and gutter—Sheet asphalt, 1½ in. top, $14,318; vitrified brick, $13,538; sheet asphalt, 2 in. top, $14,838; creosoted block, $16,918. Cement curb and gutter—Sheet asphalt, 1½ in. top; $13,748; vitrified brick, $13,016; sheet asphalt, 2 in. top, $14,236; creosoted block, $16,188. The property owners on the streets will be asked to choose what material they want.

The City Council of Springfield, O., has passed ordinances authorizing the advertising for bids for the paving of West Main St., East High St., and College Ave. Contracts will be awarded about the first of Sept. Floyd Johnston is President of the Sinking Fund Trustees.

The report of the three viewers appointed to inspect the proposed change in road asked by the Commercial Water Co., Youngstown, O., at Stop 19 in Coitsville Township, has been presented to probate court. If the change in road is granted a 50-ft. roadway will traverse the dam, which will be constructed by the water concern there. The viewers, Frank M. Moore, William McCombs and Nicholas Frech, recommended the change in roadway as asked providing the water company build and maintain the new roadway, including the bridge over the spillway of the dam.

County Surveyor Ed S. Ault, Marion, O., has completed his estimate of the cost of improving the Prospect pike from the end of the paving to the south line of the right-of-way of the Hocking Valley Ry., by laying tar macadam. The estimate of the entire cost is $5,170. The commissioners have determined to improve this pike by the same system as used on the Caledonia pike east of the city and a strip of road out of Caledonia on the Claridon pike is also to be improved.

Oklahoma.

El Reno, Okla., has awarded a contract to the Cleveland Trinidad Paving Co., for the widening of the paving on Rock Island Ave., from 30 to 65 ft., for a distance of four blocks at $2.25 per sq. yd. Bids were opened Aug. 6.

The Cleveland Trinidad Paving Co. has been awarded a contract by the city of El Reno, Okla., for the paving of Bickford Ave., from Rogen to Penn St., for $2.25 per sq. yd. The bids for the paving of two additional blocks from Foreman to Clark were rejected. Bids were opened Aug. 6.

Oregon.

The City Council of Baker City, Ore., has awarded a contract to Warren Construction Co., for the laying of hard-surface pavement from Court St., to Shipping St., at a cost of in the neighborhood of $30,000. The bid on the bitulithic composition is $1.90. For the stretch from Shipping to Madison St., which will be paved with rock macadam, the award was made to the Capital Improvement Co., for $2,462.

The Roseburg, Ore., City Council has received petitions from property owners for six more blocks of paved streets.

The City Council of Wallowa, Ore., has ordered the grading and coating of the streets of the city with shell-rock to conform with the cement sidewalks and crossings to be installed at once preparatory to paving. It will probably be two or three years before all the streets are paved.

A new district for hard-surface pavement has been formed in Portland, Ore., called the East 39th St. district. This district embraces East 9th from the north line of East Stark to East Ankeny, between East 39th and Floral; East Oak between East 33rd and East 39th; East Pine between East 32nd and East 33rd; East 33rd between East Stark and East Ankeny; East 35th between East Stark and East Oak; East 37th between East Stark and East Oak Sts. It is proposed to lay asphalt on concrete pavement and the cost is estimated at $74,000. All these streets are to be improved in one district, all the territory being in the south side of Laurelhurst.

Pennsylvania.

The State Highway Department at Allentown, Pa., has awarded a contract for constructing the new state road in Lehigh County, which will be an extension of the Walberts Pike, to George H. Hardner of Allentown. The stretch to be improved extends from Walberts to Siegersville. Trap rock will be used.

At a special session of the City Council of York, Pa., an ordinance was passed appropriating $5,000 for the completion of the paving on North Duke St., and $4,700 for the paving of street intersections and before non-assessable property.

The Paving Committee of the City Council of Butler, Pa., has awarded contracts for the paving of portions of Washington St., Lookout Ave., Beckert Ave., Sullivan Ave., and Jackson St., as follows: Washington St., awarded to F. E. McQuistion at $1.43 per sq. yd.; Porter National brick to be used. Lookout Ave., awarded to Norman J. Boyer, at $1.10 per sq. yd.; DuBois and Butler brick to be used. Beckert Ave. and Sullivan Ave., awarded to Tony Morelli, at $1.10 per sq. yd.; DuBois and Butler brick to be used. Jackson St., awarded to Norman J. Boyer at $1.23 per sq, yd.; DuBois and Butler brick to be used. At the same time Norman J. Boyer was awarded the contract for the construction of a public sewer on Federal St., at $0.35 per lin. ft.; $35 for manholes, and $65 for each flush tank.

The city of Reading, Pa., has awarded the contract for paving Spring St., bids for which were opened July 27, to Fehr & O'Rourke, Reading, Pa., at $10,286. Bessemer block will be used. The same contractors were also awarded the contract at $2.07 per sq. yd. for constructing 27,550 sq. yds. of vitrified brick pavement, bids for the latter work being opened Aug. 3. John E. Weidner was also awarded the contract for 1,850 sq. yds. granite block paving at $2.23.

The county commissioners at Pittsburg, Pa., have awarded the contract for the macadamizing of the Crab Tree road to the McLaughlin Contracting Co., for $17,734.

Tennessee.

J. W. Williams has secured two street paving contracts from Roach & Manigan, general contractors of Memphis, Tenn. The work will be started at once.

Texas.

George W. Bancroft, B. F. Brown, E. L. Reid and S. H. Farwell of Orange, Tex., have conferred with the police jury at Lake Charles relative to the proposed Trans-Calcasieu road. It is probable that the road will be constructed. Colonel Sam Park, President of the Jefferson County Good Roads Association, Beaumont, Tex., is interested.

Bids were received Aug. 10 by J. Q. Adamson, County Judge, Sherman, Texas, for the construction of 65 miles of roadway 14 ft. wide on stone and concrete foundation with asphalt binder. The contract was awarded to McNerny Bros., of Muskogee, Okla., for $250,000. J.C. Feild, Feild Bldg., Denison, Tex., Engineer.

The county commissioners at Bellingham, Wash., have established the C. C. Cornell road, and next month will call for bids for clearing and grading it. The road connects Glacier with Warnick.

Utah.

City Engineer George F. McGonagle of Salt Lake City, Utah, has completed surveys for the new feed line from City Creek canyon to the high ground on the north bench, representing an outlay of about $125,000.

The Board of Couny Commissioners has appropriated $2,000 to be used in improving the county road from Provo north to the point of the mountain, a like amount having been appropriated for that purpose by the state.

The paving of Third West St., at South Temple St., in Salt Lake City, Utah, has been held up by the granting of an injunction in the suit brought by the Salt Lake & Los Angeles R. R. Co., against P. J. Moran, the

Utah Light & Ry Co., Salt Lake City, and George F. McGonagle, City Engineer. The railway company claims that it owns West South Temple St. at that point and the question will come up when the injunction case is argued before Judge C. W. Morse.

Virginia.

The South Ghent Land Co., of Norfolk, Va., has awarded to Perry W. Ruth & Co., the contract to pave Raleigh, Beissevain and North Aves., with sheet asphalt at $1.89 per sq. yd. Contract for granolithic sidewalks has been awarded to the same company.

Washington.

County Engineer Charles Lindbery of Whatcom County, Bellingham, Wash., has submitted his preliminary estimate of the cost of constructing the 2½ miles of road from Silver Beach to Woodlawn to the county commissioners. The estimated cost is $9,000.

In company with H. L. Bowlby, state highway commissioner, the Board of County Commissioners, Bellingham, Wash., inspected the Guide Meridian road, leading to Lynden, with a view to learning just what the county's rights are to the $17,000 in the state aid road fund. The state commissioner will determine whether the work needed on the Guide and one or two other county roads leading south will warrant the payment of the $17,000 to Whatcom County by the state.

Judge John Broyles of Excelsior, has reported to the Whatcom County Commissioners at Bellingham, Wash., that he is ready to turn over to the public the Herman road, from Glacier to a point 14 miles east near the pass on the north fork of the Nooksack River. This road would have been completed last winter had not the high waters torn away the grades already made.

Wisconsin.

✣Bids will be received by the Board of Public Works, Milwaukee, Wis., until 10:30 a. m., Aug. 20, for furnishing the necessary labor and material for grading to a subgrade the roadway and paving same with permanent sand stone pavement on concrete foundation, Pleasant St. from Milwaukee River to North Water St. H. E. Briggs is Commissioner of Public Works.

✣Department of Public Works, Milwaukee, Wis., will receive bids until 10:30 a. m., Aug. 19, for paving the roadway with brick on the following streets: Michigan St., from Jefferson to Lake in Third Ward; Seventh St., from Walnut to Germania St., in Sixth and Tenth Wards; Lincoln Ave., from Forest Home Ave. to 22nd Ave., in Eleventh Ward and Park St., from a point 214 ft. east of northwest ¼ section 31.

✣Bids will be received until 10:30 a. m., Aug. 20, by the Department of Public Works, Milwaukee, Wis., for furnishing material and labor for the grading of the roadway and paving same with permanent asphalt pavement on concrete foundation on 15th St., from Grand Ave. to Cedar St. L. S. Everts is Deputy Comptroller.

The city of Antigo, Wis., has awarded a contract to W. H. Fisher for the paving of four blocks of street in the city with macadam for $8,674. Bids were opened Aug. 6.

Canada.

Montreal, Que., will construct sidewalks this summer at a cost of $500,000. In all about 25,000 sq. yds. of flagstones, 80,000 yds. of asphalt, and 50,000 sq. yds. of cement will be laid.

J. Conn of Winson, Ont., has been awarded a contract by the city of Collingwood, Ont., for the construction of 3,636 sq. yds. of street paving with a 3-in. tar-lithic wearing surface. The paving will be constructed on a 5-in. concrete base. The contract was awarded at $1.55 per sq. yd. Bids were opened Aug. 9.

WATER-WORKS AND SEWERAGE

Alabama.

The plans and specifications for the new water plant for the city of Gadsden, Ala., have been received and the city will be in a position to go ahead with the letting of the contract for the plant on the first of Sept., as contemplated.

The General Contracting & Construction Co., R. L. West, Pres., Atlanta, Ga., has been awarded a contract by the city of Gadsden, Ala., for the construction of a waterworks station, filters, machinery and extensions. The sub contractors on the work are Henry R. Worthington, New York; Laidon-Dunn-Gordon Co., Cincinnati, O., and the American Water Softener Co. The contract was awarded at $70,360, Hazlehurst & Anderson, Engineers, Atlanta, Ga. Bids were opened Aug. 4.

Arkansas.

The Kress Construction Co., of Stuttgart has secured the contract to put in the sewer system at Newport, Ark., their bid being $30,747.

The Texarkana city council on the Arkansas side expects to pass an ordinance at its next meeting providing for the extension of the sewer system to all portions of the city that are now unprovided with sewerage. Property owners in the districts have expressed their approval of the proposed extension.

The city council of Paris, Ark., has passed an ordinance forming the city into an improvement district and a committee is at work securing the proper number of petitioners for the issuance of $75,000 worth of bonds for the purpose of installing a system of waterworks. The plans have already been drawn and an estimate as to cost has been made by an engineer. The water will be supplied from a lake to be formed on Short Mountain creek, south of Paris. A standpipe will be located on an elevation of 181 ft., which lies between here and the lake.

Plans have been prepared by Dickinson & Watkins of Little Rock, Ark., for the construction of a waterworks system in Conway, Ark. The board of public work is arranging to secure right of way contracts for the pipe line from Gleason to Conway, a distance of about six miles. Surveys for two or three possible routes for the mains have been made. According to the plans the pumping station will be located on the banks of the Cadron at Gleason and will be situated a few hundred yards north of the plant of the Freeman Lumber Co. Wooden pipes will be used throughout the system.

California.

City Engineer Winn of Hollister, Cal., has prepared plans and specifications for the construction of a 6-in. sewer on Central Ave., in the Pierce addition, and the same has been adopted by the town trustees.

W. J. Smith was the lowest bidder for the construction of the western part of the south side sewer west of Bay St., Alameda, Cal., bidding $17,264 on the work. Bids for the eastern section will be advertised for later.

A. L. Chalmers, 624 Walsworth Ave., Oakland, Cal., has been awarded a contract for the construction of a reservoir, wooden tank, extending main, etc., at Fort Barry, Cal. Bids were opened Aug. 6.

Colorado.

Denver, Colo., has awarded a contract to Holme & Allen Pipe & Construction Co., for laying the pipe and making repairs to the distributing system of the old South Denver water plant. Work is to begin as soon as the pipe is received and according to the contract the work will be completed by the end of the month.

Connecticut.

Secretary Caplan of the permanent paving commission of New Haven, Conn., appeared before the board of local improvements of that city and announced that it was desired that a sewer should be put through Ellsworth Ave., between Chapel and Edgewood, so that work on the laying of the pavement there might be started soon. The board granted petitions for sewers in East Rock road, Chatham St., Morris St., Clinton Ave., Chambers St., Salem St. and North Front St.

Georgia.

The contract for Atlanta's new 10,000,000-gal. addition to its waterworks filter plant has been signed by the Mayor and Robert E. Milligan, for the New York Continental Jewell Filteration Co., which was awarded the contract at $31,000.

Idaho.

The North Side Twin Falls Land & Water Co., of Boise, Ida., has awarded contracts for the construction of the Jerome reservoir to Donald Grant & Co., and Conway & Wilhite. The work will be commenced at once, as it is desired to get the greater part of the work completed this season. The Jerome reservoir will have a capacity of 150,000 acre ft., and will cover an area of 8,000 acres in extent. By the construction of this reservoir the water of the Snake river will be converted during the flood season for use when needed on the North Side Twin Falls project.

The city clerk of Caldwell, Ida., sold bonds Aug. 15, in the sum of $76,000 for waterworks improvements.

Illinois.

✣Bids will be received until 8 p. m., Auggust 25, by City Clerk, Wheaton, Ill., for the construction of approximately 17,726 ft. of vitrified pipe drains, 8-in. to 27-in. in diameter, estimated to cost $15,273. Also two smaller sewer and drain improvements estimated to cost $1,672 and $392 respectively. Arthur L. Webster is City Engineer.

The city council of Quincy, Ill., has passed ordinances providing for the construction of sewers as follows: On Cherry st. from Fourth to a point 200 ft. west of Third st., thence north in alley 188 ft.; estimate $951. On alley, between Fourth and Fifth st. and Cherry and Spruce sts.; estimate, $875. On Spring st. from Seventeenth st. to a point 500 ft. east Twenty-second st.; estimate of cost, $2,684. From Twenty-fourth and Broadway running south to Vermont st., on Vermont st. east to Twenty-seventh st., thence north on Twenty-seventh st. to Broadway; estimate of cost, $2,533.

A petition has been presented to the city council of Colchester, Ill., for a sewer along Elizabeth St., beginning at a point where Elizabeth St. crosses South St., and running south on Elizabeth St., to the Corporation line.

The board of local improvements of Morris, Ill., has awarded a contract to the Ottawa Construction Co., of Ottawa, Ill., for the construction of the Kiersted St. sewer for $1,430.

The city council of Canton, Ill., has been petitioned for the construction of a sewer on Chestnut St., between Eighth and 11th Aves.

A contract has been awarded to the American Engineering & Construction Co., Ashland Blk., Chicago, Ill., for the construction of a brick sewer at Chicago from the existing 73d St. sewer to the Stony Island Ave. pumping station for $5,800. The work includes a 41-in. sewer. Bids were opened Aug. 5.

New York capitalists are behind a project to construct a reservoir and filter at Lake Bluff, Ill., to supply filtered water to all the small cities and villages between Evanston and Waukegan, and eventually to small suburbs on the west side of Chicago. Construction Engineer Rogers of New York has already placed his plans before the municipal officers of Wilmette and will enlist the support of local capital.

The city council of Herrin, Ill., has passed an ordinance providing for a municipal owned and operated waterworks plant. The estimated cost of the plant is $75,000.

Walter M. Hoy of Sycamore, Ill., assisted by the committee, surveyed and measured the distance, etc., for the water system to be constructed there, and estimated the cost at $3,300 complete, the same to consist of a tank to hold 75,000 gals. of water, a five hp. engine, a six-in. water pipe with the necessary hydrants to be laid through the streets.

The board of local improvements of the village of Bement, Ill., has awarded a contract to C. O. Knapp and Curtis Knapp for the laying of water main with necessary hydrants and other attachments in the north part of the town for $1,643.

Charles Barber of the village of Manlius, Ill., is preparing to construct a pumping station and lay water mains in all parts of the village.

Indiana.

The members of the Jeffersonville city council voted unanimously for a resolution which provides for a local sewer on Pearl St., from Court Ave., to the river, with branches on Maple, Chestnut and Market Sts.

The town council of West Terre Haute has awarded to Samuel McKay the contract for the construction of a sewer from Summer Ave., to the gravel pit. Resolutions were also passed to put in sidewalks and curbings on South Sixth, South Eighth and Poplar Sts., and on the north side of West Paris Ave.

Michael Burke has been awarded a contract in Peru, Ind., for the construction of a lateral sewer from Benton to Lincoln St., between Main and Fifth Sts., for $1.24 per lin. ft.

After a week's examination of the northeast part of the city City Engineer Roberts of Terre Haute, Ind., has recommended a route for a new sewer line intended to drain the city from 13th St., and Eighth Ave., east and north to the city limits. The new line will be put in from 13th St., and Eighth Ave., east to 14th St., north to Plum St., and east to 23d St., and will cost in the neighborhood of $40,000.

George H. Palmer has received a contract to construct the 10-in. sewer on Miles St., in Logansport, Ind., for 81 cents per ft. The sewer is a square and a half long, extending from the alley between 15th and 16th Sts., east, to the center of 17th St.

Residents of Brightwood, Indianapolis, Ind., are opposed to the sale or lease of the water works plant in the suburb to the Indianapolis Water Co. They have informed Dr. W. H. Johnson, president of the city council, that they wish to have the plant repaired and the mains extended.

Iowa.

✣City Clerk J. H. Clark, Indianola, Ia., will receive bids until 7:30 p. m. August 23, for furnishing necessary labor and materials for the construction of sanitary sewer as follows: 6,447 ft. 10-in. standard vitrified sewer pipe. 12,087 ft. 8-in. standard vitrified sewer pipe. 1,258 ft. 6-in. standard vitrified sewer pipe. 33 common manholes, 13 drop manholes, 9 flush tank siphons, set in manholes. 800 house connections. 328 manhole steps, ½x10-inch round iron. H. H. Gilliland is Engineer.

✣City Clerk, Hawarden, Ia., T. J. Reeves, will receive bids until 8 p. m., Sept. 3, for the construction of about 18,000 ft. of vitrified pipe sewer, 8, 10 and 12-in. pipe.

✣Bids will be received until 7:30 p. m., Sept. 9, by City Council of Carrington, N. D., for the extension of the water mains of the water works system of that city.

✣Bids will be received until 3 p. m., Sept. 5, by City Council of Grand Forks, N. D., for remodeling and reconstructing the present slow sand filter. A certified check for $500 payable to the Mayor must be filed with each bid. Charles J. Evanson is City Auditor.

Bids received by William E. Gamble, Mount Vernon, Ia., on Aug. 8, for furnishing all material and labor necessary for the construction of a reinforced concrete reservoir according to plans and specifications prepared by Fremont Turner of Des Moines, Ia., have been rejected and the matter will be acted upon some time in the future.

At a meeting of East Des Moines Improvement league plans were discussed and a committee appointed to confer and report at the next meeting upon the question of asking the city council to make extensive improvements in East Des Moines. Among them is desired a trunk line sewer two and one-half miles long, a system of graded streets and electric lights. The sewer as planned would extend from Hull Ave., in a southeasterly direction to the Des Moines river. S. A. Ross is president of the league.

The city council of Burlington, Ia., has instructed the city engineer to draw up plans for a sewer to extend from Moore St., down Mt. Pleasant, and to connect with the Hawkeye sewer.

The village of Le Mars, Ia., contemplates purchasing the water works plant of that place. The franchise has three years more to run.

The city council of Ellsworth, Ia., is having preliminary plans for the establishment of the waterworks system made, which was recently authorized at a special election.

City Engineer Reuben C. Hart has been instructed by the city council of Clinton, Ia., to make plans and estimates of cost for the construction of sewers in districts 3 and 4, estimated to cost $90,000 and $12,000 respectively. W. E. Hayes is city clerk.

The city council of Clinton, Ia., has instructed City Engineer Reuben C. Hart to make plans and an estimate of cost for the construction of a waterworks system at an estimated cost of $600,000. W. E. Hayes is city clerk.

The Iowa City, Ia., city council is contemplating the conversion of Ralston creek, which flows through the town into a sewer, to solve numerous municipal problems as to sanitation and convenience. The cost of the improvement will be $200,000.

The W. K. Palmer Engineering Co., of 7717-720 Dwight Bldg., Kansas City, Mo., have completed surveys for a complete sewer system for Winterset, Ia. Plans and specifications will be finished shortly. Information can be obtained at the office of the engineers.

Kansas.

City Clerk William Sence of Wichita, Kan., has registered before a state official at Topeka, Kan., the College Hill sanitary sewer bonds aggregating $123,000. These bonds were issued to pay for sewerage in sewer district No. 12. Finlay Ross is city auditor.

Residents in the extreme southern portion of Wichita, Kan., are preparing a petition for a sanitary sewer in that section. The proposed sanitary sewer district extends from Harry St., south to the city limits, and from the Arkansas River on the west to Hydraulic Ave. on the east. The sewer district probably will be connected with the main sewer that is proposed to run south near Hydraulic Ave. W. E. Dixon, president of the South End Round Table, is interested.

The following bids were received at Horton, Kan., for the construction of sewers on Aug. 2; W. B. Hazen, St. Joseph, Mo., Engineer: Inter-Mountain Bridge & Const. Co., Tecumseh, Nebr., total $34,081.27, contract awarded; C. U. Heuser, Salt Lake City, Utah, total $34,709.40; Kelly & Carter, St. Joseph, Mo., total $37,781.50; E. D. Reed, Clay Center, Kan., total $35,289; Oleson H. Schmidt, St. Joseph, Mo., total $35,450.81; Hamilton Bros., Newton, Kan., total $32,911.55; did not bid on all items.

Maryland.

✣The Board of Awards, Baltimore, Md., will receive bids until 11 a. m., Sept. 7, for the construction of a sanitary laterals in District 14 and furnishing and erecting a coal and ash handling plant in the sewage pumping station. The work will include approximately 23,000 lin. ft. of 8 to 15-in. vitrified pipe sewers; 30 lin. ft. brick and concrete sewer 30-in. diameter; 10,000 lin. ft. of 6-in. house connections. George N. Numsen is president of the board.

Massachusetts.

The board of aldermen of New Bedford, Mass., has approved the plans of City Engineer Williams for the outlet of the proposed intercepting sewer, out in Buzzards Bay, 3,000 or more ft. from the end of Clark's point, and has passed an order authorizing the engineer to submit the same to the state board of health.

Patrick McQuade has been awarded the contract for erecting a new garage for the water department of New Bedford for the sum of $4,327.

The following bids were received Aug. 1 by the Metropolitan Water Works, Boston, Mass., for Contract No. 326, laying water pipes in Chelsea, Mass., (1) standing for Michael Russo, Boston, Mass. (awarded contract), (2) for L. Devincenzi & Co., Boston, Mass., (3) for Coleman Bros., Boston, Mass., (4) for Bryne Contracting Co., Boston, Mass., (5) for John E. Palmer, Boston, Mass., (6) for Thomas Bruno, Revere, Mass., (7) for Chas. M. Callahan, Boston, Mass., (8) for John J. Falvey, Somerville, Mass., and (9) the Commonwealth Construction Co., Boston, Mass.:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Laying 36" cast iron pipe, 3,080 lin ft.	$ 1.80	$ 1.91	$ 2.00	$ 2.48	$ 2.60	$ 2.50	$ 2.45	$ 2.75	$,2.75
Laying 30" cast iron pipe 730 lin. ft.	1.50	1.91	2.13	2.48	1.70	2.25	2.40	2.45	2.25
Laying 12" & 8" C. I. pipe for blow-offs—60 lin. ft.	60	.50	1.50	1.00	1.00	1.00	1.50	1.50	1.75
Rock excavation above grade 20 cu. yds.	6.00	2.50	6.00	5.00	5.00	4.00	4.00	6.00	6.00
Rock excavation below grade 2 cu. yds.	8.00	4.00	8.00	5.00	6.00	6.00	4.00	8.00	8.00
Earth excavation below grade—20 cu. yds.	1.00	1.00	2.00	1.00	2.00	2.00	2.00	2.00	1.25
Chambers for blow-off, by-pass & air valves—6 chambers	45.00	40.00	75.00	40.00	70.00	50.00	50.00	60.00	75.00
Chambers for 30" & 36" valves 2 chambers	75.00	55.00	75.00	80.00	95.00	75.00	100.00	60.00	100.00
Spruce piles driven and cut off —10,000 lin. ft.	.18	.21	.27	.20	.23	.25	.24	.25	.28
Spruce lumber in place for foundation—10 ft. M. B. M.	40.00	40.00	45.00	50.00	50.00	60.00	75.00	40.00	50.00
Concrete masonry—50 cu. yds.	6.00	6.50	7.00	8.00	9.00	8.00	7.00	8.00	8.00
Totals	$9,751	$10,560	$12,081	$12,938	$13,321	$13,484	$13,516	$14,304	$14,[illegible]

Michigan.

The city of Sandusky, Mich., has voted the issuance of bonds for the construction of sewers, waterworks and electric lights.

Samuel A. Freshney has estimated the cost of constructing a sewer in Deloney St., from Hovey St., to Watson St., in the city of Grand Rapids, Mich., at $510, and of constructing a sewer in East Fulton St., from East Side trunk sewer to Ottawa St., at $12,620.

The council of Manistee, Mich., has been petitioned for the construction of a main sewer in Eighth St., between Cypress and Cedar Sts.

Plans are being prepared by Prof. Gardner S. Williams of the engineering department of the University of Michigan, Ann Arbor, Mich., for the improvement of the water works at Big Rapids, Mich. Among the improvements the plans call for a new flume and new wheels.

On recommendation of the committee on sewers the sewer on North Fuller St., in Grand Rapids, Mich., from Michigan Ave., to the contagious disease hospital is to be built at once. An appropriation of $4,000 has been provided for this purpose.

Minnesota.

✣Bids will be received until 7 p. m., August 20, by Village Council of Monticello, Minn., for the laying of 2,000 ft. of 12-in. sewer pipe W. J. Thompson is Village Recorder.

✣Bids will be received until 10 a. m., August 22, by A. H. Scherer, City Clerk, Mankato, Minn., for the necessary labor and material for the installation of about 2,600 ft. of 6-in. water mains, 372 ft. of 10 in. water mains, and necessary hydrants.

The village council of Long Prairie, Minn., has voted to install a sewer system in the village and the work will be pushed as fast as possible in order that the work may be finished before the winter. Bids for plans are now being advertised for. The main sewer will start from Elm St., and run west down Osakis St., to Walnut St., thence north and empty into the river.

E. T. Sykes, supervisor of the water works of Minneapolis, Minn., has discovered a new site for a storage reservoir on the heights west of Glenwood park and has recommended to the city council that a 10,000,000-gal. reservoir be constructed there.

Mississippi.

An election has been called at Cleveland, Miss., to decide whether or not a water works system to cost about $15,000 to $20,000 will be installed.

Missouri.

The board of public works of St. Joseph, Mo., has ordered the construction of sewers in districts Nos. 40 and 112.

Montana.

The city of Townsend, Mont., will contract a water works system. Engineer Thorpe of Bozeman, Mont., has been secured to prepare plans and specifications. It has been planned to sink a drive well 100 ft. deep.

The water committee of the city council of Great Falls, Mont., has awarded the contract for laying a 15-in. water main on Second St., to Nilson & Smith of Great Falls for $2,830.

Nebraska.

✣Bids will be received until 6 p. m., Sept. 2, by E. E. Cook, City Clerk, Cozad, Neb., for the construction of a system of water works. H. S. Welch, North Platte, Nebr., is Engineer.

The city council of Grand Island, Nebr., it is stated, will make another effort to have the contemplated sewer system for the soldier's home near this place connected with the city system. An engineer has been selected by the trustees of Grand Island college, which is on the line of the proposed system, and it is now planned to have this engineer and the city engineer make detailed plans for the connection of the places and present them before the proper state authorities.

Nevada.

The following bids were received for constructing a sewer system, using deep socket sewer pipe, for the city of Winnemucca, Nev., L. C. Kelsey, Salt Lake City, Utah, being the consulting engineer for the work: R. M. Barsden & Co., Butte, Mont., $31,945; Reno Construction Co., Reno, Nev., $33,530.86; J. D. Hanley, Salt Lake City, $33,600; Carty Hartman and Morhan, Winnemucca, Nev., $34,774; Roberts Const. Co., Reno, Nev., $37,262; Tibby & Forbes, Salt Lake City, $39,970. R. M. Barsden & Co., was awarded the contract at the following itemized bid:

Excavating and backfilling:		
Earth, per cu. yd.	18,130	[illegible]
Gravel and boulders	907	[illegible]
Solid rock		[illegible]
Vitrified pipe:		
8 in., per lin. ft.	13,170	.30
10 in., per lin. ft.	5,115	.40
12 in., per lin. ft.	2,434	.50
15 in., per lin. ft.	200	.75
18 in., per lin. ft.	1,790	1.05
Y's—each:		
8 x 6	819	1.20
10 x 6	290	1.35
12 x 6	117	1.60
15 x 6	4	2.30
18 x 6	31	4.10
Manholes, each	57	57.50
Manholes, add depth lin. ft.	26	3.50
Flush tanks, each	9	95.00
Septic tank, each	1	3,000.00
Total		$31,945.00

New Jersey.

✣Bids will be received until 7 p. m., August 25, for the construction of an addition to the waterworks system: The work includes the following: (A) Furnishing, F. O. B. High Bridge, N. J., together with all connections, valves, castings and specials, about three miles of gravity main. Separate bids to include all above are requested for:

(1) 10″ spiral riveted pipe, No. 10, No. 11, No. 14.
(2) 12″ spiral riveted pipe, No. 10, No. 12, No. 14.
(3) 10″ cast-iron pipe.
(4) 12″ cast-iron pipe.

B Cart pipe and distribute and connect same.
C For excavating and backfilling trench.
D For laying and connecting pipe.
E For combination of C and D.
F For furnishing material and constructing Catchment Reservoir and enlarging Distributing Reservoir, complete.
G For building enclosing fence.

Complete plans and specifications may be seen at the office of the Borough Clerk or at the office of the Engineer, F. S. Tainter, No. 1 Newark Street, Hoboken, N. J.

The Sewerage Committee of Caldwell, of which John W. Gosman is chairman, has presented its report to the Caldwell Borough Council recommending immediate action in sewering the entire town and draining to a disposal plant to be erected in the western extremity of West Caldwell Borough beyond Swamp road, at a total approximate cost of $80,000. It is estimated that 26,000 ft. of main sewers and 7,500 ft. of trunk sewers to connect with the disposal plant in West Caldwell Borough, and 12,400 ft. of laterals will meet present needs.

Sylvester Nicolette has been awarded a contract by the city of Potsdam, N. J., for the construction of a sewer and drain on Larned St., for the sum of $1,275.

The township committee, Kingsland, N. J., passed upon the plan to raise $20,000 by bonds for the extension of its water mains to property owners who have petitioned for the improvement. Petitions will be circulated at once for a special election call to vote on the plan.

New York.

✣Bids will be received until August 25 by Sage Foundation Homes Co., for the construction of 1,000 ft. of 48″ and 1,800 ft. of 42″ storm water drain in Austin Ave. and Backus place, Forest Hills, Long Island. Bids are requested on brick, concrete, reinforced concrete and lock joint pipe. Plans and specifications are on file in the Engineer's Office, Sage Foundation Homes Co., Forest Hills, Long Island.

✣Bids will be received until 2 p. m., August 25, by Village Board of Canajoharie, N. Y., for furnishing wood stave cast iron pipe to the village of Canajoharie, N. Y. The contract includes 10 miles of 8, 10 and 12 in. wood stave pipe; 3 tons cast iron specials; 356 tons cast iron pipe; 5 tons cast iron specials. Vrooman & Perry, are the Engineers.

✣Bids will be received by the Village of Canajoharie, N. Y., until 3 p. m., August 25, for constructing a water system for the village. The work includes laying 10 miles of 8, 10 and 12-in. wood stave pipe; distribution reservoir laying one and one-half miles of 12-in. cast iron pipe and the necessary appurtenances. Charles E. Schultze is Chairman of the Board of the Municipality. Vrooman & Perry are Engineers.

The State Water Supply Commission gave a hearing in Albany recently upon the application of the village of Canajoharie, N. Y., to amend the plans previously approved by the commission for a new water supply system. Those who appeared before the commission in favor of the plans were N. J. Herrick, village attorney, J. H. McLaughlin, village clerk, and Charles E. Perry, the engineer who drew the plans. The village has sold bonds to the amount of $150,000 for the work.

Walter McCulloch of Albany, N. Y., Chief Engineer for the State Water Supply Commission, with City Engineer E. A. Fisher of Rochester, N. Y., has made preliminary plans for the completion of the surveys in Rochester for the proposed storage dam to regulate the flow of the Genesee River.

George Serafind has been awarded a contract by the city of Binghamton, N. Y., for the construction of a sewer on Alice St., for $505. Bids were opened Aug. 3.

North Dakota.

✣Bids will be received until 7:30 p. m., Sept. 9, by The City Council of Carrington, N. Dak., for the construction of a septic tank, main outlet sewer and for certain sewers in sewer district No. 1. H. L. Winterer is City Auditor.

The contract for the construction of new water mains in Rugby, N. Dak., amounting to $11,327, was let by the city council to L. W. Sehruth of Fargo.

Ohio.

✣Bids will be received by the Director of Public Service, Elyria, O., until noon, August 19, for the construction of a sewer on West St., from end of present sewer to Huron Road. Rose Moriarty is clerk. A certified check for $500 must be filed with each bid.

✣The village clerk of Lakewood, O., B. M. Cook, will receive bids until noon, August 29, for furnishing labor and material for the construction of Hird St. sewer, Northland Ave. sewer and Northland Ave. water main. Plans and specifications are on file at the office of Wm. H. Evers Engineering Co., 332 The Arcade, Cleveland, O.

✣Bids will be received by the Secretary of the Board of Control, Mansfield, O., until noon, August 19, for furnishing the necessary labor and material for the construction of sewers including the following approximate quantities: 3,345 ft. of 8-in. sewer; 746 ft. 10-in. sewer; 3,730 ft. of 12-in. sewer; 2,150 ft. tile drain; 9 manholes; 2 lampholes; 3 flushtanks. Also for spiking, surfacing and tarring or oiling 9,300 sq. yds. of road; 3,540 cu. yds. grading; 400 tons stone; 3,610 ft. curb to reset; 265 sq. yds. cross walks. John Cahill is Director of Public Service.

✣Bids will be received by the Trustees of Public Affairs, Barnesville, O., until noon, August 23, for the necessary labor and material for the construction of a water pipe from southwest corner of East Main St. and Warren Ave. to the Friends Boarding School, a distance of 6,550 ft. The work includes 1,400 ft. of 8-in. pipe; 5,000 ft. of 6-in. pipe; 150 ft. of 4-in. pipe; 8 hydrants. J. W. White is Clerk.

The contract for constructing sewers in sewer district No. 1, of district No. 3, Youngstown, O., has been awarded to William Lehmann of Cleveland for $21,768. The work will cover 11 blocks in the district.

Plans have been prepared for the construction of a sewer in Observatory place, Cincinnati, O., from Observatory Ave., 450 ft. north, and in Vista, Patton Belmont, Ivy, Bolce, Fairview, Lillac, Maple, Grigg and Holly Aves. Edwin Henderson is city clerk.

Bonds for the completion of the city's intercepting sewer system have been issued by the city administration of Cleveland, O. Assistant City Engineer Estep has estimated the cost of the entire system at $2,000,000, but just a portion of the system will be constructed at this time. The system will be extended from W. Ninth St., to W. 58th St.

The Pleasant Ridge Village Council, O., has voted for the purchase of a site for a sewage disposal plant. The plant and sewerage system, it is estimated, will cost $175,000.

Henry W. Davis, Youngstown, O., has contracted with W. J. School for the sewering of the Pleasant Grove residence addition on the Youngstown & Southern. A complete and independent sewering system providing for disposal of refuse will be installed. Mr. Davis has also contracted with Mentzer & Whalen to lay about two miles of 5 ft. cement sidewalks in the addition.

Bids were opened Aug. 1, by the city of Galion, O., A. D. Theobald, City Engineer, for constructing sanitary sewers in nine sewer districts, contracts being let as follows: District No. 1, U. S. Construction Co., Columbus, O., $1,745; District No. 2, U. S. Construction Co., $1,560; District No. 3, U. S. Construction Co., $3,792; District No. 6, W. H. Ralston, Mt. Vernon, O., $3,579; District No. 7, C. L. Allen, Marion, O., $7,680; District No. 8, A. J. Stough, Galion, O., $8,946; District No. 9, C. L. Allen, Marion, O., $9,773; District No. 11, W. H. Ralston, $2,710. The contract for constructing sewers in District No. 5 was not let. The U. S. Construction Co., Columbus, O., was low bidder in this district, its bid and the engineer's estimate being as follows:

	U. S. Const. Co.		Estimate.	
	Unit.	Total.	Unit.	Total.
Earth, etc. ..$	.55	$5,410.96	$ .38	$3,738.48
Brick masonry	8.75	1,651.13	12.00	2,264.40
Concrete	5.90	58.41	8.00	74.20
Laying sewer				
8"-10"	.06½	418.14	.06	385.98
12"	.07½	19.28	.08	20.56
15"-18"	.09½	205.96	.10	216.80
20"-22"-24 ...				
Laying sub-drain	.13	1,168.41	.11	988.68
Standard M. H. tops ...	8.50	306.00	8.50	306.00
Tight M. H. tops				
Manhole pans.	2.50	90.00	3.00	108.00
Manhole steps.	.25	47.00	.20	37.60
Timber foundation	16.00			
Sheeting left in	16.00			
Sewer pipe ...	79%		80%	
15"		78.08		61.69
12"		71.87		49.10
10"		234.62		194.88
8"		947.68		902.55
6"		97.41		90.48
4"		216.36		206.15
Y poles........	.05	10.80	.05	10.80
Cast iron pipe.	38.00	118.56	29.00	90.48
Cast iron specials				
Inspection covers	1.00	29.00	3.00	87.00
Vent caps.....				
8" flap-gate...	10.50	94.50	9.00	81.00
Total		$11,733.00		$10,415.00

Engineer Kotte has suggested that the new sanitary sewer for the south side of Main St., Alliance, O., be run up the sidewalk. The proposition will be left to the property owners.

Frank M. Worstall has been given a contract by the service department of Zanesville, O., for the installation of the Pine St. storm sewer for $400.

The board of control of Dayton, O., has approved the bids of Larkin Bros. for the construction of sanitary sewers in parts of Districts 8, 9, 3 and 10, for $38,000.

The citizens of New Philadelphia, O., have voted to issue $130,000 in bonds for the purchase of the plant of the New Philadelphia Water Works Co.

The Water Works, Sewer & Paving Construction Co., Citizens Bldg., Cleveland, O., has been awarded the contract for furnishing the material and labor necessary for the improvement of Quincy Ave., from Maple Brow Drive to East boulevard by constructing a water main therein and for constructing a water main in Cedar Ave. Bids were opened Aug. 9. The F. A. Pease Engineering Co., No. 931 Williamson Bldg., Cleveland, Engineers.

Oklahoma.

Plans have been made by F. H. Kilburn of Woodward, Okla.; for the construction of a flow line, installation of a new pump and extension of water mains in connection with the city waterworks of that city. The mains will be extended 8,000 ft., having a 12 in. gravity flow line. The work, it is estimated, will cost $35,000. F. H. Kilburn has charge of the work.

Oregon.

Surveys are now being made for the state fair grounds sewer in Salem, Ore., from the new bleachers to the main sewer on the ground.

Pennsylvania.

A special committee of the city council of Pt. Carbon, Pa., was authorized to make their report on the sewerage system. It is the object of the council to increase the indebtedness of the borough $20,000 for the purpose of placing a sewerage system throughout the entire town. Pt. Carbon is a borough near Pottsville, Pa.

An ordinance has been passed by the borough council of Pt. Carbon, near Pottsville, Pa., granting the right of way to the Silver Creek Water Co., to lay pipes through several of the streets of the borough. This company now has the pipes laid from Tumbling Run to Palo Alto, and it is their intention to continue the same through to St. Clair, there connecting with the pipes from the Silver Creek dam.

The borough council of West Chester, Pa., has passed a resolution providing for the employment of an engineer to prepare plans and specifications for sewering the town. Nathan R. Rambo is borough surveyor.

A water company will be organized in Fawn Grove, York County, Pa., soon to supply the vicinity with water. The company will be capitalized at $5,000.

J. H. Stilzer of Philadelphia, Pa., has been awarded the contract to construct a catch basin and reservoir at the American Viscose Co.'s silk plant in Marcus Hook. The reservoir will have a capacity of 750,000 gals. of water. More than 10,000 cu. yds. of earth will be removed.

South Carolina.

The city of Aiken, S. C., held an election Aug. 16 to vote on the proposition of whether or not the city will issue $78,000 in coupon bonds, for the purpose of extending its waterworks system.

South Dakota.

City Surveyor D. C. Washburn of Aberdeen, S. Dak., is at present drawing plans for the city water works of Hettinger, where they will install a fire department. Mr. Washburn has been at Hettinger getting the lay of the land, drainage possibilities, etc., for his use in the future in the laying of a sewer system.

The citizens of Morristown, S. Dak., have inaugurated a movement for the construction of a municipal water works system, and a committee has been appointed to investigate the matter, as to cost, etc.

The contract for the construction of a water works in Wakonda, S. Dak., has been awarded to the Western Engineering Co., of Yankton.

Mellette, S. Dak., has awarded a contract to Spratt Bros. & Co., of that city for extending water mains about 1,200 ft. for $.90 per ft. The work includes excavating and filling, three Ludlow hydrants; 4-in. cast iron pipe for main and cross at every street crossing, with $40 extra for each hydrant. Bids were opened Aug. 8.

Texas.

Dallas, Tex., has awarded a contract to Joe B. Winslett, Jr., & Co., for the construction of a 6-in. sewer in the alley between Holmes and Lenway extended to the city limits. The sewer will be 1,200 ft. in length.

J. B. Wilson has petitioned the board of commissioners, Dallas, Texas, for the construction of a sewer 23 ft. below the surface of Elm St., instead of 20 ft., as originally asked for.

The special committee appointed by the city council of San Angelo, Tex., to investigate the condition of the sewer system, and to report on the advisability of its purchase by the city, under the franchise the present sewer company holds, has recommended its purchase. Dr. L. C. G. Buchanan is interested.

A committee of citizens of Hearne, Tex., has been engaged during the past month looking into the water works proposition, and a mass meeting will be called some time in September, when it will be thoroughly discussed.

A contract has been let by the city council of Brownsville, Tex., for additional machinery for the electric light and water plant, consisting of double dynamos, pumps and engine. The total sum of the purchase is $18,500. The contract for the electrical appliances and machinery was awarded to the Westinghouse Electrical Co., and for the machinery for the water plant to the Harrisburg Foundry & Machinery Works.

From sale of bonds for new improvements the city council of Paris, Tex., the city council appropriated $71,000 for streets and sidewalks, $20,000 for water works extension and $5,000 for public buildings.

Utah.

The contract for the construction work on one of the sewer extensions at Murray, Utah, has been awarded to Gilkerson & Long of Salt Lake, the bid being $4,005.

Washington.

A special election will be held in Vancouver Aug. 20 to vote on bonding the city for $40,000 for the building of a sewer system to cost $50,000.

West Virginia.

The city council of Martins Ferry, W. Va., has passed the ordinance appropriating $4,000 to be used in drilling water wells at the pumping station.

Wisconsin.

✣Bids will be received by M. H. McKee, City Clerk, Barron, Wis., until 4 p. m., August 22, for the necessary labor and material for the construction of an addition to the present system of water works as follows: 1. Storage and gravity supply consisting of a 35,000-gal. tank and 90-ft. steel tower. 2. 132-ft. of 6-in. cast iron pipe with fittings. 3. Six-inch valve and fittings to connect discharge on pump with 6-in. supply pipe to tank.

J. C. Lawrence, state railroad commissioner and president of the state good roads association, recently held a conference with the president of the Milwaukee Railway to discuss the construction of a proposed highway in Snoqualmie pass in return for the state road route which the company purchased from the state highway board for $10,000. It is estated that the railroad company will construct the road at its own expense.

Wyoming.

The contract for the new water, sanitary sewer and electric lighting system for Wheatland, Wyo., has been awarded to P. O'Brien & Co., of Denver, at $68,720.

Canada.

✣Bids will be received until 8 p. m., Sept. 1, by Board of Works for the following contracts in Peterboro, Ont.: Contract A—(1) Laying 2,000 ft. sanitary sewer; (2) laying 4,200 ft. storm drains. Contract G—Electrically operated air compressors and ejectors. Contract P—Sewage pumping station. Contract S—Tile sewer pipes, 30 in. to 8 in. Plans and specifications, etc., may be seen at the City Engineer's Office, Peterboro, or at the office of the consulting engineers, Toronto

✣Sealed bids will be received by J. W Johnston, Esq., Secretary-Treasurer, Dauphin, Man., for the following: Contract "A"—Labor, laying about 6 miles of water pipes and sewers, subdivided into two sections. Contract "D"—Furnishing cast iron water pipe and special castings. Contract "E"—Furnishing gate vales for fire hydrants, etc. Contract "M"—Labor and materials for ten miles of gravity main, subdivided into three sections. Contract "R"—Constructing concrete reservoir. Contract "S"—Furnishing sewer pipes. Contract "W"—Furnishing wooden [illegible] are the Engineers.

OFFICE OF THE SEWERAGE COMMISSION OF THE CITY OF BALTIMORE.

SEALED PROPOSALS, Indorsed, "Proposal for Constructing Lateral Sewers in District 14, Sanitary Contract No. 55"; and "Proposal for Furnishing Coal and Ash Conveying Plant, Sanitary Contract No. 56"; addressed to the Board of Awards of Baltimore City, will be received at the office of Mr. J. Sewell Thomas, City Register, City Hall, Baltimore, Md., until 11 A. M., Wednesday, September 7th, 1910, for constructing Sanitary Lateral Sewers in District 14, and furnishing and erecting a coal and ash handling plant in the Sewage Station building, as shown on plans on file in the office of Mr. Calvin W. Hendrick, Chief Engineer of the Sewerage Commission.

Specifications and plans can be obtained upon application at the office of the Sewerage Commission, Room 904, American Building, Baltimore, Md., on and after Tuesday, August 16th, 1910. The following charges will be made for each specification and blueprints:

Lateral Sewers in District No. 14, Sanitary Contract No. 55	$ 5.00
Coal and Ash Conveying Plant, Sanitary Contract No. 56	10.00

These charges will be refunded upon the return, on or before September 7th, 1910, of the unused specifications and plans in good condition, or upon the return of the General Specifications, if any, and plans, in case a bid is submitted.

A certified check of the bidder, for the respective amounts shown below, on a clearing-house bank, made payable to the order of the Mayor and City Council of Baltimore, will be required to be deposited with each bid:

	Amount of check.
Lateral Sewers in District 14, Sanitary Contract No. 55	$2,300.00
Coal and Ash Conveying Plant, Sanitary Contract No. 56	1,500.00

APPROXIMATE QUANTITIES.

LATERAL SEWERS IN DISTRICT NO. 14, SANITARY CONTRACT NO. 55.

23,000 lin. ft. vitrified pipe sewers, 8" to 15" diam.

30 lin. ft. brick and concrete sewer, 30" diameter.

10,000 lin. ft. 6-inch house-connections.

The successful bidder on each contract will be required to give bond and comply with the City's Charter respecting contracts.

The Board of Awards reserves the right to reject any and all bids.

By order of the Sewerage Commission.

W. D. PLATT,
Chairman, pro tem.

HARRY W. RODGERS,
Secretary.

Approved:

GEORGE N. NUMSEN,
President Board of Awards, pro tem.

U. S. Engineer Office, Room N., Customhouse, New Orleans, La., August 9, 1910. Sealed proposals for building lock and dam and lockkeeper's dwelling on Bayou Teche, La., will be received at this office until 11 a. m., September 9, 1910, and then publicly opened. Information on application. Lansing H. Beach, Lt. Col., Corps of Engrs.

Notice to Contractors. Sealed bids for building Section 2, Beacon Hill Tunnel for the Cambridge connection, including a three-platform station located under a portion of the existing Park-street Subway station and Boston Common, will be received by the undersigned until 12 o'clock M. of Tuesday, August [illegible] 1910. Specifications and forms of contract can be obtained at 15 Beacon street, 9th floor. The right to reject any and all bids, and to award the contract as is deemed to be for the best interest of the City of Boston is reserved. By order of the Boston Transit Commission, B. Leighton Beal, Secretary.

(Proposal Advertisements Continued on Page 54.)

Cost Keeping and Management Engineering

By HALBERT P. GILLETTE and RICHARD T. DANA

This is the first book ever published on the subject of cost keeping on contract work. Its authors are pioneers in the field, and, although they have written much that has appeared in the form of articles—particularly in the pages of *Engineering-Contracting*—this book is the first presentation on the subject in a complete and logical sequence.

In the opening chapter the authors endeavor to reduce the **management of men** to a science, by laying down **ten fundamental laws of management,** each of which is fully discussed.

The second chapter contain 17 **fundamental rules for securing minimum cost.** These two chapters are wholly novel and of far reaching importance to all men who are, or hope to be, in charge of other men.

The authors then proceed to describe and illustrate their own systems of cost keeping, which they have developed on their own contract work and have also been installed on the work of other contractors, giving both the **punch card reports**—a form of report which they were the first to devise and the more common blanks to be filled in with pencil.

The last chapter contains numerous systems of cost keeping developed by other engineers and contractors, and is a **veritable mine of suggestive hints** as well as of examples of excellent blanks for special purposes.

The following is the list of chapters:

CHAPTER I—THE TEN LAWS OF MANAGEMENT.
CHAPTER II—RULES FOR SECURING MINIMUM COST.
CHAPTER III—PIECE RATE, BONUS AND OTHER SYSTEMS OF PAYMENT.
CHAPTER IV—MEASURING THE OUTPUT OF WORKMEN.
CHAPTER V—COST KEEPING.
CHAPTER VI—OFFICE APPLIANCES AND METHODS.
CHAPTER VII—BOOKKEEPING FOR SMALL CONTRACTORS.
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CHAS. S. HILL . . . .
C. T. MURRAY . . . .
H. P. KIRKLAND . . . .
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Traction Engine Plowing.

We give considerable space in another part of this issue to a report on methods and costs of farm plowing with traction engines. While the general purpose of this article is directed to others than contractors a great many of the data given are applicable to traction engine work of any kind. There is another point to the article which is not without suggestiveness to the contractor and other owners of traction engines. This is the possibility offered them of contracting for farm plowing during dull seasons of construction work. One of the heaviest burdens on the traction engine as a contractor's tool is the great proportion of the time which it is idle. Any means by which this expense may be lessened is worthy of attention. If two months could be added to the engine owner's working year by taking on farm plowing in spring and fall it would help materially to reduce his interest charges. The article, which we publish, indicates what the opportunities and profits are in this direction, and as before stated, it gives many data on overhead and operating charges which are generally useful.

A Critic Answered.

Certain test data recently reprinted in these columns are criticised by a correspondent who signs himself "Critic." He doesn't believe that they are accurate. This is the least part of his censure, however. He deplores an editorial commendation of the report in which these data appeared and submits that it should have been our task to verify the data before we ventured to praise them. He also asks that "if such a thing be possible," we tell him "in a few words" why editors of engineering papers do not verify the data which they publish. As this letter in a measure represents a class we will endeavor to answer our "Critic." There is an old story or an unfrocked monk, who, when asked why he had left his monastery, replied that there were three reasons, the first of which was that he had been thrown out. So the editor when asked why he does not verify all the statements made in his columns may answer that there are several reasons, the first of which is that he could not publish a paper if he did.

Engineers' License Laws.

In replying last week to a correspondent who requested the names of those states having laws regulating the practice of engineering and surveying we omitted to name the state of California. Our attention is called to this omission by a valued reader who writes as follows:

"On March 31, 1891, the Governor of California approved a bill entitled 'An Act to define the duties of and to license Land Surveyors.' Thus this state was the first in the Union to have a law licensing surveyors and of all the laws now on the statute books it shows evidence of the most care in its preparation. Why California was omitted by the committee of the American Society of Civil Engineers from the list of states having such laws is strange to me for the law is yet in force."

If we may judge from the letters coming to us, the ever-present sentiment among engineers that legal regulation of the practice of engineering is desirable will find voice during the coming winter in several states in the shape of acts submitted to the legislatures. It is most desirable in our opinion, if such laws are to be enacted, that they be of the same general character and we would urge again that engineers having the work of drafting engineers' license acts study the report of the Committee of the American Society of Civil Engineers, which was published in our issue of July 6, 1910.

Extravagance in Using Cement.

American engineers are extravagant cement users. In many cases where the German or French or Italian engineer would use a natural cement or even some cheaper trass or puzzolana substitute the American uses Portland cement without question. This is not his only manner of extravagance; he also uses richer mixtures in many places than a European engineer would think of using. In bridge work in America, for example, footings and foundations will be a 1:3:5 concrete which will be richened to a 1:2:4 mixture for arch ring and spandrel structure, while in a similar case in Europe there would be at least three and perhaps five grades of concrete. A German or Italian bridge will often start with a 1 to 12 or 14 concrete footing, very likely of trass or puzzolana cement, and grade up by several steps in quality of concrete to a final mixture seldom richer and often not as rich as 1:2:4. Nor is the European engineer a parsimonious cement user. He will and does use very rich mixtures, veritable mortars, in some of his bridge work, but he does it only for certain members and he cuts down the size of these members to correspond, as for example the thin reinforced mortar arch rings of Monier construction in Germany. Is there a lesson in this matter for American engineers?

In another column of this issue a contributor points out the possibilities of cheap substitutes for Portland cement and intimates the economy of using them more frequently. We do not share any fear that this contributor may have as to a future large increase in cement prices due to combinations, nor do we grant so wide a field or so much intrinsic merit to the various substitute cements which he names. Our belief is that there is nothing so good as good Portland cement and as a general rule nothing cheaper than plenty of cement. This is the American idea in cement using and it is supported by very good arguments. Our contributor names one of them in quoting the old masons' saw: "dilute your mortar with the sweat of your brow." This is just the point. You can make a good puzzolana concrete by putting much work on it. In the same way also you can make lean mixtures of Portland cement serve many purposes for which rich mixtures are commonly used. In both cases you reduce the cost for cement which is only one factor in the total cost. The other factor is the labor of mixing and this is increased. With wages as they are in America it generally is cheaper to use more cement or a better, though more expensive, cement, than to add much to the amount of labor.

We do not imagine that these facts are unknown to our contributor, but in making the point intended in his article he has not given them emphasis. The point urged by him deserves attention. There are frequently instances where the location of work is so isolated that the cost of getting Portland cement to the job is nearly prohibitive. It was such an instance as this that prompted the paper which we publish. The facts there given were first worked out for a client who planned a large irrigation project in Wyoming which required a haul of 69 miles from the railway for the large quantities of cement needed and who, therefore, was driven if possible to find some local substitute. Another practical illustration occurred in the practice of one of the editors of this journal some years ago in building a smelting plant in South America. In this case lime kilns were built and the lime used to replace a portion of the cement—which cost $6. a barrel on the ground—required for masonry. As a final illustration our readers will recall the Roosevelt dam in Arizona; here a complete Portland cement mill was considered a profitable investment.

While we believe that it is idle to urge or to argue the general substitution of puzzolana cements for Portland cement to any wide extent, there is merit in keeping their possible use in mind. There is merit, too, in keeping in mind the European practice of using lean mixtures of concrete. Despite the difference in American conditions and wages of labor rich mixtures are not infrequently pure extravagance. It is nothing else to use a 1:3:5 concrete, or, as we know of being done, a 1:2:4 concrete, for a pavement base on good soil. The same thing is true of much concrete footing and foundation work and of much concrete construction of other kinds. Nor is it always economy to substitute cement for labor in mixing. Quite often the extra cement serves no better purpose than to make up for slovenly mixing and placing.

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CONCRETE AND REINFORCED CONCRETE SECTION

The Grafton Bridge, Auckland, New Zealand; the Longest Concrete Arch Bridge in the World.

A concrete highway bridge containing a main arch span of 320 ft. has recently been completed at Auckland, New Zealand. This is the longest concrete arch span in the world; the others completed or in process of construction being as follows:

	Ft.
Walnut Lane, Philadelphia (completed).....	233
Sitter Road, Switzerland (completed).......	259
Rocky River, Cleveland (in progress) .	280
Street Bridge, Spokane (in progress)	281
Medina, New York Barge Canal.............	285

The Grafton Bridge was authorized by vote in 1905, by which the city officials were authorized to borrow £30,000 for its construction. In 1906 Mr. Walter E. Bush, city engineer, Auckland, called for plans and bids for constructing a bridge either of concrete or of steel. Two bids were received as follows:

Ferro-Concrete Co. of Australasia (concrete)	£31,739
J. McLean & Sons (steel)................	28,739

The bid for the steel bridge provided for its construction by the American Bridge Building Co. Mr. Bush recommended the acceptance of the bid for a concrete bridge on the grounds of, (1) less cost for maintenance, and (2) greater beauty. The plans for the concrete bridge called for a structure 960 ft. long, consisting of the following spans:

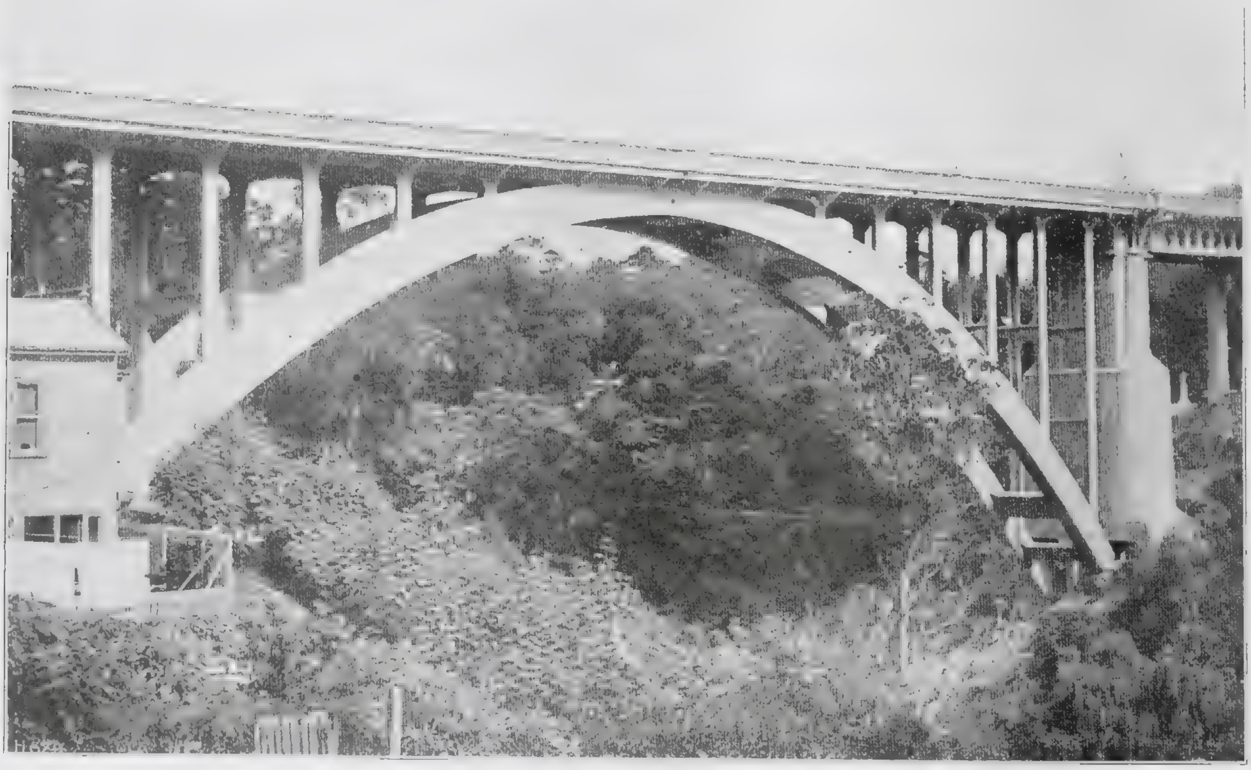
	Ft.
1 girder span............	35
1 girder span............	37½
4 girder spans, each....	[illegible]
1 girder span................................	78½
1 girder span........ .	80½
1 girder span................................	42
1 arch span............	320

The three shorter girder spans are solid girder and slab design and the six longer girder spans are open panel design, with three girders each.

The feature of the bridge is of course the main arch span, which is clearly shown by the accompanying illustration. This span consists of two parallel arch ribs tied together at 21-ft. horizontal intervals by reinforced concrete ties 8⅓ ft. wide by 20 ins. thick haunched 18 ins. into the ribs. The ribs are 6 ft. x 4 ft. 2 ins. at skewbacks, 9 ft. 9 ins. x 4 ft. 1 in. at girder, and 5x4 ft. at crown. Each rib is hinged at crown and skewbacks by cast steel hinges resting on I-beam grillages embedded in the concrete. The ribs take footing on two abutments resting on solid sandstone, these abutments being wholly separate from the main end piers. The rise of the arch ribs is 84 ft. c. to c. of hinges.

The deck is supported on the arch ribs by tower bents spaced 18 ft apart in the horizontal. The legs of these bents are of T-sections and the taller ones are braced together by horizontal beams, also of T-section, about 30 ft. apart vertically; the legs carry at their tops 3 ft. 7 in. x 10-in. floor girders haunched into them. The floor girders support five parallel 1-ft. 8-in. x 10-in. stringers, carrying a 6-in. deck slab. The sidewalks are carried by brackets on each side. The parapet walls are 4 ft 9 ins. high.

The bridge was designed by Mr. R. F. Moore, chief engineer of the Ferro-Concrete Co., assisted by Mr. C. Rosegger. We are indebted for information furnished by Mr. Walter E. Bush to *Concrete and Constructional Engineering* of London, England, for the data from which this brief description has been prepared.



View Showing 320-Foot Concrete Arch Span of the Grafton Bridge, Auckland, New Zealand.

The grand total of Panama Canal excavation in July was 2,406,288 cu. yds., of which 2,371,583 cu. yds. were charged to "work excavation" and 34,705 cu. yds. to "plant." The dry excavation amounted to 1,466,014 cu. yds. and was principally by steam shovels. The dredges removed 940,274 cu. yds. in addition to the amount pumped into Gatun dam by suction dredges.

Reinforced Concrete Sea Wall Construction of Separately Molded Members.*

The new system of sea walling now being carried out by the Sydney Harbor Trust, at Miller's Point, has been the object of much interest to engineers and others interested in construction under water, this harbor being the first port in which the trestle wall system, here described, has been adopted. Two varieties of this principle of construction have now been tried with equal success, both having been designed by Mr. W. E. Adams, A. M. Inst. C. E., who holds the position of designing engineer to the Sydney Harbor Trust, under Mr. H. D. Walsh, M. Inst. C. E. This system was devised with the object of finding a practical solution of several well-known engineering difficulties in connection with the building of retaining walls, the foundations of which are under water. These difficulties may be briefly summarized as follows:

(1) Work carried out under water is always open to doubt, on account of the obstacles to thorough inspection, and is necessarily much more costly than work done on dry land. Obviously, therefore, it is advisable to perform as much of the labor on dry land, and as little under water as possible. The invention of reinforced concrete, together with the assistance of modern lifting appliances, have together rendered this object attainable to a very large extent.

(2) Sea walls, more frequently perhaps than not, are required to be built on indifferent foundations. Even where a rock bottom exists, the cost of a deep gravity section wall is very great, but to build stably on a yielding foundation enhances the cost to a practically prohibitive extent. The concentration of pressure at the toe of a gravity section wall, and the consequent inequality of the pressure on the base, apart from the question of cost, con-

---

*From information furnished by Mr. W. E. Adams, Designing Engineer, to "Concrete and Constructional Engineering," London, England.

stitutes the greatest objection to walls that resist the overturning moment mainly by their own weight.

The essentials to be regarded in designing a sea wall, therefore, resolve themselves into four factors. Firstly, economy of cost; secondly, avoidance of all unnecessary work under water; thirdly, stability; and, fourthly, a flexibility sufficient to allow the wall to accommodate itself to unequal settlement, and even to lateral movement of the foundations.

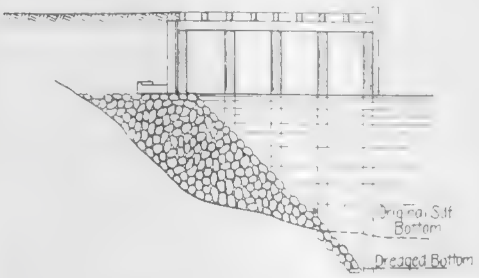


Fig. 1—General Plan of First Type of Separately Molded Concrete Sea Wall.

Setting out with these several points in view, and taking them in order, it is evident at once that the gravity section wall is extravagant in material. The L-shaped section, built of concrete reinforced with steel bars, offers a suitable alternative. The greatly reduced weight of an L-section renders it possible for full height vertical sections of the wall to be built on dry land and transported to the foundations, thus avoiding any work under water but the preparation of the foundation. As regards stability against overturning, a very much wider base can be economically secured than in the gravity section wall, and hence greater stability combined with more uniformity of pressure on the foundations. Further, an L-section wall built of completely articulated vertical members set up in close contact, each being self-sustaining and capable of individual movement without influence upon the remainder, presents a solution of the flexibility problem. All four factors can, therefore, be secured in this way.

Now, it is evident at once that complete stability against overturning can be secured with the L-section wall, almost regardless of what it may be placed upon, provided only that the foundation is nearly uniform in bearing capacity on lines running transversely to the direction of the wall. Thus, on a foundation of uneven consistency longitudinally, but fairly consistent transversely, a wall can be built secure against overturning and of such flexibility that it will move considerably out of line, both vertically and horizontally, without risk of failure.

In many cases, as, for instance, at the rear of a timber frontage wharf, this is all that is required. The horizontal alignment is not as important as economy of cost, and the want of vertical alignment can be made up by a parapet or coping after settlement has ceased.

Seeing that an almost infinite degree of stability can be secured in the L-section wall by lengthening the base member, the question naturally arises as to whether it would not be possible to omit each alternate section or "trestle," and close up the gaps with slabs, or plates, resting against and between the flanges of the trestles. Such a system would obviously effect a considerable saving in the cost of the wall. The next consideration to suggest itself is whether or not more than each alternate trestle could be deleted? The omission of an alternate trestle would necessarily throw an additional load upon those remaining. As the increased pressure would, of course, be transmitted to the foundations, it is in the latter that the limitations will be found. On hard rock the spacing apart could be wide, and as preparation of the bottom is only necessary under each trestle, the saving in labor on foundations would not be less than 100 per cent. On less stable bottoms the spacing apart would be proportionately reduced, and on ballast, or other yielding ground, they could be placed in contact, unless special support be provided at the site of each spaced out trestle, either by driving piles and capping them with concrete, or where the ground is not too soft, by bedding distributing plates of reinforced concrete underneath.

As the stability of the L-section wall is virtually secured by counterpoise, much as we load up the rear legs of a crane, it is apparent that a larger reserve of stability could be acquired by laying a plate upon the end of the base member to react against a larger mass of the filling (see Figs. 1 and 2).

In view of these several considerations, the L-section articulated wall has theoretical advantages that should give it many points of superiority over either the gravity section or the monolithic L-section.

The first attempt to put these surmises into practice was made by the Sydney Harbor Trust in 1907 at the new wharf then under construction at Miller's Point, for the Messageries Maritimes Co. This is a timber wharf 490 ft. long by 40 ft. wide, the deck level standing 14 ft. above low-water mark. A wall was required at the back to retain the filling forming the reclamation. The rear row of piles stood in from 10 to 23 ft. of water at low tide, and at an average distance of 40 ft. out from the original shore line. After the piles had been driven and capped, sandstone ballast was tipped in until the level had been brought up to low water mark. The slope of the ballast under the wharf at 1 vertical to 1¼ horizontal then just reached to the front row of piles in 32 ft. of water, as shown in Fig. 1. While these works were in progress, tenders were called for the sea walling. Alternative offers were received for: (a) Trestle and Plate Wall; (b) Concrete Block Wall; (c) Stone Masonry Wall. The tender for (a), being the lowest, was accepted, the work of setting in place being undertaken by day labor.

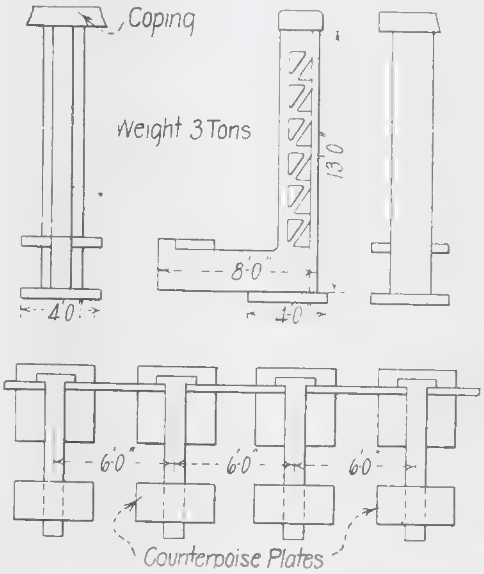


Fig. 2—Details of First Type of Separately Molded Sea Wall.

The trestles, slabs, foundation, and counterpoise plates were manufactured on the ground by the contractors, Messrs. Gummow, Forrest & Co., Ltd., the cost being £3 per lin. ft. run of the wall. After the several parts had been given time to set, the ballast was dressed to a level berm extending about 8 ft. beyond the front line of the wall. Beds were formed for the foundation plates by ramming down into the ballast a strong wooden templet, the exact size of the plate, the ramming being done by a 30 cwt. pile-driving monkey suspended from a crane. The templet was then removed, and the foundation plate, shown in Fig. 2, laid in the recess and dollied down hard and level, the monkey being again used, care being taken not to damage the plate. At the same time a line of bagged concrete was laid on the ballast under the remainder of the base member of the trestle, and rammed level by hand. The complete foundation being thus prepared, the trestle, weighing nearly three tons, was lifted by crane and swung into its place. It being only possible to work during two hours per tide, at low water, as many of the foundations as possible were first prepared, and when the water began to hinder this operation the trestles were next put into place, and any time that remained over was expended in setting the retaining slabs in place. Sixty lineal feet of wall were thus erected complete in one day, and, had it been necessary, more than double that length could have been set up. The rate of erection in this kind of work is governed entirely by the lifting and dollying plant available.

The reclamation was carried out by tipping soil, ballast, and clay from the cart tail, working out from the shore. No attempt was made to sort or select the materials, except that a small quantity of stone was first packed over the counterpoise plates to hold them in position. No injury was done to the concrete by falling stones, and no hitch of any kind occurred during the progress of the work. Particulars of settlement were carefully observed and noted. During the progress of the filling, which was carried out with only reasonable uniformity, the whole wall sank bodily from 5 to 7 ins. A horizontal walling had been placed on the rear row of piles to line the trestles against, and while this probably assisted in maintaining a perfect alignment during the settlement, it is evident, from frequent inspection, that no great pressure was borne by it.

During the first six months after completion of the reclamation the wall settled from 1 to 2½ ins., making a total of from 6 to 9½ ins., and it has remained stable ever since, a period of nearly three years. The settlement, it might be remarked, is similar in extent to that which occurred at the adjoining wharf (Dalgety's), where a gravity section stone masonry wall of the same height, and 7 ft. 6 ins. thick at the base, had been built three years earlier. But while the unequal settlement of the wall at Dalgety's Wharf caused many of the large stones to break on their beds, the trestle wall remains quite true and fair, and without rupture of any kind, though the filling behind it has sunk in many places as much as 16 ins.

In connection with the designing of the trestles and plates, the following limiting stresses were fixed upon:

	Lbs. per sq. in.
Extreme fibre stress of concrete in compression	[illegible]
Shearing stress in concrete	75
Direct compression in concrete	[illegible]
Tensile stress in steel reinforcement	16,000

Pressure on foundation not to exceed 2 tons per sq. ft.

The vertical member of the trestle was designed as a Visintini cantilever, the stresses assured being such as would be developed against 6 ft. run of wall 14 ft. in height, the trestles being spaced 6 ft. apart c. to c. In addition a live load of 200 lbs. per sq. ft. was assumed. The general dimensions of the various members are shown on Fig. 2.

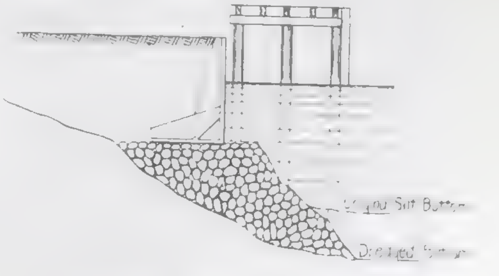


Fig. 3—General Plan of Second Type of Separately Molded Concrete Sea Wall.

Though special attention was given to the steel reinforcement it possesses no unusual features. Great pains were taken in framing up the rods, the horizontals and diagonals being bent not a close fit round the verticals. All rods were first bent round pins fixed in a solid frame, so that all corresponding parts were exactly alike. The concrete was composed of 1 part Portland cement to 2 parts sand, and 4 parts of finely broken basalt.

The trestles were manufactured in an upright position.

Following on the success of the trestle and plate wall it was decided by the engineer-in-chief, in October, 1907, to apply this system on a much larger scale in the new wharfage scheme about to be commenced to the southward of Miller's Point. It was necessary in this connection to build a sea wall 1,350 ft. long at the rear of the timber wharfage. Previously the practice had been to build a solid wall and timber wharf, the timber construction being 40 ft. wide, in order to secure a depth of 32 ft. along the front of the wharf at low tide. The ballast, it might be remarked, usually takes a slope of from 1 to 1 to 1¼ to 1.

A timber frontage wharf 40 ft. wide at that date cost £15 per lin. ft. But timber work being perishable and requiring continual maintenance, it is, of course, advisable to build as little of the timber portion and as much of the permanent reclamation as possible. To dispense with timber altogether would, in one sense, be desirable; but while it is cheap and good it is the most economical class of construction that can be applied to deep water berths. If, therefore, the timber portion were to be built only 20 ft. wide, there would be available in lieu of 20 ft. width, £6 10s. per ft. to go towards the cost of a deeper sea wall at the rear. Adding to this £4 per lin. ft., which would be the cost of a sea wall 14 ft. high at the rear of a wharf 40 ft. wide, there would be available £10 10s. towards the sea wall at the back of the 20 ft. wide wharf. The question then arose whether a sea wall could be built for this rate, and in such a way that there would be 32 ft. of water at the berth. Referring again to Fig. 3, it will be seen that such a wall would require to stand in 12 ft. of water, and have a total height of 21 ft. 6 ins. Obviously, a gravity section wall of sufficient bulk to stand upon so indifferent a foundation would cost a great deal more, approximately £13 per ft. In testing the stresses for a trestle and plate wall it was found that the concentrated pressure upon the foundation at each trestle, if spaced apart, would be far too high for ballast; but ranging the trestles contiguously the pressure could be reduced to the permissible limit, 2 tons per sq. ft.

In view of these considerations the work was undertaken, the limiting stresses being fixed as before. The height decided upon for the trestles was 21 ft. 6 ins., the width of fall 3 ft. 6 ins., and they were required to carry in addition a dwarf parapet wall 4 ft. high with filling behind, and a live load of 200 lbs. per sq. ft. This made the total height to be sustained by the trestles equal to 27 ft. 6 ins. Tenders were called in October, 1907, for the construction of the trestles upon the site and the contract was awarded to Messrs. Gummow, Forrest & Co., Ltd., the rate being £8 15s. per foot run of wall.

The ballast having been completed, leaving a berm of 8 ft. outside the line of the toe of the wall, the preparation and levelling of the foundations was commenced. A heavy ram constructed of two 14x14 in. iron-bark spars, with flitches at the lower end to increase the area of 2 ft. 8 ins. x 2 ft. 8 ins., was suspended between the leaders of a floating pile frame. This was raised and dropped upon the ballast until a hard and fairly level surface was obtained. Two old rails were then lowered down and levelled up at 12 ft. below low-water mark, and at a sufficient space apart to accommodate the base of the trestles. The inner rail was kept lower than the outer one, to give the trestles a batter of 4 ins. Small shingle was next thrown in and screeded off by divers, using a straightedge with the rails as guides. After the bottom had been thus prepared and levelled up, the trestles, weighing 9 tons, were swung into place by a floating 15-ton crane.

It was found that, including picking up and bringing them to the site and lowering them into place, eight trestles could be set up in one day, or 28 ft. of wall.

The trestles, as well as having a batter of 4 ins., were set 9 ins. behind and clear of the piles, so that they should not in any way bear against the wharf. They stood upright in the water without trouble, but a temporary strut was always placed at the working ends to prevent accident.

As the load increased to its maximum, signs of settlement, as expected, became apparent, together with slight lateral movement. The ballast, it might be noted, stands upon a sloping bed of still clay, into which it was pressed by the superimposed weight. The settlement varied considerably in extent, ranging from 2½ to 7½ ins., and the lateral movement from 2 to 6 ins. At one place, where sloping rock lay near the surface, it was not considered safe to put the trestles on ballast. A bed of bagged concrete was, therefore, laid and rammed level, and the trestles set upon this portion did not move when filled up.

It will be seen, by reference to Fig. 4, that the base member of the trestle tapers towards the rear. This was arranged, firstly, to enable the filling to penetrate below and help to bed the trestle, and, secondly, to allow for swinging, should there be a tendency to creep out of line in setting up.

For lifting, wooden toggles were put through the holes in the webs, shown on the drawing, and wire rope slings slipped over, so that when lowered into the water the trestle assumed a truly vertical position. It might be of interest to note that the center of gravity in air was not quite the same as in the water, the trestles not being wholly immersed at any time. The correct position of the slings was found after a few trials, and so uniform were the trestles in size and distribution of weight that the slinging position remained constant throughout.

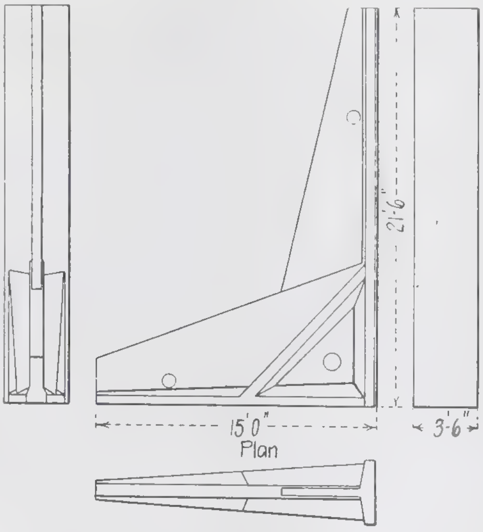


Fig. 4—Details of Second Type of Separately Molded Sea Wall.

The work of constructing the trestles was carried out by the contractors in a praiseworthy manner, without hitch of any kind, the molding being done face downwards. The molding forms were very stoutly framed together of oiled Oregon pine, fitted in panels in such a way that the whole could be taken apart when the molding was finished.

The steel reinforcement was put together complete, and set up in place ready for enclosing in the molding forms. The diagonal and cross ends were wrapped, not a close fit, round the vertical rods, and the whole, when framed up, formed a rigid skeleton, capable of being moved about. The steel rods were supplied by Messrs. G. & C. Hoskins, Ltd., of Lithgow, manufactured from Australian ore. The concrete was composed of 1 part of cement to 2 parts of sand and 4 parts of finely broken basalt. The first portion of the wall built has now been standing 18 months, and is in perfect condition.

Manufacture and Use of Slag Cement and Other Substitutes for Portland Cement.

BY W. D'ROHAN.*

The use of concrete in the irrigation construction of the west has long since passed the experimental stage and become an absolute necessity. The headworks and reservoirs of the various canals are always situated way up in the mountains, remote from a railroad and in most inaccessible places, so that very often engineers are forced to abandon the works as the great cost of freighting to those places swallow up the limited funds at their disposal.

The principal material to be hauled for the construction is cement. The others can always be found in close proximity to the works and as there is a probability of a big increase in the cost of cement to the consumer, owing to the recent combine of manufacturers, a cheap and efficient substitute becomes a necessity for the irrigation engineer and the homesteader.

The following paper briefly describes how these substitutes can be practically home-made very cheaply by any one with a little care and the material tested before and after manufacture, with little trouble. The various recipes given are not experiments, but have been used in Europe, Africa and Indian for many hundreds of years, and give concretes which offer an absolute resistance to alkali and acid bearing waters.

Every engineer is acquainted, theoretically at least, with the manufacture and use of Puzzolan cement in Italy and Puzzolan-Trass cement in Germany and Holland. The old Roman cement belonged to this class of Puzzolans, and all the substitutes offered in this paper must be classified as artificial Puzzolans belonging to this category.

The principal artificial Puzzolan cement made in this country is manufactured by grinding with slaked lime, blast-furnace slag which has previously been granulated by a large stream of water at great pressure. This must not be confused with a true Portland cement made by mixing limestone and slag, grinding very finely the resulting mixture and burning to a clinker. For this latter, the slag must come from furnaces working only pure ores and fluxed with low magnesian limestone, and must not contain more than 48 per cent of silica and alumina; 3 per cent of magnesia or 12 per cent of iron.

For the manufacture of Slag Puzzolan, any slag is available, thus placing the refuse heaps of the numerous smelters throughout the west at the disposal of the engineer. The slag is granulated as above, then a small quantity of this slag is ground up with slaked lime to a fine powder and the resulting cement tested; if satisfactory, the actual manufacture starts; if otherwise, more or less lime is added until the best results are slow setting, it is customary to add 2 to 4 per cent of caustic soda or potash to hasten the setting. This soda is generally added to the water used in slaking the lime and as it quickly carbonizes, slag cement becomes slow setting again with long storage.

Pulverizing this slag is a very laborious proceeding and as only large jobs permit the installation of special grinding machinery, this cement, as a home-made product, is hardly likely to appeal to the hustler; still, it is found in England that one laborer can pulverize from 20 to 30 cu. ft. per day using a heavy, flat, concrete tamping iron; that is from 5 to 8 barrels per day and 85 per cent of it will pass through a 180 mesh sieve.

Puzzolan cement made from slag is characterized physically by its light lilac color; the absence of grit attending fine grinding and the extreme subdivision of its slaked lime element; its low specific gravity (2.6 to 2.8) compared with Portland (3 to 3.5) and by the intense bluish green color in the fresh fracture after long submersion in water, due to the presence of sulphides, which color fades after exposure to dry air.

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*39 Glenn Court, California St., Denver, Colo.

This Slag Puzzolan is essentially a hydraulic cement and is generally for use in foundations and under water. It disintegrates after 3 or 4 years when in dry air, owing to the oxidation of the sulphides in the atmosphere. The disintegration can be easily prevented by the use of oil in the mixing. Half a gallon per yard is sufficient, linseed, olive or asphaltic base oils being used.

The drainage system of New Orleans was built of this Slag Puzzolan cement and is the finest work of its kind.

Artificial Puzzolans are pulverized brick or tile, broken pottery and glass, burnt clay, wood, and bone ashes, charcoal, powdered pumice stone and the scoria of forges, and all are available in the manufacture of cements. The use of pulverized bricks, tile and burnt clay in the manufacture of hydraulic mortars extends from remote ages to the present day. An analysis of the mortar in the ruins of the Palais des Fermes in Paris, built by the Romans, shows that 26.10 of pulverized bricks, tile or burnt clay, with 65.70 parts of lime, 4 silex and 4.20 alumina formed the mixture.

A cement much used in India is made of 1 part slaked lime and ½ to 1 part of finely ground brick dust.

Count Chapal calcined ochrey clays and made a good Puzzolana. M. Mason sunk casks filled with them in the Seine and after 6 months were found to be extremely hard.

General Treussart states that a mixture of common lime with sand and powdered brick in equal parts forms a hydraulic mortar requiring a breaking weight of from 221 to 331 lbs., which he considers sufficient for general purposes; he found, however, that bricks exposed to a current of air while burning, make a quicker setting cement than those not so exposed.

The present custom of Italians and French is to throw up clay and fuel loosely together and burn it slowly, then grind it up with slaked lime, using 1 part lime to 1½ parts clay. A laborer can pulverize 30 cu. ft. or 8 barrels of this material in a day. To this mixture is added 2 or 3 per cent of alkali, either soda or potash, for the purpose of forming a soluble silicate to act upon the lime in setting and sometimes 1 per cent of finely pulverized quartz or sand rock is added.

A cement of equal parts of unslaked lime, pulverized charcoal and powdered sandstone was discovered in the Mausoleum of a Tartar Prince. It was so hard that the bricks could not be pulled apart without breaking.

Coal ash mortar was used by Col. Fanshawe at Water Point Gibraltar in 1790-1, and is still in good shape. Lime 2 1-2, sand 2 1-2, coal ashes 2 1-2, burnt clay 1 1-2, smith's cinders 1 1-2, being the mixture.

Masons' cement, that will not crack under water, is made of equal parts of quicklime, pulverized baked bricks and wood ashes. Thoroughly mix and dilute with sufficient olive oil to form a manageable paste. It immediately hardens and does not crack.

Common mortar of ashes is made by mixing together 2 bushels of newly-slaked lime, 3 bushels of wood ashes, which, when cold, is to be well beaten. The oftener beaten before being used, the better. It is an excellent mortar for resisting alternate moisture and dryness.

Two bushels of slaked lime, 1 of burned clay and 3 of sharp sand, to which can be added the aggregate, is a good water concrete.

One bushel of pulverized quicklime, 2 of slaked lime, and one of burnt clay or brick dust, with as little water as possible, makes a good cement. Boiled potatoes incorporated with lime and sand or burnt clay, improves it. (Austin 1871.)

Dr. Shaw gives the following description of a Maltha used in Tunis and other parts of Africa: 1 of sand, 2 of wood ashes and 3 of sifted lime powder, mixed with a little water. When well incorporated, add a little oil, and beat up once every day for four days, regaging with a little water and oil. This makes a splendid hydraulic cement, harder than granite.

Dr. Brindley Higgins of London, possibly the greatest experimenter of his day, with limes and cements, patented a cement, as follows:

Fifty-six pounds coarse, washed sand, and 42 pounds fine sand, mixed together and wet with lime water; then add 14 pounds of lime and 14 pounds of fine bone ashes. If for use under water, use only 5 pounds of bone ashes. This cement was extensively used with great success in England.

M. Baggi of Gottenburgh, made use of a very hard, black, schistous rock, which he burned for a considerable time and afterwards pulverized and mixed with lime to make a good hydraulic mortar.

Mr. John Smeaton in 1756 used a mixture of 1 part of lime with 1 part of Puzzolana as a mortar in building the Eddystone Light House, which by its durability, earned for him undying fame as an engineer.

Silenitic mortar which is very commonly used in England, is made by the addition of from 2 to 4 per cent of sulphate of lime, (plaster of Paris or gypsum) or green vitrol. This addition saves half the lime, is four times as strong and is an excellent substitute for Portland cement.

M. Vicat recommends testing all Puzzolanas by acids, recommending diluted muriatic or nitric acid, and in lime water. (1) It will be found that those not acted on by the acids, and having no action on lime water, are inert. (2) Those that are moderately acted on by acids, and act moderately in lime water, have very little energy. (3) Those which are powerfully acted on by acids and which are active in lime water, are energetic.

From the analysis of Portland cement and the foregoing recipes, it will be seen that lime is the principal active agent in all cements, whether Portland, natural or Puzzolana. The only exception probably is magnesian cement in which pure carbonate of magnesia, called magnesite, when burnt in a heat of great intensity, about cherry red, ground to a fine powder and made into paste with water, possesses considerable hydraulic energy. This calcined magnesite has been patented under the name of Union Cement. Its characteristic property, however, upon which it depends for its peculiar value, is not developed when mixed with water alone, for in that case the induration or setting is due to the crystallization of the hydrated magnesia or oxide of magnesium. But if the burnt and pulverized magnesite or Union Cement be mixed up with chloride of magnesium, for which the bittern water of seaside salt works has been found to be a cheap and suitable substitute, a chemical combination takes place between the oxide and the chloride of magnesium and oxychloride of magnesium is formed. This is a very remarkable hydraulic cement, being greatly superior to any other new cement in strength and hardness, not excepting even Portland cement.

Owing to the enormous deposits of limestone in the United States, the ease with which lime is manufactured, and as only caustic or hot lime is to be used in the manufacture of the Puzzolans, it will be seen that these cement substitutes can be made at about one-third the cost of Portland cement. Lump lime can usually be purchased at one-fourth the price of cement. Besides the freight is almost eliminated. Where lime is not conveniently to be had, there is nothing to prevent its manufacture. In every gang of Irish or Italian laborers will be found one or two men who have burned stones in the old country and they can be depended upon to produce good lime. Limestone, chalk or marl deposits are usually burned, but nearly al calcareous and carboniferous stones make good lime. They acquire the properties of lime in the highest degree when they are slowly heated in small fragments until they appear to glow with a white heat, when this is continued until they become non-effervescent.

If a man decides to burn his own lime, the first thing to do is to test the rock available. This is done with ten cents' worth of diluted nitric or muriatic acid and an ordinary water glass. Drop a small piece of rock into the acid in the glass; if no action takes place, the rock is not suitable; if it effervesces and falls to pieces, the search is successful. This rock can now be further tested by burning four or five small pieces in an ordinary fire until they do not effervesce with the acid. Grind them up when cool and make into a paste with water and 50 per cent clay or powdered brick. The boiling test can now be applied as in the case of Portland cement, and the percentage of clay increased or diminished accordingly. Too much lime cracks the paste and too much clay disintegrates it. In this way a first-class cement can be made.

Burning the rock in the open air is a slow proceeding, but it is said to be beneficial, owing to the amount of carbonic acid which the lime absorbs from the air. Generally speaking, however, it is much better to put up a kiln in the shape of a large bottle. It can be built of rocks and mud, with a grating made of any old irons or rails, and should be so arranged that the draft can be checked. On this grating is laid the fuel, over which the rock is loosely placed, the first row in the shape of an arch, and the rest loosely piled in. The heat is slowly applied at first by means of the draft check, and burning is completed when a piece of the rock does not effervesce in the acid. This takes from 15 to 20 hours. This lime is ready for immediate use. Sometimes, however, the lime is allowed to stand for several months after slaking before being used, and this practice is said, in some instances to increase the hydraulic energy of the product, probably in consequence of the partial recarbonization of the line, facilitating the process of silification which takes place between the lime and the alkaline silicates contained in the Puzzolana.

From the foregoing, necessarily outlined, description, it is evident that anyone can manufacture a good cement from materials at his disposal. The fallen timber in our forests can supply charcoal and wood ashes; sawdust from the mills, broken bricks, tile and pottery are all available. Puzzolan cements are naturally weaker than Portland, and the former require a little more careful and longer mixing and less water. It was a mixim among the old masons to their laborers that they should dilute the mortar with the sweat of their brows; that is, labor a long time, instead of drowning it with water to have it done sooner. It must be remembered that these Puzzolanas have stood the test of time, and Portland cement is comparatively new.

The hardness of the Roman cement discovered in modern times is attributed to several circumstances. The Romans built their walls of great thickness, and thick walls constructed of materials which are bad conductors of the atmospheric fluids always preserve a latent humidity, more or less sensible according as the distance between the faces of the wall is more or less great. It is well known that the temperature of a block of building, in consequence of the inconductivity of its elements, varies but little. Here we have the secret of the hardness of old Roman cement or mortar; it is a hydrate of lime, and thus, instead of being destroyed by humidity, as a plaster or common lime would be, it benefits by it just as aquatic plants thrive on water; moreover, a uniform temperature is peculiarly suited to its preservation. The scrupulous care which the Romans took in the selection of their materials is a grand element in the duration of their constructions. Stone was not employed until it had been exposed to the effects of the air for two years, and if, at the end of that time, it did not appear sound, it was broken up and used for filling the foundation walls. When the cement was used for covering surfaces, the Romans were accustomed to lay it on thick, sometimes to the depth of four or five inches, and it is evident that such a solid coating would last much longer than a thinner one, and have a great [illegible] the walls themselves.

These home made [illegible] doses of sand than the ordinary Portland cement. For mortar, 1 part cement, 4 of sand, will be found sufficiently strong for general purposes. For concrete, 1, 3 and 5 mix will be about the best. It is advisable to use lime water when mixing and as little as possible.

As Puzzolan cements set very slowly, the forms for concrete work should be left on for at least 14 days. If, after six months, the walls are washed three or four times with equal parts of silicate of soda and potash, dissolved in six parts of water, it will be found that the concrete is much harder than the average Portland. The silicates can be purchased for about a cent a pound. The usual tests of Portland cements can be applied to those Puzzolans, as well as those of Vicat, quoted above.

Slag cement usually exhibits a slight discoloration after boiling, which, however, is harmless.

EARTH AND ROCK SECTION

Construction Methods and Organization in Constructing the Buffalo Water Works Tunnels.

(Concluded from p. 142.)

Land Tunnel and Shafts.

The land tunnel extends from Shaft 1 at the old pumping station to Shaft 3 at the new pumping station. Construction was carried on from three shafts, Shaft 2 being located 2,700 ft. from Shaft 3 and 1,560 ft. from Shaft 1. Single headings were driven south and north, respectively, from Shaft 1 and Shaft 3, and a double heading, one north and one south from Shaft 2. The length of excavation in each heading was as follows:

Shaft 3, north	1,976.5
Shaft 2, south	736.1
Shaft 2, north	858.4
Shaft 1, south	692.5
Total	4,263.5

Except in the heading from Shaft 3 the concreting was largely done after all the excavation had been completed so that it will be described altogether. The excavation will, however, be described for each heading separately.

EXCAVATION.

Shaft 3, Single Heading.—The method of sinking Shaft 3 has been described in connection with the lake tunnel work. Work on the heading was begun in January, 1908. After about 350 ft. had been driven a seam was opened about 1 ft. above the floor and so much water developed that it was decided to put the work under air pressure. A bulkhead and air locks were installed between April 1 and 15. Up to this time the rock was a close grained limestone in horizontal beds interspersed with shale, and the seams ⅛ to ½ in. between limestone and shale were filled with silt which admitted water freely and permitted air to escape. After putting the tunnel under 12 lbs. air pressure the excavation was continued to a point 600 ft. from the shaft where the leakage of air became so great that the pressure fell to 8 lbs. Simultaneously similar troubles developed in the lake tunnel and it was decided to increase the compressor plant and to install the plant for concrete lining. This work occupied from the end of May to Oct. 5, 1908, and during this time the tunnel ahead of the air lock was allowed to fill with water. As indicating the amount of water it may be noted that the heading was flooded in 8 hours, and the water registered 25 lbs. gage pressure. As soon as the increased compressor plant and the concrete plant were ready in October, air was turned on and the water allowed to escape. At 10 lbs. pressure the heading was dried and cleaned up and concrete lining was placed up to the working face. This jumped the pressure up to 18 lbs., and excavation was resumed.

The work proceeded without particular incident until a point was reached about 1,900 ft. from the shaft. Here in 12 or 15 ft. the leakage of air ran the pressure down to 6 lbs. and water came in in quantity. At this time the concrete work was some 500 ft. behind the excavation. Work in the heading was stopped and a bulkhead was put in about 40 ft. back of the face. The air pressure came up to normal and the concrete lining was advanced to the heading. Air was then turned on behind the bulkhead and the water released. The bulkhead was then broken down and by plastering the walls and face with clay the lining was advanced to within 5 ft. of the face. It was found that a seam extended across the face and back along each side wall for several feet. This seam was so large that a full length of 2-in. pipe was pushed into it all but about a foot. A grout pump was connected to the pipe and between 400 and 500 bags of grout were forced into the seam. This grout was mixed in the proportion of 1 bag of cement to 2 cu. ft. of sand. As the air was escaping through the seam it was not necessary to calk the mouth of the seam to prevent the grout from back flowing. This grout completely stopped the seam and the remaining 85 ft. of heading were excavated without trouble.

In driving this heading two full and one split drilling shifts were worked with three mucking shifts and two concrete shifts. The tunnel being rectangular and only 10x12 ft. in section was driven full size with 10 cut holes and 10 side round holes as shown by Fig. 1. The rock, while not remarkably hard, was in alternate soft and hard horizontal layers which caused some drilling troubles and unless drilled carefully broke out with a very jagged face. When, however, the men had learned the rock they averaged 6 ft. per shot using 8 ft. steel. One week two shifts made 84 ft. in 12 shots, but 10 ft. steel was used in several shots. It was the general practice to take in 10-ft. steel and use it if there was time for a 10-ft. round, otherwise to use 8 ft. steel. Trouble was had in loading the bottom holes as the air pressure was not strong enough to keep the water back and it forced out the powder and tamping. To remedy this the load was stopped 6 to 8 ins. from the mouth of the hole and a wooden plug grooved on one side for the firing wires was driven in to hold the charge. As a general thing the rock broke into a mixture of large and small stuff excellent for rapid mucking. The width of the tunnel, however, cramped the work and only about 5 men could shovel, while the height of the face made the muck run quite high per lineal foot of tunnel.

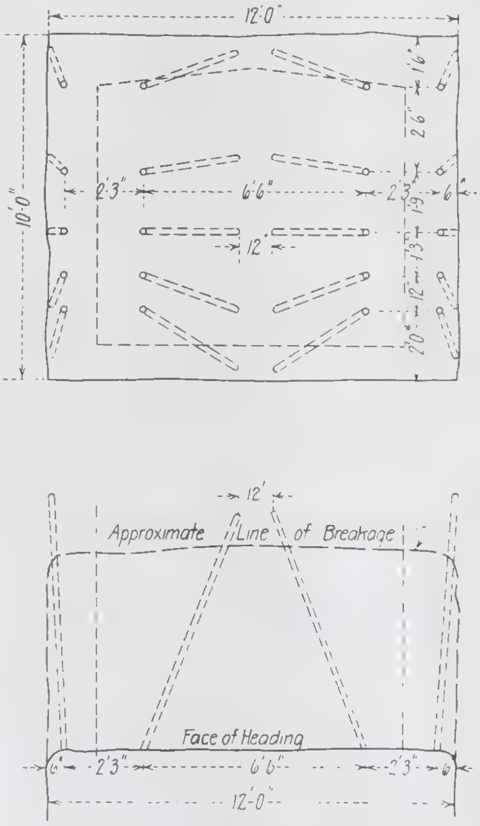

Fig. 1—Arrangement of Drill Holes in Driving 10x12 Foot Land Tunnel for the Buffalo Water Supply.

To handle the muck a single 24-in. track ran from near the lock to the heading where it ended in a short switch which was moved ahead every winding. The grade was descending toward the shaft and to handle the cars a double drum hoisting engine was installed about 800 ft. from the lock. The cable from one drum ran direct to the lock while from the second drum the cable ran toward the heading through small snatch blocks hung from the roof to a snatch block near where they were concreting. This block was moved ahead every day. Two cars of concrete would be pulled out of the lock with the first cable, then two more, and the four cars hauled to the engine where the second cable was hooked on and the haul continued to the concrete forms. Here the concrete would be dumped and the empty cars pushed by hand to the heading. When the cars had been loaded with muck they were sent down grade to the lock, hauling the slack cable with them.

In two or three places between a point 600 ft. from Shaft 3 and the end of this heading, the rock in the roof required timbering for stretches of 40 to 50 ft. At these points hitches were cut in the side walls close to the roof and caps of 10 to 12-in. round oak piling were set across tunnel. As these caps were placed wedges were inserted between them and the roof until several caps were in place when these wedges were replaced by 4x12-in. plank 16 ft. long spaced about 12 to 18 ins. apart. These planks were wedged up against the roof rock and when they came more than a foot above the lining they were embedded in the concrete; when lower than this they were pulled as the concreting approached them.

Shaft 2; Double Heading.—Shaft 2 was 9x11 ft. in section and a large amount of water requiring two 4-in. pumps to handle it, was encountered in sinking it. When the shaft was bottomed the two headings, one north toward Shaft 1 and one south toward Shaft 3, were driven for about 100 ft. each to develop the rock. The rock proved to be a hard limestone in horizontal layers from 6 ins. to 2 ft. thick. This rock drilled well but the formation was blocky unless the holes were drilled exactly level which was practically impossible. As the seams did not carry much water it was decided to start the work without compressed air. In sinking the shaft and driving the trial headings hoisting was done with a stiff-leg derrick. The muck in the headings was loaded into buckets on flat cars, pushed to the shaft and the buckets hoisted and dumped into side dump cars which ran to the spoil bank. The shaft was bottomed in July and in August a cage was installed in the shaft and work started full force. Then there began about as large and variegated an assortment of troubles as ever happened on a tunnel job.

Ventilation.—At first ventilation in the land tunnel gave trouble. The powder smoke hung in the tunnel for hours after a blast and it was no uncommon sight to see half a dozen men knocked out by smoke and gas, although the best obtainable powder was used. To remedy this trouble a well drilling machine was brought onto the work and 8-in. holes were drilled and carried from the surface to the tunnel at intervals of about 400 ft. all along the land tunnel. Two of these holes were between shafts 1 and 2 and four between shafts 2 and 3. As the heading cut each hole a 5-in. Buffalo Forge Co. fan operated by a 5x7-in. upright engine was connected; this fan was piped so that it could be used either to exhaust air from the tunnel or to force air into the tunnel. Operating by suction alone the fan would just about handle the air provided by the blow-off from the compressed air main and the exhaust from the drills, particularly after the heading had advanced any distance beyond the air hole. The result was that the tunnel between the air hole and the working face was cleared, but that portion back of the air hole to the shaft was not affected. The remedy was found in operating the fan first for about 15 mins. to exhaust the smoke between air hole and working face, then to reverse it and force air into the tunnel; this influx from the face combined with the blow-off and the air escaping from the drills forced the smoke back to and out of the shaft.

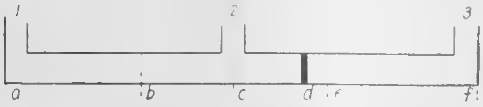

Fig. 2—Diagram Illustrating Sequence of Concrete Work.

Sulphur Gas.—When the ventilating troubles had been overcome, pockets of gas began to be met. This gas seemed to come only from certain seams and in these only for short distances. It was a sulphur gas and often could be detected only by its effect on the eyes, the edges and insides of the lids becoming inflamed and finally sore and very painful. At times one would be completely blinded for two or three days. At times so many men were laid up that it was hard to keep the gangs filled even with a double force. This gas trouble was worse in the north heading. The water coming out of the gas seams was as black as ink at times and at other times carried a white sediment which when collected and dried turned yellow and proved to be almost pure sulphur. This water attacked the piping and pumps causing numerous breaks and leaks. The ventilating fans helped to keep this gas down but failed to do away with it entirely.

Water Troubles.—Meanwhile the flow of water increased and with a break down of the pumps the tunnel was flooded. The pumps were repaired and additional pumps installed until the water could be handled.

Drill Troubles.—The tunnel was driven full size 10x12 ft. as heading. As stated the rock lay in horizontal strata from 6 ins. to 2 ft. thick. Between the strata were thin seams of flint and the strata themselves varied in hardness. It was found that if the holes were driven level those strata in which the holes were would be blown out neatly leaving shelves of rock 12 to 18 ins. thick between. To remedy this the holes were inclined, the bottom holes looking down and the top holes looking up so as to cross several strata. This introduced a new trouble, the drills jamming, due to slight deflection of the holes in passing at a flat angle from soft to hard strata. The only remedy found for this trouble was the old one of using "iron" or "shot" in the holes. After various tests it was found that next to cast iron the best material for "shot" was cold pressed hexagon nuts and blank ¾-in. nuts were bought in kegs and in some ground a keg would be used in a fortnight.

Blasting Troubles.—Missed holes were of frequent occurrence at first. The current for firing was 220-volt a. c., tapped from the wires of the local street lamps. The exploders were the ordinary double strength exploders. The water in the bottom holes, however, chilled the powder (60 per cent dynamite) so that these exploders would shatter inside the stick without firing it. To remedy this a special quadruple double strength exploder was secured.

Working Methods.—In driving the headings 4 drills were used, mounted on two 8-ft. columns; 1⅜ octagon steel was used in 4, 6, 8 and 10-ft. lengths and with bits beginning at 2⅜ ins. for 4-ft., and decreasing 3/16 in. for each succeeding length. This made the bit of the 10-ft. steel 1⅝ in., which permitted the use of 1¼-in. powder. The arrangement of holes was substantially as shown by Fig. 1. At first the cut and side round were fired in two shots, but it was found that the heading would square up better if the four topmost cut and side holes were fired as a third shot, and this method was followed except when the top holes came in soft rock, then the two-shot method did well enough.

At the beginning two 10-hour shifts of drillers and muckers were worked, the drill gang in one heading and the mucking gang in the other heading for each shift drilling and mucking alternating in each heading. This was an economical method, but the progress was slow and later two shifts of both drillers and muckers were worked in each heading, the plan followed being to drill and fire a round each shift.

The muck was removed from the heading in 1 cu. yd. cars hauled by mules, both in tunnel and on top to the dump. A single track was used in the tunnel. This track had a short diamond turnout at the cage and within about 30 ft. of the face it branched into two tracks leading to the muck pile. The hauling was done in two-car trains.

The organization at shaft 2 was about as follows. There was a day walking boss in direct charge who also looked after shaft 1. Under him came a night walking boss who had general charge at night. In each heading there was a heading foreman who had 4 drill runners, 4 helpers and 1 nipper who was also a helper and rated as such. This gang had nothing to do with the mucking except to throw back enough muck to permit of sitting up the drills. There was a muck foreman and 7 to 9 muckers in each shift. After drilling the drill gang threw their drills, columns, etc., back onto the muck pile and the muckers carried them back while the drillers blew out and loaded the holes. The muckers also brought the machines back and threw them on the muck pile at the beginning of the shift. Hose, wrenches and valves were looked after by the drillers themselves. At first a powder man was hired to make up the charges, but it was found more satisfactory to hire a better class of men for nippers and put them in charge. In addition to the drilling and mucking gangs there was for each shift a pumpman, a pipe fitter and a cage man in the tunnel and on top a mule driver, two top men, a hoisting engineer and a blacksmith and helper.

Owing to the difficulties mentioned the progress was nothing remarkable. At times it ran up to 76 ft. per week per heading, with an average of 60 ft. per week working two shifts; working one shift the progress ran up to 43 ft. per week with an average of 34 ft.

In working from shaft 2 the heading north met the heading south from shaft 1 on Dec. 31, 1907. The south heading from shaft 2 was carried 736 ft. and discontinued. The reason for this was that at about this point water was encountered in large amounts and also that it seemed better to concentrate all plant at shaft 3 and work from there. The south heading from shaft 2 was trimmed up and a 5-ft. bulkhead was built about 500 ft. from the shaft and the heading was allowed to flood.

Shaft 1, Single Heading.—Shaft 1 was located at the old pumping station and in order to clear the buildings the tunnel from it was swung around on a curve to connect with the direct line to shaft 2; the direct line of main tunnel would have passed under the pumping station. Considerable water was met in this heading and the sulphur gases were worse than in the headings from shaft 2. Otherwise the work and working methods were about the same. The heading was holed through on Dec. 31, 1907. To hole through the last 10 ft., a hole was first driven clear through the separating rock and then 4-ft. rounds were drilled from each side. These were charged and fired simultaneously on both sides by passing the wires through the 10-ft. hole. Two shots were made, first the cut holes and second the side round holes, and the rock broke almost to true lines for the full section.

Excavation Progress.—In driving the land tunnel it was difficult to make fast progress as the conditions were continually changing requiring new organizations to meet them. The actual monthly progress of each heading was as given in Table I. It will be noted that in the north heading from shaft 3 there was practically straight-forward work from Oct. 18, 1908, to Feb. 14, 1909. During this period of 104 working days of which 8 days were lost, leaving 96 days worked, the progress was 1,169.2 ft., or 11.1 ft. per day, firing two shots. The maximum progress in one week during this period was 86.1 ft., or 14.3 ft. per day.

CONCRETE LINING.

As indicated in the preceding account of the excavation work the concrete lining for the heading north from shaft 3 was carried on simultaneously with the excavation although it did not always keep pace with it. It will also be recalled that after the heading south from shaft 2 had advanced some 736 ft., that it was stopped and a bulkhead put in about 236 ft. back from the face; also that all the tunnel excavated from shafts 1 and 2 had been allowed to flood while finishing the driving north from shaft 3. The conditions are indicated diagrammatically by Fig. 2. To summarize, while driving the heading north from shaft 3 the three headings from shafts 1 and 2 had opened the tunnel from *a* to *e*, a bulkhead had been built at *d*, and all the tunnel from *a* to *e* had been allowed to fill with water. The north heading from shaft 3 was holed through at *e* and the concrete lining was carried up to bulkhead *d*.

After completing the lining from shaft 3 north to bulkhead *d*, it was tested for leaks by dropping the air pressure to 12 lbs. Several leaks were disclosed and were repaired by cutting out the porous spot and filling it again with a grout pipe inserted. When the filling had set, grout was pumped in behind the lining until the leak was closed.

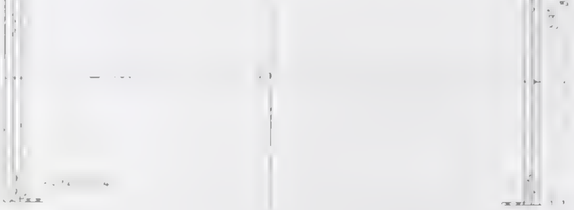

Fig. 3—Rib of Jackson Form for Concrete Lining of Land Tunnel.

The next question to decide was whether it were possible to line the tunnel from *d* to *a* without pressure and handle the water by pumping or to bulkhead Shafts 1 and 2 and put on pressure throughout. To test the matter out the pressure from *d* to Shaft 3 was dropped and at 7 lbs. sections of the floor near the lock at Shaft 3 blew up from hydrostatic pressure. It should be noted that where the blow-up took place the concrete floor had been placed before reinforcement had been decided upon. The floor came up in blocks 3 to 4 ft. square and 12 ins. thick and the concrete was of excellent quality. This test demonstrated the necessity of completing the lining under pressure. The broken flow was repaired and steps taken to bulkhead Shafts 1 and 2.

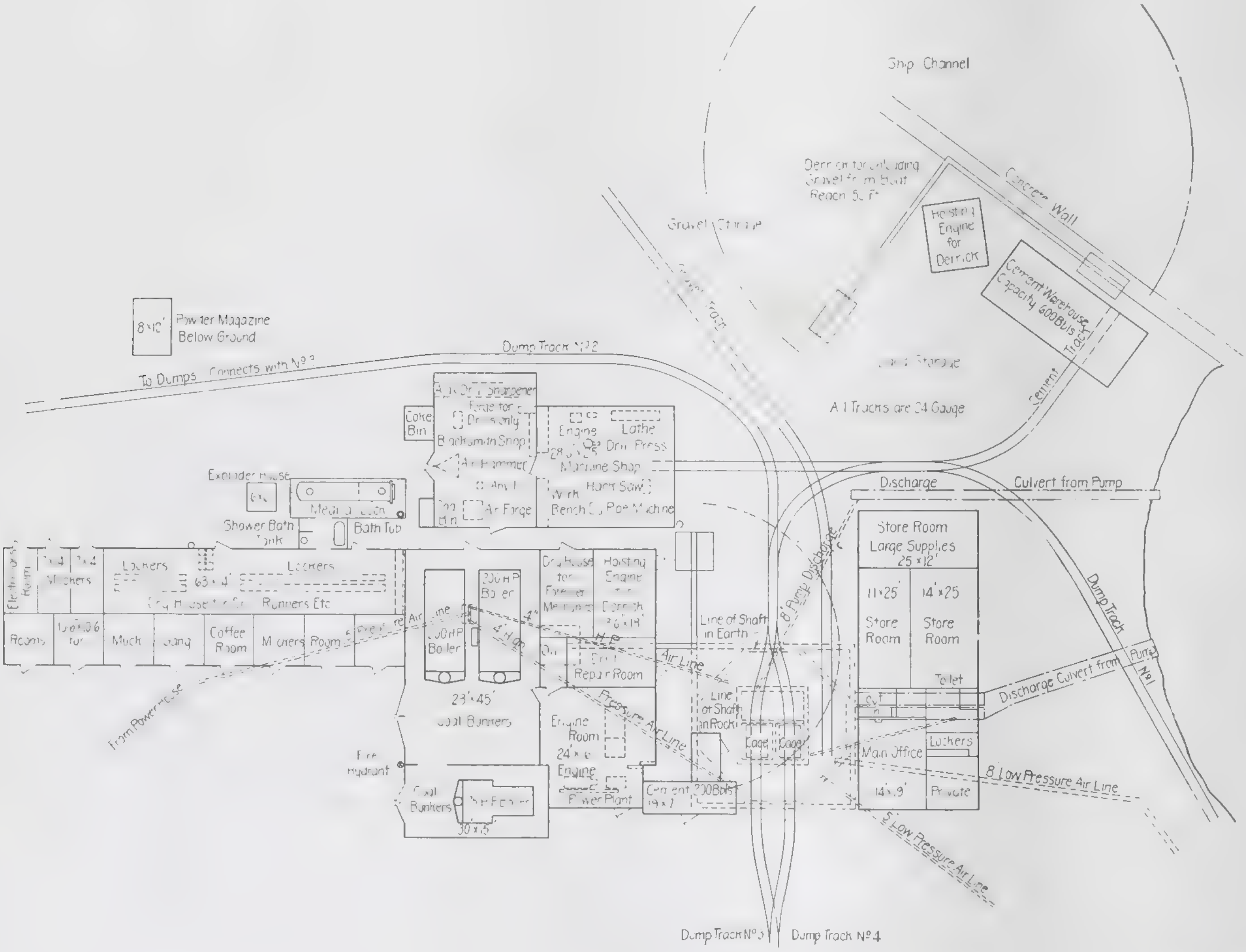

Fig. 4—Detail Plan of Plant at Shaft 3, Buffalo Water Supply Tunnels.

In placing the bulkheads in Shafts 1 and 2 it was intended to concrete a section of lining from both, but the approach of winter and the stopping of gravel boats combined with small gravel storage space at Shaft 1, led to concentrating the work at Shaft 2, where there was storage room for accumulating all the gravel needed. Each shaft was bulkheaded a short distance below rock level with reinforced concrete 3 ft. thick through which were two 3x8 ft. locks, one for men and the other for materials and also pipes for pump connections. Pumping lowered the water in the shafts so that the bulkheads could be built.

The air pressure in the section under air was lowered and two 6-in. pipes, which ran through the bulkhead between the two sections of tunnel, were connected with two 6-in. Blake pumps. These drew the water level down low enough and the locks were placed and concreted in. When the concrete in the shaft bulkheads had set enough the shaft locks were closed and the pumps disconnected in the tunnel. The 6-in. pipes mentioned were left open and several 4 in. holes were drilled through the bulkhead. In 24 hours after closing the shaft locks the water in the entire 2,200 ft. of tunnel had disappeared and the bulkhead was blown out. Some of the water had run down to Shaft 3 and had been pumped out, but the greater part of it had been forced out through the rock by the air pressure. In other words, it went out the way it came in.

As soon as the bulkhead was removed the track was laid from Shaft 2 to a connection with the track from Shaft 3, which ended near the bulkhead. This track was blocked up with the bottoms of the ties at the grade of the concrete floor. A Hains concrete mixed was placed in Shaft 2 directly under the material lock and a wooden chute led from the bottom hopper of the mixer down to a point about 4 ft. above the track level. Outside a pile of gravel had been stored near the shaft; a 24-in. gage track led from it to the shaft. A hopper was built under the track and a chute led from the hopper down to the material lock. Concreting was then started, the bottom being concreted first, starting at Shaft 2 and working toward Shaft 3. This entire stretch of bottom 535 ft. was laid in about five days of three 8-hour shifts each. The force working included 3 men on top, 2 men inside on the mixer and 5 men on the concrete inside. Two men loaded the gravel into a 1 cu. yd. bottom dump car, filling the car up to a mark, which gave a 21 cu. ft. batch. The car was pushed to the shaft, the cement thrown on top of the gravel and the whole dumped into the hopper under the track and running from there into the material lock, through the chute. This chute was hinged for its lower 6 ft. The lock tender swung the hinged section aside, pulled the lock door shut and signaled the inside man by means of an electric bell. The inside lock tender let the air into the lock and as soon as the pressure equalized the lower door dropped open and the concrete dropped into the top hopper of the mixer. The lock tender closed the lock door and sent the lock back out. Then he dropped the concrete through to the second hopper in the mixer. The second man on the mixer then sent it through the remaining hoppers, dropping it down the chute into the car, when the men below signaled him. Three men pushed the car to where the concrete was to be used and the remainder of the gang spread it, placed the reinforcing rods, etc.

After the bottom had been completed the forms were set up and work started on the sides and arch. The concrete was not carried quite to Shaft 2, owing to some of the roof near the shaft being low, but 518 ft. of it was concreted in two weeks and five days. The total section should be 51 cu. ft. of concrete per linear foot of tunnel, but was found to run almost exactly 3 yds. or 80 cu. ft.

Between Shafts 1 and 2 considerable grading had to be done, as the loose muck in some places ran from 6 ins. to 1 ft. high. A track was first laid all the way through and all the high places were graded down, using the muck to grade up the low places and also to fill in two old pump chambers at Shafts 1 and 2. The bottom for the entire distance, 1,550 ft., was then laid, starting at Shaft 1 and working back towards 2. A siding just north of Shaft 2 had been put in and a trolley wire strung from the air lock near Shaft 3 to Shaft 2 and then on from Shaft 2 to Shaft 1. In concreting the bottom two or three cars would be filled and pushed to the siding. One of the 5-ton electric locomotives was used to push these cars up to the place where they were dumped. Upon returning there would be three more cars ready. When the bottom was completed forms were set up in Shaft 1 and this shaft, which was at the Front Ave. Pumping Station, was lined with concrete up to the bottom of the bulkhead in the shaft. Forms for the tunnel lining were then set up, beginning at Shaft 1 and the sides and arch were concreted toward Shaft 2. The trolley wires were rolled back a short distance from the forms and the two coils of wire hung at opposite sides of the tunnel. The car used in this end was one with a reel on it, allowing the car to run for 500 ft. beyond the end of the trolley wires. However, the usual way was to take down only enough trolley wire for one week's concreting, averaging about 200 to 250 ft. The progress on the concreting of the sides and arch was unusually rapid, running as high as 304 ft. in one week. Sundays were utilized to clean up the section concreted and pull up tracks, etc., leaving nothing but completed tunnel behind. The average progress per week of tunnel concreted, including bottoms, sides and arch, was about 172 ft. for the 1,550 ft. The gang on each 8-hour shift included 3 men on top, 2 mixer men inside, 1 motor man on the car and 1 foreman and 6 men placing concrete with 3 extra men on the day shift, stripping and re-setting forms. The highest week's work was 273 ft. and the lowest was 57 ft., the latter being at Shaft 1 and the curve immediately adjoining it.

For concreting the walls and roofs Jackson forms were used. Figure 3 shows the rib for these forms. The lagging was steel channels.

CONSTRUCTION PLANT.

The construction plant under this heading includes general plant alone; local plant has been described in connection with the particular work for which it was used.

Power Plant.—The main power plant was located nearest, but some little distance from Shaft 3. It contained five compressors, as follows:

	Cu. ft.
(1) Ingersoll Straight Line	1,440
(2) Ingersoll-Rand Cross-Compound	1,320
(3) Ingersoll-Rand Cross-Compound	1,320
(4) Rand Corliss Compound	3,900
(5) Ingersoll-Rand Duplex Single Stage	2,500
Total capacity cu. ft. per min.	10,480

Compressor No. 1 was used for operating drills in sinking Shafts 1 and 2, then for low pressure air supply in the headings, then was moved out to the intake shaft for drill operation and finally was reinstalled at the power house to help out on the low pressure air in lining the land tunnel. Compressors 2 and 3 supplied high pressure air, 125 to 130 lbs. at the receivers, to operate the drills. Compressors 4 and 5 were used for low pressure work only. Steam for the compressors was supplied by the folowing boiler plant:

	Hp.
3 75-hp. Erie return tubular	225
3 100 hp. return tubular	300
2 250 hp. Heine safety water tube	500
Total boiler horsepower	1,025

These boilers operated an electric lighting plant besides the compressors. Air was piped to Shaft 3 by an 8-in. and a 5-in. low pressure main and a 5-in. high pressure main. When working there, the 5-in. main was continued to Shaft 2, and from there a 4-in. main to Shaft 1. There was a complete equipment of feed water pumps, condenser pumps, etc.

Machine Shop Plant.—The general machine shop plant was located at Shaft 3 (Fig. 4). A boiler plant of two 200-h.p. Scotch and one 75-h.p. Lee boilers furnished steam for the machine shop and electric haulage railway and also for the shaft hoists and pumps. The main elements of the shop plant were a drill repair shop, a general machine shop, and a blacksmith shop. The machine and blacksmith shop equipment included lathe, drill press, power hack saw, pipe threading and cutting machine, many wheels, compressed air forge, heating furnace for drill steel, drill sharpener, tempering vats, etc. The large task of the shop plant was drill repairs and drill sharpening. No repairs to drills were made in the tunnel, except the putting in of new chuck bolts. If anything further was required the heading boss loaded the drill onto a muck car and when it reached the surface the top men turned it into the drill shop. Two or three spare drills were kept in the tunnel for substitution. Setting in a new drill took only a few minutes and a repair could be made in the shop with good light and proper tools in one-fourth the time required in the tunnel. Moreover the repair was made by a skilled man, thus reducing error and possible damage. One man repaired all drills working one to two days a week. Drills were tested after repairing. A tripod on a concrete foundation and having an oak block for the chuck to strike was used. After being repaired every drill was mounted in this tripod, turned down straight and then run for a few minutes, with the chuck striking the oak block, to determine if it ran properly, rotated, etc.

The amount of sharpening was large for the rock drilled was very hard. Until Oct. 1, 1909, all sharpening was done by hand and fortunately competent blacksmiths were had. In September, 1909, 3 blacksmiths and 3 helpers were worked in three 8-hour shifts and handled the steel for two drill shifts each, of which took from 120 to 150 pieces of steel. On Oct. 1 an Ajax Junior drill sharpener taking steel up to 9 ft. was installed and after getting some steel ahead 1 blacksmith and 1 helper kept the steel sharpened for three shifts of drillers. Ingersoll E 24 (3¼-in.) drills were used throughout the work.

GENERAL COMMENT.

In general comment on the work described we give the following in the words of Mr. C. H. Hollingsworth, Superintendent for the contractors, who has furnished us the data from which this article has been prepared:

TABLE I. SHOWING PROGRESS OF EXCAVATION BY MONTHS IN EACH HEADING OF LAND TUNNEL.

From Shaft 3, North.	Lin. ft.
February, 1908	111.6
March, 1908	202.9
April, 1908	144.5
May, 1908	140.3
October, 1908	228.6
November, 1908	260.9
December, 1908	309.8
January, 1909	308.7
February, 1909	180.8
May 28, 1909	88.6
	1,976.5
From Shaft 2, South.	**Lin. ft.**
July, 1907	43.2
August, 1907	120.2
September, 1907	142.9
October, 1907	204.8
November, 1907	88.9
December, 1907	136.1
	736.1
From Shaft 2, North.	**Lin. ft.**
July, 1907	92.1
August, 1907	76.9
September, 1907	138.5
October, 1907	203.6
November, 1907	88.9
December 31, 1907	258.5
	858.5
From Shaft 1, South.	**Lin. ft.**
September, 1907	158.
October, 1907	128.2
November, 1907	189.6
December 31, 1907	216.7
	692.5

Accidents and Air Troubles.—The only fatal accident on the work in the 3½ years of its duration was in November, 1907, when one of the men was caught by the cage while working Shaft 2 and killed. No one was injured by a powder explosion on the work, and the only serious accident aside from the one fatality was the catching of a man under one of the electric locomotives. His leg was crushed but did not have to be amputated. A stock of medical supplies was kept in the office at all times and the timekeepers on the various shifts were quite expert in first aid work and frequently bandaged serious hurts, so that no further attention was needed. However, in all serious cases the ambulance was called and the men sent to the hospital. The chief trouble was from bends or caisson disease. This was usually confined to new men, however, and I should judge that from 75 to 90 per cent of the new men had it in a greater or less degree either their first or second shift on the work in spite of the fact that any new men on a shift were brought out of the air by their foreman or the lock tender after the other men were all out so they could take plenty of time. The time of decompression lasting from 12 to 15 minutes in 25 lbs. of air. On the other hand after they had gotten over their first attack it seemed next to impossible for them to get the bends again, no matter how quickly they came out, with a few exceptions. As for the exceptions noted, it seemed impossible for them to come out at any speed whatever. Some of them after coming out from work would be attacked with the bends while in the dry house and would immediately be placed in the hospital lock and the pressure run up about ½ lb. higher than the pressure under which they had been working and the outlet valve set from the outside so that the decompression would take at the rate of about 5 minutes per pound or about 2 hours for 25 lbs., but on coming out they would often be attacked again. The next time the time would be increased to 2½ hours and even then it would often prove useless and we have had men that failed to get rid of it after going in the lock three or four times with hot baths and hot coffee between times. They would then be sent to the hospital and with these stubborn cases the men were not allowed to go back to work. The other workmen in spite of orders would go in and out of 25 lbs. of air from 1 to 2 minutes and feel no effects. One thing noted was that either in summer or winter a damp spell would bring on several cases of the bends. Also men that were subject to attacks of rheumatism would have a touch of the bends immediately after such an attack.

A peculiar thing was that while the atmosphere away from the locks was quite cold and that near the locks was intensely hot, the lock tenders had as much or as little of the bends as the others. The air from compressors was discharged near the locks and there was sufficeint leakage at the heading to cause considerable current and to make the air quite cool. Otherwise, the supply pipes would have been carried close to the heading.

Bonus System.—Early in 1909 a bonus system was inaugurated for the drill runners, helpers and heading foremen. The average week's work was set at 55 ft., which would be good progress under such unfavorable conditions as were encountered. The two drilling shifts had each to break 27.5 ft. of ground and for everything over that the foreman received 50 cts. per ft., the drill runners 30 cts. per ft. and the helpers 20 cts. per ft. I made the linear foot of tunnel a working basis, as what we wanted was linear feet of tunnel and nothing else. I have heard of the linear foot of holes being the natural basis on which to base a bonus system for rock drilling and have seen that scheme tried, but I must confess that I never could see the sense in paying a drill runner bonus on a lot of holes that you do not need and do not want. Given a bonus per foot of holes drilled and a drill runner will fill a heading so full of holes that it will look like a cribbage board and he will pick the soft spots, and he or the heading boss do not give a hoot whether they break 30 or 60 ft. per week and the chances are they will run the former figure very close. On the other hand tell the heading foreman that he and his men will get bonus on everything over a certain progress per week and leave it to the walking boss to make him keep to line and grade and the results will be surprising. As it is up to the foreman whether he puts in 10 or 20 holes he will naturally put in as few as possible and that will save powder; also he will put the holes where they should be to get results and that means progress and money saved. Also the foremen picked their men and played no favorites. When the three shifts drilling system was started the burden was shifted to the "muckers" and the bonus was adjusted again to meet the new conditions. First of all the week's work was left at 55 ft., as under the new scheme the drilling gangs had to "muck" out their headings, set up and drill and get out in 8 hours, whereas before that had only to set up drill and get out.

In the new bonus scheme all men not previously given a bonus were taken in, including "muck" foreman at 30 cts. per ft., "muckers" at 10 cts. per ft., motor men, switchmen, lock tenders, cage men, top men, etc.. A bonus was also given the concrete men on all progress over 66 ft. per week, and the pipe fitters, electricians, etc., also came in. The motor men on the cars were given bonus on the heading progress and also on the concrete as if they were on the concrete side above the "muckers" would run shy of cars and vice versa. Also the drill gangs developed a tendency to take it easy in firing and so run over on the next gang's time, so I arranged a penalty of 1 ft. an hour, 6 ins. for a half hour, 3 ins. for 15 minutes, etc., to be taken from the gang causing the delay and given to the gang delayed. This quickened things up wonderfully and the delays would not average a half hour per month. Also if the "muck" was not out of the heading the "muck" gang was held until the last minute and this developed team work and that, I may say, is the key to the whole matter.

I have read and heard a vast amount about developing individual effort and segregating men, etc., but individual effort by the wholesale is not worth a hang alongside of team work. For illustrations see the professional baseball teams and college foot ball teams. There may be work where a whole lot of men each working his own gait will get good results, but I have never run across any personally on contracting work. For instance, I have seen 14 muckers take down 36 ft. of scaffold, 48 ft. of 18-in. gage tracks, and carry it back 150 to 200 ft., carry 6 drills, 4 arms, 2 columns, 2 foot blocks, 2 tripods, the same distance and down over the bench, load 120 pieces of steel on a car, carry back air and water lines, pick up all blocking, throw their picks and shovels in a car and get back 500 or 600 ft. from the heading inside of 20 minutes. Also I have seen men from the drilling gang turn in and help the muckers fill cars after they had finished their holes and were waiting for the other drillers. That is what I mean by team work. Of course, it requires time and patience to develop team work, but the results are worth while. Also while encouraging gangs to do their best and come out ahead, it is extremely poor policy to lay much stress on the rivalry business. Each shift has to do its best and take no thought of the other shift. I remember very well one job on which I was engaged where the higher powers did everything to encourage rivalry, including playing off different nationalities against each other and various other forms of stirring things up. The result was that things were most beautifully stirred up and it took a great part of my time handling foremen and walking bosses and trying to get it into their heads that it was only a playful spirit of rivalry that prompted some man on the other shift to leave the main track sticking into the tunnel roof timbers, instead of in its proper place in order that aforesaid other shift might be credited with a certain amount of progress at a certain place, regardless of how heavy they shot or that it was really cute of the other shift to stick in any old kind of a set of timbering in a soft ground heading, leaving my shift to take it down and re-timber it. Also it was a large tax on my time to carefully kick the idea out of my foremen and others that they should put one over on the other shift in the same manner or that because they were "left bad" they could sit down and wail about it. When in the allotted two weeks I had the other shifts turned over to me it was just the same. They were impressed with the idea that they would get a good mark by working some trick on the other shift such as slighting their work and leaving a poorly timbered face in order to get in extra progress on their shift. And I must say the idea was encouraged largely by those in authority, hence all manner of trouble and mixups. With that in mind I have fired more men from this present work for trying such tricks and for continually whining about how things were left for them than for any other reasons. The result was that they knew they would get a square deal and were not afraid to make a legitimate kick and at the same time did not come with all kinds of troubles. They knew also that they were expected to turn out a day's work in spite of any trouble and no hard-luck story passed current for work done. Also they got along well with each other and left things in order for the next shift, perhaps not because they wanted to but they left them that way just the same. The foremen on the work at one time were as follows: 6 heading foremen, composed as follows: 3 Negros, 1 Canadian, 2 Americans; 6 muck foremen, as follows: 3 Englishmen, 1 Pole, 1 Negro; 6 concrete foremen, as follows: 1 Negro, 1 Swede, 1 German, 2 Englishmen and 1 Pole, and 1 track foreman, who was a Pole; and these men had no difficulty in getting along with each other and getting the work done also.

In speaking of progress on this work in all cases is meant the progress of heading and bench or for the completed tunnel and in the lake tunnel the progress usually means that the amount of tunnel mentioned was driven complete and lined with concrete as the concrete kept pace with the heading in most cases.

Another matter that contributed to the progress of the work was the fact that while the heading and other foremen were given absolute control over their several gangs the walking bosses and superintendent kept a sharp lookout on the work and the way it was going and pointed out to the foremen any trouble with the gangs that had escaped his notice. For instance, at first in the headings the foremen placed the runners on the top or bottom machines, regardless of whether they were big or small men. When new men came they claimed that they were best on a top or bottom machine according to their idea of which was the easiest job. However, we soon got the heading foreman so that they picked the tallest men for the top machines and the short men for the bottom and the same with helpers. It is very easy to do this except, of course, where all the men in a gang are all about the same size, which very seldom happens. Even then, however, some of the men have a longer reach than others, which makes them better for the top machines. The object in this as in other matters was to systematize the work so as to take up all loose motion and lost time and at the same time make it easier for the men.

The work was designed by and executed under the supervision of the Department of Public Works of the City of Buffalo. Mr. Francis G. Ward is Commissioner of Public Works and Mr. S. J. Fields was Engineer in charge of the work. The Buffalo Dredging Co. had the contract for all the work on the shafts, tunnel and intake crib. Of this company, Mr. S. J. Darhn is Vice-President and General Manager and Mr. John Record, Chief Engineer. The men directly in charge of the work for the contractors were C. H. Hollingsworth, who was Superintendent from the beginning. Under him were C. Lund, Master Mechanic; T. O'Connor, J. Brown, W. B. Converse, R. G. Stowell and R. Mosier, walking bosses, and to these credit is due for the successful handling of the work and the working out of details of the plant.

Methods of Handling by Scows Some Four and One-half Million Cubic Yards of Soil from Excavation.

In excavating for the tunnels and terminal station for the new Pennsylvania R. R. entrance to New York City a total of 4,457,800 cu. yds. of spoil was loaded onto scows, transported to various points, and unloaded or dumped. The contract for this disposal was held by Henry Sluss, M. E., of New York City. Sluss was delivered to the scows at four points, but some 3,203,400 cu. yds. were delivered at a special disposal pier at 72d st. and the North River in Manhattan. The general plans of this disposal pier are given in the accompanying sketch. This sketch and the following description of the methods of disposal are abstracted from a description* of the work by Mr. George C. Clark of the engineer staff of the Pennsylvania terminal work.

The total number of cubic yards of material disposed of amounted to:

	Place measurement, Earth	Rock	Total barge measure[illegible]
[illegible] Street and North River	242,800	[illegible]	[illegible]
Pier No. 72, North River	673,800	1,488,000	3,203,400
From cross-town tunnels			570,400
From under-river tunnels			402,500
Total			4,457,800

The material was delivered as follows:

To the freight terminal of the Pennsylvania Railroad Company at Greenville, N. Y.	3,454,800
To the Meadows Division of the Tunnel Line between Harrison, N. J., and the North River Portals	711,900
To other points selected by the contractors	291,100
Total	4,457,800

The handling of this large quantity of material required the loading of from 10 to 20 scows per day (and for more than two years the average was 14), and, as the average time spent in one round trip was 3⅓ days, a fleet of more than 50 scows was required to keep all points supplied and allow for a few to be out of service and undergoing repairs.

All loaded scows were towed from the docks, with the ebb tide, to a stake boat anchored in the bay about one mile off shore at Greenville; and were taken from there to the different unloading points, as required, by smaller tugs which also returned the empty scows to the stake.

The unloading plants were similar at the different points, although that at Greenville was much larger than the others. It included 5 land dredges and 8 traveling derricks of two types, one floating and the other mounted on wheels and traveling on a track of 16-ft. gage. The derricks handled the large rock, which was loaded at Pier No. 72 by derricks and telphers. They were of the ordinary A-frame type, and were designed to handle 20 tons. They were operated by 9x10-in. Lidgerwood double drum and swinging-gear engines. The large rock was deposited by the derricks either in the channels along which they worked or in the fill along shore, without the use of cars. The land dredges were equipped with a 60-ft. boom and a 2½-yd. Hayward bucket operated by a 14x18-in. double drum Lidgerwood dredging engine. They loaded into 9-yd., standard-gage, side-dump cars, built by the contractor, and unloaded the scows to within about 1 ft. of the deck, a Hayward bucket being unsuitable for closer work without greatly damaging the scows. The material remaining was loaded by hand into skips which were handled to the cars by small derricks, one of which was located at the rear of each dredge. The cars were taken to the dump and returned by 25-ton, standard gage, engines which had previously done service on the Manhattan Elevated Railroad, but were spotted for loading by the engine on the dredge.

In order to keep a record of the fleet of scows, which would show the available supply at a glance, a board 10x15 ins., and covered with a heavy sheet of ruled paper, was arranged as shown by Fig. 2. It was divided into 12 vertical columns, the first of which was headed "Scows" and contained the name or number of each scow in service. The next four columns denoted loading points, and were headed "Pier No. 72," "Thirty-third Street, East River," "Thirty-fifth Street, East River," and "Long Island City," respectively; the sixth column was headed "Greenville," the seventh "Hackensack," the eighth "Passaic," and the ninth "Governors Island," being unloading points, the tenth and eleventh, "Stake Boat" and "Dry Dock," respectively, while the twelfth was for "Extra pins," not in use. To indicate the condition of the scows, small pins with colored heads were used; white indicated empty; blue, working; black, loaded; red, being repaired; and a pearl-colored pin, missing. Thus a white-headed pin opposite the number 6 in the column headed Pier 72 indicated that scow No. 6 was lying at that pier waiting to be placed in position for the loading, whereas a black-headed pin at the same point meant that the scow had received its load and was ready to be towed.

The scows were all taken from the general service about the harbor; some of them were practically new, while others had seen much service. They were of two general types, truss-framed or bulkhead-framed; all were flat-bottomed, with a rake of about 45° at bow and stern. The truss-framed scows were built

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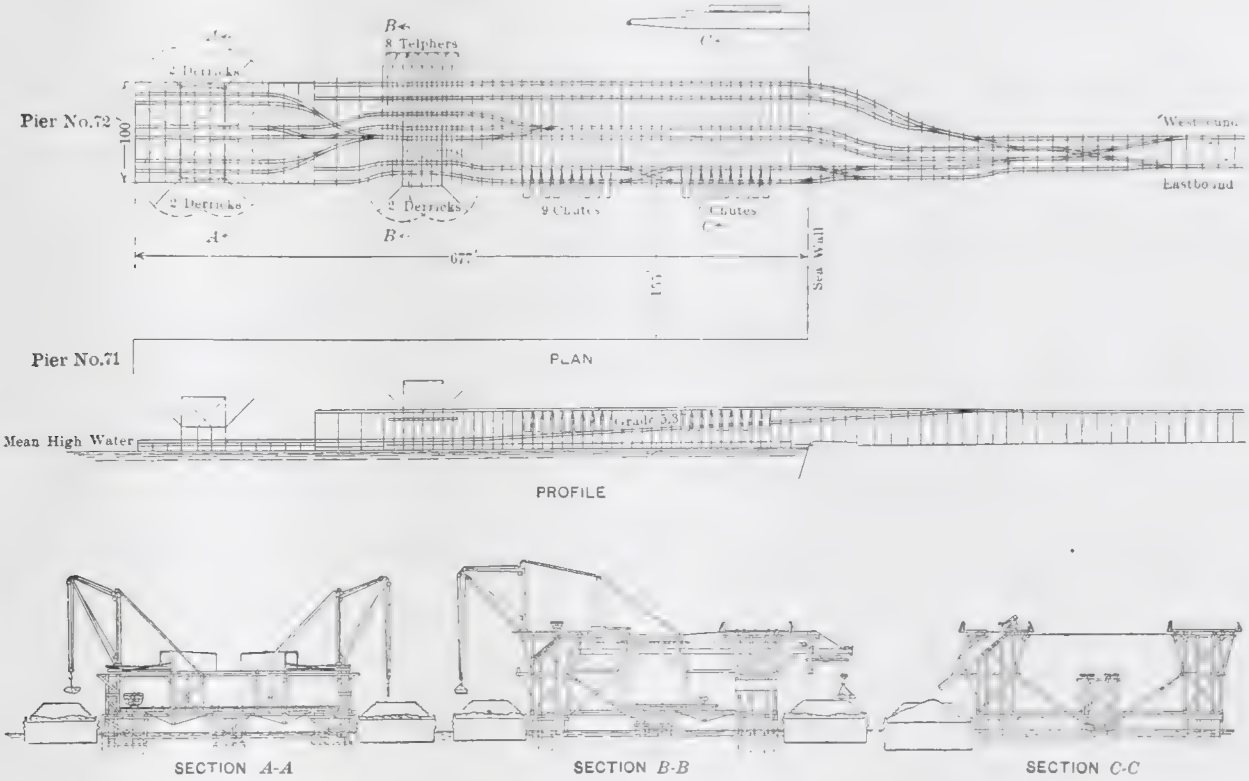
*[illegible] New York Extension of the Pennsylvania R. R., The Site of the Terminal Station. [illegible] Am. Soc. C. E., Vol. LXVIII, p. [illegible]



Plans for Pier Plant for Loading Scows with Spoil from Tunnel Excavation.

with a cross-truss every 10 to 15 ft., on which rested, fore and aft, two classes of beams, main and intermediate. The main beams were built of timbers ranging from [illegible] ins. to 14x14 ins. were scarfed at the joints, and trussed with the bottom logs. The intermediate beams were of timbers varying from 6x6 ins. to 10x12 ins., had butt joints, and were dapped at the cross-trusses to give a convex surface to the deck, which was built of 3-in. and 4-in. plank, from 8 to 12 ins. in width, running athwartship. The sides of the scows of this class were spiked and bolted to trusses similar to those running under the main beams. The bulkheaded boats had both sides and two longitudinal bulkheads placed so as to divide the scow into three sections of equal width, built of 8x8-in. or 10x10-in. timbers, laid one upon the other, and bolted through from top to bottom. The beams on these boats ran athwartships, rested on sides and bulkheads, and ranged from 6x10-in. to 10x12-in., spaced 2 ft. apart, and dressed to give a convex surface to the deck, which was usually 3 ins., in some cases 4 ins., in thickness, and made up of narrow plank from 4 to 6 ins. in width.

These boats had all been designed for lighter work than they were here required to perform, and a large amount of breakage occurred from the start. In order that the contractors for the excavation should be unhampered as to method of loading, the contracts provided that they should pay for all damage done to the scows in loading, other than ordinary and usual wear and tear, all other damage being at the expense of the contractor for disposal. A rigid system of inspection was necessary to determine and record properly the damage for which each contractor was responsible; and, as much of the breakage could not be noticed from the exterior, a thorough examination of the interior of each scow was made before and after every loading. In order to keep proper records, the bays of each scow, formed by the cross-trussees, were numbered, beginning aft with number 1 and going forward to the bow, and the longitudinal bays formed by the main beams were lettered, beginning with "*A*" on the port side. A beam broken in "1-*A*," therefore, would be an intermediate beam in the stern port corner bay, and a beam broken in "10-*A*-*B*" would be a main beam at the bow end on the port side. The underside of each plank was marked with a number beginning with 1 at the stern and increasing by units to the bow. In addition to recording the date, location, extent and party responsible for each damage, in a book kept for that purpose, the injured member was marked with paint, the color of which indicated the party responsible. The repairs were made by the contractor for the disposal of material, and the cost was assessed according to the marking in the boat.

Scows.	Loading Points.				Unloading Points.						Extra Pins.
	Pier No. 72	Thirty-third St. East R.	Thirty-[illegible] St. East R.	Long Island City	Greenville	Hackensack	Passaic	Governor's Island	Stake Boat	Dry Dock	
H. S. No. 1											Empty
H. S. No. 2											
H. S. No. 3											
H. S. No. 4											White Pins not in use placed here
H. S. No. 5											
H. S. No. 6											
H. S. No. 7											
H. S. No. 8											

The careful inspection of the damage done to scows and the cost of their repairs enables a fairly accurate statement to be made of the amount at different points, and it is here given on the basis of cost of repairs per cubic yard, barge measurement, of material handled.

	Cost. in cts. [illegible]
Repairs of damage done in [illegible] material from [illegible]	[illegible]
Repairs of damage done in [illegible] material from [illegible]	[illegible]
Repairs of damage done in [illegible] material from under-river tunnels..	1.77
Repairs of damage done in transporting and unloading material from all points	[illegible]

The above figures do not include the expense due to scows which were overturned or sunk while in service, which amounted to 0.4 cent per cu. yd., additional.

A statement of canal excavation published in the Canal Record contains a new estimate of the amount of material yet to be removed in each of the construction divisions, the total increase being 7,871,172 cu. yds. Of this amount 7,330,525 cu. yds. are added to the estimate of excavation in the central division, to allow for slides in Culebra cut, for silting in the Chagres section, for lowering the bottom of the canal from 40 to 39 ft. above sea level in the Chagres section, and for excavating a ship basin north of Pedro Miguel locks. A comparative statement showing the original and revised estimates follows:

Estimate of December, 1908.		[illegible]	
Atlantic Division.		Atlantic Division.	
Wet	[illegible]	Wet	[illegible]
Dry	[illegible]	Dry	[illegible]
Total	[illegible]	Total	43,357,345
Central Division.		Central Division.	
Culebra Cut	78,042,295	[illegible]	[illegible]
Other	[illegible]	[illegible]	[illegible]
Total	[illegible]	Total	[illegible]
Pacific Division.		Pacific Division.	
Wet	[illegible]	Wet	[illegible]
Dry	[illegible]	Dry	[illegible]
Total	41,794,791	Total	[illegible]
Gr. total..	174,666,594	Gr. total.	182,537,766

ROADS AND STREETS SECTION

Concrete Pavement Construction at Boise, Idaho.

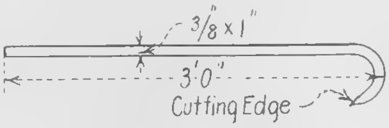
The city of Boise, Idaho, has recently thrown open to traffic some 8½ blocks of concrete pavement. The contract for this pavement was let nearly a year ago, but owing to the many unforseen difficulties encountered by the contractor it was not completed until late in July of this year. The pavement was constructed on Front St. and will be subjected to a slow but heavy traffic. The width of the pavement is 69½ ft. The reason for this being that on the south side of the street no sidewalk or curb is required as teams drive directly to the warehouses located on that side. The street car track is laid in the center and the north sidewalk and curb are narrowed to 10½ ft. The cross section of the pavement was made with a rise continually across the street of .02 ft., and with no crown except on three blocks. The concrete was mixed in the properties of 1-3-7. It was found that this mix produced a concrete that filled well, and which after thorough tamping could be smoothed off with a wooden float. There was no top cost, the specifications requiring only a uniform surface with no stones larger than ½ in. in diameter showing. After the concrete had set sufficiently it was covered with 2 ins. of dirt and was left wet for seven days. The concrete was 8 ins. thick, expansion joints, ½ in. wide, were pointed at the curbing and at each 25 ft. at right angles to the center line of the street. The joints were made with ½-in. boards, which were left in the concrete for two or three weeks, until it had set hard. Some of these boards were left in the concrete all winter. The contractor had much difficulty in securing these boards and found it an expensive task. It was also hard on the edges of the joints. A hook ⅜ in. wide and 3 ft. long shaped as shown in the accompanying cut, gave the best satisfaction in removing the boards.

The joints were filled with a mixture of tar, pitch and sand, all heated together and poured in when hot. The joints had to be gone over at least twice to fill them full.

A good quality of river sand having 30 per cent of voids was used for the concrete. The gravel consisted of crushed granite boulders up to 6 ins. in diameter, porphyry, rhyolite and various other forms of river work in a mountainous county. These were received through a 2½-in. mesh screen. The gravel was obtained from the bed of the Boise River and was all passed through a jaw crusher to crush the oversize. Tests showed that the gravel contained about 40 per cent of void. The cement used was made at Devil's Side, Utah, and is known as "Red Devil."

The mixing was done by two machines—a 5½ cu. ft. batch mixer run by a gasoline engine, and a 7⅓ cu. ft. batch mixer run by an electric motor. The larger mixer gave a much higher efficiency. Grading work was commenced on Sept. 13. The sub-grade was fairly good as little spongy material was found and sand was only found in a few places. As the sand will have little chance of moving it was considered good foundation. The sub-grade was rolled with a 16-ton roller and all spongy places refilled with gravel. The use of the roller was loaned by the city, but in the data given below the cost of rolling to the contractor is estimated at $10, this estimate being for coal, engineer, repairs, etc. As the sub-grade was very good, very little rolling was required; in fact the roller was in use for only 7 days. The total cost of the excavation was $3,010. As the total excavation amounted to 5,594 cu. yds. the cost per cubic yard was 54 cts. As the bidding price for the excavation was 48 cts. per cubic yard, the figures show that the contractor lost $325.30 on this portion of the work. This loss, however, was reduced approximately $150 by the sale of dirt from the streets.

Concrete mixing was started on Oct. 7 and finished July 8. No concrete work was done from Dec 9 to April 21. Table I shows the outputs of the mixers by months and the labor cost of mixing and placing the concrete. The total labor cost of mixing and placing the concrete was $5,452.74. As a total of 4,483.16 cu. yds. of concrete was placed the cost per cubic yard was $1.22. Included in this cost is the finishing of sub-grade after rolling. (The contractor sublet the excavation, but was to do all work after the subgrade was rolled.) This he did with his concrete gang when the gravel supply was irregular, or when moving mixers, or when the gasoline engine was out of order. The covering and watering is also included in the concrete labor cost, and some of the uncovering is also included. The total number of batches of concrete was 22,298, the average cost per batch being 25 cts.



Hook for Lifting Form Boards for Concrete Pavement.

The total yardage of pavement was approximately 20,408. A summary of the cost of the work to the contractor, according to records kept by inspectors on the job, shows the following:

	Total.	Per sq. yd. pavement.
Excavation, 5,594 cu. yds., at 54 cts.	$ 3,010	$0 1475
Concrete labor, mix and place 4,483 cu. yds., at $1.22	5,483	0.2686
Cement, 13,181 sacks	9,061	0.4440
Sand and gravel	3,900	0.1911
Roller, 7 days, at $10	70	0.0034
Cleaning pavement and labor on expansion joints	451	0.0221
Paving pitch and tar	600	0.0294
Sand joints	6	0.0003
Extras, estimated	1,000	0.0490
Totals	$23,581	$1.1554

In the above summary the cost of the gravel is largely an erstwhile, as only about one-half was obtained from the contractor's plant, the remainder being obtained from various other sources at about $1.10 per cu. yd. The gravel obtained from the contractor's plant cost 80 cts. per cubic yard delivered. The sand also cost 80 cts. per cubic yard. The cement was contracted for at $2.75 but the contractor was frequently forced to buy where he could and often paid more than the contract price for small lots. Labor was paid $2.50 per 8-hour day and teams were hired at the rate of $5.00 per day.

The following is the contractor's final estimate on the work:

4,483.16 cu. yds. concrete, at $5.20	$23,312.43
5,594.18 cu. yds. excavation, at 48 cts.	2,685.20
30 cu. yds. subgrade, at 55 cts.	16.50
30 cu. yds. refill, at 85 cts.	25.50
9,988 lbs. gutter plates, at [illegible] cts.	199.40
Total amount due	$26.539.03

This against his cost of $23.58 shows a profit of $2,957, which is 11 per cent. It was freely predicted among the contractors that this contractor was losing money.

Only a block and a half of the pavement was opened to traffic last fall, so it is impossible to judge as to its wearing qualities. However, the Board of Public Works of Boise this spring let a contract for nearly 60,000 sq. yds. of similar pavement, except that the thickness is to be 6 ins. We are indebted to J. B. Marcellus, Assistant City Engineer, Boise, Idaho, for the above information.

TABLE I.

	Mixer No. 1—5½ Cu. Ft. Capacity.				Mixer No. 2—7⅓ Cu. Ft. Capacity.			
Month.	Days worked.	Approx. cu. yds.	No. batches.	Labor cost mixed place.	Days worked.	Approx. cu. yds.	No. batches.	Labor cost mixed place.
October	21	582.7	3,697	$ 838.80	[illegible]	110.4	509	$ [illegible]
November	16	306.4	2,076	553.50	18	50.1	2,460	682.70
December	2	33.6	[illegible]	[illegible]	1	28.4	144	39.00
April	6	156.3	[illegible]	[illegible]	1	22.2	104	34.10
May	..	.....			19	..	2,870	647.24
June	22	.....	[illegible]	751.25	26	...	4,150	1,139.50
July	6	.....	[illegible]	125.50	[illegible]	...	[illegible]	187.00
Totals			11,206	$2,582.95			11,092	$[illegible]

Average Practice in Street Cleaning and Sprinkling in the Larger Towns of Great Britain.*

The materials employed in the formation of the surface of the streets must to a great extent influence the nature and amount of street cleaning. The number of towns where a large proportion of the streets are paved with granite or other stone setts, is greater in the North than in the South. This may probably be accounted for by the extensive deposits of granite in Scotland, North Wales and Leicestershire, rendering the material easily obtainable.

The more modern luxuries of wood paving and asphalt have not been adopted to any great extent, the practice being very dissimilar and the North still displaying its conservatism over the South. Thus while Glasgow has been content to lay one mile of wood paving, possibly as a sample, and did not like it, Birmingham has laid 15 miles and Bristol has laid 15½ miles; and if these local authorities could yield to all the demands made upon them would lay as many more.

The asphalt paved road, probably the most easily cleansed and the most sanitary, does not find much favor outside the Metropolitan district, probably on account of its unsuitability for any road not having a flat gradient. Nearly half the street mileage of Holborn is laid with asphalt, and a considerable length in Westminster. When the weather is either very wet or very dry asphalt is at its best, but there are times when the atmospheric conditions are such that horses seem to lose all control over their legs. In the case of this material, more perhaps than in any other, scrupulous cleanliness is necessary, and with its impervious smooth surface this is easily effected with an abundance of water and the squeegee, always provided that the newly-washed surface does not freeze; if so, there is trouble.

A street laid with wood, when the joints have been reduced in thickness to a minimum, presents, when new, a surface easily swept and washed, but it must be conceded that by its very nature absorption must take place, and that much more in the case of soft woods than in that of the harder timbers, such as Jarrah and Karri. As the surfaces become fretted and the edges of the blocks worn away the evils of absorption are increased, as are also the difficulties of cleaning. Here, again, the cleaner the surface the longer it will wear and conduce to the ease and safety of traction.

The words "stone-sett paving" conjures up before the mind an infinite variety. The modern practice of using carefully-dressed stones accurately laid on concrete, with scarcely any thickness of jointing material, will produce a surface almost as easily cleansed as wood paving, with the additional advantage of retaining its condition much longer. There are, however, many tens of miles of streets even in the best towns, still paved with large, uneven, irregularly laid pieces of granite, with open joints holding and retaining the droppings of the streets, rendering abortive the efforts at cleaning. Fortunately the rotary brush can be passed over these surfaces, dragging out the dirt without injury to the material. One city out of the 20 considered confesses to having still 145 miles of its streets paved with pebbles and it is therefore not a matter of surprise that its engineer states that practically all its streets are cleaned by mechanical sweepers; but it is doubtful whether even these can effectually pull out all the dirt or dust from the hollows.

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*From a paper by T. H. Yabbicom, city engineer, Bristol, England, presented at the second International Road Congress, Brussels. Of the 20 "towns" considered five were in the metropolitan district of London, 12 were English towns outside the metropolis, two were in Scotland and one in Ireland. The average population of the 20 towns is 360,000.

Sixteen of the 20 great towns now under consideration have been able to make definite returns of the mileage of the streets paved with various materials. It has been found that the total length of streets in these 16 towns is about 3,200 miles. Of these 32 per cent are paved with stone setts, 3 per cent with wood paving, 5 per cent with various materials (including asphalt), and 60 per cent are still maintained as macadam. Evidently, therefore, the question of cleaning macadam roads is of very great importance. The quality of the stone with which the surface is composed naturally varies to a great extent with the locality and the material obtainable in the vicinity, but of late years the tendensy has rightly been to employ the better classes of granite, basalts and other tough stones, even when the first cost is higher, rather than the softer limestones. The latter are easily crushed under the heavy weights that roads are now called upon to sustain, and by their ready absorption of water are converted into mud to the great increase in the cost of cleaning. A road made of inferior materials causes a large item in municipal expenditure.

Of the 20 towns, horse-drawn rotary brushes are used on the streets of 14 of the number to clean the macadam roads, the engineers of the other six being of opinion that the mechanical sweeper tends to damage the surface. It is thus seen that the majority are in favor of the rotary brush, but it requires to be applied with very great discretion, and the author gave up the use of these mechanical appliances, after having been strongly in favor of them, on account of their effective action, because the coarse bass of which the brush is composed dragged away the finer particles of the surface if applied heavily. Still it is evident that the consensus of opinion is in favor of their use. Almost invariably they are drawn by horsepower.

Efforts have been made at various times to produce a machine which not only will brush the road but at the same time raise the sweepings into a cart attached to it. At least six towns have given trials to these inventions, but the unanimous opinion is that not one has proved itself quite satisfactory.

It is scarcely necessary to record that in all the great towns the principal streets are cleaned at least once in the 24 hours, and still more frequently when necessary; this being independent of the continuous cleaning that will be noticed further on. The amount of traffic and the conditions of the weather must decide what has to be done. The second-class streets are usually swept three times a week. With regard to suburban roads and third-class streets the practice varies from a daily cleaning in some towns to once a week only in others. Whether the street cleaning is carried out better during the day or night is a point on which the towns are not unanimous; there is much to be said on both sides. During the night there is less interference with the traffic by the machines, and the latter having a fair way can act more expeditiously. During the day it is possible to exercise more complete supervision. In eight towns the streets are swept during the night. In seven others by day, and in the five others on the list both by day and night. It is evident, therefore, that opinions on the question are nearly equally divided, and local circumstances probably determine which shall be continued.

After the streets have been swept by night or by day, with or without mechanical appliances, it is the practice in the majority of the great towns to employ a number of street orderlies, men or boys, to go continuously through the principal thoroughfares and pick up litter and horse droppings, or as one city engineer expresses it "tidying up all day." In the opinion of the author this process is so important, not only from the point of neatness, but of health, that he was surprised to find one exception. These collections are small in quantity and are usually placed in hand carts for conveyance to some known point from which they can be removed by a cart. A very ordinary receptacle is a bin either above ground or sunk below the level of the pavement. Where there is a depot within reasonable distance the contents of the hand carts can be taken there direct. This cleaning by street orderlies is much increased in winter and wet weather, when the slop cart has to take the place of the hand cart for street cleaning, for the best method to be then adopted is more dependent on the changes of the weather than the work of any other department of the municipality.

In each of the 20 great towns under consideration the labor for cleaning the streets is employed directly by the corporation. In two of the metropolitan boroughs the carting away and disposing of the sweepings is in the hands of contractors, but in every other case the removal is effected by the administration. Of course, the contractors provide their own tips and get rid of the material to their own advantage.

The provision of suitable places of deposit in the neighborhood of crowded cities is an increasingly difficult one year by year. The practice is generally to tip slop in tanks from which the water is allowed to drain; sometimes the residuum is taken away for use on land. The sweepings from paved streets have a higher manurial value, and at certain times of the year maintain a ready sale; in fact, the author's experience is that at times the demand for sweepings from wood paving is greater than the supply. When the demand is slack much is given away, or is used as dressing on lands belonging to the municipalities. If it were not for the difficulty of transit, land occupiers would find the sweepings most useful and economical; and of late years traction engines are called into use for transporting large quantities into the country. Seaside towns have the advantage of being able to send out the unsalable portions in barges, and drop them at a point where the tides will not return them. Other towns, having a system of canals, are able economically to send away the sweepings in boats. In some towns the holders of allotment grounds under the Corporation are supplied with all they desire gratuitously.

When the streets are dry the usual practice is for a water cart to precede the brush, otherwise a cloud of dust is raised. This is, of course, more especially the case with the mechanical sweepers, but even the hand broom may make things very unpleasant and insanitary. Attempts have been made to combine a rotary brush and a water sprinkler in the same machine; various types having been tried by eight of the 20 towns with different results. The experience of five towns was unsatisfactory, two found the combination a great success, while the remaining one engineer used a petrol water van and sweeping machine combined, and found that it did its work in a satisfactory manner, but was unsuited to city work.

So far the author has endeavored with the kindly help afforded by very full returns of the practice of his confreres, to give a concise account of the average method of collecting and distributing street sweepings in the large towns of Great Britain and Ireland. Each place has its own peculiarities of situation, and environment, which dictate largely the methods to be employed, but all are directed to the same end, namely, a thorough endeavor not only to render the streets sanitary and free from effluvia, but to maintain them in a neat and tidy condition, clear of the hourly deposit of the rubbish of a great city. It is not possible to generalize as to the cost, because there is no prescribed method of keeping the accounts of county boroughs, and therefore comparison is impossible. From his own experience, the author is of opinion that a rate of 4d (8 cts.) or 5d. (10 cts.) in the £ ($4.86) per annum would provide a sum equivalent to the requirements of most places, and may be in excess of that spent by some in the ordinary everyday duties of street cleaning. At times all calculations and the most careful estimates are rendered useless by an unusual continuance of severe weather. A heavy fall of snow may occasion an expenditure of hundreds, or even thousands of pounds. Coming generally at a time of the year when work is most difficult of obtainment, the opportunity of the "unemployed" occurs, and provides for them something to do, which is as or more beneficial to the community than much of the so-called relief works. It is not the custom to employ soldiers to clear the streets of the towns of Great Britain and Ireland, as has been done in some Continental cities.

SNOW REMOVAL.

Snow is a visitant dreaded by the city engineer; its coming is uncertain, and the amount cannot be foretold. Even latitude is not a guide, for although as a rule the heaviest falls occur in the North and the Midlands, yet there have been years when the South of England has been the subject of a blizzard and a snow covering a third of a metre in depth, while the northern towns have experienced complete immunity.

Some towns have local Acts of Parliament which enable the police to call upon the householders to clear the snow from off footways in front of their premises, and this is the practice in about one-half of the towns noted. But even in those towns there are many miles of footways outside unoccupied premises, public buildings, places of worship and blank walls, bridges and viaducts where the paths would never be cleared at all if the municipality did not do it. The authorities of the other ten towns undertake the whole duty. By whomsoever the snow is cleared from the path it finds its way to the road, and then has to be removed at the public expense.

Every town of any importance makes careful and systematic arrangements in advance to deal with a fall of snow if it does come. The ordinary sweepers are warned to assemble at given centers, where foremen can take charge and direct their labors. If the weather is very severe, many workmen are thrown out of their ordinary employment and take temporary service with the Corporation, so that there is not much difficulty in procuring hand labor. It is very important to attack a fall at its commencement, and, if possible, keep the lines of vehicular traffic open. Where there is a network of tramways the stoppage of one car may result in a complete dislocation of the service to a district. All towns employ snow plows of one form or another, a very usual pattern being a diagonal board or plate on wheels drawn along by horses and delivering the snow at one side. This is very trying work for horses and cannot be resorted to unless the snow is newly fallen and before it has been trodden hard. V-shaped plows, propelled by an electric motor car, are in some towns employed to clear the tramway tracks.

Having succeeded in heaping the snow into ridges, the duty follows of removing it from the street as expeditiously as possible, but at times and in some places much difficulty is experienced in getting an adequate supply of horses and carts. If the fall of snow has been very heavy much ordinary work comes to a standstill, and the carts usually so employed are available for snow clearing. The very efforts made for a resumption of traffic, however, make the usual channels of employment again available, and this extraneous help disappears. A prudent superintendent makes his arrangements before the winter sets in for a supply of carts to be sent to different points when necessary.

In order to reduce the heavy outlay involved in clearing a town of its snow, it is necessary to have as many points as possible to which the carts may proceed to discharge their burdens, the cost of the cartage being a serious item. Vacant sites afford convenient places of deposit provided they are not too near dwellings. Rivers, especially when they are tidal, are very suitable, as any quantity can be discharged into them without inconvenience, but the length of haulage may be considerable and increase the cost. In some towns a portion of the snow is [illegible] this was can only be resorted to when the sewer is capacious and a strong body of sewage running; then the snow is quickly melted by the high temperature of the sewer air and disappears, but the practice should not be carried out with snow contaminated with a large proportion of street dirt.

The practice of using salt for the purpose of enabling the snow to be cleared easily and expeditiously is resorted to in many towns, but there the authorities make a sort of apologetic excuse for so doing by stating that the practice is only resorted to in "special cases," or "only on the tramway track," or but "very little used." There is no doubt that the use of salt is objected to by a large section of the the public on account of the intense cold produced, resulting in injuries to both man and beast, for which compensation has been awarded against the local authority in some cases. Some superintendents are of opinion that it is not possible to cope with a heavy fall without a liberal use of salt, but other equally important towns have found a way out of the difficulty without the employment of a freezing mixture.

It is almost impossible to formulate a scale of the costs of snow removal, the length of the haulage being so different in various places. A fall varying from 4 in. to 6 ins. in depth (undrifted) in January, 1909, cost the different municipalities named the sums set against each: Bradford £802, Bristol £1,660, Glasgow £824, Leeds £686, Leicester £2,273, Newcastle-on-Tyne £1,100, and Sheffield £1,049. The fall cost Liverpool $4,000, although large quantities of salt were used and the slush was washed down the sewers.

STREET WATERING.

Street watering, to some extent, is almost a necessity with even the best systems of cleaning which experience has evolved. This is forced upon the local authority, not only by the inconvenience to the inhabitants of having their goods and furniture spoiled by the deposition of layers of dust, but by the irritation caused by blinding particles impossible of avoidance. Still worse is the danger to health by the inhalation of an atmosphere laden with the possible germs of disease. The well-known, and to some constitutions painful effects of "hay fever" is attributed to the air being laden with the pollen of grasses, and possibly other plants in the spring of the year, and it therefore seems equally possible that during an epidemic of some disease the spores may be carried by the winds considerable distances, to find a congenial soil in which to propagate. Of course the macadam road, with its disintegration under rapid traffic, is the worst source of dust, and determined efforts have been and are being made to reduce the dust nuisance. It is not, however, the province of this paper to deal with the various methods which have been tried with varying success in this direction.

Tar in one form or another has been the most favored remedy, and there are probably few towns in England that have not tried experiments with tar-macadam, tar-painting and tar-spraying. All these processes aim at binding together the surface particles into a waterproof coating, which prevents the formation of mud in wet weather, followed by dust on dry days. But, however perfect the road surface may be, and unlikely to be disturbed by wheel action, dust will accumulate on it in towns from a variety of causes. Sweep the street as carefully as possible, let the street orderlies be ever so constantly picking up the refuse, yet on a dry day the rapidly-moving vehicles, with bodies within a few inches of the ground, set up a vacuum, causing a rush of air sufficiently powerful to raise and carry a cloud of dust. It is therefore not yet possible to do without "street watering."

In all large towns there is now an ample supply of water, and it is the exception rather than the rule for economy to be necessary in its use, even in dry seasons. In the great majority of cases the town supply is owned and controlled by the corporations, or in the London boroughs by the Metropolitan Water Board. In Belfast and Edinburgh the water supply is controlled by trustees outside the Corporation. At Birkenhead a portion of the supply is obtained from a company, and in Bristol and Newcastle-upon-Tyne the whole of the supply, for all purposes, has to be bought from private companies. The result of these various controls is that very different sums are charged to the various corporations for the water sprinkled over the street. Thus, in Edinburgh and Sheffield no charge is made for the water used. In Huddersfield the nominal charge of £150 per annum is made. Where the water is supplied by measure the charges vary from 2½d. per 1,000 gallons in Cardiff, 3d. in Leicester, 4d. in Manchester, 5d. in Newcastle-on-Tyne, 6d. in the London boroughs, Birmingham and Leeds, to 8d. and 9d. in Birkenhead and Bristol. Belfast pays £1,100 per annum for the water used on the streets, or a sum nearly equal to that expended by Bristol, where the water is bought by measure. The populations are nearly equal, but the length of the macadam streets in the latter is about double that in the former. There is absolutely no rule as to how the charge shall be framed, but probably the London price of 6d. per 1,000 galls. most nearly represents the cost to the undertakers. Edinburgh, Glasgow, Manchester and Liverpool, with their magnificent water supplies, may afford to be liberal where the health of the community is the object.

By general consent the watering season extends from the first week in April to the end of September, although there are no fixed dates on which to commence or finish, and as necessity knows no law it often happens that a dry, boisterous week in March brings out the carts. In like manner it may be desirable to keep some at work in October.

In the majority of the 20 towns under consideration, all the important streets and roads are watered when necessary. In Leicester rather less than half the total mileage is regularly watered, and in Newcastle-on-Tyne not one-fourth. In Westminster the practice of watering the entire area is confined to macadam roads, while those covered with wood and asphalt are treated to water in the channels only, where the dust generally collects. Macadam roads that have been treated with tar require a minimum of watering, a slight sprinkling before brushing being all that is necessary, the author's experience having been that the expense of tar treatment is nearly recouped by the saving effected in street watering.

As might be expected, various types of water vans are in use in different towns. These may be divided into the four-wheeled van, holding 400 to 450 galls., and the two-wheeled van, containing 200 to 300 galls. With two exceptions these vans are all drawn by horses, but Westminster and Cardiff employ, in addition, motor vehicles for street watering. The 4-wheeled van is usually a rectangular steel tank, but Holborn and Birkenhead employ cylindrical bodies. The 2-wheeled van is usually adopted on steep gradients, and is especially suited for such roads if made on the balance-suspension principle, so as to avoid all the weight being thrown on the back of the van when ascending a hill. In some places the water barrel mounted on two wheels is still employed, but is gradually giving place to the rectangular body. Several of the leading manufacturers have given special attention to watering plant, and placed on the market many ingenious devices by which the driver can control the delivery of the water from one or both sides, in either light, medium or heavy sprays. But whatever may be the form of the body of the cart containing the water the method of sprinkling it on the surface is of the first importance. It does not make so much difference on paved streets as on macadamized roads; in the latter as much damage may be done by injudicious watering as would be effected by a thunder shower. The nearer the sprayed water can be made to resemble a gentle shower the better, but it is useless to expect this desired end to be effected by the intelligence of the ordinary driver of a water cart. The old cast-iron tube distributor, with holes ⅛ in. in diameter, pouring out a deluge that washed away the surface material of the road was very dear to the driver, whose anxiety was solely to report that he had put down so many van loads of water during the day. Now, however, most vans are provided with some appliance for reducing the quantity of water used, while at the same time producing a more effective result than converting the street into a river. It is not possible to notice all these, but several towns use the rotary distributor, scattering the water by centrifugal force. This is very effective on wide streets before the traffic is about, but the appearance of the machine in the distance has been known as the cause of the hasty disappearance of foot passengers into doorways or other safe places of retreat, accompanied by comments the reverse of complimentary. Of the many nozzles that have been designed with the object of dividing the streams of water into a fine spray the author has found none equal to that designed by Mr. T. Caink, the city engineer of Worcester. Other favorite patterns are the "American," the "Hook," the "Wadsworth," the "Barnard Castle," the "Warwick," and the "Middlesex."

In addition to distributing water from vans with the intention of preventing the rise of dust many towns use hose pipes, attached to a hydrant, for the purpose of washing paved streets, or those laid with asphalt. This process belongs, however, to the cleaning rather than to dust prevention. The author is not aware of any town in Great Britain or Ireland where the hose pipe is used to sprinkle the surface as is done in Paris.

Opinions differ as to whether the continual watering of a macadam road has an injurious effect upon it. With a continuance of very dry weather the surface has a tendency to break up, which the judicious use of water may prevent, and thus be advantageous. Most road engineers are, however, of opinion that if a road is kept in a sloppy condition the surface is softened so as to be easily pulled away by motor traffic. Those roads that have had the advantage of tar treatment, do not of course, suffer in this way, they possess the double advantage of not breaking up in dry weather and not requiring water to allay dust.

During the past ten years many chemical preparations have been placed on the market with the intention of diminishing the dust nuisance, by binding together the particles on the surface of the road. They generally take the form of a deliquescent salt, which, when dissolved in the water and spread over the road, absorb moisture from the atmosphere and keeps the surface damp. For this purpose sea water was used many years ago. It has been ascertained that eight of the towns referred to have made no experiments in this direction; the other twelve have done so, but neither is at all enthusiastic about the results. Westrumite, Pulvicide, calcium chloride have all been tried, the latter most frequently. The author was anxious to learn the experience of other towns as to whether these chemicals in solution have a detrimental effect on macadam, but although some engineers state that they have ceased to continue their use, it seems that the determination was arrived at more because they did not fulfil expectations than for any injury to the road surface. The author's own experience has been that the salts, especially the calcium chloride, by reason partly of its cheapness, can be used on gradients where tar-spraying would not be desirable. The effect, however, does not last long, a heavy shower of rain falling soon after the salt has been spread washing it away, and it cannot tend to preserve the road.

Although street watering is no more than a palliative, very evanescent in its effects, at one time covering the road with thin mud, which half an hour later is blowing about in the form of dust, the former condition condemned by the owners of vehicles and the latter the cause of endless complaints from shopkeepers, we have not arrived at a point where we can do away with the water cart, but like most other things in municipal government, it requires using with intelligence and discretion. The vagaries of English weather make the lot of a watering superintendent an anxious one. A wet morning, on which no water cart is sent out, may be succeeded at midday by hot sunshine and a gusty east wind [illegible] the morning may break dry and dusty with every available watering machine on the roads, to be followed by clouds and rain before noon. Sadly the dripping but useless carts have to return to their quarters.

WATER-WORKS AND SEWERS SECTION

Leaping Weirs, Syracuse Intercepting Sewers.

The design of the intercepting sewer, in Syracuse, N. Y., which will divert the ordinary sewage flow from Onandaga Creek, has developed a new method of controlling the amount of sewage to be intercepted.

The device is known as a leaping weir and is used in lateral sewers at points where they pass over the intercepting sewer or such other sewers as lead directly to the main intercepter. Figure I shows a typical detail of an intercepting chamber with a leaping weir.

In passing over the intercepter on its way to the creek, the lateral sewer is made to leap over a gap as shown in the figure.

The scheme is based on the principle of water falling from an orifice and producing a curve in falling, which is modified in size, in proportion to the head of water.

With the gap a certain width, and the upstream pipe raised to a certain head above the pipe on the opposite side of the gap, the amount of water intercepted by falling through the gap, will be constant.

The design calls for a cast iron half section of pipe for the discharge. This is so placed that it can be made to slide back and forth for a few inches, in this way regulating the amount of sewage to be intercepted. A small dam is placed in the end of the cast iron pipe to prevent the sewage which leaps the gap, from running backward into the intercepter.

A series of experiments were run with a model leaping weir to determine the practicability of using this principle. The results are shown by the curves in the diagram, Fig. 3.

The curve No. 1 was not satisfactory because no dam was used in the discharge pipe and some of the water flowed back from the discharge pipe into the intercepter. Curves Nos. 2 and 3 show that all the water was intercepted up to a certain volume of flow, after which the amount intercepted was constant.

In making the experiments a hose was used and the water run through a meter. The amounts of intercepted water and that not intercepted were also measured for a check, by use of the Frances formula. The results checked very closely. The leaping weir is a result of the idea of Mr. Glen D. Holmes, Chief Engineer, Syracuse Intercepting Sewer Board. The experiments were carried on under supervision of Mr. L. J. Lyon, Assistant Engineer.

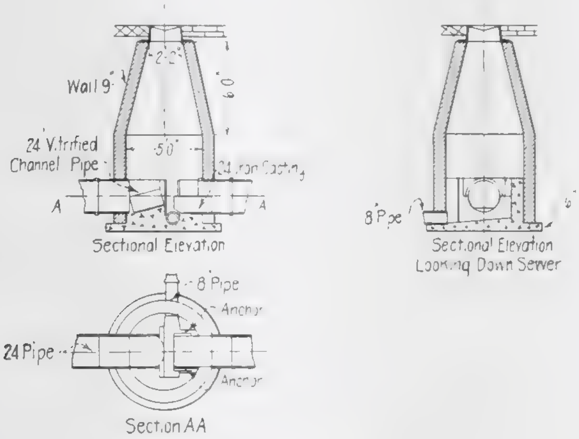

Fig. 1—Intercepting Chamber with Leaping Weir, Syracuse, N. Y.

Specifications for Determining Cost of Garbage Incineration.

In calling for plans and proposals for constructing two garbage incinerating plants at San Francisco, Cal., the contractor is required to name and guarantee an average cost per ton of incinerating refuse of a certain composition. To determine whether this guarantee is fulfilled tests are required from which the cost is to be calculated. As features of general interest we reprint here from the elaborate specifications issued by the San Francisco Board of Public Works the clauses relating to tests and cost of incineration:

Tests.—Sec. 225. In order to demonstrate the capability of the plants to incinerate refuse without the use of additional fuel, and in accordance with the specifications and guarantees, certain tests shall be made, as specified below. The sufficiency of the incinerating plants to fulfill the specifications and guarantees will be judged from these tests, as hereunder set forth. The contractor shall pay the expense of all tests, unless otherwise herein provided. All the tests will be under the direction of the city engineer.

Sec. 226. The contractor shall make the tests at such times as he desires and as are acceptable to the city engineer, provided, however, that for at least one month the furnaces shall have been subjected to a slow drying to avoid cracks in the brick work. For this purpose the contractor shall maintain in each furnace a small fire with oil or other fuel, as may be approved by the city engineer, and the maintenance of such fires shall be at the contractor's expense.

Sec. 227. Tests to determine the difference between the actual net cost of incinerating refuse and the guaranteed net cost of incinerating refuse shall be made by the contractor, under the direction of the city engineer, and they shall be the basis upon which either a bonus or a damage will be computed. The actual net cost of incinerating refuse at each individual plant shall be considered as being the average of the costs, ascertained from the tests made from each of its units.

Sec. 228. In order to demonstrate the actual net cost of incinerating 1 ton of refuse, each unit shall be tested for 4 days of 8 hours each. The tests shall be made so that every unit will be tested. Only one unit will be tested at one time, and the city engineer will determine which unit shall be used for each test. The contractor will be permitted to operate the other unit at the same time.

Sec. 229. The fulfillment of each and all of the guarantees specified shall be judged not only from the tests specified in Sec. 228, but also from a test which shall be the normal operation or run of each plant for at least 30 days including the time required to determine the actual net cost of incinerating refuse.

Sec. 230. The contractor shall conduct a test in one or more of the units to demonstrate the value of using oil as additional fuel for the purpose of supplementing the calories furnished by the refuse. This test shall consist of a 4-hour run at normal capacity supplied with refuse containing more water than 1,000 lbs. per ton or less combustible than 460 lbs. per ton, or both more water and less combustible as aforesaid. The temperature in the combustion chamber shall be maintained as stated in the guarantee.

Sec. 231. The city engineer may require any part of the furnaces, boilers, engines, motors, or generators or their appurtenances to be separately tested. The contractor shall afford all necessary facilities for doing this, and should the city engineer so require, any such part not found satisfactory shall be made so without delay.

Sec. 232. The contractor shall, in conjunc-

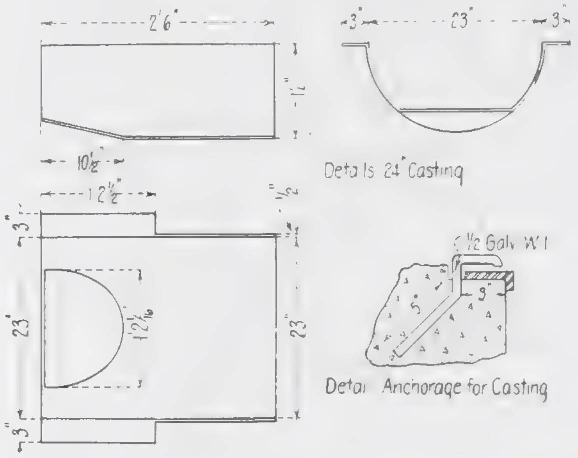

Fig. 2—Details of Iron Pipe Sections and Anchor for Leaping Weirs.

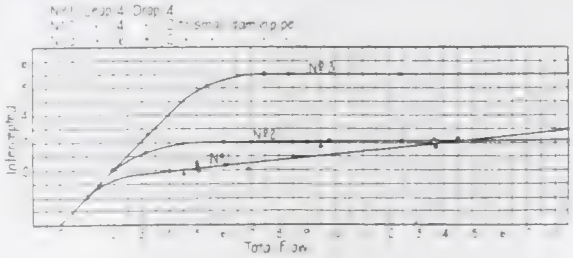

Fig. 3—Diagram Showing Results of Tests of Leaping Weir.

tion with the city engineer, conduct the operations for the 30 day tests and for all of the 4 day tests and shall demonstrate the capabilities of each plant. The contractor shall instruct the men who will operate the furnaces for the city, as to their respective duties.

Sec. 233. The contractor shall furnish at his own expense a competent and experienced superintendent to conduct the tests in conjunction with the city engineer, and this superintendent shall not leave the works while tests to determine the actual net cost of incinerating refuse are being made.

Sec. 234. The contractor shall find all labor required by him according to a written statement from him delivered to the city engineer, giving the number of laborers of each class required, as stated in Section 242, for making any and all of the tests required by these specifications.

Sec. 235. The city and county of San Francisco will pay all laborers required with the approval of the city engineer at any and all of the tests required by these specifications or ordered by him, at the prices stated in Section 242. The city will also furnish at its own expense all engineers and attendants required for making observations, reading instruments, or recording notes, during the tests. The contractor shall pay the superintendent called for in Section 233 and the laborers and attendants required for drying and burning the samples.

Sec. 236. The city of San Francisco will furnish free of charge to the contractor all necessary refuse, water, light, lubricants and fuel oil for all tests required by these specifications, and none of these items will be included as any part of the cost of incineration in computing the actual net cost of incinerating refuse.

Sec. 237. The test to determine the quantity of steam to be credited in computing the actual net cost of incinerating refuse (Section 243) shall consist in ascertaining the total quantity of water evaporated in the boilers by weighing the feed water supplied to them and weighing the refuse fed into the furnaces during the time of the test of each unit. These quantities shall be reduced to an equivalent evaporation from and at 212° F per pound of refuse computed according to the Marks-Davis-Low tables of equivalent evaporation, and Jacobus's table of the specific heat of superheated steam, and the test in general shall be conducted as nearly as possible in accordance with the most recent code of rules for conducting boiler trials adopted by the American Society of Mechanical Engineers. The refuse supplied shall contain on an average, when dumped into the furnace, not more than 1,000 lbs. of water per ton, and not less than 460 lbs. of combustible per ton. The probable gross rate of evaporation ascertained in this manner for refuse containing 1,000 lbs. of water per ton and 460 lbs. of combustible per ton shall be stated by the contractor in his proposal.

Sec. 238. The test to determine the quantity of combustible and water contained in the refuse before dumping into the furnace shall be made by collecting at random from each wagonload supplied to the furnace a fair average sample, in the opinion of the city engineer, of at least 1 cu. ft. When such samples have been collected for a day's test they shall be combined. Any large pieces shall be cut or broken up and the whole thoroughly mixed. This mixture shall be divided in halves and one of these halves mixed and divided again in halves. This process of mixing and halving shall be continued until the sample shall be reduced to a quantity of not less than 3 cu. ft. This final sample shall be comminuted until it shall be, in the opinion of the city engineer, in a proper condition for the drying test. The contractor shall pay the expense of securing and preparing the samples for testing. In order to determine the quantity of water contained in the refuse before dumping into the furnace, this sample shall be dried at a temperature of 220° F until no further decrease of weight is observed for a period of 6 hours. The difference of weight between the original and the dried sample shall determine the quantity of water contained in the refuse from which the sample was secured. The contractor shall provide suitable apparatus satisfactory to the city engineer and pay the expense of this test.

Sec. 239. The test to determine the quantity of combustible contained in the refuse before dumping into the furnace shall be made after the water has been evaporated as stated in Sec. 238, by burning this sample until no further decrease of weight is observed for a period of 4 hours. The difference of weight between the dried sample and the remaining ash shall determine the quantity of combustible contained in the refuse from which the sample was secured. The contractor shall provide suitable apparatus satisfactory to the city engineer and pay the expense of this test.

Cost of Incineration.—Sec. 240. The actual net cost per ton of incinerating refuse at each plant under this contract shall be based upon the average actual expenditures for labor in connection therewith, as specified in Section 242, and on the computed net revenue from the quantity of steam produced as specified in Section 243.

Sec. 241. The expenditures and revenues from which the average actual net cost of incineration (Section 247) will be determined, are the expenditures for labor and power used from the time when the refuse has been dumped or thrown from the wagons to the time when the clinker and ashes have been delivered outside of the room housing the incinerator units at least 1 ft. beyond the wall thereof, and the revenues from the steam evaporated in the boilers.

Sec. 242. The city engineer will note the number of men employed in operating the incinerating plant during the test, and the cost of the labor required for operating the unit being tested will be computed at the following unit prices:

Engineers	$4.50 per day of 8 hours
Feeders, stokers and clinkerers	$3.50 per day of 8 hours
Laborers	$3.00 per day of 8 hours

The laborers shall not do any work in the operation of feeding, stoking or clinkering the furnaces.

When a man performs labor that is common to more than one unit, such as handling refuse and clinker and attending the power machinery, the cost shall be computed at such proportion of the total cost of labor as the unit tested bears to the total number of units actually served.

After the refuse is weighed, the contractor may pick out iron scraps or other material that cannot be incinerated. However, any materials so removed will be weighed and the amount of their weight deducted from the weight of the refuse delivered to the incinerator unit being tested. The expense of picking out of the refuse iron scraps or other material that cannot be incinerated shall be borne by the contractor. It will, however, not be charged to the expense of operating the plant during the test to determine the actual net cost of incineration.

Sec. 243. The quantity of steam to be credited in computing the actual net cost of incineration (Section 241) shall be the gross total number of pounds of steam evaporated in the boilers less the quantity which has been required and used in conection with all operations of incineration within the limits specified in Section 241. The gross quantity of steam shall be ascertained and measured by weighing the feed water supplied to the boilers. The quantity of steam to be deducted shall be determined by means of a self-recording St. John meter or its equivalent and approved by the city engineer. The value of the steam credited shall be taken at the rate of 4 cts. per 100 lbs. of steam evaporated in the boilers from and at 212° F.

Sec. 244. If the average quantity of combustible in the refuse as shown by the test is between 460 and 520 lbs. per ton, the contractor's guaranteed net cost of incineration shall be decreased for each pound of combustible per ton in the refuse exceeding 460 lbs. the amount the contractor directs in his bid that it shall be decreased.

If the average quantity of water in the refuse as shown by the test is between 1,000 and 900 lbs. per ton, the contractor's guaranteed net cost of incineration shall be decreased for each pound of water per ton in the refuse less than 1,000, the amount that the contractor directs in his bid that it shall be decreased.

Sec. 245. If the average amount of combustible in the refuse burned is less than 460 lbs. per ton, or if the average amount of water is more than 1,000 lbs. per ton, the 4 day test will not be considered as binding. However, should the contractor on account of the calorific deficiencies in the composition of the refuse be willing, and should the city engineer approve, then the result of the test will be considered as binding and the contractor's guaranteed net cost of incineration will be increased by amounts computed as follows:

If the amount of combustible in the refuse as shown by the test is between 460 and 400 lbs. per ton, the contractor's guaranteed net cost of incineration shall be increased for each pound of combustible per ton in the refuse less than 460 the amount the contractor directs in his bid that it shall be increased.

If the amount of water in the refuse as shown by the tests is between 1,000 and 1,100 lbs. per ton, the contractor's guaranteed net cost of incineration shall be increased for each pound of water in the refuse exceeding 1,000, the amount that the contractor directs in his bid that it shall be increased.

Sec. 246. The city engineer will prepare an accurate statement; first, of the total number of tons of refuse incinerated during the time of the test; second, of the number of hours of labor, of each class as stated in Sec. 242, devoted to each operation, and third, of the total number of pounds of steam evaporated in the boilers and the total number of pounds used for incineration, forced air draft, transportation or other purposes within the limits specified in Section 241. An independent statement will be prepared for each 4 day test of each unit of each plant.

Sec. 247. From the city engineer's statement (Section 246) and from the debit for labor (Section 242) and credit for steam (Section 243), the city engineer will determine the actual net cost per ton for incinerating the average refuse within the meaning of Section 240 and computed for each individual plant, as stated in Section 227.

Bonus and Damage.—Sec. 248. If the actual net cost per ton of incinerating refuse, as determined by the city engineer, according to Section 247, is under or over the cost guaranteed by the contractor as computed and limited in Section 244 and Section 245, then the city and county of San Francisco will respectively pay to the contractor a bonus or charge him with a damage to be computed from the difference between the actual net cost of incineration and the guaranteed net cost of incineration.

Sec. 249. The difference between the guaranteed net cost of incineration and the actual net cost of incineration, upon which the bonus will be paid to the contractor or a forfeit required of him by the city, will be limited to 8 cts. per ton.

Sec. 250. If the actual net cost per ton of incinerating refuse, as determined by the four 8-hour tests of each unit, is lower than the net cost of incinerating refuse guaranteed by the contractor, the contractor will be entitled to, and the city will pay to the contractor, a sum equal to the difference between the guaranteed net cost of incinerating refuse and the net cost as ascertained by the official test, multiplied by the probable output of the plant in tons of refuse incinerated in three years, which, for the purpose of this computation, is assumed at 120,000 tons for the North Beach Station and also 120,000 tons for the Islais Creek Station.

If the actual net cost of incinerating refuse, as determined by the tests, exceeds the net cost of incinerating refuse guaranteed by the contractor, the contractor shall forfeit to the city a sum equal to the difference between the guaranteed net cost of incinerating refuse and the net cost as ascertained by the official test, multiplied by the assumed output of the plant in tons of refuse incinerated in three years, as above specified.

The bonus or damage to be paid or forfeited shall be computed independently for each plant from the guarantees and the results of the tests made of each plant.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Some Exposure Tests of Structural Steel Coatings.*

TABLE OF RESULTS OF EXPOSURE TESTS OF STRUCTURAL STEEL PAINTS MADE BY WESTINGHOUSE, CHURCH, KERR & CO.

	One Year Exposure				Two Years Exposure			
	One Coat		Two Coats		One Coat		Two Coats	
Class.	No. of Tests.	Av. Rtg.	No. of Tests.	Av. Rtg.	No. of Tests.	Av. Rtg.	No. of Tests.	Av. Rtg.
Carbons	65	21%	51	70%	34	2%	30	46%
Graphites	67	18	56	66	42	3	41	47
Iron oxides	74	35	71	69	72	10	52	16
Red leads	50	58	39	77	19	16	29	61
Read lead primers	0		13	75	0		14	56
White leads	23	51	11	82	3	0	3	25
Zinc oxides	5	25	5	69	5	3	5	50
Mineral hydrocarbons without pigments	66	20	73	46	36	0	37	18
Mineral hydrocarbons with pigments	10	16	11	53	7	0	7	20
Vegetable hydrocarbons with and without pigments	13	19	13	57	3	0	3	5
Cements	7	36	7	46	1	0	1	0
Chromates	11	32	24	70	9	0	9	39
Vehicles	22	8	7	11	3	0	3	0
Miscellaneous	94	28	103	67	70	7	85	39

About three and a half years ago Westinghouse, Church, Kerr & Co. exposed to the weather on the roof of the building occupied by them at the southern extremity of Manhattan, 24 small steel plates each coated with a so-called "steel preservative paint." The great difference soon noted in the protective value of these paints led to the testing of other paints and coatings until some 1,600 plates have now been exposed, painted with 530 different coatings submitted by 271 manufacturers or dealers.

The results obtained to date are more or less interesting according to the conclusions which may be drawn from them. Herein we will state only the facts, the conclusions may be drawn by each for himself.

The method employed in most of these tests was as follows: Small samples of the ready mixed paints were submitted by the manufacturer or dealer, together with a statement of the principal ingredients entering into their manufacture. Each paint was applied to two mild steel plates of about No. 16 gage, 2 ins. wide and 6 ins. long, which had first been well cleaned of oil and foreign matter by rubbing with a cloth saturated with benzine. Each plate had its number plainly stamped in one corner. One plate was given one coat and the other two coats. Care was taken to give a uniform full coat to both sides and all edges of the plates. All painting was done indoors by the same person. About five days were allowed between coats for drying. After the second coat had dried the plates were fastened to boards with galvanized iron tacks and exposed on the roof at an angle of 45° facing south. Fig. 1 shows some of these plates on the boards as they are now exposed on the roof.

On the day the plates were exposed scratch marks were made with a sharp instrument across two opposite corners of each plate. These scratch marks cut through the paint film leaving bright metal exposed so that rust could and did start immediately along these lines.

At regular intervals after exposure each plate was examined and a record made of its condition. The one quality which was being sought and the prime factor which entered into the rating of the paints was protection against rust.

An arbitrary scale of ratings was adopted based on the amount of rust apparent on the plate. Until some small spot of rust appeared the plate was rated at 100%, except cases of fading, alligatoring, bad chalking, etc., without any rust apparent, which were rated at 97%. When one small spot of rust, the size of a pinhead, appeared the plate was rated at 90%. When several such spots or one larger spot of rust appeared the plate was rated at 85%. When the sum of the areas of the rust spots totaled an area of about ¼-in. square the plate was rated at 80%, when ½-in. square at 75%. When the combined area of rust spots totaled about 1 sq. in. the plate was rated at 70% and so on down the scale until zero rating indicates the plate entirely rusted on the exposed side. Fig. 2 shows a series of plates in various stages of the progress of the rust from 100% to zero. Examinations were made and results recorded at the end of two weeks, four weeks, six weeks, twelve weeks, and every three months thereafter.

The scratch marks across the corners of the plates developed some interesting results by showing the relative resistance offered by the various coatings to the spread of the rust which got its start where the bright metal was exposed. In one case the coating failed at many points and the plate rusted at each of these weak spots, but the coating did not allow the rust to progress under it and therefore the rust spots were small and the rust at the scratch mark still confined within narrow limits. Should this paint be called a good inhibitor and a poor excluder? In another case a paint allowed the rust to spread rapidly where it once got a start at the scratch marks but did not allow a single spot of rust to start on any other portion of the plate. Is not this evidence of a poor inhibitor but a good excluder? Both of these plates were exposed the same length of time.

Another interesting and somewhat curious fact has been noted in these tests. It is that the various classes of pigments fail in characteristic manners. A plate coated with a graphite paint does not rust in the same manner as one coated with red lead or an iron oxide.

As the test plates were exposed from time to time throughout the year in lots of about 200 it would not be fair to compare the three or six months' rating of a paint exposed in June with the corresponding rating of one exposed in November, after the one had been subjected to warm dry weather and the other to an equal period of cold, rain and snow. For this reason, the one year and two year ratings are compared in all cases, so that all have been exposed to the four seasons in succession one or more times.

As noted above, each manufacturer was asked to state the principal ingredients in his paint and on the basis of these statements the samples were classified into groups depending upon its chief pigment, or, in the absence of pigments, upon its vehicle. In this way the paints were divided into a number of classes as follows:

Carbons.—In this class are grouped the natural and artificial carbons except graphite.

Graphites.—This class contains both the natural and artificial graphites.

Iron Oxides.—These also include both the natural and artificial pigments, some of which were received in paste or dry form to which pure linseed oil was added in our laboratory.

Red Leads.—This class includes both the straight red lead and oil mixed in the laboratory shortly before applying and the ready mixed red lead paints which contain considerable percentages of other pigments to keep the lead in suspension. These red leads had no other coating over them.

Red Lead Primers. These consist of tests in which the first coat was a red lead paint, either "ready mixed" or straight red lead and oil, while the second coat was of some other class. Of course, no one coat tests could be made in this way. The second coats in this class were of widely different varieties.

White Leads.—This class is rather surprisingly small and is made up largely of paints mixed from the paste in our own laboratory.

Zinc Oxides.—Few makers put out a zinc oxide paint for structural steel.

Mineral Hydrocarbons without Pigments.—This class is composed of paints made of the various kinds of tars and tarry refuse, and the various minerals of an asphaltic nature, gilsonite, elaterite, etc., but without any pigments added to them. They form one of the more numerous groups and as a rule are much lower priced than the oil paints. They also form the class for which the greatest merit is usually claimed by the makers and agents.

Mineral Hydrocarbons with Pigments.—This class is made up of the same character of materials as the last, but with various pigments added. For instance, a paint made of gas tar and iron oxide would fall in this class rather than in the iron oxide class.

Vegetable Hydrocarbons with and without Pigments.—This class includes distillates and residual pitches of vegetable oils, etc. They are not numerous enough to divide into two groups hence those with and those without pigments are placed in the one class.

Cements. — Several manufacturers have acted upon the oft published statement of the fact that Portland cement offers a protection to steel against rust and have put out a paint said to be made up largely of cement. These paints are here grouped in a class by themselves. As they have appeared in the market mostly within the past two years only one of them has had a full two years' exposure.

Chromates.—Another effect of recent paint literature has been to cause the appearance of a number of paints said to contain chromates or chromic acid in some form. Some of these have appeared within the past year and no tests of those can be included in this paper.

Vehicles.—This class contains the oils, varnishes, and transparent coatings containing little or no pigment but which are more or less used for the protection of steel.

Miscellaneous.—Into this class are grouped all the coatings which do not fall into one of the above groups or concerning which the maker refused proper information to enable the paint to be classified. Other subdivisions were made in our laboratory records, but they each contained so few representatives that they were all thrown into this miscellaneous class for purposes of comparison in this paper.

In the accompanying table is given a summary of the results obtained with each class of paints for one and two years exposures of one and two-coat specimens. This table also gives in each case the number of tests which entered into each result.

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*Paper by C. M. Chapman read before the American Society for Testing Materials' Annual Meeting, 1910.

Traction Plowing Outfits—Operating Methods and Costs.*

The factors entering into the economy of either steam or gasoline plowing are so many and so varied that certain ones may easily be overlooked; hence, they will be discussed in some detail.

COST OF OPERATION.

The actual cost of operation includes not only the cash outlay for labor, fuel, oil, repairs, etc., but the interest and depreciation on equipment. The figures presented in this connection are not to be taken as final, because (1) very few operators keep accurate accounts; (2) depreciation and repair charges must be based almost entirely on estimates, and (3) with the improvement in equipment and with the education of operators the efficiency of outfits must be gradually increased.

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*From Bulletin No. [illegible] Agriculture, by L. W. Ellis.

Overhead Charges.—Among the factors in the cost of plowing which are very often disregarded by operators who have not had a business training are the overhead charges, which include interest on the money invested and the depreciation of the outfit. If the outfit is bought on time the matter of interest is necessarily brought to the owner's attention. However, it is a frequent practice among owners who have paid cash to allow nothing for interest on their capital, thus apparently increasing the net profits from their work when as a matter of fact the venture may not be paying as good a rate of interest as might have been obtained by depositing the capital in an ordinary savings bank. Seven or 8 per cent interest is a common rate on machinery notes in the sections where traction plowing is most common.

The matter of depreciation is probably even less considered by the average operator than that of interest. Depreciation charges should be made in order that at the expiration of the life of the outfit a sufficient amount shall have been set aside either to replace the outfit in its original condition or to restore to the owner his original capital. The rate of depreciation depends, of course, upon the wear and tear on an outfit during a given period of use, or, in other words, upon the life of the outfit. The practice of traction plowing is so new that the average life of plowing engines can not be accurately determined, and the rapid improvements in equipment make of little value such figures as are obtainable from outfits already partially worn out. The life of plowing engines depends not only on the care given and the amount of work done, but upon natural conditions, such as climate, soil, topography, and in the case of steam engines the water used in the boilers. The soil in particular, with respect to its resistance, uniformity, and grittiness, exerts a great influence on the life and repairs of both engines and plows.

Manufacturers of steam outfits vary in their estimates of the life of plowing engines from 4½ years when given maximum use to 20 years for ordinary use with excellent care. The general opinion of the manufacturers ranges between 8 and 12 years, converging at 10. The factor of use per year must be taken into consideration. In California 11 owners of large steam engines plowing nearly 3,500 acres per year each make an average estimate of 15 years. Thirty out of 76 correspondents in the Southwest estimate 10 years as the life of their engines, the average of the whole number being 10.04 years. The average acreage per year reported from these operators is 1,075. In the Northwest and Canada 32 out of 85 operators estimate 10 years, and the average estimate is 10.7 years. Their average acreage per year is 797. Taking the two sections together and considering, as before, only those operators who state the annual acreage and the estimated life 62 out of 161, agree on 10 years, the average being 10.4 years, while the average area plowed per year is 903 acres.

The consensus of opinion regarding the life of engines used in plowing and thrashing might fairly be taken as a basis for estimating the rate of depreciation, but closer inquiry in the field reveals the fact that while many engines of the type now being put out will have a life of 10 years the majority of operators do not expect 10 years' service in plowing. A great many place the plowing service at from 4 to 6 years, after which, when equipped with new gears and generally rebuilt, the engines are fit for service in thrashing as long as the boiler lasts, which may easily reach a like period thereafter. For this reason it is probable that the majority of correspondents who placed the life of their plowing engines at 10 or more years misunderstood the question asked in the circular letter sent out by the Office of Farm Management. After duly considering all the data and estimates regarding the life of plowing engines, a rate of 10 per cent of the first cost of the engine is taken as the value consumed annually in plowing alone during the first five years of the life of the outfit.

Since approximately 90 per cent of the engines reported as plowing are used also for other purposes—principally thrashing—and an average of reports indicates approximately equal periods of plowing and thrashing, a division of the interest and depreciation charges on the basis of comparative wear and tear becomes necessary. The wear and strain on engines in the two operations is essentially different, being heaviest on different parts during each. When thrashing, the wear is mainly on the engine parts, and in plowing on both the engine parts and the traction gearing. The wear in plowing has been variously estimated at from two to ten times that in thrashing. The opinion of several of the leading manufacturers and other authorities centers about 75 per cent of the total wear as chargeable to plowing, as compared to 25 per cent for thrashing during equal periods of service. Since the reports from operators indicate practically the same number of days' plowing and thrashing each year, these figures are taken as the basis for dividing the overhead charges. Repairs might be included under this head, since they can be divided on this basis, but it has been considered more appropriate to include them under running expenses.

Following the method outlined of calculating and dividing the overhead charges, the division on an engine costing $3,000 would be, for the first five years, at the rate of 10 per cent depreciation and 5¼ per cent interest for plowing, 3⅓ per cent depreciation and 1¾ per cent interest for thrashing. With regard to the calculation of interest, however, the average investment during each five-year period must be ascertained. Granting the approximate correctness of the preceding assumption is seen that the total rate of depreciation of of the engine will be $400 a year and at the end of the fifth season the value will have been reduced to $1,000. As interest is taken on the value of the engine at the beginning of each season, the average value during the five seasons is seen to be $2,200. Interest at 7 per cent, therefore, would be $154 each year, or $115.50 for plowing and $38.50 for thrashing. Depreciation during the same time would be $300 and $100, respectively. During the last five years of the life of the engine both interest and depreciation would be chargeable to thrashing, the former at the rate of 7 per cent on an average valuation of $600 and the latter at an average rate of $200. As a matter of fact the establishment of depreciation charges must be largely theoretical even in the most carefully conducted manufacturing or transportation enterprises, but the matter is one which should be carefully figured upon by every operator. Few traction engines are ever actually worn out; hence the values are seldom reduced to a practical zero. Without extended investigation, which it is hoped may be undertaken, accurate figures covering the entire life of traction engines are not to be had, but without such figures from a considerable number of operators the estimates given are as likely to indicate the truth as any which might be made.

With regard to the life of plows and minor equipment, no data are at hand and depreciation is charged arbitrarily at 10 per cent. Plow depreciation is of course wholly chargeable to plowing, but that of miscellaneous equipment, being due to practically equal use in plowing and thrashing, is charged equally to both.

Repairs, Oil, Etc.—As previously stated, the division of repairs may be made on the same basis as that of overhead charges. From such data as are at hand, together with estimates from men in a position to have considerable knowledge on this point, it is possible to arrive two ways at the cost of repairs per acre plowed. The average cost of repairs per year is estimated by several authorities at $100, of which $75 would be chargeable to plowing. Other authorities estimate the cost of engine repairs per acre at from 6 to 10c, and data from those operators who reported on this point indicate the latter figure as close to the average. It may be, however, that their figures covered the cost of repairs chargeable to thrashing, and that an estimate of 10 cts. per acre for engine repairs would probably cover the cost of keeping the majority of engines in good condition for work. Plow repairs are estimated at from 75 cts. to $2 for each working day, including the expense of sharpening. The latter is much greater in the case of moldboard plows than with disk plows; hence, in estimating the cost of plowing, a larger figure per acre is allowed in the Northwest than in the Southwest.

In addition to expenses for repairs, labor, fuel, etc., from 2 to 5 cts. per acre must be allowed for various lubricants, including crude oil for traction gearings, engine and cylinder oil, grease, and hard oil.

Labor.—From three to six men are needed in operating a steam-plowing outfit. One guides, and a second usually fires the engine. One of these frequently looks after the plows. A third man and team supply the engine with water and fuel, and two men with teams are needed if supplies are to be hauled any great distance. Frequently one man gives his entire time to the plows, while a cook is needed in many cases. The engineer is naturally the best paid, receiving, according to correspondents, an average of $3.12 per day in the southwest group of States, $4.43 in the northwest group, and $4.30 in California. The guider's wage is more uniform, averaging $1.88. The plowman and teamsters are paid from $1.50 to $1.75 in most cases, the former having a slight advantage, while $1 is the common figure for the cook. In many cases it would be economy to pay much higher wages for the engineer, at least, as good management and efficient help tend to reduce delays through accidents or other causes. Board at 50 cts. a day for each man and 75 cts. for the use and board of each horse are usually to be added to wages in arriving at the labor cost. The majority of operators furnish board, many boarding but not paying the men on idle days In estimating the labor cost per acre in this bulletin no account has been taken of wages, board, and keep of teams on idle days, but this amount, if it could be ascertained, should be added to the total. It is doubtful whether, on the average, steam-plowing outfits are able to work more than two days out of three during the plowing season, owing to accidents, moving, bad weather, and other causes.

The average daily cost of fuel as gathered from operators, is given elsewhere under estimates of the cost of plowing. The quantity and cost per acre vary with the locality, the kind and cost of fuel, the acreage plowed per day, the condition of the soil, the construction of the engine, the efficiency of the operator, and perhaps other factors. Coal is most used in steam tractors, though wood is used to a limited extent, and straw in some sections. Crude oil is used extensively in California.

Water.—In steam plowing the quality and proximity of water are important factors. As the daily consumption ranges from 1,500 to 5,000 gals., the labor involved is considerable, and is much increased with the hauling distance. Muddy or alkali water, by depositing a sediment in the boiler reduces the evaporation per pound of coal consumed, necessitates frequent washing of the boiler, and causes rapid depreciation of the flues. Some boilers will evaporate a greater quantity of water per pound of fuel than others, thus producing steam more economically, but frequently the poor handling of an engine will cause the waste of a large quantity of water. From the averages shown in Table II it will be seen that the water used per pound of coal is 7.49 lbs. in the Southwest and 7.74 lbs. in the Northwest. In California it is approximately 9.4 gals. of water per gallon of oil.

PLOWING CAPACITY OF TRACTION OUTFITS.

Certain factors governing the average acreage plowed daily or yearly have already been mentioned. This acreage is the output of the plowing equipment and crew, and in great measure it represents the success of the venture. It is the product of distance traveled in plowing and the width of the cut of the plows. The latter is governed largely by the

TABLE II.—DATA IN REFERENCE TO STEAM PLOWING OUTFITS OPERATED IN CALIFORNIA, IN THE SOUTHWESTERN AND THE NORTHWESTERN SECTIONS OF THE UNITED STATES, AND IN CANADA.

Work accomplished, etc.	California.	Southwest.	Northwest.	Canada. 1.	Canada. 2.
Number reporting	11	[illegible]	[illegible]	[illegible]	[illegible]
Acres plowed annually for self	2,800	[illegible]	310	[illegible]	....
Acres plowed annually for others	689	589	348	628	....
Acres plowed annually, total	3,489	1,055	658	1,007	
Percentage of custom plowing	20	[illegible]	[illegible]	61	
Size of engine (horse power)*	110	[illegible]	[illegible]	29	[illegible]
Cost of engine	$5,500	$2,680	$2,505	$3,420	
Number of plows†	[illegible]		[illegible]	11	[illegible]
Width of furrow cut (feet)†	20.45	12.8	11.18	12.83	10.03
Cost of plows†	$506	$451	$657	$860	
Hours of work each day	10.6	11	11.44	12.31	
Miles covered each day‡	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acres covered each day	[illegible]	25.7	22.9	21.4	[illegible]
Days of plowing for the year	69	41	29	47	
Men employed	6	[illegible]	[illegible]	[illegible]	[illegible]
Horses used	[illegible]	[illegible]	4	[illegible]	[illegible]
Labor and board (by day)	[illegible]	$11	$14	$14	
Quantity of fuel used each day§	[illegible]	[illegible]	[illegible]	3,151	[illegible]
Quantity of fuel used for each acre§	0.14	98.4	126.6	147.4	150.4
Cost of fuel for each day	$7.28	$6.91	$8.71	$8.34	
Cost of fuel for each acre	[illegible]	[illegible]	[illegible]	[illegible]	
Quantity of water used each day**	[illegible]	[illegible]	[illegible]	72.8	57.1
Cost of oil, etc., for each day	$1.00	$0.57	$0.59	$0.87	....

*Brake horse power. Nominal or tractive rating about 60 horse power.

†Less than one-fifth of the outfits reported in the Southwest use moldboard plows. These average 9.18 bottoms, cutting 10.7 feet, and cost $561 each. From 10 to 20 disk plows would be used to cut the average of 13.2 feet reported. These sets average $428 in price. The figures in the table are for the average of both types.

‡"Miles a day" is miles traveled with plows in the ground as figured from the daily acreage and the average width of the furrow. The distances traveled in turning, etc., is not included.

§For California expressed in barrels of crude oil; elsewhere in pounds of coal.

**For California expressed in gallons, elsewhere in the United States in barrels of 31.5 gallons.

power of the engine and by the soil conditions, but the former is influenced by a multitude of circumstances. The reports from 220 operators indicate an average working day for steam outfits of 11.27 hours, and the various engines have speeds ranging from 2 to 3 miles an hour. The average cut of moldboard plows in the Northwest is ascertained to be 11.18 ft., and of disk plows in the Southwest 13.2 ft. At 2.5 miles an hour the theoretical daily capacity of moldboard plows would be about 38 acres, and of disks about 45 acres. The daily average for the Northwest, using moldboard plows almost exclusively, is approximately 22.9 acres, and for the Southwest, using disk plows principally, 25.7 acres; hence, the actual performance is much lower than the theoretical capacity of outfits. Much of this loss is unavoidable, due to slippage of traction wheels and to time spent in turning and in taking on supplies. In the latter operation alone the loss of time may easily reach 25 per cent. Observation of steam outfits in the field shows that the time spent in taking on supplies varies with the crew and amounts to from five to fifteen minutes out of each hour. The importance of getting the greatest service out of the equipment is not always appreciated, especially by hired crews.

The tendency frequently is to attempt to secure high acreage by running at a high speed or by overloading the engine. The latter evil is the more common, the temptation to add an extra plow or a load of harrows often being too strong to resist. The effects of exceeding the maximum durable speed or load are to be seen in increased wear and breakage, with consequent delay, which overcomes any advantage gained by crowding the outfit. The reports received from operators do not distinguish clearly as regards performance between sod breaking and stubble plowing. Taking the data as a whole, it is found that approximately two-thirds of all operators harrow, disk or roll on the ground while plowing. The percentage is higher in the Southwest than in the Northwest, and in most cases somewhat greater power is used for this extra work, owing to the wider cut of plows. Of steam outfits 54 per cent and 27 per cent of one make of gasoline outfits reporting from the Northwest do other work while plowing, and 10 per cent and 3 per cent, respectively, of the total cost shown elsewhere may be charged to this extra work, basing the division on proportionate power consumption. Practically all these outfits use moldboard plows. The average nominal or tractive horsepower used in pulling plows only is 2.23 per foot cut for steam engines and 2.69 for gasoline engines. Therefore, 2.6 hp. and 3.14 hp. nominal rating, are left, respectively, for each 14-in. plow bottom, after deducting the power used in pulling harrows, etc. In the Southwest 13 per cent of the power of the average steam outfit reported and 11 per cent of that of the average gasoline outfit reported are shown to be chargeable to work other than plowing. Of the steam outfits 70 per cent and of the gasoline outfits 80 per cent report extra work. After deducting the power thus consumed, 1.75 nominal horsepower per foot cut is expended by the steam outfits in pulling plows and 2.22 hp. by gasoline outfits. This is based on the average width of furrow cut by the disk-plow outfits, as shown in Table II. From 8 to 10 in. is the usual cut per disk. From this it would appear that two or more plows should be dropped if harrowing is done, depending on the draft of the extra load, and that 10 moldboard or 15 to 20 disk plows are a load for the average steam engine, while the type of gasoline engine mentioned can handle fewer plows than steam engines of equal nominal rating. From 30 to 50 per cent more acres can usually be covered each day in stubble plowing than in breaking virgin sod, and the coal consumption to the acre averages less, though probably not in the same ratio. Sod breaking is usually shallower, and the heavier draft is overcome somewhat by the increased efficiency of the engine on the firm footing afforded by the sod.

INCOME FROM TRACTION-PLOWING OUTFITS.

The apparent profit in steam plowing is so great as to encourage the reckless buying of equipment. From 30 to 40 acres is not an uncommon day's work and the mere running expense is often below $20. At prices ranging from $1.50 to $4 to the acre the daily income is apparently much in excess of operating expense, the factors of interest, depreciation, expense during idleness, and cost of moving often being overlooked. A study of the data given later as to the acreage plowed annually will show that, except in California, where holdings are much larger, the custom acreage is nearly or more than equal to the area plowed for the owner of the outfit. It follows, then, that even with all other factors favorable, financial success is doubtful where the custom rate is low.

The following table shows the range and average of custom prices, as reported by operators of both steam and gasoline outfits:

The lowest figures are usually for stubble plowing and the highest for breaking sod, but the rates charged by the same operator for the two kinds of work are not as far apart as the range indicated. In parts of Kansas a difference of only 25 cts an acre is made, and a difference of 50 cts is reported by more operators in both Plains sections than any other figure. A difference of $1 or more is, however, common in the Northwest. In some cases these prices cover both plowing and harrowing, while in others from 10 to 25 cts an acre are added for harrowing. The prices in the corn belt and in Kansas, Oklahoma, and Texas (the average being $1.50 in Kansas and $1.62 for the three States) are so low as to leave little or no margin to cover expenses during idleness and net a profit. With all other factors equal, a slight increase in the rate will often turn an unsuccessful venture into a profitable one.

AVERAGE RESULTS WITH STEAM-PLOWING OUTFITS.

In view of the extreme variation in conditions encountered by individual operators, any averages of results must be taken with due regard for local conditions. Table II presents a summary of the data taken from reports complete enough to give the desired information. These include results for a part of the season of 1908. For the purpose of comparison, two columns are shown for Canada. The first is from direct reports from operators. In the second column averages are taken from the annual traction-plowing numbers of "The Canadian Thresherman and Farmer," from 1905 to 1909, inclusive, and represent 214 letters of steam plowmen in answer to that journal's annual circular letters on this subject. A small percentage of the letters are duplicated; that is, they are from the same operator in different years, and several correspondents reporting under column 1 are also found under column 2. The average of coal used given in column 2 is from 150 operators, many using either wood or straw or not reporting at all. Those using wood report about 2 cords a day as an average. The average number of barrels of water used by Canadian operators apparently varies greatly. However, a difference in standards may explain the variation. If the 72.8 barrels in column 1 were of 31.5 imperial gallons of 10 lbs. each and the 57.1 barrels in column 2 were of 42 imperial gallons, the water used per pound of coal would be 7.21 and 7.82 lbs., respectively. It is difficult otherwise to account for such a wide variation.

The data for 1907 and 1908 under column 2 are much nearer the figures contained in first-hand reports from the Northwest and Canada, as is to be expected in view of the time covered by the latter. For these two years the averages of data contained in 118 letters show the size of the engine to be 27.7 hp.; number of plows, 9.09; width of furrow, 10.6 ft.; miles a day, 16.75; acres a day, 21.52; number of men, 4.53; number of horses, 3.57; quantity of coal a day, 3,245 lbs.; quantity of coal for each acre, 150.8 lbs.

COST OF PLOWING WITH STEAM ENGINES.

Table III the acre cost of plowing is based on the data in Table I. A considerable number of other operators were interviewed, but principally with regard to points not covered in the circular letters, their experience and results being on a par with those of the correspondents. It was found impracticable to separate the cost of harrowing in each report; hence, the corrected total for plowing alone is based on the percentages given under the discussion of acreage plowed.

The cost of men and teams on off days and of moving from place to place between jobs

TABLE I.—PRICES CHARGED FOR TRACTION PLOWING IN FIFTEEN STATES AND IN CANADA.

Location of outfits.	Number of operators reporting.	Prices charged for plowing. Lowest.	Prices charged for plowing. Highest.	Prices charged for plowing. Average.
North Dakota, South Dakota, Minnesota, and Montana	73	$1.25	$4.00	$2.99
Nebraska, Colorado, Kansas, Oklahoma, Texas, and New Mexico	116	[illegible]	3.50	1.88
Indiana, Illinois, Iowa, and Missouri	6	1.00	2.00	1.44
California	12	1.25	1.60	1.32
Canada	23	1.75	5.00	3.66

TABLE III.—ACRE COST OF STEAM PLOWING (INCLUDING HARROWING, ETC.) IN CALIFORNIA, IN THE SOUTHWESTERN AND THE NORTHWESTERN SECTIONS OF THE UNITED STATES, AND IN CANADA.

Details of cost.	California.	Southwest.	Northwest.	Canada.
Interest on engine	$0.069	$0.098	$0.143	$0.131
Depreciation on engine	.158	.254	.381	.34
Repairs on engine	.08	.10	.10	.10
Interest on plows	.009	.024	.056	.048
Depreciation on plows	.015	.043	.10	.035
Repairs on plows	.02	.035	.066	.07
Interest and depreciation on miscellaneous equipment	.012	.037	.059	.039
Labor and board	.326	.428	.611	.654
Fuel	.144	.269	.38	.39
Oil, grease, etc	.02	.022	.026	.041
Total	$0.853	$1.31	$1.922	$1.898
Corrected total	...	$1.14	$1.73	...

must be added to the cost per acre of plowing. This will frequently more than offset the correction for harrowing the cost for each day of idleness being higher, of course, with steam than with gasoline outfits. The days of idleness are more frequent, possibly one in three, adding 10 to 15 cts per acre to the cost given. Since both breaking and stubble plowing are included, and in unknown proportions, no satisfactory statement can be made as to the relative cost of each. However, the daily running expenses are not essentially different; hence the relative cost is probably in inverse proportion to the daily acreage.

COMPARATIVE RESULTS WITH STEAM ENGINES OF DIFFERENT SIZES.

Table IV shows fairly well what may be expected of steam engines of the small, medium, and large sizes generally used for plowing. Extremes are not represented. It will be noted that in the Southwest the medium-sized engines seem to be the most popular, and those of the largest size in the Northwest, while few small engines are used in either section. With the exception of the quantity of coal per acre in the case of small engines in the Northwest, the averages show the results that might be expected from the size of the engine, and in this case the number of operators is so small as to render the figures of little value. The number of men and horses evidently is not in proportion to the size of the engine. In both sections the small engines apparently travel more miles a day than the larger ones, this figure, as before, being calculated from the acreage plowed and the width of furrow. The figures as to horsepower per foot cut and the reciprocal "feet cut per horsepower" are quite significant, indicating that the larger engines furnish greater power per unit of nominal rating than the smaller. A comparison of sections on this point shows that from 20 to 25 per cent more power per foot of width is required in the Northwest than in the Southwest. The wider use of disk plows will account for a large part of this difference.

TABLE IV. COMPARISON OF VARIOUS SIZES OF STEAM PLOWING ENGINES USED IN THE SOUTHWESTERN AND THE NORTHWESTERN SECTIONS OF THE UNITED STATES AND IN CANADA.

	Southwest.			Northwest and Canada.		
Details for steam outfits.	18, 20 and 22 horse-power.	25 horse-power.	30, 32 and 35 horse-power.	18, 20 and 22 horse-power.	25 horse-power.	30, 32 and 35 horse-power.
Number of outfits	10	42	22	5	21	41
Average size of engine	20.2	25	31.95	20.4	25	31.9
Width of furrow (feet)	9.15	12.25	16.67	7.5	10.23	13.2
Width of furrow (inches)	109.8	147	192	90	122.8	158.4
Men employed	3.6	3.43	3.76	3.8	3.95	4.39
Horses used	3.4	3.05	3.3	2.6	2.95	3.8
Acres covered each day	20.5	23.2	33.4	16.8	19.6	25.2
Miles covered each day	18.5	15.6	16.5	18.5	15.8	15.8
Horsepower per foot cut	2.21	2.04	1.92	2.72	2.44	2.42
Feet cut per horsepower	.452	.49	.521	.368	.409	.413
Pounds of coal used each day	2,350	2,457	3,218	1,780	2,552	3,100
Pounds of coal used for each acre	114.6	105.9	96.3	106	130.2	123.0

CABLE SYSTEM OF STEAM PLOWING.

In England, Germany, and other countries a common type of steam plowing involves the use of plows or other implements drawn by cables. A number of these outfits, all of foreign make, are used in various parts of the West, principally in California, and there chiefly on large sugar-beet ranches. So far as known, all of these outfits are of the double-engine type, a traction engine being located during operation at either side of the field. Steel cables, 80 to 100 rods long, attached to the implement, are wound on drums mounted beneath the engine boilers, the engines pulling alternately. In this way the entire power of the engines is available for work, none being used in moving their own weight across the fields. The engines advance alternately the width of the furrow, moving in parallel directions at right angles to the furrow. In many cases permanent roads along the sides of the fields insure a firm footing for the traction wheels. Balance plows are used, i. e., right and left hand moldboard plows are mounted in gangs facing a pair of large wheels. In plowing, the implement is not reversed, the forward gang being tilted out of the ground on one trip and plowing on the return. Frames to which harrows, rollers, etc., may be attached, cultivators, beet plows, and other implements for cultivation are a part of the equipment, and usually all tillage operations connected with the beet crop are accomplished without the use of animals.

Plowing is done at a depth of 12 to 14 in. for sugar beets, and in heavy adobe soil from 10 to 20 acres are covered per day. Light cultivation is done at a depth of 7 to 9 in. and deep tillage at from 14 to 16 in., the cultivators being 16 ft. and 10 ft. in width, respectively. Cultivating is done at the rate of 25 to 35 acres and harrowing at the rate of 50 acres a day. A special implement, lifting 6 rows of beets at a depth of 12 to 16 in. is used in harvesting, and from 15 to 25 acres are covered in a day when necessary. No time is lost in taking supplies, as the engines are stationary, and little time is wasted at the ends of the furrows, one engine being ready to start pulling as soon as the other finishes.

From five to eight men are used in plowing, including a foreman, two engineers, one or two teamsters, two plowmen, and a cook. From 6 to 8 barrels of crude oil daily supply both engines. The expenses, not including interest and depreciation, are about $30 a day, or from $2 to $3 an acre. In comparing this with the cost of operating direct traction outfits, the great difference in depth of plowing must be kept in mind. Interest and depreciation charges are heavy, though the outfits are in use the greater part of the year. The investment for each outfit, including freight and duty, is from $25,000 to $30,000. The cables, which cost from $600 to $900 each, last from six to eighteen months in continuous use, and bad water destroys flues in from six to twelve months; otherwise the outfits are capable of long service.

In view of the heavy initial and operating cost, the use of this equipment is restricted to large enterprises. One ranch in California uses five sets of tackle in handling 10,000 acres of sugar beets, using horses only in seeding and hauling. Each outfit is said to replace 120 horses and the necessary drivers. Another outfit, operating eleven months in the year, handles 1,300 acres of beets. Others are to be found in large vineyards, while a large number are used in sugar-cane culture in Hawaii. While these outfits are not suitable for use on a small scale it would seem that a modification, embodying numerous advantages and adapted to more general use, might be produced in the United States and sold at a price within the reach of small operators.

INTERNAL-COMBUSTION ENGINES.

Internal-combustion engines, represented by gasoline and kerosene motors, are usually of smaller size than the steam engines used for plowing. They range from 12 to 40 hp. nominal rating, and from 19 to 80 hp. brake rating. As before explained, the nominal rating is supposed to denote the equivalent of the work of the number of horses specified which is performed by the engine, while the brake rating indicates the power of the engine for belt work. In size internal-combustion engines range from a weight of a little more than 2 tons to 17 or 18 tons, although the majority in use are between 5 and 10 tons. As a rule, they are rated higher in proportion to actual brake horsepower than are steam engines, but have a higher tractive efficiency than the latter; that is, deliver a larger proportion of the total power in effective pull. The same confusion as to rating prevails and, owing to the differences in the practice of various manufacturers, gasoline engines are frequently expected to do more than their actual horsepower warrants. In price these motors are usually more expensive per brake horsepower than steam engines, the types most used ranging in cost from $1,300 to $2,500 delivered free in territory within reasonable distance from the factories.

Gasoline engines, using this term to designate all of the oil-burning internal-combustion class, present a great variation in type, having so recently been developed as to lack the standardization possessed by steam traction engines. The four-cycle motor is universally used. Most of the smaller tractors are of the single-cylinder type, which is the most economical of fuel but not so steady in running as multiple-cylinder types, on account of the longer interval between power strokes. On account of the limitations to the size of cylinders this type must necessarily continue to be made in small units, the more powerful tractors now on the market using two, three or four cylinders. These may be either vertical or horizontal, and if horizontal either "twin" or "opposed," i. e., either side by side or in line on opposite sides of the crank shaft. The larger the number of cylinders the more complicated the motor, but usually the more smooth running, owing to the more nearly continuous succession of power strokes. Two opposed pistons in a single cylinder are used on one type. The variation in engine speed is considerable, ranging from 220 to 1,600 revolutions a minute, but as a rule not over 550 revolutions are made at normal speed. Differences in the method of governing, ignition, reversing, and cooling are notable, the latter including air, water, oil, and steam cooling devices. Practically all tractors are gear driven, but great variation as to the height and width of traction wheels is found.

A few types are equipped for burning either gasoline, kerosene, or distillate (low-grade kerosene), although no motor has as yet been developed which will handle the different fuels equally well under all conditions. Distillate is largely used on the Pacific coast, but is not easily obtainable in other sections. Kerosene is used to a great extent in at least one of the leading plowing tractors. Both kerosene and distillate ar cheaper by the gallon than gasoline, and reports from correspondents indicate that the fuel cost per acre is less also. Alcohol is not as yet a commercially important fuel for traction engines. Opinion as to the relative merits of kerosene and gasoline is divided. The former may be used successfully where the engine is operating under a full and rather constant load, as in plowing, but owing to its heterogeneous composition it does not give such perfect combustion under varying conditions as does gasoline. As a rule, from 1 to 2 gallons of the latter are used per day for starting and warming up the kerosene motors; hence its use is seldom entirely dispensed with. The rapid development of internal-combustion engines for marine, automobile, traction, and stationary purposes has increased the demand for gasoline and the rate of exhaustion of the supply, so that it seems only a question of time when the less volatile oils will of necessity be used extensively in tractors. For the present, however, gasoline remains the standard fuel and the majority of new tractors are being designed primarily with a view to its use.

COST OF PLOWING WITH GASOLINE ENGINES.

As is the case with steam engines, the practice of using gasoline motors for plowing is so new that satisfactory figures regarding life, repairs, etc., are not to be had. It follows, therefore, that figures on the cost of plowing are not conclusive except as regards the expenses which may be designated as current. The first successful gasoline tractors were put on the market about 1903, and comparatively few have been out long enough for operators to become thoroughly familiar with what may be expected of them, yet the figures given in the following pages may be taken as indicative of their practicability.

With regard to the factors of interest and depreciation the same general points will apply to gasoline as to steam engines. It is doubtful whether the comparative wear in plowing and thrashing will be in the same proportion as with steam engines, as the gasoline engines are less likely to be overloaded in plowing. Gasoline engines when first developed were stationary and could be rated on the same basis as stationary steam engines or in comparison with horses on a small horsepower. Later on, some of these same engines were mounted on traction trucks and given the same rating as before. This naturally confused purchasers, who expected these engines to draw the same load as steam engines of equal rating. Serious disappointment to the users and damage to the tractors were the result. A few makes of gasoline tractors were given a nominal rating, based on the number of horses which they would equal in effective pull, though the various manufacturers took different bases for their ratings. Operators soon found that gasoline tractors could not be forced beyond the maximum of power developed at the time of explosion, and were not to be relied upon for getting out of serious difficulty when already pulling a full load. On this account it is probable that gasoline engines as a whole pull loads more suited to their normal and durable power than do steam engines. On the other hand, owing to the smaller margin of brake horsepower over and above the nominal rating, they are more likely to be crowded to their limit in running separators or other machines driven by belt power. A leading manufacturer of gasoline engines estimates the wear and tear at 70 and 30 per cent, respectively, for plowing and thrashing, when given equal length of service. Other authorities who have given thought to this point are of the opinion that, with the exception of such makes as have a low nominal rating in proportion to actual horsepower, gasoline engines as a class will be worn almost equally by plowing and thrashing. Taking the whole class of gasoline tractors, it is probable that a division of wear and tear and interest on the basis of 60 and 40 per cent for the two operations will be as accurate as can be assumed at this time.

The life of gasoline tractors will at present depend very largely upon the make, owing to the large number of experimental machines which are being offered. However, since the data contained in this bulletin are taken only from those makes of tractors which have demonstrated for several seasons their practicability in the hands of a number of operators, the assumptions made in connection with the life and service of steam engines may be repeated here and the same rate of interest and depreciation taken. Estimates from a number of operators of the internal-combustion tractor now in most common use place the life of the outfit at ten years, and although this is probably in excess of the actual service the exact figures can not be determined, as practically none of the standard outfits have been abandoned on account of wearing out.

TABLE V.—DATA IN REFERENCE TO GASOLINE PLOWING OUTFITS OPERATED IN THE SOUTHWESTERN AND THE NORTHWESTERN SECTIONS OF THE UNITED STATES AND IN CANADA.

Work accomplished, etc.	Southwest.	Northwest.	Canada	All outfits *
Number of outfits	10	11	11	26
Acres plowed annually for self	479	335	..	399
Acres plowed annually for others	362	300		316
Acres plowed annually, total	841	635	....	715
Percentage of custom plowing	43	47	....	44
Size of engine (horsepower)	22	22	22	22
Cost of engine	$2,254	$2,300	....	$2,300
Number of plows used†	12	6.77	7	....
Width of furrow cut (feet)†	8.83	7.9	7.93	8.18
Cost of plows	$347	$244	....	$294
Hours of work each day	10.1	10.55	....	10.23
Miles covered each day	17	18.25	16.8	17
Acres covered each day	17.4	17.5	16.1	16.94
Days of plowing for the year	48	36	....	42
Men employed‡	2	2	2	2
Labor and board (by day)‡	$7	$7	....	$7
Quantity of fuel used each day (gals.)	53.6	49.4	§50	49.2
Quantity fuel used each acre (gals.)	3.08	2.8	§3.1	2.9
Cost of fuel for each day	$5.26	$7.31	..	$6.27
Cost of fuel for each acre	$0.302	$0.418	....	$0.37
Cost of fuel (gallon)	$0.098	$0.147	....	$0.1275
Cost of oil for each day	$0.505	$0.462	....	$0.487

*Data from correspondents only, including several scattered outside of the two principal sections.

†The figures for the Northwest are for moldboard plows and for the Southwest for disk plows; the average of all outfits includes both.

‡Two men were reported in all but a few cases, and this number was recommended as a most satisfactory crew. No horses are included, as the reports indicate their use for only a few hours each week, if at all.

§United States gallons.

Repairs to engines are estimated at 10 cts. an acre and $100 a year, respectively, by two officials of the company making the tractor just mentioned, these amounts being deemed ample to keep all parts in perfect order and recommended as being economical expenditures on the part of the purchaser. The former figure supports the estimates of several correspondents and may in this case be fairly assumed as correct. The plows used are of the same type as those employed with steam engines, though of course fewer in number, and the plow repairs will be proportionately less. The cost of miscellaneous equipment will usually be covered by $100, as provision must be made for but two men and the transportation of a comparatively small quantity of fuel and water.

TABLE VI.—ACRE COST OF PLOWING WITH GASOLINE ENGINES (INCLUDING SOME HARROWING) IN THE SOUTHWESTERN AND THE NORTHWESTERN SECTIONS OF THE UNITED STATES.

Details of cost.	Southwest.	Northwest.	All outfits.
Interest on engine	$0.103	$0.139	$0.124
Depreciation on engine	.214	.29	.257
Repairs on engine	.10	.10	.10
Interest on plows	.023	.022	.023
Depreciation on plows	.041	.038	.041
Repairs on plows	.034	.057	.041
Interest and depreciation on miscellaneous equipment	.009	.012	.011
Labor and board	.402	.40	.413
Fuel, usually kerosene	.302	.418	.370
Oil, etc	.029	.026	.029
Total	$1.257	$1.502	$1.409

The labor, cost of operating gasoline outfits is usually limited to the wages and keep of two men, one for the engine and one for the plows. This is true regardless of the size or make of the tractor. Horses are used but a few hours a week, if at all. In many sections gasoline is delivered in the field by the dealer, horses thus being dispensed with entirely. Licensed engineers are not usually required with gasoline outfits, and consequently the labor rate is usually lower than with steam outfits. The cost of maintenance is of course less, and $7 a day for the wages and board of the two men required will probably cover all but a very few cases. The figure allowed for labor includes the wages of a first-class engineer, as, notwithstanding the simplicity of gasoline engines, skilled labor is as essential to the best results as with steam engines. Board is allowed at the rate of $1 per day, and a small charge for the occasional use of a team may easily be covered by the figure given for labor cost. The other items of cost as figured from the reports of twenty-six correspondents using one of the leading plowing tractors are given in the following table of averages. The column headed "Canada" includes reports from eleven Canadian operators of this same tractor, published by "The Canadian Thresherman and Farmer" in its annual plowing numbers from 1905 to 1909, inclusive.

The following table, showing in detail the estimated cost of plowing with gasoline tractors, is based upon the foregoing averages and assumptions and should be analyzed rather than taken as a whole. Harrowing or similar work is included in 27 per cent of the cases in the Northwest and in 80 per cent in the Southwest.

As in the case of steam outfits, a portion of this average cost, based on the horsepower estimated to have been consumed, is chargeable to harrowing and other operations. This is ascertained to be 3 per cent in the Northwest and 11 per cent in the Southwest; consequently, the corrected acre cost of plowing only should be $1,457 and $1,119, respectively. However, no charge for the labor and cost of moving has been included, nor for labor on days when owing to bad weather or breakage no plowing was done. In most cases the crew of two men of a gasoline outfit

TABLE VII.—COMPARATIVE PERFORMANCE OF GASOLINE TRACTORS IN BREAKING AND PLOWING IN THE NORTHWESTERN SECTION OF THE UNITED STATES

	Two cylinder, 22 horsepower.*			Four cylinder, [illegible] horsepower.†		[illegible] horsepower.‡	
Details of cost, etc.	Breaking.	Plowing.	Mean.	Breaking.	Plowing.	Breaking.	Plowing.
Gallons of fuel used each day	51	51	51	45.1	[illegible]	[illegible]	[illegible]
Gallons of fuel used for each acre	3.32	2.26	2.79	3.42	[illegible]	[illegible]	[illegible]
Average price of fuel (gallon)	$0.151	$0.141	$0.146	$0.16	$0.16	$0.16	[illegible]
Cost of fuel for each day	$7.72	$7.20	$7.46	$7.24	$6.87	$3.87	$4.28
Cost of fuel for each acre	$0.512	$0.318	$0.415	$0.548	[illegible]	[illegible]	[illegible]
Cost of labor for each day	$7	$7	$7	$7	[illegible]	[illegible]	[illegible]
Cost of labor for each acre	$0.465	$0.31	$0.388	[illegible]	[illegible]	[illegible]	[illegible]
Cost of labor and fuel for each acre	$0.977	$0.628	$0.803	[illegible]	[illegible]	[illegible]	[illegible]
Cost of oil for each acre	..	..	..	$0.06	$0.043	..	..
Number of plows used	..	..	..	5.63	8.1	4.25	6
Width of furrow cut (feet)	6.52	10.14	8.33	6.57	9.45	4.96	7
Horsepower per foot cut	[illegible]	2.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acres covered each day	[illegible]	22.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miles covered each day	[illegible]	18.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Number of reports received, 9. †Number of reports received, [illegible]. ‡Number of reports received, 10.

could more easily find employment elsewhere during unfavorable weather than the larger crew of a steam outfit, and, as has been pointed out, fewer idle days from this cause are the rule, owing to the lighter weight of the engine. Perhaps one day in four would be a fair estimate of time lost from all causes. If the expenses of a 5-mile move, together with the board and a half day's wages of the two men, are allowed on each idle day, the extra expense to be borne by each day of productive labor would be from $1.75 to $2 or from 10 to 13 cts. an acre, thus offsetting the reduction for harrowing.

Table VII includes data furnished by operators in the Northwest on three types of gasoline tractors, distinguishing between breaking sod and plowing stubble as regards fuel consumption and acreage per day. In the case of the two-cylinder tractor the mean between breaking and plowing is given for the purpose of comparison with the figures presented in Table V.

The two-cylinder tractor is frequently operated with kerosene, and hence shows a lower average price per gallon of fuel. Labor is assumed at the rate of $7 a day, although this is in excess of the average reported by the majority of operators. It will be noted that the acreage in plowing is 150, 142, and 130 per cent, respectively, of that in breaking, while miles a day and the daily consumption of fuel are practically the same. The labor cost would remain the same for both kinds of work, and since the engine is usually loaded approximately the same in either case the daily figures for interest and for wear and tear would remain stationary. The variation in plow cost is so slight that for practical purposes the comparative cost of breaking and plowing can be considered as in inverse ratio to the width of furrow cut. Taking 1.4 as the ratio between the acreage in plowing and that in breaking, and assuming the daily expense to be the same in both cases, the figures shown in Table VI would indicate that without harrows attached the outfits in the Northwest break prairie at a cost of $1.70 an acre and plow in stubble at $1.214, while those in the Southwest accomplish the work at rates of $1.466 and $1.05 an acre, respectively.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association.—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Railway Engineering and Main-
American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H. Warder, Monadnock Block, Chicago, Ill.

PERSONALS.

Wm. Davis, a retired contractor, of Chicago, died Aug. 17 at Lake Harbor, Mich., aged 71 years.

Mr. E. A. Kemmler, Supervising Engineer, of Muskogee, Okla., has resigned to resume private practice at Columbus, O.

George H. Breymann, senior member of the Breymann Dredge Co. of Toledo, O., was killed Aug. 16 in an automobile accident near Toledo.

Robert Telling of Chicago, Superintendent for Koeffer & Co., contractors, was killed Aug. 17 at Edwardsville, Ill., by a falling derrick. He was building a concrete arch over the Clover Leaf.

Mr. C. E. Brinser, heretofore Supervisor of the Pennsylvania R. R., has been appointed Division Engineer of the New York, Philadelphia & Norfolk, with office at Cape Charles, Va.

Mr. I. Paul Jones has resigned his position with the U. S. Reclamation Service, at North Yakima, Wash., and will enter the service of the Sacramento Valley Irrigation Co., at Willows, Cal.

Mr. W. A. Beerbower, heretofore Engineer Maintenance of Way of the Denver, Northwestern & Pacific at Denver, Colo., has been appointed General Superintendent, in charge of the operating, engineering and maintenance departments.

Mr. Herbert R. Abrams has been appointed Superintendent of Street Construction for the city of St. Louis, Mo. Mr. Alden Chase succeeds Mr. Abrams as District Engineer and Mr. Edward F. Sobelewski succeeds Mr. Chase as Assistant Engineer.

Mr. W. S. Kinnear, Assistant General Manager of the Michigan Central, has accepted the Presidency of the Kansas City Terminal Railway Co. and will have charge of the construction of the extensive terminal which that company will build at Kansas City, Mo.

Mr. Flint F. McGregor, Chief Engineer in the maintenance of way department of the Houston Electric Co., has resigned that position and will on Sept. 1 leave Houston to assist his father, Dr. J. D. McGregor, in conducting the McGregor plantation in Washington county, Texas.

Mr. F. Lavis, M. Am. Soc. C. E., has been appointed General Manager of the Dominion Construction Co., general railroad contractors, New York City. He will still retain his interest in the firm of Guerber, Lavis & Co., acting in an advisory capacity in matters relating to railroad location and construction.

Mr. J. H. Linnard, Naval Constructor, for years senior officer in the Bureau of Construction and Repair of the navy, at his own request has been placed on the retired list by the direction of the President. The retirement is under the 30-Year Service law, which allows retirement with pay. He entered the naval service in 1877, being appointed from Pennsylvania.

Ernest K. Richardson, Superintendent of Construction in the office of the Supervising Architects, Washington, D. C., died Aug. 17 at Kansas City, Mo. Mr. Richardson went to Kansas City, Mo., two months ago from Washington, D. C., to supervise the construction of the new federal building at Independence, Mo., and the additions to the one in Kansas City, Kas. He was 26 years old and his home was in Covington, Va.

Mr. George W. Nock of New York, chairman of the Board of Directors and Chief Engineer of the San Antonio, Rio Grande & Tampico R. R., has resigned. It is announced that Mr. Nock is promoting the railroad from Poteet on the Artesion Belt to Pleasanton, Atascosa County. This road will ultimately be extended to the Crowther oil fields in Duval County. The San Antonio, Rio Grande & Tampico R. R. is now building south from San Antonio to the Rio Grande.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Garbage Destructors.—Morse-Boulger Destructor Co., New York. Folder, 3½x8½ ins.; 6 pp.

This circular illustrates and describes particularly the smaller sizes of garbage destructors made for hospitals, hotels and institutions of various sorts. Mention is also made of large city plants such as are represented by the municipal destructors at Boston and at Buffalo, N. Y.

"New Ingersoll" Coil Punches.—Ingersoll-Rand Co., New York, N. Y.

The "New Ingersoll" pick machine or puncher, operated by compressed air, does the work of six to fifteen skilled pick miners in undercutting. Its greatest field is in horizontal seams. But it is also adapted for undercutting in pitching seams, the angle of which does not exceed ten, or occasionally fifteen, degrees from the horizontal.

Modern Coal and Ore Handling Machinery.—The Brown Hoisting Machinery Co., Cleveland Ohio. Paper 11x8 ins.; 64 pp.

This is a book of very handsome illustrations, one to a page, of coal and ore handling plants which have been installed by the company named. The text is confined to captions explaining the illustrations. As a pictorial index of the work of the company named this collection of views is forceful.

Belts, Hose and Engineering Hardware.—W. D. Allen Mfg. Co., Chicago, Ill. Cloth 6½x10 ins.; 638 pp.

This is a general catalog and price list of a numerous line of goods, supplies and tools for plumbers, gardeners, machinists, contractors and power plant operators. Particular mention may be made of the firm's line of leather and endless belting and tools for installing and repairing belts. The line of heavy, wide and long leather belts which is tested is a notable one. This catalog should be had by buyers of the classes of supplies named.

What Concrete Will Do.—The Lawrence Cement Co., New York, N. Y. Paper, 6x9 ins.; 194 pp.

This is a handsome and a notably useful book for the homeuser of concrete. In order it describes and illustrates methods of mixing concrete and constructing forms and the building of walls, floors, stables, silos, fences and a score of smaller structures required about the home and on the farm. The text is well written and practical and the illustrations are excellent; both the amateur and the professional concrete worker will find a copy useful to have.

Five miles and a half of the Panama Canal at the Atlantic entrance will be opened to navigation for the sand and rock fleet of the Atlantic division this week. Tugs with barges in tow from the quarry and crusher at Porto Bello and from the sand pits at Nombre de Dios, which now enter the French canal at Cristobal, will enter it at Mindi, and from that point continue, as heretofore, through the old channel to Gatun. The part of the new canal to be used is not completed, but a channel more than 15 feet deep at the shallowest point and 100 feet wide at the narrowest point has been made and the dredges are constantly broadening and deepening it to the full width of 500 ft. and the full depth of 45 feet. Five miles of the canal at the Pacific entrance are in use by vessels of all kinds, and the 5½ miles at the Atlantic entrance now to be used for construction purposes will make 10½ miles already actually useful.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

The general assembly of Louisiana has passed the bill submitting to the voters of the state a bond issue of $6,500,000 for a Panama exhibition to be held at New Orleans in 1915.—According to the Canal Record of Aug. 10, a new estimate of the amount of material yet to be removed in the construction of the Panama shows an increase over the estimate of December, 1908, of 7,871,172 cu. yds. The estimate of December, 1908, was 174,666,594 cu. yds. and the revised estimate of July 1, 1910, is 182,537,766. The increase is principally to allow for slides in the culebra cut, for silting in the Chagres section, and for lowering the bottom of the canal from 40 to 39 ft. above sea level in the Chagres section.—About 5½ miles of the Panama canal at the Atlantic entrance were opened to navigation last week for the sand and rock fleet of the Atlantic division.—The first construction work on the new $6,000,000 flood protection work for East St. Louis, Ill., was started last week. The first work called for the diversion of Cohokia creek and is being done by the S. H. R. Robinson & Son Constructing Co., St. Louis, Mo., at a contract price of $259,152.—The first definite steps for an improved outer harbor for Chicago, Ill., were taken last week when the trustees of the sanitary district of Chicago directed their chief engineer, George M. Wisner, to prepare plans and estimates of the cost of such work.—J. G. White & Co., Inc., New York City, have been awarded the contract for the complete engineering and construction of a large hydro-electric power plant on the Ocoll river in Polk county, Tennessee, for the Eastern Tennessee Power Co. The estimated cost of the work is $2,000,000.—The Department of Railways and Canals of the Canadian government has extended the time for receiving bids for the construction of the superstructure of the Quebec bridges from Sept. 1 to Oct. 1.—The grand total of excavation on the Panama canal during July was 2,406,288 cu. yds., of which 2,371,583 cu. yds. were charged to canal excavation. The dry excavation amounted to 1,466,014 cu. yds., principally steam shovel work. The dredges removed 940,274 cu. yds., in addition to the amount pumped into Gatun dam by suction dredges.—The International Railway Congress, which recently closed its eighth session at Berne, Switzerland, has voted to hold its next meeting, which will come in 1915, at Berlin.—The first contract in connection with the construction of the Engle dam by the U. S. irrigation service has been awarded. This contract called for the construction of a branch railway, about 10 miles long, to the site of the dam near Elephant Butter, N. Mex.—The past week has seen the letting of a considerable number of railroad construction contracts. Among them may be noted the following: Hodges-Downey Construction Co., Birmingham, Ala., for filling in six trestles between McGehee and Ferguson, Ark., for the M. H. & L. R. R. (Missouri Pacific system), the contract including about 600,000 cu. yds. of earth excavation; J. J. Baxter, Jackson, Miss., for filling in two trestles on the Illinois Central R. R. between Corinth and Haleyville, the work consisting of 140,000 cu. yds. of steam shovel work and about 50,000 cu. yds. of team work: L. J. Smith Construction Co., Kansas City, Mo., for several new ballasting contracts in Eastern Kansas for the Missouri Pacific R. R.; H. Dalhoff, Little Rock, Ark., for constructing the Stuttgart & Rice Belt R. R., a 22-mile line to extend from Mesa to Stuttgart, Ark.; the Northwestern Engineering & Constructing Co., Milwaukee, Wis., for construting the proposed interurban line of the Sterling-Moline Traction Co., which is to connect the two Illinois cities named in its title; George B. Brady, El Paso, Tex., at $51,280 for construction of roadbed for 10-mile railroad to the Engle Dam site near Elephant, Butte, N. Mex., for the U. S. Reclamation Service; Mulvill Bros., Alton, Ill., for constructing the electric railway, of the Alton, Jacksonville & Peoria Ry Co., from Alton to Jacksonville, 18 miles, the contract including 250,000 cu. yds. of earth excavation; the Dominion Construction Co., 165 Broadway, New York, for the construction of the cut-off of the Boston & Maine R. R., at New Durham, N. H.; T. W. Kirkbride, Inc., 16 Campbell Ave., Roanoke, Va., for constructing five miles of grade and masonry for the Elk River & Little Kanawka R. R., from Gassaway, W. Va.; the Dominion Construction Co., 165 Broadway, New York City, for the construction of a double track tunnel and approaches near Canaan, N. Y., for the Boston & Albany R. R.

Pablo Trevino.

To those writers of stories of the West, who, judging from their present output, are running somewhat shy of material, we recommend this true account of the happenings that led to the death of Pablo Trevino, a Mexican construction foreman. For the past ten years Pablo has been engaged on construction work in all parts of Texas and even up in Louisiana. During all this time he had been working for the same contractor, an American, and between the two a strong friendship existed. Pablo was a hard and faithful worker; he was a man who had been tried many times and had never been found lacking. A few months ago an American was killed on the Mexican border, under particularly tragic circumstances. The murderer was supposed to be a Mexican named Jacinto Trevino, a cousin of Pablo. Naturally the Americans were aroused and they made many attempts to bring the murderer to justice. Pablo's employer took a prominent part in these attempts and as a result he received a letter, supposedly from Jacinto, warning him that he was to be killed for the part he had played. Pablo, not knowing of the letter—also warned the contractor, and offered to cross the river into Mexico and "get" Jacinto, in order to save the contractor from possibly being shot from ambush. The contractor would not consent to this, but told Pablo that there was a reward of $750 for Jacinto and that he (the contractor) would pay this if Jacinto were delivered unharmed on the Texas side of the line. Pablo said that he would bring Jacinto over, but that he did not want the reward; that he would not betray his relative for money; his reason for the attempt as stated by the contractor being "that he simply was a better friend to me and wished to turn Jacinto over to justice that I might avoid being killed by him." The contractor instructed Jacinto to do absolutely nothing without his first approving of it. Early this month the contractor went to the north on a business trip. Jacinto did not know of his departure, and on finding it out, it seems, he was much disappointed, and then for the first time, becoming impatient, he disobeyed his orders, and made the attempt which resulted in the encounter near the Rio Grande river, between Texas Rangers and Mexicans, in which Pablo and a ranger were killed and two rangers were wounded. In speaking of the affair the contractor paid the following tribute to his friend: "I simply want the world to know that poor Pablo, whose lips are now sealed in death, and who can not now talk for himself, was sincere in his efforts to do me good and was a 'true blue' friend, one that had been before put to the test and found faithful. If his instructions had been fulfilled no disastrous affair would probably have occurred and we would undoubtedly at this time be free of a desperado that has caused more than unpleasant happenings."

Employers' Liability Laws in New York.

Two employers' liability laws will go into effect in New York State next month. One of these—the employers' liability law passed by the state legislature on May 24 last—makes the master responsible only for negligence of the superior servant. While it takes from the master the right to plead assumption of risk it allows him to fall back on contributory negligence provided he proves his plea. The law calls for preliminary consent in writing by both parties, and such consent is final and binding unless the master has violated state safety ordinances or has been guilty of gross misconduct. The other law—the employers' compensation act, passed June 25 last—is of particular interest to contractors, as it is mandatory as to the compensation plan for employers of workmen in certain extra hazardous occupations, such as the constructon of tunnels and subways, the erection of structures involving iron and steel framework, and work requiring dangerous proximity to gun powder. The plan is optional with the workmen, but the consent is automatic with the acceptance of any pecuniary benefits. The act does away with the common law doctrine that the workmen assume the risks incident to a hazardous employment. It provides that the employee is entitled to compensation in case of personal injury due to the "necessary risk or danger of the employment of one inherent in the nature thereof" or when the employer or any of his agents or employees has failed to exercise due care or to comply with laws affecting the industry. In cases where the accident is due in whole or in part to the serious and wilful misconduct of the workman no compensation is allowed.

The Advance of Learning.

Press dispatches record an unfortunate occurrence in educational circles—unfortunate perhaps because the moving picture machines were not on hand—which took place recently at one of the leading eastern universities. It seems that a certain student in the engineering department, more celebrated for his athletic activities than for his scholarly attainments, in order to secure his diploma, was required to remain at the university after the session had closed to make up the work in which he had previously failed. This peeved the student exceedingly and so after receiving his diploma he used the document to light a cigar in the office of the dean of the engineering department. "I will show you what I think of your institution and the diploma," said he as he touched a match to it.

"Don't try that or there will be trouble," said the dean by way of warning. To which the recent graduate replied: "If that is what you mean take off your glasses." Then ensued a rough and tumble fight in which the dean, like the late lamented hope of the white race at Reno, failed to come back, and was forced to call upon two of his assistants to help. And as this was not enough, the recent graduate called upon his "favorite professor" and treated him likewise.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

City Council of Selma, Ala., has granted a franchise to Ernest Lamar and associates for the construction of a railroad tapping the coal and mineral fields and at Birmingham joining Selma directly with the great West and Northwest.

According to an announcement made by officials of the Louisville & Nashville R. R., work will be started some time this year on the double tracking of the line between Birmingham and Decatur, Ala.

The Tuscaloosa Mineral R. R., recently incorporated, has applied to the City Council of Tuscaloosa, Ala., for a franchise over certain streets. F. G. Blair, Tuscaloosa, is interested. The company proposes to build a line from Tuscaloosa, to open up mineral territory in the northern part of the county.

Reynolds Bros., Montevallo, Ala., owning a short line of railroad extending south from Brent on the Mobile & Ohio, have secured right of way to Heiberger, 13 miles north of Marion for an extension.

The Illinois Central R. R. awarded contract last week to J. J. Baxter of Jackson, Miss., for the filling of two trestles on its Alabama line between Corinth and Haleyville. The work will consist of 140,000 cu. yds. of steam shovel work and about 50,000 cu. yds. of team work. The contractor has agreed to load at least 1000 cu. yds. per day with his steam shovel and must furnish his own cars and locomotives. This makes the third contract which the I. C. has awarded to J. J. Baxter this year.

Arkansas.

The City Council of Jonesboro, Ark., has granted a street car franchise to a company of Northern and local capitalists, represented by Preston Hatcher of Jonesboro. The company must build and operate one mile within a year or forfeit the franchise. The company also proposes the construction of an interurban line to Nettleton.

The City Council of Hot Springs, Ark., has granted a franchise to the Hot Springs Street Railroad Co. to extend its lines in South Hot Springs.

Capitalists of Danville, Ark., are having a preliminary survey made for a railroad to be built across the mountain to Wing to give an outlet to Fourche Valley.

H. Dalhoff, Little Rock, Ark., has been awarded the contract for constructing the Stuttgart & Rice Belt R. R. The contract calls for building the line from Mesa on the Rock Island, 21 miles due south and one mile west to Stuttgart. The contract is said to amount to $250,000. It is to be completed by Nov. 20.

The State Board of Railroad Incorporation has granted the Gulf & Magnolia Northern Ry. a 92-mile extension of its charter, making a total length of 126 miles for the road, with terminals at the Oklahoma and Louisiana lines. The line heretofore extended from Magnolia, Columbia county, to Hope, Hempstead county, a distance of 34 miles, passing through Waldo, Columbia county. An extension has now been secured from Hope west through Hempstead, Howard and Sevier counties to the Oklahoma line, passing through Columbus, Horatio and others. This extension is 55 miles. The other extension granted is from Magnolia southeast through Columbia and Union counties, to the Louisiana line at Junction City. This extension is 37 miles. This company is capitalized at $900,000. Sam Q. Sevier is president of the road.

M. L. Byers, chief engineer of the M. H. & L. R. R. branch of the Missouri Pacific system, awarded contract on Aug. 16th to Hodges-Downey Construction Co., of Birmingham, Ala., for the filling of six trestles between McGehee and Ferguson, Ark., on the Helena division. The contract contains approximately 600,000 cu. yds. of earth excavation. The haul in some places will average about 30 miles, while at others it will be but a few hundred feet. The work is strictly a steam shovel proposition, the contractor furnishing his own shovels, cars, and locomotives. There is no specified time in which the work must be done, but it is understood that contractor will begin at once, and expedite the contract as much as possible.

Arizona.

The surveying crew of the El Paso & Southwestern R. R. is now straightening weak places along the right of way from Fairbanks to Benson, Ariz., and is making ready to resume the completion of the location survey for the proposed extension of the main line down the San Pedro valley from Benson to Winkelman.

California.

Surveys have been completed for an extension on the Butte County R. R. from Sterling to the Big Meadow Valley. The road at present is 31 miles long and is principally used for logging purposes. F. G. Sommer, Chico, Cal., is Chief Engineer.

The Central California Traction Co., 347 Grant Ave., San Francisco, has opened its line to Stockton and is planning to make connections with the Oakland-Antioch line at Lodi and give through service to San Francisco Bay some time next year. The line of the Oakland-Antioch road is being extended as fast as possible and may reach Antioch next April. The Central California Traction Co. is said to be planning to build a line into Antioch from Lodi if the Oakland-Antioch did not care to extend that far.

The Lantry-Sharpe Construction Co., Kansas City, Mo., which has the contract for constructing the new Arizona, Mexico & Gulf of California R. R., is to start work shortly on the construction of the pier at Port Lobos. This pier will be the first work in connection with this railroad as it is planned to have it ready for receiving supplies for the railroad construction.

Advices from Stockton, Cal., state that within the next year the Atchison, Topeka & Santa Fe Ry. will expend between $300,000 and $400,000 for the improvement of its yards in the Villa tract.

Work is progressing rapidly on the double tracking of the Southern Pacific Ry., between Tracy and Sacramento, Calif., and it is expected that all work will be completed by the end of this year. Several gangs are busy widening culverts and bridges for the improvement.

The Southern Pacific, according to advices from Salt Lake City, Utah, will start work on the construction of a line from Klamath Falls, Ore., to Alturas, Cal., as soon as right of way can be secured. The road will not end at Alturas, but will be extended to Reno. Surveyors are now engaged in locating and correcting the route which has been recently surveyed down the Pitt river to establish a permanent line. The Modoc portion of this line will run for a distance of over 60 miles through Modoc county and will follow the Pitt River from Lookout south to Bieber, Lassen county, Cal.

Advices from Auburn, Cal., state that the Utah Construction Co., which built the western Pacific from Salt Lake to Oroville, Cal., has completed the contract for grading between Applegate and Colfax and is preparing to move its outfit to Colorado, where the company has a large contract.

Erickson-Peterson Co., who have the contract for constructing the section of the Southern Pacific Rocklin cutoff between Applegate and Rocklin, Cal., will require at least a year and a half to complete the work. On this section there are many tunnels and the contractors are unable to employ a large number of men with advantage. Engineers, it is said, have more than four years' work ahead of them as the cutoff is to be extended to Gold run.

As expected for some time the surveyors of the Southern Pacific R. R. Co., and those of the Humboldt & Eastern R. R. Co., are racing for the Wildwood pass, the arbitrary point through the summit of the coast range mountains on the route to Eureka from either Redding or Red Bluff on the Sacramento River. Wildwood pass is the most available gateway through the high mountains, and the party that reaches it first and makes a location survey through it will have gained a distinct advantage for the company it represents. The two parties are working in opposite directions. The Humboldt and Eastern party is working down the Hayford creek and the Southern Pacific started near Cottonwood creek and is working up into the hills.

Officials of the Sacramento & Sierra R. R. have completed surveys and negotiations for the right of way and actual construction work is now under way. The line will be built as far as Rattlesnake Bar this year and next season it will be extended into the heart of the rich timber districts of the county. Electric and gasoline power will be used by the trains operating on the road on the level grades and in the hilly sections steam will be used as a motive power.

Engineers of the Porterville Northeastern Ry., mentioned in our issue of August 10, have completed preliminary survey for the entire line and have the location survey from Fresno east as far as Milo under way, and also the stretch from northeast to the mills at Baldwin Flat, which will be the terminus. From that point the grade averages a rise of .7 per cent. C. S. Freeland, Porterville, Cal., is Chief Engineer.

The City Council of Los Angeles has authorized the publication of the notice of sale of an electric street railway franchise along Evergreen Ave. from Brooklyn Ave to Blanchard St., and thence along Blanchard St. to the easterly boundary of the city.

Colorado Items.

BY A. B. KOENIG.

A. B. Koenig arrived in Denver on Aug. 4th expecting to spend a month in this territory but through being unfortunate or carelessness, he sprained his ankle on Sunday, Aug. 7th, at Corona, Colo. Tried to get off the train for a snow ball, (not a high ball; this is kidding on the square) so this column is not going to be as long or interesting as it would have been if Koenig would have had a chance to spend all the time that he intended to put in this part of the country. Following are a few items he secured before being crippled which will be of interest to a whole lot of our eastern friends, who lost track of some of the boys that went west a year or two ago and have been longing to hear from them and wanting to know of their whereabouts.

R. H. Lawrence is chief engineer of the Cimarron & Northern R. R. at Cimarron, N. Mex.

Cook & Devine have finished their work on the Union Pacific R. R. in Colorado. They have 12 teams and an engine idle.

J. L. Posey, purchasing and sales agent of equipment of the Central Colorado and Power Co., reported business fine. Posey is in the lime light in Colorado. Every body knows who he is and is talking about him.

C. L. Waters of Silverton, Colo., secretary of Miners' Union No. 26, one of the seven men who entered Gold King mine through fire to rescue three miners that were entombed on July 26, 1907, and the only one to return to surface alive, is one of the wide-awake boys we met while in Denver.

W. C. Steen is finishing a part of the Model dam and irrigation work at Trinidad, Colo. He expects to put 15 teams to work for the next couple of months plowing 2,000 acres of land in this territory.

Wheel Scraper Smith, who has got well acquainted and liked by the boys in the neighborhood of Pueblo is now being addressed Uncle Tom. Smith was very pleasant and reported business good when Koenig met him at Pueblo the other day.

The Utah Construction Co. have their work on the Colorado Southern well covered and making rapid progress.

Henry Heiser of the Contractor Supply & Equipment Co. took a run down from Denver to Pueblo to talk over a lot of business matters with contractors in this territory.

Edwin V. Brake, the prince of good fellows and deputy state labor commissioner of Colorado, was really the best entertainer that Koenig met while out there. Colorado needs a few more Brakes to double the population of Colorado in a short time.

Geo. Lawrence is still with the Kennefick Quigley Hoffman Construction Co., of Kansas City, looking after their interests at Canon City.

Following are a few of the contractors in the neighborhood of Pueblo that Koenig expected to see and shake hands with, but he failed to see a few of them on account of his sprained ankle. He expects to return shortly and pay his respects to those that he did not see: Phillips Const. Co. & O'Gara, Lima, Colo.; Eggleston and Matthews, Lima, Colo.; Fields B. Arthur & Co., Lima, Colo.; Ripley and Hasselman, Larimer, Colo.; Sullivan and Sullivan, Larimer, Colo.; Ed. Lindsay, Larimer, Colo.; Reiwitz and Lucia, Larimer, Colo.; Graham and Bradbury, Huerfana, Colo.; L. B. Hammon and Son, Graneros, Colo.; Hoffman and Crook, Huerfano, Colo.; Eby Bros. Const. Co., Huerfano, Colo.; The McDowell Const Co., Huerfano, Colo.; Frank King, Huerfano, Colo.; Ed. Mahugh, Huerfano, Colo.: Cupp and Ballard, Walsenburg, Colo.; McCabe and Steen, Walsenburg, Colo.; P. J. Clark, Mgr. J. H. Nations Const Co., Walsenburg, Colo.; Hancock and McMahon, Walsenburg, Colo.; Harry Knowlton, Walsenburg, Colo.; Allen and Lafferty, Walsenburg, Colo.; Connelly Bros., Walsenburg, Colo.

Florida.

The Palm Beach Farms Co., C. J. West, local representative, West Palm Beach, Fla., is planning to build a narrow gage railroad to run from West Palm Beach, west through the Okeechobee road lands, and then striking a southerly course, to go through the large land holdings of the Palm Beach Farms Co. It will extend south probably as far as Deerfield, running parallel with the Florida East Coast railroad, and about five or six miles west of this line. The road will be financed by the Palm Beach Farms Co. and will be for the convenience of the farmers who are expected to settle on the holdings of this company within a short time. The C. T. McCrimmon Co., of Miami, Fla., will be in charge of the work.

Georgia.

Officials of the Rome & Northern R. R. and the Chattanooga Southern R. R. are reported to have signed the agreement effecting a physical connection between the two lines. The Chattanooga Southern runs from Chattanooga to Gadsden, Ala., a distance of 90 miles. Under the agreement with the Rome and Northern the Chattanooga Southern will build from Bronco, on its line in Walker county, a distance of eight miles, to Trion. The Rome and Northern will build from Gore, its present northern terminus, to Trion, a distance of nine miles. The trackage agreements entered into for a term of years between the two lines provides that each line is to use the track of the other between Chattanooga and Trion and Rome and Trion as its own. The Chattanooga Southern will build the 16-mile link from Rome to Rockmart, connecting there with the Seaboard Air Line, as soon as the other link is closed. It is stated that engineers will be put in the field immediately and construction work begun as soon as the location is made. H. M. Smith, Rome, Ga., is Chief Engineer Rome Northern R. R.; Chas. Hicks, Chattanooga, Tenn., is General Manager of the Chattanooga Southern R. R.

Idaho.

The Pacific & Idaho Northern Ry., E. M. Heigho, president, Weiser, Idaho, has started a preliminary survey from Meadows to Payette lakes and down Long Valley as far as Roseberry.

Reports from Boise, Idaho, state that engineers are running a line between Dixie and Boise, via Black's creek. It is thought to be a preliminary survey for the proposed Owinza-Boise-Payette cutoff.

Iowa.

The Mason City & Clear Lake R. R., which holds a franchise in Mason City, Ia., until 1921, on account of extensive improvements which they have under consideration desire an extension of the same. The matter will be submitted to the people, settled by a vote.

Grading on the proposed line of the Waterloo, Cedar Falls & Northern extension to Waverly, Ia., has been completed and the laying of rails will be started early next month. It is expected that the overhead work will be completed and everything completed for the inauguration of service December 1.

Illinois.

The Lake Shore & Michigan Southern Ry. has purchased a strip of land nearly a mile in extent on South Chicago Ave., at Chicago, running parallel with their right of way. The land runs approximately from 87th to 93rd Sts. and it was bought to be used for the consummation of the plan for four-track work to Buffalo. Other strips have been purchased from time to time and as soon as the railroad has obtained the property for connecting links the work of track building will be begun.

Joseph and John Martin, Belleville, have been grading the roadbed for a 300-ft. mine spur for the Mulberry Hill Coal Co. near Freeburg.

The Buda Co., Chicago, Ill., has been awarded the contract for supplying the special track to be used in the construction of the projected line of the Eastern Illinois Ry. Co., which has a franchise for operating from Harvey through Dolton, Thornton Township and West Hammond. Grading work on the line will be started at once. A. L. Drum & Co., 125 Monroe St., Chicago, Ill., are the engineers.

Press reports state that P. W. Leffler, 318 S. Kensington Ave., La Grange, Ill., has been notified that the government of Austria-Hungary has granted his company a concession to construct a Leffler electric system railway between Vienna and Budapest, a distance of 155 miles. It is stated that the road will be first-class in every particular and will cost about $25,000,000.

B. L. Stephens, of Peoria, Ill., is now in New York City endeavoring to arrange for the financing of the Galesburg & Peoria Interurban Line. The projected line will be about 50 miles long.

The Sterling-Moline Traction Co. has formally awarded the contract for constructing its proposed interurban line to the Northwestern Engineering & Construction Co., of Milwaukee, Wis. It is believed that grading work will be started this fall. According to a statement of H. S. Green of Morrison practically all deals necessary to the securing of the flowage rights along Rock River have been closed. These rights are necessary in connection with the expenditure of $500,000 for a power plant and dam on Rock River at Lyndon, which will be expected to furnish power for the proposed electric line between Sterling and Moline. A. G. Van Patten, Sterling, Ill., is General Manager of the Traction Co.

A deed has been filed in the recorder's office at Belleville transferring the property of the Belleville and Interurban Railroad Co. to Joseph E. Gundlach, trustee, for $10,823.46. The property consists of a graded right of way and trestle work for an electric railway extending from Belleville to Main St. in Smithton, seven miles south of Belleville.

Farmers and property owners along the state road between Catlin and Fairmount are trying to induce the Illinois Traction System, Champaign, to extend the interurban line to the latter place.

The White Hall Ry. Co., of White Hall, has increased its capital stock from $40,000 to $50,000.

Work is well under way on the construction of the new Chicago, Milwaukee & St. Paul yards at Manheim, Ill., about 20 miles east of Elgin, Ill. It is hoped to have about 35 miles of line laid by September and 100 miles by the first of the year at this point. The yards when completed will be among the largest in the world.

The Alton, Jacksonville & Peoria Electric Ry. Co. awarded contracts on Aug. 16 for the construction of its line from Alton to Jerseyville, Ill., to Mulvill Bros., of Alton, Ill. The contract includes earth excavation, 250,000 yds., rock excavation, 2,400 ft., piling and bridging, 2,400 ft. The grading is all team work for 18 miles and is suitable in quantity for any sized team outfit. Mulvill Bros. are shipping their own team forces on this work and will sublet the bridging and 100,000 yds. in quantities to suit outfits.

H. A. Strause, vice-president and chief engineer, Falkenau Electrical Construction Co., Chicago, Ill., has been appointed consulting engineer of the Alton, Jacksonville & Peoria Railway Co., to undertake the design of the extension of this system to Jerseyville, Ill., involving about 20 miles of roadbed, track, and overhead construction, together with power house. The contract for the grading work has been let to Mulvill Bros., Alton, Ill., as noted elsewhere in this column.

Indiana.

The Evansville & Eastern Electric Ry. Co., Evansville, Ind., has applied to the City Council of Rockport for the privilege of laying a track on Washington St. to connect the present track with the Grandview extension.

Advices from Nashville, Ind., quote J. A. Johnson, promoter of the Indianapolis, Nashville & Southern Traction Line, as stating that the new road would be completed within six months. The contract for the grading has been let, and machinery will be at work by Dec. 25.

The Indiana State Railroad Commission has passed upon the plans and specifications for what will probably be the largest interlocker system in the world. Nine railroads will use the system, which is to be built on the Illinois-Indiana state line. The roads are the Michigan Central, Chicago Terminal, Chicago Junction, Kensington & Eastern, Erie, Monon, Nickel Plate, Indiana Harbor Belt and Wabash.

King Brothers, Montezuma, Ind., are now grading the road beds for the coal switches to be laid from the C. & E. I. coal switch out of Clinton, into section 31, Clinton township, where the two new United States steel coal mines are to be sunk. Some of the work will be heavy, passing across rather rough territory.

A. A. Campbell, 134 Monroe St., Chicago, Ill., is reported to have purchased the old Wabash & Erie canal bed extending from the south limits of Lafayette to the Fountain county line, a distance of 13 miles. It is said that the purchaser proposes to build a railroad for the purpose of reaching the gravel deposits found in the high bluffs along the line, on which he has obtained options.

All grading has been completed on the South Shore line from Gary to Hammond, Ind., by way of East Chicago and track laying has also been accomplished as far as the latter city. It is expected to have the track ready for operation by October.

Iowa.

Iowa City has voted to grant a franchise to the Iowa City, Ottumwa & Southwestern Ry., which proposes the construction of an inter- [illegible]

The City Council of Mason City has extended the franchise of the Mason City & Clear Lake Electric Ry. Co. for 25 years. This will enable the company to finance additions to its line.

Kansas.

The Gulf & Northwestern R. R. Co. has completed a survey across Western Kansas, which connects the various railroads running east and west through the state. It is said that construction work will be started this fall. John A. Keeran is Secretary and C. W. Gasaway is Chief Engineer.

The establishment of a street car line in Emporia, Kan., is proposed and the Business Men's Association of Emporia has appointed a committee to meet with representatives of a company from Dayton, O., which proposes to install a system. M. Wilhite, Emporia, is interested.

The State Board of Railroad Commissioners has granted the Kansas City, Kaw Valley & Western Ry. Co., of which John McDaniel is General Manager, permission to issue $1,500,000 of stock for the construction of an extension of its line to Topeka. It is intended that this line shall be an extension of the line from Kansas City to Bonner Springs, which is already in operation. The company is said to have raised sufficient money to build the road and that construction work from Bonner Springs west will begin at once.

The Atchison, Topeka & Santa Fe Ry. is reported to have decided to construct a 15-stall round house at Hutchinson, and also to concentrate the switch yards in the east part of the city into a large and complete yard.

Surveys are to be started this fall for the proposed railroad to run from Wichita to Beatrice, which is being promoted by Rezin Iams, Clay Center, Kan. The company is to take out a charter shortly and proposes to have a capital stock of $5,000,000. It is said that representatives of the company will go about this fall to submit the proposition to foreign capitalists. Francis B. Morgan, C. E., McPherson, Kan., is interested.

H. G. Palmer of the Securities Selling Co., of Montreal, Que., has been over the proposed route of the Salina, Tipton & Northwestern R. R., and if his report is favorable it is said that the Montreal company will furnish the money to build the line. The road is to run north and south through the wheat fields of Kansas. The promoters are making an effort to secure aid from the communities through which the line will pass in the sum of $2,500 a mile.

The city of Caney, Kan., has voted to issue $20,000 of bonds to aid in the construction of the Cherryvale, Oklahoma & Texas Ry. Six miles of right-of-way of this road have been graded from Caney to Wann, and it is expected to continue the grading to Delaware within a short time. This part of the work is on the southeast line from Caney with a proposed terminal at Fayetteville, Ark. The proposed main line of the railway will extend from Cherryvale through Caney, Pawhuska and Geary, with El Paso as the proposed terminus.

The Metropolitan Street Ry. Co., of Kansas City, Mo., is getting materials on the ground for the construction of three new street car lines in Kansas City, Kans. The lines are extensions of the Quindaro boulevard and Chelsea lines, and a new crosstown line on 18th St., connecting Minnesota and Central Aves.

The construction of an electric railway from Fredonia to Thayer, via Altoona is under consideration. It is estimated that it will require about $3,000 to make a survey and of this amount Fredonia has already subscribed $1,500. William Nees, Independence, Kan., is interested.

Kentucky.

The Corbin-Somerset-Cumberland River Construction Co. has been organized at Somerset, Ky., for the purpose of making a survey and securing a right of way for a proposed new railroad from Corbin, Ky., to Somerset, thence south to the Cumberland River. The proposed line of road will extend from Corbin to Hopkinsville, Ky., the first 40 miles. Corbin to Somerset to be built at once.

George F., Austin and Edward G. Piles, who have the contract to construct the extension of the Indian Creek & Pound River R R., a lumber carrier from Pound, near Pound Gap, the Kentucky-Virginia border to the headwaters of Pound River, ten miles, have announced that a ten-mile extension will be begun at once up Laurel Fork, where a rich timber district lies undeveloped. The Indian Creek & Pound River road is owned by the Currier Lumber Co., with headquarters at Glamorgan, Ky. C. W. Currier is manager.

Louisiana.

Grading work is under way on the Concordia Central R. R., a new lumber road being built for the D. K. Jeffries Co., of Chicago, Ill. A force of 125 men under the direction of Clarence Boyle is engaged in clearing the right of way. They have cleared 4 miles and E. H. Jackson is grading it. The general headquarters of the road will be at Natchez, Miss., and sawmills will be erected along the line. The road will run from the Mississippi River, 7½ miles south of Vidalia, La., and will be built 7 miles towards Alexandria, La., with which point ultimate connection will be made.

Maryland.

Work is now under way between Sir John's Run, six miles west of Hancock, and Great Cacapon, on flood prevention work on the Baltimore & Ohio R. R. The cost of the work will be about $200,000. The work includes several large fills at different places along the river bank. Charles F. King, Fairmont, W. Va., is the contractor.

Good progress is being made all along the line of the Western Maryland's 81 mile extension between Cumberland, Md., and Connellsville, Pa. At the rate of advance now being made the contractors will finish between Confluence and Connellsville by next April. Not much trouble is being anticipated with slides along the line as the road is being constructed in such a manner that the possibility of landslides in the mountains will be reduced to a minimum.

A committee of citizens of Back Creek Valley, Berkeley county, W. Va., have been in conference with officials of the Hagerstown Ry. Co., Hagerstown, Md., looking to the construction of a trolley line through that section. J. B. Clary, Hedgesville, W. Va., is interested.

Massachusetts.

The Berkshire Street Ry. Co., Pittsfield, has been granted a franchise to build a line on Elm St. in that city.

The Boston & Eastern R. R. Co., through its representative, John Bickford, Beverly, Mass., has deposited $10,000 with the city treasurer of Boston, Mass., in compliance with a section of the legislative act under which that company is authorized to construct a tunnel under Boston harbor as a part of its proposed line from Boston to Beverly, Danvers and other places on the North Shore. The main purpose of the money deposited is to provide for the expense of the Boston transit commission in surveying for the tunnel before the work of construction shall begin.

The Hampden R. R. Co., organized in July, as noted in our July 27 issue, to build a railroad from Springfield to Bondville, has filed plans with the State Railroad Commission showing that his road will cost about $3,196,000. Of this sum $116,675 will be paid for right of way over private property and $1,854,639 for grading. It is proposed that there be stations at Springfield, Chicopee Falls, Ludlow, Three Rivers, Hastings Crossing, Holyoke and Willimansett. The incorporators of the company include Ralph D. Gillet, Westfield, Mass., and F. T. Ley, of Springfield, Mass.

The Boston & Albany R. R., according to plans under consideration will lay about 10 miles of new line in the vicinity of Springfield, Mass., this fall at an estimated cost of $25,000. About $50,000 will also be spent for the construction of new tracks between Woronoco and Washington.

The Berkshire Street Ry. Co., Pittsfield, Mass., has been petitioned to extend its Briggsville line from its present terminus to Stamford, Vt..

Minnesota.

Richard Evans, of Minneapolis, Minn., has erected a camp near Cloquet, Minn., for his 6½-mile sub-contract on the Canadian Northern Ry.

The Chicago, Milwaukee & St. Paul R. R. has purchased land in Hastings, Minn., for the right of way for the proposed cutoff between the Hastings & Dakota and the river division. Car shops, stock yards and round house, etc., will be built at Hastings, which will be a division point.

Advices from International Falls, Minn., state that the Terminal Company is having a line surveyed which will connect its Loman line with its local tracks. The proposed extension which will obviate the necessity of the company running its trains over the M. & I. between International Falls and Nakoda, will cross the latter's line near Nakoda and then run 2½ miles northeast through state swamp, when it will swing due north through the center of 17-70-24, and connect with the Terminal Co.'s Rainy Lake spur in 35-71-24 or about one mile east of town. This line would require but about six miles of track building. It is not improbable that this line will be built this fall in time to care for the traffic of the Loman line, which is now rapidly nearing completion.

Mississippi.

The Bonhomme Southwestern Ry. Co. has asked right of way and terminal facilities in the City of Hattiesburg, Miss. This road was formerly a logging road constructed by W. S. F. Tatum for his mill at Bonhomme, about three miles southwest of Hattiesburg. The road is constructed for about 18 miles and the promoters propose to extend the line to Columbia immediately, with the ultimate object of going into Baton Rouge, La., following closely the survey of the Atlantic, Birmingham & Southwestern.

Missouri.

A petition has been filed with the County Court at St. Louis for a new electric railway to run along Gravois road from the intersection of Gravois Ave. and the River Des Peres, connecting with a $100,000 road house at Sappington, St. Louis County, and extending through the county on Gravois road to Fenton. August A. Busch, Harry B. Hawes, Frank Weber, Charles Lemp and George J. Tansey of St. Louis are interested. The line will be about 15 miles long.

The Missouri, Kansas & Texas Terminal R. R. Co. has filed a certificate of increase in the capital stock from $100,000 to $10,000,000.

In our last issue we mentioned that a company had applied for a charter to build a railroad from Cape Girardeau to a connection with the Frisco Ry. in New Madrid County. A charter for the road has now been granted, the name of the company being the St. Louis & Southern Missouri R. R. Co. The capital stock is $700,000. The stockholders, all residents of New Madrid County, Mo., are as follows: A. B. Hunter, L. A. Lewis, W. H. Ganaflo, M. J. Conran, Murray Phillips Jr., R. D. Hunter, E. S. McCarty, David Mann, Lee Hunter, Joseph Hunter, Thomas Gallivan and T. J. Brown.

Officials of the St. Louis & San Francisco at Joplin, Mo., have confirmed the report, it is said, that the surveyors were preparing lines for the construction of an entrance to the new Union station at that place. It is also probable that arrangements will be made for removing the unnecessary tracks at 10th and Main Sts.

The St. Louis & Kansas City Electric Ry. Co., D. C. Nevin, president, Kansas City, Mo., has made first payment on the 30-year leases which the company holds on a body of 1,000 acres of coal lands near Harrisburg, Boone County. A spur track will be built from Columbia to Harrisburg to tap the coal fields.

St. Louis Items.

BY A. B. KOENIG.

The extension of the St. Louis, Brownsville & Mexico R. R. from Kingsville north to San Antonio is now assured, according to the announcement of Albert T. Perkins, vice president of the road, who is now in San Antonio. He says that his road has already secured contracts on the right of way as far north as Alice, on the San Antonio and Aransas Pass railroad. The road will be first to be built to that connection, and arrangements have already been made for a service into San Antonio over the tracks of the San Antonio and Aransas Pass. Vice President Perkins predicts that the first train will be running into San Antonio in less than one year. As soon as the branch to Alice is completed the road will begin the extension north to San Antonio, so that the road can run all the way on its own tracks.

J. L. McElree, representing the St. Louis & Kansas City Electric Railway Company, made first payment on the thirty year leases which the company holds on a body of 1,000 acres of coal lands near Harrisburg, Boone County. A spur track will be built from Columbia to Harrisburg to tap the coal fields. A blanket vein 4 feet thick is known to exist.

The secretary of state on Aug. 14th issued a charter to the St. Louis & Southern Missouri R. R. Co., for construction of a railroad from Cape Girardeau to an intersecting point on the St. Louis and San Francisco railroad in New Madrid county. The line is to start at the City of Cape Girardeau and proceed through the counties of Cape Girardeau, Scott and Mississippi to the point stated in New Madrid county. It will be wholly within this state, and be approximately 70 miles in length. The capital stock is $700,000. The stockholders are all residents of New Madrid county, Mo., and hold shares as follows: A. B. Hunter, 45; L. A. Lewis, 90; W. H. Ganaflo, 90; M. J. Conran, 45; Murray Phillips, Jr., 90; R. D. Huter, 45; E. S. McCarty, 70; David Mann, 90; Lee Hunter, 45; Joseph Hunter, 45; Thomas Gallivan, 22, and T. J. Brown, 23.

Work on the completion of the electric line between Belleville for the Mascoutah Traction Co. has been resumed. Two car loads of piles arrived the other day for the construction of the trestle through Silver Creek bottoms.

A contract to excavate the site of the new Union Station in Kansas City, was let by the executive committee of the Kansas City Terminal Railway Co. to C. D. Smith & Co., Memphis, Tenn. Sixteen bids were considered, but the figures were not made public. This means that actual work will start on the station site as soon as the contracting company can convey implements here and procure men. There are 750,000 cubic yards of earth to be removed and the work is to be completed by May 1, 1911. Two lines of track are being laid for the shovels to work upon and will be ready in a day or two. There is a low and high line track. It is intended to have one or two shovels at work on the top of the hill, and another at the base, near O. K. creek. For each shovel put to work it will require 120 acres to haul away the earth. With three shovels, as is planned, 360 cars and eight locomotives will be required daily. The Terminal company owns 225 cars and twenty-five engines. Cars probably will be borrowed from some of the railroads. Most of the earth will be taken east of Sheffield, to be used in the Blue River yards. After the exact grade of the terminal tracks has been determined, earth will be taken to other places as required.

The L. J. Smith Construction Co. was awarded several new ballasting contracts in Eastern Kansas by the Missouri Pacific R. R. Co. last week. L. J. Smith, the president of this company, informs us that all of his work on the Missouri Pacific R. R. is getting along nicely and they are making rapid progress with same.

A. B. Koenig, wife and daughter, left here on Aug. 2 for Colorado on a business and pleasure trip. He attended to part of his business and had a little pleasure as he sprained his ankle at Corona, Colo., on Sunday, Aug. 7th, trying to get off the train to get a snow ball which he intended to put in a refrigerator and send to the editors of the Engineering Contracting in Chicago to keep them cool during this hot weather, but as he was not able to get the snow ball the poor editors in Chicago will have to make the best of it, and if necessary use electric fans or ice water to keep cool. They surely have A. B. K.'s sympathy and good wishes.

B. A. Cader, Arena, N. Dak., expects to finish his work next week at this place.

Mike Tansey one of the old timers and best fellows this country ever saw, died at 4 a. m on Aug. 16, at his camp four miles from Lometa, Texas, on the Santa Fe R. R., from lung trouble. His body will be brought to St. Louis for interment. Tansey was personally known by more contractors and railroad men than any contractor in the southwest.

John Conley writes us from Lometa, Texas, that he is still with the Morey Faulhalber Co. at that point and work is progressing fine. Labor plentiful, but very poor.

T. W. McDonald, Arena, N. Dak., will have 18 teams and a machine idle shortly.

Montana.

Former Senator W. A. Clark is reported to have subscribed $3,000,000 of the proposed bond issue of the Helena and Butte electric line, construction work on which is to begin this fall. The line will be 75 miles long and will cross the main divide of the Rocky Mountains. It will be operated by power generated at a dam across the Missouri River near Helena, and, in addition to connecting the two cities, will furnish transportation facilities to a number of mining districts whose operations have been retarded by lack of it. The dam is rapidly nearing completion.

Nevada.

The Nevada Copper Belt R. R., W. F. Sanders, Chief Engineer, Mason, Nev., is to build a 17-mile extension from Mason to its Nevada-Douglass mine. The extension will cost about $700,000.

Advices from Reno, Nev., state that a promoter, who recently disposed of a large acreage of saline lands near Sand Springs in Churchill County, is having a survey made for a railroad from Fallon to these lands, a distance of 23 miles. The lands were purchased by J. Otis Draper, New York City, who has ordered this road surveyed. The new owner will built the line and use it to haul the products of the salt lands to Fallon, where the cars will be switched onto the Southern Pacific tracks.

The Central Pacific R. R. (a Southern Pacific project) has filed a map of its proposed route with the County Recorder at Reno, Nev. According to the map, the line begins at Fernley, crosses the old Central Pacific Railroad bridge and through the site of the old shops at Wadsworth. Then it goes down the Truckee on the west side of Pyramid Lake, over Astor Pass, into the Honey Lake country.

New Hampshire.

The Dominion Construction Co., 165 Broadway, New York City, has been awarded the contract for the construction of the Durham cutoff at Durham, N. H., on the Boston & Maine R. R.

New Jersey.

The Public Service Ry. Co., Newark, N. J., is considering extending its electric railway from Woodbury, N. J., to Paulsboro, N. J., and possibly on to Pennsgrove.

New Mexico.

The Atchison, Topeka & Santa Fe Ry. has completed surveys for a new overland direct route road between Las Vegas and Mora, county seat of Mora County. One route has been surveyed going via the La Cueva ranch and another via Sapello, both coming out into the Sapello Valley, thence along the high line into Mora.

The contract for the construction of a branch railroad from a point between Cutter and Engle, N. Mex., to the site of the Engle dam has been let by the U. S. Reclamation Service to George B. Brady, El Paso, Tex., at $51,280. The contract for the bridge work was let to Brown & Connor, Tucumcari, N. Mex., at $5,400.

Information has been received from Las Cruces, N. Mex., to the effect that Sam Reynolds and Isidora have awarded the contract for the purchase of a quantity of ties to be used in the construction of the Las Cruces Ry., which will run from Las Cruces to the Agricultural College. Grading will be started at once.

The contracts for the masonry work on the culverts and bridges for practically the entire line of railroad now being built from Madera to Terrazas by the Mexico Northwestern Ry. Co. has been let. Work is now progressing under the superintendency of Jas. Campbell, Chihuahua, Mexico. B. H. Bryant, Casa Grandes, Chia, Mexico, is chief engineer. The Mexico Northwestern Ry. has also commenced grading on its branch line from San Antonio station on the main line of the Chihuahua division to the town and silver mining district of Cusihuiriachic. This line will be about 24 kilometers long and will be completed by Jan. 1, 1911.

New York.

The Mayor of Jamestown, N. Y., has appointed a committee, of which Cyrus E. Jones is a member, to confer with officials of either the Pennsylvania or the Lake Shore R. R. Co. to secure an extension to Jamestown to provide additional shipping facilities.

The Dominion Construction Company, 165 Broadway, New York, has been awarded the contract for the construction of a double track tunnel and approaches on the Boston & Albany R. R. near Canaan, N. Y.

The Southwestern New York Traction Co., C. M. Van Curren, President, Bolivar, is securing right of way for a trolley line from Bolivar to Richburg, which it is proposed to build at once. The distance is two miles. The proposed line is to follow the main highway, passing under the Shawmut Railroad track at its crossing just north of Bolivar village. In Bolivar the line will connect with the New York & Pennsylvania Traction Company's road, while at Richburg its terminus will be at the foot of Depot St.

At a meeting of the directors of the Syracuse, Lakeshore & Northern R. R., the map showing the route of the proposed extension of the Lake Shore road between Fulton and Oswego, was approved and same will be filed with the clerk of Oswego County, N. Y. It is proposed to have the extension in operation before January 1. Nearly all the right of way has been graded and the abutments for the bridge across the Oswego River at Fulton have been placed.

The Rochester Belt Line R. R. Co. has applied to the State Public Service Commission for a certificate of convenience and necessity, and for permission to construct its belt road, 15 miles in length, to girdle the city of Rochester. The company was incorporated some two months ago with capital stock of $2,000,000. Its purpose is to make possible an interchange of freight between the various railroads which enter the city, and it also will carry passengers. In the petition it is set forth that the road will be operated both by steam and electricity, and will be mainly a freight belt line, connecting all railroads of the city. Permission also is asked to exercise franchises and to determine the manner of crossing streets, avenues and highways. The directors of the company include Henry C. Brewster, John F. Alden, Edgar M. Curtice, Benjamin E. Chase, George F. Roth, Martin B. Wollf, V. Moreau Smith and Thomas H. McInnerney, all of Rochester.

The Delaware, Lackawanna & Western R. R., G. J. Ray, Chief Engineer, Hoboken, N. J., is reported to have its plans for its proposed terminal work in Buffalo ready for submission to the State Public Service Commission. The improvements at Buffalo include the erection of a modern passenger station, which will, it is said, front on the east side of the foot of Main St. Together with its trackage approaches and other terminal improvements, it will take in the section from Main St. to Michigan. It is also proposed to erect the freight terminal of the Lackawanna west of Main Street and to carry the freight tracks across Main Street on a steel trestle.

North Dakota.

Advices from Jamestown, N. Dak., state that graders on the Pingree-Wilton line are making good progress and the grade is already completed from a point near Pingree to the Pipestem and beyond. The work includes some heavy cuts and fills west of the river. The headquarters of the contractors are at Pingree, N. Dak. at present.

Engineers of the Northern Pacific working in McKenzie County, N. Dak., have about completed their work in that vicinity and are planning to shift their camp. The fact that a preliminary survey was made through the county, over practically the same route now being located, some four years ago, and that the line is now established is evidence that the company contemplates the extension of the Turtle Lake branch to Glendive, Mont. Just when the line will be built is of course a matter of conjecture but the consensus of opinion is that steps will be taken toward construction within the next two or three years, as the government grant for a right of way will terminate at that time.

Ohio.

The Lake Shore & Michigan Southern Ry., Sam'l Rockwell, Chief Engineer, Cleveland, O., has submitted estimates to council committees of Sandusky, O., for the elimination of three grade crossings. The work will cost $519,000 of which the city will have to pay $119,000.

Resolution has been before the City Council of Toledo authorizing the city engineer to prepare plans and specifications for the elimination of the grade crossing of the Pennsylvania R. R., at the east end of the Cherry St. bridge.

The Pennsylvania R. R. has about completed plans for the elimination of every one of its grade crossings in the East End at Cleveland, from Central Ave. S. E. to St. Clair Ave., inclusive, and even for the temporary grade crossing, abolitions as far north as the lake front section. All of the plans will show the temporary abolitions. Trestles will be erected in a few months across the entire East End and the streets will be lowered. In this manner, though none of the finishing touches will be completed, the grades of all of the crossings will be separated without delay and it is estimated that all of this work can be completed within eight months.

The Bluffton, Geneva & Celina Traction Co., which proposes an electric railway to connect Bluffton and Celina, has effected traffic agreements with the Western Ohio and Ohio Electric companies which will permit the new line to enter Toledo over the latter's lines. The new road is completed between Bluffton and Geneva, and the other portion will be pushed to completion in the spring. Connections will be made with the Western Ohio at Celina, and with the Ohio Electric at Lima.

Engineers of the Baltimore & Ohio R. R. have completed plans for the construction of a new channel for Crooked Creek near Butler and the work will probably be begun within a short time. The new channel will be constructed with a view to prevent washouts of the tracks of the company. The new channel will be about 2,000 ft. long and the work will be done under the direction of H. A. Rudolph, Mansfield, O., Supervisor B. & O. R. R.

The Toledo & Ohio Central R. R. has let a contract to John Herriott of Jerome Township to furnish that road with ties for the coming year. The contract calls for at least 200,000 ties.

An official of the Cleveland Short Line Ry. the freight belt line now under construction, is quoted as stating that $8,000,000 had already been expended and [illegible] of line are now in operation. When completed the new line will extend from Collinwood around the city of Rockport, a distance of 18½ miles. The estimated total cost of the work is $16,000,000.

Preliminary plans for eliminating Big Four and Columbus, Sandusky & Hocking grade crossings at Columbus from the Union Station north through Milo and Grogan have been submitted to Chief Engineers G. P. Smith of the Big Four and Thomas Rodd of the Pennsylvania for their approval. The Big Four will eliminate five crossings and the Columbus Sandusky & Hocking seven. Sixty-five per cent of the total cost will be borne by the city. This will necessitate a bond issue of $900,000. Henry Maetzel is City Engineer.

Oklahoma.

The Buffalo & Northern Oklahoma R. R. Co. has been organized by residents of Buffalo and other towns in Northwestern Oklahoma. The capital stock is $100,000 and the company proposes to build a railroad east and west through several counties in that locality at present without railroad facilities. E. M. Best was elected President, with O. L. Zook Vice-President, F. C. Platte, Secretary, E. C. Johnson, Treasurer. The work of running the survey from Buffalo eastward to Avard, in Woods County, was put in charge of Eugene Tilleux of Hutchison, Kan. Avard is the western treminus of the Arkansas Valley & Western, which was built six years ago from Vinita. It is understood that the Buffalo & Northern will turn the line over, after construction is completed, to the Frisco Company.

The Motor Car & R. R. Co., of Oklahoma City, organized recently primarily to open up the northwest to the cattle industry, especially in connection with the new packinghouse industry of Oklahoma City, has made some changes in its proposed route. Instead of making the wide southern detour on the outskirts of Packingtown and south of Central Ave. the road will build through Huber and Frosts Additions, connect with the Rock Island belt loops and finally terminate at Agnew and Central Aves.

Citizens of Harper County, Okla., have asked the co-operation of the Chamber of Commerce, Enid, Okla., in securing the construction of the Avard line of the Frisco westward into the coal region of New Mexico. The proposed line would run north of the projected route of the Enid, Ochiltree & Western. The line would intersect Woods county, Harper county, Ochiltree county, Texas county and Cimmaron county, thence running west into the New Mexico coal fields.

Oregon.

The City Council of Eugene has granted the Oregon Electric Ry. Co., of Portland, a franchise over 5th St. The franchise provides that the line between Albany and Eugene shall be completed and in operation within 18 months after the franchise is in effect; a $10,000 bond is given to insure the carrying out of the provisions of the franchise. The Lane County Asset Co., of Eugene, is also given the right to use the 5th St. tracks the entire length of the street, the latter company previously holding a franchise from the city limits on the west to High St. on this thoroughfare. The duration of the franchise is 25 years. In the meantime the Lane County Asset Co. has asked the council for an extension of a year of the company's franchise on the streets of Eugene for building an electric line, and has announced that it will commence construction work next year.

The Oregon Railroad & Navigation Co., G. W. Boschke, Chief Engineer, Portland, Ore., has taken out a building permit at Portland, authorizing the erection of a 600-ft. steel and concrete dock and warehouse. The structure will extend west from the western terminus of the new steel bridge. Its cost, as given in the permit issued from the office of the city building inspector, will be $130,000.

The Astoria & Columbia River R. R., T. H. Croswell, Chief Engineer, Portland, Ore., has been making detailed surveys for a proposed cutoff at Tongue Point. The cutoff is to start at the commencement of a big curve a short distance west of the John Day River and run through the bluff several hundred feet south of the present track. It will then follow the short line back of the Hammond Lumber Co.'s mill and continuing along on solid ground to a point about 200 ft. west of the Astoria Box Co.'s plant, where it will connect with the existing trestle. The main object in making the change is to do away with the heavy curve at Tongre Point, as well as with a long stretch of trestle, that is expensive to keep in repair. A cut is to be made through the bluff at the point and the earth secured there will be utilized to fill in the grounds at the depot.

Announcement has been made that the Des Chutes Ry., a Harriman line, will be extended from Redmond, its former proposed terminal, southward to connect with the Nation-Klamath Falls cutoff.

Twohy Brothers, Spokane, Wash., who are rebuilding the main line of the Oregon Railroad & Navigation Co., between Pendleton and Yoakum, 18 miles, are to establish temporary electric light plants at different points along the right of way and put on night shifts. There are now five steam shovels at work and this number will be increased by one or two. About 400 men are at work and others are being added as fast as they can be secured.

The City Council of Ashland, Ore., has granted a franchise to the Southern Pacific Co. for a spur line into the heart of the city over which a motor car will be operated.

Pennsylvania.

The Lehigh Valley R. R., E. B. Ashley, Chief Engineer, New York, N. Y., has about completed surveys for a new short line between Weatherly and White Haven. The road is to be used chiefly for the handling of freight. It will cut off a steep mountain and heavy grades and a roundabout way of getting from Mauch Chunk to Wilkesbarre and from Hazleton to the Wyoming District.

The Borough Council of Shenandoah has been considering granting the Schuylkill Ry. Co., Girardville, Pa., a franchise to extend its traction line on North Main St., Shenandoah.

Surveys have been made between Van Ormer on the Cresson Division of the Pennsylvania System and Glasgow on the Bellwood Division, and it is believed a branch will be built between the two places. The line would be only four miles long.

Grading work is to be started next month on the construction of the line of the Waynesburg & Blacksville Street Ry. Co. The line is to be built over the old franchise of the Waynesburg & Monongahela Ry., which was purchased by the Waynesburg & Blacksville Co. some time ago. Grading work will be carried on at three different parts of Waynesburg at the same time, with the probability that East Waynesburg will be the scene of the first activities. Waynesburg and West Waynesburg construction will be started shortly after that of East Waynesburg.

It is believed that the Philadelphia & Reading Ry. will, next year, take up the matter of holding two additional tracks from Mingo to Phoenixville. Surveys for this line already being made. The tracks would be quite expensive as it would require much excavation and an additional bridge across the Schuylkill river some distance below the present arch bridge spanning the stream.

Preliminary steps have been taken for the building of a railroad line from Brownstown, Lancaster County, to Birdsboro, Berks County, connecting the Schuylkill Division of the Pennsylvania Railroad. The new road is intended as an outlet for the cement mills now building at Brownstown, and it will be known as the Brownstown and Schuylkill Railroad. It will run through Morgantown, Brownsville, Terre Hill, Martindale, Hinkletown and Farmersville and will connect at Brownstown with another new line, now building, the Lancaster & Northern R. R.

South Carolina.

Residents of St. Matthews are advocating the construction of a branch line from that place to either Creston or Cameron on the Atlantic Coast Line R. R. In either case the branch would be about 8 miles long.

Tennessee.

The Knox Construction Co. has been incorporated with a capital stock of $20,000 and proposes to engage in the construction of steam railroads, electric railroads, sewers, conduit work, dams, locks, bridges, buildings, tunnels and subway work. The main offices will be at Knoxville, Tenn. The members of the company are T. A. King, of Louisville;

P. J. Millett, of Paris, Ky.; G. W. Callahan, of Knoxville, Tenn., and B. A. McCallie, of Knoxville.

Texas.

Surveys will be completed and estimates prepared by Sept. 1, for a railroad from Longview to extend into the ore fields of Cass County a distance of 30 or 40 miles. Surveys have also been made for a line between the mines at Longview to a connection with the Missouri, Kansas & Texas R. R. Col. Lewis P. Featherstone, Galveston, Tex., is interested.

Asher Richardson, Asherton, Tex., President of the Asherton & Gulf Ry., now operating 32 miles of line, is stated to have succeeded in financing the proposed extension of that line from Asherton west to Eagle Pass, 50 miles, and from its present junction point on the International & Gulf Northern to Arkansas Pass, about 140 miles. Engineers are now in the field locating the route of the proposed extensions.

City Council of San Antonio has granted the San Antonio Traction Co. permission to extend its South Flores St. line to the city limits, a distance of about a half mile.

A. F. Parker, Engineer of the State Railroad Commission, has completed a valuation of the Timpson & Henderson Ry. On the total mileage of the road, 33.61 miles from Timpson to Henderson, he placed a valuation of $400,850.54, or $11,628.99 per mile. The company sought this valuation so that it might secure from the railroad commission authority to borrow money for the purchase of additional equipment.

Steel for the first stretch of the Temple-Northwestern R. R. out of Temple has been shipped from Kansas City and the laying of steel will begin at Temple in a very few days.

The Paris & Mount Pleasant R. R. now has 12 miles of line completed and the remaining 13 miles have been graded. The road will be opened to traffic soon. N. M. Ragland is General Manager.

The St. Louis, Brownsville & Mexico Ry. has purchased the steel for the construction of its line from Kingsville to Alice, a distance of about 22 miles.

Announcement is made by Master Commissioner William H. Flippen that he has set Sept. 15 as the date for the sale at public auction at Palestine, Tex., of the International & Great Northern R. R. Co. and its properties.

According to a recent announcement of Albert T. Perkins, vice president of the St. Louis, Brownsville & Mexico R. R., the extension of that road from Kingsville north to San Antonio is now assured. The road has already secured contracts on the right of way as far north as Alice, on the San Antonio & Aransas Pass R. R. The road will be the first to be built to that connection, and arrangements have already been made for a service into San Antonio over the tracks of the San Antonio & Aransas Pass. As soon as the branch to Alice is completed the road will begin the extension north to San Antonio, so that the road can run all the way on its own tracks. It is also said that the Frisco has plans for extending the line south from Brady to San Antonio, thus giving the Frisco another trunk line from Brownsville to St. Louis, with Mexico connections.

A committee of Abilene business men has been appointed to interview the officials of the Texas Central R. R. to secure the construction of the proposed Rixing Star branch to Abilene, Texas, as originally contemplated.

Notice has been issued from the headquarters of the Texas & Pacific R. R., to the effect that the 75-lb. steel in the vicinity of Fort Worth, Texas will be taken up and about 40 miles of 85-lb. rails installed. The exact stretches of track to be relaid with heavier steel were not designated in the notice but it is understood among officials that before 1912 the entire road between Fort Worth and Shreveport will be replaced with the heavy steel. All places between Fort Worth and El Paso, where the traffic is heaviest, will be relaid with the new material within the next six months, it is reported.

Reconnoissance surveys have been made for extension of the Texas Central R. R. east from Waco to Trinity and west to Roswell, N. Mex., and it is believed that some definite action regarding these will be taken Sept. 22, when the stockholders meet at Waco to vote on a bond issue of $20,000,000 to be used largely for extensions and betterments.

The contract for the Altus, Roswill, Lubbock & El Paso R. R. has been let to the Woods Construction Co., Springfield, Mo., according to advices from Silverton, Texas. The work includes 60 miles of line between Lockney and the Hale County line. Work will begin at once on the contract, which requires that steel be laid into Silverton by Dec. 15.

Information from Pecos, Texas, is to the effect that the Pecos Valley Southern Ry. is completed from Pecos City to Saragosa, a distance of 30 miles, and that everything is in order to commence the immediate operation of the road.

Grading for the proposed Houston-Bayshore Interurban road has been started at LaPorte. Edward Guy & Sons, LaPorte, have the contract for the work between South Houston and La Porte and expect to complete the work in 60 days.

Steel laying on the two extensions of the Orient out of San Angelo, Texas, is making rapid progress, according to advices received from that city. The stretch from the stock yards to the Red Arroyo bridge on the Eldorado extension will be completed on to the river as soon as the bridge is constructed. On the Mertzon extension track layers are 10 miles out of San Angelo. The most difficult work on this line will be the middle Concho bridge and it is not expected by the officials that track laying from this point to Mertzon can take place until October 1.

The Commercial Club of Belton, Tex., has accepted the proposition of L. E. Walker, president of the Quanah, Seymour, Dublin & Rockport R. R., to bring the road through Belton, making a division point at that place.

The City Council of Beaumont is considering an application of Col. I. D. Polk, Beaumont for a franchise for the proposed Beaumont & Port Arthur Interburan Ry.

Patton & Gibson Co., Ltd., Durant, Okla., has been awarded the contract for the enlargement of the Katy yards in West Denison. The contract will require the moving of abopt 500,000 cu. yds. of material.

Utah.

Surveys are being made for a new railroad route from Gordon Creek to Colton with the primary object of opening coal mines in the vicinity of the latter place. The Wheelwright Construction Co., Ogden, Utah, is reported to be interested in the project.

It is now believed that the Ogden-Brigham City line of the Ogden Rapid Transit Co. will be completed before Oct. 1. Something of a record in interurban track laying was accomplished on this line early this month when Foreman J. H. Schuffleberg, with his crew of 40 men, laid a little over a mile of track between Willard and Brigham in one day.

Construction work, according to advices from Salt Lake City, on the $750,000 station built by the Denver & Rio Grande, the Western Pacific and the Salt Lake City Union Depot & Railway Co., has been about finished, and trains are now running into and departing from it. The structure was designed by Henry J. Schlacks, Chicago, Ill.

Virginia.

A company of which H. M. Luck, President of the Luck Construction Co., of Roanoke, Va.; E. E. Franey, a banker, iron furnace and oil man, of Steubenville, O., and S. W. Harrell, of Roanoke, are the principal stockholders, has purchased the property of the Catawba Coal & Iron Co., located in Botetourt county, near Roanoke. The new owners will build a railroad from Cloverdale to the properties.

West Virginia.

The Ohio County Commissioners have granted the Panhandle Traction Co., G. O. Nagle, General Manager, Wheeling, an extension of its franchise for one year in order to complete the improvements in the vicinity of Glennova. There is now a turn in the road between Warwood and Glennova, and the improvements contemplate the straightening of this road and the building of a bridge over Glen's Run at a cost of between $6,000 and $8,000, of which the traction company will pay half, the other half to be paid by the county.

C. A. Sims & Co., Philadelphia, Pa., have the contract for the construction of a 50-ft. dam across "Possum Hollow" to secure a better water supply for the B. & O. engines at Newburg, W. Va. When completed this reservoir will be 50 ft. deep and will cover some ten or fifteen acres.

T. W. Kirkbride, Inc., 16 Campbell Ave., Roanoke, Va., has been awarded the contract by the Elk River & Little Kanawha R. R. for five miles of grade and masonry, besides all the bridges out of Gassaway. The bridges are to cost $40,000 and the total amount of the contract is about $60,000.

It is reported that the Baltimore & Ohio R. R. has awarded a contract for the construction of a 4,500-ft. tunnel and three miles of railroad in the vicinity of Grafton, W. Va. The improvement, which will eliminate an old tunnel at Tunnelton, W. Va., is estimated to cost about $2,000,000.

The City & Elm Grove R. R. Co., J. W. Smith, Chief Engineer, Wheeling, W. Va., is planning to drive a tunnel through Wheeling Hill for the use of the Elm Grove Division of its electric railway.

Wisconsin.

The Badger Ry. Co. has been incorporated with a capital stock of $10,000 and proposes to build and operate an electric line from Whitewater, through La Grange and Sugar Creek, to Lake Geneva.

The Cincinnati Construction Co., which projects an interurban line from Janesville to Madison, has begun grading work at Edgerton in order to hold its franchise at that place. Stephen Madden is the contractor in charge of the work at Edgerton.

The State Railroad Commission has granted permission to the Minneapolis, St. Paul & Sault Ste. Marie Ry., Thos. Green, Chief Engineer, Minneapolis, Minn., to construct an extension from Superior to the Minnesota state line en route to the plant of the United States Steel Co., near Duluth.

Wyoming.

Residents on East 19th St., Cheyenne, Wyo., have petitioned the Cheyenne Electric Ry. Co., A. T. Young, General Manager, Cheyenne, to build a line on that street out to Lake Minnehaha.

Canada.

The Board of Public Works, of Windsor, Ont., has disapproved of the plans of the Sandwich, Winson & Ambersburg Ry., Jas. Anderson, General Manager, Windsor, for the proposed extension of its street car line to the Michigan Central's new tunnel station, Windsor, and has reported in favor of a different route to tap a rapidly growing section of the city. If the recommendation of the board is approved by the city council and adopted by the company, the double-tracking of Ouellette Ave. will be extended from Park St. to Wyandotte St., and on Wyandotte St. a new line will be built west to Wellington Ave., then south to the tunnel station on the east side of Wellington.

Officials of the Canadian Pacific Ry. have concluded negotiations for the purchase of nearly a mile of river front property at Kamloops, B. C., on the North Thompson River, at a cost of approximately $100,000. On this property the main running tracks of its line will be constructed, and also yard and terminal facilities. The total cost of this new construction work is set at approximately $200,000.

Johnson & Carey are now working over 600 men in their contract for filling in the railway bridge over Racing Lake, near Fort Francis.

The Windsor, Essex & Lake Shore Ry., W. W. Chisholm, Chief Engineer, Kingsville, Ont., operating 38 miles of electric railway, has placed $1,000,000 worth of bonds on the market. Both terminals of the line will be extended a considerable distance and it is also proposed to erect a freight spur line into

Windsor's civic factory site if permission is obtained from the city and railway commission.

Engineers of the Canadian Northern Ry. are rushing survey work on the gap between Selwood and Port Arthur, Ont. It is believed that this work will be completed this winter so that actual construction can be started in the spring. The gap is about 550 miles and the route east will be several miles north of the C. P. R. right of way. West of Nipigon the line will dip southward and come in to Port Arthur along the lake front.

The route of the Grand Trunk Pacific line from Regina, Sask., westward has been located as far as Moose Jaw. Leaving Regina, the line will run due west on a continuation of Fourth Ave., for about two miles. It will then strike northwesterly for half a mile to the blind line between the top row of sections in township 17. This blind line will be followed due west until the west side of range 23 is reached, from which point the railway will run in a south-westerly direction to Moose Jaw. The officials of the Grand Trunk Pacific are now only awaiting a settlement of its terminal matters with the Regina city council to immediately let a contract for the construction of this line westward, and also to finish up the link from the city southward to its grade on the line to the boundary. Every effort is being put forth to rush construction on the line from Balcarres to Regina, but the contractor, Mr. J. D. McArthur, is badly handicapped owing to the difficulty of securing sufficient men and teams for the work.

Mexico.

The international treaty permitting the construction of the Pan-American Ry. bridge across the Suchiate river between Mexico and Guatemala has been signed by the secretary of foreign relations, Enrique C. Creel for Mexico, and envoy extraordinary and minister plenipotentiary, Victor Sanchez Ocana for Guatemala. A contract was entered into by each government with David E. Thompson, Mutual Bldg., City of Mexico, President of the Pan-American Ry. D. D. Colvin, Gamboa, Oaxaca, Mexico, is Chief Engineer of the Pan-American Ry.

Bids are asked until Aug. 30 by H. M. Taylor, Director of Construction of the Ferrocarriles Nacionales de Mexico, Buenavista Station, Mexico, covering furnishing of material and construction complete of the following station buildings: Cuernavaca, state of Morelos, a two-story stone passenger station, of 1,150 square meters. Iguala, state of Guerrero, a one-story passenger station, of 550 square meters. Balsas, state of Guerrero, a one-story combination stone passenger station and warehouse, of 918 square meters.

A commission representing the merchants and hacendados of Tlalnepantla has asked the secretary of communications and public works for assistance in obtaining property consents for the extension of the electric street railway from Atzcapotzalco to that city, thus connecting the town with the capital. The tramways company has had under consideration the extension of its lines to Tlalnepantla for some time and the survey for building the line has been run.

Antonio Lozano, Mexican Consul at Los Angeles, Cal., has obtained from the Mexican government a right of way concession in Mexico for the construction of a railroad, which will be about 80 miles in length and will extend from Puerto Isabel to the international boundary. He is now said to be negotiating with capitalists for the building of the road, and is also taking up the matter of securing a right of way from the boundary line to Yuma where the railroad is proposed to connect with the Southern Pacific.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arizona.

Work is to be resumed on the Santa Cruz reservoir project, and will be pushed to completion. Canals have been surveyed from above Florence to the present site of the reservoir, also from the Sacaton mountains on the north to the Sawtooth range on the south, an area covering more than 50 miles in length. This is designed, it is stated, to harness the overflow of the Santa Cruz River. The activities of the company at present are directed to the construction of canals and ditches within the radius of Florence on the north, Toltec on the east, Maricopa on the west and the Jack Rabbit mine on the south. This is the company controlled by Col. W. C. Greene. Interested with him are R. M. Axford and V. S. Griffith of Tucson, Ariz.

California.

Edward Von Geldern, engineer for levee district No. 2, of Yuba City, has prepared specifications and plans for the proposed work of raising and widening the levee of levee district No. 2 near Nicolaus. Bids for doing the work, which will include the clearing of the right of way and the building up of the levee, will be taken shortly. The improvements will be mostly dredger work.

The Sacramento Valley Irrigation Co. of Willows has taken up options held on 14,000 acres of land in the vicinity of Willows. The company will extend its canal system through the several tracts.

Petitions are being circulated in the Turloch Irrigation District to call an election to vote on issuing $1,000,000 of bonds for irrigation development work.

A petition has been circulated among the taxpayers of the Modesto Irrigation District, Modesto, asking the directors to call an election for the purpose of voting bonds to the amount of $50,000 for the purpose of completing the reservoir. The work at the reservoir is progressing rapidly and the voting of more bonds will assure completion this winter.

Colorado.

The McDowell Construction Co., Rocky Ford, Colo., has been awarded a contract by the Pueblo-Rocky Ford Irrigation Co., Pueblo, Colo., for constructing the Bradford Lake outlet at Huenfano, Colo. The work will include an 800-ft. tunnel, open cut from station lining of shaft and portal to tunnel. The work includes a 6-in. concrete lining.

Advices from Fort Morgan, Colo., state that a definite agreement as to the repairs on the Riverside reservoir has been reached by the directors of the Riverside Irrigation district and the officers of the Riverside Reservoir & Land Co., represented by Camfield and Shields, the contractors. Bonds to the amount of $300,000 will be issued contingent on confirmation of the land holders of the district for the enlarging of the reservoir, the repairing of the dam and the construction of a new intake. A new toe wall 12,000 ft. long, 5 ft. deep and 1 ft. thick, will be built, a new coping 12,000 ft. long and 4½ ft. high, will be placed on the dam and 12,000 ft. of the cement slope will be resurfaced with 5 ins. of new concrete.

A hearing is to be held on Sept. 26 on the application of the Stockmen's Ditch Co., for the condemnation of a large tract of land for reservoir purposes. The company is composed of farmers in Beaver township, in the southwest part of Washington county. The project is located on Beaver Creek and the water is to be secured from the flood waters, and centrifugal pumps will be used in raising the water. The project will bring 40,000 acres of the land under the new ditch.

Residents of the east side at Pueblo, Colo., have asked the city officials to build a levee on the north side of Fountain Creek.

Illinois.

The contract for the dredging in the Creek Union Special Drainage district near Weldon has been let to D. T. Dilley of Indiana at 11.49 cts. per cubic yard. The contract amounts to about $7,000.

Excavation has been started on the diversion of the Cahokia Creek at East St. Louis. This is the first work in connection with the construction of flood protection for East St. Louis. The diversion channel is to be 300 ft. wide and 20 ft. deep and the contract for the work was let some time ago to S. H. R. Robinson & Son Contracting Co., St. Louis, Mo., at $259,152. The entire flood protection system will cost about $6,000,000 and will include the construction of a levee along the river front and the establishment of a drainage system at the foot of the bluffs. The work is to be done for the East Side Levee & Sanitary Board, of which T. N. Jacob, East St. Louis, Ill., is Chief Engineer.

Indiana.

James L. Taylor, Monticello, Ind., has moved his dredge to Muncie, Ind., where he has a ditch contract amounting to about $50,000.

Grant DeWitt, Lewisville, Ind., has been awarded the contract for excavating, furnishing and laying tile for a drain in Henry County. Bids for the work were opened at New Castle, Ind., on Aug. 13.

Iowa.

City Council of Clinton, Ia., is considering digging a channel through Beaver Slough. R. C. Hart is City Engineer.

Kentucky.

As noted in our last issue, the contract for constructing the Mill Creek cut off in Jefferson County has been let to C. H. Dishman, Evansville, Ind. The contract includes 95,000 cu. yds. of earth excavation and three 30-ft. span concrete bridges. This work is in connection with Mill Creek drainage project. Plans for the Pond Creek project are now being prepared and contracts for this work will be let in about a month. J. R. Gaines, Louisville, Ky., is County Surveyor in charge of the work.

Louisiana.

Parties owning a stretch of 8,000 acres of land in the Parish of Orleans, New Orleans, La., bounded by the Louisville & Nashville, the New Orleans & Northeastern and the tracks of the New Orleans Terminal R. R., with the outer edge touching the Fisherman's Canal, the boundary line between Orleans and St. Bernard Parishes, have planned to drain the tract and improve its value. The three railroads, almost surrounding the property, form a permanent embankment around it, and the only expense attached to protecting it from flood waters is in building a levee along the canal front.

The Lafourche Dredging Co., New Orleans, La., has been chartered with a capital stock of $25,000 and will engage in the business of building and constructing levees, embankments, digging ditches, canals and general reclamation and irrigation work. The officers of the company are Johnston Armstrong, president; Roger Holmes, vice-president and Wilton E. Aymar, secretary.

Minnesota.

Board of Municipal Works of Winona, Minn., is considering extending and raising the levee in front of the water works plant.

Montana.

✣Bids will be received by the Secretary of the Yellowstone Irrigation District at Sanders, Mont., until Sept. 3, for the extension and enlargement of the Sanders Irrigation canal. The work is estimated by Henry Gerharz Engineering Co., Billings, Mont., to cost $170,000.

The U. S. Reclamation Service, Washington, D. C., has decided to construct ditches for the irrigation of about 9,000 acres of land on the Fort Peck Indian Reservation in Montana.

Memphis, Tenn., and Vicinity.

(SPECIAL CORRESPONDENCE.)

A. C. Devers has taken a large levee contract at Bryan, Tex.

C. C. Price of the Southern Improvement Co., states that he will move his large outfit to Lucca, Ark., to resume his levee contract at that place which he was forced to abandon last season on account of the extreme high water.

S. T. Watson, superintendent for Roach & Stansell at Bryan, Texas, was accidentally killed by dropping his revolver, the bullet plowing its way through his heart. Sam was one of the most popular superintendents in the employ of Roach & Stansell, and has a large number of warm friends among the contractors in the Southern states, all of whom will greatly mourn his loss.

A. D. Montgomery was in town for a few days last week and reports his contract at Wellborn, Texas, going along nicely. However, much rain is needed in Texas before the dirt will handle to good advantage. This is the general complaint from all contractors working in that state, according to Al.

Stanton Palmer, president of the Metropolitan Construction Co., of Kansas City, Mo., which firm has on hand so many large street contracts throughout the prominent cities of the Southern states, came to Memphis last week to take in the local situation. Stanton is as cherry as ever and very pleased with the progress being made by his firm on all contracts under way.

Tom Garvin, formerly assistant city engineer, has gone into the concrete construction business and has secured two extensive sewer contracts from the city government.

H. J. Roper, who was awarded contract for the paving of Neptune street with tar macadam, has started his grading work on this street and states he is very desirous of subletting his tar macadam to some reliable construction firm, inasmuch as he has not the equipment necessary for this latter work.

Bob St. John is doing some mighty quick levee work on the west bank of the Brazos river in Burleson county, Texas, and states that he will have completed his entire contract by Oct. 15th, when he will be in the market for new work. Bob is so pleased with Texas that he states he will probably never come back on the levees of the Mississippi river.

A. J. Olson, of Olson & Lesh, this city and Chicago, has just returned from Oklahoma City where he put in bids on two new concrete buildings to be erected there. The big boy states that Oklahoma City is a booming town and one of the "comers" of the Western states.

There seems to be a golden opportunity in this territory for men with capital to open up some new stone quarries, for those quarries now running can not begin to supply the stone needed for construction work in the city and the contractors are sorely pressed for this class of material. Nearly all street work has been seriously delayed on account of stone and Chief Engineer Haylow of the Memphis Street Railway goes on record as saying that this commodity has been one of the most serious handicaps to the work which his company has under way in Memphis. While there are a number of quarries in Arkansas which could supply the local market, the freight rates from point across the river are prohibitive for Memphis delivery and as a result, these quarries are not able to get any stone into Memphis. Maj. Walker, for instance, was able to close contract for a large quantity of stone for government use from Arkansas at .65 cts. per cubic yard. This same stone laid down in Memphis would cost about $1.75. There are a number of large stone ledges on the N. C. & St. L. and L. & N. railroads near Memphis which have never been quarried and it is somewhat surprising that a company is not organized to take the stone out and market it here. Surely the large amount of street work now under way, together with the new buildings going up and those which are contemplated, would be sufficient guarantee for the sale of at least 150 cars a day.

George Lacy of Arkansas City has begun work on his new contract at Dawson Landing, Ark.

McClavey Bros. will finish at Rosedale, Miss., about Oct. 15th. Jim McClavey is in charge of the work, which is being handled to good advantage. Although but a young fellow and just out of college, Jim has made a wonderful success at contracting and big things may be expected of him in the future.

City Engineer Weatherford states that he will require the railroads interested to begin work on the two large subways to be built at Rayburn St., and at South Third St., within 60 days. The work will cost approximately $700,000.

It is reported that the Tennesse Traction Co. will begin the construction of their new line from Memphis to Jackson, Tenn., within the next 30 days. The distance will be about 90 miles and the roadbed will be of standard specifications in all respects. W. K. Burton of Memphis is president.

The writer dropped around at Tom Bruce's sales stable last week, which is considered headquarters for all the contractors when they come to Memphis, and saw the finest lot of large mules he has seen in many days. Much trouble was experienced in the early part of the season by contractors in getting the class of mules required for heavy work, but anticipating the large levee lettings which have recently been held in this city, Tom went West and bought up all the good mules he could find. As a result no difficulty will be experienced by those who were successful in the getting of new contracts in securing the class and amount of mule flesh which they will require. Tom Bruce is to be congratulated on his fine judgment and forethought which is a boon to all the contractors.

Maj. M. L. Walker, government engineer, is off on a much needed vacation to his summer home in New Jersey.

Bridge Engineer Thompson of the I. C. R. R. was in the city for a few days last week.

J. D. Lynch of Monmouth, Ill., has been awarded a contract by the I. C. railroad for excavating about 100,000 cu. yds. of earth in Iowa.

M. J. Roach of Roach & Stansell, has gone to Texas to inspect the various contracts of his firm in that state.

It is reported that the Frisco railroad will soon be ready to let contract for the construction of a new freight yard at this place. The work will be all steam shovel excavation and the contract will contain approximately 450,000 yards.

Texas.

The Commissioners Court at Brenham, Tex. is considering establishing a levee district near Chapel Hill. Dr. John McGregor, Chapel Hill, is interested.

Wisconsin.

George Hagen, Contractor, Winona, has been building a fleet of nine barges and installing dredging machinery at the foot of Main St. on the lake shore at La Crosse, preparatory to dredging the lake this fall and filling in the territory adjacent on the three years' contract let to the La Crosse Dredging Co.

MISCELLANEOUS CONSTRUCTIONS

Arkansas.

The C. Hegewald Co., New Albany, Ind., has been awarded the contract by the government to furnish the iron work for a government dam to be built in the Arkansas river at Stark, Ark., the contract price being about $20,000.

California.

The city trustees of Ocean Park have decided to construct a municipal concrete pier at the foot of Mildred Ave. It will cost about $60,000.

The following bids were received Aug. 11 by the board of public works of Oakland, for the construction of the quay wall on the estuary between Myrtle and Clay Sts.: Carterra Construction Co., San Francisco, $222,365; Metropolis Construction Co., $290,725; Robert C. Storrie & Co., $317,430; Cotton Bros. & Co., $319,520; San Francisco Bridge Co., $319,757.40; Rickon Ehrhart Construction Co., $327,725.50; Alfred H. Voght, $328,559.35; Pacific Construction Co., $347,185; C. D. Vincent, $352,005; Mercier Frazier Co., $352,880; Thomson Bridge Co., $374,935; Hyde Harjes & Co., $380,950. The city engineer's estimate was $340,000.

Cotton Bros., Oakland, Cal., have been awarded the contract at $119,000 for constructing the Livingston St. pier for the City of Oakland. The pier will cost the city about $175,000 as the additional sum is to be expended for warehouses, and ship loading and unloading facilities.

The Great Western Power Co., of San Francisco, has found solid rock 75 ft. below the bed of the Feather River at Intake, where it plans to build a large concrete dam. In digging down to this foundation a ledge bearing considerable gold quartz was found. It is said that the Greek laborers employed on the digging become so excited over the find that the company had to place a guard over the men to keep them from giving up their jobs digging in an effort to find nuggets. The company adopted a policy of working that makes the water muddy so that the real value of the earth under the dam cannot be ascertained.

Connecticut.

✣Harry Taylor, Lieut. Col., U. S. Engineers, New London, Conn., will receive bids until 3 p. m., September 15, for dredging in Bridgeport Harbor, Conn.

District of Columbia.

✣Bids will be received until 2 p. m., August 29, by Commissioners of Washington, D. C., for equipping with electrical apparatus, switch boards, wiring and carpenter work in the Physics laboratory of the Business High School, Rhode Island Ave., between 8th and 9th Sts., northwest, Washington, D. C.

✣Bids will be received until 10:30 a. m., Sept. 8, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing Oxy-Acetylene Welding and Cutting Plant, Cold Rolled Steel, Bronze, Drift Bolts, Copper Gaskets, Lock Washers, Screws, Valves, Cocks, Steam Whistles, Water Gauges, Water Gauge Glasses, Hose Nozzles, Pipe Fittings, Slip Scrapers, Chain Blocks, Grindstones, Saws, Vises, Peavies, Cold Chisels, Reamers, Foundry Brushes, Horse Brushes, Headlight Burners, Lantern Globes, Door Catches, Buckles, Cups, Steel Tapes, Rules, Twine, Rubber Valves, Engine Oil, Coke, Etc.

✣Bids will be received until 11 a. m., October 1, by Beekman Winthrop, Acting Secretary of the Navy Department, Washington, D. C.; for completing power plant at the U. S. Naval Academy, Annapolis, Md.

Items marked thus ✣ indicate work now open for bids.

Illinois.

The board of trustees of the Sanitary District of Chicago, Ill., have passed resolutions providing for plans and estimates of the cost of an outer harbor for Chicago, and the district's chief engineer, George M. Wisner, has been instructed to do the work before Dec. 1.

Indiana.

✣Bids will be received until 1 p. m., Sept. 6, by J. W. Sanderson, treasurer, N. H. D. V. branch, at Marion, Ind., for drilling two gas or oil wells.

Iowa.

The East Des Moines Commercial League is to ask the City Council of Des Moines to build a retaining wall between Walnut and Locust Sts. on the east river bank.

E. H. Lundy, Eldora, Ia., is to make a proposition to that city whereby he will erect a $10,000 concrete dam across the Iowa River at the site of the present wooden dam and will also erect a new power plant supplying both day and night service.

Kansas.

The Freeborn Construction & Engineering Co. has commenced placing concrete in the dam it is constructing across Little River at Central Ave., for the city of Wichita, Kan. G. H. Strayer is superintendent of construction for the contractors.

Louisiana.

✣Bids are asked until 11 a. m., Sept. 9, by Lt.-Col. Lansing H. Beade, U. S. Engineer, Room N, Custom House, New Orleans, La., for building lock and dam and lockkeeper's dwelling on Bayou Teche, La. The site of the proposed work is 3½ miles below St. Martinville, La., which is on a branch line of the Southern Pacific R. R. The work to be done consists in furnishing all the plant, materials and labor necessary to construct a concrete lock on pile foundations with wooden gates and all accessories; a timber-crib dam on pile foundation, with concrete abutment; making the excavation necessary for widening stream above and below the dam; placing all bank protection; building one lockkeeper's dwelling with accessories, and doing any incidental work necessary to the proper completion of these structures. The approximate quantities are as follows: Reinforced concrete incl. steel (Lock Walls) (Alternative bid) 580 cu. yds.; excavation, 40,000 cu. yds.; foundation piles, 48,260 lin. ft.; guide piles, creosoted, 6,100 lin. ft.; sheet piles, wooden, 166,250 ft. B. M.; sheet piles, steel (Alternative bid) 18,475 sq. ft.; back filling and embankment, 7,469 cu. yds.; concrete, 8,480 cu. yds.; concrete, reinforced incl. steel (Wing walls) 138 cu. yds.; reinforced concrete incl. steel (Abutment—Alternative bid) 191 cu. yds.; valves, cylindrical, No. 4; structural steel, 14,510 lbs.; steel reinforcement (Lock floor) 60,000 lbs.; bolts and special irons, 20,702 lbs.; cast iron, 41,750 lbs.; timber in permanent construction, 132,490 ft. B. M.; timber, creosoted, 96,389 ft. B. M.; timber in gates, 36,254 ft. B. M.; timber shoring, 10,000 ft. B. M.; riprap filling, 2,614 cu. yds.; bank protection, riprap, 500 sq. yds.; gage tile (4 gages) 76 lin. ft.; mattress protection, 2,011 sq. yds.; lockkeeper's dwelling, complete, No. 1; tile drain, 350 lin. ft.; walks and concrete paving, 90 sq. yds.; capstans, No. 2; bank protection, concrete (Alternative bid) 500 sq. yds.

Maine.

✣Lieut. Col. George A. Zinn, U. S. Engineer, 537 Congress St., Portland, Me., will receive bids until Noon, August 29, for removing the wrecks of schooners Young Brothers and Henry L. Peckham in Kennebec River at Iceboro, Me.

Massachusetts.

✣Superintendent of Streets, City Hall, Boston, Mass., will receive bids until noon, Sept. 12, for lighting the streets and alleys of the city with gas incandescent mantle burners for a period of two years, beginning Feb. 1, 1911.

Minnesota.

Citizens of Hokah, Minn., have raised $1,600 toward rebuilding the dam recently swept away, destroying Lake Como, a southern Minnesota summer resort. It is said that if the dam is rebuilt eastern capitalists plan to organize a waterpower company which will furnish electric power and light to Hokah, Caledonia, Houston, Lanesboro, Rushford and other towns in that vicinity, and which will build and operate an interurban line from Caledonia through Hokah to La Crosse. Albert Foster, La Crosse, Wis., is chairman of the committee.

The city of Fergus Falls, Minn., has engaged L. P. Wolff, Consulting Engineer, St. Paul, Minn., to investigate and report on a plan for rebuilding the wrecked dam of that city.

Mississippi.

✣Bids are asked by Capt. Clarke S. Smith, U. S. Engineer, Vicksburg, Miss., until Noon, October 20, for steel hull self propelling hydraulic dredge, steel pontoons and pipe line also for the component groups thereof, including steel dredge hull, steel pontoons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant.

New Jersey.

The Delaware River Improvement Co. of Newark, N. J., has been incorporated with a capital stock of $100,000 and proposes to construct a dam across the Delaware River at Boardman's Ferry. The incorporators are P. Ingalls, West Orange, N. J.; F. Osgood, South Orange, N. J., and H. C. Gilmour, Newark, N. J.

Ohio.

J. R. Cowell, Director of Public Service, Toledo, has recommended to the city council that funds be appropriated to defray the expense of dredging out the lagoon at Bay View park. He estimates that it will be necessary to remove about 20,000 cu. yds. of earth from the bottom of the lagoon, and that the operation will entail an expense of probably $4,000.

Condemnation proceedings and the securing of the right of way for straightening the channel of the Great Miami River south of Washington St., in Dayton, O., are now under way, and as soon as completed the work will be advertised. Authority for issuing bonds, amounting to $450,000 for the work was authorized by a vote of the people at the last election. F. J. Cellarius is City Civil Engineer.

Pennsylvania.

✣Bids will be received until Noon, September 15, by Maj. Herbert Deakyne, U. S. Engineers, 815 Witherspoon Bldg., Philadelphia, Pa., for dredging in the Delaware River.

✣Bids will be received until 11 a. m., August 25, by Maj. Chauncey B. Baker, Depot Quartermaster, 26th St. and Gray's Ferry, Philadelphia, Pa., for furnishing and delivering at the depot 50,000 shelter tent poles to conform with the requirements of the specifications.

The following bids were received Aug. 11 by City of Philadelphia for improving the pier at Philadelphia: Franklin Eyre & Son, $11,187; Costello & Co., $11,738; Filbert & Co., $12,162; Latta & Terry Construction Co., $12,955; American Paving & Construction Co., $13,255; Armstrong & Latta Co., $14,915.

Tennessee.

J. G. White & Co., Inc., 43 Exchange Place, New York, has been awarded the contract for the complete engineering and construction of a hydro-electric power plant for the Eastern Tennessee Power Co. The dam and hydro-electric power station will be constructed on the Ocoee River at Panceville, Polk county, Tennessee, about 12 miles from Cleveland, Tenn. The dam will be of cyclopean concrete and about 700 ft. long on the crest; 430 lin. ft. of this dam will be of the overflow type and 350 lin. ft. will be of the non-overflow type. The overflow portion will be about 110 ft. high above mean water stage having its crest at about elevation 825 and will be of the usual ogee section. It will be equipped with suitable flashboards and the necessary temporary and permanent sluices. The non-overflow portion of the dam will be about 13 ft. higher than the overflow section and will be of a special section to accommodate penstock intakes at the top and penstocks passing from the intakes to the turbine below. The power house will be located on the down stream side of the non-overflow portion of the dam and will be an integral part of the same. The substructure will be of massive concrete and will consist mainly of piers and arches below the dam. The turbines will be located at the elevation of the main floor and will discharge into the tail race under the arches. The superstructure will consist of brick or stone walls with enclosed steel columns. These columns will support the superstructure floors, crane runway and steel roof trusses. The superstructure floors will be reinforced concrete slabs supported on steel girders and floor beams. The roof slabs will be reinforced concrete supported on steel purlins and will be provided with suitable roof covering. The power equipment will consist of four main units of normal rated capacity of 3,000 kw. each; one 200 kw. exciter unit, the necessary step up transformers and switching equipment for the control of this apparatus. Each main unit will consist of one tandem horizontal turbine in enclosed case direct connected to a 3 phase, 60 cycle, water wheel type, alternating current generator. Each generator will have mounted on its shaft an exciter having a capacity sufficient for its excitation. Miscellaneous equipment will consist of an electrically driven traveling crane; a transformer truck; necessary gates and gate hoists; water, oil and air circulating systems; miscellaneous piping; plumbing fittings, pumping apparatus, lighting system and all other apparatus which is essential for the complete equipment of a first-class station. A tailrace will be excavated for some distance down stream from the power house and will, if found necessary, be separated from the main river channel by timber crib or concrete wall. The shore of the river adjacent to the power house will, if necessary, be protected by means of riprap. A permanent gravel or macadam road will be constructed from the present highway to the power house entrance. Along the Ocoee River and tributaries thereof, public roads will be relocated at various places where their present grade is below the maximum flow line of the reservoir. New bridges, culverts, etc., will be built where necessary, due to these changes. The estimated cost is approximately $2,000,000.

Bids were opened Aug. 10 by Maj. M. L. Walker, U. S. Engineer, Memphis, Tenn., for furnishing riprap stone at spalls, the contract being let to Zeb Ward, Little Rock, Ark., for 18,000 tons riprap and 2,000 tons spoils at 65 cts. per ton f. o. b. cars on railroad track at quarry.

Wisconsin.

R. A. Lang, Eau Claire, Wis., has the contract for building a dam on Kinnickinnick River, two miles from the St. Croix in Wisconsin. The dam will afford power for an electric plant to supply electricity for light and power at Prescott and River Falls. Work has already been started.

The Barnett & Record Co., Minneapolis, Minn., which has the contract for foundations for the new Great Northern ore dock at Allouez, Superior, has the work so well along that everything will probably be ready to start the steel superstructure by Oct. 15. About 300 men are employed on the foundation work. The contractors are using one floating pile driver and four other drivers for placing the 11,000 piles required for the dock foundation alone. Two dredges—one a dipper dredge and one a hydraulic are also at work. The steel work will be done by the American Bridge Co., 9,000 tons of steel being required.

Texas.

✣Bids are asked until Noon, September 10, by Maj. G. P. Howell, U. S. Engineer, Galveston, Texas, for dredging Port Bolivar Channel, Texas.

The Commercial Club of Corpus Christi is taking steps for the construction of a causeway over Nueces Bay to unite Corpus Christi with San Patricio county. It is announced that J. A. Franklin of the St. Louis Bankers Trust Co. will finance the enterprise after the riparian rights of abutting land holders are secured by the company. It is proposed that the two counties contribute to the dam as a means of securing a free roadway. The work will cost about $250,000. . Fred Roberts, Corpus Christi, is the promoter.

Virginia.

✣Bids will be received until Noon, September 19, by Lieut. Col. Mason M. Patrick, U. S. Engineer. Room 2, Custom House, Norfolk, Va., for dredging Thimble Shoal.

✣Bids will be received until Noon, September 20, by Lieut. Col. Mason M. Patrick, U. S. Engineers, Room 2, Custom House, Norfolk, Va., for dredging the channel to Newport News, Va.

Washington.

✣P. F. Clark, City Clerk, Aberdeen, Wash., will receive bids until 5 p. m., September 28, for the improvement of the Tide Lands in Aberdeen, between Broadway and Division Sts.; the Northern Pacific track and the hill, as provided by Ordinance No. 940, creating filling district No. 1. According to the estimate the work will include the clearing of 250 acres of streets. lots and alleys and the filling of 1,500,000 cu. yds. of earth; constructing about 4,000 ft. of pipe drains. Official advertisement of the work will be found elsewhere in this issue. C. W. Ewart is City Engineer.

West Virginia.

✣Bids will be received by F. W. Altstaetter, Captain, U. S. Engineers, Wheeling, W. Va., until 11 a. m., September 16, for the construction of a lock and guide walls, bear trap weirs and Chanoine weir for dam No. 19, in the Ohio River.

Wisconsin.

✣Bids will be received by Maj. Charles S. Bromwell, U. S. Engineer, Milwaukee, Wis., until noon, September 12, for constructing reinforced concrete caissons and pile pier, removing old pier and dredging at Racine Harbor.

✣Bids will be received until Noon, August 30, by Clyde Warnick, City Clerk, Crandon, Wis., for the construction and installation of a complete electric plant. Work is divided in three sections as follows: (1) Steam plant including tubular boilers and direct connected high speed engine; (2) brick building; (3) electric machinery, including pole line, generator and switch board, etc.

Canada.

✣Burlington Beach Commission 800 Bank of Hamilton Building, Toronto, Ont., will receive bids until August 31, for the construction of and filling in behind concrete revetment wall about 1,650 ft. long, 7 ft. base on the Bay Front at Burlington Beach. A certified check for $500 must be filed with each bid. E. G. Barrow is Engineer.

✣Bids will be received by R. C. Desrochers, Secy., Department of Public Works, Ottawa, Ont., until 4 p. m., September 13, for the construction of an extension to the breakwater in Colpoy's Bay at Wiarton, Bruce County, Ont.

✣Bids will be received until 4 p. m., Sept. 12, by R. C., Desrochers, Secy., Department of Public Works, Ottawa, Ont., for the construction of an extension to the North Wharf at Pelee Island, Essex County, Ont.

✣Bids will be received until 4 p. m., Sept. 12, by R. C. Des Rochers, Secretary of Department of Public Works, Ottawa, Ont., for construction of a one yard dipper dredge for Prince Edward Island.

✣Bids will be received by the Department of Public Works, Ottawa, Ont., until 4 p. m., August 31, for the construction of a breakwater at Bare Point in the harbor of Port Arthur Electoral District of Thunder Bay and Rainy River. R. C. Des Rochers is Secretary of the Department.

✣Bids will be received until August 29 at 5 p. m., by the commission, Continental Life Bldg., Toronto, Ont., for the construction of a transformer station building near Port Credit. Adam Beck is chairman of the commission.

✣Bids will be received by G. R. Geary, chairman, Board of Control, City Hall, Toronto, until noon, Sept. 6, for the following materials: 20,800 ft. of partly worn or relaying rails, 400 oak ties and 4,800 cedar ties for construction of Industrial tracks on the east bank of the Don.

✣Bids will be received by W. W. Clarke, city clerk, Charlottetown, Prince Edward Island, until noon, Sept. 10, for supplying the city with electric light for street and commercial purposes.

City Engineer Rust, of Toronto, Ont., has recommended the construction of groynes for the protection of the beaches at the city. The cost is estimated at $11,500.

The Canadian Public Works Department has awarded the following contracts: For dredging in Miramichi bay, N. B., W. J. Poupore, Montreal, and A. & R. Loggie, each get a contract for $100,000 approximately. L. Cohen & Son, Montreal, will dredge at Montmagny, total being about $8,000, while N. Trudel will build breakwater at Matane, costing $5,500.

BRIDGES AND BUILDINGS

Alabama.

At a recent meeting held at the Commercial Club Rooms of Mobile, Ala., the representatives of Mobile and Baldwin Counties discussed the feasibility of building a bridge to connect Mobile and Baldwin Counties. Many different plans were suggested but nothing definite was decided upon.

California.

The contract for the construction of the new concrete arch bridge over Dry Creek between Oroville, Cal., and Oro Vista has been let to O. A. Peter, at $2,747. The arch will be 40 ft. wide and 40 ft. long and will be built of reinforced concrete.

At the request of the Levee Committee and the Board of Trustees, Sacramento, Cal., the Western Pacific has decided to improve the bridge over the American river north of the north end of 19th street, by removing 8 of the piers, which are condemned and replacing same with 4 larger ones, thus making the spans which were formerly 80 ft., 160 ft.

Plans and specifications for the bridge across the Sacramento River at Meridian have been filed with the surveyor of Sutter County, Cal., at Yuba City, by the Scherzer Rolling Lift Bridge Co., Chicago, Ill. The structure which is to be built jointly by the Northern Electric and Sutter and Colusa Counties will, under the present plans, be 246 ft. long with track bed for the cars, 16 ft. wide, wagon road 24 ft. wide and is estimated to cost $120,000.

According to advices from Sonora, Calif., J. N. Pickle, surveyor of Tuolumne County, has been authorized by the Supervisors to prepare plans and estimates for the construction of a bridge across Curtiss Creek, near the town of Algerine.

Connecticut.

The Board of Public Works, New Britain, Conn., is to take up the matter concerning the Monroe St. bridge, which has been in service only about 3 years and is already in need of repairs.

District of Columbia.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Sept. 21, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Warrensburg, Mo.

✣Bids will be received until 3 p. m., Sept. 26, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Greensburg, Pa.

✣Bids are asked by Frank Pierce, Acting Secretary of the Department of the Interior, Washington, D. C., until 2 p. m., August 25, for the extension of a vacuum heating system to the Pension Office Building and the construction of a concrete trench from the intersection of the tunnel connecting the old Post Office and the Patent Office Buildings to the Pension Office building, to be used in connection with the extension of such system.

✣Bids will be received until 3 p. m., August 30, by James Knox Taylor, supervising Architect, treasury department, Washington, D. C., for test borings for the new postoffice building, Washington, D. C.

The York Engineering Co., Inc., York, Pa., has been awarded a contract at Washington, D. C., for improving heating system at weather bureau for $2,659. Bids were opened Aug. 5.

Florida.

Board of County Commissioners at a recent meeting at Jacksonville, Fla., let the contract for the construction of two reinforced concrete bridges on Middleburg Road to the Southern Bridge Co., at a cost of $984 each.

Idaho.

Plans are being prepared by the engineers of the Oregon Short Line Ry. for the construction of a new steel bridge over the Snake River at American Falls, Idaho. The new structure will be 14 ft. higher than the present bridge and will be double tracked. It is believed that the work will be done by the American Bridge Co., at a cost of about $400,000.

Commissioners of Blaine County will hold a hearing 2 p. m., Sept. 12, at the courthouse at Hailey, Idaho, on the petition and application of the citizens for the construction of a wagon bridge across the Malad River just below and east about 1-5th of a mile from the junction of Willow Creek and said Malad River.

Illinois.

Bids were received and rejected by the Clerk at Mendota, Ill., for the construction of three bridges, one at Jefferson St., one at Fifth and the other at Ninth Ave., as follows: Herman Bierwirth, $3,334; Charles Walter, $4,006; H. Zolper & Sons, $4,042. Work will be readvertised.

Advices from Taylorville, Ill., state that the Committee rejected all bids for the construction of eight steel bridges across the big union drainage ditch in King township.

According to information received from Bloomington, Ill., the contract for the construction of a reinforced concrete foot bridge across the dam between the lakes was awarded to Henry Behrends for $1,200.

Engineers are making soundings and measurements preparatory to drawing up plans and

Items marked thus ✣ indicate work now open for bids.

specifications for the construction of the New Colona bridge over Rock river to connect Rock Island and Henry Counties. The contract for the improvement will be let soon, it is said.

The department of public works of Chicago, Ill., has awarded a contract to the Edge Moor Iron Works for furnishing and delivering at the 68th St. pumping station and erecting place three 350-h. p. water tube boilers for $12,200. Bids were opened Aug. 17.

The Decator Bridge Co., Decatur, Ill., has been awarded a contract at Ottawa, Ill., for the construction of a steel bridge over Covel Creek, with concrete abutments for $3,257. Bids were opened Aug. 5.

Indiana.

✣Bids will be received until 11:30 a. m. Sept. 10, by the trustee of Elkhart township, Noble county at Wawaka, for the construction of a high school building. George E. Kelner is trustee.

✣Bids will be received until 1 p. m. Sept. 8, by commissioners of Spencer county at Rockport, Ind., for the construction of seven county bridges. John T. White is auditor.

✣Bids will be received until 2 p. m., Sept. 8, by county commissioners at Lebanon, Ind., for the construction of six county bridges in Boone county, Ind. B. F. Herdrich is auditor.

✣Bids will be received until 1 p. m., Sept. 6, by the commissioners of Dubois connty at Jasper, Ind., for the construction of ten bridges. M. A. Sweeney is auditor.

✣Bids will be received until 10:30 a. m., Sept. 5, by the commissioners of Tipton county at Tipton, Ind., for the construction of five bridges. J. F. Barlow is auditor of the county.

✣Bids will be received until 10 a. m., August 25, by commissioners of Marion county at Indianapolis, Ind., for the construction of six culverts. Albert Sahm is auditor of the county.

John W. Scott of Ingalls, Ind., has been awarded a contract in Anderson, Ind., for the construction of two concrete bridges, one 60 ft. span at $1,290 and one 18 ft. span at $525. Bids were opened Aug. 16.

The County Commissioners at Columbus, Ind., at a special session held recently adopted plans for the construction of a bridge to be built near Burnsville, known as the Wright bridge.

Board of City Council is taking into consideration the matter of constructing a new bridge across the East Race at LaSalle Ave., in South Bend.

The Board of County Commissioners, New Castle, Ind., have rejected the bid of the Pan American Bridge Co., the only one for the structure across Flatrock on the W. D. Pierce farm, northeast of the town. The bid was $1,425, while the appropriation was only $1,250.

Freeholders residing in the northeastern part of Warren township, Ind., have filed with the county commissioners, Indianapolis, Ind., a petition for the construction of a bridge over Grassy Creek, in Section 28, in the northeast corner of the township.

The only bid received by the County Commissioners at Goshen, Ind., for the construction of the Lexington Ave. bridge in Elkhart, Ind., was that of the Elkhart Iron & Bridge Co., which was $5,400, about $900 over the appropriation. The matter was referred to the city council.

Iowa.

✣Bids will be received until August 25, by City Clerk, for the construction of a new city hall in Knoxville, Ia. S. K. Butterfield is Mayor.

All bids for the construction of the proposed bridge at Walnut St., Des Moines, Ia., were referred to Councilman John MacVicar and it is expected that he will recommend awarding the contract for the work to John Wheeler Construction Co., Geneva, Ill., for $169,661, the lowest bids received. The other bids were J. W. Turner Improvement Co., $197,000; J. C. Mardis, also of Des Moines, Ia., $195,475.

Kansas.

✣Commissioners of Waubaunsee County will receive bids at Alma, Kan., until Noon, August 29, for the construction of a bridge across the Kaw River at Sweeney Crossing in Kaw Township. C. C. Stotler is County Clerk.

Plans have been filed by the officials of the Santa Fe Ry. for the construction of the Cleveland Ave. viaduct in Topeka, Kan. According to drawings the street car company will also be accommodated.

Maryland.

The Board of Awards, Baltimore, Md., has awarded the contract for the construction of two bridges over the Western Maryland R. R. One at Seventh St. to the Raymond Concrete Pile Co., for $33,004; another at Stony Run to C. B. Clarke & Co., Asheville, N. C., for $47,720.

Two contracts were awarded at $1,550 to the Farris Bridge Co., Pittsburg, Pa., for the construction of a steel bridge on Williams Road over Town Creek, the structure to be 72 ft. long, and for a 65-ft. steel bridge from Luke, Md., to Frazee's over Town Creek.

Massachusetts.

✣Bids will be received until noon, Sept. 1, by superintendent of streets, Boston, Mass., for the repair of the Broadway bridge in South Boston.

✣Bids will be received until 3 p. m., Sept. 1, by park department at the office of the commission, Pine bank, Olmsted Park, Jamaica Plain, Boston, Mass., for erecting a brick sanitary and locker building on the William Eustis Playground, Norfolk Ave., Rosbury.

The contract for the construction of the proposed bridge over the Chicipee River in Three Rivers, Mass., has been awarded to W. N. Flynt Granite Cox., Monson, for $21,000. The structure will be a granite faced, concrete filled arch bridge.

Michigan.

Contractor Whitney Wells has started work sounding in the river at Thirteenth St., Bay City, Mich., preparatory to sinking piles for the construction of the proposed bridge across the river at that point. It is expected that this preliminary work will require two or three weeks for completion.

City Engineer of Flint, Mich., has been instructed to prepare plans and estimates for the construction of a bridge across the Flint river to Moon Island. The cost of the work will be defrayed by the Park Board.

Minnesota.

Engineers of the Great Northern Ry. Co., have submitted to city engineer of Minneapolis, Minn., plans for the reconstruction of bridges forming the railroad viaducts on University Ave. and on the corner of 15th Ave. and Fourth St.

Missouri.

A proposition to borrow $20,000 for the construction and repair of bridges recently damaged by highwater was voted upon Aug. 23 at Palmyra, Mo.

The County Court, according to advices from Louisiana, Mo., has awarded the contract for the construction of a bridge across Peno creek to the Missouri Bridge Co., for $3,725; for the construction of a bridge across Sulphur creek to the Midland Bridge Co., at $1,313.

Nebraska.

It has been announced by R. A. Duff, Nebraska City, Nebr., and T. H. Pollock of Plattsmouth, Nebr., that construction work will be commenced shortly on the new 3-span steel bridge across the Platte River at Oreapolis within a few weeks. The structure which will shorten the distance between Plattsmouth and Omaha 30 miles, is estimated to cost $20,000.

New Hampshire.

The contract for the replacing of an old wooden bridge across the Connecticut river between Walpole, N. H., and Westminster, Vt., has been awarded to the Walsh Holyoke Steam Boiler Works, Holyoke, Mass. The structure will be a steel plate girder type and is estimated to cost $20,000.

New Jersey.

✣Bids will be received by James Knox Taylor, supervisor architect, treasury department, Washington, D. C. until 3 p. m., September 23, for the metal shelving, etc., in the extension to the United States postoffice and courthouse at Trenton, N. J.

The John A. Roebling's Sons Co., Trenton, N. J., has awarded a contract to the Raymond Concrete Pile Co., of New York and Chicago for placing Raymond concrete piles in the foundations of Wire Mill No. 2 at the Roebling, N. J., plant.

The project for a new bridge at Albany Ave., Atlantic City, N. J., where the auto boulevard enters that city, was turned down August 10 at the meeting of the Atlantic County Board of Chosen Freeholders.

According to advices from Newark, N. J., contracts were awarded F. W. Shrump Sons Co., as follows: For the extension of the Beam bridge on Runnymede road over Pine Brook in the borough of Essex Falls, $1,154; for extension of arch bridge on Mountain Ave., near Forest Ave., North Caldwell, $748; for concrete arch bridge in Ashworth terrace, $1,079.

New York.

G. Elias & Bro., Buffalo, N. Y., has been awarded the contract by the Commissioners of the County at Wilkesbarre, Pa., for furnishing lumber for the Water St. bridge at Pittston, Pa., for $1,172. The material includes 25,000 ft. of white oak plank and 12,484 ft. of yellow pine.

Ohio.

✣Bids are asked until 1 p. m., August 29, by Board of County Commissioners, St. Clairsville, O., for the construction of a reinforced concrete arch bridge over Steep Run in Colerain township to replace the bridge recently destroyed by a storm. E. E. Shepherd is County Auditor.

✣County Commissioners, Akron, O., will receive bids until 11 a. m., Sept. 2, for the repair of the Portage St. bridge over the Cuyahoga River, Cuyahoga Falls, O. A certified check for $200 must be filed with each bid. C. L. Wirth is Clerk.

Plans and specifications have been approved by the board for the construction of the new Fifth St. bridge in Zanesville, O., and bids for the work will be asked shortly. The structure will be of concrete encased in steel approaches with three river spans. The roadway is to be paved with brick with cement filling and the sidewalks are to be of reinforced concrete.

County Commissioners, according to advices from Zanesville, O., have received the following bids for the construction of the stone abutments to the Duncan Run bridge in Harrison township: Mercer & Gardiner, $1,257; Robert Flautt, $1,065; Edgar Williams, $829. The last bidder was awarded the contract.

The County Commissioners, Columbus, O., have awarded the contract for encasing the abutments of the McKinley bridge over Darby Creek in Pleasant township to Cooke & Cooke, Columbus, for $2,481. The engineer's estimate for the work was $3,875.

The board of county commissioners at Toledo, O., has awarded a contract to Joseph Wolff of Toledo, O., for the construction and building of abutments and repairs to an approach to bridge on County Road No. 332 over Swan Creek. Bids were opened Aug. 16.

Information received from Defiance, O., states that petitions are in circulation in the south B. & O. district for the construction of a bridge across the Maumee river at some point between Delaware Bend and Defiance.

Oklahoma.

The County Commissioners at Oklahoma City, Okla., have taken up with the Morris Packing Co., and the Park Commissioners the matter of constructing a bridge over the Canadian River near Packingtown.

Items marked thus ✣ indicate work now open for bids.

Pennsylvania.

✣County Commissioners, Uniontown, Pa., will receive bids until Noon, August 25 for the construction of a bridge over George's Creek near the residence of A. S. Provance. The superstructure will be of steel consisting of one clear 70 ft. span with 14 ft. roadway. Robert Powell is Clerk. John S. Langley is Commissioner.

✣Bids will be received by C. T. Straughn, County Controller, Pottsville, Pa., until 10 a. m., August 29, for the construction of a new steel bridge over Mahanoy creek on South Third St. in the borough of Ashland.

The contract for the construction of the proposed new bridge between Sunbury, Pa., and Packer's Island, according to advices from Milton, Pa., was let to the York Bridge Co., at $84,300. The structure will have six spans. Other bids received were as follows: Penn Bridge Company, six span bridge, $99,555; four span, $95,555; J. S. Melivane & Company, Chambersburg, six span bridge, $100,000; four span, $96,500; Penn Steel Company, $84,450, for a six span bridge, and $85,950 for four spans.

The Clinton county commissioners at Lock Haven, Pa., have awarded a contract to the Groton Bridge Co., of Groton, New York, for the construction of a steel span bridge with a Kreodone block floor and concrete substructure also, for a steel span bridge with a concrete floor and concrete substructure over Sinnemahoning Creek at Keating in East Keating township for $7,794. Bids were opened Aug. 12.

A contract has been awarded W. H. Herr, at $8,300 for replacing the wooden bridge at the northern end of Pennsylvania Ave., Tyrone, Pa., which crosses Bald Eagle creek at that point, with a concrete arch structure 79 ft. long and 36 ft. wide, including a 6-ft. sidewalk.

Tennessee.

The contract for the construction of a steel bridge over the Conasauga River at Conasauga, a town of Benton County, Tenn., has been awarded to the Joliet Bridge Co., Joliet, Ill., for $43,250.

Texas.

Advices from Cuero, Texas, state that the DeWitt County Commissioners in session August 13, granted the petition of the taxpayers and ordered a special election to be held November 8 to vote on authorizing the issuance of $15,000 in bonds for the construction of public bridges in DeWitt County and across the stream that constitutes the boundary line of said county known as Colletto creek.

Advices from Cameron, Texas, state that the Commissioners Court has awarded the contract for the construction of a steel bridge on Walker's creek, 6 miles northeast of Cameron. The contract price is $2,254 and work is to be completed by November 15.

The Commissioners of Walker County, Huntsville, Texas, have closed a contract with the Missouri Bridge & Iron Co., Dallas, Texas, for the construction of a steel bridge over Harmon's creek on the Cincinnati road. The contract price was $2,800.

Washington.

The City Council of Seattle, Wash., has adopted a resolution authorizing the Board of Public Works to construct a bridge over the Lake Union at Stone Ave., wide enough to carry a double track car line, a wagon road and foot walks. Work will be started as soon as the government grants its authority. It is expected that a portion of the cost will be borne by the Seattle Electric Co.

The contract for the construction of a highway bridge across the Hoquiam river near London has been awarded A. W. Tweeden Contracting Co., Tacoma, Wash., for $2,498. The structure will be built of steel on cylinder piers and will be 80 ft. long.

Wisconsin.

The matter of constructing a new bridge across the Nemadji River at West Fourth St. between the East End proper and Allouez, Superior, Wis., is being agitated by Alderman W. E. Idler of the Tenth ward by request of the citizens.

The town boards of Lake and Grover county board at Marinette, Wis., have awarded a contract to the Elkhart Bridge & Iron Co., for the construction of a steel bridge on the section line between sections 23 and 24, 25 and 26 of the town 31, range 21, and on the dividing line of the Peshtigo river between the towns of Grove and Lake, for $4,180. Bids were opened Aug. 15.

Canada.

✣The time for receiving bids for the superstructure of the Quebec Bridge will be extended from Sept. 1, to October 1. L. K. Jones is Secretary of Department of Railways & Canals, Ottawa, Ont.

Petitions are being circulated for presentation to the City Council of Winnipeg, Man., for the construction of a pontoon bridge across the Assiniboine River at the new city park.

Advices from Hamilton, Can., state that the Canada Bridge Co., has been awarded the contract for the construction of the Hastings County bridge at Belleville over the Moira River on the boundary line. The work is estimated to cost $10,500.

Mexico.

The Wm. P. Carmichael Co., Fullerton Bldg., St. Louis, Mo., has been awarded the contract for the design and construction of the five-story reinforced concrete frame for the hotel Gante, Mexico City, Mex. This is a second contract in addition to the special raft foundation and waterproof basement now under construction. The completed building will cost about $1,200,000 pesos and is designed and supervised by Jose Luis Cuevas, architect, Mexico City. It will extend one block in length from Avenida 16 de Septiembre to Calle Zuleta.

WATER-WORKS AND SEWERAGE

Alabama.

Preparatory to making plans for the big septic tank to be built by the board of revenue of Birmingham, Ala., on Village creek, near Ensley, L. M. Salter, county sanitary engineer, is making surveys and gathering data on the question. Bids for the erection of the new tank will be asked as soon as the plans are completed.

Arkansas.

The contract has been let by the commissioner of sewer district No. 58 of Little Rock, Ark., for the construction of a sewer in the district, which includes a large section in the southern part of the city. The contract was awarded to James Trainor for $8,500. This is exclusive of the cost of the septic tank, which will be built later. The district includes the territory between Broadway on the west and Cumberland St. on the east, 23rd St. on the north and the Rock Island tracks on the south.

California.

The contract for the construction of the western part of the south side sewer west of Bay St., in Alameda, Cal., has been awarded to W. J. Smith for $17,264. Bids for the eastern section will be advertised for later.

The city trustees of Yreka, Cal., have awarded the contract for running an open cut and the placing of a concrete dam in the bed of Yreka Creek, at the corporation works, to Mowrey & McDonald for $2,486. The contract calls for an open cut across the bed of Yreka Creek, a distance of 270 ft., a concrete dam 18-in. thick at the base will be imbedded one ft. in the bedrock. This dam will be four ft. above the bed rock of the present well, from which the city water is pumped, which will back all the water from the main channel of the creek and cause it to run into the well and keep the same filled at all times.

Plans have been prepared by Olmstead & Gillian of Los Angeles, Cal., for the construction of a complete sewer system in Monrovia, Cal., estimated to cost $120,000. The city will hold an election about Oct. 1 to vote on the issuance of bonds for this purpose.

The city of Monrovia, Cal., will hold an election about Oct. 1 to vote on the issuance of bonds in the sum of $50,000 for improvements to the water system. It is desired to replace with 16-in. pressure pipe the main Chapman wells two and one-half miles west of the city limits and to rehabilitate the entire distributing system south of White Oak Ave.

The town board of trustees of Alturas, Cal., has been at work on the proposition of putting in a water and sewer system in the town of Alturas. They have selected the firm of Sloan & Robson, consulting engineers of San Francisco, to prepare estimates for water and sewerage system. After estimates have been prepared the town will hold an election to decide whether or not bonds will be issued for the work.

Colorado.

The town trustees of Yuma, Colo., are preparing to call a special election for the purpose of bonding the town for making improvements on the water works and taking up the remainder of the old bonds. New water mains will be laid and a new stand pipe will be erected.

The board of aldermen of Denver, Colo., has passed a bill appropriating $16,000 for improvements and extensions to the old South Denver water system. The projected improvement includes the laying of 16 blocks of 12-in. pipe from South University Ave. along Jewell St. to South Clarkson from which about 12 blocks of 6-in. sub-mains will be extended to supply the residents adjacent.

District of Columbia.

✣The Commissioners of Washington, D. C. will receive bids until 2 p. m., August 29, for the construction of sewers in the District of Columbia. John A. Johnston, E. M. Markham are Acting Commissioners.

Georgia.

A committee from the city council of Dalton, Ga., has recommended the purchase of the Crown Cotton mills property just outside the north limits of the city for the construction of a new waterworks and electric light system. The top of Mount Rachel will probably be used and a reservoir of 1,000,000 gals. will be constructed.

Illinois.

✣Bids will be received until 7 p. m., August 25, by W. H. Dawson, City Clerk, Bushnell, Ill., for the construction of about 33,565 lin. ft. of clay pipe sanitary sewers for the city in the sizes 8, 10, 12 and 15 in. Excavation from 6 to 16 ft.

The citizens of Flora, Ill., have voted to build a water works system.

The village board of Westfield, Ill., is planning for a waterworks plant by issuing bonds to the amount of $10,000 or $12,000 for the purpose of securing water and protection against fire; indications are favorable to the success of the scheme.

Consulting Engineer J. Cadogan Morgan of Chicago, Ill., who has been employed by the city of Bloomington, Ill., to locate and supervise the water supply system of Bloomington, has submitted his report of the surveys showing the blue prints and drawings, the exact locations of the various wells, and places where new wells should be sunk.

The Special Park Commission, 200 Randolph St., Chicago, Ill., has awarded a contract to Daniel Hardin of 3139 Indiana Ave., Chicago, for all labor, material and appliances used in installing drainage and water supply system at Hamlin Ave. playgrounds for $998. Bids were opened Aug. 13.

Indiana.

✣Bids will be received until 10 a. m., Sept. 7, by the commissioners of Delaware county at Muncie, Ind., for the improvement of public highway. Joseph E. Davis is auditor of the county.

✣Commissioners of Sullivan County, Ind., Sullivan, will receive bids until noon, Sept. 6, for the construction of a stone road in Cass township. Ben. C. Rowder is auditor of the county.

✣Bids will be received until noon, Sept. 6, by the commissioners of Miami County at Peru, Ind., for the construction of gravel roads in Peru and Butler township, seven in all. Charles Griswold is auditor of the county.

✣Bids will be received until 1 p. m., Sept. 5, by the commissioners of Decatur County at Greensburg, Ind., for the construction of a macadamized road in Salt Creek township. Frank E. Ryan is auditor.

✣Bids will be received until 1 p. m., Sept. 5, by the Benton County commissioners at Fowler, Ind., for the construction of a stone road in York township. Lemuel Shipman is county auditor.

✣Bids will be received until 1 p. m., Sept. 5, by the commissioners of Decatur County for 13,653 ft. of macadam roadway. Frank E. Ryan is auditor of the county at Greensburg, Ind.

✣Bids will be received until 10 a. m., Aug. 29, by the Board of Public Works, Indianapolis, Ind., for repairs to **Harding street sewer;** for paving roadway of Henry street from Delaware to Alabama street; for resurfacing roadway of Washington street from Union railway tracks to Cruse street with asphalt; for cement sidewalks in Pratt street from Paca street to Tenth street; for cement sidewalks in Nineteenth street from Rural street to Parker avenue.

The board of public works of Kokomo, Ind., has awarded a contract to J. H. Watson & Co., for the construction of the Milner sewer for $1,494. The sewer is to run from North St. to the Union St. sewer.

Iowa.

✣Bids will be received by A. C. Kuyper, City Clerk, Pella, Ia., until 6 p. m., Sept. 6, for the installation of a combined water and light plant, including 18,000 ft. of 10-in. pipe, filter gallery, well, 2 buildings, 2 A. C. Generators, 2 motors, 2 engines, 2 pumps, 3 boilers, transmission line, city lighting—lines, lamps, etc. Iowa Engineering Co., Clinton, Ia., are the Engineers.

A special election has been called for at Alvord, Ia., to vote for $4,000 to extend the waterworks system.

The city council of Clinton, Ia., has passed a resolution instructing the city engineer, R. C. Hart, to prepare an estimate of the cost of the installation of a modern municipal water plant, to take the place of the present plant, whose franchise will expire within a short time.

Bids received at Hawarden, Ia., for construction of a sewer system were rejected as being too high. The lowest bid received was that of the Lytle Construction Co., of Sioux City, Ia., being $24,955. The work will be readvertised.

A resolution has been introduced in the city council of Marshalltown, Ia., calling for the extension of the sewer on North Fifth St., between Jerome and Park Sts.

The city council of Tama, Ia., has employed C. A. Baughman of Ames as city engineer to have charge of the city's interest in the laying and construction of the new sewer system. County Surveyor W. H. Holstead was also engaged to make a survey of the line down State St. and to survey and establish a grade line for that street south of the C. & N. W. railway tracks.

The contract for the construction of a sewer on Maple St., in Burlington, Ia., from Summer St., to May Ave., has been awarded to George Peterson, the lowest bidder.

The city council of Muscatine, Ia., has let the contract for the West Hill sewer to August Korneman, the lowest bidder, for $3,586.

Plans have been completed for the construction of a sewer system in Greenville, Ia. The sewers will be placed in Rustin St., Bismarck St., St. George St., St. Charles St., Logan St., and Grace St.

Hamilton & Schwartz have been awarded a contract in Shenandoah, Ia., for the construction of about 2¼ miles of sanitary sewers for 77 cts. for 12-in. pipe, 72 cts. for 10-in. pipe and 65 cts. for 8-in. pipe, and manholes $40 each. The sewers will be constructed as follows: Iowa St. from its intersection with Sheridan Ave. to its intersection with Valley Ave. with 12-in. vitrified sewer pipe. Valley Ave. from its intersection with Iowa St. to its intersection with Sycamore St. with 12-in. vitrified sewer pipe. Sycamore St. from its intersection with Valley Ave. to the intersection with Wabash Ave. with 12-in. vitrified sewer pipe. Wabash Ave. from its intersection with Sycamore St. to its intersection with Broad St. with 12-in. vitrified sewer pipe. Sheridan Ave. from its intersection with Center St. to its intersection with South Webster St. with 10-in. vitrified sewer pipe. South Webster St. from its intersection with Sheridan Ave. to its intersection with East Thomas Ave. with 10-in. vitrified sewer pipe. East Thomas Ave. from its intersection with South Webster St. to its intersection with Staple Ct. with 10-in. vitrified sewer pipe. Bids opened Aug. 10.

Kansas.

Water mains are to be laid from 17th St., in Hutchinson, Kan., on north four blocks on Main St. to 21st., and from there to the new fair grounds.

The city council of Kinsley, Kan., has passed an ordinance calling for an election for the purpose of voting bonds in the sum of $12,500 to extend the present waterworks system. The extension contemplates the laying of some 17,000 ft. of new water main.

The city council of Salina, Kan., has been petitioned for the construction of several sewers. The council will probably order the construction of from $8,000 to $10,000 worth of sewers this fall.

Plans and specifications are being prepared by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the construction of a waterworks at Onaga, Kan. The estimated cost of the work is $20,000.

Plans and specifications have been completed by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for sewers and sewerage purification work for Garnett, Kan., estimated cost, $50,000. Bids will be received in about four weeks.

Plans and specifications have been completed by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the construction of a waterworks and lighting plant at Oakley, Kan., at an estimated cost of $40,000. Bids will be received as soon as the plans have been approved by the state board of health.

Kentucky.

✣Bids are asked by J. A. Hughes, Mayor, Winchester, Ky., until 1 p. m., August 30, for furnishing the necessary labor and material for the construction of 8½ miles of sewers from 6 to 15-in. in diameter, including manholes, lamp-holes, flush tanks, etc.

✣Bids will be received until 6 p. m., Sept. 13, by J. A. Dougherty, Clerk, Cynthiana, Ky., for the laying of a sewer in Wilson Ave., in Battle Grove Ave., grading and macadamizing Battle Grove Ave. and for laying concrete walk curb and gutter on Water St.

✣Bids will be received by the Commissioners of Sewage, Louisville, Ky., until noon, September 2, for the construction of Section F., of the Beargrass Intercepter Contract No. 73. The work includes about 940 ft. of 29-in. reinforced concrete sewer; 1,729 ft. of 33-in. plain concrete sewer; 2,543 ft. of earth excavation, maximum cut 29.5 ft. minimum cut 9.5, average cut 21.2 ft. about 640 cu. yds. of concrete and about 25,000 lbs. of steel. J. B. F. Breed is Engineer.

Bids for the construction of Section A of the eastern interception of the new sewerage system in Louisville, Ky., were opened by the sewer commission on Aug. 5. This section of the work will connect with section A of the southern outfall sewer, at the State Fair grounds. The contract, as yet, has not been awarded.

The Louisville, Ky., Commissioners of Sewerage, 605 Equitable Bldg., received bids on Aug. 5 for the construction of Section A, western interceptor, Contract 72, the work including the following approximate quantities: 3,239 ft. of 60-in. reinforced concrete sewer, diameter 5 ft., including about 3,239 ft. of earth excavation, average cut about 19.1 ft.; about 1,450 cu. yds. of concrete and about 67,000 lbs. of steel. The contract was awarded Guild & Co. of Louisville, Ky., for $45,226. J. B. F. Breed is chief engineer of the commission. H. P. Eddy, 14 Beacon St., Boston, Mass., is consulting engineer.

Maine.

✣Trustees of the Portland Water District, Portland, Me., will receive bids until noon, Sept. 12, for 14 miles of pipe. Bids will be received on 48-in. steel pipe; plates ¼-in. to ⅜ in. thick, delivered and laid complete; 42-in. cast iron pipe delivered; laying 42-in. cast iron pipe. C. W. Fenn, 11 Exchange St., Portland, Me., is Engineer.

Maryland.

The B. F. Bennett Building Co., will build the pipeline pumping station to be erected on South St., between Lombard and Pratt Sts., in Baltimore, Md., for $148,000.

At a meeting of the city council of Annapolis, Md., the first steps were taken toward the construction of a disposal plant which will pump all of the sewerage of Annapolis a considerable distance into the bay. A commission will be appointed to devise plans and ascertain costs.

Massachusetts.

✣Bids will be received until noon, August 29, by superintendent of streets, Street Department, Boston, Mass., for the construction of artificial stone sidewalks in Beaumont St., Dorchester.

✣Bids will be received until noon, August 29, by the superintendent of streets, Boston, Mass., for the construction of a macadam roadway bulkhead and fence in Dorchester Ave. and Boston St., South Boston.

✣Bids will be received until noon, August 29, by the street superintendent, department of streets, Boston, Mass., for the construction of artificial stone sidewalks in Washington St., Roxbury.

The following bids were received by the water commissioners of Greenfield, Mass., for the construction of the new Rocky Mountain reservoir. For completion by December 20, 1910, P. A. Breglio, $39,949; John E. Palmer, $40,874; Field, Barker & Underwood, $46,393; R. H. Newell & Co., $40,325; Crosby & Parker, $44,990; for completion by June 1, 1911, P. A. Breglio, $37,257; John E. Palmer, $36,924; Field, Barker & Underwood, $41,118; R. H. Newell & Co., $36,425; Daniel O'Connell's Sons, $33,317; Crosby & Parker, $38,900. The estimated cost of the reservoir including engineering, was $29,480. The lowest bid, that of O'Connell's Sons, is $3,837 higher than the estimate. The lowest bid on the shorter time was that of P. A. Breglio.

Comprehensive plans for the proposed intercepting sewer for New Bedford, Mass., which have been prepared by City Engineer William F. Williams, were presented to the state board of health, along with considerable data regarding float tests which have been made in the lower harbor.

Michigan.

✣Bids will be received by the City Clerk of Grand Rapids until about September 8, for the construction of concrete basins in connection with the new filtering plant. The work will include about 35,000 cu. yds. of earth work and about 7,000 cu. yds. of concrete masonry. Hering & Fuller, 170 Broadway. New York City, N. Y., are Engineers.

The city council of Steelton, Mich., has awarded a contract to the Sewer Pipe Co., of Akron, O., for the furnishing of sewer pipe for sewer construction.

Minnesota.

✣The Board of Trustees of the Village of Edgely, Minn., will receive bids until 8 p. m., September 2, for drilling a 4-in. well at the electric lighting plant of the village. J. E. Bowen is Village Clerk.

The United States Cast Iron & Pipe Co., was the successful bidder for the 60,000 ft. of water pipe for the city of Minneapolis, Minn. The amount of pipe to be used is 6,000 tons and the price varies from $24 to $24.50 per ton. The largest amount is 21,000 ft. of 36-in. pipe for the new supply main which is to be constructed from Camden Place to the main at the intersection of Lyndale and Hawthorn Aves. The mains will cost $166,000.

Mississippi.

The board of mayor and aldermen of Seminary, Miss., has issued $10,000 in bonds for the erection and completion of a school house and waterworks system. T. W. Cranford, Jr., is chairman of the municipal executive committee.

The B. A. Heidenreich Co., has been awarded the contract for extending the water mains of the city of McComb, Miss.

Missouri.

The board of public works of St. Joseph, Mo., has recommended for passage by the city council ordinances providing for the construction of sewers in districts Nos. 22 and 40.

Plans and specifications for the construction of a waterworks and sewers for La Plata, Mo., are being prepared by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo. Bids will be received some time in October.

Plans and specifications for waterworks and sewers for Monroe City, Mo., have been prepared by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo. The estimated cost is approximately $70,000. Bids will not be asked until some time in the spring.

Bids were received Aug. 9 at Slater, Mo., for waterworks extension and improvements and the contract was awarded to Jos. Bortenlanger of that city.

Plans and specifications have been prepared by Burns & McDonnell, Scarritt, Bldg., Kansas City, Mo., for the construction of a complete sewer system for the city of Joplin, Mo. The plans calls for the expenditure of about $60,000. J. B. Hodgedon is City Engineer.

Montana.

A pumping plant is to be installed in the city of Townsend, Mont., in connection with the waterworks system. It has been planned to sink a drive well 100 ft. deep from which good pure water will be secured.

City Engineer Helmick of Helena Mont., has estimated the cost of constructing the outflow sewer in the Broadwater addition at $7,300.

The State Board of Examiners at Helena, Mont., has awarded a contract to John Sturrock of that city for the construction of a water works system in Miles City, Mont. Bids were opened Aug. 8.

Nebraska.

City Engineer Hamm of Fremont, Neb., has estimated the cost of constructing the sewer extension on 17th St., from Nye to Platte Ave., at $4,700. The engineer has also prepared plans and specifications for this work and has presented the same to the city council.

New Jersey.

✣Bids will be received until Noon, August 31, by Frederic H. Smith, Constructing Quartermaster, Fort Hancock, N. J., for the construction of a sewer outlet at Fort Hancock, N. J.

Chas. Ippolito, 83 Cone St., Orange, N. J., has been awarded a contract at Madison, N. J., for the construction of 12 miles of sewers from 9 to 18 ins. in diameter, with manholes, flush tanks and other appurtenances, and a small sewage ejector station for $67,335. Bids were opened Aug. 8.

New York.

✣The president of the borough of Brooklyn, New York, Alfred E. Steers, will receive bids until 11 a. m., August 31, for 15 street improvement contracts, the largest one being No. 6, for regulating and repaving with iron slag on a concrete foundation the roadways of 41st St. and 44th St., from 5th Ave. to 6th Ave., together with all work incidental thereto. The engineer's estimate of the quantities is as follows: 4,810 sq. yds. iron slag pavement, with cement joints (one-year maintenance); 20 sq. yds. old stone pavement, to be relaid; 805 cu. yds. concrete for pavement foundation; 870 lin. ft. new curbstone, set in concrete; 2,020 lin. ft. old curbstone, reset in concrete. The time allowed for the completion of the work and the full performance of the contract is thirty (30) working days. The amount of security required is fifty-nine hundred dollars ($5,900).

✣Bids will be received by George Cromwell, president of the borough of Richmond, borough hall, St. George, New Brighton, New York, until noon, August 30, for three street improvement contracts, the largest being as follows: No. 2, for furnishing all the labor and materials required for regulating and grading the Castleton Ave. extension from Columbia St. to Jewett Ave., building the necessary bridge and appurtenances, together with all work incidental thereto. The engineer's estimate of the quantity and quality of the material and the nature and extent, as near as possible, of the work required is as follows: 1,000 cu. yds. of excavation; 700 cu. yds. of excavation, below 0.00 elevation; 10,600 cu. yds. of additional filling, furnished and placed; 6,000 lin. ft. of piles, furnished, driven and cut; 270 cu. yds. of concrete, mixed 1-2-4, for arches, furnished and placed; 20 cu. yds. of concrete, mixed 1-2-4, for spandrel wall, furnished and placed; 124 cu. yds. of concrete, mixed 1-2-5, for retaining wall, wing wall, basins, and culverts, finished and placed; 454 cu. yds. concrete, mixed 1-3-5, for piers, abutments and invert foundation, furnished and placed; 12 cu. yds. of concrete, mixed 1-3-6, for headers and pavement foundation, furnished and placed; 30,000 pounds of steel bars, furnished and placed; 200 lin. ft. of new 5-in. bv 16-in. bluestone curbstone, furnished and set; 60 lin. ft. of old curbstone, to be redressed, rejointed and reset; 402 sq. yds. of vitrified brick pavement, furnished and laid; 5 sq. yds. of vitrified brick pavement to be relaid; 6 sq. yds. of asphalt block pavement, furnished and laid; 5 sq. yds. of asphalt block pavement, to be relaid; 60 sq. ft. of flagstone, to be relaid; 64 sq. yds. of cobble stone pavement, furnished and laid; 20 lin. ft. of eight (8) inch vitrified drain pipe, furnished and laid; 100 lin. ft. of four (4) inch vitrified drain pipe, furnished and laid; 100 lin. ft. of galvanized iron pipe fence, including posts, furnished and set; 110 lin. ft. of wrought iron fence, furnished and set; 2 basin head covers and rims, furnished and set.

The time for the completion of the work and the full performance of the contract is one hundred and twenty (120) days. The amount of security required is twelve thousand dollars ($12,000).

Application has been made to the State Water Commission for permission to allow the board of public work of Hornell, N. Y., to make necessary extensions to the water system of the city. The proposed extension consists of the new storage reservoir along Seeley creek, and a new and large pipe line. The cost of the storage reservoir is estimated at $55,000 and of the pipe line at $45,000. Francis M. Cameron is city attorney.

The Civic association of Manhasset, N. Y., is agitating a movement for the installation of a municipal water plant. The plan suggested is to bond the town in the sum of $120,000. A committee has reported that a plant adequate for supplying water to the Manhasset school and Lakeville school district could be installed for $120,000.

Plans are being prepared by Walter McCulloch, chief engineer for the State Water Supply Commission at his office, Livingston Bldg., Rochester, N. Y., for the construction of the proposed storage dam to regulate the flow of the Genesee river in Rochester.

The amended plans for the new sewer system for Rochester, N. Y., containing changes ordered by the state commissioner of health, and additional changes made by the city engineer in sympathy with the attitude of the commissioner were sent to Albany for the approval of the commissioner.

North Dakota.

The city council of Minot, N. Dak., has agreed upon a plan for the restoration of the east wall of the city reservoir. The specifications adopted were submitted by Alderman Jacob Schmid and will necessitate the expenditure of about $2,000.

The city council of Fergus Falls, N. Dak., has authorized the engagement of L. P. Wolff, engineer of St. Paul, Minn., to look over the proposition of repairing the dam which was destroyed a year ago.

The city council of Carrington, N. Dak., by a unanimous vote voted to accept the plans and specifications furnished by L. P. Wolff of St. Paul, Minn., for a system of sewerage disposal.

The office force of the city engineering department of the city of Grand Forks, N. Dak., is preparing plans and specifications for a sewer main from Seventh to Eighth Aves. in the alley between Cottonwood and Cherry Sts.

R. B. Easton has the contract for making plans for the new sewer system to be installed in the village of Bowbells, N. Dak.

Ohio.

✣Bids will be received until Noon, August 29, by R. M. Cook, Clerk of the Village of Lakewood, O., for furnishing necessary labor and material for the improvement of Hird St. and Northland Ave., by constructing sewer therein, and Northland Ave. by installing a water main.

The board of control of Norwood, O., has awarded contracts for street improvements and water main extension. M. F. Quill of Cincinnati was awarded the contract for extending the water main on Montgomery Ave. for $2,447. George Murdoch was awarded the contract for the improvement of five streets at the following figures: Shannon Ave., $9,356; Grove Ave., $1,607; Besuden Ave., $9,599; Cavagna Ave., $11,303; Elvin Ave., $10,441.

The city of West Carrollton, O., has voted the issuance of bonds in the sum of $20,000 for the installation of an electric light and waterworks plant.

The village of Mt. Blanchard, O., is agitating the construction of a waterworks. It is probable that the council will act favorably upon the matter.

The city of Bellefontaine, O., will probably award the contract about Oct. 25 for the construction of the proposed sewer system. Sanitary Engineer H. E. Riggs of Toledo, O., has recommended that the work be awarded in small jobs.

Service Director D. M. Armstrong and City Engineer Kotte of Alliance, O., have devised plans for sewers at the intersection of Arch Ave., and Main St. The proposition is to put a new storm sewer across Main St., at Arch Ave., that will take care of the water from the avenue. It is also proposed to put beneath the storm sewer, at a depth of about six ft., a sanitary sewer of sufficient size to take care of the sewage from that section of the city, thus eliminating the digging of two trenches.

W. H. Ralston of Mt. Vernon, O., has been awarded a contract for the construction of the sewage purification plant for the Pennsylvania reform school at Morganza, Pa., for $9,500.

The service director of Zanesville, O., has awarded a contract to J. E. Brown for the installation of a storm and sanitary sewer in Galigher and Eastman Sts., from Cochran alley to Blocksom St., for $1,026.

Oregon.

The water committee of Salem, Ore., has endorsed the plan for the purchase by the city of the Salem Water Co.'s plant. Dr. W. B. Morse is interested.

The city of Eugene, Ore., has sold bonds in the amount of $60,000 for the erection of a filtration plant at the local waterworks and for the extension of the mains.

Pennsylvania.

✣Bids will be received until Noon, October 1, by Clerk of the Borough of West View, Pa., for the construction of main sewers and a disposal plant. Trimble & Miller, Pittsburg, Pa., are Engineers.

✣Bids will be received until about Sept. 1 by the Smithton Electric Light & Water Co., Smithton, Pa., for water works improvements estimated by John Hengsteller, Scottdale, Engineer, to cost $10,000.

✣Borough of West View, Allegheny County, Pa., will receive bids until Noon, October 1, for the construction of main sewers and disposal plant. H. L. Donaldson is Secretary of the borough. Trimble & Miller, Fourth Ave., Pittsburg, Pa., are Engineers.

Authority to establish a municipal water plant has been received by Bristol, Pa., from the State Board of Health,, but the borough will again try to buy the existing plant before acting finally.

Frank Bongardner of Harrisburg, Pa., has been awarded the contract for the construction of the Riverton Consolidated Water Co.'s new filter plant at Carlisle, Pa. The new plant will be erected on the site of the old Rose mill along the Yellow Breeches creek. The buildings will be of concrete and the machinery of the latest type.

The city council of Lancaster, Pa., has authorized the issuing of $75,000 bonds to improve the water system.

J. H. Stitzer of Philadelphia, Pa., has been awarded the contract by the American Viscose Co., at Marcus Hook, Pa., for the construction of a catch basin and reservoir at its silk plant. The reservoir will have a capacity of 750,000-gals. of water. More than 10,000 cu. yds. of earth will be removed.

The city council of South Fork, Pa., has awarded a contract to W. T. Burkett of that city for the building of the addition to the sewer system for $5,335. The contract for furnishing pipe for the work was awarded to John W. Walters of Johnstown, Pa., for $1,400. O. P. Thomas of Johnstown, Pa., is the engineer.

Dr. Samuel G. Dixon, State Health Commissioner, has informed the officials of Derry, Pa., that the new sanitary sewer and disposal plant, installed a year or so ago at a cost of $75,000, is inadequate and unsatisfactory. Dr. Dixon has been asked to send a representative from his office to make a detailed and exhaustive examination of the system and disposal plant.

The city council of the borough of West Chester, Pa., has decided to proceed in the matter of giving the place a sewerage system, without asking the voters to give their consent to their borrowing money for the purpose. The plan is to build an outfall system by which connections may be made with the sewers now in service, and with the necessary mains and disposal plants. The system, it is estimated, will cost $40,000. The borough will employ an engineer to furnish the necessary plans and select a suitable location for the plant.

Fabrizio D'Andrea has been awarded the contract for the construction of the 10th ward sewer in Scranton, Pa., for $3.50 per lin. ft. The sewer will be 5,640 lin. ft. long and will empty into the Dunmore sewer.

An ordinance has been introduced in the city council of Erie, Pa., providing for the issuance of bonds in the sum of $10,500 for the construction of a storm water drainage sewer system in the Sixth ward.

W. T. Burkett of South Altoona, Pa., has been awarded a contract for laying an extensive addition to the sewage system of South Fork for $5,335.

The borough council of Mechanicsburg, Pa., has awarded the contract for terra cotta and cast iron sewer pipe for Main and Washington Sts., to Hauck Bros., the lowest bidders.

South Dakota.

The voters of Willow Lakes, S. Dak., at a recent special election decided against bonding the town in the sum of $9,500 for the construction of a sewerage system.

The state commissioner of school and public lands has given his official consent for the purchase of the waterworks bonds recently issued by the town of Gettysburg, S. Dak. The work of installing the system will begin at once.

Myrmo Bros. of Sioux Falls, S. Dak., have been awarded a contract in Canton, S. Dak., for the construction of four blocks of sewers at 50 cts. per lin. ft. and $33 for each manhole. Bids were opened Aug. 16.

Tennessee.

The plans and specifications for a system of sanitary sewerage for Union City, Tenn., have been adopted by the city council, and the contract awarded to Sullivan & Long, of Bessemer, Ala. The contract amounted to $28,484. The work is to be done in installments, and the first installment to be done the present year will amount to $12,500. This will include a septic tank. The system includes all the flush tanks, manholes, and drop manholes.

Texas.

The Texas Co., Beaumont, Tex., will at once build an 8-in. pipe line to run direct from Shreveport to the Texas refinery at Port Arthur.

W. E. McCorquodale, of Orange, Tex., has been awarded the contract for the extension of the sewer on Main St., north on Fourth St., in that city.

The city of Galveston, Tex., will connect the city sewer with that of the United States government at Fort Crockett. City Engineer Dickey has submitted an estimate to the city council for the connection with the government sewer, being $8,636. Authority was given the commissioner of waterworks and sewerage to advertise for bids for the work.

Utah.

A pipe line franchise for Salt Lake county was granted to the Riverton Pipe Line Co., of Salt Lake City, Utah, by the board of county commissioners. The company has purchased the rights and pipes from the mouth of Bear canyon, near Draper, and proposes to extend a water system through various highways in that part of the county.

The city council of Murray, Utah, has engaged Joseph Ulmer as city engineer, and it is said that the work of further platting the city and installing a sewer system will be pushed rapidly. The engineer will also have charge of the work of installing the new pipe line from Big Cottonwood canyon. Contracts for the installation of the sewer system have been awarded.

Washington.

The committee appointed to investigate the feasibility of constructing a joint water supply system for Hoquiam and Aberdeen, Wash., has reported in favor of the plan. Engineers of both cities were instructed to get all possible data. The proposed improvement will cost $1,000,000.

The city council of Ellensburg, Wash., has decided to proceed with the building of the southeast sewer system at a cost of $12,000. The cost of the main sewer is $13,325. The council will build the northwest sewer.

The city engineer of Olympia, Wash., has estimated the cost of constructing the sewer in the Fifth ward, for which a resolution was introduced in the city council, at $18,000. The new sewer will commence at the intersection of Union and Franklin Sts., and will follow the center of Franklin St. south to the intersection of 24th and Franklin Sts., thence west on 24th St. to the intersection of 24th and Washington Sts., thence south to the city limits.

The contract for laying a sewer in the West End of Tacoma, Wash., has been awarded by the commissioner of public works, to Joseph Water & Co., for $58,500. The main line of the trunk sewer will begin on State St. in the vicinity of the ball park and run to North 15th St.

Anton Warter has been awarded a contract by the commissioner of public works of Tacoma, Wash., for the construction of cement sidewalks in the district which comprises the following streets for $8,842: Baltimore St., from North 39th to 40th; Bennett St., from North 39th to North 46th St.; North 39th St. from the west line of Home Place addition to Shirley St.; Orchard St. from North 39th St. west of Orchard St. to 39th St. east of Orchard; North 42d St. from Bennett St. south of North 42d St. to Bennett St. north of North 42d St.

Wisconsin.

✣City Council of Algoma, Wis., will receive bids until Sept. 1, for the construction of a vitrified pipe sewer estimated to cost $4,000. W. Neseman, Jr., is City Clerk.

✣Bids will be received until 6 p. m., August 29 for furnishing all materials and doing necessary work for the construction of 2,328 ft. of 10 in. and 1,825 ft. of 12-in. pipe sewer including 13 manholes. Jeff. Woodnorth is Clerk of Waupaca, Wis.

The city of Oshkosh, Wis., will vote on the proposition of purchasing the water plant in the near future. The city council has adopted a resolution providing for a special election.

Bids were received Aug. 17 by L. F. Fish, city clerk of West Allis, Wis., for the construction and laying of sewers, manholes, connections, fittings, etc., including the following approximate quantities: 3,338 ft. 18-in. pipe, 1,034 ft. 15-in. pipe, 4,240 ft. 12-in. pipe, 9,634 ft. 10-in. pipe, 6,234 ft. 8-in. pipe and about 92 manholes. Said sewers are distributed in about thirty different streets or parts of streets. Between 4,000 and 5,000 ft. of the above sewer work is to be let in the contract and the remainder in a separate contract. All bids were rejected. The work will be readvertised.

Wyoming.

The city of Worland, Wyo., has sold bonds in the sum of $40,000 for the construction of a waterworks system. Work on the system will be commenced at once.

Canada.

✣Bids will be received by S. Somerville, City Treasurer, Vernon, B. C., until August 29, for the purchase of the following debentures: For water works extensions, $10,000, 25 years, 5 per cent, payable half yearly; for local improvement cement walks, $8,000, 15 years, 5 per cent, payable half yearly; for Seventh street improvement, $4,500, 20 years, 5 per cent, payable half yearly; for sewer extensions, $3,500, 25 years, 5 per cent, payable half yearly.

✣Bids will be received until 8 p. m., August 24, by T. J. Blain, town clerk, Brampton, Ont., for the construction of 6,000 lin. ft. of concrete walk, extension of sewer system, including 1,500 ft. of 10-in. sewer and 4,000 ft. of 8-in. sewer. W. M. Treadgold is town engineer.

✣As only one tender was received by Barber & Young, York township engineers, 57 Adelaide St., East Toronto, Can., for the construction of the vitrified pipe sewer on Spadina Road northerly from the limits and 592 ft. of vitrified pipe sewer on Walmer Road northerly from the city limits, the work will be readvertised for August 29.

✣Bids will be received until September 8, by President University of Saskatchewan, Saskatoon, Sask., for all works in connection with sanitary and storm sewer and sewage disposal works for the buildings and grounds of the university.

✣Board of commissioners city of Montreal will receive bids at the city hall, until Sept. 14, for the work to be done in the construction of new intakes in the River St. Lawrence at the entrance of the Aqueduct. The works consist in the furnishing and laying in the bed of the river, of about 3,200 feet of steel pipe, 6 feet in diameter; the construction of a concrete intake pier 1,200 feet from shore, as well as other accessories, and all the dredging and excavating required in the execution of these works; all according to specifications, plans and profiles, which may be examined or obtained, at the office of the superintendent of water works, city hall, Montreal.

The city engineer of Toronto, Can., has recommended that a 5 ft. circular brick sewer be constructed on Bloor St. from Clendenan Ave. to connect with the proposed main sewer for the southern portion of Toronto Junction near the corner of Bloor and Keele Sts. This sewer would drain the district bounded by Bloor St., High Park Ave., Annette St., and the Western city limits.

Plans have been presented to the board of control of Montreal, Que., for the new water intake which is to be extended out into the middle of the St. Lawrence river.

The city engineer of Toronto, Can., has recommended the construction of a main sewer for the purpose of draining the southern portion of Toronto Junction. The sewer will run from Bloor St. south on Keele St. to Geoffrey St., east on Geoffrey St., to the rear of the lots fronting on Keele St., through private property to Westminster Ave.; east on Westminster Ave. to Indian road; south on Indian road to Wright Ave.; east on Wright Ave. to Glendale Ave.; south on Glendale Ave. to a point 300 ft. south of the north St. line of Wright Ave.; thence easterly through private property to Sunnyside Ave.; south on Sunnyside to Queen and along Queen to intersection of King St. The sewer is a 3 ft. circular, constructed of either brick or concrete.

P. Kilkinny of Moose Jaw, Saskatchewan, has been awarded a contract by that city for the construction of a cast iron water main, 3,286 ft. of 6-in. and 700 lin. ft. of 12-in., for $13,975. Bids were opened Aug. 15.

ROADS, STREETS AND PAVEMENTS

Alabama.

The commissioners' court, in session at Heflin, Ala., is considering the opening of a new road out from Heflin to the Tallapoosa River, and the building of a bridge two miles above the old Ross bridge, which would give a near route for South Cleburne.

The commissioners of Morgan county, Ala., at Decatur have awarded contracts for grading, draining and macadamizing of approximately 10 miles of county road as follows: Goodrich & Crinkley, New Decator, Ala., for $18,309, for five miles; A. G. Patterson, Falkville, Ala., for $4,965, for one-half mile. The work includes grading, draining and macadamizing the Decatur Danville road from Decator to top of mountain, three miles; Falkville road west from Cedar Plains to McKinley church, 7 miles. The prices are, earth excavation $.25 per cu. yd.; macadam, $1.75 per cu. yd.; rock culverts (dry) $4.50 per yd.; concrete $8 per yd. Bids were opened Aug. 9. R. P. Boyd, New Decator, Ala., county engineer.

Arizona.

Dr. Schnabel, E. T. Wright, Frederick Lyne, O. T. Wade, Thomas Q. Bullock, and other ranchers and settlers in the Rillito Valley, Tucson, Ariz., are taking subscriptions to extend the Speedway across the Pantano, past the Magnetic observatory and into the Tanque Verde valley.

California.

✣Bids will be received until 8 p. m., August 29, by City Council, Richmond, Cal., for macadamizing with oiled macadam, Ohio St., from the easterly line of First St., to the westerly line of 10th St. The work includes concrete curb and gutters and other improvements. I. R. Vaughn is City Clerk.

✣Board of Public Works, Oakland, Calif., will receive bids until 11 a. m., Sept. 7, for furnishing the necessary labor and materials for the improvement of northern side of 12th St., between Fallon and Lake Shore Boulevard. Walter Fawcett is Secretary.

✣Park Commission of Oakland, Cal., will receive bids until 2 p. m., Sept. 8, for furnishing labor and materials for the construction of an asphalt roadway in Lakeside Park. H. F. Vogt is Secretary of the Commission.

In the matter of the petition of A. C. Shaw for the construction of a road in the Barstow colony, the supervisors at Fresno, Cal., appointed J. B. Henderson and W. J. Hutchinson as viewers.

The railroad company in Roseville, Cal., has announced its intention of opening up a street from Lincoln St., to the new depot at once. When that street is opened it is probable that those interested will take up the proposition of extending Main St. through to the depot on the north side.

The board of supervisors at Sacramento, Cal., have accepted the bid of A. McDonald to permanently improve the 12th St. road from the city limits to the American river bridge, for $3,466. The roadway will be of oiled macadam and the strip from the city to the bridge is about a mile and a half long. The board also passed an order declaring the Glann road, near Galt, a public highway.

The supervisors of Napa County, at Napa, Cal., have awarded a contract to Moyer Bros., for road work in Brown's Valley, three miles west of Napa. The contract price is $5,290, and the contractors are required to macadamize one and one-half miles of road to a width of 16 ft.

Colorado.

The state highway commission of Colorado has apportioned $1,000 to Chaffee county for improvement of roads.

The contract for construction of three miles of road connecting Fort Collins, Colo., and Estes park, was awarded by the county commissioners to Charles Baker, for $3,790. The road connects the Masonville road, southwest of Fort Collins, through Missouri canon, over the Green Ridge glade to the Thompson river, thence up the little canon to the Estes park road.

Otero County Commissioners, La Junta, Colo., have decided to improve the county road between Fowler and Rocky Ford and recently made a trip to Pueblo in the interest of supplies necessary for the improvement.

Connecticut.

New Britain, Conn., has awarded a contract to Warren Bros. Co., for paving railroad area on Main St., aggregating 4,150 sq. yds. of bitulithic.

Delaware.

✣Bids will be received by Constructing Quartermaster, Fort DuPont, Delaware City, Del., until 11 a. m., September 12, for macadamizing a section of Port Penn Road, adjacent to Fort Dupont, Del.

The following bids were received on Aug. 16 by Levy Court Commissioner Daniel Thompson, Wilmington, Del., for the construction of five stretches of road: Telegraph Road, from Newark to Maryland line, 1.6 miles. Juniata Paving Co., of Philadelphia, trap rock, $14,202; limestone, $16,067. Horrigan Contracting Co., Wilmington, granite, $13,957.67; trap rock, $13,800; dyer stone, $14,598; limestone, $14,201; awarded contract on dyer trap rock for $14,598. B. F. Wickersham, of Kennett Square, granite, $16,600. J. E. Francis, Berks county, Pa., granite, $18,236; limestone, $18,847. John A. Clark, Wilmington, locksley stone, $13,860; granite, $14,230; granite, $14,410; trap rock, $14,960; limestone, $15,330. George M. Freck, Philadelphia, trap rock, $15,248.20; limestone, $15,248. State road between Hare's Corner and Tybout's Corner, a distance of 3.69 miles. Juniata Paving Co., trap rock, $36,193; limestone, $39,032. Stewart and Donohoe, trap rock, $42,109; granite, $41,270; limestone, $40,234. S. E. Francis, trap rock, $47,750; limestone, $44,553. Horrigan Contracting Co., granite, $35,751; trap rock, $34,080; dyer trap, $27,600; limestone, $32,976; awarded contract on dyer trap rock for $19,000. B. F. Wickersham, trap rock, $45,915. John A. Clark, trap rock, $36,600; granite, $37,800; Schuylkill, $38,400; Birdsboro, $39,600; limestone, $37,700. Lancaster turnpike between Red Clay Creek and Hockessin, a distance of four miles. Corcoran Construction Co., West Chester, local stone, $37,990; awarded contract on local stone for $37,990. Joseph F. Bradley, Wilmington, $38,615. Nelson-Meredith Co., Atlantic City, $53,942. John A. Clark, $54,950. Horrigan Contracting Co., $54,936. Road from Delaware City to St. Georges, a distance of 2.55 miles. Juniata Paving Co., trap rock, $15,640; limestone, $17,685. J. E. Francis, granite, $21,314; limestone, $22,242. Stewart and Donohoe, Birdsboro trap, $20,138; granite, $19,422; limestone, $20,138. John A. Clark, locksley stone, $16,800; granite, $17,400; Schuylkill, $17,700; trap, $18,300; limestone, $18,517. Horrigan Contracting Co., granite, $15,920; trap, $15,558; dyers, $16,694; limestone, $16,850. B. F. Wickersham, granite, $19,900; limestone, $23,400. Joseph Anderson, granite, $16,600. Lore Ave., Brandywine hundred, .393 mile. Horrigan Contracting Co., granite, $5,024; awarded contract on Brandywine granite for $5,025. B. F. Wickersham, granite, $6,500.

District of Columbia.

E. G. Gummel, 300 Rhode Island Ave., nw. Washington, D. C., has been awarded a contract by the district commissioners, Washington, for grading, setting and resetting curb, and cobble gutters at $.39, $.27 and $.37 respectively. Bids were opened Aug. 15.

Florida.

W. W. Hatch Sons & Co., Goshen, Ind., have been awarded the contract for constructing 525,000 sq. ft. of concrete sidewalks for the city of Pensacola, Fla. The contract price was 9 cts. per sq. ft. Bids were opened Aug. 10.

Illinois.

✣Bids will be received until 3 p. m., August 30, by the Cimmissioners of Highways at the office of George A. James, Clerk of Sycamore, Ill., for the construction of a road between the townships of Sycamore and Cortland in DeKalb County. John Carlstrom is Commissioner.

✣Sealed bids will be received by the Board of Local Improvements of Upper Alton, Ill., until 8 p. m., August 30, for the construction of 3,700 sq. yds. of brick pavement on 4-in. concrete base with cement grout filler and 2,688 lin. ft. of combined curb and gutter in Averill Ave. and Mills Ave. The cost of the work is estimated by the engineers as $8,090. B. B. Stakemiller, 302 Commercial Bldg., Alton, Ill., is engineer.

✣Bids will be received by the Commissioners of Highways at the office of the Clerk of township of O'Fallon, St. Clair County, Illinois, until 3 p. m., Sept. 3, for the construction of a macadam road.

The city council of Dixon, Ill., has passed ordinances providing for brick paving on the north and south sides of the river. The pavement will be laid on Third St., and other streets on the south side of the river at an estimated cost of $36,135, and on Everett and Fellows Sts., and Palmyra Ave., at an estimated cost of $5,798.

Contracts for the improvement of the following streets by paving will soon be awarded by the board of local improvements of Chicago, Ill.: Milwaukee Ave. from Kedzie to

Items marked thus ✣ indicate work now open for bids.

Belmont Ave.; Lawrence Ave. from Central Park to Kedzie Ave.; Lawrence ave. from Northwestern Railroad to Clark St.; Irving Park Boulevard from Ashland to Lincoln Ave.; Belmont Ave. from Sheffield to Ashland Ave.; Belmont Ave. from Halsted to Clark St.; Belmont Ave. from Robey St. to Chicago River; Morgan St. from Madison to Washington St.; Crosby St. from Division to Larrabee St.; Elm St. from Sedgwick to Crosby St.; Kingsbury St. from Chicago Ave. to Erie St.

Harry McMullen has been awarded a contract in Kankakee, Ill., for the paving of the alley south of Court St., for one block, between Schuyler and Dearborn Aves. with brick.

An ordinance has been passed by the board of trustees of Upper Alton, Ill., for paving Brown St., with brick. The estimate being 19,615 sq. yds. of brick pavement, 12,748 lin. ft. of combined curb and gutter. The estimated cost of the improvement is $41,935. Resolutions have also been passed by the board of local improvements for the construction of 28,500 sq. yds. of more brick pavement and 18,700 lin. ft. of combined curb and gutter at an estimated cost of $63,325. B. B. Stakemiller, Civil Engineer, 302 Commercial Bldg., Alton, Ill.

David Trunck of the firm of Trunck & Dowling Co., Freeport, Ill., has been awarded a contract in Stockton, Ill., for the paving of the new railroad yards in that city with brick. The work includes 60,000 yds. of pavement.

Department of public works of Chicago, Ill., has awarded a contract to the American Brakeshoe & Foundry Co., for furnishing and delivering to the city of Chicago at the waterworks shops South Ashland Ave., 250 tons of hydrants and stop valve castings for $40 per ton. Bids were received Aug. 15.

The American Brakeshoe & Foundry Co., has been awarded a contract by the department of public work of Chicago, Ill., for furnishing and delivering to the various city pipe yards cast iron valve basin and fire cistern covers during the period ending Dec. 31, 1910, as follows: 1,600 complete covers (curbs and lids), 200 extra lids for $25.85 per ton. Bids were opened Aug. 15.

Jas. A. Guckley Co., Chamber of Commerce, Chicago, Ill., has been awarded a contract by the department of public works of Chicago, for furnishing and delivering 5,000 cedar blocks for paving purposes at the various ward yards in the city for $.37 per sq. yd. Bids were opened Aug. 10.

The board of local improvements of Peoria, Ill., has awarded a contract to Douglas A. Myers, 209 W. Armstrong Ave., Peoria, for paving the roadway of Meyer Ave. from the intersection of Pecan to Lincoln Ave. with brick pavement 30 ft. wide. The work includes the following approximate quantitits: 920 cu. yds. excavation, 30 lin. ft. stone protection (4 in. x 14 in.), 1,646 lin. ft. cinder foundation under cement curb (6 in. x 12 in.), 1,646 lin. ft. Standard No. 1 cement curb, 2,743 sq. yds. concrete foundation (5 in.), 2,743 sq. yds. sand cushion (2 in.), 2,743 sq. yds. brick pavement, 2,743 sq. yds. sand filler (½ in.). Work must be completed by October 15th next. Bids were opened Aug. 15.

Indiana.

The contract for the paving of Governor St., in Evansville, Ind., between Lincoln Ave. and Louisiana St., with brick, will likely be awarded to the Bedford Nugent Co., the lowest bidders. S. G. Rickwood is president of the board of public works.

The county commissioners at Marion, Ind., have been petitioned for the construction of gravel roads in Richland township as follows: Beginning at the southeast corner of section 15 and running to the Peru-Converse pike, a distance of over two miles, and for a road from the northeast corner of section 14 and running to the Delphi gravel road or pike, a distance of over three miles.

The commissioners of Brown county, Nashville, Ind., have granted the petitioning citizens of Jackson township an election for the purpose of voting on the proposition of building 17 miles of gravel road in that township. The election will probably be held in December.

The contract for the construction of the gravel road in Center township, Hebron, Ind., petitioned for by Dr. H. M. Evans and others, was awarded to Ackerman and Runyon, by the county commissioners for $11,080. The road consists of three strips, totaling about three miles.

Dillard Artis has been awarded a contract in Marion, Ind., for the improvement of Adams St., between First and Second Sts., for $6.87½ per lin. ft.

J. W. Sullivan, Alexandria, Ind., has been awarded a contract by the county commissioners of Madison county at Anderson, Ind., for the construction of a gravel road in Jackson township for $2,225. Bids were opened Aug. 16.

Iowa.

The city council of Council Bluffs, Ia., has under contemplation a new scheme for the repaving of Broadway St. The plan provides for the paving of the street with brick, using the present block for a permanent foundation. City Engineer Samuel L. Etnyre proposes the laying of the present block on its side with a slight space around each block and the filling in of the crevices with sand.

Kansas.

The board of county commissioners at Wichita, Kan., has let a contract for a sand-clay road running on Lawrence Ave. south nine miles to Salem township, to R. L. Bobbitt & Co., of Wichita. The contract being awarded for $5,330.

The Kansas Bitulithic Co. has been awarded a contract by the city of Wichita, Kan., for the installation of 26,255 sq. yds. of bitulithic pavement on Cleveland Ave.

The Kansas Bitulithic Co., has been awarded a contract in Rosedale, Kan., for the construction of 2,620 sq. yds. of bitulithic pavement on Shawnee St.

Plans and specifications have been completed for sewers and sewerage purification work for Pleasanton, Kan., at an estimated cost of $40,000. Bids will be asked for in about four weeks.

Kentucky.

Residents in Bethlehem township, Jeffersonville, Ky., have voted in favor of building free gravel roads. The roads will be built in the near future.

Louisiana.

Bids opened Aug. 16 for constructing street crossings on 28 streets in Crowley, La., hav been rejected and bids will be re-advertised for in the near future. L. B. Baudreaux is city clerk.

Massachusetts.

✤Bids will be received until noon, September 1, by superintendent of streets, City hall, Boston, Mass., for furnishing, delivering and erecting two steam turbine driven centrifugal pumps for the Calf Pasture pumping station.

Maryland.

Baltimore County Roads Engineer, H. G. Shirley, Towson, Md., has awarded a contract to the David M. Andrews Co., of Baltimore, Md., for the improvement of Lawrence Ave., for $3,392. The bid being: excavation, $49; 24-in. corrugated iron pipe at $1.60; 6-in. macadam, $.79 and 8-in. macadam at $.95.

Michigan.

Wick O'Connell & Co., of Houghton, Mich., have been awarded a contract in Negaunee, Mich., for the paving of a number of streets. The company expects to start work immediately.

The Iona-Belleview Road association has been formed at Iona, Mich., to build six miles of road from Iona to Trenayn. The amount available at present for the work is $6,000, and the average cost per mile of the road is $1,500.

H. D. Conway has submitted the lowest bid to the board of public works of Jackson, Mich., for the Liberty, Water and Milwaukee St. paving work, aggregating $31,196. The amount of work included is as follows: Water St., 70,100 sq. yds.; Liberty St., 62,610 sq. yds.; Milwaukee St., 32,290 sq. yds. The bid also included curbing, excavation and retainer.

Minnesota.

Two blocks of Third St., in Bemidji, Minn., wil be paved at once, preliminary to paving operations throughout the entire business district. Cement will be used.

E. A. Dahl has been awarded a contract in Nashauak, Minn., for the paving of Central Ave., for $7,935.

Mississippi.

✤The Chancery Clerk, J. D. Laughlin of Warren county, Vicksburg, Miss., will receive bids until noon, September 5, for grading and widening the Whitaker Hill on Baldwins Ferry Road.

Missouri.

The county court of Buchanan County, in session at St. Joseph, Mo., proposes to build a new road north of Saxton, four to five miles in length, tapping a district that has only a roundabout way of reaching St. Joseph. The road will be known as the Ben Grimes road.

Wyandotte County, Mo., this year will spend about $8,000 caring for its rock roads. This does not include the expense of oiling. Three thousand dollars is to be expended in Shawnee township, $3,000 in Wyandotte township and $2,000 in Quinardo township. The money is to be used in ditching, cleaning and repairing the roads.

The county court in session at Kansas City, Mo., has awarded a contract to Colyer Bros., for six miles of macadam road between Levasy and Oak Grove, Mo., for $37,182.

Notwithstanding that the street department is having trouble getting contracts completed before the close of the fiscal year, another lot of contracts were let last Tuesday by the Board of Public Improvements of St. Louis for brick, wood block, macadam and telford treatment. The asphalt contracts were held up temporarily, because the contractors alreay have all the work thev can do in this line. The following contracts were awarded: Pacific avenue between Chouteau avenue and Papin street, Hiram Lloyd Building and Constructions Company, brick, $1,569.78; Arsenal between Kingshighway and Woods street, Webb-Kunze Const. Co., brick, $37,183.80; Minnesota between Meramec and Gasconade streets, Ruecking Const. Co., brick, $8,362.52; Twenty-first between Bremen avenue and Penrose street, Daniel Murphy, brick, $12,789.74; McRee between Spring and Tower Grove avenues, Fruin-Bambrick Const. Co., brick, $37,186.30; Lemp between Utah and Wyoming streets, Ruecking Const. Co., brick, $6,168.30; Twenty-first between Branch and Salisburv streets, Daniel Murphy, brick, $10,359.02; Bulwer avenue between Grand and Prairie avenues, Daniel Murphy, brick, $10,456.25; Victoria avenue between Billion and Tamm, Hiram Lloyd Building and Const. Co., brick, $13,685.38; Crittenden between Nebraska and Pennsylvania avenues, Fruin-Bambrick Const. Co., brick, $1,732.90; Duncan avenue between Boyle and Newstead, running south of Duncan avenue, Fruin-Bambrick Const. Co., brick, $8,995; Alaska avenue, between Itaska and Osceola, Ruecking Const. Co., brick, $15,778; Campton, between Winnebago and Miami streets, G. Eyermann & Bro., brick, $5,905.28; Bertha between Hodiamont and Western City limits, except right of way of United Railways Co., Heman Const. Co., brick, $2,839.82; Idaho avenue, between Bates and Itaska streets, G. Eyermann & Bro., brick, $27,232.68; Juniata street, between Ohio and Gravois avenues, Hiram Lloyd Building and Const Co., brick, $19,526.20; Alabama avenue between Fillmore and Bates streets, Hiram Lloyd Building and Const Co., brick, $9,724.50; Twenty-third street between Hebert and Palm streets, Daniel Murphy, brick, $2,793.99; Maiden Lane, between Twenty-fifth and Jefferson avenue, Daniel Murphy, brick, $5,198.35; Natural Bridge between Spring and Fair avenues, Furin-Colnen Const. Co., brick, $27,412.80· St. Louis, between Union boulevard and Belt av-

Items marked thus ✤ indicate work now open for bids.

enue, Hiram Lloyd Building & Const. Co., brick, $10,754.96; Greer from Union boulevard westwardly about 449 feet, Bambrick Bros., Const. Co., brick, $4,243.86; Minnesota between Osage and Keokuk streets, G. Eyermann & Bro., brick, $6,705.96; Natural Bridge from Grand to Spring avenues, Fruin-Colnen Const. Co., brick, $4,172.70; Glasgow from Cass to St. Louis avenues, Harry F. Heman, $17,952.95; Twentieth from Washington to O'Fallon, Jas. E. Perkinson, brick, $24,890.46; Twentieth from O'Fallon to Cass avenue, Wm. H. Redemeyer, $9,059.08; Twentieth from Cass to Branch street, Skrainka Const. Co., brick, $52,255.90; Twentieth from Branch to Salisbury streets, Wm. H. Redemeyer brick, $11,258.90; Arsenal between Morgan Ford and Kingshighway, Granite, Bituminus Paving Co., macadam, $25,294.68; Portis, between Scanlon and Arsenal street, Granite Bituminus Paving Co., macadam, $9,512.21: Bent between Humphrey and Hartford street, Granite Bituminus Paving Co., macadam, $13,505; Semple between North Market and St. Louis, Granite Bituminus Paving Co., macadam, $21,272.24; Union between St. Louis and Natural Bridge, Granite Bituminus Paving Co., macadam, $27,650.79; Waldemar between Forest Park and McCausland, Webb-Kunze Const. Co., telford, $3,773.40; McPherson, Kingshighway, Union boulevard, G. Eyermann & Bro., wood block, $27,466.43; Gay street from Twelfth to Thirteenth street; G. Evermann & Bro., wood block, $2,388.40; Twelfth from Franklin to Tyler street, G. Eyermann & Bro., wood block, $25,437.74; Twelfth from Tyler to Hebert street, Granite Bituminous Paving Co., wood block, $31,168.40.

Montana.

County Surveyor Merrifield at Chinook. Mont., has laid out and surveyed a county road on the north side of the Milk River and the Great Northern track from Havre to Chinook. The road will run as near the foothills as far as practicable.

Nebraska.

The city council of Hastings, Neb., has been petitioned for the paving of Bellevue Ave., from Second St., to Fourth St. F. P. Olmstead is interested.

The city council of Lincoln, Neb., has approved the contract for the repaving in district No. 40. The contract calls for 5,805 yds. of asphalt paving and 4,260 sq. yds. of brick gutter.

Nevada.

A petition is being circulated in Reno, Nev., by Deputy Assessor Martin, asking that the county commissioners construct a road to the Wedekin mine from the end of Eighth St. The distance is only a little over a mile.

New Jersey.

✣Committee of the Board of Chosen Freeholders, Essex County, New Jersey, will receive bids until 10 a. m., September 8, at Newark, N. J., for grading and paving with Telford, Pleasant Valley way, extending from Bloomfield Ave. in the Borough of Vernoa to Mountain Ave., in the town of West Orange, a distance of about 4 miles. Wallace Ougheltree is Director.

✣Bids will be received until 2 p. m., September 2, by Committee of Board of Bergen County Chosen Freeholders, Hackensack, N. J., for the improvement of Essex St., from Terrace Ave., Hackensack, to the Saddle road. Each bid must be accompanied by a check for $1,000. E. T. Galoway is one of the Committee.

✣Board of Chosen Freeholders of Middlesex County, will receive bids at New Brunswick, N. J., until 2 p. m., September 12, for the construction of a gravel road according to plans and specifications on file at the office of the County Collector, 40 Patterson St., New Brunswick, N. J. The road will begin in Spotswood, at the road running from Spotswood to the Old Bridge, and Englishtown Road and will extend southerly to the road to Texas, N. J., a distance of 2.015 miles.

✣Bids will be received by the Board of Managers of the New Jersey Sanatorium for Tuberculous Diseases, until 8 p. m., Sept. 1, for furnishing all labor and material for the construction of .2 mile of road on state lands at Glen Gardner as per plans prepared under the supervision of the State Road Department. Plans and specifications are on file at the office of Dr. S. B. English, Glen Gardner, N. J.

The Standard Bithulithic Co., has been awarded a contract in Bayonne, N. J., for paving on Prospect Ave., amounting to 16,150 sq. yds.

The county board of freeholders at Camden, N. J., awarded a contract to E. C. Humphreys of Hackensack, N. J., for the construction of an amesite road 14 ft. wide, 85-100 miles long, known as Chapel Ave., at Merchantsville, N. J., for $12,114. Bids were opened Aug. 10.

New York.

✣Clerk of the Village of Bronxville, N. Y., Frank Dinsmore, will receive bids until 8 p. m., Sept. 6, for furnishing the necessary labor and material for grading and paving Midland Ave., in the said village from the boundary line of the village of Tuckahoe to the boundary line of the city of Mount Vernon. Chambers & Hone, No. 1 Liberty St., New York City, are Engineers.

A proposition is likely to be presented to the city council of Lestershire, N. Y., which provides for the bonding of the city in the amount of $30,000 for the paving of Main St.

The New York State Roads Commission at Albany, N. Y., has awarded a contract to Warren Bros. Co., for paving Main St., in the village of Herkimer, N. Y., with bithulithic pavement, amounting to 11,451 sq. yds.

The board of public works of Troy, N. Y., has awarded the contract for paving Broadway from 15th to 19th St., to Michael W. Nolan of Watervliet, N. Y. The contract prices were as follows: Paving, $3.19 per yd.; curbing, $.89 per ft.; catchbasins, $60 each.

A. D. Osborne has been awarded a contract in Binghampton, N. Y., for the resurfacing of Henry St., from State to Chenanga St., with brick, for $1.77 per sq. yd.

The Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., Brooklyn, N. Y., has been awarded a contract for grading, etc., Parkside Ave., in the borough of Brooklyn. Bids were opened Aug. 11. The contract was awarded for $39,707.

The Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., Brooklyn, N. Y., has been awarded a contract by the Arsenal Central Park Board, New York City, for paving, etc., traffic rd. Ocean Parkway, Brooklyn, for $61,259. Bids were opened Aug. 10.

North Dakota.

✣Bids will be received until 7:30 p. m., Sept. 9, by city council of Carrington, N. Dak., for the extension of the water mains of the water works system in the said city. H. L. Winterer is city auditor.

Ohio.

✣Board of County Commissioners will receive bids at Cleveland, O., until 11 a. m., August 31, for paving Ridge Road No. 2, with Medina Block stone from station 47 to station 52 plus 50; also for laying pipe on Depot Road from station 49 plus 20 to station 66 plus 20. John F. Goldenbogen is Clerk.

✣Bids will be received until August 29 by the Commissioners of Huron County, for the improvement of the township line road between Richmond, O., and Norwich townships, just outside of Chicago Junction. The road to be improved is three miles in length, and the contract will call for the construction of eleven bridges at a cost of about $5,690; 33,057 cubic yards of grading at a cost of $8,925,39; new ditches costing $90; 21,072 square yards of macadam at an estimated cost of $14,328.96, and fifty driveways at a cost of $150.

The county commissioners at Columbus, O., have authorized the improvement of North High St. road from the city limits of Columbus to Worthington. The distance is 4½ miles. The road will be finished with a light tar dressing and the cost will exceed $20,000. The commissioners also accepted the proposition of Dr. S. B. Hartman for the improvment of the Hartman road from the end of the present improvement to Shadesville, a distance of 2½ miles. The road will be graded up gradually and given a macadam top. Two high hills will be eliminated, and the cost to the county will be about $15,000. The Klickinger road will be improved also, from the North High St., road to the Scioto River, a distance of 2-3 miles. Half of this road runs through lowlands on an embankment nearly 20 ft. high, which is protected on the north side by a rip-rap wall. This improvement will cost $10,000.

The sinking fund trustees of Springfield, O., have purchased bonds authorized by the city council for the paving of West Main, East High and College Ave. this fall. The bonds issued and accepted were the following: For city's share of East High St., $19,575; for city's share of West Main St., $19,807; for city's share of College Ave., $1,322; for property holder's share of College Ave., $9,856; for macadamizing College Ave., from Wittenberg Ave. to a point 316 ft. West, property holder's share, $873.60.

The Public Service Director, Sandusky, O., has awarded the contract for paving Washington St., to the Andrews Asphalt Co. This street will be paved with Trinidad asphalt. The director has recommended that a contract be awarded to the same firm for the paving of Franklin St.

The Public Service Director of Cincinnati, O., has awarded the Kirchner Construction Co., the contract for the improvement of Tafel St., between McMicken and Wagner Sts., with macadam and brick. The contract was awarded for $6,842.

The courthouse commissioners at Newport, O., have awarded contracts for improvements to be made at the Courthouse as follows: Cement paving, F. G. Ader Co., $1,096; marbleized fiber floor, Marbleizer Fiber Co., $961; plumbing, James McLane & Son, $90; lineoleum, Dine-Schabell Co., $233; painting and glazing, J. D. Pagan, $1,410; electric wiring, the Home Electric Co., $190; cleaning outside brick and stone work, Sanitary Cleaning, $1,400; interior wall decorators, August Koch, $179; It is expected that work will be started at once in order that the building may be ready for the opening of Court in October. The Commissioners also made provision for taking up notes for $6,000, for money secured on the indorsement of the late Judge Berry for the purpose of completing the work of building the marble stairs several years ago.

The Cincinnati, O., city council has awarded a contract to A. J. Brehm for the work in Glenway Ave., due to the Wilder Ave. landslide, for $15,000, and to A. J. Henkel & Bro., for the paving with granite, instead of wood blocks, of the intersection of certain streets with Reading road, at $42,250.

The contract for the paving of Neill St., from Columbus Ave., and Wayne St., in Sandusky, O., was awarded to Anthony G. O'Donnell of that city. The street will be paved with brick.

The Peters Bros. Co., has secured a private contract from the N. C. R. Co., in Dayton, O., for street paving and repairs on the factory property aggregating about $20,000.

It is reported that Wildes & Davidson have been awarded a contract in Akron, O., for the paving of East Market road and the Kenmore road with brick. The pavement on East Market road will be one mile long and 14 ft. wide, and that on the Kenmore road will be over two miles long.

The contract for the construction of the new state macadam and brick roadway, near Petersburg, O., at the estimate of $12,413 has not been let. It is now necessary to have the road re-estimated and new bids will be asked for. The road is one and a quarter miles in length and 1,444 sq. yds. of brick pavement was to be used, the balance being of macadam. J. C. Wonders, Columbus, O., is State Highway Engineer.

The France Co., of Toledo, O., has been awarded the contract by the county commissioners of Lucas county for the macadamiz-

Items marked thus ✣ indicate work now open for bids.

ing of Point Place road. Bids were opened Aug. 16.

Oregon.

The board of county commissioners at Salem, Ore., have rejected the bids of the Owl Construction Co., $64,911, and that of the Capi-tal Improvement Co., $64,644 for construction of the Silverton-Marquam road, and will re-advertise for bids. The length of this road to be improved is 4⅓ miles.

It is probable that East 39th St. in Portland, Ore., will be extended and improved to the site of the Reed Institute. It is one of the longest streets opened north and south on the east side, reaching from the north side of Laurelhurst southward nearly to the Reed Institute property. Already a considerable portion has been paved from East Stark St., to Hawthorne Ave., and graveled to Division St.

The board of county commissioners at Salem, Ore., have considered the petition for the Christenson-Hasselbacker road, and rendered a decision in favor of the petitioners.

The Warren Construction Co., was awarded a contract in Dalles City, Ore., for paving Fourth St., with bitulithic, amounting to 13,830 sq. yds.

The Warren Construction Co., has been awarded a contract in Cottage Grove, Ore., for the paving of Main St. with bitulithic. The work includes 7,200 sq. yds.

The Warren Construction Co., has been awarded a contract in Ashland, Ore., for the paving of several streets with bitulithic, amounting to 62,978 sq. yds.

Portland, Ore., has awarded a contract to the Warren Construction Co., for paving with bitulithic aggregating 38,000 sq. yds.

Pennsylvania.

✣The Avalon Boulevard Co.: will receive bids until noon, August 30, at the office of Charles R. Hall, 1415 Real Estate Trust bldg., Philadelphia, Pa., for the construction of 2.9 miles of gravel road across the marsh land from Swainton to Avalon, Cape May County. The work includes 1,558 lin. ft. of bridge work, including one steel draw span. R. Fendall Smith is Engineer.

The McLaughlin Contracting Co., has been awarded the contract for the macadamizng of the Crab Tree road in Allegheny county. The contract was awarded for $17,734, and is one of the four for road work in the county for which bids were opened this month.

Charles Stapf has been awarded a contract by the city council of New Castle, Pa., for the paving of Cochran St., and the grading of Sharts St., for $799.

J. G. McGuire & Co., of New Brighton, Pa., were awarded the contract for the paving and curbing of Main St., from 12th to 16th St., by the city council of Wheeling, W. Va. J. R. Patrick of Wheeling, is Engineer.

A new brick road leading from Brookville, Pa., to Dubois, Pa., is projected with good indications of success. All but one of the townships through which it is to pass have acted favorably upon the proposition, and it is hoped that the residents will be in favor of the project.

The city of York, Pa., has awarded a contract to the Standard Bitulithic Co., for constructing 1,500 sq. yds. of bitulithic pavement on Manchester St.

The following bids were received by the State Highway Department, Harrisburg, Pa., for the construction of road in Moon township, Allegheny Co., Pittsburg, Pa.; bids closed Aug. 10: Donald McNeil, 908 Adelaide St., Pittsburg, Pa., $14,137, local stone bot., Newcastle stone top; $16,134, local stone bot., Amiesite top. Hassam Paving Co., 37 Wall St., New York, $15,649, slag or stone bot., Hassam cement top. McLaughlin Contracting Co., Pittsburg, Pa., $13,767, native stone bot., limestone top; $17,742, native stone bot., bit-macadam top. Ridge Bros. Co., Pittsburg, Pa., $13,274, native stone bot., Beaver or Lawrence Co. limestone top; $17,249, native stone bot., bit-macadam top.

The following bids were received by the State Highway Department, Harrisburg, Pa., for the reconstruction of roads in Union township, Washington County, Washington, Pa.; bids closed Aug. 17: Standard Bitulithic Co., 50 Church St., New York, $6,070, Nat. stone bot., nat limestone top; $8,045, Nat. stone bot., Warrenite top. Rietsch Brothers, Washington, Pa., $6,027, Nat. stone bot., limestone top; $7,438, Nat. stone bot., bit-macadam top (mech. mixed). W. E. Howley, Frick Building, Pittsburg, $4,662, Nat. stone bot., limestone top; $5,880, Nat. stone bot., bit-macadam top (mech mixed); $5,637, Nat. stone bot., bit-macadam top (hand mixed); $6,124, Nat. stone bot., bit-macadam top (penetration method). Hallam Const. Co., Washington, Pa., $5,-900, Nat. stone bot., limestone top; $7,827, Nat. stone bot., Warrenite top; $7,632, Nat. stone bot., Amiesite top. Donald McNeil, 908 Adelaide St., Pittsburg, $5,616, Nat. stone bot., limestone top; $6,726, Nat. stone bot., Amiesite top.

The following bids were received by the State Highway Department, Harrisburg, Pa., for construction of road in Carroll township, Washington County, Washington, Pa.; bids closed Aug. 17: Standard Bitulithic Co., 50 Church St., New York, $82,683, Nat. stone bot., local limestone top; $102,832, Nat. stone bot., Warrenite top. Rietsch Brothers, Washington, $86,393, Nat. stone bot., Nat. lime or sand stone top; $101,830, Nat. stone bot., bit-macadam top. Hallam Const. Co., Washington, $73,903, Nat. stone bot., local limestone top; $95,050, Nat. stone bot., Warrenite top; $92,-916, Nat. stone bot., Amiesite top. J. Ancarane, Portvue, $66,426, Nat. stone bot., blue limestone top; $82,723, Nat. stone bot., bit-macadam top, penetration method; $78,723, Nat. stone bot., bit-macadam top, mech. and hand mixed. W. E. Howley, Frick Building, Pittsburg, $64,821, Nat. stone bot., limestone top; $83,044, Nat. stone bot., bit-macadam top, mech mixed; $80,377, Nat. stone bot., bit-macadam top, hand and penetra. method. Donald McNeil, 908 Adelaide St., Pittsburg, $69,231, Nat. stone bot., limestone top; $81,231, Nat. stone bot., Amiesite top.

South Dakota.

✣All bids received by the city commissioners of Huron, S. Dak., Aug. 15, for the construction of sewers and appurtenances including 860 lin. ft. of 18-in. sewer, 4,000 lin. ft. of 8-in. sewer were rejected and the work will be readvertised for August 29. S. S. Oviatt is city auditor.

Tennessee.

Bids for the paving of the Rossville road were received by the county commissioners at Chattanooga, Tenn. Bids were received on two classes of paving, one to be an asphalt macadam, and the other macadam surface with a coating of oil as follows: Barber Asphalt Paving Co.: Bermudez penetrating, $1.11 a yd.; Bermudez mixing, $1.20. West Construction Co.: Bermudez penetrating, 98c; Bermudez mixing, $1.16; curb 45c lin. ft.; inlet basins, $6 lin. ft. Noll Construction Co.: Bermudez penetrating, $1.10; Bermudez mixing, $1.30; Standard Oil penetrating, 84c; standard Oil mixing, $1.02; curbing, 49½c; inlet basins, $5. Chickamauga Quarry & Construction Co.: Standard Oil penetrating, $1.08. Southern Paving & Construction Co.: Standard Oil penetrating 94c; Standard Oil mixing $1.19; curbing, 45c; inlet basins, $3.27. Chamberlain-Freeman Construction Co.: Curbing, 45c; inlet basins, $5. Howard Eggleston: Curbing, 65c; inlet basins, $2.99. Trimble & McCain, Curbing 63½c; inlet basins, $4. H. S. Bosler, Curbing, 56c; inlet basins, $5. J. H. Bragg: Curbing, 54c; inlet basins, $3.40.

Texas.

The Dallas Automobile Club of Dallas, Tex., has appointed a committee consisting of Col. Frank P. Holland, A. V. Lane, Louis Blaylock, H. S. Keating and L. P. Turfs to confer with the county officials in regard to the matter of improving the Fort Worth-Dallas pike.

Arrangements have been practically completed in Temple, Tex., for the extension of the paving work which is now under way in the city by Ockander Bros., the new work to penetrate the residence section on North Main St. The street will be paved for 20 blocks with Hassam pavement.

A petition has been presented to the county commissioners of Caldwell County, Lockhart, Tex., asking the court to submit a proposition to the voters as to whether this precinct will issue $75,000 in bonds for the purpose of building good roads.

The county commissioners at Edna, Tex., have voted upon the issuance of bonds in the sum of $100,000 for good roads. The plan is to have the work done under the supervision of a competent engineer; a system of drainage will also be started in connection with the building of the roads.

At a recent meeting of good roads advocates held in Sulphur Springs, Tex., it was unanimously voted to issue bonds in the sum of $100,000 for the construction of good roads. Mayor R. B. Keasler and F. W. Mack, secy. of the Commercial club are interested.

The Texas Bitulithic Co., has been awarded a contract in Fort Worth, Tex., for the placing of 16,500 sq. yds. of bitulithic pavement on certain streets.

Bids were received Aug. 15 by George C. Baker, Jr., county judge, Richmond, Tex., for the construction of a system of county roads for District No. 1 of Fort Bend County. Action has been deferred until the latter part of the month in order to give the consulting engineer, the Tolman Engineering Co. of Houston, Tex., time to tabulate the bids. The following were bidders on the work: W. D. Hayden, Galveston, Tex.; the Texas Grading Co., Houston, Tex.; and the Texas Building Co., of Fort Worth, Tex.

Utah.

The county commissioners at Salt Lake City, Utah, have been petitioned for improvements on the old territorial road leading to Big Cottonwood and Little Cottonwood canyons. It is probable that the improvement will be ordered in the near future.

Bids were opened Aug. 5, by the board of public works of Salt Lake City, Utah, for the paving of Second St., from Third south to the Warm Springs. The contract was awarded to P. J. Moran of that city, for $191,-724. The extension, which is 10 blocks long, and is known as extension 67, is the biggest single improvement of its kind in the history of the city, and is to be finished in 360 days.

Virginia.

✣Bids will be received until 10 a. m., August 26, by the State Highway Commission, Richmond, Va., at the office of the County Road Board, Drakes Branch, Va., for the construction of about 15 miles of soil road 2.4 miles of macadam road in Charlotte County, Va. P. St. J. Wilson is State Highway Commissioner.

Washington.

Commissioner Owen Woods of Tacoma, Wash, has ordered a survey of a new route for the proposed Cliff Ave., drive. It is proposed to begin at a point opposite the Commercial dock bridge and run the drive to near the Tacoma tennis grounds. W. W. Seymour is working to revive interest in the plans for a boulevard along the brow of the cliff overlooking the harbor.

The Chamber of Commerce of Bellingham, Wash., has voted that $10,000 must be loaned to the state in order that state road No. 6, connecting Shagit and Whatcom counties along the waterfront can be completed. R. L. Kline is chairman of the committee appointed by the chamber to examine the work already done.

The board of public works of Everett, Wash., has passed upon favorably the proposed improvement of Kromer Ave., and adjacent Sts. The improvements take in Pacific Ave., from Grand to Kromer Ave., and

Items marked thus ✣ indicate work now open for bids.

Kromer from Wall St., to the north line of the Kromer Ave. trestle. Brick and asphalt will be used.

Plans are being prepared by City Engineer W. C. Raleigh for a new road leading from Pacific Ave. to the Center St. factory district, in Tacoma, Wash. The city engineer's idea is to build a wide roadway through Gallagher gulch and afford a much shorter route to the factory district than can be obtained otherwise.

The Mount Adams road in Yakima County, North Yakima, Wash., is to be surveyed and improved by the county authorities. The road leads from North Yakima through Union Gap, White Swan, Fort Simcoe and the Cedar Valley to The Dalles.

The contract for paving improvement district No. 18 in Puyallup, Wash., has been awarded to the Warren Construction Co. The work includes 8,198 sq. yds.

The following contracts have been awarded to the Warren Construction Co., in Chehalis, Wash., for paving with bitulithic: District No. 74, 6,833 sq. yds.; district No. 75, 6,195 sq. yds.; district No. 76, 4,887 sq. yds.; district No. 77, 4,478 sq. yds.; district No. 79. 2,164 sq. yds.

Wisconsin.

✣As all bids received August 1, by the City Clerk of Waukesha, Wis., for the improvement of West Ave. and North St., were rejected, and the work has been readvertised for Sept. 6. The contract includes 3,076 cu. yds. excavation; 6,632 lin. ft. of concrete curb and gutter; 12,140 sq. yds. tar macadam. M. R. Butler is City Engineer.

Eighth Ave., in Milwaukee, Wis., is to be widened between Cleveland Ave. and Grant St., and paved with brick. The council committee refused to rescind proceedings for the improvement.

The county commissioners at Superior, Wis., have awarded a contract to Chas. Bjkosland of Bennett for $1,825 and to C. A. Anderson of Bennett for $505 for the following road improvement: For ditching on the east side of the road and for graveling the roadway from the north line of Section 22; southerly to the east and west center line of said section 22, town 46, range 12; also for ditching on east side of road and brushing and graveling roadway from 150 ft. north of the culvert near the north eighth line of section 26 to about 30 rods south of the south line of said section 26, town 46, range 12, and brushing and turnpiking road from last named point to 60 or 70 rods south of township line between towns 45 and 46 to connect with road already graded; also for brushing and turnpiking road from the corner of section 1-2-11-12 south to the quarter post between sections 13 and 14, township 45, range 12. C. J. Morisset is commissioner of highways.

Canada.

Col. W. M. Davis, City Engineer of Prince Rupert, B. C., has estimated the cost of the contemplated improvements for the business section of the city, known as Section 1, at $400,000. The work includes grading and paving of streets.

The Warren Bituminous Paving Co., has been awarded a contract for constructing 6,077 sq. yds. of bitulithic pavement in Toronto, Ont.

R. L. Frost of Moose Jaw, Saskatchewan, has been awarded a contract in that city for the construction of concrete walks as follows: 63,000 sq. ft. concrete walk, 9,000 lin. ft. of combined curb and gutter and 6,000 sq. ft. of concrete crossings for $15,330. Bids were opened Aug. 15.

E. J. Elliott, 279 Main St., Toronto, Ont., has been awarded a contract in that city for the construction of granolithic sidewalks amounting to 1,000 lin. ft., 4 ft. in width, for $.49 per lin. ft. Bids were opened Aug. 15.

NOTICE TO CONTRACTORS.

Sealed bids for the construction of Water-works and Street lighting systems for the City of Pella, Iowa, will be received at the office of the City Clerk until six (6) o'clock P. M. of the 6th day of September A. D., 1910, when they will be publically opened and considered. Separate bids will be entertained as follows:—

1. For hauling and laying pressure main and branches from the filter gallery at Howell Station to the City of Pella including the placing of all valves, washouts and hydrants; also furnishing and constructing valve chamber complete.
2. For furnishing cast iron pipe and specials including valves, hydrants and washouts.
3. For furnishing material and constructing filter gallery, well and pump house at Howell Station.
4. For furnishing material and constructing power house in Pella.
5. For furnishing generators, motors, switch-boards, and all electrical apparatus.
6. For furnishing stationary engines at power house.
7. For furnishing and installing pumps in pump house, at Howell Station.
8. For furnishing and installing boiler plant with heater and feed pumps in power house.
9. For furnishing and erecting transmission line complete from power house to pump house.
10. For furnishing and installing street lighting lines, lamps and complete electroliers.
11. For furnishing all lead and jute.

All bids must be accompanied by a cash deposit or a certified check on some responsible bank, equal in amount to ten (10) per cent of the amount of the bid.

Proposals must be made on blanks furnished by the City, and in accordance with the plans and specifications on file, or they will be considered informal and may be rejected. Manufacturers of engines may submit their own propositions on their own type of engines if they so desire. Proposals will also be entertained on any materials separately.

Plans and specifications can be seen at the office of the City Clerk or Mayor, or at the office of the Engineers, or a complete set of plans may be obtained by intending bidders upon application to the engineers and payment of ten (10) dollars to cover the cost of the plans, or partial plans may be obtained as follows: Sections 1, 2, 5, 6, 7, 8, 9 and 10 for $1.00 each without blue prints, and required prints furnished at cost extra. The City reserves the right to reject any and all bids.

N. J. GESMAN, Mayor
A. C. KUYPER, City Clerk.
IOWA ENGINEERING COMPANY,
Engineers, Clinton, Iowa.

NOTICE TO CONTRACTORS.

The undersigned committee will receive sealed proposals up to September 3, 1910, at 7:00 o'clock in the afternoon of said day for the construction of all that part of the sewer system of the First Sewer District of the city of Algoma, Wisconsin, which has been ordered by the common council of said city to be constructed, viz.: commencing on Fremont street, about 300 feet west of the Sixth street intersection thereof, running thence east to Fourth street, and thence north on Fourth street to the Ahnapee River; and on Steel street, from the Second street intersection thereof, west to connect with the said Fourth street sewer main, and which work includes the following:

The laying of approximately 520 feet of 18 inch sewer pipe, 306 feet of 15 inch sewer pipe, [illegible] feet of 12 inch sewer [illegible] feet of 8 inch sewer pipe, 11 man-holes and 23 catch-basins.

All of the work and material shall be performed and furnished in accordance with the plans and specifications therefor now on file in the office of the city clerk. For convenience and expedition communications in reference thereto may be addressed to the city engineer, whose name and address are as follows: "A. C. Greaves, Sturgeon Bay, Wis."

Bids shall specify, in detail, the cost per linear foot, the cost of manholes and the cost of catch-basins, etc., for constructing said sewer, and shall include the cost of all connections, so that when completed the sewer so constructed will constitute a completed working system of sewerage.

A form of contract and bond will be furnished by the city of Algoma, which bond shall be signed also by two sureties justifying in the aggregate to an amount equal to the contract price agreed upon, or by an approved surety company for the same amount, and all bids shall be accompanied by a certified check for $500.00 payable to "G. W. Warner, Treasurer," city treasurer of Algoma, to be forfeited to said city in case said bidder shall be successful and shall then default. The right to reject any and all bids is reserved by the undersigned.

Dated, Algoma, Wis., August 17, 1910.

MICHAEL MELCHIOR,
HENRY BARTHEL,
PETER KASHIK,
Committee on Streets and Bridges and ex-officio Board of Public Works.

RIVER IMPROVEMENT BIDDERS WANTED.

Des Moines, Iowa.

Bids will be received up to 9 o'clock a. m., September 12, 1910, for extensive river improvement for flood protection along the Des Moines and Raccoon rivers in Des Moines, Iowa. Write to Neal Jones, City Clerk, Des Moines, Iowa, for specifications and for forms of proposals and other particulars. The work includes about 650,000 cubic yards of excavating; also levee construction, and will be let in part or whole.

NEAL JONES, City Clerk,
Des Moines, Iowa.

U. S. ENGINEER OFFICE, Montgomery, Ala., August 17, 1910. Sealed proposals for dredging channel from Apalachicola River to Saint Andrews Bay, Fla., will be received at this office until 1 o'clock P. M., Sept. 16, 1910, and then publicly opened. Information on application. H. B. Ferguson, Capt. Engrs.

U. S. ENGINEER OFFICE, Montgomery, Ala., August 17, 1910. Sealed proposals for dredging at entrance to Saint Andrews Bay, Fla., will be received at this office until 1 o'clock P. M., Sept. 16, 1910, and then publicly opened. Information on application. H. B. Ferguson, Capt. Engrs.

PROPOSALS FOR HYDRAULIC DREDGE. U. S. Engineer Office, Vicksburg, Miss., Aug. 20, 1910. Sealed proposals for steel hull self-propelling hydraulic dredge, steel pontons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant, will be received at this office until 12 m., Oct. 20, 1910, and then publicly opened. Information on application. Clarke S. Smith, Capt. Engrs.

(Proposal Advertisements Continued on Page 53.)

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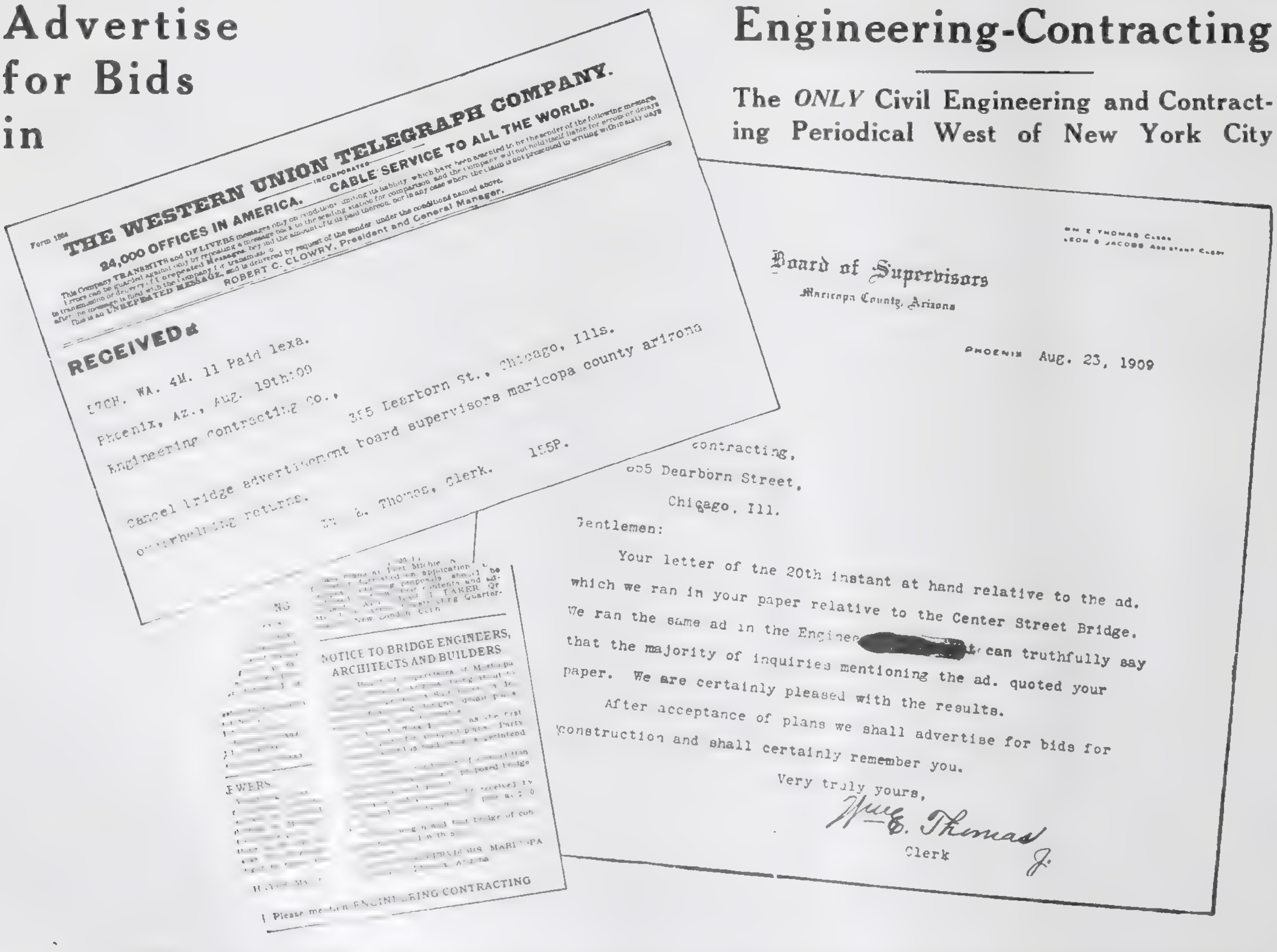

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Phoenix Aug. 23, 1909

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Clerk
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Snow Removal in New York City.

The cost of removing snow from the streets in New York City during the winter of 1909-10 was $1,410,000. The total number of cubic yards of snow removed was 1,975,075 and the cost per cubic yard was 71½ cts. The mileage of streets cleaned was 396. For the winter of 1908-09 the cost of snow removed was $739,000; the amount removed was 1,649,000 cu. yds., and the cost per cubic yard was 45 cts. The miles of streets cleaned was 418. Last winter the snow removal work was done almost entirely by the Street Cleaning Department forces, while in the previous winter the work was done by contract on the yardage plan. These figures and the fact that the snow removal work last winter was performed no more efficiently than in previous winters would indicate the desirability of having the work done in some way other than by Department forces. Nevertheless, the Board of Estimate, as noted elsewhere in this issue, has adopted a report recommending that the Commissioner of Street Cleaning again handle the snow this coming winter with his own force and the addition of hired laborers and equipment. Inasmuch as the two methods—the area system and the yardage plan—heretofore adopted for snow removal by contract have been unsatisfactory, and the day labor plan of last winter, as shown by its excessive cost and inefficient performance, was likewise unsatisfactory, it would seem that the only likely solution of the problem is the adoption of some plan different from those already tried. The principal objections urged against the area system are that the contractor gets paid for work done by the elements and that on this account he is tempted to let the work lag, hoping for a warm spell or for rain. The chief objections to the yardage plan have been the many opportunities for graft, the taking away of much of the Department force from its regular work and the incompetency of the Department force to measure and calculate the capacity of the carts. As the haul is the principal element in the cost of snow removal, it has been suggested that in the uptown district of the Boroughs of Manhattan, Brooklyn and The Bronx the parks be used as dumping grounds. By this means and by dumping in the manholes of sewers at all points which are reached by tide water the present long hauls could be greatly reduced. It has also been suggested that a form of contract could be devised which would minimize the objections to both the area system and the yardage plan. Under the old area system the streets were divided into four schedules. Schedule A covered all the important arteries and streets in the business district, and schedules B, C and D included the less important streets and the residential districts. Under the area system the streets under schedule A were always cleaned first. The suggested plan proposes that the streets under schedule A be paid for by the area system and the streets under the other schedules by the yardage plan. This would insure the prompt cleaning of the main thoroughfares for the contractor would not be ordered into the other schedules until schedule A was finished. Under this plan the work on schedule A would only require ordinary inspection to see that the streets were being cleaned. When work on the yardage system was started a small force of checkers and measurers would be sufficient to look after a district and even this could be reduced by accepting the contractor's rating on the carts as evidenced by the payments he had already made the truckmen on schedule A. This plan seems to be feasible; certainly it has many advantages over the plan of doing the work by day labor with its resulting certainty of excessive cost and unsatisfactory performance.

The New York Workmen's Compensation Law and Its Effect on Costs.

Brief editorial mention was made last week in our Contract News Section of the so-called workmen's compensation law which goes into effect in New York State on Sept. 1. Technically this is an added article (Article 14-a. —Workmen's Compensation in Certain Dangerous Employment), or an amendment to the general "Act Relating to Labor, etc.," which became law a year ago. Virtually, however, the new article is a new act; it specifies certain broad classes of employment and lays down special and drastic requirements for compensating workmen for death or injury suffered while engaged in them. Furthermore, and herein lies the particular interest of the act to the readers of this journal, the employments specified are chiefly those connected with construction work.

From the text of the Article which we print in another column, it will be seen that eight classes or kinds of employment have been selected and named as dangerous. Very little construction work of any kind escapes inclusion, and practically no construction work involving skilled and experienced labor. Tunnel, subway and compressed air work of all kinds are included; work on scaffolds 20 ft. high or more; iron or steel framework of all kinds; work in proximity to explosives; work on railway track; work on any apparatus charged with electric current, and work operating locomotives, motors and hoists. With modern construction methods this list excludes very few operations from the "dangerous" class. Doubtless the legal mind would find other exceptions, but to the layman it would seem that about the only workman not insured is the man with the shovel and pick and he only when carefully isolated.

To continue, the new law compels contractors to insure every workman engaged in any of the eight classes of employment named against death or serious injury. The mere fact that he is engaged in any of the employments named grants to the workman the right of insurance and he forfeits this right only in case the accident results from his own serious or willful misconduct or in case he chooses voluntarily to abrogate it by bringing action for damages under other statutes. Note how drastic these provisions are. The mere fact that the workman is engaged in one of the "dangerous employments" named writes him an insurance policy which nothing but his own "willful misconduct," which by the way must be proven, can invalidate.

The amount of this insurance is for death, if dependents are left, 1,200 times the workman's average daily wage provided this amount does not exceed $3,000. In case the workman's death leaves "part dependents" the insurance is some "proportionate sum, according to the injury to such dependents." In case of no dependents the insurance is the cost of medical attendance and burial not to exceed $100. For injury only, the workman, after two weeks, will receive a weekly sum "not to exceed $10 a week or extend over more than eight years from the date of the accident," but the exact amount of which will be determined taking as guiding factors the weekly wage, the period of service and the future earning capacity of the workman. It will be observed that the payments specified are substantial amounts.

It is not our purpose here to consider the fairness or justice of this law, but looking at it from the viewpoint of the man who pays the bills, how does it affect the cost of construction work? Obviously it must increase the cost. A new and direct monetary liability is placed upon the contractor and no way is open to him except to charge for the risk. This is as plain as two times two as it is also plain that the public in the end pays the bill and will pin the blame on excessive profits of contract work. This law adds to the hazards of the contracting business and the contractor deserves extra pay therefor, and in the end he will get it.

There is a feature to this law, moreover, that is not common to laws and ordinances which relate to contract work. This is that the extra charge to provide for insurance of workmen will fall on private as well as on public work. The 8-hour law in New York and elsewhere affects only public work; the same is true of city ordinances requiring security and withholding a percentage of the pay, those requiring the contractor to assume all claims for damages, and a half dozen others which contractors for public work can name. None of these apply on private work, but the new workman's compensation law does. Its possible effect on costs is therefore immeasurably greater than previous laws and ordinances relating to construction work.

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CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Employing Concrete in Marine tructures With Data on Durability of Concrete in Sea Water and Examples of Typical Marine Structures of Concrete*

Various materials have been used in the construction of various structures but concrete has superseded the general use of others. Concrete has been used in subaqueous foundation work in many ways. The most natural and simplest method was to take advantage of the hydraulic properties of the cement and deposit it under water and let it harden. The concrete so deposited did not always properly set and very unsatisfactory results were frequently obtained. In the early days the cement was not of uniform quality and could not be depended upon. This lack of uniformity caused the outer faces of the concrete to crumble away, on the removal of the molds, and holes several inches deep appeared in the face of the mass and the entire block did not seem to be of good sound concrete.

An examination of a quay wall constructed of concrete placed "en masse in situ" along the North River in the harbor of New York. Fig. 1 resulted in the abandoning of this plan of construction, and the use of base blocks manufactured on land and set on the foundation by means of a derrick was again reverted to. The employment of concrete laid "en masse," however, has been successful in places where the conditions were most favorable and the water was clean and the concrete subjected to little or no current and only a small wave action; but unless such is the case, good results cannot be expected. The water must be practically quiet inside the cofferdam so as not to disturb the freshly laid cement, thus washing it out of the mixture and preventing hardening. Even then it is almost impossible to avoid laitance. Very good results have been obtained by the Department of Docks of the City of New York, but this method of depositing concrete is used only when success is assured.

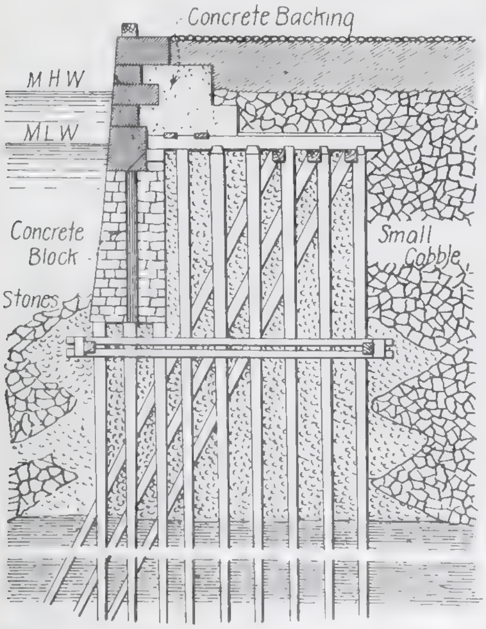

Fig. 2— Bulkhead Wall in Silt, New York Dock Department.

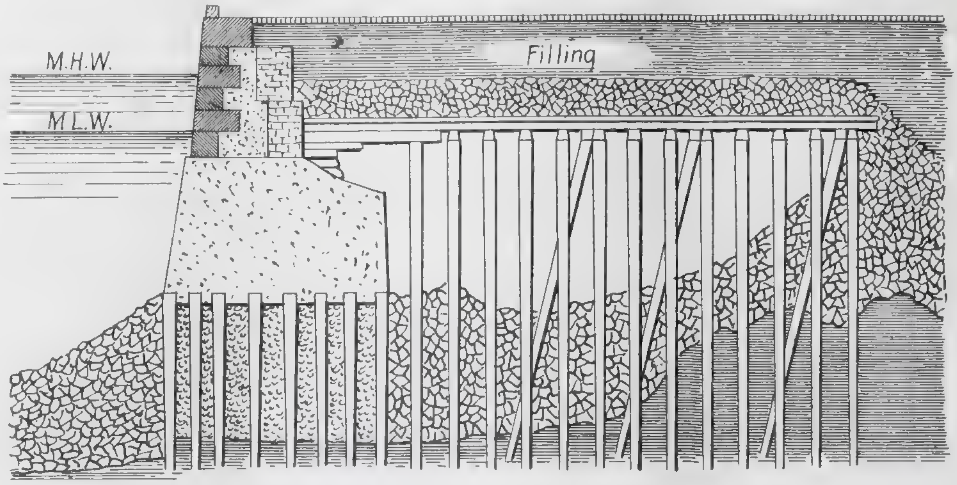

Fig. 1—Type of Bulkhead Wall Prior to 1876 New York Dock Department.

A radical change was introduced into the Department of Docks when Mr. G. S. Greene became its engineer-in-chief in 1876, and he developed the wall shown by Fig. 2. This wall, designed as a quay or river front wall on the North River and founded on a layer of silt so thick that hard bottom could not be reached by the longest piles obtainable, is a floating wall, but still has filled all the necessary requirements. In order, however, to make this structure stable and prevent movement, it was found necessary to dredge the river bottom to a depth of about 30 ft. below mean low water, and make a new and more compact foundation by depositing a rip-rap bank with a cobble core before the driving commenced and driving the piles through this fill. On these piles were placed large concrete base blocks weighing about 70 tons. As it is impossible to cut off piles at a uniform grade under water, the foundation of the block was made level by means of a mattress placed on top of the piles, this was filled with mortar mixed 2½ parts Portland cement to 3 parts sand screened to ¼ in., and in this manner a perfectly smooth and level bed was obtained for the base blocks. Figures 3, 4, 5 and 6, show various modifications of this wall adapted to the local conditions. In hard bottom, Figs. 3 and 4, the relieving platform is omitted. If the rock is sufficiently near the surface to obviate the necessity of using piles, the bottom in such a case, after being cleaned off, is levelled up with concrete in bags and floated off with a rich mixture of gravel and concrete to make a smooth bed for the base blocks, Figs. 5 and 6.

There is no reason why the quay wall just described should not survive centuries. It was constructed entirely without metal, wooden treenails being used to fasten the timbers together, the lumber and piles are entirely covered and thoroughly protected from the air and the entire structure should therefore last forever. Frequent examinations have failed to reveal any damage to the cement by action of salt water. It must be noted here, however, that everything connected with this work was carried on with the utmost care, under constant supervision and the materials used were the best of their kind to be obtained in the market and they were thoroughly inspected and tested. Concrete manufactured in this manner should withstand the action of salt water and experience has shown that it does. This type of wall was first constructed in 1876, and certain sections have been completed and tested for a period over 30 years, and are to-day apparently as sound as when first completed.

In Southampton, England, the chief deterioration of the ferro-concrete structures, built by the London & Southwestern Ry., took place well above the tide, where the concrete piles and superstructures were subjected to the action of the air and rain only. This was also noted by the Italian engineers on their breakwaters; there the concrete blocks above water, which were alternately wet and dry, showed signs of crumbling on their faces and had to be repaired from time to time. In Southampton, however, the trouble was probably due to the fact that the structures, which showed signs of deterioration were overloaded and were subjected to the moving loads of heavy freight trains and the vibrations of heavy coal hoists, as the other wharves at that place constructed at the same time, with identically the same care and the same materials, but not subjected to the heavy overloads, show no signs of deterioration and are standing the wear and tear of time well. The best English Portland cement was used in this work, and none was allowed in the structure unless it had been thoroughly tested.

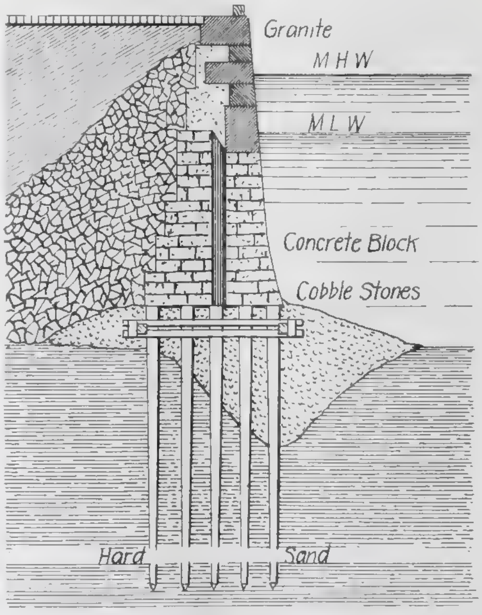

Fig. 3—Bulkhead Wall on Sand, New York Dock Department.

The coal barge jetty at Southampton built by the railway, Fig. 7, is founded on piles made of 1 part Portland cement and 3 parts sand and gravel mixed. This sand and gravel mixture was dredged directly from the Solent and is practically a uniform mixture of 1 part sand and 2 parts gravel. The piles are reinforced and were driven with a steam hammer through a chalk fill into a hard bottom of well packed sand and gravel. The entire structure is of reinforced concrete. The maximum weight possible to place on any one pile is 17 tons. The structure has been in use over 8 years and already shows signs of deterioration. This is probably due to the excessive vibration caused by the coal hoisting machinery and the moving of the immense crane along the dock. This wharf was the pioneer dock built by this road, and is probably too light. All the other docks which are not subjected to similar vibrations as the coal dock do not show any signs of wear and in fact have cost practically nothing for maintenance, they were designed for the same heavy dock loads.

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*Abstract of a paper by Chandler Davis, Consulting Engineer, New York, N. Y., presented at the 1910 convention of the National Association of Cement Users.

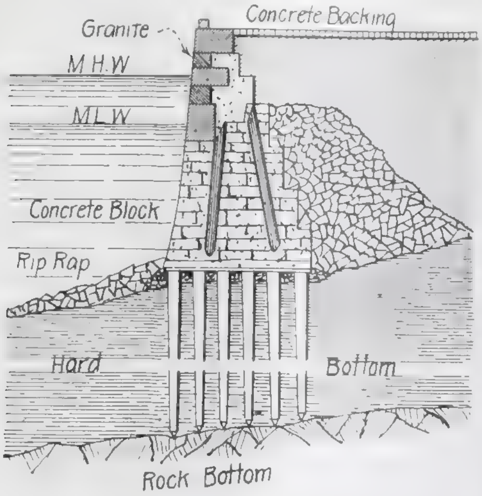


Fig. 4—Bulkhead Wall on Piles Driven Through Hard Bottom, New York Dock Department.

The Southwestern railway has adopted the Hennebique system in their work and have had great success with their docks. Figures 8 and 9 show two of the larger undertakings at their Southwestern Railroad Terminal. The Woolston Jetty on the Itchen opposite to the railroad docks, was built in the year 1899 and to date has cost nothing for repairs except for the damage done by a large steamer having been in collision with it, and this was very slight.

In the case of the Southampton structures deterioration due to the action of salt water has not been noticed to have taken place, and Mr. F. E. Wentworth-Shields, M. Inst. C. E., Dock Engineer of the London & Southwestern Ry., is of the opinion that if great care is exercised in making and placing concrete an impermeable material will be made which can withstand the action of salt water.

The large Eastham locks built by them at the entrance of the Manchester ship canal were begun in 1887 and have been in constant use since 1892, and although the tidal range amounts to 32 ft. at spring tides the concrete to-day is even better than the day it was deposited. Mr. W. Henry Hunter, M. Inst. C. E., chief engineer of this company, states as follows: "My experience in the use of Portland cement in salt water has now extended over 30 years and I have not known of any failure of such work when the concrete has been properly mixed and deposited," thus corroborating Mr. Wentworth-Shields' opinion.

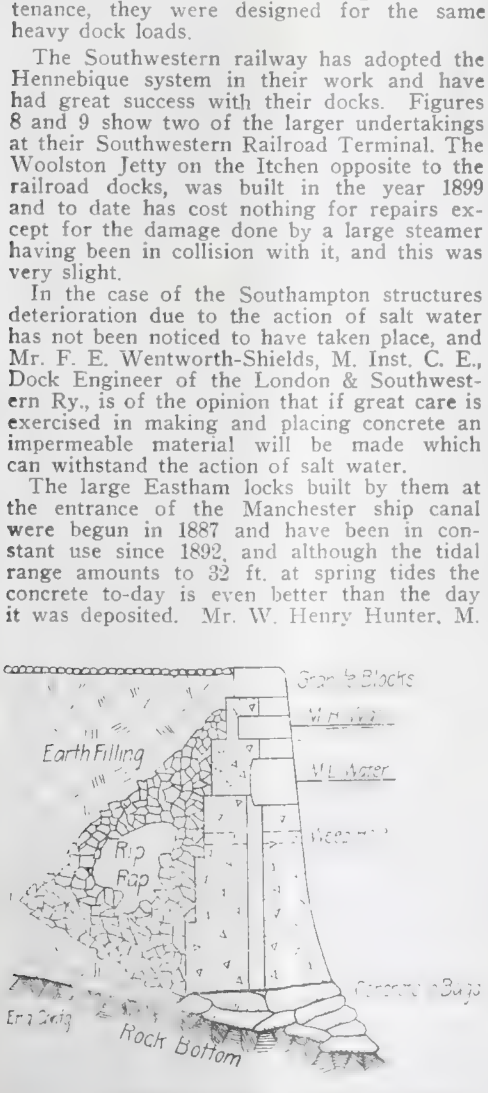


Fig. 5—Bulkhead Wall on Rock Bottom, New York Dock Department.

Com. Luigi Luiggi, Inspettore Superiore del Genio Civile, Italy, has had considerable experience in the construction of concrete maritime works both in Italy and in the Argentine Republic. He always employed a rich impermeable mortar, well mixed, when the concrete was exposed to the action of the sea water. The concrete directly subjected to the wave action is protected with granite or faced with a mixture of mortar about 2 ins. thick and made of 1 part of cement and 1 part of sand. This mortar was thoroughly mixed and well worked against the molds and backed with a 20-in. layer of concrete mixed 1 : 2 : 3 while the remainder of the wall is composed of 1 : 2 : 5 concrete, mixed medium wet so that when it is well rammed, the water will show on the surface, and the resulting structure is absolutely waterproof. The concrete, however, must be absolutely impermeable or the life will be limited as the salt water percolating through the concrete will soon cause it to deteriorate and the mass will eventually crumble away. In a dry dock built by Com. Luigi Luiggi at the Argentine naval station at Bahia Blanca, a rich concrete backing was used. This dock was put into commission in 1902 and is absolutely tight, not showing any signs of leaks. Great care was taken, however, in the placing of the concrete to see that everything connected with the work was done in the best manner and that the various layers of concrete were laid so as to avoid all chances of leaks occurring at the horizontal joints between the old and new concrete.

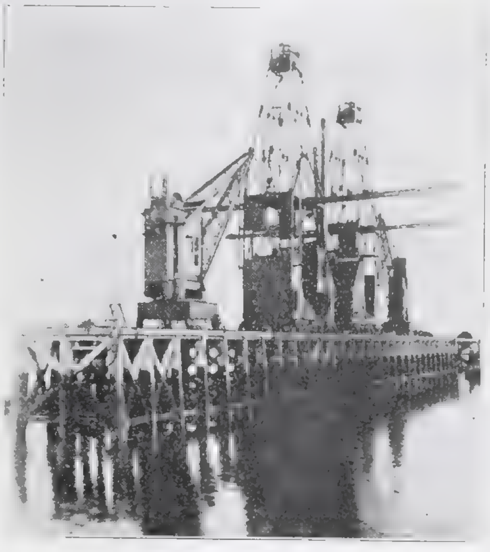


Fig. 8— View of Coal Barge Jetty, Southampton, England.

In the construction of Italian breakwaters several plans were developed and finally they were built with concrete face blocks laid in courses, as experience showed that a wall constructed in this manner and in accordance with the plans shown by Figs 10 to 14,, withstood the action of the salt water of the Mediterranean and the heavy blows of the high waves better than if the blocks had simply been deposited without care or order.

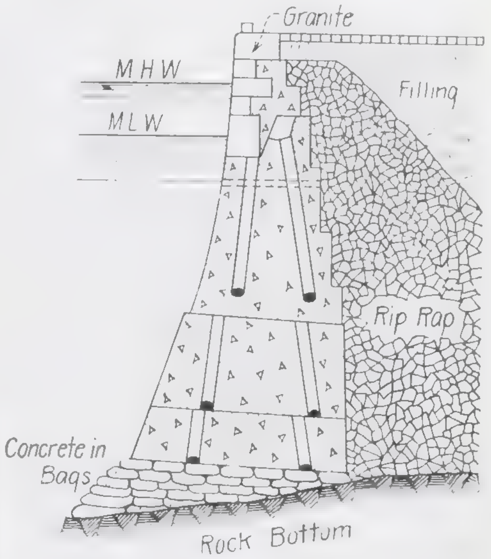


Fig. 6—Bulkhead Wall on Rock Bottom, New York Dock Department.

The great advantage of the plan which called for a rubble backing faced with concrete face blocks laid in regular courses over a facing laid randomly was soon noticed. The close joints prevented the sea from washing through the structure and gradually disintegrating and wearing down the face of the blocks until finally they were washed out of the wall's face by the receding water, necessitating repair work.

The wall with its face laid in regular courses is better able to resist the action of the salt water and the repairs are very slight, due chiefly to the disintegration of the outer faces of those blocks, which are placed above water, and which are alternately dry and wet. Repairs are readily made by refacing the blocks with a coat of mortar mixed 1 : 2½. The Giano Mole, Genoa, is built in accordance with these plans, and although completed in 1888, has required very little repairing and the cost of maintenance of this break-

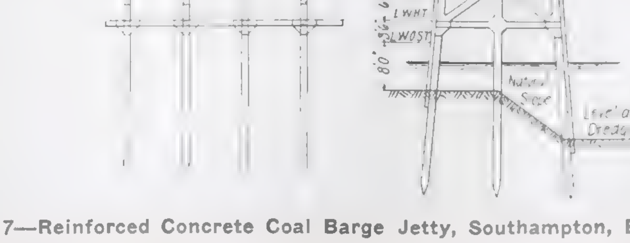


Fig. 7—Reinforced Concrete Coal Barge Jetty, Southampton, England.

water has been very slight, although it has been exposed to the heavy southeasterly gales and the huge waves rolled in by them. Puzzolana was used in the construction of this breakwater.

The Dutch have used concrete extensively in their harbor works. Figures 15, 16 and 17 are examples. The concrete in all cases has worn well and they have had no trouble with their docks. An improvement in the method of constructing their walls was the introduction of a pneumatic caisson, which enables them to cut off their piles and lay the platform and build up the concrete wall to a point above M. L. W. dry. This has proven a very satisfactory and economical method of doing the work; every step can be inspected as it progresses and the possibility of obtaining poor results eliminated as the concrete is laid in place, dry. The sea walls in Holland, some of which are very old, do not give any evidence of having been affected by the salt water.

The Belgians, in the construction of the large breakwaters at Heyst, used reinforced concrete shells, which were floated to place and sunk at low tide by being filled with concrete. This avoided the use of large derricks, which would probably have been wrecked by the heavy storms off that coast.

This work proceeded very rapidly even under most unfavorable conditions. The Heyst breakwater was completed in 1903, and although exposed to heavy seas and to large changes in temperature is standing today as sound as ever.

Figures 18 and 19 show the types of walls built by the City of Philadelphia along Delaware Ave., G. S. Webster, M. Am. Soc. C. E., Chief Engineer, and J. A. Bensel, M. Am. Soc. C. E., Consulting Engineer for the Gidard Estate. The concrete wall in each case, from about M. L. W. up, was built of concrete laid en masse with expansion joints every 72 ft., and, although completed 11 years ago, is in splendid condition. The specifications were very strict and supplies which did not conform to them were rejected and not used in the work. The mixture was 1 part Portland cement, 3 parts coarse sand or gravel graded from fine to coarse and screened to reject all particles greater than ¼ in. in diameter, free from loam, dust and dirt, and 6 parts of broken stone, clean broken granite, trap rock or other hard approved stone crushed to pass a 2-in. ring and screened to reject all pieces less than ¼ in. in diameter. The concrete was carefully mixed and then deposited in the forms with great care, and the entire work was carried on in a first class manner. The Portland cement was of the best quality and was required to pass very rigid inspection, showing a tensile strength mixed 1:3 of 170 lbs. per sq. in. at the end of 7 days and at the end of 28 days 240 lbs. per sq. in. At first a granolithic facing, composed of 2 parts Portland cement and 3 parts of granolithic broken stone was worked in next to the form as the coarser concrete was cast, but this eventually was abandoned. The general condition of this bulkhead is good and the entire work is a proof that carefully worked concrete will give lasting results.

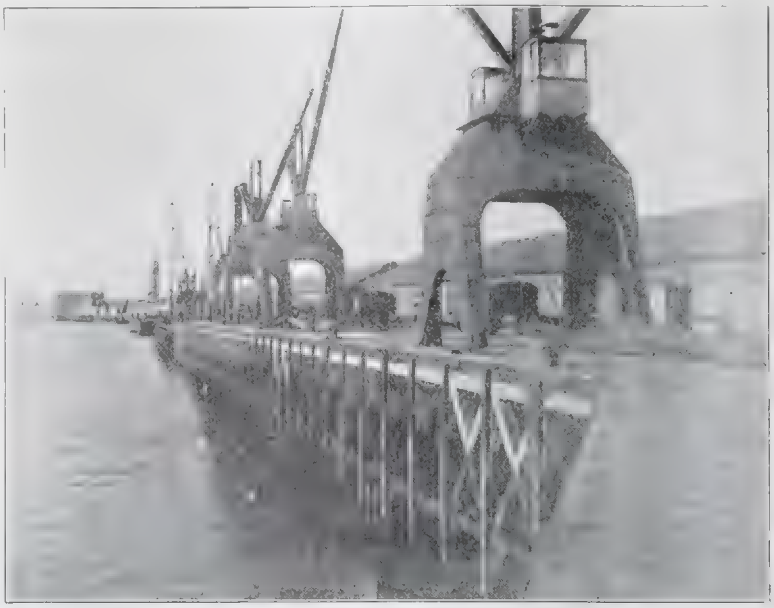


Fig. 9—Reinforced Concrete Railway Docks, Southampton, England.

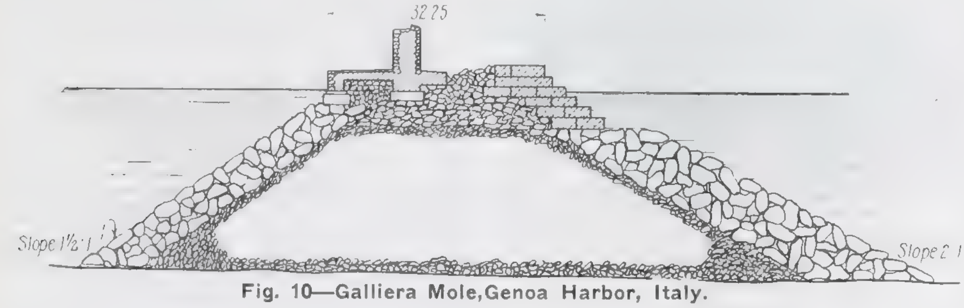


Fig. 10—Galliera Mole, Genoa Harbor, Italy.

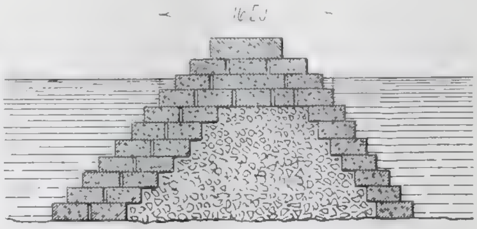


Fig. 13—Vegliaia Mole, Leghorn Harbor, Italy.

Concrete has not only been used as a protection against the inroads of the sea; it has also been adopted as a protection against the ravages of the teredo. This worm infects the waters of our entire Atlantic seaboard, south of Eastport, Me.; it is more active in the southerly regions, where the water remains warm the year around, and some protection against its voracity was sought. Creosoting was found to be fairly satisfactory, but not permanent enough, so that eventually concrete was employed as a protection against the teredo and limnoria.

The United Fruit Company, having to contend with this pest, determined to put in a worm-proof dock at Bocas del Toro, Panama, and they retained Mr. T. H. Howard Barnes, M. Am. Soc. C. E., to design a concrete wharf. The entire superstructure was built of reinforced concrete resting on a substructure of untreated southern pine piles. These, after they were driven to grade, were protected by 2-in. concrete shells, reinforced with 6x6 in. electrically welded wire mesh, as manufactured by the Clinton Wire Cloth Co. The shells were built on land and were allowed to set thoroughly before being placed in the work; they were slipped over the piles to protect them. A 2-in. space was left between the piles and the shells, which was afterwards filled with concrete, a rich grout being first placed in the bottom of the space and allowed to harden sufficiently to enable the water to be pumped out and the remainder of the concrete laid dry. The dock seems to be wearing satisfactorily, although fairly large steamers land alongside; the concrete protection of the piles has not shown any signs of cracking or disintegration

Mr. J. M. Braxton, assistant engineer, U. S. Army, has designed a pile which he has used in his work in the vicinity of Jacksonville, Fla. Plates 19, 20, 21, Figures 20 to 22, show the design. The pile is composed of concrete reinforced with twisted steel rods. On the lower end it is fitted with a cast iron point, the interior of which contains two ribs at right angles, to which the twisted steel reinforcing rods are secured. The point is so cast that it forms a shoulder of about 2 ins. greater diameter than the pile. This shoulder engages and supports a wrought iron shell which is used to transmit the blows of the driving hammer directly to the point, relieving the concrete of the shock due to the hammer blows. The pile is driven as any

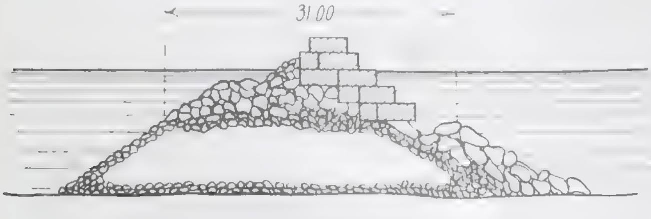


Fig. 11—Giano Mole, Genoa Harbor, Italy.

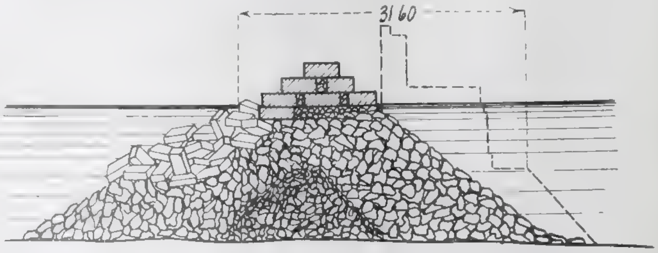


Fig. 12—New Mole, Cantania Harbor, Italy.

wooden pile would be; the iron shell, however, is removed after the driving is completed.

The advantage of this pile is that as soon as driven it is capable of supporting the load or structure that is to be placed upon it, the pile is not subjected directly to the blows of the driving hammer and it is built in a form flat on the ground. It can be made and used in any length which is obtainable in wood. In actual work at Key West this pile has been driven 2 ft. into the coral rock, in addition to having been driven through the overlying sand and boulders, the driving shell being easily withdrawn afterwards. These piles are being used by the government at Key West, Fla., in a dock designed by Captain George R. Spalding, Corps of Engineers, U. S. Army.

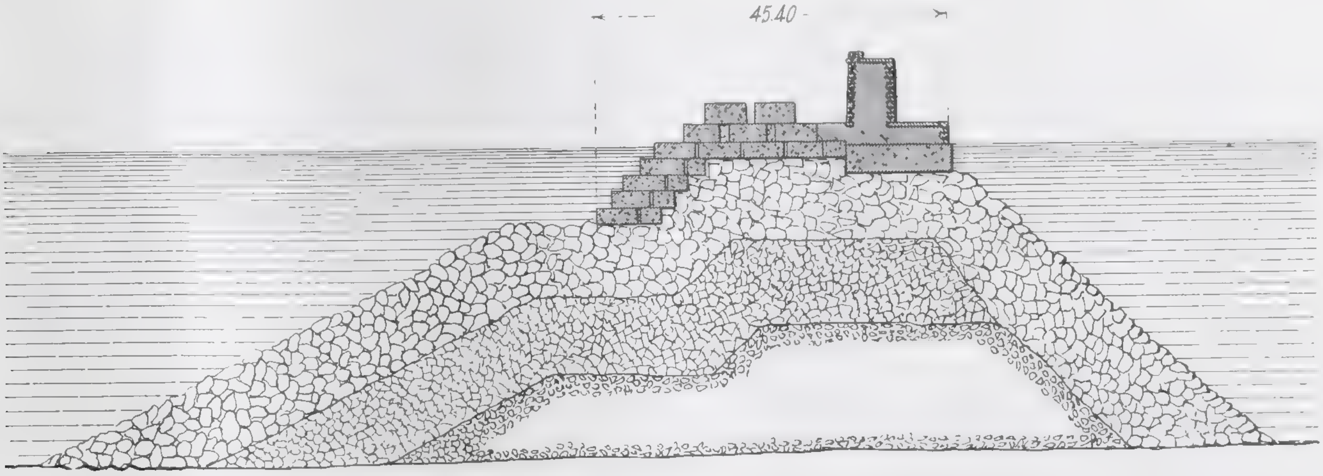
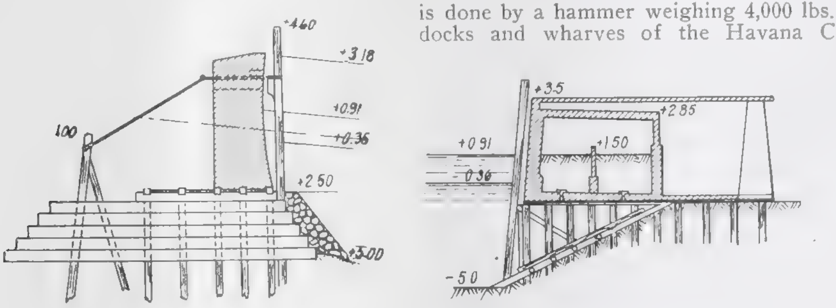


Fig. 14—Breakwater at Harbor of Naples, Italy.



Figs. 15 and 16.—Bulkheads of the Spoorweghaven, Rotterdam, Holland.

John Monks & Sons of New York, the contractors of the Mallory Line dock at Jacksonville, Fla., have used a concrete pile which can be manufactured at slight cost and as easily handled and driven as a wooden pile. It was designed by Mr. John W. Ripley, M. Am. Soc. C. E. The pile is made by wrapping a layer of concrete around a wooden core. The concrete is first spread out on a wire mesh and the whole is attached to the core and rolled around same. The wrapper is then secured by binding wires spaced about 2 ft. centers along the pile, which is then covered with a ⅛-in. to ¼-in. thick coating of mortar. While the piles are hardening they are wet down each day for several days after completion. Tests made at the U. S. Arsenal at Watertown showed that the Ripley piles have great strength and a pile a little over 14 ins. in diameter and 20 ft. long tested as a long column broke at 240 tons, or about 3,000 lbs. per square inch. They will stand the hardest driving, and at Jacksonville, Fla., they were successfully driven through a fill of coral rock and dirt into the rock bottom without damaging the concrete protection. A test for bond showed the enormous strength of 15 tons per linear foot of pile.

Another pile which has been extensively used is the Chenoweth reinforced concrete pile, designed by Mr. Alexander Crawford Chenoweth. It can be manufactured without the use of forms and only requires the simplest kind of machinery in its construction. The process of manufacturing these piles consists simply in rolling a sheet of concrete spread out on a wire mesh into a cylinder about a center tube; steel bars are used as a further reinforcement. The pile after having been rolled is tied at frequent intervals with wire to hold the roll together while the concrete is setting. Figure 23 shows this pile. They can be made in almost any length; the longest made thus far was 80 ft. When used in salt water the proportion of the concrete is 1 part of cement, 2 parts of sand and 3 parts of gravel. This proportion, according to Mr. Chenoweth, gives the best results and the required density for piles to be used under such conditions. Figure 23 shows the driving cap and cushions used with this pile. The driving is done by a hammer weighing 4,000 lbs. The docks and wharves of the Havana Central Railway at Muelle de Luz, Havana, Cuba, are founded on Chenoweth piles. They are wearing well and do not show any signs of deterioration in the dirty waters of that harbor.

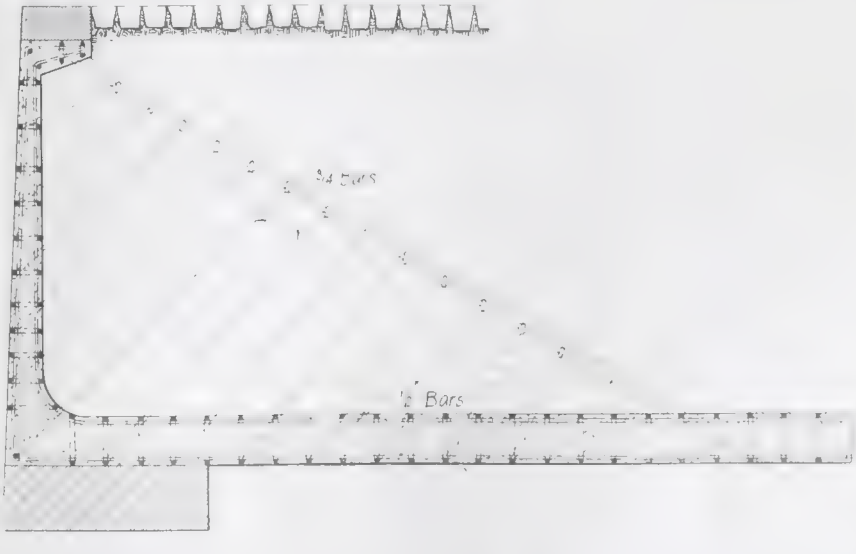


Fig. 17—Bulkhead of the Schiekold, Rotterdam, Holland.

The Japanese have successfully used concrete in their harbor works and report very good results. They use Japanese cement almost entirely and by careful manipulation and placing of the concrete the walls withstand the action of the sea water without any reported failure. The proposed pier now being constructed at Kobe, Japan, K. Morigaki, chief engineer, is shown by Fig. 24. The geological formation of the harbor of Kobe is similar to that of the North River, New York; both have a very deep underlying bed of silt; hard bottom is found at such depths that artificial foundations have to be constructed.

The bottom was dredged to a depth of 42 ft. below M. L. W., forming a trench 58 ft. wide on the bottom the length of the wall. This was filled with sand to —34 ft. and finally brought to grade —30 ft. with an embankment of gravel and rip-rap carefully leveled off on top.

The wall proper rests on ferro concrete caissons. These shells, weighing from 1,600 to 2,200 tons, are built on the land and after being allowed to season for two months are floated to place by means of a specially designed depositing dock. A longitudinal diaphragm divides each caisson into two parts, the front half of which is filled with concrete and the rear portion with sand and gravel. This style of quay wall has been successfully used by the engineers of Rotterdam, Holland, and proven to be economical. The wall is then built up to the proper grade with concrete and granite as shown. A rip-rap embankment is deposited in the rear and between the caissons and brought to such a height that the toe of this bank will not project beyond the toe of the caisson. The work is not completed as yet, but so far seems to be satisfactory; some settlement has been observed, as would be expected, but nothing very serious. Then entire structure will be built of concrete made with Japanese cement, the "Asano" brand being used chiefly.

Although the majority of the work carried on in concrete has been successful, a number of failures have been recorded. A most notable failure due to the deterioration of the concrete is the Graving dock at Aberdeen, Scotland. This dock, which was built of concrete, was opened in 1885 and immediately showed signs of leaks. Two years later, in 1887, the leakage was so bad that Mr. William Smith, M. Inst. C. E., was called in to make a report on the condition of the dock. Samples were cut out of the concrete and sent to Professor Brazier of Aberdeen University to analyze. This was done and it was found that the deterioration was due to the chemical action of the salt water on the cement. Professor Brazier says:

> The analyses of the series of decomposed cement show a remarkable difference to the original cement, inasmuch as that in all these samples there is found a large quantity of magnesia and a large proportion of lime, in the form of carbonate. I believe this alteration is brought about entirely by the action of the salt water upon the cement. There is no other source for either the magnesia or the carbolic acid.

Mr. Philip J. Mersent, M. Inst. C. E. (Proceedings of the Institution of Civil Engineers, Vol. CVII), was called as a consulting engineer to report and as a result of his examination reported that as near as he could determine the deterioration existed chiefly in those sections where the proportions were 3 parts sand to 1 part of cement or even more. This high ratio of sand gave a very porous concrete. The mortar layer plastered on the surface of the concrete and mixed 1 part of cement to 1½ parts of sand had as a rule hardened thoroughly and was in very good condition, as was also the concrete which was mixed 1 part cement, 2 parts of sand and 4 parts of stone. Therefore Mr. Mersent states that the concrete must be impermeable to water if it is to have any life at all, and as long as it is so, it will last indefinitely. Permeable concrete soon deteriorates and rapidly goes to pieces, softening and eventually crumbling away. Mr. J. W. Sandeman, M. Inst. C. E., as well as Com. Luigi Luiggi, M. Inst. C. E., both advocate an impermeable concrete.

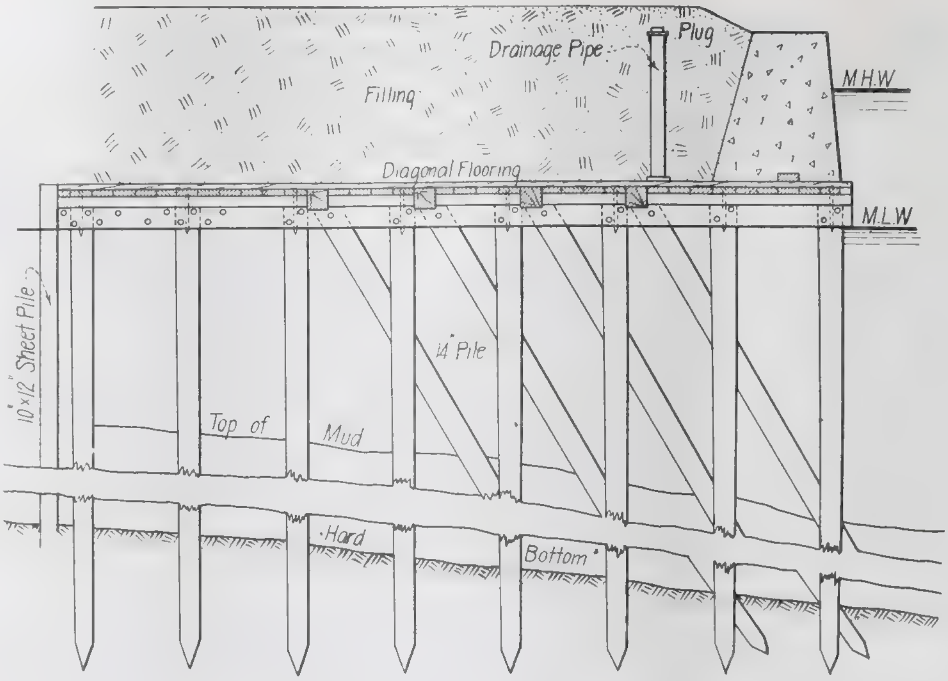


Fig. 18—Delaware Ave. Bulkhead, Philadelphia, Pa.

Mr. Sandeman in his paper on "Action of Salt Water Upon Concrete" states that concrete must be impervious if it is to last any length of time, and the maximum proportion of the sand in the mortar must not be more than twice that of the cement. The mortar must exceed the maximum voids in the aggregate so as to thoroughly cover the aggregate as well as fill all the voids. Concrete proportioned as above will give satisfactory results, provided the materials are of the best quality of their respective kinds. The concrete must be impermeable if it is to be used under or in salt water. They found that a concrete made with mortar composed of cement and a fairly coarse sand gave better results and a more impermeable concrete than one mixed with a larger proportion of fine sand. Bearing this in mind, Com. Luigi Luiggi was able to build a perfectly tight dry dock at Bahia Blanca.

Concrete to be used in water and salt water especially must be impermeable or it otherwise will soon be destroyed by the action of the chemicals in the water. The cement must be of the best quality and be thoroughly analyzed, tested and inspected before using. The sand must be a clean, sharp sand free from loam and all vegetable and foreign matters. The stone must be a clean, sound stone or a clean gravel of the proper size. Great care must be taken with the mixing and the placing of the concrete and if this is done, there is no reason a concrete structure should not be as lasting as one of stone.

The great ease with which concrete structures can be built, the small cost of annual maintenance and the almost indestructibility of the structure should recommend the use of this material in preference to others and more than overcome the greater initial cost. Eliminating such charges as would be common to all kinds of quay walls, such as backfilling, dredging and paving, a concrete wall founded on short wooden piles and hard bottom and faced with granite from about mean low water up would cost about four times as much as a wooden crib bulkhead. The cost of maintenance of the masonry wall would be practically nothing and its life unlimited, while the crib bulkhead, every 15 years, would require rebuilding from M. L. W. up, and the annual repairs to same would be considerable. The above comparison of construction is based on prices as they were ten years ago. At the present time the cost of lumber has nearly doubled, while the prices of cement, broken stone and sand have practically remained stationary, so that today the initial cost of the concrete struoture would not be much more than twice to two and one-half times that of the wooden bulkhead or dock.

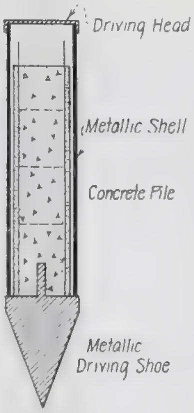


Fig. 20—Section of Braxton Concrete Pile.

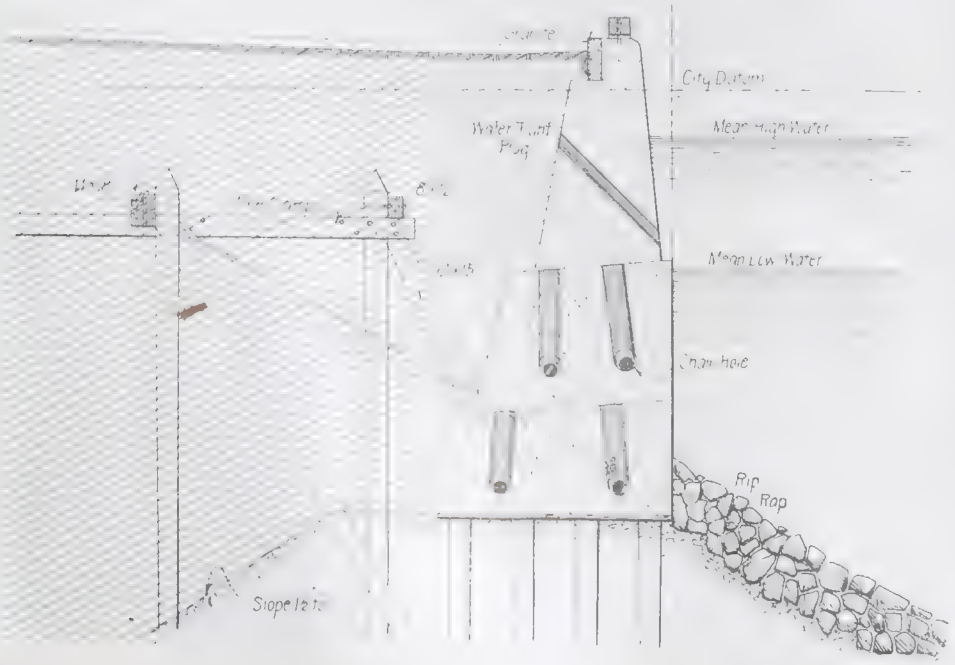


Fig. 19—Delaware Ave. Bulkhead, Philadel phia, Pa.

The United States having considered that it had an inexhaustible supply of lumber, has not developed the use of concrete in its harbor works to the same extent that other nations have, nations which are less fortunate in the natural resources. However, the constant drain made on the eastern pine forests has practically exhausted them and the great advance in prices has obliged the engineer to search for some material to replace wood and this will naturally cause them to turn to concrete.

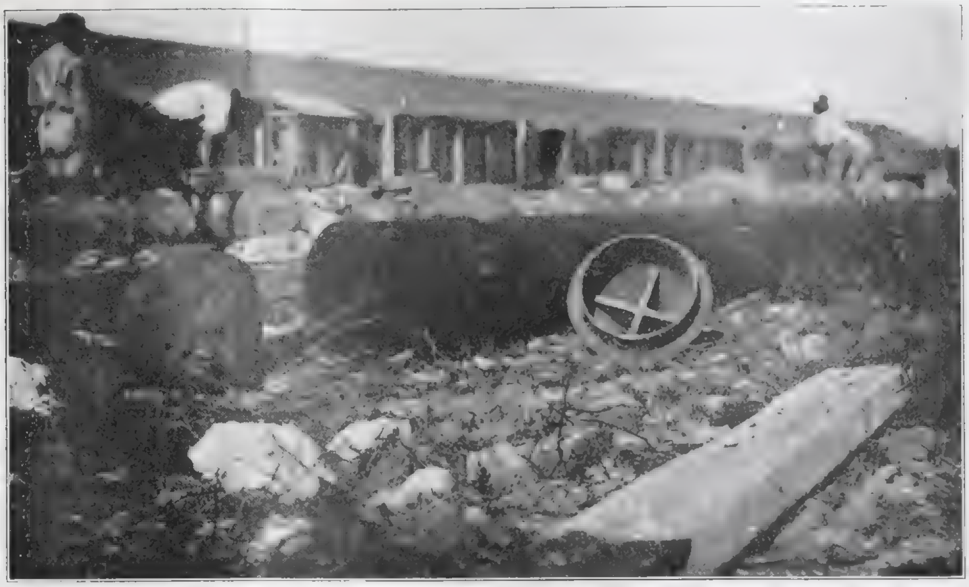


Fig. 21—View of Shoe and Shell for Braxton Concrete Pile.

An Act To Amend the Labor Law, in Relation to Workmen's Compensation in Certain Dangerous Employments in New York.

Section 1. Chapter thirty-six of the laws of nineteen hundred and nine, entitled "An act relating to labor, constituting chapter thirty-one of the consolidated laws," is hereby amended by inserting therein a new article, to be Article 14-a thereof, to read as follows:

215. Application of article. This article shall apply only to workmen engaged in manual or mechanical labor in the following employments, each of which is hereby determined to be especially dangerous, in which from the nature, conditions or means of prosecution of the work therein, extraordinary risks to the life and limb of workmen engaged therein are inherent, necessary or substantially unavoidable, and as to each of which employments it is deemed necessary to establish a new system of compensation for accidents to workmen.

(1) The erection or demolition of any bridge or building in which there is, or in which the plans and specifications require iron or steel frame work.

(2) The operation of elevators, elevating machines or derricks or hoisting apparatus used within or on the outside of any bridge or building for the conveying of materials in connection with the erection or demolition of such bridge or building.

(3) Work on scaffolds of any kind elevated twenty feet or more above the ground, water, or floor beneath in the erection, construction, painting alteration or repair of buildings, bridges or structures.

(4) Construction, operation, alteration or repair of wires, cables, switchboards or apparatus charged with electric currents.

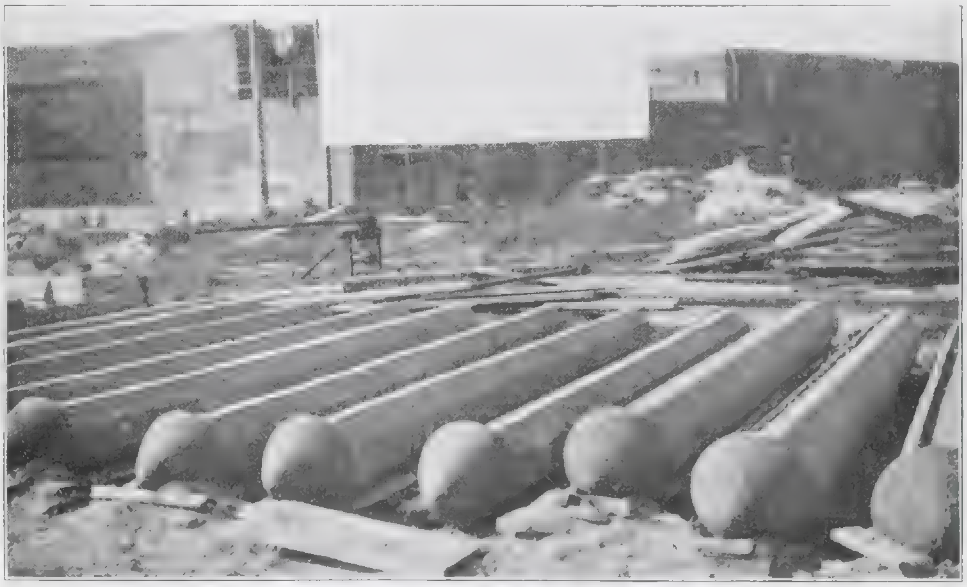


Fig. 22—View Showing Completed Braxton Concrete Piles.

(5) All work necessitating dangerous proximity to gunpowder, blasting powder, dynamite or any other explosives, where the same are used as instrumentalities of the industry.

(6) The operation on steam railroads of locomotives, engines, trains, motors or cars propelled by gravity or steam, electricity or other mechanical power, or the construction or repair of steam railroad tracks and road beds over which such locomotives, engines, trains, motors or cars are operated.

(7) The construction of tunnels and subways.

(8) All work carried on under compressed air.

216. Definitions. The words, "employer," "workman" and "employment," or their plurals, used in this article, shall be construed to apply to all the employments above described.

217. Basis of liability. If, in the course of any of the employments above described, personal injury by accident arising out of and in the course of the employment after this article takes effect is caused to any workman employed therein, in whole or in part, or the damage or injury caused thereby is in whole or part contributed to by

(a) A necessary risk or danger of the employment or one inherent in the nature thereof; or

(b) Failure of the employer of such workman or any of his or its officers, agents or employes to exercise due care, or to comply with any law affecting such employment; then such employer shall, subject as hereinafter mentioned, be liable to pay compensation at the rates set out in section two hundred and nineteen-a of this title; provided that the em-

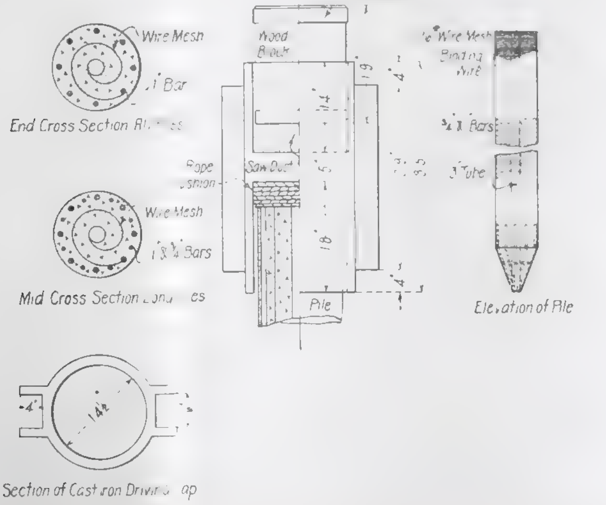


Fig. 23—Details of Chenoweth Concrete Piles and Driving Cap.

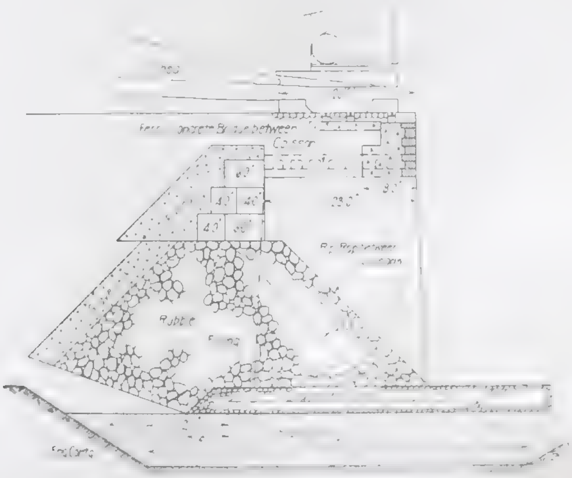


Fig. 24—Quay Wall, Kobe Harbor, Japan.

ployer shall not be liable in respect of any injury which does not disable the workman for a period of at least two weeks from earning full wages at the work at which he was employed, and provided that the employer shall not be liable in respect of any injury to the workman which is caused in whole or in part by the serious and willful misconduct of the workman.

218. Rights of action not affected. The right of action for damages caused by any such injury, at common law or under any statute in force on January one, nineteen hundrer and ten, shall not be affected by this article, and every existing right of action for negligence or to recover damages for injuries resulting in death is continued, and nothing in this article shall be construed as limiting such right of action, but in case the injured workman, or in event of his death his executor or administrator, shall avail himself of this article, either by accepting any compensation hereunder in accordance with section two hundred and nineteen-a hereof or by beginning proceedings therefor in any manner on account of any such injury, he shall be barred from recovery in and deemed thereby to have released every other action at common law or under any other statute on account of the injury after this article takes effect. In case after such injury the workman, or in the event of his death his executor or administrator, shall commence any action at common law or under any statute other than this article against the employer therefor he shall be barred from all benefit of this article in regard thereto.

219. Notice of accident. No proceedings for compensation under this article shall be maintained unless notice of the accident as hereinafter provided has been given to the employer as soon as practicable after the happening thereof and before the workman has voluntarily left the employment in which he was injured, and during such disability, but no want or defect or inaccuracy of a notice shall be a bar to the maintenance of proceedings unless the employes proves that he is prejudiced by such want, defect or inaccuracy. Notice of the accident shall state the name and address of the workman injured, the date and place of the accident, and in simple language the physical cause thereof, if known. The notice may be served personally or by sending it by mail in a registered letter addressed to the employer at his last known residence or place of business.

219-a. Scale of compensation. The amount of compensation shall be in case death results from injury:

(a) If the workman leaves a widow or next of kin at the time of his death wholly dependent on his earnings, a sum equal to twelve hundred times the daily average of such workman at the rate at which he was being paid by such employer at the time of the injury subject as hereinafter provided, and in no event more than three thousand dollars. Any weekly payments made, under this article shall be deducted in ascertaining such amount.

(b) If such widow or next of kin at the time of his death are in part only dependent upon his earnings, such proportionate sum not exceeding that provided in subdivision a as may be determined according to the injury to such dependents.

(c) If he leaves no dependents, the reasonable expenses of his medical attendance and burial not exceeding one hundred dollars.

Whatever sum may be determined to be payable under this article in case of death of the injured workman shall be paid to his legal representative for the benefit of such dependents, or if he leaves no such dependents, for the benefit of the persons to whom the expenses of medical attendance and burial are due.

(2) Where total or partial incapacity for work at any gainful employment results to the workman from the injury, a weekly payment commencing at the end of the second week after the injury and continuing during such incapacity, subject as herein provided, equal to fifty per centum of his average weekly earnings when at work on full time during the preceding year during which he shall have been in the employment of the same employer, or if he shall have been in the employment of the same employer for less than a year, then a weekly payment of not exceeding three times the average daily earnings on full time for such less period. In fixing the amount of the weekly payment, regard shall be had to the difference between the amount of the average earnings of the workman before the accident and the average amount he is able to earn thereafter as wages in the same employment or otherwise. In fixing the amount of the weekly payment, regard shall be had to any payment, allowance or benefit which the workman may have received from the employer during the period of his incapacity, and in case of partial incapacity the weekly payment shall in no case exceed the difference between the amount of the average weekly earnings of the workman before the accident and the average weekly amount which he is earning or is able to earn in the same employment or otherwise after the accident, but shall amount to one-half of such difference. In no event shall any compensation paid under this article exceed the damage suffered, nor shall any weekly payment payable under this article in any event exceed ten dollars a week or extend over more than eight years from the date of the accident.

219-b. Medical examinations. Any workman entitled to receive weekly payments under this article is required, if requested by the employer, to submit himself for examination by a duly qualified medical practitioner or surgeon provided and paid for by the employer, at a time and place reasonably convenient for the workman, within three weeks after the injury, and thereafter at intervals not oftener than once in six weeks. If the workman refuses to submit to such examination, or obstructs the same, his right to weekly payments shall be suspended until such examination has taken place, and no compensation shall be payable during or for account of such period.

219-c. Incompetency of workman. In case an injured workman shall be mentally incompetent at the time when any right or privilege accrues to him under this article, a committee or guardian of the incompetent appointed pursuant to law may, on behalf of such incompetent, claim and exercise any such right or privilege with the same force and effect as if the workman himself had been competent and had claimed or exercised any such right or privilege; and no limitation of time in this article provided for shall run so long as said incompetent workman has no committee or guardian.

219-d. Settlement of disputes. Any question which may arise under this act shall be determined either by agreement or by arbitration as provided in the code of civil procedure or by an action at law as herein provided. In case the employer fail to make compensation as herein provided, the injured workman, or his committee or guardian, if such be appointed, or his executor or administrator, may then bring an action to recover compensation under this article in any court having jurisdiction thereof, or in any court which would have had jurisdiction of an action for recovery of damages for negligence for the same injury between the same parties. This article however shall not be construed as extending the jurisdiction of any such court to award judgment for an amount greater than now allowed by law. Such action shall be conducted in the same manner as actions at law for the recovery of damages for negligence. The judgment in such action if in favor of the plaintiff shall be for a sum equal to the amount of payments then due and prospectively due under this article. Such action must be commenced within six months after the happening of the accident or in case of the death of the workman by such accident within six months after the appointment of his legal representative in this state, or in the event of his physical incapacity, within six months after the removal thereof, or in the event of weekly payments by the employer hereunder, within six months after such payments have ceased. In such action by an executor or administrator the judgment may provide the proportions of the award or the costs to be distributed to or between the several dependents. If such determination is not made it shall be determined by the surrogate's court, in which such executor or administrator is appointed, in accordance with this article, on petition of any party interested on such notice as such court may direct.

219-e. Preferences and exemptions. Any person entitled to weekly payments under this article against any employer shall have the same preferential claim therefor against the assets of the employer as allowed by law for a claim by such person against such employer for unpaid wages or personal services. Weekly payments due under this article shall not be assignable or subject to levy, execution or attachment.

219-f. Attorneys' liens. No claim of an attorney-at-law for any contingent interest in any recovery under this article for services is securing such recovery or for disbursements shall be an enforceable lien on such recovery, unless the amount of the same be approved in writing by a justice of the supreme court, or in case the same be tried in any court, by the justice presiding at such trial.

219-g. Liability of principal contractors. If an employer who shall be the principal enters into a contract with an independent contractor to do part of such employer's work, or if such contractor enters into a contract with a subcontractor to do all or any part of the work comprised in such contractor's contract with the employer, the said principal shall be liable to pay to any workman employed in the execution of the work any compensation under this article which he would have been liable to pay if that workman had been immediately employed by him; and where compensation is claimed from or proceedings are taken against the principal then, in the application of this article, references to the principal shall be substituted for references to the employer, except that the amount of compensation shall be calculated with reference to the earnings of the workman under the contractor or employer by whom he is immediately employed. Where such principal is liable to pay compensation he shall be entitled to be indemnified by any person who would have been liable to pay compensation to the workman independently of this section. Nothing in this section shall be construed as preventing a workman from recovering compensation under this article from the contractor or subcontractor, instead of the principal; nor shall this section apply in any case where the accident shall occur elsewhere than on, or in, or about the premises on which the principal has undertaken to execute the work or which are otherwise under his control or management.

(2) The act shall take effect September first, nineteen hundred and ten.

Work was begun on the first trestle for the Colon harbor breakwaters at the Atlantic entrace of the Panama Canal on Aug. 8. At present a regular track pile driver is driving the piles, but in the course of a few weeks a steam piston driver will be on the Isthmus. The new driver is built to drive piles not only on the line on which it runs, but also for tracks running parallel to the operating track. The trestle now under construction will extend from Toro Point 11,000 ft. to the entrance of the Canal, and the breakwater will be built by dumping rock from dump cars run out on this trestle.

The contract for building a new ladder dredge for the Pacific Division of the Panama Canal to William Simons & Co., Ltd., of Renfrew, Scotland. This company was the lowest of the three bidders, one of which was an American firm whose proposal was considered excessive. The dredge will cost $399,340 and is to be delivered at Balboa 365 days from the date the contract is signed, making the voyage from Scotland through the Strait of Magellan to the Pacific entrance of the Canal under its own steam.

ROADS AND STREETS SECTION

Snow Removed in New York City.

The matter of removing snow from the city streets has always been one of the most difficult problems which has confronted the city officials of New York City. In an effort to devise some satisfactory plan for snow removal the Board of Estimate early this year appointed a committee to investigate the matter. The committee made its report on July 1 and this report was adopted by the Board of Estimate. The committee considered various plans of snow removal which may be roughly divided in three classes: (1) The collection and removal of snow by hand labor and carts, under the area and cubic yardage systems, the snow to be dumped into the rivers and sewers. (2) Mechanical devices for removing snow and dumping it either into the sewers or the rivers; and (3) melting devices, either stationary or portable, for the disposition of the snow.

The report of the committee, in part, follows:

1. The committee has carefully considered the question of contract on area system and is opposed to this form of contract, for the reason that no form of contract under this system has as yet been devised that will eliminate the element of chance, and that will be fair and equitable, both to the city and to the contractor.

The proper administration of a contract under the cart-load or cubic yardage system depends entirely upon the amount of control exercised by the commissioner of street cleaning, through his snow office, in measuring the capacity of the carts and properly checking of the number of loads hauled. No such accurate system has yet been installed as would warrant the committee in advocating such a contract for this winter. Experience has shown that in previous years bids for the removal of snow have been confined to a few large contractors, resulting in prices which your committee believes to be excessive.

2. Mechanical Devices, etc.—The suggested devices have been chiefly scrapers that would not remove the snow entirely from the surface of the streets. It may be that, as auxiliaries to other systems, some of these may prove to be usable.

3. Snow Melting Apparatus, etc.—Many of these devices the committee believes to be too high in cost of construction and operation, and others not mechanically correct. A few of them seem to have merit, and are worthy of further consideration.

Your committee believes that this should be a winter of experimentation as to the best methods of snow removal, and that various schemes should be tried, such as the greater use of the sewers, various mechanical devices, such as scrapers and snow melting machines, in order that the city may finally determine upon a permanent policy for handling this most difficult problem, and that any saving made may accrue to the city and not to the contractors.

Of the various devices submitted, two have seemed worthy of further attention, and if the recommendations of the committee meet with your approval, will be investigated in more detail; these are: (1) A self-propelling machine consisting of boiler, steam engine, elevator and melting appliance, all mounted on wheels. The snow is shoveled by hand into the elevator, which carries it to the melting tank, where it is brought into contact with the heat of the boiler and direct steam. The cost of operation and the feasibility under actual working conditions have not been accurately determined, but the designers of this machine have offered to demonstrate the efficiency of their invention, during the coming winter, without cost to the city. (2) A stationary underground melting plant into which the snow is dumped from the vehicles, either carts or scrapers, through openings on the street surface. The snow falls upon grates, where it is met by a hot air blast from a series of coke furnaces; settling basins underneath receive and hold the solid matter brought along with the snow, and only the water is allowed to reach the sewers. Some arrangement could probably be made with the designers of this plant for an installation at a reasonable figure, with a view to giving this method a thorough test. The location suggested for the experimental plant was at the south end of Cooper square triangle, and for a five hundred cubic yard per hour capacity plant the estimated cost was $50,000, in which sum is included the cost of operating for the first year.

Your committee, therefore, recommends as follows:

1. That no contract for the removal of snow be entered into by the commissioner of street cleaning for this winter; but that the commissioner be instructed to make arrangements for handling the snow this coming winter with his own force, with the addition of hired laborers and equipment.

2. That the commissioner of street cleaning be instructed to prepare and advertise immediately for carts, horses and drivers, to be tendered to the department upon call of the commissioner, at so much per day; the specifications for this contract to be submitted to the board of estimate before being advertised. In this connection, the commissioner should also be instructed to ascertain from the various city departments the number of trucks each of the departments can make available for snow removal work. Further negotiations should be entered into with various trucking concerns, with a view to making some arrangement for the hiring of trucks that may be out of use during or after snow falls.

3. That careful experiments should be made, looking toward the greater use of the sewers of the city for the removal of snow.

4. That $100,000 special revenue bonds be authorized, in pursuance of section 188 of the Greater New York Charter, for experimenting with various mechanical devices approved of by this committee for the removal of snow from the streets and that engineers to be designated by this committee be authorized, in addition to the engineers of the street cleaning department, to supervise and report upon the results of these experiments.

In accordance with the report of this committee, the Commissioner of Street Cleaning prepared a form of contract for carts for the coming winter, which was submitted to and approved by the Board of Estimate, as follows:

Notice is hereby given that the commissioner of street cleaning intends during the coming winter season of 1910-1911, under the authority of section 541 of the Greater New York Charter, to hire for the purpose of removing snow and ice from the streets of the City of New York, such and so many horses, carts, or other vehicles of various sizes and capacities, as well as machines or other devices suitable for the purpose, at agreed rates or prices per load, per gang, per length of haul; the rate or price to be made for each different class of vehicle or device hereinafter described.

The compensation will cover the furnishing of the vehicle with horse and driver, or, if a motor vehicle, the motor power and operator.

Vehicles will be classed as follows:

Class "A"—Two-wheel ash or coal carts and single-horse express wagons or other vehicles having a capacity approximately of 1.5 cu. yds., water measure.

Class "B"—Bottom dumpers, sand trucks, and dirt trucks, with sideboards, or other vehicles having a capacity approximately of 2.5 cu. yds., water measure.

Class "C"—Bottom dumpers, brick trucks, and 4-wheel ash trucks, or other vehicles, having a capacity approximately of 3.5 cu. yds., water measure.

Class "D"—All vehicles having a greater capacity than 3.5 cu. yds., water measure. Vehicles of this class will be measured and payment will be made per cubic yard, water measure.

All vehicles must be of proper pattern, subject to the approval of the commissioner of street cleaning, or his representative. All vehicles must be of such a pattern as to permit of dumping quickly.

Bids for each class of vehicles must be made for length of haul, as follows:

Less than ¼ mile, between ¼ and ½ mile, between 1 and 1½ miles, between 1½ and 2 miles.

Points of dumping will be designated from time to time and may be varied at the discretion of the commission or the inspector of snow removal, and each contractor must hold himself in readiness to dump at any point designated from any section within the district bid upon. The point of dumping may be at the pier or bulkhead line, upon vacant property, into sewer manholes, or at other points as may be secured by the department of street cleaning.

The length of haul will be determined by estimation from the map commencing at the center of gravity of the district and measured to the designated point of dumping.

Computation of the work to be paid for will be made daily.

The contractor, as a condition of his being entitled to receive these rates, and as a consideration therefor, must have ready at the loading point for the winter of 1910-1911, at least 20 vehicles within two hours after the commissioner of street cleaning has ordered the work to begin. And such gangs of vehicles shall be kept continuously working, day and night, in specified districts, until notified by the commissioner to stop the work, and the contractor must provide for the substitution of horses and drivers or motor operators so as to comply with the provisions of the labor law.

The work of loading the vehicles will be done by laborers employed by the department of street cleaning, and when so loaded the vehicles shall be driven to the dumping point designated by the loading foreman of the department and there unloaded and dumped as directed by the dumping foreman of the department.

The contractor shall on demand by the commissioner dismiss without delay from his service on this work, any agent or employe who by disorderly, quarrelsome or disobedient conduct or incompetency in his manner of doing the work may lessen the efficiency of the said work.

The contractor shall have at all hours of the day and night a representative at some place designated by him before the work begins upon whom the commissioner or his representative may serve notice as to increase of force, discharge of drivers or stoppage of the work whenever he may deem it necessary. And the contractor will provide and maintain at his own cost and expense an office conveniently located in the Borough of Manhattan, and will provide and maintain telephone service at all hours of the day and night.

The hiring provided for in this notice will be done by the commissioner after receiving bids from the owners or agents of the owners of said vehicles and devices, and the bids will be received by gangs of districts as given in the "Schedules of Snow Removal of the Department of Street Cleaning for 1910-1911," and bidders will be allowed to bid for one or more gangs as they may elect.

Within five days after receiving the bids for this hiring or at any time subsequent thereto to be determined by the commissioner, the contractor shall furnish to the commissioner satisfactory evidence that he has or has secured the use and control of a sufficient number of vehicles to carry out the requirements of the work aforesaid.

A change has been made in the place of meeting of the annual convention of the American Railway Bridge and Building Association from Fort Worth, Tex., to Denver, Colo. The convention will meet at Denver on Oct. 18, 19 and 20, 1910.

The Conclusions of the Sections of the Second International Road Congress Regarding Various Phases of Road Construction and Maintenance.

One of the most important features of the Second International Road Congress at Brussels was the conclusions reached by the various sections regarding phases of road construction and maintenance. These sections considered the following subjects: (1) Metalled and Paved Roads; (2) Foundation and Drainage of Road; (3) Light Railways and Tramways; (4) Cleaning and Watering; (5) Choice of Surfacing; (6) Distribution Systems under Roads; (7) Influence of Weight and Speed of Vehicles on Bridges; (8) Design of Road Vehicles; (9) Motor Omnibusses. While the conclusions do not bring out much that is new, yet they express in concrete form ideas which formerly in many cases have been held but vaguely. The conclusions arrived at by the sections were embodied in the following resolutions, which we reprint from our English contemporary The Surveyor:

METALLED AND PAVED ROADS.

Use of Binding Materials in the Construction of Metalled Roads.—The Congress believes that it is desirable to pursue and develop the applications of the use of binding materials in the construction of metalled roadways, special attention being given:

(1) To determine in each case the character of the binder best suited to local conditions.

(2) To determine as exactly as possible the physical and chemical characteristics to be specified for tar, bituminous, asphaltic or other binders as best suited.

(3) To compare the different results obtained in various methods of construction.

(4) To investigate the influence that storing of tarred metal during a more or less extended period, before being used, may have upon the perfection of the work.

(5) To make a study of the deteriorations that the materials are subjected to during use.

(6) To specify the system to be advised where ordinary metalling has proved deficient and stone paving cannot for some reason be applied.

(7) To establish for each district, according to local conditions and in each case the relation between cost and the result obtained.

Use of Trackways in Paved Roads.—(*a*) Apart from exceptional cases depending upon local conditions, the construction of trackways in paved roadways can be considered but an expedient.

Progress Made in Combating Wear and Dust.—Confirming the resolutions passed at the Paris Congress in 1908, the Congress believes—

(1) That superficial tarring may be considered as definitely accepted in practice, and that the advantage to be derived from spreading fine sand or suitable stony material after tarring and rolling the same is not at present proved, and should form the object of comparative tests.

(2) That in the future application of these methods the attention of road builders could be drawn with benefit to the comparison of results obtained by the laying of tar, bituminous or asphaltic substances hot or cold by machine or by hand, both from the point of view of cost and from the point of view of the efficiency of the operation.

(3) That it is desirable, in comparing results, to take into account the quantity of the materials composing the metalling, the intensity of traffic and tonnage, as well as the climate.

(4) That with due regard to the resources of each region in tar, bituminous or asphaltic substances, it is important to specify in contracts the conditions that are to be fulfilled, especially as regards the preservation of "life;" that is to say, the property of preserving the binding power.

(5) That it would be desirable that a comparison be established between the advantages of tarring—this word being taken in its broadest sense—in different cases; whether the operations are to be frequently repeated, small doses being applied each time, or whether larger quantities are to be applied at greater intervals. Furthermore, whether, in the metalling itself, a tar, bituminous or asphaltic binding material has already been incorporated or not.

(6) That the conclusion adopted by the first Congress is to be maintained *in toto*, running as follows: emulsions of tar or of oil, hydroscopic salts, etc., have a real but not a lasting efficiency. Therefore their use should be limited to special circumstances, such as on racecourses, and in connection with festivals, processions, etc.

FOUNDATION AND DRAINAGE OF ROADS.

Foundation.—(1) The formation and construction of foundations of roadways should be made the stronger in proportion to the lesser compactness of the ground. The foundation should have more body and resistance the more it is exposed to internal deterioration and external wear.

(2) In the choice of the system of foundation for roadway, both stone sett and metalled, stress should be principally laid on the degree of dryness and dampness of the subsoil, while having regard to the possibility of their drainage and to their geological nature and to the nature of the materials of the locality.

Drainage.—(3) In soils where preliminary drainage is required before construction the general methods of drainage should be applied to the whole or to a part of the road body and to the bed of the metal if necessary.

(4) The cross and longitudinal sections of roads and those of side gutters should be established so as to facilitate the flow of the trickling water and to prevent infiltration of water into road surfaces, which should be made as impermeable as possible.

The evaporation of superficial dampness should be encouraged by every means.

(5) The works for the foundation and for drainage should be carried out simply and economically, and by using the materials of the country so far as possible.

LIGHT RAILWAYS AND TRAMWAYS.

(1) In the study of the new roads to be constructed both in the neighborhood of large towns as well as in the open country it may be useful to try to provide a sufficient road width for the construction of a light railway outside the roadway.

The designs should be of such a kind as to provide for every kind of traffic.

It is desirable that the supplementary costs should be defrayed by the owners of the light railway as far as the part of the road reserved for the rail track is concerned.

(2) The construction of sunken rails in the metalled roadways is always harmful to the viability of roads, and there results a marked increase in cost of the maintenance. It is desirable that this method should be avoided as much as possible.

The presence of tramway rails in paved roads makes the repair of the paving very difficult where the latter abuts against the rails. It is necessary to diminish that nuisance as far as possible by appropriate methods.

(3) Where the railway is placed by the side of the road it is preferable, where the width of the road permits, to construct it on a special track, inaccessible to wheeled traffic and super-elevated in order to allow greater safety.

It is necessary in all cases to provide proper drainage.

In the case of metalled roadways, the owners of the railway should be obliged to construct on the outside border of the roadside a depot for materials for the repair of the road; the same obligation should be in some cases extended to paved roads.

(4) The removal of trees along roadsides should not be tolerated unless in special cases.

If the width between the tree rows is insufficient for the rail track to give the necessary width for ordinary wheel traffic the track should be laid on the outside of the trees.

(5) It is desirable that the owners of light railways should assist the work of maintaining the area of the road or roadway occupied by the rails or contiguous to same or pay the costs of this maintenance.

CLEANING AND WATERING.

Throwing refuse upon the public roads should be carefully avoided. Such refuse should be removed by the municipality and not by the owners of adjoining property provided the cost of this work is recovered from the latter.

In large towns it is necessary to give special care to cleaning and watering.

Cleaning should be done as rapidly as possible.

Watering must be frequent and limited in amount according to local conditions.

Washing and sweeping should be done as early as possible. Mechanical processes are particularly recommended.

Improvement in the implements should be sought for with a view of ensuring the most complete cleaning with the least inconvenience to the public.

Motor machines can be advantageously used for cleaning and road watering in large towns.

CHOICE OF SURFACING MATERIALS.

(1) Macadam causes dust and mud, is expensive to maintain, and is suitable in large cities only for streets where the traffic is not very great or heavy.

(2) The experimental work carried out in recent years with macadam improved by using a bituminous or tarry coating or binder must be continued in order to determine the best methods of utilizing this kind of construction under varying conditions, so that this question may be submitted again at the next conference.

(3) Stone pavement has great qualities of resistance and durability. Its maintenance is easy and economical; it produces hardly any dust, and is suitable where there are tramway tracks.

(4) It should be adopted in thoroughfares whenever noise is of little consequence or when wood or asphalt surfaces are not suitable. It should consist of setts regular in shape, durable, but not slippery, wearing evenly, and laid upon a foundation and with close joints.

(5) The Congress desires to see the trials of small sett pavements continued wherever local circumstances and traffic conditions permit.

(6) Wood paving is noiseless; not slippery if kept clean; it stands very heavy traffic. The use of it should be extended even to thoroughfares through which run tramway lines.

(7) The respective advantages of soft and hard wood blocks must be a subject of discussion at a forthcoming Congress.

(8) Asphalt pavements should be recommended owing to their good qualities from the hygienic point of view and their ease of cleaning and of repair. This surfacing is almost noiseless and produces but little dust, but is unsatisfactory adjacent to tramway rails.

(9) There is opportunity for its use in fashionable thoroughfares where the traffic is not severe, where there are no tramways, and where the grades are very moderate.

(10) Finally, the trials of asphalt flag and block pavements should be continued.

DISTRIBUTION SYSTEMS UNDER ROADS.

(1) It is desirable to free as far as possible the carriageways from the minor distribution systems of pipes which now encumber them and to leave in them only the large sewers and mains which require little attention.

(2) As far as possible the minor distribution pipes which are connected to the adjoining houses should be doubled and placed on both sides of the street. This doubling is especially recommended for streets with heavy traffic and also for those where the surface rests on a solid foundation.

(3) It is advisable to consider the advantages of placing all distribution systems except gas in subways of suitable dimensions under the footways. In this case great care must

be taken to prevent flooding caused by breakage of water pipes.

(4) When the distribution works have been actually placed under the carriageway, the Congress advises that the system of doubling should be applied prudently by taking advantage of the opportunity given by considerable repairs or alterations.

(5) Complete agreement is necessary between all authorities interested in the streets in order to conduct their operations so as to interfere as little as possible with the traffic. It is most desirable that all street works should be under the general direction of those responsible for maintaining the surface. The work must be carried out as rapidly as possible, and so as to reduce the space occupied on the public highway and the obstruction to traffic.

(6) Trees planted in the footways in urban districts should be chosen so as not to inconvenience the frontagers by their leaves nor to interfere by their roots with the distribution systems.

INFLUENCE OF WEIGHT AND SPEED OF VEHICLES ON BRIDGES, ETC.

(1) The development of mechanical traffic has not had up to the present the effect of increasing the weight of vehicles generally beyond the limits recognized by regulations and custom in connection with constructional calculations. In any case it is desirable that when existing regulations are revised steps should be taken to test bridges by placing upon them the heaviest probable loads under the most unfavorable conditions and exclusively composed of mechanical vehicles.

(2) Under the present conditions of constructing motor vehicles and building public roads it does not seem possible that the speed of vehicles could have any effects on modern and well-built bridges which have not already been duly taken into account in the usually adopted methods of calculations of strength. It may be advisable, however, when testing new bridges or re-testing bridges to make use of the heaviest motor-driven vehicles permitted to run, and running them at high speed.

(3) The consolidation (solidarization) of the different parts of which bridges are composed aids their capacity to withstand the effects of vehicular traffic.

DESIGN OF ROAD VEHICLES.

Animal-drawn Vehicles.—(1) Heavily-loaded vehicles with narrow tires may cause exceptional damage to roads laid down for general traffic.

(2) It is desirable that trials should be taken in hand for the purpose of determining the relation which should exist between the load, the diameter of wheel, and the width of tread, so as to avoid abnormal damage.

Mechanically-drawn Vehicles.—(1) Such automobiles as fall under the head of "touring cars" cannot cause abnormal damage to the roads so long as their speed is kept within limits.

(2) Public service automobiles cannot cause appreciable damage to the road provided that the maximum speed does not exceed 25 Kilometres per hour; that the maximum axle-load does not reach 4 tons on the heaviest-loaded axle.

(3) Commercial motors need not cause exceptional damage to a well-constructed road provided that the following limits are adhered to: First type—vehicles in which the axle-load is less than 4½ tons; maximum speed, 16 kilometres per hour.

In the narrow streets in towns and large cities, when vibrations of the ground are to be feared, it is possible to minimize the inconvenience by reducing the speed in a suitable degree.

Second type—vehicles in which the maximum axle-loads are between 4½ and 7 tons, and the maximum speed 12 kilometres per hour.

It is desirable that experiments should be taken in hand in order to determine the maximum width of the tires of all automobiles while still insuring that under normal conditions the distribution of the load on the ground should take place over the whole supporting area.

(4) Ribbed or grooved iron tires cause abnormal damage to the road no matter what their width or what load they support.

(5) Vehicles propelled by mechanical power cannot cause extraordinary damage to the curved portions of roads provided that at these points a sufficient super-elevation is given, and that the curved portion is not approached or traversed at an unreasonable speed.

(6) With a view to saving the roads it is desirable that car builders should go carefully into the question of clutches and brakes, so that the skidding of the wheels may be avoided, balance the motors as perfectly as possible, and allow a reasonable raising of the center of gravity.

MOTOR OMNIBUSES.

The Congress is of opinion that public motor omnibus service should be encouraged. As a final resolution the Congress is of opinion at the present moment to decide definitely on the respective advantages of the two modes of transport, but that one forms the complement of the other and not the rival, and the adoption of one or other method largely depends on local conditions.

The progress of motor-omnibus traffic and the extent of the use of this method of transportation is capable of great extension—(*a*) by the use of wheels fitted with rubber tires; (*b*) by any progress made in construction.

The number of passengers carried by motor omnibuses should be greater for the town than for the country.

WATER-WORKS AND SEWERS SECTION

Some Experience in Treating High-Colored Water from the Penobscot River at Bangor, Me.

The purification of the water of the Penobscot River at Bangor, Me., is, owing to its high color, low turbidity and mineral composition, very difficult and is accompanied by several peculiar chemical facts. In the report of James M. Caird, chemist and bacteriologist, for the Bangor Water Board, for the year ending Feb. 10, 1910, some experience with this water is given which we abstract.

The drainage area of the Penobscot River, above the water works intake, is about 7,700 square miles. About 70 per cent of this drainage area is composed of forests. The drainage from numerous farms finds its way into the river. The sewerage from several localities is also discharged into it. There are also several large pulp mills on the river, which discharging their waste into the water causes it to carry at times considerable wood pulp. Wood pulp in considerable quantities was present in the water on five days. The composition of the water is rather peculiar for a river, in that it is always highly colored and contains little or no turbidity. The average color was 71.2 parts per million, while the turbidity was only 2.39 parts per million. The average bacteria per c. c. was 1,725, while 61.9 per cent of the 1 c. c. samples examined gave positive presumptive tests for B. Coli-communis. During the year 1,392,824,000 gallons of water were treated.

A complete sanitary examination of this water is made once a week; once a month a mineral analysis is made.

The plant consists of the following: Low duty pumps, chemical house, coagulation basin, filters, clear water well, and high duty pumping station. The low duty pumps deliver the water to the coagulation basins; after passing through the basins it is delivered by gravity to the filters and thence to the clear water well, from which it is taken by the high duty pumps and delivered to the consumers. As the water is passing to the coagulation basins the chemicals, sulphate of alumina and lime are added. There are two coagulation basins, with a combined capacity of 1,500,000 gallons.

A test was made to learn the time required for the water to pass through the basins and the filters. A solution of common salt was added to the water on the suction side of the low lift pump and samples of the filtered water were collected every 15 minutes and tested for chlorine. During this time the plant was operating at the rate of 5,000,000 gals. per day, and it required 2¼ hours for the salt to pass through the basins and filters.

In treating this water the length of time which the coagulant has to act, and the temperature are very important factors. When the temperature is above 50° F. the coagulation forms rapidly and in large flocs; with a lower temperature the coagulation forms slowly and in extremely fine particles. With a longer period of time, better coagulation and more sedimentation would take place. This would produce better results and a longer period between washing filters and a less amount of wash water. It would be an easy and inexpensive matter to place some baffles in the present coagulation basins in such a way that they would increase the length of time it takes for the water to pass through the basins.

Experiments have been made using sulphate of iron and lime as coagulents, but the results were not satisfactory. Sulphate of alumina is used as a coagulent, and owing to the low alkalinity of the unfiltered water it is necessary to use an alkali, lime or soda-ash. Nearly all of the sulphate of alumina used contained some free acid.

It is to be noted from Table I that only two of the shipments contained over 17½ per cent aluminum oxide. The large amount of iron is a serious detriment in treating this water, as it forms compounds with the coloring matter in the water and it is very difficult to remove.

TABLE I.—SHOWING THE COMPOSITION OF THE VARIOUS SHIPMENTS OF SULPHATE OF ALUMINA USED DURING THE YEAR.

Date, 1909.	Alum., Al_2O_3.	Iron, Fe_2O_3.	Acid, SO_3.	Water, H_2O	Ins'Ble.
April	18.60	.50	39.60	42.10	.13
May	16.65	1.79	40.10	42.60	.16
June	14.20	4.86	39.04	43.50	.08
August	16.67	2.40	40.13	40.70	.06
September ..	16.80	2.13	39.35	44.30	.05
October	17.21	1.59	39.58	38.81	.10
November ..	17.44	1.87	39.24	38.70	.12
December ...	17.61	1.70	41.46	39.44	.14
1910.					
January ..	17.47	.94	37.77	40.50	.10
Average ...	16.96	1.98	39.70	41.18	.10

Good sulphate of alumina should be of the following composition: Not less than 17½ per cent aluminum oxide Al_2O_3, not more than .40 per cent iron Fe_2O_3, not more than 37½ per cent acid SO_3, not over 47 per cent water H_2O, not over 0.5 per cent insoluble matter and no free acid.

It is possible to obtain a good floc and color removal using sulphate of alumina alone, but the filtered water would not be alkaline. As soon as lime or soda-ash is added, the color returns to the water and the coagulation becomes very fine and is retained on the filter beds with great difficulty. Owing to this peculiar condition the treatment of this water is very difficult.

Laboratory experiments have been made to determine the effect of various amounts of sulphate of alumina on the color and alkalinity of the unfiltered water. (Table II.)

The results indicate that it is impossible to remove any of the color unless over 1 gr. of sulphate of alumina per gallon is used. It is also seen from the table that by using 1.5 grs. of sulphate of alumina per gallon, the color is reduced about 50 per cent, while with 2 grs. the color is reduced about 80 per cent.

TABLE II.—SHOWING THE ACTION OF VARIOUS AMOUNTS OF SULPHATE OF ALUMINA ON THE COLOR AND ALKALINITY, ONE-HALF HOUR ALLOWED FOR REACTION-TEMPERATURE 45°F.

Color parts per million.	Alumina, grs. per gallon.	Alkalinity parts per million.	Alkalinity used, parts per million.
55.	0.0	12.	0. blank
55.	.5	9.	3.
55.	1.0	5.	7.
26.	1.5	3.	9.
10.	2.0	plus	11.

It is found (Table III) that 1 gr. of sulphate of alumina per gallon of water will reduce the alkalinity 7 parts per million and that 2 grs. will reduce the alkalinity 11 parts, or an average of 5.5 parts per million per grain of sulphate of alumina. In these experiments the sulphate of alumina contained about 17 per cent aluminum oxide and about 1½ per cent iron oxide.

TABLE III.—SHOWING THE RANGE OF ALKALINITY IN PARTS PER MILLION, IN UNFILTERED AND FILTERED WATER AT BANGOR, ME.

Alkalinity, parts per million.	Unfiltered. days.	Filtered days.
0-5	5.	358.
6-10	305.	6.
11-15	54.	0.

From Table III it is seen that on five days of the year the alkalinity of the unfiltered water was less than 6 parts per million, while on 305 days, or about 84 per cent of the year, the alkalinity was between 6 and 10 parts per million. The following table shows the alkalinity in parts per million:

	Unfiltered.	Filtered.
Maximum	14.0	7.0
Minimum	4.0	1.0
Average	8.8	3.1

With such a low alkalinity it is seen that the sulphate of alumina must be applied with great care to insure anything like uniform and satisfactory results.

In several places clay has been used with good success in making up the deficiencies in the alkalinity, therefore experiments (Table IV) were made with two kinds of clay; i. e., red and blue. In the laboratory tests it was found that the blue clay gave very satisfactory results in making up the alkalinity.

TABLE IV.—SHOWING THE ACTION ON THE COLOR AND ALKALINITY OF VARIOUS AMOUNTS OF CLAY AND SULPHATE OF ALUMINA.

Color parts per million.	Alkalinity parts per million.	Clay grs. per gallon.	Alumina grs. per gallon.
55.	12.	untreated water	
48.	6.	1.0	1.5
19.	4.	1.0	2.0
12.	2.	1.0	2.5
48.	8.	2.0	1.5
18.	4.	2.0	2.0
12.	2.	2.0	2.5

The plant was operated using various amounts of clay and sulphate of alumina, and while it was found that the clay produced an alkalinity, it was impossible to get the aluminum hydrate in such form that it would be retained by the filters, therefore as far as the trouble due to the aluminum hydrate passing the filters was involved there was no benefit from the use of clay.

TABLE V.—SHOWING THE RANGE IN COLOR, IN PARTS PER MILLION IN THE UNFILTERED, FILTERED AND CITY TAP WATER, BANGOR, ME.

Color parts per million.	Unfiltered, days.	Filtered, days.	City tap, days.
0-20		46.	33.
21-30		175.	145.
31-40		[illegible]	[illegible]
41-50	27.	41.	41.
51-60	43.	26.	22.
61-70	150.	8.	8.
71-80	72.	1.	0.
over 80	71.	0.	1.*

*Due to flushing mains.

From Table V it is seen that the color of the unfiltered water is rather high, being above 60 parts per million on 293 days, or about 80 per cent of the time. The color of the filtered water was below 41 parts per million on [illegible] days, or about 79 per cent of the time. The following table shows the color in parts per million:

	Unfiltered.	Filtered.	City tap.
Maximum	145.	70.	100.*
Minimum	45.	4.	4.
Average	71.	32.	33.

*Due to flushing mains.

The results show that 54.9 per cent of the color is removed.

The Penobscot River carries little or no turbidity, Table VI:

TABLE VI.—SHOWING THE RANGE IN TURBIDITY IN PARTS PER MILLION.

Turbidity parts per million.	Unfiltered. days.	Filtered. days.	City tap, days.
0-0	129.	163.	243.
1-5	203.	200.	111.
6-10	17.	2.	0.
11-15	6.	0.	0.
16-20	1.		
21-25	2.		
26-30	3.		
31-40	0.		
41-50	2.		

The unfiltered water contained a turbidity of less than 11 parts per million on 349 days, or 95 per cent of the time, and contained no turbidity on 129 days, or 35 per cent of the time.

The turbidity in the filtered water on 75 days was due to aluminum hydrate passing through the filters. The following table shows the turbidity in parts per million:

	Unfiltered.	Filtered.	City tap.
Maximum	50.00	6.00	5.00
Minimum	0.00	0.00	0.00
Average	2.39	1.01	00.15

The results show a removal of about 58 per cent of the turbidity.

The average amount of sulphate of alumina used was about 1.57 grs. per gallon, while 0.31 grs. per gallon of lime was applied. One grain of lime per gallon of water increases the alkalinity about 6 parts per million. Whiting was used part of the time to make up the deficiency in alkalinity with partial success. It was found that 1 gr. per gallon increased the alkalinity 11 parts per million. The use of whiting is more desirable than lime, or soda-ash, as it does not tend to "set" the color.

TABLE VII.—SHOWING THE ACTION OF SULPHATE OF ALUMINA AND WHITING ON THE COLOR AND ALKALINITY OF THE UNFILTERED WATER, BANGOR, ME.

Grains per gallon.		Parts per million.	
Alumina	Whiting.	Color.	Alkalinity.
blank		55.	10.
1.50	.50	45.	8.
1.50	.75	45.	10.
1.50	1.00	45.	12.
2.00	.50	18.	5.
2.00	.75	18.	8.
2.00	1.00	18.	10.

It is to be noted that with an increase in the amount of whiting used the color of the filtrate did not increase, and that very small amounts increased the alkalinity of the effluent. These experiments were so satisfactory that the plant was operated using whiting in place of lime. Operating the plant using sulphate of aluminum at the rate of 1.50 grs. per gallon and whiting at the rate of 0.25 gr. per gallon, the color was reduced 58 per cent and the filtered water contained 3 parts per million of alkalinity. Owing to the difficulty in obtaining the whiting its use had to be discontinued.

As the pumps are operated by water power and the tide reaches the plant, the speed of the pump varies considerably. Previous to October the sulphate of alumina was applied by gravity, but owing to the change of rate the pump required almost constant attention of an operator to adjust the amount used. If the operator did not happen to be present when the tide changed, too little or too much coagulant was applied, consequently the efficiency of the plant changed. To overcome this trouble an automatic feeding device was installed by the New York Continental Jewell Filtration Co. and became operative in October. This device consists of a turbine in the supply main operating a balanced four way valve, consequently there is very little load upon the turbine shaft. The balanced four way valve admits water from the high pressure line to a pump which discharges the proper amount of coagulant to the unfiltered water. This pump is so arranged that the amount of coagulant applied can be easily regulated without changing the strength of the solutions. This device was tested with the water passing through the supply main at from 1.28 ft. to 4.46 ft. per second, and was found to apply the coagulant at a uniform rate under the range of velocity.

The daily bacterial tests show that the basins remove 66.21 per cent of the bacteria, the effluent from the basins containing 583 bacteria per c. c. Once a week a complete sanitary analysis is made of the filtered water. Comparing the results of the sanitary analysis of the unfiltered and filtered waters it is found that the—

	Pct.
Free ammonia, was reduced	34.5
Albuminoid ammonia, was reduced	33.7
Nitrogen as nitrates, was reduced	27.7
Required oxygen, was reduced	65.7
Iron, was reduced	58.1

A mineral analysis of the filtered water is made every month.

The filter plant consists of 24 Warren filters, each 10 ft. 6 ins. inside diameter, having a combined sand area of 2,040 sq. ft., equal to about 1-21 of an acre. The depth of the sand in the filters is about 24 ins. The filter beds of 18 filters consist of quartz having an effective size of .97 mm. uniformity coefficient of 1.41 with 60 per cent finer than 1.37 mm. Six of the filters contain sand which has an effective size of .85 mm. uniformity coefficient of 2.00 with 60 per cent finer than 1.50 mm.

The most serious troubles have been due to the inability of the filters to retain the aluminum hydrate.

The filters removed 57.47 per cent of the applied bacteria, the filtered water containing 248 bacteria per c. c. The total combined efficiency of the basins and filters was 85.63 per cent.

Of the 1,042 samples of 1 c. c. each of the unfiltered water examined for B. Coli-communis, 644, or 61.9 per cent, gave positive results, while 76, or 7.29 per cent, of the samples of the filtered water gave positive results. From these results it would appear that 88.2 per cent of the B. Coli-communis was removed.

TABLE VIII.—SHOWING THE RANGE IN BACTERIA PER C. C. IN UNFILTERED COAGULATED, FILTERED AND CITY TAP WATER, BANGOR, ME.

Bacteria per c. c.	Unfilt., days.	Coagulated, days.	Filt., days	City tap, days.
0- 25		33.	101	128
26- 50		26.	30.	32.
51- 75		22.	21.	21.
76- 100	2.	17.	20	17
101- 250	29.	62.	70	74.
251- 500	106.	69.	75	39.
501- 1000	60.	51.	31.	19.
1001- 2500	64.	47.	17.	10.
2501- 5000	50.	10.	1.	0.
5001-10000	18.	3.	0	
10001-15000	6.	0.		
over 15000	1.			

The following table shows the bacteria per c. c.:

	Unfilt.	Coagulated.	Filtered.	City tap.
Maximum	15,750	5,700	3,060	1,970
Minimum	86.	4.	2.	1.
Average	1,725.	583.	248.	175.

	Pct.
Bacteria removed by basins	66.21
Bacteria removed by filters	57.47
Bacteria removed by plant	85.63
Bacteria removed in mains	29.50
Bacteria removed to city tap	89.86

A bed of fine sand 12 ins. in depth was placed in a filter for experimental purposes It was found that with this finer sand it was possible to retain the aluminum hydrate on the filter, and the results were good. This filter would operate at the rate of 249,000 gals. per day, while the filter with the coarse bed of 24 ins. depth would operate at the rate of 327,000 gals. per day. The fine sand required the filter to be washed oftener.

Owing to the small capacity of the clear water well it is necessary to operate the filters at times at a very high rate, sometimes as high as 7,000,000 gals. per day. The filters have no controllers, consequently the rate is not uniform, and even if they were equipped with controllers the rate would have to be excessive at times to meet the consumption.

With a clear water well of greater capacity it would be possible to operate the filters at a more uniform rate and the results would be much better.

At times the filters have to be forced far beyond any reasonable rate of filtration. Comparing the area of the sand beds with that in modern plants, the rate for the Bangor plant should not exceed 4,500,000 gals. per day gross. At the time these filters were installed they operated without any coagulant, and represented an up to date filter of that time.

These filters require a large amount of wash water, and about 3,000 gals. of coagulated water has to be wasted in washing one filter. During the year 12,339 filters were washed, an average of 33.8 per day. Filtered water is used in washing the filters, the total amount being 121,129,000, or 8.69 per cent of the water filtered. The average amount of water used in washing each filter was about 9,800 gals.

With a filter plant of modern design the wash water should not be over 4 per cent, which would mean a considerable saving in the operating expense, as filtered water is used to wash the filters.

In testing for B. Coli-communis, samples of 1 c. c. each are examined, the number of positive presumptive tests follow:

TABLE X. SHOWING TESTS FOR B. COLI-COMMUNIS.

	Unfiltered.	Filtered.	City tap.
Samples examined	1042	1042	1040
Positive	644	76	16
Per cent positive..	61.9%	7.29%	1.53%

Sedimentation, coagulation and filtration reduced the B. Coli-communis 88.25 while passing through the clear water well and the distribution system effected a further reduction of 79 per cent. The total reduction of B. Coli-communis from unfiltered to city tap water was 97.5 per cent.

Complete sanitary examinations of the city tap water are made every week. The sample is obtained about 1½ miles from the pumping station.

Comparing the results of the sanitary analysis of the filtered and city tap waters it is seen that in passing through the clear water well and distribution system that there is a reduction in free ammonia, albuminoid ammonia, iron, bacteria per c. c., B. Coli-communis, and an increase in nitrogen as nitrates, required oxygen, alkalinity.

A mineral analysis of the city tap water is made every month. The number of bacteria decreases 29.5 per cent in passing through the clear water well and in 1½ miles of mains, while B. Coli-communis decreases 79 per cent.

Commencing on Feb. 21, 1910, hypochlorite of lime, or "bleach," has been used in connection with the operation of the plant. While this method has not been used a sufficient length of time to give any great amount of data, it is found that the bacterial efficiency has greatly improved, the color removal is greater and it has been possible to reduce the amount of sulphate of alumina used 0.25 gr. per gallon, and the use of lime for making up the deficiency in alkalinity has been eliminated. The results up to this time indicate that this method will be very successful with this water.

Methods and Cost Preparing and Placing Ashes or Cinders for Filtering Material in Contact Beds.

BY I. G. BRADBURY, M. Am. Soc. C. E.*

Filtering material is one of the largest cost items in every sewage disposal plant, in which filtration is made a part of the process of purification. Local conditions naturally control the selection of the material to be used. Sand is frequently so expensive as to be almost out of the question, especially in view of the fact that its exclusive use requires much greater area and consequently larger quantity of material than if a coarser material and one of the high rate types of filter be installed.

For contact filters no material is more satisfactory or economical than a good grade of ashes or cinders, those produced by locomotives being particularly good. These are largely either of a vitrified or coky nature and therefore less liable to disintegration than the softer ash produced by some industrial plants. An excellent ash is produced by many iron and steel mills and furnaces.

This material can frequently be purchased from the railroads and can always be found in quantity in large cities, or those having important industrial plants. In Ohio the market price ranges from practically nothing up to $3 per car at the place of production, and the railroad companies will often furnish round house cinders for the price of hauling, provided they are not using the product for filling along their lines.

During the fall of 1901 the writer was employed as resident engineer in charge of the disposal plant at Mansfield, Ohio, where 1¼ acres of contact filters were filled to a depth of 4.75 ft. with crushed and screened locomotive cinders, the work being done by day labor and all apparatus and material purchased directly by the city. The figures given below are therefore actual costs in real money and not approximations.

The filter beds are laid out in the form of a circle about 280 ft. in diameter, divided into five beds by radial embankments. The crushing and screening plant was erected close to the outer edge of the circle, and a siding was run alongside the crusher; there was, therefore, no hauling of the raw material and the average haul for the finished product was about 160 ft.

The plant for preparing the material consisted of a coke crusher or sizer, in which the cinders pass between two rolls with corrugated faces, removable in segments, Fig 2, a chain and bucket elevator to raise the crushed material to the screen, and a jigling screen, known to the trade as the Columbian Separator. Power was furnished by a traction engine hired by the day, and the whole apparatus housed and provided with bins and chutes, Fig. 1, for economical handling of the cinders. This outfit, which was furnished by the Jeffrey Mfg. Co. of Columbus, Ohio, proved in every way suited to the requirements. The shaking screen is the only one which can successfully remove the dust and flake, as the material is usually moist and requires a hard jolting to separate the particles. The screen stands at an angle of 45° and has a movement as recalled by the writer of about 2 ins. at a rate of about 150 per minute. A wire screen cloth of 3 meshes to the in. removed all dust of less than ⅛ in. diameter, and practically none of greater size, the whole plant producing a beautifully clean material from ⅛ to ¾ in. in dimension.

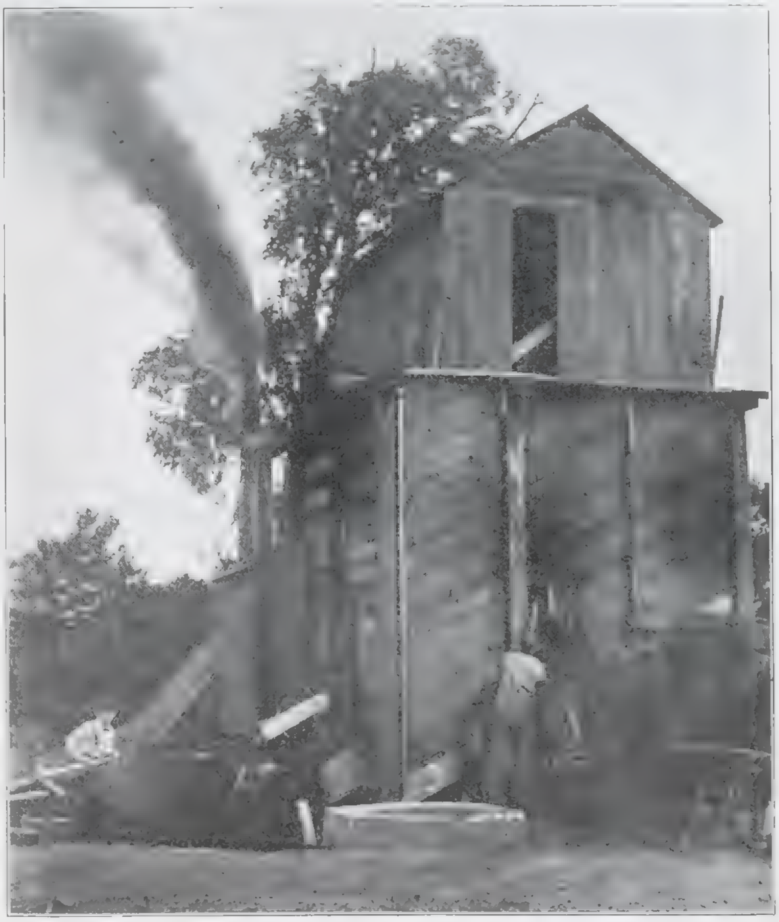


Fig. 1—Slag Crusher Plant and Bins, Mansfield, O., Filter Plant.

The cinders were received in flat bottomed coal cars with side boards containing an average of about 30 cu. yds. They were shoveled from the cars onto a platform, beneath which the crusher was set, with its hopper on a level with the floor. The siding was extended beyond the plant a sufficient distance to hold 10 cars and on a grade which allowed the cars to be placed at the platform by gravity after a train was set by the switch engine. The product of the screen, which was set about 40 ft. above the crusher, fell into bins, from which the filter material could be drawn by chutes into wagons or into a small car, while the dust was drawn into the emptied flat cars and hauled away by the railroad free of charge.

A strip around the outside of the beds was first filled by wagons to a sufficient width to lay a movable track on the cinders, and the remainder was handled by means of the small car, which held about 1½ cu. yds., dumped from the side, and was run by hand by two men on the track referred to.

Roundhouse cinders were purchased direct from the Pennsylvania R. R. at a price of $8 per car. The weight per cubic yard is from 1,200 to 1,300 lbs., 439 cars, or about 12,970 cu. yds. of the raw material were required to produce the 9,579 cu. yds. of coarse screenings used, showing a loss of 26 per cent. This is slightly better than can be counted on as the cinders were of exceptional quality. It is not safe to figure on more than 65 per cent of the raw material passing the screens.

The total cost, including crushing and

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*Consulting Engineer, Columbus, O.

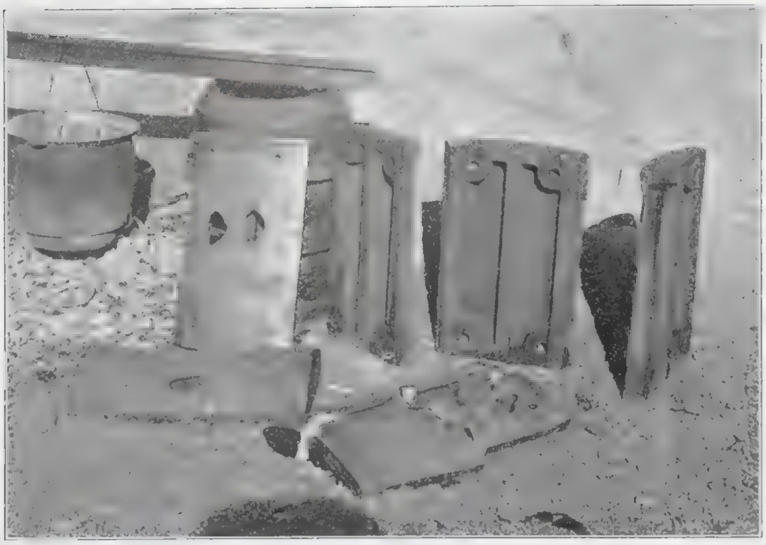

Fig. 2—View Showing Wear of Crusher Rolls, Slag Crushing Plant, Mansfield, O., Filter Plant.

screening plant, foreman and all expense of every kind was as follows:

Cost of Outfit:	
Machinery	$ 850.00
Lumber	222.63
Labor on bin	87.30
Side track (labor only)	208.10
Awning	5.80
Total	$1,373.83
Repairs, new parts, etc.	281.34
Cost of Material:	
438 cars of cinders at $8	3,512.00
Cost of Operation:	
Labor	$2,573.42
Coal	80.00
Use of engine	101.25
Oil	34.43
Insurance	14.00
Total	$2,803.10
Total cost	$7,970.27
Per cubic yard	0.832

The cost per cubic yard of finished material was as follows:

	Per cu. yd.
Crushing and screening plant, bins, etc. (applicable only to similar quantities)	$0 144
Repairs, etc.	0.029
Cinders	0.366
Handling	0.293
	$0.832

,The last item can be subdivided as follows:

	Total	Per Cu. Yd.
Labor unloading cars	$ 462.27	$0.048
Labor at crusher and placing cinders	2,111.15	0.220
Power	215.68	0.023
Insurance	14.00	

The cost of placing in filters by means of the small cars was about $0.02 per cubic yard.

The price paid for labor varied from $1.50 to $1.75 per day averaging probably $1.60. The foreman received $2.50 per day and the engine man $3. The entire job was handled carefully and close attention to business is necessary to duplicate the results.

STEAM AND ELECTRIC RAILWAY SECTION

Methods and Cost of Renewing Rail

BY D. A. WALLACE.

The following data include various items of work besides rail renewal proper but all come within the same general classification.

RAIL RENEWAL.

Gang Organization.—In the following statements of steel gang organization it is understood that the spikes have not been pulled or the ties adzed before the gang commenced work.

(1) Foreman and 15 men; renewing 60-lb. with 90-lb. rail; 12 tong men with 90-lb. rail. Pull 10 rails with entire gang, throw out old rail and adz with entire gang, where necessary. Use 12 men to lay in the new rail while the rest wrench. Put the 12 tong men to spiking while the other 3 men are pulling spikes from 10 rails ahead.

(2) Foreman, 31 men and 1 water boy. 10 tong men; 8 spike pullers; 1 man with push car distributing bolts, spikes and tools; 4 men bolting; 7 men spiking every third tie; 1 man putting in angle bars with one bolt in rear hole loose; 1 water boy.

(3) Foreman and 50 men. Always pull two spikes and skip one, with the entire gang while waiting for trains and use enough men to put on angle bars to help out while waiting on trains. 12 tong men; 12 men pulling spikes; 12 men spiking every third tie; 5 men wrenching; 1 man putting on bars; 1 water boy; 1 man with push car distributing bolts, etc.; 6 men throwing rail out. With this organization the 6 men throwing the rail out can keep ahead until near the close of the half day's work when they can all go to spiking. When starting on the second half day's work the tong men can be used to full spike the side laid in the forenoon while the claw bar men are pulling 2 and skipping 1 on the other side. The 6 men throwing out rail can as soon as they catch up with the spike pullers be used to full bolt while the tong men are full spiking. Never should joint ties be full spiked until wrenched tight and full bolted. If spike pullers get too far ahead let them come back and throw rail out while the 6 throwing out men are full spiking.

(4) Foreman, 31 men and 1 water boy. 10 tong men; 8 spike pullers; 1 man with push car distributing; 4 men bolting; 7 men spiking every third tie; 1 water boy; 1 man putting on angle bars with the rear bolt loose. Have 20 claw bars on hand so that 20 men can pull spikes for every two ties and skip one while waiting on trains. Be sure that all tracklaying tools are carried on the push car, with angle bars, etc., as well as all connections, and the car left on the track until the flags are called in. Start 8 men to pulling spikes on the line side (2 claw bars and 2 knockers). Use spikers to throw the old rail out.

(5) Foreman, 31 men and 1 water boy changing 60 to 60-lb. rails; old rail out to give tong men a start. After the tong men have started and catch up with the spike pullers and two knockers, throwing out and laying in, four wrenchers can keep right behind the tong men. If the tong men fall too far behind, the spike pullers will uncouple a joint with a maul and turn back to meet them, throwing the rail out as they proceed. So that they will not have to pass each other: 1st. spikers will skip 21 ties; 2d. spikers will skip 18 ties and, 3d. spikers will skip 15 ties.

(6) Foreman, 31 men and 1 water boy changing 60 to 60-lb. rail. Always use fastest spikers in front. Close up line side at noon and take gage side after dinner. If gage is perfectly safe pull outside spikes and leave inside and use gang as before.

(7) Foreman, 31 men and 1 water boy, changing 60 to 90-lb. rail. 12 tong men; 6 spike pullers; 1 knocker; 1 man putting in bars ahead; 3 men wrenching; 1 man with push car with tools, etc.; 7 men throwing out rail for 7 or 8 rails to give tong men a chance to lay rail in; 7 men will then fall in behind the wrench men and spike every third tie.

(8) Foreman, 31 men and 1 water boy. Use tong men and spike pullers to keep ahead of spikers changing them as necessary, closing at noon. If gage is perfect pull outside spikes and then gage up after the rail is laid. Rails should never be gaged as it is laid unless necessary, as it is impossible to get a first-class gage on relaying new rail for the reason that spikes are sticking up and nuts piling up against the rail and the rail is not close to the ties on account of burrs. Ties should be spaced within 30 days after rail renewals and rail should be gaged when ties are spaced.

Job 1.—Relaying 58-lb. with 85-lb. rail, full bolted, full spiked and gaged, with negro labor at $1.25 and foreman at $60 per month, in May, 1906. The work was done by a gang organized as previously indicated. The number of hours under the heading "delays" is the number of hours the entire gang was delayed from the actual work of rail laying. The delays include delays by trains of which there were eight, and time spent in trucking badly distributed rail, etc. The angle bars were 6-hole, 4-in. bars. It is seen from the figures given that it is approximately one-fourth more costly to lay track with Wolhaupter joint splices than with this 6-bolt angle bars. The work was full bolted, full spiked and completed each day. Connection for trains was made by using a short piece of old rail cut to fit and connected with the new rail by a compromise joint. The records are as follows:

No. of Men.	Hours Delay.	Feet Laid.
32	5	942
33	2	1,200
32	4	1,487
33	4	1,716
33	3	437*
36	3	1,300
31	3	650*
27	3	1,642
34	3	1,642
35	3	1,650
29	5	1,269
33	5	1,200
34	4	1,900
36	5	1,860
37	2	1,200*
31	3	1,200†
31	3	1,200†
33 Average		1,305

*One No. 10 switch. †Laid with Nothampton joint splices.

The cost was $3.33 per 100 ft. of track or $176 per mile of track.

Job 2.—In this record the time charged to "delays" includes time spent in distributing and carrying rail and also a few delays by trains. Owing to the narrow fills at some places, and to the amount of rock at others, it was occosionally necessary in unloading the rail to skid it off in piles and then redistribute it from the piles with the steel gang. When there are entries in the column "No. of men" and no track is shown to have been laid on that day, the force was occupied in adzing and pulling spikes. The rail was 56-lb. changed to 70-lb. and all rail was curved for curves of 5° and over. About one-fourth of the time was consumed in curving and tracking rail.

One-half the entire distance was curves of 5° and over. The record is as follows:

No. of Men.	Days Delay.	Feet Laid.
8	8	.....
2	2	.....
10	10	.....
14	14	.....
19	....	1,599
17	....	1,665
17	12	493
17	17	.....
17	....	1,582
26½	2½	1,487
10½	....	363
28	28	.....
27	2½	1,653
12	12	.....
8	8	.....
23½	....	2,000
15	15	.....
53	....	3,592*
29½	....	1,614
31	....	2,630
8½	8½	.....
28½	....	1,855
31	....	2,138
14	14	.....
467	153½	22,671

*One No. 9 turnout.

Negro labor was employed at $1.15 and $1.25 per day and foreman at $75 per month. For the first nine days' work the rate was $1.15 and for the remainder of the time it was $1.25 per day. The cost of the work was as follows:

Item.	Per Ft.	Per Rail.	Per Mile.	Per Cent.
Unloading	$0.004	$0.13	$21.05	9.8
Curving	0.0054	0.179	28.66	13.4
Distribut'g	0.003	0.097	14.59	6.8
Laying	0.0283	0.936	149.80	70.0
Total	$0.0407	$1.342	$214.10	100.0

APPLYING TIE PLATES.

The tie plates were applied to white oak ties on track in service. These plates were placed under the rail and settled with a sledge. After three or four days they were settled completely with a sledge. During this work, there were an average of 6 braces to a rail to remove. White labor was employed at $1.10 per day and foreman at $50. The record was as follows:

No. of Plates.	No. of Days.	Plates per man per day.
653	7	83
324	5½	59
375	5	75
34	1	34
176	5½	32
216	3	72
400	3	133
60	½	120
216	1½	140
542	4	137
250	2½	100
180	1½	120
100	1	100
Average		93

The cost of applying each plate was 1.1 ct.

GAGING TRACK.

(1) This record is of work done by season gangs. The track was in very poor gage due to sharp curvature and rotten white oak ties. In the majority of cases the rail was gaged on each tie. All old spike holes were plugged. Ties were adzed when necessary. The foreman made a hand in every case. There was an average of 6 braces per rail. Negro labor at $1.25 and foreman at $50 per month were employed.

No. of Feet.	No. of Days.	per man per day.
330	2	165
480	2	240
270	1	270
210	1½	140
690	3½	200
420	2	210
190	½	380
300	2	150
600	4	250
700	4½	155
210	1	210
100	1	100
510	2½	200
120	1	120
260	1	260
550	2	275
120	½	240
120	1	120
180	1	180
600	4	250
690	3½	200
		205.4* Feet

*Average.

The total cost of gaging one mile was $28.30.

(2) This record was made by a picked gang. Every tie was gaged and holes plugged. No rail braces were used as the track was on tangent. The gang consisted of 1 foreman at $50 per month and 4 laborers at $1.10 per day. On this work 2 men were placed drawing spikes and 2 men spiking, the foreman assisting in lining the rail, etc. This gang gaged 1,440 ft. in 10 hours, at a cost of $22 per mile.

DISCONNECTING RAIL.

The work consisted in unbolting 30-ft., 4-bolt rail and in fastening loosely one pair of angle bars to each rail with two bolts. Negro labor at $1.25 and foreman at $75 per month were employed. The record was as follows:

No. of Rails.	No. of Days.	Rails per man per day.
90	2	45
85	2	42
95	2	48
100	2½	40
75	1½	50
Average		45

The cost was as follows:

One rail	$0.027
One mile of rail	4.45
One mile of track	8.90

TIGHTENING SPIKES.

This work was done by regular gangs on regular maintenance work. Each spike was driven home; each man took one rail length. Negro labor at $1.25 per day and foreman at $60 per month were employed. The record was as follows:

No. of Rail Lengths.	No. of Days.	Rails per man per day.
30	2	15
40	3	13
45	3	15
21	1½	15
Average		14

The cost of tightening was 9 cts. per rail length or $14.40 per mile of track.

APPLYING RAIL BRACES.

The rail braces were applied by small gangs and track walkers on curves which had been put up to gage. The labor was white at $1.10 per day with foreman at $50 per month. The record was as follows:

No. of Braces.	No. of Days.	No. per man per day.
200	1	200
100	½	200
400	2	200
300	2	150
200	1	200
450	3	150
Average		183

The cost to apply one brace was 0.6 ct.

CURVING RAIL.

Rail 33 ft., 70-lb was curved to 5°. Rail curved from side and placed in a roller Jim Crow in the center of the track and curved by 8 men. Six men could do the work, but 8 were needed to move the rail.

8 men 10 mins. at $1.15 per day	$0.153
1 foreman 5 mins. at $75 per mo.	0.020
Total, one rail	$0.173

This gives a cost of $55.36 per mile.

WRENCHING.

(1) This work was on 4-bolt joints on 56-lb., 30-ft. rail; the bolts had not been tightened in 5 years. At each joint one bolt was broken out and replaced. Negro labor at $1.10 and foreman at $50 per month were employed. The record was as follows:

No. of Joints	No. of Days.	Joints per man per day
162	3½	46
304	5½	55
147	2½	58
422	5	84
261	3	87
80	2	40
Average		61

The cost of tightening was as follows:

1 Bolt	$0.0045
1 joint	0.018
1 mile of track	6.35

(2) On this job the bolts were in good shape in 6-bolt joints on 33-ft. rail. Negro labor at $1.25 per day and foreman at $60 per month were employed. The record was as follows:

No. of Joints	No. of Days.	Joints per man per day
85	1	85
150	2	75
40	½	60
Average		80

The cost was as follows:

One bolt	$0.0025
One joint	0.015
One mile of track	5.00

Equipment Depreciation and Renewal on Railways.*

In a previous article by the writer dealing with equipment depreciation attention was called to the difficulties which would be encountered in dealing with equipment renewals and depreciation as proposed by the Interstate Commerce Commission and the hope was expressed that the commission would amend, for the present at least, the classification of operating expenses about to be promulgated by omitting therein the provision for "Depreciation" and amending the provision for "Renewal" to the effect that the latter would represent the current cost of replacing all equipment vacated. In the meantime the commission could collect data from which it could be determined how far the use of any fixed per cent of depreciation would be of practical application or possess any practical value. Understanding then that the main object of these provisions by the commission was to control undercharges to operating expenses by charging equipment vacated to capital expenditures and, conversely, to overcharges to operating expenses by additions to equipment which should have been charged to capital expenditures, I suggested to the commission the simple remedy of a suitable primary account in their classification of operating expenses to which should be charged the amounts which the railways had included in the operating expenses for equipment vacated. The proportion that the amounts thus charged for locomotives and for cars vacated would bear respectively to the total number of locomotives and of cars owned would furnish a unit for comparing these charges to operating expenses of one railway with those of another, as, in a general way we compare the cost per mile of road or track for maintenance of way and structures and thus determine from our knowledge of these matters whether or not the charges are above or below a fair and reasonable cost for maintenance and renewals. Statements Tables II, III, IV and VI, again submitted, afford a fair illustration of the practicabiltiy of these suggestions. The statements submitted in October, 1907, have been supplemented with the results for two additional years, and there is now submitted a statement (Table I) showing annually for three years the amount and the per cent which the cost of the equipment vacated bears to the total cost of the equipment in service, the amount and the per cent thereof charged to operating expenses, and the amount and the per cent of the salvage value.

The cost of the equipment of the Southern Pacific Co. and transactions in respect thereof have been selected for the purpose of illustration. The constituent companies have complete records of the cost of their equipment, and, since 1885, they have dealt with the replacement of their equipment as they have dealt with the replacement of anything else which was destroyed, worn out, or otherwise disposed of, by charging to operating expenses the current cost of replacing in kind such equipment

These records are complete for 25 years, and it may be reasonably assumed that the depreciation in recent years is about the normal average for these companies. The results shown on Table I are therefore of interest in illustrating the complications and confusion in accounting which would result from the adoption of any fixed per cent other than for a mere temporary expedient to distribute an estimated amount equally over the 12 months of the fiscal year, this amount to be adjusted at the close of the fiscal year to the actual facts. The per cents in this statement are the average of equipment owned by 15 separate companies, and the per cent of each company for any class of equipment differs materially from that of the other. The wide range of these average per cents demonstrates the fact that, in these replacements, the railways are governed by conditions other than depreciation and that, irrespective of any arbitrary per cent which may be fixed or adopted, the retirement of equipment will be governed solely by that which it is believed will be best for the service at the time.

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*From an article by William Mahl, Vice-Pres., Union Pacific and Southern Pacific systems in the "Railroad Age-Gazette" for March 4 and May 20, 1910.

Pending the collection of satisfactory data on which to base a fairly accurate per cent of depreciation on the cost of the equipment, the Southern Pacific Co., in its desire to comply with the requirements of the Interstate Commerce Commission's classification, has, since July 1, 1907, charged to the primary account of "Renewals" the original cost (estimated if not known) of all equipment vacated, less salvage value. Prior to that date, for a period of 22 years the companies had charged to their operating expenses the cost of replacing. Since 1898 the cost of replacing has been at least one-third greater than the original cost, an important difference.

From Table I it will be seen that the per cent which the actual replacements on "Depreciation" bears to the original cost of the equipment differs materially from that of the preceding years, and it must be evident from these results that the use of any arbitrary per cent will be misleading as to facts unless a readjustment be made annually to conform to the facts. The increasing number of cars of metal construction will materially change all our estimates of depreciation. In discussing with railway officers in charge of their motive power, the writer was surprised to learn that, on the railways on which freight cars of metal construction had been in use for over a decade, the replacements compared to the number of cars in service had been so small as to be an unimportant factor in an estimate of depreciation as distinguished from repairs and renewals. It is not at all unlikely that the depreciation in metal cars will not be much above that for locomotives (in which obsolescence has been about the only item), as locomotives are repaired and rebuilt so long as they can be profitably employed in the service to which they are adapted or assigned. As an illustration of this the reader is referred to the annual report of the Colorado & Southern R. R. Co. for the year 1907 in which locomotive No. 145 is reported as placed on the road in 1868. Until recently there were some locomotives in service on the Illinois Central R. R. that were placed on the road in 1857, and there are no doubt instances of this kind on other railways.

In concluding, the writer again expresses the hope that the Interstate Commerce Commission will amend its classification of operating expenses by substituting the primary account of "Replacements" for "Renewals" and for "Depreciation," and by permitting the railways to charge to "Replacement" the current cost for reproducing in kind the equipment vacated or in capacity in the instances in which the companies desire to do so. The sum thus charged to "Replacement" will show the expenditures by the railways in maintaining the standard of their equipment suitable to their traffic and as may be permitted by their means. The commission in its classification for additions and betterments provides that, as equipment is condemned, destroyed, sold or otherwise disposed of, the capital account should be reduced by the cost of equipment vacated and, conversely, that all equipment acquired should be charged to the capital account. This is a simple and businesslike disposition of the matter and the integrity of the capital account in respect of equipment is thus fully maintained. It now remains only for the commission to make a similar disposition of the equipment vacated, i. e., to charge the difference between the cost to replace, less salvage, in the operating expenses to a suitable primary account.

A railway differs from an industrial enterprise in this that to give satisfactory service to the public it must maintain the physical condition of its property in a high degree of efficiency, as any neglect therein is quickly reflected in its payments for casualties. Therefore the expenditures must be of necessity sufficient to fully make good the annual depreciation.

The per cent of freight-train cars vacated to the total number of freight-train cars in service at the beginning of each year for the past 19 years was as given in Table V.

TABLE V.

Year.	Pct.	Year.	Pct.
1891	3.44	1901	3.13
1892	3.75	1902	3.53
1893	3.00	1903	3.15
1894	2.57	1904	3.01
1895	3.41	1905	3.48
1896	2.87	1906	6.83
1897	2.28	1907	6.67
1898	3.54	1908	6.45
1899	4.41	1909	5.49
1900	3.02		

Including the large number of cars vacated in the year 1906, the average for the 19 years is 3.89 per cent.

TABLE II.—LOCOMOTIVES.

Year.	Average serviceable number.	Expenditures and charges for. Repairs.	Expenditures and charges for. Vacated.	Per locomotive per annum. Repairs.	Per locomotive per annum. Vacated.
1909	1,846	$5,488,840	$385,335	$2,973	$208.74
1908	1,818	5,798,950	80,969	3,090	44.54
1907	1,691	5,717,666	271,826	3,381	160.75
1906	1,655	5,042,967	767,407	3,047	463.69
1905	1,637	5,179,486	143,377	3,164	87.59
1904	1,516	5,370,649	70,334	3,543	46.39
1903	1,419	4,412,410	197,382	3,110	139.10
1902	1,323	3,528,199	237,848	2,667	179.78
Average 8 years	1,613	$5,067,396	$269,310	$3,122	$166.32

TABLE III.—PASSENGER TRAIN CARS.

Year.	Average serviceable number.	Expenditures and charges for. Repairs.	Expenditures and charges for. Vacated.	Per car per annum. Repairs.	Per car per annum. Vacated.
1909	1,759	$1,601,276	$ 91,289	$ 910	$ 51.90
1908	1,742	1,688,727	125,022	894	71.77
1907	1,700	1,361,829	120,889	801	71.11
1906	1,624	1,194,668	146,950	736	90.48
1905	1,566	1,221,568	102,301	780	65.53
1904	1,483	1,094,459	128,248	738	86.48
1903	1,349	1,013,262	315,930	751	234.19
1902	1,300	963,747	124,680	741	95.90
Average 8 years	1.565	$1,267,441	$144,413	$ 810	$ 92.28

TABLE IV.—FREIGHT TRAIN CARS.

Year.	Average serviceable number.	Expenditures and charges for. Repairs.	Expenditures and charges for. Vacated.	Per car per annum. Repairs.	Per car per annum. Vacated.
1909	44,011	$4,561,715	$ 838,277	$104	$ 19.05
1908	44,312	4,011,716	1,036,482	92	23.39
1907	43,562	3,875,955	1,058,274	89	24.24
1906	44,172	3,173,773	1,269,492	72	28.74
1905	44,887	2,893,135	562,053	64	12.52
1904	44,571	3,031,840	524,882	68	11.78
1903	41,982	2,779,309	512,697	66	12.21
1902	38,625	2,380,410	465,372	62	12.04
Average 8 years	43,265	$3,338,482	$ 783,441	$ 77	$ 18.00

TABLE I.—PER CENT OF COST OF EQUIPMENT VACATED TO TOTAL ORIGINAL COST.

		Equipment condemned, destroyed, sold or otherwise placed out of service during the year.					
	Original cost.	Credited to replacement account (original cost).	Per cent on cost.	Charged to operating expenses.	Per cent on cost.	Salvage and amounts received from other companies.	Per cent on cost.
Locomotives:							
Year ended June 30, 1909	$ 23,384,711	$ 478,459	2.05	$ 385,335	1.65	$ 93,124	0.398
Year ended June 30, 1908	24,260,769	252,025	1.04	80,969	.33	171,056	.71
Year ended June 30, 1907	21,815,471	357,474	1.64	201,850	.93	155,624	.71
Total	$ 69,460,951	$1,087,958		$ 668,154		$ 419,804	
Average for three years	23,153,650	362,653	1.57	222,718	0.96	139,935	0.61
Average per cent of salvage to original cost of equipment vacated							38.59
Passenger Train Cars:							
Year ended June 30, 1909	$ 10,359,072	$ 204,765	1.98	$ 91,289	0.88	$ 113,477	1.10
Year ended June 30, 1908	10,274,615	264,653	2.58	125,022	1.22	139,632	1.36
Year ended June 30, 1907	10,046,121	210,944	2.10	139,928	1.39	71,016	.71
Total	$ 30,679,808	$ 680,363		$ 356,238		$ 324,125	
Average for three years	10,226,603	226,787	2.22	118,746	1.16	108,042	1.06
Average per cent of salvage to original cost of equipment vacated							47.64
Freight Train Cars:							
Year ended June 30, 1909	$ 33,032,484	$1,328,441	4.03	$ 844,467	2.56	$ 483,974	1.47
Year ended June 30, 1908	32,705,781	1,637,358	5.01	1,025,122	3.14	612,237	1.87
Year ended June 30, 1907	33,164,958	1,768,416	5.33	1,136,919	3.43	681,497	1.90
Total	$ 98,903,222	$4,734,215		$3,006,508		$1,727,708	
Average for three years	32,967,741	1,578,072	4.79	1,002,169	3.04	575,903	1.75
Average per cent of salvage to original cost of equipment vacated							36.49
Work Equipment:							
Year ended June 30, 1909	$ 3,587,470	$ 91,420	2.55	$ 52,473	1.46	$ 38,947	1.09
Year ended June 30, 1908	3,131,657	68,434	2.19	40,079	1.28	28,355	.91
Year ended June 30, 1907	2,641,313	95,142	3.60	67,116	2.54	28,026	1.06
Total	$ 9,360,441	$ 254,996		$ 159,667		$ 95,329	
Average for three years	3,120,147	84,999	2.72	53,222	1.70	31,776	1.02
Average per cent of salvage to original cost of equipment vacated							37.38
Total:							
Year ended June 30, 1909	$ 70,363,736	$2,103,085	2.99	$1,373,564	1.95	$ 729,522	1.04
Year ended June 30, 1908	70,372,822	2,222,471	3.16	1,271,191	1.81	951,280	1.35
Year ended June 30, 1907	67,667,863	2,431,976	3.59	1,545,813	2.28	886,163	1.31
Total	$208,404,422	$6,757,532		$4,190,567		$2,566,965	
Average for three years	69,468,141	2,252,511	3.24	1,396,856	2.01	855,655	1.23
Average per cent of salvage to original cost of equipment vacated							37.99

TABLE VI.—SUMMARY OF REPLACEMENTS.

Year.	L'c'motives.	Train cars. Passenger	Train cars. Freight.	Road service. cars.
1909	45	51	2,434	533
1908	29	78	2,810	183
1907	34	63	2,949	148
1906	127	47	3,389	103
1905	29	28	1,556	78
1904	17	32	1,367	56
1903	34	78	1,270	33
1902	53	51	1,266	50
Total number vacated	368	428	17,041	1,184
Average for 8 years	46	54	2,130	148
Per cent to total number in service	2.85	3.45	4.92	3.83
Credited replacement fund	$3,464,164	$1,733,558	$9,484,266	$425,358
Charged to operating expenses	2,154,478	1,155,308	6,262,359	270,268
Scrap value or price realized for equipment sold	1,309,686	578,250	3,221,907	155,090
Average price per locomotive or per car credited to replacement fund	9,413	4,050	557	359
Average price per locomotive or per car charged to operating expenses	5,855	2,699	367	228
Average proceeds, sale or salvage	3,559	1,351	189	131
Per cent of salvage	37.80	33.35	33.97	36.45
Total credited to replacement fund				$15,107,346
Total charged to operating expenses				9,842,413
Total scrap value or salvage				5,264,933

Table I shows the number of locomotives and cars vacated in each of the eight years, the amount credited to the replacement fund, the amount charged to operating expenses, and the amount of salvage.

The writer has received a number of requests for a statement showing the "Per Cent of Cost of Equipment Vacated to Total Original Cost" for each of the companies for which the average was published in Table I in a previous article. In response to these requests the accompanying statement is now submitted. As the "per cent" is the important unit the amount of money involved is omitted.

The large percent for the Nevada & California and the South Pacific Coast is caused by the disposal of their narrow gage equipment. Each of the companies disposed of its equipment as it was destroyed, worn out, or sold when its further use became unprofitable and dealt with it in its operating expenses as they did with any other detail of its transportation plant which required replacement in the course of the maintenance of the property.

It will be seen from the statement that the "per cents" differ widely as to years and as to companies for the same equipment. The complications which would result from the use of a fixed per cent for renewal or depreciation and the adjustments which would constantly become necessary to bring the charges into accord with the actual facts and the actual expenditures are apparent.

The classifications of the Interstate Commerce Commission provide that there should be charged in respect to equipment condemned, destroyed, or sold:

To "operating expenses"—(*Renewals*) the original cost (estimated if not known), record value, or purchase price of all equipment condemned, destroyed, or sold, less (*a*) the amount previously charged (since July 1, 1907) for depreciation up to date of retirement and (*b*) scrap value of salvage or the amount received from sale of equipment retired; and to "Profit and Loss" the depreciation which had accrued prior to July 1, 1907, so that in effect the year's charges bear the entire cost of the equipment vacated, less the salvage value.

Also another charge to "operating expenses" —(*Depreciation*) for a monthly charge representing depreciation on the cost of the equipment in service.

The Southern Pacific Co., in the absence of any facts about "Depreciation" (other than the replacement of equipment as it was vacated), thought it best to continue its past practice, and charge to the operating expenses, as "Renewals" only, the cost of all equipment vacated (less salvage value) had made no charge to "Depreciation" or to "Profit and Loss."

TABLE VIII AVERAGE CHARGE PER FREIGHT TRAIN CAR OWNED PER YEAR

Years ended June 30:	Charged to operating expenses. Renewals.	Charged to operating expenses. Depreciation.	Charged to operating expenses. Total.	Charge to profit and loss.
Southern Pacific Co., 1907	$26.10	....	$26.10	
Southern Pacific Co., 1908	23.39		23.39	
Southern Pacific Co., 1909	19.05	....	19.05	....
No. 1, 1909	4.51	$18.38	22.89	.
No. 2, 1909	2.71	13.12	15.83	.
No. 3, 1909	.43	6.63	7.06	$7.58*
No. 4, 1909	1.99	11.59	13.58	
No. 5, 1909	1.93	9.50	11.43	.
No. 6, 1909	.06	19.70	19.76	..
No. 7, 1909	5.73	13.82	19.55	14.54*
No. 8, 1909	1.92	2.66	4.58	†20.85
No. 9, 1909	24.56	....	24.56	....
No. 10, 1909	1.09	13.94	15.03	..
No. 11, 1909	4.76	15.02	19.78	
No. 12, 1909	7.44	17.69	25.13	
No. 13, 1909	.35	24.18	24.56	

*The charges to profit and loss by these companies did not show separately the amounts charged for account of depreciation for locomotives, passenger train cars, freight train cars, and work equipment. The entire amount was therefore carried against freight train cars, which, of course, is not a proper unit, but it furnishes some information as to the amount taken up in the year's expenses for account of depreciation for all equipment.

†Includes depreciation and other charges.

As an illustration of the practical working out of the two methods, the following statement prepared from information given in the published annual reports of the railways for the year ended June 30, 1909, may be of interest. The amounts charged to "Renewals" and to "Depreciation" of freight cars only have been selected, as a greater number of freight cars are annually vacated, destroyed, or condemned than of other equipment, and, therefore, the renewals may be assumed to be about the normal annual depreciation.

In the absence of more accurate information, the average number of cars in service during the year was assumed to be one-half of the aggregate number of cars on hand at the beginning and at the close of the year.

As the names of the companies are not essential for this illustration, numbers have been substituted for them. With the exception of companies Nos. 3, 7 and 8, the Profit and Loss accounts of the companies did not disclose any charges for "Depreciation" accruing prior to July 1, 1907, and, therefore, it was assumed that none were made.

Those familiar with the physical operation of a railway know that the efforts of the management are constantly directed towards the improvement of the physical character of the property and of its efficiency to the end that its service to the public may be still further increased thereby.

The staff to whom is committed the maintenance of its equipment is alert in adopting any design or device by which the durability and service of the equipment is augmented. It is a well known fact that, as locomotives, cars or other equipment are taken into the shops for repairs or renewals, details of construction which have proven themselves weak are replaced with details of greater strength either in design or by the substitution of material of greater durability. It is the exception when a locomotive, car or other equipment leaves the shops after a general overhauling that it has not been improved in design, durability and service.

In thus making repairs and renewals to its equipment, the management has fully discharged the obligation which rests upon it to keep unimpaired the capital account of the property entrusted to it by the owners and the obligation to the public in respect to the cost of operating its railway.

In conclusion, the hope is again expressed that the Interstate Commerce Commission will amend its "Classification of Operating Expenses" by omitting altogether the provisions for "Depreciation" and amend the provisions for "Renewals" to read "This account includes the current cost for reproducing in kind, or in capacity, all equipment condemned, destroyed or sold, less scrap value of salvage or the amount received from sale."

With this change in the classification and the credit to "Equipment" for the cost of the equipment condemned, destroyed, sold or otherwise disposed of as now provided in the classification of the Interstate Commerce Commission for "Additions and Betterments," the commission, the owners of the property, and the public will have some reliable information of the relation between the cost of the equipment vacated and the amount taken up therefore in the Operating Expenses.

TABLE VII PERCENT OF ORIGINAL COST OF EQUIPMENT VACATED TO TOTAL ORIGINAL COST, CHARGED TO OPERATING EXPENSES.

Companies.	Years in operation.	Locomotives 1909.	Locomotives 1908.	Locomotives 1907.	Locomotives Av.	Passenger train cars. 1909.	Passenger train cars. 1908.	Passenger train cars. 1907.	Passenger train cars. Av.	Freight train cars. 1909.	Freight train cars. 1908	Freight train cars. 1907.	Freight train cars. Av.	Work equipment. 1909.	Work equipment. 1908.	Work equipment. 1907.	Work equipment. Av.
Central Pacific	40	2.70	0.69	0.86	1.38	1.26	1.07	1.72	1.35	4.59	7.07	4.79	5.47	2.28	0.86	1.08	1.41
Gal., Harrisburg & San Antonio	[illegible]	.34		..	12	.17	.11	.16	.15	3.21	4.07	9.50	5.85	1.51	1.65	4.51	2.59
Houston, E. & W. Texas	[illegible]	..	4.03	..	1.36		...		..	4.87	[illegible]	.92	3.16	..	8.94	5.71	
Houston & Shreveport	[illegible]	...	...		...												
Houston & Texas Central	36	13.02	...	2.00	4.99		.20	3.24	1.18	9.24	[illegible]	2.33	6.21	3.89		.21	4.95
Iberia & Vermilion	16																
Louisiana Western	[illegible]						.05		.02	1.43	1.34	2.12	1.64	.39	7.07	4.52	3.64
Morgan's La. & Tex. Co	13		..				.69		.33	.68	.91	3.35	1.63	.20	3.32	8.63	3.44
Nevada & California	[illegible]	9.01		4.47	4.61		...			5.69	11.85	15.95			4.35		1.52
New Mexico & Arizona	[illegible]	...		...						..							
Oregon & California	37	4.19		1.02	1.73			.33	.11	9.39	6.70	8.12	8.15		1.11		
Sonora Railway	26	6.82		12.14	6.64		...			7.49	6.19	3.20	5.52	1.23			.44
Southern Pacific	38	1.26	.47	1.48	1.07	2.41	2.28	[illegible]	2.39	3.44	[illegible]	3.70	3.70	1.16		1.62	1.22
South Pacific Coast	[illegible]	6.44	41.[illegible]	21.99	29.94	.02	13.50	[illegible]	6.38	4.70	11.50	28.83	17.70	15.15	41.92	1.67	[illegible]
Texas & New Orleans	[illegible]					.05		.17	.07	.95	[illegible]	2.78	1.63		1.92		3.23

*None owned.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Draft of a Suggested Law Licensing of Land Surveyors.

BY ERNEST M'CULLOUGH.

The writer has always been interested in the subject of the licensing of surveyors and of civil engineers and has studied the matter as fully as possible. Copies of all the bills introduced from time to time in the legislatures of various states have been read and considerable correspondence has been had with the framers of many of the bills. He has arrived at the conclusion that were it not for the fact that a large number of men want such legislation and sooner or later will get some sort of legislation, it is unnecessary. These conclusions he stated in a series of articles written for the Engineering World in 1906. The movement, however, is widespread for some sort of legislation and underlying it all is the desire to make surveying a closed profession. It has now reached the point where a demand is heard for the licensing of engineers as well as of land surveyors. The recent absurd bill proposed to the legislature of New York has awakened the American Society of Civil Engineers to the danger that the profession may be hurt by unwise legislation and that society is taking steps to promote a movement leading toward proper action in order that the dignity of the profession will not be hurt while an attempt is made to protect it.

Whether any great degree of success will be met with in passing laws to license civil engineers it is certain that some laws may be passed to license land surveyors. Several states now possess such laws, the first having been passed in California in March, 1891. There is a strange lack of uniformity, however, in them and it is essential for proper professional standing that the laws in all states should be as nearly as possible uniform. The writer therefore offers the following draft of a law that can be placed upon the statute books of every state in the union and be constitutional. To explain some provisions it is necessary to state that to make it compulsory for land surveyors to be examined and licensed will be fought in every state and delay the passage of the law. In many states it may be deemed unconstitutional in that it interferes with the inalienable right of every American citizen to do as he pleases so long as he hurts only himself. Two classes of surveyors are therefore provided for and the man who employs a surveyor knows exactly what he is doing and can make no claim for loss if he employs one who is not licensed.

The enacting clause and title of the law will of course conform to the usage in each state, the expressions here used being merely suggestive:

AN ACT ENTITLED AN ACT TO DEFINE THE DUTIES OF AND TO LICENSE LAND SURVEYORS.

Be it Enacted by the Senate and Representatives of the State of ...., That,

1. Any person in the state of .... desiring to practice as a land surveyor may apply to the State Board of Examining Surveyors, as hereinafter provided, for an examination and upon passing said examination in a satisfactory manner shall be entitled to receive under the signature and seal of .... (here insert the name of the official granting the license), a license to practice land surveying within this state; said license to continue in full force and effect so long as the said licensed land surveyor shall continue in the active practice of land surveying and maintain the bond hereinafter provided for, in full effect. If the said licensed surveyor shall discontinue for a period of five years continuously to follow the work of a land surveyor as such then his license shall be void and a new license will not be issued until another examination shall have been passed. The licensed land surveyor shall give a bond to the state of .... in like manner as the bonds of notaries public, conditioned for the faithful and competent performance of his work in the sum of Five Thousand Dollars and any person suffering loss by reason of a mistake made by, or of the incompetence of the said licensed land surveyor, may sue upon said bonds and recover all actual damage suffered or loss sustained by reason of said mistake or incompetence of said licensed land surveyor; provided, that the said mistake must consist in the inaccurate measurement of an angle or line or of an inaccurate plat or map or both, and that where a mistake is claimed in the relocation of a corner regarding which there may be differences of opinion between surveyors there shall be no recovery because of loss or damage alleged as the result of a possible error in opinion because of conflicting evidence. Every licensed land surveyor shall possess a seal bearing the coat of arms of the state with his name and the words Licensed Land Surveyor thereon. He shall stamp all his plats and other papers which may be required or necessary as evidence, with said seal and also sign his name followed by the words Licensed Land Surveyor of the State of .... Such notes, papers and plats thus signed and sealed shall be prima facie evidence in every court in the state.

Section 2. All persons who practice land surveying in this state without having passed an examination and without a license as provided in this act who sign maps, plats, notes and computation sheets and books shall place after their signature the words Not Licensed. If they have stationery and cards and signs with any designation thereon of their business as being that of land surveying or anything thereon to indicate that they do and perform the work pertaining to the surveying of land, then they shall also display prominently in type, the size of that used for their name, the words Not Licensed. A violation of this section of this act shall be a felony of like nature and degree as the obtaining of money or other valuables by false pretenses.

Section 4. In all counties of this state wherein two or more licensed land surveyors have their places of business the County Surveyor shall be a licensed land surveyor. In all villages, towns and cities, wherein two or more licensed land surveyors reside the town or city engineer or surveyor, or both, shall be a licensed surveyor. No person shall be appointed or elected as surveyor or engineer of a highway, drainage or irrigation district in this state who is not a licensed surveyor and if any person accept such an appointment without the qualifications herein stated he shall have no standing in a suit for the recovery of fees or other payments for services rendered. If any persons other than licensed land surveyors are selected or appointed to make surveys of disputed land lines or to apportion estates or to serve as surveyors or as civil, hydraulic or sanitary engineers upon any state, county or municipal boards or commissions they shall have no standing in a suit for the recovery of fees or other payments for services rendered; provided, that nothing in this act shall interfere with the employment of consulting engineers as such, the nature of whose duties will not require on their part the actual surveying or mapping of land lines or the superintendence or direction of land surveying work. No permits shall be issued for the erection of buildings fronting upon any public property or adjoining public property until stakes defining said property have been set and a certificate to that effect issued by a licensed land surveyor, the penalty being the loss of all the rights of the public in and to any property that may be encroached upon by said building if erected without such survey or by reason of an improper survey by any person other than a licensed land surveyor, the remedy reserved to the public being a suit for recovery against the official wrongfully issuing said building permit, the term public property being held to mean property actually owned by the public or in which the public has an easement and property held for public use.

Section 5. Any person desiring to obtain a license to act as a licensed land surveyor shall make an application in writing to the State Board of Examining Surveyors setting forth that he is over 21 years of age; of good moral character and that he has had three years' actual experience as a land surveyor, or if he has completed in residence a course of surveying at a school where land surveying is taught in a manner fully equal to that of the teaching in the State University and has a certificate setting forth this fact, then he shall be required to have only two years practical experience in addition to said work done in residence at the institution where he has studied surveying. Upin receiving said application the Board of Examining Surveyors shall issue a temporary license to be effective when the bond hereinbefore provided, shall have been duly approved, which temporary license shall be in force and of full effect until the applicant shall have been examined and his fitness discovered by said examination; provided, that if the application be made within 30 days prior to the next examination, then no temporary license shall be issued. The applicant shall be examined in arithmetic so far as this subject is covered in the public schools of the state; in geometry to prove his ability to calculate areas and volumes of planes and solids and the computation of earthwork; in algebra to show his ability to solve equations of the first and second degree, and a knowlerge of the fundamental operations of algebra; in trigonometry to determine his ability to solve plane triangles and perform such trigonometrical calculations as may have to be done and performed by land surveyors. The questions asked and the examples set shall be as practical in character as possible and no catch questions shall be asked. The examination in surveying shall test the knowledge of the applicant on the use of the compass, the solar compass, at least two different kinds of solar attachments for transits, the use of the sextant, transit, level and barometer. At least two methods of finding the true north by direct observation without the use of a solar attachment or solar compass must be demonstrated, one of which must be a direct observation on the sun. He must understand how to survey lines and areas and compute areas and divide land. He must have a knowledge of the legal questions arising in the relocation and restoration of lost boundaries and be familiar with the United States laws and regulations for the surveying and resurveying of public lands and mining claims. He must be familiar with methods for surveying highways and ditches and the calculation of earth work and grading quantities. He must be a neat draftsman. He must show that he has read and is familiar with the paper by Justice Cooley of the Michigan Supreme Court on the judicial functions of surveyors. No certificate or diploma shall excuse any applicant from the examination in surveying but graduates in surveying or engineering courses of schools and colleges approved by the Board of Examining Surveyors may upon presentation of their diploma or certificate, be excused from the examination in arithmetic, geometry, algebra and trigonometry.

Section 6. The Board of Examining Surveyors shall consist of five members appointed by the Governor to serve for five years or until their successors are appointed. The first members appointed shall decide by lot which shall serve respectively for one, two, three four and five years, so that one appointment shall be made annually thereafter, for a term of five years. The chairman of the Board shall be the professor of surveying at the State University, one member shall be recommended by the members of the American Society of Civil Engineers from among their members residing in this state, one member shall be appointed upon the recommendation of the State Society of Engineers and Surveyors, one member shall be selected from the county surveyors of the state and the fifth member shall be appointed from the city engineers of the state. The board shall appoint a secretary who may be a member of said board. The headquarters of the board shall be at the state university and stated examinations shall be held three times each year in the months of January, May and September at the state university. Three members of the said board must be present at each examination and all the members shall have a part in arranging the scope of the examinations. Each applicant for a license shall pay to the secretary of the board a fee of twenty-five dollars to cover the cost of the examination and the license and shall in addition pay his own expenses to and from the place where the examination is held. If he fail to pass the examination and a license is not granted, then ten dollars shall be refunded him. No charge shall be made for the issuance of the temporary license granted as hereinbefore provided. Upon the first of January of each year the board shall meet and pay bills, salaries, etc., and the money then remaining on hand shall be equally apportioned among the members of the board and this shall be the total compensation received by them for their services in connection with said work, except that each member who has attended meetings shall be reimbursed for all his actual expenses incurred in attending said meetings, the said expense account being deducted before the remaining funds are divided among the members. Members who have been absent from any examinations shall have deducted from their share the sum of five dollars per day for each day they were absent and the money so deducted shall be added to the share of those who were present at said times. All stationery shall be furnished the board by the state for the first year in which this act is in force, the cost of stationery thereafter to be a part of the expenses herein in this section mentioned.

Section 7. In the office of the recorder of each county in the state there shall be books for the plats filed by licensed land surveyors, which plats must bear their seal and signature, and a charge of fifty cents shall be made for the filing of each one of said plats and binding them in said plat book, which shall be carefully indexed and cross referenced; no plats filed by persons not licensed land surveyors to be filed in said books. These plats shall be on cloth mounted paper in sheets measuring 21 in. by 30 in. with a border line one inch from the top, the bottom and the right hand end and two and one-half inches from the left hand end for binding space. Upon said plat shall be shown every monument, corner and line established and such other information as shall be sufficient to enable any competent surveyor from the information contained on this plat alone, to retrace every line and restore every corner or monument. The date of the survey and of the filing of the plat shall be given and the bearings of the lines shall be given with reference to the true meridian which shall have been ascertained at the time of the making of the survey. It shall be the duty of every licensed surveyor to tie every survey to at least two monuments of masonry or metal, or both, and to show the exact location of said monuments on the plat of the survey, with reference points so shown that the monuments can be located by future surveyors. Surveys shall be made with steel tapes certified correct by the United States Geodetic Survey or the Bureau of Standards in Washington, D. C. The plat shall be filed in the office of the recorder of the county in which the survey was made within sixty days after the field work of said survey has been done and no person shall be obliged to pay for any survey made by a licensed land surveyor until the plat of the survey shall have been properly filed. Failure to file said plats within the time herein required shall be considered a misdeameanor and punishable as such by fine not exceeding two hundred and fifty dollars, each day of delay after the expiration of the sixty days herein mentioned to constitute a separate offense.

Section 8. All acts and parts of acts inconsistent with the provisions of this act are hereby repealed.

Section 9. This act shall take effect and be in force ten days after its passage and approval.

If an act similar to the above were passed in each state an immediate improvement in the character of surveying work done will be noticed. The profession will then be restored to its old time place of honor and the surveyors will be respected as of old.

If at any time laws are passed to license civil engineers it will be sufficient to begin the examination of a civil engineer by requiring that he first pass the examinations to become a licensed land surveyor. After that he will have to be examined in applied mechanics, the properties of materials used by engineers, the theory and practice in the design of structures, comprising buildings, bridges, dams, retaining walls, etc., the flow of water and the sanitation of cities, etc. The acts for the licensing of surveyors and engineers should be separate to avoid misunderstanding and trouble. It is likely that every state will have laws regulating the practice of land surveying long before any good laws are passed to regulate the practice of civil engineering.

No matter how rigid the laws are it is well to provide for two classes of practitioners so that opposition to the passage of the laws will be reduced to a minimum. When the public learns that the licensed man has passed a rigid examination and is under bonds the man who is compelled to place the words Not Licensed after his name will soon go into some other business or be engaged on such a cheap class of work as not to be a competitor of worthy surveyors. The lack of compulsion also will lead to the very best men banding together to guard the profession.

The Library of the New York Public Service Commission, First District.*

The Public Service Commission for the First District has jurisdiction in New York City over gas and electric companies, railroads and street railroads, including under the Rapid Transit Act and the laying out of rapid transit routes, the preparation and supervision of contracts for construction and operation, and in certain cases the granting of franchises. The surface, elevated and subway companies in New York City carry annually over 1,300,000,000 passengers, which exceeds by more than 66 per cent the total number of passengers carried on the steam railroads of the entire country. The gas companies of the city produce more than 20 per cent of the entire gas output of the United States.

The problems coming before the Commission in relation to rates, service, equipment and subway construction are numerous and important, and involve in many cases the working out of new methods and the laying down of policies of tremendous importance. The Commission has a staff of over 600 employes. About 300 of these are the engineers, draftsmen and inspectors engaged directly in the work of subway planning and construction. The Commission has drawn into its service highly trained statisticians, economists, accountants, lawyers and engineers of all kinds.

As a tool for the use of this large organization it has established an office library. The library is intended to be a working office collection of books, pamphlets and periodical articles needed in the current work of the Commission and in the consideration of the various questions that come before it. The library aims to collect and index material in such a thorough and scientific way that when information is wanted in relation to car brakes, gas meters, franchise terms, Paris subways, etc., the material from which the desired information may be secured will be at hand. The library now contains some 2,600 volumes and 5,400 pamphlets, making the total collection 8,000.

Selection and Collection of Material.—In a special office library, great care must be taken in the selection and collection of material. Selection must be exhaustive but discriminating. All possible sources must be searched for useful material, but just as great care must be exercised to exclude material not needed. The efficiency of the collection is reduced by every useless book it contains. It is often a doubtful question as to whether a particular book should be added to the collection, and an even more troublesome question as to whether a book now on the shelves should be discarded. The librarian must use his best judgment. He will make mistakes both in original selection and in discarding, but it must be done.

In the library of the Public Service Commission we examine regularly the "Publisher's Weekly,' and the lists of the United States and parliamentary publications. We get track of most of the books and pamphlets desired, however, by a rather careful perusal of a number of technical journals that relate to public utilities. Among the most important are "Electric Railway Journal," "Light Railway and Tramway Journal," "Electrical World," "Engineering News," "Progressive Age." Here we find reference to the annual reports of the various public utility companies of American and European cities and to many printed papers and special reports, official or unofficial, relating to public utilities. The lists published by Stone & Webster and the current bibliographies in the "Journal of Political Economy," and "American Political Science Review" and the "Economic Quarterly" are also useful. Much material has been obtained by writing directly to the American consuls and to the public officers and company officials in the large cities of the world.

But as important as are the books, the pamphlets and special reports, they are outranked in value by the periodical article. In the numerous general, economic, law and technical periodicals of this and other countries there are many articles of the utmost importance in the routine work of the commission, and in the consideration of the various problems that come before it. The library receives some 25 periodicals that are systematically examined, for articles and material of use to the Commission. In addition we examine the index to legal literature contained in the "Law Library Journal," the "Readers' Guide to Periodical Literature" and most important of all, the "Engineering Index." The "Engineering Index" is a monthly annotated index of the more important articles appearing in some 200 American and European technical journals. The publishers of the Index undertake to supply copies of the articles listed. This is a great convenience, especially in securing copies of articles in foreign periodicals. As soon as the Index is received it is checked up and an order sent in for copies of all the articles of special interest.

Classification.—A special library will usually require a special classification. The standard classifications are all right for the smaller public libraries. Standard classifications have been specially designed to meet the requirements of a general collection. They are usually a sad misfit when applied to a special library. The special working collection is intended to serve very definite needs and is required to answer certain definite problems. The purpose of the classification is to aid in supplying desired information with speed and certainty. The resources of the library must be classified around the special problems that are to be solved. "Close" classification is also essential. There should be a special heading or subheading in the classification for practically every subject, no matter how minute, concerning which information will be frequently wanted.

The classifications that we have worked out in the library of the Public Service Commission is extremely simple. The broad subjects are arranged alphabetically. Subheadings are arranged alphabetically under the main heading. States and countries are arranged alphabetically, and cities alphabetically under the state of country. The alphabet is much in evidence. The scheme has the advantage of fitting in well with an alphabetic catalogue.

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*A paper by R. H. Whitten, Librarian New York Public Service Commission, First District, New York, N. Y., in "Special Libraries" for March, 1910.

A feature of the classification is the system of uniform interchangeable headings and subheadings. Certain subheadings are used uniformly under each of the main utility headings and certain main headings are used also as subheadings. Thus "Accidents" appears as a main heading and also as a subheading under "Gas," "Electricity," "Transit," "Railroads," etc.

The notation used in the classification is a combination of letters and figures. Letters of the alphabet are used to represent all headings other than regional; e. g., Fr, Franchise; Ra, Railroad; Ga, Gas, etc. Regional headings are represented by Arabic numerals. States and countries are always designated by 2 figures and cities by 3 figures. These numbers are read as decimals, though the decimal point is uniformly omitted; e. g., 401 Boston follows 40 Massachusetts and precedes 41 Michigan. The same notation means the same thing wherever it occurs. Ac always means Accidents, whether as a main heading or as a subheading; e. g., Ac, Accidents; GaAc, Gas-Accidents; RaAc, Railroad Accidents, etc. The same number is always used for a given city or country wherever it occurs in the classification; Ga401, Gas-Boston; Ra401, Railroads-Boston, etc.

The above are some of the main features of the classification. They are subject, however, to numerous elaborations, modifications and exceptions.

Arrangement of Material.— All magazines, clippings and pamphlets are kept in large vertical file drawers. The clippings are usually placed in manila folders. They are arranged under exactly the same headings as the books on the shelves. Under each heading they are arranged chronologically according to year of publication. Each article or pamphlet has a separate file number, corresponding to the book number in the case of volumes on the shelves.

Of the 25 periodicals received, only 6 are bound. Articles of interest from periodicals that we do not bind are clipped, put in folders and placed in the vertical file drawers. The same treatment is also applied to the numerous special copies of periodicals not taken regularly, but which are purchased because they contain some article of interest. The vertical file drawers keep the material free from dust and offer a maximum of convenience in consultation. The material is compact and can be easily and quickly consulted.

Catalogue:—The card catalogue is in three main divisions, each alphabetically arranged: (1) Author and title; (2) subject headings; (3) regional headings.

The subject headings used in the classification are retained in the catalogue and used in their various combinations. Magazine articles and pamphlets are catalogued just as fully as books, and the cards for the articles are placed in the catalogue with the cards for the books. Chapters or parts of books relating to specific subjects are separately catalogued. A feature of the catalogue is the complete entry under the regional heading. Every subject entry relating to a particular city or country is duplicated under the city or country heading. We find it a great convenience to be able to find everything we have relating to Paris, for example, together under that heading.

We try to realize that it is not so much particular books or sets of books that we need to classify and index as it is the specific information contained in the books. Our catalogue is not used nearly so frequently to find the location of a particular book as it is to find information in regard to some particular subject. The more specialized a library becomes the more important, as well as practicable it becomes to classify and index information rather than books or sets of books.

Bulletins and Publicity.—A library bulletin is issued once or twice a week containing references to current books, articles and pamphlets received by the library. Each bulletin is a single sheet. It is mimeographed and sent out to about 250 officers and employees of the Commission. The person receiving the bulletin checks in the margin the books or articles he desires to see, signs his name to the sheet and returns it to the library. On receipt of this sheet at the library, the book or article desired is sent if available, and if not, the name of the applicant is placed on a reserve list. Often it seems desirable to bring a particular article or book to the special attention of some officer or employe. To do this the item in question is stamped in red with a rubber stamp marked "special" on the copy sent to the particular person in question. An article or book that will probably be of interest to but one or two or three persons is omitted from the bulletin and is sent directly to the individuals interested with a blank form stating that it is being transmitted for inspection and the request to return as soon as possible. In these ways we attempt to carry out the recognized function of the office library, that of bringing promptly to the attention of the officers and employes of the Commission the new books and the articles of interest in connection with their official duties.

The bulletin is a notable success in directly increasing the use of the library. It also has a publicity feature. It is a constant reminder of the existence of the library and of the nature of the material that may be found there. The office library is an innovation and the habit of turning to it for information must be acquired. Various forms of publicity should be resorted to, to aid the development of the library habit. I think we could and should do more in this direction than we have in the past.

Reference Lists.— Numerous special reference lists are prepared from time to time on subjects of special interest. Our close classification, analytic catalogue entries and combined periodical and book catalogue make the preparation of special reference lists much simpler. Often all that is required is a straight copy of the catalogue entries.

Blue Print Methods.—We are experimenting on a new form of catalogue that promises certain distinct advantages. The catalogue entries on each subject are arranged chronologically and copied on letter size onion skin paper. This makes a negative from which a blue print may be taken. A single sheet or sheets being devoted to each subject, it is possible to add future accessions to the original sheet, without the necessity of recopying. We can thus have always an up-to-date catalogue on loose sheets. It is of course easier to consult a catalogue with five to twenty entries on each page than to finger over the cards in a card catalogue. Another advantage will be that we can make portions of the catalogue available in the various bureaus of the Commission. Thus we can supply the Franchise bureau with a loose leaf always up-to-date catalogue of franchise material, the Bureau of Statistics and Accounts with a catalogue of accounts, finance and statistics, and similarly for the various other bureaus and departments. Another advantage will be that we can always supply a blue-print copy of any part or parts of the catalogue. It seems probable that these will in large measure take the place of the special reference lists that we have been preparing. A reference list is out of date as soon as it is made. The advantage of having available an always up-to-date list is evident.

Collection of Information.—The library also compiles data on various subjects, and particularly in relation to public utility supervision and conditions in other states and cities. To a considerable extent, the qualifications essential for the scientific selection and collection of material are the same as those required for the compilation of the information contained in the material. These functions are therefore combined and the library, so far particularly as conditions in other states and cities are concerned, both collects and collates information. Thus detailed reports have been prepared in relation to the supervision of street railways in England and Prussia, the subway system of Paris and the laws and experience of various cities in relation to the indeterminate franchise and in relation to profit sharing as a method of franchise compensation. Numerous brief comparative statements have also been prepared. Much of our most valuable information has been drawn from the laws, methods and experience of the great cities of Europe.

I think that this combination of library work and collection or investigation is a practical one. The librarian gains an intimate knowledge of the contents of the material in his collection. His direct use of the material shows him the weak places in it and enables him to fill up the missing portions that are so absolutely essential to an efficient working collection. Active use of his collection helps the librarian, moreover, to get away from the habit of looking at the book as the unit of library work. It helps him to a realization that it is facts and information that it is his function to classify, arrange and make readily available rather than particular books or sets of books.

Quick Service.—The necessity for quick service is a fundamental and all sufficient reason for the existence of the special library. Information to be of use in the everyday work of the world must be quickly available. Quick service multiplies use—this is as true of libraries as it is of transit systems. The importance of quick service should therefore condition and mold the entire organization of the special or office library, its classification, arrangement and cataloguing.

In the development of a special library emphasis needs to be laid on these two things: First, the necessity for quick service, and second, that the service rendered is for the purpose of giving information and that the library is not merely dealing in copies or titles of books and articles. While we hold these ideals in the library of which I am speaking, we still lack much of their complete realization.

PERSONALS.

Mr. W. O. Sauzonbacher, Piqua, O., has been appointed an engineer in charge of construction work on the Ohio Canal and has opened an office at Massillon, O.

George F. Folsom, an old-time Superintendent of Construction on the Boston & Providence R. R., died Aug. 19 at the home of his daughter near Boston, Mass. He was 80 years of age, and had been retired since 1888.

Mr. Paul Hansen, who has been Acting Chief Engineer of the Ohio State Board of Health during the absence of Mr. R. W. Pratt, has been appointed State Sanitary Engineer to the State Board of Health of Kentucky.

Mr. Cicero D. Hill, Engineer of the Board of Local Improvements of Chicago, Ill., and Chief Engineer of Sewers of that city, has been promoted to the position of Superintendent of Sewers. Mr. Geo. C. D. Lenth, Division Engineer of the Board of Local Improvements, succeeds Mr. Hill.

Mr. J. N. Chester, formerly Chief Engineer of the American Waterworks & Guarantee Co., and Mr. Thomas Fleming, Jr., formerly Principal Assistant Engineer in charge of the design and construction section of the Pennsylvania State Department of Health, have entered into a partnership and will engage in practice as consulting engineers, with offices in the Union Bank Bldg., Pittsburg, Pa.

Mr. John F. Stevens, M. Am. Soc. C. E., President of the Oregon Trunk R. R., and head of the Hill interest in Oregon, has been elected President of the Spokane, Portland & Seattle Ry., to succeed George B. French, who resigned several weeks ago. Mr. Stevens was also elected director and president of the Astoria & Columbia River & Northern R. R. and The Dalles, Portland & Astoria Navigation Co.

J. Roosevelt Shanley, a well-known contractor, of New York City, died suddenly Aug. 25 at his country home in Stamford, Conn. He was a son of the late B. M. Shanley of Newark, N. J., who handled many important pieces of construction work for the Pennsylvania R. R. He is survived by his wife, Olga M. Shanley. Mr. Shanley was President and Director of Shanley-Morrissey, Incorporated, contractors; the American Automatic Switch Co., and the Royal Machine Co.; Treasurer and Director of B. M. Shanley's Sons and the Concrete Building Block Co., and Secretary and Director of the B. M. & J. F. Shanley Co. and the Stewart-Kerbaugh-Shanley Co. He was 55 years old.

The U. S. Civil Service Commission, Washington, D. C., will hold an examination, on Oct. 5, to secure eligibles from which to make certification to fill a vacancy in the position of inspector, qualified as a good all-round building inspector, male, at $900 a year, in the Quartermaster's Department at Large, Fort Crockett, Tex., and vacancies as they may occur in any branch of the service requiring similar qualifications. It is desired to secure as applicants for this position young men recently from technical schools who have not yet acquired the practical experience to justify placing them in charge of work for which experienced civil engineers and superintendents of construction are required.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The principal government contract of the past week appears to have been the one for excavating in the Niagara River below the ship lock at Black Rock Harbor. This contract was let to Arthur H. Vogel, Milwaukee, Wis., at $532,100. The contract includes 580,000 cubic yards earth excavation at 22 cents, 190,000 cubic yards bed rock at $2.05, and handling 10,000 cubic yards excavated rock with derrick at $1.50.—Hearings were begun at Chicago on August 29, by the Interstate Commerce Commission on the proposed increase of freight rates by the railroads. The contention of the railroads includes: 1. The railroads are without money to finance necessary physical improvements. 2. They can not finance the extensions and renewals which commerce demands without enlarging revenues. 3. During ten years past 850 State and Federal laws have been enacted, increasing the expenses or reducing the earnings of railroads. 4. Cost of materials has advanced, and so has the type of equipment now in general use.—Announcement has been made that the new $7,000,000 Mississippi bridge of the McKinley interurban system at St. Louis, Mo., will be formally opened to traffic on Thanksgiving day.—The mayor of Cincinnati, O., has signed an ordinance giving the Union Depot & Terminal Company of Ohio a right to erect a $30,000,000 depot and terminal in Cincinnati.—One of the largest railroad construction contracts that has been let recently was signed at Los Angeles on August 25 by the San Pedro, Los Angeles & Salt Lake Railroad. The contracts are for the building of the "high line" between Guelph and Crestline. a distance of 60 miles. This stretch of line will obviate the necessity of running overland trains over the washed-out Salt Lake basin where disastrous washouts have occurred. The contracts are said to amount to $6,000,000. The names of the successful contractors were not announced. Among the other construction contracts let recently are the following: Carl Hall & Co., Duluth, Minn., and John Runquist, Duluth, for constructing 20-mile extension of Spring Mine line of the Duluth & Iron Range R. R. to Dunka River; Erickson & Peterson, San Francisco (reported) for continuing the Southern Pacific cut-off from Rocklin to Truckee, the work including 23 tunnels; P. W. Ryan, Janesville, Wis., for grading between Palestine, Ill., and Wauconda for the new Waukegan, Rockford & Elgin Electric Railway; Hyde & McFarlin, New York City, for the construction of the Lehigh Valley Short Line between Lumber Yard and White Haven, Pa.; Peppard & Co., Minneapolis, Minn., for building a spur for the Chicago & Northwestern Ry. to the Chicago Lake Mine; Bennett & Talbott, Greensburg, Pa., for tunnel work near New Grafton, W. Va., the contract amounting to about $2,000,000; Gibson-Carr Construction Co., Middlesboro, Ky., for constructing a 3-mile extension to the Tye Forks branch on the Cumberland R. R.—One of the largest bridge contracts let recently was the contract for constructing a highway bridge over the Connecticut River between Old Saybrook and Oly Lynne, Conn. The contract for this work was let to the Pennsylvania Steel Co., at $198,045.—A large sewer contract in Denver, Colo., was let last week to the Dennis Gibbons Construction Co., of Denver. The contract was for the construction of the Washington Park storm sewer. The sewer will be about 18 miles long and will cost about $175,000.—Extensive improvements are contemplated by the Berkshire Street Railway Co., of Pittsfield, Mass., which was acquired some time ago by the New York, New Haven & Hartford R. R. Extensions costing about $2,000,000 are to be made in the next three years and some of these are nearly "ripe" for construction work.

County Road Systems and Toll Roads.

One of the recent developments of the good roads agitation has been the construction of county highway systems. The first of these systems was constructed some six or seven years ago near Jackson, Tenn. Since that time several other counties in Tennessee have taken up the matter and have voted bonds for the construction of systems of improved highways within the limits of the counties. In the State of California, also, several counties are now constructing such systems, some of them being quite extensive in character. The earliest plan of improved road construction in this country—the building of systems with turnpikes by private capital—may be said to be the granddaddy of the present day county road system. These old toll roads played an important part in the growth of the country. They were built at a time when there was no such thing as State aid, and very little money from other sources was available for road building. The capital stock of the companies in many cases was taken by the persons who would be most directly benefited by the construction of the road. Quite often these percons paid for their shares by manuel labor or by teams in the construction of the road. In South New Jersey the first turnpike company was chartered in 1849, and immediately began the improvement of the road leading from Burlington to Camden. In the ensuing ten years scores of turnpike companies were incorporated. In fact, more charter for companies of this kind were granted in that time than in all the other years of the State of New Jersey's history. Most of the toll roads in New Jersey were made of gravel because stone at that time was not easily accessible. This condition of affairs continued for about 40 years, during which time a great many of the companies went out of existence partly from lack of suitable material with which to keep the roads in order. In 1885 a law was enacted giving turnpike companies the right to issue bonds and to build stone roads on the old gravel foundation. Under this law the first stone road constructed in a rural district south of Trenton was built. Others followed and they were so satisfactory that the public clamored for more; but now they wanted free roads, and the New Jersey Legislature rose to the occassion by enacting a State aid law. In the State of New York the more important toll roads were constructed of plank. The first of these—the Syracuse and Central Square plank road—was 16 miles long and cost $1,487 per mile, lumber at that time costing $5.20 per 1,000 feet. The road had a single track, eight feet wide, except over a few spots of yielding sand. In its first two years, ending July, 1848, more than 160,000 teams passed over its first eight miles. This travel, it may be noted, wore down the hemlock plank, of which the road was constructed, one inch, where they had not been floated. That the profits from some of these toll roads was oftentimes large may be shown by giving some figures on the Syracuse and Central Square road noted above. Upon the first eight miles of this road, the tolls during its first two years, ending July, 1848, amounted to $12,900 and the expenses for salaries and repairs amounted to $1,500. This leaves $11,400 for dividends and rebuilding. The travel had worn the plank down one inch, and it is stated that another inch could have been worn down before a renewal would have been neccessary. Under the New York Plank Road Law, under which most of the plank toll roads were built, the following tolls were established: For every vehicle drawn by two horses, etc., 1½ cents per mile and ½ cent for each additional animal; for vehicles drawn by one horse, ¾ cent per mile; for a horse and rider or led horse, ½ cent per mile; for every score of sheep, swine or meat cattle, 1 cent per mile.

A Useful Invention.

It has remained for a Japanese engineer to devise a method of silencing parliamentary bores, which will prove a boon to all law making bodies. With slight modification this method would no doubt be gladly welcomed by the speaker of our own house of representatives. The modification for our own congress would be the fixing of the trap so that it could be sprung at the will of the speaker. Had this arrangement been in use at the last session of congress it is safe to say that the insurgent congressmen would have spent most of their time crawling out of the basement. This invention of he Japanese engineer is as follows: Attached to each seat in the House of Parliament he proposes to have a metal tube, the top being about the size of a franc piece or shilling. Each member of the House is to receive a leaden ball or bullet on entering. These balls can be easily passed into the tube, which carried under the floor leads to a receptacle immediately under the place where a member stands when addressing the assembly. This spot is like the traps on the stage of a theater. The trap is so arranged that when a certain number of balls, not less than one-half the number of members of a full House, have reached their receptacle the trap is made to descend automatically, carrying with it the garrulous speaker, or bore, as the case may be. No points of order have to be raised, the displeasure of the House is manifest in silence. Away goes the bore, and another speaker is called upon.

McGinnis and Pietro.

It is with all due respect for venerable old age that we gravely submit the following: J. McGinnis, a contractor of the Northeast, met his friend Donovan on the pier of the American Line the other day. Donovan had just landed from the old country. Stopping at a hotel, McGinnis said: "Now, Donovan, my boy, I'll give you a taste of liquor that will make you think the ancient kings left ambrosia for ye. Bartender, give us a couple of drinkings of that forty-year-old Bourbon ye have in the private bottle fer me." The bartender placed the "private bottle" on the bar with two very small glasses, which he half-filled with the precious fluid. Donovan lifted the pony daintily to the light, and then turning to McGinnis said: "How old did ye say this is, Mac.?" "Forty years," said Donovan, with another critical look at the glass, "it's small for its age, ain't it?" As to Pietro, Everybody's Magazine, states that he had drifted down to Florida and was working with a gang at railroad construction. He had been told to beware of rattlesnakes, but had been assured that they would always give the warning rattle before striking. One hot day he was eating his noon luncheon on a pine log when he saw a big rattler coiled a few feet in front of him. He eyed the serpent and began to lift his legs over the log. He had barely got them out of the way when the snake's fangs hit the bark beneath him. "Son of a guna!" yelled Pietro. "Why you no ringa da bell?"

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Alabama, Florida Southern R. R. Co has been incorporated with a capital stock of $40,000 and proposes to build a 25-mile line from Marmill, Ala., to Malone, Fla.

The New Orleans, Mobile & Chicago R. R., W. F. Owen, General Manager, Mobile, Ala., is said to be planning to erect a new dock just south of its present pier at Choctaw Point near Mobile.

Construction work on the Birmingham Southern R. R. has been completed over half way to Bessemer from Ensley, and it is believed that the remainder of the line will be finished by Jan. 1. The line will be used by the Tennessee Coal, Iron & R. R. Co. in haulages originating with its industrial companies between the two terminals. The work has been surveyed through Wylam, Corey, through a portion of Possum Valley to the south of Dolomite. The entrance to Bessemer will be along the present right of way of the street car line to a point near Woodward and then the new line will run alongside the Louisville & Nashville tracks. J. B. McIntyre, Ensley, Ala., is chief engineer.

Regarding the proposed double tracking of the Louisville & Nashville R. R. north of Birmingham, B. M. Starke, General Manager of the company, recently made the following statement: "We have mapped out two routes with the engineers, but we have made no actual appropriation for the work. It is generally believed that when the work is started we will have two good routes to follow and will have every bit of desired information to assist us in the work. We cannot announce when the work will start at this time as that is a matter for the future."

A proposition is being submitted to the residents of Birmingham whereby a direct railroad route will be built connecting Birmingham and Mobile, Ala. J. T. Cochran, owner of the Tombigbee Valley R. R., operating from Mobile on south to Silas, Choctaw County on the north, and from a point near Ivy Sumter County to Reform, Pickens County, is planning to build the line from the last point to Birmingham, a distance of 83 miles, providing financial aid can be secured.

Arkansas.

Kaiser & Maloney, of St. Louis, Mo., have moved their outfit to Stuttgart, Ark., where they have a grading contract on a new railroad.

The Gulf & Magnolia Northern R. R. will probably ask bids in about a month for constructing its proposed line. This road proposes a line, 125 miles long, from Junction City, Ark., to the Oklahoma State line near DeQueen. S. Q. Sevier, Hope, Ark., is President.

A charter has been granted the Prescott & Reader Ry. Co., for the construction of a line of railway from Prescott, Nevada County, to Reader, Ark., a distance of 20 miles. The authorized capital of the company is $200,000, of which $40,000 has already been subscribed. The directors are George W. Rogers, S. B. Curtis, S. L. Kahn, Little Rock; G. L. Harrison, Reader, Ark. A committee authorized to open books for the reception of stock subscriptions includes George W. Rogers, J. Lyons, Z. B. Curtis, S. L. Kahn, and T. W. Kirkwood.

Since the Parker Railroad proposition fell through, the citizens of Monticello, Ark., are advocating the raising of $300,000 in that town and Hamburg, to build a 30 mile railroad to connect the two places.

California.

The Central California Traction Co., San Francisco, has been granted a franchise to construct and operate a spur track through the Fair Oaks at Stockton, connecting its line with the Santa Fe.

The City Council of Oakland has awarded a 50-year franchise for an extension of the Central Pacific Co., a subsidiary corporation of the Southern Pacific Co., from its present Melrose terminus to Stanley road, Elmhurst. The line will be a part of the general electrolization scheme by which the Southern Pacific will gridiron Oakland, Berkeley and the surrounding territory. The railroad will be an extension of the 1st St. and Alameda lines and will tap the territory for several miles skirting the San Leandro Blvd.

The Southern Pacific Ry. is reported to have awarded the contract for building its cut-off from Rocklin to Truckee, with the exception of the 6-mile tunnel at Donner Lake, to Erickson & Peterson, San Francisco, who constructed a greater part of the cut-off from Rocklin to Auburn. The plans call for the boring of 23 tunnels between Colfax and Truckee in addition to a large amount of grading.

The San Pedro, Los Angeles & Salt Lake R. R., E. G. Tilton, Chief Engineer, Los Angeles, Cal., is reported to have signed construction contracts at Los Angeles on Aug. 25 for the building of its "high line," between Guelph and Crestline, a distance of 60 miles. This stretch of line will obviate the necessity of running overland trains over the washed out Salt Lake basin, where disastrous washouts have occurred. The contracts are said to involve the expenditure of $6,000,000.

Construction work on the Hanford & Summit Lake R. R., has been started and it is expected that the road will be completed about Jan. 1. This is to be an electric line extending from Hanford to Summit Lake, a distance of 18 miles. It will cost about $500,000, and is being built under the supervision of John B. Rogers, Chief Engineer, 52 Eleventh St., San Francisco, Cal.

Grading work on the Porterville Northeastern R. R. has been started from Porterville. The work is being done under the superintendency of the firm of French Brothers, railroad contractors. While it has not as yet been definitely decided upon, it is probable that for the present at least, the grading work will be done by the railroad. It is entirely possible, however, that later in the year the work may be let by contract. C. S. Freeland, Porterville, is Chief Engineer.

It is reported that the Oregon Short Line Ry. is planning the construction of a road to Los Angeles, via Reno, and one to Portland, Ore., via Alturas, Cal. As soon as deeds for the right of way have been filed the company will begin the building of a branch from Klamath Falls, Ore., to Alturas, which is to be ready for operation in 22 months. It will eventually be extended from Alturas to Reno, Nev. For 60 miles it will run through Modoc county, following the Pitt river south of Lookout to Bieber, Lassen county, Cal.

Colorado.

Board of City Supervisors, Denver, Colo., has granted the Colorado & Southern R. R. Co., right to lay a spur track from its main line along Third St. between Wazee and Wynkoop, to the warehouse of the Capital Ice and Storage Co.

A party consisting of John F. Wallace, New York City; H. U. Wallace, Chicago, Ill., W. E. Green, vice president and general manager of the Denver, Laramie & Northwestern, with headquarters in Denver, and W. D. Hodge, Chief Engineer of the same road, have made an automobile reconnaissance trip from Denver, through the Wind river country in Wyoming, Idaho Falls and over the Camas prairie. The object of the trip is said to be to determine the practicability of extending the Denver, Laramie & Northwestern R. R. through Boise to the Pacific coast.

Georgia.

The R. G. Peters Mining Co., Rome, Ga., has purchased 5,000 acres of iron ore property near Canton and will build a 3-mile railroad from the property to a connection with the Louisville & Nashville R. R. T. E. Grafton, Rome, Ga., has the contract to raise the ore.

Track laying has been started on the extension of the Georgia, Florida & Alabama Ry., between Kimbrough, Ga., and Richland, Ga. This road is 176 miles long, and was built and owned by J. P. Williams of Atlanta.

Illinois.

Material is on the ground for the new electric railway being built from Amboy northeast to DeKalb. Tracklaying is reported to have been started near Lee Center. This is the road being constructed by the Burns Construction Co., Isabella Bldg., Chicago, Ill.

P. W. Ryan, Janesville, Wis., has been awarded the contract for doing all the grading on the new Waukegan, Rockford & Elgin Electric road between Palatine and Wauconda. Work on the grading is to be completed by Dec. 1 and was started last week.

Right of way is being secured for an electric interurban railway following the east bank of the Illinois River from East Peoria north to Lacon.

At the annual meeting of the stockholders of the Aurora, Elgin & Chicago R. R. Co., at Chicago on Oct. 18, the proposition of the directors to purchase the property of the Chicago, Wheaton & Western Ry. Co. will be considered and determined. The question of changing and enlarging the objects for which the Aurora, Elgin and Chicago R. R. Co. was created or organized will also be considered. The Chicago, Wheaton & Western Ry. Co. is a railroad of some 13 miles in extent which was completed the latter part of last year. It is understood that the property is bonded for $429,000, or about $33,000 a mile. The new line, which extends from Wheaton through West Chicago to Geneva, is now operated by the Aurora, Elgin & Chicago R. R. Co. If the purchase is approved by the stockholders the road probably will be paid for in general mortgage bonds of the purchasing corporation.

Condemnation proceedings to secure possession of several pieces of property in South 46th Ave. and between Jackson Blvd. and Van Buren St. and in West Harrison St. have been started by the Chicago & Western Indiana R. R. The railroad desires the property for track elevation projects before it goes ahead with plans for a large terminal station between Polk and 12th Sts. and Dearborn and State Sts. The road has been buying up land for nearly two years in the downtown district and has secured practically all that is necessary for the terminal itself, and it is now acquiring the property in several connecting links in some of the outlying districts.

What's a chigger? We will confess that we don't know. Anyway they have 'em down at Charleston, Ill., as is shown by the following item taken from the Charleston News of Aug. 20. Incidentally the item gives some information about a proposed electric railway extension. "Chief Engineer Hyatt of the Charleston-Paris electric line, now being surveyed as an extension to the Charleston Electric which has two branches in this city in full operation, is a young man from near Chicago, and possibly a native of the effete east or from Europe. He is a clever young man but he does not know a chigger, or at least till he recently came to Coles county and threw out a tangent into the brush and bottoms and now he has been properly introduced to burrs, beggar lice, Spanish needles, nettles, pizen vines, ticks, mosquitos and chiggers. Heretofore he never saw a chigger; never heard of a chigger, and he thinks they never grow save near the Ambraw, and that is where he is in error. He knows they bite like all fury and the profanity of the members of his transit signal corps is equal to the swearing of the English army as they marched through Flanders, according to Uncle Tobey. Engineer Hyatt says he stormed the citadel through the vicinity of the Big Four bridge, and he found no amazing engineering problems, only such as was encountered by following a small rivulet to get down to proper datum. His bunch is now out about Kansas station, but have been returning to Charleston every night, so far as that he can live in Charleston and run out and in on the steam road every morning and evening as the trains just suit him. He was asked if the leading functionaries met him in Ashmore, but he said he could not say, as he did not know any of them, but that all of them appeared to be present."

Officials of the Chicago, Burlington & Quincy R. R. are reported to be considering tentative plans for the construction of switch yards at Eola to relieve the Hawthorne yards in Chicago of the present congested condition.

The Cleveland, Cincinnati, Chicago & St. Louis Ry., F. W. Smith, Construction Engineer, Cincinnati, O., will let contracts about Sept. 15 for its new 25 stall roundhouse to be erected at Mattoon at a cost of $150,000. An additional $100,000 will be spent on other terminal improvements.

The sale of the Macomb & Western Illinois R. R., a 22 mile standard gage steam line, operating from Macomb, has been postponed until Sept. 5. It was proposed to sell this road on Aug. 13. Two parties are reported to be figuring on its purchase.

Advices from Fulton, Ill., state that work is progressing rapidly on the terminals of the Chicago & Northwestern R. R. at that place. Included in the work most noticeable is the section between the Burlington right of way and the old main line double track, south from the FX tower to a point about ¼ mile north of east, which has been filled, leveled and brought to grade.

The Sterling-Moline Traction Co. has completed surveys for its projected 100-mile line and has secured the capital for its construction. The route of this road is from Sterling through Prophetstown, Lyndon, Morrison, Erric, Hillsdale, Barstow to Moline. The Northwestern Engineering and Construction Co., Milwaukee, Wis., has the contract for this line. W. E. Elliott, Milwaukee, Wis., is General Manager and Joseph Wright, Moline, Ill., is Secretary.

At a meeting of the stockholders of the St. Louis Southern Ry. at East St. Louis, Ill., the contract for the construction of the 50 miles of line between East St. Louis and East Genevive was let to Taussig & Chase, at $20,000 per mile. The St. Louis Southern Ry. was recently organized and on Aug. 19 elected the following officers: George C. Rogers, president; Judge Offenbacher, vice president and counsel; F. C. Smith, secretary; J. H. Hohl, treasurer. The new road will connect with the Illinois Southern at East Genevive for the present, running its trains into Chester over that line, and will use the old Conlogue to enter the Relay depot and will make use of the new bridge to run its trains into St. Louis.

Indiana.

The Northwestern Indiana Traction Co., which proposes a line from Hammond to Chicago Heights, Dyer, Crown Point, Lowell and Cedar Lake, has secured all necessary franchises for its line from Hammond to Crown Point with the exception of Hammond. A larger part of the right of way for the line has already been donated. This is the road being promoted by Eugene Purtelle, of Chicago, Ill.

Surveys are under way for the proposed electric railway from Bremen to Mishawaka. It is understood that actual construction work will not be started until next spring. This is the line being promoted by Neff Bros of Bremen.

Iowa.

The preliminary survey for the Davenport, Iowa City interurban line has been completed by the Walsh Construction Co. of Davenport, Ia. The survey taken in the preliminary trip went along the old B. C. R. & N. tracks as far as Stockton, when the crew followed the Rock Island main line into Iowa City. Of the towns taken in by the survey are Blue Grass, Stockton, Durant, Wilton, Moscow, Atalissa, West Liberty, Downey and Iowa City.

The Sioux City & Spirit Lake Ry. Co., which projects a 106-mile line from Sioux City to Spirit Lake through northwestern Iowa, has completed surveys. Definite information as to the plans of this proposed road will probably be available in about two weeks. Frank Patch, Commercial Club, Sioux City, Ia., is President.

The construction crews are repairing bridges and the track is being repaired for ballasting on the Newton line between Rockwell City and Gowrie, Ia., and it is believed that the electrification of the road will be started at no distant date. After that improvement the line will probably be extended to Sioux City.

Grading work has been started near Nora Springs by the Charles City & Western R. R., which is building a line southeast of Mason City between Charles City and Rockford.

Kansas.

Surveys have been completed and estimates made for a single track electric railway from Coffeyville to South Coffeyville. The line will be about one mile long and will be constructed this fall, it is said. According to the estimate of the engineer, F. S. Hathaway, Coffeyville, the line will require 1,761 cross ties, 188,610 tons of steel rails, 73 kegs of bolts, 15 kegs of spikes. The cost is as follows: Clearing and grubbing right of way, $250; excavation and embankment for road bed, 15 cts. per cu. yd.; right of way, $450; pile, trestle, $600; four cattle guards, ballasting, 2,152 cu. yds.; 104 poles; one mile of trolley wire; 480 ft. of drain pipe, and 4,160 ft. of brace and other overhead wire.

Surveys have been made on the proposed electric interurban line from Nowata, Okla., to Coffeyville, Kans., and part of the right of way obtained. As proposed the road will start at Nowata, touching Delaware, Lenapah, Seminole and several thickly settled farming communities and it will run through South Coffeyville and connect with the present interurban line at some convenient point in the city. It is said that the money necessary to build the road has been assured and that actual work of construction will begin by fall. John Wettach and W. V. Thraves, Nowata, Okla., are interested.

Kentucky.

The construction of a traction line from Newport, Ky., to Alexandria is again under consideration. A company to build this line over the Alexandria Pike was organized some time ago by the late Judge Berry, but his death caused a halt in the proceedings. A holding company has now been organized to take over the rights of the old company, and it is said the prospects are now bright for the building of the line. The route has already been surveyed.

Practically all right of way has been secured in Carter county for the proposed Kentucky North & South Ry., and John C. Homer, Right of Way Agent, has moved his headquarters to Tygarts Valley in Greenup County. The northern terminal of the road is to be Fullerton, Ky.

Articles of incorporation have been filed with the Secretary of the State and the Railroad Commission for the Bowling Green & Northern R. R., which proposes the construction of a line from Bowling Green, Ky., north to a point on the Illinois Central R. R., in Grayson County, 15 miles from Bowling Green. The company is capitalized at $100,000.

The Gibson-Carr Construction Co., Middlesboro, Ky., has been awarded contract for constructing a 3-mile extension to the Tye Fork branch of the Cumberland R. R.

Louisiana.

Engineers of the Louisiana & Arkansas R. R. are to run lines for an extension of the road from Jena in LaSalle Parish, La., to Jonesville on the Black River, at once. The distance is about 25 miles, and the officials hope to later extend the road an additional 25 miles to Natchez, Miss. W. H. Vance, Stamps, Ark., is Engineer Maintenance of Way.

Recent developments of the Rock Island Ry. Co. affairs have prompted the expectation that they will soon construct an extension from Eunice, La., to New Orleans. It was understood when the line which now reaches Eunice was projected from Little Rock south, that it was the intention ultimately to carry it to New Orleans, but the money appropriated did not provide for that amount of work, and after Eunice was reached there was a halt, since which time nothing has been done.

Maryland.

The Baltimore, Chesapeake & Atlantic Ry., Willard Thomson, General Manager, Baltimore, Md., has expressed its willingness to connect its line with the Delaware railroad at Centreville, if the cost does not exceed $35,000.

The Frederick R. R. Co., O. B. Coblintz, Chief Engineer, Frederick, Md., is to electrify its Thurmont division, running from Frederick to Thurmont, and formerly called the Washington, Frederick & Gettysburg road, at a cost of about $75,000. The company will also build and equip a new powerhouse sufficient to operate both roads at a cost of about $200,000. Since the building of the Thurmont road it has been operated by steam. The present plan is to operate it by electricity for passenger service and to continue steam for freight hauling. It is understood that the plan to continue the road from Thurmont to Emmitsburg and on to Gettysburg will be taken up later.

The New York, Philadelphia & Norfolk R. R., Elisha Lee, Superintendent, Cape Charles, Va., is considering double tracking its line from Delmar to Cape Charles.

Massachusetts.

Officials of the Berkshire Street Ry. Co., Pittsfield, Mass., have been going over the ground for a cable or trolley line to be built to the summit of Mt. Greylock; according to an act of the legislature the line is to be built within the next three years.

By the act of the State Legislature by which the New York, New Haven & Hartford R. R. took over the Berkshire Street Ry. Co., the management is required to make four important extensions within three years at a cost of $2,000,000. It is now said that these extensions are to be made as rapidly as possible and officials of the road are making plans for the work. The first of the extensions to be built is the line from Great Barrington to South Egremont, about 3½ miles, the construction of which has already begun. After that will come the extension south from Great Barrington to the state line some 12 miles. L. S. Storrs, Mutual Bldg., Springfield, Mass., is President.

The State Railroad Commission has been giving hearings on the petition of the Hampden R. R. Co., mentioned in our last issue, for a location certificate. According to information brought out at the hearing the road is feasible and practical from engineering and operating points of view. It was brought out that at the Connecticut river bridge, proposed for Holyoke, the masonry is planned for two tracks and the steel work for one track. The clearance is about 30 feet. The road will connect the Grand Trunk at Barretts Junction with Holyoke and Springfield, and it will also connect the Athol branch with Springfield. All rights of way, outside of Springfield, are 200 ft. wide, and provision is made for no grade crossings. Henry S. Durkee, Springfield, Mass., was the engineer representing the railroad.

The Connecticut River R. R. Co., has filed with the Railroad Commissioners a petition for permission to construct a mile and a half of track in Chicopee connecting that place and Chicopee Falls, crossing the river at Chicopee. William Whiting, Boston, Mass., is President and J. P. Snow is Chief Engineer of the company. The latter estimates the cost of the work at $77,000. The route as filed with the petition is as follows: It is to begin at Grattan street, near the Stevens Arms Company plant, and follows the curve of the Chicopee river, crossing land of Michael Shay, Edward J. Larry, Johanna Buckley, Celeste St. John, Raymond Noyes, J. Degray, John Ondirk and John B. Wood, with one-half of one degree descent curve. Beginning on land of Charles Chapin the descending grade is increased to over three-fourths of one degree. It continues across the land and on the adjoining land of James Patterson, makes a 15-degree curve, crosses the river on a steel bridge and joins the Chicopee Falls branch of the road.

Michigan.

Peppard & Co., Minneapolis, Minn., have been awarded a contract by the Chicago & Northwestern Ry. to build a spur to the Chicago Lake mine. The spur will start at a point near Jumbo just above Pentoga and run northeasterly to the Chicagon mine, probably touching the Blair, Michaels, Swanson and other properties on the way. E. L. Burrill representing the contractors, has been at Iron River to start the work.

Track laying on the Detroit, Bay City & Western Ry. being built for Handy Bros.., coal operators, Bay City, has been started. The road is graded through to within a mile or two of Caro. A complete work train outfit has been leased from the Grand Trunk Ry., the track laying machine comes from the Manistee & Northern, while the engine in use belongs to the Michigan Central.

George E. Bardeen, of Otsego, Mich., is to shortly ask a franchise to enter Kalamazoo with an electric railway which he proposes to build from Kalamazoo to Otsego to connect with one which will be constructed from Grand Rapids to Otsego.

The Muskegon Traction & Lighting Co. will shortly place 72-lb. rails on Pine St., from Western Ave. to Walton St., on Walton St., and on Sanford St., from Walton to the Fourth St. switch at Muskegon. Permission to make these and other minor improvements has been secured from the council.

The Escanaba Traction Co. is projecting a 6½ mile extension from its present line in Gladstone northerly through Kipling and Masonville to Rapid River. The extension will require two small bridges, about 40 ft. span, and an overhead crossing. Surveys have not been made as yet. Construction contracts will be let as soon as surveys are made and right of way secured. J. H. Stack, Escanaba, Mich., is President; D. A. Brotherton, Escanaba, is Chief Engineer.

Minnesota.

The Electric Short Line Co., E. D. Luce, President, has petitioned the City Council of Minneapolis, for permission to cross city streets to its proposed terminal at 7th St. and 3d Ave. N. Right of way except across streets is owned by the company through to the city limits at Glenwood park by way of the Bassett's creek valley, and it is announced 80 miles westward through Hennepin, Carver, McLeod, Meeker and Kandivohi counties. Grading has been completed for eight miles from the end of Western Ave. to a point just beyond Medicine lake, and it is said that track-laying will begin at once. It is planned to begin operating cars by Nov. 1 on this first leg of the line.

Alfred Millard, a capitalist of Washington, D. C., and J. McNelly, a railway promoter of Minneapolis, have been examining conditions at Brainerd with the idea of putting in another railway to the north of Brainerd, to develop the new country from Merrifield to Cross Lake. As proposed the line would also tap the Rainy River country and connect with the Minnesota & International railway at Brainerd or near it, run to Cross Lake, thence to Longville, and then perhaps in a northeasterly direction to Deer River, where connections would be made with the Great Northern. It is said that the line might be extended to International Falls.

The Duluth & Iron Range R. R. is building a northeasterly extension of the Spring Mine spur to Dunka River. The length of the spur is 20 miles, and Carl Hall & Son and John Runquist, both of Duluth, Minn., have just been awarded the contracts for the work. W. A. Clark, Duluth, is Chief Engineer of the Duluth & Iron Range R. R.

Engineers of the Chicago, Milwaukee & St. Paul Ry., according to advices from Fergus Falls, Minn., have surveyed a line through the southern limits of that city, curving to the northwest, crossing the river and the Northern Pacific tracks in the western outskirts. It is believed the crew is heading for Fargo and Moorhead.

Duluth and the Ranges.

By Peter E. Meagher

H. J. Lanferman spent a couple of days with us here recently and left for the East.

O. A. Lewellen, in charge of the Minneapolis branch of the J. I. Case Threshing Machine Co., was here with us recently. He reported business as being very good in his line.

J. D. Kelvie representing the N. Y. & N. J. Lubricant Co., spent a day with us here this week. He made a trip over the Iron Ranges, and was on his way to New York. Mr. Kelvie was agreeably surprised to find such a large amount of mining, stripping and construction work going on in this vicinity. He said he had no idea that there was as much of it as he found.

G. A. and F. R. Jones of Jones Brothers, contractors, Columbus, O., were visitors with us recently. They were up here looking at their work of stripping the Crosby Mine on the Iron Range. They reported all of their contracts in excellent condition.

C. J. A. Morris was a visitor, and said that they had just about finished their large contract on the Great Northern Railroad in North Dakota, and that their dock contracts in the harbor at Duluth and Superior were progressing very nicely, and all of them would be completed before the closing of navigation.

A. Berglund of Franzin & Berglund, subcontractors on the Canadian Northern extension into Duluth, was a caller a few days ago. He said they had their camps erected and would start work immediately.

Andrew Perrin of Carl Hall & Co., came in to see us and said his firm had just been awarded a contract amounting to six miles of work by the Duluth & Iron Range RR. Co., and that they would ship their outfit, erect camps, and would start on this work at once, and would rush same as fast as possible.

The Minnesota Steel Co., of Duluth, which is a subsidiary corporation of the Oliver Iron Mining Co., which is the steel corporation, took out a building permit last week from the city of Duluth amounting to $10,000,000. The fee paid the city by the steel corporation for this permit was $1,415. The Minnesota Steel Co. for the past year have had a large number of men clearing a vast tract of land on the outskirts of the city of Duluth, and have already erected a power plant and some other smaller buildings. The buildings will all be constructed of steel and concrete. The first unit, which is the blast furnace, consists of two steel stacks, eight hot blast furnaces, two casting houses, two hoisting engine houses, one stock house and bins, one gas engine blowing house, one electric power house, four concrete bins for granulating slag, one pig casting building, one ladle house, the by-product coke plant to have 110 ovens, one condensing house, one coal crusher and mixing house, one coal unloading station, one storage tank, one gas boiler, and tar ammonia tanks. The open-hearth plant will have seven furnaces, one main building, one mixer building, one gas producer house, one stock house, a laboratory and office building. The 40-inch blooming mill will have one soaking pit building and four pits, one main mill building, one engine house, one gas producer building, two reheating furnace buildings and furnaces. The 28-inch finishing mill will have one main mill building, one motor building, one hot bed building, one rail finishing building, one tie plate building, one splice bar building, one structural finishing plant, and one storage building. Another unit will be the combination mill and pumping station, one machine shop building, one plate shop building, one forge shop building, one foundry, one storehouse, a thawing-out plant, and all buildings needed for a complete cement plant. There will be gate houses, scale houses, round houses, and the miscellaneous equipment consists of gas and steam engines, turbines, boilers, heaters, condensers, motors, mixers, electric cranes, roll trains and tables, pumps, gas producers, derricks, gas and water mains, sewers, transmission lines, etc. It is also understood that the steel corporation have appropriated $20,000,000 in addition to the $10,000,000 already appropriated to be used in the construction of this vast plant. It is understood here that this work is to be started immediately. I do not know as to whether the Minnesota Steel Co. will do this work themselves or let it to contractors. At the time of this writing it is impossible to find this out.

Thomas Higgins of Higgins & McDonald, and his superintendent, Mr. Thompson, were callers last week. They have already started on their rock contract on the Canadian Northern extension near Duluth.

C. R. McLain was awarded a contract last week by the city of Chisholm, Minn. It was for concrete, and amounts to about $12,000. Work to be started immediately.

Peter Pastoret of Pastoret-Lawrence Co., was a caller, and said that they expected to have their large sewer contract at Rice Lake, Wis., completed in about 30 days, and their paving job in Duluth at the same time. Their various other contracts were in excellent condition, and they expected to have all of them completed this fall.

H. J. Cooper, concrete contractor, is idle at the present time, and is looking for some work. Any one having concrete work to let can address Mr. Cooper care of this office.

The labor situation at Duluth and vicinity at the present time seems to be in a very satisfactory condition. There are quite a few men here at the present time, and just about enough work to take care of them. There is quite a demand up here at the present time for foreigners such as Austrians, Bulgarians, and Italians. This office is very short of this class of labor, and could use 500 or 600 of them at the present time.

Contractors and others when in this vicinity are cordially invited to make the Labor and Equipment offices of Peter E. Meagher, 409 West Michigan street, Duluth, Minn., their headquarters while here. If you want to know anything, ask it.

Mississippi.

The Bonhomie Southwestern R. R. Co. mentioned in our last issue has been chartered. The company proposes to construct a line southwest and west from Hattiesburg to Columbia, making important tap connections for several existing lines. The incorporators are: W. S. F. Tatum of Hattiesburg, W. O. Tatum and S. E. Travis.

Missouri.

An ordinance has been before the City Council of Kansas City requiring the Metropolitan Street Ry. Co. to extend its 12th St. car line from Jackson Ave., the present terminus, to Winchester Ave.

According to an announcement reported to have been made by S. T. McDermott, Vice President of the Laclede, Dallas & Western

R. R., at Springfield, Mo., the road would ultimately extend as far as that city.

Montana.

The City Council of Belgrade, Mont., has vacated certain streets as requested by the Gallatin Valley Electric Ry. Co. of Bolzeman, Mont. This concession with the provision of lands for terminals is said to assure Belgrade a branch line of the road from Buckley's ranch south of Central Park.

The Chicago, Burlington & Quincy R. R. now has under construction a short cut-off, about 30 miles, from Scribner, Mont., to Fromberg on the Northern Pacific. It is expected that the cut-off will be completed early next spring.

Surveys for the new Great Northern line from a point near Moccasin to Lewiston, Mont., have been completed by the crew in charge of F. T. Howes. The route for which right of way arrangements are said to have already been made will now be inspected by A. H. Hogeland, Chief Engineer of the Great Northern, St. Paul, Minn.

Nevada.

Will Packard, of Reno, Nev., who has been contracting on tunnel work for railroads in Alaska, has gone to Montana, where he will take a contract for some tunnel work on the Hill lines.

Surveys are to be started by C. W. Kinney, Sand Springs, Nev., for a railroad 23 miles long connecting the Fallon-Hazen line of the Southern Pacific at Fallon with the salt deposits at Sand Springs, in Churchill County. Construction work will be started soon it is said and financial support will be obtained from J. Otis Draper and other New York capitalists.

New Mexico.

The Roswell, Tucumcari & Northern R. R. Co. is reported to have sold its bonds in New York City, thus assuring the construction of the road. Preliminary work on the road is to be started at once.

New York.

Preliminary work is reported well along for the proposed electric railway from Geneva at Port Gibson, which is to be built by the Syracuse Railroad Construction Co., a subsidiary of the Beebe interests of Syracuse. The proposed road would connect at Port Gibson with the R. S. & E., furnishing a Rochester-Geneva route over which limited cars would be operated. The road would be 12 miles long.

The Erie R. R. is planning improvements to cost $240,000 for Meadville, Pa., Jamestown, N. Y., and Kent, Ohio. Meadville yards are to be extended at a cost of $40,000. Jamestown improvements will cost approximately $60,000, while Kent is scheduled for an expenditure of $140,000. The additional trackage for the freight yards at Jamestown, it is said, has been ordered and will be pushed to completion, while plans and drawings for the improvements at the other points have been completed.

The D'Oiler Engineering Co., Philadelphia, Pa., has been awarded the contract for supplying steel lock gates, pumping plant, etc., bids for which were opened Aug. 16 by the U. S. Engineer at Buffalo.

The Board of Estimates of New York City has granted to the Forty-second Street, Manhattanville & St. Nicholas Avenue Ry. Co., Edw. A. Maher, General Manager, 65th St. and 3rd Ave., New York, a franchise to operate and construct extensions to its existing lines as follows: Beginning at and connecting with the existing tracks in Manhattan Street at or near the easterly line of Twelfth Avenue; thence by double track, curving westerly in and upon Manhattan Street to Twelfth Avenue; thence southerly to double track in and upon Twelfth Avenue to West 129th Street; thence curving easterly into West 129th Street to the central line of West 129th Street; thence easterly by single track in and upon West 129th Street to Manhattan Street, and thence connecting with the existing eastbound track in Manhattan Street.

North Carolina.

The Isthermal Traction Co., has completed surveys for its projected route from Gastonia, N. C. to Rutherfordton, 76 miles and will have surveys made from the latter place to Asheville, a distance of 46 miles. It is estimated that the cost of grading the roadbed from Gastonia to Rutherfordton will be about $4,000 per mile. The company is planning to build the link connecting Gastonia and Dallas this fall. Capt. K. S. Finch, Charlotte, N. C., and George C. McKay, Rutherfordton, N. C., are interested.

The Piedmont Traction Co. has applied to the City Council of Charlotte, N. C., for a franchise to enter the city with its interurban line. Considerable work has already been done on the South Carolina end of the line, the headquarters of the company for that section being at Greenville, S. C.

North Dakota.

Advices from Mandan, N. Dak., state that the last piece of grading work on the south line and the Cannon Ball-Mott line has been finished and contractors have left the work in condition for the commencement of track laying. All bridges between Mandan and Cannon Ball have been completed.

The Grand Forks Street Ry. Co. has completed surveys and has secured the capital for the construction of one mile of line at Grand Forks, N. Dak. It has not been decided when construction contract will be let. R. B. Griffith is President and A. E. Morrison, Grand Forks, N. Dak., is General Manager.

Ohio.

The acting mayor of Cincinnati has signed the ordinance giving the right to the Union Depot & Terminal Co. of Ohio to erect a $30,000,000 station in Cincinnati. The company, which will erect the station is headed by A. S. White, President, and John H. Bleekman, Vice-President and General Manager, both of New York City.

The Columbus, Urbana & Western Electric Ry. Co., Columbus, O., is said to have made arrangements to begin construction on the extension of the line from Fishingers to Dublin as soon as the right of way between these places had been secured. Material has been contracted for and the line will be rushed to as rapid a completion as possible. The company hopes to have cars running to Dublin before the first of the year.

Efforts are being made to have the Ohio Electric Ry. Co., of Cincinnati, extend its Lima-Defiance line into the business section of Defiance.

The Midland Power & Traction Co., W. A. Gibbs, General Manager, Cambridge, O., is soon to begin the construction of a new line from Byesville to Pleasant City. The line will be six miles long and will be all in Guernsey County. It will cost about $100,000, and is to be completed before the end of the year.

A new syndicate is reported to have been formed for the purpose of taking over the Cincinnati, Georgetown & Portsmouth R. R., at present operating 70 miles of line, and extending it from West Union to Portsmouth.

The Norfolk & Western R. R. has completed the purchase of 22 acres of land north of Circleville, over which it will build its double track.

The Lake Erie, Bowling Green & Napoleon Ry. Co. has made surveys for its projected 11-mile extension from Woodsville to Elmore and to Grand Rapids. The capital for construction has not been entirely secured as yet, and contracts will not be let until the balance of the securities is disposed of. E. H. McKnight, Bowling Green, O., is Chief Engineer and General Manager.

It is stated that as soon as the injunction against the issuance of $1,000,000 of additional stock of the Hocking Valley Ry. is lifted extensive improvements will be started. The most important of these is to complete the double tracking of the road from the river to Toledo. At the same time the terminal facilities, both in Toledo and Columbus, must be doubled to accommodate the increased business expected to follow. Among other plans for the Hocking Valley is the building in West Virginia of a line from the Point Pleasant terminal to connect with the Chesapeake & Ohio between Gauley, W. Va., and Portsmouth.

The Cleveland, Cincinnati, Chicago & St. Louis Ry. has begun receiving steel for relaying the track of the recently acquired Ohio Central R. R., between Berwick and Toledo, with 80-lb. rails. The double tracking of the line between Carey and Berwick, seven miles, is also under consideration.

The Mahoning Valley Street Ry. Co. has submitted a belt line proposition to the city council of Warren, O. The council is requested to extend the franchise for 25 years and allow the company to double track Market St. The company promises in return, if council so wishes, in three years, to cross the river with its tracks providing there is a suitable bridge and approaches at Summit St.

The Ryan Construction Co., which has the contract of making the new grade for the N. & W. double track work between Portsmouth and Wakefield, has completed its work between Portsmouth and a mile west of Lucasville and has moved its camp and headquarters from the Bannon farm to the M. J. Conwell place between Clifford and Wakefield where it will remain until the contract is finished.

Advices from Youngstown, O., state that steam shovel forces at the Ohio Works of the Carnegie Steel Co., have been ordered to start work on the belt line from the Ohio works and the Niles furnace to be known as the Youngstown & Northern Ry. It is expected that after this line has been completed the construction of one to McDonald Mills will be started. There has been rumors that the road will extend eastward in time to New Castle, where it may connect with the Bessemer railroad, controlled by the United States Steel corporation.

Oklahoma.

At a meeting of the directors of the Osage & Western R. R. at Fairfax, on Aug. 20, Joseph Osler of New York City and H. U. Wallace, consulting engineer, of Chicago, were elected directors. Work on the construction of the Osage & Western has commenced near Billings, Noble County, and will be carried on westward through Fairfax toward Pawhuska and Bartlesville. The Osage & Western is understood to be a Katy extension.

The Clinton & Oklahoma Western Ry., Guy V. McClure, Chief Engineer, Clinton, Okla., is reported to have arranged for a loan of $750,000 from an Eastern firm for the purpose of extending the line 100 miles further west into the Texas Panhandle. The proposed route is up the Washita River to Gem City, thence to Canadian, Tex., and passing through Cheyenne, Okla.

A bonus of $15,000 has been raised by the citizens of Buffalo, in Harper County, towards the construction of the Buffalo & Northern R. R., the incorporation of which was noted in our last issue. The plan is to build an extension for the Frisco northwest from Avard, Okla., to Woods, Harper and Beaver counties.

Grade stakes are being placed for a proposed extension of the Missouri, Oklahoma & Gulf Ry., north of Wagoner to Joplin, Mo., and Pittsburg, Kan., and thence to Kansas City. J. J. Harrison, Durant, Okla., is Chief Engineer.

Oregon.

The Oregon Electric Ry. Co., Portland, Ore., has preliminary surveys under way for its electric railway from Albany to Eugene. The work has been finished between Harrisburg and Junction City. It is proposed to cross the Willamette River about 600 ft. below, or north of the Southern Pacific bridge and the survey follows the Southern Pacific track to Junction City, entering the town on Greenwood St.

The Oregon Trunk Ry. Co., John F. Stevens, President, Portland, Ore., has filed amended articles of incorporation which outline its construction plans in Oregon. The amended articles show the purpose of the company to build and operate a line of railway from a connection with the Spokane, Portland & Seattle road, opposite a point near Celilo, Oregon, up the Deschutes River to Klamath Falls and also from a point on this line in township 35 south, range 7 east, in Klamath County, to the city of Medford, 70 miles, and also a line from a point in section 9, township 18 south, range 12 east, in a southeasterly direction through Crook and Harney Counties 155 miles to a point in township 26 south, range 33 east. The amended articles also will permit the corporation to build and operate other branch lines in Washington and Oregon, to purchase and operate steamboats, stage lines and other transportation companies, to purchase other lines, issue stocks and bonds and the like.

George Wilson, of Portland, has work under way at Olney on his grading contract in the Astoria Southern Ry.

The Harriman Lines, William Hood, Chief Engineer, San Francisco, Cal., have under way for completion this fall the following work, which includes bridges, new lines, block signals and depot buildings in Oregon: Branch line Crabtree to Lebanon, eight miles, $300,000; Beaverton-Willsburg cutoff, 14 miles, including steel bridge over Willamette river at Oswego, $1,200,000; Natron to Klamath Falls extension, 191 miles, known as the Oregon Eastern, appropriation for 147 miles (70 miles now being built—34½ miles south from Natron and 36 miles from Klamath Falls north), $9,830,000; Pacific Railroad and Navigation company lines from Hillsboro to Tilamook, 90.24 miles, $3,800,000; Deschutes road south from mouth of Deschutes river to Redmond in Crook county, 133 miles, $5,320,000; Lake Creek and Coeur d'Alene road from main line of the Oregon Navigation near Buckleys to Windy Bay and Lake Coeur d'Alene, 14 miles, $700,000; Oregon and Washington Peninsula tunnel from St. Johns branch of Oregon Navigation toward Stockdale, 2.7 miles, $680,000; St. Johns to Troutdale line, 16 miles, $515,000; Steel bridge at Portland for Oregon Navigation, $1,640,000; Eight steel bridges on Southern Pacific and Oregon Navigation lines, $377,000; new 90-ponnd steel rails for Southern Pacific and Oregon Navigation lines, $570,000; automatic signals, 100 miles, $110,000; line changes and passing tracks, $910,000; new passenger stations (eight) and new freight house at Portland, $153,000.

Engineers of the Oregon Short Line R. R. have been making soundings in Salt Lake to Antelope Island and this has given rise to a report that the work was preliminary to the construction of the Raft River cut-off, which would save 75 miles over the present route of this road between Salt Lake City and Portland, Ore. The cut-off would be a continuation of the Buhl branch through the level valley to the Snake River, thence through the box canyon west of Huntington down the Homestead Valley to Lewiston and over an all-water grade down the Columbia River to Portland.

Engineers of the Oregon Trunk Line are reported to be working in the vicinity of Klamath Falls, Ore., and it is expected that the line will soon be run into that city. A camp of about 20 surveyors is now situated at Rocky Point, and the road they have traced runs from the north through Klamath Reservation, past Rocky Point by way of Lake of the Woods and Four Bit Creek and on toward Medford. Some work has also been done toward Aspen Lake, which lies on this side of the Medford line.

Pennsylvania.

The Baltimore & Ohio R. R. has a crew of surveyors at work at McKeesport for the purpose, it is believed in that city, of devising some plan for securing additional trackage.

The Waynesburg & Blacksville Electric Ry. Co. has purchased land at Waynesburg for a freight depot and freight yards. The company is a subsidary concern of the Pittsburg & Blacksville Traction Co., of which W. M. Laws is President.

Surveys are underway for the route and grade profiles for the trolley line which is to connect the Philadelphia division of the Lehigh Valley Transit Co. at North Wales, Pa., with the Philadelphia and Western at Villanova. The syndicate, which is headed by E. B. Smith & Co., of Philadelphia, will let the contract for grading the route as soon as the engineers have drafted the specifications.

The Pittsburg, Butler, Slippery Rock & Grove City Traction Co. has applied for a charter and will have preliminary work completed this fall for its proposed line from Butler to Grove City. Final surveys are to be started soon and it is hoped to have everything ready for construction work by next spring. The company has franchises in Center, Franklin, Brady and Slippery Rock townships, Slippery Rock borough and in Liberty and Pine Townships, Mercer County and Grove City. Charles Gibson, Pittsburg, Pa., is one of the promoters.

Capitalists of Chambersburg are perfecting plans for building a trolley road between that place and St. Thomas. The company was chartered four years ago as the Chambersburg & Western, and surveys were made. The road will require 7½ miles of track and definite decision as to its construction will be made as soon as $100,000 of stock is subscribed. Over $90,500 of this has been subscribed.

Promotion work is reported as being well along for the proposed Meadville & Titusville trolley line and it is said that actual construction work may be started in the near future. F. F. Murray, Titusville, Pa., is interested.

The Lake Shore & Michigan Southern Ry. is reported to be considering building a road from Titusville to Franklin by way of Breedtown and Dempseytown to connect with the Franklin & Clearfield line. Some surveying has been done, it is said, and it is reported that the company contemplates starting construction soon.

Practically two-thirds of the grading work on the Pittsburg, Shawmut & Northern R. R. extension between a point near Knoxville to the Allegheny River and thence to Freeport has been completed. The contract for 14,000,000 lbs. of bridge steel has been awarded to the American Bridge Co. and erection work on the viaducts is under way. Along Mahoning Creek 36 miles represents very heavy construction, including four tunnels, aggregating over a mile in length, and four high viaducts. The maximum grade on the entire line of the Pittsburg & Shawmut from Hyde to Freeport, 102 miles, will not exceed 6-10 of 1 per cent. It is said that the Shawmut interests have made surveys for the continuation of the line from Freeport down the banks of the Allegheny River into Pittsburg. The Shawmut line would then come in above the Pennsylvania & Conemaugh division, making a terminal on the North Side.

Hyde & McFarland, New York, City, have been awarded the contract for the construction of the Lehigh Valley short line between Lumber Yard and White Haven. Hyde & McFarland have just completed a large iece of railroad construction for the Delaware, Lackawanna & Western R. R.

South Dakota.

The South Dakota Interurban Ry. Co., Bijou Hills, S. Dak., is planning to have surveys started about Sept. 1. The company has secured about 50 miles of right of way on the east end of the line and is planning to have actual construction work started this fall.

Capitalists of Aberdeen, S. Dak., have filed with the County Auditor, at Fargo, N. Dak., a blue print of the proposed line of the Dakota Southern R. R., which they are promoting. The route as laid out will be through Fargo from the northwest along the Red River through the town of Kindred and down through the counties of Hansom and Richland, thence along the Cheyenne River southwestward.

Tennessee.

The Board of Trade of Nashville, Tenn., is endeavoring to have H. H. Mayberry, Stahlman Bldg., Nashville, take up the matter of constructing interurban lines to Gallatin, to Clarksville and to Nolensville-Lewisburg.

The City Council of Chattanooga has granted a franchise giving the Chattanooga Ry. & Light Co. the right to lay new tracks on many important streets of the city. The privileges granted by this ordinance will allow many connections between present tracks. One important change will be a loop on the west side.

Promotion work is well along for the proposed electric railway connecting Nashville, Springfield and Clarksville. Joe Frank, John M. Gray and R. M. Wilson of Nashville; J. Parkens, of Franklin, are the proposed incorporators of the road, which is to be known as the Tennessee Rapid Transit Co.

The Southern Railway has asked bids for the construction of a subway at its crossing at Lamar avenue, in Memphis, Tenn. The work will contain approximately 18,000 cu. yds. of earth excavation and 1,000 cu. yds. of reinforced concrete abutment walls. This will be the first subway to be built under the new laws which were recently passed by the city of Memphis and which City Engineer goes on record as saying he will enforce to the letter. These laws provide for subways over a number of streets where dangerous crossings exist.

The Birmingham & Northwestern R. R., recently chartered, has elected the following officers: R. M. Hall, Dyersburg, Tenn., president; John L. Wisdom, vice-president; M. W. Ewell, secretary; I. B. Tigrett, treasurer. The company proposes to build a railroad from Jackson to Dyersburg. Much of the proposed route has already been surveyed and the map and profiles prepared. The final survey will begin at once. The city councils of Jackson and Dyersburg will be asked at their next meetings to call a special election at which the people may vote on the question of whether or not they will subscribe to the stock of the railroad. Jackson is asked to subscribe $75,000 and Dyersburg $50,000. The next meeting of the stockholders of the road will be held early in October, after Jackson and Dyersburg have voted on the question. John L. Williams, Jackson, Tenn., is Chief Engineer.

It is reported in Chattanooga, Tenn., that H. H. Shackelton, president and principal promoter of the Rome & Northern R. R., will ask the city for a bonus of $50,000 for the construction of a connecting link between his road and Chattanooga in order to give the city another direct line to Atlanta.

Surveys are now under way by the engineers of the Harriman, Knoxville & Eastern R. R. for the proposed new line from Harriman to Knoxville. Citizens of Harriman have subscribed $3,000 to the company for the purchase of the necessary right of way and terminal site. As proposed, the route will be 12 miles shorter than the other lines between the two cities.

Double tracking on the Knoxville division of the Southern Ry., between Citico and Sherman Heights, Tenn., is progressing nicely and according to advices from Knoxville, Tenn., the work between Chattanooga and Ooltewah will be completed within a few weeks.

Thrasher & Gunter, Chattanooga, Tenn., who have the contract for double tracking the Nashville, Chattanooga & St. Louis R. R., have five camps established and work progressing at a satisfactory rate.

Texas.

The State Railroad Commission will soon inspect and make valuation of the following branches of the St. Louis, Brownsville & Mexico R. R.: The Port O'Connor branch 89 miles in length, in operation since May 15; Tres Palacios spur to Collegeport, 17 miles long, nine miles of which is in operation and the remaining 8 miles to be completed within six months; Brownsville Belt, 12 miles in length, under construction, and Donna Sugar Mill spur, 2½ miles long, in operation. The company places on those lines a valuation of not less than $18,000 per mile.

Tracklaying has been started on the Galveston-Houston Interurban Ry. The work was started at Texas City Junction and will extend toward Houston, as the grading along this portion of the right of way has been completed and the engineers are about ready for the laying of the rails. This road is being constructed for the Stone & Webster Engineering Corporation, of which Mark Lowd, Houston, Tex., is Engineer.

Grading work has been started at San Marcos for the new street railway system in that city, franchise for which was granted several months since. The work being done now is grading for the tracks through the Westover addition in the west end of the city. It is expected the cars will be in operation by Jan. 1.

The Wootan Wells Short Line R. R., a narrow gage line, 2½ miles long, connecting Wootan Wells and Wootan is to be made standard gage. The material is said to have been purchased and it is understood that work will be started at once. M. D. Watson is President.

Tracklaying on the Temple Northwestern Ry. was started at Temple on Aug. 24 and is to be pushed as rapidly as possible as the steel for 30 miles of track has nearly all been loaded on cars. It is expected to have the road in operation as far as Gatesville by Oct. 1 and from Temple to Comanche by Jan. 1.

The Texas-Mexican Ry., M. M. Lyendecker, General Superintendent, Laredo, Tex., is said to be planning to extend its line to Aransas Pass. It is stated that preliminary surveys and estimates of cost for grading and construction work have already been made over this line from Robstown to Aransas Pass, and that a recent visit of officials was to perfect the plans prior to making reports to higher officials of the National Lines of Mexico, who will consider from a commercial standpoint the proposition of enterting the new port.

The International & Great Northern R. R. is said to be considering building a branch line from Cotulla down the valley of the Nueces River.

According to information received from Comanche, Tex., the surveyors of the Cotton Belt Ry. have finished their preliminary survey and now have the projected line located from Hamilton to Comanche. It is believed in that vicinity actual construction work will be started soon.

The Crystal City & Uvalde R. R. has had its charter amended so as to provide for an increase of capital stock from $65,000 to $100,000, and also for an extension of the road from Crystal City to Gardendale. E. Breaker, Crystal City, Tex., is Chief Engineer.

The annual meeting of the stockholders of the Quanah, Acme & Pacific Ry. will be held at Quanah on Sept. 16, and at this meeting it is expected that C. E. Engsminger, Chief Engineer, Quanah, will submit final survey reports on the proposed southwestern extension between Paducah, the present terminus in Cottle County, and El Paso, via Roswell. It is believed that Engineer Engsminger will recommend a survey across and up the caprock other than the old Ash Mead survey.

The Gulf, Texas & Western Ry., B. B. Cain, General Manager, Jermyn, Tex., is to build a spur from Jermyn to the coal fields near that city.

Residents of San Saba County, Tex., have subscribed $13,720 in cash for the right of way for the proposed line of the Houston & Texas Central Ry. Co. Advices from San Saba, Tex., are to the effect that work is progressing rapidly.

Advices from Bonham, Tex., state that the laying of heavy steel has been resumed by the construction crew on the east end of the division of the Texas & Pacific R. R. and work will be pushed on to Whitesboro. This work was started last year but was stopped at a point near Blossom, east of Bonham, Tex.

Advices from Stamford, Tex., are to the effect that H. L. Erisman, Field Engineer of the Stamford & Eastern Ry., is busy organizing a crew for making the preliminary survey of the projected line.

Grading on the right of way of the Kansas City, Mexico & Orient R. R. north of Fort Stockton was started early this month. Steel has been already laid to Mertzon. Rush orders have been issued to the grading crews and it is expected that the gap between San Angelo and Fort Stockton will soon be built. When the line is completed to Topolobampo, the system will include 1,659 miles of trackage.

The surveying crew of the Texas North & South R. R. has passed through Brady, Tex., and are now pushing toward Coleman. As the land is quite level between the latter points it is probable that the work will require less time than other sections, such as in Kendall County. It is stated that grading contracts will be let soon for the work beginning at the southern terminus.

Blue prints have been completed for the enlargement of the Cotton Belt Ry. yards in east East Waco, Tex. It is found that the work will be far more extensive than at first supposed and that it will necessitate the expenditure of a large amount of money.

Grading on the Fort Worth & Rio Grande R. R. from Brady to Menardville, Tex., is progressing in a satisfactory manner. The line is almost completed to the new town of Callan, about 14 miles northeast of Menardville. Contractor E. B. Hutchins has the heavy work along the San Saba River nearly completed.

Surveys have been about completed for the line of the Brownwood Southwestern R. R., from Brownwood to Rockwood, 30 miles. It is reported that grading contracts will be let soon. R. A. Love, Brownwood, Tex., is the promoter.

The Fort Worth & Denver City Ry. Co., R. C. Gowdy, Chief Engineer, Fort Worth, Tex., is reported as about ready to have extensive improvements started at its yard at Wichita Falls. The improvement will involve a considerable amount of concrete work.

Utah.

The County Commissioners at Logan on Aug. 22 took up the application of Leo Nielsen, representing Ogden and Salt Lake capital, and officials of the Logan Rapid Transit Co. for a franchise for a line to connect with the line in course of construction from Ogden. The line Nielsen proposes to construct and operate will run from Wellsville to Highland, Millville, Providence, Logan, Greenville, Hyde Park, Smithville, Richmond and Lewiston. He also asks for a franchise for a side line to Paradise and the south end of the county.

Good progress has been made with the construction work on the Bingham & Garfield R. R. The tunnel between Markham Gulch and Freeman Gulch, which is to be 1,400 ft. long, had, on the middle of the month, been driven more than 100 ft. by the Meyers Construction Co., and the 2,100-ft. tunnel between Freeman and Smelter Gulches has been driven fully 175 ft. Some work has been done upon the two remaining tunnels on the route. Considerable grading has been done the entire distance. It will doubtless be a year, however, yet before the new road will be ready to handle ore.

It has been announced by the officials of the St. George, Iron Mountain & Grand Canyon R. R. that surveys have been completed for the line and that construction work will soon be started. M. Maxwell, Beaver, Colo., is interested.

Virginia.

Surveys have been started for a proposed railroad between Roanoke and Floyd Courthouse.

At a meeting held recently at Heathsville an executive committee consisting of the following were appointed to take steps for the construction of a railroad down the Northern neck of Virginia: Joseph W. Chinn, Jr., chairman; Dr. B. H. B. Hubbard, Edwin Broun, William Blundon, C. Harding Walker, F. C. Booker and Wat. T. Mayo, with Asa S. Rice as secretary and treasurer. This committee will go to work at once to secure the right of way through the Northern Neck counties, and get subscription from persons owning lands within five miles of the proposed road. The proposed road will start from the Chesapeake and Ohio Ry. at Hanover Courthouse and run through King William, King and Queen and Essex to Rappahannock, where it will cross the Rappahannock river, running thence through Richmond county just above Warsaw, touching the southern part of Westmoreland and passing down near the dividing line between Lancaster and Northumberland to Sandy Point Harbor, near the mouth of the great Wicomico River.

Washington.

J. D. Crary, Aberdeen, Wash., is promoting the building of an electric railway between the Willapa Harbor Country and Grays Harbor. The former owners of the Grays Harbor Power Co. are said to be back of the project.

John Rosene, Seattle, Wash., formerly head of the Guggenheim interests in the Northwest and Alaska, is said to be contemplating constructing 60 miles of railroad into the territory lying northwest of Skagway. It is said that he has a force of mining experts and engineers at work figuring possible tonnage and ascertaining the best route for a railroad.

The Northern Pacific R. R. is said to be planning to construct a new round house and car shops in Pasco, Wash.

Advices from Tacoma, Wash., state that on August 15 the joint line of the Oregon & Washington Ry. and the Chicago, Milwaukee & Puget Sound Ry. was thrown open for operation through Gray's Harbor Country. For two years the companies have been engaged in the building of this line. From Centralia to South Aberdeen the construction was done by the Harriman interests and from McKenna, on the Tacoma Eastern, the Milwaukee built to meet the Oregon & Washington's line at Portolla. From Portolla to South Aberdeen the line is owned jointly by the Oregon & Washington and Milwaukee, the entire road being built on a low grade. Owing to the difficulty of securing a suitable right-of-way across the Chehalis at Aberdeen the road has not been extended to Aberdeen proper and Hoquiam, but that is expected to follow soon, and it is generally supposed it will be even further extended.

Condemnation proceedings have been started by the Tacoma Eastern R. R. Co., a subsidary concern of the Chicago, Milwaukee & Puget Sound Ry., to obtain right of way for its extension southward to the Cowlitz River. The survey of the new line follows closely the route of the North Coast projected line and is designed to serve a heavily timbered territory. John Bagley, Tacoma, Wash., is General Manager.

West Virginia.

The Baltimore & Ohio R. R., A. W. Thompson, Chief Engineer, Baltimore, Md., is planning to have work started shortly on an extension of the Paw Paw branch to a new mine to be opened below Rivesville. To reach this mine it is necessary for the B. & O. to run its line through the village of Rivesville and the undertaking will be an expensive one. It is said that all of the rights of way have been secured.

The Roberts & Schaeffer Co., Chicago, Ill., has been awarded a contract by the Baltimore & Ohio R. R. for constructing a coaling station at Sir John's Run, W. Va. The station is to be reinforced concrete construction.

Information has been received from Dobbin, W. Va., to the effect that the Parsons Pulp & Paper Co., will extend its railroad about 30 miles. E. C. Abernathy is Superintendent of the company which operates a line at the present time 19 miles in length.

The successful bidder for the tunnel work on the Baltimore & Ohio R. R., near Grafton, W. Va., mentioned in a recent issue of Engineering-Contracting, was Bennett & Talbot of Greensburg, Pa. The contract price for the work including three miles of track was $2,000,000.

Wisconsin.

An attempt may be made by the common council of Milwaukee, through the city attorney, to compel The Milwaukee Electric Railway & Light Co. to operate cars on the double trolley system to prevent electrolysis to water pipes and conduits.

It now looks as though the Chicago & Northwestern Ry. would soon resume work at Tunnel City. The negotiations with the Milwaukee road on the proposition for an open cut for both roads are said to have failed and it is probable that the Northwestern will now go ahead with the original plan for a tunnel north of the Milwaukee road's tunnel.

The Fairchild & Northeastern Ry. Co., N. C. Foster, President, Fairchild, Wis., has applied to the State Railroad Commission for permission to extend its line west from Fairchild through Eau Claire County into Dunn County to a junction with the Chicago, Milwaukee & St. Paul Ry. If the permit to build is granted it is understood that work will commence on the extension at once.

The Racine Country Club, of Racine, Wis., is planning to obtain a right of way from the main line of the Chicago-Milwaukee electric line to the club grounds, a distance of two miles. If successful, a line will be built and power obtained from the Chicago-Milwaukee line to operate the cars. Then a franchise will be sought to build east from the club's property and into the business district of Racine. This would give the Chicago-Milwaukee line an excellent entrance into that city.

It is reported that financiers of Tomah, Wis., are making arrangements for the extension of the railroad between Wilton and Ontario to that city.

The Prairie Farm & Southeastern R. R., of Prairie Farm, Wis., has begun construction work near Emerald on its proposed steam road from Prarie Farm to that place. This railroad is being built by the farmers and business men directly on the line.

Canada.

The Hamilton, Waterloo & Guelph Ry. Co. is reported to have secured sufficient financial backing in London, England, to assure the construction of the line. John Patterson, Hamilton, Ont., is the promoter.

The Canadian Northern Ry. has submitted plans to the St. Boniface, Man., council for the proposed subway which it is to build on Tache St. The plans provide for a 40-ft. subway to be built entirely at the expense of the railway.

According to a statement of C. M. Hays the Grand Trunk Pacific management expects to have the main line completed into Prince Rupert in 1912, or 1913 at the latest. The rapidity of construction hinges upon labor conditions, which this year have been very unfavorable. On the main line and prairie branches construction gangs are deficient to the number of 5,000 men. Two exploratory parties are now engaged making a reconnaissance in connection with the proposed branch from the main line to Vancouver. One party is working south from a point near Fort George. This would indicate that its starting point may be farther east than was originally proposed. The other party is working north from Lytton. The determination of the route into Vancouver, whether by way of the Lillooet country, branching off from the Fraser above Clinton, or by way of Lytton, has been left for future consideration. Construction will not be undertaken until the main line is completed. No purchases of terminals or waterfront in Vancouver or vicinity have been or are contemplated at present. False Creek as a terminal is still regarded with favor by the management.

It is reported that construction work will be started soon on the Alberta & Great Waterways Ry., which is surveyed to run from Edmonton, Alberta, to Fort McMurray. W. R. Clarke and J. A. L. Waddell, both of Kansas City, Mo., are president and chief engineer respectively of the road.

The Kettle Valley Lines (Spokane & British Columbia Ry.), E. M. Holland, General Manager, Republic, Wash., is reported to have awarded a contract for an extension from Rock Creek to Bull Creek, on the west fork of Kettle River, a distance of 35 miles, construction work to be started early next month. The building of a 25-mile section of the same road from Merritt south through Nicola Valley is in progress. The company has authority to extend its line from a point south of Merritt across the Hope Mountains to Ruby Creek, below Hope. At Ruby Creek, after bridging the Fraser, connection will be established with the Canadian Pacific railway, with whose tracks it already connects at Midway and Merritt.

The Grand Trunk Ry. is making preparations for the improvement of its roadbed in western Ontario by laying 90-lb. rails in place of the 80-lb. steel now in use. The section between Chatham and Windsor will be the first to be reconstructed.

Officials of the Canadian Pacific Ry. at Winnipeg, have announced that the double track between Winnipeg and Portage la Prairie will be in operation by Sept. 15. Double tracking will be continued to Brandon, grading being under way, and steel may be laid this year if conditions are favorable.

Instead of double tracking its line from Smith's Falls to Peterboro as originally planned, the Canadian Pacific Ry. is now said to be planning in the near future to build an entirely new road west from Smith's Falls to Toronto through a country a part of which at least is not at present served by a line of railway. A survey party has been looking over the country between Smith's Falls and Belleville, and everything is said to have been practically arranged for the building of a line between these two points and from Belleville to Toronto. The survey is already made from Belleville to Toronto. The new line will run north of the Rideau Lakes, the present line being in all probability used to either Perth or Bathurst, and the new line would be run from either of those points.

The Canadian Northern Ry. is reported to have completed arrangements with the Council of the city of St. Boniface, Man., for extensive improvements there within the next two years, including a large roundhouse, storehouses, coal warehouses, freight sheds, the Union Depot to be shared with the G. T. P., and a new traffic bridge to be built across the Red River from Winnipeg. The total improvements will cost over $1,000,000, and the company has signed a bond guaranteeing the completion of the work within two years.

A jury at Weyburn, Sask., which has been investigating the death of D. M. McLean, the sub-contractor on the G. T. P. near Cordeax, about 18 miles from Weyburn, has returned a verdict that he came to his death by the accidental discharge of a gun. The position in which the body lay when found, the direction the shot took through the body, and other minor details, led to the decision that it was purely accidental, and not suicide, as was reported. The body has been buried in the Weyburn cemetery, and a brother has taken over the sub-contract and is proceeding with the work.

Mexico.

Bids will be received until Sept. 10 by H. M. Taylor, Director of Construction of the Ferrocarriles Nacionales de Mexico, Buenavista Station, City of Mexico, covering furnishing of material and construction complete of station building at the City of Colima, State of Colima. A certified check payable to the Ferrocarriles Nacionales de Mexico for $4,000 must be attached to the bids.

The Mexican Northwestern Ry., B. H. Bryant, Chief Engineer, Casas Grandes, Chihuahua, Mexico, has begun work on a spur from the main line of the El Paso Pearson line, to the mines of the Candelaria Co., from the station at San Pedro. Work is also to be started soon on a 20-kilometer branch from San Antonio to Cusihiariachua.

Bids will be opened Sept. 2 at the office of H. M. Taylor, Director of Construction, Buena Vista Station, City of Mexico, for clearing, grading and masonry covering proposed branch line for the Interoceanic Ry. Co. between Oaxaca and Tlacolula, state of Oaxaca, a distance of 33 kilometers. Bidders will be required to accompany bid with a certified check for $10,000, payable to the Interoceanic Ry. Co. of Mexico.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

O. O. McDonald, Cloverdale, Ind., who has the contract for ditch work in the Yellow Banks Drainage District, has received several cars of machinery to be used on the work. Two boats will be used on the job. One of the boats will be launched at Elaine and the other at Wabash. The former boat will work up to Johnson's Canal and then float down and finish the Yellow Banks ditch, a distance of 21 miles. The latter will begin work at Wabash, at the head of Cypress ditch, and work down to the river, a distance of 15 miles. The contractor has 18 months in which to complete the work, which will cost about $65,000. These two ditches, when completed, will drain and levee about 65,000 acres of farming land. The average depth of the ditches will be about 10 feet, with a 1-to-1 slope. The width at the bottom of the ditches will be from 10 feet at the source to [illegible] at the mouth.

California.

The Sacramento Valley Colony Co. has filed papers at Red Bluff appropriating 5,000 ins. of water in the Sacramento River at the point where Hoodlum Chut and Jackstaff Bend join. The water is to be diverted by means of pumps on the west bank of the river and will be used in irrigation in Tehama and Glenn Counties. This company recently purchased from the Herbert Kraft Co. a large tract of land along the Sacramento River in the Capay Rancho, in Tehama and Glenn Counties.

Colorado.

Plats for a number of reservoir sites have been filed at Greeley by Rollo Wilson of Denver, President of the North Poudre & Weld County Reservoir & Ditch Co. of Denver. The system contemplates the building of 14 reservoirs in Weld and Larimer Counties, costing $2,000,000, the enlargement of the Harrigan and various reservoirs owned by the North Poudre Irrigation Co. of Greeley. If this project is carried out, it will provide irrigation for thousands of acres adjoining and north and east of Carr in Weld County, as well as a large acreage in eastern Larimer County.

The directors of the Lower Latham reservoir are planning to extend the present dam 3 ft., and built a concrete wave wall 6 ft. high. The Lower Latham reservoir is a flood water proposition east of Evans and supplies a large acreage in the vicinity of Kersey and eastward.

The Riter-Conley Co., Pittsburg, Pa., on Aug. 26 was awarded a contract by the U. S. Reclamation Service for furnishing the following pipe for the Uncompahgre Project, Colo.: 3,808 feet riveted ingot iron pipe, 26 in. inside diameter, at $4.01 per foot; 1,416 feet rivited steel pipe, 36 in. inside diameter, at $5.48 per foot.

Indiana.

A petition has been filed in the Circuit Court at Washington, Ind., for the dredging of 35 miles of Prairie Creek and its tributaries in the northern part of Daviess County. The estimated cost of the project is nearly $70,000, and it will probably be done.

Kansas.

W. B. Hazen, C. E., St. Joseph, Mo., has made a report to the Commercial Club of Frankfort, Kan., regarding the construction of a levee at that place. The work will include building ½ mile of levee running about 250 cu. yds. per station; four storm sewers 50 ft. in length each, with back pressure valves on each; removal of an old dam, and clearing the Black Vermillion River of debris. The estimate cost is $4,350. It is proposed to try to raise the funds by subscription.

The Kaw Valley Drainage Board of Kansas City, has awarded contracts to G. A. Butcher and Joyce Bros. Contracting Co. for building a dike to extend along the north side of the river from Matoon Creek, west of Kansas City, Kan., to the 5th St. bridge. The dike will be four miles long, and will range from 17 to 20 ft. in height. It will be constructed of earth, and will later be faced with revetments of stone or concrete. The dike, exclusive of the revetments, will cost $20,000. As soon as the contractors finish their work of throwing up the earthen embankments, the board will let the contracts for covering the surface of the dikes facing the river with concrete. A movement now is on foot to sell the entire $1,250,000 issue of bonds voted to improve the river. As soon as the bonds are sold the board will be in a position to push the work of widening and deepening the channel, and will not be handicapped as it has been by the lack of funds.

Louisiana.

The Police Jury of the Parish of East Baton Rouge, Baton Rouge, La., has been petitioned to take steps for a proposed bond issue of $375,000 to be raised by a 2½ mill tax for 40 years, to be devoted to good roads and drainage and to a court house and accessories in the parish seat.

Mississippi.

The Judicial Court at Winona, Miss., has awarded a contract to build levee in Poplar Creek Swamp, on Bill Biggers' road, across pond, to H. M. Biggers at 17½ cts. per cu. yd. The contract to build a levee in Poplar Creek Swamp, Slough bridge, was let to H. M. Biggers at 14½ cts. per cu. yd.

About September 20, Capt. Clarke S. Smith, in charge of Third District Mississippi River Improvement, will let contract for the construction of approximately 200,000 cubic yards of levee enlargement work in Lower Yazoo Levee District. The work will begin at station 1717 and extend to station 1900 and will be all riverside work, while standard United States Government specifications will apply. This levee begins a short distance below the work being done at present on the Riverton Loop by the construction firm of Lawrence Brothers and traverses some extremely heavy Mississippi swamp lands. The exact date of the letting to be announced later.

New York.

Bids were opened Aug. 23 by the State Superintendent of Public Works at Albany for Barge Canal Contracts Nos. 67 and 79. Contract 67 provides for the reconstruction of the locks at Lockport, and Contract No. 79 for the construction of a bridge over the Oswego Canal at Bridge St., Oswego. Five bids were received for Contract No. 67, the lowest bidder being Larkin & Sangster, of St. Catherines, Ont., whose bid was $1,149,401 as against the engineer's estimate of $1,290,880. The other bidders were: Smith, McCormick Co., Easton, Pa.; S. Pearson & Son, Inc., New York; MacArthur Bros. Co., New York, and Buffalo Dredging Co., Buffalo. Larkin & Sangster, the low bidders, have been engaged on the Canadian canals and locks for the past 12 or 14 years. There were five bidders also for Contract No. 79, the lowest being Lupfer & Remick, of Buffalo, whose bid was $37,480 as against the engineer's estimate of $39,735. The other bidders were: M. Fitzgerald, Hoosick Falls; E. J. Doyle & Co., Albany; United Construction Co., Albany, and the G. & W. Mfg. Co., New York. The work embraced in Contract No. 27A, being that portion of the contract work at Fort Edward originally embraced in Contract No. 27, left unfinished, was advertised, but no bids for the work were received on Aug. 23.

Ohio.

The Foohey Dredging Co., Fort Wayne, Ind., has been awarded the contract at $65,500 for the dredge work for the widening, deepening and straightening Little Scioto River. Bids were opened at Marion, O., by Ed. S. Ault, County Surveyor. Other bidders on the work were: W. A. D'Arcy, Dayton; Ed. Rodette, Toledo; R. H. and G. A. McWilliams, Chicago; Gilmore Brothers, Toledo; Walcott Dredging Co., Walcott, Ind.; H. N. Oberlander, Bucyrus; E. C. and A. J. Brady, Marion; Yoder & Swartz, Nappanee, Ind.; J. L. Taylor, Monticello, Ind.; E. D. Barr, Potterville, Mich., and C. H. Sternberg & Co., Chicago. The sale of the team work on the improvement will be made within a few weeks.

Memphis, Tenn., and Vicinity.

(Regular Correspondence.)

J. W. Williams has taken contract from Jimmy Omberg for the excavation of the Corlinia subway, which is a part of Jimmy's Union Station contract. Jimmy is wearing a happy smile these days, when his large contract is making such fine headway.

Brinkley Snowden is now putting down his first batch of Bithulitic pavement on his new Bayard subdivision. When Brinkley gets all his streets finished and his terraces complete, he will have one of the finest pieces of residental property in the South. Charlie Lowrance did the grading on the property and did it to a Queen's taste, too.

Russell Martin states he will have something good to offer Memphis street contractors within the near future. All ears are pricked when Russell speaks, for he seldom fails to make good his advance bulletins. Russell Martin had perhaps built more subdivisions than any man in the South and from all indications he will be building them for many days to come.

"Spike" Hennessey, formerly of this city, and now in charge of the Metropolitan Construction Co. operations at Fort Worth, Texas, wrote to an old friend the other day and gave glowing reports of the good work being done at Fort Worth. It will be remembered that "Spike" was one of the brightest young men in the operating department of the Illinois Central R.R. in this city. "Spike" states that the only regret he has is not being able to take all his old railroad friends to Fort Worth. He doubly regrets not having jobs to give them all. "Spike" promised to return for a short visit in the latter part of September.

W. D. Miller moved his outfit to Pickney, Ark., last week, where he has taken a contract from the St. Francis Levee Board for about 25,000 cu yards. "Dunc" has always liked good work and can tell it the minute he casts his eyes over a contract.

Bob Leonard has largely increased his forces on the St. Francis Levee in Arkansas and expects to complete his job early in September. Bob seldom fails to make good a statement of this sort.

Hemingway & Adams have sublet some work from George Lacy in the White River levee district.

G. C. Price has rented a number of his biggest mules to H. P. Streicher for use on some of the latter's city work. The balance of Price's teams will be rented by Ed Manigan for the same sort of work.

Last Thursday the steel hull steamer Kate Adams had aboard one of the large outfits belonging to Lowrance Bros., which was bound for Rosedale, Miss., where Charlie Lowrance is to do some work for Roach & Stansell. The big mules and large grading machines loaded the boat pretty well to the guards. Charlie states he will ship his engines by rail.

Jim Cary has sublet from Bob Cheshire about 200,000 yards of country road work, which is reported to be begun at once. And Jim can make the dirt fly when he gets well started.

H. N. Rogers has moved his outfit on a contract for the St. Francis levee board near Pickney, Ark., and from the stories told about the contract, the dirt is simply jumping into the large levee. Harry is a hustler, all right and will make dirt jump if any one can.

Bob Leonard was in town the other day and says he is doing some pretty work on the large protection levee which he is building around the city of Helena, Ark. Bob states that when he has completed this large embankment, the citizens of this prosperous little town need entertain no fears from future high waters, which have played such havoc in the northern portions of the city. Bob will be very proud of his reputation of having conquered the ravages of the big river. Aside from this, Bob has built the city a very nifty street car line, which is a great boon to a booming town like Helena.

When P. McCadden and his hustling sub-Contractor T. S. Shields complete the levee which they are working on below Helena and when George Lacy will have finished the connecting link which he is putting up near Dawson, Ark., all that fertile land contingent to the city will be amply protected from future floods and those living behind can draw a sigh of relief.

A prominent official of the N. C. R. R. states that the sub-ways in Memphis will be begun within 30 days. This will be greatly due to City Engineer Weatherford, who has left nothing undone to make the railroads fulfill the contract which they have entered into with the city of Memphis.

Local contractors have been having a great deal of trouble in getting experienced engineers for their traction engines and concrete mixers and it is reported that a committee of contractors will be organized this week to wait on Mayor Crump and have him change a city ordinance which requires contractors to use union labor on their engines and mixers. It seems that the Unions here at Memphis were not able to supply skilled engineers and when the contractors attempted to work non-union men who were competent the Union leaders had the laws enforced and as a result the contractors underwent a serious hardship. One prominent contractor is reported to have paid two union engineers to sit in the shade at $4.00 per day while a non-union man ran his engine. However, the Unions promise to import some skilled engineers and the contractors look forward to a brighter situation.

There will be a big opening for "muckers" and drain-ditch men in this territory within the next 60 days when the large government contracts let on the 8th, are begun. At present this class of labor is very scarce, and those that are in the city are holding out for unusually large salaries. However, when the "hobo" begins to come South with the Teal and Mallard, the situation will take on a better front and all the ditchers necessary can be secured.

L. C. Dulaney, who is working near Greenville, Miss., reports his contract getting along as well as could be expected, and this means much, for L. C. only expects big things. L. C. is at present very much interested in the senatorial race which is on in Mississippi, but not too much so as to cause him to lose interest in his large levee and railroad contracts.

J. W. Coburn has just completed a large culvert job at the corner of South Third and Webster streets. The work is pronounced to be an exceptionally fine piece of concreteing.

Lewis Kavanaugh, one of the best known contractors in this section has journeyed all through Canada and the Western coast cities in order that he might get a good idea of what will be doing in construction circles next spring. And Lewis is bubbling over with good tidings. He says the Canadian railroads will spend large sums next season, while all indications point to the fact that our Western roads will do the same. Then too Lewis had an eye to street paving, for son, don't you know that Lewis is Vice-President of the Metropolitan Construction Co., which company is simply eating up Southern street work. Lewis says the South is big enough for him, but that the Western partners of his must be kept in work too.

Sam Walker is going right along with his local sewer contracts and expects to have them all finished by the first of the year.

J. H. Weatherford, City Engineer of Memphis, was in Chicago Saturday last to attend a meeting of the society of Municipal Engineers of which he is Vice-President. While Heiskell was away, his job was held down by Assistant Engineer Pashby.

Big Bill McTighe, in charge of the sewer construction department of the city, states that he has all his work pretty much in hand and that the various contractors are digging some. Like to know who wouldn't dig when Bill was over him?

All the gravel contractors are complaining of the lack of gravel. They say they cannot get nearly enough gravel from the pits even though they are willing to pay any price. This fact, some say, is largely due to the car shortage which exists on the N. C. & St. L. railroad. That road hauling into Memphis the majority of the gravel being used for city work.

W. E. McGhee has secured contract from the City of Memphis for resurfacing a number of brick streets with asphalt and to date Billy has made some great progress. It makes a very pretty street, too.

Don McRea, the popular city engineer of Little Rock, Ark., was in town last week for a day renewing old acquaintances. Don says he likes municipal work very well and it has quite a fascination for him. While Don was with the Rock Island he was considered one of the shining lights in the engineering corps.

Texas.

The Commissioners' Court at Brownsville has established Cameron County Drainage District No. 1 and an issue of drainage bonds has been provided for. The amount to be covered by these bonds is $204,600. They will yield 5 per cent interest and will run five to thirty years. The maximum tax was assessed to take care of these bonds, 15 cents on the $100, and a sinking fund of 2 per cent provided. The estimated area to be drained by this improvement is 81,000 acres, assessed in 1909 at $875,618.

Utah.

The city of Salt Lake will probably take steps soon for the covering of the South street canal. A. F. McGonagle is City Engineer.

The Davis & Weber Counties Canal Co. of Ogden, will have work started early this month on the lining of its canal with cement. The Gillis Construction Co., Salt Lake City, as previously noted, has the contract for six miles of the canal and Doil & Co., Ogden, has two miles. James G. Wood, Clearfield, Utah, will superintend the work for the company.,

Washington.

Advices from Pasco, Wash., state that surveys are under way in that vicinity for an irrigation project in the Columbia valley, which will furnish water to a section large enough to accommodate 6,000 new homesteaders. The water will be taken from the Columbia river at Priest rapids and carried on the 200-ft. level.

MISCELLANEOUS CONSTRUCTIONS

Alabama.

✣Bids will be received until 1 p. m., Sept. 16, by Capt. H. B. Ferguson, Montgomery, Ala., for dredging at entrance to Saint Andrews Bay, Fla.

✣Bids will be received until 11 a. m., Sept. 23, by H. Jervey, Maj. U. S. Engineers, Mobile, Ala. for dredging in harbor at Mobile Ala

Connecticut.

✣Bids will be received until Sept. 23, by U. S. Engineer, New London, Conn., for the furnishing of insulated cable.

✣Bids will be received until noon, Sept. 8, by New Haven Water Co., 100 Crown St., New Haven, Conn., for the construction of an earth dam with concrete core wall and spillway, containing about 3,500 cu. yds. of rolled earth embankment and about 900 cu. yds. of concrete; a 5x5½-ft. concrete conduit about 1,500 ft. in length; a 5x5½-ft. reinforced concrete inverted siphon about 1,000 ft. in length; and about 1,700 lin. ft. of 6-ft. rock tunnel lining. A. B. Hill is Engineer.

District of Columbia.

✣Bids will be received until noon, Sept. 22, by Lieut. Col. W. C. Langfitt, U. S. Engineer, 920 17 St., N. W., Washington, D. C., for dredging Lower Cedar Point, Md., and in Upper Machodoc and Dymers Creek, Va.

✣Bids will be received until noon, Sept. 8 by William Crozier, Chief of Ordnance, Washington, D. C., for furnishing armor for two 14-in. gun turrets, model 1909.

✣Bids will be received until noon, Sept. 30, by William Crozier, Chief of Ordnance, Washington, D. C., for furnishing two 14-in. gun turrets, model 1909.

✣Bids will be received by William Crozier, Chief of Ordnance, U. S. Army, Washington, D. C., until noon Sept. 5, for furnishing electrical apparatus for two 14-in. gun turrets, model 1909

✣Bids will be received until Sept. 2, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing one sluice gate, 24-in. and 2 check valves.

District of Columbia.

The War Department at Washington, D. C., has awarded a contract to the Bethlehem Steel Co., of South Bethlehem, Pa., for furnishing two sets of steel forgings for 14-in. gun, model 1910, and one jacket forging; gun steel $0.21 per lb., and nickel steel $0.30 per lb. Bids were opened Aug. 12.

The Richmond Iron Works Corporation of Richmond, Va., has been awarded a contract by the War Department, Washington, D. C., for furnishing 600, more or less, 10-in. shell, cast iron, model of 1907, for $24.35 each. Bids were opened Aug. 12.

The Bethlehem Steel Co., of South Bethlehem, Pa., has been awarded a contract by the War Department, Washington, D. C., for furnishing two sets of steel forgings, 6-in. guns, model of 1908, at $0.21 per lb. for gun steel, and $1.75 per lb. for nickel steel. Bids were opened Aug. 12.

Georgia.

✣Bids will be received until noon, Oct. 1, by Col. D. C. Kingman, U. S. Engineer, Savannah, Ga., for the dredging in harbor at Savannah, Ga.

Idaho.

Advices from Wallace state that a large force is to begin at once the driving of a 4,000-ft. tunnel on the National Mining Co.'s property near Mullan. The work will be by day labor.

Illinois.

✣Bids will be received until noon, Sept. 7, by the South Park Commissioners at their office, 57th St. and Cottage Grove Ave., Chicago, Ill., for furnishing and delivering approximately 4,200 cu. yds. of black earth upon Grand Blvd., between 39th and 43d Sts. J. H. Burdett is Secretary of the Commission.

The D. Trunck & Dowling Co. has been awarded a contract to build a dam across Yellow Creek in Krape Park, at Freeport, Ill. The dam is to be 118 ft. long and 9 ft. high, and it will be constructed below the old one. It is understood that Mr. Krape intends to put in a lighting system, and the dam is being built with the purpose in view of making the park an amusement center at a future date.

Indiana.

✣Bids will be received until 5 p. m., Sept. 12, by Board of Trustees, Indiana State School for the Deaf, Indianapolis, Ind., for furnishing boys' uniforms for the scholastic year 1910-1911. Richard Johnson is Superintendent.

Board of Trustees, Indiana State School for the Deaf, Indianapolis, Ind., will receive bids until 5 p. m., Sept. 12, for furnishing and delivering coal to the school for the year ending in Sept. 1, 1911. R. O. Johnson, Indianapolis, Ind., is Superintendent.

Ralph Beaton, receiver for the White River Light & Power Co., of Noblesville, Ind., has been granted permission to issue receiver's certificates to the amount of $100,000 for the completion of the hydraulic dam near Noblesville. It is expected that the dam can be finished and in operation within 90 days.

Iowa.

The Park Dam Co. has been organized at Eldora by Lundy & Wood, local attorneys, and A. J. Latimer, an electrical engineer of Mason City, and the company will at once ask of the voters of Eldora a franchise of the streets and alleys of the city, in return for which they will build a $10,000 dam on the Iowa river near there.

Kansas.

The officials of Kansas University at Lawrence, Kan., are planning to construct a pond on Mt. Oread on the campus grounds. The pond will cover about two acres and will require the construction of a fair sized dam. The general work will be under the supervision of Professor Hoad of the University.

Maine.

✣Bids will be received until noon, Sept. 19, by Lieut. Col. George A. Zinn, U. S. Engineer, 539 Congress St., Portland, Me., for the construction of riprap jetties in Saco River, Me.

The following bids were received Aug. 22, at Portland, Me., by Lt. Col. Geo. A. Zinn, Corps of Engineers, U. S. A., for dredging in Stockton Harbor, Me., (1) standing for price per cu. yd., and (2) for price per cu. yd. for boulders: John H. Gerrish, Melrose, Mass., (1) 10.6 cts., (2) $3.00; J. P. O'Riorden, Charlestown, Mass., (1) 13.45 cts., (2) $20.00; Charles M. Cole, Fall River, Mass., (1) 18 cts., (2) $10.00; Bay State Dredging Co., Boston, Mass., (1) 14.2 cts., (2) $7.50; J. S. Packard Dredging Co., Providence, R. I., (1) 8.34 cts, (2) $9.00; P. H. Doyen Co., Portland, Me., (1) 9.7 cts., (2) $6.00.

Maryland.

✣Bids will be received until 1 p. m., Sept. 20, by Col. T. L. Casey, U. S. Engineer, 309 Custom House, Baltimore, Md., for dredging in Southwest Baltimore Harbor and Curtis Bay Channel, Md.

Massachusetts.

The following bids were received Aug. 22, at the U. S. Engineer's office, Boston, Mass., for removing wreck of barge "Harboson Hickman," in Plymouth Harbor, Mass.: The T. A. Scott Co., Inc., 292 Pequot Ave., New London, Conn., $650; Lewis W. Blix, 363 W. 47th St., Brooklyn, N. Y., $678; Betts Bros. & Co., 16 New St., East Boston, Mass., $793; Frederick Wallace Submarine Diving & Wrecking Co., 43 Tremont St., Boston, Mass., $980; Alfred S. Sorensen, 36 Atlantic Ave., Boston, Mass., $990; Thomas Fitzgibbon, 40 Abbott St., Beverly, Mass., $1,172; Johnston & Virden, Lowes, Del., $1,295; Merritt & Chapman Derrick & Wrecking Co., 17 Battery Place, N. Y., $1,474; Thames Tow Boat Co., New London, Conn., $1,600; The Breakwater Co., 1222 Arcade Bldg., Philadelphia, Pa., $2,740.

Michigan.

The Leathem & Smith Co. of Sturgeon Bay, Wis., has been awarded the contract by the government to furnish 7200 tons of riprap stone for the work at Ludington. Each one of these stones must weigh not less than three nor more than five tons each. It will be necessary to go either to Kelley's Island, Lake Erie, or the Chicago drainage canal for the stone. The contract aggregates about $18,000 and work will be commenced as soon as possible.

Minnesota.

The Northern Dredge & Dock Co., Duluth, Minn., has been awarded the contract for dredging the channel at Portage Entry for the U. S. Government, the contract price being 20 cts. per cu. yd., and the work requiring about 100,000 cu. yds. of dredging.

The St. Paul & Western Coal Co., of St. Paul, Minn., is reported to have plans under consideration for the complete overhauling of its coal dock on Connors Point near the Interstate bridge at Duluth, converting the present structure into practically a new dock, the cost of improvements to be in the neighborhood of $500,000 or more. The plans are said to be for an addition to the dock which is now 1,800 feet long which will increase the capacity of the dock several thousands of tons. James Patten, Duluth, Minn., is local superintendent.

Missouri.

✣Bids will be received until noon, Sept. 19, by Maj. E. H. Schulz, U. S. Engineer, Kansas City, Mo., for constructing and delivering steel hull stern wheel tow boats.

New Jersey.

✣Bids will be received until noon, Sept. 19, by Frederick H. Smith, Constructing Quartermaster, Fort Hancock, N. J., for the construction of a corrugated iron oil house.

New York.

Arthur H. Vogel, Milwaukee, Wis., has been awarded a $532,100 contract for the excavation of the channel in Niagara river, below the sixth lock, near Buffalo, N. Y., for the U. S. government. His bid was as follows: Dredging material, overlying bedrock, 22 cts. a yard; excavating bedrock, $2.05 per yard, and handling material with derrick, $1.50 per yard. The contract for the proposed channel through Niagara River extending from the ship canal lock at the foot of Strawberry Island channel to the deep water of Niagara River opposite the Bedell House, Buffalo. The channel will be 23 ft. deep and 400 ft. wide.

Ohio.

The Construction Department of The Safety Insulated Wire & Cable Co., New York city, has been awarded a contract by the Middletown Gas & Electric Light Co., Middletown, Ohio, for laying underground electrical conduits and in installing cables in that city for approximately $12,000. Work is progressing rapidly and the company expects to operate part of the system by Sept. 1st.

Resolutions have been presented to the Council Committee on Public Improvements of Toledo, O., for the erection of two concrete docks along the river front, one at the foot of Lagrange St. and another at Riverside Park. The dock at the foot of Lagrange St. will be 99 ft. wide and will cost in the neighborhood of $11,900. The one proposed for the site at Riverside park will be much smaller and will probably cost about $2,230.

✣Bids will be received until 2 p. m., Sept. 26 by John C. Oaks, Maj., U. S. Engineer, 415 Custom House, Cincinnati, O., for constructing dam No. 13, in the Kentucky River with abutment and protection wall at Thirteen Post Office, Ky.

Pennsylvania.

Bids were opened Aug. 16 at the U. S. Engineer's office at Buffalo, N. Y., for harbor improvements at Erie, Pa., the Great Lakes Dredge & Dock Co. of Chicago being awarded the contract at 24 cts. a cubic yard for deepening the inner entrance channel, the east end of the basin and a portion of the west end at Erie. The contract does not call for any bedrock excavation. The total amount of the company's bid is $42,960.

The Fore River Shipbuilding Co., Quincy, Mass., has been awarded the contract at $448,400 for constructing the suction dredge for the U. S. Government, bids for which were opened at Philadelphia on Aug. 10. The dredge will be stationed at Southwest Pass on its completion. It will be 315 ft. in length with 50 ft. beam, and will draw 20 ft. It will be somewhat different from the usual type built by the government in that the suction will be amidships instead of the pipeline being fitted at either side as in the majority of the dredges.

Texas.

✣Bids will be received until noon, Sept. 19, by Maj. G. P. Howell, U. S. Engineer, Galveston, Tex., for the dredging of the Texas City Channel, Texas.

Virginia.

✣Bids will be received until noon, Sept. 21, by Lieut. Col. M. M. Patrick, U. S. Engineer, Room 2 Custom House, Norfolk, Va., for dredging in harbor at Norfolk, Va.

✣Bids will be received until noon, Sept. 22, by Lieut. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for the dredging of the south branch of Elizabeth River, Va.

Washington.

✣Bids will be received by City Clerk, Aberdeen, Wash., until 5 p. m., Sept. 28, for the improvement of the Tide Lands in Aberdeen, between Broadway and Division Sts., the Northern Pacific track and the hill as provided by Ordinance No. 940 creating filling district No. 1. The improvement contemplates the clearing of 250 acres of streets, lots and alleys, and the filling of 1,500,000 cu. yds. of earth, and constructing about 4,000 ft. of pipe drains. Separate bids will be received for the clearing, filling and drains. Plans specifications and bidding blanks are on file in the office of Charles W. Ewart, City Engineer, at the City Hall, Aberdeen. Official advertisement appeared in our last issue.

The City of Olympia, Wash., has awarded the contract for making the Carlyon fill to the Puget Sound Bridge & Dredge Co., Seattle, Wash., at $90,020. The Carlyon fill, which is the first of a series of proposed fills which will carry the reclamation of the tide flats lying between the city channel and the government channel on the East Side, more than a mile down to deep water, extends from Third St. down to the line midway between C and D Sts., and compromises 19 blocks and 9 fractions of blocks. The material for this first fill will be taken from the city channel, which will be deepened as far as the work permits, to a depth of 25 feet, the same as in the turning basin recently deepened in making the Water St. fill.

Concrete work for the new government dry dock at the Puget Sound navy yard was started the middle of this month. A feature of the construction of this dock is that it has not been necessary to drive piling in the bottom of the pit to afford a foundation for the concrete and stone work. A total of 100,000 cu. yds. of concrete is to be used in the bottom of the dock, and the thickness at the medial line, on which the keels of the ships will rest will be 17 ft., tapering to a thickness of 12 feet along the sides. The concrete will be reinforced with slabs of granite, the trimmings from the granite blocks with which the sides of the dock will be faced. Four months' time will be required to complete the concrete work, after which the granite sides of the structure will be built. The concrete is being mixed with a 2-yd. capacity machine and is hauled and dumped by locomotives and cars. C. J. Erickson is the contractor.

Canada.

It is stated at the Canadiain Department of Public Works at Ottawa, Ont., that a preliminary report of the survey of the Saskatchewan River between Edmonton to Lake Winnipeg will be ready for parliament this session, but that it will take another session in which to gather the complete data required. It is not proposed to make the Saskatchewan navigable by the construction of a long stretch of canal. Locks will be built only where there are heavy falls of water. In stretches the depth of the water will be increased by the construction of wing dams and dredging.

BRIDGES AND BUILDINGS

Alabama.

The commissioners' court at Talladega, Ala., has ordered the construction of a new bridge across Peckerwood Creek. The structure will be on the Mitchell's Ferry Road between Talladega Springs and the Coosa River in the extreme southwestern part of the county.

Work has been started taking down the old Madison avenue bridge over the Central of Georgia Railroad tracks in Montgomery, Ala. A new structure of reinforced concrete will be constructed in its place and $7,900 has already been deposited with the city treasurer for the immediate erection of the same.

Arkansas.

Advices from Fort Smith, Ark, state that the city hopes to have all litigation disposed of and arrangements completed for letting the contract for the bridge across the Arkansas River by the next meeting of the board early in September.

California.

✣Board of Supervisors, Oakland, Cal., will receive bids until Sept. 12 for the construction of a bridge across Alameda Creek, near Brightside, Niles Canyon. The cost of the work is estimated $10,700.

Residents in the vicinity of Newville, Willows, Cal., are circulating a petition asking for the construction by the Board of Supervisors of a bridge across Dry Creek. It is thought work will be started soon if the request is granted.

Colorado.

Advices from Canon City, Colo., state that bridges and culverts recently washed out by floods in Pueblo County will necessitate an expenditure of $35,000 for their replacement.

Civic bodies of Colorado Springs, Colo., believing that the old bridge at the end of Cascade avenue, near Roswell, is no longer fit for use, have signified their willingness to co-operate with the county commissioners for the construction of a new steel and concrete structure.

Connecticut.

The Saybrook & Lyme Bridge Commission

has awarded the contract for the construction of the highway bridge over the Connecticut River between Old Saybrook and Old Lyme, Conn., to the Pennsylvania Steel Co., whose bid was $198,045, the lowest submitted by seven bidders, who were as follows: Strobel Steel Co., $238,000; American Bridge Co., $211,458; the Pennsylvania Bridge Co., $225,000; Berlin Bridge Co., $246,000; King Bridge Co., Cleveland, $233,800; Bristol Bridge Co., $213,134; Phoenix Bridge Co., $200,610.

District of Columbia.

✣Bids will be received by Jesse E. Wilson, Assistant Secretary, Department of the Interior, Washington, D. C., until 2 p. m., Sept. 12, for the installation of a vacuum heating system for the Freedmen's Hospital and Howard University buildings in Washington, D. C.

Georgia.

The Druid Hills Corporation will construct a reinforced concrete arch bridge under the tracks of the Inman Park Branch of the Sea Board Air Line Railroad at Ponce de Leon avenue in Atlanta, Ga. The structure will have a clear span of 58 feet.

Illinois.

✣Bids will be received by the Commissioner of Public Works, 705 City Hall, Chicago, Ill., until 11 a. m., Sept. 2, for repairing, lengthening and reconstructing the draw span of 106th street bridge over the Calumet River. The work includes 78,600 pounds structural steel, 24,600 pounds cast iron counterweights, 12,500 feet B. M. oak timber, 20,000 feet B. M. yellow pine, 4,000 feet B. M. white pine. The cost of the work is estimated at $9,000.

✣Bids will be received until 11 a. m., Sept. 2, by the Commissioner of Public Works, Chicago, Ill., for repairing and reconstructing abutments, approaches and center pier protection of the 106th street bridge over the Calumet River. The work includes: 25,000 feet B. M. oak, 15,000 feet B. M. yellow pine, 35,000 feet B. M. white pine, 17,000 lineal feet oak piles delivered, 16,500 lineal feet piles driven, 50,000 cubic yards of dredging, 6,000 pounds structural steel. The cost as estimated is $10,000.

Advices from Peoria, Ill., state that the Illinois Steel Bridge Co. has been awarded the contract for the construction of a 70-foot span steel and concrete bridge over the west fork of Copperas Creek in Orion Township. The contract price was $2,055.

The city council of Springfield, Ill., took into consideration at their last meeting the proposed Chicago, Peoria and St. Louis Railway Company viaduct over West Jefferson street crossing. The city is willing to stand $1,500 of the cost, while farmers in the vicinity are ready to subscribe another $1,500, leaving but $1,000 of the total $4,000 cost to be paid by the railway.

Trustees of Rockdale, Joliet, Ill., have come to an agreement whereby J. C. Adler, owner of the property south of the I. & M. Canal, will donate the necessary land for the bridge and approaches. It is expected that the structure will be erected soon.

At a recent hearing held by Maj. T. H. Rees, U. S. Engineer, Federal Building, Chicago, Ill., the representatives of commercial interests favored the removal of the present structure over the Chicago River at Chicago avenue. Among those who took an active part in the hearing were: E. A. Halsey, representing the Chicago Real Estate Board; G. F. Fisher, superintendent of construction for the Lehigh Valley Coal Company; George A. Tripp of the Association of Commerce; H. C. Lust, counsel for Illinois Manufacturers' Association; Edward T. Cahill, representing Sprague, Warner & Co.; Thomas G. Philfeldt, city bridge engineer.

Advices from Rock Island, Ill., state that bids will soon be asked for the construction of two new bridges across the Rock River. It is said the funds for the work will be received from rentals paid by the Tri-City Railway Company for the use of the structures.

The Illinois Steel Bridge Co., Jacksonville, Ill., has been awarded the contract for the construction of a two-span bridge 122 feet long with 16-foot roadway over Center Creek at Dudman's Ford, nine miles southeast of Carthage, Mo. The contract price was $2,475.

Indiana.

✣Commission of the Indiana State School for the Deaf, Indianapolis, Ind., will receive bids until 9 a. m., Sept. 13, for delivering and installing certain lines of general equipment for the new school. R. O. Johnson, Indianapolis, Ind., is Superintendent.

✣Board of School Commissioners, Indianapolis, Ind., will receive bids until 8 p. m., Sept. 13, at the office of John E. Cleland, Business Director, 312 N. Meridian St., for steam heating and ventilating plant, plumbing, electric wiring at school 43.

✣Bids will be received until noon, Sept. 7, by Commissioners of Lake County at Crown Point, Ind., for the construction of a wooden bridge over Deep River. C. A. Johnson is County Auditor.

✣Bids will be received until 10 a. m. Sept. 5, by the Commissioners of Johnson County at Franklin, Ind., for the construction of seven small bridges. William B. Jennings is Auditor.

The Board of County Commissioners at Bluffton, Ind., have filed estimates for the construction of fourteen new bridges within the next year. The cost of the work is about $6,800. There will be two large bridges, one over Rockcreek ditch east of Liberty Center and another over a creek near Domestic. These will be concrete arch bridges.

The County Commissioners at Albion, Ind., have awarded the contract to the Elkhart Bridge & Iron Co., Elkhart, Ind., for the construction of two new steel bridges at $546 and for repairing two bridges and abutments to J. J. Kime, Kendallville, Ind., for $609; repairs to one bridge and set of abutments, J Burnett, Rome City, Ind., $438; repairs on one bridge and set of abutments, J. C. Veazey, Albion, Ind., for $291.

Board of Public Works and Mayor of South Bend, Ind., are taking steps toward immediately condemning the property upon which to build the new bridge across the St. Joseph River at Washington avenue.

A petition has been filed with the County Commissioner at Terre Haute, Ind., by the Linton Township asking for the construction of a concrete bridge over the William Dobbs Creek in Linton township.

H. F. & L. J. Burk, of New Castle, Ind., have been awarded a contract by the commissioners of Rush County, Rushville, Ind., for driving piles under piers at Malcolm Ford, Big Flatrock River, for $1,200. Bids were opened Aug. 20.

Iowa.

Advices from Council Bluffs, Iowa, state that the Union Pacific Railroad is considering the construction of a 4-track bridge estimated to cost $5,000,000 over the Missouri River between Council Bluffs and Omaha. J. D. Isaacs, Chicago, Ill., is consulting engineer of the Railroad Company.

The Indiana Bridge Co., of Muncie, Ind., has been awarded a contract by the city council of Fort Dodge, Iowa, for the construction of the South 3d street viaduct, including a new river bridge to conform with the viaduct proper for $57,332. Bids were opened Aug. 22.

Kansas.

✣Board of Education, Wichita, Kan., will receive bids until 3 p. m., Sept. 5, for the following work in the new High School Building: No. 2 plumbing, sewering and gas fitting; No. 4 heating and ventilating. C. S. Caldwell is Secretary.

✣County Clerk L. C. Noel, Girard, Kan., will receive bids until noon, Sept. 12, for I beam channels and railing for nine bridges located in Crawford County.

Blue prints have been submitted to the commissioners of Douglas County, Kansas, for the construction of a concrete bridge in the city of Lawrence. It consists of nine spans each 123 ft. long, and the entire bridge reaching over 1,190 feet of water tide. The piers which support the structure are to be of solid concrete 12x36 feet, resting on concrete bases 24x44 feet. It is the purpose to sink these foundations until a solid foundation can be found, which will take it about fifty feet below the surface of the water of the river. As stated in the plans the bridge will have a double roadway with two railway tracks in the center.

The Board of County Commissioners, Ottawa, Kan., has awarded the contract for the construction of a new steel bridge over the Fort Scott crossing to the Canton Bridge Co., Canton, Ohio, for $8,150. The next lowest bidder was the Capital Iron Works, Topeka, Kan., their estimate being $8,160.

Kentucky.

The Fiscal Court of Nicholas County, according to advices from Carlisle, Ky., has let the contract to the Empire Bridge Co., Lexington, for the construction of a 82-ft. steel bridge across Elk Creek near Abner's mills. The structure will replace the old bridge washed out by a flood in July and is estimated to cost $2,000.

Maine.

Norman H. Cook, of Portland, Me., has been awarded the contract by the U. S. government for the construction of a frame ice house at Fort McKinley, Me., for $4,389. Joseph F. Gohn, Capt. and Quartermaster. Bids were opened Aug. 18.

Bids were opened Aug. 18 by Capt. Joseph F. Gohn at Fort Williams, Me., for the construction of a brick fire station, and contracts were awarded as follows: Ed. C. Ricker, Portland, Me., $2,979; Norman H. Cook, Portland, $4,581; Kennedy & Peterson, Boston, Mass., $4,494; T. L. Merrill Co., Portland, $65; Whitall Electric Co., Westerly, R. I., $135.

Maryland.

✣Bids will be received by the Bureau of Yards & Docks, Navy Department, Washington, D. C., until 11 a. m., Sept. 10, for additions to power plant and distributing systems naval hospital, Annapolis, Md.

Michigan.

City officials of Flint, Mich., and those of the Perre Marquette Railroad are making arrangements for the construction of a new bridge to replace the old structure over the tracks at the West Court street crossing.

Minnesota.

At a recent meeting of the Board of the County Commissioners at St. Paul, Minn., it was decided that the Wisconsin Central Railway must build at once a new bridge on the right of way at Arcado street, just north of the city limits. The work will be done under the supervision of the County Engineer.

The County Board, Mankato, Minn., has decided to have the surveyor prepare plans and estimates at once for the construction of a wagon bridge across the Le Sueur River at Red Jacket Ford. It is thought that the structure, which will have a concrete floor, will cost about $10,000.

Missouri.

✣Bids will be received until 1 p. m., Sept. 7, by William Kohlman, County Highway Engineer, Carthage, Mo., for the necessary labor and material for the erection of the following bridges: No. 1, the Hall's ford bridge crossing Spring River on the section line road between sections 25 and 26, township 29, range 32 w.; No. 2, the Margrave ford bridge, crossing Little North Fork on the section line road, between sections 23 and 26 in township 30, range 30 w.; No. 3, the Scotland bridge and trestle crossing Grove creek and the Mo. Pac. Ry. Co.'s tracks on the section line road, between sections 1 and 12, township 27, range 32 w.; No. 4, the Castle Rock bridge, crossing Turkey creek, on the section line road between sections 35 and 36, in township 28, range 33 w.

The contract for the construction of a reinforced concrete arch bridge over Grove Creek on the county line not far from Scotland, Mo., has been awarded the Hughes & Hammond Bridge Co., Kansas City, Mo., for $1,850. The structure will have a 40 ft. span and 16 ft. roadway.

Nebraska.

The County Commissioners and the Papillion Drainage District, Omaha, Neb., have signed a contract whereby the commissioners will take up the matter of constructing bridges over the ditches on the county roads and the cost will be defrayed by the district.

The Commissioners of Washington County at Fremont, Neb., as a result of the recent inspection of the bridge over the Elkhorn River at Arlington, decided to replace the structure with a new steel bridge.

New York.

✣Bids will be received by the Bureau of Yards & Docks, Navy Department, Washington, D. C., until 11 a. m., Sept. 10, for the construction of a pier from the main land to Cob Dock, Pier D, Navy Yard, New York.

✣Bids will be received by the Constructing Quartermaster, Fort Hamilton, N. Y., until 11 a. m., Sept. 22, for the construction and plumbing of ordnance shop.

✣Bids will be received until 10 a. m., Sept. 13, by Constructing Quartermaster, Fort Slocum, N. Y., for the construction of a porch for one field officers' quarters at Fort Slocum, N. Y.

✣Constructing Quartermaster, Fort Hamilton, N. Y., will receive bids until 11 a. m., Sept. 22, for the construction, including plumbing, heating, electric wiring and fixtures of lavatory addition to barracks.

✣Bids will be received by the Constructing Quartermaster, Fort Hamilton, N. Y., until 11 a. m., Sept. 22, for the construction, including plumbing, heating, electric wiring and fixtures of one field officers' quarters, and one 6-set officers' quarters.

The Raymond Concrete Pile Co., of New York and Chicago, has been awarded the contract for the Raymond concrete piles and foundations for a warehouse for the Nielson Investment Co., St. Louis, Mo. Baker & Knell, architects.

The Turner Construction Co., 11 Broadway, New York City, has been awarded the general contract for the construction of a 3,000 ton coal bunker of reinforced concrete, a stable and office building and a hay store house, with retaining walls, railway track scales, wagon scales, paving, etc., for the Scranton & Lehigh Coal Co., at Vanderveer Park, Brooklyn, N. Y. Work will be started at once.

Information received from Dundee, N. Y., states that the bridge over the stream on the Lakemont and Rock Stream road would be rebuilt as recommended by the engineers who recently inspected the structure.

North Dakota.

✣Bids will be received until 2 p. m., Sept. 7, by the County Auditor, I. W. Healy, Bismarck, N. D., for the necessary labor and material for the construction of two steel bridges, one of which to be located about one mile southwest of Sterling and the other on the section line of Sections 2 and 3, township 140.

Morton County Commissioners at Mandan, N. D., have let a contract to the Fargo Bridge & Iron Co., of Fargo, N. D., for the construction of the following seven bridges for $13,490: In township 137, range 80. The structure is to consist of an 80-ft. steel span on tubes with 32-ft. approach at one end and 16-ft. approach at the other and concrete backings and wings; also for two 16-ft. eyebeam bridges on concrete foundations, and two 40-ft. two-truss span bridges on steel pile foundations with concrete backings and wings, and one 50-ft. low-truss span bridge on steel pile foundations with concrete backing and wings, and one 26-ft. eyebeam bridge on steel piles with concrete backing and wings. All bridges to have 16-ft. clear roadway.

Ohio.

✣Bids will be received until noon, Sept. 2, by the Board of County Commissioners, Cincinnati, Ohio, for the construction under Specifications No. 86, of a bridge and approaches thereto on the Brierly Creek Road in Green Township.

✣Bids will be received until noon, Sept. 13, by the Board of County Commissioners, Lima, Ohio, for the labor and material for the construction of a steel bridge over Hog Creek. C. R. Phillips is clerk of the board. Each bidder is required to submit a certified check for $200 with each bid.

✣County Commissioners at Columbus, Ohio, will receive bids until noon, Sept. 14 for the necessary labor and material for the following work: Encasing in concrete the east abutment of the Dublin Bridge over the Scioto River, in Washington and Perry Townships, including 70 cu. yds. wet excavation, rock and loose rock; 100 cu. yds. dry excavation and back-fill; 90 cu. yds. rock excavation; 860 cu. yds. reinforced concrete; 26,000 lbs. reinforcing steel rods; 90 cu. yds. sandstone masonry removed; 12 cu. yds. sandstone coping redressed and reset; 100 cu. yds. crushed limestone on roadway; clearing and grubbing; raising superstructure. F. M. Sayre is County Auditor.

✣Bids will be received at Ashland, Ohio, by the Board of County Commissioners until noon, Sept. 7, for the following: First—For the furnishing all the labor and materials for the construction of the J. A. Roberts bridge, Orange township, Ashland county, Ohio. Second—For furnishing complete in place a new substructure, consisting of stone abutments on concrete footers. Third—For furnishing all the tools, labor and materials for the filling of the approaches of said bridge, complete. J. F. Welty is County Auditor.

✣The Ashland County Commissioners will receive bids at Ashland, Ohio, until noon, Sept. 7, for the following: First—For the furnishing all the labor and material for the construction of the Jos. Sheet bridge, Montgomery township, Ashland county, Ohio. Second—For the furnishing complete in place a sixty (60) foot truss superstructure with concrete floor. Third—For furnishing complete in place of new substructure, consisting of one abutment on concrete footers. Fourth—For furnishing all the tools, labor and materials for the filling of the approaches of said bridge, complete. J. F. Welty is County Auditor.

✣The Commissioners of Ashland County, Ashland, Ohio, will receive bids until noon, Sept. 7, for the following: First—For the furnishing all the labor and materials for the construction of the O. J. Powell bridge, Montgomery township, Ashland County, Ohio. Second—For the furnishing complete in place a 60-ft. steel truss superstructure with concrete floor. Third—For furnishing all the tools, labor and materials for the rebuilding of one old stone abutment on new concrete footers. Fourth—For furnishing all the tools, labor and materials for the filling of the approaches of said bridge, complete. J. F. Welty is County Auditor.

At a recent meeting of the County Commissioners, Columbus, Ohio, the contract for casing the abutments of the McKinley bridge over the big Darby Creek in Pleasant township was let to Cook & Cook for $2,481. Other bids were as follows: E. Elford, $3,083; E. Walz, $3,467; Baumgartner & McPherson, $3,601; F. Moorhead, $2,472; the last bid, although the lowest, was held irregular.

The County Commissioners at Hamilton, Ohio, have let the contracts for the construction of three small bridges in Fairfield, Ross and Milford townships. It is expected to build and repair a number of other structures before the cold weather sets in.

A contract has been let to the American Bridge Co. for the construction of the big viaduct to be built in Youngstown, Ohio, from Center to Poland avenue for the Republic Iron & Steel Co. Engineers estimate the cost of the proposed work, which will require 1,000 tons of steel, at $100,000.

The Universal Construction Co. has been awarded the contract by the County Commissioners for the construction of repairs to the Heck River bridge south of Tiffin, Ohio. The contract price was $3,800.

J. Blim & Son, Youngstown, Ohio, have been awarded the contract for the construction of a bridge pier for the structure over the Meander River in Ellsworth township. The contract price per cu. yd. for masonry was $5.49.

The County Commissioners at Cincinnati, Ohio, have awarded a contract to John Snyder of Norwood, Ohio, for the construction of a concrete bridge on Duck Creek Road, near Henry Cordes' place, Columbia township, for $1,287. Bids were opened Aug. 19.

Oklahoma.

The County Commissioners at Okemah, Okla., have awarded the contract for 24 additional bridges to the Missouri Valley Bridge & Iron Co. for $35,000. Work on the structures will be commenced as soon as possible, as the contract calls for their completion Dec. 1.

Pennsylvania.

✣Bids will be received until noon, Sept. 8, by County Commissioners, Uniontown, Pa., for the construction of abutments and wing walls for bridge over Mountz Creek in Bullskin township at the place where the public road from Murphy's crossing to Detwiler's Mill crosses said creek.

✣Bids will be received until 2 p. m., Sept. 16, by the State Highway Department, Capitol Building, Harrisburg, Pa., for the complete construction and erection of a cement masonry bridge at Station 898-00 on the National road, Washington County. Joseph W. Hunter is State Highway Commissioner.

✣Bids will be received at the office of the State Highway Department, Capitol Building, Harrisburg, Pa., until 2 p. m., Sept. 16, for the construction of a cement masonry bridge at Station 91811 on the National Road in the County of Washington. Joseph W. Hunter is State Highway Commissioner.

✣Bids will be received by the State Highway Department, Harrisburg, Pa., until 2 p. m., Sept. 16, for the complete construction and erection of reinforced concrete bridge at Station 92780 on the National Road, Washington County. Joseph W. Hunter is State Highway Engineer.

✣Bids will be received until 3 p. m., Sept. 28, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for miscellaneous changes in the Administration Building, Philadelphia, Pa.

At a recent meeting of the County Commissioners, Indiana, Pa., the contract for the construction of a bridge over Barr run in Banks Township and another over the same run at Dilltown to C. E. Amond, Penn Run, Pa.

The Reading Railway, according to reports received from Philadelphia, has awarded the American Bridge Co. the contract for the construction of a girder bridge consisting of five 33-ft. spans in the town of Perkiomen Junction, thereby eliminating the grade crossing.

South Dakota.

The City Council of Spearfish, S. D., have awarded the contract for the construction of the steel bridge to span the creek at the fish hatchery crossing to the Standard Bridge Co.

Tennessee.

Advices from Benton, Tenn., state that the Polk County Court is considering an appropriation for the construction of a bridge over the Osoee River at Cox's Ford, near Benton. According to the plans under consideration the structure would cost $18,000.

Texas.

The Commissioners' Court at Marlin, Tex., have ordered an election for October to determine whether or not bonds to the amount of $1,000 shall be issued for the reconstruction of the High bank bridge over the Brazos River, a large portion of which recently collapsed.

Utah.

Residents of Lincoln avenue, Salt Lake City, Utah, have petitioned the city council for the construction of a bridge across Emigration Canyon Creek at Lincoln avenue.

County Commissioners have taken up with the town authorities of Midvale, Utah, the matter of constructing a steel bridge across the Jordan River to replace the old structure now spanning the stream.

Virginia.

✣Bids will be received at the Clerk's office of the State Highway Commission, Warm Springs, Va., until noon, Sept 1, for the construction of two steel bridges over Cowpasture River, one at H. L. Page Ford and one at Gale Ford, in Bath County. P. St. J. Wilson is State Highway Commissioner.

A reinforced concrete bridge is to be built across the river a few miles west of Richmond, Va. Although it was the intention of the company to build the bridge this year the contractors fear freezing and favor the postponement of the work until next year.

Washington.

County Engineer Bowers, Prosser, Wash., has been making preliminary arrangements for the construction of a bridge across the Yakima River at Lockwood place, Kiona. Levels have been taken and with other necessary information have been submitted to the contractor.

The Finance Committee of the city of Seattle, Wash., has recommended the appropriation of $20,000 representing one-half the cost of a temporary bridge across the arm of Lake Union on Stone avenue, between West Lake avenue and Kilbourne street, from the general fund. The remaining cost of the structure will be borne by the Seattle Electric Co.

West Virginia.

✣Bids will be received until 11 a. m., Sept. 27, by Captain F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for the construction of a fireproof power house and chimney and installing two 115-H. P. boilers, two steam driven air compressors, receivers, piping, etc., at Dam No. 26, Ohio River.

✣Bids will be received until 11 a. m. (Eastern time), Sept. 29, by Captain F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for the construction of two 2-story eight-room lockkeepers' houses at dam No. 11, Ohio River.

Wisconsin.

✣Board of Public Works, Racine, Wis., will receive bids until Sept. 3 for painting the State and 4th street bridges and viaducts and 6th street viaduct.

✣Bids will be received until 3 p. m., Sept. 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the approaches at the U. S. Post Office at Platteville, Wis.

✣Bids will be received by the State Board of Control, Madison Wis., until 4 p. m., Sept. 12, for the necessary labor and material for the construction of a hospital for the criminal and violent insane at the Northern Hospital for the Insane, Winnebago, Wis.

Board of Public Works of Appleton, Wis., have awarded the contract for the construction of a steel and reinforced concrete repairs to the Lawrence street bridge. The contract price was $2,969.

The contracts for the construction of two bridges in Wisconsin has been awarded to William H. Shons, Freeport, Ill. The first structure will be at Genoa Junction and will cost $4,000 and the second at Broadhead over the Sugar River, to cost $4,800.

A special election is to be held in Janesville, Wis., Sept. 6, to vote on the question of building two bridges over Rock River, one at Racine street and the other at 4th avenue.

Wyoming.

✣Bids will be received until 10 a. m., Sept. 8, by the Board of Commissioners, Laramie County, Cheyenne, Wyo., for the necessary labor and material for the construction of the Torrington bridge over the North Platte River. The work includes the construction of 1,000 feet of wooden bridge one mile east of the present structure and the removal and use of all materials that are found in good condition in the old bridge excepting three steel spans. C. E. Artis is County Clerk.

Canada.

✣Bids will be received until 4 p. m., Sept. 14, by R. C. Desrochers, Secretary Department Public Works, Ottawa, Ont., for the construction of a public building at Waterloo, Ont. Plans, specification and form of contract can be seen and forms of tender obtained on application at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station F, Yonge street, Toronto, Ont., at the Postoffice, Waterloo, Ont., and at the Department of Public Works.

✣The Canadian General Electric Co., Ltd., 212 King street west, Toronto, Ont., will receive bids until 5 p. m., Sept. 6, for the various trades in connection with extension to the company's machine shop at Peterboro.

The city of Winnipeg, Man., has awarded the contract for the construction of a culvert over the Seine River at Provencher avenue to Guilbault & Co., for $27,810.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received by the Town of Attalla, Ala., until 8 p. m., Sept. 5, for the construction of about 600 sq. yds. sidewalk paving and 800 lin. ft. of combination curb and gutter. Wilburn Hill, Gadsden, Ala., is Engineer.

The Board of Revenue of Birmingham, Ala., has been petitioned for the paving of Red Mountain Road, from Hinds Peevy's place to 24th St., with macadam.

All bids for the building of the extension of Fairview Ave. to the Woman's College, Montgomery, Ala., have been rejected because they were too high. It has been decided by the board of revenue that the work shall be done by the County Engineer, J. T. Bullen. W. A. Sherley will have charge of the work.

The Court of County Commissioners at Selma, Ala., has let a contract for the construction and building of six and four-tenths of a mile of road east of this city to the Mulberry bridge, which is the boundary line between Dallas and Autauga Counties. The successful bidder being J. W. Cook & Co., of Montgomery, Ala., who bid $16,714.

Arizona.

✣Bids will be received until 2 p. m., Sept. 13, by Robert A. Craig, Secy. Board of Control of the Territory of Arizona, at Phoenix, Ariz., for the construction of a territorial highway between the towns of Bisbee and Douglas, in Cochise County.

Arkansas.

At a recent convention held by the citizens of Lee County, Marianna, Ark., it was decided to spend $100,000 for the construction of good roads and bridges throughout the county. The Marianna Commercial Club is interested.

In Jefferson County Court, Pine Bluff, Ark., a petition has been filed for the organization of an improvement district, contemplating the longest stretch of improved roadway in the county, seven miles on the Sulphur Springs and four miles on the Camden roads. The estimated cost of the work is $11,000. The roads are to be graveled.

California.

✣Advices from Riverside, Cal., state that the County Board will receive bids until September 11 for the construction of the new Box Springs grade macadam drive, including 21.5 miles of roadway. The specifications call for a driveway 16 ft. wide, on each side of which is to be a 5-ft. strip with an oil surface roadbed. Corrugated iron culverts are to be used.

✣The lowest bid received by the Park Commission, Oakland, Cal., for the paving with asphalt of roadway in Lakeside Park, was that of the City St. Improvement Co., $20,423, while the highest was that of the Barber Asphalt Co., $23,962. All bids for the contract were rejected and bids will be received for the work until Sept. 8. Henry F. Vogt is Secretary Park Commission.

The contracts for constructing two of the sections of the Foothill boulevard, in the San Dimas vicinity have been awarded by the Supervisors of Los Angeles County, Los Angeles, Cal., to Rife & Cave of Redlands, for $13,500, and $1.60 per ton for laying the macadam for one section, and $12,500 and $1.65 per ton for macadam for the other section.

Colorado.

A conference has been called at Glenwood Springs, Colo., Sept. 20, to discuss the proposed automobile road between that city and Grand Junction. The state highway commission has set aside $5,000 to be used in the improvement of the road and it is expected to raise $10,000 in Garfield and Mesa Counties. The Commissioners have a plan for shortening the road 20 miles by building six miles of new road.

Delaware.

H. C. Clark, Delaware City, Delaware, was the lowest bidder for the construction of an oyster shell road from Harrisonville, N. J., to Fort Mott, N. J., for which bids were opened by the Constructing Quartermaster of Fort Dupont, Delaware City, on Aug. 25. Mr. Clark bid $0.86¾ per sq. yd.

Florida.

✣Bids will be received until 10 a. m., Sept. 2, by the Board of Trustees Putnam County Bonds, for the construction of 10 miles of hard surfaced road from the limits of the city of Palatka, Fla., over the upper Rice Creek bridge toward Bannerville, Fla. R. F. Ensey, Palatka, Fla., is County Engineer. Stewart Worden is Secretary.

The County Commissioners of Osceola County, Kissimmee, Fla., have awarded a contract to L. E. Lindsay of Peghorn for the construction of the county road from Whittier to Bassinger, a distance of about 28 miles for $225 per mile. The specifications for the work are as follows: Muck, grade from 3 to 4 ft., width on top 18 ft.; prairie, 6-in. bed 30 ft. wide; pine palmetto, 6-in. bed 30 ft. wide; sawgrass, grade 3 to 4 ft., width on top 18 ft.; hammock, 6-in. bed 30 ft. wide; ponds with sand bottom, grade 1 to 2 ft., width on top 18 ft.; grass ponds, 6-in. bed 30 ft. width. All bridges to be 16 ft. wide; built of 2x6 heart pine with five stringers, either of 5x8 sawn lumber or of lightwood of sufficient size.

The Southern Colonization Co., which owns a tract of land in the vicinity of the Kissimmee Valley, has offered to lend the County Commissioners of Osceola $6,000 for the purpose of building a good road between Whittier and Bassinger. The Commissioners have accepted the offer and the road will be built soon.

Georgia.

Fred. J. Paxon, President of the Chamber of Commerce, Atlanta, Ga., has appointed Paul Norcross and R. M. Walker as a committee to co-operate with committees from the Chambers of Commerce at Jacksonville and at Macon on the establishment of a highway from Atlanta to Jacksonville.

Illinois.

✣Commissioners of Highways, O'Fallon, Ill., will receive bids until Sept. 3, at 3 p. m., for the construction of a macadam road in the Township of O'Fallon. G. Schildknecht is one of the Commissioners.

✣Bids will be received by the Town Clerk at Epworth, Ill., Robert Lutz, until Sept. 12, for the construction of two gravel or rock roads in the town of Hawthorn, White County, Ill.

✣Bids will be received by the Commissioner of Highways, Harrisburg, Ill., until Sept. 3, for the construction of a rock or macadam limestone road from South Granger St. on Sloan St. to the west corporation line of Harrisburg. Enoch Hall is one of the Commissioners.

✣Bids will be received until Sept. 15, by W. R. McCaslin, Engineer in Charge, Nokomis, Ill., for about 23,000 sq. yds. of vitrified brick paving.

✣Board of Local Improvements, Charlesp. m., will receive bids until Sept. 6, at 1 p. m., for the construction of 6.375 lin. ft. pavement, with concrete curb and gutter. C. A. Quackenbush is City Clerk. Official advertisement will be found elsewhere in this issue.

✣Bids are asked by the Board of Local Improvements, C. A. V. Standish, Secretary, Chicago, Ill., until 11 a. m., Sept. 2, for the following street improvement work: Improving alley, 48th St. to 49th St., 1,200 lin. ft. concrete curb, 1,020 sq. yds. brick on 6. in. concrete, 5 manholes to be adjusted and one new corner with iron lid; alley 47th to 48th St., 980 lin. ft. concrete curb and 770 sq. yds. brick on 6 in. concrete; alley 48th to 49th St., 1,560 lin. ft. concrete curb, 1,240 sq. yds. 3-in. creosote blocks, 2 in. sand cushion and 6 in. concrete base; South Center Ave., 3,260 lin. ft. sandstone curb, 1,000 cu. yds. earth filling, 4,950 sq. yds. brick pavement on 6 in. concrete, 13 new catchbasins and 10 old manholes to be readjusted; Cottage Grove Ave., north of 51st St., 5,260 ft. granite concrete combined curb and gutter, 5,240 ft. granite concrete gutter, 400 sq. ft. sidewalk, 10,500 cu. yds. earth cutting, 18,400 sq. yds. creosoted blocks on 6 in. concrete base, 34 new catchbasins, 1,000 lin. ft., 9-in. tile pipe, 10 old manholes to adjust, 20 cast iron gratings, 26 old catchbasins to adjust and 30 new covers with iron lids; West 55th St., Lake Ave. to Everett Ave., 1,920 ft., granite concrete combined curb and gutter, 100 sq. ft. sidewalk, 2,840 sq. yds. asphalt or 6 in. concrete base, 10 new catchbasins and 200 ft. 9-in. tile pipe; Grand Ave., West Chicago Ave. to North Kedzie Ave., 3,040 lin. ft. sandstone curbing, 2,100 cu. yds. earth cutting, 4,030 sq. yds. brick pavement and 7 new catchbasins; Hollywood Ave., Southport Ave. to Clark St., 1,200 lin. ft. granite concrete combined curb and gutter, 600 cu. yds. earth filling, 3.700 sq. yds. macadam, 4 new catchbasins and 2 new cast iron gratings; South Michigan Ave., 68th St. to 71st St., 3,940 ft. granite concrete combined curb and gutter, 100 sq. ft. sidewalk, 1,600 cu. yds. earth filling, 6,010 sq. yds. asphalt pavement on 6 in. concrete, 2 new catchbasins, 100 ft. 9-in. tile pipe, 10 new covers with iron lids, and 18 cast iron gratings; West North Ave., 12,210 ft. sandstone curb, 2,200 ft. stone curb recut and reset, 12,000 cu. yds. earth cutting, 2,950 sq. ft. cement sidewalk, 41.300 sq. yds. brick pavement, 10 new catchbasins, 80 old catchbasins to be adjusted; North Shore Ave., 1,700 ft. concrete combined curb and gutter, 400 cu. yds. earth filling, 2,570 sq. yds. asphalt on 6 in. concrete base etc.; West 13th St., South Canal to South Jefferson St., 900 ft. gravel concrete combined curb and gutter, 500 ft. gravel concrete gutter, 200 sq. ft. sidewalk, 2,500 sq. yds. asphalt on 6 in. concrete base, 4 new catchbasins, 4 new covers with iron lids, etc.; Wolfram St., 5,100 ft. granite concrete combined curb and gutter, 8,440 sq. yds. asphalt, 16 new catchbasins, 24 old manholes to be adjusted, 12 old catchbasins to be adjusted, 12 new covers with iron lids, 50 ft. 9-in. tile pipe and 2 cast iron gratings.

The citizens of Moline, Ill., have subscribed $18,000 for building a six-mile macadam road to connect Rock Island, Davenport and Moline with the Knoxville turnpike.

Jno. A. McGarry & Co., 1001 Security Bldg., Chicago, Ill., at 32½ cts. per sq. yd., was the low bidder for resurfacing South Loomis St., Chicago, from West 25th St. to West 31st St.

The City Council of Evanston, Ill., has voted to pave McDaniel Ave., from the south line of Central St., to the north line of Noyes St., with granite top macadam at an estimated cost of $13,856. The city has also passed a resolution providing for the paving of Sherman Ave., from Noyes St., north to Central St., with brick at an estimated cost of $19,666.

A road petition has been filed in the County Court at Springfield, Ill., asking for the establishment of a road district in North Campbell Township, just east of the city. The district is known as the Eastland Road District and will include over 2,800 acres of land.

City Engineer Clark G. Anderson of Moline, Ill., has estimated the cost of constructing the road leading from the city to the rural town hall, at $18,000. The money is available and it is probable that construction work will be started this fall.

The Board of Local Improvements of Batavia, Ill., has awarded a contract for the paving of Batavia Ave. to the Inter Ocean Paving Co., of Chicago, Ill., for $24,875.

The Board of Local Improvements of Chicago, Ill., has awarded the contract for paving La Salle St., from Madison St. to Jackson Boulevard, to the Citizens Construction Co., for $3.42 per sq. yd. The paving will be of creosoted blocks.

Vermillion County Commissioners, Newport, Ind., have awarded a contract to Geo. W. & Charley Sykes, of Newport, for the construction of the Coon Hollow road in Clinton township, about 2¼ miles in length, for $5,300. Bids were opened Aug. 26.

The County Commissioners of Vermilion County, Newport Ind., have awarded a contract to Harry A. Carpenter of Cloverland, Ind., for the construction of the Higgins gravel road in Eugene township, about 1.62 miles in length, for $9,321. Bids were opened Aug. 26.

Indiana.

✣The Indianapolis, Ind., Board of Public Works will receive bids until 10 a. m., Sept. 9, for improvement of first alley west of Pennsylvania st., from Thirtieth st. to Thirty-second st.; Pennsylvania st., from Thirty-eighth st. to Fortieth st.; first alley north of St. Joseph st., from Delaware to Pennsylvania st.; Michigan st., from Rural street to Emerson ave.; first alley north of Thirtieth st., from Pennsylvania st. to first alley west.

✣The Common Council of Rushville, Ind., will receive bids until 7:30 p. m., Sept. 6, for the construction of 3,000 sq. ft. of cement sidewalks on Maple St. Thomas S. Cauley is City Clerk.

✣Commissioners of Lake County at Crown Point, Ind., will receive bids until noon, Sept. 6, for the construction of six gravel roads. C. A. Johnson is Auditor.

✣Board of Commissioners Grant County will receive bids until 2 p. m., Sept. 6, at Marion, Ind., for the grading and paving of certain highway in Franklin township. A. Y. Stout is Auditor.

✣Bids will be received by the Board of School Commissioners until Sept. 2, at Indianapolis, Ind., for the grading, graveling and sodding of school grounds of No. 35 Madison Ave. and Raymond St. John E. Cleland, Business Director.

✣Bids will be received until 10 a. m., Sept. —, by the Board of Park Commissioners, Indianapolis, Ind., for the construction of cement sidewalks in Capitol Ave., from 16th to 21st St.

The County Commissioners at Paoli, Ind., have approved the petition presented by W. W. Pinnick and others for the construction of the West Baden and Orangeville road in Northwest Township. A. N. McPheeters has been appointed engineer for the road.

Preliminary steps for the paving of Mercer Ave., in Decatur, Ind., from its intersection with Second St. to the corporation line, south, and for Adams St., from Second St. to 13th St., a distance of about two miles, have been taken by the City Council.

Iowa.

✣Bids will be received until Sept. 8, by T. E. Nichols, City Clerk, Atlantic, Ia., for the construction of 3 miles of asphaltic concrete pavement and 6 miles of cement curb, etc. A certified check for $2,000 must be filed with each bid. C. P. Chase, Iowa Engineering Co., Clinton, Ia., is Engineer.

✣Bids will be received by the City Recorder, Otto P. Geiger, Dubuque, Ia., until 8 p. m., Sept. 1, for the improvement of Bluff St. from the end of brick pavement between 15th and 16th Sts. to the north lot line of 8th St. with sarco macadam or its equal. City Engineer estimates that the improvement will require 3,628 lin. ft. of curbstone reset and 8,557 sq. yds. of sarco. A check for $1,000 must be filed with each bid.

The City Council of Council Bluffs, Ia., has passed a resolution providing for the repaving of Broadway from the east line of Second St. to the west line of Sixth St., and Main St., from the south line of Broadway to the south line of First Ave., with vitrified brick with a 5-in. concrete base.

The City Council of Clinton, Ia., is considering the reconstruction of the Ravine road from Bluff Boulevard to the Elviro road. The City Engineer has estimated the cost of improving the road at $1,986.

The citizens of Wasington, Ia., are agitating the construction of another river-to-river road. They propose to take the matter up with the commercial clubs of the towns along the new way. The new road as proposed starts from Davenport, thence through Muscatine to Washington, Sigourney, Knoxville, Indinaola, Winterset, Greenfield, Griswold, Carson and the Bluffs.

Kansas.

Petitions are being circulated among the farmers north of Hutchinson, Kan., for the construction of a sand-clay road through the sand hills on the North Plum St. road. The petitions call for the establishment of a road improvement district and an expenditure of $1,000 a mile in the improvement. Will S. Thompson and C. O. Hitchcock are interested.

Kentucky.

The Board of Public Works of Paducah, Ky., has awarded a contract to A. J. Miller & Son of Lynchburg, Va., for Contract "C" as follows: Granite curbing, 6,150 lin. ft., at 76 cts. per lin. ft.; 6,300 lin. ft. of concrete gutter at 23 cts. per lin. ft.; 31,300 sq. ft. of concrete sidewalks at 11⅔ cts. per lin. ft.; 930 sq. ft. of concrete driveways, 14 cts. per lin. ft., and 500 lin. ft. of cast iron drain pipe, 26 cts. per lin. ft. Bids were opened Aug. 23.

Maine.

The following bids were received Aug. 15 by Capt. Joseph F. Gohn, Constructing Quartermaster, 655 Congress St., Portland, Me., for the construction of a service road at Fort McKinley, Me.: Worster & Wilson, Portland, $6,345; R. D. Shaushan, Portland, $3,997; F. H. Marshall, Portland, $4,977; J. W. Gulkin, Portland, $7,750, and Forgione & Romano Co., South Portland, Me., $6,090.

Maryland.

The Board of Awards, Baltimore, Md., has awarded a contract to Patrick F. Reddington, 321 St. Paul St., Baltimore, Md., for paving Park Terrace from Park Ave. to Robert St., for $5,680. Bids were opened Aug. 17.

The State Roads Commission has awarded the contract for paving Liberty road, between Walbrook Junction and the city limits of Baltimore, Md., to the Monroe Paving Co. The contract for improving the Belair road, between the city limits and Overlea, with pitched macadam was awarded to E. P. Lindsay. Work on both thoroughfarec will be begun immediately.

Michigan.

The board of county road commissioners,

Items marked thus ✣ indicate work now open for bids.

Iron Mountain, Mich., has awarded a contract to John E. Blomgren for $1,095 for the construction of the Iron Mountain-Homestead road.

The contract for the building of the 9-ft. macadam road on Genesee Ave., from the easterly line of Saginaw, Mich., to Cook's Corners, was let by the county road committee to Crowley Bros. The specifications call for Burt Portland cement and trap rock.

The survey for five miles of the East Main St. road out of Battle Creek, Mich., which is being made by Harlem K. Whitney, with a view of estimating the cost of improving this stretch to make it a state reward road of Class B, is nearly completed.

Minnesota.

The Park Board of St. Paul, Minn., has awarded a contract to Keough Bros. for grading Section No. 4 of the parkway for $7,375. The board also awarded a contract to Chris. Johnson for grading Section 3 for $6,279.

Property owners of Northeast Brainerd, Brainerd, Minn., had a mass meeting recently, and will petition the city council to put in cement paving on Third Ave.

The city council of Albert Lea, Minn., is planning on having College St. and intersecting streets paved in the near future. It is proposed to pave College St., from Union depot to Washington St., and all the intersecting streets between Main and College Sts., the east end of Water St., and the north end of Broadway. City Engineer William Barneck has estimated the cost of the proposed pavement as follows: Creosoted block, $37,484; vitrified brick, $36,168; sandstone, $45,209; mineral rubber, $36,168.

Mississippi.

✣Bids will be received until Sept. 5 by Parham Williams, Chancery Clerk, Holmes County, Miss., at Lexington, for the working of the public roads by contract in the Cruger and Ashton precincts, District 5, for the remainder of the contract made with the late J. D. Pettus.

The county commissioners of Holmes County, Lexington, Miss., have granted the petition of G. D. McCaleb for the establishment of a road commencing on the Lexington and Ebenezer road and intersecting the Lexington and Brozville road about two and a half miles southwest of Lexington.

Missouri.

The county court at Kansas City, Mo., has let contracts for six and one-half miles of new rock roads as follows: Hiler Road, three miles, from the end of the Spring Branch Road to Oakland Church, to Colyer Bros., $17,074; Mastin School Road, three and one-half miles, between Grandview and the Belton Road, to Davidson Bros., $17,363.

Montana.

Work is to be started the latter part of this month on improving the roads, bridges and trails from Belton, Mont., in the Glacier National Park, at a cost of $15,000.

Nebraska.

✣Bids will be received until 2 p. m., Sept. 3, by H. E. Wells, Clerk of Lancaster County, Lincoln, Neb., for the grading of a county road between the southwest corner of the northwest quarter of Section 32, Town 12, R. 6, and the county line, a distance of 5½ miles. Road is to have a crown of 2½ ft. above the bottom of the ditch.

R. M. Dodge has been detailed by the U. S. government to put in a mile of model road at Central City, Neb. The site for the road has not as yet been selected, but it is likely that the mile of road just west of Central City along the Union Pacific tracks, the mile north from Bishop & Withrow's corner, will be selected for the demonstration.

New Hampshire.

✣State Engineer H. C. Hill, Concord, N. H., will receive bids until 1 p. m., Sept. 9, for the construction of a trap rock road in East Kingston, N. H.

✣Bids will be received by H. C. Hill, State Engineer, New Hampshire, Concord, N. H., until 1 p. m., Sept. 9, for the construction of a gravel road in Gorham, N. H., estimated to cost $7,900.

New Jersey.

✣Bids are readvertised by W. T. Joyce, Township Clerk, for the construction of a stone road from Smalley's Corner, beginning at the South Pemberton stone road and running southerly to the Buddtown road in Vincentown, Southampton Township, Burlington County, N. J., a distance of 2.9 miles. Bids will be opened at 1:30 p. m., Sept. 6. E. Thompson is Engineer in charge.

New York.

✣Department of Public Works, Buffalo, N. Y., will receive bids until 11 a. m., Sept. 2, for paving Vandalia St., 26 ft. wide; Republic St., 24 ft. wide; Ledger St., 24 ft. wide; Barton St., 26 ft. wide; Rano St., 30 ft. wide; Princeton Pl., 22 ft. wide. F. G. Ward is Commissioner.

The bureau of engineering at Buffalo, N. Y., has completed the plans for the repaving of Elmwood Ave., between North and Virginia Sts., in connection with the widening of the avenue there.

Ohio.

✣Bids will be received until noon, Sept. 2, by the County Commissioners at Columbus, Ohio, for the necessary labor and material for macadamizing the Smith Davis Road as follows: Section No. 1—From the west corporation line of Worthington to the Hocking Valley R. R. track at Elmwood, and from Elmwood south to the Sharon-Clinton Township line, a distance of 19,350 ft.; 4,300 tons crushed limestone; 2,000 tons crushed limestone screenings. Section No. 2—From the Hocking Valley R. R. track at Elmwood to the east end of the Scioto River Bridge at Dublin, a distance of 17,130 ft.; 3,700 tons crushed limestone; 1,700 tons crushed limestone screenings.

✣Bids will be received until noon, Sept. 10, by W. F. Whittier, County Surveyor, Delaware, Ohio, for the work of constructing the Delaware and Sunbury Pike. The road is located in Berlin and Berkshire townships and extends from the old railroad bed to the village of Sunbury, including nine miles of grading, draining and macadamizing.

✣Bids will be received until 8:30 p. m., Sept. 13, by Commissioners of Public Works at the office of the City Engineer, Olean, N. Y., for the construction of vitrified brick pavement, with concrete foundation and concrete curb and gutter in West Henley St., from the west line of South First St. to P. R. R. switch at 15th St. R. B. Fordsworth is Engineer.

✣Bids will be received until 7:30 p. m., Sept. 13, by Commissioners of Public Works at the office of the City Engineer, Olean, N. Y., for the construction of vitrified brick pavement on concrete foundation in Whitney Ave., from the west line of North Union St. to a point 40 ft. west of the west line of North First St. R. B. Fordsworth is Engineer.

✣Bids will be received until 8 p. m., Sept. 12, by Frank Sibley, Town Clerk, Scarsdale, N. Y., for the resurfacing with a bituminous macadam of the highway known as the New York Post Road in the town of Scarsdale. E. J. Wulff is Engineer.

The county commissioners at Columbus, Ohio, have awarded the contract for the improvement of the Hilliard and Dublin road, a distance of 12¼ miles to John M. Snouffer, 46 West Oakland Ave., city. The road lies in Norwich and Washington townships and will be of water-bound macadam. The contract price was $25,221.

The commissioners of Lucas County, Toledo, Ohio, have awarded a contract to C. W. Ryan, of Maumee, Ohio, for the construction of a macadam country road in Waterville township. Bids were opened Aug. 20.

The Lucas County Commissioners, Toledo, Ohio, have awarded a contract to Russell & Jennison Co., Nicholas Building, Toledo, Ohio, for the construction of a macadam road on Lewis Ave., from Sylvania Ave. to the northwest line of Toledo addition, Washington township. Bids were opened Aug. 22.

An estimate was prepared by Public Service Director Lea, of Cleveland, Ohio, showing the cost of making land for a lower driveway and boulevard along the four-mile stretch from Edgewater park to the mouth of Rocky river. It is estimated that it would cost the city $600,000 to make land for a wide lower boulevard at the foot of the high bluffs which now fringe the lake and an additional $100,000 would be needed for paving a 100 ft. roadway.

State Highways Commissioner James C. Wonders, of Columbus, Ohio, has awarded a contract to A. Emery & Son for the paving of the Coopermill road for one mile beyond the corporation limits, Muskingum county, for $12,150. The work is under the supervision of the state highway commission.

Contracts have been awarded for rebuilding three of the four pikes that were advertised for sale at the door of the court house in Urbana, Ohio. L. W. Runkle received the contract for rebuilding the road south of St. Paris to the Runkle pike for $1,075; John Sheedy received the contract for repairing the pike south of Urbana for $2,225, and for the road running through Kingscreek for $1,125. The repairs average about a mile in length each.

The city council of Upper Sandusky, Ohio, has awarded a contract to P. Drake & Sons, of Marion, for the paving of Johnson St., with brick. The contract calls for the use of some 500,000 bricks.

The Wayne County Commissioners at Wooster, Ohio, have awarded the contract for the paving of the west part of the Jones road across the bottoms west of Wooster, a distance of two-thirds of a mile to D. R. Houser, of Wooster, for $7,881.

A petition will soon be signed by the property owners in Liverpool, Ohio, for the improving of Bradshay Ave., from Ambrose Ave. to Avondale St., by grading, curbing and paving. The total cost of the improvement will approximate $10,000.

The city council of Covington, Ohio, has ordered the paving of Madison Ave., between 11th and 12th Sts., with wood block as a test and to take the place of the asphalt.

William Harret & Co. has been awarded a contract by the county commissioners at Cincinnati, Ohio, for the construction of the Dugan Gap road at a cost of $13,082.

Pennsylvania.

✣Bids will be received by the State Highway Department, Capitol Building, Harrisburg, Pa., until 2 p. m., Sept. 16, for the construction of 1,076 ft. of road, extending from station 551 end of present macadam to station 561 76 end of the present paving on the National road in Brownsville borough in the county of Fayette. Joseph W. Hunter is Highway Commissioner.

The city council of Chester, Pa., has passed an ordinance providing for the paving of the following streets: Broomall St., from Philadelphia, Baltimore & Washington Railroad to Third St.; Concord Ave., from Third St. to the Philadelphia, Baltimore & Washington Railroad; Edgmont Ave., from Second St. to Third St.; Fifth St., from Edgmont Ave. to present asphalt, about 100 ft. west of Morton Ave.; Fourth St., from Edgmont Ave. to Welsh St.; Flower St., from Front St. to Third St.; Highland Ave., from Third to Sixth St.; Madison St., from Sixth St. to Twelfth St.; East side of Market St., from East Graham St. to Front St.; Morton Ave., from Philadelphia, Baltimore & Washington Railroad to 115 ft. north of Tenth St.; Providence Ave., from Sixteenth St. to Twenty-fourth St.; Penn St., from Front St. to Third St.; Seventh St., from Madison St. to Butler St.; Second St., from Market St. to Edgmont Ave.; Second St., from Penn St. to Fulton St.; Second St., from Lamokin Run to Thurlow St.; Third St., from Concord Ave. to Clayton St.; Welsh St., from Fourth St. to Edgmont Ave.; with sheet asphaltum, bithulithic, wood block, granite block, or vitrified brick or block.

The county commissioners at McKeesport, Pa., have decided to pave the thoroughfare from Second Ave., in McKeesport, to the Boston bridge in Versailles borough, a distance of over three miles.

The borough council of Point Marion, Pa., has awarded Thoney Pietro, of Morgantown, the contract for paving Mechanic St., for $3,500.

A survey of the proposed new county road from Freeland to Wilkes Barre, Pa., has been started.

A new road is favored by the viewers of East Pike Run township, Washington, Pa. The road will begin at a point on the Coal Center and Beallsville road, 120 ft. north from the intersection of the Pike Run and Malden road with the Coal Center-Beallsville road to a point in the Coal Center-Beallsville road 1,481 ft. south of the point where the Brownsville road in the township crosses the Coal Center-Beallsville road.

South Dakota.

The city commissioners of Sioux Falls, S. D., have awarded the contract for paving Sixth St., from Main Ave. to the Sixth St bridge to Joe Sampson for $2.92 per sq. yd. Granite pavement will be used.

Tennessee.

M. J. Clark & Sons, Memphis, Tenn., on Aug. 19 received bids for approximately 65,000 cu. yds. of gravel roadway for their new subdivision between Poplar and Court Aves., Memphis, Tenn. M. Eugene Clark has charge of the awarding of the bids. The gravel will be pit run and screened from either Tishomingo or Camden pits, and standard city of Memphis specifications will be adopted.

On or about Sept. 1st, S. R. Martin, Memphis, Tenn., will receive bids for the grading and graveling of approximately 10,000 cu. yds. of subdivision work, which will be a continuation of the present Stonewall place. Standard city of Memphis specifications will apply, while the gravel will be either from Tishomingo or Camden pits. It is reported an alternate bid on crushed stone instead of gravel will be considered.

Texas.

✣Bids will be received until Sept. 13 at noon, for the paving of Main St. road, according to the plans and specifications on file in the office of the County Engineer. J. B Ashe is Auditor of County, Houston, Texas.

The petition of J. W. Thomppson, et al, for a road beginning at the intersection of the Perry & Austin survey with Clear creek was granted by the County Commissioners of Houston, Tex., provided donations of the necessary right of way are made to the county.

The Board of County Commissioners at Sherman, Texas, has awarded a contract to Dennis McNerney for work in the Denison road improvement district to the amount of $850,000.

The city council of Santa Barbara, Cal., has passed a resolution providing for the construction of 900 ft. of highway eastward from the Hot Springs Ave., on the Coast highway to the city limits. It is estimated that the improvement will cost $2,000.

Robert Staritt and Ira Orcutt, of Orleans Cal., have been given a contract to construct 10,125 ft. of road from a point above Weitchpec up the Klamath river, at a cost to the county of $4,950.

Virginia.

The Board of Supervisors of Warren County, Front Royal, Va., have applied to the Circuit Court for an order for an election on a bond issue of $30,000 to build a macadamized road from that county to the Rappahannock line on top of the Blue Ridge

Washington.

✣Information from Tacoma, Wash., states that bids will be received until Sept. 1, by the County Engineer, for the construction of the proposed Browns Point Road. The cost of the work is estimated at either $28,000 or $50,000.

The Pierce County Commissioners, Tacoma, Wash., have established the Browns Point boulevard and bids for its construction will be received at once. The new roadway, which has been under consideration for nearly ten years, will extend from Tacoma to the King county line, a distance of five and a half miles along the east side of the bay. It has been known as the Dash Point road. The road will cost approximately $50,000. Torger Peterson is commissioner.

A meeting is to be held by the automobile clubs of the Pacific Coast on Sept. 4, at the Hotel Washington Annex, Seattle, Wash., to discuss the feasibility of constructing an international highway from Mexico to Canada.

The J. C. McGuire Co., of New Brighton, Pa., were recently awarded the contract for paving Pleasant Ave., from Skull Dun to 22d St., in Wheeling, W. Va.

WATER-WORKS AND SEWERAGE

Alabama.

The city of Albertville, Ala., recently held an election to vote on the issuance of bonds in the sum of $25,000 for the purpose of building a water works plant.

An election will be held at Birmingham, Ala., on Sept. 19 to vote on the question of whether the water plant shall be sold for $140,000 and the light plant for $50,000. Both plants are located at North Birmingham.

Arkansas.

J. C. Wilson has obtained a franchise to install a new sewerage system, water works and light plant in the city of Clarksville, Ark.

California.

✣Board of Public Works, Oakland, Cal., will receive bids until 11 a. m., Sept. 21, for furnishing necessary labor and material for the construction of a storm sewer in San Pablo Ave., from 59th St. to 67th St., with an outlet on 66th St. Walter B. Fawcett is Secretary.

The city of Pleasanton, Cal., has awarded a contract to Schmidt Construction Co., 2121 Shattuck Ave., Berkeley, Cal., for the construction of sewers and sewage disposal works for $24,500. Bids were opened Aug. 15.

The public utilities committee of San Francisco, Cal., has recommended to the board of supervisors that authorization be given for the issuance of $3,000,000 water bonds to inaugurate the new municipal system.

The city of Sisson, Cal., is agitating the question of a new water supply and the board of trustees are negotiating for a new source, which will furnish pure water. Harvey J. Sarter is running lines and making plans and specifications for the water system. Plans are also being prepared by the surveyor for the construction of a sewer system.

A. L. Chambers of Oakland, Cal., has been awarded the contract by the board of town trustees of Los Gatos, Cal., for extending the sewer system of that city for $1,800. The plans call for a section of the proposed sewer to extend 234 3-10 ft. on San Jose Ave., while the other section is to be constructed on the same highway for a distance of 1,076 ft. and to carry a 6-in. pipe.

Colorado.

The contract for the construction of a water works system for the town of Grand Valley, Colo., was recently awarded to D. G. Gordon of Pueblo, Colo. The system consists of concrete reservoir, wood pipe to reservoir, and cast iron pipe in town, about 25,000 ft. in all. The contract was awarded for $26,000. Theo. Rosenburg of Glenwood Springs, Colo., is the Engineer.

The town board of trustees of Johnstown, Colo., has decided to install a water works system at a cost of $12,000, to be ready November 1. The contract has been awarded to Fairbanks, Morse & Co.

The contract for the construction of the Washington Park storm sewer, Denver, Colo., has been awarded to the Dennis Gibbons Construction Co., and the work of construction will begin within the month. The sewer will be 18 miles long, and the contract was awarded for approximately $175,000. The same firm also has the contract for the construction of the 32-mile sewer, the main line being from Berkeley Lake to University Park and having several small branches.

District of Columbia.

Asa E. Phillips, superintendent of sewers, Washington, D. C., is planning to build two sections of sewers, one between Shepherd road and 14th St. and the other between Emerson St. and Georgia Ave., the entire work estimated at $30,000. The work will include 1,600 ft. of tunnel, averaging 9½ ft. in diameter. Bids for this work are to be received at once.

Florida.

An ordinance has been introduced in the city council of New Smyrna, Fla., providing for the offering of a franchise to Fred Whitaker for water works, electric light or gas plant.

Idaho.

At an election held in Mountainhome, Ida., on Aug. 17, the people voted down the proposition to construct a water works at an estimated cost of $48,000.

Illinois.

✣Engineer W. S. Shields, 140 Dearborn St., Chicago, Ill., is receiving estimates until Sept. 15, 8 p. m., for the construction of a 50,000 gal. capacity steel water tank at Toulon, Ill Arthur Shinn is City Clerk.

✣Board of Local Improvements, Chicago, Ill., Charles A. V. Standish, Secretary, will receive bids until 11 a. m., Sept. 7, for the construction of sewers in West North Ave. as follows: 2,690 ft. 2-ring 4½-ft. sewer, average depth 15 ft., 2,720 ft. of 2-ring 3¾-ft sewer, average depth 15 ft., 2,650 ft. of 2-ring 3½-ft. sewer, average depth 14.5 ft.; 1,680 ft. 2-ring 3-ft. sewer, average depth 12.5 ft.; 900 ft. of D. I. 2-ft. sewer, average depth 16 ft.; 110 ft. 2-ring 2½-ft. sewer, average depth 13 ft; 500 ft. S R 2 ft sewer, average depth 14 ft.; 250 ft. 1½-ft. sewer, average depth 12 ft. The work includes 53 manholes, 56 catchbasins, and is to be completed by August 1, 1911. The Engineer's estimate of the work is $66,000. A certified check for 10 per cent the amount of bidding price is to accompany each bid

✣Board of Local Improvements of Chicago, Ill., will receive bids until Sept. 1, for building brick sewer systems in West Belmont Ave., North 50th Ave., West Addison St., and North 52d Ave.

✣Board of Local Imuprovements, Waukegan, Ill., will receive bids until 8 p. m., Sept 1, for the labor and material for the following improvements: A system of sewers with necessary manholes, catchbasins and house connections in portions of Sherman Place, Clayton St., Fairview Place and Madison St. A sewer with necessary manholes, catchbasins and house connections in a portion of Washington St. from Fulton Ave. to west line of Section 20, all in the City of Waukegan, Lake County, Illinois.

The contract for constructing a dam for the Centralia Water Supply Co., at Centralia, Ill., was awarded Aug. 20, to John D. Vogt, Belleville, Ill. The work will amount to about $22,000. The contract for constructing the pipe line, gate house and spillway amounting to about $77,000, was awarded to H. H. Hall, 535 Murphy Bldg., East St. Louis, Ill.

Items marked thus ✣ indicate work now open for bids.

The Harper Engineering Co., of East St. Louis, Ill., are engineers for the work.

Mayor John R. Cronin of Joliet, Ill., contemplates the transfer of $25,000 from the city hall fund to the water department fund, to be used for drilling a well and equipping a station on the west side of the river, and also drilling an additional well at the pumping plant on Washington St. Matt Bercheidt, City Clerk.

East Peoria, a suburb of Peoria, Ill., is taking steps toward the installation of a water works system. A committee composed of Dr. Stiers, Ike McKinsey and John Kraembuhl has been appointed to investigate conditions.

Plans have been outlined by the North Shore Sanitary Association, of which David H. Jackson is president, for the disposition of the sewage of the North Shore, Chicago, Ill., and to decide upon a plan whereby a water supply free from contamination can be procured for the municipalities of Highland Park, Lake Forest, Lake Bluff, North Chicago, Waukegan, Highwood, Ravinia, the U. S. Naval Training Station and Fort Sheridan.

The water works committee of the city council of Charleston, Ill., has awarded a contract to the Des Moines Bridge & Iron Co., for the construction of a water works tower and tank for $2,985.

The citizens of Carlyle, Ill., have voted the issuance of bonds in the sum of $13,000, to be expended for the extension of the water works and electric light systems.

Alvord & Burdick, civil engineers, 140 Dearborn St., Chicago, Ill., are preparing a report for a sewer and purification system for South Milwaukee, Wis. Improvements to the pumping station at South Milwaukee will also be considered.

The P. J. McNulty Co. were the successful bidders for the system of sewers from 59th place to 65th St., and from Kedzie Ave. to Hamlin Ave., in the city of Chicago. The accepted bid amounted to $92,100. The system, according to their contract, must be completed by Sept. 1, 1911.

Civil Engineer Paddock has submitted a plan to the city council of East Moline, Ill., for the construction of a sewer in that city. The plan provides for the laying of at least six miles of sewer mains which will drain all that part of East Moline south of the tracks and lying between First and 15th Sts.

Bids were opened August 24 by the Board of Local Improvements of Chicago, Ill., for constructing several small sewers, the low bidders being as follows: South 42d Court, Michael Pontorelli, 4817 W. Dakin St., Chicago, $884; South 43rd Ave., Nicholas Mancini, 900 W. Taylor St., $871; South 43rd Court, Michael Pontorelli, $3,483; South Laflin St., Tutelli & Scully, 518 W. Taylor St., $607; West 99th St. and South Irving Ave., Simon Ryan, 2927 W. Congress St., Chicago, $2,806.

Surveyor E. O. Hills, assisted by C. R. Flatt is making surveys of Fulton, preparatory to making a profile and an estimate of the cost of a sewage system of the business portion of the city.

The board of local improvements of Galesburg, Ill., has awarded a contract to the Ottawa Construction Co. for the construction of the sewer in the east part of the city for $14,336. The sewer is to be constructed on Berrien St., as far east as Indiana Ave., from there it is to run north to Main St., and east on Main St. as far as Division.

Indiana.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 7, for local sewers in and along Bellefontaine St., from 20th St. to Sutherland Ave.; alley west of East St., from Raymond St., 895 ft. north; alley west of West St., from McCarty St. to Wyoming St.; alley north of Lincoln St., from Leonard St., 977 ft. west; McPherson St., from 20th St. to Sutherland Ave.; Euclid Ave., from Michigan St., 1,130 ft. north.

✣Bids will be received until 7:30 p. m., Sept. 5, by the Common Council of Union City, Ind., at the council chamber, 111½ West Columbia St., for the construction of a main sewer branch and laterals, connections and appurtenances. Ross C. Sutton is City Clerk.

Petitions for the construction of sewers on Portage Ave., from Elwood Ave. to the city limits and on Olive St. from Kenwood to Washington Ave., have been approved by the board of public works of South Bend, Ind.

Frank W. Leibole has been awarded a contract for constructing the 10-in. sewer on First St., by the city council of Goshen, Ind., for $0.35 per ft.

The board of public safety of Terre Haute, Ind., has awarded a contract to P. O'Leary & Son for the construction of a new sewer extension from the Ten's engine house, in North 14th St., to the sewer on Lafayette Ave., for $0.36 per lin. ft.

Iowa.

✣Bids will be received until Sept. 10 by the Board of Supervisors of Jone County for the drilling of a well on the county farm. Tubing of the well to be 5⅝ in. galvanized. Louis Gardner, Anamosa, Ia., is Auditor.

The town of Lamotte, Ia., has voted in favor of the proposition of installing a water works system.

The city of Marshalltown, Ia., will probably hold an election Sept. 30 to vote on the issuance of bonds in the sum of $30,000 for the extension of the sewer system to the city limits.

Kansas.

The city council of Hutchinson, Kan., has awarded the contract to C. Howard for the construction of the Severence St. sewer for $9,812, and the contract for constructing the Poplar St. sewer to Davis & Everett for $4,501. G. L. McLane is City Engineer.

Kentucky.

Noble & Gardner of Paducah, Ky., have been awarded the contract for the construction of a system of sewers in Newport, Ark., for $40,000. George A. Gardner of the firm is preparing to sub-let part of the work and to arrange for the inauguration of the work.

Maine.

✣Bids will be received until noon, Sept. 12, by the Trustees of the Portland Water District, Portland, Me., for the construction of 14 miles of pipe, as follows: 48-in. steel pipe, plates ¼ in. to ⅜ in. thick, delivered and laid complete; 40-in. cast iron pipe, delivered; laying 42-in. cast iron pipe. C. W. Fenn, 11 Exchange St., Portland, is Engineer.

Maryland.

✣Bids will be received until noon, Sept. 5, by the Town Commissioners, Centerville, Md., for the construction of about 12,500 ft. of 8, 10 and 12 in. sewers; about 2,400 ft. of house connections; 45 manholes. Morse & Cockey are Consulting Engineers, 603 Continental Trust Bldg., Baltimore, Md.

The town council of North East, Md., has granted a franchise to George A. M. Johnson, for a period of 20 years, for the construction of water works for the town.

Cumberland, Md., proposes the installation of a new water works system. It is planned to take the water supply from the Potomac River. George G. Young is Mayor.

A permit has been granted by the mayor of Baltimore, Md., to a number of residents of Hampden, allowing them to begin the construction of a sanitary sewer in the territory bounded by 33rd St., Wellington, Chestnut and Elm Aves. The improvement will cost $3,000.

Michigan.

✣Bids will be received until 2 p. m., Sept. 8. by A. H. Dumond, City Clerk, Owosso, Mich., for the construction of sewers, including 1,600 ft. of 24-in. sewer, 880 ft. of 20-in., 500 ft. of 15-in., 80 ft. of 6-in. Y branches; 12 manholes; 1 special catchbasin inlet for flushing.

Contracts for the construction of sewers in Stevenson, Highland and Garland Sts., have been awarded to W. N. Sager by the common council of Flint, Mich. The Stevenson St. sewer, from the Flint river to Kearsley St. will be about 570 ft. long; the contract price being $819. The Highland St. sewer from Detroit St. to the east end of Highland will be 230 ft. long and its estimated cost is $277. The sewer on Garland St., from 10th Ave. to the north end of the street will be about 1,300 ft. long and will cost about $2,343.

The citizens of Caro, Mich., recently met at the council chambers to confer with H. E. Riggs, sanitary engineer of Toledo, O., in regard to the best means of disposing of the sewage and the location of a filtration plant at some point which would eliminate all danger of contamination with the water works system or the river above the sugar factory. It was finally decided to locate the plant on the south side of the water works.

Bond propositions are now being considered by the city council of Kalamazoo, Mich., which will probably be submitted to the voters at the fall election for improvements aggregating $100,000 as follows: The Bryant St. sewer, from Portage Creek to Portage St., $1,200; the Greenwich place sewer, from Kalamazoo to Willard, $600; sewer in the santary zone, $20,000; Fulford St. sewer, $15,000; Patterson St. sewer, from the river to Douglas Ave., $10,000; new wells at water works, $3,000; tail race sewer, from Third to Vine, $1,500; two bridges on Mill and Gull Sts., $40,000; water main extensions, $10,000.

Plans have been prepared by City Engineer Terry of Flint, Mich., for the construction of the following sewers: 11th St., from Pine to Harrison St., Bonbright St., from Witherbee to Oren St.; Pine St., from 11th to 15th St.; Frost St., from Flint River to Third Ave.

City Clerk James Schriver of Grand Rapids, Mich., sold bonds Aug. 22 in the sum of $20,000 for the construction of sewers.

The Keckonen Hardware Co. of Calumet, Mich., has been awarded a contract by the village of Ahmeek, Mich., for furnishing the pipe necessary in the installation of a sewer system, for $1,616. The work of ditching for the sewer and laying the pipe was awarded to Hiltunen & Waino for $1,100.

Minnesota.

The plans and specifications for the extension of the water system in Austin, Minn., by bringing in the water from the City Farm Springs east of the city have been completed and bids will be advertised for at once.

The citizens of Farmington, Minn., have voted in favor of the proposition of installing a water works system.

The village council of Grand Rapids, Minn., has let the contract for the construction of the lower end of the Leland Ave. sewer to the Grand Rapids Improvement Co., for $4,894.

Fraser & Danforth of Red Wing, Minn., have been awarded the contract in Chippewa Falls, Wis., for constructing the 14 blocks of new sewer on Spring, Rural and River Sts., for $6,975.

Missouri.

A delegation of members of the Oak Hill Improvement club recently appeared before the board of public works of St. Joseph, Mo., and exacted a promise from that body to immediately invite bids for the construction of an extension of the 32d St. main sewer, from the alley between Lafayette and Seneca Sts., south and parallel with 32d St. to Mitchell Ave.

The plans for the new sewer system for Miles City, Mont., as revised by the firm of Burns & McDonnel, Scarritt Bldg., Kansas City, Mo., have been received by the city engineer.

Montana.

The city council of Helena, Mont., has awarded a contract to Adami Bros. for $24,454 for the construction of the district sewer in the Broadwater addition. The same firm also was awarded the contract for the construction of the Broadwater addition outflow sewer for $7,050. Miracle-Tripp Co. was awarded the contract for the Sixth Ave. improvement district work for $11,948.

Items marked thus ✣ indicate work now open for bid.

Nebraska.

Contracts have been awarded by the City of Alliance, Neb., to the Katz-Craig Construction Co. of Omaha, Neb., for extension of the city water mains and doubling the water system. The improvement will cost $19,000.

Grand Island, Neb., is planning on building a sewer system to the soldiers' home and suburbs, half of the cost being appropriated by the state.

The city council of Fremont, Neb., has passed an ordinance for the extension of the sewerage system in the Northside addition. The estimated cost of the work is $4,700 and the expense will be borne by the property owners.

New York.

✣Commissioners of Public Buildings, Monroe County, Rochester, N. Y., will receive bids until 10 a. m., Sept. 3, for the construction of sewage disposal plant, etc., and group of buildings to be used for a tuberculosis hospital on the Monroe County Farm at the corner of Henrietta and Westfall Roads. Thomas J. Bridges is Chairman of the Commission.

✣Bids will be received until 10 a. m., Sept. 13, by Board of Commissioners of Public Works, for the construction of vitrified pipe sewer and appurtenances in Main St., from North Union St. to the Olean Creek. R. B. Fordsworth, City Bldg., is Engineer.

The board of contract and supply of Rochester, N. Y., has awarded the contract for the construction of the Humboldt, Hampden and Marion St. sewers to William H. Sours for $24,013.

The board of local improvements of Flatbush, Brooklyn, N. Y., has approved measures calling for street curbing in New Lots and sanctioning plans for a number of new sewers in Flatbush and for the construction of a sewer in Church Ave., from Gravesend Ave. to 14th Ave., with an outlet sewer in 14th Ave. to 37th St.

The village of Lyndonville, N. Y., has voted against the proposition of installing a waterworks system in the village.

Howard Wing, civil engineer of Buffalo, N. Y., it is reported, has been awarded the contract by the sewer commission of Albion, N. Y. for the preliminary work to be done in connection with the proposed sewer system for that city.

North Dakota.

✣Bids will be received until 4 p. m., Sept. 8, by W. V. O'Connor, Clerk of the Park Board, Grand Forks, N. Dak., for the construction of an 8-in. sewer from the proposed public comfort station in Riverside Park, 350 ft., more or less. W. P. Davies is President of the Park Board.

An election was held Aug. 30 in Onida, N. Dak., to vote on the issuance of bonds to the amount of $10,000 for the purpose of installing a system of water works for that place.

The city council of Carrington, N. Dak., has accepted the plans and specifications furnished by L. P. Wolffe of St. Paul, Minn., for a system of sewerage disposal for Carrington. Work will be started this fall.

The city of Dickinson, N. Dak., held a special election August 30 to vote on the proposition of increasing the debt limit $70,000 for the installation of a complete sewer system.

Ohio.

✣Bids will be received until noon Sept. 6, by Director of Public Service, Youngstown, O., for the necessary labor and material for the construction of sewer in Phelps St. from Lincoln Ave. to Boardman St. W. H. McMillin is Clerk. Plans and specifications are on file at the office of the City Engineer.

✣Director of Public Service, Elyria, O., will receive bids until noon, Sept. 2, for the necessary labor and material for the construction of a breakwater at the Elyria water works pumping station west of Lorain. Rose Moriarty is Clerk.

✣Bids will be received until noon, Sept. 17, by J. W. Shimek, Clerk of the Board of Control, Newburgh, O., for the necessary labor and material for the construction of sewer and water mains in the following streets: First, E. 130th St., formerly known as Brett Ave., sewer pipe; 2d, Aetna Road, sewer pipe; 3rd, Anderson Ave., sewer pipe; 4th, Buckeye Road, water main, 5th, E. 115th St., formerly Adams St., water main; 6th, Union St., between E. 105th and E. 107th St., water main.

✣Bids will be received until noon, Sept. 3, by A. W. Shatto, Village Clerk, Newburgh Heights, O., for the construction of sewers in Alpha Ave., Beta Ave., Bridgeview Ave., Cuyahoga St., Gamma Ave., McGregor St., Sigma Ave.

Phillips & Bixel, Superior St., Cleveland, O., have been awarded a contract by the village of Euclid, O., for laying 6-in. water main on Lawnview Ave., from the north line of Euclid Road to the center line of Roseland Ave., for $2,654. Bids were opened Aug. 22. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, Engineers.

Bonds in the amount of $138,400, recently authorized by the city council of Canton, O., will be sold Sept. 29. The issue contains an appropriation of $125,000 for the improvement of the water works, and $6,100 for the construction of a sanitary sewer in St. Elmo St., a storm sewer in Cedar and Dewalt Sts., and sanitary sewers in Warner Ave. and Dorn alley.

H. A. Grimmer, City Auditor of Hamilton, O., will sell bonds Sept. 6 in the sum of $50,000 for improvements to the water works system, and $50,000 for the construction of sewers.

The board of control of Niles, O., has sold bonds in the sum of $32,000 for the construction of sewers in sub-district No. 4 of district No. 3. The work on the sewer construction will be commenced at once.

The board of control of Middletown, O., has contracted with John Arpp, Jr., to build sanitary sewers in the city for $14,700.

The Massillon Iron & Steel Co. of Massillon, O., has been awarded a contract in Zanesville, O., for furnishing the city with an indeterminate quantity of cast iron water pipe at $24.65 per net ton for 4-in. standard bowl and spigot pipe and $23.16 for the 6-in. size.

The city council of Newark, O. has passed an appropriation for $100,000 for the old water works of H. H. Verrill of Portland, Me. The city has partly completed the municipal plant.

Michael J. Cooney has been awarded the contract for installing the West Main St. storm water sewer by the board of control of Springfield, O., for $9,404. M. J. Banin, Engineer.

Construction Superintendent Hefferman of the water department, Dayton, O., has recommended to the city council the laying of 950 ft. of 8-in. water pipe at once because of proposed paving on Germantown St., to the corporation line. The cost is estimated at $1,187.

Plans and specifications for a storm sewer on Glendale and Oxford Aves. were submitted by City Engineer F. J. Cellarius to the city council of Dayton, O. The cost is estimated at $1,755

William Strachan of Lancaster, O., it is reported, has received the contract for the construction of a sewer at Bremen. The sewer is to be 4,706 ft. long and two ft. in diameter. The contract was awarded for $5,913.

The city council of Piqua, O., has ordered the building of a storm sewer for the northwest part of the city. It is estimated that the improvement will cost $12,000.

The sewer committee of the city council of Springfield, O., is planning for the laying of a number of sanitary and storm water sewers, for which applications have been filed. Among those to be constructed are Walter St., Maiden Lane, East Liberty St., Innisfallen Ave. and Cedar and Lowry Aves.

Oklahoma.

The city of Carmen, Okla., held an election Aug. 29 for the purpose of voting $15,000 additional revenue to extend the water works and electric lights.

Oregon.

The city council of Klamath Falls, Ore., has awarded the contract for the construction of the second unit of the sewer system of the city to the Chico Construction Co., of Chico, Cal. The second unit of the system comprises 7,792 ft. of pipe from six to 12 in. in diameter. The price for which the work is to be done is $12,490. The Chico Co. is now at work on the first unit, having obtained the contract some time ago.

Pennsylvania.

The City Council of Allentown, Pa., has sold bonds in the sum of $34,500 for the construction of sewers. The council at the same time awarded the contracts to George Hardner as follows: Lehigh St., from Little Lehigh to Auburn St., $5,190; Summer Ave., Lehigh to Little Lehigh, $17,542; 10th St. Linden to Turner, $1,022; Sixth St., Hamilton to Linden, $590; Fourth and Chew Sts., to Jute St.. and the Jordan Creek, $2,371; Sixth St., From Cedar to Summer, $2,935.

The Dale Borough Council (P. O. Johnstown, Pa.) has passed the ordinance providing for the combined storm water and sewage sewers in Von Lunen road and in Hoffman alley. The sewer will extend from Blum St. to Clark, McMillen and Messenger Sts. and to Solomon's Run. The pipe will be from 15 in. to 20 in. in diameter and the average depth of the sewer will be five ft. 8 in. The contract will be let as soon as possible.

The city council of Lebanon, Pa., has passed a bill providing for a special election for the purpose of voting upon the proposed increase of the city's indebtedness for the construction of the system of sewers. It is estimated that the system would cost $110,000.

The finance committee of the city council of West Chester, Pa., has awarded the contract for the construction of about 1,100 ft. of brick conduit to Joseph U. Fritchie & Son of Lancaster, Pa., for $4,186. The sewer will be constructed from Seventh Ave., at Gibbon's Run to the Pennsylvania Railroad.

The city council of Erie, Pa., has awarded a contract to F. J. Eichenlaub for the reconstruction of a 12 and 9-in. sewer in West 12th St., from Cascade St. westwardly, 1,320 ft.; the bid being as follows: 12-in. pipe, 90 cts. a ft.; 9-in. pipe, 80 cts. a ft.; 6-in. pipe, 40 cts. a ft.; 12x9x6-in. Y or T branch, $1.10, man holes, $35. Of the other bidders, Edward Driscoll bid $1.10 for 12-in. pipe, while David Jones and Joseph McCormick & Bro. each bid $1.40. The reconstruction of this sewer must be completed before the paving of the street can be finished.

J. U. Fritchey & Son of Coatesville, Pa., has been awarded a contract by the sanitary committee of the Coatesville borough council for the construction of 2,000 ft. of brick storm sewers.

Fabrizid D'Andrea has been awarded the contract for building the 10th ward sewer in Scranton, Pa., for $3.50 per lin. ft. The sewer is to empty into the Dunmore sewer, and is to be 6,640 ft. in length. The cost will be approximately $25,000.

City Engineer M. B. Cowden of Harrisburg, Pa., has put his force to work preparing the specifications of the sewers that will be built this year under the $100,000 loan item for sewer extensions.

The water department of Harrisburg, Pa., has awarded the contract for the building of the additional concrete wall at the basin at the filter plant to William S. Miller of the firm of Coder & Miller for $2,287.

South Dakota.

✣Bids will be received by F. W. Raymond, City Auditor, Aberdeen, S. Dak., until 8 p. m., Sept. 12, for the construction of all sewers ordered by the city council as follows: Sixth Ave. southeast, Dakota to Jackson St.; Second Ave. southeast, Washington St. to 230 ft. west.; Lincoln St. north, First to Second Ave. northeast, including approximately 366 ft. of 10-in. pipe; 386 ft. of 8-in. pipe; 232 ft. of 8-in. pipe; three manholes.

✣Bids will be received by Lewis Larson, City Auditor, Sioux Falls, S. Dak., until 9

Items marked thus ✣ indicate work now open for bids.

p. m., Sept. 6, for the construction of all main and trunk sewers in the West Side Sewerage District. Plans and specifications are on file at the office of the city engineer or L. P. Wolff, St. Paul, Minn., Consulting Engineer.

The voters of Willow Lakes, S. Dak., have voted against the proposition of issuing bonds in the sum of $9,500 for the installation of a sewer system because bonds for the same amount were not voted for at the same time. It is probable that another election will be held to vote on the issuance of $19,000 in bonds for sewers and water works system.

Texas.

✣C. W. Fassett, City Clerk, El Paso, Texas, will receive bids until Sept. 20, for the construction of a complete garbage, refuse and sewage disposal plant for the city of El Paso. The work is estimated to cost $100,000. F. H. Todd is City Engineer.

✣Bids will be received until 10 a. m., Sept. 20, by C. W. Fassett, City Clerk, El Paso, Texas, for the construction complete of Garbage Refuse and Sewage Disposal Plant. Public Works Engineering Co., Consulting Engineers, Beck Bldg., Portland, Ore. Work is advertised elsewhere in this issue.

The contract for the drilling of a new well at Oak Cliff, Dallas, Tex., has been awarded by the board of municipal commissioners to R. H. Dearing & Sons for $8.45 per ft., if the city furnishes the steam or at $9.65 if the contractor generates the steam from his independent plant. The well is to be sunk near the wells of the present waterworks plant and will be from 1,600 ft. in depth to 2,500 ft., with a 10 and 8-in. bore.

The following bids were received Aug. 22 by Constructing Quartermaster P. Whitworth of Fort Crockett, Galveston, Tex., for the construction of a sewer system at that post: General Contract Co., New Orleans, La., $30,900; Isaac Heffron, Galveston, Texas, $17,650; Kelso & Vautrin, Galveston, Texas, $16,950; Galveston Gas Fitting & Plumbing Co., Galveston, Texas, $17,247.

The city of Ennis, Tex., has completed the sale of its $12,000 issue of waterworks bonds and four and one-half miles of 4-in. and 8-in. mains have been ordered. The business district will contain 1,296 ft. of 8-in. main and the residence and outlying districts will contain 22,600 ft.

An election was held in Texarkana, Tex., on Aug. 23 to permit the people to pass upon the settlement of differences between the city and the water company. The city recently voted the issuance of bonds in the sum of $200,000 for a new water system and if the differences are settled steps will be taken to invalidate the issue.

The city of Terrell, Tex., recently held an election to vote on the issuance of bonds for the improvement of the city's light and water plant.

The city council of Floresville, Tex., has decided to purchase a new engine and air compressor for the city water works.

A contract for the construction of the sewer from Akard St., eastward on Elm to the Wilson Bldg., in Dallas, Tex., has been awarded by the board of municipal commissioners to the Dallas Lime and Gravel Co., for $3,455. The sewer is to be 10-in. in size and will at the lowest point be 22 ft. below the surface.

Utah.

At a recent meeting of the city council of Ephraim, Utah, it was decided to call a special election in order to decide the question of bonding the city for a waterworks system. R. E. Caldwell, the engineer, after making a careful estimate, said that the cost of installing the system with cast iron pipes will be $83,000; riveted steel pipes, $38,000; wood stave pipes, $33,000. He recommended the use of wood stave pipes.

Washington.

Plans for the construction of a sewer system in Kennewick, Wash., estimated to cost $40,000, are being examined by the Consulting Engineer.

Wisconsin.

The city council of LaCrosse, Wis., has voted to refer the matter of bonding the city for $250,000 for a new pumping plant and sedimentation basin to a vote of the people.

✣Bids will be received until 7:30 p. m., Sept. 6, by Board of Trustees, Waterloo, Wis., for the construction of concrete reservoir; concrete foundation for steam pump; laying 18,000 lin. ft. 4, 6, 8 and 10-in. water mains; setting fire hydrants; valves and valve boxes. J. H. Thompson, 324 Dearborn St., is Consulting Engineer. P. E. Peschel is Village Clerk.

Canada.

✣Town Clerk of Rainy River, Ont., will receive bids until Sept. 6, for the following: A—Laying 300 ft. of 15-in. sewer pipe; laying 650 ft. of 12-in. sewer pipe; laying 650 ft. of 10-in. sewer pipe; laying 1,700 ft. of 9-in. sewer pipe; laying 350 ft. of flexible joint iron pipe; constructing 19 manholes; constructing 2 flush tanks; constructing 6 lamp holes; constructing pump house and installing machinery; B—Laying 3,450 ft. of 6 in. pipe; laying 1,100 ft. of 8-in. pipe; laying 3,300 ft. of 9-in. pipe. C— installing disposal plant. J. H. Wilson is Town Clerk.

✣Bids will be received until Sept. 6, at 1 p. m., by J. H. Wilson, Town Clerk, Rainy River, Ont., for the following sewer work: A. Laying 300 ft. of 15-in. sewer pipe; laying 650 ft. of 12-in. sewer pipe; laying 650 ft. of 10-in. sewer pipe; laying 1,750 ft. of 9-in. sewer pipe; laying 35 0ft. flexible joint iron pipe; constructing 19 manholes; constructing 2 flush tanks; constructing 6 lamp holes; constructing pump house and installing machinery. B. Laying 3,450 ft. of 6-in. pipe; laying 1,100 ft. of 8-in. pipe; laying 3,300 ft. of 9-in. pipe. C. Installing disposal plant.

The City Council of Winnipeg, Man., has decided to construct four trunk sewers. The districts to be benefited and the cost as it is divided among the various streets are as follows: District north of Poison Ave., Jefferson Ave., McPhillips, Red River, $275,690; McPhilips St., Jefferson, Selkirk Ave., $118,500; total, $394,190. Clifton District—Clifton, Portage, Sargent, $101,222; Lavinia, Clifton, Strathcona, $6,757; total, $114,736. District west of Clifton—Center from Assiniboine River to Portage Ave., $19,382. Ash St. District—Ash St., Assiniboine River to Godfrey, $44,495; Godfrey, Cambridge St. to Renfrew $56,905; total, $101,400. Grand total for four districts, $629,708.

The town of Fernie, B. C., on Aug. 15 voted to borrow $27,000 for sewer extension and $4,500 to install a fire alarm system.

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NOTICE TO CONTRACTORS.

The undersigned committee will receive sealed proposals up to September 3, 1910, at 7:00 o'clock in the afternoon of said day for the construction of all that part of the sewer system of the First Sewer District of the city of Algoma, Wisconsin, which has been ordered by the common council of said city to be constructed, viz.: commencing on Fremont street, about 300 feet west of the Sixth street intersection thereof, running thence east to Fourth street, and thence north on Fourth street to the Ahnapee River; and on Steel street, from the Second street intersection thereof, west to connect with the said Fourth street sewer main, and which work includes the following:

The laying of approximately 520 feet of 18 inch sewer pipe, 306 feet of 15 inch sewer pipe, 1022 feet of 12 inch sewer pipe, 940 feet of 10 inch sewer pipe, 606 feet of 8 inch sewer pipe, 11 man-holes and 23 catch-basins.

All of the work and material shall be performed and furnished in accordance with the plans and specifications therefor now on file in the office of the city clerk. For convenience and expedition communications in reference thereto may be addressed to the city engineer, whose name and address are as follows: "A. C. Greaves, Sturgeon Bay, Wis."

Bids shall specify, in detail, the cost per linear foot, the cost of manholes and the cost of catch-basins, etc., for constructing said sewer, and shall include the cost of all connections, so that when completed the sewer so constructed will constitute a completed working system of sewerage.

A form of contract and bond will be furnished by the city of Algoma, which bond shall be signed also by two sureties justifying in the aggregate to an amount equal to the contract price agreed upon, or by an approved surety company for the same amount, and all bids shall be accompanied by a certified check for $500.00 payable to "G. W. Warner, Treasurer," city treasurer of Algoma, to be forfeited to said city in case said bidder shall be successful and shall then default. The right to reject any and all bids is reserved by the undersigned.

Dated, Algoma, Wis., August 17, 1910.

MICHAEL MELCHIOR,
HENRY BARTHEL,
PETER KASHIK,

Committee on Streets and Bridges and ex-officio Board of Public Works.

PROPOSALS FOR HYDRAULIC DREDGE. U. S. Engineer Office, Vicksburg, Miss., Aug. 20, 1910. Sealed proposals for steel hull self-propelling hydraulic dredge, steel pontons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant, will be received at this office until 12 m., Oct. 20, 1910, and then publicly opened. Information on application. Clarke S. Smith, Capt. Engrs.

U. S. Engineer Office, Room N., Customhouse, New Orleans, La., August 9, 1910. Sealed proposals for building lock and dam and lockkeeper's dwelling on Bayou Teche, La., will be received at this office until 11 a. m., September 9, 1910, and then publicly opened. Information on application. Lansing H. Beach, Lt. Col., Corps of Engrs.

(Proposal Advertisements Continued on Page 51.)

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Some Notes on "Improved" Methods of Transporting Mixed Concrete

"Concrete is conveyed into place by wheelbarrows, carts, cars or buckets." This statement from a well known text book summarizes current practice with a fair degree of accuracy. It is interesting to note, however, that improvements in methods of transporting concrete have been recently undertaken by a number of contractors and others engaged in concrete work. Doubtless the prevailing methods named by the text book have features open to criticism. They are comparatively slow and rather expensive in labor and plant charges and, because of the runways and trestles required, are somewhat of a hindrance to other operations. On the other hand they are adaptable to a wide range of conditions, and this cannot be truly said of the improvements that have been offered. We are reminded of these matters by a number of jobs of concrete work which have incidentally come under our personal observation where unusual methods of handling concrete from mixer to forms are being employed.

In some of the recent concrete building work in Chicago concrete has been distributed from hopper towers to floor and column forms by means of gravity chutes. The method is substantially the same as the one described in our issue of March 30,. 1910, which we think originated with and we know certainly has been perfected by Pacific coast builders. In the article referred to we quoted some very significant figures showing the economy of chuting concrete as compared with the older methods of transportation. It appeared quite certain also that nothing was lost through chuting in the substantial quality of the concrete work produced. Our information is that the recent Chicago work confirms both of these facts. Pacific coast contractors have successfully delivered concrete by chutes to upward of 500 ft. from the mixer.

Gravity chutes obviously involve certain requirements as to elevations with which it is often inconvenient to comply and this has led to various attempts to secure means of making the concrete flow on level grade or even up-grade. The editors recall an instance some years ago where concrete was conveyed some scores of feet at nearly level grade in a temporized V-shaped trough by stationing men with shovels at intervals along the trough, these men keeping the concrete moving by "paddling." In a large building work recently noted practically the same method was employed except that, instead of men with shovels, mechanically operated paddles were used.

Briefly the conveyor consists of four sections of V-shaped steel troughs, each about 25 ft. long. Into one end of this trough the concrete is discharged from a hoist tower hopper, and from the other end of the trough it flows into the forms. The trough is supported at approximately a level grade, and above it and over its center is supported a rod having a reciprocating motion of about 30 ins. To this rod at intervals of about 20 ins., are attached downward extending shovel blades which reach nearly to the bottom of the trough. These shovel blades are so hinged that they stand rigid during the forward stroke of the reciprocating bar, but during the return stroke will tip up and ride over the concrete. The reciprocating bar is operated by a small motor located at the hoist tower. The trough is pivoted to the hoist tower so that it can be swung over a wide area and is supported by guys from the tower and by wooden horses underneath. We are informed that with this arrangement 180 cu. yds. of concrete have been placed in floor forms in 12 hours, with only four men tending the conveyor, leveling and tamping. It will be seen that about 100 ft. is the conveying distance at which this device has worked. A 7 hp. motor was sufficient for its operation.

A conveyor of the type described is obviously restricted to grades rising only very slightly above level. For steeper runs, as most of our readers know, use has been made of belt conveyors and in a future issue we shall give some account of such a plant, accompanied by cost data. One disadvantages of belt conveyors which has been noticed on several pieces of work is the slopping over the belt edges of the concrete. This means some waste, but far the greater objection is the hardening of the slopped material about the conveyor mechanism, and on the ground or structure underneath. In one case recently observed there were series of hardened concrete cones standing as high as a man's head all along under the belt. A remedy for this was found by mixing the concrete quite dry for conveying and wetting it down at the distributing point for placing in the forms. In most cases where belt conveyors have been made for concrete the conveyor construction and operation have not been well studied out with the characteristics of the materials to be handled in mind.

Two methods of conveying concrete which seem to have been very attractive to inventors are direct pumping and propulsion by compressed air. Knowing what has been done in hydraulic dredging in pumping mud and other mixtures of water and earth it would seem reasonable to assume that concrete might be similarly handled. We have, however, never heard of its being done successfully, while we do know of several attempts which have been absolute failures. Propulsion by compressed air has met with more success, experimentally at least. We are speaking of course, of propulsion of concrete proper; as is well known neat cement and mortar grouts are both handled successfully by compressed air, and grout pumps or grouting machines are familiar manufactured articles.

The most notable experiments with compressed air propulsion of concrete that have come to notice, were those made a year or two ago by Messrs. G. W. Buzzell and W. H. Larkin. After several trials these gentlemen devised an iron tank having a door at the top for charging the tank with concrete, and which could afterward be closed air tight, and at the conical bottom a discharge pipe connection. In the side of the tank there was a connection for the compressed air pipe. It will be seen that this is substantially the construction of the ordinary grouting machine; the tank was charged with concrete and sealed, after which the air and discharge valves were opened and the batch forced out through the piping. A 4-in. discharge pipe was used and concrete was delivered through 400 ft. of piping, having several 90° bends, and one 180° bend on a 4-ft. radius. It was also delivered to a height of 100 ft. above the mixer. A 1:3:5 concrete of 2-in. stone mixed wet was employed, and of various air pressures tried 50 lbs. per sq. in. was found most efficient.

The crucial tests of any or all of these methods of conveying are their effect on the quality of the mixture and their cost. There seems to be no reason to fear that any of the methods mentioned except pumping cannot, with proper care, be made to deliver a mixture in good condition. As to cost of conveying, they all show very attractive figures. Practically, however, the gravity chuting system is the only method that has been widely employed in actual work. From the records available this can, we believe, be considered a successful method from all points of view within the limits of its working range. It is not our purpose to make comparisons, however, as the data are not available for true comparison, but merely to point out that ways lie open for other than the common methods of handling mixed concrete, and that they offer possible means of economy.

Effect of Salt Water on Concrete.—Experiments will be undertaken by the Atlantic and Pacific Divisions to determine the effect of sea water on the concrete for the lower locks at Gatun and Miraflores, in order, that it may be decided whether it will be advisable to take steps for protecting the concrete. To this end the division engineer of each division has been directed to have made six slabs about 3 ft. square and not less than 6 ins. thick of concrete, the same as that used in the lock masonry, the larger parts of the aggregate to be forked away from one face of the block leaving that face with a finish similar to that of the lock walls. Two of these slabs will be left untreated; two of them will be treated with sodium silicate in the form of soluble glass in solutions of different strength, and two of them will be treated by Sylvester's process with alum and soap, using ¾ lb. of soap to gal. of water applied boiling hot for the first wash, and 24 hours later, a solution of alum, 2 ounces to the gallon, applied cold. One of each pair of slabs will be given a double coat, and the other, two double coats of the respective washes. After they have been treated in this way the slabs, together with those left untreated, will be exposed to the action of salt water at a point as near as possible to the location of the lower guide walls at Gatun and Miraflores. They will be placed in the water simultaneously and allowed to remain immersed until the walls are erected, and it becomes necessary to decide whether or not they are to be treated to resist salt water.

The walls that will be subject to action by salt water will be only those of the lower or sea level locks, and the guide walls leading into these locks. At Miraflores, about 1,400,000 sq. ft. of surface will be thus exposed, and at Gatun about 1,270,000 sq. ft.

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CONCRETE AND REINFORCED CONCRETE SECTION

Notes on the Construction of a Reinforced Concrete Arch Bridge, with Some Costs.

BY W. A. HOYT.*

In concrete bridge construction, as in other work, there is first the general problem, after the contract is signed, of how to attack the individual job. It is commonplace to say that each job has its special problems and that profits largely depend upon the solution of these problems in developing the general scheme for handling the work. Often the contractor is so busy with his estimating that a half thought out plan is adopted, or sometimes even no plan at all is developed. Often too, a very elaborate plan is laid out which has to be discarded, or, if retained, is a constant financial burden. There are various instances of thousands of dollars in equipment being entirely abandoned because of the impracticability of the scheme, and various other instances where the initial cost for the plant, and its installation, for mixing concrete is about as much per cubic yard as the concrete should have cost in place. The writer has in mind a recent conspicuous instance where the concrete mixing and handling plant cost about 60 cts. per cu. yd. of concrete it was to place. Under a less elaborate scheme many yards of concrete have been placed for less money in equally as difficult a situation.

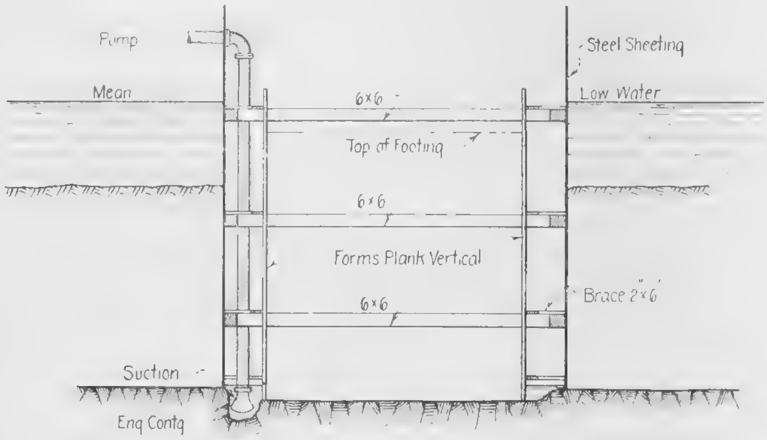

Fig. 1—Section of Cofferdam With Outside Annular Sump.

In both cases of under equipment or over equipment the trouble appears to be in the lack of knowledge of what the different parts of the work should cost. There are times, however, when economy in the actual performance of the work has to be sacrificed for a larger economy or to meet specific needs.

In a bridge job the more hazardous work comes first with the foundations. This, together with the plant and its installation, brings a heavy initial outlay. Available funds may be limited just at this time for various sufficient reasons, and the work therefore may have to progress for a short time at a disadvantage. Or it may be that unit prices upon which payments are to be made are not well chosen. The price upon this first work may not be sufficiently large to make the job nearly or quite self sustaining; then it may be necessary to push toward the more profitable work even to the detriment of other parts.

The prices for the first work should carry as much of the profits for the whole job as is possible without making the bid unbalanced. The writer has carried through work on funds representing less than 10 per cent of the total contract and this amount being necessary but for a short time at the beginning of the work. The remainder of the time the job carried its own financial burden. He has also seen other jobs carrying a constant burden of nearly 30 per cent of the contract price for nearly the life of the job, just because the unit prices were not well chosen and profits were not large. Yet there are sometimes disadvantages in a high price for this first work, for, as in bridge work, the amount is not definitely known and if the amount is decreased then an undue amount of the profits are sacrificed.

The particular job now before us is a highway bridge of seven 80-ft. spans. There is a rapid current with from zero to 5 ft. of water. The piers and abutments extend to bed rock, varying from 8 to 14 ft. below mean low water. An old steel bridge rests on stone piers on the same center line as the new bridge, the floor being about 5 ft. lower. There are 5,860 cu. yds. of concrete to place in the new bridge in six months' time. The materials have to be delivered by wagons. Traffic must be maintained on the old bridge until the new bridge can receive it. What should be the general scheme and how large a plant is warranted? Answers to this question from various experienced parties would be interesting. The answer of the parties who did this work is outlined below.

It was decided to shift the steel bridge bodily to one side onto pile piers, allowing about 3 ft. clearance between the new position of the old bridge and the new bridge. Excavation for two of the shallow piers was started at once, also preparations for driving piles for the temporary pile bents to support the 120 ft. span steel trusses in their new position. These bents were made of 6 piles driven in two rows about 9 ft. apart, the rows being about 3 ft. centers, sway braced in both directions, and capped with 12x12-in. timbers. Between these bents and the old stone piers timber cribs were build up using timbers cut to length to be used in the centers later. The 12x12-in. caps were extended over the cribs to the stone piers. On top of these caps 3-in. planks were placed as ties to support railway rails. The seats provided for the trusses on the bents were about 1 ft. lower than the seat on the pier.

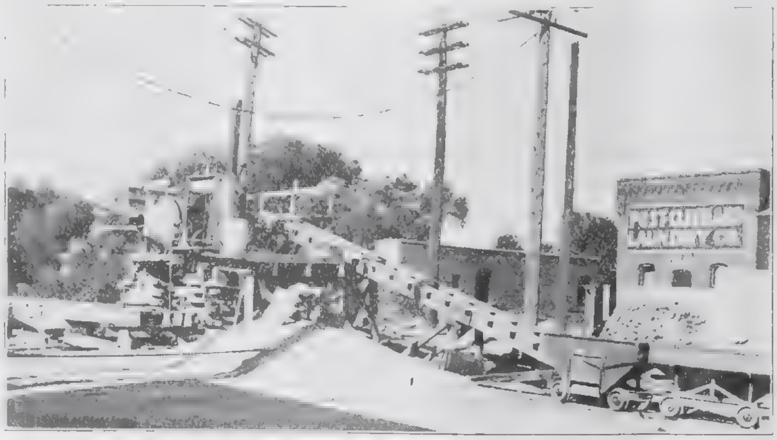

Fig. 2—View of Concrete Mixing Plant for Arch Bridge Work.

When the time came to shift the trusses they were raised by hand jacks, supported on the bed of the stream, and a railway rail, well greased, was slipped under the shoes. Timber struts were placed horizontally between the trusses as near the shoes as possible. A heavy chain was slung around the far truss just above the shoe to which was attached a double and single block with 1¼-in. manila rope.

A double action winch was mounted on the far end of the pile bent around the drum of which passed the 1¼-in. rope. Thus with a winch and blocks attached at each end of the span, and 12 men and 1 foreman, a span could be slid over bodily in 4 or 5 hours with little difficulty. For such work, however, a wire cable is preferable, the manila rope being elastic caused the movement to take place in a series of jerks.

Part of the concrete in the piers was put in through the bottom of the old bridge before it was moved; most of the piers, however, were put in from the old bridge in its new position, 2 ft. gage track for Koppel cars being laid on the sidewalk and the cars pushed by hand from a mixer to a chute.

The water work was the most troublesome. The current being swift, deflection dams had to be used for some of the piers. These were made by nailing two legs to one end of a 4x6-in. stick. The legs were about half the length of the 4x6-in. sticks, thus making a gravity horse. With the legs down stream planks were then placed on the inclined up stream leg and pushed down the slope into the water, a few boulders being placed on the plank to help hold them in position.

The material to be excavated consisted of about 2½ ft. of loose shaley conglomerate, then sand and gravel with boulders.

The method of cofferdaming for shallow work up to 6 or 8 ft. was to drive wood sheet piling (3 in. T. & G.) to within 2 or 3 ins. of the neat lines of the concrete foundations. For deep work (12 to 14 ft.) 6-in. Carnegie steel sheet piling was used, driven with only about 2 ins. clearance, thus making the sheeting act as forms for the concrete.

The selection of material for a cofferdam is important and should be adapted to the material to be driven through. Books upon the subject have much to say about deep and difficult foundations, but leave a great amount to be said about the "simple" foundations. Yet these simple foundations often mean a heavy

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*Consulting Engineer, Old Colony Building, Chicago, Ill.

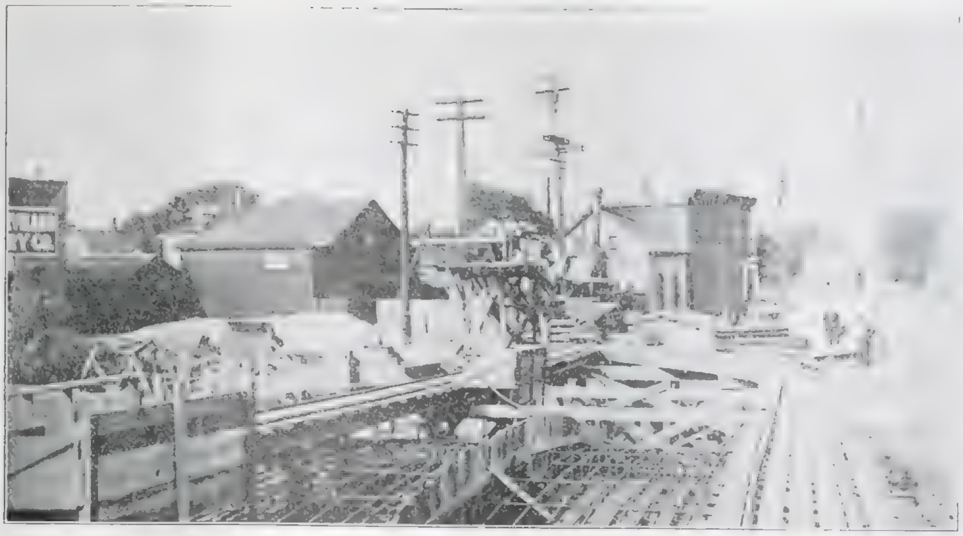

Fig. 3.—View Showing Arrangement of Tracks from Concrete Mixer.

loss to the contractor and a poor if not dangerous quality of workmanship. In quiet shallow water (2 or 3 ft.) with clay or sand bottom, 2-in. T & G sheeting may be used, or 3-in. T & G stuff for 4 or 5 ft. depth. But if the material contains boulders, roots, or logs, the T & G. planks are not suitable, as a small obstruction will throw them out of line, thus causing leaks. Triple lap Wakefield sheeting made of boards for shallow depths and 2-in. planks for greater depths is better and safer.

The wood sheeting was driven by hand and the steel sheeting was jetted down or jetted and driven with a small temporized pile driver, consisting of a breast derrick fitted with short leads and mounted upon a scow; the hammer being the follower from the large driver. This was raised by passing the hammer line around the "nigger head" of a small vertical engine mounted on the scow. It was not an economical device for a large piece of work.

The steel sheeting was pulled by means of block and fall attached to a portable gin pole, the hoisting rope running to the nigger head of a large hoisting engine.

In nearly all the foundations there was trouble with excess water, requiring in most cases a 6-in. centrifugal pump running at nearly full capacity.

Concrete placed under water may be and sometimes is of good quality, but this cannot be accomplished by simple inexpensive methods. Projects inland are usually too small to warrant the extra plant required to perform this subaqueous work successfully. Tubes suspended with their lower end a few inches above the bottom and kept filled with concrete may be used successfully if suspended from the boom of a derrick or in some other way, with ample room and hoisting power with which to operate it. It is next to impossible to prevent the tube from clogging occasionally and frequently when men are new at the work. When it does clog there is delay and much profanity if there is not sufficient hoisting power to raise not only the choked tube but also the choked chute leading to the tube. Tapering the tube does not remedy the trouble entirely.

If the area to be filled is sufficiently large and the amount of water sufficiently small, the suction from the pump may be placed in a large open top box at a distance from concrete operations. The water thus being drawn from the surface and flowing over the edge of the box has a much reduced current. In this way the water may be kept to a depth of two or three feet and the concrete deposited in a pile above the water line and pushed bodily from within the pile out into the water, with little loss of cement, until when within a few feet of the box.

The only absolutely sure way, however, is to place the concrete in the open. To accomplish this a new method was tried on one pier. This method was to drive the sheeting with 2-ft. clearance all around the foundation for the pier, and then build forms inside the coffer dam to exact position from the rock to the necessary height. Thus a space between the sheet piling and the forms was left all around the base, at the rock surface. A sump was dug for the suction in the 2-ft. space so the water could be drawn down to the rock. Thus the entire amount of concrete was deposited in the dry with absolute certainty of results. (See Fig. 1.) The amount of sheeting and the excavation were, of course, somewhat increased, but this was somewhat compensated for by the greater ease and regularity of placing the concrete. The grade of this concrete for this pier could have been made very much leaner with perfect safety. For the case in question cyclopena concrete or large boulders were allowed to be thrown in; they could have been more carefully placed and a larger amount used. The forms for this pier base were made of old planking set endwise, thus making a closer fit on the rock at bottom and permitted it to be pulled with ease. The cross bracing sustaining the sheeting was left undisturbed, part of it being concreted in, other parts being knocked out as the concrete reached it.

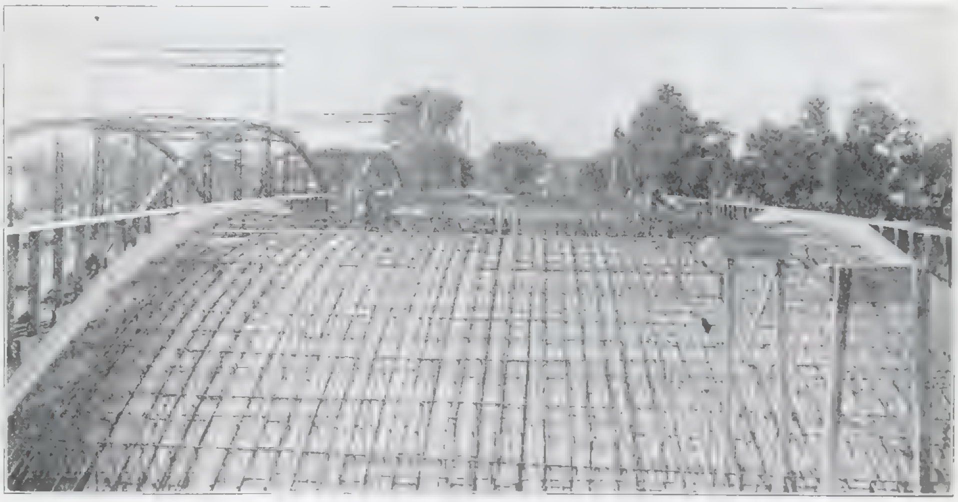

Fig. 4—View Showing Reinforcement in Position for Arch.

The mixing plant consisted of two ¾-cu. yd. mixers, one at each end of the bridge, Fig. 2. For 5,860 cu. yds. of concrete the question is: How much can be spent in rigging up a plant for greatest economy. The materials were delivered by wagon at street grade. The mixers were elevated sufficiently to allow discharge from mixer into Koppel cars which ran out on a nearly level track. An inclined track for Koppel cars to supply the mixer, led from a trench dug in the street to an elevated hopper over the mixer. Thus the material was wheeled to a platform at the level of a street surface and dumped into the charging car. A small double cylinder 6 H. P. hoisting engine handled the cars up the incline, the cars being dumped directly into the mixer. The charging cars shown in Fig. 2 were abandoned and Koppel cars substituted.

The labor and lumber for erecting each mixing plant amounted to about $75.00.

The depositing of the concrete in the arches was by means of Koppel cars running on two trestles built out over the arches about 20 ft. apart, Fig. 3.

With this plant a batch of about 15 cu ft. was discharged in 2 minutes when all was running well, the average for several successive days being 24.3 batches per hour, or about 14 cu. yds. per hour. The force of men required for mixing and placing, including 2 foreman, averaged about 33 men, 20 manufacturing the concrete and 13 placing it. The average wheel for material was 100 ft. The

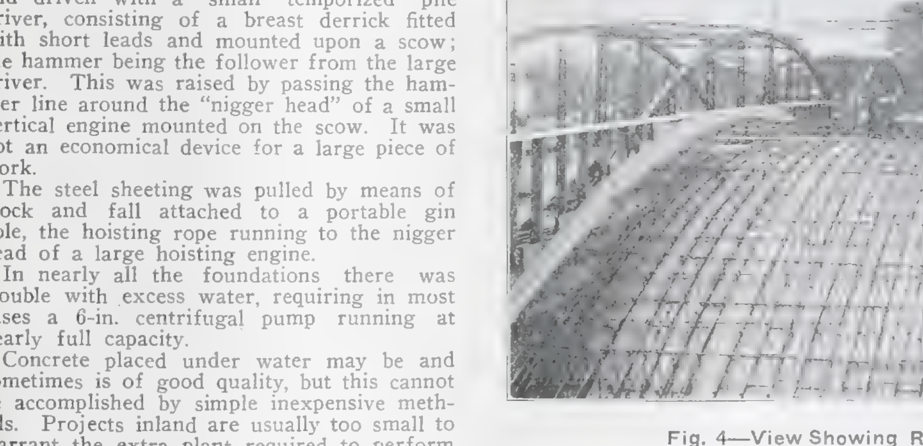

Fig. 5—Details of Centers for Concrete Arches.

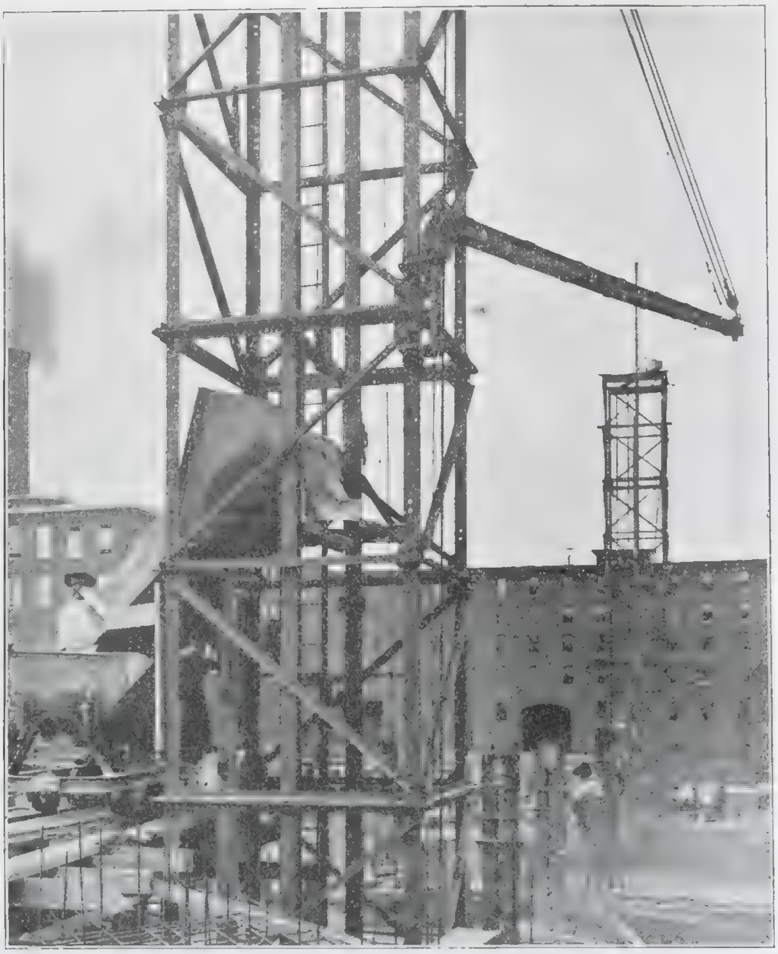

Fig. 1—View of Steel Hoist Tower With Derrick Attachment.

wages of laborers' were $2.25 for 9 hours, amounting to about 57 cts. per cu. yd. for mixing and placing. This force could have been reduced by 6 men if certain conditions had been slightly altered. The 57 cts. per cu. yd. does not include, of course, overhead expense, extra handling of material plant installation, and many other things which should be properly charged to this end of the work.

One interesting point about the work was the fact that the arch steel was ordered in one length, making rods which were 1⅛-in. round diameter about 96 ft. long. This length worked out much better than if the rods had been ordered in two or three lengths, because there was ample room to handle this length, Fig. 4. The labor cost of placing this steel, including threading both ends and placing stirrups, amounted to about $4.10 per ton.

There were about 300,000 ft. B. M. of lumber used.

The design of the centers is shown by Fig. 5, which is thought by the writer not to be the most economical in the use of lumber.

The 1-inch lagging worked all right but the 2x12-in. joists 16 ins. on centers deflected badly in places and the two side spans were stiffened at the center of the span in the last centers erected.

The contract price for the bridge was about $68,000, which was $10,000 too low. The writer was superintendent for a portion of the work after it had been started by others.

Steel Construction Towers for Concrete Work.

The increasing use of steel in connection with the erection of concrete and reinforced concrete work is well illustrated by the accompanying photograph and drawings of a steel construction tower which was designed and is being used by the Aberthaw Construction Co., of Boston, Mass., on the new 12-story reinforced concrete cotton warehouse which they are erecting for the Massachusetts Cotton Mills at Lowell, Mass.

The excessive waste of lumber in connection with reinforced concrete work makes it imperative that sooner or later steel shall be substituted as far as possible. The towers shown herewith are made up in sections having a total height of 10 ft. 9 ins. over all. They are of very simple design, composed principally of 4x4x⅜-in. angles for the uprights, and 2½x2½x¼-in. angles for the horizontals and braces. On two opposite sides are 5-in. channels which serve as guides for the automatic dumping concrete bucket. A good view of this bucket is shown by Fig. 1 just after it has been tripped and is dumping the concrete into an industrial car.

These towers are suitable for any class of building, and can be erected to any desired height by simply adding additional sections. They are sufficiently stiff to be used for heights over 100 ft. On this particular job they will eventually be 108 ft. high. The top and bottom flanges of every section are marked from a flat pattern in order to secure interchangeability. In each section holes are punched in the 4x4-in. uprights in order that the seat plates, Fig. 2, of the derrick can be bolted thereto, thus making it possible to place the derrick at any desired height. On one side of the tower is a ladder made up of 5x3x 5/16-in. angles and ⅝-in. rods, the ladders being made up in sections the same length as the sections of the tower. Two towers of ten sections each are being used on this job. They cost the Aberthaw Company, laid down and ready for erection, approximately $500 each, or $50 per section. This may appear high as compared with wooden towers, but the steel towers are subject to very little depreciation and can be used over and over again.

So far five sections of each tower have been erected, bringing the height of each up to 54 ft. The total cost of labor for erecting has so far amounted to $441; but this figure will be materially reduced on future work, as the laborers are entirely green in the handling of the towers and consequently the labor costs run high. The tower was designed by the Aberthaw Construction Co., and was built by the Boston Bridge Co., Boston, Mas.

Methods and Cost of Constructing an Irrigation Conduit of Separately Molded Half-Rings of Reinforced Concrete.*

The Tieton Project of the U. S. Reclamation Service includes some 30,000 acres lying north and west of North Yakima, Wash., in the Courche Creek valley.

The general scheme of the irrigation system is simple, the supply being diverted from the Tieton River at a point some 14 miles above the irrigable lands and conducted in a reinforced concrete conduit or aqueduct along the Tieton Canon to an elevation sufficient to permit of piercing the Naches Ridge by a tunnel so as to deliver into the Courche valley for distribution. This paper describes the main canal or aqueduct along the Tieton Canon, several novel features of design and construction likely to be of interest having been adopted on that work.

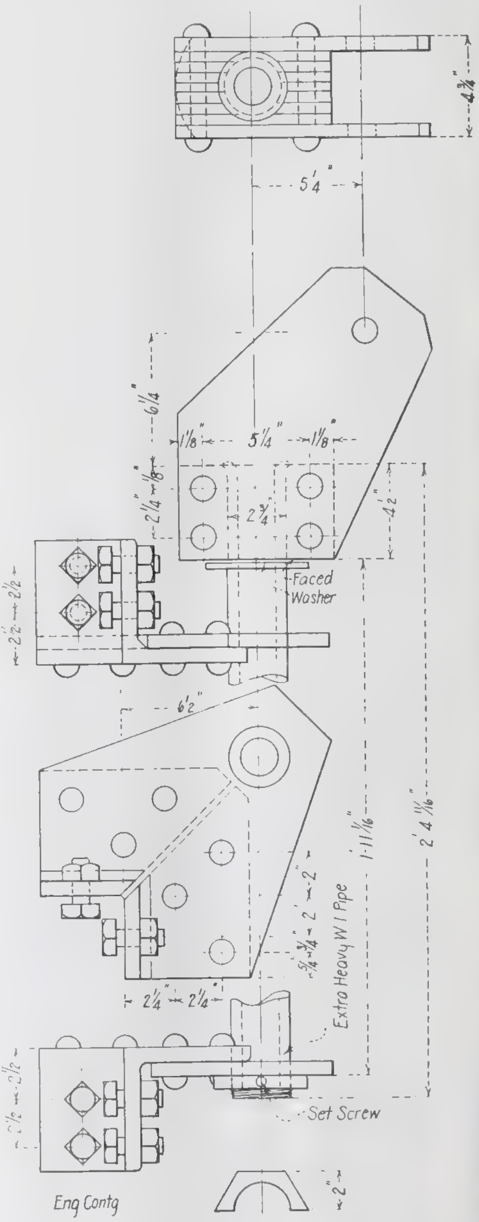

Fig. 2—Details of Foot Block for Attaching Derrick to Steel Hoist Tower.

Surveys made in 1905 and 1906 disclosed the fact that the greater part of the main canal would lie on side-hill slopes averaging close to 60 per cent. The side-hill material for the most part consisted of soils and gravelly clays frequently intermingled with slide rock material and occasionally consisting wholly of slide rock, the latter being the local term for a talus of large rock fragments. The earthy material in the side hill was found to be generally unstable during the spring, when frost was coming from the ground, and this instability was later found to be particularly noticeable in some of the slide rock material when lubricated by moisture and clay, as was frequently the case.

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*From the "Tieton Canal," by E. G. Hopsen, Proceedings, American Society of Civil Engineers, Vol. XXXVI, p. 936.

The idea at first had been to excavate a side hill ditch of horizontal section and to line it with concrete, but the side-hill material *in situ* was found to be mostly at the natural angle of repose, and any considerable disturbance by undercutting the slopes, such as would be necessary for this type of construction, would result in extensive slides until a new condition of equilibrium should be reached. Later, it was found that much of the supposedly solid rock formation was very little more stable than the earth, the material being frequently fractured and jointed in every direction, with slippery clay seams, and disintegrating rapidly on exposure to the weather.

The conclusions reached were: (1) That the type of canal should preferably involve as little disturbance of the natural side-hill slopes as possible; (2) that the canal should be a practically self-sustained structure, capable of resisting considerable external earth pressure on its upper side, and of sufficiently rigid cross-section to retain its integrity against internal hydrostatic pressures without dependence on any support from the outside embankment.

It will at once be seen that the flume type more nearly fulfills these requirements than any other, except as to external earth pressures, which do not apply, besides possessing the advantage of a low first cost. Flume construction, moreover, wholly avoids the disturbance of the natural slopes. The most unsatisfactory features of large flume construction are obviously maintenance and periodic renewal. The Reclamation Service has systematically endeavored to avoid temporary types of structures, on this account, unless conditions are such that they have an incontestable economic advantage.

In the vicinity of the Tieton Canon the lumber most available for flume construction was yellow pine and fir. Of these, red fir was the more desirable because of its superior durability and comparative freedom from warping. It happened, however, that the local supply of red fir was insufficient for so large a work, and an adequate supply would have necessitated shipments from a distance, at high cost. It was estimated that pine used in a structure of this kind would have an average life of from 10 to 12 years, and, in addition, would require heavy annual maintenance and renewal work. Allowing for complete renewals every 10 or 15 years and necessary repair work each year, and capitalizing the first cost and necessary maintenance and repair work at 6 per cent., it appeared that a pine flume, when thus capitalized, would be actually as costly as a permanent structure even 2½ times as great in first cost. As a matter of fact, careful estimates showed that a well-built pine flume, properly supported on posts founded on masonry pedestals, would cost more than one-half as much as the permanent structure that has been built, so that the early abandonment of a flume design was fully justified.

The Reclamation Service, therefore, attempted to combine some of the advantages of flume construction with the more permanent types by working out a design in reinforced concrete, which alone promised to give the lateral stiffness necessary to resist both external and internal loadings, as well as to reduce the undercutting of the side-hill slopes to a minimum.

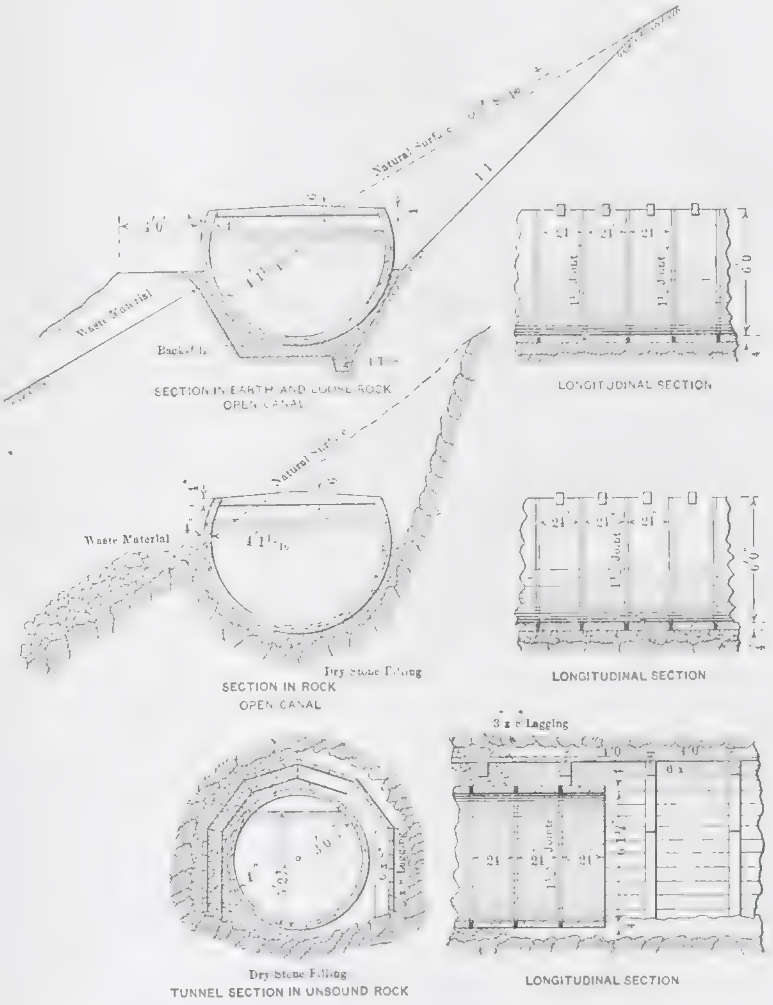
The most conspicuously practical difficulties in the way of masonry construction on the canal location were lack of concrete materials, water, and working space. Gravel and sand in any quantity could only be found at certain localities along the bottom of the canon. Water for mixing and sprinkling would have to be taken from the river, many hundreds of feet below the canal location except at its upper end, and, moreover, the transportation of building materials and the conduct of building operations on the canal line would obviously be attended with much inconvenience on account of the steepness of the canon walls and the narrowness of the ledge on which work must be done.

It was further apparent that reinforced canal lining capable of resisting the stresses to which it would be subjected and at the same time economical in the use of materials to the fullest extent could not be built in place advantageously on the canal location so as to insure the necessary excellence of work on a large scale; on the other hand, it was plain that first-class work in reinforced masonry could be executed in the bottom of the canon at places where there was sufficient working space, and water and good concrete material could be had in abundance.

It was concluded that, if the lining could be made satisfactorily in the yards, the difficulties of handling and transportation could be overcome by careful organization and the selection of a suitable plant. The most serious problems to solve, in connection with this plan of construction, were the determination as to whether reinforced concrete sections or shapes such as these would permit of handling and transportation without serious injury to themselves, whether the back-filling could be done satisfactorily so that the shapes would not subsequently settle irregularly, and whether the joints between the shapes could be made in a satisfactory way.

During the spring and summer of 1906 several designs were prepared for concrete shapes, and later, experimental sections were built and tested in the grounds of the local office of the Reclamation Service at North Yakima. The test sections were made of many different shapes and sizes. They were tested, as to their ability to stand internal stress, by a special apparatus applying internal pressures at points where the resultants of internal hydrostatic pressures with a full conduit would fall. This testing apparatus consisted of an A-frame set inside the concrete shape with each leg delivering pressures obtained by tightening up a tension rod passing midway between the struts and resisted by a yoke on the outside of the bottom of the shape. The pressures were registered by a special device, and were noted carefully during the period of each test, the shape itself being at the same time subjected to a close scrutiny and the development of all cracks and changes in diameters being measured and noted carefully.

The conditions to which the shapes were subjected during this test were obviously not exactly parallel to those resulting from actual field conditions, it being impossible to duplicate by mechanical means the varied stresses under working conditions. The tests, however, were in many ways much more severe than might reasonably be expected under working conditions, and in every case the pieces were tested to failure. It was found during the experiment that the shapes possessed considerable elasticity; that hair cracks developing under pressure apparently had no permanent weakening effect, and that certain sections possessed much rigidity and strength. These experimental shapes were cast in wooden forms, and, owing to the swelling of these, the reinforced concrete cross-bars were frequently cracked at the point where they joined the main body of the shape. The test pieces were weakened to a considerable extent owing to this cause. In spite of this disadvantage, however, the tests showed that, with proper care, reinforced concrete shapes such



Typical Sections of Reinforced Concrete Irrigation Conduit.

as these could be built cheaply and handled safely.

The shape that appeared to be the most satisfactory resisted internal pressures of 3,350 lbs. from each strut, which was more than twice what the hydrostatic pressure would be with the canal entirely full of water. Under this pressure it was found that the horizontal diameter increased about ⅝ in., which, however, was largely recovered when the pressures were removed. During the application of pressure some hair cracks could be detected on the face of the concrete under tension, but, after the pressures were relieved, they wholly disappeared. The sections were tested for external stresses due to handling in various ways, such as being dropped on a hard floor from a height of several inches, being rolled on one side, and being dropped from greater and greater heights until they were finally broken.

From data obtained during these tests it was determined that this method of construction promised satisfactory and economical results on a large scale, and final designs for open canal and tunnel sections were prepared. Complete plans and specifications for canal construction were made, and the work was advertised for public contract, bids being opened during November, 1906. Two alternative methods of bidding on the canal construction were offered, one being to build the lining in sections, as above described, and shown by Fig. 1; and the other being by the older and standard method of depositing concrete lining in place in the canal. Only one bid was received, and that was based on the method of manufacturing and placing the concrete shapes as described previously.

A contract for manufacturing and laying concrete shapes was awarded, and work was started during 1907. After little more than a start had been made by the contractor, the plant and work were taken over by the Reclamation Service, and the work was carried to completion in the fall of 1909, all work being done by force account under the direction of the engineers of the Service.

Figure 1 shows the typical cross-sections of open canal work and tunnel work as constructed. The sections or shapes in which the lining was manufactured are of uniform length (measured along the canal) of 2 ft., both for open canal and tunnel work. Each shape consisted of a slab of reinforced concrete, 4 ins. in thickness, molded to the desired shape. The reinforcement consisted of ⅜-in. corrugated rods placed 4 ins. c. to c. Each open canal shape was stiffened by a 4x6-in. cross-bar, which had for reinforcement two ⅜-in. corrugated rods. The tunnel shapes were completely cylindrical. The concrete in these shapes was generally composed of 1 part of cement to 10 parts of unmixed aggregates, the latter being proportioned so as to give a mixture as dense as possible. The shapes were all cast on their sides in steel molds. The molds were made of thin sheet-steel, riveted to steel angles, and stiffened with suitable bracing of light angle iron. The molds for the open canal were made in four pieces, two inside and two outside. All tunnel molds were made in six pieces, of similar construction. All parts were light, the heaviest being handled easily by two men. The method of construction may be briefly described as follows:

At points along the bottom of the canon, level spaces, each of a few acres in extent, were selected and used as yards for manufacturing the shapes. These spaces were necessarily of small area, being practically all the space available, the canon being generally a mere gorge. At some of these points concrete material was at hand, but at others it had to be hauled from a distance. All open canal and tunnel lining shapes were cast at these yards, the process being continued until each yard was filled, or the necessary number of shapes were cast. Whenever the yards were sufficiently large so that storage could be had to enable the first shapes cast to be cured and hardened properly, a process requiring 30 days, before the yard was entirely filled, the manufacture of new shapes and the removal of the finished product took place simultaneously, so that at one end of the yard new shapes were being made, while at the other end shapes were being loaded on cars and hauled away, this being continued until all lining appurtenant to that yard had been completed. At other points, where space was limited, a yard would be filled with shapes which would then be left to harden while work started at some other point.

All mixing was done in cubical batch mixers, each batch exactly filling a mold, the open canal shapes containing about 0.47 cu. yd., and the tunnel shapes about 0.50 cu. yd. All the aggregates were screened by rotary screens and segregated into two grades of gravel and one of sand, the coarsest gravel used passing a 2½-in. mesh. All material was obtained from the river bed or adjacent bars, passed through a crusher, and screened, the coarser fragments being returned to the crusher. A very wet mix was used.

The yards for manufacturing were first cleared of obstructions, such as large rocks, fallen logs, etc., and, if necessary, roughly leveled and staked out preparatory to placing the forms or molds in position. In placing the molds, the inside forms were set up over a portable templet and bolted firmly together, so that all shapes should have exactly the same inside dimensions by being fitted to the same templet. The latter, when bolted together, were then laid in their correct position on the ground, being supported by small wood blocks; the outside forms were then placed in position, spaced 4 ins. outside of the inner forms, and held there by wooden blocking and iron clamps. The next step was to prepare a firm and correctly molded base on which to tamp the concrete in the molds. This was obtained with a preparation of sand and plaster of Paris worked to the consistency of mortar and tamped to a thickness of about 1 in. in the bottom of the mold. The top of this plaster was readily brought to a smooth, even surface by metal molding irons. The plaster of Paris quickly hardened into a tough plastic mass, which wholly closed the bottom of the mold and gave an even bed on which to ram the concrete; it also prevented the leakage of the finer portions of the concrete material.

A regular gang in each yard attended to the setting up and removal of the forms and their subsequent cleaning and transportation to other localities, also to the preparation of the plaster of Paris bases. This gang acquired much dexterity by constant repetition of the same process, which had to be performed many thousand times during the work. Frequently, keen rivalry existed between the gangs in different yards as to how many forms could be set up in place in a given time.

After being set up, all forms were carefully oiled on the surfaces with which the concrete would come in contact. After the bases had hardened sufficiently, the concrete-placing gang performed its share of the process, a batch of concrete being hauled from the mixer to each shape in turn in an ordinary bottom-dumping car, the material being dumped into a vat placed next to the form to be filled. The mixture was immediately shoveled into the mold, the steel reinforcement being placed at intervals of 4 ins. as the mold was gradually filled. The reinforcement was held in place during the process with spacing bars of proper width, which were withdrawn as the concrete gradually filled the mold. The mold when filled was left for a short time for the concrete to settle, it being usually found that a settlement of about ½ in. to 1 in. would take place as the material gradually consolidated and air bubbles escaped. Before the initial set had taken place, however, the shape was finished by troweling off the top surface evenly with mortar and molding it with a special molding iron so as to form a depression around its upper edge for jointing purposes.

The process of setting up forms and placing concrete and steel was performed with remarkable expedition and by a comparatively small number of men, considering the large variety of special parts to be handled. The regular gang for setting up and handling the forms and preparing the bases consisted generally of one foreman and 10 men. This gang would set up generally about 80 to 100 forms per day at an average cost of a little more than 50 cts. per form, or equivalent to about $2.20 per cu. yd. of concrete. The average cost of excavating, handling, crushing, and screening the concrete aggregates was about $1.50 per cu. yd. of concrete. The cost of mixing and delivering the concrete to the molds was about 70 cts. per cu. yd. The cost of placing concrete in the moulds, including the handling and placing of steel reinforcement, was about 65 cts. per cu. yd. In other words, the total labor cost for the finished concrete in the molds was about $5.05 per cu. yd. The cost of plant and supplies added about $3.20 to this figure, the latter including the cost of all steel forms, mixers, crushers, pipes, pumps, teams, and wagons used in connection with making the concrete for the open canal shapes. The total cost, therefore, for labor, supplies, and plant for this concrete was about $8.25 per cu. yd.

The concrete shapes after being cast were left undisturbed for intervals of from 24 to 36 hours before the forms were removed. During the colder weather this period was sometimes extended to two or three days. At these times the top and exposed surfaces of the molds were covered with wet gunnysacks to prevent the occurrence of sun cracks in the concrete. The molds were then removed simply by collapsing the inside centers, after removing the interior bracing, and then peeling off the outside forms, after unbolting them. The reinforced cross-bars in the open canal shapes were left with their bottom form, which consisted of a 1½-in. pine plank, in place, supported in its middle by a small wooden prop. The forms were stripped by a trained gang in a very systematic and expeditious way. Each part of the removed form was carefully laid aside for reassembling, and afterward cleaned, oiled, repaired as required, and transported to a fresh location to be used again.

The concrete when stripped invariably had clean, smooth surfaces with sharp edges and good color. Immediately after stripping, the concrete was covered with gunnysacks or canvas and sprinkled continuously for a period of about 10 days in the warm weather. For this purpose a complete system of piping, hose, and pumps had been established in each yard, and the water was delivered from the nozzles under a good pressure, thus making the sprinkling effective. In the larger yards as many as two or three men were continuously sprinkling the concrete; this proved to be one of the most difficult parts of the process to execute in a satisfactory way, owing to the large areas over which the yards extended. In spite of all precautions and vigilance, it appeared that this portion of the work was perhaps executed in the least satisfactory way. From time to time, however, tests were made of the comparative qualities of the concrete cured in the yards, and apparently it was not appreciably inferior in strength or toughness to samples of concrete kept continually immersed in water.

The cost of wetting and finishing the concrete for open canal shapes was about $1 per cu. yd., thus bringing the cost of concrete up to $9.25 per cu. yd. for labor, plant, and supplies for the completed shape, or about $4.10 for each shape measuring 2 ft. along the canal line, or equivalent to a little more than $2 per lin. ft. of canal lining for the open canal.

About 35 lbs. of steel was used for each shape, and about ½ bbl. of cement, each costing about $2.10 and $1.50, respectively; so that the final cost of the concrete in the open canal shapes when completed and lying in the yard ready for transportation to the canal, including the cost of cement and steel, was about $8 per shape, or $4 per ft. of canal lining, or, if reduced to a yardage basis, equal to about $17 per cu. yd.

The costs of tunnel lining were somewhat higher than the above, largely due to the fact that the plant charges for tunnel were more than for open canal work, as there was a smaller quantity of tunnel lining to build, so that the distributed plant costs were higher. The final cost of labor, plant, and supplies in 1908 for tunnel lining was about $11.50 per cu. yd. of concrete. The gross cost, including cement and steel, was about $19 per cu. yd., or about $9.50 per individual shape 2 ft. long, or $4.75 per lin. ft. of tunnel lining.

The foregoing figures for the costs were obtained about the end of 1908, after about one-half the work was completed and the more serious initial difficulties of construction had been overcome. Administration and engineering charges are included, averaging in amount about 13 per cent, inclusive of the cost of building a wagon road, described later.

The shapes were permitted to lie in the yards for a period of not less than 30 days, after which they were raised from their beds and hauled to the point where they were loaded on special cars for delivery to the canal.

Before leaving the yard, all sand and plaster of Paris that might be still adhering to the bottom edges of the shapes was removed. This required only a few moments' application of a wire brush. The shape was then lifted with a differential block and loaded on a special steel car. The loaded car was then pushed on a siding ready for transportation to the canal.

From each yard inclined hoists driven by electric motors, or cableways similarly operated, were used to deliver the loaded shapes to the canal location. Sometimes as many as two or three cars were hoisted at a time, depending on the length and steepness of the incline. The loaded cars when delivered at the canal location were made up into trains of four or five cars and hauled by horse along a temporary track laid in the canal bed to the point where laying operations were in progress. Sidings at suitable intervals permitted the passage of empty return cars. Transportation was thus reduced to a simple and economical process, the labor cost of transporting and handling the shapes from the yard to the canal and hauling along the canal being about 33 cts. per ft. of lining.

The loaded train of cars was stopped at the siding nearest to the point where shape-laying was in progress, each full car as required being individually run forward to be unloaded; the empty cars were shunted to the main track for final return to the yard.

A special device was used for unloading the shapes from the cars, and handling and placing them in final position in the canal. This device consisted essentially of a braced frame of 3-in. iron pipe supporting an overhead I-beam running longitudinally to the canal, directly over the spot where the cars delivered their loads. On the I-beam there was a small trolley carrying a differential block. From the differential block was suspended the newly delivered concrete shape, and the trolley permitted longitudinal adjustment. Lateral adjustment was obtained by a device permitting the overhead I-beam to be swung from one side of the canal to the other as required. The delivered shape was suspended from the differential block by a yoke fitting to the inside of the shape.

The shape when delivered was first swung from the car by the differential pulley, the empty car being immediately run back. The shape, hanging from the block and overhead trolley, was then run along the I-beam to its correct position in the trench, all lines and grades having been taken in advance so that final adjustment could be made without the loss of more than a few moments. Various ingenious devices were elaborated by the trained crews who performed this laying work, so that the shape when once adjusted in position was firmly held by clamps and blocks prior to the deposition of the back-filling.

The process of delivering and setting these shapes was a very interesting one, the gangs being thoroughly drilled and each man an expert in his line of work. As each open shape weighed about 1,800 lbs., engineers familiar with the placing of heavy masses will realize the difficulty of adjusting them accurately and speedily. Adjustment for each shape had to be made for line and level, both laterally and longitudinally. When adjusted in position and carefully blocked, the shape was at once back-filled, the space between the bottom of the concrete shape and the canal bed being from 4 to 6 ins. The back-filling material was shoveled into this space from the end, each shovelful being tamped with long iron rammers to such hardness that the shape generally began to be raised from its bed by the pressure of the rammed material before the ramming was discontinued. A great deal of attention was given to the thorough tamping of the back-filling directly under the shape so that there should be no danger of subsequent settlement. The back-filling for a width of about 6 ft. under the shapes, therefore, was watched very carefully, and only selected material was used for this purpose, all material of a loamy nature being excluded.

The back-filling around the sides of the shapes was not done with the extreme care used in the other portions, the material being shoveled in from the top and rammed every foot or two in depth by hand rammers. A space about 1½ ins. in width, between the concrete shapes, was left for the jointing, to be performed subsequently.

The laying gang, consiting of 1 inspector, 1 foreman, and 8 laborers, laid on an average from 40 to 50 shapes per day in open canal work, or a total of from 80 to 100 ft. of canal lining. The cost of labor in handling and placing the shapes was about 47 cts. per lin. ft. of lining, this price including the cost of all back-filling.

On sharp curves shapes molded a little narrower on one side than on the other were inserted, but when the curves were of large radius no specially molded shapes were used, the curve being entirely taken up by the joints.

The jointing, the last process, was carried on as far as possible during the early mornings and the cooler weather so that the concrete would be at the lowest possible temperature at the time the joints were made. During this process the portion of the canal being jointed was covered with canvas to exclude the direct rays of the sun and to keep the temperature low, the canvas being generally kept wet so that the temperature would be lowered by evaporation.

The joints were made of concrete of a fine aggregate, the stones passing a ½-in. mesh. The joint was well filled, but before the concrete had acquired its set, the surface of the joint in the interior of the canal was scraped off and a finish coat of mortar was troweled on, so that the finished surface of the joint was exactly flush with the surfaces of the adjacent shapes. The width of the joints permitted any small irregularity, due to the placing of the shapes or to the dimensions of the shapes themselves, to be taken up without any jog in the interior of the canal. The result of this jointing work has been in general very satisfactory, the interior of the canal having a remarkably smooth and even surface.

The joints after completion were kept well wet until the concrete had hardened, and whenever practicable the canal after being jointed was kept full of water, so that the joints were hardened under the best conditions.

Up to the end of 1908 the average cost of placing about 13,000 ft. of open canal shapes, including removal from the yards, transporting, placing, and back-filling in the trench, was about $1.30 per lin. ft. of canal lining, or $2.60 per shape. The cost of jointing about 5,000 ft. of lining was found to average about $1 per joint, or 50 cts. per ft. The gross cost, therefore, of the concrete lining in place, including all plant and general charges, engineering, and administration, but excluding any canal excavation or preparation of the canal bed, was about $5.80 per ft.

All long tunnels on the canal except one (the Trail Creek Tunnel) were lined with reinforced concrete shapes built in rings 2 ft. in length. There were three of these tunnels having an aggregate length of about 8,000 ft. All were driven through lavas and basaltic formations, and, for the greater part of their length timbering was required, even for temporary support. The tunnel lining was cast in yards in the same manner as the open canal lining, and the shapes were finally delivered in the tunnel on small cars. These cars were specially designed for lightness and compactness, so that the empties could be readily lifted from the track and stacked temporarily in the tunnel pending their return to the yards, without interference with the delivery of the loaded cars.

As in the case of the open canal shapes, special mechanical devices were used for handling the completed shapes at the point where laying operations were in progres, and thereafter holding them in place during back-filling. The device consisted essentially of a steel I-beam supported on rollers and braced to the bottom and sides of the completed work. The delivered shape was supported by a yoke fitting inside of it and running on a trolley along the I-beam, by which it could be readily run into position. The supporting I-beam permitted all vertical and lateral adjustment and held the shape in position during the process of back-filling in spite of its great weight and the cramped quarters in which the men worked.

The back-filling was rammed into position as soon as each shape was accurately adjusted. In cases where there were large cavities over the roof or in the haunches, requiring excessive quantities of back-filling, pine logs and blocking were used as fillers to a considerable extent. All back-filling on the bottom and sides, however, was made with fragments of hard rock.

The jointing was done subsequently in the manner described for the open canal work, the devices used being, of course, modified to suit the different conditions of the tunnel work. By constant drilling and practice the men were able to lay the shapes in the tunnel in a very expeditious and satisfactory manner. Alinement and grades were always scrupulously kept, and the back-filling could readily be made subject to constant and vigilant inspection. It may be remarked here that this method of lining for small tunnels has proved very successful, both from economic and qualitative standpoints.

The tunnel which was not lined by this method was driven through about 3,200 ft. of very hard and firm basalt, and, as there seemed to be no necessity for a permanent arch for the roof, it was decided to omit it, in general, and build concrete lining in place by the usual methods. It was found, however, that the actual cost of lining and back-filling, which in this case included only the side-walls and invert, exceeded the cost of the complete circular lining by the shape method as previously described. This was due principally to the excessive quantities of concrete required to fill holes and cavities in the sides caused by irregularities in blasting the tunnel. The method of tunnel lining by shapes is advantageous inasmuch as the costly masonry lining is kept to a minimum imposible to attain with the older method. The principal advantage of the method of building lining by shapes, however, is that first-class work can be assured with greater certaintly than by the standard method, all masonry being built in the open, and subject to rigid inspection; the placing and back-filling are also carried out under much better control than is possible under ordinary conditions of tunnel work. The experience derived from lining the tunnels for the Tieton Canal has remonstrated that this method of tunnel lining can be readily used wherever tunnels of moderate dimensions require treatment.

The cost of tunnel lining in the yard at the end of 1908 was about $4.75 per ft. of completed shapes. The cost of transporting, laying, back-filling, and jointing tunnel shapes was found to approximate $3.60 per lin. ft., so that the completed tunnel lining in place, including all plant and operation charges, but not including any excavation or timbering, was approximately $8.35 per lin. ft.

The other principal feature of canal construction was the excavation for the open canals and tunnels. All tunnels, except one short one, were built by force account, that is, by a force organized and operated by the engineers of the Reclamation Service. The aggregate length of tunnels thus built was about 10,000 ft. There were no noteworthy features connected with this tunnel work, except that costs were generally kept down to a satisfactory figure, in spite of the difficult nature of the material encountered, and the entire work was completed without any serious mishap.

The two lower tunnels, called the Tieton and North Fork Tunnels, respectively 2,900 and 3,000 ft. in length, were driven by compressed air drills of the ordinary type, the compressor being located in the bottom of the cañon, midway between the tunnels. Tunnel operations were generally carried out in two 8-hour shifts per day, although the arrangements of the shifts was frequently altered to meet changing conditions. The cost of driving these two tunnels, including all material for plant, up to the end of 1908, when the greater portions were completed, was about $19 per ft. It may be of interest to know that these figures represent actual costs of tunnel work during a period when labor was abnormally high and difficult to obtain and hold, the work being also at a remote location where all material and supplies had to be hauled from a considerable distance.

The following are the details of the cost of tunnel driving for the North Fork and Tieton Tunnels:

	Per lin. ft.
Labor in tunnel	$ 8.00
Explosives	1.50
Supplies	0.50
Power-plant operation	1.10
Blacksmith shop	0.75
Timbering	2.50
Plant charges	5.00
Total	$19.35

The above costs include engineering and administrative charges. The inside dimensions of these tunnels, as excavated in the rock, were approximately 8x8 ft.

The third long tunnel, the Trail Creek Tunnel, was driven for almost its entire length through an unusually hard blue basalt. The driving was effected at first by electric drills operated by three-phase, 60-cycle, 220-volt alternating current. As the work progressed, continual trouble was caused by breakage of parts of these drills, the springs operating the rebound being particularly susceptible to injury. Duplicate parts could only be obtained after much delay. In addition, there was much difficulty on account of labor, it being found practically impossible to obtain drillmen skilled in the use of electric drills. Ordinary drillmen would generally refuse to use the apparatus, or, if persuaded to make a trial, would obviously use it in an unsympathetic and ineffective way. Careful study, however, of the effectivenes of the electric drills, even when skillfully handled, showed that in very hard rock they were uneconomical, their penetrative power being low. Eventually, Temple-Ingersoll drills were substituted, and the work was completed with them. These drills are practically air drills driven by an electrically-operated air pump on a small truck. This apparatus was found to be much more effective than the electric drills for which they had been substituted, the blows being much more forcible and the penetration correspondingly more economical. This apparatus, moreover, was found to be far less subject to injury than the electric drills.

The cost of driving the Trail Creek Tunnel proved to be much higher than that of the other two tunnels, the corresponding figures for tunnel excavation being about $20 per lin. ft., in spite of the fact that little or no timbering was required.

Excavation in the open canal, that is, the preparation of a bed for the concrete shapes, was also attended with considerable difficulty because of the location of the canal, the steep slopes, and the numerous side gullies and gorges which broke the continuity of the sidehills and required special treatment. The line was located so as to reduce the excavation to a minimum and also that there should be the minimum disturbance of the natural slopes of the hillside. The natural slopes, however, were frequently so steep that a 1½ to 1 slope on the upper side of the canal excavation would only intersect them at a considerable distance above the canal line, so that, even with the shallow cut required for this type of construction, a large quantity of material had to be removed.

Practically all excavation was by hand, the steepness of the hillside not permitting the use of animals or mechanical methods. Much of the excavation was in rock. The average cost of excavation per cubic yard up to the end of 1908 was about 65 cts., inclusive of both earth and rock. It is probable that about 30 per cent of the entire work was in solid or loose rock. Wherever the canal location was in earth, a 4-in. drain tile was laid along the bottom of the trench on the side toward the hill, outlets for the drain being built at intervals of from 300 to 500 ft. This drain was for the purpose of taking care of natural groundwater, or seepage water from the canal, and preventing its accumulation and consequent tendency to soften the bed of the reinforced lining.

All deep gullies on the line of the canal were crossed on dry rubble embankments, and, where necessary, masonry culverts were built at the bottom of these. At certain points large jutting shoulders of rock necessitated short tunnels, 100 or 20 ft. in length, and in such cases the tunnels were driven of sufficiently large section to permit of laying open canal shapes continuously through them, thus making no break in the continuity of the open canal.

The physical difficulties attending the construction of the Tieton Canal were considerable. The cañon was practically inaccessible before work was commenced, except at its lower extremity, and by trails meandering from side to side, sometimes at heights of 800 or 900 ft. above the stream bed and sometimes necessitating dangerous fords. To make preliminary surveys, the engineers had to establish camps at remote points, where the delivery of the necessities of life was attended with much difficulty.

One of the first steps after completing the surveys was to build a wagon road the entire length of the canal along the bottom of the cañon. This work had been almost completed in the fall of 1906 when a heavy flood practically obliterated all that had been accomplished. Several bridges which had hardly been used were swept away, and the bottom lands were altered, eroded, and heaped up with débris to such an extent that the topography could hardly be recognized. After this flood had subsided, however, operations were immediately resumed, bridges were rebuilt, and the road was completed early in 1907.

The Reclamation Service at once proceeded to develop water-power in order to drive the tunnels, advantage being taken of a steep fall in the river to build a power canal giving at its lower extremity a static head of about 30 ft. The turbine installation developed about 350 h. p., the turbine being belt-connected with a two-stage air compressor and a generator for lighting and power purposes.

All this apparatus was successfully installed and housed toward the end of 1907. Substantial camps were also built at suitable points along the cañon. Another hydro-electric installation was made near the upper end of the canal for operating the mixers and crushers in the various manufacturing yards, and also for hoisting and delivering material and shapes to the canal location. Altogether, about 60 h. p. was developed at two power plants, most of which was transformed, transmitted and used at distances for construction and lighting purposes.

At the main power station a machine and blacksmith shop was established where all repair work was done and all steel forms, special mechanical devices, and even some rolling stock were manufactured or fitted. Machine drills, lathes, rolls, drill sharpeners and other equipment were set up at this point, the motive power being compressed air. This establishment assumed quite extensive proportions as the work developd, and was the scene of much activity throughout. It should be remembered that operations in so remote a locality necessitated field execution of practically all repair and renewal work, much of which under other conditions would be sent to distant shops.

Time and difficulties of transportation, however, did not permit of much dependence on outside help, and, except in case of breakage or loss of special machinery parts or fittings, practically everything was done in the cañon.

The working season in this country is comparatively short, except for tunnel work. Operations in the open can seldom be carried on before the end of April, especially in connection with masonry work, the snow lingering very late, being sheltered by the depth of the cañon and the forest growth. Roads are usually impassable in the early spring. The building of concrete shapes had also to be stopped by the middle of October, work of this type being particularly susceptible to injury by frost. On one occasion a batch of some 200 shapes manufactured during the end of October and beginning of November, 1907, was injured to such an extent by freezing that most of them had to be destroyed.

Labor frequently proved very difficult to obtain, and more especially during 1907. Wages for common labor varied from $2 to $2.50 per day, tunnel drill men from $3 to $3.75, the working day being 8 hours. It was noted that the effectivenes of labor invariably proved to be in inverse ratio to the rate of wages. The laborers chiefly consisted of so-called "white men," being a cosmopolitan collection of native Americans, Scandinavians, and Germans, with a few English. The higher classes of labor, such as machinists, sub-foremen, and the like, were practically all native Americans.

It is believed by the writer that construction of this type has not been used elsewhere on any large scale, if at all. It has proved a successful method of building, and may be recommended for adoption elsewhere wherever conditions are such as to warrant such action. It should be remembered, however, that this type of work is particularly exacting on the organization and personnel, probably requiring more careful supervision and control than the standard methods usually adopted.

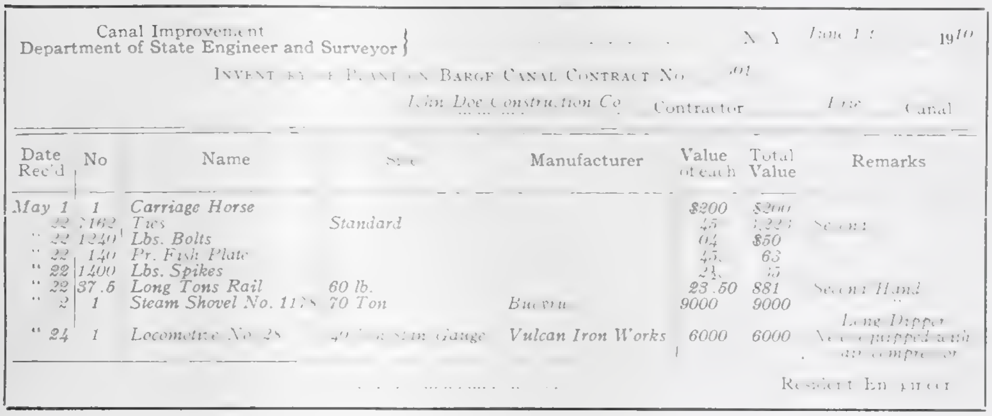
The engineers in local charge at the commencement of work were Joseph Jacobs, M. Am. Soc. C. E., District Engineer, and E. McCulloh, M. Am. Soc. C. E., Resident Engineer, both acting under the direction of D. C. Henny, M. Am. Soc. C. E., Supervising Engineer, and the writer. The organization of the work, however, was mainly built up under the local direction of Mr. C. H. Swigart, then Project Engineer, aided by an able corps of assistants. Much of the success of the work is due to the skill and ingenuity of Mr. Maney, the Superintendent, and Mr. Cronholm, Master Mechanic. The writer was associated with the work until the beginning of 1909, after which it was continued and completed under the direction of Mr. C. H. Swigart as Supervising Engineer and Mr. J. S. Conway, Engineer. All operations were under the general direction of F. H. Newell, M. Am. Soc. C. E., Director, and A. P. Davis, M. Am. Soc. C. E., Chief Engineer, of the Reclamation Service.

Roadmasters' and Maintenance of Way Association.—The 28th annual convention of the Roadmasters' and Maintenance of Way Association will be held at the Great Northern Hotel, in Chicago, Sept. 13-16, 1910, being called to order at 10:30 a. m. on Sept. 13. The following subjects will be discussed at the meetings: Proper Care of Track Material and Tools; Cattle Guards; New and Improved Appliances, including Ties; Standard Switch Target; Rail Fastenings, including Insulated Joints; Tie Plates and Rail Anchors; paper on Treated Timber, by J. L. Single; paper on subject to be selected by himself, by W. M. Camp. Topical questions for discussion: (a) Dressing of Gravel Ballasted Track; (b) Paving of Ditches; (c) Length and Size of Ties; (d) How to Drain the Midway of Double Track, Whether by Surface Ditches or by Tile Drains; (e) Should the Gage on Curves be Readjusted to the Side of the Rail Head and by Moving Which Rail; (f) Quality of Track Labor. The officers report a greater increase in membership this year than in any past year and a large attendance is expected. James Sweeney, roadmaster, Denver & Rio Grande, Salida, Colo., is president, and Walter E. Emery, chief engineer, Peoria & Pekin Union Ry., Peoria, Ill., is secretary.

EARTH AND ROCK SECTION

Engineers' Cost Keeping System New York State Barge Canal.

A comprehensive system of cost records is kept by the New York State Engineer and Surveyor on the contract work on the New York State Barge Canal. The purpose of this is primarily to protect this state against claims for extra work, and secondarily to provide the engineers with information to aid them in making future estimates and letting future contracts.



Canal Improvement Department of State Engineer and Surveyor			N. Y.	June 1?		1910	
Inventory of Plant on Barge Canal Contract No. 301							
John Doe Construction Co			Contractor			Erie Canal	
Date Rec'd	**No**	**Name**	**Size**	**Manufacturer**	**Value of each**	**Total Value**	**Remarks**
May 1	1	Carriage Horse			$200	$200	
" 22	[illegible]	Ties	Standard		.45	[illegible]	Second
" 22	1240	Lbs. Bolts			.04	$50	
" 22	140	Pr. Fish Plate			.45	63	
" 22	1400	Lbs. Spikes			.02½	35	
" 22	37.5	Long Tons Rail	60 lb.		23.50	881	Second Hand
" 2	1	Steam Shovel No. 11[illegible]	70 Ton	Bucyrus	9000	9000	" Long Dipper
" 24	1	Locomotive No. 28	40 ton standard gauge	Vulcan Iron Works	6000	6000	New equipped with air compressor
							Resident Engineer

Fig. 1.

This system worked out is very satisfactory and the costs as kept by it have been surprisingly accurate. One instance, where a contractor's books were examined as a result of a suit, showed a total cost of $78,000—and a difference between the actual cost and the engineer's cost of only $200. This was, of course, much closer than the engineers had hoped to check with the actual costs and is doubtless much closer than can ordinarily be expected. It is generally thought, however, that these estimated costs will be within 5 per cent of the actual costs of the work.

When a contract is started the Assistant Engineer's office keeps track of all the plant brought on the work and all the accessories to the work. This inventory is kept in the form shown by Fig. 1. The name of each article or machine is given and its value stated. In many cases the values are given to the engineers by the contractors. The inventory is added to as new plant is brought into the work and at regular periods new inventories are taken to check up and verify the old ones.

The average life of the different machines is assumed and a monthly depreciation and interest on investment is charged into the unit costs for the monthly work done. All small tools are divided into lots to the value of $100 or $200 each, according to the size of the contractor's plant, and each lot is charged against the particular branch of work for which the tools are mostly used.

Each contract is divided into its different classes of work and for the purpose of abbreviation, each feature is designated by a capital letter. These features are subdivided into the different items and each item is given a small letter. Each contract item, or the items separately considered in bidding, are numbered. In charging out labor or supplies the number designating the contract item, is given. The division of the work into its various features is made by the engineer directly in charge of the contract. The only item which is general for all the contracts on the canal is *A*—which stands for General Office, Superintendence, etc. This allows latitude in dividing the work and is necessary in order to get the proper divisions as no one list of features and subdivisions could be applied to different contracts. A sample list of features is as follows:

Features-Contract No. 21.

A—General office superintendence [illegible]
B—Scottsville road bridge abutments.
C—Guard lock and approaches.
D—Brooks avenue bridge abutments.
E—Chili road bridge abutments.
F—Scott road approaches.
G—Drainage ditches.
H—Prism-shovel No. 1 and train outfit.
I—Prism-shovel No. 2 and train outfit.

These features each cover several contract items which are numbered for reference, and for an example may be shown as follows:

Contract Items.

1. Clearing.
2. Grubbing.
3. Excavation.
4. Sheeting and bracing.
5. Rock channeling.
6. Concrete—1st class.
7. Concrete—2d class.
8. Wash wall.

The contract items are further subdivided and lettered as follows:

Subdivision of items.

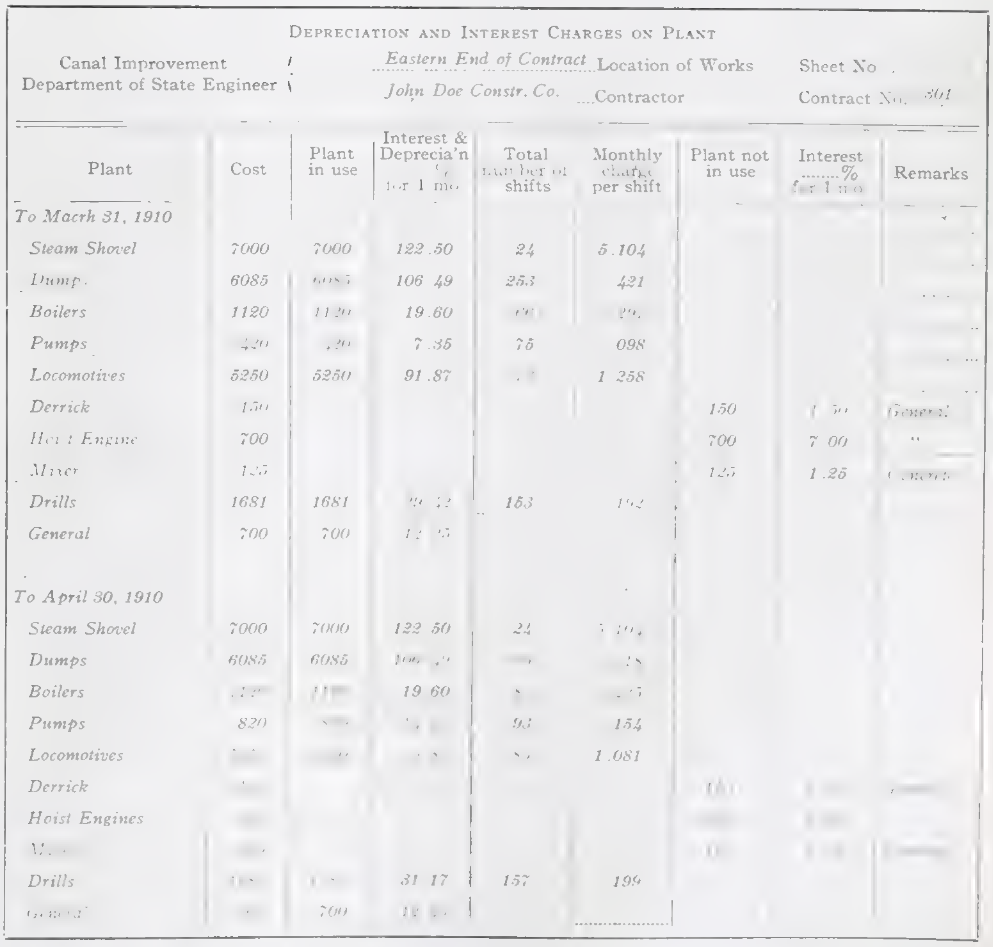
a—Drilling and blasting.
b—Digging and loading.
c—Transportation.
d—Spreading and compacting.
e—Mixing.
f—Forms.
g—Hauling machinery and supplies.
h—Electric plant and buildings.
i—Repairing.
j—Coffer-dams, pumping, etc.
k—Driving (piles).
l—Assembling and erecting (steel).
m—Stone crushing.
n—Peeling and banding piles.
o—Building levees.
p—Surface finishing (concrete, etc.).
q—Manipulating (riprap, stone, filling, paving, etc.).
r—Painting.

With this list as a basis the timekeeper or inspector soon memorizes the letters and figures and with no trouble at all can jot down the distribution as he is looking over the work. For example, if a certain man is working on Drainage Ditches loading earth into cars, he is shown on inspector's sheet charged to G3b.

The depreciation and interest charges on the plant are kept as shown by Fig. 2. The original value or cost is given for each machine. The value of the part which is being used is given, and the interest and depreciation charges for one month is shown. The total number of shifts worked during the month is noted and the total charge divided by the number of shifts to show the monthly charge per shift. Any plant which is not in use is figured at 1 per cent per month for interest and depreciation. A card system is used in getting the daily distribution of time on the different machines. Each machine has a card of its own and a record of that machine for a month is shown each day on the card. The cards are numbered and are referred to on the weekly and monthly sheets by their numbers.

The force account kept by the inspector is on weekly and monthly sheets. Figure 3 shows a weekly report giving the force for each day and the features and items to which the force has been charged. At the head of each column showing the day of the work, space is indicated for showing the condition of the weather.

Figure 4, showing the monthly report, indicates the sum of the weekly reports for the



Depreciation and Interest Charges on Plant

Canal Improvement Department of State Engineer			Eastern End of Contract	Location of Works			Sheet No.	
			John Doe Constr. Co.	Contractor			Contract No. 301	
Plant	**Cost**	**Plant in use**	**Interest & Deprecia'n ..% for 1 mo.**	**Total number of shifts**	**Monthly charge per shift**	**Plant not in use**	**Interest ....% for 1 mo.**	**Remarks**
To Macrh 31, 1910								
Steam Shovel	7000	7000	122.50	24	5.104			
Dumps	6085	6085	106.49	253	421			
Boilers	1120	1120	19.60	[illegible]	[illegible]			
Pumps	420	420	7.35	75	098			
Locomotives	5250	5250	91.87	[illegible]	1.258			
Derrick	150					150	1.50	General
Hoist Engine	700					700	7.00	"
Mixer	125					125	1.25	Concrete
Drills	1681	1681	[illegible]	153	[illegible]			
General	700	700	[illegible]					
To April 30, 1910								
Steam Shovel	7000	7000	122.50	24	[illegible]			
Dumps	6085	6085	[illegible]	[illegible]	[illegible]			
Boilers	[illegible]	[illegible]	19.60	[illegible]	[illegible]			
Pumps	820	[illegible]	[illegible]	93	154			
Locomotives	[illegible]	[illegible]	[illegible]	[illegible]	1.081			
Derrick	[illegible]					[illegible]	[illegible]	[illegible]
Hoist Engines	[illegible]					[illegible]	[illegible]	
Mixer	[illegible]					[illegible]	[illegible]	[illegible]
Drills	[illegible]	[illegible]	31.17	157	199			
General	[illegible]	700	[illegible]					

Fig. 2.

19 10

—Excavation Item   Contract No. 301   Sheet No. 1

PKE—Prism Lock No. 32 to Lock No. .. Feature

Subdivision	Previous Total	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total for Year	Total to Date
General	56.33					117.52								117.52	172.85
a—Drilling and Blasting	30.21														30.21
b—Digging and Loading						992.44								992.44	992.44
c—Transporting						2441.94								2441.94	2441.94
d—Spreading and Compacting															
Total Cost for Month						3551.90								3551.90	
Units Completed during Month						789								789	
Av. Cost per Unit for Month						45								.45	
Total Cost to Date	85.54	85.54	85.54	85.54	85.54	3637.44							3637.44		3637.44
Units Completed to Date	190	190	190	190	190	979							979		979
Av. Cost per Unit to Date	45	45	45	45	.45	46							46		46

Fig. 3.

month. In this case the sample sheet shown indicates the labor and machinery on *PKE*, or, for example, the canal prism from lock 32 to 33. The contract item 4 meaning excavation, and one of the letters indicating the class of material, as earth or rock. Under the heading Subdivision of Items, *b* and *c*, are given, which may indicate respectively—digging and loading, and transportation. The card numbers given refer to the machines as before mentioned. The original monthly reports are sent in to the main office at Albany and a blue print copy of them is retained by the assistant engineer on the work. At the main office all reports are carefully checked

MONTHLY STATEMENT OF LABOR, MACHINERY AND MATERIALS

Canal Improvement }
Department of State Engineer }

John Doe Construction Co. Contractors
Richard Roe Engineer in Charge

Sheet No. *1 of 6*
Contract No. *301*
For Month Ending *May 31* *1910*

Labor Machinery Materials	Daily of 8-hour Rate / Cost of Materials	Feature	Contract Item	Subdivision of Items	From 1 to 6	From 7 to 13	From 14 to 20	From 21 to 27	From 28 to 31	From to	Number of Days Worked	Number of 8-hour Shifts	Cost for Month
Salaries, Office and Misc. Expenses		A											1800 00
Premium on Bonds		A											864 89
Insurance		A											177 36
Walking Boss	5 77	PKE	4		2½	3	3	3	1½		26	13	75 01
Timekeeper	3 27	PKE	4		2½	3	3	3	1½		26	13	42 51
Shovel Engineer	5 77	PKE	4	b	5	6	6	6	3		26	26	150 02
Cranesman	3 85	"	"	"	5	6	6	6	3		26	26	100 10
Fireman	2 50		"	"	5	6	6	6	3		26	26	65 00
Watchman	1 77		"	"	6	7	7	7	4		31	31	54 87
Laborers	1 75		"		26	[illegible]	36	37	19		28	151	264 25
	1 50		"		4	5	6	6	4		25	25	37 50
Coal (Tons)	2 65			"	11.7	15.6	15.6	15.6	7.8		26	66.3	175 70
Interest and Depreciation Card No. 3													145 00
Mechanic	[illegible]	PKE	4	c		1					1	1	3 85
Foreman	[illegible]		"	"	5	6½					11	11½	40 25
	3 00			"	8	14½	9	8	2½		27	42	126 00
Carpenter	[illegible]					2	1	½			4	3½	10 50
"	[illegible]					[illegible]	1				5	4½	11 25
[illegible]	[illegible]					5½	2				6	7½	13 13
Locomotive Engineers	[illegible]			"	15	[illegible]	[illegible]	18	9		26	77	221 76
Switchmen	[illegible]				16	20	19	21	11		31	87	152 25
Watchman	[illegible]				6	7	7	7	4		31	31	54 87
Laborers	[illegible]			"	198	252	182	104	20		27	756	1134 00
Teams	[illegible]				2	5½					8	7½	30 00
Coal (Tons)	[illegible]				10.8	14.4	14.4	12.	6.4		26	58	153 70
Interest and Depreciation													
Cards No. 15, 16, 19, [illegible]													
107, 108, 110, 113, 117, 123, 142,													
145, 271, 273, 277, [illegible]													490 38

Fig. 4.

Contract No...*301*.. Sheet No. [illegible] Week Ending *May 13, 1910* *Eastern End of Contract* *Harry Boyd*, Timekeeper	Rate per 8-hour Shift and Cost of Materials	Feature	Contract Item	Subdivision of Item	Fair Stormy Warm Cold Very Cold Saturday	Fair Stormy Warm Cold Very Cold Sunday	Fair Stormy Warm Cold Very Cold Monday	Fair Stormy Warm Cold Very Cold Tuesday	Fair Stormy Warm Cold Very Cold Wednesday	Fair Stormy Warm Cold Very Cold Thursday	Fair Stormy Warm Cold Very Cold Friday	No. of Days Work'd	Total Number of 8-hr. Shifts per Week	Total Cost per Week
Walking Boss	[illegible]	*PKE*	*4*	..	*½*		*½*	*½*	*½*	*½*	*½*	*6*	*3*	
Timekeeper	[illegible]				*½*		*½*	*½*	*½*	*½*	*½*	*6*	[illegible]	
Shovel Engineer	*·77*	*PKE*	*4*	*b*	*1*		*1*	*1*	*1*	*1*	*1*	*6*	*6*	
Cranesman	*385*		..	..	*1*		*1*	*1*	*1*	*1*	*1*	*6*	*6*	
Fireman	*250*		..	..	*1*		*1*	*1*	*1*	*1*	*1*	*6*	*6*	
Watchman	*177*		..	..	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*7*	*7*	
Laborers	*175*		..		*5*		*5*	*5*	*6*	*6*	*6*	*6*	*33*	
..	*150*			..	*1*		*1*	*1*	*1*	*1*	*1*	*5*	*5*	
Coal	*265*		..		*2.6*		*2.6*	*2.6*	*2.6*	*2.6*	*2.6*		*15.6*	
Int. and Deprec., Card No. 3														
Mechanic	*85*	*PKE*	*4*	*c*			*1*					*1*	*1*	
Foreman	*50*		..	..	*1*		*1½*	*1*	*1*	*1*	*1*	*6*	*6½*	
..	*300*		..	..	*2*	*2½*	*2*	*2*	*2*	*2*	*2*	*7*	*14½*	
Carpenter	*300*		..	..			*1*	*1*				*2*	*2*	
..	*250*		..	..	*1*				*1*	*1*	*½*	*4*	*3½*	
.. *Helper*	[illegible]		..	..	*1*		*1*	*1*	*1*	*1*	*½*	*6*	*5½*	
Locomotive Engineer	*288*		..	..	*2*		*3*	*3*	*3*	*3*	*3*	*6*	*17*	
Switchmen	*175*	..	..	..	*3*	*2*	*3*	*3*	*3*	*3*	*3*	[illegible]	*20*	
Watchman	*177*		..	..	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*7*	*7*	
Laborers	*150*		..	..	*40*	*22*	*34*	*38*	*42*	*39*	*37*	*7*	*252*	
Teams	*400*				*1*	*1*	*1*	*1*	*1*	*1*	*½*	*6*	*5½*	
Coal	*265*		..	..	*2.4*		*2.4*	*2.4*	*2.4*	*2.4*	*2.4*		*14.4*	
Int. and Deprec.														
Cards No. 15, 16, 19, 42, 43, 44, 50, 107, 117, 271, 277, 372, 108, 110, 273, 113, 123, 142, 145														

Fig. 5.

and the items are redivided to show the costs on contract items per unit for the month and the cost per unit to date.

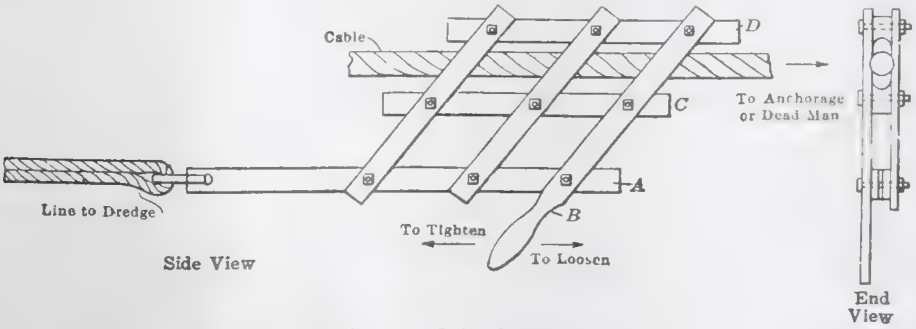
The costs of the different contract items are thus distributed as shown by Fig. 5. This form is on a loose leaf system printed on both sides of the sheet with space on each side for three features, or items, like the one given.

For so large a work, and such a great number of large contracts as are being carried on in the construction of the New York State Barge Canal it would seem that a very complicated system for keeping costs would necessarily have to be employed. This system, however, which is working very successfully, is very simple and easily understood.

We are indebted to Mr. John H. McElroy, Resident Engineer in charge of the cost keeping department, for the information used in preparing this article.

A Simple Cable Grip for Dredge Lines.

The accompanying sketch shows a grip for use on the swinging or anchor lines of dredges where ready readjustment of length is essential. The book cable or side line is attached to the eye of the grip as shown and the free end of the shore line passes between the bars *C* and *D* of the grip. Any pull on the lines tends to tighten the grip. To take up slack the grip is knocked loose by a sledge blow on the arm *B* and a new hold taken. This grip is the invention of E. T. Wall, dredge master of "Natomas No. 1" dredge, operating near Folsom, Cal., and is described by him in the *Engineering and Mining Journal* for Aug. 20, 1910.



Details of Simple Grip for Dredge Lines.

Method and Cost of Deepening and Lining a Creek Channel Under the Arch of a Canal Aqueduct.

The intercepting sewers now under construction at Syracuse, N. Y., run parallel to Onandaga Creek, a stream which has formerly been the carrier of sewage for a large portion of the city, and which under the new plan will carry only the storm water and overflow from the intercepter. This plan involves the lowering of the creek bed and the lining of the channel for a considerable portion of its length.

The Erie Canal crosses this creek in a thickly populated district of the city. The canal is carried over the creek by an old masonry aqueduct which is built in three arches, each of 25-ft. span. In low water season all the water generally passes under the center arch. The stream is bordered by buildings whose walls come almost to the water's edge, and the stream is spanned by a large building which is partly supported on the lower side of the canal aqueduct. The work described here comprises only that portion of the creek channel coming under the arch of the aqueduct.

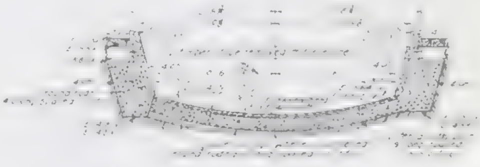


Fig. 1—Section of Creek Channel Showing Concrete Lining.

Contract work was delayed until winter, because the New York State Canal officials would not permit the work to go on during the season of navigation in the canal. The work involved the excavation of the creek bed under the center arch of the aqueduct to a depth of about 8 ft. and for a distance of 253 ft. About 163 ft. of this distance represents the width of the aqueduct. Figures 1 and 2 show a plan and section of the work. The invert of concrete laid under the aqueduct was 18 ins. thick and was reinforced with 1-in. rods spaced 1 ft. apart. The balance of the invert was made 12 ins. thick and was not reinforced. Part of the masonry of the piers of the aqueduct was cut away and the concrete underpinning walls were placed in 3-ft. sections.

The contractor began the work on Dec. 10, 1909. From this date until Feb. 1, 1910, the time was spent in building cofferdams and installing an 8-in. centrifugal pump. The cofferdams were of 8 ft. steel sheet piling (Lackawanna and Corrugated), and also of wood made by three thicknesses of overlapping plank. The steel sheet piling was driven across the creek channel at the ends of the aqueduct piers, both above and below the culvert, and the wooden dams were placed between the piers above and to the side of the channel which was to be improved.

The excavation was started at the lower end and progressed up stream in sections of about 10 ft. The side walls were then placed in the excavated section and immediately following, the invert was placed. A 12-in. vitrified pipe underdrain was laid as the excavation proceeded. Three 8-hour shifts were worked and the number of laborers on each shift varied from 14 to 30. The excavated material was all thrown upon runways and wheeled in barrows over the lower cofferdam and dumped in the creek channel to be rehandled at such time as the work reached the culvert, the contractor believing that he could then make proper disposal of it by hoisting it to the street. As it happened a winter flood carried the bulk of the spoil away. The wheeling from the excavation to the spoil was about 150 ft. and from 6 to 8 men were used on the barrows.

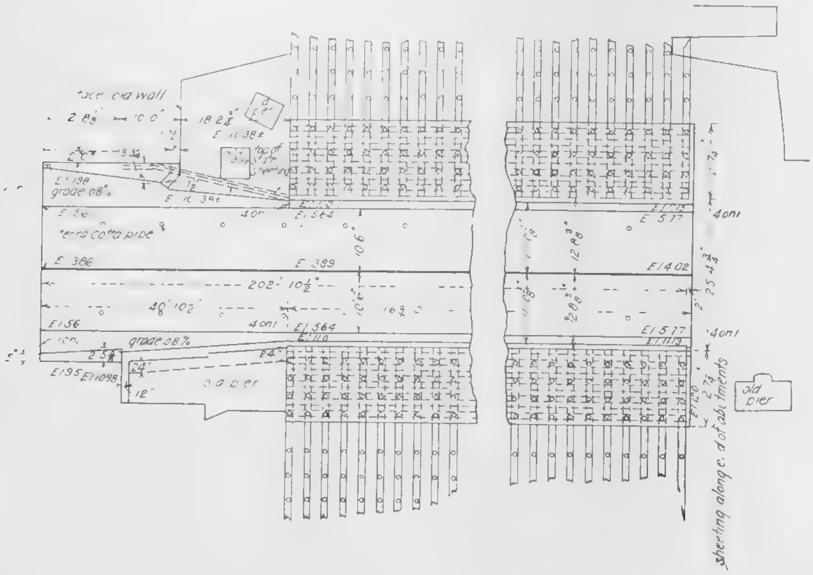


Fig. 2—Plan of Creek Channel Showing Concrete Lining.

The mixer, a Foote ½ cu. yd. batch mixer, was placed in the east arch under the canal spillway and the opening in the spillway was used to lower the material for concrete. Both the centrifugal pump and mixer were operated by steam bought from the gas plant on the lower east side of the culvert. The cost of steam was $8 per day. The sand and stone were both heated with steam and in some cases salt was used. The steam pipes for heating the material were placed in long boxes, with holes in them, which were located under the stock piles. It required 8 laborers to operate the mixer, 1 at the skip and water bucket, 1 at the discharge, 2 on sand, and 4 on stone, loading and wheeling. Generally 8 men were used to wheel the concrete from the mixer to the place of depositing, where 4 men were spading and ramming. A gang of 4 men was kept up on the tow path of the canal where the material was received in wagons and shoveled down through the spillway opening. This number of men constituted a full working force and was varied according to conditions. The concrete was mixed in proportions of 1:3:5. Atlas Portland cement and Solvay limestone were used. The sand was shipped from Batavia, N. Y., and at times was mixed with limestone crusher dust from the Solvay plant in Syracuse.

The cost of the work was very high, owing to the unusually difficult conditions under which it had to be done. All of the work except the mixing of concrete was done by hand. The cost was approximately as follows:

Excavation; 2,058 cu. yds.:	
Labor	$6,408.00
Plant depreciation	50.00
Bailing and draining (steam and drain tile)	585.00
Lighting	25.00
Total	$7,068.00
Cost per cubic yard of concrete	3.14
664.5 cu. yds.:	
Labor	$1,548.00
Cement	841.00
Sand	310.00
Stone	465.00
Plant depreciation	100.00
Lumber and forms	300.00
Total cost	$3,564.00
Cost per cubic yard	5.37

A total of 731 bbls. of cement were used or 1.1 bbls. per cubic yard of concrete. There were 17,760 lbs. of reinforced cement at 2½ cts. per lb. and 77 ft. of 3-in. vitrified pipe at 4 cts. per ft. The labor of placing the reinforcing steel and vitrified pipe is included in the concrete labor costs. These costs are, of course, exclusive of insurance and administration expenses. The work was completed about May 1, 1910, and is part of a contract involving the construction of a large number of sewers being built by the Syracuse Intercepting Sewer Board. Mr. R. J. Lyon is Resident Engineer on the work and Mr. Glen D. Holmes is Chief Engineer of the Syracuse Intercepting Sewer Board.

ROADS AND STREETS SECTION

Construction and Maintenance of Parkway Roads.*

The subject of road construction and maintenance has been very thoroughly discussed during the last few years and it appears to be the general opinion that some kind of bituminous binder should be used in the work. Engineers and chemists have differed consideraly in their specifications for this bituminous material. The writer does not feel qualified to give specifications, as he has generally used commercial products, choosing those which appeared to be best suited to the work. Therefore, a general description of the methods and materials which have been used in the construction and maintenance of macadam and gravel surfaced roads will be given.

The roadways constructed under the direction and supervision of the writer in the development of the Metropolitan Park System of Boston, Mass., have been for the most part roads which were to be subjected to only pleasure traffic, i. e., light, horse-drawn vehicles and automobiles.

At the commencement of the work of constructing these roadways, as it was desired to build them in the best and most durable manner, they were generally built of macadam by the usual methods. In the construction of these roads trap rock or other hard rock was generally used.

It soon became evident, however, even before the motor car was used to great extent, that this type of road surface was not well suited to the class of traffic which used it, as a large percentage of the pleasure vehicles were equipped with rubber tires and there was not enough wear upon the stone to supply the binder necessary to keep the roads in good condition. The sections of road constructed with the softer grades of stone were much more easily maintained in good condition and the actual wearing away of the surface was slight. With the advent of the automobile the stripping of the surface of the macadam roads, especially those constructed with the harder grades of stone, immediately became so rapid that it was necessary to adopt other methods of construction than that of the ordinary macadam.

Some gravel surfaced roads were constructed during the early stages of the development of the system and these proved to be much better suited to the light traffic than macadam. They were better for horse driving, less affected by automobiles and more easily repaired. During the last six or seven years this type of road has been built almost exclusively for these parkway drives.

They have been built with special care in the selection of materials and in the workmanship. Where possible, it has been the practice to obtain material composed of sharp, angular stones with only sufficient clay to properly bind the stone. In some cases it has been necessary to use a clean, sandy gravel and add clay binder during the process of construction, which method is generally not as satisfactory as when the material is in the proper proportions in its natural state. The surfacing material is 8 ins. in depth and is laid in two 4-in. layers, and each layer is thoroughly compacted by the use of sectional grooved rollers drawn by horses. All stones larger than 1½ ins. in diameter are screened out, or in cases where the material in the bank contains but little stone larger than this size, the larger stones are raked out after the gravel has been spread upon the road.

The principal objection to this type of road is that at the season of the year when the frost is coming out it is likely to rut if the amount of clay binder is at all excessive. This condition lasts only for a short time and the road surface is easily and cheaply smoothed out if the work is done immediately after the frost is out in the spring and before the surface becomes compacted in its rutted condition.

To overcome this objection and still continue to have the gravel surfaced type of roads for the parkways, the writer has been for the last two years using a crushed stone base of about 4 ins. in thickness with a 2½ to 3-in. layer of binding gravel on top. This method provides good drainage and a good base for the gravel surface. After the completion of the surface and before it has become too hard to readily absorb the material, a treatment of heavy asphaltic oil is applied which serves to make it dustless and in a large measure to preserve it. About 1 gal. of oil to the square yard is required.

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*Report by John R. Rablin, Engineer Metropolitan Park Commission, Boston, Mass., presented at the Second International Road Congress at Brussels.

In some instances where it was necessary to allow heavy traffic on the parkway on account of the fact that an existing road has been replaced by the parkway, and generally in these instances double roadways are constructed, one roadway is built with macadam for the use of this traffic. Since the automobile has come into use to such large extent, the practice in the construction of these macadam roads has been to use a bituminous binder with the top layer of stone. The method used has been that which is known in this vicinity as the penetration method, which is the grouting of the stone with the bituminous binder after it has been laid upon the road and thoroughly rolled. The bituminous material is applied at a temperature of from 150° to 200° F. and sufficient is used to fill the voids near the surface, which usually requires about 1½ gals. to the square yard of surface. After the application of this material the surface is again thoroughly rolled and a flush coating of bituminous material is then applied by brooming or by spraying or other distributing machines and the surface covered with clean, sharp stone screenings, and again rolled. This forms a gritty, well bonded surface which has proved very satisfactory.

The writer has observed considerable work of this character which has been done by the mixing method, which is the mixing of the stone used in the top 2 ins. of the road surface with the bituminous material, either by hand on mixing boards or by machines. While the results are apparently very much the same, there is no doubt that better work is done by this latter method, but the cost is somewhat greater.

The bituminous material used in the work on the parkway roads has been generally a refined coal tar for the first application, and a mixture of refined tar and residual asphalt for the flush or painting coat. The mixture contained 10 per cent asphalt. The object of the asphalt is to give life to the surface and prevent its becoming hard and brittle, and therefore slippery, which is the tendency of the tar. This percentage of asphalt is too small to be of much advantage over straight tar, and the use of clear asphalt for this class of work is advisable even at an increased cost. A residual asphalt specially prepared with a light oil as a carrier has recently been put upon this market, which appears to be particularly well suited to this work.

The types of roads which have been described are, in the writer's opinion, suitable not only for parkway roads but for highways in general outside cities, the character of the surface to be used, whether stone or gravel, depending on the class of traffic which it will carry.

In the matter of maintenance of roads it is a fact well known to those who have charge of the work that constant and systematic attention is in the end the most economical plan. On account of the varying conditions of traffic during the last few years, which have necessitated much experimental work and many changes in methods of maintenance, it has been difficult to retain any system in the work.

The first noticeable effect on the parkway roads of the changing conditions of traffic, due to the increasing numbers of motor vehicles in use, occurred in the summer of 1906. Investigation was immediately begun to find some means to prevent the quick destruction of the roads which, up to this time had been kept in excellent condition at comparatively small expense.

The method of painting the roadway surfaces with refined coal tar appeared to have most merit, although but little tried in this country and with varying success. This treatment was immediately used upon a large portion of the macadam roads, and with patching and re-treatments when necessary has served to protect these roads and keep them in good condition up to the present time, whereas, if they had not been so treated they would have been destroyed in a few months and would have required resurfacing. These roads are in excellent condition today, and with careful maintenance will probably continue so for some time. One objection to this treatment is its slipperiness for horses in cold weather, but by the use of coarse, sharp stone screenings up to ¾ in. in size with the tar coating, this is overcome to a large degree. Wherever a well drained subgrade exists the frost has had no bad effects upon the surfaces so treated.

The use of heavy asphaltic oils upon existing macadam and gravel surfaced roads, as well as in construction work, has generally proved very satisfactory. At present there are quite a number of commercial products on this market which are being used for this work, and on account of the difficulty of obtaining a satisfactory analysis to determine their quality, the determination has been made by the actual use of the various products on the roads. The materials which have proved satisfactory by this test have been purchased from year to year merely as commercial products and without preparing any specifications. By the use of these oils, which it is claimed contain from 60 to 70 per cent asphaltic residue, a treatment is required about once in two years with some patching between treatments. This applies only to roads having a light traffic, including automobiles, and on roads having a fairly heavy traffic an application may be required each year.

On some of the shaded roads in the woods reservations, the use of calcium chloride has proved quite satisfactory. Motor vehicles are generally excluded from these roads and they are used exclusively by light, horse-drawn vehicles. This treatment serves to lay the rust and keep the roads in a uniformly dampened condition at all times. This material has the power of absorbing and holding the moisture from the air or from the rains that fall, and practically no attention is required on this class of roads except the applications on an average of about once in four weeks. This treatment has been tried upon roads of the same class as those upon which the asphaltic oils are generally used, but as the material has practically no binding quality, the action of the automobiles soon has a bad effect, producing cup holes in the surface which hold the water and become enlarged in a very short time to such a degree that the road requires resurfacing.

In the work of resurfacing macadam and gravel roads the same methods are used as previously described for the original construction of these roads. The surfaces are cleaned and scarified, new materials added to reshape them, and the tar, asphalt or asphaltic oils used as in new construction.

The costs of the various types of road work which have been described have been omitted because they would be of little value, as they will vary considerably in different sections of the country on account of cost of transportation of the bituminous materials from the source of supply. Also, the cost of road materials will greatly vary. However, it can be stated that probably nowhere, at least in the United States, would the additional cost of the bituminous materials, above that of the ordinary macadam or gravel roads, be prohibitive, or even excessive in comparison with the benefits derived from their use. One of the principal benefits of these methods, both to the traveling public and to the residents along the roads, is the practical elimination of the dust nuisance.

Although, up to the present, the various specifications which have been prepared for bituminous binders have apparently produced nothing of greater value than the commercial products, it seems evident that in the near future sufficient information will be acquired by the use of the various materials to insure the preparation by experts, of a standard specification.

In the absence of such a standard specification the manufacturers have been considerably handicapped, as it has been difficult and unprofitable to meet several different ones, but it is evident that they have endeavored to produce the best possible materials for this class of work and would be very willing to conform to a standard.

The Use of Binding Materials in the Construction of Macadamized Roadways.*

The general agreement among highway authorities that the insertion of a special binding material into the metal of a road surface is necessary to effect such a surface as will sustain successfully and economically the strains it is likely to be subjected to by the traffic for a future period of reasonable length, naturally raises two queries:

a. What sort of a binding material shall be used?

b. How shall a proper binding material be inserted with the metal?

It must be understood here that, in the following remarks there is no intention to prescribe for local or specific conditions, any of which cases may so affect the problem as to nullify many or all general conclusions. Specific conditions should be considered as such and the prescription made accordingly. In all cases, however, there are general principles which can and should be considered in each instance, and it is the aim of the writer to now treat of the general matters alone.

There are two binding materials now offered to road authorities: Lime cement and bituminous cement. The object of this paper is to limit the consideration to the latter.

Bituminous cements for road work are not yet well understood by engineers or chemists. A very limited variety of them has been successfully used for a number of years in sheet asphalt work and it is fairly well known what properties are desirable in these particular materials although there is some dispute in this matter still unsettled. With the sudden great increase in the demand for similar material and in the variety of such material offered for use occasioned by such demand and other conditions, a large number of materials have appeared. Very little is known about the behavior of the older materials under the new conditions of use or of the newer materials either as to their fitness for use or their success in use under known conditions of application and trial. The time since the new use of the older materials under new conditions and since the appearance of the newer materials, has been too short to accumulate the desired information and to draw definite conclusions on all the desirable points. Up to within less than a year no concerted effort had been made to collect uniform information on the points of general interest in the matter. Probably, however, the loss of time was unavoidable. Now there is at work a special committee of the American Society of Civil Engineers, whose particular duty it is to collect uniform detailed information concerning bituminous binders. The committee is proceeding carefully and thoroughly and is meeting with encouraging interest and assistance from many sources. It is the unofficial opinion of the committee that considerable time, even several years, will necessarily elapse before conclusions can be clearly reached by it, but it is hoped that this committee may be able to render great service to the profession by reporting from time to time the information secured by it, and, as a particular point may become clear, its conclusions on that point. The length of time, suggested as likely to be required for the completion of its work, is largely due to the dearth of information concerning the details of the work done prior to the formation of the committee.

In a general way it may be said at this time that bituminous materials (as ordinarily understood by the term) may include "Binders" and "Greasers." The latter may be useful for such purposes as dust laying, but their consideration will be omitted here.

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*Report [illegible] Maryland [illegible] the Second International Road Congress at Brussels.

Bituminous binders must, first of all, bind. Their power, *per se*, to adhere to the road metal must be of the highest. Their adhesive ability must, if not equal their cohesive strength, at least be sufficient for the purposes of their application and *vice versa*. Consequently, such a test as the "ductility test," which measures the ability of the material to elongate without rupture, seems insufficient to determine this binding ability of a material offered and a better one should be devised.

They should be fluid in the technical sense of the term. That is, they must impart to the road surface a self-healing ability and must, as far as practicable, be so far from being brittle as to successfully resist the shocks of iron-shod traffic even in the coldest and most hostile weather. Again, when successful, under cold weather conditions as regards resistance to shocks, they must not become so fluid under opposite conditions as to become displaced from their proper position in the road surface.

They should be, in regard to these characteristics, as stable as possible under the conditions of their use. (The methods of using them are discussed later and it will then be noted that under some circumstances a high degree of instability for a portion of the actual material used may be desirable). If fluxed to meet local or particular conditions the base should still be of a character which will preserve the above characteristics, notwithstanding the temporary presence of the flux, and against the altering influences of atmospheric forces.

A desirable bituminous binder should combine the above characteristics with the least practicable admixture of useless or possibly obnoxious adulterants.

With the present limited knowledge of the effects of many of the known constituents of bituminous binders generally and until more is known of the effects on the material itself from the various methods being used in their preparation, it is impossible to prescribe just what laboratory analyses should be made or just what limits are allowable, for variation in a particular determination, if success in the use of the material under specific conditions is to be had. It may be safely assumed that certain analyses, similar to some of those recognized as desirable from the previous experience with sheet asphalt pavements, are pertinent, at least for the purpose of obtaining information as to their value, in the cases of the new materials. For instance, it has been fairly well proved in sheet asphalt work that the presence of paraffine in asphaltic cement is pernicious. Therefore an analysis for paraffine in the newer cements is justifiable for furnishing, in connection with the observations on their actual use, information as to the maximum allowable percentage of paraffine that can be made without detriment.

On the other hand, because there may be some agreement among asphalt users that an excess of the presence of free carbon over a very small percentage in the cement is indicative of a material that will prove unsatisfactory in use, it does not necessarily follow that the limitation of the allowable percentage of free carbon in the newer cements, such, for instance, as refined tars, is either necessary or desirable. The ultimate aim of all analyses and investigations, as referred to, is to supply such information as will enable the expression in specifications of such definite figures for the results of a described analysis, as will insure in the normal material the characteristics before noted as necessary for a satisfactory bituminous binder. Considerable light must yet be had on the subject and preferably it should come from many quarters. The committee of the American Society of Civil Engineers, which has been before referred to, and of which the writer has the honor to be chairman, is endeavoring to collect the information that to them seems desirable and the writer begs leave to express here his sincere hope for the co-operation and assistance to the committee of the members of this Congress. He is convinced that more valuable assistance could not be had by the committee.

Once the characteristics of a satisfactory bituminous binder are known clearly and its properties are thus capable of being expressed definitely in specifications according to the needs of the conditions of its use, the other query follows: "How shall it be used?"

There may be two methods, at least in general:

First: The "Mixing Method."
Second: The "Penetration Method."

Local conditions frequently determine the choice. As yet the experience and its records are not clear enough to draw fair comparisons between the values of the two methods for general use.

Advocates of the mixing method claim that for severe traffic better results are reached by it by reason of the avoidance of waste in the bituminous binder used and the greater uniformity of its distribution and of the surface secured. The advocates of the penetration method claim that the application of it can be readily made under circumstances when the mixing method would not be justifiable, such, for instance, as the treating of an existing macadam road in good condition and whose treatment is only necessitated by a sudden influx of motor traffic; that the avoidance of the necessity for mixing machinery and the reduction of costs by this penetration method justifies a use of bituminous binder in excess of the actual waste; and, that by the exercise of some care, results can be secured of a sufficient uniformity in all respects. Also it is not yet proved that, both theoretically and practically, the filling of the otherwise irreducible voids in the coarser aggregate of the surfacing by consecutive applications, after these voids have been reduced to the minimum, of the finer sizes and then the application of the binder, is not better in every way and productive of equally good and perhaps better results. Future records, as before referred to, and especially when due consideration is given to traffic records, will probably clear up many of these points.

While the writer is fairly familiar with the work done in this country under the mixing method, he feels that a detailed report on the use of such methods might better be left to those of greater actual experience in charge of such work and therefore will append a statment of his recent work with bituminous binders under the penetration method.

In 1907, the city of Annapolis, Md., improved certain streets aggregating 8,600 sq. yds. with tarred macadam under the supervision of the writer and the specifications provided for the use of the penetration method. The macadam was laid as ordinarily, using a hard blue limestone bound with screenings of the same material. After thoroughly rolling and watering, the macadam was allowed to dry and then swept, with hand brooms, clean of all dirt, dust and fine material, and until the stones of the second course were not only exposed, but the spaces between them were, as far as possible without actually dislodging the second course stone, clean of finer material.

Tarvia was delivered in barrels, and heated in a portable tank, holding perhaps three barrels at a time, to an unknown temperature (probably about 150° C.) and applied through a hose from the tank to the cleaned macadam. On an average of 0.50 gals. per square yard was left on the road, it being spread by means of hand brooms pushing a wave of the warm material over the surface. Some three or four hours later, the more absorbent spots were supplied with enough additional tar to apparently leave a uniform coating of about ¼ in. over the macadam. A coat of stone chips, varying in size from ¼ in. to ¾ in. in their longest dimension, was then spread evenly over the tarred surface to a depth of about 1 in. and rolled, and the street the next day opened to traffic. The subsequent surface, at first slightly granular, soon became smooth like sheet asphalt. Under use there was no dust except when the removal of foreign dirt and detritus brought on by traffic was neglected. The surface was not unduly slippery in cold and wet weather nor soft in warm periods and generally resembled closely a street of sheet asphalt or bitulithic. It retained its original properties, not even scaling off in spots, for about two years when an apparent death of the tar began. This showed itself by the refusal of the tar to re-bind, even in warm weather, in places where its bond became broken from any cause. The surface has since been renewed, and apparently the life of the old tar perhaps revived by another light application of similar tar perhaps a trifle thinner in consistency with some screenings in the same manner, and now appears to be good for another, it is hoped somewhat longer, period.

The penetration of the tar into the macadam appeared to be generally between 1½ and 2 ins. The price per square yard of the macadam was 82½ cts. and the price of tarring (including screenings, etc.), was 7½ cts. per square yard.

Since this work, the writer has had charge of several similar pieces of work with similar, though in most cases better results. The greatest difficulty encountered has been the securing of satisfactory and uniform bituminous binders. Up to the season of 1909 at least, the prevailing variation in the characteristics of even refined bituminous materials offered under trade names has been so great as to offer a serious obstacle to successful work with them. Another criticism of many materials, such as most of the refined tars, is their tendency, as noted, to apparently lose their life and become brittle at too early a period.

With the advent of the working season of 1909 a large increase in the variety of bituminous binders offered in the market was noticeable. Under these conditions and knowing of the lack of information generally as to definite facts concerning the characteristics of these various materials, of their availability for use under definite methods, and of the results that might be expected in any case from such use, it seemed advisable for the writer to experiment, to a certain extent at least with some of them in connection with the regular work of his office.

Accordingly arrangements were entered into between the state of Maryland and Baltimore county (Maryland) to treat a road known as Park Heights avenue with a bituminous binder. The work was to cover a stretch of road about 8 miles in length beginning at the city limits of Baltimore city. The traffic over this road was by actual count found to average, during 56 hours on 8 different days in October and November, 1909, 19 motor cars, 23 single horse wagons, and 9 two (or more) horse wagons per hour (between 4 a. m. and 8 p. m.). The macadam was about 8 yds. wide with a street railway track on one side and an earth road 4 yds. wide along the other.

Work was begun in July, 1909, at the city limits and at a point six miles therefrom simultaneously, and carried on toward the center, the same bituminous materials being used on each section. The old macadam was considerably worn in places and the whole width of the macadam was first scarified to a depth of about 2 ins. Enough fresh stone (trap rock on the city end and limestone on the outer section) varying in size from 1 to 2 ins. on their longest dimension was then spread to give the road an even surface, with a cross slope from the center to each side of 6 ins. The stones were then thoroughly rolled, particular care being taken to reduce the voids to the minimum. It is estimated that double the ordinary amount of rolling was done. On this rolled stone were then applied, in sections whose length depended on the quantity of the material at hand, ten varieties of bituminous binder. The accompanying table shows the characteristics of these binders in the form adopted by the committee of the American Society of Civil Engineers. The binder was applied hot (between 80° and 150° C.) and in most cases to an extent that would completely fill the voids in the stone. In some cases, a slight film of the thicker material was left over the rolled surface. The application of binder varied from 5 gals. to 1½ gals. per sq. yd. Shortly after the application of the binder—generally late in the same day—the treated surface was covered to a depth of from ½ to 1 in. with an even coat of stone chips (¼ to ¾ in.). As soon as convenient afterward, the latter was fairly thoroughly rolled. Any spots showing an excess of binder on the surface, whether developed under rolling, under traffic, or under the rays of the sun, were lightly dusted with clean sand (generally dredged from under water) and this dusting was continued as often as necessary. The work was continued until about Nov. 15, 1909, when unfavorable weather necessitated its interruption until next year.

It is too soon to report on the success of this work but a narration of some incidents connected with it, and of the results secured to date may be of interest. In the first place, it was expected to use about 2 gals. of binder per square yard of road and it was found that this amount was just about what the voids of the rolled stone would hold. It very soon became evident, however, that the use of this much of an asphaltic material (such especially as No. 1 in the table) was open to serious objections. Even where no appreciable thickness of the binder was left on top of the stone, under rolling or even merely under the action of the sun, material No. 1 rose through the screenings and subsequently applied sand so that repeated applications of the latter were needed and now a "carpet" of bituminised sand and screenings exists on these portions of the road to a depth of 1½ ins. over the stone. It is entirely possible that this thickness may require additions when the next warm season arrives.

While it may be argued that in the end the presence of this "carpet" is valuable for several reasons, it was found that it was more or less objectionable during the period to date. During its early existence, while not adherent enough to keep wheels to cause "scabbing" or removal of portions of the "carpet," the excess of lighter bituminous material in it did cause, from its staining of the vehicles, some complaints. As sand was added to absorb the fluids, rising to the surface, and the thickness of the carpet began to be appreciable, it was noticed that the resistance to traction was greatly increased, especially during the warmer hours of the day and that this increased resistance was so great as to be seriously objectionable in many instances. These effects, apparently of an unnecessary excess of the binder, gradually decreased with age and are at present (November, 1909) practically unnoticeable. It may be they will re-appear next summer though it may fairly be hoped, from the relatively large loss shown by this material under the evaporation tests and by the increase in the harness of the residues after evaporation, at different temperatures (see table), that by the advent of the next warm weather, the "carpet" will have become set enough to offer no further cause for criticism on these grounds.

In the attempt to profit by the first experiences as related above, the quantity of this binder (No. 1, applied between July 15 and August 15) per square yard was reduced subsequently with later shipments to as low as 1.7 gals. per square yard, instead of over 2 gals. as at first and the annoyances above described were correspondingly reduced. Otherwise this material has so far given satisfaction in every way.

Material No. 2 (applied between Sept. 1 and Oct. 15) seemed similar in many respects to No. 1 except being considerably more fluid. Its extra fluidity was objectionable in that it made the filling of the voids near the crown of the roadway difficult without a considerable loss of material at the sides, and the unpreventable escape of a certain amount of the binder along each side of the roadway on to the shoulders gave grounds for much objection to the filth thus caused.

The difficulties were partly overcome by gritting the sides of the pitched roadway as soon as the binder appeared at the surface of the stone there, and then re-pouring and gradually gritting to the center. This material appeared to rise through the grit to a slightly greater extent than No. 1. Otherwise than noted, the results seem similar to those of No. 1 so far, though this material (No. 2) does not set as quickly nor as much as No. 1. On account of its fluidity the quantity of binder per square yard used for the area covered was about 3½ gals.

Material No. 3 (applied between Sept. 1 and Oct. 1) was a peculiar one. Some 30 odd years ago crude petroleum was delivered in Baltimore from the West Virgina and Pennsylvania wells and burning oil produced therefrom. The burning oil was distilled from the crude and then washed with strong sulphuric acid. The acid removed the tarry and asphaltic constituents and the mixture of acid and pitch was sold to a fertilizer company. This latter company diluted the mixture which precipitated the pitch and allowed the recovery of the acid. The residue was dumped into a depression near the fertilizer works and in course of time reached a mass of some 30,000 or 40,000 tons. It laid there for a period of 20 or 30 years, more or less under water and subject to the action of the slightly brackish nature of the same. A couple of years ago a company started to put this material on the market for road uses. The material from the dump was heated in tanks with lime added to neutralize the acid remaining in it. It was then boiled in an open kettle to drive off the water and lighter fractions and then fluxed to the proper consistency by the addition of either an asphaltic petroleum (from Texas) or water gas tar from the local gas works, previously refined to remove the water, etc. The first use of the prepared compound was made a little over a year ago, in Baltimore county, by cleaning off a good macadam road built some years previously, applying the compound hot, and covering with stone screenings. The resulting surface appears very similar to a sheet asphalt and seems still very satisfactory.

In the work this year on Park Heights avenue, the method followed in its use was the same as that before described for materials No. 1 and No. 2. This No. 3 was delivered in a much more viscous or thick state at normal temperatures than the No. 1 and No. 2 and required more heating. It did not waste at the sides as did these others nor did it give nearly as much trouble by rising to the surface of the screenings. It set much more readily and the early results seem so far much more satisfactory. About 3 gals. per square yard were used.

Material No. 4 (applied between Sept. 1 and Nov. 15) was a refined water gas tar. A year ago this office used about 800 gals. of similar material with much success in treating about 700 sq. yds. of old macadam in good condition. The results were most satisfactory in every way, the resulting surface being comparable to good sheet asphalt and neither too soft in summer nor brittle in winter. Consequently, notwithstanding the prejudice in some quarters against water gas tar, a considerable quantity (21,000 gals.) was used in this year's work. The tar this year came from another producer but appeared similar in every way to that so successfully used in 1908. Two consistencies were used (No. 4 and No. 4-A). No. 4-A was slightly the thinner. Their action and results so far seem similar to those of the use of No. 3. About 3 gals. were used per square yard.

Number five (applied between Sept. 15 and Oct. 15) was supposed to be a refined coal tar put on the market by a company which has had, so far, the greatest success with the use of coal tar in pavements, the laying of which is the main business of this concern. This material came in a slightly heavier or less fluid state than No. 4. About 3½ gals. per square yard were used.

Number six (applied between Oct. 10 and Oct. 20) was a refined coal tar made and advertised by a company expressly for such a purpose as this. It seemed about the same consistency as No. 2. About 5 gals. per square yard were used.

Number seven (applied between Aug. 1 and Sept. 15) was a refined water gas tar ordered from the same local concern that supplied the water gas tar used so successfully in 1908. On delivery, however, it appeared to be altogether too fluid for satisfactory use and though used, it was afterward found necessary to top-dress all but about 1,000 sq. yds. of the work with No. 4-A in order to perfect the results. Investigation showed that although the same prescription had been followed for its manufacture as has been carried out in making the 1908 tar, a change in the character of the oil used by the gas works in carburetting the gas resulted in a totally different refined tar for road use. The further use of this particular material was consequently abandoned.

With all of the tars except No. 7, the practical results so far seem about the same and quite similar to those of No. 3. They seem more adhesive than the asphaltic oils and do not give nearly as much trouble from rising through the coatings nor do they waste out at the sides to the same extent. Their setting is much earlier. It is yet too soon to report on the comparative length of life, the brittleness in cold weather, the tendency to scale off or on the effects of traffic on these materials. Generally speaking, the refined coal tars were the easiest to apply as they seem to reach a greater fluidity at a moderate degree of heat. Already some complaints of excessive slipperiness in cold weather on No. 4 have come in.

Number 8 (applied between Nov. 1 and Nov. 15) was a small lot (500 gals.) of heavy binding oil, donated by a concern whose main business is the supplying of burning oil and lubricants. It was used as an experiment in order to prove or disprove the representations of its producers as to its value for this work. In appearance it was similar to No. 2 and its action and results so far have been almost identical with No. 2. About 3½ gals. per square yard were used.

Number 9 (applied between Oct. 20 and Nov. 10) was a refined coal tar of about the same consistency as No. 5. About 4 gals. per square yard were used.

A careful watch of the results of the work this year will be kept and the notes thereof considered in connection with the analyses shown in the table.

In all human probability this form of analysis (as adopted by the committee of the American Society of Civil Engineers) is not perfect, but the writer believes it as good if not better than any yet suggested. The writer admits his dissatisfaction with the analysis for "consistency or viscosity" as included in the form. To him it does not appear to truly indicate this quality of the material under consideration, but in the absence of better tests it seems unavoidable. He hopes that a more satisfactory method of determining and expressing the consistency of a material will soon be devised and is at present at work on a test which seems to promise satisfaction.

However, if this form is generally used for a relatively short period it is entirely probable that the value of any portion of it will be quite clearly proved and then from this form as a base a more satisfactory form can more readily be devised.

By the comparison of results in different localities and in connection with the consideration of uniform analyses of the materials used it may be hoped to soon clear up some disputed points concerning the effect of certain constituents to be found in the materials. For instance, it is claimed by some reputable parties that the presence of free carbon in a bituminous binder is objectionable. The water gas tar used by the writer in 1908 contained but two-tenths of 1 per cent of free carbon. The most successful extended use of tar in this country has occurred in the construction of a vast amount of tar macadam by the company furnishing material No. 5 and in this work the tar used was coal tar similar in every respect to No. 5 except that being used under the mixing method, a thicker or less fluid tar was permissible. In that tar the free carbon content ran as high as 35 per cent. It does not, therefore, seem proper to say at this time that the percentage of free carbon is a plain criterion by which to judge of the probable value of a tar or of its prospects for a considerable length of life, especially as the high carbon content tar has been successfully used for at least ten years.

As stated, the various materials used were applied at temperatures between 80° and 150° C. Some seemed to require for easy handling more heating than others. No. 2 could have been applied readily at a temperature of not over 40° C., while No. 4 did not flow or penetrate freely unless at least up to 135° C. The material for the section near the city was all delivered in tank cars at a station about ½ mile from the center of this section, and was heated by steam under about 50 lbs. pressure. With the temperature of the air at 30° C., the loss of heat in hauling from the car to the road varied from 1° to 10° C. With the air temperature at 15° C. this loss reached as much as 25° C. The material for the outer section was delivered in barrels and heated by a direct flame under a portable boiler holding about 250 gals.

In the work of the writer this year, the effort was made to exclude from use any materials that were greatly questionable of success for any reasons. The majority opinion to the effect that an excess in the paraffine content over 2 per cent had proved objectionable in sheet asphalt work caused the avoidance of the use of any such material in this work and the same may be said regarding an excess over 5 per cent of the free carbon content in asphaltic compounds. It may be deemed advisable, however, another season to experiment in this work with just such materials. The opinions to the effect that the residue of naphtha soluble portions should show a decidedly adhesive quality also limited the selection of material.

Of course not every available material of satisfactory characteristics was used by any means, and it is hoped that another season opportunity may be had to add largely to the list of materials used.

As stated in the paper presented by the writer to the Paris Congress in 1908 it seems to the writer that there are two ways of treating a road with bituminous binders. One is to use the macadam as a foundation for a "carpet" or surface coat of finer material mixed with some form of bituminous cement. The other method is to reinforce the cementing properties of the wearing surface of the macadam itself, by impregnating it in the case of already constructed macadam, with a bitumen of sufficient fluidity to insure the proper penetration, or in the case of new construction by the addition of a bituminous cement to the wearing course during the process of construction. And again "The writer believes that the principles of Tresaguet and M'Adam before expressed must be followed without deviation if the utmost degree of success is to be secured, and that any neglect of them can only result in inferior work. Attempts to provide, on the top of macadam, a carpeting of rock screenings and bitumen that will relieve the objections of dust or mud and of the dislodging of the wearing surface of ordinary macadam under automobile traffic must be regarded as the abandonment of macadam except for foundation purposes and as efforts towards substitutes for asphaltic surfaces. It is entirely possible that some such substitutes may be found to be practicable for situations where macadam, previously satisfactory is now becoming unsuitable, but it seems probable that, if the cost and life of such surfaces are considered, it will be agreed that a considerable zone exists between ordinary macadam and asphalt that will be most satisfactorily occupied by properly built and pitch cemented macadam.

With these ideas in mind, the work on Park Heights avenue was started with the intention of avoiding the construction of any definite carpet over the macadam and of securing a true macadam surface whose voids filled with bituminous cement and some of the smaller sizes of stone. As noted, the construction of the carpet in the earlier stages of the work proved unavoidable and it probably now exists, in thicknesses varying from ½ in. to 1½ ins. for 35 per cent of the total area treated. It quite probably is fortunate that another opportunity for comparisons is thus afforded.

In conclusion the writer desires to express the hope that, with the interest now taken by highway engineers and the public generally in the use of bituminous binders in road work, concerted action on the part of the engineers may be had. The existence of many of the uncertainties of today in this matter can be traced directly to an unfortunate lack of records in comparable form from different sources. Further, the writer wishes to emphasize his belief that the problem as a whole is one for engineers themselves. Chemists will, of course, be necessarily consulted and will be of great assistance in the matter, but the record of the past shows that even the most eminent chemical authorities are, without the slightest intention to be critical or disrespectful to them in any way, so unversed in the principles and practice of road making as to be absolutely unfit for deciding so many of the questions in this connection that, for an early and satisfactory solution of the questions now demanding settlement, it only remains for engineers to take charge of the matter and concertedly to apply their abilities, supplemented by the best chemical advice possible, to the problem.

Notes on Road and Street Work.

Steam Rolling of Roads.—In our issue of June 8, 1910, we printed a paper by Mr. E. A. Hackett on the steam rolling of roads in County Tipperary, Ireland. In a discussion of the paper before the first Irish Road Congress Mr. Hackett gave the following additional details regarding the work: About 3 yds. of 2½-in. stone to the statute perch, about 16 ft. wide, was placed on the roads. This worked out about 3½ ins. consolidated on the crown, going to about 2 ins. at the sides. Sand of a limestone nature was used for binding. The stone is delivered on the side of the road at 72 cts. per cubic yard. The spreading costs from 3 cts. to 18 cts. a yard. In some cases the stone is spread and watered for about 12 cts. per yd. The rolling works out about 12 cts. per cu. yd. and a 15-ton roller rolls about 150 lin. perches in a fortnight—11 working days. This is about 50 tons per day.

Portable Hose Flushing Rig.—It has been the practice in many smaller eastern cities to clean asphalt pavement by flushing with a line of rubber hose. In most cases this line of hose is mounted on small wheel buggies 3 or 4 ft. apart, and is coupled to various hydrants along the route. The outfit is sometimes pulled by a team of horses attached to a light cart, with the hose nozzle projecting 3 or 4 ft. in front of the horses. This method in a measure proved unsatisfactory owing to the fact that ordinary cotton fire hose could not stand the dragging over the pavement and more expensive rubber hose had to be used. Even with the latter several new lengths were necessary each season. A plan to obviate this wear on the hose has been devised by the Street Department of Seattle, Wash. The outfit used there consists of several 15-ft. lengths of 2-in. pipe joined together by 4-ft. pieces of extra heavy fire hose. Each length of 2-in. pipe is mounted near both ends on broad tired caster wheels which are screwed to a plank, the pipe being fastened firmly to the latter by means of a pair of U bolts. The full length of the assembled sections is about 200 ft. The pipe sections are threaded on both ends and the hose attacshed by standard couplings. The pipe sections are also connected by chains although this precaution seems hardly necessary. In order to bring the nozzle to a convenient height one of the pipe sections has a goose neck at one end supported by a bracket on the corresponding truck. The outfits are used chiefly on streets with steep grades of which Seattle has no small number, and on residential streets. The outfits are delivered on a one horse wagon from the store house of the Street Department to the locality where the flushing is to be done. The pipe sections are then assembled and the hose taken from the wagon to draw the outfit from place to place. A gang of three men operates the outfit and under average conditions they are said to clean about 18,000 sq. yds. of stone or brick pavement in a working day of eight hours.

Cost of Working a Road Metal Quarry.—The following data on the working of Whinstone quarry for securing road metal have been taken from a paper presented before the first Irish Road Congress by John W. Leebody, County Surveyor, South Tyrone, Ireland. The quarry plant was installed and worked under the direction of Mr. Leebody, the road metal obtained being used on the country roads. The plant was as follows:

1 16 ins. by 9 ins. Baxter Portable Breaker.
1 2½ tons Pooley weighbridge.
1 Office and store for tools.
1 3-in. Daw steam drill.
1 Store for explosives (1,000 lbs.).

The cost of the plant, including a short approach road to the quarry, and a steel top bridge, 16 ft. span over a stream, was $4,617. Power to work the breaker and drill was supplied by one of the county steam rollers—two of which were, when purchased, fitted with the necessary connections and appliances, a third having been specially fitted after purchase. The following details for the year ending Sept. 30, 1909, of the production of material will give a fair idea of the possibilities of this quarry. Cost of production, exclusive of charges for depreciation and interest on capital, 37.66 cts. per ton. Breaker run, 147 days. Steam drill run, 143 days. Average output of breaker, 55.9 tons of road metal per day. Weight of explosives (geliginite) used, 980 lbs. Total weight of material quarried, 12,192 tons. Production of material per lb. of explosive used, 12.44 tons. Price charged for road metal in quarry, 66 cts. per ton. Price charged for screenings in quarry, 50 cts. The actual work in the quarry is in charge of an experienced foreman, who weighs and keeps records of the daily output of the quarry. These daily records are summarized and checked monthly by the assistant of the district in which the quarry is situated, he being paid for this work an annual sum of $48.60, chargeable to the working expenses of the quarry, in addition to his salary as assistant. With these exceptions, all the bookkeeping in connection with the quarry is done in the author's office. In connection with the quarry one of Averling & Porter's steam tractors and two end dumping wagons were purchased at a cost of $3,030, for hauling the broken stone to the railroad station. The following are the details of tractor working for year ending Sept. 30, 1909, may be of interest:

Total number of working days	243
Average cost per working day, exclusive of depreciation and interest on capital, but including cost of loading railway wagons	52 cts.
Number of days hauling stone to railway station	171.
Average tons hauled per day	21.15 tons
Average cost per ton, exclusive of depreciation and interest on capital	24.6 cts.

Width of Tire and Road Resistance.—In a discussion of a paper at the first Irish Road Congress regarding the economy of good roads both in expense of upkeep and in the life of horse flesh and vehicles, Mr. S. C. Blair gave the following data regarding experiments that had been made on the width of tire and road resistance. He stated that most of the experimenters differ from one another in details of little practical value, but in the main points their results are in close agreement, and an average may be taken to give as near the actual truth as possible. This average for the pull of a horse on a level good road he gave as 120 lbs. at a rate of 3 miles per hour. The resistance of ordinary farm carts on a good macadam road has been found to be 50 lbs. per ton on the level, while on a bad road from 75 to 100 lbs. is well within experimental limits. It can thus be seen that from 25 to 50 lbs. per ton may be saved in pulling effort to the horse, which means a saving of from 20 to 40 per cent of his average power, or, that the load may be increased from 50 to 100 per cent for the same tractive effort. These figures allude only to the resistance losses, friction, etc., and must not be taken as representing the actual power expended, since very few roads are level for any great distance, and extra power must be used on gradients. But, since the resistance losses are constant, no matter what other varying losses there may be, a lessening of the resistance is an actual saving of power. With regard to wear and tear of vehicles, no extensive experiments have been conducted, but it is quite evident that the violent jolting to which a vehicle is subject on a rough stony road must shorten its effective life very considerably. The best width of tire he stated has been conclusively shown to be the broad tire. General Morin, who was appointed by the French government to make extensive investigation on this subject, showed that 30 per cent more tonnage could be carried over a good road on 4½ in. than on 2½-in. tires, but that beyond 4½-in. there was no advantage, and he also showed that a load of nearly 2½ tons on 1½ in. tires did no perceptible damage to the road even when wet. Mr. Blair also gave the following figures supplied by Professor Hele Shaw which are interesting in this respect, though the widths of tire are extreme:

	Resistance per ton in lbs. 1½-in. tyre.	6-in. tyre.
Rough macadam	[illegible]	98
Ploughed land	[illegible]	283
Mud 3 ins. deep	[illegible]	400

Size of Broken Stone for Road Purposes. There is considerable difference of opinion regarding the size to which stone should be broken for road purposes, a good deal, of course, depending on the exact purpose for which it is required. In a paper read before the first Irish Road Congress Mr. R. H. Dorman, M. Inst. C. E., stated that for bringing up the light slacks which form in a steam-rolled road, very fine stone, ¾-in. to 1-in. gage, is the best, while for putting a center in a much-worn road, which will be completed with a finishing coat of fine stone, or for making up low sides or filling deep channels, stone 3½ ins. to 4 ins. may be used, and stone of intermediate sizes in different cases according to the circumstances and the quality of the stone. In specifying the size of a stone, it should be definitely stated whether the stone is to pass through a ring in every direction or if in one direction only will be sufficient. It is important that stone should be broken cubical, as such stone will pack much better and wear better than flat or irregular stone; it is therefore advisable to specify that the bulk of the stone, say 90 per cent, will pass through a ring in every direction; it is useless specifying that the whole of it shall pass in every direction through any ring of a moderate size; because no contractor could get stone broken so precisely as to do this. During recent years there has been an inclination on the part of English surveyors to specify for stone of a very small gage, 1½ to 2 ins., but Mr. Dorman considers that stronger roads and an equally good surface can be obtained by using stone of from 2¼ ins. to 2¾ ins., and he does not recommend stone broken to 1½ ins. except for petty repairs. For roads which are not to be steam-rolled, he recommends a gage of 2 ins. to 2¼ ins., and for steam-rolling, 2½ ins. to 2¾ ins., but in order to obtain an exceptionally good surface, 2¼ ins. may be specified for whinstone and other hard rock, as well as for coarse-grained granite. On the other hand, stone up to 3 ins. may be accepted for soft limestone, as it is crushed a good deal during the rolling operations, and it will wear very evenly although coarsely broken. He states that hand-broken stone has the advantage of machine-broken stone in uniformity of size. Some machine-broken stone will consist of 30 per cent of flats or flaky stones, and perhaps an equal quantity of very fine stuff which has not been screened out, so that there is only 40 per cent of cubical stone produced; but if a stone is inclined to break cubical, 80 per cent of such stone, broken by hand, may be expected to be fairly cubical. If a machine, however, turns out cubical stone which is properly screened, the material may be looked on as quite equal to hand-broken stone. It should be remembered that if the stone prepared for the breaker is all clean, sound quarried stone, the resulting material will also be free from any dirt or inferior material, whereas in the case of hand-broken stone, it is very difficult to prevent a proportion of dirt, quarry debris, etc., getting mixed up with it in the process of handling.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Initial Cost, Cost of Maintenance and Depreciation of Wooden Passenger Cars.

At the regular meeting of the Association of Transportation and Car Accounting Officers held June 21-22, 1910, the committee on Conducting Passenger Transportation presented for consideration a new set of rates for the use of passenger cars, giving as its reason the increased cost of passenger equipment cars. In a table accompanying the report there were shown from data collected by the committee the initial cost of passenger equipment cars now as compared with 20 years ago, cost of maintenance and rate of depreciation per year. These figures are of general interest and we abstract them in the accompanying table.

INITIAL AND MAINTENANCE COSTS AND DEPRECIATION OF WOODEN PASSENGER CARS.

Class of cars.	No. of cars owned today.	Initial cost. Cost 20 years ago.	Initial cost. Cost today.	Present annual average mileage per car.	Present average annual cost of maintenance.	Rate of Depreciation per year. Pct.
Coaches	10,717	$4,905.06	$9,433.11	42,812	$529.78	3.4
Comb. pass. and bagg. cars	1,791	4,268.99	7,637.44	36,813	489.65	3.25
Chair cars (owned by railroad)	628	6,494.80	9,796.77	78,650	964.72	3.7
Sleeping cars (owned by railroad)	667	14,509.14	19,401.00	81,783	627.28	3.33
Parlor cars (owned by railroad)	329	9,614.71	13,616.67	37,870	556.01	3.4
Tourist cars (owned by railroad)	145	5,800.00	11,863.00	68,739	550.00	3.5
Colonist cars (owned by railroad)	304	5,325.00	9,842.50	61,353	547.53	3
Baggage cars	2,749	3,084.18	5,193.68	68,439	503.76	3.5
Express cars	713	2,634.00	3,968.74	60,898	351.03	3.7
Dining cars	335	11,332.89	16,356.35	94,468	888.82	3.4
Comb. baggage and mail cars	1,012	3,455.74	5,760.59	63,371	421.32	3.5
Postal cars	599	4,225.48	6,942.83	88,011	544.32	3.4
Postal storage cars	70	3,749.89	5,463.72	102,794	505.22	4

Cost of Cleaning Weeds and Grass From Track.

BY D. A. WALLACE

The following four records of costs of cleaning weeds and grass from track are of work of section gangs, the men getting $1.10 per day and foreman $45 per month. In the first two cases the weeds were removed only from end to end of ties. One or two men went ahead with picks and loosened the gravel and 2 men followed pulling weeds and grass by hand, each man working a strip 4 ft. wide. There was a considerable crab and Bermuda grass. In the third case the cleaning was done from edge to edge of the ballast, giving an additional width of about 18 ins. While the record is of one man's work only it was selected as an average of several days' work of a gang. The records are as follows:

(1) Rock ballast, weeds, medium thick:

Number of Feet	Number of Days	Feet per Man per Day
5,280	8	660
5,000	9	555
5,280	9	586
Average		600

The cost per mile was $11.15.

(2) Slag ballast, weeds medium thick:

Number of Feet	Number of Days	Feet per Man per Day
18,500	12½	1,480
1,400	9½	117
3,200	7	457
390	1	390
3,360	4½	946
8,600	8	1,075
6,700	20½	300
2,640	3½	754
Average		693

The cost per mile was $9.80.

(3) This work was in gravel ballast and the weeds were very thick. One man cleaned 210 ft. in one day. The cost per mile was $19.40.

(4) Gravel ballast, weeds medium thick:

Number of Feet	Number of Days	Feet per Man per Day
1,740	10	174
4,410	14	315
2,760	5	552
7,560	12	630
Average		417

The cost per mile was $15.30.

Two Records of Cost of Railway Track Reconstruction.

BY D. A. WALLACE

The following records give the cost per 100 ft. and per mile for reconstructing track on two jobs one in 1906 and the other in 1908.

(1) The work consisted in putting up dirt track on crushed stones, replacing 58-lb. rail with 85-lb. rail and renewing 15 ties per 100 ft. The itemized cost was as follows, using negro labor at $1.25 per day and foreman at $60 per month:

Materials:	Per 100 Ft.	Per Mile
2,784 cu. yds. stone at 45 cts.	$ 23.71	$1,252.80
Ties at 35 cts. each	5.25	277.20
133,577 tons rails at $30	75.32	3,977.13
Angle bars at 64 cts.	3.87	204.80
Bolts at $4.90	1.21	63.70
Spikes at $3.20	2.06	108.80
Total materials	$ 111.42	$5,884.43
Labor:	**Per 100 Ft.**	**Per Mile**
Unloading stone	$ 3.11	$ 164.25
Raising grade 7 ins	5.53	292.00
Unloading ties at 0.9 cts.	0.14	7.13
Applying ties at 10.4 cts.	1.56	82.37
Unloading rails	0.18	9.60
Unloading fastenings	0.01	0.53
Laying rails	3.46	184.00
Stone surfacing, 3 ins., 2 ins raise	7.50	396.00
Unbolting old rails	0.18	9.75
Loading old rails	0.44	23.25
Stripping track	1.25	66.00
Total labor	$ 23.36	$1,234.88
Grand total	$ 134.78	7,119.31
Credit 9.15 tons old rails at $16	$ 27.33	$1,464.32
Net cost	$ 107.45	$5,654.99

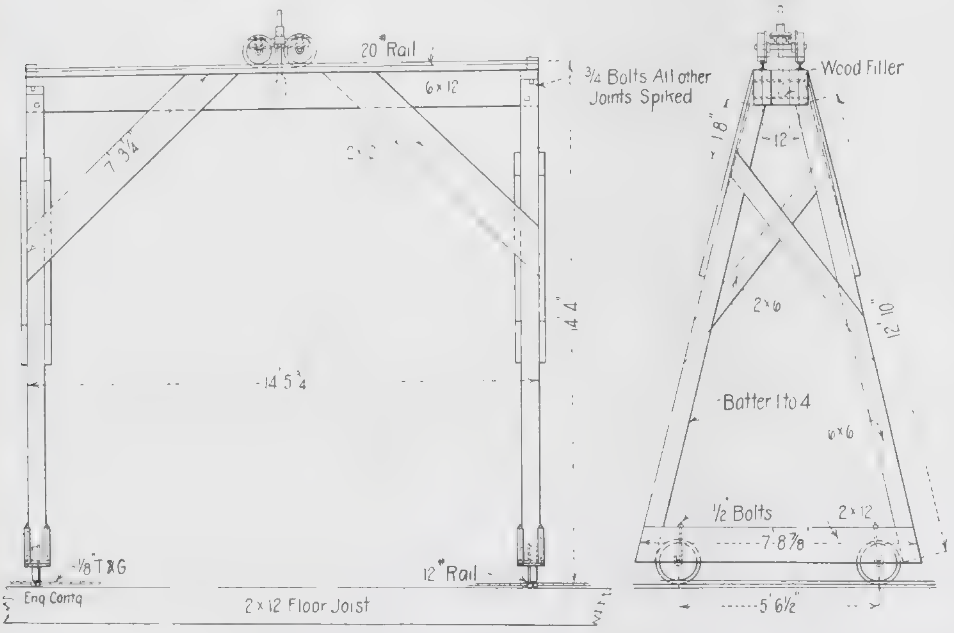
(2) The work comprised 5 miles of track, 21 years old, 50 per cent of which consisted of 6° curves. The track had about 4 ins. napped stone under the ties and spaces between the ties filled in with enough coarse rock to prevent bunching of the ties. The rail was 30-ft., 56-lb. and had been in service 21 years. Approximately 7 ties per rail were broken off or decayed. The rails were replaced with 33-ft., 70-lb. rails, joint ties spaced, and 8 months later the track was raised, 6 ins. in gravel unloaded from hopper bottom coal cars at a cost of 15 cts. per cu. yd. on cars at pit and 15 cts. per cu. yd. for a haul of 80 miles, making a total cost of 30 cts. per cu. yd. on the ground. About 25 ties per 100 ft. were renewed. Negro labor at $1.25 per day and foreman at $75 per month were employed. The cost of the work was as follows:

Materials:	Per 100 Ft.	Per Mile
110 tons 70-lb. rail	$ 66.66	$3,520.00
Angle bars at 70 cts. per pair	4.85	256.00
1¼ in. bolts at $5	[illegible]	[illegible]
Spikes at $4	1.13	60.00
1,000 cu. yds. ballast at 30 cts.	5.68	300.00
1,320 ties at 31 cts.	[illegible]	[illegible]
Total materials	$ 86.12	$[illegible],575.20
Labor:	**Per 100 Ft.**	**Per Mile**
Unloading rail	$ 0.40	$ 26.05
Unloading fastenings		0.25
Carrying ties		28.66
Distributing [illegible]	0.27	14.59
Laying rail	[illegible]	149.80
Surfacing first raise 4 ins.	1.94	102.50
Surfacing second raise	[illegible]	72.50

Dressing ballast		2.27	119.85
Unloading ties at 1.6 cts.		0.40	21.12
Applying ties at 10.7 cts.		2.67	141.24
Loading and unloading old rails		0.75	39.77
Total labor	$	13.45	$ 716.33
Grand total	$	99.57	$5,291.53
Credit 88 tons old rail at $24.	$	4.00	$2,112.00
Net cost	$	95.57	$3,179.53

An Easily Constructed Portable Crane for Erecting Heavy Plant.

The accompanying cut shows a portable, home made crane which will be found useful by contractors in plant erection. This crane is simply an enlarged sawhorse mounted on mine car wheels and provided with a trolley and was designed by Mr. C. C. Brayton, who describes* it as follows:



Portable Crane for Erecting Heavy Plant.

The crane was designed by myself, is original as far as I am concerned, and was improvised for installation of equipment at a mine of which I had charge. It differs in general from the common hand-operated crane only in that the floor of the building rather than the walls support it, and in that it is, to an extent, portable. The equipment at the mine where the crane was built was electrically driven, all in one building, and consisted of a 140-hp. hoist, a 1,000 and a 500-cu. ft. compressor. It was essential, knowing the life of the property, to construct as light and cheap a building as possible, and it was desired at the same time to provide a means for installing the equipment and for taking care of repairs. A crane with a span equal to the width of the building and supported by the walls was obviously out of the question. A trolley for each machine supported by the roof and walls was not only out of the question, but also undesirable on account of having but one horizontal line of travel. The saw-horse crane was therefore designed and the building constructed of the lightest possible framing.

The crane was built for a maximum load of 6,000 lbs., which was the weight of the heaviest single piece of machinery, and with a span a few inches greater than the width of the widest machine foundation. The arrangement of machines to avoid waste of floor space necessitated a crane track for each. These rails were spiked to the floor joists before the double floor was laid, and the top of the rail is practically flush with the floor surface and out of the way. Owing to delay in delivery of material the installation was made before the completion of the building. The electric wiring is under the floor and is therefore out of the way of both the crane and the employees.

The crane cost complete, without chain block, $100. The weight is approximately 2,000 lbs. The material entering into its construction, with the exception of the timber, came from the usual scrap pile found about a mine. The crane handled the installation entirely satisfactorily, and with a great saving in both labor and time. It can still be used in handling heavy pieces while making repairs. For installations of this kind and occasional repairs, it accomplishes exactly the same result as the hand-operated crane; that is, the placing of the load where it is wanted, is practically as efficient, and is much cheaper. It is far superior to the fixed trolley with only one horizontal line of travel.

The crane is easily and cheaply built, is readily moved when loaded, requires no extra strength in roof, walls or floor of the building to support it, and pays for itself even in small installations and repairs. On account of its portability it can be made to serve several machines in the same building. At a small additional cost it could be built to handle double the load and could also be provided with means to facilitate the two horizontal movements of the load.

In general, mining machinery, such as hoists and compressors, is installed by a gang of men using main strength, rollers, jacks and pinch bars, with occasionally the aid of a chain-block suspended from shears, temporary frame work, or some other fixed support, and heavy repairs are made in much the same way. Such work is not only expensive and slow, but also offers a considerable chance for breakage through accidents. This crane can be adapted to nearly all ordinary mine-machinery installations and repairs, and to a great variety of other machinery installations and repairs. In certain cases, of course, character of installation, frequency of repairs, weight of machines, or permanency of installation and building, warrant a trolley, or some type of overhead crane. There are other uses to which a cheaply constructed contrivance of this kind can be put.

Cost of Handling Large Steel Pipe by Motor Truck.

Some parts of the Catskill Aqueduct for the New York water supply are built of steel pipe 9 ft. 6 ins. in diameter and 7 ft. 6 ins. in length. Two pieces of these pipe are riveted in the shops and shipped in these 15-ft. sections, weighing 5 tons each, on barges to the nearest point to the work on the Hudson River. At Cold Springs, New York, the Snare & Triest Co. haul these pipes to the work on a Hewitt motor truck of 35 hp. The distance from the wharf to the work is about 1½ miles. The road is good all the way, but there is a rise of 350 ft. in the first half of the distance from the river, and then the slope is downward to an elevation of 250 ft. at the work. The truck makes twelve round trips in 8 hours and has made 13 trips carrying one 15-ft. section of pipe each trip. The track is loaded by a derrick at the dock and at the site of the work it is unloaded by a cableway.

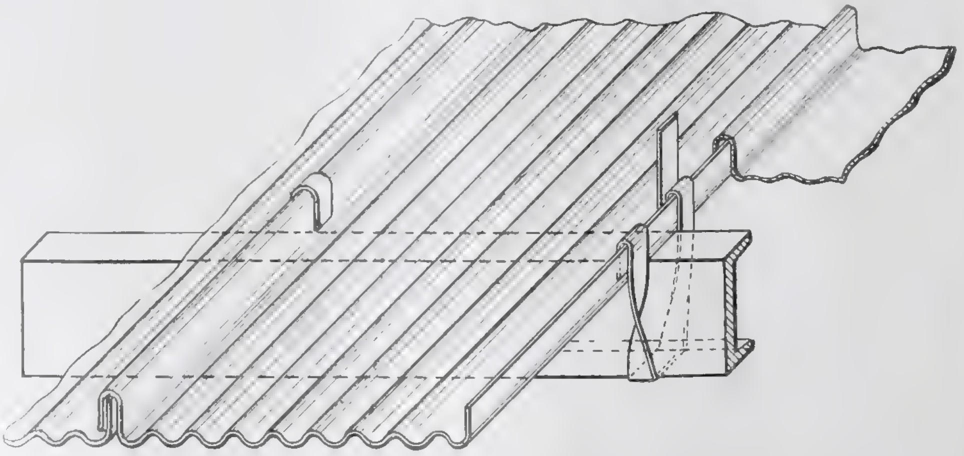
The labor cost for an 8-hour day is $4 for a driver and $1.75 for a helper. The machine uses 18 gals. of gasoline a day.

The repairs on the truck for the first six months were about $700.

This repair account includes a set of rear tires at $600. The machine was bought second hand and the first tires were nearly gone so that it is estimated that $700 would be a fair annual repair bill. As a comparison of the difference between the use of horses and the use of the truck it may be noted here that a team of 8 horses were used for this work at its commencement. This outfit made four trips a day.

A New Corrugated Iron Roofing and Siding Applied Without Riveting.

The accompanying drawings show a new form of corrugated iron sheet for roofing or siding. This sheet is pressed with right and left relays shaped as shown giving where two sheets are "joined" an unusually deep joint to keep out water. This joint is claimed to save an appreciable amount of sheeting in joints and to give a much stronger side lock. This sheeting is also novel in being attached to the framework without rivets; special clamps are used instead by which all the work is done from above. This corrugated sheeting is manufactured by the Edwards Mfg. Co., Cincinnati, O., from which we have received the following statement:



A New Construction of Corrugated Iron Roof.

In summing up the advantages of this form of roofing it is apparent that its greatest advantage is in the method of application, principally the fact that it can be applied without the use of rivets of any kind. It is impossible to puncture a roofing sheet, even for the purpose of riveting, without destroying the value of the sheet to an appreciable degree. An entire roof can be put on of this material without puncturing the sheets in the least. This is especially valuable where galvanized iron is used, for the coating is absolutely left intact over the entire surface and all edges. It can be applied more closely to the purlins, thus holding the sheets more firmly in position. It makes a 50 per cent more water tight job. It can be applied more quickly and easily, no scaffolding being necessary and since there are no rivets it is not necessary to have a man hold up the sheet while the riveting is being done.

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*Mining and Scientific Press, Aug. 6, 1910.

While this roofing is primarily adapted for the use on buildings having steel purlins it can be applied on wood purlins or sheating boards quite as well. The cleat in this case is nailed to the wood purlin or sheathing in such a manner as entirely to conceal it after the roofing is completed.

The cost of the material is somewhat more than the cost of regular corrugated sheets, but the saving in side laps and in application more than makes up for the difference. This roof has been applied to a number of large buildings in various parts of the country, which have given absolute satisfaction. One of these roofs covers a single building requiring over 1,000 squares. This roof was put on three years ago and it has given perfect satisfaction in every respect.

Rolling a Surface on Concrete. [illegible] majority of the contracts for construction of the Catskill aqueduct a roller has been substituted for scruding the surface of the invert. On the cut and cover work the aqueduct is of a horseshoe shape and the invert is placed in 15 ft. alternate sections. Formerly the invert was surfaced with a little cement mortar for finishing and was well trowelled. At present, however, most of the contractors have adopted the use of a roller. Some rollers are made of a loaded pipe, but the best for the purpose is the 2½ in. steel shaft, 15 ft. long, as used by the H. S. Kerbaugh Co. at High Falls. After the concrete surface is leveled off and taken a partial set, two finishers use the roller and produce an excellent, smooth and even surface without the use of additional cement mortar.

A Hand Operated Device for Cutting Off Submerged Piles to Uniform Level.

BY ARTHUR C. FREEMAN.

The physical conditions encountered during the building of the foundations for supporting the rails of the Old Dominion Marine Railway at Norfolk, Va., required cutting off 306 piles under water at a depth of from zero to 26 ft.

There were not enough piles to be cut to justify bringing to the job a steam outfit and diver, so it was decided to make a device for cutting by hand without the use of a diver. This was done and proved a complete success. It consists of a rectangular frame 4 ft. 3 ins. by varying length, made up of 2x2x⅜-in. angles, stiffened by curved braces at the lower end and by knee braces at the upper end so bolted to the top of frame that the length from saw to the point of support is adjustable for any distance. An ordinary 4-ft. cross-cut saw was attached to the bottom by means of split bolts and tightened by nuts to the frame. The top of the frame has a small lug which fits into a saddle for support at the center of the top of the frame and free to allow a rocking motion while restrained from rising during the sawing. Two ropes were attached to the side of frame at the bottom near the saw, one pair being to supply power to produce the see-saw motion for cutting, the other to apply pressure to the saw in the line of cutting. The saddle supporting the frame rests on a "ribbon" or grade line made up of 4x4s placed some uniform distance above line of cut-off and to the same grade. Clamps hold the saddle to the "ribbon" and are easily detached to move the frame to the next pile for cutting. The foreman stands at the frame to steady it and give directions, two to three men were placed at each of the power lines, while one man held both of the pressure lines. The cuttings were made in three lifts, 12, 18, and 26 ft. from the point of support. The grade of cut-off was ⅜-in. to the foot descending to the water, making the cut of the last piles 26 ft. under water. After cutting the elevations were tested and showed in no case a variance over ¼ in., which was as close as could be done by hand work above surface. The maximum number of piles cut in one day was 47.

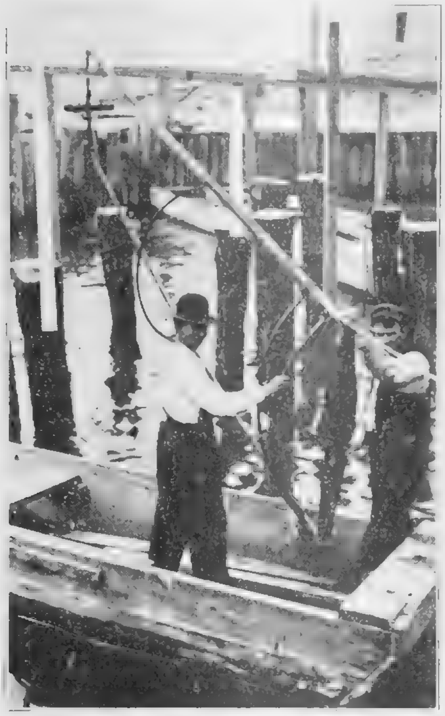

Fig. 1—View Showing Hand Operated Device for Sawing Off Submerged Piles.

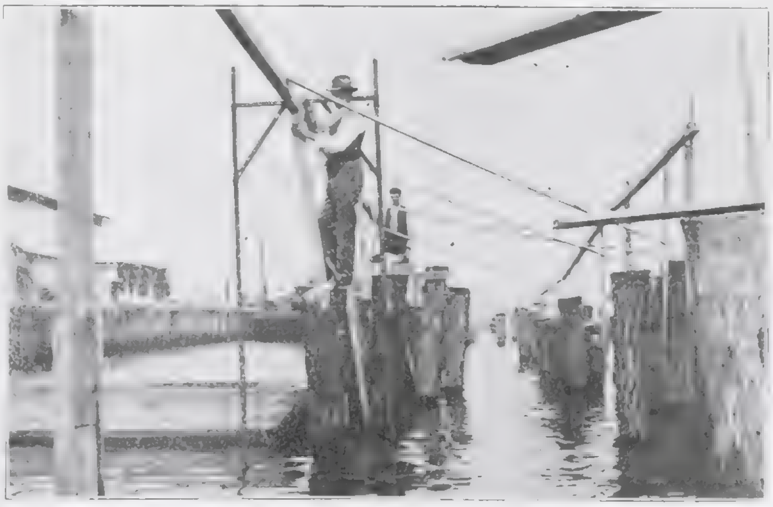

Fig. 2—View Showing Method of Operating Submerged Pile Saw.

The following table shows the costs taken from the time book: Wages: Foreman $4.00, helper $2.00, labor $1.50.

75 piles at 12 ft. cutting av. cost [illegible] cts. each
67 piles at 18 ft. cutting av. cost 32 cts. each
164 piles at 26 ft. cutting av. cost 42 cts. each

This device proved so successful that arrangements are being made to place it on the market.

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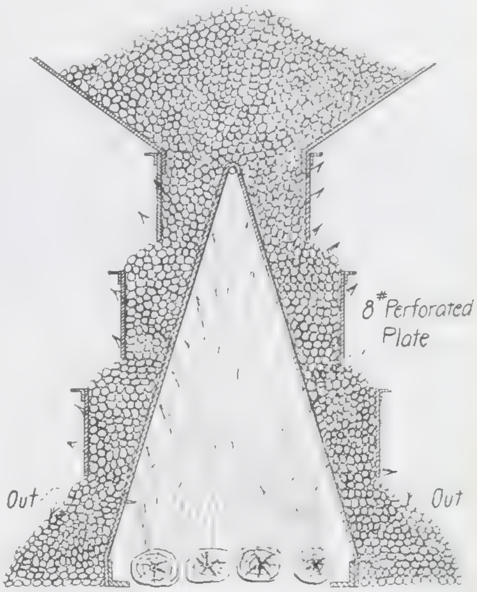
*Consulting Engineer, Norfolk, Va., Construction Engineer for the Old Dominion Marine Railway.

A Portable Gravel and Sand Heater.

The accompanying cut illustrates diagrammatically a heater for sand and gravel which deserves notice for its compact portable form. This heater was designed by Mr. Charles A. Mullen, contractor, primarily for paving work but it should prove equally suitable for heating concrete materials in cold weather. As will be seen a continuous inverted V-shaped plate of No. 10 gage metal is riveted into two end plates which carry a hopper on top and a set of side plates arranged in flights as shown. The inverted V-plate is perforated and the hot air from the wood fire inside passes out through these perforations and the descending layer of gravel on each side. The whole apparatus is mounted on trucks. In operation the gravel is shoveled into the top hopper and flows down the sides as fast as it is removed at the bottom. In the sand heater the inverted V-shaped plate is not perforated but otherwise construction is the same as for the gravel heater. These heaters are made in various sizes to suit the needs of the contractor by the Tidewater Wire Works, Hoboken, N. J.



A Portable Gravel and Sand Heater.

Western Society of Engineers.—The first regular meeting of the Western Society of Engineers for the fall session will be held Wednesday evening, Sept. 7, at 8 o'clock. The paper for the evening is on "High Pressure Water Service for Fire Protection," by Mr. J. B. Sando, of Milwaukee.

Method and Cost of Excavating Canal Prism Using a Ladder Dredge and Special Conveyor; New York State Barge Canal.

The ladder dredge which was built at Adams Basin on the Barge Canal during the summer of 1909 is one of the most novel sights along the entire work. This dredge was started on July 30, 1909, and worked 4 months of the season and was then laid up for the winter, as the canal is drained during the winter season. The costs given further on are for these 4 months' work.

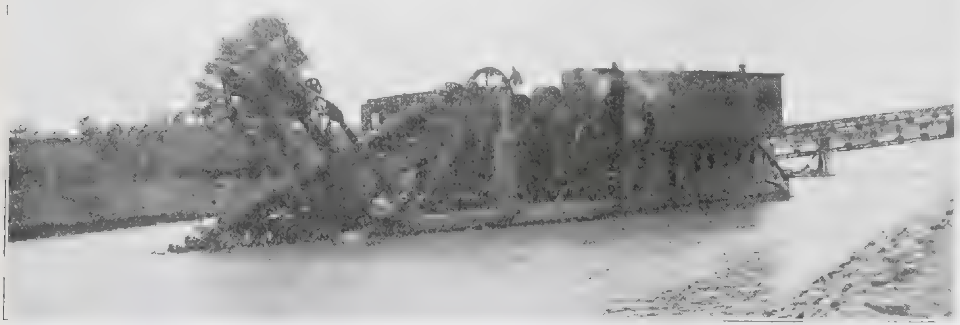


Fig. 1—Front View of Ladder Dredge and Conveyor Plant, New York Barge Canal.

As will be seen from the illustrations this dredging plant differs from other types in that the excavated material is carried by a series of belt conveyors to the spoil bank. The dredge itself is floated on two steel pontoons which are parallel to each other and are braced together by a rigid frame work. A gantry projects out in front and between these pontoons. This gantry supports the "ladder" or endless chain of buckets, which extends down between the pontoons to the bottom of the canal. The buckets move downward on the underside of the ladder and come up loaded and discharge into a hopper at the top. The buckets are each of 5 cu. ft. capacity. From the hopper at the top of the ladder the material is discharged onto a belt which in turn discharges into a second hopper and second belt at the rear of the dredge which projects out to the rear of the machine. A third belt is carried on a separate pontoon. It runs on a steel cantilever framework which carries the belt 40 or 50 ft. onto the canal bank. The pontoon which carries this belt is so arranged that it can be turned at any angle and still have its receiving hopper under the discharge of the second dredge belt. The belts are each operated by a separate motor receiving power from the dredge. The dredge plant cost $70,000.

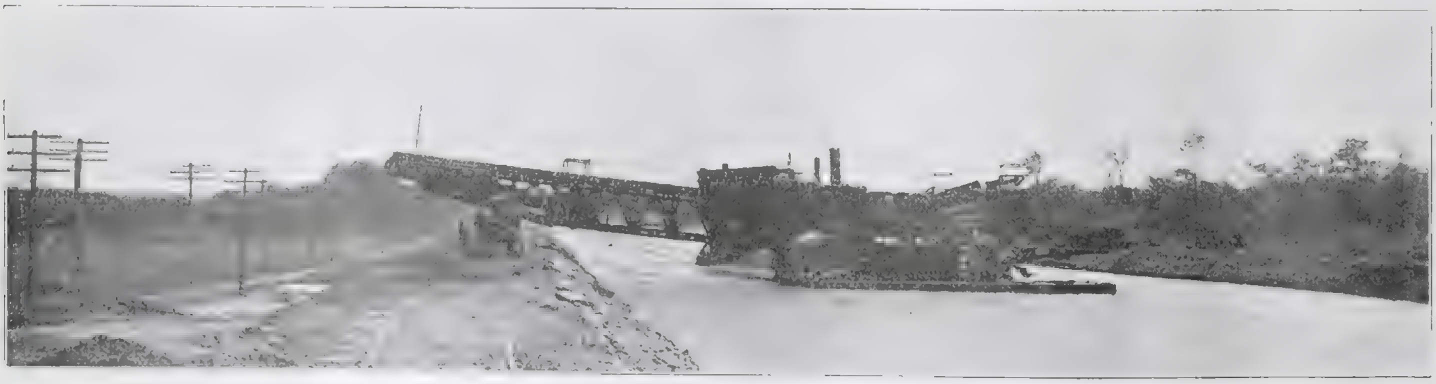


Fig. 2—Rear View of Ladder Dredge and Conveyor Plant, New York Barge Canal.

The plant took out from 20,000 to 32,000 cu. yds. per month during the first few months it was in operation in 1909, working three 8-hour shifts per day. The chief difficulty met with in the first part of the work was holding the soft material in embankment. At first very heavy wooden forms were built to hold up the embankment to its full height. These proved very expensive and inefficient; they gave way in places and the soft material, which flowed out over the adjacent land, had to be scarped back. The plan now adopted is to build dikes of sod and earth about 4 ft. high along the outside edge of the embankment. The material is then deposited by dredge within the dikes, the dredge moving along as soon as the material reaches the top of the dikes. When the material deposited has dried out sufficiently, a second series of dikes is built on top of the first and the dredge moved back to fill again.

The cost of the work done last season is given by months as follows:

August, 1909; 18,638 cu. yds. Excavated:

Coal and oil	$1,984.50
15 tons coal for hoisting engine at $2.85	42.75
Misc. supplies for hoisting engine	5.25
Misc. supplies for hoisting engine and derrick	6.48
Hauling supplies	54.00
Crew of dredge	2,296.68
Total cost	$4,389.66
Cost per cubic yard (cts.)	23.6

Drains and scrapers supplemented the dredge moving 6,244 yds. for a total of $1,280.50 or 20.5 cts. per cu. yd. The cost of wooden forms and of spreading and compacting amounted to $1,193.25 for 10,015 cu. yds. of embankment or 11.9 cts. per cu. yd.

September, 1909; 32,000 cu. yds. Excavated:

Interest, dep. and repairs	$2,205.00
180 tons at (2 tons per shift)	513.00
150 gals. gasoline at 12 cts.	48.00
Oil (80 gals. at 19 cts.; 60 gals. at 35 cts.)	36.20
1,200 lbs. grease at 8 cts.	96.00
200 lbs. waste at 8 cts.	16.00
Teams	215.00
Labor	2,827.00
Total cost	$5,956.20
Cost per cubic yard (cts.)	18.6

A total of 90 8-hour shifts were worked. The cost of the embankment was as follows:

Labor spreading and compacting	$3,151.50
Hauling form lumber	177.16
Cost form lumber	1,125.00
[illegible]	290.00
[illegible] forms	828.32
Hauling supplies	55.00
Total	$5,626.98

Only 11,000 cu. yds. were allowed for the above work on embankment as the forms gave way and the soft material had to be scraped back. This brought the cost of embankment for the month up to 51.1 cts. per yd.

October, 1909; 25,500 cu. yds. Excavated:

Interest and depreciation	$2,351.66
186 tons coal at $2.85	530.10
Labor	3,145.58
Teams	5.00
Oil, grease and waste	153.09
Gasoline	18.60
Repairs	18.90
Total cost	$6,222.93
Cost per cubic yard (cts.)	24.4

A total of 93 8-hour shifts were worked. The cost of embankment was as follows:

Labor spreading and compacting	$2,898.25
Forms	567.50
Erection	108.50
Hauling	95.00
Total	$3,669.25

This gives for 21,800 cu. yds. of embankment a cost of 16.9 cts. per cu. yd.

Street Cleaning and Watering in Twenty Great Towns of the United Kingdom.*

The City of London is a too highly specialized unit for its ways to be used in comparison with those of provincial towns, but five of the boroughs in the metropolitan district—Holborn, Islington, Westminster, West Ham and St. Pancras—have been selected as fairly typical of work in central and in suburban boroughs; one connected with the most ancient traditions of the kingdom and one the outgrowth of modern industrial enterprise.

The English towns outside the metropolis selected as representatives of the ordinary methods of street cleaning have been Birkenhead, Birmingham, Bradford, Bristol, Cardiff, Huddersfield, Leeds, Leicester, Liverpool, Manchester, Newcastle-upon-Tyne and Sheffield. In Scotland, Edinburg and Glasgow, and in Ireland, Belfast, are representatives.

The populations of these cities and boroughs very from 55,215 in Holborn to 760,357 in Liverpool; some are seaports, others far inland, so that the types are different, producing various methods of procedure. Their importance may, however, be seen from the fact that the average population of the 20 towns is 360,000.

Of the 20 great towns now under consideration, 16 have been able to make definite returns of the mileage of the streets paved with various materials. It has been found that the total length of streets in these 16 towns is about 3,200 miles. Of these, 32 per cent are paved with stone setts (blocks), 3 per cent with wood paving, 5 per cent with various materials (including asphalt), and 60 per cent are still maintained as macadam. Evidently, therefore, the question of cleansing macadam roads is of very great importance.

Of the 20 towns, horse-drawn rotary brushes are used on the streets of 14 of the number to cleanse the macadam roads, the engineers of the other six being of opinion that the mechanical sweeper tends to damage the surface. It is thus seen that the majority are in favor of the rotary brush, but it requires to be applied with very great discretion, and the author gave up the use of these mechanical appliances, after having been strongly in favor of them, on account of their effective action, because the coarse bass of which the brush is composed dragged away the finer particles of the surface if applied heavily. Still it is evident that the consensus of opinion is in favor of their use. Almost invariably they are drawn by horsepower.

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*From a paper by T. H. Yabbicom, City Engineer of Bristol, England, read at the Second International Road Congress, held at Brussels, Belgium, August, 1910.

Efforts have been made at various times to produce a machine which not only will brush the road, but, at the same time, raise the sweepings into a cart attached to it. At least six towns have given trials to these inventions, but the unanimous opinion is that not one has proved itself quite satisfactory.

It is scarcely necessary to record that in all the great towns the principal streets are cleansed at least once in the twenty-four hours, and still more frequently when necessary; this being independent of the continuous cleansing that will be noticed further on. The amount of traffic and the conditions of the weather must decide what has to be done. The second-class streets are usually swept three times a week. With regard to suburban roads and third-class streets, the practice varies from a daily cleansing in some towns to once a week, only, in others.

Whether the street cleaning is carried out better during the day or night is a point on which the towns are not unanimous; there is much to be said on both sides. During the night there is less interference with the traffic by the machines, and the latter, having a fair way, can act expeditiously. During the day it is possible to exercise some complete supervision. In eight towns the streets are swept during the night, in seven others by day, and in the five others on the list both by day and night.

After the streets have been swept by night or by day, with or without mechanical appliances, it is the practice in the majority of the great towns to employ a number of street orderlies, men or boys, to go continuously through the principal thoroughfares and pick up litter and horse droppings, or, as one city engineer expresses it, "tidying up all day." In the opinion of the author, this process is so important, not only from the point of neatness, but of health, that he was surprised to find one exception. These collections are small in quantity, and are usually placed in hand carts for conveyance to some known point from which they can be removed by a cart. A very ordinary receptacle is a bin, either above ground or sunk below the level of the pavement. Where there is a depot within reasonable distance the contents of the hand carts can be taken there direct.

In each of the 20 great towns under consideration, the labor for cleansing the streets is employed directly by the corporation. In two of the metropolitan boroughs the carting away and disposing of the sweepings is in the hands of contractors, but in every other case the removal is effected by the administration. Of course, the contractors provide their own tips and get rid of the material to their own advantage.

The provision of suitable places of deposit in the neighborhood of crowded cities is an increasingly difficult one year by year. The practice is generally to tip slop in tanks from which the water is allowed to drain; sometimes the residuum is taken away for use on land. The sweepings from paved streets have a higher manurial value, and at certain times of the year maintain a ready sale; in fact, the author's experience is that at times the demand for sweepings from wood paving is greater than the supply. When the demand is slack much is given away, or is used as dressing on lands belonging to the municipalities. If it were not for the difficulty of transit, land occupiers would find the sweepings most useful and economical, and of late traction engines are called into use for transporting large quantities into the country. Seaside towns have the advantage of being able to send out the unsaleable portion in barges, and drop them at a point where the tides will not return them. Other towns, having a system of canals, are able economically to send away the sweepings in boats. In some towns the holders of allotment grounds* under the corporation are supplied with all they desire gratuitously.

When the streets are dry the usual practice is for a water cart to precede the brush, otherwise a cloud of dust is raised. This is, of course, more especially the case with the mechanical sweepers, but even the hand broom may make things very unpleasant and unsanitary. Attempts have been made to combine a rotary brush and a water sprinkler in the same machine, various types having been tried by 8 of the 20 towns with different results. The experience of the 5 towns was unsatisfactory; 2 found the combination a great success, while the remaining 1 engineer used a petrol water van and sweeping machine combined, and found that it did its work in a satisfactory manner, but was unsuited to city work.

Snow Removal.—Some towns have local acts of Parliament which enable the police to call upon the householders to clear the snow from off footways in front of their premises, and this is the practice in about one-half of the towns noted. But even in those towns there are many miles of footways outside unoccupied premises, public buildings, places of worship and blank walls; bridges and viaducts where the paths would never be cleared at all if the municipality did not do it. The authorities of the other 10 towns undertake the whole duty. By whomsoever the snow is cleared from the path it finds its way to the road, and then has to be removed at the public expense.

Every town of any importance makes careful and systematic arrangements in advance to deal with a fall of snow if it does come. All towns employ snow plows of one form or another, a very usual pattern being a diagonal board or plate on wheels drawn along by horses and delivering the snow at one side. This is very trying work for horses, and cannot be resorted to unless the snow is newly fallen and before it has been trodden hard. V-shaped plows, propelled by an electric motor car, are in some towns employed to clear the tramway tracks.

Having succeeded in heaping the snow into ridges, the duty follows of removing it from the street as expeditiously as possible, but at times and in some places much difficulty is experienced in getting an adequate supply of horses and carts.

The practice of using salt for the purpose of enabling the snow to be cleared easily and expeditiously is resorted to in many towns, but there the authorities make a sort of apologetic excuse for so doing by stating that the practice is only resorted to in "special cases," or "only on the tramway track," or but "very little used." There is no doubt that the use of salt is objected to by a large section of the public on account of the intense cold produced, resulting in injuries to both man and beast, for which compensation has been awarded against the local authority in some cases. Some superintendents are of opinion that it is not possible to cope with a heavy fall without a liberal use of salt, but other equally important towns have found a way out of the difficulty without the employment of a freezing mixture.

Street Watering.—Street watering, to some extent, is almost a necessity with even the best systems of cleansing which experience has evolved. Of course, the macadam road, with its disintegration under rapid traffic, is the worst source of dust, and determined efforts have been, and are being, made to reduce the dust nuisance. It is not, however, the province of this paper to deal with the various methods which have been tried with varying success in this direction.

Tar in one form or another has been the most favored remedy and there are probably few towns in England that have not tried experiments with tar-macadam, tar painting and tar spraying. But, however perfect the road surface may be, and unlikely to be disturbed by wheel action, dust will accumulate on it in towns from a variety of causes. It is therefore not yet possible to do without "street watering."

In the majority of the 20 towns under consideration, all the important streets and roads are watered when necessary. In Leicester rather less than half of the total mileage is regularly watered, and in Newcastle-on-Tyne not one-fourth. In Westminster the practice of watering the entire area is confined to macadam roads, while those covered with wood and asphalt are treated to water in the channels only, where the dust generally collects. Macadam roads that have been treated with tar require a minimum of watering, a slight sprinkling before brushing being all that is necessary, the author's experience having been that the expense of tar treatment is nearly recouped by the saving effected in street watering.

As might be expected, various types of water vans are in use in different towns. These may be divided into the four-wheeled van, holding 480 to 540 (U. S.) gals., and the two-wheeled van, containing 240 to 360 (U. S.) gals. With two exceptions these vans are all drawn by horses, but Westminster and Cardiff employ, in addition, motor vehicles for street watering. Whatever may be the form of the body of the cart containing the water, the method of sprinkling it on the surface is of the first importance. It does not make so much difference on paved streets as on macadamized roads; in the latter as much damage may be done by injudicious watering as would be effected by a thunder shower. The nearer the sprayed water can be made to resemble a gentle shower the better, but it is useless to expect this desired end to be effected by the intelligence of the ordinary driver of a water cart. Several towns use the rotary distributor, scattering the water by centrifugal force. This is very effective on wide streets before the traffic is about, but the appearance of the machine in the distance has been known as the cause of the hasty disappearance of foot passengers into doorways or other safe places of retreat, accompanied by comments the reverse of complimentary. Of the many nozzles that have been designed with the object of dividing the streams of water into a fine spray, the author has found none equal to that designed by Mr. T. Caink, the city engineer of Worcester.

During the past ten years many chemical preparations have been placed on the market with the intention of diminishing the dust nuisance, by binding together the particles on the surface of the road. They generally take the form of a deliquescent salt, which, when dissolved in the water and spread over the road, absorbs moisture from the atmosphere and keeps the surface damp. For this purpose sea water was used many years ago. It has been ascertained that 8 of the towns referred to have made no experiments in this direction; the other 12 have done so, but neither is at all enthusiastic about the results. Westrumite, pulvicile, calcium chloride have all been tried, the latter most frequently. The author was anxious to learn the experience of other towns as to whether these chemicals in solution have a detrimental effect on macadam, but although some engineers state that they have ceased to continue their use, it seems that the determination was arrived at more because they did not fulfill expectations than for any injury to the road surface. The author's own experience has been that the salts, especially the calcium chloride, by reason partly of its cheapness, can be used on gradients where tar spraying would not be desirable. The effect, however, does not last long, a heavy shower of rain falling soon after the salt has been spread washing it away, and it cannot tend to preserve the road.

Although street watering is no more than a palliative, very evanescent in its effects, at one time covering the road with thin mud, which half an hour later is blowing about in the form of dust, the former condition condemned by owners of vehicles and the latter the cause of endless complaints from shopkeepers, we have not arrived at a point where we can do away with the water cart, but like

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[*Land divided into small plots for cultivation by residents of cities or towns.—Ed.]

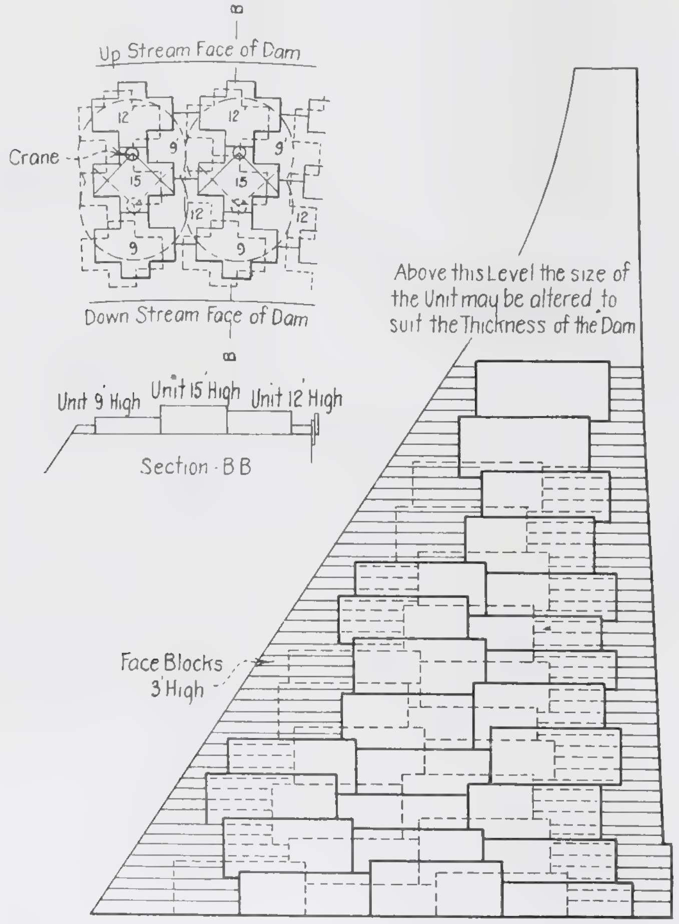
most other things in municipal government, it requires using with intelligence and discretion. The vagaries of English weather make the lot of a watering superintendent an anxious one. A wet morning, on which no water cart is sent out, may be succeeded at midday by hot sunshine and a gusty east wind, or the morning may break dry and dusty, with every available watering machine on the roads, to be followed by clouds and rain before noon. Sadly the dripping but useless carts have to return to their quarters.

A Proposed Novel Method of Constructing a Rubble Concrete Dam for An Australian Irrigation Works.

Plans developed for storing for irrigation purposes the waters of the Murrimbigee River in New South Wales call for the construction of a curved masonry dam 232 ft. high above foundations and having the cross-section shown by the accompanying drawing. In a paper before the Sydney University Engineering Society, Mr. L. A. B. Wade, Chief Engineer Irrigation and Drainage, Department of Public Works, New South Wales, describes briefly a proposed system of construction of this dam which is unique. This system is illustrated by the diagrams herewith.

The dam will contain some 300,000 cu. yds. of masonry. This masonry will be rubble concrete of which 33⅓ per cent will be rubble stone up to a maximum weight of 15 tons. The concrete proper in the body of the dam will be of the proportions of 375 lbs. of cement, 12 cu. ft. of sand and 20 cu. ft. of stone; the dam will be 3 parts 2½-in. stone and 2 parts ¾-in. stone. To insure water tightness both faces of the dam will be of plain concrete in the proportions of 375 lbs. of cement, 7½ cu. ft. of sand and 15 cu. ft. of stone; 3 parts of the stone being 2-in. and 2 parts being ¾-in. This concrete facing will be 12 ins. thick.

The plan is to place the concrete in separate blocks of varying heights and dimensions which will break joints with each other both horizontally and vertically and have irregular lines in plan. The illustration shows a plan and section of the blocks or units proposed to be constructed; they have been designed to give the bond desired, and at the same time with a view to economical construction. It will be seen that their greatest length is along the longitudinal axis of the dam; this is with a view of the concrete and plum-stones in the more centrally situated line of blocks being placed from a cableway, handling up to 15 tons weight. Their area and dimensions in plan are such that a large crane, to handle 10-ton loads, can then be placed upon them for the purpose of constructing the surrounding blocks. The areas are also sufficiently roomy to allow of the embedding of very large-sized plum-stones without any discomfort or danger to the laborers working inside the boxing which will have to be erected to contain them. The up-stream and down-stream faces will be carried up in 3-ft. layers, and will break joint horizontally with the units in the heart of the wall; the large plum-stones embedded in the concrete will be placed to project through the top finished surfaces and make an additional bond with the succeeding units or layers.



Section of Proposed Rubble Concrete Dam.

PERSONALS.

Mr. Daniel W. Cahill of Watertown, N. Y., has been reappointed Superintendent of Public Buildings of New York State.

Mr. Jos. A. Moore, Division Engineer of the Board of Local Improvements, City of Chicago, in charge of paving, resigned his position owing to ill health. His successor has not as yet been appointed.

Mr. Charles H. Pierce, who has been Assistant Professor of Mechanics and Railroad Engineering at the University of Vermont for the past four years has been appointed Assistant Engineer in the Water Resources Branch of the U. S. Geological Survey and will be stationed at Honolulu, Hawaiian Islands, for a study of the water resources of that territory.

Mr. Charles Talbot Porter, an engineer and inventor of international reputation died Aug. 28 at his home in Montclair, N. J., after a brief illness. He was 85 years old. In recognition of his work in advancing steam engineering and for improvements in engine construction, Mr. Porter received the John Fritz medal in 1909. Mr. Porter, who was a graduate of Hamilton College, originally practiced law, but abandoned that field as the result of handling a case involving a patent. He retired from active business in 1890.

The following appointments have been made by the New York State Highway Commission: Assistant engineers, salary $5 a day, R. F. T. Wilke, Thurman W. Dix, of Albany; levelers, salary $4.50 a day, James G. Brennan, Albany; R. W. Heerlin, Schuylerville; Howard C. Young, Little Falls; chainmen, salary $2.50 a day, Perley H. Brigham, J. J. Stahl, E. D. Burkhart, Albany; Norman E. Drexler, Green Island; Robert S. Wait, Norwich; highway inspectors, salary $3.50 a day, John P. Dugan, Amsterdam, for Montgomery county; Fred M. Douglas, Canandaigua, for Ontario county; for axemen, salary $2 a day, Arthur Barbiers, Van Vredenburg; W. J. Henry, Albany; Walter S. Redfern, Fort Edward; W. Chase Young, Hudson, Falls; LeRoy E. Guard, Norwich.

Mr. James L. Millspaugh, General Superintendent of the Michigan United Ry. Co., resigned on Sept. 1 to take a high official position with the Piedmont Traction Co., with headquarters at Charlotte, N. C. Mr. George M. Faber, formerly with the Cleveland, Southwestern & Columbus Railway at Newark, Ohio, has been appointed superintendent to fill the vacancy caused by Mr. Millspaugh's resignation, and two new positions, Superintendent of Equipment and Engineer Maintenance of Way, have been created. Walter Service, formerly of the Milwaukee & Chicago Electric, will have charge of the equipment, and M. S. Rolls, from the Cleveland City Railway, will have charge of tracks and roadbed. Other departments will be reorganized in the near future.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us i. you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING-CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Specialties.—Tide Water Iron Works, Hoboken, N. J. Paper, 6x9 ins.; 12 pp.

This catalog contains several illustrations and descriptions of tools, buckets, cars and mixers dealing and especially with various carriers and outfits for use in the repairing of streets.

Modern Sanitation.—Standard Sanitary Manufacturing Co., Pittsburg, Pa. Paper; 6¾x9¾ ins.; 40 pp.

This is the August issue of the monthly magazine which the company publishes, and which is devoted to the development and advancement of modern sanitation. One of the articles running through several numbers, which may be useful to contractors and engineers, is entitled "Plumbing Estimates and Contracts." The book contains also various suggestions of the best types of plumbing fixtures and accessories.

Lehigh Portland Cement. — Lehigh Portland Cement Co., Indianapolis, Ind. Paper; 6x9 ins.; 17 pp.

This monthly pictorial pamphlet gives various views of recent buildings, culverts, road and motor speedway construction and a double page illustration of the Galveston concrete arch causeway, which extends across the sea between the city and the mainland.

Pennsylvania Terminal Waterproofing.—Barrett Manufacturing Co., New York-Chicago. Paper; 9¾x9½ ins.; 4 pp.

This pamphlet is an illustrated announcement covering the use of Barrett pitch and felt waterproofing at the New York terminal station of the Pennsylvania Railroad.

De Laval Centrifugal Pumps. — De Laval Steam Turbine Co., Trenton, N. J. Paper; 6x9 ins.; 96 pp.

A most interesting book for hydraulic engineers and users of pumping machinery. In connection with the description of nearly all pumps, which are illustrated by diagrams and half-tone cuts, are various remarks and information on the principle of design of such pumps and their selection for various services. Curves showing the test characteristics of all the various types of centrifugal pumps which were designed for different conditions and operated by motor or steam are given. These tests include various sizes of single and multi-stage pumps.

Sardusky Portland Cement.—Sandusky Portland Cement Co., Sandusky, Ohio. Paper; 6¾x9 ins.; 32 pp.

A catalog descriptive of the Medusa White Portland Cement of pure white color, describing the uses of this class of cement for buildings, ornamentation, stucco, blocks, statuary, cemetery work, colored concrete, etc. Various photographs are given showing examples of the above named classes of work. Also various data and tests are given.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week. Bids will be received by Bob Parman, City Clerk, Oklahoma City, Okla., until 5 p. m., Sept 19, for the construction of 16.75 miles of asphalt pavement including 302,670 sq yds The cost of the work is estimated at $981,937.33 by W. C. Burke, City Engineer.—Board of Local Improvements, Chicago, Ill., will receive bids until 11 a. m., September 13, at the City Hall, for the construction of a large amount of cement sidewalks throughout the city.—G. W. Holmes, President Drainage District Greenville, Miss., has advertised for bids to be received until Sept. 30, for the construction of 20 miles of ditches. The work, which will include 400,000 cu. yds. of excavation, will be let to the lowest bidder.—MacArthur Bros. Co., Fisher Bldg., Chicago, Ill. has been awarded the contract by the Rio Grande Reservoir & Ditch Co., for the construction of a storage reservoir at Santa Maria Lake, 20 miles from Creede, Colo. The work will include a large earth dam, wood stave pipe, outlet tunnel, outlet canal, spillway diversion dam, ditches. The contract price was $200,000.—La Compania Agricola La Santena, San Bernardo, No. 3, Mexico City, Mexico, has announced that bids will be accepted for the execution of all earthwork required to open a canal 63 miles long. The project will require about 9,000,000 cu. yds. of earth excavation.—P. J. Moran, Salt Lake City, Utah, at $49,779, was the lowest bidder for the construction of a water works aqueduct at Provo, Utah. The contract includes a large amount of excavation, filling, embankment, tunnelling, etc.—The Sanitary District of Chicago, Ill., has entered into a contract with Sebastian Krug, Chicago, Ill., whereby the latter agrees to remove 704,070 cu. ft. of stone blasted from the bed of the canal near the village of Lemont. He also agrees to pay the District $88,008.75 for the old canal "spoil bank," or about 12½ cts. per cu. yd. A period of 6 years to complete the work has been granted the contractor.—The following bids were received by Col. McD. Townsend, U. S. Engineer, Detroit, Mich., for constructing the upper section of the canal to be used in connection with the new Davis Lock at Sault Ste. Marie: MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., $688,105; Great Lakes Dredge & Dock Co., Chicago, $688,105; W. J. Newman Co., Chicago, $904,850; John Marsch, Chicago, $1,072,867. The work includes excavation of a portion of the new navigation channel, building canal walls and piers, preparing a new head race and forebay with controlling works, ice passages and weir, removal of existing and building of new dikes and the furnishing of all the labor plant and supplies. The section of the canal included in that portion of it west of the international bridge, to deep water, about 1,200 ft. in length, of which several hundred feet adjacent to the bridge is dry work, necessitating construction of a cofferdam and removal of water before the rock is taken out.

Some Census Figures. According to the official count of the returns of the 13th census New York City has a population of 4,766,883. In 1900 the city had a population of 3,437,202, the gain during the ten years having been 1,329,681 or 38.7 per cent. In 1890 the population of the territory now embraced in New York City was 2,507,414 the increase to 1900 having been 929,788, or 57.1 per cent. It will be thus seen that the city maintained practically the same percentage of increase during the last two decades. The increase during the 20-year period has been in the territory north of the Harlem River, where the residents of the metropolis are pushing to escape the congestion of Manhattan Island. In considering these figures it may not be amiss to recall the fact that the builders of the old city hall, not so many years ago, finished off the front of the building in fine style and left the back in a rough state, because they never expected anybody to get up that far.

Two Stories of James J. Hill. It is the custom nowadays for periodicals and the daily press to devote some little space to the witty sayings of prominent men and to stories of their early life. Probably more good stories are told of James J. Hill, head of the Great Northern system, than of any other of the present day men of prominence. One story current in railroad circles many years ago is as follows: At a street meeting of the Salvation Army in St. Paul, one of the soldiers came up to a Swede, who was watching the proceedings with much interest, and said to him: "Don't you want to work for Jesus?" To which the Swede replied: "No, tank you; I've got a yob workin' for Yim Hill." Another story of more recent vintage is given in Success Magazine as follows: In the first days of James J. Hill's wonderful career as railroad builder and manager he and "Diamond Joe" Halliday met on the levee in St. Paul one day when "Jim" was helping to start a freight train over the little up-grade, the engine's horsepower requiring more or less human aid. Hill and his friends had just made the purchase of the St. Paul & Pacific, and "Diamond Joe's" fleet of Mississippi stern wheelers was then the dominant factor in transportation problems of the new Northwest. "Jim, I'll race one of my boats against your train," "Diamond Joe" said. "Don't know about that," Jim answered. "Some of your boats are pretty fast." "Race you upstream; water high—current swift," insisted Halliday. "What!" exclaimed Hill in surprise. "You mean that you would race your boat in the water? Huh! Not much. I'm willing to give you odds, but not that big. Turn her paddles on dry ground and I'll go you."

Municipal Notes. In Germany they have the strange idea that the executive head of a municipality should be a man who has the experience and ability to fit him for the work. How the cities secure men of this kind is shown by an advertisement which appeared recently in a number of prominent German newspaper. The advertisement announced a vacancy in the position of Mayor of Madgeburg, and stated that candidates for the position must apply before Sept. 1. The advertisement stated that the salary was $5,250 a year, including the rental of a dwelling, and that an allowance of $1,000 a year was made for office expenses. The majority of candidates applying for the position are men who have had previous experience as mayors in smaller cities. They choose their mayors differently in England, but in no other country probably have they more quaint and curious customs to hedge in the head of a municipality. One of the strangest of these customs is that employed at High Wycombe, where on the 9th of November of each year—inauguration day—the mayor has to be weighed. This custom has been observed for about 600 years. The mayor-elect, clad in cocked hat, silk stockings, blue coat and knee-breeches, walks at the head of the procession consisting of the councillors, the beadle and the mace-bearer. Upon reaching the Town Hall the mayor is placed upon the scales by the head constable, and a record of his avoirdupois is solemnly made in a book kept for this purpose.

The Advance of Speed. The following item recently appeared in the daily press: "Locomotive No. 732, a new type of the Pennsylvania, designed to reduce running time of express trains between Camden and Atlantic City to fifty minutes, covered four and a half miles in two and a half minutes this week between Egg Harbor and Absecon, a rate of 108 miles an hour. The train it hauled was made up of twelve heavy steel cars. The new engine appears to be bearing out the claims of traffic managers that the fifty-seven miles from Camden to the shore can be made in fifty minutes instead of sixty minutes in perfect safety." Now read this; it appeared in the Newcastle (England) Courant of Oct. 1, 1825, and relates to the opening of the first public railway for steam locomotives by Edward Peese and George Stephenson: "Certainly the performance excited the astonishment of all present, and exceeded the most sanguine expectations of every one conversant with the subject. The engine arrived at Stockton in three hours and seven minutes after leaving Darlington, including stops, the distance being nearly 12 miles, which is at the rate of four miles an hour; and upon the level part of the railway. The number of passengers was counted about 450, and observed more clung to the carriages on each side. At one time the passengers by the engine had the pleasure of accompanying and cheering their brother passengers by the stage coach, which passed alongside, and of observing the striking contrast exhibited by the power of the engine and of horses: the engine with her 600 passengers and load and the coach with four horses and only 16 passengers."

At the first meeting at Stillwater, Okla., of the incorporators of the Oklahoma Public Service & Interurban Lines chartered recently, seven incorporators, as follows, were elected directors for the ensuing year: Harry L. Drullard and A. G. Lampke of New York City; Harry K. Lytle of Brooklyn, N. Y.; Claude Powell, Ralph Sturgeon, G. W. Tucker and Lewis Lampke, all of Stillwater. Mr. Powell was made chairman of the Board of Directors, with Mr. Sturgeon as secretary, and the board was authorized to el [illegible] other members to serve for one year. The proposed lines are to run from Stillwater to Morrison, 14 miles; Stillwater to Perkins, 10 miles; Stillwater to Glencoe, Jennings and Sapulpa, 79 miles, and from Stillwater to Coyle, Langston and Guthrie, 45 miles. The grading contract for the first of these lines was let some time ago to Dan Sweeney & Co., Oklahoma City. The contract for the bridge work was let to M. B. Ryan & Co. Shawnee, Okla. This is for the Morrison Division, 14 miles. Contracts for other divisions will be let as they become ready for construction.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Tuscaloosa Mineral R. R. Co., which projects a 21-mile steam railroad from Tuscaloosa, Ala., to Brookwood, has completed surveys and has secured the capital for construction. Construction contracts will probably be let in October. The Chief Engineer has not been engaged as yet. F. G. Blair, Tuscaloosa, Ala., is President.

The Chattanooga Southern R. R., Chas. Hicks, General Manager, Chattanooga, Tenn., has received the steel for a 3-mile spur to be built to the plant of the Southern Iron & Steel Co., near Gadsden.

The Alabama, Florida & Southern R. R. Co., mentioned in our last issue has located offices at Dothan, Ala., and the capital stock of $40,000 has already been paid in. The incorporators are E. L. Marbury, W. S. Wilson, G. H. Malone, B. G. Farmer and J. W. Malone.

We are advised that reports stating that the Louisville & Nashville R. R. Co. is considering the double tracking of the line between Birmingham and Decatur, Ala., are premature. Some surveys are now under way, but nothing definite has been decided concerning the work. W. H. Courtenay, Louisville, Ky., is Chief Engineer.

Arkansas.

The Town Council of Nettleton has taken up the matter of granting a franchise for the proposed interurban line from Jonesboro. Franchise for the line in the latter place has been granted to Preston Hatcher, of Jonesboro, who is the chief promoter of the line.

The Marianna & Southwestern R. R. is considering extending its line from its present terminus at Big Creek, Ark., on the Frisco to Obery. Plans for the construction of this extension have not been completed. The road is now doing a logging business between Big Creek and Heth. J. T. Robertson, Marianna, Ark., is President.

We are advised that the report, that the Missouri Pacific Ry. was contemplating constructing a line from Crane to Fort Smith, Ark., is erroneous.

Construction work is now well under way on the Doniphan, Kensett & Searcy R. R. Lund & Hill, Little Rock, Ark., are the engineers.

The Walsh Construction Co., Davenport, Ia., has been awarded the contract for about 175 miles of ballasting work on the Missouri Pacific Ry. from Little Rock north.

Work is to be resumed at Pine Bluff, Ark., on raising a bonus of $100,000 to secure for Pine Bluff the Memphis, Dallas & Gulf R. R. It is expected that the entire amount will be raised by Sept. 10.

Construction work has been started on the 22-mile extension of the Stuttgart & Rice Belt R. R. H. Dalhoff, Stuttgart, Ark., has the general contract, which calls for the building of the road from Mesa (mile 88 on the Rock Island two miles this side of DeVall's Bluff) 21 miles due south and one mile west to Stuttgart. The contract includes the grading, track laying, bridge building, fencing, erect the telegraph line, furnishing all materials. Four depots are to be built by the contractor, a brick station costing about $10,000 at Stuttgart, and three others to be located in the trio of new towns to be established and developed between Mesa and Stuttgart. D. A. McGrea of Little Rock is Chief Engineer of construction. A considerable part of the work has been sublet Kaiser & Maloney, Stuttgart, being among the subcontractors. It is the intention of the railroad company later to build the line 38 miles further through a rich virgin timber forest to the Arkansas River.

Communications have been received by Mayor A. G. Lowry, Hope, Ark., it is reported, from W. K. Ross, promoter of the proposed Northwestern Louisiana & Gulf R. R., in regard to right of way and bonus inducements which the city would be willing to offer to secure the construction of that line through it. With the building of the Gulf & Magnolia R. R., and the possibility of securing this one, Hope is in a good position to have six railroad lines centering there.

California.

The supervisors of San Francisco will soon take up the matter of constructing the Geary St. municipal electric railway. The line will probably be operated by the overhead trolley system. Mr. Manson, San Francisco, is City Engineer.

The Huntington electric line, now being constructed from Claremont to Upland, has right of way agents at work securing the necessary land between Upland and the county seat 20 miles to the east. A considerable amount has been obtained along what is known as the Boulevard, in the eastern part of Upland. It is announced that the crew now laying rails between Upland and Claremont will soon take up the renewal of the entire line between Upland city and Ontario.

The Laton & Western R. R. Co. has completed surveys and has received the capital for the construction of 15½ miles of line west of Laton, Cal. Construction contracts are to be let at once. S. F. Cochran, Laton, Cal., is Chief Engineer, and L. A. Nares, Fresno, Cal., is President.

The C. A. Blume Construction Co. has secured a contract from the Western Pacific R. R. to build the steel frame of the railroad company's new shops near Sacramento. With the completion of the brick foundations, which are being built by the Ransome Construction Co., the work on the steel frame will be started.

Surveys have been made and $1,020,000 of capital is on hand for the construction of the Geary St. municipal electric railway at San Francisco. The road is to be 14 miles long and will be single track. The date for awarding construction contracts has not been determined. Marsden Manson is City Engineer of San Francisco.

Officials of the Southern Pacific have been over a route for a line between Benica and Valejo, a survey for which was made some years ago, and this is taken to indicate that the company contemplates taking up the proposition in the near future.

Erickson & Peterson, San Francisco, are making good progress with their contract for constructing the Southern Pacific Rochlin and Clipper Gap cutoff, and indications are that the work will be completed in about 18 months. The contractors have their headquarters near Bowman.

Grading work on the Arizona & Eastern R. R. has been completed for nine miles from Winkelman and the company is now ready to lay the rails. The Copper Canyon tunnel 1,000 ft. long through granite has also been completed.

The Southern Pacific is reported to have received at Fernley, Mo., 100 miles of 90-lb. steel for its Fernley line and for the proposed branch from Fernley near Wadsworth into northern Nevada, California and southern Oregon. It is stated that the reason the construction of the line has not started before this time is that the railroad company has been having considerable trouble with the government concerning the building of culverts and aqueducts over that portion of ground northwest of Wadsworth, where the government intends to some day build a big irrigating canal.

A corps of surveyors in charge of W. S. Matthews, who has been making surveys of the townsite of Brockway, Lake Tahoe, has arrived at Oroville, Cal., and is preparing to survey the proposed route of the Butte-Plumas R. R.

According to an announcement reported to have been made by A. D. Moran, Treasurer of the Nevada-California-Oregon Ry., New York City, the current rumor regarding the sale of the line to the Western Pacific Ry. is entirely without foundation, and the company is planning the construction of an extension to its line within a short time. George S. Oliver, Reno, Nev., is Chief Engineer.

Pueblo, Colo., Items.

ITEMS BY A. B. KOENIG.

Chas. Wells was in the other day. He is doing some force account work for the D. & R. G. R. R. which will hold him until next year.

Sullivan Bros. report their work at Larimer, Colo., progressing nicely.

Eggleston & Mathews are piling up big estimates at San Carlos.

Lucia & Reiweitz are figuring on subbing 100,000 yards more of work from the Utah Const. Co., in addition to what they already have.

Mike Collins is now with the Utah Const. Co., at Larimer, Colo.

Wheel Scraper Smith has been under the weather the past week. He is over it now and says he never felt better in his life.

During an electric storm, lightning struck the tent of P. J. Clark, manager of J. H. Nations Const. Co., rendering Clark and his wife unconscious. We are pleased to report the complete recovery of Mr. and Mrs. Clark. It takes more than lightning to kill a live wire like Clark.

P. J. Heinley of Heinley Bros., spent the past week in town.

Contractors when in or passing through Pueblo are invited to call at Koenig's Labor Agency, 326½ Victoria Ave., right opposite the Union Depot. Joe Bayless, manager of this office will post you on what is going on in this part of the country.

Colorado.

The Colorado & Southern Ry., H. W. Cowan, Chief Engineer, Denver, Colo., is making investigations and surveys with a view to improving the South Park line of that system, between Denver and Leadville and particularly on that portion between Como and Leadville. The line is narrow gage and the main purpose of the contemplated improvements is to avoid the heavy expense of operating the line as now constructed over the heavy grades and in winter often beset by snow.

According to a recent announcement of Darius Miller, president of the Colorado & Southern and the Chicago, Burlington & Quincy R. R., the two systems are to be connected at five points in Colorado and Wyoming. The Colorado & Southern will have an unbroken road from Orin Junction, Wyo., to Fort Worth, Tex., and until the Wyoming link is built will use the Chicago and Northwestern from Orin Junction north to its junction with the Burlington, forming J. J. Hill's long-planned direct route from Galveston to Seattle. The points of contact between the two systems will be at Denver, Greeley, Cheyenne, Guernsey and Orin Junction. Plans of the two roads combined involve the expenditure of between $12,000,000 and $15,000,000. These include construction of the Big Horn canyon line from Thermopolis south and east to Orin Junction, under way and on which work recently was temporarily stopped.

The Chicago, Burlington & Quincy R. R. has secured much right of way for its Hudson-Greeley line. We are advised, however, that the company has no plans for the construction of the line in the near future.

As right of way agent T. S. McMurray of the Chicago, Burlington & Quincy R. R. has recently purchased 3 miles of right of way north of Kersey, Colo., it is generally believed the company is planning on pushing through that part of the country. Surveyors have been working the vicinity for some time and it is said that a permanent survey has been decided upon.

Vice-President Mohler, of the Union Pacific, is quoted as stating that steel laying will begin within a short time on the line between Dent and Fort Collins through Weld and Larimer Counties, the grade for which has already been completed. The company is also planning to run a branch from the Weldon-Orchard country to Barnesville, Colo., to connect Briggsdale, the terminus of the Crow Creek branch with Gover, a distance of 15 miles. The latter work will not, however, be taken up this year.

The Colorado & Southern Ry. system has had surveys made and has secured a portion of the right of way for the Wellington-Cheyenne line, which will be constructed to connect the company's parts in Colorado and Wyoming and as a contract has been signed with the city of Cheyenne to have the line constructed within two years and that time is rapidly diminishing it is believed work will be started at once. Bonds have been issued recently to provide funds for the improvement and the company has succeeded in disposing of the same. E. F. Vincent, Denver, Colo., is Assistant Chief Engineer.

Connecticut.

Contracts have been let for the double tracking and elimination of grade crossings on the Hulington branch of the New Haven & Derby R. R. (New York, New Haven & Hartford line) between Hawleyville and Shelton.

Georgia.

The Jacksonville & Atlantic Short Line Ry. Co. has been organized and projects a line about 215 miles long. Surveys have not been made as yet and only a part of the capital for the construction of the line has been secured. The chief engineer has not been named as yet. B. B. Gray, Pinebloom, Ga., is interested.

Plans are reported to have been practically completed for completing the railroad from Hawkinsville to Perry. Eight of the 22 miles of line have already been graded and sufficient capital to complete the road is reported to have been secured. Plans for extending the road from Hawkinsville south through Florida to the gulf are also being made. T. B. Ragan, Hawkinsville, Ga., is interested.

Idaho.

Construction work is now under way on the 15-mile extension of the Pacific & Idaho Northern Ry. from Evergreen to New Meadows. Maney Bros., as previously noted, have the contract for this work. The Pacific & Idaho Northern is now surveying a line from New Meadows to Roseberry, 25 miles. Lee Highley, Weiser, Idaho, is Chief Engineer, and E. M. Heigho, Weiser, Idaho, is President.

Illinois.

The Chicago, Burlington & Quincy Ry. is securing land near Barstow for constructing a yard capable of caring for 200 cars.

Indiana.

The promoters of the Fort Wayne & Toledo Electric Railway Co., to whom a franchise was granted some time ago to build an interurban line to Bryan, O., but who failed to file the proper bonds, have asked the county commissioners for a regrant of the franchise. It is said that the promoters have plenty of capital in sight now.

Preliminary surveys have been made by A. A. Coffee, Huntingburg, Ind., with a view to extending the Ferdinand Ry. from Ferdinand, Ind., to St. Meinrad. It is probable that if this extension is built the line will later be extended to Troy. This is a steam road, eight miles long. Hugo C. Rothert, Huntingsburg, Ind., is Receiver.

Efforts are being made to have the Northern Indiana Ry. Co., South Bend, Ind., extend its traction line to a new factory district in the northeastern part of Elkhart.

A meeting of the stockholders of the Fort Wayne & Springfield Ry. Co., Decatur, Ind., was held at Decatur the latter part of last month, to decide on the question of building a southern extension.

Iowa.

The Crooked Creek R. R., W. H. Whiteford, General Manager, Lehigh, Ia., is considering extending its steam road to Fort Dodge, Ia. The road at present is 18 miles long.

Rattenborg, Ross & Judd, Atlantic, Ia., have been awarded the grading and construction contracts for the Iowa & Southwestern Ry., which proposes a line to run from Clarinda through College Springs to Blanchard. Work will be commenced at once on the grading. It is expected that the grading will be done by Barnes & Shugart, who have the contract for grading on the south extension of the Atlantic, Northern & Southern Ry. The road is to run 16 miles approximately and will cost about $300,000. The Kimballton Construction Co., Atlantic, Ia., has the contract for the bridge work.

The Mason City & Clear Lake R. R. Co., a Delaware corporation, has filed its articles of incorporation with the Secretary of State at Des Moines. The company has a capital stock of $1,000,000, its incorporators being as follows: W. E. Brice, F. E. Johnson, C. H. McNider, F. J. Hanlon of Mason City; B. L. Cutier of Tama, and William M. Pyle of Wilmington, Del.

Engineers of the Chicago Great Western R. R. have completed surveys to Clarion for a proposed line from Des Moines. The survey crosses the south line of the county near the southeast corner of Wall Lake township. It passes the south end of big Wall Lake and takes a diagonal course through Lincoln township on into Clarion to the west of the fair grounds. It crosses the Rock Island track about 100 ft. east of the interlocking plant and intersects the Great Western tracks at a point about two blocks south of the depot.

Right of way agent H. W. Clovis, of the Red Oak & Northeastern, has announced that all right of way except that which it will be necessary to condemn has been secured for the proposed road. Between Red Oak and Winterset 90 per cent of the 70 miles has been arranged for, and he will now start working the territory between Winterset and Des Moines.

Kansas.

The Walsh Construction Co., Davenport, Ia., has been awarded the contract for constructing new yards at Hoisington, Kan., for the Missouri Pacific, the contract requiring the moving of about 400,000 cu. yds. of dirt.

Citizens of Caney, Kan., have voted bonds to aid the construction of the Cherryvale, Oklahoma & Texas R. R. from Caney southwest through Oklahoma. The issuance of the bonds is on condition that the money voted will be an investment when the road is built. Another condition is that the roundhouse, shops and other terminal facilities will be located at Caney. Six miles of right of way has been granted from Caney to Wann, Okla., and it is expected to continue grading to Delaware immediately. From Wann one line is chartered to be built southeast to Fayetteville, Ark., and the other southwest to El Paso, Tex.

Definite steps for the construction of the Wichita, McPherson & Gulf Ry. will probably be taken some time this month. Preliminary surveys for the line are now under way by engineers of the Midland Valley Ry., of which the first mentioned line is to be an extension. C. E. Ingersoll, Midland Bank Bldg., Philadelphia, Pa., is President of both companies.

In order to facilitate matters, W. E. Stone, Eldorado, Kan., who is in charge of the completion of the Kiowa Hardtner R. R., has purchased outright the R. J. Ross tract of land near Kiowa, over which the horseshoe curve necessitated by the agreement to change the Santa Fe crossing is to be constructed. A force of men is now at work removing the crossing. Negotiations for more right of way are now pending.

The Missouri Pacific is to spend about $500,000 this fall in improvements to the Wichita division. These will include the ballasting of tracks and the laying of new rails. The line from Denesea to Wichita, a distance of 86 miles, will be ballasted. The L. C. Smith Construction Co. of Kansas City, as previously noted, has the contract for ballasting the lines. It now has eight trains hauling gravel from Pueblo, Colo., for this work and several miles of the track from the Geneseo end have already been ballasted. It will take six or eight months to ballast the Geneseo branch and it will cost about $150,000 to do the work. About 70 miles of track from Eldorado to Yates Center will be relaid with 85-lb. steel. New rails sufficient to lay about 30 miles of this line have been received and the work of laying the track will commence about Sept. 10. The Kiowa branch from Wichita to Kiowa is to be relaid with 75-lb. rails, and the stretch of track from Reece to Durand with 85-lb. steel.

According to advices from Beatrice, Neb., the promoters who recently obtained a charter in Kansas for the construction of a line from Wichita, Kan., through Greenleaf, Salina, McPherson and other Kansas towns and are now seeking a charter in Nebraska to extend the line to Beatrice. The company will then be capitalized at $5,000,000 and surveyors will be put in the field to make a preliminary survey. A note concerning the charter of the company in Kansas appeared in the Aug. 3 issue of *Engineering-Contracting*.

Grading work has been started on the extension of the Scott City & Northern R. R. north from Scott City through Russell Springs to Winona on the Union Pacific, was started. The survey has been completed for some time, and two steam graders and a large force of men are now busy with the construction work. Trains are now running on this line between Garden City and Scott City, and during the next 10 or 12 months the company expects to have extensions completed south as far as Liberal on the Rock Island, and north to St. Francis on the Burlington.

Board of Railroad Commissioners have directed the Missouri Pacific Ry. to place in good order its branch from Kansas City to Virginia City, Neb., running through northeast Kansas.

C. W. Humberd, Marysville, Kan., has started work on his contract with the Union Pacific R. R. for grading and filling in on the track near Cleburne where there was a cave-in a few months ago.

Kentucky.

The Lexington & Eastern Ry., John Marston, Jr., Chief Engineer, Lexington, Ky., now operating 93 miles of steam line, has filed amended articles of incorporation by which it is given power to increase its indebtedness from $4,000,000 to $10,000,000. This money will be used in extending the road 115 miles from Jackson, penetrating the Perry, Letcher and Knott coal fields and reaching Virginia, where connection can be made to reach the tidewater.

The Henderson Traction Co., of Henderson, Ky., operating six miles of line, has been purchased by the Tennis Construction Co., of Pittsburg, Pa. This is a step for the extension of the interurban system from Evansville and Owensboro to Henderson and the probable construction of a bridge across the Ohio, 4½ miles above that city. The building of this bridge, together with other extensions and improvements, will involve the expenditure of something like $3,000,000.

Grading work is stated to have been started for the proposed traction line of the Covington, Big Bone & Carrollton Ry., running south from Covington, to Crescent Springs. The line is to cost $2,000,000, and it will take a year to build. The line will have its southern terminus at Carrollton, the county seat of Carroll county. Coming north the main line will pass through Ghent, Warsaw, Union, Florence, Erlanger, Crescent Springs, Ludlow and West Covington.

According to advices from Frank H. Alfred, General Superintendent, Cincinnati, Hamilton & Dayton Ry. Co., the report stating that the company had decided to construct an extension into Kentucky, is incorrect.

Massachusetts.

The State Railroad Commission has decided to withhold its approval of a franchise of the Boston & Eastern Electric Ry. to await the action of the next Legislature on the general questions of transportation in Boston. The Boston & Eastern, as previously noted in these columns, proposes to construct a line connecting Boston with Salem and Beverly by means of a tunnel under the harbor and a terminal at Postoffice square, Boston. It had secured legislative sanction subject to the approval of the state railroad board, so far as the Boston end of it was concerned. The company has already put up a cash deposit of $10,000, to guarantee the expenses of borings, etc., for its Boston tunnel, and it is stated that MacArthur Bros. Co., New York and Chicago, who are known as the principal petitioners, were ready to put up even $300,000 in cash as an evidence of good faith and of their intention to build the road as proposed. Mass meetings are now to be held along the proposed route in an effort to have the railroad commission reverse its decision.

Michigan.

Contractors have been over the projected route of the Detroit, Lansing & Grand Rapids Ry. and it is believed that construction work will be started this fall on a portion of the proposed electric railway. The company proposes a line 35 miles long from Brighton, Mich., to a point near Detroit. F. A. Bean, 706 Union Trust Bldg., Detroit, Mich., is Chief Engineer.

Gust Fredin, Ishpeming, Mich., has been awarded a contract by the Lake Superior & Ishpeming Ry. and the Marquette & Southeastern Ry. for the construction of a railway line from the Cleveland Cliffs Iron Co.'s North Lake property to the Barnes mine, being opened up at Dexter, also for the construction of a spur from the main line, near Gwinn, to the Cyr property, which the Cleveland-Cliffs Iron Co. is opening up. This latter spur will be about 1½ miles in length. The line from North Lake to Dexter will be about 3 miles. Mr. Fredin, who has had crews working since early in the summer on the highway in Ely township, extending west from Ishpeming, also on the road that connects Marquette and Dickinson counties, expects to finish both of these contracts early this month, when all of his workmen will be transferred to the railway jobs. The grading for the Dexter line has already been started, but work on the Cyr branch will probably not be commenced until about Sept. 12.

The grading of the Lansing-Grand Ledge Ry. line is practically half completed and according to reports from Lansing, Mich., the grading gang is within 5½ miles of that city. Kneal & Ryan of the above city have met with no serious difficulties and it is expected that the grading will be completed by Nov. 1.

Minnesota.

Hosford & Engstrom, railroad contractors, have returned to Northfield, Minn. Work on the road in Montana where they have been engaged the past summer having been suspended.

The outfit of Richard Evans, the contractor who has the grading work on the section extending south from Munger, Minn., on the Canadian Northern line from Virginia to Duluth, Minn., has arrived at its destination. It consists of 18 teams of horses, 40 men, and tents, graders, etc.

Mississippi.

The Summit & McComb Motor Line Co. has completed a 5-mile line from Godbold Wells through Summit to McComb City, Miss. The company was recently incorporated as mentioned in our Aug. 3 issue. J. E. Randall, Summit, Miss., is Chief Engineer and Ted Blackmore, Summit, Miss., is President.

The Newton Northwestern R. R. has completed surveys for 14 miles of its projected line and is now getting out estimates. This company projects a 44-mile line from Newton, Miss., through Conchalton and Walnut Grove to Carthage. D. L. Ragland, Newton, Miss., is President.

Missouri.

The Metropolitan Street Ry. Co., of Kansas City, Mo., has made preliminary surveys of extensions of the Brooklyn, Indiana and 27th St. lines at Kansas City. It is said that as soon as the reports are submitted material will be ordered and men put to work. The Brooklyn line is to be extended from 37th to 39th, the Indiana from 31st to 36th and the 27th from its present terminus east six blocks.

Grading work on the St. Joseph-Savannah interurban line from St. Joseph, is well along and will probably be completed by Oct. 15. The Flick Construction Co. has the contract for the grading work north of the county line and will also grade a stretch of roadbed from the Vey roadhouse north to the county line. Work of laying rails and stringing trolley wires will start from the end of the present Industrial City line, the roadbed being graded to the Vey roadhouse, ready for the rails. As soon as the connecting link between the Vey road house and the county line is graded, work of laying rails and stringing wires over that section of the track will be started, this part of the roadbed to be finished first. J. H. Van Brunt, St. Joseph, Mo., is Manager of the interurban company.

The Kansas City Terminal Ry. Co., of Kansas City, Mo., has placed a steam shovel at work preparing the founadtions for the new terminal station at Kansas City. Two more shovels are to be placed on the job soon. The excavation work is to be completed by May 1, 1911. Previous reports stated that the excavation work had been let to contract but later advices are to the effect that it will be done by the railway company. J. V. Hanna is Chief Engineer.

St. Louis Items.

BY A. B KOENIG.

Statistics compiled by the executive officials of the railroads indicate that nearly seventy million dollars has been appropriated in the last five years for terminal improvements in St. Louis. The Terminal Railroad Association is prepared to invest thirty million dollars immediately and to set aside approximately sixty million dollars additional for constructive operations during the next decade. The railroad improvements under way and projected at St. Louis represent allotments aggregating at least $160,000,000, and a probable disbursement of more than $175,000,000. More work has been done at St. Louis, railroad officials maintain, in five years than any other center, excepting only New York, where new passenger terminals and tunnels have been built. Considering the expenditures involved in plans, which already have been approved, and pointing to an investment exceeding $160,000,000, St. Louis ranks first in terminal development. In fact, the aggregate will exceed $175,000,000. The improvements were inaugurated by the Wabash, which spent $10,000,000 providing freight terminals and depots in St. Louis. The St. Louis Southwestern recently purchased land for individual freight terminals, and its property will cost about $10,000,000. The Missouri, Kansas & Texas operations now in progress will cause an expenditure of more than $10,-000,000. The Rock Island is now constructing immense yards and stations and its investment will total about $10,000,000. The Rock Island and Frisco have invested jointly about $7,-000,000. The five items are equivalent to more than $47,000,000.

The Terminal Railroad Association has spent about $7,500,000 on ordinary improvements, and the Missouri Pacific-Iron Mountain System, whose terminals are immense, has invested about $5,000,000 for enlargements and betterments. The new property of the St. Louis Transfer Company is appraised at $500,000. The Manufacturers' Railway, controlled by Aug. A. Busch and associates, has put $2,500,000 in a new terminal system and the Illinois Traction Company has invested $7,000,000 in its bridge and terminals. The total of these five items is $22,500,000, bringing the aggregate of appropriations already authorized up to $69,500,000. Most of this money invested, but some of the work is now in progress. The Manufacturers' Railway proposes investing at least $7,500,000 additional. The improvements projected by the Terminal Railroad Association during the next ten years will cost at least $90,000,000 and possibly more than $100,000,000. The development in prospect indicates an investment of $97,500,000 to $107,500,000. This is in addition to the authorized appropriations, mostly used already, approximating $70,000,-000. The aggregate investment in improvements completed, $70,000,000, and projected. ranging from $97,500,000 to $107,500,000, will approximate $167,500,000 to $177,500,000. Most of the development has been in the North and Northwest St. Louis, although the improvements of the Missouri Pacific-Iron Mountain System and the Manufacturers' Railway are in South St. Louis. It is estimated that the cost of the work north of Washington Ave. in the last five years is about $62,000,000. The expenditures of the railroads at St. Louis will be enormous in ten years. With the total of $177,500,000 just mentioned might properly be included the expense that the Chicago & Northwestern will bear in entering St. Louis. This railroad recently completed a survey from Peoria to St. Louis. Accepting the total of $69,500,000 as the investment in the last five years, the railroads have expended on an average $13,900,000 a year at St. Louis. Taking the estimate of $107,500,000 a year for the next decade. The aggregate of $177,500,000, which is not considered an excessive estimate, indicates an average of nearly $12,000,000 a year for fifteen years for special work and in addition to ordinary operations. Railroad officials state that, in order to invest $100,000,000 or more at St. Louis in the next decade it is necessary that there should be some basis of understanding among the municipality, the mercantile organizations and the carriers. St. Louis has an extraordinary opportuity, they insist, to realize marvelous progress. One of the plans for harmony is to adjust the rate problems of the St. Louis district quietly through the instrumentality of the Business Men's League Traffic Bureau. The arbitraries against East St. Louis will be eliminated, the St. Louis passenger traffic arbitrary will be removed and the differential against St. Louis in the Illinois coal rate will be modified in a satisfactory manner.

The development of terminal properties, individual and union, has a dual significance. It means that the carriers desire to establish a mammoth traffic gateway at St. Louis and also increase and perfect the facilities for handling local and suburban.

Ware & Spencer are getting along nicely with their work on the Santa Fe railroad near Carrolton, Mo.

C. E. Adams expects to be through with his work in Arkansas by October first and will have 25 teams idle. Charlie is wanting some more work. Address him at the Hotel Main, Little Rock, Ark.

St. Louis capital probably will be used to some extent in furnishing additional transportation facilities for New York City. The Public Service Commission for the First district of New York State advertises for bids on the construction of the proposed tri-borough subway and elevated system which is to augment the present lines of the Interborough Rapid Transit Company. The new line complete is estimated to cost in the neighborhood of $120,000,000.

The Smith-Scott Company, which is a consolidation of John Scott & Sons and Hannon & Hickey, two St. Louis contracting firms with C. D. Smith & Co. of Memphis, Tenn., expects to bid on at least $10,000,000 of this construction. They are now working on a section of the Fourth Avenue-Brooklyn subway at a cost of $1,500,000 and are equipped to bid on a considerable part of this line.

The New York subways now in operation built only a few years ago are already seriously congested by the heavy traffic and the new lines will parallel the Interborough to a considerable extent. Passengers will be able to ride over the new lines the entire length of Manhattan Island from Pelham Bay Park at the northern limits of the Bronx, and over the Fast River to Brooklyn out to Coney Island.

The Public Service Commission is advertising for bids under two different methods, one involving construction alone, to be paid for by the municipality, and the other including in one contract the construction, equipment and operation of the entire tri-borough system by private capital. The latter method is made possible by a recent change in the rapid transit law of New York, which permits the construction and operation of rapid lines by private capital under an indeterminate franchise. Since the opening of the existing subways the passengers have been increasing at the rate of 120,000 per day.

Kaiser & Maloney have finished their work in the city and moved their outfit to the Cotton Belt R. R. to Stuttgart, Ark.

B. E. Riley, who is representing John Scott & Sons, has 150,000 yards of station work to let on the Cotton Belt R. R. near England, Ark. The fills run from 2 to 5 ft. Prices 14 to 15 cts.

E. A. Rankin & Sons are going to finish their work near Muncey, Ind., and then sell their outfit and go to farming.

J. W. Skinner left here for Little Rock, Ark., to start on his Iron Mountain R. R. bridge work.

Jack Hickey of Hickey Bros. spent several days in town. Hickey reports a shortage of labor on their Indiana work in the past week.

I. G. Printy writes us from Arena, N. D., that he is about through at that point and is in the market for some more grading.

I. G. Grommett of Alton, Ill., and John Scott & Sons of St. Louis have 20 miles of grading on the electric line between Alton and Jerseyville to sublet.

Labor continues to still be a scarce article in this part of the country. With the government river improvement work opening up in the south and the cotton season beginning there will be no trouble for all the idle laborers in the country to get employment by coming this way.

Chas. Truitt, president of the Federal Commissary and Supply Co., returned to St. Louis after a two weeks' fishing trip in Minnesota. Charley reports catching only little ones. Big ones not biting or probably were muzzled.

Mr. Petersen of Petersen & Fell Boarding & Commissary Co. spent several days in town. Hard work seems to agree with him.

W. R. Rowland, manager of the Petersen & Fell Boarding & Commissary Co., has been visiting their various camps along the Iron Mountain R. R. in Missouri, Arkansas and Louisiana and found them in fine condition.

The Universal Const. Co., which is composed of the Hickey Bros., Hannan & Hickey, and John Scott & Sons, have started work on their mammoth sewer contract in the city.

J. J. Maloney is now with Hannon & Hickey near Mt. Carmel, Ill.

Montana.

Grading work on the projected line of the Gallatin Valley Electric R. R. has been finished and track laying is now in progress. The projected length of this line is 27 miles and it is to extend from Bozeman Springs, Mont., to Three Forks on the Chicago, Milwaukee & Puget Sound R. R. N. C. Van Natta, Bozeman, Mont., is Chief Engineer.

New Jersey.

The Millville, Tuckahoe & Ocean City Electric Transportation Co., of Millville, N. J., has been incorporated with a capital stock of $100,000 and proposes to construct an electric passenger and freight line between Millville and Ocean City. The incorporators are E. W. Rush, Hartwell Shepherd, Thomas Frome, George Haines, Tillman Rush and E. C. Wainwright.

The Morris County Traction Co., Morristown, N. J., is asking a franchise at Summit, N. J., to enable it to extend its trolley line from Maple St. through the city limits to the city line at Chatham.

The Central R. R. of New Jersey, according to reports, contemplates building a new line from Tamaqua to Slatington, where it will connect with the main line. Such an improvement would give the Central a direct connection with the Reading at Tamaqua, Pa., without touching any leased lines, which is not now the case.

New York.

The Town Board of Southport has granted the Elmira Water, Light & R. R. Co., of Elmira, N. Y., a franchise to build a trolley line on Pennsylvania Ave. from the limits of Elmira to Caton Ave. at Southport Corners.

Frederick W. Whitridge, 204 E. 128th St., New York City, receiver of the Union Ry. Co., has been granted permission to make an extension to cost about $65,000. The extension will begin and connect with the tracks of the company in Westchester Ave., New York City, at East 167th St.

The Walsh Construction Co., Davenport, Ia., has been awarded the contract for eliminating curves and grades on 9 miles of the Boston & Albany R. R., near Greenbush. The work will require a number of cuts through rock hills.

Surveys have been completed for the first 5 miles of a new electric railway which is to extend from Geneva to Port Gibson. No definite plans, however, have been made for the construction of the proposed road. C. D. Beebe, Syracuse, N. Y., is interested.

The New York & North Shore Construction Co., Long Island City, N. Y., has applied for a permit to construct a double track surface railroad on Bayside Boulevard, from Ashburton Ave. to Tenth St., and on Tenth St., from the Bayside Boulevard to Broadway in the Third Ward, Long Island City.

North Carolina.

Yancey County, North Carolina, will vote Sept. 24 on taking $100,000 of stock in the Black Mountain Ry. Co., which is proposed to be built from a point near Boonford, Mitchell County, on the C. C. & O. Ry. through Burnsville, the county seat, to a point near the Cane River postoffice. The conditions call for the beginning near Boonford, crossing the North Toe river, running thence to the valley of the South Toe, thence down South Toe river to the mouth of Crabtree creek; thence from Crabtree creek to Burnsville; thence west down the valley of the Pine swamp to Cane river, and thence to Cane River postoffice. The line will be about 15 miles in length and is to be completed within a year from the time the bonds are issued. Further conditions require the issue of $30,000 in bonds when the line is completed and in operation from Boonville to Micaville, $20,000 from the link from Micaville to Burnsville is operating and the remaining $50,000 when the road reaches Cane river. The average grade is to be 1 per cent, in two places a grade of 3 per cent is permissible.

Transylvania County has voted to subscribe $100,000 to the capital stock of the Greenville & Knoxville R. R. Co., which is to build a line from Greenville to Brevard. It is proposed to extend this road through the Pink beds into Haywood County and down the Pigeon river, via Canton to Knoxville. W. H. Patterson of Atlanta, Ga., is President.

Surveys have been made and the construction capital has been secured in part for the proposed 13-mile line of the Elizabeth City & Abbeville R. R., from Elizabeth City, N. C., via Weeksville, to the Albermarle Sound. Construction contracts will be let about Jan. 1. Patrick Mathew, Edenton, N. C., is Chief Engineer, and C. E. Kromer, Elizabeth City, N. C., is President.

Since the burning of the Carolina & Northwestern Ry. shops in July, the towns of Chester, Gastonia, Hickory and Lincolnton have been contesting to secure the location of the rebuilt shops. Engineers are at present deciding the cost of developing the different sites and it is believed that Gastonia and Lincolnton stand the best chance for the improvement. S. D. Scarborough, Chester, S. C., is at the head of the department.

It has been announced in Wadesboro, N. C., that the Winston-Salem Southbound R. R. will be completed and the first train operated over it by Sept. 23. Two bridges, one over the Yadkin at Whitney and the other over Rocky River north of Ansonville, are in course of construction, and this work will cause the greatest delay in the completion of the entire road. The contractors between Wadesboro and Rocky River will be ready when the bridges are finished. The new line will run under the track of the Seaboard Air Line Ry. east of the Seaboard passenger station, and will connect with the tracks of the Atlantic Coast Line.

North Dakota.

The Wahpeton-Breckenridge Street Ry. of Wahpeton, N. D., which has been under construction since May 15th, has been placed in operation. It is reported that the line will be extended out across the prairies in the spring and that the line as completed is but the beginning of an interurban line that will eventually connect Great Bend, Hankinson, Lidgerwood, Sisseton and Watertown.

Ohio.

F. J. Cellarius, City Engineer of Dayton, O., has completed tentative plans for the elimination of grade crossings in this city, and the matter of bonds for the work may be voted on at the November election. The work would cost about $2,000,000, of which the railroad companies would have to pay 65 per cent.

Oklahoma.

Surveys for the proposed line of the Buffalo & Northern Oklahoma R. R. have been started under the direction of Chief Engineer Tilleaux of Hutchinson, Kan. The surveys are being made for an extension of the Frisco Railroad westward from Avard, 60 miles, to Buffalo, through Woodward. Citizens of Ashland, Kan., are asking for an extension of the line from Buffalo.

Oregon.

The Albany Interurban Ry. Co., J. M. Hawkins, Manager, Albany, Ore., has secured a franchise at Brownsville, Ore. The company has made surveys for a line from Albany to Brownsville, Crawfordsville, Holley, Sweet Home, Waterloo, Lebanon and back to Albany. According to the terms of the franchise the road is to be completed and in operation within two years.

August Lovegren, a lumberman of Preston, Wash., has been having surveys made from a point near Gaston on the Southern Pacific through Forest Grove to the Patton Valley District, where he will establish a sawmill.

Right of way for the projected railway of the Mount Hood Railway & Power Co., which will run due east from Portland to a point near Bull Run, has practically been secured and it is hoped to have actual construction well advanced early next year. R. C. Gillis, Los Angeles, Cal., was recently elected President of the company.

Articles of incorporation have been filed at Portland, Ore., with the County Clerk by the Grants Pass & Western R. R. Co., which is capitalized at $500,000 and has principal offices at Portland. The object of the new company is to construct and operate a line of railroad and telegraph system for some point connecting with the Oregon & California R. R. at or near Grants Pass or some practical route in a general southwesterly direction to Crescent City, Cal. The incorporators are J. P. O'Brien, Portland, Ore., General Manager Oregon R. R. & Navigation Co., C. G. Sutherland, and James G. Wilson.

Reports from Junction City, Ore., are to the effect that a crew of 16 Southern Pacific surveyors have located at that place and are running lines through the Siuslaw country and down to Florence from that city and also to Corvallis or in that direction. It is believed if the line is ever built to the coast from the vicinity of Junction City it will have a very easy grade, and by going through what is called the low pass, a tunnel through the narrow divide, with no rock to cut through, it would let the road down into the Lake Creek Valley, thence to the coast on a water grade. This route would be through the heaviest timber belt in Lane County, and nearly 10 miles shorter than from Eugene.

It has been announced by T. H. Croswell, Chief Engineer, of the Spokane, Portland & Seattle Ry. Co., Portland, Ore., that reports to the effect that the company had decided to construct a cutoff at Tongue Point, are entirely without foundation.

Pennsylvania.

The New Park & Fawn Grove R. R. Co. has been granted a charter for a line in York county to extend to the property of Edward

James near the Maryland border, a distance of 5 miles. The company plans later to connect with the Maryland & Pennsylvania R. R. in Maryland at a point south of Delta, so as to have an entrance into Baltimore. John H. Anderson, New Park, Pa., is President.

The awarding of contracts for the building of the Tower City, Reiner City & Johnstown Short Railway has been delayed for the present. The building of the line will be taken up later. This is to be an eastward extension of the Schuylkill & Dauphin Traction Co.

Swanson Brothers, Rockwood, Pa., have taken a sub-contract for 8 miles of work on the Western Maryland R. R., and are just moving their outfit onto the job.

Construction work in the vicinity of Meyersdale on the extension of the Western Maryland R. R. is being rushed. The Somerset Construction Co. is now building a large concrete culvert in the Altmiller hollow just outside the city limits of Meyersdale. This culvert will be 250 ft. long, 6 ft. high and 4 ft. wide. Forty-two men are at work on it, and it will be finished by the end of this month There is to be a big fill at this place and it is expected that the grading sub contractors for this section, Head & Wright, will soon have a steam shovel at work on the deep cut through the High Street hill in order to get the dirt necessary for the big fill. Head & Wright are making rapid progress on the rock cut and big fill one mile east of Meyersdale, just below Glade City. The steam shovel at work on this cut is eating rapidly into the hill and a considerable portion of the neighboring hollow in which a big concrete culvert has been constructed is already filled up with rock and earth from the big cut. About two weeks ago five dirt cars went over the high temporary trestle from which the dirt is dumped for the big fill. A dinkey engine was used to draw the derailed cars to the top of the hill again. Head & Wright are working two shifts on the big rock cut. Fisher & Corazzo have two steam shovels at work on their contract east of Garrett and have considerable grading finished. Between Garrett and Rockwood and between the latter place and Casselman, little construction work has yet been done, but in the vicinity of Markleton, Pinkerton and Harnedsville the work is being pushed rapidly. Both portals of the Pinkerton tunnel have been set and subterranean rock drilling is now in progress. Good progress is being made on the two bridges which span the Youghiogheny River at Ohiopyle. Work upon the second bridge, which crosses the river just above the falls, was started the latter part of August. A cofferdam was erected in the river but it is necessary to keep a pump working all the time because of the water which seeps through the holes drilled for blasting. It will be necessary to blow out a big rock in the river bed. McCourt & Herndon have received another concrete mixer. It will be put on the lower bridge job at once, making three of these in all.

Information received from Dover, Del., is to the effect that in addition to the number of new depots to be built by the Pennsylvania R. R. Co. in Delaware, the company has arranged to design sidings and double tracking through Delaware, particularly at Armstrong, Gree Spring and Laurel, to cost over $200,000.

It is reported that the Carter Construction Co. which has the contract for the construction of the Western Maryland's new extension from Cumberland, Md., to Connellsville, Pa., has given assurances that the line can be completed within 15 months and the officials of the railroad believe that by Nov. 1, 1911, the new line will be turned over to the operating department. Of the 87 miles of right of way necessary, over 60 miles have already been secured, and under the laws of Pennsylvania, the state in which the unsecured portion lies, it is legal for the company to file a bond and condemn the property.

Rhode Island.

The City Engineer of Providence, R. I., has completed plans for the abolition of grade crossings of 'the New York, New Haven & Hartford R. R., at Plainfield St., at Hartford Ave., Providence. The matter of securing the necessary legislation will be taken up at the January session of the State Legislature.

Residents of Eden Park, Providence, R. I., have taken up the matter with J. S. Murdock, Legal Representative of the Grand Trunk Ry., of having a fourth survey made, to skirt the eastern shore of Blackamore Pond and thence lead to the west of Eden Park, going through the Tolman estate. It was pointed out that this route would not cross so much inhabited property as any of the three surveys first taken. The present survey, as published, crosses Park avenue near the Narragansett Trotting Park, skirts Blackamore Pond, goes through the Caleb Mann estate, thence through the upper section of Eden Park and to the Pawtuxet River, from which any point between Edgewood and Cowesett could be easily reached.

South Dakota.

It is stated that the extension work on the Belle Fourche Valley line will be stopped when steel is laid on the present grade to await the action of Congress upon the bill opening the remainder of the Cheyenne River lands. If the bill passes the House (it is already through the Senate), the line will be built down the Cherry Creek to Leslie and thence to a junction with the Pierre line near Midland.

Tennessee.

The Memphis Union Station Company under date of Sept. 2 issued bids to be opened Sept. 8th in the office of the Chief Engineer, Louisville, Ky., for the construction of the following work in connection with the new $3,000,000 union station being erected in Memphis: Reinforced concrete baggage room, reinforced concrete mail and express sub-ways, concrete retaining wall in connection with underpass. The work will embrace in the neighborhood of 10,000 cu. yds. of concrete work and about 18,000 cu. yds. of earth excavation. J. Werness, 9th and Broadway streets, Louisville, Ky., is Chief Engineer. All bids are requested to be in by noon on the day of the letting.

The Tennessee Rapid Transit Ry. Co. has surveys under way for the construction of about 120 miles of line from Clarksville to Lewisburg, Tenn., through Nashville. Capital for the construction has not yet been secured, neither has a definite time been decided upon for the letting of the contracts. R. T. Wilson, Nashville, Tenn., is President of the company, and J. L. Parkes, Jr., is interested.

Texas.

Frisby & Frisby, Beeville, Tex., promoters of the Nueces River Valley R. R. have started surveys from Beeville west and it is stated that actual construction will begin within 60 days. By the terms of the bonus raised at Beeville the construction must begin within that period or it is forfeited. Three corps of engineers will likely be put to work at different sections of the route.

The State Railroad Commission has issued a ruling requiring the International & Great Northern and Trinity & Brazos Valley railroads to build a connecting track at Newby, near Jewett, Leon County.

Efforts are being made at Corpus Christi to have the Corpus Christi Street & Interurban Ry. Co. extend its street railway line to the Epworth encampment grounds and to the Alta Vista Hotel, several miles south of the city.

Surveys have been made and the capital has been secured for the construction of the projected line of the Trinity Valley Traction Co. The route is from Dollars to Palestine, Tex., via Waxahachie and Corsicana. Construction contracts are to be let in about 90 days. Shipman & Denny, 304 Scollard Bldg., Dallas, Tex., are the engineers; J. V. Watkins, 304 Scollard Bldg., Dallas, is President.

The Missouri, Kansas & Texas Ry. has been looking over the route for a railroad from Waco, Tex., east through Mart, Mexia and Fairfield.

The matter of constructing a railroad from Austin, Tex., to Fredericksburg, Tex., 80 miles, is under consideration but has been held up for the present owing to the conditions of the bond and money market. Preliminary surveys for this line have been made, as was noted in our issue of Aug. 10. W. S. McGregor, Temple, Tex., is interested.

The Atchison, Topeka & Santa Fe R. R. is seeking an entrance to Waco, and it is said that the tracks of either the Missouri, Kansas & Texas or the Cotton Belt will be used. In this connection it is likewise stated that the Santa Fe will construct its own line into Waco at an early day.

Officials of the International & Great Northern R. R. have been making an investigation of the Valley of the Nueces River as to the traffic possibilities, with a view of constructing a branch line from Cotulla to Corpus Christi, a distance of about 125 miles. It is believed that the plans for constructing the proposed line are as yet only tentative, and that no definite action will be taken until after the road passes from its receivership and is reorganized on a sound basis.

The St. Louis & San Francisco R. R. has contracted for trackage rights from Paris, Texas, to Dallas, 98 miles, over the Gulf, Colorado & Santa Fe; and from Dallas to Fort Worth, 34 miles, over the Rock Island lines, and is running its own trains through to Dallas and Fort Worth.

Meetings have been held at Belton to devise ways and means of carrying out the contract made by the Commercial Club with Judge L. E. Walker to build the Quanah, Seymour, Dublin & Rockport R. R. by way of Belton, provided $50,000 in stock and $40,000 in bonds of the company could be placed with the citizens of this place and the right of way and depot grounds in Bell County furnished free of cost to the company. By the terms of the contract Belton is to be a division point.

The city of Greenville, Tex., has granted a street railway franchise to S. A. Price and associates of Dayton, O. It is expected that construction work will be started soon and that about $200,000 will be expended. The directors of the company will be: S. A. Price, W. F. Briedenbach, Albert Emanuel, L. A. Clark and H. L. Warren. The officers will be Albert Emanuel, President; L. A. Clark, Vice-President, and W. F. Briedenbach, Secretary-Treasurer.

William Carlisle, Atchison, Kan., has purchased the Beaumont & Great Northern R. R. from the West Lumber Co. of Houston, Tex. The road was formerly the property of the Carlisle-Pennell Lumber Co. of which Mr. Carlisle is a member, and was sold with their Texas mills and timber lands last December. The road is about 34 miles long, and extends from Livingston to Trinity, Tex. It is said to be Mr. Carlisle's intention to extend the road to Beaumont and Waco. The physical valuation of the road is not far from $1,000,000.

Surveys for the Texas North & South Ry. have been completed to Coleman, making a complete survey from Boerne, in Kendall County, via Fredericksburg, Mason, Brady to that place. It is stated that the surveyors will proceed up the proposed road to Seymour, in Baylor County, at once.

John Scott, St. Louis, Mo., has the contract for extending the Cotton Belt to Comanche. The Comanche branch will leave the main line at a point about four miles north of Hamilton, near the second crossing of the Stephenville dirt road, and follow the river bottom via Gentry's Mill, running north of A. A. Shilg's place and on to Comanche via the city of Gustine.

Information received recently from Weatherford, Texas, to the effect that grading on the Chicago, Weatherford & Brazos Valley R. R. is progressing rapidly, there being about 100 teams on the job. The road will be ready for steel within 90 days.

Six work trains are now located on the line of the St. Louis, Brownsville & Mexico R. R. between Bay City and Refugio, Texas, and it is expected that reconstruction work between Algoa and Kingsville, Texas, will be completed by November 15. The light rails are now being replaced with 85-lb. steel on the main line and the old ones are used on the new lines notably the Brownsville Belt line, etc.

It is reported in Roswell, N. M., that A. R. Morrison, who represents the Roswell, Tucumarri & Northern R. R., has announced that he has obtained necessary funds for the survey and preliminary work on the road and has sold $4,000,000 of bonds with which to start construction.

The ordinance committee of the City Council of Beaumont and the advisory committee of citizens are working on the terms of a proposed new franchise for the Beaumont Traction Co.

Announcement has been made that the Frisco extension from Brady to Menard and the Santa Fe project from Lometa to Eden will be finished and in operation in time to take care of the spring shipments of cattle from Menard, McCulloch, San Saba and other counties in that section.

We are advised that the Rio Grande & Eagle Pass Ry. will not at the present time make any extension to its line. This railway is reported to be considering extending its line down the valley of the Rio Grande from Laredo to Sam Fordyce, where it will connect with the St. Louis, Brownsville and Mexico. The distance traversed will be about 125 miles, and the territory opened up is among the most valuable for irrigation and grazing purposes in the state. The road at present runs from Laredo to Minerva, a distance of 29 miles.

Preliminary surveys and estimates of the probable cost are under way for the construction of the projected line of the Texas-Mexican Ry. from Robstown to Aransas Pass, Texas. Officials including Vice President A. C. Hamilton and M. M. Leyendecker, General Superintendent, at Laredo, Texas, have been making arrangements in Aransas Pass for an entrance to the city.

General Manager M. J. Healy, Texico, N. M., of the Texico, Farwell & Gulf Ry. Co., is reported to have received information from the East to the effect that funds are now available for the construction of the first 50 miles of the projected line. It is believed that contracts for this work will be let at once. Arrangements have already been made for the construction of the new line across the Santa Fe on the state line.

According to an announcement reported to have been made recently by A. T. Perkins, Vice-President of the St. Louis, Brownsville & Mexico R. R., the company has decided to construct a branch line from Kingsville to Alice, a station on the San Antonio & Aransas Pass R. R., a distance of 22 miles, in order to gain immediate communication with San Antonio, Texas. The line in question will ultimately form a part of the main line to that city which will be 125 miles long. The country traversed is prairie land and no serious engineering problems will be encountered. C. B. Rogers, Kingsville, Texas, is General Manager of the company.

An agreement, subject to ratification, terms of which will be made known to the public later, was reached at the conference held at Waco, Texas, Aug. 23, between a committee of the city's business Men's Club and a representative body of the Santa Fe Ry. officials including F. G. Pettibone, Vice-President, and J. S. Hershey, General Freight Agent, regarding the subject of the railroad's entrance to the city by either constructing an extension or leasing trackage from the Missouri, Kansas & Texas (Katy) Ry. or Cotton Belt Ry.

Utah.

The Commissioners of Utah County at Provo have granted a franchise for an interurban electric railway over the public highways in Utah County to the following: A. J. Evans, S. L. Chipman, W. L. Hayes, J. B. Keeler, D. R. Beebe, W. H. Brereton, Arthur N. Taylor, J. D. Dixon, H. T. Reynolds, John Jones, James McBeth and George C. Whitmore. The franchise gives the right of way over all county roads over four rods in width, the grantee to select the rout of the cars. According to the franchise preliminary surveys must begin within six months and the route must be selected within 12 months. At least 25 miles of the road must be built within three years. The promoters are affiliated with Simon Bamberger of Salt Lake City and the road is to run from Salt Lake to Payson and probably further south. So far, franchises have been granted in all towns north of Provo and the promoters expect to start at once petitioning for rights of way in the southern end of Utah county. Afterwards applications will be made to Salt Lake City and county. It is said that the promoters have plenty of funds to finance the work and that they will begin construction as soon as all the franchises have been secured.

Scipio & Clauser Construction Co., 256 25th St., Ogden, Utah, have taken a contract for about 8 miles of new railroad through Provo Canyon and will start work about Sept. 15. They will use about 500 laborers. Scipio & Clauser's outfits have been working in Denver, Colo., and in Pasco, Wash.

As mentioned in our last issue the San Pedro, Los Angeles & Salt Lake R. R. has awarded the contracts for the construction of the proposed high line to eliminate the danger of such washouts as the road suffered this spring. The Utah Construction Co., Ogden, Utah, was given the first 32 miles leading west from Caliente to Lieth, while the remaining distance from Lieth to Guelph was awarded to Shattuck & Edinger, Los Angeles, Cal. Construction work will be started at once, and it is hoped to have the new roadbed completed for operation with 85-lb. rails by the 1st of March, 1911.

Virginia.

Advices from Cape Charles, Va., state that surveys for the proposed railroad on the Eastern Shore, from Queenstown to a point on the Atlantic coast, have nearly been completed, the only thing halting the work at this time being the unharvested crops along the right of way. It is said that the Virginia Legislature will be asked to grant a charter to extend the line down the Peninsula to Cape Charles.

The catawba Coal & Iron Co., according to advices from Fincastle, Va., has passed into the hands of northern capitalists, and it is thought that work on a railroad will be started next month. The right of way has already been secured, and the survey made from the old Catawba furnace to Cloverdale, on the Norfolk & Western. C. E. Willis is Manager.

Work which had been suspended will be started soon on the northern extension of the Carolina. Clinchfield & Ohio R. R., from Dante, Va., to Elkhorn City, W. Va., where a connection will be made with the Chesapeake & Ohio Ry. The promoters have also completed plans for the construction of an extension from its southern terminus at Spartansburg, S. C., to Charleston, S. C., to touch tidewater, and it is probable that work will be started in the near future. M. J. Caples, Johnson, Tenn., is Vice-President and General Manager of the company.

Washington.

The Chicago, Milwaukee & Puget Sound R. R. is said to be planning to start work this winter on its line to tap the Yakima Valley.

Statement reported to have been made at the Roadmaster's office in Ellensburg, Wash., is to the effect that the Chicago, Milwaukee & Puget Sound R. R. will start work this winter on its line to tap the Yakima Valley. It is planned to do the heavy work in the winter months in order that the light grading may be pushed rapidly when the ground thaws in the spring.

West Virginia.

The Buckhannon, Western & Glenville Electric Ry. Co., of Buckhannon, W. Va., has been chartered with a capital stock of $5,000, and proposes to build an electric line from Sago, Upshur County, by the nearest route through Upshur through Weston in Lewis County and on to Glennville and the territory lying between these points. The incorporators of the company are S. C. Rumisell, L. H. Morrison, J. G. Hall, G. F. Day and others of Buckhannon, and J. A. Crislip, of Clarksburg, W. Va.

Preliminary work, only, has been done for a proposed trolley line through Bach Creek Valley, Berkeley County, W. Va. As noted in our Aug. 24 issue a committee of citizens have been in conference with the Hagerstown Ry. Co., of Hagerstown, Md., in an effort to have the company build the line. No survey has been made as yet but prospects are good for the ultimate construction of the line. J. B. Clary, Hedgesville, W. Va., is interested.

Talbott & Bennett, Fairmont, W. Va., have been awarded the contract for constructing a new tunnel at Tunnelton for the Baltimore & Ohio R. R. The tunnel will be 4,100 ft. long and the work will require over 900,000 cu. yds. of excavation.

The Morgantown & Dunkard Valley R. R. Co., Morgantown, W. Va., has filed a formal acceptance of its franchise for extensions on the streets of Morgantown.

Wisconsin.

The State Railroad Commission has issued a certificate of necessity allowing the construction by the Milwaukee Western Electric Road of a line from Beaver Dam to Fox Lake.

The State Railroad Commission has granted a certificate to Minneapolis, St. Paul & Sault Ste. Marie R. R. allowing it to build a line of road in Superior from its present terminal to the ore dock. The competing roads in Superior brought strenuous opposition to the company's application. The commission also granted a certificate to the road for the Pokagema Bay route, an extension of the present line to the site of the proposed plant of the United States Steel Corporation.

The Twin City & Lake Superior Ry. Co. (Arrow Line) has secured options on practically all of the right of way which it will require in reaching the city limits of Superior, Wis., from the present terminus of the road at Holyoke. The right of way acquired by the Arrow Line leads to a point on the city limits just south of the diagonal road which it is evidently the intention to follow into the city if proper arrangements can be made. The Superior terminus of the Arrow Line will be at Logan Ave. and 21st St. if the present plans of the road materialize.

Canada.

As a result of the purchase of the Bay of Quinto R. R. by the Canadian Northern Ry. it is said that the construction of the Ottawa and of the Toronto-Ottawa line will be commenced at an early date. This will mean that the Canadian Northern line between Ottawa and Toronto will be completed several months earlier than was anticipated, and will be in operation not later than the fall of 1911.

It is reported at St. John, N. B., that the Canadian Pacific Ry. has secured a controlling interest in the New Brunswick Cold Storage Company's plant, at the head of the harbor at St. John, just beyond the Intercolonial Ry. terminals. It is further stated that the Canadian Pacific has secured an option on the properties between the cold storage plant and the Intercolonial Ry., and proposes to build extensive freight terminals there, with perhaps a railway station, and a hotel fronting on Mill and Main Sts.

The Canadian Northern Ry. has formally taken over the Bancroft & Irondale and Central Ontario Ry. The Irondale & Bancroft road is 50 miles long, and extends from Kinmount Junction to Bancroft, where the Central Ontario line runs from Picton to Maynooth, a distance of 132 miles. A stretch of 34 miles more, from Maynooth to Whitney, is now under construction.

A meeting will be held in the near future to complete the financial reorganization of the Brockville & Westport Ry. and the Marmara short lines, extending from the C. P. R., near Ivanhoe, to the iron mines. These two roads have been purchased by the Canadian Northern.

Bids are asked by the Commissioners of the Transcontinental Ry., P. E. Ryan, Secretary, Ottawa, until noon, Sept. 14, for approximately 7,543 gross tons of 80-lb. steel rails, and the necessary rail fastenings, delivered f. o. b. cars at Cochrane, Ont., on or before Oct. 1, 1910. Tenders must be made on the forms supplied by the Commissioners, which may be had on application to Gordon Grant Chief Engineer, Ottawa, Ont.

Advices from Vancouver, B. C., state that another contract for the extension of the Kettle Valley Ry. line from Rock Creek to Bull Creek on the west fork of the Kettle

River, a distance of 35 miles, has been awarded to L. M. Rice & Co., of Vancouver and Seattle, Wash. Grading has already been completed from Midway west for 10 miles and construction work will be started within three weeks. The building of a 25-mile section of the same road from Merritt south through the Nicola Valley is now in progress. The company has authority to extend its line from a point south of Merritt across the Hope Mountains to Ruby Creek, below Hope. At Ruby Creek, after bridging the Fraser River, connection will be established with the Canadian Pacific Ry., whose tracks it already connects with the Midway and Merritt. The distance from Midway to Ruby Creek is about 271 miles. By means of its connections the Kettle Valley route will afford as direct a line between the coast and the Kootenays as the V. V. & E. Ry.

Mexico.

The Mexico Tramways Co., V. L. Havens, Engineer, Apartado 124 Bis, City of Mexico, has been granted a concession to construct an electric railway between the village of Santa Fe, a suburb of the City of Mexico, and Toluca in the state of Mexico. The line will be 52 kilometers in length and the company must begin its reconnoissance within six months and must complete five kilometers of track within two years from the time the first work is begun. The 52 kilometers of track must be completed in ten years.

Arrangements are stated to have been completed and the official announcement will be made soon of the sale to the National Railways of Mexico of the Pan-American R. R. and the Vera Cruz & Isthmus R. R. The Pan-American has been controlled by Paul Morton, president of the Equitable Life Assurance Society; David E. Thompson, former United States Ambassador to Mexico, and their associates. The Vera Cruz has long been operated by the Mexican Government. The first is capitalized at $10,000,000, all issued, and bonded for $8,400,000. The second is capitalized at $1,000,000, and the bonds are guaranteed by the Mexican Government.

The Mexican-Pacific Co., of which Moritz Thomsen, Seattle, Wash., is President, is now engaged in the construction of a railroad from Acapulco on the seacoast to its plantation. The company has between 600 and 800 natives at work on the railroad now and has the rails, ties and considerable equipment already on the ground. The Mexican government has given 1,000 feet of waterfront on the Acapulco harbor to the company as a site for wharves and warehouses.

Cuba.

The Cuba R. R. Co. has completed the construction of 278 kilometers of track between San Luis and Marti via Bayamo and from Bayamo to Manzanillo. The line from Marti via Guamo, Bayamo, Negintas Yara and Manzanillo is now in operation. This latter line is 180 kilometers long. Geo. B. Allan, Bayamo, Cuba, is Superintendent of Construction.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arizona.

Preliminary surveys have been completed and estimates made for the dam and power buildings for the Sabino Canyon reservoir project of the Western Electric Co. William B. Alexander, Tucson, Ariz., is Consulting Engineer.

City of Tucson, Ariz., has granted John Mets right of way through city land for an 8-ft. canal to the Treat tract near the city farm.

California.

The Sacramento Valley Irrigation Co., Willows, Cal., has for the present held up the matter of constructing laterals and drains for the Delavan and Maxwell units. Contracts for the Delavan unit work were to have been let in August. This work involves about 1,200,000 cu. yds. of excavation. E. P. Mills is Assistant Engineer.

Colorado.

MacArthur Brothers Company has been awarded contract by the Rio Grande Reservoir & Ditch Company for the construction of a storage reservoir at Santa Maria Lake, twenty miles from Creede, Colo. The work will consist of a large earth dam, about 90 ft. high; a 40-in. diameter continuous wood stave pipe, 8,000 ft. long; an outlet tunnel, about 600 ft. long; an outlet canal 3,000 ft. long; spillway; diversion dam, and a large amount of ditch work. Amount of contract $200,000. Work will be started immediately and will be completed by next summer. MacArthur Brothers Company have just completed a large dam for the Eastern Colorado Power Company, near Boulder, Colo., and will be able to shift much of their plant onto this work.

Illinois.

The Crane Creek Drainage & Levee District of Schuyler County, Ill., has awarded the contract to the Arbuckle-Ryan Co., Toledo, O., at $18,000 for furnishing and installing tandem compound 4-valve, 280 H. P. engine, one 36-in. centrifugal pump, two 72x18 boilers and all necessary auxiliaries including fore bay discharge and foundation work. The contract for the pumping station building was let to Wessel & Sons, Beardstown, Ill., at $2,700. Bids for the above were opened Aug. 26 at Rushville, Ill.

On Aug. 29, 1910, bids were received as follows at the office of Wm. Biester, Belvidere, Ill., attorney for the Hunter Drainage District No. 1 of Boone County, Ill., for furnishing and laying of 28,202 ft. of farm drain tile ranging from 4 to 20 ins. in diameter; maximum cut 6 ft. and minimum cut 3 ft.; character of soil, a mixture of peat and blue clay. Jas. A. Reeves, agent for National Drain Tile Co., Streator, Ill., $4,876.59; Belvidere Cement Products Co., Belvidere, Ill., $4,675; Haeger Estate, Elgin, Ill., $4,490; Clarence W. Petrie, Sycamore, Ill., $4,761.45; Munson Bros., Capron, Ill., $4,300 (awarded contract). Arthur L. Webster, Wheaton, Ill., is the Engineer.

McAllister & Peterson, who were awarded the contract for dredging 6,000 ft. of open ditch for Wheaton, Ill., have contracted with the city of Wheaton and property owners for the extension of this ditch for 3 miles farther.

Kansas.

Land owners in Allen County are considering building a levee to protect their land from overflows of the Neosho River. W. C. Hoad, State Engineer, Lawrence, Kan., was recently over the ground looking into the matter.

The City Commissioners of Topeka and the County Commissioners will soon reach a definite decision regarding the construction of that portion of the south side dike from Kansas Ave., Topeka, to the Rock Island R. R. bridge approach. At present an earth dike is favored, the estimated cost of this, exclusive of right of way cost, being $20,791, as against $51,000 for a concrete wall. The earth dike contemplates some loose rock embankment, about 3,700 cu. yds., the earth being surfaced next to the river with the rock. The earth dike would have a base of 100 ft. in width while the top would be 20 ft., the height varying according to the grade line. The estimates for the concrete dike call for a 14 to 17 ft. cantilever and a 12 ft. gravity wall. V. R. Parkhurst, Topeka, Kan., is County Engineer.

Mississippi.

✣Bids will be received by G. W. Holmes, President Drainage District, Greenwood, Miss., until Sept. 30 for 20 miles of ditches in that district including about 400,000 cu. yds. of excavating.

Nebraska.

The State Board of Irrigation has extended the time two years at the end of which the Tri-State Canal Co. of Stottsbluff and Morrill counties must complete nine miles of ditch on the eastern end of the present canal. The company expended $95,000 last year on the work.

Ohio.

Contracts for ditch work have been let as follows by Ed. S. Ault, County Surveyor, Marion, O.: Team work on the Little Scioto River improvement from Hillman Ford north to the county line, August Kohbarger, at $2,153; trench work for the Northrup ditch in Prospect Township, Harry Kohbarger; tile, Richwood Clay Mfg. Co., at $1,856.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

Thomas A. Gavin has been awarded a contract by the city for 30,000 lineal feet of sewer work. The work is now well under way and promises to be finished by January 1st.

Jake Baxter is making good progress on his I. C. R. R. work near Greenville, Miss. Jake is wearing his usually happy smile these days when the weather is good and the digging fine. Jake thinks he will have all his I. C. work finished on or perhaps before contract time.

Maj. M. L. Walker has returned to the city after a two weeks' vacation and is preparing to turn over the papers in his office to Capt. Clarke S. Smith, who is expected in Memphis on the 15th of September to assume charge of the United States engineers' office. Maj. Walker has been transferred to Ft. Leavenworth, Kan., at which station he has been made commander.

Fay Carey, of this city, has an outfit of thirty teams idle at Durant, Okla., and is ready to take a contract from some one with real work to offer.

Tim Shea, one of the old-time foremen, is in Memphis on the lookout for a good job. Tim has lately been with Sam Bush, but Sam is on railroad work, while Tim seems to like the old levees better, so concluded to come back to the mighty Mississippi's banks.

A. D. Montgomery was in town last week from his contract near Clay, Texas. They still need rain in the Prairie State and until they get it things will not move on as fast as they might.

A. C. Deever has finished a large contract of levee work on Brazo's River in Texas, and is ready for some more work.

C. D. Smith & Co., of this city, state that they did not sign up the contract for excavating the Union Station proposition in Kansas City. The contractors and the terminal company could not come to an agreement on all the points embraced in the contract and the Union Station Co. has decided to do the work with their own forces, which they will either lease or rent. The contract involves about 700,000 cu. yds. of excavation and was considered an exceptionally good one by all the contractors who submitted bids on same.

The brick work on the big Cotton Exchange building has been finished and Olson & Lesh, the contractors, state they will turn over the building complete within a short while. This is undoubtedly the tallest building in the south and one of the most handsome. The architect, Mont Woods, has accomplished some remarkable artistic effects, and every one knows how hard these are to gain in a skyscraper.

Lou McClavey, the hustling levee builder who has come into this territory from Omaha, has taken a piece of work from Roach & Stan-

Items marked thus ✣ indicate work now open for bid.

sell at Reelfoot Lake, Tenn., which is said to embrace 50,000 cu. yds. of new levee. Lou states he will move on the work at once and complete same in record time.

The Lake View Traction Co., the new interurban line from Memphis to Lake View, Miss., will operate its first car on Sunday the 18th. The car will leave Memphis at 6:30 a. m., in charge of Billy Hayden, the Chief Engineer of the road, and will contain the President and Board of Directors; after that, cars will be run every thirty minutes each day in the year. A big picnic will be spread at Lake View and the inauguration of the first traction line in west Tennessee will be celebrated in a style befitting the occasion. The lake View Traction Co. has been built in the face of almost insurmountable odds, the local press and city fathers having been its strongest opponents, while even within its own ranks the spirit of dissention has crept in, and it was only the untiring efforts of Bill Hayden, the little engineer who never gave up, that the road was at last built.

The Memphis Parkway Commissioners are building one of the finest pikes in the Southern States and when Ben Turner finishes his contract for the graveling the driveway will be as smooth as asphalt. Only screened gravel with a very fine top coat of stone dust is used, and this is well rolled and sprinkled and the top well oiled. As a result, a road of almost perfect smoothness is obtained, while its lasting quality is almost as long as tar macadam.

The Central Bank Building, eighteen stories high, has been completed by Murch Bros. in record time and last week was turned over to the owners ready for occupancy.

Billy Bryant has closed a contract for furnishing crushed stone used in connection with all tar macadam streets to be built in this city. Billy also has some very pretty gravel contracts in his jeans and seems to have the stone and gravel situation pretty much as he wants it. Billy is a hustler, all right, and very few good deals escape his notice.

H. W. Brennan has almost finished Lamar Boulevard. This was one of the hardest street contracts ever awarded by the city and the contractor has shown a remarkable stick-to-it-iveness in finishing the work as soon as he has. Brennan was rendered some great assistance by Billy Troy, the gravel man.

Jack Falls, the young capitalist, says he is determined to erect the largest twelve story cotton building in the South within the next three months. Jack does not mince words, so all contractors in the line of reinforced concrete construction may well begin to sharpen their pencils and get ready when Jack says the word.

Incidentally, Jack Falls was the man who built the first reinforced concrete building in Memphis, the Kalleher Building, which has been a great source of convenience to all the building was constructed.

Tom Shields was in the city Friday and Saturday and feels good over his work on White River. Tom is a hustler all right and when he and Pat McCadden get together on a piece of work as they are now on, the levee begins to assume large proportions.

Billy Bickford, the hustling concrete contractor of this city, has taken a contract to rebuild the old Shelby County Court House. Billy has his forces already on the job and is beginning to demonstrate how much work he can do within a given length of time. Billy says he will have the work completed by January 1st.

Billy Troy was awarded the contract for graveling Clark's sub-division in this city and states that he will be ready to begin work within the next two weeks. The contract is quite a large one and Billy states that he will do all in his power to rush same to an early completion.

Contractors in this section are looking forward to Capt. Clarke S. Smith's announcement of the date he will let contract for 200,000 cu. yds. of enlargement levee work in the Lower Yazoo district. As exclusively announced in this paper last week, the work will be advertised within the near future, perhaps as soon as Capt. Smith returns from his vacation, and classes of small manufacturers, for which end there are a number of contractors ready to gobble up the work when the date comes.

General Superintendent S. S. Morris of the Yazoo & Mississippi Valley Railroad has returned to the city after an inspection trip with his assistant, J. R. Rison. While Jack Rison would give out no definite news as to the amount of new work his company was contemplating doing this fall, one could judge that something was on the carpet, and this was confirmed by the manner in which Supt. Morris evaded the question direct. Then, too, it was reported that Jake Baxter was nosing around these parts lately, and when Jake puts in an appearance, it always foreruns some good news in the construction line.

Bill Percy, of the Lake View Traction Co., states that his road has not been given a square deal by the city fathers and until his company feels that they can accept the charter granted them, they will not begin construction on the city lines. This will prove a source of disappointment to a number of city contractors who were figuring on taking a part of the work of grading through the city. However, Billy Hayden, the Chief Engineer of the company, is of the opinion that within a very few weeks all matters will be amicably arranged with the City Commissioners and that work will begin at once. In fact, says Hayden, he has already made surveys to Covington and Collerville, suburbs of Memphis, and unless the directors of the road were in earnest these surveys would have never been begun.

Chas. Hudson, the hardy little labor agent who conducts a place of business on the corner of Front and Poplar Sts., predicts a scarcity of labor in this territory during the coming fall when so many large contracts will be begun. Now is the time for labor agents to get busy and import Northern labor, for it really seems true that the local supply will not nearly come up to the demand.

Texas.

✤Board of Commissioners, Brazoria County Drainage District No. 4, Brazoria County, Texas, will receive at the office of the County Judge, Angleton, Texas, until October 4, bids for 646,786 cu. yds. of earth in the construction of canals, drains, ditches, and laterals in said district; clearing and grubbing 13.1 acres of land; clearing 16.6 acres of land. O. W. Willits is Chairman, E. G. Miller is Secretary, of the Board of Commissioners.

Washington.

The Klickitat & Simcoe Irrigation Co., organized about a year ago and capitalized at $250,000, has filed with the county auditor at North Yakima, Wash., plats which show that the company intends, with the waste waters of the upper Klickitat River, to water between 7,000 and 10,000 acres of land on the Yakima Indian reservation. The plat shows that the company is reserving a site for a reservoir on the Diamond fork of the Klickitat at the mouth of Coyote creek, and that it has provided for a waterway about 21 miles in length to the water course of Toppenish creek, which will carry the water to the reservation.

Canada.

The Canadian Government has a corps of three engineers and 12 assistants in the field making surveys for a new route for the Welland Canal. It is expected that a report will be ready for the forthcoming session of Parliament on the cost of the projected new route. No location has been fixed as yet, though several are in view. A rough estimate places the cost at $50,000,000. This would provide a 21-ft. waterway. In connection with this scheme it would also be necessary to deepen the St. Lawrence canals to make them correspond. If the new one were built, the present Welland Canal would be required for through traffic till those on the St. Lawrence were changed.

Mexico.

✤Bids will be received at once by LaCompania Agricola La Sautena, San Bernardo, No. 3, Mexico City, Mex., for the execution of all earth works required to open a canal with a length of about 63 miles including about 9,000,000 cu. yds. of earth.

MISCELLANEOUS CONSTRUCTIONS

California.

W. L. Porterfield, Long Beach, has made a proposition to the City Council of Long Beach for the construction by private capital of a 1,500 ft. pleasure pier at the foot of American Ave. The cost is estimated at $126,000.

The Los Angeles & Redondo Ry. Co., G. J. Kuhrts, Chief Engineer, Los Angeles, Cal., proposes to construct a 1,200 ft. concrete pier at Redondo Beach. The plans provide for a pier with berths for four vessels.

Plans have been completed by H. W. Metcalf, Architect, and Prof. L. A. Waterbury, of the University of Arizona, for a horseshoe pier at Long Beach. The plans provide for a double-decked structure entirely built of reinforced concrete, to cost $700,000 and to yield the city $62,000 annually in revenue. As proposed, the pier would extend out 2,000 ft. from American Ave., then to a point 200 ft. south of the outer end of the present pier, and thence to Pine Ave., either the old pier or a new one being used for that section of the structure.

The Bureau of Harbor Improvements, of Los Angeles, Cal., Homer Hamlin, City Engineer, has prepared plans and specifications for dredging a portion of the inner harbor directly in front of Wilmington. Plans and specifications have also been prepared for a wharf at the foot of Fries St., Wilmington, beginning at United States Station, No. 430, and extending along the established harbor line a distance of 330 ft. The proposed improvements are to be made with the $33,000 unexpended balance of the $100,000 bonds issued by Wilmington, prior to consolidation, for harbor improvements.

Nataniel Ellery, State Engineer, Sacramento, Cal., has been directed to close a break in the levee on Jersey Island on the San Joaquin River. The work will cost about $40,000.

The Calusa Sandstone Co., of San Francisco, Cal., has been awarded a contract in Oakland, Cal., for building a fountain at Lakeside Park. The fountain is to be built of the best grade of Georgia marble and when completed will cost $10,612. Bids were opened Aug. 25.

District of Columbia.

✤Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until 11 a. m., Sept. 17, for the railroad system extensions at the United States Navy Yard, Boston, Mass. W. M. Smith is Acting Chief of the Bureau.

✤Bids will be received until 11 a. m., Sept. 7, by E. Eveleth Winslow, Maj. U. S. Engineer, Honolulu, T. H., for furnishing 25,000 barrels of Portland cement.

✤Bids will be received until 2 p. m., Sept. 7, by Commissioners, District of Columbia, for furnishing underground signal and telephone cables for the electrical department of the District of Columbia.

✤Bids will be received by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., Sept. 20, for suction dredge lad-

Items marked thus ✤ indicate work now open for bids.

der, steel castings, steel discharge pipe, electric motors, punches and dies, electric cable, lumber, etc.

✣Bids will be received until noon, Nov. 8, by Beekman Winthrop, Acting Secretary Navy Department, U. S., Washington, D. C., for the construction of six torpedo boat destroyers Nos. 37-42.

Florida.

The following bids were received Aug. 24 by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for excavation work in Biscayne Bay: Southern Dredging Co., Mobile, Ala., 25 cts. per cu. yd., for removing sand and $2.44 per cu. yd. for rock; P. Sanford Ross Inc., Jersey City, N. J., 30 cts. for sand and $2.78 for rock. The work calls for the removal of rock and sand from the bottom of the bay, which is to be done for the purpose of widening and deeping the channel to some 18 ft. About $75,0000 is available.

Illinois.

✣Bids will be received by the Board of Trustees Sanitary District, Chicago, Ill., Room 1500 American Trust Building, until noon Sept. 7, for the installation of electrical equipment and for the construction of a tunnel and machine foundations in the city hall substation. J. J. Corcoran is Acting Clerk of the Board and Robert R. McCormick is President.

The Sanitary District of Chicago has entered into a contract with Sebastian Krug, Chicago, Ill., by which the latter agrees to remove 704,070 cu. ft. of stone blasted from the bed of the canal near the village of Lemont. Mr. Krug agrees to pay the district $88,008.75 for the old canal "spoilbank," which is 12½ cts. a cubic yard. He is allowed six years in which to remove the rock. Mr. Krug plans to install a rock crushing plant.

Indiana.

✣Bids will be received until 10 a. m., Sept. 9, by the Depot Quartermaster, Jeffersonville, Ind., for furnishing necessary quartermaster's supplies.

Kentucky.

The General Council of Louisville, Ky., on Sept. 6 took up the matter of making an appropriation for the purpose of putting under ground the wires of the city fire alarm system. The cost of making the necessary cables and installing them will be from $60,000 to $75,000. Edward Tierney is Chairman of the Board of Public Safety.

Louisiana.

✣U. S. Engineer, Lieut. Col. Lansing H. Beach, Custom House, New Orleans, La., will receive bids until 11 a. m., Sept. 9, for the construction of lock and dam and lock keeper's dwelling on Bayou Teche, La.

Maine.

✣Lieut. Col. George A. Zinn, U. S. Engineer, 537 Congress St., Portland, Me., will receive bids until noon Sept. 26 for the construction of a breakwater at Matinicus Harbor, Me.

✣Bids will be received by Lieut. George A. Zinn, U. S. Engineer, 537 Congress St., Portland, Me., for dredging in East Boothbay Harbor, Me.

The following bids were received by Lieut. Col. Geo. A. Zinn, Corps of Engineers, U. S. Army, at Portland, Me., for removing wrecks in Kennebec River: P. H. Doyen Co., Portland, Me., $2,900; Rowe Bros. Co., Richmond, Me., $1,787; Johnston & Virden, Lewes, Del., $3,306; Lewis W. Blix, Brooklyn, N. Y., $3,440; Brown & Bailey, New York, $6,700; Snow Marine Co., Rockland, Me., $2,195; F. W. Carlton, Bath, Me., $2,500.

The following bids were received by Lieut. Col. Geo. A. Zinn, Corps of Engineers, U. S. A., at Portland, Me., for placing stone in breakwater near Bar Harbor, Me., on Sept. 2: Rowe Brothers Co., Richmond, Me., $1.05 per ton; Sylvester I. Hill, Portland, Me., $1.08 per ton; P. H. Doyen Co., Portland, Me., 87 cts. per ton; E. S. Belden & Sons, Hartford, Conn., $1.03 per ton; S. A. Bailey, New York City, $2.93 per ton.

Maryland.

✣Bids will be received until 1 p. m., Sept. 29, by Col. Thomas L. Casey, U. S. Engineer, Room 309 Custom House, Baltimore, Md., for the dredging in Rockhall, Queenstown, Claiborne, Cambridge and Crisfield Harbors and Susquehanna, Elk, Chester, Warwick Choptank, and Manokin Rivers, Lower Thoroughfare, at or near Wenona, Deal Island and Tyaskin Creek, Md., Nanticoke River, Del.

Massachusetts.

✣Bids will be received by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., until noon, Sept. 26, for dredging in Hingham Harbor, Mass.

Michigan.

✣Co. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., will receive bids until 3 p. m., Sept. 26, for furnishing 9,000 tons of rock for the piers at St. Clair Flats Canal, Mich.

The following bids were received by Col. McD. Townsend, U. S. Engineer, Detroit, Mich., for constructing the upper section of the canal to be used in connection with the new Davis Lock at Sault Ste. Marie: MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., $688,105; Great Lakes Dredge & Dock Co., Chicago, $688,105; W. J. Newman Co., Chicago, $904,850; John Marsch, Chicago, $1,072,-867. The work includes excavation of a portion of the new navigation channel, building canal walls and piers, preparing a new head race and forebay with controlling works, ice passages and weir, removal of existing and building of new dikes and the furnishing of all the labor, plant and supplies. The section of the canal included in that portion of it west of the international bridge, to deep water, about 1,200 ft. in length, of which several hundred feet adjacent to the bridge is dry work, necessitating construction of a cofferdam and removal of water before the rock is taken out.

Minnesota.

✣Bids will be received until 11 a. m., Sept. 8, by Maj. D. W. Arnold, Chief Quartermaster, Department of Dakota, St. Paul, Minn., for furnishing hinges, iron lime, locks, etc.

The Commissioners of Aitkin, Crow Wing and Mille Lacs Counties have appointed a committee, of which Thos. Anderson is Chairman, to construct a concrete dam at the outlet of Mille Lacs so as to raise the water level 30 ins.

The Carnegie Coal, Dock & Fuel Co., Pittsburg, Pa., has purchased 80 acres of dock property on St. Louis Bay at Duluth immediately east of the Zenith furnace plant, on which it will construct a coal dock at an estimated cost of $750,000.

New York.

✣Bids will be received by F. A. McNeely, Secretary State Armory Commission, Albany, N. Y., for the installation and furnishing of a 3 H. P. direct connected hoisting apparatus to operate present freight elevator and a two horse power motor to operate lath and buffing wheel at the New York State Arsenal, 7th Ave. and 35th St., New York City.

✣Bids will be received until 11 a. m., Sept. 13, by George Cromwell, President of the Borough of Richmond, New York City, for furnishing and delivering broken stone at Stazle A. yard, Swan St., Tompkinsville, S. I., including about 1,000 tons of ¾ in. broken stone and at Stable B. Yard, Columbia St., west New Brighton, S. I., including 1,000 tons of ¾ in. broken stone.

✣Bids will be received until noon, Oct. 3, by William T. Rossell, U. S. Engineer, Room 802 Army Bldg., 39 Whitehall St., New York City, for dredging in Arthur Kill, N. Y., and N. J., Raritan Bay, Shrewsbury, River and Woodbridge Creek, N. J.

Work is to be started this month on the boring of a tunnel through rock 250 ft. beneath the bed of the East River from the Lawrence Point plant of the Consolidated Gas Co., in Astoria, L. I., New York city, to the gas holders at East 132nd St., The Bronx. The tunnel is the first step to be taken by the company in carrying out its plan of enlarging its Lawrence Point plant so that ultimately from that point will be distributed all of the gas used in New York, Westchester County and Long Island.

Oklahoma.

Steps are being taken at Muskogee, Okla., for the construction of an $800,000 dam and hydro-electric development on the Grand River about 60 miles north of Muskogee. At a recent meeting at Muskogee a committee composed of H. B. Spaulding, D. N. Fink, A. C. Trumbo, P. B. Hopkins, J. A. Markham and T. H. Martin, all of that city, was appointed to solicit subscriptions towards the building of the dam and to effect a temporary organization of the $300,000 stock company to undertake the work.

Oregon.

Petitions are being circulated at Portland, Ore., asking that an amendment to the City Charter be submitted to the voters Nov. 8, providing for the creation of a dock commission and the issuance of bonds in the sum of $2,500,000.

Pennsylvania.

✣Bids will be received until 10 a. m., Sept. 7, by Commanding Officer, Frankford Arsenal, Philadelphia, Pa., for furnishing under circular No. 23, 43,051 lbs. bar steel, 2.25 in. in diameter, 8 ft. lengths and 5,005 lbs. bar steel, 1.875 in. diameter, 8 ft. lengths.

✣Bids will be received until noon Oct. 1, by Maj. Herbert Kyne, U. S. Engineer, 815 Witherspoon Bldg., Philadelphia, Pa., for the dredging and dike construction in Delaware River between Philadelphia and Trenton.

✣Sealed bids will be received in duplicate until 1:30 p. m., Sept. 8, by Thomas Cassedy, Secretary, Central Poor District of Luzerne County 20 North Franklin St., Wilkesbarre, Pa., for drilling a bore hole on the premises of the Central Poor District at Retreat, Pa. Proposals will be for holes as follows: One for a 6-in. and other for an 8-in. bore hole, and to be based on the cost for a depth of 500 ft., with additional estimates for a further depth, up to 1,000 ft., the price to be named for each 100 ft. beyond 500 ft. casing always included. Owners will furnish steam power and water necessary, and will do all carting of machinery, etc.

The County Commissioners at Pittsburg are gathering data looking to the selection of a location for a proposed tunnel under Mt. Washington at Pittsburg. It is estimated that $1,000,000 will be expended on the tunnel.

Texas.

✣Bids will be received until noon, Sept. 27, by Maj. G. P. Howell, U. S. Engineer, for dredging channel from Arnasas Pass to Corpus Christi, Tex.

✣Bids will be received until Sept. 10, by Fred H. Gallup, Captain and Quartermaster, U. S. Army, Fort Sam Houston, Texas, for the furnishing of four electric desk fans.

A progress report on the Galveston causeway shows that on Aug. 30 the work was over half done. The contractors were then about ready to begin work on the arches which will be the main part of the big bridge. For the past two weeks or more the timber crew has been assembling and fitting the parts of the centers and these are now laid out on barges ready to go into place. As soon as one set is up connecting two of the foundation piers, then will come the work of pouring the concrete, which will be kept up night and day without interruption, until the set is finished. It will take from 30 to 60 days for the concrete to set and cure, when the forms will be removed and taken to another span of the bridge. The first actual work on the causeway was started on Sept. 17 when the first timbers of the first cofferdam for the initial pier were spiked together and sunk to the bed of the bay. The work up to this time has progressed remarkably fast. All of the 28 piers are in place, with the exception of two, and work on these is now going ahead. In that time also 8,500 concrete piling have been manufactured and have been driven and a large quantity of the filling material for the protected roadway has been put in place

Virginia.

Bids were received Aug. 29 by Lieut. Col. Mason M. Patrick, U. S. Engineer, Room 2, Custom House, Norfolk, Va., for dredging 63,000 cu. yds. in the Appomattox River, Va., and the contract was awarded to W. H. French of Norfolk for 17¼ cts. per cu. yd.

Washington.

The Chicago, Milwaukee & Puget Sound Ry. is planning extensive improvements for Piers 6 and 6½ at Seattle, Wash.

Wisconsin.

Crandon, Wis., has awarded a contract to Longstad Meyer Construction Co. for the construction and installation of a complete electric plant for $12,500. Bids were opened Aug. 30.

The following bids were received Sept. 1 by Chas. S. Bromwell, Major, Corps of Engineers, at Milwaukee, Wis., for dredging at Port Washington Harbor, Wis.: Great Lakes Dredge & Dock Co., Chicago, Ill., (1) dredging about 70,000 cu. yds., 19 cts. per cu. yd., (2) dredging about 26,000 cu. yds., 36 cts. per cu. yd., total $22,660; Adolph F. Bues, Milwaukee, Wis., (1) 17½ cts. per cu. yd., (2) 34¾ cts. per cu. yd., total, $21,285; Greiling Bros. Co., Green Bay, Wis., (1) 18 cts. per cu. yd., (2) 50 cts. per cu. yd., total, $25,600.

Canada.

The Canadian Department of Public Works, Ottawa, is preparing a special report on the storage of waters on the upper Ottawa River by means of dams at Kippewa and Temiskaming. It will show the general effect of such work in the regulation of the flow of the river, the intention being to conserve high water for seasons of the year when the river is low. An important feature of the report, however, will emphasize the claim that the works in progress and those to be undertaken will be of greater utility when the Georgian Bay canal is constructed. This consideration enters largely into the plans.

The City of Portagela Prairie, Man., is to expend $10,000 for repairing its dam on the Assiniboine River.

✣Bids will be received by Commissioner of the Transcontinental Railway, P. E. Ryan Secy., Ottawa, Ont., until noon, Sept. 14, for one air, steam, water and oil piping system; two pipe tunnel and wiring ducts required in connection with the Transcontinental Railway shops east of Winnipeg.

✣Bids will be received by P. E. Ryan, Secy. Commissioners of Transcontinental Railway, Ottawa, Ont., until noon, Sept. 14, for the furnishing of rails and rail fastenings as follows: 7,543 gross tons of 80-lb. steel rails and for the necessary rail fastenings delivered f. o. b. cars at Cochrane, Ont., on or before Oct. 1.

✣Bids will be received by R. C. Desrochers, Secy. Department of Public Works, Ottawa, Ont., until 4 p. m., Sept. 28, for the construction of a wharf and two retaining walls at the city of Hamilton County, Wentworth, Ont.

✣Bids will be received until noon, Oct. 31, by Alexander Johnston, Deputy Minister of Marine and Fisheries, Department of Marine and Fisheries, Ottawa, Can., for the construction of a twin screw steel lighthouse and buoy steamer for the Pacific Coast to be delivered at Victoria, B. C. Dimensions as follows: Length between perpendiculars, 200 ft., breadth 38 ft., depth 17 ft. 6 in., draft 11 ft. 6 in. She is to be capable of 12 knots per hour.

Mexico.

S. Pearson & Son, Ltd., City of Mexico, have been awarded a contract by the Mexican Government for dredging and deepening the harbor at Guaymas. The harbor is to be deepened so that vessels of large tonnage can enter and discharge cargoes at the docks. A part of the land on one side of the bay is to be reclaimed, which the company is to receive in addition to $3,500,000 gold for its work.

BRIDGES AND BUILDINGS

California.

✣Board of Supervisors of Santa Clara County, Cal., San Jose, Cal., will receive bids until 11 a. m., Sept. 19, for the construction of a reinforced concrete bridge and fill at Campbell Creek on the Saratoga and Mountain View Road. Henry A. Pfister is Clerk.

The following bids were received by the Board of County Supervisors, Fresno, Cal., for the construction of the proposed bridge across Kings River at the site on Section 8-13-24: Hyde, Harjes & Co., San Francisco, $40,478; Burrell Bridge and Construction Co., Oakland, $39,997; Cotton Bros.' Co., Oakland, $39,943; Mervy-Elwell Co., Oakland, $38,897; Healy Tibbitts Construction Co., San Francisco, $38,646; Thomson Bridge Co., San Francisco, $38,247; Pacific Construction Co., San Francisco, $35,963.

Residents in the vicinity of Fall River, Cal., have petitioned the Board of County Supervisors at Sacramento, Cal., for the construction of a new bridge over Fall River at Fall River Mills. The work will be delayed until next spring, it is thought, as the old structure will be repaired this fall.

The Western Pacific R. R. Co. has awarded the contract for the construction of the steel frame for its new shops near Sacramento, Cal., to C. A. Blume Construction Co. The Ransome Construction Co. now has work under way on brick foundations.

The Highway Commission, San Diego, Cal., has decided in connection with the construction of the Coast Road known as Route No. 2 of the County boulevard system, to build a number of bridges as follows: Over the Santa Margarita river, 450 ft. long, two 100-ft. trusses, the remainder to be of piling; La Flores river, 135 ft. long, two piles of 17 ft. each, and one truss of 100 ft. with two feet of vents; San Onofre creek, 133 ft. long, both trusses and piling; South branch of San Mateo creek, 17 ft. of trestle piling; San Onofre creek proper, 300 ft. long, two 100-ft. trusses and the remainder to be trestles on piling.

Advices from Hayward, Cal., state that the contract for the construction of additional width to the bridge across the San Lorenzo Creek has been let to T. B. Russell for $6,585.

The Escondido Construction Co. has submitted a bid of $8,870 for the construction of the bridge over the Bernardo River at Bernardo, Cal. Other bidders are Merced Bridge Co., $8,562; Standard Iron Co., $10,370; Wright & Hyde, $9,650.

Colorado.

A special meeting of the City Council of Pueblo, Colo., has been held to consider the plans of the Pueblo Bridge Co., for the construction of the proposed bridge over the Arkansas River on Union Ave. Work will be commenced on the structure soon, as the contract under which the funds were acquired requires the construction of the bridge in a 12-month period, part of which is now gone.

District of Columbia.

✣Bids will be received until Sept. 29, by R. G. Valentine, Commissioner of Indian Affairs, Department of Interior, Washington, D. C., for the necessary labor and materials for the construction of day school plant at Bishop Day School, Cal.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Oct. 10, for the marquise over the main entrance of the Post Office, Court House and Custom House, Superior, Wis.

The Upton Smoot Construction Co. has been awarded a contract for the building of an addition to the garage at Medical School Hospital, Washington, D. C., for $1,950. Bids were opened Aug. 20.

Florida.

Advices from West Palm Beach, Fla., state that a company has been formed with a capital stock of $30,000 for the purpose of constructing a draw bridge over Lake Worth. H. O. Geer, who is promoting the project, states that the structure will run from Lake View Ave. in Phillips Point to Rayol Palm Ave. in the Royal Palm addition on the east side of the lake. It will be twenty ft. in width, and will have a draw of 150 ft. The bridge will be about five ft. higher than the present bridge over Lake Worth, which will enable all boats except those carrying masts, to go under without opening the draw. The draw will be operated by mechanical means. The approaches at each end of the bridge will be of permanent construction. Concrete walls will be made, and these filled in with dirt, and each of the approaches will extend into the lake 200 ft., the same width as the streets of which they are a continuation.

Georgia.

The entire bond issue of $100,000 for the construction of a new bridge across the river at Dillingham St. has been sold to southern people. Among the purchasers are W. E. Bush, of Augusta, Ga., 86 of the $1,000 bonds at $1,001.36; Mrs. Mildred Turner, Oswichee, Ala., $9,000 at $1,005, and L. J. Render, of La Grange, bought $5,000 at $1,020.

Illinois.

The Cleveland, Cincinnati, Chicago & St. Louis R. R. has awarded the contract to A. J. Yauger, Pekin, Ill., for the construction of a new bridge at a point west of Downs over the Kickapoo Creek. The old trestle work bridge at that point, which is 400 ft. long, will be torn down entirely and almost three-fourths of that length filled in with solid earth. The bridge is to be replaced by four massive concrete arches. The three at the west side being of 20-ft. span, the west one to carry the usual water of the creek and the other two to take any possible flood that might occur. The fourth arch at the east side will be of 20-ft. span for a wagon roadway to pass beneath the tracks. This is a $30,000 contract and all the work is to be completed about Dec. 1.

The Great Lakes Dredge & Dock Co., which has the contract for the construction of the new $120,000 Chicago & Western Indiana R. R. bridge over the Calumet River at 124th St., Chicago, Ill., has started work on the structure. The old bridge will remain intact until the completion of the new one.

The Board of Local Improvements have instructed Ira G. Hedrick, Bridge Engineer, Kansas City, Mo., to prepare plans for the construction of a low structure at Peoria, Ill. The new bridge will be connected with the old bascule now standing and the old approaches will be used. This change was made necessary on account of the railroads contributing $25,000 each instead of $35,000 for the construction of the necessary $70,000 approach to a high structure.

The Board of Local Improvements of Bloomington, Ill., have decided to take steps for the construction of a bridge over Sugar Creek on North Clinton St., between the properties owned by S. R. White and J. P. Walker. The structure as proposed is estimated to cost $3,700, of which the B. & N. Ry. and the owners of the abutting property will pay a part.

The Joliet Bridge Co., Joliet, Ill., has been awarded the contract for the construction of the bridge over Little Bureau Creek near the Corey Farm, Kasbeer, Ill., by the County Commissioners at Princeton, Ill.

Representatives of the Fifth, Thirtieth and Thirty-first Wards are urging the Chicago Railway officials and the Sanitary District Trustees to take definite action on the reconstruction of the bridge in Kedzie Ave., crossing the drainage canal, in Chicago, Ill.

Following bids were opened by B. J. Mullaney, Commissioner of Public Works, Chicago, Ill., for the repairs to the abutments, center pier protection and approaches of the 106th St. bridge over the Calumet River: Great Lakes Dock & Dredging Co., 138 Washington St., Chicago; removing west abutment, center pier protection, filling, excavating, etc., $1,265; oak, 25,000 B. M., $1,975; yellow pine, 15,000 B. M., $1,035; white pine, 35,000 B. M., $2,065; oak piles, delivered, 17,000 ft., $3,060; piles, driven, 1,650 lin. ft., $1,897; chains for pile clumps, structural steel, 6,000 lbs., $300; dredging, 5,000 cu. yds., $1,400; total $12,997. The Fitz Simons & Connell Co., 131 LaSalle St., Chciago, removing west abutment, center pier protection, filling, excavating, etc., $1,500; oak, $25,000 B. M., $2,125; yellow pine, 15,000 B. M., $1,125; white pine, 35,000 B. M., $2,275; oak piles, delivered, 17,000 lin. ft., $3,400; pile, driven, 16,500 lin. ft., $1,980; chains for clumps, structural steel, 6,000 lbs., $270; dredging, 5,000 cu. yds., $1,500; total, $14,175.

Following bids were received by B. J. Mullaney, Commissioner of Public Works, Chicago Ill., for the repairing, lengthening and reconstructing the draw span of the 106th St., bridge over the Calumet River: Roemheld Construction Co., 171 LaSalle St., Chicago, (1) lengthening and reconstructing draw span, etc., $8,625; (2) additional structural steel, 2,000 lbs., $140; (3) additional steel castings, 2,000 lbs., $240; total, $9,005. The Kettler-Elliott Erection Co., (1) $9,812; (2) $80; (3) $220; total, $10,112. Gandele Bros. & Co., (1) $10,500; (2) $150· (3) $340; total, $10,990. Geo. W. Jackson Co., Inc., 756 W. Jackson Blvd., Chicago, (1) $11,390; (2) $100; (3) $400; total, $11,890. John J. Gallery, 138 Washington St., Chicago, (1) $12,500; (2) $180; (3) $200; total, $12,880; Strobel Steel Construction Co., 98 Jackson Blvd., Chicago, (1) $13,300; (2) $100; (3) $240; total, $13,640.

Indiana.

✣Bids will be received until 10 a. m., Sept. 12, by L. D. Cabell, Assistant Depot Quartermaster Jeffersonville, Ind., for repairs at the Knoxville National Cemetery: (1) repairs to old stone bridge; (2) painting of all repairs thereto; (3) repairs to outbuildings; (4) concrete construction on cemetery grounds; (5) furnishing 50 cu. yds. of soil.

The commissioners of Marion County, Indianapolis, Ind., have awarded the following contracts for the construction of culverts throughout the county: Chas. Hoover, two concrete steel culverts in Decatur township for $1,085; Volpp & Foitz, one culvert in Center township for $840; A. W. Moore Co., one culvert in Pike township for $872; Chas. Hoover,one culvert in Lawrence township for $580; one culvert in Lawrence township for $510; one culvert in Lawrence township for $535; one culvert in Lawrence township for $550. Bids for this work were opened Aug. 25 and awarded Aug. 27.

✣Trustees of Eagle Township will receive bids until noon, Sept. 22, at the office of Layton Allen, 44 Lombard Bldg., Indianapolis, Ind., for the construction of 8-room school house at Zionsville and repairing old building at same place. H. H. Avery is Trustee.

Iowa.

The City Council of Fort Dodge, Iowa, has awarded the contract for the construction of the 3d St. viaduct to the Indiana Bridge Co., at $57,332. Eleven firms submitted proposals.

Kansas.

The Leavenworth Bridge Co., of Leavenworth, Kan., has been awarded a contract by the county commissioners of Waubaunsee County, Alma, Kan., for the construction of a bridge across the Kaw River for $15,700. Bids were opened Aug. 29.

Harvey and Sedgwick Counties, according to advices from Newton, Kan., will join in the construction of a 60-ft. concrete bridge on the line south of section 36, Sedgwick township to replace the old wooden structure.

Louisiana.

✣Bids will be received until noon, Sept. 14, by Board of County Commissioners for the alterations and additions to the 2-story brick courthouse at Thibodaux, La. Favrot & Livaudais, Ltd., 839 Gravier St., New Orleans, La., are architects.

The Budget Committee of the New Orleans City Council have reported favorably on the Frawley ordinance based on a report of Acting City Engineer Willis, appropriating $14,000 out of the budget of 1919 for the immediate renovation of the Hagan Ave. bridge over the New Basin Canal. Plans for the work have been prepared and bids for the same will soon be advertised.

Massachusetts.

Geo. T. Rendle, of 28 School St., Boston, Mass., at $9,972, was the lowest bidder for repairing Broadway Bridge in South Boston. Bids were opened Sept. 1.

Michigan.

Plans have been decided upon by the City Council for the construction of the proposed concrete bridges at Gull and Mill St. over the Kalamazoo River in Kalamazoo, Mich. Each bridge will be 200 ft. long, consisting of three spans. The Mill St. bridge will have a 24 ft. roadway and no sidewalk, while the Gull St. structure will have a roadway 31 ft. wide and 6-ft. sidewalk.

Minnesota.

At the next meeting of the West End Hillside Improvement Club, Duluth, Minn., ways and means will be discussed to secure the replacement of the bridge over Miller's Creek at 13th St., which was washed out 15 years ago.

Owing to the great expense in connection with the construction of such a bridge as is proposed by the Park Board, Minneapolis, Minn., over the canal between Lake Calhoun and Lake of Isles in Minneapolis, Minn., the Chicago, Milwaukee & St. Paul has suggested as a substitute a concrete bridge estimated to cost $14,000, which is $9,000 below the estimate of the other structure proposed. W. F. Decker and W. P. Cowles, the latter engineer of the Park Board, have decided to inspect similar bridges at Evanston, Ill.

Missouri.

The county commissioners of Nodaway County, Mo., have awarded a contract for the construction of 28 bridges and 11 steel culverts in different townships of the county to H. H. Sparks, of Omaha, Neb., for $9,563. Bids were opened Aug. 18.

The contract was awarded by the City Council of Hannibal, Mo., to Hueston & Bland, at $2,958 for the construction of the two concrete abutments for 3d St. bridge.

Montana.

✣Bids will be received at the office of the Granite County Clerk, Philipsburg, Mont., until 4 p. m., Sept. 13, for the construction of a combination wagon bridge across the Hell Gate River at Nimrod, Mont. The structure will be of Oregon fir with 16-ft. roadway, floored with 4-in. native fir plank. The cost will be borne equally by Missoula and Granite Counties.

Nebraska.

Five spans of the St. Joseph & Grand Island R. R. bridge over the Platte River north of Grand Island, Neb., have been destroyed by fire and immediate steps will be taken toward the reconstruction of the same.

A movement has been started in Ravenna, Neb., looking to the construction of a bridge across Beaver Creek, a half mile west of that place.

New Jersey.

Plans have been approved by Secretary Dickenson of the United States War Department for the construction of a $60,000 Scherzer rolling lift bridge which is to span Grea Channel in front of the Stone Harbor Yacht Club, Stone Harbor, N. J. Material for the structure has already been ordered and work on the bridge, which will be 1,100 ft. in length, will be done under the supervision of the company's engineers.

New York.

✣Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until 11 a. m., Sept. 24, for the construction of a mortuary at the naval hospital, Brooklyn, N. Y. W. M. Smith is Acting Chief of the Bureau.

✣Bids will be received until noon, Sept. 8, by B. F. Cresson, Jr., Deputy and Acting Commissioner of Docks, Pier A, foot of Batter place, North River, Manhattan, New York City, for furnishing all the labor and materials required for reconstructing and repairing the ferry structures at the foot of Broadway, East River, Borough of Brooklyn.

✣Bids will be received until 11 a. m., Sept. 9, by Alfred E. Steers, President of the Borough of Brooklyn. City of New York, for furnishing all the necessary labor and materials for the alterations and repairs to basement of building 327 Schermerhorn St., borough of Brooklyn (Department of Public Charities), to fit up same for the Domestic Relations court.

✣Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., October 12, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Malone, N. Y.

Board of Contract and Supply, Rochester, N. Y., has awarded the contract to Whitmore, Rauber & Vicinus, at $10,572 for the construction of a reinforced concrete bridge over Red Creek at Westfall Road, near the southern limit of Genesee Valley Park. The new bridge will take the place of an old frame structure.

According to information received recently from Niagara Falls, N. Y., plans have been submitted to the Grade Crossing Commission for the construction of the approaches to the proposed new bridge over the tracks of the New York Central R. R. at 11th St., from North to Grove Ave.

Superintendent of Public Works F. C. Stevens, Albany, N. Y., has awarded the contract No. 79 (Barge Canal) to Lupfer & Remick, 590 Ellicott Sq., Buffalo, N. Y., at $37,480.

Town Boards of Fenton and Chenango, N. Y., have awarded the contract for the construction of the steel and iron highway bridge between the two cities to the Climax Road Machine Co., Marathon, at $17,543. Bids received are as follows: United Construction Company, Albany, sub-structure and steel superstructure, with high trusses, $18,578; Owego Bridge Company, sub and super-structure, with floor, $18,450, without floor, paving, etc., $17,400; Climax Road Machine Company of Marathon, steel superstructure, 382 ft. in length, with floor, $13,920; sub and superstructure, $17,543; Owego Concrete Company, concrete arch bridge, $19,000.

The Board of Public Works, Oneida, N. Y., has taken up the matter of constructing a new lift bridge over the feeder at Sherman St. The Common Council has already acted favorably on the proposition.

Ohio.

✣The Board of County Commissioners, Cuyahoga County, at Cleveland, Ohio, will receive bids until 11 a. m., Sept. 10, for furnishing necessary labor and material for the repair of Lorain road on Rocky River bridge approach and at Kamms Corner, Rockport. J. F. Goldenbogen is Clerk of the Commissioners.

✣The Board of County Commissioners, Cincinnati, Ohio, will receive bids until noon, Sept. 16, for the construction under Specifications No. 103, a concrete bridge over Toad Creek, near the Colerain Pike on the River road in Colerain township. Fred Dreihs is Clerk and Stanley Struble is President of the Board.

Archer & Day, of Bellaire, Ohio, has been awarded a contract for the construction of a bridge over Steep Run in St. Clairsville, Ohio, for $7.70 per cu. yd. Bids were opened Aug. 29th.

At a joint session of the Boards of Commissioners of Knox and Licking Counties at Mt. Vernon, Ohio, the following bids were received for the super and substructure of the joint Knox-Licking County bridge, known as the Mitchell bridge, 1½ miles west of Lock, Milford township, for the superstructure the Mt. Vernon Bridge Company presented a bid for $4,000. The Capital Construction Company of Columbus bid $4,195. The Illinois Bridge Company presented plans and bids for a concrete bridge, there being three bids—one for a 90-ft. span concrete arch for $3,997, one for a 95-ft. span concrete arch for $4,386 and one for two 50-ft. spans for $4,387. The bids on the substructure were as follows: P. M. Barnes piling 40 cents per lin. ft.; concrete $6.34 per cubic yard; Payne & White piling 50 cents per lin. ft.; concrete $5.48 per cu. yd.

A proposition is being agitated by a member of the City Council to circulate a petition to secure an election to vote on the question of issuing bonds amounting to $1,000,000 to provide funds for the construction of the proposed high level bridge from Clark Ave. S. E., to Clark Ave. S. W., Cleveland, Ohio, cost of which is estimated at $900,000.

The Chicago, Lake Shore & Michigan Southern R. R. has decied to construct a bascule lift bridge at Ashtabula, O., at the Shipyard site. Work, it is planned, will be completed by March, 1911.

Contracts for the construction of several bridges in the northern part of Belmont County have been awarded at St. Clairsville, O., to contractors as follows: L. C. Rothermund was given the five following contracts: The forks of the road bridge, the Jones bridge, the Frazier bridge, the Walcot No. 1 and northeast walls, and the coal bank wall on Sloan's run. Robert McMillen was awarded the following: he Cunningham wall, log cabin wall and Berkles run bridge. Archer & Day were awarded the contract for the Cash bridge. Stone and concrete will be used in all these bridges.

The Mt. Vernon Bridge Co. was awarded the contract for the construction of the Sixth Ave. bridge and the Beadle bridge across Fetler's run, the first being 60 ft. long and 28 ft. wide and the latter 54 ft. long and 14 ft. wide. The bids received were as follows: Sixth Ave., superstructure, Oregonia Bridge Co., $2,893; Beadle superstructure, $1,527. Reichelderfer Bros., Beadle bridge, $1,510. Carolina Eng. Co., Sixth Ave., $2,857; Beadle, $1,570. Capitol Construction Co., Sixth Ave., $2,810; Beadle, $1,545. York Bridge Co., Sixth Ave., $2,850; Beadle, $1,507. Mt. Vernon Bridge Co., Sixth Ave., $2,723; Beadle, $1,487.

The Commissioners of Huron County, O., have awarded the contract for the construction of Marsh Run bridge in Celeryville, the estimated cost of which was $1,300, to the Modern Construction Co., Fremont, O., for $1,249. Bids were received as follows for the Kellogg bridge, the estimated cost of which was $1,900; Riley Pardo, Monroeville, $1,900; Truett & Rikeman, Milan, $2,187.50; R. A. Booth, Sandusky, $1,815.10; I. M. Kooker, Fitchville, $2,175. For the Hindley bridge, the estimated cost of which was $838.73; Riley Pardo, Monroeville, $804.40; Truett & Rikeman, Milan, $1,024.20; R. A. Booth, Sandusky, $859.10; I. N. Kooken, Fitchville, $866.50.

Oklahoma.

✣Board of County Commissioners, Pawnee, Okla., will receive bids until 6 p. m., Sept. 19, for the necessary labor and material for the following: Bridge over Camp Creek on the one-sixteenth line running east and west through the south ¼ of section 25-21-4 E. I. M. Material for said bridge to be steel. Also bridge on the section line over Hell Roaring Creek between sections 10 and 15-21-6 E I M. Bids will be accepted for stone piers with steel structure, also for stone arch. Also bridge over Ranch Creek between sections 19 and 30-21-7 E. I. M. Bids will be received for stone piers with steel superstructure, also with tubular piers with steel superstructure. Also bridge on section line over Kinney Creek between sections 25 and 36 E. I. M. Bids will be received for stone piers only. Also one steel structure on Cimarron River in the west one-half of section 31-20-10 E. I. M. Bids will be received for one steel span 180 ft. with tubular piers. Frank Shoemaker is County Clerk.

Pennsylvania.

✣Bids will be received until Sept. 8 by the County Commissioners at Uniontown, Pa., for the construction of a bridge over Georges Creek in Nicholson and Springhill townships.

✣Bids will be received by the Commissioner of Beaver County at Beaver, Pa., until 10 a. m., Sept. 13, for the construction of a concrete bridge over Crow's Run near Wallace City in New Sewickley township.

✣Bids will be received until noon, Sept. 12, by R. J. Cunningham, County Controller, Pittsburg, Pa., for repairing the floors of the following county bridges, viz.: 1 and 2, Campbell's Run, S. S.; 4, 5, 6, 9, 10, 14, 15 and 17, Chartiers Creek; 2 and 12, Deer Creek; 3 and 4, Deer Creek Little· 1, Kellys Run; 3, 4, 5 and 6, Killibuck Run; 2, Long Run; 4, Lowries Run; 1, Pangburn Run; 4, Peters Creek; 2, 7 and 8, Pine Creek; 2, Plum Creek; 2, Popeto Creek; 1, 2 and 3, Robinsons Run, north branch; 3, Robinson's Run, south branch; 1, Sandy Creek; 2 and 3, Sewickley Creek Little; 1, Sewickley Creek Little, south branch; 5, Turtle Creek, and repairing masonry bridge No. 1, Cow Run. Bids shall be by the lump sum for each bid complete, shall be accompanied by a bond in the amount of the bid, of a surety company approved by the Common Pleas Courts of Allegheny County. The right to reject any or all bids is reserved. Specifications can be seen and blanks for bidding obtained at the office of the county engineer, room 308 courthouse.

✣Bids will be received until noon, Sept. 15, by the County Controller, Pittsburg, Pa., for installing feeder system for electric lighting of buildings at Allegheny County Home, Woodville, Pa. R. J. Cunningham is County Controller.

✣Bids will be re received by R. J. Cunningham, County Controller, Pittsburg, Pa., until noon, Sept. 15, for the installation of a low pressure steam supply and return mains and connections at Allegheny County Home, Woodville, Pa.

✣Board of Commissioners, Lehigh County, at Allentown, Pa., will receive bids until 10 a. m., Sept. 12, for furnishing all labor and material for the construction of the super and substructure of a two-span concrete encased steel girder bridge over the Ontelaunee Creek, Lynn Township, near Wanamaker. Pa. J. S. Troxell is Clerk.

J. S. McIlvaine & Co., of Chambersburg, Pa., have been awarded a contract for the construction of a new steel bridge over Mahanoy Creek on South Third St. in the borough of Ashland for $2,480. Bids were opened Aug. 29.

The County Commissioners at Hollidaysburg., Pa., will at once take steps toward the construction of a new bridge to replace the old structure which was recently destroyed by a traction engine. A concrete structure is under consideration.

Plans have been completed by the Survey Bureau, Philadelphia, Pa., for the widening of the Chestnut St. Bridge. Instead of a 26-ft. cartway and 6-ft. sidewalks, the cartway will be increased to 36 ft., making it possible for teams to use the bridge both ways without the necessity for using the car tracks, and the walks will each be 8½ ft. wide. This will relieve the congestion that for years has been a source of annoyance and a handicap to West Philadelphia.

The Board of County Commissioners, at Ebensburg, Pa., have awarded the contract to William Schmidt, Johnstown, Pa., at $1,800, for the construction of a bridge over the South Fork Creek near Lovett. Other bidders were J. A. Lord, Hastings, $1,950, and the Fetterman Engineering Co., Johnstown, Pa., $2,090. The only bid received by the Commissioners for the construction of the bridge in Carroll township at Eckenrode's Mills was that of J. Ashley Lord, $2,200.

The County Commissioners at Butler, Pa., have awarded the contracts for the following: Superstructure of the New West St. bridge, Penn Bridge Co., Beaver Falls, at $5,942; substructure of concrete to I. T. Heaven, Mount Chestnut, at $6.17 per cu. yd.; superstructure of the Kearns bridge in North Butler to the American Bridge Co., at $2,915; substructure to J. D. Fleming, Millerstown, for $5.94 per cu. yd.

The contract has been awarded Williams & Co., Pottsville, by the Reading Ry. Co., for the construction of concrete arches to replace the wooden truss bridge over the Schuylkill River at Mill Creek Junction near Pottsville.

Commissioners of Montgomery County, Pa., have awarded the contract for the construction of a bridge at Pottstown to Willauer & Co., Pottstown, for $4,774. A contract for the construction of a bridge in Marlborough was awarded James Smith, Green Lane, at $2,992. Other bids were as follows: For the High Street structure—William Hallman, $5,223; $1 cubic yard for excavation; $4.90 for masonry. John H. Rush, $4,998; 50 cts. cubic yard for excavation; $6 for masonry. Missimer & Wohl, $5,203.20; 50 cts. for excavation; $5 for masonry. Shull Construction Co., $6,740; 85 cts. cubic yard for excavation; $6.75 for masonry. Massillon Bridge Co., $5,380; 60 cts. cubic yard for excavation; $6 for masonry. James M. Smith, $5,749; $5.40 for masonry. For Swamp Bridge—William Hallman, $3,982.51; 75 cts. cubic yard for excavation: $5 for masonry. Massillon Bridge Company, $3,740; 75 cts. cubic yard for excavation; $6.25 for masonry. James M. Smith, $2,992; $4.90 for masonry.

Bids for the new College Ave. bridge in York, Pa., were received in sections as follows: A and B means the retaining wall and filling in from Oak Lane, at the eastern end of the structure, to the Northern Central railway, where it is proposed the first concrete arch will begin. The section from Oak Lane to the east bank of the Codorus Creek, including the proposed concrete arch across the railroad tracks, is known as "A, B and C." The remainder of the bridge is known as "C and D." The bids were: Drury Construction Co., B and C, $68,000; A, B and C. $72,950; A B, C and D, $85,450; Zero Concrete Co., B and C., $65,000; A, B and C, $69,800; A, B, C and D, $82,300. Bids were received as follows for the improvement of the old College Ave. bridge by encasing it in concrete: Nelson & Meredith Co., $31,985; Hartley, Ziegler Co., $23,278.

Engineers of the Philadelphia & Reading R. R. Co. are now preparing plans for the construction of the new steel bridge over the Schuylkill River at Mill Creek Junction, near Port Carvon Station, Pa. The structure will also extend over the lower road to Pottsville as does the present structure.

Tennessee.

The Nashville Bridge Co., according to advices from Waverly, Tenn., has the contract for the construction of a steel bridge over the Duck River at Link Ford at $18,500. Material is now being hauled to the scene of construction.

Texas.

✣Bids will be received until October 1, by H. H. Simmons, General Manager, El Paso & Southwestern R. R. Co., of Texas, at El Paso, Tex., for the enlarging of the company's El Paso freight house.

The contract for the construction of the Travis St. bridge in San Antonio, Texas., has been awaded by the city council to the Leversledge Bridge Co., Fort Worth, Tex., at $14,800. The structure will be of reinforced concrete and the city will pave it from its own plant.

The City Council of San Antonio, Texas, has granted the Galveston, Harrisburg & San

Antonio Ry. Co. an extension of 60 days to the time in which to complete the Hays St. viaduct.

Advices from Dalhart, Texas., state that plans have been made for the construction of a $10,000 bridge and dam over the Rita Blanco Canyon leading into Dalhart from Hartley County, connecting with Denrock Ave., making a 20 ft. deep lake several miles in length.

The County Commissioners at Gonzales, Texas, are preparing to advertise for bids for the construction of a steel bridge near Dreyer and Hamon to cost $6,000.

Commissioners of DeWitt and Goliad Counties, Texas, have awarded the contract for the construction of the county line bridge over the Fifteen Mile Coletto to M. S. Hasie, Jr., Dallas, Texas, for $5,798. The structure according to the terms of the contract must be completed by May 1, 1911.

Washington.

Chas. F. Burgeson of Tacoma, Wash., has been awarded a contract by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of pile trestle bridge across the Carbon River for $3,200. The work includes furnishing material and construction. Bids were opened Aug. 13.

The Board of County Commissioners, according to advices from Malott, Wash., has awarded the following contracts: Combination steel and timber bridge over the Okanogan River at Omak, William Oliver Bridge Co., Spokane, Wash., $12,470; a combination steel and timber bridge over the same river at Tonasket to the Hennepin Bridge Co., Minneapolis, Minn., at $6,288; combination wood and steel bridge across the Methow River at Winthrop to the William Oliver Bridge Co., Spokane, Wash., at $4,920.

Canada.

✣Bids will be received until noon, Sept. 14, by the Transcontinental Railroad Commission. P. E. Ryan, Secy., Ottawa, Ont., for wiring system required in connection with the locomotive shops of the National Continental Railway east of Winnipeg, Man.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received by Robert Tait, City Treasurer, Montgomery, Ala., until noon, September 19, for the paving of the roadway of Madison Ave., from the west side of Bainbridge St. to the city limits, with brick, asphalt, bitulithic Blome, granotoid block, mineral rubber, wood block, Hassam granite block or Hassam's compressed concrete pavement.

The Board of Revenue of Birmingham, Ala., is advertising for bids for road improvements to be made with the $12,500 road fund which was awarded the county by the decision rendered in the road and bridge tax suit between Birmingham and Jefferson County. The fund is to be expended as follows: Pool's Ford road, Shades mountain, $2,000; water works hill road, $1,540; Brookside and Mineral Springs road, $2,000; Johns road, $4,000; Lewisburg and Walker Chapel highway, $1,000: Short Creek hill road, $1,250; Shoal Creek hill road, $1,000. The improvements to be made to the majority of these roads are only on stretches of one or two miles, the greater part of the work consisting of grading.

Arizona.

The Board of Supervisors of Prescott, Ariz., has been petitioned to construct a new wagon road over an alleged easy grade from Prescott to Walnut Grove, a distance of 40 miles. The estimated cost of the road is $7,500

California.

Greenwell & Donlon have been awarded a contract by the County Commissioners at Santa Barbara, Cal., for the construction of a road in Road District No. 4, in the Fifth Township, for $2,750.

An auto club has been organized at Woodland, Cal., with the following officers: W. H. Gregory, pres.; J. D. Musgrove, secy; and L. H. Stephens, treas. The organization has been perfected for the purpose of promoting the construction of state or inter-county roads.

Advices from Fresno, Cal., state that efforts are being made to improve the Silver Creek road on the west side to the Arnold Oil district as far as the San Benito County line. A route south of the present road has been proposed. The estimated cost of improving the road is $15,000.

Colorado.

The State Highway Commission of Colorado has made the following appropriations for the construction of roads: To Mesa County, for the road from DeBeque to Palisade, $2,500; to Prowers County, $1,000; to Montrose County, $1,500; to Archuleta County, $1,000.

Idaho.

C. H. Helmer has been awarded a contract for the construction of about 12,500 lin. ft. of cement sidewalks at Burley, Ida., for $1.85 per lin. ft. for 12 ft. walk and curb, and $.14 per sq. ft. for 5 ft. and 6 ft. walks. Bids were opened Aug. 24.

Illinois.

✣Bids will be received until 11 a. m., Sept. 13, by the Board of Local Improvements, 302 City Hall, Chicago, Ill., for the following proposed sidewalks: Ave. L., from 96th St. to 104th St., including 420 sq. ft., cement sidewalk, average fill 2½ ft.; Augusta St., from Willow Ave. to Austin Ave., including 2,260 sq. ft. of 6-ft. cement sidewalk, average fill 1 ft., 380 lin. ft. of 1 1-6 ft. cut; Belmont Ave., from North 41st St. to North 42d Ave., including 1,100 sq. ft., average fill 1 ft., 180 lin. ft. of 1 ft. cut; Bismarck Place, from Noble St. to 984 ft. east, including 1,200 sq. ft., average fill 1 ft., 200 lin. ft. of 1 ft. cut; Byron St., from North Mozart to North Richmond St., including 540 sq. ft., average fill 2 ft.; Commercial Ave., from 87th St. to 91st St., including 5,000 sq. ft., average fill 8 ft.; Castello Ave., from North 40th to the C. M. & St. P. Ry., including 1,200 ft., average fill 1½ ft.; North Central Park Ave., from Elston Ave. to Grace St., including 900 sq. ft., average fill 1 ft.; Cullom Ave., from North Clark to North Ashland Ave., including 2,400 sq. ft., average fill ½ ft.; Devon Ave., including 9,000 sq. ft., average fill 1½ ft.; Eberly Ave., from Elston Ave. to Grace St., including 180 sq. ft., average fill 2 ft.; West 15th St., from South Halsted to South Canal, 5,500 sq. ft., average fill 2 ft.; North 40th Court, from Humboldt Ave. to Armitage Ave., 14,500 sq. ft., average fill 1 ft.; West 41st St., from Butler St. to Wallace St., 300 sq. ft., average fill 1 ft. (repair work); South 41st, from West 31st St. to West 32d St., 2,000 sq. ft., average fill 1 ft.; East 45th, from Cottage Grove to Vincennes Ave., 1,300 sq. ft., average fill 1 ft. (repair work); Harbor Ave., from The Strand to 92d St., 7,000 sq. ft., average fill 3 ft.; South Hoyne Ave., from West 105th to 107th St., 3,300 sq. ft., average fill 1½ ft., 275 lin. ft. of 1½ ft. cut; Lawrence Ave., from Drainage Canal to North Albany Ave., 4,000 sq. ft., average fill 2 ft., 660 lin. ft. of 2-ft. cut; Langdon St., from Clybourn Ave. to Uhland St., 280 sq. ft., average fill 1 ft.; Larrabee St., from Crosby to Hawthorne St., 700 sq. ft., average fill 1 ft. (repair work); Milwaukee Ave., from West Lawrence Ave. to West Sunnyside Ave., 300 sq. ft., average fill 1 ft., 50 lin. ft. of 1-ft. cut; McHenry St., from West North Ave. to Blanche St., 1,590 sq. ft., average fill 5 ft.; West 99th St., 3,200 sq. ft., average fill 1 ft.; North Oakley Ave., from West Division to Iowa St., 1,650 sq. ft., average fill 1 ft., 275 lin. ft. of 4-ft. cut; Otis St., from Vedder to West Division St., 1,100 sq. ft., average fill 6 ft.; Perry St., from Cullom Ave. to Berteau Ave., 330 sq. ft., 1½ ft., average fill 55 lin. ft. of 1½ ft. cut; West Quincy St., from South Clinton to South Jefferson St., 3,100 sq. ft., average fill 1½ ft.; South Seeley Ave., 2,700 sq. ft., average fill 1½ ft.; West 63d St., from Chicago & Western Indiana R. R., to South Halsted St., 1,200 sq. ft., average fill 1½ ft.; State St., 540 sq. ft., average fill 3 ft.; South Sawyer Ave., from Ogden Ave. to a point 75 ft. south of West 21st St., 1,900 sq. ft., average fill 1 ft. (repair work); South Chicago Ave., from East 87th to Saginaw Ave., 10,000 sq. ft., average fill 3½ ft.; West 21st St., from South Jefferson to South Halsted St., 4,500 sq. ft., average fill 2 ft.; West 39th St., from South Western Ave. to South California Ave., 1,800 sq. ft., average fill 1 ft.; West Wellington St., from North Sacramento Ave. to North Whipple St., 159 sq. ft., average fill 1 ft. (repair work); Winston Ave., from West 95th St. to West 99th St., 9,800 sq. ft., average fill 1 ft., 1,600 lin. ft., ½ ft. cut; West Dakin St., West Byron St., West Berenice Ave., North 56th Ave., North 57th Ave., North 58th Ave., North 59th Ave., North 60th Ave., including 18,000 sq. ft., average fill 1½ ft.; 75th St., 77th St., 78th St., 79th St., Cottage Grove Ave., Evans Ave., Langley Ave., Plain Ave., St. Lawrence Ave., including 7,600 sq. ft., average fill 3 ft.; West Lawrence Ave., West Leland Ave., West Wilson Ave., West Sunnyside Ave., West Montrose Ave., North Hamiln Ave., North Avers Ave., North Springfield Ave., North Harding Ave., North Harding Ave., North 40th Ave., including 21,000 sq. ft., average fill 2 ft.; 27th St., Lime St., Leo St., Quarry St., including 3,700 sq. ft., average fill 1½ ft.; West 64th St., West 65th St., West 66th St., South Paulina St., South Hermitage Ave., South Wood St., Honore St., South Lincoln St., South Winchester Ave., South Robey St., including 40,000 sq. ft., average fill 1½ ft.; West 24th St., West 25th St., South Hamlin Ave., South Springfield Ave., South Harding Ave., South 40th Ave., including 192 sq. ft., average fill 1½ ft.; West 76th St., Yale St., Vincennes Road, including 2,500 sq. ft., average fill 1 ft., 400 lin. ft. of 1 ft. cut; East 79th St., East 80th St., East 81st St., East 81st Place, East 82d St., Kimbark Ave., Chauncey Ave., Woodlawn Ave., including 10,000 sq. yds., average fill 1½ ft., 1,000 lin. ft. of 1½ ft. cut; Byron St., Grace St., North Sacramento Ave., North Whipple St., North Albany Ave., North Troy St., North Kedzie Ave., including 9,000 sq. ft., average fill 1 ft.; 82d St., 83d St., 83d Place, Illinois Ave., Ontario Ave., Bond Ave., Coles Ave., Houston Ave., Commercial Ave., and Railroad Ave., including 10,000 sq. ft., average fill 1½ ft.; Humboldt Ave., Castello Ave., Dickens Ave., McLean Ave., Armitage Ave., and North 47th Ave., including 10,000 sq. ft., average fill 3 ft.; West Irving Park Blvd., West Dakin St. West Byron St., West Berenice Ave., West Grace St., North 48th Ave., North 49th Ave., North 50th Ave., North 51st Ave., North 52d Ave., including 18,000 sq. ft., average fill 1½ ft.; 135th Place, 136th St., 136th Place, Levden Ave., 138th St., Calumet Ave., Forest Ave., Indiana Ave., including 6,000 sq. ft., average fill 2½ ft.; West Division St., Thomas St., North Central Ave., North Park Ave., North Waller Ave., Lewis St., including 9,000 sq. ft., average fill 1 ft.; Lawrence Ave., Gunnison Ave., Short Place, Edwards St., Argyle St., Munds St., Gross St., North 55th Ave., Our St., Milwaukee Ave., including 4,500 sq. ft., average depth 1 ft.; West 60th St., West 61st St., West 62d St., South Morgan St., South Carpenter St., Aberdeen St., South May St., South Center Ave., including 1,200 sq. ft. average fill 1 ft.; West North Ave., Court, Lemoyne St., Grand Ave., Hirsch St., North 40th Ave., North 40th Court, North 41st Ave., North 41st Court, including 6,000

Items marked thus ✣ indicate work now open for bids.

sq. ft., average fill 1 ft.; West 61st St., West 62d St., Honore St., South Lincoln St., South Winchester Ave., South Robey St., including 27,000 sq. ft., average fill 1½ ft., 2,000 lin. ft., of 1½ ft. cut.

✣Bids will be received by the Board of Local Improvements, Champaign, Ill., until 2 p. m., September 12th, for the construction of improvements on Fourth St. The work includes the following approximate quantities: Excavation, 8,500 cu. yds.; brick pavement on concrete foundation, asphalt filler, 10,800 sq. yds.; combination concrete curb and gutter, 8,050 ft.; stone false curb, 96 ft.; stone retaining curb (new), 194 ft.; stone retaining curb (reset), 286 ft.; cast iron gutter plates, 32; steel for Boneyard bridge, 6,750 lbs.; concrete for Boneyard bridge, 60 cu. yds.; iron railing for Boneyard bridge; catch basins, 7, Style A, average depth 7.6 ft., 4 Style B, averare depth 7.4 ft.; vitrified tile drain, 255 ft. of 20-inch, average depth 6.7 ft.; 655 ft. of 18-inch, average depth 5.7 ft.; 1,450 ft. of 15-inch, average depth 6.8 ft.; 850 ft. of 12-inch, average depth 7.3 ft.; 360 ft. of 10-inch, average depth 6.0 ft.; 300 ft. of 8-inch, average depth 6.5 ft.

✣Bids will be received until 1 p. m., September 15, by the County Commissioners at the office of J. C. Seyster, Oregon, Ill., for the construction of a macadam road in that town.

Curdie & Mansia of Alton, Ill., have been awarded a contract by the Board of Local Improvements of Upper Alton, Ill., for the paving of Mill Ave. and Averill Ave., for $7,329. The work includes 3,700 sq. yds. of brick pavement on a 4-in. concrete base at $1.59 per sq. yd.; 2,688 lin. ft. of curb and gutter at $0.48 per lin. ft. Bids were opened August 30.

T. H. Land has been awarded a contract by the Highway Commissioners of Carmi Township, Carmi, Ill., for the construction of three miles of road on the Possum road, connecting with S. Church St. Gravel will probably be used.

Edward J. Boies of Sycamore, Ill., has been awarded a contract by the Commissioners of Highways for the construction of one and one-half miles of road between the townships of Sycamore and Cortland, in De Kalb County. The road is to be built at cost under the supervision of the Commissioner of Highways and will require 2,000 yds. of crushed rock and screened gravel. Bids were opened August 30.

The City Council of Peoria, Ill., has passed an ordinance providing for the improvement of South Adams St., from Hamilton to Bridge, with creosote block.

The board of local Improvements of Cairo, Ill., has awarded a contract to L. W. Johnson for the paving of Eighth St., from Ohio St. to Jefferson Ave., for $7,701. The board also awarded a contract to Roy L. Williams for the paving of Sycamore St., from 34th St. to the city limits, for $41,885.

Indiana.

✣Bids will be received until 10 a. m., Sept. 9, by Board of Public Works, Indianapolis, Ind., for the following improvements: Roadway of Meridian St., from Maryland St., to Georgia St. Roadway of Meridian St., from Georgia St. to Union Railway tracks; roadway of Meridian St., from Washington St. to Mary St., from Washington St. to Maryland St.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., Sept. 12, for the following improvements: Cement sidewalks in Highland Place, from Twenty-first St. to Marlette Drive; cement sidewalks in Hiatt St., from Morris St. to Miller St.; cement sidewalks in Nineteenth St., from Central Ave. to College Ave.: curbing in Locke St., from Indiana Ave. to Walnut St.; cement sidewalks in Iowa St., from Meridian St. to Union St.

✣Bids will be received by the Common Council of Lebanon, Ind., until 7:30 p. m., Sept. 12, for the construction of cement sidewalks on Green St. Edmund Connor is City Clerk.

✣Bids will be received until 2 p. m., Sept. 17, by Commissioners of Clinton County at Frankfort, Ind., for the construction of eleven gravel roads. Charles F. Cromwell is Auditor.

The Commissioners of Vermillion County, at Newport, Ind., have awarded contracts for the construction of two gravel roads as follows: George W. & Charles Sykes of Newport, Ind., at $5,300 for the Coon Hollow gravel road, 2 8-100 miles in length, Clinton Township; H. A. Carpenter, Cloverland, Ind., at $9,321, for the J. F. Higgins, et al., gravel road, 1.62 miles in length, Eugene Township. Bids were opened August 26.

Tipton County Commissioners will build an expensive mile of gravel road in Madison Township at an estimated cost of $6,000.

Iowa.

✣Bids will be received until 7:30 p. m., September 12, by the City Council of Anamosa, Ia., for the construction of cement sidewalk along the north side of Lots 5 and 6, Block 7, Shaw's addition to Anamosa, Ia., including about 600 sq. ft.

The city of Villisca, Ia., has let a contract for paving to Hamilton & Schwartz of Shenandoah for $2.05 for the paving and $.40 for the curbing.

Kansas.

The Kansas Bitulithic Co. has been awarded a contract in Kansas City, Kan., for paving Quindaro Blvd., from 17th to 19th Sts. The work includes 5,850 sq. yds.

Maryland.

Advices from Centerville, Md., state that Road Engineer F. E. Schnepfe has decided to immediately direct his attention toward the improvement of the road leading from Centerville Landing across the short bridge into Corsica Neck. Another road to come under the improvement plan is the one crossing the Rolling Bridge, near Centerville. This is the first work undertaken toward securing permanent road construction in Queen Annes county.

Massachusetts.

The city of Cambridge, Mass., has awarded a contract to the Warren Bros. Co. for paving such streets as may be designated by the Superintendent of Streets during the season of 1910 with bitulithic.

Adams Pond Co. of 79 Milk St., Boston, Mass., has been awarded a contract by the Boston City Council for the construction of artificial stone sidewalks on Beaumont St., for $2,400. Bids were opened August 29.

The City Council of Boston, Mass., has awarded a contract to Jeremiah H. Sullivan of 95 Milk St., Boston, for the construction of artificial stone sidewalk in Washington St., for $1,409. Bids were opened August 29.

The City Council of Boston, Mass., has awarded a contract to James Doherty of 133 Calumet St., Boston, for the construction of a macadam roadway bulkhead and fence in Dorchester Ave., and Boston St., South Boston, for $2,607. Bids were opened August 29.

The contract for the paving of Main St., from Hawthorne St. to Webster Sq., in Worcester, Mass., has been awarded to the Hassam Paving Co. The contract calls for 13,200 sq. yds. of 4-in. granite paving at $2.99 per sq. yd.

Michigan.

✣City Council of Owosso, Mich., will receive bids until September 15 for the construction of pavement on Ball St., between Mason and Exchange Sts. The cost of the work is estimated at $2,447.

Minnesota.

✣Bids will be received until 11 a. m., September 9, by H. P. Edwards, County Auditor, Fairmont, Minn., for the construction of State Road No. 2, from the East Quarter Corner of Sec. 1 and running through Sections 1, 2, 3 and 4, to the West Quarter Corner of Sec. 4, in Elm Township. H. P. Edwards is County Auditor.

The City Council of Albert Lea, Minn., proposes to pave College St., from the Union depot to Washington St., and all the intersecting streets between Main and College Sts., the east end of Water St., and the north end of Broadway. The City Engineer has prepared plans and specifications for the curbing of College St., from the M. & St. L. R. R. tracks to Washington St.; Washington St., from William to South Pearl Sts.; Euclid St., from College to Main Sts.; Adams Ave., from College to Main Sts.; Water St., from Broadway to Washington Sts., and Broadway to its north limit. The estimated cost of constructing curb on these streets is $3,929.

Mississippi.

H. W. Daniels has been awarded the contract for building pike or levee on Louisville and Houston road, beginning at Sturgis and ending at Sand Creek, for $.10 per cu. yd.

Missouri.

The following contracts for paving with bithulithic have been awarded the Granite Bituminous Paving Co., in St. Louis, Mo.: Arsenal St., 8,630 sq. yds.; Semple St., 5,998 sq. yds.; Union St., 10,003 sq. yds.; Bent Ave., 4,780 sq. yds.; Porlis Ave., 3,477 sq. yds.

The City Council of Joplin, Mo., has passed a resolution providing for the construction of both sides of the roadway of Mineral Ave., from the south side of Hill St., to the north line of Third St., and curbing the same. Guy T. Humes is Mayor, O. E. Lichliter, City Clerk.

New Jersey.

✣Bids will be received until 2 p. m., New Brunswick, N. J., by the Board of Chosen Freeholders of Middlesex County, Asher W. Bissett, Clerk, for the construction of a gravel road beginning in Spotswood at the road leading from Spotswood to the Old Bridge and Englishtown Road and extending southerly to the road to Texas, N. J., a distance of 201 miles.

New York.

✣Bids will be received by George Cromwell, President of the Borough of Richmond, New York City, until noon, September 13, for five contracts for the construction of sidewalks, the largest being No. 2, for furnishing all the labor and materials required for constructing flag or cement sidewalks, reflagging on Van Duzer St., between Richmond turnpike and Hannah St., and other streets, together with all work incidental thereto. The Engineer's estimate of the quantity and quality of the material, and the nature and extent, as near as possible, of the work required is as follows: 10,000 sq. ft. of cement sidewalk, to furnish and lay; 13,000 sq. ft. of new flagstone, to furnish and lay; 3,000 sq. ft. of old flagstone, to retrim and relay. The time for the completion of the work and the full performance of the contract is 60 days. The amount of security required is $2,400.

✣Bids will be received until 2 p. m., September 8, by K. L. Martin, Commissioner of Bridges, Park Row Bldg., for laying and relaying water and gas mains and grading and paving streets adjacent to the municipal building.

✣Bids will be received until 11 a. m., September 14, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for 23 street improvement contracts, the largest being No. 7, for regulating and repaving with asphalt on a concrete foundation the roadway of Warren St., from Clinton St. to Court St., and from Smith St. to Third Ave., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 9,855 sq. yds. asphalt pavement (five years' maintenance); 50 sq. yds. old stone pavement, to be relaid; 1,370 cu. yds. concrete, for pavement foundation; 5,800 lin. ft. new curbstone, set in concrete; 250 lin. ft. old curbstone, reset in concrete; 18 noiseless covers and heads, for sewer manholes. The time allowed for the completion of the work and the full performance of the contract [illegible] amount of security required is $7,300.

✣Bids will be received by the State Commission of Highways, Albany, N. Y., S. Percy Hooker, Chairman, until 1 p. m., September 12, for the construction of the following highways [illegible]

Items marked thus ✣ indicate work now open for bids.

Road No. 695, known as the Otto Cattaraugus Road, 1.21 miles long; Road No. 697, known as the Otto-East Otto Road, 2.27 miles in length. Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of Division Engineer M. W. Wilbur, Cutler Bldg., Rochester, N. Y.

Warren Bros. Co. has been awarded additional contract in Herkimer, N. Y., for paving Prospect St., with bitulithic.

Warren Bros. Co. has been awarded a contract in Rome, N. Y., for paving E. Willett and Elm Sts., with biluthic.

The village of Falconer, N. Y., will immediately sell bonds in the amount of $60,000 for the purpose of providing stone curbs, and paving with brick, Main St., 36 ft. wide, from the east boundary of the village to the westerly boundary of the village: Work St., 32 ft. wide, from Pine Hill Cemetery to the Erie Railroad tracks; Everett St., 32 ft. wide, from the easterly boundary of proposed paving on Work St., to the D. A. V. & P. R. R. tracks. Fred R. Ford is Village Clerk.

The following bids were received recently for the grading and paving of 12th St., Lansingburgh, from the Hudson River to Fifth Ave., by the Board of Contract and Supply of Troy, N. Y.: Walter E. Hassam, new curb, $1, relaying old curb, $.40; granite block pavement, $3.15, concrete cement pavement, $2; John H. Gleason Co., new curb, $.90; catch basins, $89; granite block pavement, $3; brick, $2.27; sheet asphalt, $2.70; concrete cement pavement, $1.90; McKenna & Walsh, new curb, $.90; catch basins, $120; brick pavement, $2.29.

Gentile & Cervi and Liberty Paving Co. have been awarded contracts for the construction of concrete walks in Buffalo, N. Y., by Capt. George H. Norton, Acting Commissioner of Public Works, for $.09 per sq. ft.

The Board of Contract and Supply of Utica, N. Y., has received bids for paving as follows: Barber Asphalt Paving Co., for paving Rudolph place from Humbert Ave. to South St., with sheet asphalt pavement with natural stone curb and walks, $2,717; sheet asphalt pavement with artificial stone curbs and walks, $2,427. For paving Thomas St. from Grant St. to Pleasant St., sheet asphalt pavement with natural stone curb and walks, $6,012.65; sheet asphalt pavement with artificial stone curb and walks, $5,392.65.

The borough officials of Brooklyn, N. Y., are planning to extend the capacity of the municipal asphalt repair plant, at the Gowanus Canal and Second Ave., by at least 50 per cent. At present the plant has a capacity of 270 cu. ft. of wearing surface and 100 cu. ft. of binder per hour, and is equipped with self-contained rotary dryers, two of which are used for heating sand and one for binder stone. The cylinders of the dryers are 40-in. in diameter, 19 ft. 6 in. long, and each set is so arranged that it may be driven independently or at the same time.

The Board of Contract and Supply of Syracuse, N. Y., has awarded the following contracts for the laying of four pavements: Central City Paving Co., for paving Lincoln Ave., from Midland Ave. to Tallman St., with asphalt, for $10,363; Central City Paving Co., for paving Prospect Ave., from Butternut to North Salina St., with asphalt, for $1,405; F. J. Baker, for paving Park Ave., from Sackett St. to Lakeview Ave., with asphalt, for $9,148, and Park Ave., from Liberty St. to Sackett St., with asphaltfi for $6,982.

North Carolina.

✣Bids will be received until 2 p. m., September 15, by the Mayor, W. Ross Davis, Whiteville, N. C., for the necessary material, machinery and labor for the construction of approximately 12,000 sq. yds. of street in said town.

North Dakota.

A good road convention was recently called by the Commercial Club of Bottineau, N. D., to discuss the proposed improvement of the mountain highways in the county. Delegates from the towns along the edge of the mountains, Bottineau, Dunseith, Rolla and St. John, attended.

Ohio.

The Ohio Engineering Co. of Elyria, O., has been awarded a contract by the Commissioners of Cuyahoga County for paving Ridge Road No. 2 with Medina block stone from station 47 to station 52, plus 50; also for laying pipe on Depot road from station 49 plus 20 to station 66 plus 20. The block stone pavement will be laid for $2.75 per sq. yd. Bids were opened at Cleveland August 31.

The County Commissioners of Franklin County, Columbus, O., are building an experimental road in the National road west from Hague Ave. to the Big Four tracks. The road is to be constructed of waterbound macadam and surfaced with asphalt. The distance is 4,000 ft.

The following bidders bid on the work of paving Harrison Ave., from Fisher's west line to the west corporation line in the city of Cincinnati, O.; estimated by the Engineer to cost $98,350: M. Sullivan & Sons, A. J. Henkel & Bro., W. C. Hahn, Kaps & Brehm, Thomas Evans, T. P. Strack, W. F. Garretson, J. B. Washburn, J. M. Quill, Jno. Ruebel. William Scully, Jr., & Bro. The main pavement is to be of granite and the crossings of wood block.

Plans have been presented to the City Council of Hamilton, O., for the paving of North Front St., estimated cost $4,000 to $5,300.

A resolution was introduced in the City Council of Cincinnati, O., providing for the improvement of Madison Ave. with wood block paving between 17th and 20th Sts.

Residents of Sixth St., from Brown St. to the canal, and of Logan St., from Green to Sixth, in the city of Dayton, O., have petitioned for the paving of those streets with brick with a combined cement curb and gutter.

The City Council of Hamilton, O., has adopted the following resolutions for paving: City Engineer prepared plans for the paving of Vine St., from Front St. to the corporation line, and for the paving of the alley running from Miami to Ninth St., north of the engine house, with brick.

The Butler County Commissioners at Hamilton, O., have voted to have the County Auditor prepare a new estimate for the paving of two miles of the Venice river road with macadam instead of three miles.

The County Commissioners have had the proposed macadam and brick roadway near Springfield Village, O., on which contractors refused to bid at the first estimate, re-estimated by the County Engineer and the State Highway Department and new bids will be asked for. The new estimate is $12,822. The road is 11¼ miles in length.

The contract for constructing three and one-half miles of pike in the southern part of Seneca County, O., has been awarded to Dishler, Mulligan & Co. of near Upper Sandusky, for $15,645.

The Commissioners of Summit County, O., have awarded a contract for resurfacing the new Copley road to the Northern Ohio Good Roads Association of Akron, O.

M. Learsch of the State Highway Commission, Columbus, O., has received the estimate of cost for paving two miles of the Venice river road from J. E. Root of Hamilton, O. The road is to run out of Hamilton, and it is estimated to cost $17,229. Bids for the work will be advertised for at once.

The service director of Dayton, O., has received petitions for the paving of Sixth St., from Brown to the canal, and of Logan St., from Sixth to Green.

Messrs. Ephriam Kinebold, J. W. Lamberjack and George Henry, comprising the Loudon Township Board of Trustees, recently met in regular session in the township office at Fostoria, O., and decided to build about one-half mile of pike on the road known as the Bull Frog road. The road is to be macadamized.

State Highway Commissioner J. C. Wonders has agreed to allow the County Commissioners at Akron, O., to change the specifications with regard to the South Main road improvement. The road, according to the Commissioners, will be wider than the others in the county.

The Board of Control of Cincinnati, O., has approved the awards of the following contracts: Two supplementary agreements with A. J. Brehm for placing piling and building a retaining wall on Warsaw Ave., one at $14,000 and the other at $7,640; supplementary agreement with the Warren Bros. Co. for the substitution of granite for wood block between the car tracks on heavy grades south of Ludlow Ave., in the improvement of Clifton Ave., at a cost of $19,500; concrete retaining wall and steps on Edinboro place, E. L. Garretson Co., at $2,628.40; wall and gutter around Eden Park Reservoir, Charles F. Runk, Jr., at $4,155; paving with wood block (between the car tracks) and asphalt Woodward St., from Main to Sycamore, the Kirchner Construction Co., at $5,039.50; improving Young St., from Bodmann Ave. to Southern Ave., the Kirchner Construction Co., at $21,013.11; automobile for the Street Repair Department, S. B. & E. Automobile Co., at $3,300.

Advices from Akron, O., state that the work of platting and making surveys for the Hudson road improvement has been completed. It is hoped to have this road improved by this fall.

Oregon.

The city of Grants Pass, Ore., has awarded a contract to the Warren Construction Co. for 3,500 sq. yds. of bitulithic pavement.

Corvallis, Ore., has awarded a contract to the Warren Construction Co. for paving 44,000 sq. yds. with bitulithic.

The Warren Construction Co. has been awarded a contract in Klamath Falls., Ore., for paving with bitulithic, amounting to 50,000 sq. yds.

Contracts for paving with bitulithic aggregating 80,000 sq. yds. have been awarded to the Warren Construction Co., in Portland, Ore.

The following bids were received by the County Court at Salem, Ore., for the construction of the four and one-third miles of the Silverton-Marquam rock road: W. D. Pugh, $57,480; Owl Construction Co., $59,201; J. E. Flynn, $46,288.

The city council of Roseburg, Ore., has granted a petition for the paving of one block of East Cass St., from Kane to Chadwick St. The city council has to date authorized the paving of 50 blocks.

The Warren Construction Co., of Portland, Ore., has been awarded the contract for paving the streets of Klamath Falls, Ore., for approximately $135,000.

Pennsylvania.

✣Bids will be received by the Avalon Blvd. Co., at the office of Charles R. Hall, President of the company, at 1415 Real Estate Trust Bldg., Philadelphia, Pa., until noon, September 15, for the construction of 2.941 miles of gravel road across the marsh land from Swainton to Avalon, Cape May County, N. J. The work will include 1,558 lin. ft. of bridging, there being one steel draw span. R. Fendall Smith is engineer.

✣Bids will be received by the State Highway Department in the Capitol Bldg., Harrisburg, Pa., until 2 p. m., September 16, for the construction of 1,076 ft. of road extending from Station 551 end of the present macadam to Station 561 76, end of present paving on National road in Brownsville Borough, in the County of Fayette, under the act of Assembly, approved April 10, 1905.

A resolution providing for the repaving of Fifth Ave., from a point below Strawberry alley as far east as an appropriation of $10,000 will allow, was introduced in the City Council of McKeesport, Pa. Brick is to be used on a concrete foundation.

The Bush Kill Quarry & Construction Co., of Easton, Pa., has been awarded a contract by the board of managers of the New Jersey Sanatorium for tuberculosis diseases for the construction of a two-mile macadam road for $12,698. Bids were opened Aug. 10.

Texas.

J. Egert has been awarded a contract by the County Commissioners at Galveston, Tex., for improvements in what is known as Section 2 in the boulevard improvement area, between 23rd and 25th Sts., for $9,500.

The city of Wharton, Tex., has voted the issuance of bonds in the sum of $15,000 for street improvements. C. A. Gordon is Mayor, J. G. Johnson is City Engineer.

The City Council of Dallas, Tex., has been petitioned for the macadamizing of Hall St., from Thomas Ave. to Emanuel Cemetery, and for the macadamizing of Hall St., from Thomas Ave. to Calvary Cemetery.

The City Engineer of Dallas, Tex., has been instructed to proceed with specifications for the macadamizing of South Lamar St., from Belleview to Arnold, and Arnold from Lamar to Austin St.

Virginia.

The County Board of Supervisors of Bedford City, Va., has ordered the macadamizing of about a mile of road leading out of the town toward the south side of Bedford. About a mile of road leading from Bedford City to the Peaks of Otter is being prepared for macadamizing.

Washington.

✣Bids will be received by the County Commissioners at Everett, Wash., until September 13, for the improvement of Hall's Lake road, from Holmes corner three-fourths of a mile.

✣Bids will be received by the State Highway Commissioner, Olympic, Wash., until 2 p. m., September 7, for the construction of State Road No. 82, in Skagit County, at an estimated cost $14,000.

The Lewis County Commissioners, Chehalis, Wash., have awarded a contract to the Warren Construction Co., of Portland, Ore., to build about half a mile of Warrenite road connecting with the Chehalis city limits to the east, and extending out from the city.

The County Commissioners at Everett, Wash., have received the following bids for the extension of North Trunk road and the Siegfreidt road: Waddle & Yost, per plans and specifications, $9,950; J. B. Snyder, per plans and specifications, $12,650 Robson & Jones, per plans and specifications, $13,145. Waddle & Yost were awarded the contract on their bid of $9,950.

State Highway Commissioner H. J. Bowlby of Washington has stated that the survey for to the head of Fidalgo Bay. It then goes in a kenberg gold mine and follows the shore line to the head of Fidalgo Bay. It then goes in a northeasterly direction along the old motor line to Summit Park, and will run parallel with the Great Northern Railroad on the south side of the railroad right-of-way to the old gravel pit, when it will join the county road, going to Dewey and Whitney. The road will be built through the Indian reservation and will be known as State aid road No. 39, or as the Fidalgo Bay road.

A plan is on foot in Seattle, Wash., for the formation of the Western Automobile Association. This organization, if formed, will be to urge the construction of an automobile highway along the coast from Mexico to Canada. Frank M. Fretwell of the Automobile Club of Seattle is interested.

Canada.

Contract for paving Darling St., from George to Market, with bitulithic, in the city of Brantford, Ont., has been awarded to the Warren Bituminous Paving Co.

The Warren Bituminous Paving Co. has been awarded contract for paving Marshall St., from Block Ave. to Sheridan St., with bitulithic, in Toronto, Can.

The bid of Frawley Bros. of Urbana, O., for the construction of the pike about one mile south of Woodstock, has been rejected by the County Commissioners and new bids will be advertised for at once. The specifications call for a macadam road and the bid submitted was for gravel.

A petition is being circulated among the property owners on East High St., Delaware, O., for the paving of the thoroughfare with brick.

WATER-WORKS AND SEWERAGE

California.

The city of Sonoma, Cal., has sold bonds in the sum of $20,000 for the construction of a modern sewer system. The work of construction will commence soon.

Citizens of Biggs, Cal., are agitating the construction of a sewer system and the board of trustees will probably call an election to vote the issuance of bonds for the purpose. The estimated cost of the system is $30,000.

Acting City Engineer De Ruiz of Long Beach, Cal., has completed the proposed sewer district for the eastern part of the city, bounded by Second and Eighth Sts., and Elm and Alamitos Aves. It is proposed in this district, which will be known as No. 7, to extend a main up Alamitos Ave., from Second to Eighth Sts., and have laterals extend to the west on streets from Third to Seventh. Laterals will also extend through the alleys and care for sewage from the rear of the lots.

The City of Oroville, Cal., has awarded a contract for the construction of a sewer system to Cotton Bros. for $90,000.

Colorado.

The special committee of the city council of Fort Collins, Colo., appointed to investigate the Lake park sewer proposition recommended its construction and the council has decided to build the sewer at an estimated cost of $22,413.

Palisade, Colo., will probably install a sewer system this fall.

District of Columbia.

✣Bids will be received by William M. Smith, Acting Chief of the Bureau of Yards & Docks, Navy Department, Washington, D. C., until 11 a. m., Sept. 10, for the construction of additions to the power plant and distributing systems, naval hospital, Annapolis, Md.

Florida.

The city council of St. Augustine, Fla., has passed an ordinance calling for an election to ratify an issue of $100,000 bonds with which to install a complete sewerage system.

Georgia.

✣Bids will be received until noon, Sept. 30, by W. G. Raoul, Chairman of the Executive Committee, State Tuberculosis Sanatorium, 708 Gould Bldg., Atlanta, Ga., for furnishing labor and material for improvements to the State Tuberculosis Sanatorium at Alto, Ga., as follows: Item No. 1—3,150 ft. 4-in. cast iron pipe; 15 4-in. by 4-in. tees. Class B, standard specifications. Item No. 2—Sewer Pipe—800 ft. of 8-in.; 1,200 ft. of 6-in.; 1,400 ft. of 4-in. pipe; 2 8-in. by 6-in. branches; 6 8-in. by 4-in.; 14 6-in. by 4-in. branches. Item No. 3—50,000 brick, all hard and well burned. Item No. 4—Four cast iron manhole covers (Atlanta standard); eight fire hydrants (Atlanta standard); seven 4-in. gate valves. Item No. 5—Furniture and other household equipment for operating sanatorium. Item No. 6—Excavating for and laying 3,150 ft. 4-in. cast iron water pipe, calking lead joints and setting 8 hydrants. Excavating for and laying 800 ft. 8-in., and 1,200 6-in., 1,400 4-in. sewer pipe, cement joints. Constructing four manholes. Excavating and curbing one cistern, 23 ft. diameter, 8 feet deep. One cistern dry curbed, 8 ft. diameter, 10 ft. deep. Contractor to furnish lead, cement and hemp packing. Item No. 7—Grading roads and grounds about building. Item No. 8—(1) Wiring main building and four (4) shacks, now in course of construction, for electric lighting. (2) Furnishing and installing fixtures for same. Item No. 9—For the construction of a powerhouse 18 ft. by 24 ft. Brick, with metal roof; contractor to furnish all labor and material, except brick. Item No. 10—One oil or gasoline electric generating set, to perform the following service: To supply current for 200 16-candle power light by night to supply current for operating during day a pump for raising 80 gallons of water per minute to a height of 208 feet, horizontal distance 1,350 ft., size of main 4 ins. One motor-driven pump for above service.

The city of Eastman, Ga., has voted bonds in the sum of $50,000 for the construction of a sewerage system and school improvements.

The citizens of Sparta, Ga., have voted $40,000 for the construction of a sewerage and waterworks system.

The city of Rockmart, Ga., has voted $10,000 for the construction of a modern sewerage system.

Illinois.

✣Bids will be received until 11 a. m., Sept. 9, by Board of Local Improvements, Chas. A. V. Standish, Secy., Room 300 City Hall, for the construction and laying of a cast iron water supply pipe with necessary special castings and with fire hydrants, valves and valve connections in N. 53d Ave., from Humboldt Ave. to Fullerton Ave. The work will include the following approximate quantities: 1,340 lin. ft. of cast iron water supply pipe, 8-in. internal diameter, 475 lbs per lin. ft., including all necessary castings; four 2½-in. double nozzle, five hydrants and 6-in. connecting pipes; 2 8-in. gate valves; 2 brick valve basins. The cost of the work is estimated at $2,227.

✣Board of Local Improvements, Chicago, Ill., C. A. V. Standish, Secy., 300 City Hall, will receive bids until 11 a. m., Sept. 10, for the construction of water service pipes in the following streets: Loomis St., from West 87th St. to West 89th St., 879 lin. ft. of lead water service pipe 1 in. internal diameter and 4 lbs. per lin. ft.; 48 brass stop cocks 1 in. internal diameter; 48 brass taps of ¾-in. internal diameter; 48 spiral cast iron shutoff boxes of the best quality, 2½ in. internal diameter and 5½ ft. long; Buffalo boxes 14 ft. out from lot line; end of service pipe 13 ft. out from lot line. The cost of the work is estimated at $719.40. W. North Ave. from N. 48th Ave. to N. Central Park Ave., including 3,715 lin. ft. of lead water service pipe, 1 in. internal diameter, 4 lbs. per lin. ft., 101 brass taps of ¾ in. internal diameter; 101 brass stop cocks of 1 in. internal diameter; 101 spiral cast iron shutoff boxes of the best quality 2½ in. internal diameter and 5½ ft. long; Buffalo boxes 16 ft. out from lot line; end of service pipes 15 ft. out from lot line. The cost of the work is estimated at $2,633.

✣Board of Local Improvements, Chicago, Ill., A. V. Standish, Secy., Room 300 City Hall, will receive bids until 11 a. m., Sept. 9, for the construction of water service pipes in the following streets: W. Chicago Ave., including 1,165 lin. ft. of lead water service pipe 1-in. internal diameter and weight of four lbs. per lin. ft.; 39 brass taps, ¾-in. internal diameter; 39 brass stop cocks of 1-in. internal diameter; 39 spiral cast iron shutoff boxes of the best quality, 2½-in. internal diameter and 5½ ft. long; 200 cu. yds. of rock to be excavated; Buffalo boxes 12 ft. out from lot line; end of service pipe 11 ft. out from lot line. Estimated cost $1,338.50. West 79th St. from S. Centre Ave. to S. Morgan St., including: 1,406 lin. ft. of lead water service pipe 1-in. internal diameter, weight 4 lbs. per lin. ft.; 57 brass taps ¾-in. internal diameter; 57 brass stop cocks 1-in. internal diameter; 57 spiral cast iron shutoff boxes of the best quality, 2½-in. internal diameter and 5½ ft. long; Buffalo boxes 8 ft. out from lot line; end of service pipes 7 ft. out from lot line; estimated cost $1,141; North Shore Ave., from Evanston Ave. to Lake Michigan, including 473 lin. ft. of lead water service pipe 1-in. internal diameter and weight 4 lbs.

Items marked thus ✣ indicate work now open for bids.

per lin. ft.; 22 brass taps ¾-in. internal diameter; 22 brass stop cocks 1-in. internal diameter; 22 spiral cast iron shutoff boxes of the best quality, 2½-in. internal diameter and 5½ ft. long; Buffalo boxes 14 ft. out from lot line; end of service pipe 15 ft. out of lot line. The cost is estimated at $371.80.

✣Bids will be received by the Board of Local Improvements, City Hall, Chicago, Ill., until 11 a. m., Sept. 3, for the construction and laying of sewer drains in the following streets: East 75th St., from Paxton Ave. to Railroad Ave., including 105 drains, 2,000 lin. ft., average depth 8 ft. Estimated cost $3,209.25. East 93rd St., from Anthony Ave. to Colfax Ave., including 240 drains, 9,000 lin. ft., average depth 10 ft., estimated cost $9,624. East 95th St., from S. Michigan Ave. to Cottage Grove Ave., including 72 drains, 3,500 lin. ft., average depth 12 ft., estimated cost $2,599. Burnside System, including 49 drains, 800 lin. ft., average depth 10 ft., estimated cost $693.

Richard Walsh, president of the village board of Silvis, Ill., has instructed the City Engineer, H. G. Paddock, to prepare proceedings for the laying of a sewer and water main on Sixth St., from Second to Third Aves., and on Fifth St., from the alley south of First Ave. to Third Ave., and through the McEniry addition.

The following bids were received Aug. 25 for the construction of a sewer and drains in the City of Wheaton, Ill., of which Arthur L. Webster is City Engineer: Northwest Drainage District—Stevens Construction Co., $14,814.85; John M. Healy Co., $14,291.58; Wm. Davidson, $14,337.97; T. H. Iglehart, $13,430.42; G. Maffioli, $12,584.94; Lanyon & Clifford, $12,009.94; C. R. Nichols, Caney, Kan., $11,626.93 (awarded contract). President St. Drain—G. Maffioli, Rockford, Ill., $1,195.76 (awarded contract); J. M. Healy Co., $1,197.85; Stevens Con. Co., $1,212.30; T. H. Iglehart, $1,242.84; Wm. Davidson, $1,321.62; C. R. Nichols, $1,391.10. Irving Ave. Sewer—G. Maffioli, $355.80 (awarded contract); John M. Healy Co., $383.00; C. R. Nichols, $397.00; T. H. Iglehart, $447.90; Wm. Davidson, $464.60; Steven Con. Co., $473.10. The two smaller improvements, President St. Drain and Irving Ave. Sewer, comprise 2,266 ft. of 8 in. drain and 700 ft. of 8-in. sewer.

The following bids were received Sept. 1 by the Board of Local Improvements, Chicago, Ill., for constructing the sewers known as the Belmont Ave. and Addison St. sewer (1) standing for Dennis Cleary, 5532 Winthrop Ave., Chicago; (2) for The Ryan Co., 1112 Tacoma Bldg., Chicago; (3) for American Engineering & Construction Co., 912 59 Clark St., Chicago; (4) for Federal Improvement Co., 949 The Rookery, Chicago, and (5) for the Parker Washington Co., 920 Chamber of Commerce, Chicago:

	Lin. ft.	Size.	(1)	(2)	(3)	(4)	(5)
Belmont Av.	3,300	3 R. 6½ ft.	$9.00	$11.00	$11.12	$10.00	$10.60
Belmont Av.	2,660	3 R. 6¼ ft.	9.00	10.00	10.73	10.45	12.20
Belmont Av.	1,550	2 R. 6 ft.	9.00	7.25	6.31	7.85	8.41
N. 70th Av.	2,660	2 R. 5½ ft.	7.00	6.00	6.28	7.45	7.77
Addison St.	1,180	D. I. 2½ ft.	6.00	3.25	2.10	3.15	4.95
Addison St.	3,090	2 R. 4¾ ft.	5.00	5.29	5.37	6.50	6.59
Addison St.	2,660	2 R. 4½ ft.	5.00	4.60	5.24	6.30	6.76
N. 52d Av.	1,340	D. I. 2 ft.	3.50	3.00	1.96	2.65	4.38
Total			$120,430	$129,486	$131,601	$443,152	$162,666

These prices include the cost of constructing 72 standard manholes, 169 standard catch basins and 4 catch basins of the following dimensions: Internal diameter 6 ft., 8 ft. of brick work, with a 3½-ft. sump and 15-in. tile pipe connection with a brick trap; also the replacing of a macadam roadway on Addison St.

Indiana.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 14, for the construction of a local sewer with appurtenances in and along the alley east of Miley Ave., from Calvelage St. to Eleventh St.

✣Bids will be received until 10 a. m., Sept. 14 by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with apurtenances in and along La Salle St., from Glen drive to Roosevelt Ave.

✣Bids will be received until 10 a. m., Sept. 14 by the Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along Keystone Ave., from Pleasant Run to a point 20 ft. south of the south property line of Woodlawn Ave.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 14, for the construction of a local sewer with appurtenances in and along Blackford St. from Indiana Ave. to a point 450 ft. south thereof.

The city council of Valparaiso, Ind., has awarded a contract to McGillicuddy & Lemster for the construction of the following sewers: Academy sewer, $725; northeast storm sewer, $1,535; Morgan St. sewer cement arch, $5.75 per sq. ft.

Iowa.

✣Bids will be received by L. J. Fisher, City Clerk, Anamosa, Ia., until 7:30 p. m., Sept. 12, for the construction of a sanitary sewer upon Garnavillo St. from the north line of the C., M. & St. P. R. R. right of way to a point to connect with the present sewer, thence north to the north line of Broadway St., being about 800 lin. ft.; the same to be constructed of vitrified 6-in. sewer pipe with necessary "T's" for all connections, joints to be laid in Portland cement, also two manholes 4 ft. at the bottom and two feet at the top with mast iron covers, the brick to be laid in Portland cement.

✣Clerk of Sioux City, Ia., will receive bids until 9 a. m., Sept. 17, for one 16-in. well, a pumping station and one electrically driven turbine pump and one horizontal centrifugal pump.

The city of Indianola, Ia., has awarded a contract to the Lytle Construction Co., of Sioux City, Ia., for the construction of sanitary sewer for $23,757 as follows: 6,447 ft. 10-in. standard vitrified sewer pipe, 12,087 ft. 8-in. standard vitrified sewer pipe, 1,258 ft. 6-in. standard vitrified sewer pipe, 33 common manholes, 13 drop manholes, 9 flush tank siphons, set in manholes, 800 house connections, 328 manhole steps, ½x10-in. round iron. H. H. Gilliland is Engineer. Bids were opened Aug. 23.

The City Council of Clinton, Ia., has outlined plans for city improvements amounting to more than $125,000 in new sewers, pavements and sidewalks.

Maryland.

Plans for the construction of a sewerage system in Centreville, Md., are being put into definite form by the Town Commissioners, Messrs. Alfred Green, Ezekiel M. Forman and Dr. Horace M. Davis. The specifications have been completed and are now in the hands of the bidders. The contract will be let about Sept. 7.

Massachusetts.

The city council of Boston, Mass., has awarded a contract to the Power Equipment Co. for furnishing, delivering and erecting two steam turbine driven centrifugal pumps for the Calf Pasture pumping station for $36,063. Bids were opened Sept. 1.

Robert H. Newell of South Main St., Uxbridge, Mass., has received the contract for the sewer outfall to be constructed in the town of Greenfield for $35,000. The contract calls for the laying of one mile and a half of concrete pipe. The outfalls are to be connected with the concrete main sewer and carried a mile from the town and emptied near the junction of the Deerfield and Connecticut rivers.

Minnesota.

Fairbanks, Morse & Co. have been awarded a contract by the city of Mankato, Minn., for the installation of about 2,090 ft. of 6-in water mains, 372 ft. of 10-in. water mains and necessary hydrants for $3,571. Bids were opened Aug. 22.

E. T. Webster of 437 Beacon Ave., St. Paul, Minn., has been awarded a contract by the village council of Monticello, Minn., for laying 2,000 ft. of 12-in. sewer pipe for $2,518. Bids were opened Aug. 20.

The board of public works of St. Paul, Minn., has awarded contracts for construction of sewers on Van Buren place, from Hoffman Ave. to Maria Ave., and on 7th St. between Ottawa Ave. and Vista Ave. Thornton Bros. received the Van Buren place contract for $1,537, and John Lind received the 7th St. contract for $10,300.

Bids will be received until Sept. 12, by Thomas Maloy, City Clerk, Bemidji, Minn., for the furnishing and laying of 2,050 ft. of 4-in. water main and accessories. M. D. Stoner is City Engineer.

Montana.

Advices from Missoula, Mont., state that contracts have been awarded for improvements at Fort Missoula as follows: John P. Grady, Missoula, water distributing system, to be completed in three months, $16,000; J. P. Adamson, St. Paul, sewer system, to be completed in four months, $15,820; P. A. Harrington, Missoula, reinforced concrete pumping plant building, $3,700; Anaconda Copper Mining Co., Butte, pumping machinery, $6,975; Mericle-Tripp Co., Missoula, walks and curbs, $5,303.

New Hampshire.

Milford, N. H., city council has awarded a contract for the construction of a sewer across the island to the Osgood Construction Co., of Nashua.

New Jersey.

✣Bids will be received until 9 p. m., Sept. 19, by J. Thomas Scott, Chatham, N. J., Secy. Joint Committee of the Boroughs of Chatham and Madison, N. J., for furnishing the necessary labor and material for the construction of: (1) about 1 mile of vitrified pipe sewer, 18-in. size; (2) a sewage disposal works with a rated capacity of 600,000 gals. per day. Plans and specifications are on file at the office of Hering & Fuller and Clyde Potts, Engineers, New York City.

Clyde Potts, Civil and Sanitary Engineer, 30 Church St., New York City, has been retained to design sewers and sewage disposal works for the borough of Monmouth Beach, N. J. Jessie W. Potter is the borough clerk.

The board of public works of Newark, N. J., has awarded the contract for constructing the Weequahic outlet sewer to the Jersey Paving Corporation for $5,917.

New York.

✣Bids will be received until 10:30 a. m., Sept. 27, by Franklin B. Kirkbride, Secretary of the Board of Managers Letchworth Village, Room 215, 55 Wall St., New York City, for the construction of a water and sewerage system at that village, Thiells, N. Y.

✣Bids will be received by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for 20 sewer contracts, the largest being No. 1, for furnishing all the labor and material required for constructing sewer in Avenue I, between E. 5th St. and Ocean Parkway, and outlet sewers in Ocean Parkway, West Side, between Avenue I and Bay Parkway; in Bay Parkway, Northwest Side, between Ocean Parkway and Avenue J, and in Bay Parkway, between Avenue J and Gravesend Ave. The Engineer's preliminary estimate of the quantities is as follows: 85 lin. ft. of 48-in. brick sewer, laid complete, including all incidentals and appurtenances; 821 lin. ft. of 42-in. brick sewer, laid complete, including all incidentals and appurtenances; 375 lin. ft. of 36-in. brick sewer, laid complete, including all incidentals and appurtenances; 131 lin. ft. of 30-in. brick sewer, laid complete including all incidentals and appurtenances; 280 lin. ft. of 24-in. pipe sewer, laid complete, including all incidentals and appurtenances; 537 lin. ft. of 18-in. pipe sewer, laid complete, including all incidentals and appurtenances; 180 lin. ft. of 15-in. pipe sewer, laid complete, including all incidentals and apppurtenances; 270 lin. ft. of 12-in. pipe sewer, laid complete, including all incidentals and appurtenances; 240 lin. ft. of 6-in. house connection drain, laid complete, including all incidentals and appurtenances; 24 manholes, complete, with iron heads and covers, including all incidentals and appurtenances; 8 sewer basins, complete, of either standard design, with iron pans or gratings, iron basin hoods and connecting culverts, including all incidentals and appurtenances; 100,000 ft. (B. M.) of sheeting and bracing, driven in place, complete, including all incidentals and appurtenances; 10,400 ft. (B. M.) of foundation planking, laid in place, complete, including all incidentals and appurtenances. The time allowed for the completion of the work and full performance of the contract will be 120 working days. The amount of security required will be $8,000.

✣Bids will be received by H. S. Thompson, Commissioner of Water Supply, Gas and Electricity, Room 1904 Park Row Bldg., New York City, until 2 p. m., Sept. 14, for furnishing and delivering cast iron pipe, special castings and valve box castings.

Charles H. Winne has been awarded a contract by the board of contract and supply of Troy, N. Y., for building a sewer in Grace Court.

Perretta & Robertaccio have been awarded a contract by the board of contract and supply of Utica, N. Y., for the construction of a sewer of vitrified pipe in Holland Ave., from the end of the existing sewer southerly to Margaret St., and in Margaret St. from Holland Ave. to Oneida St., for $2,302.

Joseph H. Clements has been awarded a contract for laying water mains in a large number of streets of Schenectady, N. Y., by the board of contract and supply.

The city engineer of Schenectady, N. Y., has had prepared a set of plans providing for a new system of surface water sewers, which it is thought will eliminate the difficulty. This call for a large trunk sewer through the Plaza, with branches extending through East alley and other streets, the cost of which is estimated at between $30,000 and $40,000.

Ohio.

✣Clerk of the Village of Nottingham, O., will receive bids until noon, Sept. 24, for the construction of a sanitary sewer in Sackett Ave. from the West Corporation line to a point 1,250 ft. east of Moses Ave. J. B. Davis & Son, 207 The Arcade, Cleveland, O., are the engineers. J. C. Steinicke is Clerk of the Village.

The trustees of public affairs of Barnesville, O., have awarded a contract to W. H. Patterson & Son, East Main St., Barnesville, for the construction of a water pipe from southeast corner of East Main St. and Warren Ave. to the Friends' Boarding School, a distance of 6,550 ft., for $.18 per ft. for 4-in. pipe, $.21 per ft. for 6-in. pipe and $.24 per ft. for 8-in. pipe. Bids were opened Aug. 23.

The state board of health of Ohio has notified the city council of Marysville, O., that it must install a sanitary sewerage system by July 1, 1911. This notice has been given owing to the pollution of the Town Run and Mill Creek.

State Highway Commissioner J. C. Wonders of Ohio has awarded a contract for paving the mile of Chillicothe pike, near Portsmouth, O., to Kaps Bros., for $8,632. Brick is to be used.

The city council of Cleveland, O., has passed ordinances providing for the following public improvements: City hall, $200,000; West Side market, $150,000; sewers, $188,000; paving, $100,000; fire stations, $90,000; parks, $50,000; contagious disease hospital, $12,000.

The village engineer of Kennedy Heights, O., has been authorized by the council to submit plans and specifications for a sewerage system for that town. The system will consist of sewers and sewage disposal plant. It is estimated that the system will cost from $150,000 to $180,000.

M. P. Campbell, 11,225 Detroit Ave., Cleveland, O., has been awarded a contract for the construction of a sewer in Hird St., in the village of Lakewood, for $3,403. Bids were opened Aug. 29.

Jno. Galvin and Jos. Winterbottom of Cleveland, O., have been awarded contracts in the village of Lakewood, O., for the construction of water mains and sewers on Northland Ave., for $3,634. Bids were opened Aug. 29.

The Board of Control of Youngstown, O., has awarded the following contracts for improvements in the city: Paving of Carolina St. to Turner & Olson for $5,072; sewering of McKinnie St., to Miller Bros., for $1,957.40; sewering of Japan St., to Hannon Bros., for $743.80; grading of Quarry St. to S. H. DeGroodt, for $1,140; grading of Decatur St., to S. H. DeGroodt for $547; grading of Pyatt St., to Ames McCarron for $1,660.

Oklahoma.

✣Bids will be received until 2 p. m., Sept. 22, by Board of Trustees, Haskell, Okla., C. W. Marston, President, for the construction of a system of water works. There will be required about 12,800 ft. of 6-in. cast-iron water pipes; about 17,200 ft. of 4-in. cast-iron water pipes; 25 fire hydrants; about 7,650 lbs. fitting; 18 valves and boxes; a galvanized iron pump house; 2 pumps of a combined capacity of 500 gals. per min.; one boiler; one steel tower and tank, 120 ft. max. water bin, 60,000 gals. capacity. Bids will be received for furnishing any of the materials above or for constructing the works complete. Proposals must be addressed to the Town Clerk, Haskell, Okla., and must contain a certified check for the sum of 3 per cent of the amount of bid. Plans and specifications on file in the office of the Town Clerk or James T. Gates, Engineer, Wagoner, Okla.

Oregon.

The sewer committee of the executive board of the city of Portland, Ore., has recommended the rejection of the bid of Paquet, Giebisch & Joplin for the construction of the Holgate St. sewer system and ordered new bids for the work. The city engineer, J. W. Morris, has estimated the cost of the work at $102,000.

Recommendations that appropriations be made by the city council of Portland, Ore., for the extension of all sewers that do not reach deep water in the Willamette River have been made by the city health board.

Pennsylvania.

An ordinance was introduced in the city council of York, Pa., providing for the construction of a storm water sewer on Madison Ave. from Hartley St. to West York Ave.

Chief Webster of the Survey Bureau of Philadelphia, Pa., has announced that bids for the construction of the Pennypack Creek intercepting sewer leading to the projected sewage disposal plant, at Holmesburg, will be readvertised. The new sewer will be 7,700 ft. in length, and will vary in thickness from 10 to 24-in. It will extend along the creek from the Delaware River to Frankford Ave., and is estimated to cost $30,000.

An effort will be made to induce the city council of Philadelphia, Pa., to provide $250,000 for further extensions of the new Cobb's Creek sewer.

South Carolina.

✣Bids will be received until 4 p. m., Sept. 10, by the Board of Paving and Sewer Commission, Greenville, S. C., W. E. Beattie, Chairman, for the necessary labor and material for the construction of sanitary sewer extensions at Greenville, S. C. C. P. Ballenger is City Engineer.

✣Bids will be received by the Sewer Commission City Council, Greenville, S. C., until Sept. 10, for the construction of approximately 6 miles of sewers in the following streets: Echols, Johns, North Main, [illegible], Stone Ave., Frank St., Garlington St., Memminger St., Lawton Ave., [illegible] Ave., Leach St., Hudson St., [illegible] St., Gibbes St., Hyde St. and Oscar St.

South Dakota.

Bids will be received until 8 p. m., Sept. 12, Board of Trustees, Wolsey, S. Dak., for the construction of lateral sewers. H. Morgan is Clerk.

Roberts & Few of Brookins, S. Dak., has been awarded a contract in Hawarden, Ia., for the construction of a sanitary sewer. The work includes 24,400 ft. of 8-in., 800 ft. of 10-in., 2,500 ft. of 12-in. salt glazed vitrified sewer pipe, 44 manholes, and cast iron pipe syphon under creek for $16,914. Bids were opened Sept. 3.

Brookins Construction Co., of Brookins, S. Dak., has been awarded a contract in Huron, S. Dak., for the construction of 860 lin. ft. of 18-in. sewer and 4,000 lin. ft. of 8-in. sewer for $5,732. Bids were opened Aug. 29.

The City Council of Wagner, S. Dak., has let the contract for the construction of a new sewerage system to Louis W. Schruth of Fargo, N. Dak., for $17,000.

Tennessee.

W. A. Park has been awarded a contract in Knoxville, Tenn., for the construction of a storm sewer on Second St. to the creek under the tracks of the L. & N. railroad.

Texas.

The city council of El Paso, Tex., has accepted and approved the plans for sewage and garbage disposal plants to cost $100,000. These plants are to be erected on land purchased about a year ago, lying in the Channzal Zone.

A contract for five car loads of sewer pipe has been awarded by the board of municipal commissioners of Dallas, Tex., to the San Antonio Sewer Pipe Co., of San Antonio, Tex. The pipe is to be 15 to 24-in. in size, with the specials to complete the specifications.

The City Council of Caldwell, Tex., is planning for the erection of a steel standpipe with a capacity of the present wooden reservoir. This improvement will require a bond issue of $5,000.

The city of Hearne, Tex., contemplates floating bonds for the construction of a waterworks. C. L. Dillard and W. A. Wilkerson are interested.

Utah.

P. J. Moran, the lowest of eight bidders on the work of constructing the waterworks aqueduct at Provo, Utah, for which Louis C. Kelsey, 402 Dooly Bldg., Salt Lake City, Utah, was engineer, bid as follows:

Work and Materials.	Approx. quan.	Price.	Amt.
Excavating and backfilling, cu. yd.:			
Earth	12,225	$ 0.60	$ 7,335
Gravel and boulders	2,396	.80	1,916
Solid rock,	100	3.00	300
Embankment, cu. yd.	794	.35	277
Tunnelling, lin. ft.	1,450	4.14	6,003
Aqueduct, lin. ft.:			
Std. sect.	17,656	1.80	31,780
Spl. sect.	330	1.91	630
Rip rap	200	2.00	400
Manholes, each	18	30.00	540
Gate house	1	596.00	596
Total			$49,779

The itemized bid of Wheelwright Construction Co., the lowest bidder for the supply mains, is as follows:

Work and Materials.	Approx. quan.	Price.	Amt.
Exc. and backfilling, cu. yd.:			
Earth	19,314	$ 0.50	$ 9,657
Gravel and boulders	2,000	[illegible]	[illegible]
Solid rock		[illegible]	
Wire wound pipe, lin. ft.:			
13-in. (250 ft. hd.)	[illegible]	[illegible]	[illegible]
16-in. (250 ft. hd.)	1,920	1.50	2,880
18-in. (250 ft. hd.)	3,360	1.65	5,544
20-in. (250 ft. hd.)	2,880	1.85	5,328
21-in. (0 to 250 ft. hd.)	808	1.75	1,414
24-in. (0 to 250 ft. hd.)	6,982.5	2.00	13,965
Special castings, lb.	[illegible]	[illegible]	[illegible]
Cast iron pipe, lin. ft.:			
8-in.	960	1.10	1,056
12-in.	1,440	2.00	2,880
Special castings, lb.	13,000	.055	715
Hydrants, each	...	50.00	...
Valves, each:			
8-in.	2	25.50	51
12-in.	3	35.80	107
14-in.	2	70.00	140
16-in.	[illegible]	[illegible]	[illegible]
18-in.	7	125.00	875
20-in.	[illegible]	[illegible]	[illegible]
22-in.	[illegible]	[illegible]	[illegible]
24-in.	[illegible]	[illegible]	[illegible]
Valve boxes, each	27	6.50	175
Total			$50,390

P. J. Moran of Salt Lake City, Utah, has been awarded a contract by the city of Ogden, Utah, for the construction of cement and granite sidewalks, sewer, lighting system, asphalt paving, 3½-in. binder on a 6-in. concrete base for $57,475. Bids were opened Aug. 30.

Vermont.

J. E. Cashman of Burlington, Vt., was the lowest bidder for the construction of a pipe line and reservoir at Keeseville, N. Y., the bid being $9,910. Bids were opened Aug. 25. The work will probably be readvertised.

Virginia.

✣Bids will be received until 4 p. m., Sept. 15, by Charles E. Bolling, City Engineer, Richmond, Va., for constructing the following sewers: Dooley Ravine sewer, brick and concrete, length 3,800 ft., diameter from 8 to 11 ft.; Virginia Ave. sewer, length 3,000 ft., diameter 8 ft., brick and concrete (principally tunnel work in rock); sewer in Leigh St. to Government Road, brick or concrete, length 2,600 ft., diameter 5 ft.

✣Board of Commissioners, City of Huntington, W. Va., will receive bids until 1 p. m. (eastern time), September 23, for the construction of a lateral sewer in the alley between 11th and 12th Aves. from 16th to 18th St.; also for grading Smith St. Hill, in the city including about 2,480 cu. yds. of excavation. John Coon is Commissioner of Streets.

Plans are being drawn in the engineering office of the water department, Norfolk, Va., for a comprehensive system of water mains on Colonial Ave. and Manteo St., north of Jamestown Ave.; 23rd St. from Debree to Colonial; 21st St. from Colonial to Colley; and Colley, from Jamestown Ave. to the Norfolk and Western railroad tracks, where it is expected to have the Seventh ward mains connect into the city.

The Board of Control of Norfolk, Va., has asked the City Engineer for an estimate on the cost of installing sewerage on Fauquier and Louisa Sts., in Berkley ward.

Washington.

Frank C. Buttz of Indianapolis, Ind., was the lowest bidder for sinking a 10-in. tubular deep well to a depth of about 500 ft., for $13.55 per lin. ft., sunk and cased, at Fort George Wright, Wash. Bids were opened Aug. 22.

West Virginia.

✣Bids will be received until 7 p. m., Sept. 14, by Frank Good, City Auditor, Parkersburg, W. Va., for furnishing and erecting two 4,000,000 gal. vertical pumping engines.

✣Bids will be received until 7 p. m., Sept. 14, by Frank Good, City Auditor, Parkersburg, W. Va., for furnishing the necessary labor and material for the construction of pump well, pipe gallery and foundations.

✣Bids will be received until 7 p. m., Sept. 14, by Frank Good, Auditor of Parkersburg, W. Va., for furnishing and erecting two 200 H. P. water tube boilers, 160 lbs. pressure.

Wisconsin.

✣Bids will be received until noon, Sept. 20, by L. F. Fish, City Clerk, West Allis, Wis., for the necessary labor and materials for the construction and laying of sewers with necessary manholes, connections, fitting, etc., including the following approximate quantities: 3,338 ft. of 18-in. pipe; 1,034 line. ft. 15-in. pipe; 4,240 ft. of 12-in. pipe; 9,634 ft. of 10-in. pipe; 6,234 ft. of 8-in. pipe; 92 manholes. Said sewers are distributed in about thirty different streets or parts of streets. Between 4,000 and 5,000 feet of the above sewer work is to be let in one contract and the remainder in a separate contract. Bids are asked per lineal foot for each size of pipe, including all manholes and fittings. All pipe above 12-in. diameter must be double strength with deep socket.

The U. S. Wind Engine & Pump Co. has been awarded a contract at Barron, Wis., for the construction of a tower and water tank to the present system of waterworks for $2,950. Bids were opened Aug. 22.

The city of Waupaca, Wis., has awarded a contract to H. O. Schaefer of Green Bay, Wis., for the construction of 2,328 ft. of 10-in., and 1,825 ft. of 12-in. pipe sewer, including 13 manholes, for approximately $5,200. Bids were opened Aug. 29.

Andrew Thomsen of Racine, Wis., has been awarded a contract in Janesville, Wis., for the laying of 5,933.59 ft. of sewer pipe on Prairie Ave., from Hyatt St. to a point 425 ft. north of the center line of Walker St.; on North Bluff St., from Prospect Ave. to a point 175 ft. northerly; on Forest Park boulevard, from Ruger Ave. to South Second St.; on Clarence St., from Court St. to Milwaukee Ave.; on Jackman St., from Oakland Ave. to Forest Park boulevard; on South Main St., district boundary line, north to Sharon St.; on Carrington St., from South Main to Garfield Ave.; on Garfield Ave., from Carrington to Vista Ave., north from Garfield Ave., to Logan St.

Canada.

✣Bids will be received by G. W. Ostrom, Town Clerk of Trenton, Ont., until noon, Sept. 19, for the construction of Main St. sewers and sewage sedimentation tank. The work includes approximately: Construction of sedimentation tank in concrete and providing and laying sewers—890 ft. of 15-in.; 665 ft. of 12-in. and 987 ft. of 8-in. Plans and specifications may be seen and forms of tender obtained at the offices of T. Aird Murray, 303 Lumsden Bldg., Toronto, Ont., or that of the town clerk.

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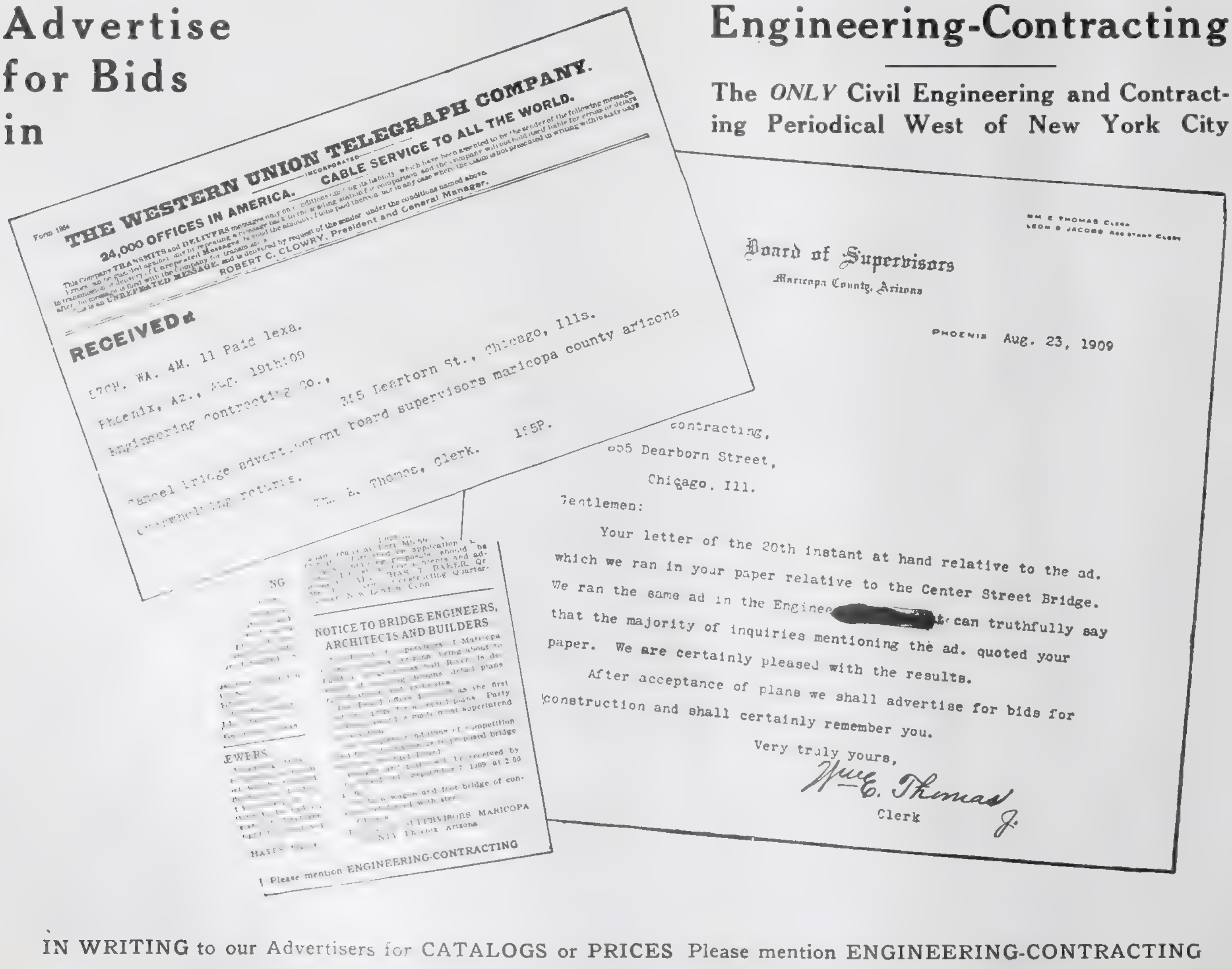

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Phoenix Aug. 23, 1909

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An Unsual Mode of Procedure in Jetting Piles.

The use of the water jet for sinking piles is comparatively old, and recurring jobs of pile jetting present little that is new in procedure or results. It is with particular interest, therefore, that we note elsewhere in this issue a variation from common practice. Reference is made to the work of constructing concrete pile supports for a section of new board walk at Atlantic City, N. J. Circumstances were fortunate in permitting one of the editors of this journal to watch this work from day to day for several weeks, and it may be said that had the editor not seen the results secured, he would have been loath to credit them. In a sense, as will be seen from the description in a succeeding column, the task was not one of jetting down piles, but of excavating by water jet holes into which piles could be sunk. In the ordinary methods of jetting the jet pipe is fastened close to or is a part of the pile, and its function is to loosen and displace, temporarily, the soil under the pile point sufficiently to permit it to be displaced permanently by the weight of the pile, aided often by light hammer blows. This idea is distinct from that of excavating a hole into which to lower the pile, which was virtually what was done at Atlantic City. The surprising feature of this work is, of course, that the excavated hole maintained its character; the natural assumption would be that, with nothing but the rising column of water to support them, the sides would cave in as fast as the sand was displaced by the jet, and that instead of a well-like hole, there would result merely a cone-shaped pit little suited for holding a pile. The hole did maintain its form in every instance and without a material amount of caving for so long a time at least as was required to swing and lower the pile, and as remarked elsewhere, the speed of this operation was often deliberate. The work at Atlantic City suggests the idea that contractors have available in the water jet a tool which is applicable in certain soils to a variety of uses such as setting poles, piles and posts and excavating around similar structures which have to be removed.

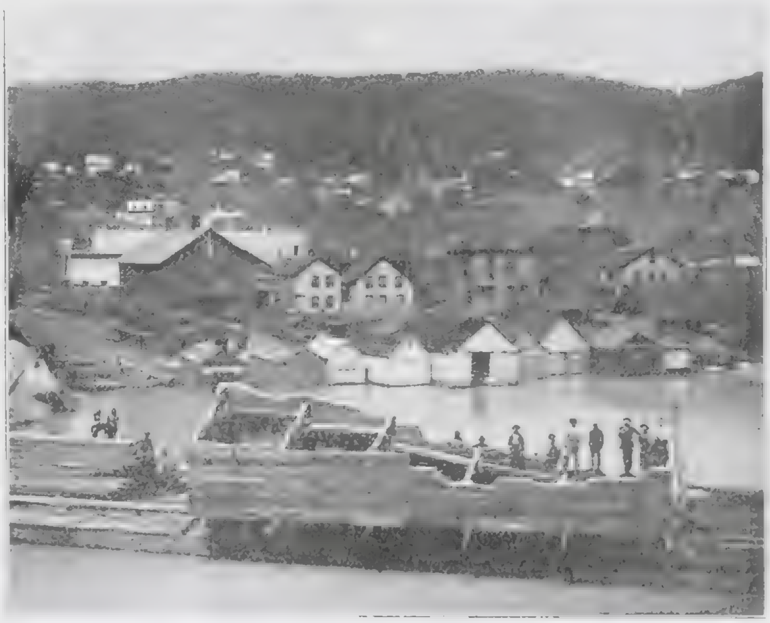
Some Notes on Cofferdam Construction on the New York State Barge Canal.

In going over the Barge Canal lock and dam work along the Mohawk and upper Hudson rivers the preponderating use of wooden cofferdams is noticeable. Steel sheeting is used in only a few places where unusually large dams and sturdy construction are required. Of wooden dams the variety is quite large. The core wall type of dam consisting of a single line of wood sheeting with earth and rock dumped on both sides proved unequal to the winter floods. Along the Mohawk except in a few places in still water the dams of this type were carried away during the first season. Comparatively few were used. A more extensively used construction and one which gave better success generally consisted of double lines of wood sheeting filled between with earth and rock.

Another construction noted was used in a shallow stretch of water on gravel bottom. Here, the cofferdam was made of small round timber which had been cut nearby. The timbers were put together after the manner of loose cribbing with long pieces on the sides and tied at intervals of 6 or 8 ft. with shorter pieces. The space inside was filled with earth and a line of sheeting was driven along the water side of the cofferdam. This construction worked well. Another type is the square timber cofferdam consisting of two long walls of square timbers dovetailed and bolted together and with cross walls at regular intervals, dovetailed into the side walls. This type is used to advantage on soft bottom material and serves as a more permanent work.

A type of cofferdam used on gravel bottom which served well was that used on dam construction on the lower Mohawk. Here square timbers were used and square cribs were made and set in the river at alternate regular intervals and filled with earth and rock. The open spaces between these cribs or piers were then spanned by two guide timbers for the sheeting which was driven all along the face of the piers.

The accompanying view shows the structure used at the upper end of the Champlain Canal where the cofferdam was on rock bottom. One crib cofferdam had been carried away and on account of the very uneven rock bottom it was difficult to place a cofferdam which would be at all permanent. It was finally decided to make a cofferdam which would fit into the jagged rock bottom. Accordingly a survey was made and more than 1,700 soundings were taken in 200 ft. The cofferdam was built of 3-in. timber in square sections. These square sections were cut in a zig-zag manner to fit exactly to the profile of the bottom of the stream. They were sunk to position and filled with earth and rock. Careful measurements were required for this and the result was highly successful. The cofferdam has now stood the floods of two seasons and appears to be unharmed.



View of Cofferdam Cut to Fit Profile of Rock Bottom.

The U. S. Steel Corporation, which a few years ago penetrated the extreme western portion of the Mesabi iron range with its Duluth, Mesabi & Northern railroad, is preparing to enter the extreme eastern portion of the range in similar manner. Its Duluth & Iron Range road, the present terminus of which is at the Spring mine, is to be extended 10 miles or more to the east. Construction work will be started shortly. The extension will tap a large belt of timber and other interests owned by the Steel Corporation and it will also open considerable areas of mineral land. Forest fires have run riot in the district this summer and have rendered necessary prompt logging operations to save much of the timber. The railroad extension will facilitate the work. Much of the mineral lands are held under option by George A. St. Clair and his associates. These holdings aggregate some 10,000 acres. The lands will be explored with transportation facilities available, and with strong likelihod that a number of mines will be developed. The presence of ore has long been known, but on account of the inaccessibility of the district very little exploratory work has yet been done.

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CONCRETE AND REINFORCED CONCRETE SECTION

The Construction Methods on the Rocky River Bridge, with Some Costs.

So much has been written about the main features of the design of the Rocky River Bridge at Cleveland, Ohio, that readers of technical journals are quite well informed regarding them. The construction work has not been written about to any great extent, however, and it will be the purpose of this article to describe the methods employed in the building of the structure, with only a brief account of its structural features and no discussion of the design.

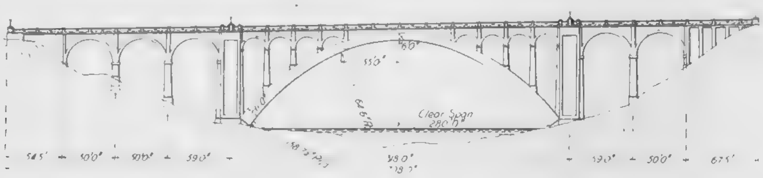

Fig. 1—General Elevation of Rocky River Bridge, Cleveland, O., With 280-ft. Concrete Arch Span.

The Rocky River Bridge is located about one-half mile from the outlet of the Rocky River into Lake Erie and it spans the river which runs here between high banks of earth, clay and shale. The floor of the bridge is about 96 ft. above the water. The bridge is entirely of concrete and is of the type known as Luxemburg construction, the essential feature of which is two comparatively narrow bridges placed side by side with the space between bridged over by the roadway. At Rocky River the space between arches is 18 ft. The length of the bridge is 708 ft. between abutments. This includes one main span of 280 ft. and five 44-ft. approach arch spans, three of which are on the west side and two on the east side of the main span. The main span consists of a pair of plain concrete ribs, each 22 ft. wide by 11 ft. thick at the springing line and tapering to 18 ft. in width by 6 ft. thick at the crown. These ribs have no steel reinforcement, but contain slabs of stone embedded in the arch on radial lines, which stones are intended to raise the compressive strength of the arch. These were placed in the concrete about 6 ins. between faces and they constitute approximately 35 per cent of the volume of the main arch ribs. The small arches of 44-ft. span are in two pairs. For each span a spandrel wall 2 ft. wide mounts each rib and runs up to the level of the bridge floor. These ribs are 5 ft. 1 in. wide by 3 ft. thick at the springing line and taper to 4 ft. x 2 ft. at the crown. This taper, it may be stated, corresponds to a batter of 1 in 40, which is carried out on all the piers and arches of the structure.

The construction plant for the bridge consistetd mainly of an 800-ft. span Lidgerwood cableway with towers mounted on rails. It was arranged so as to move sideways and thus gave access to any strip of the bridge on which it was desired to work. The cableway was capable of carrying 10 tons or more and actually carried some loads which were estimated to exceed this amount. The main cable was 3 ins. in diameter and the load line was ¾ in. in diameter. Once in about three months the main cable was taken up, or shortened to take out the sag, which usually developed in that length of time. The load line was renewed about every three months which gave it a working life of about 80 or 90 days. This cable was afterward used on small derricks and the like.

The broken stone used for the piers was 2 in. slag and for the balance of the work was limestone of the same size. All material was shipped in by railway to a point about ½ mile from the bridge. The cement was stored in a shed at the depot and was sometimes hauled directly from the cars to the cement shed at the bridge. The hauling averaged about 6 loads of 60 sacks each in 10 hours. When the mixer was running the cement was delivered directly to the mixer platform. The stone and sand were delivered in gondola cars on a sidetrack at the railway station. A derrick with ½ cu. yd. clamshell bucket was stationed here and a slope bottom bin of 15 cu. yds. capacity was built alongside the tracks. The bin was raised high enough for wagons to pass under to receive their loads. A bottom dump wagon made 10 trips a day between the bins and the bridge, a distance of about ½ mile. The unloading of the gondola cars was done by the clamshell which dumped the stone or sand into the bin. There was no swinging motion on the derrick and 2 men were required to pull the boom back and forth from car to bin. The average number of cars of stone unloaded in this way each day was 4 and of sand was 7. The gang consisted of 1 engineer at $3, 1 foreman at $3.50 and 5 laborers at $1.75, a total of $11.75 per day. The cement was required to be kept in storage, however, until testing had been done and in order to get enough on hand for running the main arch, several sheds located along the side track were rented for a short period and a storage capacity of 8,000 sacks was obtained.

In planning the sequence of operations in the construction of the bridge, it was decided first to build the foundations for the main piers, then simultaneously those for the abutments and then for the remaining three piers. Following this, the forms for the south half of the bridge were to be prepared, beginning with the two main piers and following with the other three piers which supported the 44-ft. approach arches. The abutments were not designed in two separate parts as was the balance of the bridge, and these were built complete in the early part of 1909. It was desired to get most of the south half of the bridge piers and arches completed before the steel center for the south rib of the main arch was ready to be mounted with the wood forms. It was necessary to have at least the greater part of the weight of the main piers to take the thrust of the arch, and it was desired to have a floor out to the main piers to facilitate communication with the work on the main arch. This was accomplished in so far as the piers and east approach arches and floor were concerned, but the west approach arches and floor were not built until after the construction of the main arch ribs.

FORMS FOR PIERS AND SMALL ARCHES.

Figure 2 shows the plans of the forms used on the main piers. It was necessary to build forms complete for one of the main piers on each side of the river and these forms were then stripped and used for the duplicate piers which stood beside under the north half of the bridge. These forms as may be noticed from the drawings, were built in sections 16 to 20 ft. high, this height varying according to convenience and with the lengths of lumber on hand. After one section of pier forms had been put up, the concrete was put in and another section was placed on top of it and filled and these operations repeated until the pier reached the desired height.

The forms were made of 2-in. tongued and grooved lumber, with 3x6-in. studding placed at 3 ft. spaces. On the sides of the pier the studding was vertical and on the forward and rear faces of the pier, the studding was

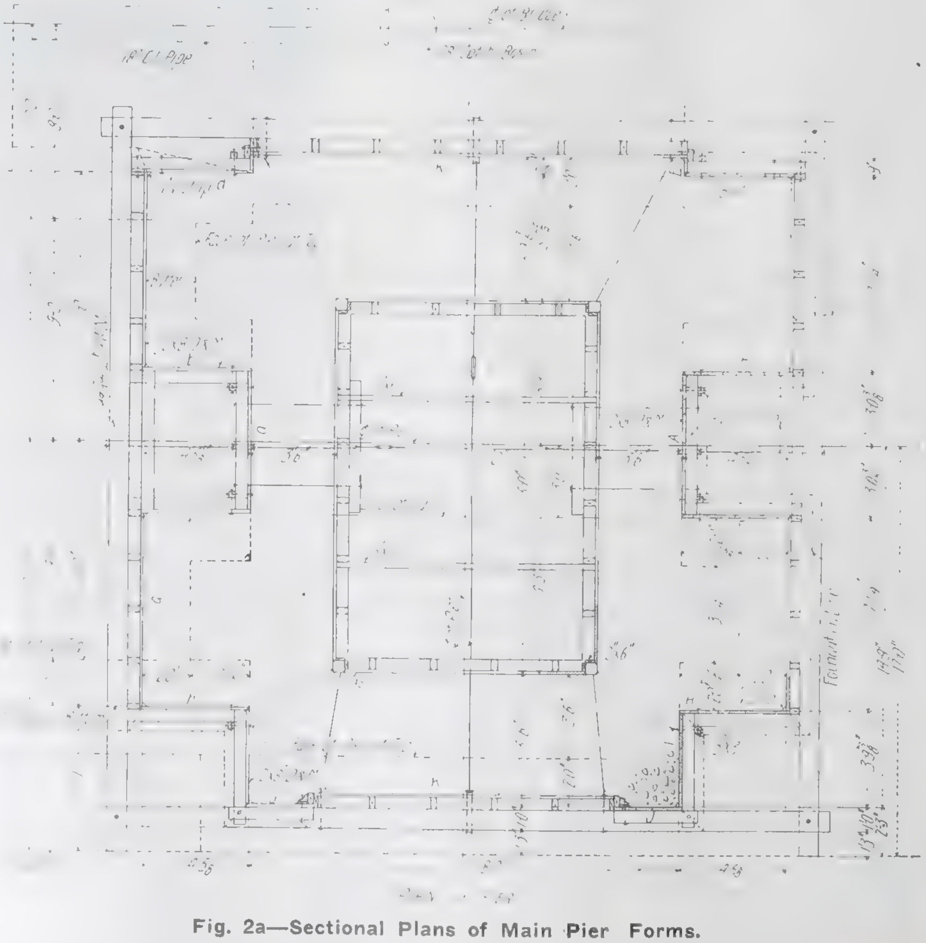

Fig. 2a—Sectional Plans of Main Pier Forms.

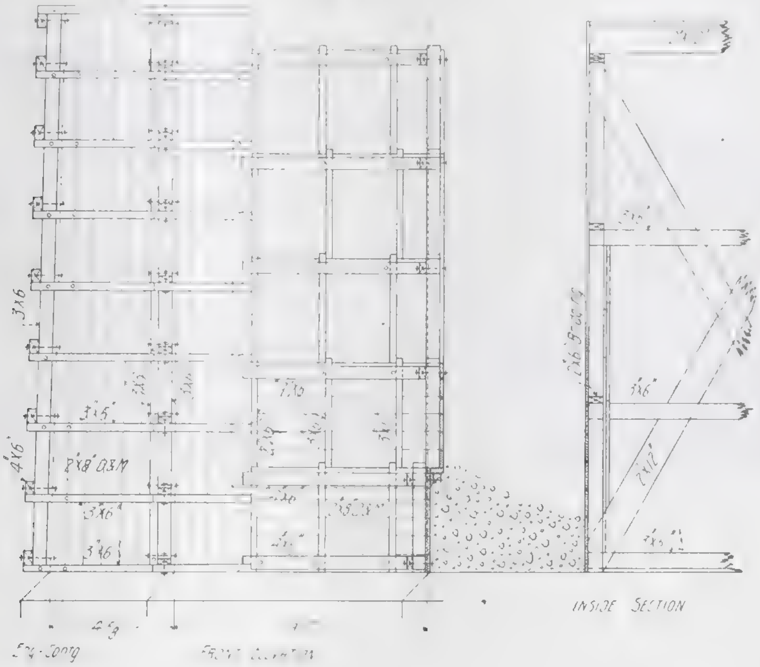

Fig. 2b—Sectional Elevation of Main Pier Forms.

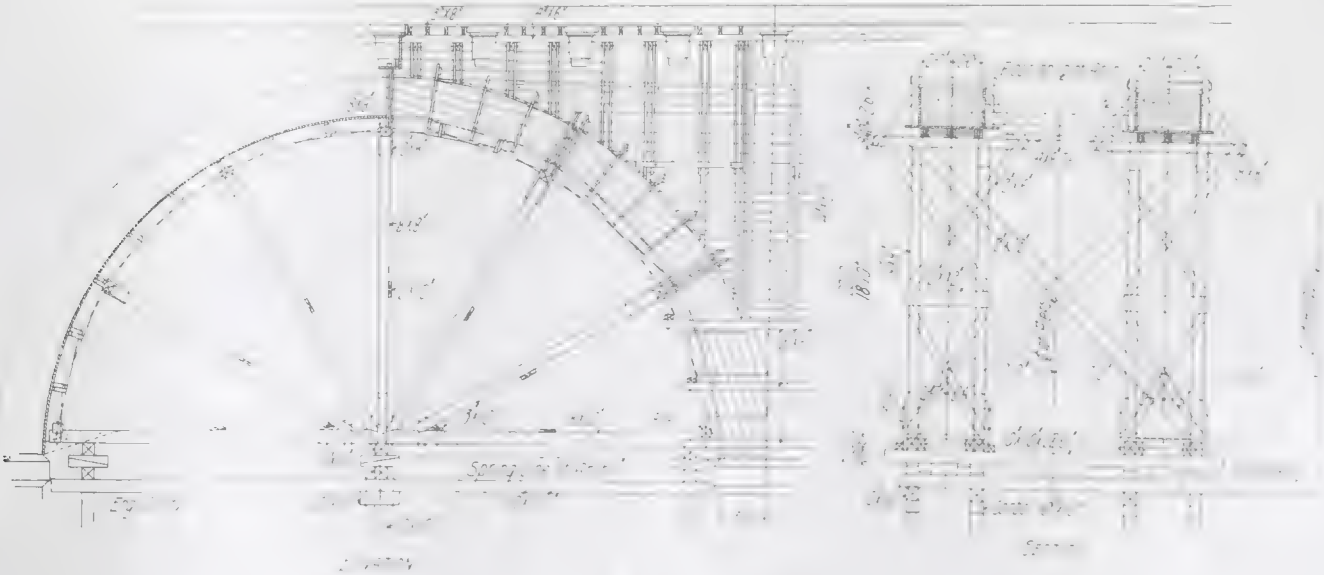

Fig. 3—Details of Forms and Centers for Approach Arches.

placed horizontally. This was done because on the sides the surface of the pier was straight for a considerable width, and it was impossible to handle a form of the width required and of the height of the section. Therefore the side forms were made with vertical studs and in sections only about 5 ft. in height. The faces of the pier were offset with two pilasters each. The sections forming the sides and pilasters were made with horizontal studs, and those for the faces of the pilasters were made with vertical studs. Around all, the pier forms were girded with 10x10-in. and 12x12-in. timbers (these timbers were purchased primarily to be used as stringers for the lagging on the steel center for the main arch but did excellent service on the piers although they were larger than necessary for this purpose) which were bolted together at the corners. These timbers came in contact with all vertical studding and the portions of the form which were not in contact with the timbers were braced to them. All the forms were made up in the lumber yard where a small carpenter shop was located. The shop contained a band saw, a circular rip saw, and a circular cross cut saw. From the yard the forms were sent on a wagon to the cableway which picked them up and landed them at a point where they could be reached by the derrick which served the pier. Besides the outside forms a rectangular core form 11x15 ft. was made for the center of the pier. This form was erected before the outside sections and was built up on the site of the pier by erecting the studding in place and then nailing the 2-in. rough plank to the studding. After this had been erected in place it was braced and cross braced inside with 2x8-in. boards and the outside forms were placed and tied temporarily to the core form, one piece at a time. At first the work was done haphazard, but the following system was soon developed as the most economical method of handling the pier forms. As shown on the plan, Fig. 2, each section is lettered. The gang of carpenters which numbered from 9 to 12, was divided after the core was ready and one part of the men set up half the forms and the other part set up the other half. The capital letters indicate the order in which one of the gangs handled their part of the forms and the small letters indicate the work of the other gang. The foreman picked out the proper pieces and they were handled by the derrick in their order. First one gang would be given a section and while that was being plumbed and temporarily braced into position the derrick would give the other gang a piece for its side. The setting up of the outside forms and temporarily bracing them in position usually required one day of 10 hours. Sections marked *A*, *E*, and *I* and *a*, *e* and *i*, were plumb and all others were battered 1 in 40. After the temporary bracing of all the forms, one gang worked on the outside and the balance on the inside of the pier. Outside temporary wooden brackets were nailed to the studding and the heavy waling was set on them. These timbers as before mentioned were placed all around the form and bolted together at the corners. They were spaced vertically at about 5 ft. After this the timbers were drilled through at various points shown for ½-in. bolts which extended into the concrete 2 ins. and had a hook nut on the end which was left in the concrete. The hook nut was wired to the waling strips which were placed inside the core wall studding. Besides the wiring at various places shown, a system of bolts was used to tie the outside timbers together at their centers. At first only wires were used but some trouble was experienced from bulging forms so the bolts were added. The inside gang attended to drilling holes in the core for the wires, placing the waling strips inside the core form and when this was done, the work on the outside had generally progressed far enough so that the inside wiring from the core to the bolts, which projected through from the outside timbers, could then be accomplished. When the pier forms were made solid by the bolting and wiring V-strips were put in the corners and the pier left for concreting. In this manner the work was repeated 16 times for the completion of the four main piers. The carpenter gang which worked on the main piers consisted of 1 foreman, 5 or 6 carpenters and 4 to 6 carpenter helpers. This gang worked alternately on one main pier and then on the other at the opposite side of the river. After a pier section was finished it was concreted before the gang returned to put on the next section above. The core form was built so that it could be ripped out, leaving the four corner posts standing. This permitted the using of the material in the core form on the section immediately above and the four posts acted as stilts holding up the rising sections. Two men were kept busy most of the time taking out the bolts soon after the concrete had set and these were taken to the blacksmith shop, re-threaded and placed in stock piles. The construction of one section of a pier took five days with a full gang and 3 days of this time a derrick engineer was needed. There were about 300 cu. yds. in the lower sections of the big piers and about 150 cu. yds in the top sections. The labor on each section cost about $206, or approximately 90 cts. per cu. yd. for the entire pier.

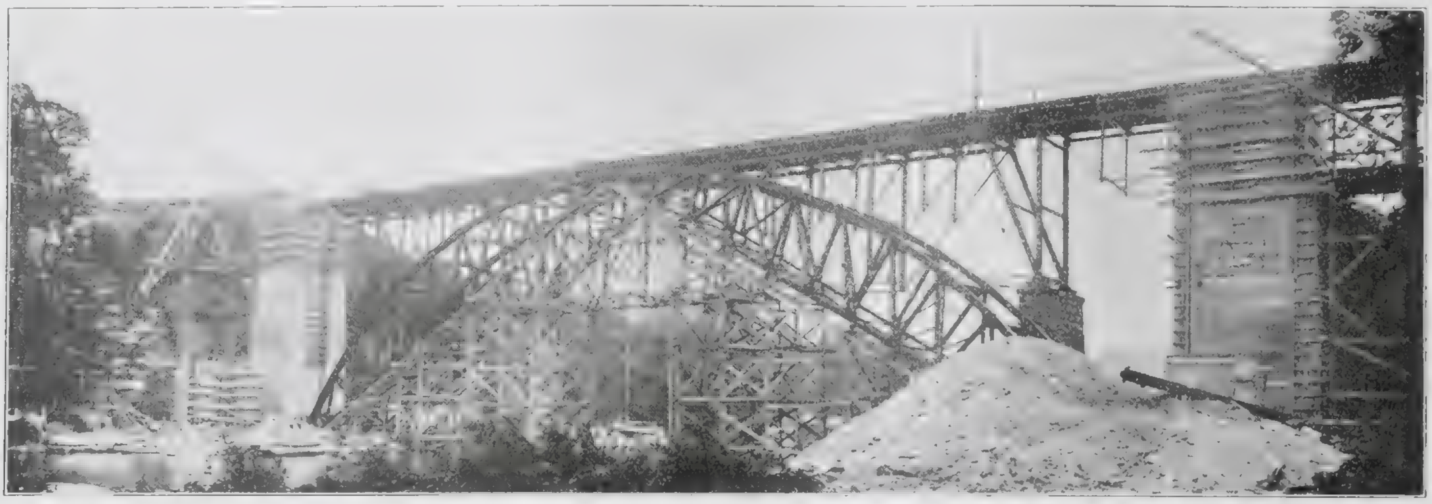

Fig. 4—General View Showing Three Hinged Steel Arch Center.

On the other piers, which were rectangular battered piers and which were built of the same class of lumber and by the same men, the costs for carpenter labor ran about 50 cts. a cu. yd. The carpenters were paid 30 and 35 cts. per hour and the helpers 25 cts. per hour. The helpers were required to have a saw, hammer, and ⅝ in. augur. It must be noted here that this gang of carpenters also carried up the timber falsework which carried the 44-ft. arches. This was done as the main piers progressed so that when these piers had reached the elevation of the springing line of the arch the falsework was ready to receive the arch form.

The approach arch forms are shown by Fig. 3. These arches are practically a half circle of 22 ft. radius. The bents were made of 8x8-in. timbers as shown. These were framed in the lumber yard and brought over on a wagon to the cableway. Each bent was handled by the cable way to its place on top of the falsework. Six of the best climbing carpenters, did the setting up. Each bent was set at its proper angle with the horizontal, the lower ones being set and braced first and lastly the center bent. The bents were tied together by the curved ribs which were made of five thicknesses of 2x8-in. rough plank sawed to the proper curve. The ribs were made in segments which dovetailed into one another. The lagging which consisted of beveled 2x4's was sawed to proper lengths in the wood shop and sent out on a wagon and delivered to the carpenters by the cableway. In the same way the sides were sent out. These sides were made of 2-in. dressed stuff and had 3x6-in. studs set about 3 ft. apart on radial lines. The studs were cut flush with the lower edge of the forms but projected a foot above the top edge. This was so that a tie could be nailed to them across the arch rib, tieing the sides together. The sides rested on top of the lagging, instead of the lagging butting against the sides. This was done because the arch was tapered from 5 ft. 1 in. at the bottom to 4 ft. at the top and the method used saved cutting the lagging to this shape. To hold the sides from spreading at the bottom, blocks were nailed against them and to the lagging. To hold the sides from lifting, diagonal pieces were nailed from the studs to the caps of the several bents. (Fig. 3.) The ties which were nailed to the studs over the top of the concrete were kept 6 or 8 ins. above the edge of the forms to allow room for the top lagging which was nailed on as the concrete was carried up. Besides nailing, this back lagging had to be braced as the pressure of the concrete under a head soon loosened it. A 4 or 6-in. piece 3½ ft. long, was used for this purpose, being placed on edge against the lagging and held tightly against it by shoving the ends under the cross ties described above. Near the crown of the arch the pressure was less and the top lagging did not have to be braced.

Six carpenters set up four of these arch ribs with the aid of the cableway in approximately 8 working days of 10 hours. They also built a runway out over them for bringing concrete in two wheeled dump carts. Each rib contained only about 35 cu. yds. so the cost of concrete per cubic yard was higher than would seem correct at first glance. The cost of carpenter labor amounted to approximately $1.20 per cu. yd. The lumber used in the arch forms is given in Table II.

CONCRETING PIERS AND SMALL ARCHES.

The concrete mixing plant was built alongside of the east cableway tower and was arranged with two bins above the mixer which were kept loaded from the stock piles nearby by means of a mast derrick operating a Williams clamshell bucket. The bins discharged into measuring boxes which were discharged into a continuous mixer designed by the contractors. The mixer consisted simply of a shaft with steel paddles (twisted to take the shape of a propeller) fastened to it, at 8-in. intervals. The shaft operated in an inclined trough of sheet steel and the mixture discharged from it into a hopper which held 1½ cu. yds. This hopper was centered over a narrow gage track which carried the dump buckets back and forth to the cableway, a distance of only a few feet. The car was pulled by a continuous cable which ran over a drum operated by a 5 h. p. engine located on the cableway tower. Large Doud dump buckets were used for the places where big batches could be dumped, but a ¾ cu. yd. Hatch bucket, which can be dumped gradually through the bottom, was found to be the best for small places in forms. In concreting the main piers a platform was used which was made especially to be picked up by the cableway and set on top of the core forms of the piers when ready for concrete. This platform was 15x11 ft. At first the concrete was dumped onto the platform and shoveled down over the edge of it through chutes, but later the buckets were set on this platform by the cableway and then picked up by the derrick and lowered till they were near the bottom and then dumped. It will be noted from the drawing of the main pier form, Fig. 3, that the wiring, bolting, and bracing of the pier was arranged so that the buckets had spaces in which to be lowered. This method of placing the concrete was eminently satisfactory, but required care in keeping the heavy buckets from bumping the forms and knocking them out of line. A rigid watch was kept on this at all times of concreting. With the system of bolting and outside timber waling the forms were quite rigid and very easily brought back to line by wedging between outside timbers and

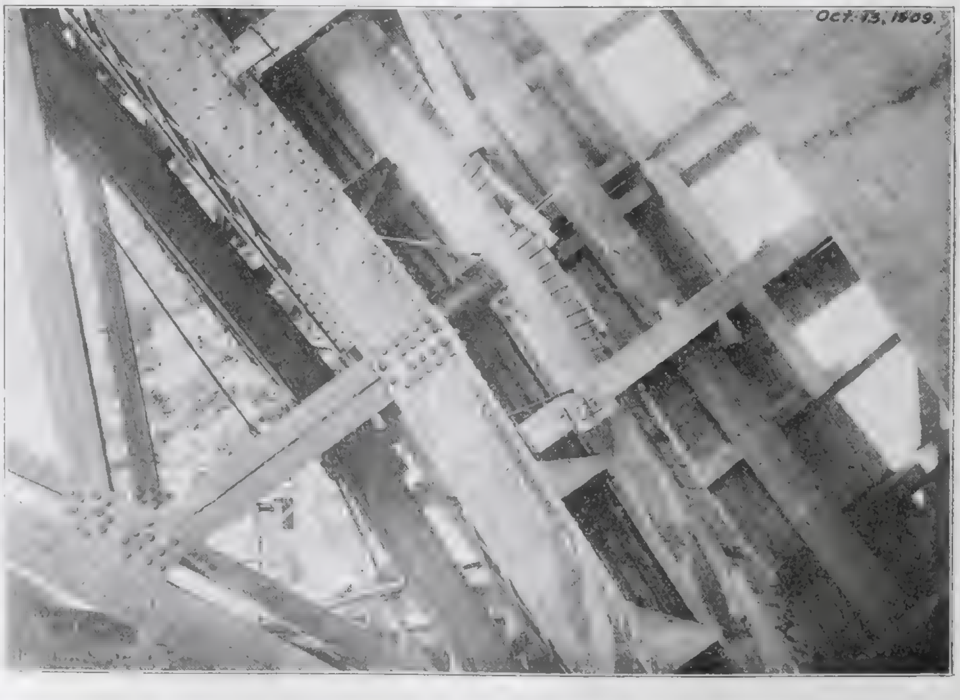

Fig. 5—Detail View of Steel Arch Center at Upper Panel Point.

TABLE I—MAIN PIER FORMS. SCHEDULE OF MATERIAL SOUTHEAST PIER NORTHEAST PIER SIMILAR. SEE FIG 2.

Quantity		Size	Length		Remarks
		Outside Walls.			
432	Pieces	2"x 8"	20'	0"	Dressed and matched
8	Pieces	3"x 6"	20'	0"	Dressed
8	Pieces	2"x10"	20'	0"	Dressed
42	Pieces	2"x 8"	14'	0"	Dressed and matched
150	Pieces	2"x 8"	8'	0"	Dressed and matched
42	Pieces	2"x 8"	18'	0"	Dressed and matched
1000	ft.	1" V strip & 200 ft O. G. Mould.			See Detail for Size
108	Pieces	3"x 6"	6'	1"	Rough
6	Pieces	4"x 6"	14'	0"	Rough
6	Pieces	3"x 6"	18'	0"	Rough
24	Pieces	4"x 6"	9'	6"	Rough
8	Pieces	4"x 6"	20'	0"	Rough
288	Pieces	2"x 6"	5'	0"	Rough
72	Pieces	3"x 6"	3'	6"	Rough
72	Pieces	3"x 6"	4'	6"	Rough
48	Pieces	3"x 6"	4'	0"	Rough
10	Pieces	2"x 6"	4'	0"	Rough
32	Pieces	3"x 3"	20'	0"	Rough
		Inside Walls.			
64	Pieces	2"x12"	16'	0"	Dressed
64	Pieces	2"x12"	10'	0"	Dressed
18	Pieces	6"x 6"	18'	0"	Dressed } Posts
80	Pieces	3"x 6"	18'	0"	Rough } Posts
32	Pieces	2"x 4"	18'	0"	Rough
24	Pieces	3"x 6"	12'	0"	Rough Braces
16	Pieces	2"x 6"	20'	0"	Rough Braces
16	Pieces	2"x 6"	24'	0"	Rough Braces
42	Pieces	2"x 6"	16'	0"	Rough Plates and Bridging
42	Pieces	2"x 6"	12'	0"	Rough Plates and Bridging
32	Pieces	2"x12"	12'	0"	Rough Joist
300	Pieces	2"x12"	16'	0"	Rough Braces
200	Bolts	½"x 7" long			
1,000	Bolts	½"x10" long			
1,300	Bolts	½"x12" long			
200	Bolts	½"x14" long			

forms. With this system of placing concrete about 150 cu. yds. were placed in a day. This was done with 8 men and 1 foreman. Besides these there were the cableway engineer, and fireman and the gang of men concerned only with the manufacturing of the concrete. This gang always consisted of 8 men as follows. One derrick engineer, 1 mixer engineer, 4 men attending to feeding the mixer, and 2 men running the car to and from the cableway and hooking on. The cost of labor per 10-hour day of mixing was about $20.50 and for placing was about $24, including the cableway labor charges. This is, of course, merely for labor and also, does not include labor on placing the granite facing, which was carried on at the same time, and will be mentioned later.

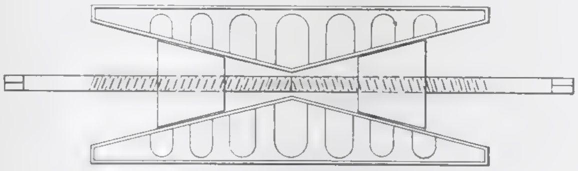
Fig. 6—Wedge for Lowering Main Arch Center 6-ins.

Concreting the first set of approach arches was carried on without the use of the cableway as this was at the time being used exclusively by the steel men who were at work erecting the steel center for the main arch span. As mentioned above a runway was built from the mixer chute out over the four ribs of the two 44-ft. spans. These four ribs were poured in two days—the two south ribs being poured one day and the two north ribs at another time. As there was only 70 cu. yds. for each day's work the concreting was finished easily within the limits of the day's time. Otherwise the work would have been carried on overtime until the ribs were completed, as it was desired to make these small ribs monolithic. The distance to the mixer was about 200 ft. and 6 men were employed to wheel the ¼ cu. yd. two-wheeled carts. Four men were in the forms for spreading and tamping and 2 men were on top to serve the men in the forms, help dump the carts, and do various services. A concrete foreman was in charge of the placing. The cost of mixing and placing the concrete in the small arch ribs was approximately 67 cts. per cu. yd.

The reinforcing bars, of which there were 48 1-in. bars and 24 ¾-in. bars, all about 16 ft. long and bent to the 22 ft. radius, required the time of two handy men for two days, bending and placing. They were bent by hand, using two 1-in. steel pins driven into a 12x12-in. timber 6 ins. apart, placing the reinforcing bar between them and prying until the bar was bent. This was repeated at different points on the bar and the curve repeatedly checked. After several bars were bent, the men became accustomed to the radius and bent the balance with much more accuracy. The bending of the 72 bars took about a day. The placing, and looking after them while concreting was being done, took another day. The cost of bending and placing was about ⅞ cts. a pound.

After running the small arch ribs carpenter work was immediately begun on the 2-ft. spandrel walls which surmounted the ribs and supported the floor. The walls were built of 2-in. material and 3x6-in. studs and the sides were wired together. An account was kept on the carpenter labor for this class of form construction, viz., the construction and erection of 100 ft. of the forms for the spandrel walls and floor of the bridge, including 16 ornamental brackets. The making of the brackets took 4 days with 3 carpenters. These brackets were used a dozen or more times. The erection of 100 ft. of superfloor forms required 6 days, with a varying number of carpenters, in all amounting to 452 men-hours. Including the brackets which cost $14 for the

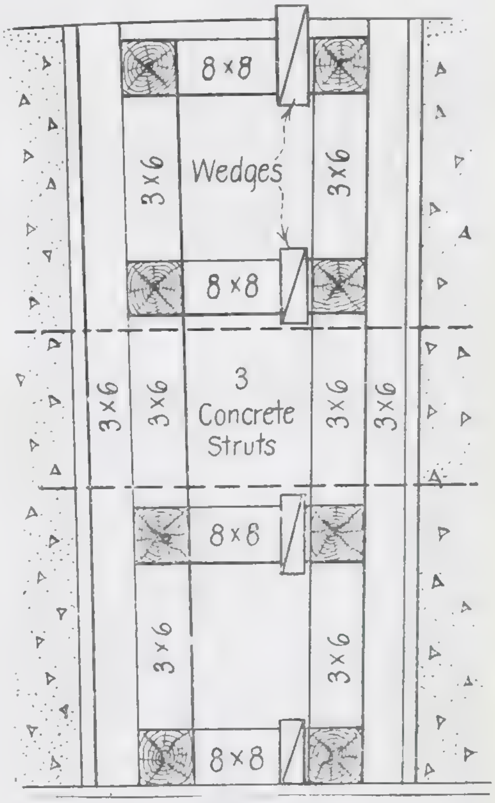

Fig. 7—Detail of Keyway Bracing.

TABLE II—SCHEDULE OF MATERIAL FOR ONE 44-FT. ARCH AS SHOWN IN FIG 3.

Item	No.	Size	Length	
Lower Cord	8	8"x10"	22'	0"
Lower Cord Splice	4	6"x10"	8'	0"
Struts	20	8"x 8"	20'	0"
Caps	14	8"x 8"	10'	0"
Braces	20	2"x 6"	14'	0"
Braces	20	2"x 6"	10'	0"
Ties	14	2"x12"	5'	6"
Ties	4	3"x 8"	3'	0"
Ties	4	2"x10"	7'	6"
Scabs	4	2"x 8"	2'	6"
Joist	84	2"x12"	14'	0"
Studding	80	2"x 6"	10'	0"
Braces	80	2"x 6"	16'	0"
Lagging. 2"x4" Beveled, board feet				2,000
Center Ties	7	4"x 8"	8'	0"
Center Braces	[illegible]	[illegible]	[illegible]	0"
Ties for Pier Tops	8	6"x 8"	12'	0"
Ties for Pier Tops	4	6"x 8"	14'	0"
Planking 2"x8" D. & M. 12' & 14' long				3,000 sq. ft.
Ties	8	2"x 8"	7'	0"
Wedges, 24 Sets		8"x 8"	2'	6"
24 Bolts		½"x16"		
4 Bolts		½"x14"		
8 Bolts		½"x18"		
4 Bolts		½"x20"		
6 Bolts		½"x12"		
4 Bolts		½"x19"		
8 Bolts		½"x10"		
8 Bolts		½"x14"		
14 Bolts		½"x13"		
56 Form Bolts		½"x1[illegible]"		
20 Form Bolts		½"x12"		
42 Form Bolts		½"x16"		
32 Form Bolts		½"x 7"		
64 Form Bolts		½"x 8"		

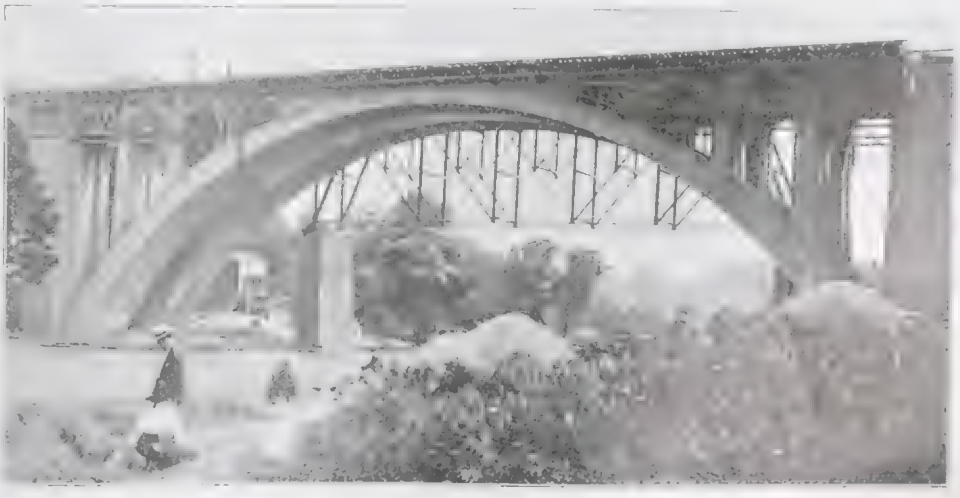
Fig. 8—View Showing Completed Main Arch Ribs.

making, the entire carpenter labor charge was $130.55. In the section built with these forms 260 cu. yds. of concrete were placed, making the cost of labor on forms approximately 50 cts. per cu. yd.

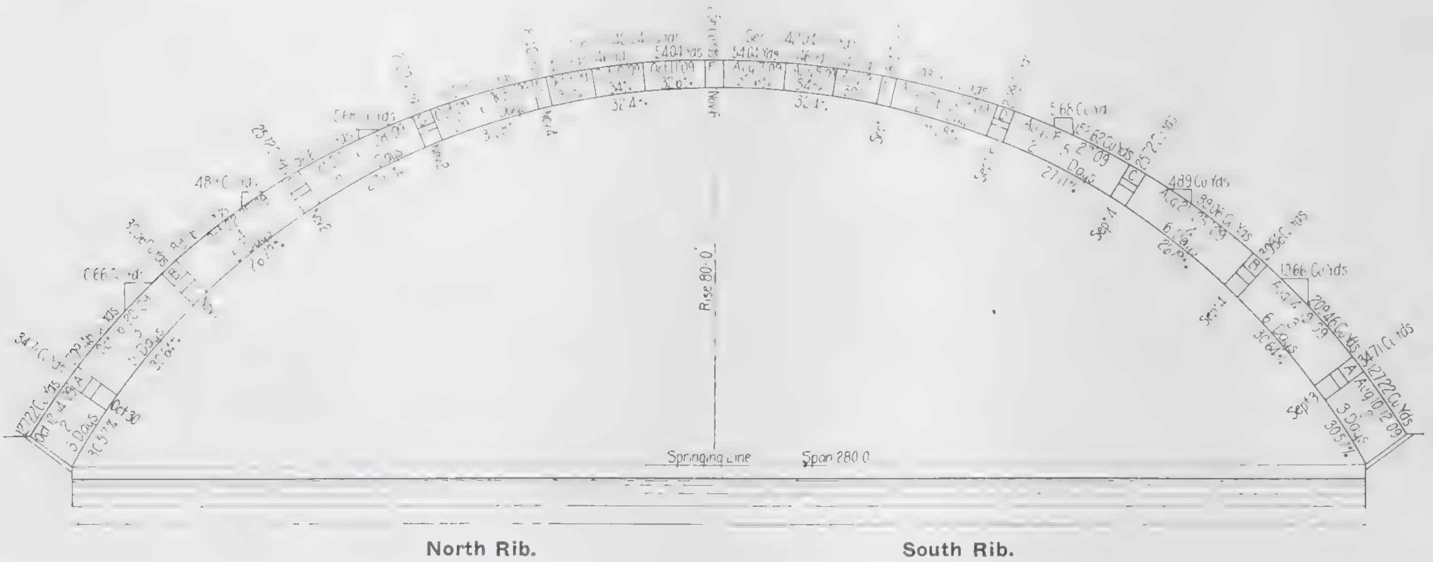

Fig. 9—Diagram Showing Progress on Main Arch Ribs.

MOVING SMALL ARCH CENTERS.

After the small arches had been in place 28 days the stripping gang proceeded to make the centers ready for moving to the position of the arches in the north half of the bridge. This consisted of moving the arch centers and the entire falsework under them, laterally 34 ft. The sides of the arch centers were stripped and stored carefully in a pile by means of a small derrick which handled each section of the sides separately as it was loosened. The wedges, which consisted of 10x10-in. blocks, 12-ins. long, sawed diagonally, were loosened under the arch center lowering it several inches clear of the concrete. There were three bents in the falsework supporting the arch center. A runway, made in line with the lower sills of the end bents of the falsework, was erected with 10x10-in. posts and caps. The falsework was then jacked up and 4-in. rollers were placed under the end bents. Before the falsework was jacked up however, it was necessary to support the center bent which was to be suspended during the moving. To do this two 1-in. cables were used. They were fastened on each side of the false work, the end of the cable being fastened around the top cap of each end bent and the cables passing down under the bottom sill of the center bent. The cables were drawn tight with a steamboat ratchet. After jacking up the falsework, ropes were fastened to the end bents and were run through a couple of pully blocks to the nigger heads of an engine where two nigger head men pulled the falsework and arch centers over to the new position a few inches at a time. The actual movement of 34 ft. required less than one hour's time. The actual labor costs of stripping and moving these arches were not kept as the work was done at odd times. It may be stated, however, that a gang of 4 to 6 men was kept continually at this class of work together with moving derricks and doing general rigging work.

THE MAIN ARCH.

The main arch consists of two ribs of 280 ft. span, 22-ft. wide by 11-ft. thick at the skewback and tapering to 18-ft. wide by 6-ft. thick at the crown. The arch is three centered, has a rise of 80 ft. 10 ins. and the line of pressure resulting from the dead and live loads follows very closely the center of the arch, thus making any steel reinforcement unnecessary. The arch spans Rocky River which at this point is at the level of Lake Erie and in winter is subject to serious ice-jams.

On estimating the cost of the movable steel arch and comparing it with the estimate of the cost of a timber centering for the two ribs, it was found that the cost for either one would be practically the same. The advantages of the steel center were, first in having a clear span unobstructing the river and safe from the winter ice; second, in the saving of time of moving the center from first to second position, and third, in the greater rigidity of the steel over the timber center. The contractor's consulting engineer, Wilbur J. Watson, of Cleveland, designed the center for the arch and has patented certain features of the design. The center evolved consisted essentially of a three hinged steel arch. The stress sheets for this center shows that it is designed to resist only the radial component of the vertical weight; the tangential component being carried to the abutments by the concrete itself, and by a system of wooden bows which were used as stringers to which the lagging was nailed. These wooden bows consisted of 12x12-in. timbers set 2 ft. on centers at the abutments and of thickness gradually decreasing up to the crown of the arch where 3x12's were used. The deformations of the steel arch under different conditions of loading and temperature were accurately calculated and a system of loading the center evolved so that no cracks were produced by movements of the arch. This system consisted in depositing the concrete in large voussoir sections, separated by key spaces of 4 ft. Three concrete struts were built in each of these key spaces of sufficient section to be able to carry the tangential component of the load. The two trusses of the three-hinged steel arch were each constructed with a 2-in. camber. This camber was taken out under the loading and the arch was built to the actual curve as designed. In placing the concrete, the crown, for about 33 ft. on both sides of the center of the span,

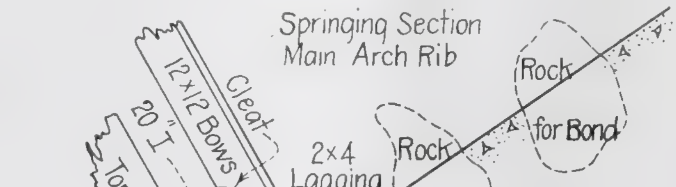

Fig. 10—Sketch Showing Arrangement of Wedges and Runway for Moving Main Arch Center.

was first loaded and the deflection was about 1¾ ins., the quarter points rising proportionately. The placing of the succeeding sections in the order as shown by Fig. 9, overcame these deflections and the quarter points receded to their true position. When all the voussoir sections had been placed the center had risen 1-in. and all the camber had been taken out of the steel trusses.

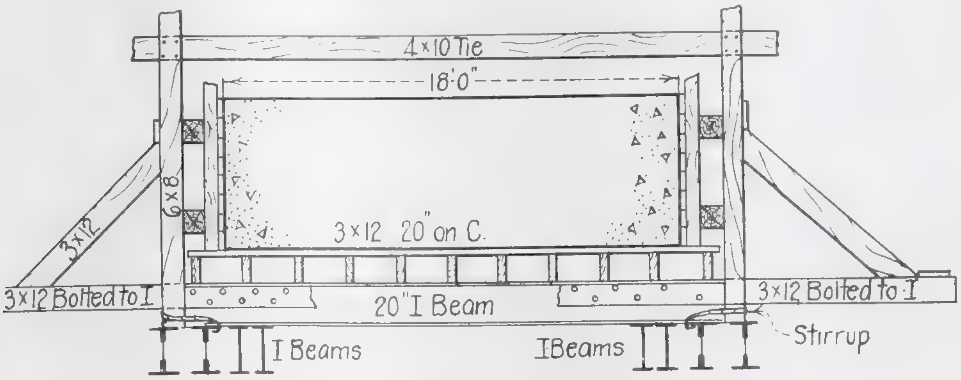

Fig. 11—Section of Main Arch Timberwork at Crown.

To return to the preparation of the work for the construction of the first rib of the main arch, the concrete in the east approach spans and floor had been completed for the south half of the bridge and the steel work of the arch center was ready about the last week in July, 1909. The top of the steel work of the arch presented a series of transverse 20-in. I-beams upon which were laid the wooden bows or stringers supporting the lagging. The I-beams had been drilled near the ends so that 3x12 in. planks about 8 ft. long and projecting out at the sides could be bolted to them. (See Fig. 11.) These were first bolted on and then a ladder was built up over them on one side of the arch, and at the top a small bridge was erected from the arch center to the floor of the existing bridge which parallels the new bridge at about 30-ft. distance. Derricks were placed on top of the main piers for handling materials for the forms being started at the abutments and the material for the crown of the arch was handled by the cableway. The derricks were placed in such a position that their booms could reach over onto the old bridge and much material was thus handled directly by the derricks without the use of the cableway. Meantime many cars of the big flat stones used in the arch were shipped in and were unloaded at the siding by a derrick with stone hooks. They were placed on flat wagon beds and delivered to the cableway and the majority were deposited down on each river bank, from there to be handled during concreting by the derricks, as far as possible. These stones averaged 8 to 12 ins. in thickness and some were over 6 ft. long and 4 ft. wide, the average being slightly smaller. They came about 35 to the flat car and each wagon carried 2 stones. In the unloading at the siding there was a derrick engineer, 2 laborers and a foreman. Five teams were used for the half-mile haul and each car was unloaded in about 1½ hours. At the bridge were the cableway engineer, a signalman, 2 men hooking on and one man unhooking.

The work of the carpenters proceeded at the same time on the main arch and the work at the crown was rushed, as this part was to be concreted first. In framing the timber bows, they were notched according to a pattern made from a 1-in. board which had been laid edgewise over the steel I-beams and marked. When they were placed in position they were butt jointed to carry the load to the abutments. Under keys *B* and *C*, however, the joints were separated and filled in with wooden relieving wedges. The timbers were fastened to the beams, merely by hooks as shown in the drawing, Fig. 10. These hooks merely prevented the timbers from sliding down. On top of the timbers 2-in. furring strips were nailed which were sawed to fit the proper curve. Unusual care and a great amount of work on the part of the Resident Engineer Mr. A. L. Stevens, in the measurements and calculations for these furring strips, is responsible for the fact that the arch is actually built to its theoretical curve. Readings were taken at each panel point both for level and horizontal distance. The horizontal distance being fixed, the elevations of the intradosal curve at these points were calculated and the furring strips sawed so as to make the proper elevation. To determine how closely the actual curve of the intrados corresponded to the theoretical curve, readings were taken on the lagging after the arch was built and before the center was lowered. This profile showed that the crown was in exactly the right position, while the maximum variation at the quarter points was less than ½ in. The length of the actual curve was within ½ in. of the theoretical length. When the arch center was lowered the concrete ring at the crown settled 0.038 ft. and 0.006 ft. at the quarter points.

The lagging consisted of beveled 2x4's and about 12,000 ft. B. M. were required. The sides were of 1⅝-in. dressed, tongued and grooved material with 3x6-in. studs. Outside the studs were two 10x10-in. waling timbers placed on a tangent to the curve. Outside these were 10x10-in. posts placed on radial lines to the main arch and resting on the top chord of the steel work. They extended above the sides of the arch and were tied across the top to the opposite posts by means of a 4x10-in. plank. At the bottom they were tied to the top chord by a ¾-in round iron stirrup as shown in Fig. 3. Two gangs of 8 to 12 carpenters were kept busy on the arch from the beginning of the carpenter work until the completion of the concrete, about 5 weeks' time.

In concreting the crown, about 6 ins. of wet concrete was spread on the bottom and the big flat stones were set on edge, on radial lines, about 6 ins. between faces. Six-inch blocks were used to hold them apart. Two gangs were worked at a time, one on each side of the arch center. The cableway brought concrete to one side and stone to the other side, and changed about. Ten or a dozen courses of stone were set and the spaces were then filled in with concrete. After the crown was loaded the voussoir sections at the bottom were started. This was slower work because the stones had to be laid nearly flat and only one layer could be put in at a time and then concreted. At noon time or after working hours, the carpenters built the keys and placed bulkheads between each of the voussoir sections. The concreting was worked up nearly to the keys before they were put in as they were in the way of placing the large stones. Usually an hour's work was sufficient with 5 or 6 men to get the timbers and material down to the work and to set one of the bulkheads before it was time to start concrete again. After this the carpenters could continue their work on the bulkhead while the concrete work was going on. The bulkhead points were marked off on the sides of the forms, and the bulkheads were set to these marks. They were made of 2-in. dressed lumber with 3x6-in. studs and three boxes were made opening through the key way to allow placing the concrete struts. The bracing is shown by Fig. 7.

Here the derricks handled the stone as far as they could reach from their location on the piers. They were then moved to a position on a scaffolding which supported them between the quarter points of the arch and the bottom chord of the old bridge alongside. From this point they reached the balance of the work. The progress and various data are shown for both arch ribs by Fig. 9.

MOVING THE STEEL ARCH CENTER

This work was started after the concrete in the last key had been in 19 days and in other parts of the arch sufficiently longer to bear the compression safely as determined by the tests of the concrete blocks. The steel arch rested on a concrete shelf on each abutment. The steel shoes supporting each of the two trusses of the arch rested on rollers and wedges, a diagram of which is given by Fig. 10. A sketch of the wedges which were designed for lowering the arch 6 ins. is shown by Fig. 6. The arch was pulled over to its new position by cables run through pulley blocks and over the drum of the 7x10-in. engines one on each side. The rigging was so made as to provide a ratio of 1 to 120. That is a movement of 120 ft. of the cable on the drum, caused the centering to shift 1 ft. on its rollers. The cost of moving the centering was slightly less than $300, but even this amount was too high and was influenced by the misplacing of a piece of grillage which allowed the centering to spread a little. It was in shoving this back to position that required three or four days' time and caused the breaking of two 60-ton jacks.

The second rib was run in about the same way as the first one except that the derricks worked in more convenient positions from the top of the first rib.

GRANITE FACING.

A point not yet mentioned in the description of construction work is the granite facing. It was required to put a facing with a mixture of 1 part cement and 4 parts granite screenings on all exposed surfaces, as the

TABLE III—SHOWING READINGS OF ELEVATIONS ON ALTERNATE PANEL POINTS OF STEEL CENTERING DURING CONSTRUCTION OF SOUTH RIB

Main Arch Centering.
Top Chord at Alternate Panel Points.

Date.	Center pin.	East Side No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	Date 1909 Aug.	West Side No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	Remarks.
July 23, 1909	76.836												temp. 68°
Aug. 6,	76.819	74.54	66.150	52.315	[illegible]	[illegible]	6	[illegible]	66.128	[illegible]	[illegible]	[illegible]	[illegible]
Aug. 9	76.708	74.47	66.156	[illegible]	[illegible]	[illegible]	9	[illegible]	66.210	52.310	33.490	[illegible]	[illegible]
Aug. 11	76.683	74.458	66.123	[illegible]	[illegible]	[illegible]	11	[illegible]	66.098	52.288	33.478	[illegible]	[illegible]
Aug. 13	....	74.468	66.113	[illegible]	[illegible]	[illegible]	13	74.441	66.181	52.301	[illegible]	[illegible]	[illegible]
Aug. 17	3 to 3:30 p. m.	74.466	66.106	[illegible]	[illegible]	[illegible]	17	74.429	66.169	52.289	[illegible]	[illegible]	[illegible]
Aug. 19	10:30 to 11:15	74.541	66.109	[illegible]	[illegible]	[illegible]	19	[illegible]	66.161	[illegible]	[illegible]	[illegible]	[illegible]
Aug. 24	2:15 to 3 p. m.	74.482	66.102	[illegible]	[illegible]	[illegible]	24	[illegible]	66.078	[illegible]	[illegible]	[illegible]	[illegible]
Aug. 26	1:30 to 2:30	74.493	66.103	[illegible]	[illegible]	[illegible]	26	[illegible]	66.053	[illegible]	[illegible]	[illegible]	[illegible]
Aug. 28	11 to 2 a. m.	74.463	[illegible]	[illegible]	[illegible]	[illegible]	28	[illegible]	65.988	52.178	[illegible]	[illegible]	[illegible]
Aug. 31	12:30 to 1:30	74.426	66.006	52.166	33.381	10.351	31	74.391	66.011	52.171	33.371	10.346	80°-89° sun

concrete was poured in the forms. Steel plates were set inside of the forms and the mixture poured between them and the form, this work being carried up simultaneously with the main bulk of concrete. The surfaces will afterward be bush hammered and then washed with hydrochloric acid thus exposing the grit of the granite facing. For the facing work, two men were usually employed to mix the material by hand and it was sent in boxes by the cableway to the work. It was here shoveled into pails by one man and lowered to the facing men in the forms. The number of men handling the facing varied according to the amount of concrete which was being put in. Several sections, however, were kept account of in the work on the piers and the cost of labor per sack of cement used is given. The facing averaged between 1 and 2 ins. in thickness. On Pier No. 1, 45 sacks were placed in 100 men-hours; on Pier No. 5, 111 sacks were placed in 232 men-hours, and on North Main Pier, 31 sacks were placed in 95 men-hours. These records were taken at times when the work was progressing at an average rate. Using 1½ ins. as the thickness of the facing, this indicates the cost of placing the facing in a straight form as 9⅓ cts. per sq. ft. of surface and in the main pier forms—which were somewhat more difficult to work in—of 14.1 cts. per sq. ft. of surface. Labor was figured at 20 cts. per hour.

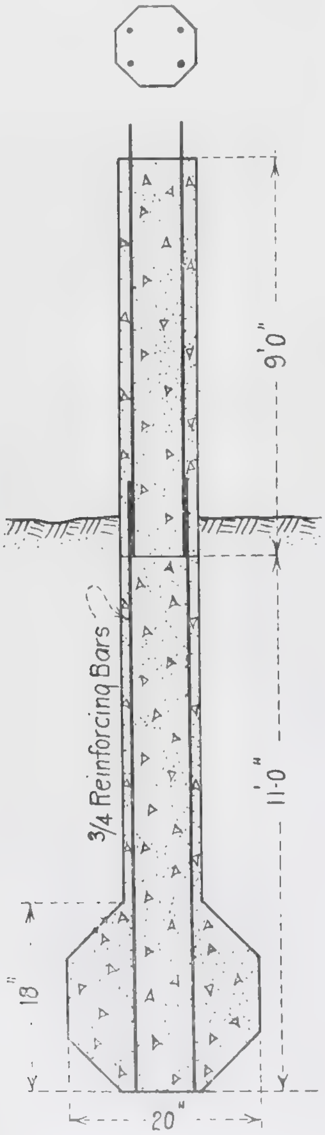

Fig. 1—Section of Reinforced Concrete Pile, Atlantic City Boardwalk.

The plans for the Rocky River bridge were prepared by the bridge department of Cuyahoga County, Ohio, under supervision of Mr. A. M. Felgate, County Engineer. Mr. A. L. Stevens is resident engineer in charge of construction for the county. The contractors are Schillinger Bros. of Columbus, O., and the contract price was $208,000, according to preliminary estimates. Wilbur J. Watson is consulting engineer for the contractors. The bridge will probably be opened for traffic late this fall.

Method of Jetting Down Concrete Piles and Records of Output.

During the past summer the board walk at Atlantic City, N. J., has been widened for a long distance on each side of the Chelsea Hotel. Reinforced concrete piles have been sunk and capped with reinforced concrete beams, upon which have been laid the timber stringers and plank that form the walk. The pile bents are 15 ft. apart, with two piles to the bent. The following facts relate to the making and sinking of about 200 piles:

When completed, each pile is about 20 ft. long, of which about 12 ft. is below ground level. Each pile is made in two pieces, the lower piece being cast and sunk with a water jet; upon this lower half of the pile is built the uper part, which pojects above the ground level. In other words, a concrete pile 11 ft. long is first sunk below the ground level, then forms are erected and the upper part of the pile is cast in place. Of course both halves of the pile are reinforced, the reinforcing rods of the lower half projecting up into the concrete that forms the upper half, as shown by Fig. 1.

This method of making the pile in two parts is decidedly advantageous in that it enables a crew of only four men to handle and sink the piles with the aid of a water jet and a tripod, no pile driver being used.

Th lower section of the pile weighs only about half a ton, and can be rolled along, tilted up with the aid of levers, and finally suspended with a pair of double blocks and tackle hung from the tripod. Therefore an engine is not necessary for the expeditious handling of the piles.

On the other hand, we cannot but question the probable durability of the reinforcing rods at the point where the new concrete of the upper section joins the older concrete of the lower section of the pile. A perfect joint is obviously unattainable. Will not the sea water penetrate at the joint and speedily rust away the reinforcing rods? It should be stated that while the joint is above water level for half the day, it is below water level during the other half, that is during high tide.

A concrete sleeve could be cast around each pile at the joint, which would, in all likelihood, shut out the water from the joint sufficiently well to prevent rusting of the iron rods.

For casting the lower part of these piles, the contractor erected a light staging, consisting of wooden "horses" with long legs, supporting a flooring of planks. A plank runway, also laid on horses, served for wheeling the mixed concrete in barrows up to the top of this scaffold, whence the concrete was shoveled into the upright molds. The molds were made in two parts, the lower part for the bulb end of the pile, and the upper part for the octagonal shaft of the pile. Each of these molds was made in two vertical halves, which could be readily stripped off the pile when it had hardened sufficiently. A crew of four men mixed, wheeled and placed the concrete, erected and removed the molds. They averaged about 10 piles thus made per day, or approximately 2¾ cu. yds. per day for the four men. This included the placing of the four reinforcing rods in the molds preparatory to casting the pile. The men worked very deliberately.

Forms for two dozen piles were provided, so that each pile was allowed to harden not much longer than 48 hrs. before it was lowered into its side and rolled out of the way. This process of lowering was best carried out by the use of blocks and tackle anchored to the upper part of one of the wooden "horses" that supported the scaffold. The upper part of the forms was first stripped from a pile, the tackle was fastened to the pile and thus it was lowered gently. After the pile was thus placed on its side, the forms around the bulb end of the pile were removed.

After a week or more of hardening the piles were rolled down the beach, and placed near points where they were to be sunk. The crew that sunk the piles usually consisted of four men, although a fifth, the sub-contractor, was present toward the latter part of the work when far greater progress was made. The water jet consisted of a piece of 2½-in. iron pipe about 12 ft. long, the upper end entering an elbow, which, in turn, connected with another elbow to which a fire hose was fastened, Fig. 2. This provided a joint at the upper end of the water jet pipe, so that the upper end of the pipe could be lowered several feet below the ground level into the hole cut by the water jet.

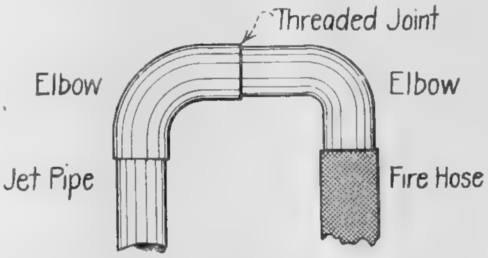

Fig. 2—Sketch Showing Manner of Connecting Jet Pipe and Hose.

In all published descriptions of jetting piles, the water jet is lowered simultaneously with the pile, the nozzle of the jet being only a short distance in advance of the toe of the pile; but on this work an entirely different procedure was followed. A tripod, whose three legs were of 3x6-in. pine, 16 ft. long, was set up over the spot where the pile was to be sunk. The water jet was supported by a rope passing through a block at the apex of the tripod. When the water was turned on from a nearby hydrant, it was positively amazing to note the rapidity with which the jet pipe disappeared. Often it took no longer than 15 seconds for the pipe to penetrate 15 ft. The material was ordinary sea shore sand. After the pipe had sunk from sight, the rope that supported it was given a turn around a cleat on the tripod, and the jet pipe was not disturbed for about 5 mins., except that in some instances it was churned up and down and swung around a little if the sand did not appear to be boiling to the surface rapidly enough.

While the jet was thus boring a large hole, the men were busy rolling a pile into position. Then they would raise its upper end and place some wooden blocks beneath the pile and about the middle, upon which the pile could be balanced and its bulb end swung around directly over the hole made by the water jet. Two of the projecting reinforcing rods were then bent toward each other and a chain wrapped around them. To the chain was hooked the tackle, and the men hoisted the pile into an upright position, whence it was lowered into the hole, often sinking without encountering the slightest obstruction. At times, a pile would stick and the water jet would be raised and lowered alongside, while

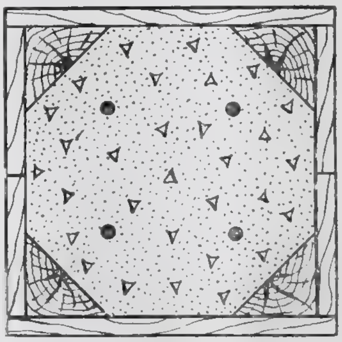

Fig. 3—Section of Form for Octagonal Pile.

the suspended pile would be swayed back and forth by two of the men. The best time noted by the observer was 9 mins. to sink one pile, 4 mins. of which were spent in moving the tripod forward to the next pile and getting the water jet in position, leaving only 5 mins. for jetting the hole and sinking the pile.

When the head of a pile was about a foot below ground level, the water was turned off and the men held it there and caved in some sand from the sides of the hole. This sand, together with the sand suspended in the water in the hole, settled compactly around the pile, and the next high tide completed the backfilling.

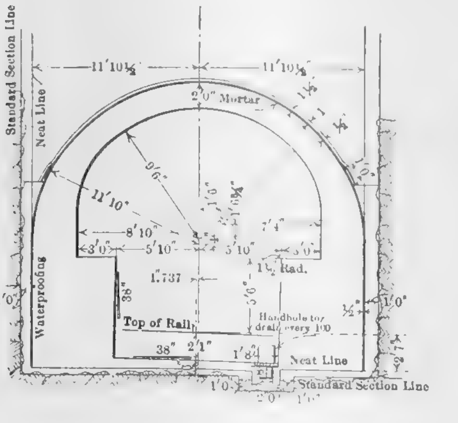

Fig. 1—Section of Tunel on Rock.

For the first ten days under observation, only 10 piles were sunk per day, the men working with no energy. During the succeeding week, when the sub-contractor himself took a hand, the daily output of the crew was doubled, and in one noteworthy afternoon 22 piles were sunk in 5 hrs. So far as we know, this afternoon's work breaks all records for sinking concrete piles with a crew of only 5 men and no engine.

At one place there was a breakwater consisting of a row of closely driven wooden piles, some of which had to be removed to make room for the concrete piles. The water jet was used for "pulling" the wooden piles, three piles in a group, being "pulled" in 15 mins. after the tripod had been placed. Almost the same length of time would have been required to "pull" only one pile, for the hole excavated by the water jet was large enough to embrace the area occupied by the three piles.

Where electric light poles had to be moved, the water jet was similarly used for taking up the pole, as well as for digging the hole in which it was subsequently replaced. This suggests the thought that wherever poles are to be placed in a sandy or loamy soil, not far distant from a stream of water, the water jet may prove the most economic method of digging the pole holes. Certainly the water jet is not used as frequently as it should be where piles are to be pulled.

In building reinforced concrete trestles for railways, etc., essentially the same method as above described could often be used to advantage. It should be noted that this method enables the contractor to give the top of the pile any level desired by the engineer; for, when the upper half of the pile is cast in a mold on top of the lower half which has been driven, it is simply necessary to drive a nail through the side of the mold at the precise level of the desired top of the pile, and the workmen then fill the mold with concrete to that level.

A pile of octagonal cross section is perhaps the best, for the mold is simply a rectangular box with triangular cleats nailed in each corner, as shown by Fig. 3.

We are unable to give exactly the output of the men who erected the forms and built the upper 9 ft. of these piles; but 4 men (carpenters) readily placed the reinforcing rods and erected the mold for the upper part of a pile in 20 minutes. The same 4 men erected the forms for the cap that rested on the two piles of a bent, and usually spent about 30 minutes doing so.

For comparative cost data, and for the design of piles, cap, etc., used in similar work on the "board walk" at Atlantic City, the reader is referred to "Concrete Construction Methods and Cost," by Gillette & Hill.

Labor Cost of Laying 12,952 Sq. Ft. of 6-In. Concrete Basement Floor.

The floor covered a 12x200 ft. hallway and nine side rooms ranging in area from 759 to 2,069 sq. ft., the total area being 12,952.2 sq. ft. The total thickness of the floor was 6 ins., composed of 4-in. base of 1:3:5 concrete, and a 2-in. surface of 1:2 mortar. The aggregates were sand and gravel. The foundation was 4 ins. of screened coal cinders, wet and tamped. The sand and gravel (bank run) was delivered in piles opposite the windows of the basement; cement was stored in one room and lumber was delivered in piles opposite the doors. The contract for laying included all labor and supervision necessary to the finished floor, with materials purchased and delivered as mentioned, and with free use of shovels and wheelbarrows, and of water.

A number of tests made on different loads determined the percentages of sand and gravel in the aggregate, so that it was necessary only to screen out the sand required for the surface coats and remix the resulting gravel with the bank run material to obtain the required proportion for the base concrete.

The unscreened sand and gravel was shoveled into the rooms through the basement windows, screened and moved with wheelbarrows to the mixing boards, which were set in the hall at two points of which there were water connections. The mixing was done by hand, working 4 men on the mixing board and 1 man at the mortar box. Lights were necessary, but as all work was under cover, no delays were caused by rain. The gang consisted of 1 foreman, who was the contractor and form setter, 1 finisher, 1 mortar mixer, and from 7 to 12 laborers. A 10-hour day was worked, the finisher requiring extra time, since all work was completed the same day that it was begun. The job was completed in 5 calendar weeks and 2 days. The work of electric wiring, steam piping, laying drain, etc., was in progress at the same time as the floor construction, which greatly hindered the progress of the concrete work and in the narrow quarters made necessary a small working party. The following was the cost of the work:

2,010½	hrs. common labor at 10 cts.	$201.05
276.4	hrs. mortar mixer at 12½ cts.	34.95
296.36	hrs. finisher at 27½ cts.	81.50
32	days foreman at $5	160.00
	Total	$477.50
	Profit	$ 50.00
	Contract price	$527.84

The cost per square foot of floor was 3.71 cts. and the contract price was 3¾ cts. This information has been furnished by C. L. Wood, engineer and contractor, Columbus, Miss.

Method of Constructing Concrete Tunnel in Open Cut, Pennsylvania Railroad.

The approaches from Long Island to the tunnels crossing under the East River to Manhattan comprise 6,950 lin. ft. of open cut tunnel and 2,555 ft. of retaining wall and invert approach. Figures 1 and 2 are typical sections of tunnel; Fig. 1 showing section in rock cut and Fig. 2 section in earth with pile foundations. To two of the four tunnels there is a combined retaining wall and invert approach constructed as shown by the sections of Fig. 3. The single or separate invert approaches to the other two tunnels are similar in type and construction.

In building concrete the following general principles were adhered to: that tunnels and inverts should be monolithic as nearly as practicable; and that the length of sections in continuous structures should be approximately 50 ft.

On all invert work resting on piles, three concreting operations were necessary; the first was the concrete base for waterproofing, which was 9 ins. thick, 3 ins. about the heads of the piles and 6 ins. over them; the second comprised the floor from the waterproofed base to the elevation of the bottom duct; the third was the construction of the side-walls. For 346 ft. of the westerly portion of *B-D* invert, Fig. 3, where the distance from the bottom duct to the surface of the ground was greater than 11 ft., it was not considered safe to remove all struts, and the side-walls were built in two lifts, making a total of four operations. The limits of these several operations are shown by Fig 3, by lines marked "construction joints." The tunnels were built in three operations above the rock foundation, or waterproofing, where not founded on rock; the first was the floor and side-walls up to the level of the ducts; the second was the bench-walls; the third was the arch.

The forms for the first lift, or waterproofing base, were very simple, consisting of a 10-in. plank along each side, braced from the sheeting so as to form a ditch for carrying off the water, and a bulkhead of the same height at the end of the section. Steel rods, of ½ sq. in. net section, were then placed resting directly on the piles, longitudinally, crosswise, and on both diagonals. These rods were intended to bind the entire mass together and prevent the piles from pulling the slab apart if subjected to lateral pressure from mud waves.

The concrete was delivered in 2-cu. yd. Stuebner buckets, handled by derricks and dumped by laborers standing on the prepared foundation, no handling of the concrete being necessary after it was dumped, excepting ramming and spading about the piles and steel rods. A surface sufficiently smooth for the waterproofing was obtained by patting the concrete with the flat of the shovel; where an occasional point of stone showed through, after the base had hardened, it was picked out and the void filled with mortar.

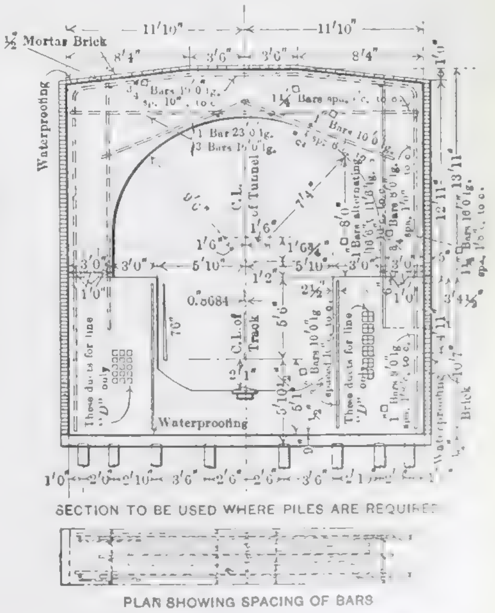

Fig. 2—Section of Tunnel on Piles

The next step was to build the brick protecting wall for the waterproofing to a height at least up [illegible]

Where necessary to make room, the lowest set of timbers was first removed, the thrust being taken by the 9-in. waterproofing base.

Forms for supporting the brick wall were built in sections, from 12 to 20 ft. long and from 4 to 6 ft. wide, of 2-in. planking securely spiked to 4x6-in. posts, and were easily swung about from place to place by the derricks and quickly set up and braced to the sheeting. The brick wall was 4 ins. thick, and a fillet of mortar was formed at the junction with the concrete base, as it was found impossible to tuck the waterproofing into an absolutely square corner and keep it there.

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*Abstract from "The New York Extension of the Pennsylvania R. R.: The Long Island Approaches to the East River Terminals," by George C. Clark, Proceedings American Society of Civil Engineers, Vol. xxxxi, p. 109.

The waterproofing, of 6 ply of felt and 7 of pitch, was applied in two sheets of three layers each and in three lengths. The first sheet of three layers was laid on the base extending from brick wall to brick wall, each strip lapping 2 ft. over the previous strip. A sheet of three layers was then applied to each brick wall, the strips running vertically and breaking joints in a manner similar to those in the base sheet, over which it lapped at least 1 ft. The second sheet of three layers was then laid on the base, lapping 1 ft. over the ends of the vertical strips, and was followed with the sheet of three additional layers on the brick walls, laid as before described.

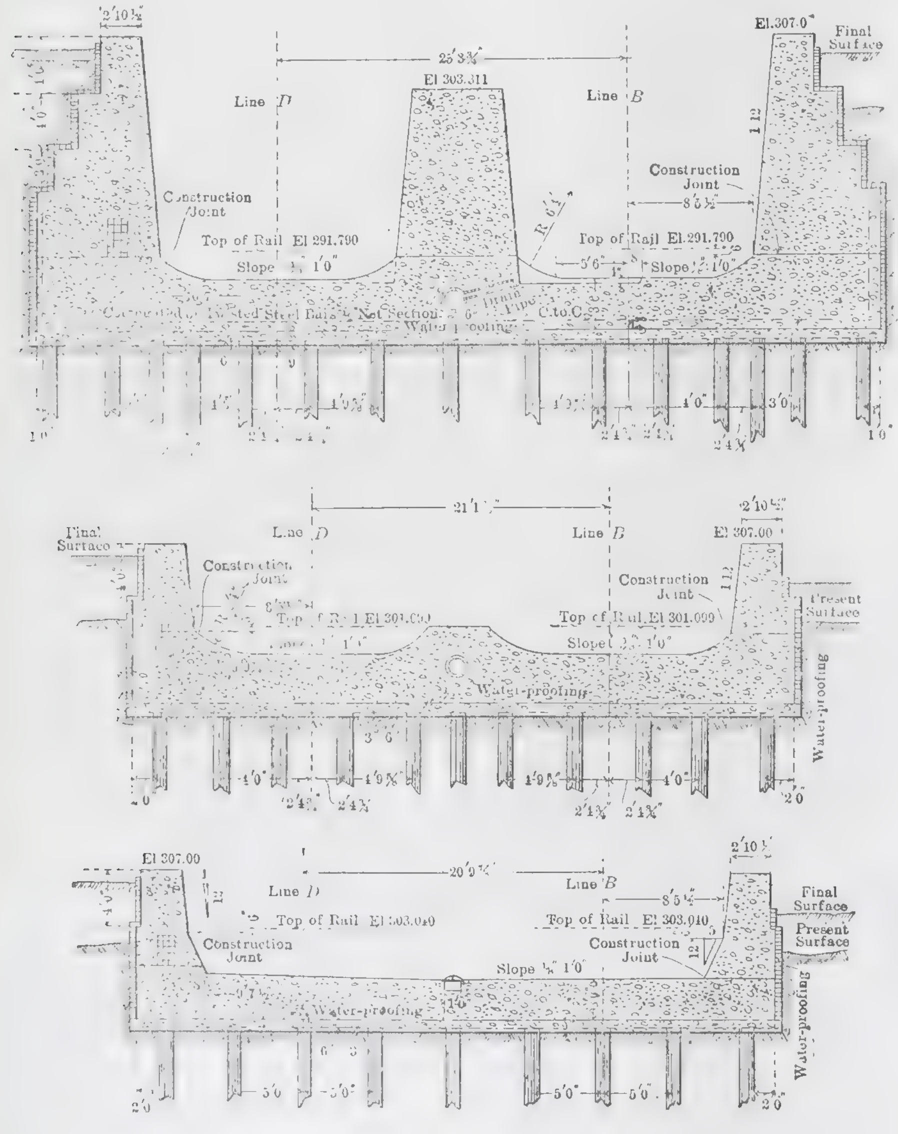

Fig. 3—Sections of Double Tunnel Approach.

It can be noted by referring to the "construction joints" shown on Figs. 1, 2 and 3, that the floor sections, as built, included the side-walls up to the duct-bench for plain floors, and for floors with fillet included the entire fillet, which extended from 0 to 9 ins. above the level of the bottom ducts, and necessitated a step down, of that amount, just in front of their location.

The forms for the few inches of side-wall built in conjunction with the plain floor consisted simply of a square timber with one side cut to form the batter of the wall. The forms for the fillet were built up in 26-ft. lengths, so that two lengths would serve for one side of a 50-ft. section and lap on the finished work. These forms are shown by Fig. 4. They were supported at one end on the finished work, at the other on the timber bulkhead at the end of the section and at four or five intermediate points on concrete pillars previously moulded for the purpose, and indicated in dotted lines on Fig. 4, and were further held in position by vertical and diagonal braces from both sides of the forms to the struts above. The drain form, likewise shown on Fig. 4, was similarly supported. Each section contained two large iron rings by which it could be lifted vertically by the derricks. In that portion of the *B-D* invert having a center-wall, four lines of the fillet forms were necessarily required. The drain, a 15-in. vitrified pipe in the floor under the center-wall, was laid as the concrete was placed, and wired up to and braced down from the struts above. The fillet forms and those for the bench-walls of the tunnels were very similar, those for the tunnels being shown by Fig. 5. They were very solidly constructed, and the bolts and wedges (shown by Fig 5) permitted their adjustment to the curves to a nicety, and enabled them to be slacked off readily for moving ahead from section to section. They were built in 52-ft. lengths, so that one end was constantly engaged by the finished work. They traveled on 70-lb. rails laid on stringers on the floor of the tunnel, being pulled ahead by a block and fall operated by one of the derricks, and, when in position for concreting, were blocked free of the rail.

The outside forms were similar to those described for the invert floor, and were used for the tunnels in earth in the same manner, being set up outside the line for the brick protection which was then built and waterproofed before the concrete was placed. For the inverts, the back forms above the duct-bench were set on the line of the back of the concrete, and the waterproofing and brickwork were placed subsequently. This was necessarily so, as the backs of the inverts stepped in at each 4 ft. of rise, and the brickwork above the first step had nothing on which to rest until after the concrete was built.

The ducts for electric cables were sometimes laid before the bench-wall forms were moved ahead, and sometimes afterward, but were in all cases allowed to set before the concrete was deposited about them. The arrangement of the ducts is shown by Fig. 1. They were of only two kinds, low-tension, and telephone and telegraph, the former being single and the latter four-ways.

The concrete was delivered in Stuebner buckets by the derricks, as described for the floor, but was not dumped in the form, but on the platform over the carriage, and shoveled from there into the form, care being required to keep it at all times at the same level at the back and in front of the ducts, as they were easily pushed out of line. This was particularly true of the four-ways which stood in a single tier six high. Two men in each bench-wall kept the concrete well rammed and spaded. After the ducts were covered, the concrete was dumped directly into the forms, and little shoveling was necessary.

The arch forms were built in sections of the same length as, and supported on, though not attached to, carriages similar to the bench-wall forms. The carriage and forms are shown by Fig. 6. The ribs, 4 ft. 6 ins., were made of two 5x3x⅜-in. angle irons, placed back to back and separated sufficiently to admit the braces. They were hinged at a point 3 ft. 3¼ ins. above the springing line of the arch, which was itself 2 ft. 8¼ ins. above the bench, and the end sections of the bottom chord, being hinged at the junction with the arch rib and bolted at the inner end, could be removed and the whole lower section of the form pulled into the position shown in dotted lines on Fig 6 when it was desired to slack the arch.

The arch ribs rested on and were securely bolted to 8x12-in. timbers laid flat and parallel to a 50-ft. chord of the tunnel curve, the arch and ribs being radial, with their ends parallel to the curve. The sheeting was of 2½x4-in. yellow pine, cut to the curve of the intrados, with radial edges, and was bolted with stove-bolts to the arch ribs. The forms were blocked into position with wedges between the longitudinal timbers mentioned above and similar timbers bolted to the top of the carriage, and also from blocking resting on the bench-walls near the outer ends of the lower chords.

The most economical procedure was to have a sufficient length of floor concreted ahead of the bench, and the beanch ahead of the arch, to enable the forms to be moved in their regular order, but the room for receiving excavated material was so limited that at times it became expedient to carry the arch even with the completed bench; in which case the arch forms were run ahead on pipe rollers and blocked up on the platform of the bench-wall carriage. The bench-wall carriage was pulled ahead for the next section of bench when desired, the arch form being left blocked up on the completed bench-wall, and its own carriage was shoved under it for the subsequent move.

The outside forms above the bench, for tunnels in earth, were similar to those described for the floor and bench-wall, but were built in sections of the same height as the vertical height of the tunnel above the bench-wall.

The concrete was dumped from the buckets before described on the crown of the arch form and with little assistance slid into position, where it was rammed and spaded into a compact mass by two men on each side of the

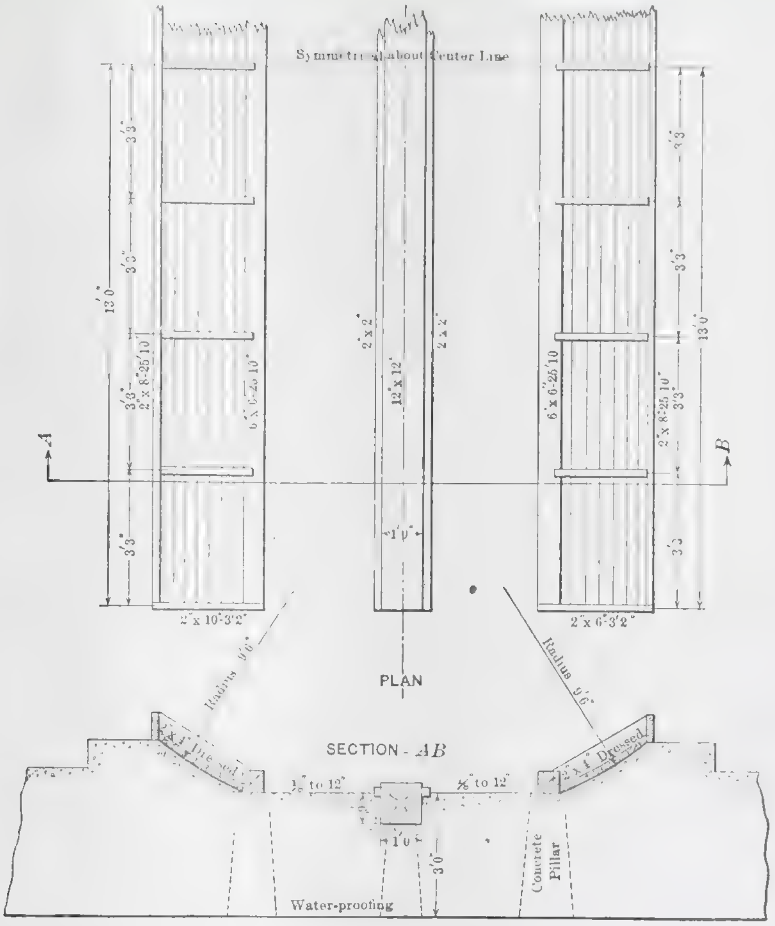

Fig. 4—Forms for Concrete Invert.

arch. After the concrete had reached the crown of the arch, the buckets were dumped at different points over the entire section, and shoveling was thus avoided.

Method and Cost Wedging and Chiseling Out Concrete in Tunnel Lining.

To install ventilating apparatus in the permanent shafts of the new East River tunnels of the Pennsylvania R. R. at New York city there had to be removed some 28 cu. yds. of previously placed concrete lining in the adjacent tunnel walls. This concrete lining was inside of the cast iron lining rings and fear of breaking these prevented drilling and blasting. The method adopted is described as follows:*

Holes were drilled in the concrete about 4 ins. apart on a horizontal line, and perpendicular to the face. Parallel to the first row and about 8 ins. above it, another row of holes was drilled, the holes being pointed downward at an angle of about 40°. Steel wedges were driven into the upper holes, and resulted in breaking out wedge-shaped pieces of concrete. Another row of inclined holes was drilled about 8 ins. above the second row. Steel wedges driven into the holes of this row broke out other fragments of concrete. This process was continued until the space for the nozzle was roughened out to approximately its final dimensions. It was then finished to nearly its final form by chisels operated by air hammers, and smoothed up with a stone-axe operated by hand.

In each tube this work required the removal of about 14 cu. yds. of material. The cost of this removal was about $72.50 per cu. yd., including the work of finishing the surface. The surface dressed was 515 sq. ft. The average depth of cutting was about 9 ins. The cost was about $2 per sq. ft. of surface dressed, including the removal of material.

Forest Fires of 1910.—Officials of the U. S. Department of Agriculture are of the opinion that 1910 will hold the record among many years for the severity of the losses from forest fires. The summer fires followed a spring season believed to have been the worst, certainly in the Lake States, known for a long time, and the danger is not yet past. The forests will not be safe until the fall rains and snows have once more made a wet blanket of the dry forest floor. That the total losses of the year will run up to many millions of dollars is considered certain. To the national forest timber burned must be added great amounts on state and private holdings, besides the immense damage done to town, farm and other property. Railroads have suffered from the interruption of traffic as well as from direct losses. A bulletin by Forester Henry S. Graves discusses forest fires and the proper methods of preventing and fighting them, in part, briefly, as follows: "The principles of fighting forest fires are essentialy the same as those recognized in fighting fires in cities. The following are of first importance: (1) Quick arrival at the fire; (2) an adequate force; (3) proper equipment; (4) a thorough organization of the fighting crew, and (5) skill in attacking and fighting fires. Quick access to fires is accomplished through the work of supervision and patrol in discovering fires before they have gained much headway, and by a well-developed system of communication through the forest by roads and trails."

Movable Pumping Outfit.—A convenient plant for pumping water out of a sump is used on the excavation of Lock 18 on the New York State Barge canal, under construction by the Acme Engineering & Contracting Co., near Herkimer, N. Y. An 8 in. centrifugal pump is placed in the sump and operated by a 2 in. vertical shaft which is about 12 ft. long. At the top of the shaft is a pulley which is belted to a motor. The motor and pulley are housed in and the house stands on four 8-ft. posts, well braced. When it is desired to move the outfit the wires are disconnected and the house, with motor and pump, is picked up bodily by the derrick and set again in a few minutes in a new place.

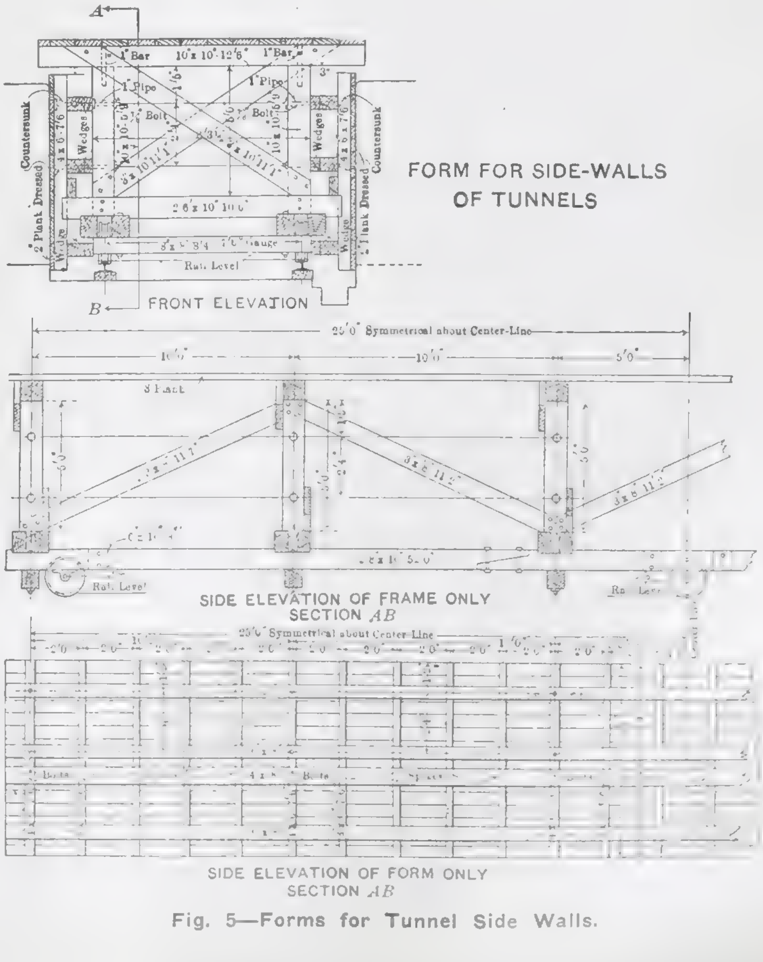
A
1" Bar
10"x 10"-12'6"
1" Pipe
Bolt
Wedges
Countersunk
2" Plank Dressed
2-6"x 10"-10'0"
Rail Level
B
FRONT ELEVATION
FORM FOR SIDE-WALLS OF TUNNELS
25'0" Symmetrical about Center-Line
10'0"
5'0"
8 Post
SIDE ELEVATION OF FRAME ONLY
SECTION AB
25'0" Symmetrical about Center-Line
2'0"
SIDE ELEVATION OF FORM ONLY
SECTION AB

Fig. 5—Forms for Tunnel Side Walls.

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*"The New York Tunnel Extension of the Pennsylvania R. R. The Lining of the Four Permanent Shafts of the East River Division," by F. M. Green, Proc. Am. Soc. C. E., vol. xxxvi, p. 1170.

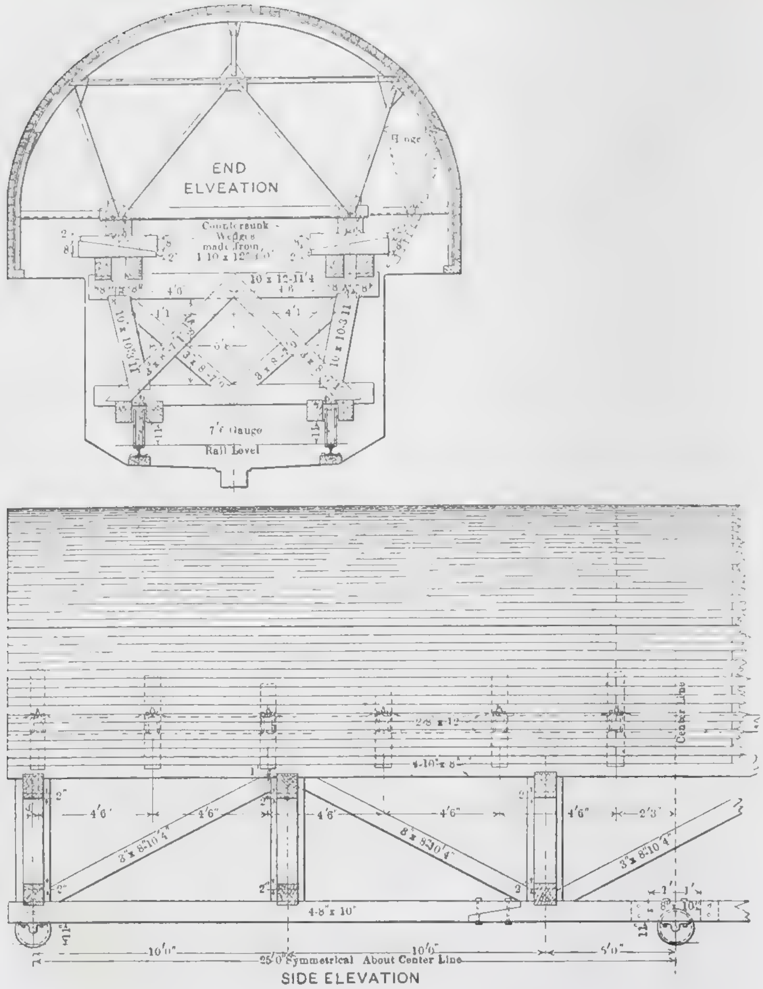


Fig. 6—Traveling Center for Roof Arch.

A consular report states that the President of Brazil recently laid the corner stone of one of two 32,000-h. p. electric power stations which are to furnish the motive power for an electric railway between the port of Victoria and the city of Itabira, in the State of Minas Geraes. The railway will be about 400 miles long, and will tap one of the greatest sources of Brazil's wealth in iron ore. One of the large waterfalls on the river Doce will furnish the power for one of the stations, and a large waterfall on a tributary stream, power to the second station. At Itabira connection will be made with the Central of Brazil, with which it will have mutual traffic agreements. It is expected to thus land at least 3,000,000 tons of ore annually at Victoria at an estimated cost for transportation of about four mills per ton-mile. About 250 miles of an existing steam railway are to be utilized for this railway, the gage to be changed from narrow to standard. The electrical equipment is to be furnished by a British concern, the entire project being financed by British capital interested in the development of the iron-ore deposits.

New Subways for New York.—Bids for new subway construction for New York City were advertised for by the Public Service Commission on Sept. 1. Replies to the prospective builders must all be filed by Oct. 27, and the work, which altogether will cover 41 miles of track, must be completed within four years after the awarding of the contracts. All of the new lines are grouped under the general title of Triborough Subway, as they are to be built in Manhattan, Brooklyn and the Bronx. A rough guess places the cost at about $125,000,000.

The United States is the largest customer for the product of Canadian mines. During the year ended March 31, 1910, the exports of mineral products from Canada to the United States were valued at $33,488,464, or

EARTH AND ROCK SECTION

Methods and Cost of Constructing the Elizabeth Tunnel of the Los Angeles Aqueduct.

In our issue of June 8, 1910, we published a detailed statement of the record and costs obtained in making the record advance of 604 ft. during April, 1910, on the Elizabeth tunnel work of the Los Angeles aqueduct. In *Mines and Minerals* for September, 1910, Mr. W. C. Aston, superintendent at the south portal of this tunnel, presents the same figures in connection with a description of the methods of work and a general summary of progress and costs during 1909. As many of these data have not been heretofore published, we reprint here those portions of Mr. Aston's article which do not duplicate the data given in our issue of June 8, 1910.

The Elizabeth tunnel, which is 26,860 ft. long, is being driven from both ends, termed the north and south portals. This tunnel has a cross section 12 ft. 4 ins. by 12 ft. 9 ins., a grade of 1 ft. in 1,000 ft., and a water capacity of 1,000 sec. ft. At the present time over 11,000 ft. have been advanced from each end, and the work is being pushed forward at remarkable speed.

Upon opening the portal the ground was found to be soft, requiring timber, but as the work progressed, it rapidly hardened, and, with the exception of a few belts of softer material at irregular intervals, has remained hard, passing through many stages of massive, blocky, stratified, seamed, and folded formation, and varying through many alterations of granite, gneiss, and schist.

To be able to approach the same rate of speed through the hard rock at the south end that could be maintained through the softer rock of the north end, and at the same time not materially increase the cost, it was decided to systematize the work to a point where the operation would become as nearly mechanical as possible, leaving it elastic enough to admit the unavoidable breaking in of green men and enlarging or contracting the size of a shift. To do this it was decided to assign a specific duty, as far as possible, to each man in the heading, which that man was required to do every day when conditions were normal without waiting orders from the shift boss. All other men working in the tunnel, but not directly in the heading, were placed upon call by the shift boss for work in the heading when necessary, and all surface laborers except compressor men and blacksmiths, were placed upon a reserve list to draw from in an emergency or when ordered by the foreman.

The track boss reporting to the foreman, but working in conjunction with the shift boss with a crew varying from 3 to 7 men and working only during the day shift, puts down all track, air, water and ventilating pipe, cleans the ditch and keeps the dump in shape. The master mechanic is in charge of all outside labor and is held responsible for the upkeep of all equipment and tools, except the electrical, which are handled by an electrician. One mechanic overhauls all machines, hose, and heading tools for the three shifts, another one repairs all cars, replaces broken wheels and draw-heads, and oils or greases them. The first requisite for rapid work was a good track. The main line both inside and outside the tunnel was centered, ballasted, and

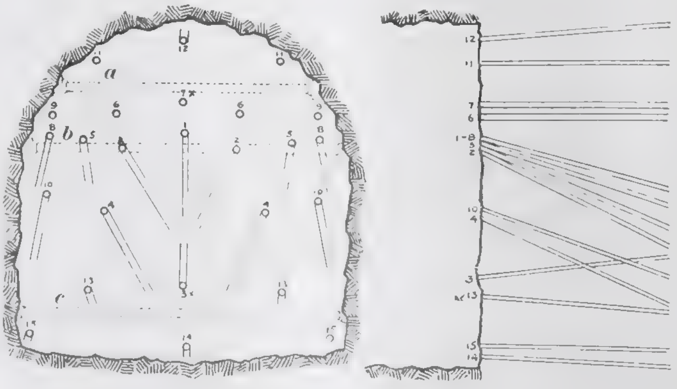


Fig. 1—Section of Elizabeth Tunnels Showing Arrangement of Drill Holes.

connected in the yard by switches and sidings to the powder magazine, timber yard, sawmill and repair shop, using 30-lb. rails, stub switches, and ground-throw switch stands.

All timber, lumber, pipe, rail, and heavy supplies were piled so that they could be unloaded from the freight wagons directly on to the piles and loaded direct on to the cars from the opposite side.

The general equipment varies but little from that in use at other tunnels being driven at the present time, and consists of the following: Two compressors, 520 cu. ft. capacity, belt driven from electric motors; two motor-generator sets, 150 hp.; one 50-hp. electric locomotive; one 30-hp. electric locomotive; nine water Leyner drills; 38 rocker dump cars, 32 cu. ft. capacity; one drill sharpener.

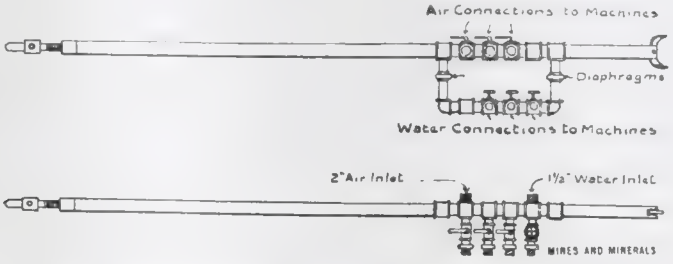


Fig. 2—Combination Manifold for Water and Air.

In addition, the machine-shop equipment included a lathe, drill press, saws, blowers, motors, and the necessary tools for such work. Most of the destructible equipment was supplied in duplicate, and extra machine drills were furnished. Each shift was supplied with a tool box and all the tools necessary for its members' work. These tool boxes were locked and one man on each shift was held responsible. A station was cut in the tunnel where all repairs to machines, hose, tools, etc., were made. Wherever possible each individual is held responsible for the tools he uses.

When going on shift under normal conditions all tools, replacements, drinking water, etc., are loaded on a flat car attached to the end of the train and hauled with the men from the portal to the repair station inside where the machines, manifold, and hose are loaded on. Upon reaching the heading the six machine men pick down the back and sides, and shovel back only enough material to allow of placing the arch bar *a* and upper main cross-bar *b* in position as shown in Fig. 1. The nine shovelers immediately string out along the tunnel, cleaning track, carrying forward the tools, unloading the steel and drills, and piling material where it can be readily reached. A reel holding a double-conductor, armored, extension electric light wire is carried to the end of the permanent wire, unwound and dragged to the heading, and connected to a cluster of lights which is fastened where it will give light to both machine men and shovelers. A compound manifold, shown in Fig. 2, carrying both compressed air and water, and mounted on a light screw cross-bar at a point as close to the drills as convenient, is next erected by the laborers and connected to the main pipe line by 100 ft. of 2-in. armored air hose, and the same length of 1½-in. armored water hose, and to the other side of the manifold three double lines of small air and water hose are connected with the drills.

When the two cross-bars are up, one drill is mounted on the arch bar *a* where it drills three holes, the other two machines are mounted on the upper main bar *b* and drill 15 holes between them. For a while nippers passed the steel, but they were discarded, as it was found that it could be passed readily by the shovelers while the cars were being switched. The nine laborers work in squads of three while loading the cars, one squad loading into the 32-cu. ft. rocker dump cars, another squad picking and loosening the dirt ahead of them, and the remaining squad resting near the switch. From this point the resting squad pushes the empty car as soon as the loaded one is hauled past them by the mule to a point where it is picked up by the electric locomotive and hauled with others to the surface in trains of from 12 to 15 cars each.

The main track and siding are both laid without being cut for frogs, and are connected by a platform switch, shown in Fig. 3. The tracks are made of 1½-in. square iron and riveted to ⅜-in. plates and straps, while the ends are tapered so the cars pass over them with but slight jolt. This switch is carried ahead from time to time and is always kept within 200 ft. of the heading. Rails placed on their sides inside the permanent rails with the ball faced against the web of the permanent rail are used for extension track. Ties are laid as rapidly as the dirt is cleared away and these temporary false rails are pushed ahead over them. When the full length of rail has been pushed forward, the track crew cleans off the ties and as a loaded car leaves the temporary track, one rail is turned over to an upright position and both ends spiked before the returning empty car reaches it. While this latter car is being loaded, the remainder of the rail between the car and the permanent track is spiked, and the process repeated with the other rail, without holding up the loading for an instant.

Flat steel sheets are laid over the floor of the tunnel for a distance of 40 ft. back from the heading. When the dirt is out, the upper main bar *b*, Fig. 1, is lowered to its second position *c*; when the drills are late, a second long bar is placed as close to the ground as the operating of the machines will permit, and as each drill finishes its upper hole, it is lowered down to this bar and drills the lifters, and if the ground is hard enough to warrant it, also drills two relievers and an up-cut hole. As soon as the upper bar is clear of the holes, the blow pipe cleans out the holes drilled and by loading from top and both sides at once the fuse is often spit within 15 minutes after the air has been shut off from the last hole.

As the last change is made on the drills, the manifold is dropped to the floor, a man with a wrench goes to either end and as each machine finishes, the small hoses are uncoupled from the manifold, coiled, and placed on the car which stands just behind already loaded with the dull steel and tools. Machines, clamps, bars, blocking, and jack-bars, each go back in turn and as the last one clears the heading the mule starts away with the car in time to escape the dirt from the blowpipe, as it cleans out the lifters.

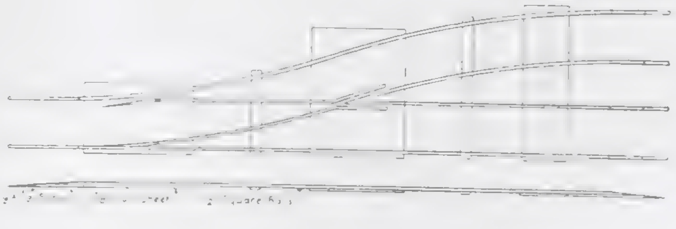


Fig 3—Platform Switch.

The powder charge varies from 15 to 40 lbs. per foot of advance, according to the hardness or toughness of the ground.

The men now string out at regular intervals along the 100 ft. of main air and water hose and carry them back to the point of safety, such pipe being too heavy to coil and place on the car. They then continue back to the cars, store their small tools in the tool box, board the cars, and wait for the machine men to spit the holes.

A No. 5½ Root pressure blower draws the powder smoke out through an 18-in. pipe until the heading is nearly clear, when the blower is reversed and fresh air blown in, about 15 to 20 minutes being required to clear the heading of gases.

Hinged tables are fastened against the sides of the tunnel and on the 7 a. m. and 3 p. m. shifts hot meals are spread for the crews. These meals are placed in a tight box in the mess house kitchen and not opened until ready to serve. On the 11 p. m. shift the lunches are served cold.

With slight modifications as conditions changed, or equipment was replaced or improved, this system has worked very satisfactorily during the past year and up to the present time. It worked so well in fact that during the month of April of this year when both labor and machinery were at their highest state of efficiency the full heading complete was driven the remarkable distance of 604 feet, through a rock that was hard enough to require as many as 27 holes per round to break.

Each shift is required to drill and blast, the length of round being regulated by the nature of ground encountered in the first hole drilled.

Discipline and strict attention to business while on shift are required of every one, while at the same time a spirit of friendliness is fostered and every man made to feel that in a large measure the success is due to his own efforts and the interest he takes. We attribute the present efficiency of the men and progress at this portal to the above policy as well as to the close adherence to detail and system which is demanded of all concerned.

A bonus of 40 cts. per foot per man for every foot driven over 2⅔ ft. per shift is being paid, bringing wages up to a good figure above the scales usually paid in other mining camps and consequently giving us a better grade of men than could otherwise have been obtained.

TABLE I.—SOUTH PORTAL ELIZABETH TUNNEL; DETAILS OF ANNUAL SUMMARY OF TUNNEL REPORTS FOR 1909.

	Totals.
Footage to date	7,585 ft.
Footage during 1909	4,476 ft.
Required progress	2,920 ft.
Daily footage (365 days)	12.26
Required daily footage	8.00
Increased footage over estimate	1,556 ft
Daily increase over estimate	4.26
Footage of untimbered section	3,274 ft.
Estimated cost of untimbered section	$131,385.62
Actual cost of untimbered section	$121,787.45
Footage of timbered section	1,202 ft.
Estimated cost of timbered section	$ 62,491.98
Actual cost of timbered section	$ 51,941.11
Average cost of timbering per foot progress	$ [illegible]
Total bonus footage	[illegible] ft
Total bonus pay roll	$ [illegible]
Average cost of bonus per foot progress	[illegible]
Estimated expenditure	$193,877.60
Actual expenditure	$173,728.56
Amount saved over estimated expenditure	[illegible]
Number of shifts worked	1,055
Number of shifts [illegible]	[illegible]
Number of men [illegible]	[illegible]
Men per foot progress	[illegible]
Average progress [illegible]	[illegible]
Number of [illegible]	[illegible]
Total feet drilled	135,896
Feet drilled [illegible]	[illegible]
Total time drilling [illegible]	[illegible]

Average time drilling per foot progress (in minutes)	49.01
Average time drilling one hole 1 foot deep	1.61
Pounds of powder used (including trimming)	143,659
Average pounds per foot	32.09
Number of cars mucked (32 cubic feet)	28,561
Cars mucked per foot	6.40
Leyner No. 9, drill repairs (3 machines per shift)	$ 4,116.99
Average cost of repairs per machine per foot	$ 0.30
Leyner No. 2 drill sharpener repairs (for 3,300 ft.)	$ 387.13
Energy used, (kilowatt hours)	608,762

TABLE II SOUTH PORTAL ELIZABETH TUNNEL; SUMMARY OF TOTAL EXPENDITURE DURING 1909.

	Totals.	Per lin. ft.
Eng. and supt.	$ 3,851.24	$ 0.86
Excavation	79,607.15	17.78
Mucking	55,556.33	12.41
Drainage	421.01	.09
Ventilation	2,313.44	.52
Light and power	24,750.71	5.53
Total untimb.	$166,499.88	$37.19
Timbering	$ 7,228.68	$ 6.01
Total timbered	$173,728.56	$43.20

Tables I and II give the heading base units for 1909, during which time 40 shifts were lost, but still the average of 365 days was 12.26 feet daily. Table III shows the general expenditures during 1909."

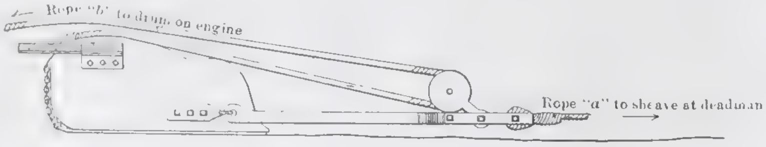
TABLE III—SUMMARY OF GENERAL EXPENDITURES DURING 1909.

	Total Cost.
Miscellaneous structures	$ 165.79
Tunnel construction	15.348.27
Miscellaneous construction equipment	5.168.85
Miscellaneous camp equipment	19.22
M. & O. live stock	183.75
M. & O. local telephone lines	31.73
M. & O. water supply	2.34
Division administration	740.86
M. & O. roads and trails	116.05
Total expenditure	$21,776.86
Pay roll	9,419.76
Bonus roll	2,377.48
Material issues	6.915.83
Material receipts	2,841.54

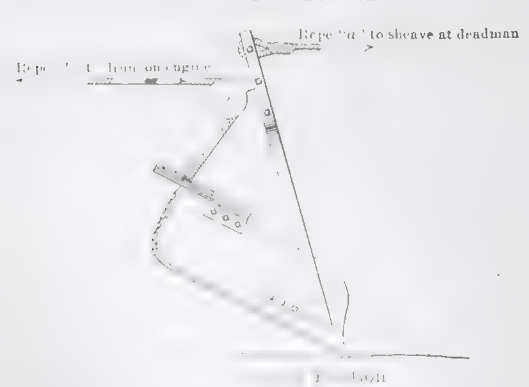
The yardage excavated is not given by Mr. Aston, but it runs for untimbered section according to the dimensions given about 4.2 cu. yds. per lineal foot. At $37.19 per lin. ft. this gives a cost of $8.85 per cu. yd.

Drag Line Scraper Plant For Wasting Mud Over Swamp Land.

In excavating the Long Island open cut and tunnel approaches to the new Pennsylvania R. R. East River tunnels* a considerable portion of the overlying swamp mud unsuitable for embankment was wasted over an adjacent area of swamp land. As this swamp area was of such a character that spoil car tracks could not be laid or maintained on it, use was made of drag line scrapers to distribute the spoil. On one side of the swamp area and forth along the edge of the swamp. A two travelers were mounted so as to run back double drum hoisting engine mounted on each traveler operated a scraper rigged as shown by the accompanying drawings. Referring to the drawing, the scraper was pulled forward by the rope *A* which passed through a sheave attached to a deadman on the opposite side of the swamp from the traveler, while the rope *b* was allowed to run loose as shown by the upper sketch of the drawing until it was desired to dump the scraper. This was accomplished by clamping the lower drum operating rope *A*, and pulling the rope *b* until the scraper was in the position shown in the lower portion of the drawing when a slight pull on the rope *A* with rope *b* slacked a corresponding amount completed the turn. The scraper was pulled back to the starting point by the rope *b*.



First Position



[illegible]

Sketches Showing Rigging for Drag Line Scraper.

Contract Excavation Tests Quality of Laborers.—Excavation is almost completed under the contract let on November 22, 1909, to Hebard & Alberts, comprising about 180,000 cubic yards of earth and rock in the channel through the Gatun Lake region, between Bohio and Barbacoas Bridge, on the Panama Canal. The excavation was in three sections, one of 40,000 cubic yards at Barbacoas, 100,000 cubic yards at Buena Vista, and 40,000 cubic yards at Bohio. About 60,000 cubic yards of the total was rock and the work was done at a flat price of 35 cents a cubic yard. Most of the material was dumped into the Chagres River and the French canal trench, and in general the hauls were short, although in one instance it was necessary to push the cars 540 feet from the point of excavation to the river. The work was done on the "task" system; that is, the laborers were paid according to the amount of material they excavated.

An opportunity was afforded to test the value of the various classes of laborers on the isthmus on the elemental basis of pick and shovel work. The force numbered from 100 to 500 men. All kinds of laborers were employed. White Spaniards and Italians recruited in Colon—voluntary immigrants anxious for work—were taken up to Bohio and they could earn just about enough from daybreak to sunset to keep them alive. They were willing and intelligent, but weak and slow. Native Panamanians, men of the class that excelled on the clearing recently completed by contract, did not find the work profitable. Negroes from the British West Indies worked in teams and did well enough, but they could earn very little more than the 10 cents gold an hour that the commission pays on regular work. French negroes, those from Hayti and Martinique, excelled all [illegible] also worked in teams, some loading while others dumped the cars, and they made $1.50 gold a day in six hours of actual work, day after day. They are well nourished, work as rapidly as the English negro, and keep up their speed all day. They are also reliable, returning to work every day and keeping at it regardless of the rain.

Traveling Derrick Without Tracks.—In completing the work on the Rocky River Bridge it has been found necessary to use a stiff leg derrick in many places. The bridge floor has been been put on except for a 20 ft. strip in the center. An ordinary A-frame derrick has been fitted with three wheels, one under each leg and one at the rear. The wheels are of about 8 in. in diameter and are arranged on a swivel. Usually planks or timbers are used as tracks for these wheels to run on. The engine and boiler are located on the derrick, and when it is desired to move a line is run ahead from one of the drums and fastened, and the derrick is pulled ahead by its own power. Men with sledges keep the wheels turned to the proper direction while moving. In this way the derrick has been moved about in all directions in a very short time and the work is greatly facilitated.

Conclusions on the Explosibility of Coal Dust.

The Bureau of Mines has just issued a bulletin on the explosibility of coal dust, with chapters by J. C. W. Frazer, Axel Larsen, Frank Haas and Carl Scholz. The bulletin was prepared by the Technologic Branch of the United States Geological Survey, which is now a part of the Bureau of Mines, and therefore will be known as Geological Survey Bulletin 425, but will be distributed by the Bureau of Mines. The conclusions of this bulletin are:

"That coal dust will explode under some circumstances, both in the presence of firedamp and without it, is now generally accepted by mining men. The writer fully agrees with this and takes the following views of the explosibility of dust and the conditions necessary for explosion.

"Experiments at Pittsburg indicate that under ordinary conditions the dust must be from coal having at least 10 per cent of volatile combustible matter, though in certain foreign experiments, it is claimed explosions were obtained with charcoal dust.

"Dust with higher percentages of volatile combustible matter is more sensitive, ash, moisture contents, and size being constant This view is based partly on the preliminary experiments at Pittsburg and on the results of experiments of M. Taffanel and other foreign investigators. Where there is a large amount of dry coal dust, judging from the Pittsburg experiments, a humid atmosphere has little effect on ignition of dust or propagation of an explosion. A long continuance of the humid conditions renders the coal dust moist and inert, but the presence of moisture in the air at the moment of explosion is not sufficient to prevent an explosion; that is, not enough moisture is carried by the mine air to reduce materially the temperature of the flame. Fully saturated vapor at 65 degrees F., an ordinary mine temperature in this country, weighs 6-78 grains per cu. ft. (15.5 grams per cubic meter). Coal dust suspendedin such a saturated atmosphere in a cloud of moderate density weighs, say, 200 grams per cubic meter. At the figures given the weight of vapor is but 7.8 per cent of the weight of dust. The Pittsburg experiments with wetted dust showed that several times this percentage of moisture in the dust, in addition to a nearly saturated atmosphere, was required to prevent propagation.

"Probably with a low dust density, the relative humidity of the air would be an important factor in tending to prevent the initiation of an explosion. However, the great purpose of artificially humidifying mine air is that it may serve as a vehicle for carrying water to the dust."

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*"The New York Tunnel Extension [illegible] Pennsylvania R. R. The Long Island Approaches to the East River Tunnels," by Geo. C. [illegible] Proc. Am. Soc. C. E., Vol. XXXVI, p. 1109

GENERAL ARTICLES AND CLASSIFIED ITEMS

Cost Keeping System for a Mine.*

Methods of cost keeping are used by most mining companies, but owing to the different units employed and to the lack of knowledge of methods at different places, no standard system is in use. Many of the large companies have excellent systems, but often they are so different from each other as to make difficult a real comparison. In mining work, of course, conditions vary and it is often found advisible to use different systems of accounting, and to employ other units. Where gold, silver, or copper alone is the product sought, it is possible to use the "ounce" or "pound" as the unit, but where the ore contains more than one metal to be recovered, it seems preferable to use the ton as the unit. In South Africa, considerable discussion has arisen lately as to whether the ton unit serves the purpose; the square fathom is suggested as the most satisfactory unit. South African laws require a standard form of reports, and while in some cases a great deal of expense is incurred in making these reports without a corresponding immediate benefit, the general result is of great benefit to the industry at large.

Form No. 9 —Front.

In Account with .. . ..

No of Company's Bill . No of Firm's Bill........................ Date........................191....

Article	Chargeable to	Amount	Amount

Form No 9 Back

Voucher No................
Month of
In Account with........
When Paid................
Paid by Check No.....
Journal Entry Page .

Charged to Accts.	Amount
As Follows	

Form No. 1

PROGRESS OF WORK REPORT

Mine .. .. .191....

Working Place	Mark	Last Measur'm't	New Measur'm't	Advance	Remarks

Form No. 2

B S	Station	Horizontal Angle	Compass Bearing	Vertical Angle	Inclined Distance	H. I.	Horizontal Distance	Vertical Distance

Form No. 3

.. ..Mine Survey Stations . . . ..Level

Station		Azimuth	Bearing	Distance	Partial		Total		Elevation
B. S.	O				Lat. cos	Dep. (sin)	Lat.	Dep.	

Form No 4

EXTRACTION REPORT

	% H_2O	Tons (Dry)	Oz. per ton (2000 lb)		Total Metal Cont'ts		Metal Recovered		% Recovery	
			Au.	Ag.	Au.	Ag.	Au.	Ag.	Au.	Ag.

Form No. 5

REQUISITION

Date 191

For .. ..

Foreman

REQUISITION

Date .. .191 .

Mr. Storekeeper:
Please deliver to bearer the following and charge to

...Foreman

Form No. 6

STOREHOUSE REPORT OF SUPPLIES ISSUED Date....................191....

No.	Department	Quantity	Article	Price Per Piece	Total Price

..Storekeeper

Form No 7

STOREHOUSE REPORT OF SUPPLIES RECEIVED Date . 191

F'm Whom Bought	No. Bill	Article	Weight	Net Cost	Freight	Duty, etc.	Tot. Cost	Selling Price

..Storekeeper

Form No. 8

STOREHOUSE STOCK BOOK Article

Article	Received			Date	Issued			
	On Hand	[illegible]	Unit Price		[illegible]	[illegible]	Total	[illegible]

When the new management took charge of the Montezuma mines it was found that the ore was low grade for so distant a country, and working conditions were found to be very different from those in Canada, United States, or even Mexico, and in order to learn as early as possible whether operations could be conducted at a profit, it became necessary to install a system of accounting that would enable the costs of any and all work to be quickly ascertained. This was necessary in order to secure data on which to base future operations, as much as to learn what the present costs amount to, and for this purpose the report forms described in this article were arranged and printed. It was found convenient to use the loose leaf system in all the departments. These loose leaves are printed in three standard sizes, 3 by 6½ in., 5 by 8 in., and 8½ by 11 in., in order to meet the various needs. The first and second sizes can be carried in the pocket in binders, while the third, which is the size of the standard letter head, is used on the desk. This last form is quite convenient for enclosing in letters to the central or city office, with the usual correspondence. The reports are all placed in spring clips and hung on the wall in the office, so that the manager has before him the details of the work in all the departments for the day. At the end of the month the sheets are removed and placed in special binders.

It is the intention to have every man in charge of any work or department make a report on the work under his charge every day. This is done not only to lessen the work of the office force, but to make the reports more accurate, and also that the man in charge will have the detailed costs of his own work in mind. Many matters are referred to the shift bosses, foremen and superintendents for their opinion, which is always more accurate and valuable where they have opportunity to become thoroughly familiar with the figures used in making up the estimates.

In a broad way the costs are segregated into labor and supplies, with spaces allowed for such other costs as do not seem to come directly under these heads. The unit of cost is the Costa Rican colon ($0.465), and the unit of weight is the ton of 2,000 lbs. The gold and silver content of the ore are given in ounces.

Form 1 is used by the mine foreman or surveyor when measuring the footage driven in the tunnels, drifts, raises, etc., and is turned into the mine superintendent who enters same on Form 14.

Form 2 is used by the surveyor when making surveys, and after figuring out his notes enters them on Form 3, which is filed in the office.

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*A paper by S. F. Shaw general manager Montezuma Mines of Costa Rica, in the "Mining World" for Sept. 3, 1910

Form 4 is used by the mill superintendent, who daily computes the ounces of gold and silver in the ore milled and enters same on the sheet. At the end of the month the total metallic content is summed up, and the average value of the ore for the month computed. When the corresponding returns from the bullion or precipitate are received from the smelter, the percentage of recovery is computed.

Form 5 is used by all the departments when ordering supplies from either the store or the materials storehouse. At the end of the day the head clerk in the store and the storehouse keeper enter these requisitions on Form 6 which is handed in to the mine office, and entered on the various reports from mine and mill. The materials issued from the storehouse are also entered in the storehouse stock book on Form 8.

Form 7 is used by the storehouse keeper when supplies are received, which are likewise entered on Form 8. By keeping this stock book it is very easy to ascertain the quantity of materials on hand at any time. This book is checked up by an invoice at the end of every month.

Form 9 is used as a voucher for all expenditures. At the end of the month a set of journal entries, accompanied by the corresponding set of vouchers, is fordwarded to the New York office.

Form 10 is used by the master mechanic for entering upon the labor and supplies for the day in the machine shop, and a daily distribution of these expenditures is made against the mine and mill.

Form 11 is used by the chief engineer in arriving at the daily expense of the power plant, and a distribution is made daily to the various departments using this power.

Form 12 is used by the mill shift bosses and is entered on Form 17 by the mill superintendent. All the labor and supplies for the day is entered and added to the total that has obtained for the month up to that date. The ore received by the mill and treated is also added to the previous total for the month, and entered under the head "to date." Other items are entered in a similar manner.

Form No. 10

MASTER MECHANICS' REPORT Date.. . 191 . .

Labor	No.	Total Amount	Supplies	Quantity	
Master Mechanic					
Foreman					
Machinists					
" Helpers					
Mechanics					
Pipemen					
Blacksmiths					
Blacksmith Helpers					
Laborers					
Total					

DISTRIBUTION OF LABOR SUPPLIES

Account Charged	Labor Cost	Supplies	Cost

.. . .Master Mechanic

Form No. 11

POWER PLANT REPORT Date.. . .. .191.. .

Labor			Supplies Used		
Kind of Work	No.	Total Wages	Article	Quantity	Cost
Master Mechanic			Tons Coal		
Engineers			" Wood		
Electricians			Gal. Fuel Oil		
Firemee			" Engine Oil		
Oilers			" Bearing Oil		
Car Men			Lbs. Waste		
Flume Repairers					
Total			Total		

H. P. Hrs. Charged to	Day	To Date
Mine		
Mill		
Smelter		

. ...Master Mechanic

Form No. 12

MILL LABOR REPORT Date........... ....191....

Labor			Supplies Used		
Kind of Work	No.	Total Wages	Article	Quantity	Cost
Foreman			Crusher Jaws		
Shift Boss			Cyanide		
Crusher Men			Dies		
Battery Men			Lead Acetate		
Tube Mill Men			Lime		
Sand Tank Men			Oil		
Agitator Men			Pebbles		
Filter Men			Power		
Car Men			Screens		
Engineers			Shoes		
Pump Men			Silex Lining		
Laborers			Waste		
Carpenters			Zinc		
Mechanics					
Total					

	Day	To Date		Day	To Date
Tons Ore Received			Agitator Tanks Emptied		
" " Milled			Press Cakes Made		
" " Thru Agitator			Stamp Hrs.		
" " " Sand Tanks			Tube Mill Hrs.		
Lbs. Precipitate					

. ...Mill Foreman

Form 13 is filled out by the mine shift bosses, and entered by the mine superintendent on Form 14. The numbered spaces at the top of the sheet are filled in with the names of the various working places, and the distribution made of the labor, chief supplies consumed, and cars of ore handled.

From Form 13 the mine superintendent enters up the distribution of labor and supplies on Form 14, carrying ahead the totals of the previous day. The cars of waste and ore are entered, and when driving headings, the feet of advance is made. When the work is that of development, the working place reports are carried forward to Form 15, giving a summary of the work done for the day, and for the month, including that day. When the work is that of breaking ore in the stopes, the items on the working place sheets are carried to Form 16 and totaled. Forms 15 and 16 are handed daily to the manager who enters the totals on Form 19.

The mill superintendent carries forward the items in Form 12 to 17, which is totaled, including all mill labor and supplies, and handed to the manager.

The bookkeeper is given the items which go to make up Form 18 by the chiefs of the various departments, who totals same and hands it to the manager.

It is thus seen that all expenses for labor and supplies are carried forward daily to Form 16, 17 and 18 and placed before the manager, who thus has before him the total expenditures for the day sufficiently itemized. Should any item look unduly large, he may call for the form from which that particular item originated and learn the reason.

Forms 16, 17 and 18 are daily carried forward to Form 19, which is totaled and sent to the New York office.

The bookkeeper enters daily the various items from Form 16, 17 and 18 on Forms 20, 21 and 22 respectively, which are totaled at the end of the month to see that they correspond with the additions carried forward on 16, 17 and 18. Any discrepancy between these and the time-book is entered along the line "to bal." At the end of the month items on Form 22, under the head of construction, development, equipment and storehouse are carried forward to the ledger and journal, and redistributed at the proper time to their respective places. The first three are properly suspense accounts, for which the expenditures incurred monthly cannot be distributed during that particular month. It may require several years to make these distributions. Items under administration, assaying, general expense, office expense and power plant are usually distributed monthly against the various headings on Forms 20 and 21, for which spaces are left at the bottom of the sheet. The totals are then set down and carried forward to the monthly summary distribution.

Form 23. This form shows the total working costs for the month for the various operations, the costs per ton, and the number of tons handled. The totals for the previous months of the year are also entered on this form, thus showing the total costs and the average costs per ton, for the year including that month.

Form 24 is used as the pay roll sheet which is sent to New York. The total labor costs as shown on the mine, mill and miscellaneous Forms 20, 21 and 22 must check with this pay-roll sheet before the accounts can be closed for the month.

Other forms of the usual kind are used for reporting assays, for entering up the assays in a special book according to different working places, for entering up both with figures and graphically the assays on the stope sheets, and on the various headings when in ore. In the mill various forms are used for keeping account of the work done by the batteries, records of slime and sand charges in the treatment tanks, of filter press work, etc.

Loose leaf journal and ledger are also used. Duplicate copies of the journal entries are made and sent to the New York office, which

Form No. 13

DAILY MINE LABOR REPORT

Date........191....

Kind of Work	1		2		3		4		5		6		7		8		9		10		Total	
	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total Wages	No.	Total
Foreman																						
Shift Bosses																						
Timbermen																						
Machinemen																						
Miners																						
Carmen																						
Cagemen																						
Pumpmen																						
Trackmen																						
Powdermen																						
Surface Carmen																						
Ore Sorters																						
Hoisting Engineers																						
Firemen																						
Blacksmiths																						
Machinists																						
Carpenters																						
Total																						
Powder																						
Fuse																						
Caps																						
Candles																						
Timber																						
Cars, 1st Class																						
" 2nd Class																						
" Waste																						
Gallons Water																						

Form No. 14

DAILY REPORT FOR WORKING PLACE..............................

Date........191....

No.	LABOR Kind of Work	Drilling or Stoping	Underground Tamming	Hoisting	Timbering	Pumping	Surface Tamming	Sorting	Other	Total
	Foremen									
	Shift Boss									
	Timbermen									
	Machinemen									
	Miners									
	Carmen									
	Cagemen									
	Pumpmen									
	Trackmen									
	Powdermen									
	Surface Carmen									
	Ore Sorters									
	Hoisting Engineers									
	Firemen									
	Blacksmiths									
	Machinists									
	Carpenters									
	Total									
	Previous Total									
	Total to Date									
	SUPPLIES									
	Powder									
	Caps									
	Fuse									
	Candles									
	Timber									
	Rails									
	Total									
	Previous Total									
	Total to Date									

	Day	To Date		Day	To Date
Cars 1st Class Ore			Feet Advance		
" 2nd Class Ore					
" Waste					
Gal. Water Pumped					
Sets put in					

Supt.

are inserted in a binder, making unnecessary entering same from the vouchers.

Some of these reports might seem at first glance to be carried into unnecessary detail, and in some instances do require considerable time to enter up. The satisfaction in knowing exactly how everything is progressing from day to day, far more than makes up for the time and expense incurred. The expense, however, is not great, as the work is distributed among the different departments. One bookkeeper with what assistance is given by the manager, takes care of copying all reports for the manager, enters up the cash books, journal and ledger, pays off the men on pay day, and handles all such office work as arises in the operations of a mine mining and milling 100 tons per day.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H McLeod, Montreal, Can. tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres.,

Form No. 15

DEVELOPMENT COST REPORT

Mine Date 191

LABOR

Working Place	Drilling	Undergr'nd Tramming	Hoisting	Timbering	Pumping	Surface Trimming		Other	Total
Total Previous Total Total to Date									

SUPPLIES

Total Previous Total Total to Date									

Form No. 16

DAILY DISTRIBUTION MINE LABOR AND SUPPLIES

Mine Date 191

LABOR

Working Place	Development	Stoping	Undergr'd Tramming	Hoisting	Timbering	Pumping	Surface Trimming	Sorting	Other	Total
Total Previous Total Total to Date										

SUPPLIES

Total Previous Total Total to Date										

	Day	To Date
Cars 1st Class Ore		
" 2nd " "		
" Waste		
Gal. Water		

..............Superintendent

Form No. 17

DAILY LABOR AND SUPPLIES DISTRIBUTION—MILL Date 191

LABOR

Kind of Work	Crushing	Fine Grinding	Classifying	Leaching	Agitation	Filtering	Precipitating	Refining	Other	Total
Foreman										
Shiftboss										
Batterymen										
Tubemill Man										
Sand Tank Men										
Agitatorman										
Filterman										
Zinc-room Man										
Carmen										
Engineers										
Pumpmen										
Laborers										
Carpenters										
Machinists										
Total Previous Total Total to Date										

SUPPLIES

Crusher Jaws										
Cyanide										
Dies										
Lead Acetate										
Lime										
Oil										
Pebbles										
Power										
Screens										
Shoes										
Silex Lining										
Waste										
Zinc										
Total Previous Total Total to Date										

	Day	To Date
Ore Received		
" Milled		
" Leached		
" Filtered		
Precipitate Produced		
Hours Run		

.............Superintendent

Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H Warder, Monadnock Block, Chicago, Ill.

Form No. 18
DAILY LABOR AND SUPPLIES DISTRIBUTION—MISCELLANEOUS

Mine LABOR Day 191

Kind of Work	Administration	Assaying	Construction	Development	Equipment	General	Office	Power Plant	Storehouse	Total
Assayer										
Bookkeeper										
Carpenters										
Cashier										
Electrician										
Development Labor										
Fireman										
Laborers										
Manager										
Masons										
Mechanics										
Mining Engineer										
Office Boy										
Stable Boy										
Storeman										
Superintendent										
Surveyor										
Teamster										
Woodchopper										
Total										
Previous Total										
Total to Date										
SUPPLIES										
Candles										
Caps										
Chemicals										
Corn										
Crucibles										
Fuel										
Fuse										
Hay										
Lumber										
Nails										
Oil										
Powder										
Rails										
Stamps										
Stationery										
Waste										
Wood										
Total										
Previous Total										
Total to Date										

....Superintendent.

Form No. 19
DAILY EXPENSE Date 191

	Department	Expense for Day	Totals for Day	Previous Total	Total to Date	Remarks
Pay Roll	Mining					
	Milling					
	Smelting					
	Other					
Supplies	Mining					
	Milling					
	Smelting					
	Other					
Miscellaneous						
Total						

. . .. Manager

Form No. 20
MONTHLY DISTRIBUTION—MINE Month .... 191....

Date	Development	Stoping	Underground Tramming	Hoisting	Timbering	Pumping	Surface Tramming	Sorting	Other	Total
To Bal.										
Total										
Previous Total										
Total to Date										
SUPPLIES										
Administration										
Assaying										
Construction										
Development										
Equipment										
General										
Office										
Power Plant										
Stable										

Superintendent

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us i. you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Surveyor's Traverse Sheets.—Kolesch & Co., 138 Fulton St., New York City. Sample sheet; 18¾x15 ins.

A new form of sheet convenient to use and much more economical than sheets ruled in the office by hand, besides insuring neater and consequently more accurate work. The sheets are rule, with printed headings, to conform with the system of figuring traverses generally in use, and are arranged for the co-ordinate system.

Cause the Power with the Need.—Stone & Webster Engineering Corporation, Stone & Webster Bldg., Boston, Mass. Paper; 7½x10¾; 24 pp.

This is an illustrated account, with map, of the enlargement of three power stations for the Boston Elevatod Railway Company, which operates its elevated, surface and subway lines, serving the city of Boston and environs.

Waterproofing Methods. — Hercules Waterproof Cement Co., 821 Mutual Life Bldg., Buffalo, N. Y. Paper; 3½x6 ins.; 24 pp.

A treatise on waterproofing and methods for strengthening standard Portland cement, taking up the subject rather in detail and giving the summary of reports made by consulting engineers regarding tests made at Philadelphia. Explans how to use when mixing with the cement and also when used as a wash coat.

Medusa.—Sandusky Portland Cement Co., Sandusky, Ohio. Paper; 7½x10 ins.; 20 pp.

This catalog sets forth the qualities of Medusa waterproof compound, a dry powder to be mixed dry with dry cement before sand and water [illegible] an inseparable

Form No. 21
MONTHLY DISTRIBUTION—MILL
Month of..................191..

Date	Crushing	Fine Grinding	Classifying	Leaching	Agitation	Filtering	Precipitating	Refining	Other	Total
To Bal.										
Total										
Previous Total										
Total to Date										
SUPPLIES										
Administration										
Assaying										
Construction										
Equipment										
General										
Office										
Power Plant										
Stable										

Form No. 22
MONTHLY DISTRIBUTION—MISCELLANEOUS
Month of..................191..

Date	Administration	Assaying	Construction	Development	Equipment	General	Office	Power Plant	Store-house	Total
To Balance										
Total										
Previous Total										
Total to Date										
SUPPLIES										

Form No. 23
MONTHLY DISTRIBUTION—SUMMARY
Month of..................191..

	TOTAL COSTS				COSTS PER TON			
	Labor	Supplies	Other	Total	Labor	Supplies	Other	Total
MINING	Tons for the Month				Tons for the Year to Date			
Development								
Stoping								
Tramming								
Hoisting								
Timbering								
Pumping								
Surface Tramming								
Sorting								
Other								
Total								
Previous Total								
Total for Year								
MILLING	Tons for the Month				Tons for the Year to Date			
Crushing								
Fine Grinding								
Classifying								
Leaching								
Agitating								
Filtering								
Precipitating								
Refining								
Other								
Total								
Previous Total								
Total for Year								
MELTING	Tons for the Month				Tons for the Year to Date			
Other								
Total								
Previous Total								
Total for the Year								
Grand Total for Month								
Previous Grand Total								
Grand Total for Year								

Form No. 24
PAYROLL OF EMPLOYES
For Month of..................191..

No.	Name	Occupation	No. Days	Rate	Amount	Hospital	Store	Board	Sundries		Total Deductions	Amount Due

part of the concrete. This pamphlet takes up in great detail the method of handling the compound for producing the results. Amounts necessary to be used per cubic yard of concrete or barrel of cement are given.

Chicago Street Paving Mixer.—Chicago Concrete Machinery Co., 221 Grand Ave., Milwaukee, Wis. 6x9 ins.; 8 pp.

This is a concise explanation, by illustration and description, of this mixer as used on streets, especially where there is necessity of keeping open traffic, the area available for operation limited and there is a wide distribution of the material to be placed.

Carbonizing Coating.—The Gohun Manufacturing Co., Canton, Ohio. Paper; 8x10 ins.; 16 pp.

A catalog illustrated with several full-page cuts of plants, structures and bridges, the steel work of which have been coated with this preservative paint. Gives a description of smelting plants where the carbonizing coating has been used to protect steel against destructive gases. Quantities necessary per unit of area.

Bolts. — Columbus Bolt Works, Columbus, Ohio; 6¼x8 ins.; 120 pp.

This is a loose leaf catalog of a clever design. It contains a complete list of bolts, nuts and carriage hardware of every conceivable description, as may be indicated by the size of the book. Cuts are given of the numerous bolts, nuts, clips, hinges and other small hardware. Tables showing sizes, weights and prices are given.

Mine and Quarry.—Sullivan Machinery Co., 150 Michigan Ave., Chicago. Paper; 6x9 ins.; 24 pp.

This is a monthly publication for July, 1910, published by the Sullivan Machinery Co., containing much useful information in the way of articles describing operations going on where mining and quarrying machinery is being used.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The Louisville & Nashville R. R. Co. has awarded the contract to Furtwangler & Smith, Birmingham, Ala., for the construction of a 10-mile stretch of new track from Corduroy on the Selma branch in Alabama to the plant of the Vanderburg Lumber Co., in Monroe County.—Board of Directors of Levee District No. 2, Sutter County will receive bids at the office of A. H. Hewitt, Attorney of the Board, Yuba City, Cal., until 11:30 a. m., Sept. 15, for the improvement, raising, enlarging and strengthening of a levee in the district.—R. G. Clark, Natchez, Miss., has been awarded the contract by Capt. Robert R. Ralston, U. S. Engineer, 3339 St. Charles Ave., New Orleans, La., for the construction of 201,000 cu. yds. of earth work in the Pontchartrain Levee District.—MacArthur Bros. Co., Chicago, Ill., at $675,288 was low bidder, August 30, for the canal construction, etc., at Saulte Ste. Marie, Mich. Col. McD. Townsend, Jones Building, Detroit, Mich., is United States Engineer in charge of the work.—Ahern Bros., Plymouth, N. H., have been awarded the contract for the construction of the new railroad between Hartford and Norwich, Conn., a distance of 40 miles. The contract price for the work was about $1,000,000.—Bids have been advertised and will be received by W. W. Schlecht, Orland Project Engineer, at the office of U. S. Reclamation Service, Orland, Cal., for the construction of earthwork of the distribution system for the project involving approximately 58,000 cu. yds. of excavation.—Twohy Bros., Marble Bank Bldg., Spokane, Wash., have been awarded the contract by the Oregon R. R. & Navigation Co. for the construction of the Coyote cut-off of the company from Coyote to Stanfield in Umatilla County, Ore., a distance of about 30 miles. Work will be started at once.—City of Harrisburg, Pa., has advertised for bids to be received until September 19, for the pavement of 58 street sections. The work includes 107,500 sq. yds. of pavement and 100,600 lin. ft. of curbing.—The Peoria-Galesburg Interurban Ry. Co. has accepted the franchise of the City Council of Peoria, Ill., for the construction of its line into that place.—B. H. Hardaway, Columbus, Ga., whose bid was $490,000, is the probable contractor for the construction of lock and dam 17 on the Black Warrior River, Ala.—Buffalo Dredging Co., 1104 D. S. Morgan Bldg., Buffalo, N. Y., at $963,415 was awarded the Barge Canal Contract No. 50, including the construction of reservoir and dam on West Canada Creek at Hinckley.—Public Service Commission First District, 154 Nassau St., New York city, will receive bids until October 20, for the construction and equipment and operation of the Tri-Borough Subway and elevated system of New York.—North Carolina Traction Co., Danbury, N. C., has advertised for bids for the necessary material for the construction, including bridge work, concrete and track finishing of 100 miles of track.

A Big Blast.

A large blast fired at Prudo, Cal., on Sept. 10, by the Colton Portland Cement Company set a new figure in quantity of explosive used in a single blast in Southern California. Twelve and a half tons of dynamite and black powder were used and 200,000 carloads of clay were loosened and made available for use by the cement company. A tunnel 100 ft. long had been driven into the side of the mountain and from this lateral 50 ft. long were run. At the ends of the shorter drifts 540 cases of explosive were placed and electric wires run to each charge. The signal was given at 10:35 by Manager T. J. Wilson and when the crash came the entire face of the mountain appeared to rise and disintegrate.

Labor Force at Panama.

The following analysis of the labor force at Panama will interest many of our contractor readers. On July 27 there were 36,450 employes actually at work on the Canal and the Panama railroad, and of this number, 29,901 were Canal employes. The gold force on the Canal work, composed almost entirely of white Americans, was 4,380. No labor recruiting was necessary during the month. The report of the Chief Quartermaster for July, shows that the number of family quarters occupied by "gold" employes was 1,683, which is three less than in June, and the occupants numbered 5,103, an increase of 55. Of this number, 1,775 were women, and 1,659 children. Bachelor quarters occupied by "gold" employes numbered 1,925 and the occupants numbered 3,576, of whom 133 were women. The family quarters, occupied by European laborers numbered 303, and the occupants, 851; bachelor quarters, 111, and the number of occupants, 5,417. The family quarters occupied by West Indians numbered 1,078, and the occupants, 3,522; bachelor quarters, 258, and the number of occupants, 5,096.

Promotions in Engineering Positions.

In accordance with recommendations of a committee appointed for that purpose, the following rules have been adopted for examinations to procure eligibles for promotion among rodmen and levelmen employed on the Panama Canal or the Panama railroad:

1. First examination to be held on the last Sunday in October and first Sunday in November, 1910. All rodmen and levelmen in the service of the Commission and Panama Railroad Company to be notified that they are expected to enter the examination on one of these dates, provided, however, that if possible, arrangements should be made to examine all applicants at the same time, and if this is not practicable, and examinations are held on different dates the problems and engineering questions be changed for the second Sunday's examination.

2. Subject to further consideration, examinations will be held every six months and all rodmen and levelmen who have not been previously examined be required to enter.

3. No employe shall be considered eligible for promotion from rodman to levelman and from levelman to transitman until he has submitted to and passed the required examination. All employes who have passed the examination will be considered equally eligible for promotion under such regulations regarding selection of employes for promotion from the eligible list by the heads of departments and divisions as may be decided upon later.

4. A rodman will be permitted to take the examination for transitman in preference to the examination for levelman if he shall so elect, and in case he passes the examination for transitman he shall be considered eligible for promotion to levelman and from levelman to transitman without further test.

5. No levelman or transitman shall be selected in the United States for service on the Isthmus as long as there are already on the Isthmus men in the lower grades who have passed the requisite examination and are available for promotion or transfer to the vacancies which it is proposed to fill.

6. Examinations will be divided into three parts:

(a) Written examination, as per sample submitted with committee's report. Relative weight, 40 per cent.

(b) Education, experience and testimonials. Relative weight, 40 per cent. For testimonials applicants will be permitted to submit original, or certified copies of letters from previous employers, which will be returned to them. A blank form should be prepared to be submitted to the head of department or division immediately employing the applicant, who will fill same out and return to the Board stating his opinion of the applicant's conduct, ability and efficiency while under his supervision, using certain specified terms such as "excellent," "very good," "average," "poor."

(c) Oral examination. Relative weight, 20 per cent.

The control of the Philadelphia & Western Ry. was recently acquired by Messrs. Edward B. Smith & Co., Philadelphia and New York, and the new interests have begun work on an extension to connect the Philadelphia & Western Railway with the Lehigh Valley Transit Co., via Norristown. A franchise has been granted by the Borough of Norristown for a line through the center of that city, passing the public square and Courthouse. The new line will be over entirely private right of way. The cars of the Lehigh Valley Transit Co., which now have their terminal at Chestnut Hill, Philadelphia, will run directly over the Philadelphia & Western Railway tracks via Norristown, into the Philadelphia Rapid Transit Co.'s terminal at 69th and Market Sts. The new connections will shorten by at least one hour the running time from Allentown and Bethlehem to the center of Philadelphia, and establish a new service between Norristown and Philadelphia.

The New York Connecting Railroad Company, financed by the Pennsylvania and New Haven Railroads, has acquired title to properties extending more than five and one-half miles through Queens from the shore of Astoria to the Glendale section, and has also purchased a tract of land at Terminal Heights, Woodside, from the Stuyvesant Real Estate Company. This tract will be used to provide switches, tournouts and a yard through which connections will be made with the Pennsylvania-Long Island system at the Sunnyside yards. In all property consents on holdings valued at more than $10,000,000 have been filed with the Public Service Commission. The project is of great importance in connection with the building of transportation lines to Queens and the linking of that borough with railroads reaching all parts of the country. As planned, the new railroad will connect with the Pennsylvania-Long Island system at three points.

The Texas Railroad Commission has assumed authority over the Bryan & College Interurban Ry., between Bryan, Tex., and the A. & M. College, and authorized the registration of $49,059 in bonds upon the property. A total valuation of $69,059 was placed on the property by the commission, but outstanding capital stock of $20,000 prevents the registration of the full amount of the valuation.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

It has been announced that the Birmingham Railway, Light and Power Co. is completing the placing of poles and overhead work and that the new Edgewood line from the terminus of the South Highland car line to Shades Valley will be ready for operation within 30 days, giving direct connection to a territory heretofore inaccessible.

According to rumors circulating in the city of Montgomery, Ala., Charles Woodward has submitted a proposition to the mayor to build and operate a new street railway system in that town. Detailed information of the plans are wanting, but it is suggested that the new company will connect Montgomery with the surrounding towns by interurban lines.

At a recent meeting held at Russellville, Ala., committees were appointed from the towns of Tuscumbia, Florence, Sheffield and Russellville to investigate conditions favorable to securing the construction of a branch of the Louisville & Nashville R. R. from Tuscumbia to Russellville.

The Louisville & Nashville R. R. Co. has let a contract to Furtwangler & Smith, Birmingham, Ala., for the construction of a 10-mile stretch of new track extending from Corduroy on the Selma branch of that road to the plant of the Vanderburg Lumber Company in Monroe county. The contract includes grading and bridging and the cost of the work will be about $70,000. The new spur track will open up a rich timber track in Monroe county and will prove valuable to that community. The contractors, Furtwangler & Smith, brought the A., B. & A. into the city, and are now at work on the removal of the Birmingham Belt tracks at East Birmingham.

City Council of Montgomery, Ala., is considering the advisability of granting the franchise requested by C. F. Woodward representing northern capitalists, for a new street railway in Montgomery, Ala. It is believed that the promoters are considering especially the construction of a line to extend from Montgomery to Birmingham, a project which has been under discussion in that section of the country for the past few months.

Information from Birmingham, Ala., is to the effect that construction work southward on the Alabama, Tennessee & Northern Ry. is progressing rapidly on to York, where connection will be made with the Alabama Great Southern. The new line will open up new territory along the route and new towns are springing up with great rapidity.

Arizona.

Mayor and City Council of Tucson, Ariz., has offered to co-operate with the El Paso & Southwestern R. R. officials in extending the Port Lobos Railroad to that city. Walter Douglas, Bisbee, Ariz., is general manager of the company.

Arkansas.

Reports circulating in the vicinity of Fort Smith, Ark., are to the effect that the officials of the Chicago, Rock Island & Pacific Railroad Co. are considering the feasibility of constructing an extension from Hot Springs to Murfreesboro.

Advices from Magnolia, Ark., state that S. Q. Sevier, president of the Gulf & Magnolia Northern R. R., has announced that surveyors began work September 1, on locating survey of the line, starting in at Junction City and working westward through Magnolia. The road will build from Monroe, La., through Junction City, Magnolia, Hope and DeQueen, with northern terminals at Salina, Kan., thereby connecting the great Northwest in a direct route with the gulf. It will make connections with the Queen & Crescent at Monroe, the Rock Island at Junction City, the Frisco at Hope and the Kansas City Southern at DeQueen. A bonus of $35,000 was raised by Magnolia through W. R. Cross, of the Commercial Club, and according to the contract with the promoters the line will be completed from Junction City to DeQueen by January, 1912. The first rails will be laid from Waldo south to Magnolia and then north to Hope, and it is the intention to run trains through from Magnolia to Hope within six or eight months.

As a result of the action of the Pine Bluff, Ark., board of trade in preventing the granting of the petition of the Missouri Pacific-Iron Mountain to have its lumber contracts with the Memphis, Dallas & Gulf R. R. cancelled by the interstate commerce commission, announcement has been received by the city from J. W. Bishop, secretary of the latter road, that work would be started immediately on the completion of the line to that city.

The Meton Valley R. R. Company will not be reorganized and the present owners of the company have made arrangements for increasing the capital stock from $32,000 to $160,000 and issuing bonds not to exceed the latter amount. Plans are under contemplation for the extension of the line southward eight miles toward Tomberlins, crossing the England-Stuttgart cut-off of the Cotton Belt at McGregor and invading a rich rice and timber belt. Owners of the company are as follows: S. M. Savage, president; Charles Neimeyer, secretary and general manager; W. M. Kavanaugh, treasurer; Dr. H. N. Street of Argenta; Walter J. Miller, president of the First National Bank of Lamar, Mo.; Sheriff T. M. Fletcher and Ed Jett of Lonoke County, and M. Schulte of Chicago, formerly industrial agent of the Rock Island and Frisco, now president of the Stuttgart and Rice Belt Railroad.

California.

According to work received by C. A. Smith, Laton, Cal., from L. A. Nares at Los Angeles, Cal., the money necessary to insure the construction of the 16-mile Laton & Western R. R. line has been secured and arrangements made to hurry up the grading and tracklaying. Bids for the work have already been advertised.

Announcement has been made by E. E. Calvin, general manager and vice-president of the Southern Pacific R. R., it is said, that surveyors are now in the field preparing for the construction of about twenty miles of logging railroad into the Trinity Forest reserve. He also stated that this work had nothing in connection with the Humboldt & Eastern project from the Sacramento river to Eureka, Cal.

The Santa Fe Ry. Co. is preparing to rebuild the original line between Temecula and Fallbrook, Cal., thus making a direct route between San Diego and San Bernardino, Cal. Three surveys were recently made for the purpose of constructing a high and dry line free from winter floods, but the project was finally abandoned. The advent of the Panama Canal and the increased eastern shipments in the San Diego section are believed to have prompted the railroad to again take up the project.

Residents of French Camp, Cal., have petitioned the Board of County Supervisors at Stockton, Cal., to change the present right of way granted the Stockton-Modesto R. R., to that along the French Camp road in order that the road will pass through that village. Supervisors are considering the matter.

Surveys have been made and promoters are securing material for the construction of a 28-mile railroad line from Fallon, Cal., to Sand Springs. The cost of the road is estimated at about $180,000 and it will be used when completed for conveying the products of the proposed salt refinery at Sand Springs. C. W. Kinney is interested in the project.

A small force is now at work on the Sacramento & Sierra R. R., closing the several gaps as rapidly as possible left in grading from a point north of Orangevale Bluffs, Cal., to the boundary of the Rancho Del Paso. As soon as the route of the new road, which will connect Sacramento with the timber lands of the Sierra Nevada Mountains, has been selected across the Haggin grant property, work of grading for the line will commence. It will be some months before the roadway is ready for the laying of rails.

Colorado.

Contractor Orman, on the Denver, Laramie & Northwestern R. R. grade between Greeley and Wellington has commenced active work and it is expected that the work will be pushed rapidly until the site of their new town of Scott, Colo., is reached.

Information received from Boise, Idaho, states that W. E. Green, Vice-President and General Manager of the Denver, Laramie & Northwestern R. R., which at present extends from Denver to Greeley, Colo., a distance of 54 miles, has announced that the road is going to build to Puget Sound, a distance from Denver of 1,500 miles. Articles of incorporation grant the company the right to construct the line to the coal fields of Wyoming, 216 miles from Denver and it is believed that the work will be pushed to that point at once and on to Elk Mountain within a year. H. U. Wallace is Chief Engineer of the company.

The Denver City Tramway Terminals Co. has acquired several large tracts of land in the vicinity of 13th, 14th, Arapahoe and Curtis Sts. for the purpose of constructing new system of loops and stations. Much of the property transferred was held by the Denver Realty company which has heretofore held the real estate of the tramway company and a part by the Evans Investment company which controls the holdings of the estate of the late Governor Evans.

The Denver & Rio Grande R. R. is to double track its entire line between Denver and Salt Lake City, Utah, and the company is preparing to spend between $10,000,000 and $12,000,000 for improvements. J. G. Gwyn, Denver, Colo., is Chief Engineer of the company.

By the merging of the Denver, Greeley & Fort Collins R. R. Co. and the Greeley & Northern Ry. & Utility Co., a new company, having for its object the construction of an electric line between Greeley and Denver, Colo., has been organized. The interested men are as follows: W. A. Trenholm of St. Paul, E. W. Genter and Ralph Hartzel of Denver, George J. Spear and H. E. Churchill of Greeley. The company plans not only for an electric line between Greeley and Denver, but an electric line to reach into the Routt county coal fields and finally connect with an eastern railroad.

The City Council of Golden, Colo., has passed an ordinance granting the Denver & Intermountain a right of way to the Clay Pits and according to a statement made by the superintendent, work will be started right away on the extensions.

Connecticut.

A number of residents on Canner St., New Haven, Conn., have filed a vigorous protest against the laying of rails in that street by the Connecticut Company, their point being that the thoroughfare is much too narrow for such tracks. Although a petition was signed by about 800 citizens in favor of the improvement, it is alleged that but a small portion of the number were residents of the street in question.

Florida.

Work it is said will be completed on the new line of the Georgia, Florida & Alabama from Carabelle, Fla., to Richland, Ga., within two weeks and the same will eventually extend to Atlanta. Jesse P. Williams, 478 Peachtree St., Atlanta, Ga., is President of the company. It is also rumored that the railroad is planning to build a branch line from a point near McIntyre to St. Mark's, where it will be possible to erect wharves and docks.

The branch of the Tampa Northern R. R., extending from Brooksville to Tooke Lake, Fla., has been extended a distance of two miles to Centralia where large mills of the Central Cypress Lumber Co. are located, thus making the branch 15 miles long.

Surveys have been completed for the Haines City branch of the Atlantic Coast Line Ry., which will pass within one mile of Pabor Lake Colony. Land and construction work, it is said, will be started in the near future. This will also greatly reduce the cost of freight transportation from Avon Park, which now lies 20 miles off the Punta Gorda and Fort Myers main line.

Georgia.

Advices from Atlanta, Ga., state that T. B. Ragan, who has been in New York arranging for the sale of necessary bonds for the construction of the railroad from Hawkinsville to Perry, Ga., has returned successful and construction work will be started in a short time. By means of the Central of Georgia and the Atlanta, Florida & Southern, Atlanta will have direct route to Hawkinsville and from Atlanta to the sea.

Officials of the Atlanta & Carolina R. R., which proposes the construction of an electric line from Atlanta to College Park, Ga., have filed a petition with the electric and other railroad committees of the city council requesting certain changes be made in the franchise granted November 19, 1906, requiring a bond of $25,000. This, the petition states, will operate a hardship on the corporation if allowed to stand, as the company will be compelled to set aside money it needs for building purposes. The petition says the company is prepared to make bond to indemnify the city against any loss or damage, but thinks $25,000 is too much to be required. The matter was to have been considered at a meeting of the electric and other roads committee at the last meeting, but as a quorum failed to show up it went over until another time.

Idaho.

Advices from Emmett, Idaho, state that the Payette Valley Railroad now has two large gangs of men at work laying track and another following ballasting the line. They are now within 7 miles of the city, which means that there is 6 miles more of tracklaying as the road enters over the McNish spur and the Idaho Northern tracks. H. E. Dunn, Payette, Idaho, is General Manager of the company.

Illinois.

The Moline, East Moline & Watertown Ry. Co., will, according to an announcement reported to have been made by Joseph F. Porter, Davenport, Ia., President, start construction work on the building of a line into the southeast bluff territory as soon as graders can be secured. Right of way has all been secured and the company hopes to push work to completion before the cold weather sets in.

Williams & Co., Railroad and Teaming Contractors, Sterling, Ill., have completed their grading contract at the new Chicago & Northwestern yards at Fulton, Ill., and are moving their outfit to Peru, Ind., on the Chesapeake & Ohio R. R.

The Chicago, Burlington & Quincy R. R. is not contemplating the construction of a switching yard at Eola, but the present yard at Hawthorne, Ill., will probably be enlarged. T. E. Calvert, Chicago, Ill., is Chief Engineer of the company.

Capital has been secured and surveys are under way for the construction of the Springfield & Central Illinois Traction Company's line from Springfield to Centralia, East St. Louis and Mt. Carmel, aggregating about 300 miles of trackage. Contracts for the construction work will not be let before the spring of 1911. Isaac A. Smith, 309 Security Bldg., St. Louis, Mo., is Chief Engineer and President of the company.

Advices from Shelbyville, Ill., state that London capitalists in company with Attorney James Vause and President Sampsell, of the Centralia Illinois Public Service Co., recently visited that city for the purpose of investing capital in electric railway lines. The proposed line between Mattoon and Shelbyville was too small to command their serious attention but their visit indicates that the line will be built west of Mattoon at an early date connecting with the Hillsboro line and giving a direct communication with Indianapolis, Ind.

Negotiations between the Illinois Traction and the Joliet & Southern Traction Companies, will probably result in the construction of a large terminal station in Joliet. The franchise to be turned over to the McKinley people provided that the tracks shall be laid over the McDonough St. bridge and along Des Plaines St. northward from McDonough to Van Buren. This will also necessitate the construction of a new structure to replace the old McDonough St. bridge. The route to Chicago may prove some problem, especially as it applies to an exit from the city. McKinley may decide to secure a franchise on Railroad and Bluff Streets from McDonough to the northern limits of the city, and build the line along the west bluff of the river channel. Or it may be advisable to cross the river at Van Buren Street to Bluff and then go northward. Another outlet might be found by going north on Desplaines east to Joliet, and then north to some point advantageous for crossing the river.

At a recent conference between the representative committee of the city of Walnut, Ill., and H. J. Dunker, representative of the Northwestern Engineering & Construction Co., Milwaukee, Wis., the Walnut body expressed their feeling that the town would do its share toward securing the right of way and preparing the road for the marketing of bonds so that a branch line could be constructed to that city from Sterling.

A meeting has been held recently at Rock Island, Ill., by the Buffalo Prairie Interurban Committee and the business men for the purpose of discussing the project of raising $100,000 with which to buy bonds of the proposed company. The people behind the scheme promise to take over the belt line proposition and carry it to completion furnishing satisfactory terminal arrangements by which Rock Island will be open to railroads desiring to enter the west end, factory district. They will pick their own route to Buffalo Prairie.

It is said that a company is being organized in Quincy, Ill., known as the Illinois Western Interurban Ry. Co., to construct a gasoline motor railway to Rushville, Littleton, Macomb and Bushnell. According to the reports 90% of the right of way has already been secured and everything looks toward the construction of the line in the near future. New York capitalists are said to be financing the project.

Work has been progressing rapidly on the Cairo & Thebes R. R. Track construction is going forward in both directions from Fayette, Ill. One gang is pushing up the easy grade toward the approach of the Thebes bridge. The iron bridge over Rock Springs has not yet been put in, but as soon as the track is laid to that point so that material can be carried there, the work will commence upon it. At the Thebes end the grading is still in progress. At Fayville they will build the signal tower, in which an interlocking plant will be installed for the crossing of the Cairo & Thebes over the Chicago & Eastern Illinois road. At Thebes they will build section houses, a foreman's house and two small houses for laborers and a tool house.

The Chicago, Milwaukee & St. Paul surveyors, according to information received from Elgin, Ill., have completed the task of running lines for the proposed short cut freight line from Spaulding to Pingree Grove. It is the intention of the railroad company to run only passenger trains and way freights through Elgin. The line for which the survey has just been completed will mean a great saving in the hauling of heavy freight. It not only cuts off many miles of hauling, but gets away from the climbing of the steep grade west of the city and also will have a tendency to eliminate the blocking of the crossing on West Chicago St.

The Atchison, Topeka & Santa Fe Ry. is laying heavy steel rails through Minonk and it is believed that the company will lay a through line from Chicago to St. Louis via Minonk, Pekin and Jacksonville, Ill.

Capital has been secured for the construction of the Eastern Illinois Ry. line between West Hammond, Harvey, Riverdale and Dolton. Surveys have been completed by A. L. Drum & Co., 624 American Trust Building, Chicago, Ill., and the railroad company will do the construction work with its own forces. T. E. Mitten, Chicago, Ill., is President.

The Peoria-Galesburg Interurban Ry. Co., has accepted the franchise granted them by the City Council of Peoria, Ill., and work will be started as soon as possible. The capital stock of the company is set at about $2,000,000, the majority of which is held by eastern interests. A bond has been filed with the City Treasurer of City amounting to $5,000.

Steps are being taken to incorporate a company to construct an electric railway to connect the Belleville-Mascoutah line, now being built with the St. Louis & St. Libory R. R. The route of the proposed new line would run from the vicinity of Green Mount cemetery through Freeburg, Ill., to a point north of Lemerton. David Thomas, Belleville, Ill., is interested in the project.

Indiana.

On a petition filed by Myron J. Carpenter, receiver of the Southern Indiana R. R. Co., United States Circuit Court Judge at Indianapolis, Ind., ruled property in Wayne County owned by the company can be sold at public auction. In the petition filed it was stated that the Evansville & Richmond Railroad Company, organized to construct a road from Evansville, Ind., to Richmond, Ind., purchased land for a right of way. The Southern Indiana Railroad Company became that company's successor, and instead of completing the line to Richmond made Terre Haute, Ind., a terminus. It was stated the land will never be of any value to the company and taxes on it are a burden.

Iowa.

A meeting was recently held by the city of Ottumwa, Ia., to discuss the matter of completing the construction of an electric railway from that city to Iowa City. It is understood that a subscription of $75,000 will be necessary for the work.

Mason City, Ia., on Sept. 1 voted to grant a 25-year franchise to the Mason City & Clear Lake Electric Ry. Co., mentioned in our last issue, which proposes the construction of a line in that vicinity. F. J. Hanlon, Mason City, Ia., is one of the incorporators.

According to information received from College Springs, Ia., the College Springs R. R. is an assured fact.

Improvements under supervision of Edward Gagnon, will soon be started on the Minneapolis & St. Louis R. R. A large force of men will go to work at once on the track between Fort Dodge, Ia., and Tara and six miles of track will be laid. The right of way will be regarded and put into first-class condition. Arrangements have been made to fill in some of the bridges and a general change for the better will be made along the route. The heavy first class rails will be put in on the new stretch of track.

Kansas.

Information received from Liberal Kan., states that the Chicago, Rock Island & Pacific Ry. will start construction work on the proposed improvements at that place as soon as the construction equipment can be transferred from Booneville, Ark., to Liberal

Surveys have been started by J. H. Titus, Chief Engineer, Arkansas City, Kan., of the Southwestern Kansas & Colorado R. R. for the proposed line from Hardtner, Kan., west for a distance of about 300 miles. Scott Bros., Coldwater, Kan.; Claude Lewis, Protection, and A. A. White, Aetna, Kan., are interested in the project.

The Kansas State Railroad Commission has been notified by A. W. Sullivan, General Manager of the Missouri Pacific Ry., that the line between Kansas City and Seneca will be improved and work started at once. This work is being done as a result of a personal investigation of the [illegible] member of the Board

The Interurban Railway, according to information received from Newton, Kan., has steel laid to the Harvey County line and is now erecting the trolley poles about 2 miles south of Valley Center, going south from that village.

Promoters of the railroad from Westmoreland, Kan., to Wamego, have contracted with an Omaha firm to construct the line. The contractors agree to take a big share of the bonds but require a $65,000 payment in cash.

Citizens of Tipton, Kan., are agitating the proposition to construct a connecting railway from that city to the Missouri Pacific, a distance of 14 miles.

The Missouri, Kansas & Texas Ry. is now laying 66-lb. steel rails on their line through La Harpe, which will extend from Iola, Kan., to Moran. Lighter rail has been used until just recently by the company.

Kentucky.

On account of the citizens of Covington and the city council not co-operating with the Chesapeake & Ohio R. R., the company has decided to move their shops and yards to Melbourne, Ky. A site known as Heber's garden comprising hundreds of acres of land has been purchased for the purpose. Work on the new improvement will be started in a short time. F. H. Haskell, Covington, Ky., is Division Engineer.

A meeting was recently held at the City Hall of Ghent, Ky., by the citizens of Ghent and Carroll county in the interest of the Covington, Big Bone & Carrollton R. R. The proposed line will start from Covington, pass through Kenton, Boone, Gallatin and Carroll counties, connecting with the C. & W. R. R. at Carrollton, following the Ohio river all the way. Grading was begun at Covington, August 26.

It is reported that the Stearns Co., Stearns, Ky., has sold $1,500,000 worth of bonds for the purpose of extending their Kentucky and Tennessee R. R. to the Tennessee Central, thus beginning a railroad from the Tennessee Central to Somerset and with the line from Corbin to Somerset, which now seems assured, Pulaski county will be traversed its full length with another road intersecting at one end the Louisville and Nashville and at the other the Tennessee Central.

The Cumberland R. R. Co. has awarded the contract for the completion of the three-mile extension of the Tye Fork Spur and also a three-mile extension of the main line to the Gibson-Carr Construction Co., Middlesboro, Ky. The Cumberland railroad at present extends out from Artemus nine miles. The road is planned to run to Jellico, Tenn., a total length of twenty-seven miles. Artemus is a station on the Louisville & Nashville Cumberland valley division, twenty miles southeast of Corbin, and between Corbin and Middlesboro. This road will run through a rich coal field.

Louisiana.

A meeting was held September 6 in Lafayette, La., to consider the movement to establish an interurban motor car belt line from that city to Cade, St. Martinville, Breaux Bridge, Arnaudville, Broussard and Port Barre, which is reported to be taking definite shape.

Maine.

Manager of the Mills at Limerick, Me., expresses his thought that he can obtain the construction of an 11-mile spur to the nearest railroad within a short time.

At a recent meeting of Skowhegan, Me., business men and citizens of Athens at the municipal building, Skowhegan, the possibilities of having an electric car line between the two places was discussed and met with the approval of all parties interested. Definite action will probably be taken regarding the matter in the near future.

Maryland.

Engineering department of the Western Maryland Ry. Co., is now figuring on steel rail, cross-tie and ballast contract for the extension which is to be built between Cumberland, Md., and Connellsville, Pa., amounting to $1,000,000 and the award of the contract will be let shortly. J. Carmichael, Baltimore, Md., is Engineer Maintenance of Way.

There has been no definite decision reached by the engineering department of the Baltimore & Ohio R. R. Co., in regard to the construction of an extension to the Paw Paw branch. A. W. Thompson is Chief Engineer, Baltimore, Md.

Boston & Maine R. R. has location surveys under way for the construction of 6,500 ft. of new line along the Chicopa River. Time for letting the contracts for the work has not yet been decided. J. P. Snow, Boston, Mass., is Chief Engineer of the Company.

Massachusetts.

C. Q. Richmond, Manager of the Berkshire Street Railway Co., has been considering the construction of a trolley line from East Lee to Huntington and a party of surveyors have been put in the field to relocate the line laid out some time ago. It will follow the old survey from Housatonic St., Lee, Mass., with the exception of one or two short strips, where the officials believe a better grade can be found. The company also has under consideration the construction of a line from East Lee to Winsted Ct.

Advices from Indiana Orchard, Mass., state that the work of constructing a new freight house, depot and rearranging the yards at the Athol branch of the Boston & Albany R. R., announced some time ago to have been given up, is again under way and will possibly be completed this fall.

Michigan.

Chief Engineer J. J. Hubbell, of the Manistee & Northeastern R. R., recently applied to the Public Domain Commission for right of way for the construction of an extension of the road across state lands in Kalkaska and Grand Traverse Counties, Mich.

Advices from Lansing, Mich., state that the last link in the Lansing-Owosso line between Pine Lake and Morrice, Mich., has been completed and is ready for operation.

Articles of incorporation have been filed by the Bay City Terminal R. R. Co., of Bay City, Mich. The capital stock of the company is placed at $15,000.

It has been announced in Bay City, Mich., that the laying of track for the Detroit, Bay City & Western railway, which is to connect Bay City with rich coal fields in the vicinity of Akron, Tuscola county, and ultimately to extend to some point on the Pontiac, Oxford & Northern railway, is progressing at the rate of one and a half to two miles per day, the work having started at the terminal in this city. The grading is completed to a point within two miles of Caro, and the builders expect to have the road completed and in operation to that city not later than Oct. 10.

J. J. Hubbell, Chief Engineer of the Manistee & Northeastern R. R. has applied to the Public Domain Commission for a right of way for an extension of the road across state lands in Kalkaska and Grand Traverse Counties, Michigan.

Minnesota.

Residents of North Minneapolis, Minn., are advocating the construction of a new cross town electric line along Emerson Ave. to Sixth Ave., and a committee is to take up the matter with the city council.

The Northern Pacific is rushing construction work on the line between East St. Cloud and Rice, Minn., and an additional 100 laborers have been put to work between East St. Cloud and Sauk Rapids, where the Northern Pacific is moving the Great Northern track to the edge of the right of way. As far as Sauk Rapids the Northern Pacific is to use the Great Northern as part of its double track system. This is under the lease covering the Great Northern line from St. Paul to Sauk Rapids. The road bed between East St. Cloud and Sauk Rapids is now being placed in condition for use. Owing to the changes made it was necessary to make a new grade. The work of grading the cut-off in the straightening out of the line between Sauk Rapids and Rice is nearly completed, but it is not thought that the steel will be laid on the new grade until next year. When it is laid a double track will be put down. The Northern Pacific now has a double track system from St. Paul to Devil's Lake, N. D., with the exception of a gap extending from Philbrook, just east of Staples to Sauk Rapids. If conditions warrant this gap will be filled in with a double track next spring.

Advices from Barnesville, Minn., state that the Milwaukee surveyors, who are running a line from Hutchinson to Fargo, have reached a point six miles south of that city. All surveying has been accepted by the railroad's engineers as far as Douglas County. When the crew reaches Fargo they will double on their tracks and set up grade sticks as far as Alexandria.

All right of way in Douglas County, Minn., has been secured and agents of the Arrow Line company are now purchasing the remaining 20 miles necessary in Burnett County, Wisconsin. Work clearing the right of way between the Twin Cities to the head of the lakes will be taken up this fall and grading, it is expected will be taken up in the spring of 1911.

At a recent meeting of the East Side Commercial Club, St. Paul, Minn., a committee of seven was appointed to confer with the street railway officials to have the routing of the Payne Ave. street cars changed so as to traverse either Third, Fourth or Fifth Sts. instead of Seventh St.

Information received from Two Harbors, Minn., states that the Northern Land Co., a branch of the Weyerhauser interests, will extend their railroad from Harris Lake to Stone Lake in Town 55, Range 12, west Mile 14 on the D. & I. R. Drummond line. The improvement is being made to develop the timber lands held by the company in that locality including Stone Lake, Bates Lake and Lake 18. Camps in section 33 will be built and a new road built to Rollins on the D. & I. R.

The Great Northern Ry., according to advices received from Wheaton, Minn., is planning the construction of a spur from Browns Valley to the head of Big Stone Lake for the accommodation of parties who are planning to build elevators and warehouses at that place.

Six pay checks issued by Johnson, Rogers & Curtiss, Contractors on the Minneapolis, St. Paul & Sault Ste. Marie R. R., on the First National Bank, Bagley, Minn., to Italian laborers were raised from $20.40 to $50.40 each. The work was done by an expert. The checks were cashed at Grand Forks and with local merchants. The work was so well done that the checks escaped the attention of the bank on which they were issued, and only were discovered by the firm in checking over with the bank.

A crew of 16 Chicago, Milwaukee & St. Paul surveyors running a line southeast of Fargo, N. Dak., has reached a point a little north of Finkle, Minn.

Duluth and the Ranges.

BY PETER E. MEAGHER.

Mr. Wick O'Connell, railroad contractor from Marquette, Mich., has been in the city recently. He said that he had several contracts under way at the present time, and they were all in satisfactory condition.

H. H. Marsh, representing the Engineering-Contracting, was a visitor recently. He was up here looking over the field for new advertising.

C. R. McLean, contractor, was a visitor a few days ago, and left us a nice order for equipment. He is engaged on three small contracts at the present time.

F. C. Peabody of the Dale & Bumgardner Company, spent a day with us here recently. He said that his firm has been awarded an extension of their contract on the Cuyuna Range Railway. They have two steam shovels working on the same.

Joseph Simpson, sales manager for the Standard Scale & Supply Company, of Chicago, spent a day with us here last week. He was up here looking after concrete mixer prospects.

A. Berglund, of Franzin & Berglund, contractors on the Canadian Northern, was a caller and said that their work was getting along in very satisfactory shape.

E. H. Hitchcock, Assistant General Manager, and Dennis Madden, General Superintendent for MacArthur Brothers' Company, were visitors with us here this week. They were up on a trip of inspection of their two stripping contracts that they have on the Iron Range near Duluth. They said that they were quite well satisfied with the progress they were making.

C. G. Borchert, representing the Arthur Koppel Company, dropped in to see us last week. He reported business quiet in his line.

Patrick McDonnell was awarded another paving contract by the City of Duluth, amounting to about twelve thousand dollars, and will start on the same immediately.

The Bowe-Burke Company have taken a contract to do considerable work, consisting of culverts and small bridges on the Canadian Northern Extension into Duluth, and have already started on the same.

A. Elwell, of Elwell & Howard, contractors on the Canadian Northern Railway, was a caller recently.

Timothy Foley, head of the contracting firm of Foley, Welch & Stewart, was a visitor in Duluth last week. He said that they have a great deal of work under way at the present time, both in the states and in Canada, and it was all in very nice shape, and that they were rushing to completion all of their contracts.

Thomas Higgins, of Higgins & McDonald, who have some rock work on the Canadian Northern Extension, is a visitor with us occasionally. He said his work is getting along fine.

The demand for men around Duluth and vicinity is not quite as brisk as it was two weeks ago; but, still there are orders enough to take care of very nearly all the men that are here. The wages offered now are very good, two dollars being the lowest paid for common labor, and for some classes of work as high as two dollars and fifty cents is being paid.

Contractors and others, when in this vicinity, are cordially invited to make the Labor and Equipment office of Peter E. Meager, 409 West Michigan street, their headquarters. We can sell you anything from a track spike to a steam shovel, and can hire for you any kind of male help from a water-boy to a general superintendent.

Mississippi.

According to reports received from Vicksburg, Miss., promoters have been securing data for the past few weeks and have under consideration the construction of an electric railroad connecting Jackson and Vicksburg, a distance of 43 miles, passing through Edwards, Bolton and Clinton. It is understood outside capital will be largely instrumental in establishing this line, if it is built. If the investigations now in progress are satisfactory, the enterprise can be financed without trouble, as much interest is being shown in the project, not only in Vicksburg, but by capitalists who are considering the matter.

Missouri.

W. C. Doane, Engineer who is running the line for the proposed interurban electric railway from Kansas City, Mo., to Springfield, has completed and filed with the company officials the survey from Butler to Rockville.

City council of Cape Girardeau, Mo., has passed an ordinance declaring the St. Louis & San Francisco Ry. a nuisance and causing their right of way through that place to be forfeited because of a violation of the contract in moving the terminal and shops from Cape Girardeau to Chaffee.

Montana.

In regard to the report that the Great Northern Ry. would soon start construction work on the proposed line from Moccasin to Lewiston, Mont., A. H. Hogeland, Chief Engineer of the company at St. Paul, Minn., announces that nothing has as yet been decided concerning the project.

Stockholders of the proposed Boise-Butte R. R., Butte, Mont., recently made an inspection trip over the suggested right of way of the line. The survey from Butte runs through Big Hole crossing the divide into Idaho with a comparatively easy grade until the Salmon River is reached and up the river to the Sawtooth range at about watergrade.

At a meeting of the Board of Directors of the Butte, Boise & San Francisco R. R. Co., in the office of President W. H. Haviland, Butte, Mont., Dr. George N. Faming of Boise, Idaho, was elected a director and first vice-president of the company. The Butte, Boise & San Francisco company entered into a contract on July 30, 1910, with the French-American Construction company, of Philadelphia, Pa., to build a road, with branch lines, from Regina, in the province of Saskatchewan, Canada, via Butte and Boise, Idaho, to Winnemucca, Nevada, approximately in all 1,500 miles. Sub-contracts will be let by the middle of September at the company's office in Butte, and active work will start immediately along the line and at Butte. The general offices of the Butte, Boise & San Francisco railroad company, and the French-American Construction company will be opened Sept. 15 at Butte, Mont.

An announcement was recently made in Lewistown, Mont., by Samuel W. Gebo, that construction work will be started in the spring and pushed to a rapid completion. Surveys have been made, and everything will be in readiness. Financial support for the line between Lewistown and Kendall was secured in Holland.

Good progress is reported from Harlowton, Mont., on the construction of the railroad between Dorsey and White Sulphur Springs, and it is thought that the road will be in use by October 1.

Nebraska.

The Missouri Pacific Ry. has completed ballasting about 500 miles of track with crushed rock replacing the old dirt ballast on the Central Branch of the Omaha division, and other divisions. About 65,000 tons of 85 and 100-lb. steel rails have also been installed.

Nevada.

The Goldfield-Ely R. R. project which is proposed as part of the transcontinental line, has advanced another step. Engineers have been employed gathering data relative to ore tonnages at Hamilton, Tybo, Reveille and other mining camps which would be on or near the Ely-Goldfield line. That work has been finished, it is said and it only remains for the data to be checked up when the reports will be placed in the hands of the promoters. Engineers have gone to San Francisco for a conference, following which they will meet in New York the principal interests behind the project. Opposition of the city of Ely to granting a right of way franchise through that city has been overcome. Not only is Ely ready to grant a franchise as soon as it is shown that the promoters are ready to begin work, but the citizens of that city, it is declared, are willing to donate to the new railroad a fine depot building.

New Hampshire.

According to advices from Plymouth, N. H., the Ahern Bros. Contracting Co., of that city, have been awarded the contract for building the new railroad between Hartford and Norwich, Conn. The stretch of railway to be built is 40 miles in length and the contract price is approximately $1,000,000. The work of construction will be started on the Hartford end at once, and efforts will be directed toward getting the first 10 miles of the road in operation first, that section being between Hartford and East Canterbury. It is the intention of the company to keep steadily at the work until the road is completed and at that rate it is supposed that the job will require two years time.

New Mexico.

An agreement has been reached between the Rock Island, Texico, Farwell & Culf R. R.. and the Townsite Company of King, N Mex.. whereby the railroad will be constructed to that point within twelve months.

New York.

The Buffalo, Rochester & Eastern Ry. Co. will apply to the Public Service Commission on September 21 for permission to construct a steam railroad between Buffalo and Troy, N. Y. Testimony concerning its financial ability and details of its arrangements for handling freight and passenger traffic at Buffalo are ready for submission.

Board of Trade, Warsaw, N. Y., at a recent meeting discussed the matter of constructing a switch and erecting a freight house on the level of Main St. as a new industry in the village is dependent upon the improvement.

The Boston & Albany has let the last contract for the completion of the fourth track between Rensselaer to Niverville, N. Y., to the Walsh-Kahl Construction Co., Davenport, Ia., and a large gang will be put to work at once. The contract includes the construction of the 1½ mile gap at Grand View and will require, it is said, much blasting.

Bids will be received by the Public Service Commission for the First District, 154 Nassau St., New York City, for the construction equipment and operation of the Tri-Borough Subway and elevated system of New York City comprising about 44 miles of line. Bids will be opened Oct. 20.

North Carolina.

The Board of Aldermen, Charlotte, N. C., at a recent meeting voted in favor passing a resolution granting the Piedmont Traction Co. permission to construct, maintain and operate a street railway in and upon the streets and highways of the City of Charlotte in the County of Mecklenburg, N. C.

Officials are quoted as stating that improvement work on the Atlantic Coast Line at Weldon and Garys, N. C., is progressing at a rapid rate and is being pushed ahead rapidly. The work includes constructing about four miles of double track line from Weldon to Garys, N. C., and elevating its track through the town of Weldon, commencing about one mile south of the present station. A large proportion of it will be on continuous steel viaduct, 3,700 ft. long, having concrete abutments, piers and pedestals. This structure will be 90 ft. above the ordinary level of the Roanoke River, and there will be required in its construction about 15,000 cu. yds. of concrete and 2,000 tons of steel.

The North Carolina Traction Co., Danbury, N. C., will receive bids at once for the material, construction work, bridge work, concrete work and track finishing work on 100 miles of track to be completed within 12 months from date of contract. Plans and specifications are on file at the office of the company.

North Dakota.

Steel laying gang has resumed work on the Cannon Ball River branch of the Chicago, Milwaukee & St. Paul coast line and residents of New England, N. Dak., have been advised that the line will be completed to the terminal by the first of October.

Ohio.

At a recent meeting of the Delphos, O., Commercial Club, the matter was under discussion of securing the construction of the proposed electric line from Geneva, Ind., to Celina, O., to Mendon, Spencerville, Ottoville and Delphos to Defiance.

Promoters of the proposed electric railway line down the Sandy Valley through Mineral City to New Philadelphia, O., have secured capital and right of way sufficient to construct the line to Mineral City, and the progress of the work now depends upon the action taken by the New Philadelphia Board of Trade.

It is believed in Toledo, O., that the old Maumee-Waterville Electric Railway washed out this spring by flood waters will never be rebuilt as the line was never a paying investment and according to all probabilities the cemetery which is now on the line will soon be moved out of the flood district. The line is the property of the Maumee Valley Railways & Light Co. of which A. E. Lang is President.

It has been announced according to advices from Columbus, O., that the Pennsylvania and Norfolk & Western Railroads will spend about $500,000 increasing their terminal facilities at that place.

Surveys have already been made for the construction of the proposed Valley Line extension from Pigeon Lake, four miles east of Angola via Metz to Montpelier, O., where a connection will be made with the proposed electric road for which construction bonds have already been sold. The Valley Line will thereby gain good connection with Bryan, the county seat of Williams County, and also Toledo, O.

At the next meeting of the Cleveland, O., city council an ordinance will be passed authorizing the issuance of $2,000,000 of bonds for the elimination of grade crossings. Plans and specifications are now under way for the work by the Pennsylvania and Lake Shore Railroads, and are expected to be submitted to the city engineer within a short time.

Workmen, according to information received from Fostoria, O., are engaged in cutting down the grades at Berwick, preparatory to making the connection between the Cleveland, Cincinnati, Chicago & St. Louis (Big Four) and the Ohio Central railroads. A steam shovel is being used on the work.

The Erie R. R., according to reports, is planning improvements to cost $240,000 for Meadville, Pa., Jamestown, N. Y., and Kent, O. Meadville yards are to be extended at a cost of $40,000. Jamestown improvements will cost approximately $60,000, while Kent is scheduled for an expenditure of $140,000. The additional trackage for the freight yards at Jamestown, it is said, has been ordered, and will be pushed to completion, while plans and drawings for the improvements at the other points have been completed. C. W. Buchholz, New York City, is const. engineer.

Oklahoma.

In formation received recently from Tecumseh, Okla., is to the effect that the surveying crew on the Rapid Transit Interurban Line has reached St. Louis, Okla., and report having found an excellent route which will require little grading to give a good roadbed.

Capital has been secured and surveys partially completed for the construction of the Winnipeg, Salina & Gulf Ry. Company's lines from Omaha, Nebr., to Oklahoma City, Okla.; Salina, Kan., to Kansas City, Mo.; Alvan, Okla., to Des Moines, N. Mex., aggregating about 1,080 miles. Contracts for the construction will be let about December 1, 1910. C. A. Slayton, Salina, Kan., is Chief Engineer; H. Leon Miller, Salina, Kan., is President.

Representatives of Muskogee, Okla., and officials of the Commercial Club have under consideration the construction of a bridge over the Arkansas River in order that the Muskogee Electric Traction Co., can make good their offer to extend their system to Fort Gibson. The latter place is making strenuous efforts to induce the County Commissioners to include $100,000 in the proposed new bond issue for building such a structure.

Harper County, Okla., which is without a railroad, is booming a plant to extend the Avard Branch of the St. Louis & San Francisco R. R. westward through Harper County to the coal regions of New Mexico.

The Fairview & Oklahoma City Railway Co. has been chartered to construct a line from Fairview to Rusk, where a connection will be made with the Chicago, Rock Island & Pacific Ry. The city of Fairview now hopes to secure the construction of the Winnipeg, Salina & Gulf Railroad also.

Work has been completed on the extension of the Oklahoma City Railway from Britton north to College Park, and the line is ready for operation. The construction required 90 days and included a large amount of heavy grading work. Grade was also constructed for a double track which can be installed at any time.

A surveying party is now in the field for the proposed extension of the Missouri, Oklahoma & Gulf north from Wagoner, Okla., to Joplin, Mo., and Pittsburg, Kan., thence to Kansas City. South from Wagoner the company now has its line practically completed into Denison, Tex.

Grading work has been completed on the Webber Falls & Muskogee R. R. from Warner to Webber Falls, and promoters announce that the road will be completed in time to handle fall shipments. Muskogee, Okla., will be entered over the Midland Valley tracks from Warner.

The Buffalo & Northern Oklahoma R. R. Co., has been chartered to construct a railroad 258 miles long, extending from the northwest border to the southeastern section of the state. The company is capitalized at $50,000, and it is expected that the cost of the work will amount to $5,150,000. The incorporators are: E. M. Best, O. L. Cook, F. C. Platt, E. C. Johnson, Albert Ewers, A. L. Rodkey, W. P. Parker, W. H. Temple, C. A. Wyatt, S. M. Hubbard, G. E. Ford, Frank White and J. L. Giffets, all of Buffalo, Okla.

Oregon.

The Portland Railway, Light & Power Co., Portland, Ore., has work well under way on the relaying of its double tracks between Hawthorne Ave. and Holgate St. on Milwaukee. New double track will also be laid on the new extension of Milwaukee St., from Holgate to Bybee Ave., a distance of ½ mile and the cost of the work is estimated at $150,000.

The Oregon Electric Ry. Co. has filed with the City of Eugene, Ore., its bonds for $10,000 as a guarantee that the electric railway from Portland to Eugene will be completed within 30 months. It has not yet been decided how the road will leave Eugene going south, but it will soon be determined and a franchise possibly on 15th St. asked for.

The Oregon Railroad & Navigation System has abandoned the former site for the proposed shops on account of the fact that the ground space was not sufficient to accommodate the buildings required and engineers of the company are to lay out the site at La Grande, Ore. Construction work will be commenced as soon as it is possible. E. C. Buhrer is Division Engineer at Pendleton, Ore.

The Lane County Asset Co., Eugene, Ore., will start work at once on the electric railway from that city to the coast. It is expected that ties will be laid as far as Elmira, a distance of 14 miles, this fall. All the cost of grading and laying the ties is to be borne by local people, many of whom have donated work and others material for the enterprise. The company has the promise of eastern capitalists that as soon as the ties are laid between Eugene and Elmira money will be forthcoming to carry the line to the coast.

E. E. Calvin, vice president of the Southern Pacific, recently announced that no definite time had been decided upon for resuming the construction of the line from Drain, Ore., to Coos Bay.

The Portland Railway, Light & Power Co., has grading under way for the construction of the proposed line from West Oregon City to within one-half mile of Oswego. When completed, the line will pass through Clackamas county and McLouglin, the new town. A. H. Richmond, Portland, Ore., is chief engineer of the company.

Pennsylvania.

A corps of surveyors have been put in the field by Crum & Davison, Engineers, York, Pa., to locate the route of the proposed extension of the Chambersburg, Greencastle and Waynesboro electric railroad from Pen-Mar to Blue Ridge Summit, a distance of several miles. The maximum grade, according to the preliminary surveys, will be 4.88 per cent, and there will be only five curves. A deep ravine along the Western Maryland railroad near Cascade will have to be crossed either by trestle or a heavy fill. The latter expedient will probably be adopted. Right of way, it is said, has already been secured. It is probable work on the extension will be commenced shortly. It will be rapidly pushed.

It is understood in Charleroi, Pa., that the Pittsburg & Lake Erie R. R. is considering the construction of an extension from its present terminal in Fayette County to Morgantown, W. Va. J. A. Atwood, Pittsburg, Pa., is Chief Engineer.

At a recent meeting of the Chambersburg & Western Trolley Co., at the office of President Ramsey, Chambersburg, Pa., the officials decided to rescind the action taken some time ago that work would not be started until $150,000 had been subscribed and have set the mark at $100,000 worth of stock, which has almost been reached.

It is reported in Warren, Pa., that capitalists have completed surveys for the construction of the proposed trolley line from Pittsburg to Conneaut Lake. Rights of way have been secured for the new line will be constructed within a short time, it is expected.

City Council of Lansdowne, Pa., has granted the Southern Pennsylvania Traction Co., which is leasing the line of the Delaware County & Philadelphia Electric Co., permission to construct a single track line down Baltimore Ave., in lieu of the double track system for which a franchise was given the company some time ago.

Advices from McKeesport, Pa., state that engineers of the Baltimore & Ohio R. R. who have been working in that district for the past three weeks are surveying for a third track for the company between McKeesport and Connellsville and eventually Cumberland. Work is already under way on the third track between Philson and Manila and Sand Patch and Yoder at the west end of the Hyndman grade, and preparations are being made to put a force of men at work on the building of the additional track between Connellsville and McKeesport. It is said most of the trackage rights have been secured, and that the entire division between Cumberland and Pittsburg will consist of at least three tracks.

Work has been started by Swanson Bros., Pittsburg, Pa., and Rockwood, Pa., on their contract on the Western Maryland R. R. contract between Garrett and Casselman, mentioned in our last issue. The force of men will be increased later.

The Ontario & Western R. R. Co. has awarded the contract for the construction of the double track line in Wayne County between Pleasant Mount and Wynwood, Pa. The contract price was $200,000.

Providing the city authorities approve the proposed viaduct plant, the Baltimore & Ohio R. R. is planning the development of the Skunk Hollow district in Bloomfield, Pa. The company desires to acquire the property necessary, by condemnation proceedings and transform the ravine into freight yards. The proposed improvement has been sanctioned by the Bloomfield Board of Trade.

Work is now in progress on Second St., above Seneca for the extension of the Central Pennsylvania Traction company's trolley line to Riverside from Harrisburg, Pa. The grading is being done by the city and as fast as it is completed the ties for the double track will be placed in position. The work will require considerable filling. It is said that from Division St. the northern terminus of the Harrisburg there will be a single track to Lewis St. in Riverside. Very little grading will be necessary through the Academy grounds.

A charter was issued at Harrisburg, Pa., Sept. 2 to the Montrose and State Line R. R. Co., Montrose, Pa., to construct a line 15 miles long from Montrose to the New York and Pennsylvania state line. The capital stock of the company is $150,000. The incorporators are: H. E. Paine, president; F. H. Widmyer, F. W. Ogden, W. J. Douglas, E. C. Randolph, T. P. Hamilton, Howard Fravel, H. J. Paine, Scranton, Pa., and R. L. Koehler, Dalton.

A special meeting of the city council of Pottsville, Pa., was recently held for the purpose of taking up the proposition of the Street Railway Co., to extend double track from Union street to Mauch Chunk, and thence to the Palo Alto bridge.

Rhode Island.

Plans for rebuilding and relaying the street car track on Plainfield St., Providence, R. I., were arranged recently by the Commissioner of Public Works, City Engineer and Rhode Island Committee.

South Carolina.

Directors of the Greenville, Anderson & Spartanburg Interurban Ry. Co., which recently acquired the Greenville Traction Co., Greenville, S. C., have announced that the capital stock of the company will be increased to $2,000,000, and that construction work will be commenced on the Greenville Belton branch at once. The lines of the company already extend from Anderson to Belton and this extension means one more step in the plan for binding the Piedmont more closely together. Contracts for the work and equipment will be let soon.

South Dakota.

The company of which R. W. Clarke, Huron, S. Dak., is at the head, and which has been for the past few years planning to establish and maintain a street railway system in Huron, has given the city to believe that work will be started on the improvement some time next spring. Surveys have been made on Dakota avenue, and Third street, the system extending south on Illinois street past the college campus to Ninth street, and going from there to Utah, north to Third, and returning to the business portion.

All tracklaying has been finished, and the Chicago, Burlington & Quincy R. R. Company's line between Nemo and Piedmont, S. Dak., is ready for operation. The new track down Stage Barn canyon is about 16 miles long and encounters some steep grades.

Tennessee.

A party of promoters have taken a trip over the proposed right of way of the Nashville & Gallatin Interurban Ry. and stops were made at all important villages and towns to discuss the matter and plans with the residents. Solicitors have now begun work in Sumner County, Tenn., to raise the stock subscription of $100,000.

In regard to persistent rumors that have been circulating in the vicinity of Nashville, Tenn., A. B. Newell, President of the Tennessee Central R. R., denies that there is any foundation to the report that the Illinois Central R. R. is planning to absorb his company.

The first stockholders' meeting of the Birmingham & Northwestern R. R. was held recently and board of directors chosen, who elected the following officers: R. M. Hall, president; John L. Wisdom, vice president; M. W. Ewell, secretary; I. B. Tigrett, treasurer; John L. Williams, chief engineer. The company has had surveys made and profiles made of the proposed route from Jackson to Dyersburg, Tenn., and final survey will begin at once. Dyersburg and Jackson are to be asked to call special elections to allow the citizens to vote on the question of subscribing $50,000 and $75,000 of stock, respectively.

Texas.

Nothing definite has been decided upon as yet by the Ordinance Committee of the Beaumont, Tex., City Council concerning the proposed new franchise for the Beaumont Traction Company.

Advices from Waco, Texas, state that material consisting of piling, bridge timbers, etc., recently passed through that city enroute to Gatesville to be used on the Hamilton extension. A construction train and crew have been put to work on the job and within 40 days it is expected that Waco will have rail connection with Hamilton, Stephenville and with a road under construction to Comanche.

A force of 100 men has been put to work on the extension of the South Flores St. trolley line in San Antonio, Texas. It will be pushed until the road is ready for the operation of cars. The line will extend from the present terminus of the South Flores St. line, Boehmer St., one-half a mile to the city limits, thence along the Corpus Christi Road for a distance of one mile. After leaving Boehmer St. the line will be built across Theo Ave., Dittmar Ave., to the intersection of the Corpus Christi and Pleasanton Roads, thence along the Corpus Christi Road. This line will give street car connection to the addition of Harlandale. Preparations are being made to build a bridge across the Rocky Creek. This structure will be built wide enough to admit the passage of vehicles on one side of the cartracks. According to announcements of the traction company officials, cars will be operating over the new extension within sixty days' time.

Construction work is progressing rapidly, according to advices from Houston, Texas, on the extension of the South End St. car line. The right of way has been cleared of timber and grading will be commenced at once. The line will, it is hoped, be in operation by Nov. 30.

Advices from the Reclamation Office at El Paso, state that the contractors who were allowed 40 days to complete 7 miles of grading on the Elephant, Butte & El Paso R. R., where a connection will be made with the Santa Fe main line, will finish the work in 11 days less time. Work laying steel and ties will be started immediately.

Preparations are being made by the construction crews of Stone & Webster Engineering Corporation, to resume track laying at once on the Galveston-Houston Interurban Ry., and according to a statement said to have been made by Mark Lowd, Galveston, Tex., General Manager of the Corporation's southwestern division, the work will be rushed through to completion.

It has been announced in Fort Worth, Tex., that all work will be completed on the St. Louis & San Francisco Ry. (Frisco) extension from Brady to Menard and also on the Atchison, Topeka & Santa Fe Railway's project from Lometa to Eden, Tex., in time to take care of the spring shipments from Menard, McCulloch, Sansaba and other counties in that section.

The Texas Railroad Commission has issued an order authorizing the registration by the Beaumont, Sour Lake & Western Ry., of four temporary first mortgage bonds aggregating $1,855,528, dated May 1, 1910, and maturing May 1, 1940, and bearing 6% interest. Of these bonds which are issued and registered on the 84.31 miles of railroad from Beaumont to Houston, Tex., three are for $500,000 each and one $355,528. They are authorized on the total valuation as placed by Engineer Parker, which is $1,940,528.

According to a statement made by W. Doherty, Traffic Manager of the St. Louis, Brownsville & Mexico R. R., in Houston, Tex., surveyors already have work under way running lines for the construction of a line between Matamoras and Tampico. The completion of such a line will give the St. Louis & San Francisco (Frisco) the shortest line by 300 miles into Mexico and would be essential in placing that system at a tremendous advantage in competing for Mexican business.

Surveyors who sectionized the Two Rivers Ranch have, according to advices from Tilden, Tex., gone to Beeville, Tex., and will start surveys immediately for the construction of the proposed railroad from Beeville to Eagle Pass. D. B. Scott, San Antonio, Tex., is Chief Engineer of the Beeville & Eagle Pass Railroad.

Efforts are being made by promoters of new coal mines to induce the Texas & Pacific Ry. to construct a spur running from Gordon in Palo Pinto County, Tex., to a point three miles north to the proposed site for new mines. B. S. Wathen, Dallas, Tex., is Chief Engineer.

Surveys have been completed for the 360-mile line of the Quanah, Acme & Pacific Ry. Co. from Paducah to El Paso, Tex. No definite time has been set for the letting of the contract. C. E. Ensminger, Quanah, Tex., is chief engineer. S. Lazarus, St. Louis, Mo., is president of the company.

It has been announced in Lubbock, Tex., that work has been resumed on the Altus, Lubbock & Roswell R. R., and will be continued until the completion. Grading and track laying on the Crosbyton-South Plains line is being rushed, and will be in operation by December 1.

Advices from Galveston, Tex., state that considerable progress has been made toward perfecting the organization of the Galveston Terminal Co. As proposed, it will mean the largest terminal company in Texas or the southwest. It will include all of the Galveston railroads and the Wharf Company, which will participate as a railroad, the Wharf Company owning several miles of railroad tracks and having been declared a common carrier. It will mean much for the handling of freights at Galveston, and it will unquestionably mean the expenditure of many thousands of dollars in improved facilities for handling freights through that port.

Field Engineer of the Stamford & Eastern Ry., H. L. Erisman, has announced that the line from Stamford to Throckmorton will be definitely located in a short time, as the preliminary lines have already been completed. The contract for construction will probably be let about the last of this month.

A good portion of the necessary bonus required of Lexington, Tex., for the construction of the Taylor, Somerville & Gulf R. R. to build through that place, has been raised, and promoters of the line believe that work will be started soon and completed to the Lexington, where a connection will be made, giving the line a short haul to Houston, Tex.

Official confirmations have been received at Canadian, Tex., to the effect that the Clinton, Oklahoma & Western R. R., which has 20 miles of line already constructed from Clinton, Okla., to Butler, has completed arrangements to secure $750,000 with which to extend its line to Canadian, Tex.

The entire grade on the Abilene and Southern R. R. extension has been completed into Hamlin, Tex., and the tracklaying crew will be at that place within a short time, and roundhouse and freight division yards located. It is also reported that Morgan Jones, president of the company, is contemplating building at once 100 miles northwest from Hamlin, either in the direction of Paducah, the terminus of the Frisco in Cottle county, or to Floydada, the present terminus of the Santa Fe branch from Plainview. A large construction camp is now located at Hamlin, presumably awaiting the starting of the work northwest.

Construction on the Brownsville Belt Road spur of the St. Louis, Brownsville & Mexico from the main line to the sugar cane fields below Brownsville, Tex., is held up on account of some difficulty in securing right of way. Officials say that work will be commenced soon.

Engineers of the Nueces River Valley R. R. have started the permanent survey from Beeville, Tex. Two lines will be run, one on a direct line, which will touch Oakville, and the other through Clareville to the south. Bonuses have been offered by the towns along the route of each and when the surveys of each have been completed the most practical one will be selected. From the Nueces river the line will be direct. Actual construction will be commenced within sixty days.

It is reported that surveys have been made paralleling the line of the Houston & Texas Central for the construction of an electric line by the Stone and Webster syndicate between Houston and Dallas, Tex., connecting with the North Texas Traction Company from Dallas to Sherman and the Galveston-Houston line between Houston and Galveston, ultimately forming a complete electric line from the northern border of Texas to the gulf.

Utah.

The Ogden Rapid Transit Co., Ogden, Utah, is rushing work with all possible speed on the line between Ogden and Brigham City and has given the public positive assurance that the road will be in operation and in shape to handle the traffic from the North to the State Fair, Sept. 23-29.

In regard to railroad construction in Utah, advices from Salt Lake City, state that work on the Bingham & Garfield railroad, which was begun about two months ago, is now progressing satisfactorily. Already approximately 40 per cent of the grading has been completed and work is now going on at the rate of 15 per cent each month. It will be several months yet, however, before any rails will be laid. The building of the road will necessitate the boring of three tunnels of considerable length, and work on these already has been begun. While the Bingham & Garfield railroad will be only a trifle over seventeen miles long, the construction is the heaviest attempted in Utah since the building of the Tintic line of the Denver & Rio Grande more than ten years ago. The maximum grade of the road will be 2½ per cent, and the maximum curvature, 6 degrees, with a small number of curves. Starting at a point in Carr's Fork and running along the north side of the canyon above the present line of the Denver & Rio Grande, the road will afford a most magnificent panorama of the valley and city.

City Council of Springville, Utah, has granted to A. J. Evans, et al, a franchise to construct their interurban line through the streets of that place. The company has secured franchise over Utah County highways, also through all the cities of the county except Spanish Fork and Provo and it is believed that these will be granted when applied for.

The extension of the Utah Light & Railway Company's line from Ninth to Tenth, east on Second South street, Salt Lake City, Utah, is being rushed by the contractors and it will be completed, it is said, by the 1st of October.

It is reported in Salt Lake City, Utah, that the Oregon Short Line is having surveys made and other preliminary matters arranged for the construction of a cut-off from some point on the Ogden-Lucin line to Rupert, Idaho, thus materially shortening the distance between Portland and Salt Lake City.

Washington.

Twohy Bros., Marble Bank Bldg., Spokane, Wash., will soon commence the construction of the Coyote cutoff of the Oregon Railroad & Navigation Co., from Coyote to Stanfield in Umatilla County, Ore., the contract having been awarded them for about $800,000. The station of Coyote is about 25 miles west of Umatilla and Stanfield is about 15 miles southeast of Umatilla, the cutoff will shorten this distance about 10 miles and with the reduction of grades and curvatures will cut down the running time between the two points. The old track will not be abandoned, but will be single track for some time.

A large number of carpenters and laborers are being sent from Seattle, Wash., up to the Copper River & Northwestern, in Alaska, to take the places of the men who are quitting and coming south leaving great gaps in the forces of the contractors who are striving to complete the road by the end of this month.

Farmers in the vicinity of Waterville, Wash., have organized a company to construct a 7-mile line between Douglas and Waterville, and the work has practically been completed and will be in service this fall.

West Virginia.

The Buckhannon. Weston & Glenville Electric Railway Co., Buckhannon, W. Va., has been chartered to construct a line from Sago in Upshur county, W. Va., to Buckhannon, Weston and Glenville, a distance of about 50 miles. The incorporators are: S. C. Rusmissell, L. H. Morrison, J. G. Hall, L. H. Treppeto, W. H. Gaston, G. F. Day, C. E. White and D. O. B. Hall, Buckhannon, and J. A. Crislip, Clarksburg, W. Va.

It is reported in Kinkwood, W. Va., that the Coal & Coke Railway, of which Henry G. Davis is president, has decided to build a connection with the Morgantown & Kingwood, and thus connect with the Pittsburg & Lake Erie, to which the Western Maryland is building an extension. A. A. Chapman, the right of way man, is surveying for the extension from Bellington to Point Marion, along the Cheat river, via Morgantown and Kingwood Junction and Trowbridge.

The South Morgantown Traction Co., Morgantown, W. Va., which has in operation 2 miles of line, will, according to an announcement made by the president, seek franchises in Monongahela and Marion counties for the construction of a line connecting Morgantown and Fairmont.

Wisconsin.

Representatives of the Dan Patch Syndicate are reported to be negotiating plans in Chippewa Falls and Eau Claire, Wis., to finance an electric railway line to connect Eau Claire and St. Paul by way of Menomonie.

The Chicago, Milwaukee & St. Paul Ry. has still consideration plan to improve the cutoff line between Hastings and Cologne, Wis. Land has been purchased at the first city for the construction of repair shops, round house and stockyards. This project was for sometime abandoned but owing to the fact that through stock trains from the western divisions to Chicago terminal can be rushed through by this route in less time, the matter was again taken up.

A plan is under consideration by the Manitowoc & Northern Traction Co., Manitowoc, Wis., to extend their line to Mishicott, and probably north to Kewaunee and Algoma. Thomas Higgins, Manitowoc, Wis., general manager of the company, has already been over the proposed route, and expresses his belief that work will be taken up in the spring.

It has been announced in Bloomington, Wis., that the Grant Railway Co., has been organized to construct a line of railroad from Woodman, Wis., through Patch Grove and Mt. Hope to Bloomington. Towns interested in the project have voted $130,000 in bonds to finance it, and Grant county capitalists will also take a large amount of stock. A connection will be made by the new line with the Chicago, Milwaukee & St. Paul Ry., at Woodman. A. Little, Grant, Wis., is president, and W. E. Lewis, Patch Grove, Wis., is secretary and treasurer.

Canada.

Penticton electorate, according to information received from Nelson, B. C., has granted the Kettle Valley R. R. right to run along Center St. to the water front, where a depot will be built and has passed a bylaw granting a bond of $25,000 to the company. The measure was passed on an understanding with the President of the company that the town would be a divisional point and extension yard and car shops would be situated there.

In Cobourg, Ont., it is now expected that the Canadian Northern Railway will rush the completion of their line eastward from Trenton to Deseronto. It is stated that contracts for thirty miles of construction have been let, and work will begin at once. This section is comparatively level, and construction work no doubt will progress speedily. Mr. Duff, who has been on Mr. Geo. Armour's engineering staff at Colborne, will be, it is stated, resident engineer on the new C. N. R. construction east of the Trent River. Messrs. Dilona and Orlando Bros. are finishing up their work on the section between here and Brighton, and may go shortly to Montreal to begin work on the Ottawa-Montreal section of the C. N. R.

Instead of the double tracking of the Canadian Pacific Ry. line from Smith Falls, Can., to Peterborough, as recently rumored, it is reported that engineers have been placed in the field to make surveys for an entirely new road west from Smith Falls to Toronto, traversing a country heretofore not served by any line. The present line west of Belleville is very hard to operate on account of the grades, and survey has already been run for the new improvement between those two places, passing north of the Rideau lakes.

Advices from Pas Mission, Keewatin, dated Sept. 7, state that construction of the Hudson Bay R. R. which will open up a new and immense section of country and provide a new water route to Liverpool, was begun near that place when the federal minister of railroads and canals turned the first sod. Fort Nelson will probably be the terminal of the road.

Representing the constituency of Milestone, A. E. Whitmore, M. P., of Regina, Sask., is now in Winnipeg for the purpose of urging the Canadian Pacific to complete the 25 miles of new line from Weyburn to Forward, Sask.

It is said that the Canadian Pacific is planning to shorten the running time from Halifax to Montreal several hours by constructing a cut-off from McAdam or Fredericton Junction in a straight line across the country to New Brunswick and Nova Scotia to the proposed winter port at Halifax.

The railway commission recently held a meeting in Ottawa, Can., for the purpose of dealing with the application of the Transcontinental Ry. for running rights over the Canadian Northern in Winnipeg, Man., so as to establish a through line from Edmonton, Alta., to Fort William.

Cuba.

President Gomez of Cuba has approved an act of the Cuban congress authorizing the executive to contract in the form prescribed by the law of July 5, 1906, for the construction of a railroad from Cifuentes via San Diego del Valle, to join the lines of the United or the Central Company, at La Esperanza. A subvention is to be granted in accordance with the terms of the law mentioned above.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

✣Bids will be received until 2 p. m., Sept. 14, by County Judge L. C. Smith, Dewitt, Ark., for the construction of 8 levees, some of them to be built across small bayous and low places, while there are some that will be several rods long, one being 200 ft.

California.

✣Bids will be received until 4 p. m., Sept. 24, by W. W. Schleicht, project engineer, office U. S. Reclamation Service, Orland, Cal., for the construction of the earth work of the distribution system for the Orland project, California, involving approximately 58,000 cu. yds. of excavation. The work is divided into sections from 8,020 to 20,000 cu. yds.

Bids will be received by the Board of Directors of Levee District No. 2, Sutter County, at the office of A. H. Hewitt, attorney of the Board, Yuba City, Cal., until 11:30 a. m., Sept. 15, for improving, raising, enlarging and strengthening, of the levee of said levee district according to the plans, profiles, cross-sections and specifications for such work in the possession of A. H. Hewitt, attorney for said board, at his office aforesaid. Said work is divided into two sections. Approximately the amount of material required for section one is 16,300 yds., and for section two is 750,000 yds. The work in section one will be team work and in section two will be dredge work. Edward Von Geldern, Yuba City, Cal., is engineer of the district. H. L. Hansen is chairman of the Board of Directors and Henry Minden is clerk.

Advices from Sacramento, Cal., state that the Yolo Consolidated Water Company has acquired lands and systems of every irrigation company in Yolo County and has sold to syndicate headed by Lieutenant Governor Porter, which will perfect great irrigation system for Yolo, Solano and Lake counties.

S. A. Martindale, 87 Schley Ave., Sacramento, Cal., who has the contract for the construction of the 13 miles of main ditch and laterals of the Hallwood Irrigation District, has work well under way. A clamshell dredge is used for doing the deeper excavating, which is from 4 to 10 ft. and the laterals are being constructed by team and scraper. The job includes about 88,000 cu. yds. of earth excavation and 205 cu. yds. of concrete masonry, and must be completed by Dec. 1. E. E. Long, Maryville, Cal., is secretary of the district.

Colorado.

Owing to the depressed condition of the

Items marked thus ✣ indicate work now open for bids.

bond market, the North Fort Morgan Reservoir Co., 725-726 Symes Bldg., Denver, Colo., which is composed of Denver capitalists, has decided to finance the irrigation district to the extent of irrigating 5,000 acres of land contiguous to Fort Morgan, Colo., which is owned by members of the company. Contract for the same will be let in the near future. However, as soon as the bond market revives the entire amount, $446,000, of district's bonds, which were recently voted, will be sold and additional work will be done, involving the construction of dams and ditches to the end of irrigating 16,000 acres in the district, will be pushed through.

A campaign has been started by P. M. North, an attorney of Rocky Ford, Colo., having for its object the dredging of the Arkansas River to transform it from its present state into a large navigable canal. He has in view the dredging of the Arkansas to a point within the borders of Kansas from which a connection with the Kansas or Kaw rivers will give a straight water route into Kansas City. It is understood that the next Congress will be asked to appropriate $3,000,000, which will be sufficient to deepen the river from Pueblo to the State line. After that, Kansas will take up the work.

The North Fort Morgan Reservoir Co., 725-726 Symes Bldg., Denver, Colo., will let the contract for the moving of 50,000 cu. yds. of earth in connection with the construction of the proposed reservoir. Work involving 230,000 cu. yds. of earth removal will be taken up in the spring. W. Rolla Wilson is secretary of the company.

Illinois.

✣Bids will be received until 8 p. m., Sept. 30, at the office of Dan Bower, County Clerk, Murphysboro, Ill., by Commissioners of the Big Lake Special Drainage District, for excavating 563,000 cu. yds. of earth required in enlarging old and cutting new ditches. Information and particulars can be obtained from Joel Dunn, Fordyce, Ill., Engineer of the project.

The following bids were received for the northwest drain, Wheaton, Ill.: Stevens Construction Co., 602 Atwood Bldg., Chicago, Ill., $14,814.85; William Davidson, 260 Wood Ct., Wilmette, Ill., $14,337.91; John M. Healy Co., 911, 112 Clark St., Chicago, Ill., $14,291.58; T. H. Iglehart, 588 Rookery Bldg., Chicago, Ill., $13,430.42; G. M. Maffioli, Rockford, Ill.; $12,584.94; Lanyon & Clifford, Waukegan, Ill., $12,009.94; C. R. Nichols, Caney, Kan., $11,626.93. The work included furnishing materials and digging trench, laying pipe and backfilling.

Iowa.

✣Bids will be received until 3 p. m., Oct. 6, by J. L. Hanrahan, County Auditor, Fort Dodge, Ia., for the construction of joint drain No. 95 in Webster County and No. 87 in Hamilton County, approximating 18,565 ft. of 12 to 26-in. tile. C. H. Reynolds, Fort Dodge, Ia., is Engineer.

Surveys under way by the Iowa Drainage, Waterway and Conservation Commission to determine the water power possibilities of the Boone River are well under way and will be rushed to completion. In preliminary work the power possibilities of the Boone in the vicinity of Webster City, Ia., were found to be of considerable consequence. L. V. Hites is secretary of the commission.

Louisiana.

The contract for the construction of 201,000 cu. yds. of earth work in the Pontchartrain levee district was awarded by Capt. Robert R. Ralston, U. S. Engineer, 338 St. Charles Ave., New Orleans, La., to R. G. Clark, Natchez, Miss. Bids for the work, which were opened Sept. 1 at 11 a. m., are as follows: Bonnette Carre Levee, including 94,000 cu. yds., at 17.9 cents; Fairview Levee, including 107,000 cu. yds., at 13.7 cents.

Michigan.

Bids were received as follows, 3 p. m., Aug. 30, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for canal construction, etc., at Sault Ste. Marie, Mich: (1) Great Lakes Dredge & Dock Co., Chicago, Ill.; (2) W. J. Newman Co., Chicago, Ill.; (3) MacArthur Bros. Co., Chicago, Ill.; (4) John Marsch, Chicago, Ill.; (A) excavation of Class "A" material, 47,700 cu. yds.; B excavation of Class "B" material, 275,000 cu. yds; (C) excavation of class "C" material, 15,000 cu. yds; (D) excavation of class "D" material, 15,000 cu. yds.; (R) channeling rock, 36,000 sq. ft.; (S) framing timber cribs, 154,000 cu. ft.; (T) filling timber cribs, 13,000 cu. ft.; (U) construction and removal of west coffer dam, etc.; (V) construction of new North dike, 1,900 ft.; (W) concrete 22,000 cu. yds.; (X) cement, 27,500 bbls.; (Y), brick, 15,000; (Z) total:

	(A)	(B)	(C)	(D)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)	(Z)
	$1.25	$1.26	$3.00	$0.60	$0.40	$0.12½	$0.50	$10,000	$10.00	$5.25	$1.55	$31.00	
(1)	$59,625	$346,500	$45,000	$9,000	$14,640	$19,250	$6,500	$10,000	$19,000	$115,500	$42,625	$465.00	$688,105
	$3.25	$1.27½	$3.00	$3.00	$0.50	$0.10	$0.50	$59,000	$30.00	$5.00	$1.55	$25.00	
(2)	$155,025	$350,625	$45,000	$45,000	$18,300	$15,400	$6,500	$59,000	$57,000	$110,000	$42,625	$375.00	$904,850
	$2.55	$1.14	$0.80	$1.50	$0.33	$0.13	$0.36	$15,000	$8.50	$4.50	$1.40	$15.00	
(3)	$121,635	$313,500	$12,000	$22,500	$12,078	$20,020	$4,680	$15,000	$16,150	$99,000	$38,500	$225.00	$675,288
	$2.60	$1.75	$4.00	$1.45	$0.45	$0.20	$0.65	$14,500	$10.50	$6.75	$1.90	$28.50	
(4)	$124,020	$481,250	$60,000	$21,750	$16,470	$30,800	$8,450	$14,500	$19,950	$148,500	$52,250	$427.00	$978,367

Nebraska.

✣Bids will be received until 10 a. m., Sept. 27, by H. W. Whitaker, County Clerk, Tekamah, Neb., for the improvement of Cram Ditch. The work includes about 10,078 cu. yds. of excavation.

Robert Ulalover, Lincoln, Neb., has been awarded the contract by the Sanitary District No. 1 for excavating 3,400 cu. yds. of dirt at $34. Kent D. Cunningham is Sec'y of the District.

North Carolina.

Farmers in the counties of Lenoir and Craven, North Carolina, have succeeded in gaining permission to improve the channel from Cove Sound to Beaufort Harbor by way of Garrett Island and Taylor's Creek. The new chanel will open up thousands of acres of rich swamp land in Lenoir and Craven counties for cultivation. It will give employment to hundreds of laborers and will enable the farmers to clear their bottom lands and begin cultivating them.

Texas.

The report of Surveyor A. W. Amthor, who is in charge of the Engineering Department of Drainage District No. 1, has been accepted by the Commissioners of Cameron County, Brownsville, Tex. The project as mentioned in our Aug. 31 issue will irrigate 81,136 acres. The principal specifications as presented in report are: Total length of ditch No. 1 65,000 ft., 3 to 20 ft. wide at bottom, 370,000 cu. yds. excavation, estimated cost $55,545; ditch No. 2, total length 80,000 ft., 3 to 30 ft. wide at bottom, excavation 362,470 cu. yds., cost $54,370.50; ditch No. 3, length 34,600 ft., 3 to 8 ft. wide at bottom, excavation, 64,124 cu. yds., cost $9,618.60; outlet ditch, length 45,000 ft., width 50 ft., excavation 265,050 cu. yds., cost $47,709; outlet ditch will extend midway between two levees, 150 ft. apart; total yardage to be moved, 1,061,944 cu. yds.; total length of ditches, 42½ miles; average depth 7 ft. and maximum cut 18 ft.; work will also include construction of 49 wagon bridges and 4 railroad bridges, estimated to cost $15,930; total cost estimated at $204,600.

Reeder & Co., San Antonio, Tex., has been awarded the contract at $17,950, by the Holland-Texas Dam & Irrigation Co., for the construction of a concrete dam 21 ft. high and 347 ft. long across Nueces River. T. N. Picnot is president of the irrigation company, which has also contracted for a 175 h. p. steam engine and boiler and pump in connection with the project for irrigating the 7,000 acres on both sides of the river.

Canada.

✣Bids will be received by A. MacEwen, Clerk of the Township of Morris, Huron County, Can., at Bluevale, for the construction of four large municipal drains. Tenders will be opened 2 p. m., Sept. 19.

Mexico.

A concession has been asked the State government of Chihuahua, Mexico, by M. C. Liquornik for the water of the Arroyo Seco, 20 miles northeast of Nuevas Casas Grandes. He has investigated the irrigation possibilities in the western part of the State and announces that a dam can be built on this arroyo capable of holding enough water to irrigate 10,000 acres.

MISCELLANEOUS CONSTRUCTIONS

Alabama.

✣Bids will be received by Capt. H. B. Ferguson, U. S. Engineer, Montgomery, Ala., until 1 p. m. Sept. 30, for cutter machinery and other accessories for a 15-in. pump dredge.

✣B. H. Hardaway, Columbus, Ga., whose bid was $490,000, will probably be awarded the contract by U. S. Engineer, Mobile, Ala., for the construction of Lock and Dam No. 17, Black Warrior River, Ala. The work includes the construction of a lock tender's house.

Colorado.

Two companies are holding their bids for the construction of the proposed tramway of the Golden Cycle Mining Co., pending the arrangements with several mine owners in the Cripple Creek District. Advices from Colorado Springs, Colo., state that the option on the property of the Golden Cycle company, held by an English syndicate, and which expires September 1, will probably not be extended, according to officials of the company. It is not known whether the option will be taken up by the prospective purchasers.

Illinois.

✣Bids will be re[illegible] 12, by Maj. C. S. Bromwell, U. S. Engineer, Chicago, Ill., for dredging and rock excavation in the Chicago River.

Indiana.

✣Bids will be received by the Depot Quartermaster, Jeffersonville, Ind., until 10 a. m.,

Items marked thus ✣ indicate work now open for bids.

Sept. [illegible], for furnishing miscellaneous supplies.

✣Bids will be received until 10 a. m., October 3, by the County Commissioners at Shelbyville, Ind., for the construction of a concrete breakwater and concrete steel culvert. G. B. Huntington is Auditor of Shelby County.

N. S. Myers of Jeffersonville, Ind., is the probable contractor for furnishing and delivering at Gray's Ferry, Philadelphia, Pa., 50,000 shelter tent poles to conform with the requirements of the specifications for $0.13 each. Bids were opened August [illegible].

Maryland.

✣Bids will be received until 10:30 a. m., September 26, by the Constructing Quartermaster, Fort Howard, Md., for the construction of three reinforced concrete cisterns and piping thereto, also painting steel water tanks and towers.

Massachusetts.

✣Bids will be received until 2 p. m., Sept. 23, by Board of Harbor & Land Commission, Boston, Mass., State House, Boston, Mass., for dredging a channel and anchorage basin in Hingham Harbor. The work to be done is the dredging of about 60,000 cu. yds., scow measurement, of material to form an anchorage basin about 700 ft. long and 300 ft. wide and a channel 75 ft. wide to connect the basin with the channel to be dredged by the United States. All dredging to be to the depth of 6 feet at mean low water. Frank W. Hodgdon is Chief Engineer.

Michigan.

✣Bids will be received by Lieut. Col. G. D. Fitch, U. S. Engineer, Duluth, Minn., until noon, September 20, for dredging in Marquette Harbor, Mich.

Launch owners of Lake Kegonsa and Stoughton, Mich., have formed a club for the purpose of constructing a pier about 500 ft. long into Lake Kegonsa to prevent sand from drifting into the Yahara River and making the river so shallow as to prevent the passage of launches between Lake Kegonsa and Stoughton.

Minnesota.

✣Bids will be received until noon Sept. 23, by Lieut. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for furnishing and placing granite riprap at upper entrance to Portage Lake, Canals, Keweenaw Waterway, Mich.

✣Bids will be received until noon, Sept. 30, by Lieut. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for dredging in Duluth-Superior Harbor.

Information received from Shakopee, Minn., states that John H. Diers, Blakeley, Minn., Secretary of the Minnesota River Improvement & Power Co., has left for Chicago, Ill., to negotiate for the sale of the first $500,000 of a million dollar bond issue for the construction of three reservoirs on the upper Minnesota river. The first of these is to be at Big Stone Lake, which will be dammed and the water raised eight feet, and will generate 600 h.p. Near Ortonville the second dam will be at the lakes of Lac qui Parle and marsh, making one large lake 26 miles long and one mile wide, with capacity of thirty-four billion feet of water. It will submerge 8,000 acres of swamp and farm lands in addition to the area of the two lakes mentioned and will generate 8,000 h.p. The third dam will be constructed at Redwood Falls and will create a lake 14 miles long and generate 11,000 h.p. In flood times it will take three days to fill the three reservoirs. The total cost of construction will be close to one million dollars and the electrical apparatus wires and installation of generators will cost another million.

Missouri.

✣Bids will be received by Maj. C. L. Potter, U. S. Engineer, Custom House, St. Louis, Mo., until 11 a. m. October 7, for building, leasing or selling one to twenty barges and for building five to fifty flat boats of wood or steel.

New York.

✣Bids will be received until 2 p. m. Sept. 15, by Capt. M. G. Spinks, Constructing Quartermaster, Fort Totten, N. Y., for furnishing and installing 21 storm sash and 1 storm vestibule on north side and west end of band barrack No. 173, and 29 storm sash and 2 storm vestibules on north side and west end of company barrack No. 172, at Fort Totten, N. Y.

✣Bids will be received by Thomas J. Higgins, Commissioner of Parks, Arsenal Bldg., Borough of Manhattan, New York city, until 3 p. m., Sept. 15, for furnishing and delivering 100 barrels portland cement (No. 2, 1910) for parks in the Borough of Bronx.

✣Bids will be received until 3 p. m., Sept. 15, by Commissioners of Parks, Arsenal Bldg., Borough of Manhattan, New York city, for furnishing and delivering 6,000 lin. ft. 2-pipe iron railroad (No 1, 1910). Botanical garden for Parks, Borough of Bronx.

✣Bids will be received until 10:30 a. m., Sept. 15, by the Fire Commissioner, 157 East 67th St., Borough of Manhattan, New York city, for furnishing 30,000 ft. of 2½-in. fire hose for boroughs of Brooklyn and Queens; 20,000 ft. 2½-in. rubber fire hose, 10,000 ft. 3-in. rubber fire hose for the Boroughs of Manhattan, Bronx and Richmond.

✣Bids will be received by B. F. Cressa, Jr., Commissioner of Docks, Department of Docks & Ferries, Pier "A" foot of Battery Place, North River, Borough of Manhattan, New York city, until noon, Sept. 20, for Contract No. 1,223, for furnishing the necessary labor and material required for the preparing for widening and extending the present pier at the foot of Gold St., Borough of Brooklyn, and for furnishing and depositing riprap thereat.

Buffalo Dredging Co., 1104 D. S. Morgan Bldg., Buffalo, N. Y., has been awarded the contract for Barge Canal Contract No. 50. The work includes the construction of reservoir and dam on West Canada Creek, at Hinckley. The area of the proposed reservoir is about 6 sq. miles. Bids were opened by F. C. Stevens, Supt. of Public Works, Sept. 7. Contract price was $963,415.

North Carolina.

✣Bids will be received until noon October 10, by Capt. E. I. Brown, U. S. Engineer, Wilmington, N. C., for dredging in Shallowbag Bay, South River, Bay River and waterway connecting Swan Quarter Bay with Deep Bay, N. C.

Ohio.

The contract for the construction of the breakwater at the Elyria Water Works pumping station west of Lorain, bids for which were opened Sept. 2, has been awarded by the Director of Public Service, Elyria, O., to the American Construction Co., Rockfeller Bldg., Cleveland, O.

Oregon.

Dipper dredge No. 1, which has been at the Government moorings, Portland, Oregon, for several weeks undergoing repairs, has been put in good shape and U. S. Engineers expect to place her in service either on the Clatskanie River or Lewis River.

United States Engineers have started work of dredging out the upper entrance to the Cascade Locks, according to advices from Portland, Ore. A small Orange peel dredge being used for the purpose. High water during the winter and spring freshets deposit a large amount of silt in the entrance to the locks and it is necessary for the engineers to put a dredge in there every summer in order to clean it out. Last year over 30,000 cubic yards of silt were dredged out, but that amount was larger than usual, as operations were extended farther than usual and accumulations were taken out that had been gathering for several years. It is thought that about 15,000 cubic yards will be the extent of the dredging this year.

Pennsylvania.

Commissioners of Allegheny County, according to advices from McKeesport, Pa., have had a force of engineers gathering data regarding the construction of a tunnel under Mt. Washington, Pittsburg. The idea in gathering the information is to enable the commissioners to select a location for the proposed tunnel. Several routes have been suggested and different interests are working to have their locality favored. The work is being done quietly. A route under Mt. Washington and a bridge over the Monongahela River to land at Forbes St., is the one most talked of. It is the intention to spend an immense sum of money for the tunnel. The least sum so far mentioned is $1,000,000.

South Dakota.

Land has been donated to the city of Aberdeen, S. Dak., by Fred Lincoln and the Street Railway Co., for the construction of a large lake in the new city park. The soil in that vicinity is quite sandy and there will, no doubt, be an excellent beach. A boulevard will also be built to skirt the lake and it is probable that the old Soo Railroad grade will be utilized for that purpose.

Tennessee.

✣Bids will be received by Maj. C. A. F. Flagler, U. S. Engineer, Nashville, Tenn., until 11 a. m., Sept. 27, for furnishing machinery fittings, etc., for two dipped dredges.

Texas.

✣Bids will be received by Maj. G. P. Howell, U. S. Engineer, Galveston, Texas, until noon October 8, for jetty work at Aransas Pass, Texas.

Virginia.

✣Bids will be received until noon, Sept. 29, by Lieut. Col. Mason M. Patrick, U. S. Engineer, Room 2 Custom House, Norfolk, Va., for dredging Onancock River and Bar, Va.

Washington.

In regard to the improvement of the Stuck River in Washington, the following information has been received from Tacoma: About 1,200 sacks of cement will be used in constructing the big wing dam on the Puyallup river near here, which is to protect property about Mattisch Point. The cement will be mixed with gravel, dumped into sacks and dropped into the form, where the sacks weld themselves together and form an almost indestructible wall. The improvement is steadily advancing, but S. H. Williams, the contractor, reports that the river bed into which he is driving the piles for jetties is about the hardest thing he has struck. He had a man count how many strokes of the pile driver it took to sink one of the 50-foot piles 32 feet into the river bed. The man counted 848 "clouts" before the "stick" had been driven to the required depth. Although at work a couple of weeks, only 38 piles have been driven, and a total of 150 will have to go under the hammer. The 38 complete one jetty except for the planking and brush work, which will go in immediately. This jetty is on the east bank of the Stuck.

Wisconsin.

The Department of Public Works of Milwaukee, Wis., has awarded a contract to the Nott Fire Engine Co., for furnishing two first size fire engine boilers for Ahren's engines for $2,300. Bids were opened August 20.

Wyoming.

Advices from Saratoga, Wyo., are to the effect that John F. Wallace, former chief engineer of the Panama Canal, and now connected with the Northern Colorado Power Company, has been looking this field over with the view of establishing plants to supply electric power to mines, cities and towns of northern Colorado and southern Wyoming. It is said he also is representing the Denver, Laramie & Northwestern railroad, which seeks a route for a branch through that section.

Canada.

✣Bids will be received by R. C. Des

Rochers, Secretary, Department of Public Works, Ottawa, Ont., until 4 p. m., Sept. 21, for the construction of a pier at Brockville, Leeds County, Ont. Plans, specification and form of contract can be seen and forms of tender obtained at this department, at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Brockville.

✣Bids will be received by the Chairman of the Canal Committee of the Dundas, Canada, town council, until Sept. 15, for dredging the Desjardins Canal, involving the removal of about 27,500 cu. yds. of material. John F. Armour, Dundas, Ont., is Engineer.

BRIDGES AND BUILDINGS

Arkansas.

✣Bids will be received by Judge L. [illegible] Smith, Arkansas County, Ark., at DeWitt, Ark., until 2 p. m., Sept. 14, for the construction of seven bridges from [illegible] to 100 ft. in length.

California.

The Los Angeles county highway commissioners have inspected the site of the proposed bridge at Colorado St., over the Arroyo Seco, in Pasadena, Cal. The engineers of the Pasadena board of trade, Williams & Nishkian, have been instructed by the commissioners to at once prepare a careful and detailed estimate of the cost of the structure. A rough estimate of the cost of the bridge is $150,000.

The Pacific Construction Co., of San Francisco, Cal., has been awarded a contract by the board of county supervisors at Fresno, Cal., for the construction of a highway bridge across King's River, Fresno, Cal., for $35,693. The work includes one 150-ft. span of steel, two 70-ft. spans on concrete abutments, 18 ft. floor surface of reinforced concrete. Bids were opened Aug. 24.

Engineers Mayberry & Parker have prepared plans for six reinforced concrete bridges to be erected near Naples, Cal., by the Pacific Electric Railway Co., and the Huntington Land Co. J. O. Marsh of the latter company states that the bridges will average 60 ft. in length and 22 ft. in width, single arch construction. The cost will be about $50,000.

The county highway commission, Los Angeles, Cal., has adopted plans for five bridges to be built on the coast boulevard, all north of Oceanside on the Santa Margarita ranch, as follows: Santa Margarita river, 450-ft. span; Los Flores river, 135-ft. span; San Onofre creek, 133 ft.; south branch San Mateo creek, 17 ft.; San Mateo creek, 300 ft.

President Geohegan and Secretary Bertonneau, of the board of trade, of Los Angeles, Cal., expect to take over figures and plans for the proposed bridge over the Arroyo Seco to lay before the county commissioners. The bridge engineers have worked out the details of the plans.

The county commissioners at Fresno, Cal., have awarded a contract to the Pacific Construction Co., for $35,963 for the construction of the proposed steel and concrete bridge across the Kings river in section 8-13-24. The plan and specifications call for a 150-ft. central span and two 70-ft. spans.

Idaho.

A petition has been presented to the county commissioners at Boise, Ida. asking for a new and wider bridge across the river at the intersection of Eighth and Ninth sts., and that the present bridge be moved to Eagle Island.

Illinois.

✣Bids will be received by W. [illegible], Town Clerk, Monee, Ill., until 1 p. m., Sept. 17, for the construction of two reinforced steel concrete bridges.

According to advices from Kewanee, Ill., the county bridge committee with the highway commissioner of Cornwall township have let contracts for the construction of what is known as the Lewis Shearer bridge. C. H. Hamann, of Geneseo received the contract to build the abutments for $2,150.

Henry Berens & Sons have been awarded a contract by the city council of Bloomington, Ill., for the construction of a bridge at Miller Park. The bridge will be of concrete, reinforced.

Plans are being formulated in the office of W. A. O'Brien, engineer of maintenance of way of the Chicago, Peoria & St. Louis Railway, Springfield, Ill., for the erection of a new reinforced concrete box culvert to be installed at "Dead Man's Crossing" on that road at Petersburg. The bridge will be built at an equal cost to the railroad and the city of Petersburg.

H. Zolper & Son has been awarded a contract by the city council of Mendota, Ill., for the building of the three bridges, one on Jefferson st., one on Fifth st., and another on Ninth ave., for $3,358.

J. B. MacAulay has been awarded a contract in Galesburg, Ill., for the construction of a bridge on West Main st., over Cedar Fork for $2,695. The bridge will be of reinforced concrete with the top strengthened with heavy iron beams.

The board of county commissioners, Metropolis, Ill., has let contract for six new concrete bridges at a cost of $12,484 to Yancy & Johnson, of Paducah, for four of the bridges and to Gass Bros. of Belleville, for the other two.

The construction of the two new bridges, one over Spring Creek at Landau Ave., and the other at Abe St., in Joliet, Ill., are being considered by the highway commissioners.

Indiana.

✣Bids will be received until 10 a. m. Sept. 27, by the Putnam County Commissioners at Greencastle, Ind., for the construction of two bridges. D. V. Moffett is County Auditor.

✣Bids will be received until 1 p. m., Sept. 24, by the County Commissioner at Wabash, Ind., for the construction of Piety and Harper bridges. J. P. Noftzager is Auditor of Wabash County.

The following contracts have been awarded by the commissioners of Marion County at Indianapolis, Ind., for the construction of culverts; bids being opened Aug. 25: Culvert on Fall and Mud Creek, in Lawrence Twp., Chas. Hoover, Maywood, Ind., $510. Culvert on Fall and Mud Creek, in Lawrence Twp., Chas. Hoover, Maywood, Ind., $580. Culvert on Fall and Mud Creek, in Lawrence Twp., Chas. Hoover, Maywood, Ind., $550. Culvert on Fall and Mud Creek, in Lawrence Twp., Chas. Hoover, Maywood, Ind., $535. Flat Top I-beam culvert in Pike Twp., A. W. Moore & Co., Indianapolis, Ind., $871.92. Flat Top I-beam culvert in Center Twp., Volpp & Fritz, Indianapolis, Ind., $840. Two concrete steel culverts, in Decatur Twp., Chas. Hoover, Maywood, Ind., $1,085.

The county commissioners at Lebanon, Ind., have awarded five contracts for the construction of bridges throughout the county to Earl Sparks of Kirklin, Ind., for $2,352, and one contract to John Adams, of Lebanon, for a bridge for $366. Bids were opened Sept. 8.

Advices from Shelbyville, Ind., state that the board of county commissioners has let contracts for culvert and bridge work to the National Concrete Co., and A. W. Morre for $9,515. The largest structure will be built across Fox ford, in Marion township.

The county commissioners at Indianapolis, Ind., have been petitioning for the construction of a new [illegible] Fall creek and Capitol Ave., in that city.

J. E. Roemheld, of the Roemheld Construction Co., has been employed by the city of Michigan City, Ind., to make an estimate of the cost of erecting a new bridge on Franklin St. It is roughly estimated that the bridge can be constructed for $15,000.

The Baltimore & Ohio, the Southern, and the Monon Railroads have plans for a new $2,000,000 steel bridge across the Ohio at Louisville, and a belt line connecting that point with New Albany and Jeffersonville.

D. B. Hill, Jackson place, Indianapolis, Ind., has been awarded a contract by the county commissioners at Franklin for the construction of seven small concrete bridges in the county for $2,641. Bids were opened Sept. 5.

The county commissioners at South Bend, Ind., are considering the advisability of constructing a new bridge at Logan St., and it is expected that they will take some definite action in the matter before fall.

The Indiana Bridge Co., Muncie, Ind., has been awarded a contract by the city of Fort Dodge, Ia., for the construction of the Third St. viaduct.

The contract for the construction of a steel bridge at Des Moines, Ia., has been awarded to the John Wheeler Construction Co., of Geneva, for $169,661.

Kansas.

✣Board of County Commissioners, Wichita, Kan., will receive bids until Sept. 26, for the construction of three bridges, one on the Harvey and Sedgwick county line, estimated to cost $1,718; second on the Delano and Attica township line, estimated to cost $1,500, and the last in Gypsum township, estimated to cost $758.

A special election will be held in Marysville, Kan., on Sept. 20 for the purpose of voting upon the proposition of issuing bonds to the amount of $8,000 for the erection of a new bridge across the Big Blue river at the foot of Broadway, in the city.

Shawnee and Wabaunsee counties Kan., will build a 40-ft. bridge over Vassar creek on the county line. Plans are now being inspected by the Wabaunsee county commissioners at Alma, Kan.

Maine.

The Aroostook Valley Railroad Co., is making preparations to bridge the Presque Isle stream near the point where the present terminal is, on Dyer St., in Bangor, Me. The new bridge will be just above the bridge of the Aroostook Lumber Co.

Advices from Portland, Me., state that the Lewiston electric road is to build a single span concrete bridge over the Presumpscot river, which will be the only one of its kind in the state. The bridge will be 125 ft. long.

Maryland.

The city officials of Port Deposit, Md., has asked the U. S. government to alter the railroad bridge over the Susquehanna River so as to avoid recurrences of the floods that submerged a part of the town last spring.

The board of awards of Baltimore, Md., has given D. V. Ault & Co. the contract for building the Harbor Board's new bridge over Jones Falls at Pratt St. It will cost $87,810, and will be finished within 115 days. The bridge is to be 120 ft. wide.

The Cecil County Commissioners at Elkton, Md., have decided to replace the old wooden covered bridge spanning Stone Run, at Liberty Grove, with an iron structure.

Massachusetts.

✣Advices from Lowell, Mass., state that the engineers of the Boston & Maine R. R. Co. will receive bids until Sept. 16, for the construction of the Billerica St. bridge.

The Boston transit commission, Boston, Mass., has received the following bids for the construction of section 2 of the Beacon Hill tunnel for the Cambridge subway construction: Coleman Bros., $281,450; Patrick McGovern, $289,925; Hugh Nawn Construction Co., $296,660; Luke Mullen, $327,850; Jones & Meehan, $332,335; Charles R. Gow & Co., $343,310; Coughlin & Shields Co., $347,925;

John E. Palmer, $359,400; John J. Falvey & Co., $435,850; Metropolitan Construction Co., $451,350.

The Coleman and McGovern bids were taken under consideration.

Minnesota.

Blue prints and cost estimates of concrete bridges, to carry the Hastings & Dakota tracks over the canal connecting Lake of the Isles and Lake Calhoun have been received by the park board of Minneapolis, Minn., from officials of the Milwaukee board. The company reports that it can construct a bridge of the design drawn by William Pierce Cowles for $24,669, another of a modified design for $18,513, and one of the simplest design for $15,959.

Missouri.

✣Bids will be received until 3 p. m., Oct. 10, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Macon, Mo.

✣Bids will be received until noon, Sept. 16, by William Elbring, Highway Engineer, Clayton, Mo., for the following work: A—Bridge, masonry, derrick work. 1. Bridge abutments on Ossenfort Road, about ¼ mile south of Wild Horse Road. 2. Bridge abutments on Stoeker Road, about ½ mile southwest of Kehr's Mill Road. 3. Bridge abutments at intersection of Staecker and Shepherd Roads. 4. Bridge abutments on Tesson Road at Gravois Creek. 5. Bridge abutments on Eldridge Ave. 6. Bridge abutments on Des Peres Ave. 7. Bridge abutments on Grant Road at Gravois Creek. B—Concrete, masonry, culvert work. 1. Box culvert on Hoffmeister Ave. 2. Box culvert on Ries Road. 3. Box culvert on Ada Ave. 4. End walls on Park Ave.

The county commissioners at Carthage, Mo., have awarded contracts for the construction of four bridges in Jasper County as follows: Illinois Steel Bridge Co., Morgrave bridge, for $4,349; Vincennes Bridge Co., Halls-ford bridge, two 100-ft. spans and 90-ft. trestle, for $11,646; Massillon Bridge Co., Castle bridge, 80-ft. span for $3,176, and Scotland bridge 160 ft. span for $6,312. Bids were opened Sept. 7.

The mayor of Independence, Mo., has been informed that arrangements had been made by the Metropolitan and the Missouri Pacific railway for the new concrete bridge on South Main St. The bridge will be lowered.

Nebraska.

Henry T. Clarke, of Camp Clarke, Morrill county, Neb., has offered to give funds to the county commissioners for the construction of a bridge over the Platte river at Camp Clarke. The old bridge was built by Mr. Clarke at a cost of $40,000.

New York.

✣Board of Contract & Supply, Albany, N. Y., will receive bids until 3 p. m., October 3, for furnishing all labor and materials for the erection and completion of a new police station on the west side of Pearl St., between Wilson and Livingstone Ave. in Albany, N. Y. Isidor Wachman is Secretary of the Board.

Gorsline & Swan Construction Co. of Rochester, N. Y., has been awarded a contract in Rochester for the razing of buildings and the building of the foundation for the new central station for approximately $600,000.

The Raymond Concrete Pile Co. of New York and Chicago has been awarded a contract for placing Raymond concrete piles in the foundation of the chapel to be built at the main entrance to Greenwood cemetery, Brooklyn, N. Y. Warren & Wetmore, architects.

Advices from Brooklyn, N. Y., state that the engineers are revising the plans for the Hell Gate bridge for resubmission to the municipal art commission. This bridge will be built by the New York Connecting Railroad Co., which is financed by the Pennsylvania and New Haven Railroads.

The Buffalo & Lake Erie Traction Co., Buffalo, N. Y., is preparing plans for a 900-ft. concrete and steel bridge at Eighteen-Mile Creek.

The town board of Newark, N. Y., has awarded a contract to the Weedsport Construction Co., for the building of the bridge on North Main st., where the steam roller broke through. The bridge will be of reinforced concrete, and will be a 30-ft. span.

A contract has been awarded by the town boards of Chenango and Fenton, N. Y., to the Climax Road Machine Co., of Marathon for the construction of a steel bridge, for $17,543. The bridge is to be finished by Dec. 1.

General Forman, B. H. Van Horn, of Oneida, N. Y., has received plans and specifications for the new bridge to be built over the feeder at Cedar St., in that town. The new structure will be of concrete.

North Dakota.

East Grand Forks of Grand Forks, N. Dak., is in favor of taking steps looking to the reconstruction of the Minnesota approach of the DeMers Ave. bridge at as early a date as possible.

Ohio.

✣Board of County Commissioners, Toledo, O., will receive bids until 10 a. m., October 3, for furnishing the necessary labor and material for the construction complete of two concrete abutments on County Road 481, over Cedar Creek, on east line section 11, south of Yondota. C. J. Sazenbacher is auditor of Lucas County. Plans and specifications are on file at the office of the county auditor.

✣Bids will be received by the Board of County Commissi ners at the office of the auditor. Lisbon, O., until noon, Sept. 19, for furnishing the necessary labor and material for the construction of a reinforced concrete skew arch to replace Bridge No. 40, near pumping station, at East Palestine, O. The structure will have a 30-ft. span with concrete support under center arch, and to have a 30-ft. roadway. Plans and specifications are on file at the office of the county auditor and of the county surveyor, B. M. French, at Salem, O.

✣Board of County Commissioners, Cincinnati, O., will receive bids until noon, Sept. 30, for the construction under specification No. 89, of a concrete bridge and fill on the road from Miamitown to Mt. Hope at residence of R. E. Simmons, Whitewater township. Plans and specifications are on file at the office of the board. Fred Dreihs is clerk and Stanley Struble is president.

✣Bids will be received until noon, Sept. 30, by Board of County Commissioners, Fred Dreihs, clerk, Cincinnati, O., for the construction under Specification No. 107, of concrete bridge on Burns road near Stone Mill road, in Colerain township. Plans and specifications are now on file at the office of the board.

Advices from Mt. Vernon, O., state that the county commissioners of Knox and Licking counties have awarded the contract for the building of the Mitchell bridge, as follows: Substructure, Payne & White for $1,896.04; superstructure, Mt. Vernon Bridge Co., for $4,000. Total, $5,896.04.

The Pennsylvania Railroad Co. is preparing to erect a new double-track, all steel bridge, to enter the city of Toledo, O.

The county commissioners at Hamilton, O., have received a petition for the construction of a bridge at the Huntsbarger farm on the Poasttown and Brown's road.

A new bridge is to be built by the Chesapeake & Ohio Railway across the Ohio river at Ironton, O., to reduce the time of coal shipments from Virginia and West Virginia by 48 hours.

The citizens of Tiffin, O., will probably ask the city council to construct a bridge across the Sandusky river in the second ward, from the foot of East Davis St., to John St., in the first ward.

Bonds have been sold by the city officials of Lima, O., for the erection of two more bridges to cost $12,000.

W. H. Sieverling, of Springfield, O., has been awarded a contract for erecting the East High St. bridge across the Big Four tracks, in Springfield, for $23,392. The new bridge will be of steel and concrete construction, and will be ornamental in design.

Residents along the road leading from Roseville-Deavertown, O., west to Crooksville, have petitioned the county commissioners for a bridge across Hoover's run on the J. E. and Walter Wigton farm.

Oklahoma.

The Okfuskee county commissioners at Okemah, Okla., have awarded contracts to the Missouri Valley Bridge & Iron Co., of Leavenworth, Kan., for $35,000 to construct 24 additional bridges. E. Stine is county clerk.

Oregon.

Estimates for two new bridges over the Williamette river were filed recently with the city auditor of Portland, Ore., by City Engineer J. W. Morris. One bridge from Division St., across the river to Sherman St., has been asked for by the South Boosters' Club and the Brooklyn Improvement Club. The engineer estimates this to cost $1,950,000. The other bridge has been asked for by Sellwood people, and to be placed from Umatilla to Douglas avenues. The city engineer estimates this to cost $875,000. The estimates are both on steel structures and covers all expenses attached to the approaches.

Pennsylvania.

✣Bids will be received by the State Highway Department, Harrisburg, Pa., until 2 p. m., Sept. 16, for the construction of a cement masonry bridge at Station 918-11 on the National road in the county of Washington. Joseph W. Hunter is state highway commissioner. Plans and specifications are on file at the office of the board of county commissioners, Washington, Pa.

✣Bids will be received until 2 p. m., Sept. 16, by the state highway department, Harrisburg, Pa., for the complete construction and erection of a reinforced concrete bridge at station 927-80, on the National road, Washington county. Joseph W. Hunter is state highway commissioner.

Boller & Hodge, consulting engineers of New York, to whom County Engineer Charles F. Sanders, of Reading, Pa., submitted his tests and specifications of the Penn St. bridge, the largest structure crossing the Schuylkill river at Reading, have sent their report to the county commissioners, in which they condemn the structure as unsafe, and recommend that the loading on the bridge, including trolley cars, be limited.

The Berks county commissioners at Reading, Pa., contemplate erecting a bridge across the Schuylkill river at Reading at a cost of about $250,000.

The commissioners of Northumberland county, Sunbury, Pa., have decided to place the new bridge over the north branch of the Susquehanna river above Sunbury, 20 ft. north of the present wooden structure.

The Lawrenceville, Pa., board of trade has joined in the movement for a new thoroughfare connecting the East End with the downtown section of the city by the extension of Grant blvd., supplemented by a bridge over Junction Hollow, connecting the Bloomfield district, and giving it an outlet to the other sections of the city.

The Union County Commissioners at Lewisburg, Pa., have awarded two contracts for building bridges in the county to the York Bridge Co., one bridge is to be built at Fry's mill over Limestone run, at Lewisburg. The other to be built at East Buffalo, and is known as the Hiram Wolfe bridge. The contracts for the masonry work were awarded to Amos Fauver.

Texas.

✣Bids will be received until 3 p. m., Oct. 7, by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, heating apparatus, gas piping, electric conduits and wiring, of the U. S. Post Office at Temple, Tex.

✣Bids will be received until 10 a. m., October 1, by John L. Young, County Judge, Dallas,, Texas, for the construction of the

Dallas-Oak Cliff Viaduct. The work will include about 43,500 cu. yds. of reinforced concrete, one steel span 100 ft. in length, about 40,000 lin. ft. of concrete piling, 8,600 lin. ft. of timber piling, and all other details necessary to complete the said structure.

Mayor Rice of Houston, Tex., has agreed to call an election to vote bonds for the construction of the Main St. viaduct on the same day that the county will note on the ship channel bond issue of $1,250,000 for the construction of a deep waterway to the gulf. The cost of the viaduct has been estimated at $379,000.

Two new bridges are soon to be built across the ship channel at Houston, Tex. A viaduct is proposed to span the waterway at Main St., and a new and larger bridge at San Jacinto St. is to take the place of the present crossing there. Plans and specifications for the San Jacinto St. bridge have been adopted, and the city engineer has been instructed to prepare plans for the Main St. bridge. The San Jacinto St. bridge will be 70 ft. wide, 50 ft. being a roadway, and 177 ft. in length.

Advices from Batesville, Tex., state that the county court has awarded the El Paso Bridge & Tram Co., of El Paso, Tex., contracts for seven iron bridges in the county and across the Nueces river, near the center of the county.

Washington.

J. A. Waddell, of the firm of Waddell & Harrington, bridge architects, has submitted his proposal for the engineering work relative to the construction of the two bridges over the city waterway and the Puyallup river to the city council of Tacoma, Wash. The engineer estimates the cost of the bridges at $621,000. Vertical lift types of bridges will probably be installed.

According to advices from Seattle, Wash., the Union Pacific Railway has reached an agreement with the Vulcan Iron Works for a right of way through its property on the waterfront for the sum of $50,000. The site will be used for the north side bridge across the Chehalis river at Aberdeen, Wash.

Wisconsin.

The chairman of the town board of Casco, Wis., is agitating the construction of a new iron bridge across the Kewanee river at Clyde.

Canada.

Advices from Vancouver, B. C., state that plans and estimates covering the proposed viaduct connecting Georgia and Harris Sts., and Dunsmuir and Keefer Sts., were submitted to the city council. The estimates are based on steel structures, similar in strength and general design to the Granville and Cambie St. bridges. The Georgia St. viaduct is to be 2,700 ft. in length and has a grade of .77 per cent as far east as the Great Northern tracks, from which point it descends at a 2.4 per cent grade to Westminster Ave. The Dunsmuir-Keefer viaduct is 2,200 ft. long, has a level grade as far east as Carrall St., and a descent of 3 per cent to Westminster Ave. The estimates presented were as follows:

No. 1. Georgia St. to Harris St. with 42-ft. clear roadway, two 7-ft. sidewalks and double track tramline, $415,000. No. 2. Similar to No. 1, except as to provision of 50-ft roadway, $459,000. No. 3. Dunsmuir St. to Keefer St. with 42-ft. roadway, two 7-ft. sidewalks and double track tramline, $350,000. No. 4. Similar to No. 3, except with provision for a 50-ft. roadway, $387,000. No. 5. Similar to No. 3, with omission of tramline, $281,000. No. 6. Similar to No. 4, with omission of tramline, $313,000.

E. C. Lewis has been awarded a contract at Toronto, Ont., for the construction of the Weston road viaduct for $17,066. The bridge will be of reinforced concrete.

ROADS, STREETS AND PAVEMENTS

Alabama.

The commissioners of Dallas County at Selma, Ala., have awarded a contract to Cook & Abrams of Montgomery for the building of the Burnsville road. The road is to commence just beyond the Beech creek bridge and extend to the joint Autauga and Dallas county bridge over Mulberry creek, a half mile beyond Burnsville. The road will be of clay gravel with 16 ft. surface, a width of 20 ft. in all.

At a meeting of the good roads advocates of Etowah County, held in Gadsen, Ala., recently a Goods Roads association was formed. W. P. Archer, mgr. of the Farmers' Union warehouse of Gadsen, was elected President, and C. S. Irvin, Secretary.

The building of a 100 ft. boulevard by the United States government from the great lakes to the Gulf of Mexico is being agitated by Charles W. Thatcher of Russellville, Ala.

Arkansas.

✣Bids will be received by Judge L. C. Smith, Arkansas County, at DeWitt, Ark., until 2 p. m., Sept. 14, for the construction of one public road running 5 miles east of Stuttgard. The road is to be graded so that it will shed all rain.

The City Council of Imboden, Ark., has let the contract for several thousand ft. of concrete walks on Front, Main and Third Sts., to K. D. Crouch of that city. The walks on Front and Main will be 8 ft. wide, while those on Third will be 4 ft. wide. Third St. will be paved its entire length, one and one-half miles.

California.

✣Bids will be received by Maj. George Mck. Williamson, Constructing Quartermaster, Fort Mason, Cal., until 11 a. m., Sept. 16, for constructing asphalt road between Lombard St. gate and guardhouse, Presidio of San Francisco, Cal.

The City Officials of Los Angeles, Cal. and the county officials have decided to improve Main St. road to Wilmington. Homer Hamlin is City Engineer.

Colorado.

A meeting of the business men and taxpayers of the county was held in the court house at Creede, Colo., recently to take up the matter of securing the consent of the Colorado highways commission in establishing the proposed state highway through this section of Colorado, from Alamosa, through Monte Vista, Del Norte, Creede and on to Silverton.

Delaware.

Good roads in Brandywine and the purchase of the pikes coming into the city were advocated at the meeting of the Levy Court, Wilmington, Del., recently.

District of Columbia.

✣Bids will be received until 2 p. m., Sept. 20, by Lieut. R. G. Alexander, Constructing Quartermaster, Washington Barracks, D. C., for the construction of concrete sidewalks, gutters, roads, etc., at that place.

Florida.

At the time of the general election in November the voters of Orange County, Fla., will vote on the proposition of bonding the county for $1,000,000 with which to build a system of brick roads extending 100 miles throughout the most traveled sections of the county.

Illinois.

✣Bids will be received until 2 p. m., Sept. 14, by Board of Local Improvements, Taylorville, Ill., for the construction of 15,632 sq. yds. vitrified block pavement to be laid upon 6-in. concrete base with sand cushion and asphaltic filler. The work also includes 5,078 cu. yds. of excavation, 189 cu. yds. of fill, 12,586 lin. ft. combined curb and gutter. J. W. Dappert is City Engineer.

The Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 300 City Hall, has awarded the following contracts for paving: Archer Ave., Western Ave. to Rockwell St., asphalt on 6-in. Portland cement concrete base, contract price $11,191, R. F. Conway Co., 720 Chamber of Commerce bldg., Chicago.; alley, Vincennes Ave., Langley Ave., 39th St., Oakwood Blvd., Parker Washington Co., 920 Chamber of Commerce, Chicago, contract price $3,218; vitrified paving brick on 6-in. Portland cement concrete base, 51st St., Cottage Grove Ave. to Grand Blvd., creosoted wood block on 6-in. Portland cement concrete base, the Ryan Co., 112-133 LaSalle St., Chicago, contract price $14,545; W. 45th St., Laflin St. to Loomis St., macadam (granite top on limestone base), contract price $3,879, Ready & Callahan Co., 47th and Halsted Sts., Chicago; Reta Ave., Cornelia Ave. to Addison St., macadam (granite top on limestone base), contract price $2,814, Inter Ocean Paving Co., 108 Dearborn St., Chicago; S. Ridgeway Ave., Ogden Ave. to W. 26th St., asphalt on 6-in. Portland cement concrete base, contract price $2,167, The American Asphalt Co., 404 Chamber of Commerce, Chicago; Rokeby St., Cornelia Ave. to Grace St., asphalt on 6-in. Portland cement, concrete base, contract price $15,097, R. F. Conway Co., 720 Chamber of Commerce, Chicago; N. Sacramento Ave., Irving Park Blvd. to Montrose Ave., asphalt on 6-in. Portland cement concrete base, contract price $20,795, R. F. Conway Co., 720 Chamber of Commerce Bldg., Chicago; S. Sangamon St., W. Adams St., W. Van Buren St., granite blocks on 6-in. Portland cement concrete base, Jas. Sackley Co., 307 Chamber of Commerce, Chicago, contract price $13,046; S. Seeley Ave., 35th St. to 36th St., asphalt on 6-in. Portland cement concrete base, contract price $5,189, The American Asphalt Co., 404 Chamber of Commerce, Chicago; W. 21st St., S. Kedzie Ave. to S. St. Louis Ave., asphalt on 6-in. Portland cement concrete base, contract price $13,562, A. Jaicks, 145 LaSalle St., Chicago; W. 37th Pl., S. Halsted St. to S. Morgan St., asphalt on 6-in. Portland cement concrete base, contract price $9,247, R. F. Conway Co., 710 Chamber of Commerce, Chicago; Washtenaw Ave., Fullerton Ave., Diversey Blvd., asphalt on 6-in. Portland cement concrete base, contract price $16,796.80, R. F. Conway Co., 720 Chamber of Commerce, Chicago; W. George St., N. California Ave. to N. Kedzie Ave., asphalt on 6-in. Portland cement concrete, contract price $16,516, R. F. Conway Co., 720 Chamber of Commerce, Chicago; Wallace St., W. 59th St. to W. 63rd St., macadam (granite top on limestone base), Central Paving Co., 172 Washington St., Chicago, contract price $6,748; Cornell St., N. May St. to Elston Ave., asphalt on 6-in concrete base, contract price $2,803, R. F. Conway Co., 720 Chamber of Commerce, Chicago; W. 45th St., Halsted St. to State St., vitrified paving brick on 6-in concrete base, contract price $33,909, R. F. Conway Co., 720 Chamber of Commerce, Chicago; E. 52nd St., Woodlawn Ave. to Lake Ave., asphalt on 6-in. Portland cement concrete base, contract price, $18,860, The American Asphalt Co., 404 Chamber of Commerce, Chicago; E. 59th St., Jackson Park Ave. to Washington Ave., macadam (granite top on limestone base), contract price $2,634, Central Paving Co., 172 Washington St., Chicago; S. Loomis St., 87th St. to C., R. I. & P. Ry., macadam (granite top on limestone base), Central Paving Co., 172 Washington St., Chicago, contract price $7,398; W. North Ave., Fleetwood Ave. to N. Ashland Ave., granite blocks on 6-in. Portland

Items marked thus ✣ indicate work now open for bids.

cement concrete base, contract price $21,815, Union Paving Co., 184 LaSalle St., Chicago.

The Board of Public Improvements of Carterville, Ill., opened bids Sept. 6 for the construction of 18 miles of concrete sidewalks and awarded the contract to William Lough & Son of Arcola, Ill., for $38,374.

The following bids were received Sept. 2 by the board of local improvements of Chicago, Ill., Chas. A. V. Standish, Secretary, for paving work in the city; "a" being price per lin. ft., for setting new sandstone curb; "b," price per lin. ft. for resetting and recutting old sand stone curb; "c," price per lin. ft., for setting new granite combined curb and gutter (concrete); "d," price per lin. ft., for setting new granite gutters (concrete); "e," price per lin. ft., for setting new granite curbs (concrete); "f," price per sq. ft., for building concrete sidewalks; "g," price per cu. yd., for earth filling; "h," price per cu. yd., for earth excavating; "i," price per sq. yd., for asphalt pavement on 8-in. concrete base; "j," price per sq. yd. for brick pavement on 8-in. concrete base; "k," price per sq. yd., for creosoted block pavement on 8-in. concrete base; "l," price per sq. yd., for macadam pavement; "n," price of manhole for adjustment of old manholes; "o," price per basin for catch basin adjustment of old catch basins; "p," price per iron cover and lid for manholes and catch basins; "q,, price per lin. ft., for gravel concrete curb and gutter (combined); "r," price. per lin. ft., for gravel concrete gutter; "s," price per lin. ft. for 9-in. tile pipe; "t," price per grating for new iron gratings; "m," price per basin for constructing new catch basins; (1) signifies lowest bid, (2) and (3) following: The Union Paving Co., 184 La Salle St., Chicago, South Center Ave., from W. 63rd St., to W. 67th St., on brick, (3) $.75 "a," $.20 "g," $2.14½ "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $14,183; Cottage Grove Ave., from 51st St. to 59th St., on creosoted wood block, $.57 "c," $.34 "d," $.60 "h," $.20 "f," $2.81 "k," $.45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $66,213: Grand Ave., from W. Chicago Ave., to N. Kedxie Ave., on brick, (1), $.69 "a," $.24 "h," $2.20 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $12,117: Hollywood Ave., from Southport Ave., to N. Clark St., macadam, (1) $.60 "c," $.25 "g," $.20 "f," $1.13 "l," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $5,482: W. North Ave., from N. Central Park Ave., to N. 48th Ave., on brick, (1), $.64 "a," $.25 "b," $.25 "h," $.20 "f'," $2.13½ "j," $45 "m," $5 "n, $20 "o," $10 "p," $.75 "s," $10 "t;" total $103,105: Parker Washington Co., 134 Washington St., Chicago, Alley from Grand Boulevard, E. 48th Pl., to Vincennes Ave., E. 49th St., on creosoted wood block, (2), $.20 "c," $2.98 "k," $5 "n," $10 "p;" total $4,027: South Center Ave., from W. 63rd St., to W. 67th St., on brick, (2), $.75 "a," $.25 "g," $2.09 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $13,960: Cottage Grove Ave., from 51st St., to 59th St., on creosoted wood block, (3), $.57 "c," $.34 "d," $.40 "h," $.18 "f," $2.89 "k," $40 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $65,407: E. 55th St., from Lake Ave., to Everett Ave., on asphalt $.60 "c," $.20 "f," $2.12 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $8,759: Grand Ave., from W. Chicago Ave., to N. Kedzie Ave., on brick (2), $.65 "a," $.10 "h," [illegible] "j," $45 "m," $5 "n," $20 "o," $10 "p;" total $12,369: S. Michigan Ave., from E. 28th St., to E. 71st St., on asphalt, (2), $.60 "c," $.30 "g," $.20 "f," $2.10 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $16,360: W. North Ave., from N. Central Park Ave., to N. 48th Ave., on brick, (3), $.70 "a," $.20 "b," $.40 "h," $.18 "f," $2.19 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s,' $10 "t;" total $107,800: W. 13th St., from S. Canal St., to S. Jefferson St., on asphalt, $.50 "q," $.25½ "r," $.20 "f," $2.13 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $6,245: Wolfram St., from N. Halsted St., to Racine Ave., on asphalt, (2), $50 "c," $.20 "f." $1.87 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $19,596: Jno. A. McGany Co., 188 E. Madison St., Chicago, Cottage Grove Ave., from 51st St., to 59th St., on creosoted wood block, (2), $.22 "c," $.30 "d," $.50 "h," $.12 "f," $2.92 "k," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;"' total $65,105 Hollywood Ave., from Southport Ave., to N. Clark St., on macadam, (2), $.59½ "c," $.50 "g," $.12 "f," $1.14 "l," $45 "m," $5 "n," $10 "o," $.75 "s," $10 "t;" total $5,659: American Asphalt Paving Co., 404 Chamber of Commerce, Chicago, E. 55th St., Lake Ave., to Everett Ave., on asphalt, (1), $.61½ "c," $.19 "f," $1.92 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $7,367: S. Michigan Ave., from E. 68th St., to E. 71st St., on asphalt, (1), $.61½ "c," $.50 "g," $.20 "f," $1.69 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $14,275: North Shore Ave., from Evanston Ave., to 830 ft. east of Evanston Ave., on asphalt, (2) $.60 "c," $.50 "g," $.20 "f," $2 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $6,670: W. 13th St., from S. Canal St., to S. Jefferson St., on asphalt, (1), $.54 "q," $.32 "r," $.22 "f," $1.75 "i," $45 "m," $5 "n," $20 "o," $10 "p." $.75 "s," $10 "t;" total $5,370: Wolfram St., from N. Halsted St. to Racine Ave., on asphalt, (1), $.61½ "c," $.22 "f," $1.74 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $19,086: Jos. Homeddy, 79 Dearborn St., Chicago, Cottage Grove Ave., from 70 ft. north of 51st St., to 59th St., on creosoted wood block, $.63 "c," $.41 "d," $.40 "h," $.25 "f," $3.47 "k," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $76,960: W. 13th St., S. Canal St., to S. Jefferson St., on asphalt, (3), $.60 "q," $.40 "r," $.25 "f," $2 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;"total $6,095: Central Paving Co., 172 Washington St., Chicago, S. Centre Ave., from W. 63rd St., to W. 67th St., on brick, $.75 "a," $.25 "g," $2.23 "j," $45 "m," $5 "n," $20 "o." $10 "p," $.75 "s," $10 "t;" total $14,653: Citizens Construction Co., Chamber of Commerce, Chicago, alley in Calumet Ave., E. 48th St., to Grand Blvd., E. 49th St., on brick, $.30 "e," $3.49 "j," $5 "n," $10 "p:" Cottage Grove Ave., from 70 ft. north of 51st St., to 59th St., on cresoted wood block, $.58 "c," $.33 "d," $.80 "h," $.20 "f," $2.86 "k," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $69,234: W. North Ave., from N. Central Park Ave., to N. 48th Ave., on brick, (2), $.55 "a," $.40 "b," $.37 "h," $.20 "f," $2.14 "j," $45 "m," $5 "n," $20 "o," $10 'p," $.75 "s," $10 "t;" total $103,892: A. J. McAllester, 1542 Garfield Blvd., Chicago, S. Centre St., from W. 63rd St., to W. 67th St., on brick, $.68 "a," $.20 "g," $2.21 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $14,276: The Ryan Co., 133 La Salle St., Chicago, (1), S. Centre St., from W. 63rd St., to W. 67th St., on brick, (1), $.70 "a," $.03 "q," $2.03 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s, $10 t;" total $13,280: Cottage Grove Ave., 70 ft. north of 51st St., to 59th St., on creosoted wood block, (1), $.55 "c," $.32 "d," $.60 "h," $.15 "f," $2.63 "k," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $62,671: The Barber Asphalt Co., Tribune Bldg., Chicago, E. 55th St., from 314 ft. east of Lake Ave., to Everett Ave., on asphalt, (3), $.56 "c," $.20 "f," $2.37 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $8,541: S. Michigan Ave., from E. 68th St., to E. 71st St., on asphalt, (3), $.57 "c," $.63 "g," $.20 "f," $2.09 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $16,709: North Shore Ave., from Evanston Ave., to 830 ft. east of Evanston Ave., on asphalt, (3), $.51 "c," $.63 "g," $.20 "f," $2.22 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $7,134: W. 13th St., from S. Canal St., to S. Jefferson St., on asphalt, $.50 "q," $.32 "r," $.20 "f," $2.25 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $6,580: Wolfram St., from N. Halsted St., to Racine Ave., on asphalt, $.57 "c," $.20 "f," $2.31 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $22,823: Jas. A. Lackley Co., Chamber of Commerce, Chicago, alley, Calumet Ave., from E. 48th St., to Grand Blvd E. 49th St., on brick, $.20 "e," $2.64 "j," $5 "n," $10 "p:" Alley St. Lawrence Ave., E. 47th St., to Forrestville Ave., E. 48th St., on brick, $.20 "e," $2.64 "j:" Alley, Grand Blvd., E. 48th St., to Vincennes Ave., from E. 49th St., on creosoted wood block, (1), $.20 "e," $2.96 "k," $5 "n," $10 "p," $4,002: S. Centre Ave., from W. 63rd St., to W. 67th St., on brick, $.73 "a," $.35 "g," $2.19 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $14,490: Cottage Grove Ave., from 70 ft. north of 51st St., to 59th St., creosoted wood block, $.60 "c," $.34 "d," $.40 "h," $.15 "f," $2.28 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $68,852: W. North Ave., from N. Central Park Ave., to N. 48th Ave. brick, $.50 "a," $.25 "b," $.75 "h," $.15 "f," $2.28 "j," $45 "m," $5 "n," $20 ""o," $10 "p," $.75 "s," $10 "t;" total $113,096: R. F. Conway Co., Chamber of Commerce, Chicago, S. Centre St., from W. 63rd St., to W. 67th St., on brick, $.68 "a," $.10 "g," $2.32 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $14,720: Cottage Grove Ave., from 70 ft. north of 51st St., to 59th St., on creosoted wood block, $.60 "c," $.37 "d," $.10 "h," $.20 "f," $3.24 "k," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $69,293: E. 55th St., from 314 ft. east of Lake Ave., to Everett Ave., on asphalt, (2), $.60 "c," $.20 "f," $2.23 "i," $45 "m,' $5 "n." $20 "o," $10 "p," $.75 "s," $10 "t;" total $8,220: Grand Ave., from W, Chicago Ave., to N. Kedzie Ave., on brick, (3), $.68 "a," $.10 "h," $2.47 "j," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $12,879: S. Michigan Ave., from E. 68th St., to E. 71st St., on asphalt, $.60 "c," $.50 "g," $.20 "f," $2.30 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $17,882: W. North Ave., from N. Central Park Ave., to N. 48th Ave., on brick, $.67 "a," $.30 "b," $.10 "h," $.20 "f," $2.30 "j," $45 "m." $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $111,103 North Shore Ave., from Evanston Ave., to 830 ft. east of Evanston Ave., on asphalt, (1), $.60 "c," $.10 "g," $.20 "f," $1.98 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $6,458: W. 13th St., from S. Canal St., to S. Jefferson St., on asphalt, (2), $.60 "q," $.40 "r," $.20 "f," $1.92 "i," $45 "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $5,885: Wolfram St., from N. Halsted St., to Racine Ave. on asphalt, (3), $60 "c," $.20 "f," $1.84 "i," "m," $5 "n," $20 "o," $10 "p," $.75 "s," $10 "t;" total $19,853.

The following contracts have already been awarded on the above work: Alley 48th St., to 49th St., Grand Blvd. to Vincennes Ave., creosoted wooden block on 6-m. Portland cement concrete base. Jas. A. Sackley Co., 307 Chamber of Commerce Bldg., Chicago, for $4,002. Center Ave., 63rd St. to 67th St., vitrified paving brick on 6-in. Portland cement concrete base, The Ryan Co., 133 LaSalle St., Chicago, for $13,280. Cottage Grove Ave., 51st St. to 59th St., creosoted wooden block on 6-in. Portland cement concrete base, The Ryan Co., 133 LaSalle St., Chicago, for $62,671. E. 55th St., Lake Ave., to Everett Ave., asphalt on 6-in. Portland cement concrete, The American Asphalt Co., 404 Chamber of Commerce Bldg., Chicago, for $7,367. North Ave., Central Park Ave. to 48th Ave., vitrified paving brick on 6-in. Portland cement concrete base, for $103,104. Union Paving Co., 184 LaSalle St., Chicago, Ill. North Shore Ave., Evanston Ave. to 830 ft. east, asphalt on 6-in. Portland cement concrete base. R. F. Conway Co., 720 Chamber of Commerce Bldg., Chicago, for $6,458. W. 13th St., S. Canal St. to S. Jefferson St., asphalt on 6-in. Portland cement concrete, American Asphalt Co., 404 Chamber of Commerce Bldg., Chicago, $5,370. Wolfram St., Halsted St. to Racine Ave., asphalt on 6-in. Portland cement concrete base, American Asphalt Co., 404 Chamber of Commerce, $19,086.

Indiana.

✣Bids will be received until noon, October 4, by County Commissioners at Spencer, Ind., for the construction of macadamized road in

Washington township. George W. Edwards is Auditor of the County.

✣Bids will be received until 2 p. m., Oct. 3, by the County Commissioners at Greencastle, Ind., for the construction of macadam road in Cloverdale township. D. V. Moffett is Auditor of Putnam county.

✣Bids will be received by Commissioner of Knox County at Vincennes, Ind., until Oct. 2, for the construction of three gravel roads. J. T. Scott is Auditor of the county.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 21, for the improvement of Illinois St., from north property line of McCarty St. to south property line of Ray St., by grading and paving the roadway.

✣Bids will be received by Common Council, Rushville, Ind., until 7:30 p. m., Sept. 20, for the construction of 3,000 sq. ft. of cement sidewalks on Maple St. Thomas S. Cauley is City Clerk.

The County Commissioners at Vernon, Ind., have awarded contracts for the construction of two pikes in Campbell township to Wilkinson & Co., of North Vernon, Ind., for $5,551, and McClure & Jater of Halton, Ind., for $5,925. Bids were opened Sept. 5.

Ward Hawkins of Sullivan, Ind., has been awarded a contract by the commissioners of Sullivan County, Sullivan, Ind., for the construction of a rock road in Cass township for $8,240. Bids were opened Sept. 6.

A contract has been awarded to the Julius Keller Construction Co., for cement sidewalks and sodded lawns in Capitol Ave., from 16th to 21st Sts., in Indianapolis, Ind. The walks will cost $.12½ per sq. ft., and the lawns $10 per sq. yd.

All bids opened Sept. 5 at Greensburg, Ind., for the construction of a gravel road in Salt Creek Township have been rejected. Frank E. Ryan is County Auditor.

Daniels & Lyst, Wysor St., Muncie, Ind., have been awarded a contract at Muncie, for the improvement of Brick St., for $21,300. Bids were opened Sept. 7.

John Adams of Lebanon, Ind., has been awarded a contract by the county commissioners at Lebanon, for the construction of two gravel roads in Sugar Creek Township for $5,200 and $4,850. Bids were opened Sept. 8.

James B. Little of Indianapolis, Ind., has been awarded a contract by the county commissioners at Wabash, Ind., for the construction of a highway on the line between Noble and Waltx townships, also gravel or macadam road in Chester township for $12,497. Bids were opened Sept. 6.

Hutsel & Wolfcale of Markle, Ind., have been awarded a contract by the Adams County Commissioners at Decatur, Ind., for the construction of a macadam road, two miles in length, in Peble township, for $5,976. Bids were opened Sept. 5.

Geo. A. Matthews, Fowler, Ind., has been awarded a contract by the County Commissioners at Fowler for the construction of the Bart stone road in York township, a distance of three miles for $8,220. Bids were opened Sept. 5.

The Commissioners of Warren County at Williamsport, Ind., have awarded a contract to Davis & Booker of Windfall, Ind., for the construction of gravel roads in Pine and Steuben townships for $26,907. Bids were opened Sept. 5.

Wilk & Co. have been awarded a contract by the County Commissioners at Rushville, Ind., for the construction of the township line road between Orange & Anderson townships for $8,750. Bids were opened Sept. 6.

Iowa.

The City Council of Clinton, Iowa, has decided to pave Third Ave., between Second and Third St., with brick. City Engineer R. C. Hart has estimated the cost of paving the avenue with brick on a concrete bed at $5,660.

The City Council of Waterloo, Ia., contemplates paving the down town district of the city with either asphalt or brick.

Property owners on Sixth Ave., northeast of 13th St., in Fort Dodge, Ia., are agitating the paving of Sixth Ave., for a distance of two blocks to connect with the 15th St. paving.

J. M. Kenety of 79 Clark St., Dubuque, Ia., has been awarded a contract in that city for the improvement of Bluff St., for $14,698. The work includes 8,557 sq. yds. of sarco paving, 3,620 lin. ft. of combined curb and gutter and 18 ft. of curb reset. Bids were opened Sept. 1.

Kentucky.

Farmers along the Charlestown road, near New Albany, Ky., are discussing a proposition to widen that thoroughfare, which is one of the most extensively traveled roads leading to New Albany. It is planned to widen the road from 30 ft. to 50 ft.

Massachusetts.

The Massachusetts Highway Commission at Boston, Mass., has awarded the following contracts in connection with the building and improving of state highways: Henry M. McBride of Brighton received the contract for the construction of 6,200 ft. of the state highway in the town of Milford for $10,030; Mr. McBride was also awarded the contract for building 1,250 ft. of macadam road for the selectmen of Milford for $2,005; D. H. Damon of Ashby will build 5,500 ft. of the state road in Townsend and Ashby for $8,420; The Worcester Broken Stone Co., of Worcester, was awarded the contract for surfacing 8,200 ft. of the state road in the town of Palmer for $4,922; H. L. Thomas of Middleboro will surface about 8,900 ft. of the state highway in the town of Whitman for $3,889. The contracts for work in the towns of Sturbridge and Sandurch were not awarded.

Minnesota.

✣Bids will be received until 8 p. m., Sept. 19, by J. A. E. Grenier, City Clerk, Cloquet, Minn., for the construction of water mains and sewers as follows: Approximately 7,000 lin. ft. 8-in. sewer pipe; approximately 7,700 lin. ft. 6-in. cast iron water pipe; approximately 18 manholes; excavating and back-filling of approximately 7,400 cu. yds. of earth and rock.

✣Bids will be received until 8 p. m., Sept. 26, by Village Council of Farmington, Minn., for the construction of a water works system, wells, pump engine, 9,600 water mains from 4 to 8 in. in diameter. L. A. Wittier is Village Recorder.

Recommendations for levies of $3,000 for the Getchell road over the hill at West Duluth and $5,000 for the completion of the Sundby road were made to the conference committee in Duluth, Minn., recently.

The General Contracting Co. has been awarded a contract in St. Paul, Minn., for the paving of Dayton Ave., from 60 ft. west of Summit Ave., to Avon St., with asphalt for $41,539.

Missouri.

✣Bids will be received until 5 p. m., Sept. 19, by A. J. McKenzie, City Engineer, Webb City, Mo., for the construction of 6,959 sq. yds. of asphalted macadam pavement. A certified check for $50 must be filed with each bid.

The City Council of Webb City, Mo., has ordered City Engineer A. J. McKenzie to prepare plans, specifications and estimates for resurfacing with asphaltic oil 41,282 sq. yds. of macadam pavement. Plans are to be submitted about Sept. 19.

Nebraska.

✣Bids will be received until noon, Sept. 16, by F. W. Irish, City Clerk, Alliance, Nebr., for the construction of sanitary sewer lateral in District No. 20, being in the alley between Toluca Ave. and Emerson Ave., from 3d to 7th St. The work includes 1,400 ft. of 8-in. vitrified pipe sewer, 3 manholes, 1 flushtank, and 22 lin. ft. ½-in. XH lead water service.

Frank Clark has been awarded a contract by the County Commissioners of Lancaster County, Lincoln, Neb., for the grading of a county road between the southwest corner of the northwest quarter of section 32, town 12, r. 6, and the county line, a distance of 5½ miles for $400. Bids were opened Sept. 7.

New Jersey.

✣Bids will be received by Maurice Lindsay, Borough Clerk, Tenafly, N. J., until 8 p. m., Sept. 14, for the construction of a stone road in that place known as Sylvan Ave. or Boulevard, extending from the south borough line to the southerly borough line of Alpine, N. J., a distance of about 1½ miles. Watson G. Clark, Hillside Ave., Tenafly, N. J., is Borough Engineer.

The Board of Chosen Freeholders of Essex County, Newark, N. J., has awarded a contract to Robert Donetz, 27 Highland Ave., Newark, for grading and paving Pleasant Valley with Telford for $29,625. Bids were opened Sept. 8.

The Essex and Hudson Joint Bridge Committee, in session at Jersey City, N. J., has failed to come to an agreement relative to the proposed paving of the Plank road. The Hudson County authorities are in favor of the use of wood block and the Essex County authorities wish the road paved with granite.

New York.

✣Bids will be received until 11 a. m., Sept. 14, by George McAneny, President of the Borough of Manhattan, New York City, for two paving contracts as follows: No. 1, for maintaining the asphalt pavement on Broadway, from the north side of Canal St. to 14th St., where the original contract has been abandoned. Engineer's estimate of amount of work to be done: 5,000 sq. yds. of asphalt pavement, including binder course. 25 cu. yds. of concrete. No. 2, for repairing asphalt block pavement in the Borough of Manhattan. Engineer's estimate of amount of work to be done: 250 cu. yds. of Portland cement concrete, including mortar bed. 5,000 sq. yds. of new asphalt block pavement. 300 sq. yds. of old asphalt block pavement relaid.

✣Bids will be received until 11 a. m., Sept. 17, by the President of the Borough of Manhattan, New York City, at his office, Room 14, City Hall, for 15 street improvement contracts, the largest one being as follows: No. 12, for regulating and repaving with sheet asphalt pavement on concrete foundation, the roadway of 46th St., from west side of 8th Ave. to the east side of 11th Ave. Engineer's estimate of amount of work to be done: 8,400 sq. yds. of asphalt pavement, including binder course. 1,650 cu. yds. of Portland cement concrete. 3,880 lin. ft. of new bluestone curbstone, furnished and set. 1,000 lin. ft. of old bluestone curbstone, redressed, rejointed and reset. 11 noiseless heads and covers, complete, for sewer manholes, furnished and set. 5 noiseless heads and covers, complete, for water manholes, furnished and set. The time allowed for doing and completing the above work will be fifty working days. The amount of security required will be Six Thousand Dollars ($6,000).

✣Bids will be received by Thomas H. O'Neill, Mayor, Auburn, N. Y., until 8 p. m., Sept. 20, for the paving of Osborne St. with Medina sandstone block and 1,800 lin. ft. of medina sandstone curbing. Plans and specifications may be obtained from Elbert C. Aldrich, City Engineer. J. S. Hanlon is City Clerk.

The Board of Contract and Supply of Troy, N. Y., has awarded a contract to John H. Gleason & Co., to lay 1,350 sq. yds. of asphalt pavement on Sixth Ave., from Rennselaer to Middleburgh St., for $1.75 per sq. yd.

Borough President Steers of Brooklyn, N. Y., has announced that as soon as plans can be perfected, and the kind of pavement decided upon, work will start on replacing the macadam on Ocean Ave., from Prospect park to Dorchester St. It is the plan of the borough president to asphalt the whole length of the avenue.

The Board of Estimate has authorized the following public improvements for Brooklyn,

N. Y., aggregating an expenditure of $200,000; work will begin immediately: Paving with granite block a strip 20 ft. wide and centrally located in Flatbush Ave. between Avenues N and U. Estimated cost, $12,200. Regulating and grading, where necessary, Diamond St. from Meserole Ave. to Greenpoint Ave., and paving with asphalt, from Meserole Ave to Calyer St., and with granite block, from Calyer St. to Greenpoint Ave.; estimated cost, $10,600. Paving with asphalt, Dumont Ave., from Van Sicklen to Schenck Ave.; estimated cost, $3,400. Paving with asphalt, Sunnyside Ave., from Vermont St. to Miller Ave; estimated cost, $3,500. Paving with asphalt, Himrod St., from St. Nicholas Ave., to the borough line; estimated cost $2,300. Paving with asphalt, East 31st St., from Beverley road to Tilden Ave.; estimated cost, $3,200. Regulating and grading 53rd St., from New Utrecht Ave. to 18th Ave.; estimated cost, $12,500. Regulating and grading Sutter Ave., from Berriman St. to Montauk Ave.; estimated cost, $1,400. Regulating and grading Livonia Ave., from Barrett St. to Hopkinson Ave.; estimated cost, $4,300. Grading to a width of 24 ft. on each side of the center line 89th St., from 3rd Ave. to 4th; grading to a width of 20 ft. on each side of the center line, from 4th Ave. to 5th, and curbing and flagging, from 3rd Ave. to 5th. Estimated cost, $4,800. Regulating and grading Montgomery St., from Bedford Ave. to Rogers; estimated cost, $9,800. Grading Lott Ave. from East 98th St. to Junius; curbing from Amboy St. to Bristol, and curbing from Amboy Watkins St. to Junius; estimated cost, $11,200.

The Board of Control of Rochester, N. Y., has awarded a contract for the paving of Arnett St., with brick to Hagaman, Miller & Hagaman for $52,012.

The Sicilian Asphalt Paving Co., 41 Park Row, New York, N. Y., has been awarded the contract by the Park Board, Department of Parks, New York City, for reconstructing the roadway of the Bronx and Pelham parkway, including surfacing with asphalt earth mixture from its junction with the eastern boulevard to the tracks of the N. Y., N. H. & H. Ry., Harlem River branch in the borough of the Bronx, for $18,334. Bids were opened Aug. 18.

The Sicilian Asphalt Paving Co., 41 Park Row, New York, N. Y., has been awarded a contract by the department of parks of New York City for the construction of rock asphalt mastic where directed on the walks of Central Park and other parks in the city for $29,425. Bids were opened Aug. 18.

Ohio.

✣Director of Public Service of the city of Ashtabula, O., will receive bids until noon, Sept. 16, for furnishing the necessary labor and material for the improvement of Mill St. from Mill St. to Fern St., and Strong St. from Hope St. to Fern St., and Strong constructing a sewer therein, according to the plans and specifications on file in said office. The work includes approximately: 1,916 lin. ft. of 8-in. sewer, 5 manholes, 2 manhole and flushtanks combined, and all other labor, material, branches and appurtenances. Bidders must use the proposals furnished by said city, which may be obtained at the office of the Engineer of the Department of Public Service, and they must comply with the "Instructions for Bidders" therein contained. A. J. Richardson, Clerk Department of Public Service, Ashtabula, Ohio.

✣Bids will be received by B. M. Cook, Village Clerk, Lakewod, Ohio, until noon, Sept. 19, for the necessary labor and material for the construction of pavement on Northland Ave., from Detroit to West Madison Ave., and on Franklin Ave., from Ridgewood Ave. to Clarence Ave. Plans and specifications for the work are on file at the office of the village clerk and also at the office of the William H. Evers Engineering Co., 332 Arcade, Cleveland, Ohio.

✣Bids will be received until noon, Sept. 30, by Board of County Commissioners, Cincinnati, O., for the improvement of South Ave., and the Werk Road from the Cleves and Bridgetown Pike to the Cleves and Warsaw Pike in Green township. Stanley Struble is President of the Board and Fred Dreihs is Clerk.

✣Board of County Commissioners, Cincinnati, O., will receive bids until noon, Sept. 30, for the improvement of the Gurley Road from Queen City Ave. to Glenway Ave., in Green township. Plans and specifications are on file at the office of the Board. Fred Dreihs is Clerk.

The contract for the paving of East Cherry and North Erie Sts., in Massillon, O., has been awarded to Philip Diefenbach & Sons by the board of control. East Cherry St. will be paved from the canal bridge to North Mill St., and North Erie St., from North St., to Cherry St. Other contracts were let for the curbing and guttering of eight streets, as follows: Pearl and Dwight Sts. to George P. Williams; Wissmar, South Waechter, Green and Walnut Sts. and Woodland and Commonwealth Aves. to Urban & Schott.

Chas. Schindler has been awarded the contract for building the one mile of state road on the Holgate Pike just north of Defiance, O., for $5,840. The road is to be constructed under the supervision of the state highway commission; the state paying part of the cost and the county part.

C. S. Dellefield was awarded the contract by the village council of Amherst, O., for the macadamizing of the stretch from the corporation line to Johnson's hill.

City Engineer Robert Hoffman of Cleveland, O., has forwarded a report to Councilman Dittrick showing the list of owners of property along the lake front from Edgewater park to Rocky river. This list was prepared at the request of Mr. Dittrick, who is planning in conjunction with Public Service Director Lea to call a meeting of interested property owners for the purpose of discussing plans for the proposed lake front boulevard.

The foll wing bids were received by the Board of Control of Columbus, O., for the paving of North High St., from Fifth Ave., north to North Columbus St.: Andrews Asphalt Paving Co. of Hamilton, O., $70,929, on asphalt, being the lowest bid; Cleveland Trinidad Paving Co., $77,138; A. G. Pugh, $81,178; William Graham, $84,260; A. C. Pugh, $77,614, on brick, being the lowest bid; William Graham, $102,586, on asphalt block; A. G. Pugh, $137,554, on stone brick.

The Board of County Commissioners at Youngstown, O., have passed upon the proposed widening of the Early road between Shehy and Oak Sts., and McGuffey St., a distance of one mile. The road will probably be widened to a width of 50 ft.

The contract for macadimizing one mile of the Dayton and Troy pike, beginning at Stop 10 and ending at a point near Chambersburg, was awarded by the county commissioners at Dayton, O., to Frank Tejan for $5,291.

The Reading, O., City Council has let contracts to Micheal Ross to improve Bonnell Ave., with macadam and a cement curb and gutter, and to August Smith to make cement curbs and gutters in Pearl, Harms and Reading Sts., in that village.

The Engineer of the State Highway Board of Ohio has submitted an estimate of the cost of building a sample of road under its plans, specifications and supervision to the county commissioners at Cincinnati, O. The Lawrenceburg and Harrison road in Whitewater township, 2.9 miles in length, is the road to be rebuilt by the state board. The estimated cost is $28,562.50 for the material and labor, and $937.50 for engineering, inspection, etc. Total is $29,500, of which the state pays $6,348.34 and the county $23,151.66. The offer has been accepted by the commissioners.

The County Surveyor has submitted specifications to the County Commissioners at Cincinnati, O., for resurfacing and oiling of Cooper Ave., from Reading pike to Montgomery pike with estimate of cost, $15,398, which were approved. The specifications for South Ave., and Werk road from Cleves to Cleves and Warsaw pike, estimated to cost $8,816 were also approved. The surveyor also submitted a revised estimate, $9,437, for improvement of Gurley road from Queen City Ave., to Glenway Ave.

The John Ruehl Construction Co., the only bidder for the improvement of the Harrison and New Haven road from Harrison pike to the Miami River at New Baltimore bid $29,325. The county commissioners of Hamilton County, Cincinnati, O., will probably award the contract to this firm.

Advices from Millcreek Valley, Cincinnati, O., state that Springfield Township Trustees are planning to improve a number of county roads this fall. Specifications have been prepared for the improvement of the following roads: McKelvey, south of Compton bridge; Wayne Ave., near Respass farm; Winton road, between Compton road and Van Zant road; Ridgeway, Forest and Laurel Aves., Williamsdale; Winton road between Cameron road and Science Hall School; Winton road, between Cameron road and Hartbrook's place; Grove Ave. south of Riddle road; Bank Lick road, east of Springdale; McKelvey road, east of Heady farm. W. A. Van Cleve is township clerk.

Edward Rvan was the low bidder for the work of paving three streets in Springfield, O., with asphalt. Mr. Ryan bid $1.75 per sq. yd. for asphalt and $1.65 per sq. yd. for brick. The board of control will probably award the contract at once.

Advices from Canton, O., state that the commissioners and trustees of Jackson township agreed to jointly improve the Crystal Springs and Canal Fulton road, along the canal for a distance of 500 or 600 ft. Tiling will be placed along the canal bank and the roadway raised about 4 ft. It is estimated that the work will cost $1,400.

The John Reubel Construction Co., Hayes Ave., Cincinnati, O., has been awarded a contract by the county commissioners at Cincinnati, for the improvement of the Harrison and New Haven road from Harrison pike to the Miami River bridge at New Baltimore, Harrison and Crosby townships, for $29,267. Bids were opened Aug. 26.

Oklahoma.

✣As mentioned under "Doings of the Week" in our last issue, bids will be received by Bob Parman, City Clerk, Oklahoma City, Okla., until 5 p. m., Sept. 19, for the construction of 16.75 miles of asphalt, a total yardage of 302,670 sq. yds. The estimated cost of the work is $984,937. The following streets are included in the work: 11th St., from Olie to Western, 26 ft. roadway, .05 miles; Central Ave., from 10th to 6th St., 26 ft. roadway, .26 miles; Poplar Ave., from Harvey to Santa Fe Ry., 40 ft. roadway; Hudson Ave., from Ave. "A" to Ave. "D," 30 ft. roadway; "B" Ave., Broadway to Walker Ave., 30 ft. roadway; Seventh St., from Stonewall to Lottie, 26 ft. roadway, .22 miles; Linwood Blvd., from Western to 10th St., 1.12 miles; Linwood Blvd., from 10th to 16th St., 1.60 miles; Linwood Blvd., from 16th St., to Grand Blvd.; 16th, 17th and 18th Sts., from Linwood to Independence St., 20th and 21st Sts. from Drexel to Independence; Drexel Blvd., from Linwood to 21st St.; Land Ave., from 16th St., to 21st St.; Independence Ave., from 17th St., to 21st St.; Young Blvd., from Linwood to 16th St.; 9th St., from Laird to East St.; Francis Ave., from Main to Reno St.; Shartel Ave., from Main to Reno St.; Dewey Ave., from Grand to Reno; Noble Ave., from Robinson to the Santa Fe Ry.; 1st St., from Western to Pennsylvania; 7th St., from Walker to Lee; Pottawatomie, from Broadway to Western; Robinson Ave., from Ash to "G" Ave.; Ave. "C" from Santa Fe Ave., to Walker; Harvey Ave., from Poplar to Ave. "G;" Avenue "A" from Robinson to Walker; 26th St., from Classen to Western; Lee Ave., from 19th St. to 22d St.; Central Ave., from 2d St., to 4th St.; Agnew St., from the alley between Hic and Ex., to Central; 37th and 38th Sts., from Classen to Western; Military Ave., from 36th to 42d; Walker Ave., from Elm to South Line of Sec. 4, T. 11, R. 3; Main St., from Ames to Pennsylvania, 24th and 25th Sts., from Robinson to Broadway; 26th St., from Robinson to the Santa Fe Ry.; Broadway from 23d to 25th St.; Walnut Ave., from 9th to 13th St.; 12th St., from Broadway to Robinson; 39th St., from Georgia to Classen; Putnam Hts. Blvd. from 38th to 39th Sts.; 31st St., from Florida to Ames. W. C. Burke is City Engineer.

✣Bids will be received until 8 p. m., Sept. 20, by W. T. Echols, City Clerk, Hugo, Okla., for furnishing the necessary labor and material for the construction of pavement, including grading, manholes, catch basins, laying of necessary drainage, tile and curb and gutter on the following streets: Railroad St., from Jackson St. to Wade St.; Dewey St., from Jefferson St.,to Wade St.; Broadway St., from Main St. to Kirk St.; Crocket St., from Duke St. to Jackson St.; Jefferson St., from Dewey St. to Broadway St.; Duke St., from Dewey St. to Crockett St.; Jackson St., from St. L. & S. F. R. R. right of way to Crockett St.; Kirk St., from Broadway St. to Dewey St.; Wade St., from Dewey St. to Railroad St.; Main St., from Broadway St. to Ethel St. H. C. Blanchard is City Engineer.

Oregon.

The City Councitl of Corvallis, Ore., has awarded a contract for paving Washington, Jefferson, Monroe and 3rd Sts., with bitulithic pavement to the Warren Construction Co., for $2.10 per sq. yd. The contract calls for a total of about 38 blocks, nearly three miles, and the total cost will be somewhat like $200,000.

The Board of Road Reviewers, Corvallis, Ore., have inspected the proposed route of a road west of the city. The road is designed to continue from Monroe St., on the west line of the city to the Philomath road.

It is proposed to extend the hard-surface improvement on Milwaukee St., in Portland, Ore., from Hogate St., to Nehalem Ave., in Sellwood. This latter part of the general improvement of the street will cost $129,474, according to the estimate of the city engineer, J. W. Morris. The general improvement of Milwaukee St., is from Hawthorne to Nehalem Aves., a distance of more than two miles, which will cost a little above $260,000, and it will be the main thoroughfare in the South East side.

Pennsylvania.

✣Bids will be received until 2 p. m., Sept. 16, by the State Highway Department, Harrisburg, Pa., for the construction of 1,076 ft. of road extending from Station 551, end of the present macadam, to Station 561-76, end of the present paving on the National road in Brownsville Borough in Fayette County.

✣Bids will be received by the City Council of Harrisburg, Pa., until Sept. 19, for the construction of pavement on 58 street sections comprising 107,500 yds. of paving and 100,600 ft. of curbing.

Work will be started soon on the state road between that now completed at Shamokin Dam to Selinsgrove, Pa. This road will make a stretch of 5 miles of perfect highway, extending all the way from Selinsgrove to Sunbury. The new road will be oiled to preserve its surface.

The City Engineer of Philadelphia, Pa., has estimated the cost of repairing the paved streets throughout the city during 1911 at $2,300,000. Director Stearns of the department of public works has asked for the following appropriations for improvements for street work: Paving intersections, $100,000; repairs to unpaved streets, $150,000; repairs to streets other than asphalt, $200,000; grading, paving, etc., in front of city property, $15,000; repaving tramway streets, $15,000; curbing, $15,000; repairs, asphalt paving, $200,000; grading roads, streets, etc., $100,000; resurfacing unpaved streets, $100,000; improved pavement, $300,000; resurfacing roads, $300,000; grading streets, $300,000; repairs to non-traction streets, $200,000; macadamizing roads, $10,000; paving street intersections, $100,000.

The city of Harrisburg, Pa., proposes to sell bonds Sept. 15 in the sum of $91,000 for paving and the construction of sewers. City Engineer M. B. Cowden has stated that if the bonds are sold the work will partly be done this fall.

The County Commissioners of Clearfield County, Clearfield, Pa., have awarded a contract to Deckman & Forsythe for the improving of the road from Shawville to the creamery at a cost of $4,000.

South Dakota.

✣Bids will be received until 8 p. m., Sept. 16, by P. L. Brown, City Auditor, Doland, S. Dak., for the construction of 5,350 ft. of sewer outlet and drain.

Texas.

The Commercial club of Corpus Christi, Tex., recently brought about a meeting of the interested parties in the San Antonio-Corpus Christi driveway to outline a plan for securing the roadway. It is probable that the road will be built this year.

County Commissioner O. P. Wolcott, Dallas, Tex., authorizes the statement that work will soon be started on the Queen's Highway road, which will connect King's Highway and the Fort Worth pike on the summit of Western Heights.

Prof. R. J. Potts of College Station, Tex., recently made a talk at the court house in Caldwell, Tex., with the result that a good roads club was organized with T. F. Gilley, President and F. H. Hitchcock, Secretary. The club will endeavor to have the roads of the county improved.

Utah.

State Engineer Caleb Tanner, acting in his capacity of secretary of the state road commission of Utah, has asked the city council of Salt Lake City for co-operation in the construction of a state road between Salt Lake and Ogden.

Advices from Ogden, Utah, state the first mile of the proposed interstate highway linking the capital cities of Idaho, Utah and Wyoming, by a well-laid macadamized public road, will be built in Ogden during the Intermountain Good Roads convention, which will be held in Ogden next month. The first link of the highway which will span three states will be built from the Riverdale bridge toward Ogden, the first work to begin with the opening of the Good Roads convention, so that the interested delegates may gather some idea of the appearance of the entire highway when it is completed. The state of Utah will appropriate $2,000 and Weber county $3,000 for that portion of the interstate highway which will pass through this county. The committee from the Good Roads association which looked over the public roads of the county decided upon the location mentioned for the first link.

Wisconsin.

✣Bids will be received until 10:30 a. m., Sept. 15, by Department of Public Works, Milwaukee, Wis., for the construction of asphalt pavement on concrete foundation and resetting the old stone curb and constructing cement sidewalks on Lisbon Ave. from Sherman Blvd. to North Ave. in 22d Ward.

✣Bids will be received until 10:30 a. m., Sept. 15, by the Department of Public Works, Milwaukee, Wis., for the paving of the roadway with brick on concrete foundation and curbing sidewalks with stone (old curb reset) on portions of streets in Second, Ninth and Tenth Wards. H. E. Briggs is Commissioner of Public Works.

✣Department of Public Works will receive bids until 10 a. m., Sept. 14, at their office, Milwaukee, Wis., for the necessary labor and material for the construction of subgrade and permanent asphalt pavement on concrete foundation and stone curb on Second Ave., from Mitchell St. to the south line of lot 13, block 1, Mitchell's subdivision, and on Windlake Ave., from Second Ave. to Sixth Ave., in the 11th and 14th Wards. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received until 10:30 a. m., Sept. 17, by Department of Public Works, Milwaukee, Wis., for furnishing the necessary labor and material for the construction of cement sidewalks and combination curbs and gutters on Eiring Place from 42d to Sherman Blvd. H. E. Briggs is Commissioner of Public Works.

✣Department of Public Works, Milwaukee, Wis., will receive bids until 10:30 a. m., Sept. 17, for furnishing necessary labor and material for grading and paving with permanent asphalt on concrete foundation Eiring Place from 42d St. to Sherman Blvd. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received by the Department of Public Works, Milwaukee, Wis., until 10:30, Sept. 16, for furnishing all necessary labor and material for grading the roadway and paving same with permanent asphalt on concrete foundation and to curb the sidewalks with stone (old curbing reset) on Holton St. from Reservoir Ave. to North Ave. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received by the Department of Public Works, Milwaukee, Wis., until 10:30 a. m., Sept. 15, for furnishing the necessary labor and material for the grading and paving with stone of portions of streets in 10th, 11th, 20th and 22d Wards.

W. F. McGovern has been awarded a contract in Milwaukee, Wis., for the paving of Pleasant St., from Milwaukee River to N. Water St., with sandstone for $3.09 per sq. yd. Bids were opened Aug. 20.

The Department of Public Works of Milwaukee, Wis., has awarded the following contracts for the construction of brick pavement on several streets; bids opened Aug. 19: Badger Construction Co., for $1.92 for paving Michigan St., from Jefferson St. to Lake St.; R. M. McGucken for $1.96 for paving 7th St., from Walnut to Germania St.; at $2.08 for paving Lincoln Ave., from Forest Home Ave., to W Ave.; at $1.95 for paving Park St.

The Badger Construction Co. has been awarded a contract by the department of public works of Milwaukee, Wis., for grading and paving the roadway of 16th St., from Grand Ave., to Cedar St., for $2.39. Bids were opened Aug. 20.

WATER-WORKS AND SEWERAGE

Alabama.

The city council of Tuscaloosa, Ala., has adopted an ordinance providing for the laying of several miles of sanitary sewers in the western part of the city.

Arkansas.

✣Bids will be received by the City Clerk, Conway, Ark., until Sept. 15, for the construction of the Conway waterworks system. The work includes 15 miles of wood pipe mains, motor-driven triplex pumps, and a 6-mile transmission line. From a concrete reservoir the town will be supplied by gravity. Dickinson & Watkins, 609 State Nat'l Bank Bldg., Little Rock, Ark., are engineers.

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Items marked thus ✣ indicate work now open for bids.

Conway, Ark., has filed with the city council the plans for the proposed system in this county, and an estimate stating that the approximate cost of the improvement would be about $95,000. The water will be taken from Cadron creek, six miles west of Conway.

Contracts have been let in Sercy, Ark., for the construction of water and sewer plants. The Pouncey Paving & Construction Co., of Helena, received the contract for the sewers and P. C. Brooks Sons of Kansas City secured the contracts for the water system. Bonds in the sum of $80,000 have been floated to pay for the two systems.

The city council of Fordyce, Ark., has approved the plans for a $30,000 sewer district which will include the entire town.

California.

A contract has been let to M. A. Elftman, of San Mateo, for the concrete work in a new 500,000 gal. reservoir, which is to be constructed in the hills back of Uplands. Pumps and pipes will be installed and the supply of water for Hillsborough, Cal., greatly increased.

The city council of Stockton, Cal., has appointed a committee consisting of D. J. O'Keefe, George H. Heimann, Robert Inglis and J. C. Dewey to interview the owners of the Boggs tract to see whether or not arrangements can be made for its purchase. It is desired to establish a sewage farm and septic tanks to dispose of the city's sewage. A bond issue will probably be submitted to the people to obtain funds to purchase the tract and establish the proposed system.

The city of Lordsburg, Cal., will install a municipal water system. Olmsted & Gillelen, 804-5 Wright & Callender Bldg., Los Angeles, Cal., Engineers.

Colorado.

✣Bids will be received by J. P. Burke, City Clerk and Recorder, Sterling, Colo., until 7:30 p. m., Sept. 16, for sanitary sewer in District No. 2, as follows: 3,805 lin. ft. 10-in. pipe sewer; 5,500 lin. ft. 6-in. pipe sewer; 14 6-in. "Y-s" off 10-in. pipe; 168 6-in. "Y-s" off 8-in. pipe; 34 Manholes complete with covers and rings; 4 300-gal. flush tanks; dirt work on 10-in. sewer; average cut 3.7 ft.; dirt work on 8-in. sewer; average cut 4.1 ft.

Delaware.

Advices from Dover, Del., state that work preparatory to establishing the Wyoming and Camden water works system is being advanced rapidly. Artesian wells will be sunk.

Illinois.

✣Bids will be received until Sept. 27 by Charles Pope, Village Clerk, Depue, Ill., for sinking an artesian well at that place, to be 1,300 feet deep. Specifications can be obtained from the clerk.

✣Bids will be received until 8 p. m., Sept. 20, by the President and Board of Trustees of the Village of Lyons, Ill., for furnishing and erecting a deep well pump, motor and accessories. A. E. Depew is Village Clerk.

Following were the low bids as opened by the Board of Local Improvements, City of Chicago, Charles A. V. Standish, Secretary, Room 300, City Hall, for the laying and constructing of sewer drains in the following streets: E. 75th St., Paxton to Railroad Ave., John W. Brunt, 2447 E. 74th St., Chicago; E. 93rd St., Anthony Ave. to Colfax Ave., contract price, $0.54 per lin. ft., Robert Carmini, 565 W. Taylor St., Chicago; E. 95th St., Michigan Ave. to Cottage Grove Ave., contract price, $0.56 per lin. ft., Robert Carmini, 565 W. Taylor St., Chicago; Burnside Ave., Cottage Grove to St. Lawrence Ave., contract price, $0.40 per lin. ft., Langley Ave., Burnside Ave. to E. 95th St., Champlain Ave., Burnside Ave., to E. 95th St., contract price, $0.40 per lin. ft., St. Lawrence Ave., C., R. I. & P. Ry., to E. 95th St., contract price, $0.38 per lin. ft., Robert Carmini, 565 W. Taylor St., Chicago.

Contracts for sewers in St. Johns Ave., Green Bay road, and in Ridgewood Park subdivision, Highland Park, Ill., have been awarded to the Stevens Construction Co., at $3,524.

The new sewer system proposed for the northeast portion of Rockford, Ill., will practically drain all the territory north of State street, and east of Longwood. The system will consist of a concrete tunnel, six feet in diameter, for a mile from its outlet, and a concrete tunnel of slightly less diameter for almost another mile, dwindling to forty-two in. in diameter before its character is changed to the sewer pipe.

Rink & Schnell, the lowest bidders for the construction of the sewer to be built in Dixon, Ill., on North Ottawa avenue, have failed to sign up the contract. The board of local improvements has instructed the city attorney to advertise for new bids on the work.

The city council of Bushnell, Ill., has received the following bids for the construction of the new sewer system proposed: Peter Simons, Quincy, Ill., $28,543; F. M. Benner & Co., Marion, Ind., $28,771; Ottawa Construction Co., Ottawa, Ill., $31,563; Hamilton Bros. Construction Co., Chicago, Ill., $26,239; Morrifield & Blair, Monmouth, Ill., $24,951. The lowest bidder was awarded the contract.

The city council of Joliet, Ill., has awarded a contract to William Moran & Co., of that city, for laying a water main in Ottawa St.

Engineer William E. Ewing, employed to prepare plans for the construction of sewers in .Summit-Argo district of Summit, Ill., has divided the district off into three districts as follows: District 1. The old village of Summit, being the territory west of Archer avenue and north of the street car line to Lyons; District 2—That part of the village embracing the subdivision of the Summit Realty Co. and the Miller-Argo Land Syndicate, extending from 55th to 59th St.; District 3—That part of the village of Summit known as F. W. McKinney's Argo subdivision, extending from 59th to 63d St., and two blocks on either side of Archer Ave. The village board proposes to issue bonds in the sum of $75,000 to the improvement.

The board of local improvements, City of Chicago, has awarded the contract for constructing tile pipe sewers with necessary catch basins and manholes in South 42d court, from West 14th street to West 15th street, to Michael Pontorelli, 4817 West Dakin street, Chicago, for $884.

The board of local improvements, Chicago, Ill., has awarded the contract for constructing a tile pipe sewer in South 43d avenue, from West 14th street to West 15th street, to Nicholas Mancini, 900 West Taylor street, city, for $871.

The board of local improvements, Chicago, Ill., has awarded the contract for constructing a tile pipe sewer in South 43d court, from West 14th street to West 16th street, to Michael Pontorelli, 4817 West Dakin street, Chicago, for $3.483.

The board of local improvements, city of Chicago, has awarded the contract for laying a water supply pipe in Vincennes road, from West 71st street to West 68th street, and thence east to State street, to Daniel Hardin, 3139 Indiana avenue, Chicago, for $2,935; 2,290 lin. ft. 8″ cast iron pipe, 65 lin ft. 6″ cast iron pipe.

The board of local improvements, Chicago, has awarded the contract for laying a water supply pipe in Warwick avenue, from North 48th avenue to North 52d avenue, to Simon Ryan, 2927 Congress street, Chicago, for $2,457; 2,660 lin. ft. 6″ cast iron pipe.

The board of local improvements, Chicago, has awarded the contract for laying the water supply pipe with necessary fittings in North 68th court, from Fullerton avenue to Belden avenue, to Simon Ryan, 2927 Congress street, Chicago, for $1,095; 873 lin. ft. 8″ cast iron pipe.

The board of local improvements, Chicago, has awarded the contract for laying a water supply pipe with necessary fittings in West 36th street, from S. Sacramento avenue, to a point 200 ft. west of west line of California avenue, to Simon Ryan, 2927 Congress street, Chicago, for $1,192; 1,186 lin. ft. 6″ cast iron pipe.

The board of local improvement, Chicago, has awarded the contract for laying a water supply pipe with necessary fittings in West 37th place, from west line of Washtenaw avenue, to a point 400 ft. west, to Simon Ryan, 2927 West Congress street, for $454; 400 lin. ft. 6″ cast iron pipe.

The board of local improvements, city of Chicago, has awarded the contract for laying a water supply pipe in North Trumbull avenue, Turner avenue, from West 51st street to a point 600 ft. north of the north line of West 51st street to Tirtelli & Scully, 518 West Taylor street, for $714; 652 lin. ft. cast iron pipe.

The board of local improvements, city of Chicago, has awarded the contract for laying a water supply pipe in North Trunbull avenue, from Foster avenue, to Balmoral avenue, to Simon Ryan, 2927 West Congress street, Chicago, for $1,311; 1,308 lin. ft. cast iron pipe.

The board of local improvements, city of Chicago, Chas. A. V. Standish, secretary, room 300 City Hall, has awarded the contract for laying a water supply pipe with necessary fittings, in South Ada street, from West 87th street to west 85th street, to Tirtelli & Scully, 518 West Taylor street, for $1,558; 1,295 lin. ft. 8″ cast iron pipe.

The board of local improvements, Chicago, has awarded the contract for laying a water supply pipe, with necessary fittings, in South Ada street, from 95th street, to West 92d street, to Malachy Murphy, 5315 Wabash avenue, for $2,043; 2,066 lin. ft. 8″ cast iron pipe.

The board of local improvements, Chicago, Ill., have awarded the contract for laying a water supply pipe, etc., in North 49th avenue, from Belden avenue, to Humboldt avenue, to Simon Ryan, 2927 Congress street, for $676; 653 lin. ft. 6″ cast iron pipe.

The board of local improvements, Chicago, has awarded the contract for laying a water supply pipe, etc., in Loomis street, from West 85th street to West 87th street, to Tirtelli & Scully, 518 West Taylor street, Chicago, for $1,532; 1,295 lin. ft. 8″ cast iron pipe.

The board of local improvements, Chicago, Ill., has awarded the contract for constructing a tile pipe sewer with necessary manholes and catch basins in West 73d place, from Bishop to Laflin street, to Joseph Molony, 769 Forquer street.

The board of local improvements, city of Chicago, has awarded the contract for constructing a tile pipe sewer with necessary manholes and catch basins in South Laflin street, from West 60th street to West 61st street, to Tirtelli & Scully, 518 West Taylor street, for $607.

The board of local improvements, Chicago, Ill., awarded the contract for constructing a system of tile pipe sewers in West 99th street from South Leavitt street, to South Irving avenue, and in South Irving avenue, from West 99th street to West 101st street, to Simon Ryan, 2927 Congress street, for $2,806.

Indiana.

We are advised that plans are completed for the construction of the waterworks system for Dunkirk, Ind., and bids will be received in about two weeks. The work to be constructed consists of brick pumping station, gasoline engine and pump, 50,000-gal. water tank and tower and about 19,000 ft. of water mains. Chas. Brossman, Union Trust Bldg., Indianapolis, Ind., is the consulting engineer.

W. F. Brunt, of Hammond, Ind., has been awarded the contract for the construction of the new sewer in Libertyville, Ill., for $11,028 by the board of local improvements of that city.

Michaels & Minnieli, of Marion, Ind., have been awarded the contract for the construction of the southwest main sewer for $8,675. The work includes vitrified pipe from 12-in. to 20-in., concrete and cast iron pipe of 30-in. diameter. Bids were opened Sept. 5.

Iowa.

✣Bids will be received by Sam Middleton, City Clerk, Eagle Grove, Ia., until noon, Sept. 19, for the construction of a sanitary sewer and drainage sewer in Dakota St. and Lincoln Ave., in that city. The approximate

Items marked thus ✣ **indicate work now open for bids.**

quantities are as follows: 340 ft. of 8-in. and 1,126 ft. of 12-in. pipe.

✣City Clerk W. E. Klingaman, Vinton, Ia., will receive bids until 8 p. m., Sept. 20, for the construction of about 1,600 ft. of 8-in. sewer, including three manholes and one flush tank.

Advices from Sioux City, Ia., state that plans have been prepared by F. W. Cappelen for the construction of a waterworks system for Morningside. Providing the plans are satisfactory to the city council, it may be possible to give similar service to the north end.

A sanitary sewer is to be constructed in Grandview Ave., Dubuque, Ia., from the present sewer in Grandview at Dodge St., south over Grandview to South Dodge, thence over South Dodge to Dodge. The specifications call for an 8-in. tile pipe. Paul Idg is city engineer.

The citizens of Cambridge City, Ind., have voted the issuance of bonds in the sum of $8,000 to improve the municipal water and light plant. Plans for the improvement will soon be prepared.

C. P. Chase, representing the Iowa Engineering Co., has submitted the report of their survey with plans and specifications for a general sewerage system for DeWitt, Ia. The plans call for a three-main sewer extending from the Northwestern railway north on East, Jefferson and Far West Sts., to the north limits of the city, making about three miles of sewerage. The estimate given by the engineers was a cost of about $4,500 a mile, with one septic tank below the slaughter house to be constructed at a cost of about $1,500 or $2,000. The entire cost of the proposed system is estimated at $17,000.

Kentucky.

The following firms have submitted estimates for the construction of Section F of the Beargrass sewer, in Louisville, Ky., bids on which were received Sept. 2.: The Henry Bickel Co., of Louisville; the American Engineering & Construction Co., of Chicago; James Ferry & Sons, of Pittsburg, and Lynch & Eady, of Louisville. Charles P. Weaver, secretary of the sewer commission, has stated that the commission would take the bids under advisement and probably award the contract within two weeks.

City Buyer R. B. Green of Louisville, Ky. has awarded the following contract, subject to the approval of the city council: P. Bannon Sewer Pipe Co., for furnishing sewer pipe in all sizes from 4-in. to 36-in., delivered at the work; the Louisville Brick Co., for furnishing hard brick for sewers and repair work for $7.50 a thousand, delivered at the work; Charles Stiglitz & Sons for furnishing sewer caps and castings.

Michigan.

Alderman Gray, of the First ward, Saginaw, Mich., has asked for the construction of a 12-in. vitrified tile pipe sewer in Seventh St., between Kirk and Norman.

The village board of Grandville, Mich., has decided upon the construction of a waterworks system in that place. The plans have not yet been completed.

E. M. Scheflow is the probable contractor for the construction of a trunk sewer and appurtenances in Owosso, Mich., for $6,700, for which bids were opened Sept. 8.

New York.

✣Bids will be received by Donald F. McLeod, City Engineer, Ithaca, N. Y., until 7:30 p. m., Sept. 28, for clearing of a reservoir site of about 40 acres, and for the construction of an earth embankment containing about 5,000 cu. yds. For the construction of a dam containing about 7,700 cu. yds. of concrete and requiring the excavation of about 4,300 cu. yds. of rock. The furnishing and laying of about 9,000 ft [illegible] pipe.

✣Bids will be received by the Board of Water Commissioners, Roslyn, N. Y., until 11 a. m., Sept. 19, for the construction of a water works system including approximately 1,600 tons of cast iron pipe, 40 tons of special castings, 125 fire hydrants, 148 valves and boxes, brick and concrete pumping station, two triplex pumps and two 50 h.p. gas engines with gas producers, and laying about 14 miles of pipe. Plans and specifications are on file at the office of Walter E. Sexton, Mineola, N. Y., Engineer, and may be obtained from him for $5.

Ohio.

✣Bids will be received by the Director of Public Service, Canton, O., until noon, Sept. 14, for furnishing the necessary labor and materials for the construction of a sanitary sewer in St. Elmo St., from Lake St. to Aultman Ave. In Dorn alley from Charles St. to Lot No. 423. In Warner Ave. from 9th St. to 8th St., and in 8th St. from Warner Ave. to Belden Ave. for the construction of a Storm Water Sewer in Cedar St., from Cleveland Ave. to Dewalt St., and in Dewalt St., from Cedar St. to Raynolds St.

✣Bids will be received until Sept. 22 by the Board of Trustees of Public Affairs, Port Clinton, O., for the construction of municipal filtration plant for the municipal water supply, including low service pumps, coagulating devices, wash water pump and air blowers. The plant is to have a capacity of 1,500,000 gals. W. G. Clark, 1048 The Spitzer, Toledo, O.

Pennsylvania.

✣City Council of Meadville, Pa., will receive bids until noon, Sept. 17, for the construction of a sanitary sewer on Steers Alley from Plum Alley east 260 ft.

Utah.

✣Board of Public Works, Salt Lake City, Utah, will receive bids until 8 p. m., Sept. 16, for the construction of pipe sewers in Sewer Extension No. 274 on Church St., to connect with the gravity outlet sewer on Fifth South St. Plans and specifications are on file at the office of the Board of Public Works or City Engineer.

Virginia.

✣Bids will be received until 4 p. m., Sept. 15, by Col. C. E. Bolling, City Engineer, Richmond, Va., for the construction of the following sewers: Dooley Ravine sewer, brick and concrete, length 3,800 ft., diameter from 8 to 11 ft. Virginia Ave. sewer, length 3,000 ft., diameter 8 ft., brick and concrete (principally tunnel work in rock). Sewer in Leigh St., to Government Road, brick or concrete, length 2,600 ft., diameter 5 ft.

✣Bids will be received until noon Sept. 20, by W. L. Craft, City Clerk, Roanoke, Va., for the construction of the sewer to accommodate the properties abutting on both sides of Gilmer ave., n. w., between 12th and 17th Sts. F. L. Gibbony, City Engineer, has plans and specifications on file at his office.

The Winchester, Va., common council has appropriated funds for the installation of two large additional sewage disposal beds in order to carry out the original plans of the engineer.

Washington.

Contracts have been awarded by the City Council of Hoquiam, Wash., to the Aberdeen Construction Co., of Aberdeen, for street and sewer improvements amounting to more than $48,000. Among the contracts is the K St. trunk sewer, which will be the beginning of a main trunk sewer system to drain the entire west side of the city.

A recommendation has been forwarded to the city council of Everett, Wash., for the granting of the proposed trunk sewer to serve Capitol Hill and vicinity.

Canada.

✣Bids will be received by the City Clerk of Trenton, Ont., for the construction of Main St. sewers and sewage sedimentation tank. The work includes approximately the construction of the sedimentation tank in concrete and laying 890 ft. of 15-in., 665 ft. of 12-in. and 987 ft. of 8-in. sewer. T. Aird Murray, 303 Lumsden Bldg., Toronto, Ont., is Engineer.

A contract has been awarded to John Mazine of 196 Spadina Ave., Toronto, Ont., for the construction of a sewer on Spadina road from Walmer road to the city limits, Toronto, for $4,003. Barber & Young, 57 Adelaide St., East Toronto, are the engineers. Bids were opened Aug. 29.

NOTICE FOR BIDS.

Sealed bids will be received until 1 o'clock noon October 1st 1910, by Henry C. First, chairman, Coal Valley Rural Road Committee, Moline, Illinois, for excavating and grading said road; beginning at the N. W. cor. of S. W. quarter of N. E. quarter Sect. 21, Twp. 17 N., R. 1 W. of 4th P. M., thence South in center line of Sects. 21, 28, and 33 to the center of said Sect. 33, constituting the 1st Section of said road; also beginning at the N. W. cor. of Sect. 3, Twp. 16 N., R. 1 W. of 4th P. M., thence South along Section Line one and one-half (1½) miles, constituting the 2d Section of said road.

The estimated quantities required for said grading are approximately as follows and may be more or less:

1st Section—

6,600 Cu. Yds. Earth excavation @ average haul of 50 to 80 feet.

2,850 Cu. Yds. Earth excavation @ average haul of 150 to 175 feet.

3,950 Cu. Yds. Earth excavation @ average haul of 200 to 225 feet.

1,780 Cu. Yds. Earth excavation @ average haul of 300 feet.

5,040 Cu. Yds. Earth excavation @ average haul of 425 feet.

2,200 Cu. Yds. Earth excavation @ average haul of 550 feet.

4,830 Cu. Yds. Earth excavation @ average haul of 725 feet.

7,110 Cu. Yds. Earth excavation @ average haul of 1,000 feet.

2d Section

1,775 Cu. Yds. Earth excavation @ average haul of 160 feet.

5,865 Cu. Yds. Earth excavation @ average haul of 200 to 250 feet.

10,500 Cu. Yds. Earth excavation @ average haul of 300 to 400 feet.

6,335 Cu. Yds. Earth excavation @ average haul of 650 feet.

2,990 Cu. Yds. Earth excavation @ average haul of 1,000 feet.

Separate bids will be required for Section 1 and Section 2 of said road, respectively, and each bid must be accompanied by a certified check for not less than 5 per cent of each bid, drawn upon some responsible bank and made payable to Moline Trust and Savings Bank, trustee, as guarantee of good faith. Said checks to be returned upon execution of contract.

The said committee reserves the right to reject any or all bids.

CLARK G. ANDERSON,
Engineer, Moline, Illinois.

U. S. ENGINEER OFFICE.—Duluth, Minn., Aug. 23, 1910. Sealed proposals for furnishing and placing granite riprap at the upper entrance to Portage Lake Canals (Keweenaw Waterway), Mich., will be received here until noon, Sept. 23, 1910, and then publicly opened. Information on application. GRAHAM D. FITCH, Lt. Col., Engrs.

PROPOSALS FOR BARGES AND FLAT BOATS. U. S. Engineer Office, Customhouse, St. Louis, Mo., September 7, 1910. Sealed proposals for building, leasing or selling 1 to 20 barges and for building 5 to 50 flat boats, of wood or of steel, will be received at this office until 11 a. m., October 7, 1910, and then publicly opened. Information on application. CHAS. L. POTTER, Major, Engrs.

(Proposal Advertisements Continued on Page 51.)

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CHAS. S. HILL . . . . Editors
C. T. MURRAY . . . . Editors
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A Lesson in Co-Ordination.

There is a delightful lack of co-ordination of information and effort between the different bureaus composing the public works department of large American cities. Years ago in our largest American city there was a story current of how the Street Department worked merrily ahead beautifully paving a wide avenue while the Sewer Department followed a few blocks behind ripping up the new pavement and putting in a sewer. We do not vouch for the truth of this story, but in another column we print one equally as good and really true. In this story are told how a Building Department permitted to be built a foundation on 50-ft. piles directly over a tunnel just previously built by the Water Department some 45 ft. below ground and also what happened. What happened, to use the vernacular, "was plenty," and those who read the story will cheerfully credit the engineer with handling successfully a rather ticklish situation. We are particularly interested, however, in the final sentence of the engineer's description of his work: "The city of Chicago paid the bills." Incidentally, it may be noted, the "bills" amounted to $325,000.

Next to the skill exhibited by the engineer in meeting the technicalities of his task we admire most the restraint shown in his final remark. A total of $325,000 is a fairish sum of money even for a big city. It would go a considerable way toward clean streets or in providing the building department with enough inspectors really to watch over new work. It was spent, however, to rebuild private property and restore a public works damaged by a private citizen. Why? Because the Building Department did not know, when it gave permission to drive piles 50 ft. deep, that underneath, the Water Department had some time before built a tunnel only 45 ft. deep. Why the Building Department did not know we cannot say, nor have we cared to inquire. Perhaps the Water Department never gave the information or perhaps it gave it and the Building Department had not recorded it or had overlooked the record. It doesn't matter much how the Building Department failed to know, or, perhaps, to remember; the essential fact is that it didn't, and "the city of Chicago paid the bills."

Another interesting feature of this accident is its demonstration of the possibility of a rather serious break occurring in a large water supply tunnel without cognizance by the Water Department officials. Incidentally the fact had been overlooked that the provisions made for closing off the tunnel so that it might be laid dry for inspection had, from various causes, become inoperative. It took three months to restore these provisions and to construct a new pumping shaft and connect it with the tunnel. We leave the reader to learn the details of this incidental work from the article in another column. The essential matter is that ordinary co-ordination of the work of the two responsible bureaus would have obviated all the trouble. Chicago is not alone in this species of mismanagement, it exists to a greater or less extent in every large American city.

Methods of Finishing Concrete.

There is a small school of concrete workers which holds that the rough, board welted surface left by the forms is the only concrete finish that is truly artistic. Popular tastes, however, approves a finer finish. Now as fine a surface finish as desired can be given to concrete—it may be made to take a very satisfactory polish and it may be tinted in a variety of shades. The real question in any case is merely a question of reasonable cost. The committee report on concrete finishes which is printed in another column of this issue, is deficient in cost data. Otherwise it is in all respects the most complete summary of methods of finishing concrete that has ever been made and as such is worthy of careful study.

In glancing over the variety of methods of finishing concrete which are listed in the report one is compelled to notice the almost complete breaking away that has taken place from the idea of molding concrete to a perfect finish or surface. We speak, of course, of plain run concrete surfaces. Moldings, ornaments, etc., are still molded and probably best molded for most work to perfect surface. But ten years or so ago it was the prevailing practice to seek surface finish by minute care in building the forms or molds. Builders of concrete work whose experience runs back a dozen years will recall the almost cabinet work finish of form facing which was required, the covering of the forms with paper, the puttying of joints, etc. These requirements are rarely met with at present, though the demand for careful finish is more common in all concrete work than formerly. Except when the method of producing the finish necessitates the removal of the forms while the concrete is green this factor of form construction does not enter largely into the problem of surface finish as this problem is now regarded.

There are few features of concrete work on which the general contractor is so likely to go wrong in estimating as the cost of surface finish. This comes, of course, from the want of good cost data. Contract prices for finishing are particularly misleading. This comes from the fact that few contractors have accurate costs on which to base estimates, and also from the fact that finish is regarded as one of the incidental items and is either lumped in with the total price or, if required to be bid on as a separate item, is put at some approximate figure, on the reasoning that any error which may result will be taken care of by the general profit on the job. It is to be regretted, therefore, that the committee did not find time to enter more in detail into the matter of costs than its report shows.

Concrete Mixers for Culebra Cut.—The work of placing concrete in the sides of Culebra Cut of the Panama Canal will be begun as soon as mixing plans, for which the Central Division has placed a requisition, can be delivered from the States. The first concrete placed will be in retaining walls on the east side of the cut at both ends, Bas Obispo and Paraiso, where the excavation has advanced far enough to permit the construction of the walls. These walls will be built on the berm at 95 ft. above sea level, and will keep material from sliding down the bank into the channel of the canal. In the plant on requisition, two 1 yd. mixers are specified, one to dump into a portable placing tower, and the other to dump into buckets which will be handled by crane. The work at Paraiso and Bas Obispo will give an opportunity to test the efficiency of the two methods of placing concrete.

Both plants will consist of three units—the mixers, the placers, and the storage bins. The mixers will be rotary, discharge by tilting while running, equipped with automatic water tank with a gage so set as to measure a uniform quantity of water into each batch of concrete, capacity 27 to 31 cu. ft. per batch, and from 30 to 35 cu. yds. of concrete an hour, to be run by steam power, soft coal burner.

In the portable tower plant the mixer and tower will be mounted on a specially constructed flat car, 10 or 12 ft. gage, constructed with necessary end timbers, so that couplers can be attached to allow the hauling or pushing of the car along the retaining wall by a switch engine. The mixer will be equipped with power charging attachment, or side loader, with frame extended so as to allow the skip to be dropped to the ground level for a low-feed level. The elevator will be run on a steel tower so constructed that it can be shipped in several parts assembled on the Isthmus. The mixer will discharge into a bucket which can be raised to any height up to 55 ft. and tipped, so as to deposit the concrete in the wall at any point. The elevator will be operated by a hoisting engine, and both it and the mixer will be supplied with steam from the same boiler.

The mixing plant with side discharge, so as to dump into a bucket to be handled by a locomotive crane, will be mounted on a standard canal flat car. On one side will be a side leader, with frame extended downward to permit the assembling of the batch of rock, sand and cement in the skip on the track level. The mixer and side loader will be operated by the same engine. The mixer will discharge on the opposite side of the flat car into a receiving hopper or temporary chute, with a capacity of two batches of concrete. This hopper will be so attached that it can be taken off in case it is desired to discharge direct into the footings of the retaining wall through a wooden chute, to be supplied by the commission.

High grade material must be used in both plants, and the equipment must be made strong enough to stand hard, continuous usage for three or four years. The steel must be well cleaned by sandblast and given a coat of red lead before shipment. The contractor will furnish instructions for erecting the plant and keeping the equipment in order.

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CONCRETE AND REINFORCED CONCRETE SECTION

Construction Plant and Methods for Building an 85,000 Cu. Yd. Rubble Concrete Dam.

A storage reservoir of 2,750,000,000 cu. ft capacity is being constructed to supply water for the Rome level of the New York State Barge Canal, by building a rubble concrete dam across the Mohawk River near Rome, N. Y. This dam is known as the Delta Dam and its construction includes besides the building of a dam proper on the Mohawk River some 5 miles north of Rome, relocating about two miles of the Black River Canal, as the present channel will be submerged by the proposed reservoir; clearing the land for the reservoir, and the removal of buildings from within its limits.

The area of the drainage basin of this reservoir is about 137 square miles, extending northerly along the east branch of the Mohawk River to Mohawk hill, and along the Lansing Kill to within about 2 miles of Boonville. The water-supply from this source will be fed down the river to Rome, where the river will enter the Barge Canal. In this vicinity the canal will be provided with spillways so as to waste back into the river any surplus water not needed for canal purposes.

The reservoir will cover an area of 4⅓ square miles, when the water stands at the crest of the dam. About 4.8 square miles of land will be acquired by the State, in order to provide margins around the reservoir. This area will be cleared of all trees and brush to within about 3 ft. above the surface of the ground The reservoir will have a capacity of about 2,750,000,000 cu. ft.; its maximum depts at the dam will be about 70 ft., while the average depth of its whole extent will be about 23 ft. The reservoir will wipe out the village of Delta and will extend northerly to the village of Werternville, submerging, however, only a few houses on the outskirts. In all, some 295 buildings, including about 70 dwellings, will have to be removed from the site. About five miles of highways will be submerged. These will be replaced, as far as necessary, by new highways located above the high-water line. The reservoir will also submerge two cemeteries and several private burying lots. The bodies in the cemeteries will, of course, be removed and buried outside the limits of the reservoir.

The dam will be about 1,100 ft in length and 100 ft. high from the crest to the lowest foundation, and will contain about 85,000 cu. yds. of cyclopean masonry. It will be provided with a spillway 300 ft. long, near its center. The water passing over the spillway will fall into a pool below, which will act as a water cushion and break the force of its fall. The minimum depth of the water in this pool will be 10 ft. A gate-house, east of the spillway, is to be constructed and provided with four 60-in. cast iron discharge pipes, having a combined capacity of about 3,800 cu. ft. per second, with water in the reservoir standing at the crest of the dam. The governing requirements in designing these pipes was to provide a sufficient discharging capacity to regulate the flow in time of summer floods, to a maximum of 2,500 cu. ft. per second, it being estimated that about 500 cu. ft. per second might pass into the river between the dam and the point where the river will enter the Barge canal, and 3,000 cu. ft. per second being considered the maximum rate of flow which should be allowed to pass into the canal at Rome during the navigation season. Each discharge pipe will be provided with a 5x5-ft. rectangular sluice-gate at its upper end and a 48-in. gate-valve at its lower end. Above the sluice-gates, in the upper gate chamber, stop planks are to be provided for use in cases of emergency.

As the reservoir will submerge about two miles of the existing Black River canal, it will be necessary to relocate the portion between a point a few hundred feet below lock No. 7 and a point a few hundred feet above lock No. 13. These seven existing locks will be submerged or abandoned. Four new locks will be used in the relocated line, one, with a lift of 12.1 ft., being in the bed of the existing canal at the beginning of the new channel. At the southern end of the reservoir site the present canal runs on the west side of the river. The new waterway will extend across the river valley and by a flight of three combined locks, of 20.6 ft. lift each, located southeast of the dam, it will ascend the east bank of the river and skirt the east shore of the reservoir to a junction with the old canal. The new canal will cross the river some 400 ft. south of the dam, on a reinforced concrete acqueduct about 205 ft. long, resting on two abutments and five piers.

The existing highway bridge over the river near lock No. 7 will be moved down-stream some 30 ft., raised about 12 feet in elevation and placed on new abutments. A new steel highway and change bridge will be placed across the canal just above the proposed new lock No. 7. A new highway will be constructed from the end of this bridge, joining the existing highway a few hundred feet north. The locations of these several structures are indicated on Fig. 1.

The estimated yield of the reservoir in the driest years is about 188 cu. ft. per second. The outflow from the reservoir will follow the natural channel of the Mohawk down to the point where the Barge canal crosses the river at Rome. In times of minimum flow

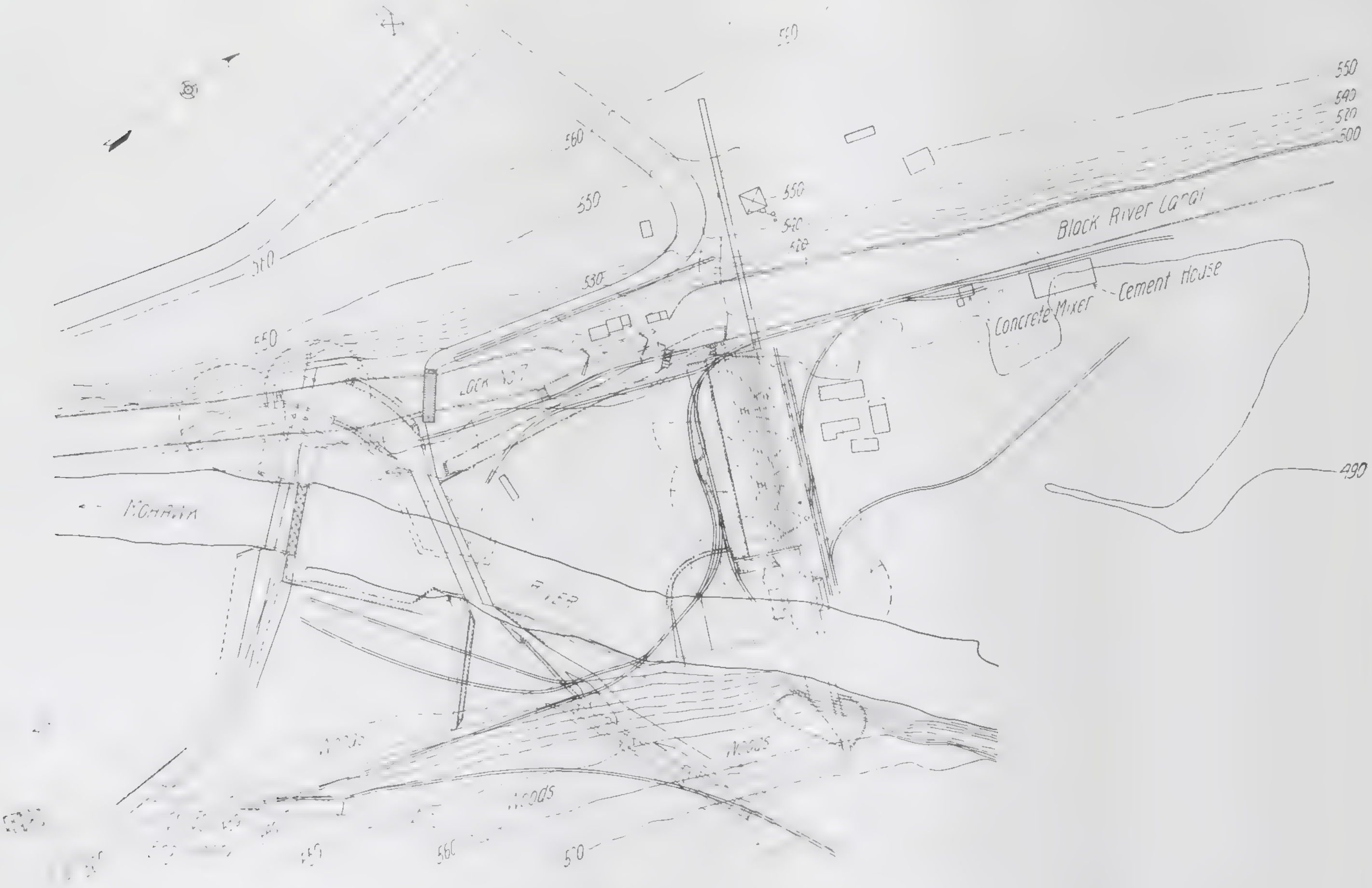

Fig. 1—General Plan of Delta Dam Showing Layout of Contractor's Plant.

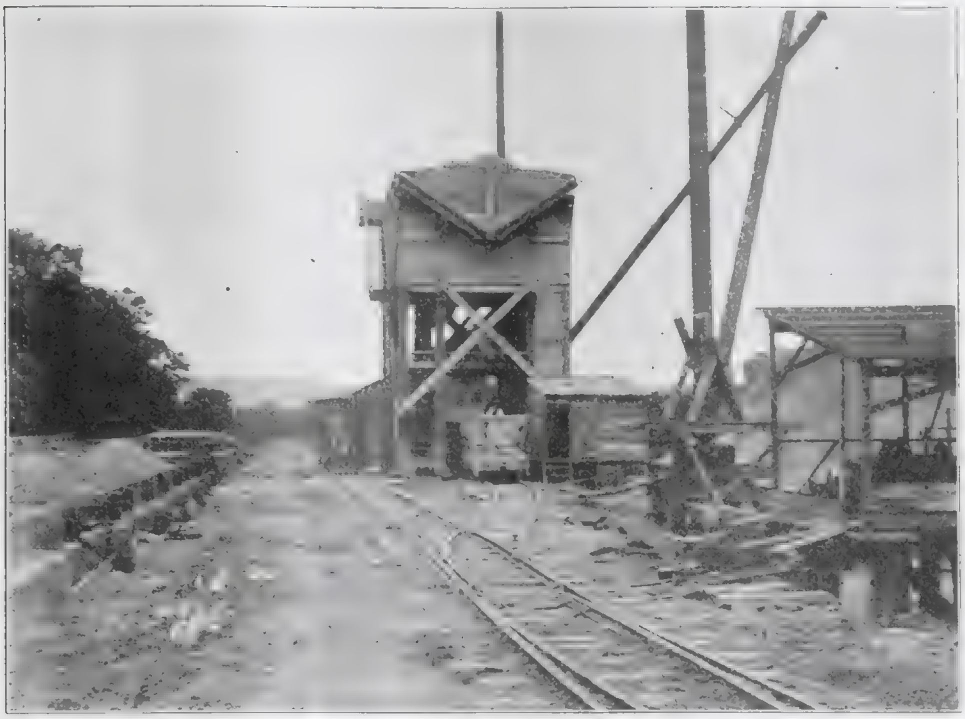

Fig. 2—View Showing Concrete Mixing Plant.

the greater portion of the Mohawk river supply will there be taken into the Barge canal very much as it is now diverted into the Erie canal.

The construction work on the project was commenced in October, 1908, and is now about 57 per cent completed. The contractor has a plant on the site representing an investment of $100,000, besides that which has been installed at three different places farther up the Black River Canal for the purposes of quarrying and crushing stone, and digging sand. The cyclopean stone, a good quality of limestone which quarries with plug and feather in large and regular blocks, comes from the Sugar River quarry, about 24 miles north of the dam. The crushed limestone is prepared by the contractor's plant at Hough quarry, 17 miles north, and the sand pit is about 6 miles north along the canal. The material is brought to the work by a fleet of 40 barges which are constantly in this service. At the site of the work a derrick equipped with a clamshell unloads the material from the scows onto a stock pile or into the bins which are above the cube mixer, which is shown by Fig. 2.

Altogether there are about 3 miles of track in service at the site of the dam. The plant layout is shown by Fig. 1. Coming from the mixer the track branches off in front of the dam and runs parallel to it on both sides. On the lower side the track crosses the river and climbs at a 4 per cent grade to the switch back and from there back again, continuing up grade to the new location of the Black River Canal. Spurs are also laid to the dump below, which has provided a roadway approach to the new location of the bridge below the acqueduct, as shown. The road is a narrow gage, and is operated with dump cars and Porter locomotives. For concrete 2 cu. yd. Steubener bottom dump buckets are used. As shown by Fig. 3, about 16 derricks are in position and are used to handle all material to and from the cars and the work. These derricks are all made of western timber and are especially well rigged and set up. They are all equipped with 8x12-in. engines and steam is furnished to all stationary engines and rock drills within a radius of about 800 ft., from a central boiler plant. This plant contains four 125-HP. Fitsgibbon marine boilers of special design. Besides the main engines on the derricks, there is also a 4x6-in. swinging engine which is of special interest because of the manner of reversing it. It is arranged to reverse by using the exhaust pipe for the steam entering the cylinder. In this way the engine is reversed and operated by the use of one lever only. As shown on the plan, a carpenter shop, blacksmith shop and machine shop are located near the boiler-house and these are completely equipped. The machine shop is capable of turning out any kind of work likely to be necessary on a job of this kind.

At the central portion of the dam the excavation was carried on by a 70-ton Bucyrus steam shovel and also with Orange peel buckets operated by the derricks. The tracks which parallel the dam on both its sides cross the river here on piles, and the derricks (in their first set up) were also founded on piles. The second location of the derricks (up midway on the dam) will be the last position necessary to complete the work.

In concreting, trains of two cars are hauled, containing two 2-cu. yd. Steubener dump buckets, which are handled from the train to the forms by the derricks. About 170 cu. yds. is an average daily output for an 8-hour day, and a record of 254 cu. yds. has been made. The proportion is 1 to 7½ sand and stone. This yardage does not represent the total yardage placed, however, due to the fact that from 45 to 49 per cent of the total volume is included in the embedded stones. This is in the cyclopean masonry of the main dam. In the smaller structures from 10 to 20 per cent of large stone has been placed. The forms for the dam consisted of 2-in. dressed lumber with heavy studding and square timbers for waling. The forms were tied together by 1-in. rods or were tied by these rods to concrete previously placed. In placing a form for the next section above one previously placed, the top row of bolts of the last section were used again. They were used to bolt a timber to the concrete face and the timber acted as a support for the form above.

On the canal relocation, a 70-ton Bucyrus shovel made a cut 2,500 ft. long and about 25 ft. deep, almost entirely in blue seamy shale. Very little blasting was done, the shovel being used to break its own way. This work was a heavy strain on the steam shovel, although it was, quite likely, cheaper to wear out the shovel than to drill and blast.

The predominating feature of the construction is the extensive use of derricks, all of which are of the mast and bull wheel type. These are placed at convenient points and are used wherever possible, to the exclusion of other methods and machinery.

The costs given in the following list include the cost of material and labor. Attention is called to the fact that the material for concrete is prepared from its natural state by the contractor, as previously described:

	To. June 1910, cu. yds.	Cu. yds. for June, 1910.	Cost per cu. yd. for June	Cost per cu. yd. to July, 1910.
Steam Shovel Excavation	......	....	....	$0.206
Derrick Excavation	3605.56	3524	$1.02	0.638
Embankment	161.18	1437	0.112	0.139
Cyclopean Masonry	..23595.99	8202	2.86	3.73
Second Class Concrete	.. 289.42	0	....	5.22

It is interesting to note in connection with the construction of the Delta dam and reservoir that it is expected to cost $75 per million gallons of available capacity (including nearly $25 for land damages). As a comparison with other large water supply basins in the eastern states, the Wachusett Reservoir cost (exclusive of soil stripping, which was not required in the Delta project), about $135 per million gallons. This includes $60 for real estate. The Ashokan dam and reservoir is expected to cost $180, while the three principal projects of the New York State Water Supply Commission for power development and flood prevention are estimated at $16 to $33 (the latter figure for the Portage basin includes $5 for real estate), and four great

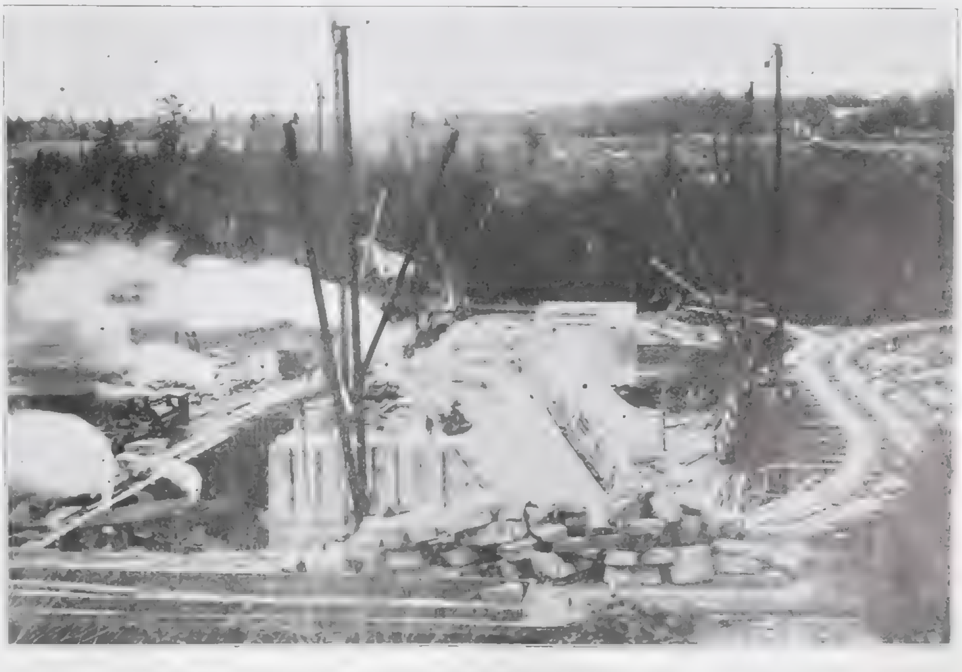

Fig. 3—View Showing Arrangement of Derricks on Dam.

irrigating basins of the West, from $5 to $17 (including land at $0.20 to $1.16) per million gallons of available storage. For New York city work, $200 has been regarded as the normal cost of storage. In France few of the reservoirs have cost less than $100, many have exceeded $300 and some even $600. In India the cost of impounding water has been in several cases about $30 and in few more than $50. It thus appears that a rational comparison on this basis cannot be made without a detailed study of the conditions and requirements of individual cases; but these data seem to imply at least that in the Delta reservoir water is to be impounded at an expense relatively as low as in other Eastern basins of greater capacity, in which the unit cost should thus be less, and which have been chosen with like restrictions as to geographical location.

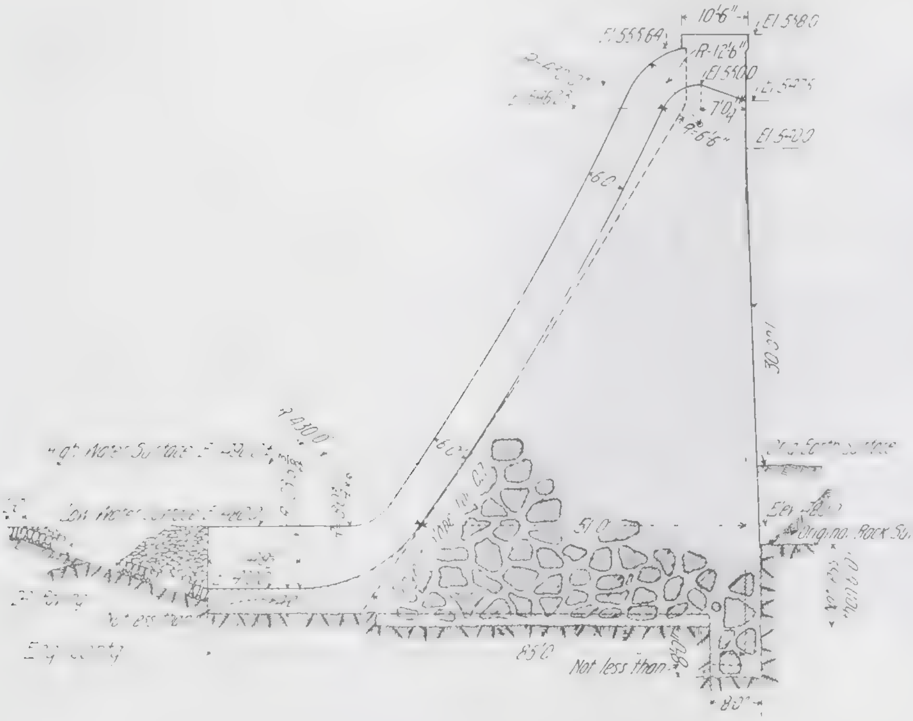

Fig. 4—Section of Delta Dam.

In the work of construction of the Delta dam the contractor, Arthur McMullan, of New York City, is represented by Mr. Wm. Melvin, Superintendent, and Mr. Geo. Palmer, Manager. For the State, Mr. C. W. Costello is Assistant Engineer in Charge, and Mr. L. C. Hulburd is Resident Engineer.

A Reinforced Concrete Cellular Approach Viaduct for a Railway Bridge.

A novel form of viaduct approach is shown by the accompanying illustration. This construction, 528 ft. long, formed a portion of an approach to a double track railway bridge, the remainder of which approach was earth fill between concrete retaining walls. The work is described as follows by Mr. George C. Clarke.*

At the time the small piers for Line 13 were constructed, it was anticipated that some movement would occur in them when the filling for the surface tracks was made about their bases, and, to prevent individual piles from moving at different rates and being broken or torn loose from the pier they supported, the sheeting was left in place. The tendency to move was not over-estimated, as a difference in elevation of 2 ft. on opposite sides of a pier, even if none of the fill touched

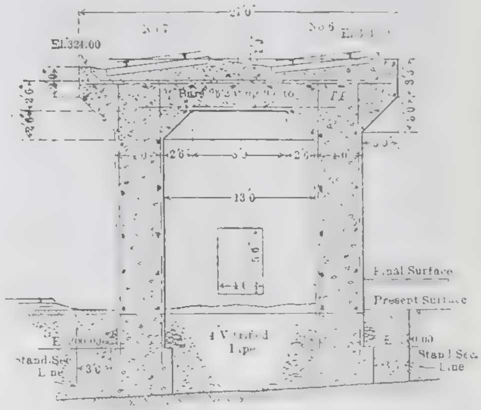

Fig. 1—Section of Reinforced Concrete Cellular Approach to a Viaduct.

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*"The New York Tunnel Extension of the Pennsylvania Railroad; The Long Island Approaches to the East River Tunnels," by Geo. C. Clarke. Proc. Am. Soc. C. E., Vol. XXXVI, p. 1109.

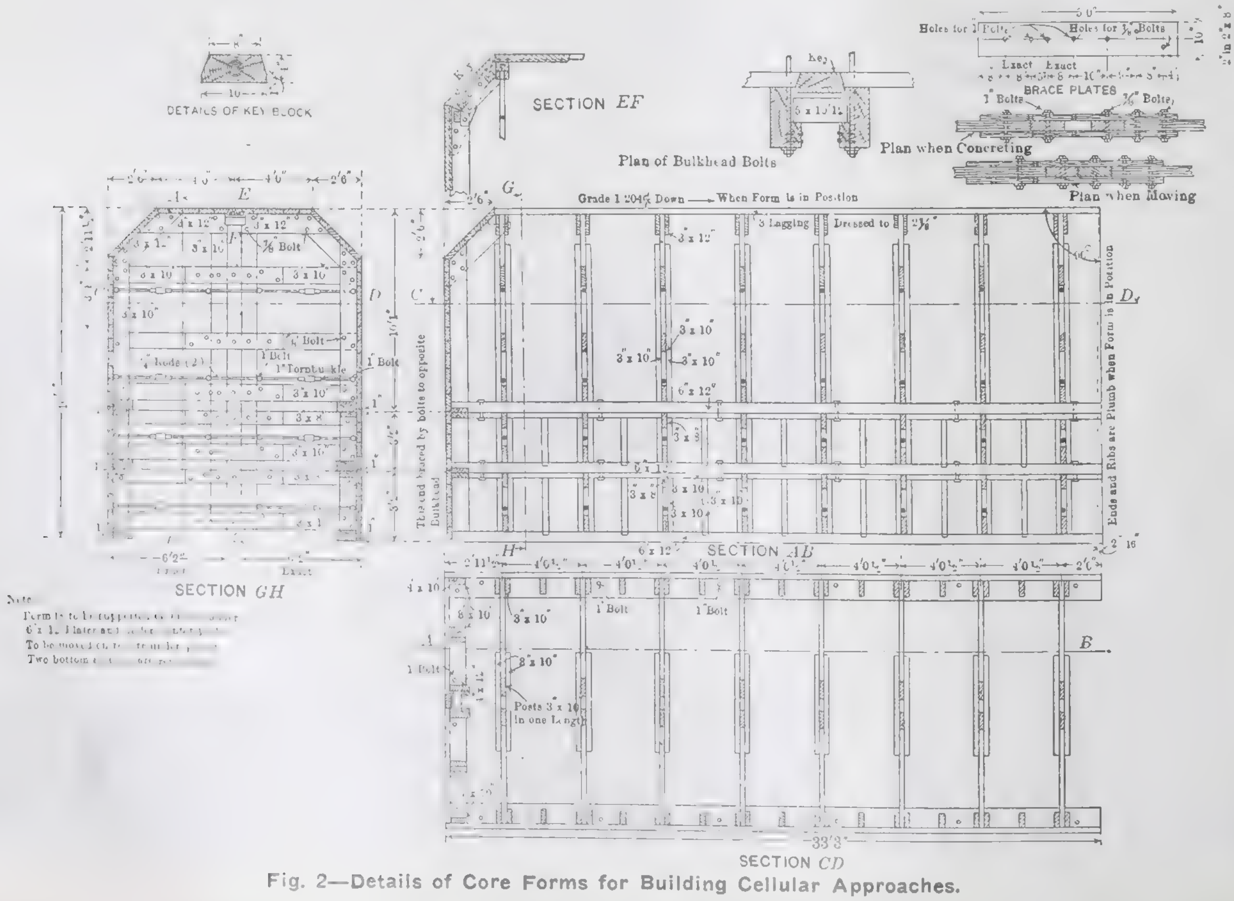

Fig. 2—Details of Core Forms for Building Cellular Approaches.

Fig. 1—General Plan of Walls for Lock 9, New York State Barge Canal.

it, caused movement away from the fill, which however, was readily counterbalanced by placing a slight excess of fill on the opposite side. The maximum movement noted in any of these piers was 1⅝ in., and the maximum variation from the original position at the completion of the fill was ⅝ in.

The original plans for the approach to the double-track viaduct for the overhead freight line contemplated an earth embankment supported by two gravity retaining walls resting for most of their length on piles. The action of the small piers noted above made it plain that it would be not only expensive, but difficult, to construct the walls, where the embankment was high, so as to keep them in their original position. The grade and location of the adjoining tracks were such as to permit the earth embankment to take its slope on the south side for a length of 368 ft. of the easterly end of the approach, while requiring that the north slope be retained. The maximum difference in elevation of the tracks on the approach and north of it being for this length only 10 ft., the gravity wall was used.

Of the easterly end of the gravity wall, which retained only from 5 to 7 ft. of embankment, a length of 142 ft. was founded on the old roadbed of the Long Island Railroad, while the remaining 226 ft. was founded on pile bents, spaced 4 ft. from center to center, and containing three and four piles in the alternate bents. Between each pair of angle of 20 degrees from the vertical. vertical bents two batter piles were set at an

As stated above, the maximum difference in elevation of the two rails, which represents the height of material retained, was only 10 ft., and in order to keep the piles below the ground-water level, the cut-off was 11 ft. below the low rail, which placed the major portion of the retaining wall below the surface, and seemed like unnecessarily expensive construction, but sufficient movement occurred in the low wall, founded on the old roadbed, to justify the additional expenditure on the higher wall.

From the westerly end of the gravity wall to the abutment, a distance of 528 ft., the cellular design shown by Fig. 1 was adopted. This is an unusual design, but has the advantage of being not only more stable than two retaining walls on piles, but less expensive, while, as compared with small piers and steel girders, it will probably prove more economical in the end, and has the advantage of presenting a continuous surface to any cars which may be derailed from the shifting tracks immediately adjoining it on the north and south.

The work was built in sections 33 ft. long, that being the distance between the crosswalls or bulkheads, and each section was constructed in two lifts, the first being both sidewalls and bulkhead from the top of the piles or rock to a line about 1 ft. below the finished grade of the adjoining tracks, and the second, sidewalls and bulkhead above that point, and roof. The construction was carried on from the west toward the east, the height of the structure diminishing in that direction and thus permitting sections of the form to be removed as the work advanced. Each bulkhead, of course, was built in conjunction with the section east of it, the rear forms for the bulkheads being the only ones that had to be knocked apart and rebuilt as the work advanced, and the timber forming them was passed ahead through the 4x5½-ft. openings shown. The interior movable form is shown by Fig. 2. It was slacked off by removing the key and tightening the turnbuckles, and, at the same time, removing wedges from under the base, the two sections, of 3 ft. 2 ins. each at the bottom, being those removed as the height of the structure diminished. The outside form was built in two sections and picked up and swung ahead by the derricks which handled the excavation and concrete. The outside and inside forms were bolted together by three lines of ¾-in. bolts spaced at 4-ft. centers.

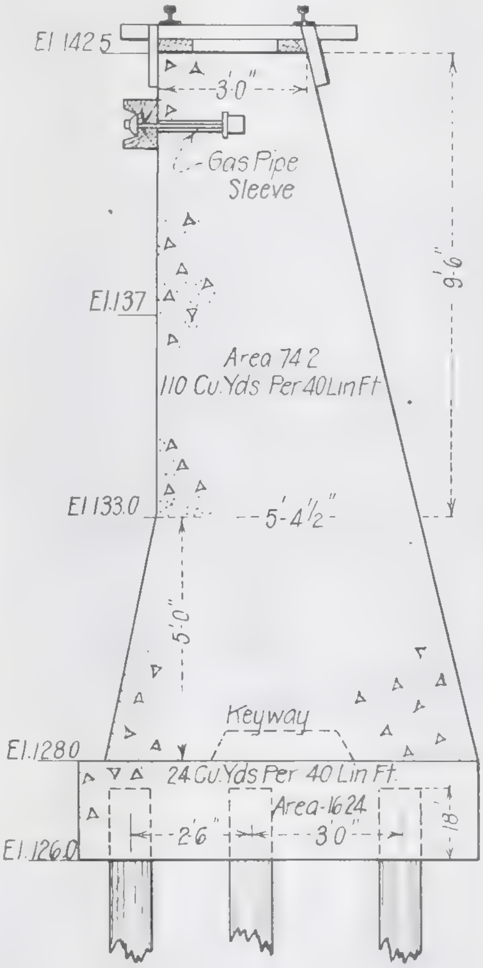

Fig. 2—Section of Lock Wall.

High Records by 70-ton Shovels on Relocation Work.—A statement is appended showing the excavation accomplished by steam shovels on the relocation of the Panama R. R. each month since January, 1910. All these shovels are of the 70-ton class, and their average output is very high for work on the Isthmus. The August record was made in one of the wettest months of the rainy season.

Month.	Output. Cu.yds.	Average No. of shovels.	No. of working days.	Output per shovel. Per day. Cu.yds.	Output per shovel. Per month. Cu.yds.
January	206,334	8.24	25	1,002	25,040
February	214,411	[illegible]	[illegible]	[illegible]	[illegible]
March	234,571	7.31	[illegible]	1,234	32,089
April	[illegible]	7.15	26	1,140	[illegible]
May	212,135	7.88	25	1,077	26,921
June	[illegible]	8.00	26	1,138	29,586
July	197,069	7.44	25	1,060	26,488
August	250,341	[illegible]	[illegible]	1,318	35,575

An Economical Method of Using a Movable Form for Long Concrete Walls, with Some Costs.

The construction of two heavy concrete walls aggregating some 1,250 lin. ft. at a cost for forms of less than 23 cts. per cu. yd., has recently been completed at Lock 9 on the New York State Barge Canal. This cost was made possible by the use of a movable wall form designed by C. R. Neher, Engineer for the Contractors, the Atlantic Gulf & Pacific Co., of New York City. The walls constructed were the approach walls to the south end of the lock named; one, the east wall, was 350 ft. long and the other on the west side was about 900 ft. long. Figure 1 shows the plan of the walls and Fig. 2 shows the section which was 3 ft. wide on top, 7 ft. 7½ ins. wide at the footing and 14 ft. 6 ins. high.

The form, a drawing of which is shown by Fig. 3, was made of 1¼-in. lagging and 4x6-in. studding. Waling timbers, consisting of two 6x8-in. pieces placed together, were spaced about 5 ft. apart, along the sides. The waling timbers were bolted securely to the studding and the front and back forms were tied together through the waling timbers by ⅞-in. bolts. As it was necessary to remove these bolts each time the form was moved a method of preparing them for easy removal was desired. The best scheme proved to be to cover the bolts with heavy Albany grease and to wind them with Neponset paper, a heavy roofing paper. To protect the paper from being torn by falling concrete or from being stepped on by workmen in the forms, a 2x4-in. stick was placed between the form walls directly above the bolt. This acted as a spreader as well as a protection for the paper on the bolt. On top of the form, and fastened to it, were 4-ft. ties for the narrow gage track. These were spaced 6 ft. on centers to permit room for opening the gates of the bottom dump cars. The form was built high enough to support this track above the finished concrete. This track was jointed to that on the finished wall by switch points, coming to the bent ends of the track on the wall. This saved cutting rails. See Fig. 3. One of the difficulties encountered in designing the form was the fact that anchor bolts were to be placed in the face of the wall at certain irregular intervals. This made the problem of arrangement of the studding somewhat intricate, but it was finally worked out by spacing the studding as shown, and using the three sets of holes, indicated, for placing the bolts.

Another difficulty was found in the fact that at intervals of 50 ft., snubbing posts were required to be placed in the wall. These posts were of such size as to require an offset in the concrete wall in order to provide sufficient anchorage. This difficulty was overcome by leaving out the snubbing posts and by placing a box on the inside of the wall form at the points for the posts, which made enough space in the wall for the snubbing posts to be put in after the wall had been completed.

The length of the form (40 ft.) was designed to include enough concrete for two

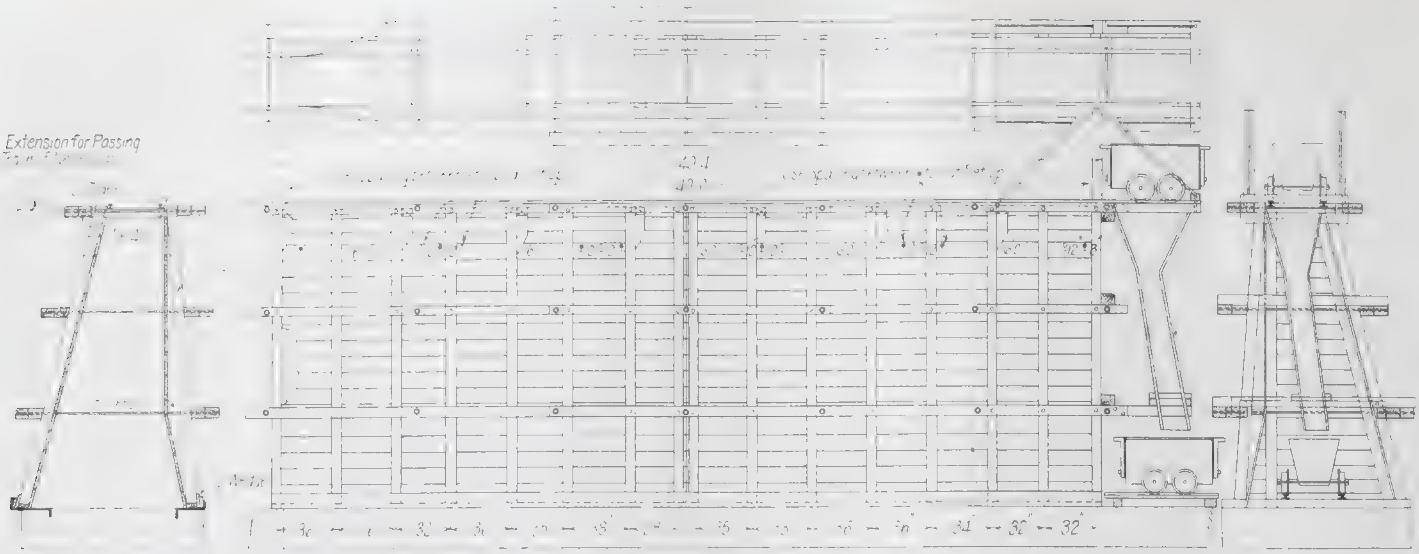

Fig. 3—Details of Movable Wall Form.

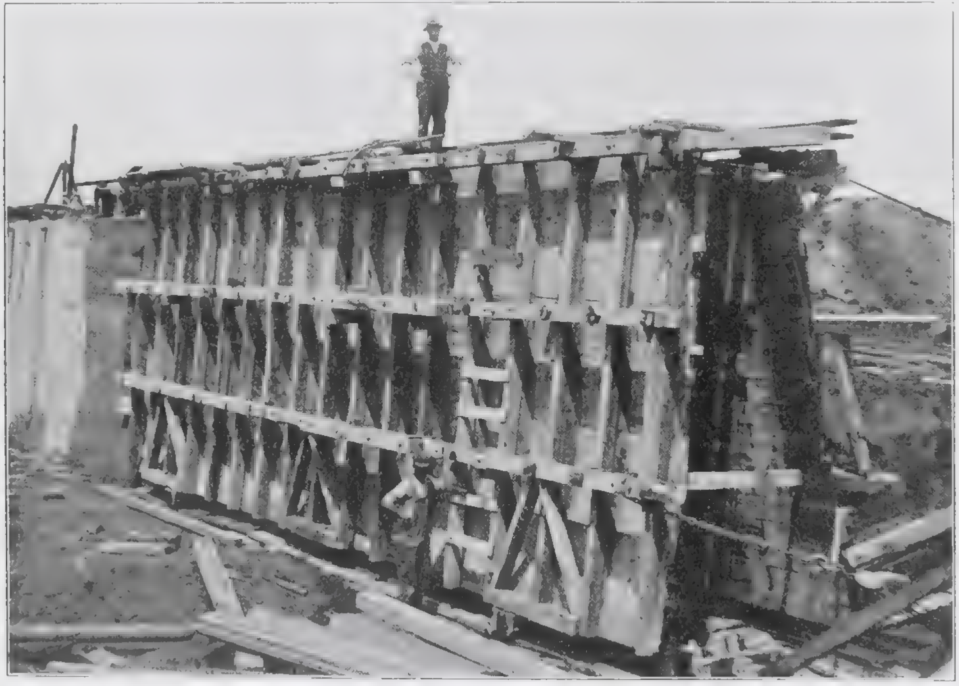

Fig. 4—View Showing Wall Form Being Moved.

working days of 8 hours. The combined yardage of the base and upper neat work in 40 ft. amounting to 134 cu. yds. The first day the concrete was carried to elevation 137 (Fig. 2). The second day the concrete was placed in the base ahead of the form (containing 24 cu. yds.), and then the upper part of the wall was completed, containing 33 cu. yds. This made 57 cu. yds. for the second day. This lesser yardage for the second day left time for the men to set molding, anchor bolts for wall fenders, finishing top surface of wall, and keys in the base.

In moving the form, the bolts were removed after the concrete had set, sometimes within 12 hours. The form was then jacked up a few inches and placed on dollies. The concrete surfaces, being battered, caused the form to be clear when raised. At the top the forms were tied together by the bolts through the top waling timbers, which were always above the concrete. The accompanying photograph, Fig. 4, shows the form being pulled ahead with a small block and tackle. The forms were pulled ahead about 6 ft. at a time and the bolts were then replaced as the hole cleared the end of the concrete. This prevented the forms from spreading. At the beginning of the work it was customary to remove the end bulkhead before moving the forms, but this method was later changed and the bulkhead was allowed to remain on the wall until ready to be reset. This was done because it was found that the corners of green concrete would chip off on pulling the bulkhead; whereas, if left somewhat longer, the concrete would not chip so readily and the bulkhead would protect the corners from being scrubbed by the passing side forms.

The base of the section ahead was concreted, as mentioned above, during the second day's work, so that it was ready to receive the forms on the following day. Figure 3 shows how the concrete car on top was run out over the end of the form on a piece of track supported by a truss, and dumped through a chute to the car below. This car delivered the concrete to the base.

After the forms had been removed from a section, considerable traffic was necessary on top of the green wall and therefore a protection to the concrete was made by placing a layer of roofing paper over the top and covering it with sand. The top of the wall was found to be damp after several days and in excellent condition.

For the curved sections of wall a special 40-ft. section of forms was built and this is shown by Figs. 6 and 7. This form was handled in the same way as the straight form, and gave equal satisfaction.

The labor of building each form required 3 days' time for 6 carpenters. Two straight forms were built and one curved form. The cost of these, including labor and material used, was $525.00. Spruce dressed lumber was used, at $23 per M. ft. B. M. The labor of moving was accomplished by 6 men, including the foreman, in from 4 to 6 hours. This labor completed the moving and lining-up ready for

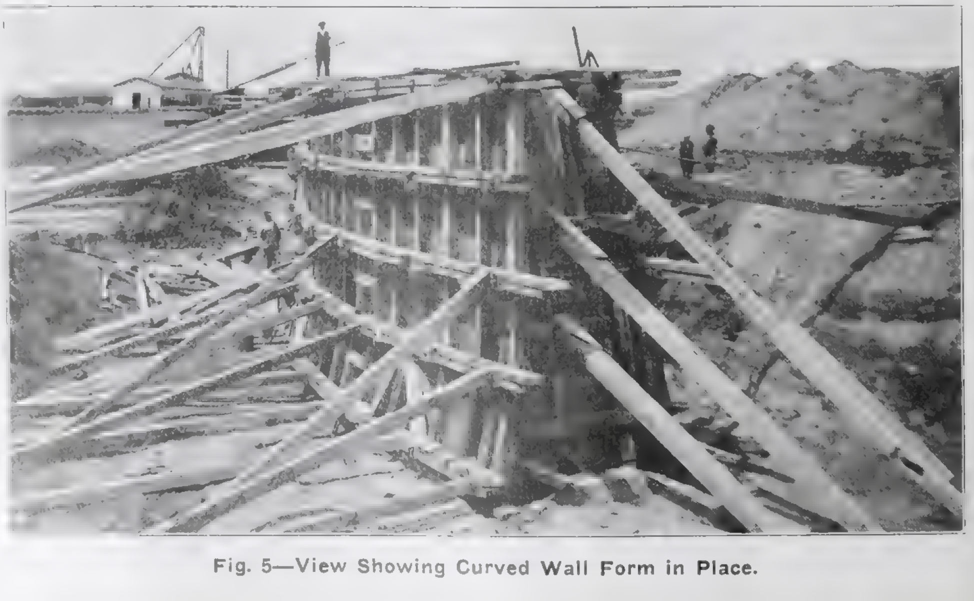

Fig. 5—View Showing Curved Wall Form in Place.

concrete. The rate of wages for these men and cost of moving were as follows:

6 hrs.—Foreman at $3.52 per 8-hour day	$2.64
6 hrs.—2 men at $3.20 per 8-hour day	4.80
6 hrs.—2 men at $2.40 per 8-hour day......	3.60
6 hrs.—1 man at $2.00 per 8-hour day......	1.50
Total cost of knocking down and setting up	$12.54

The cost per cubic yard of forms and the setting up for the entire work may be estimated as follows:

Cost of material and building of 3 40-ft. forms	$525.00
36 setups at $12.54..........................	451.44
Total	$976.44
Total cu. yds. + Neatwork............	4.370
Cost per cu. yd. concrete..............	$0.22 3-10

This is a very small cost, and it may be noted also, that the forms on completion of the work were in a very good condition and might have been used for three times as much wall as was built.

This method may be used to best advantage, where walls are parallel and close together, by placing the mixer at one end, working both walls forward at one time, and using one form on each wall. On a single wall the mixer should be set in the center and the work carried from this point in both directions. This type of form for long walls secures the maximum use of forms with the minimum amount of movement and knocking down, and gives the proper sequence of form setting and placing concrete, using the average day's work of 8 hours to the best advantage.

We acknowledge our indebtedness for information used in preparing this article to Mr. C. R. Neher, M. Am. Soc. C. E. The work was carried on by the Atlantic Gulf & Pacific Co., Contractors, of New York City. Mr. D. B. La Du is Resident Engineer for the State.

Report of the Committee of the National Cement Users Association On the Treatment of Concrete Surfaces.

Cement.—The color of the surface is largely that of the cement which is used. Although there is some difference in the shade of gray of standard Portland cements, the difference is so slight that with very few exceptions no thought need be given to the color of cement. There are also some white cements on the market which give a very pleasing treatment to the finished surface. Consideration should be given to some extent to seasoning, as a well seasoned cement is less likely to cause craze cracking or shrinkage cracks than one which is fresh. The subject of fineness of grinding is of less importance but is worthy of some consideration.

Sand.—If the surface is tooled or scrubbed, particles of sand will be exposed to view and their color will have an important influence upon that of the surface. Their size will also have an influence upon the texture. A sand with large round grains such as is found on the sea coast in places, the grains being practically of one size, cannot be used in as rich a mixture as sand of variable size and angular grains, because the round grains will rub from the surface with considerable readiness if the mixture is 1:2 or leaner, and as the grains in the first named sand are large they have more influence upon the color than sand of variable sizes. A light gray or white quartz sand will lighten up the color of the mortar very materially so that it would appear that some pigment had been used with the cement. Stone dust makes an excellent sand and when of a grayish color can scarcely be distinguished from that of the cement, thus giving a uniform appearance. Quite a variety of colors and textures can be obtained by care in selecting the sand, either natural or stone dust, of variable sized grains, ranging from that which will pass a 30-mesh sieve to that which would just barely be rejected upon a ¼-in. sieve.

Stone.—The stone, still more than the sand, can be used to vary the appearance of the finished surface on account of its larger size and ease with which it can be cleaned of cement when the latter is still green. It is possible to get a very wide range of colors in stone and one color can be used or two or more can be mixed together and give very pleasing effects, the size ranging from rejection of the ¼-in. sieve to that which would just pass a 2-in. ring. Contrasting the angularity of broken stone with the round and smoother surfaces of gravel, gives effects which are still more varied than with quarry stone, and are just as durable so far as strength and waterproofness are concerned.

Foreign Matter.—It is also possible to get some pleasing effects by the introduction of foreign matter such as broken brick, glass, fragments of metal like copper, brass, and even nails are sometimes used, but the rust and stain from iron nails is unsightly. Sometimes ores, such as the green ore of copper, have been used for producing certain effects. Oil, glue, lime, have also been introduced at times for certain purposes. In one instance the following mixture was used: To every barrel of cement was added 4 lbs. of salt and 20 lbs. of quicklime slacked for one week, passed through a fine screen, 4 lbs. of lampblack and 1 lb. of linseed oil. In preparing this the lime was first slacked and while yet hot the salt in solution together with the lampblack and oil, were added and all stirred thoroughly together, the mixture then being passed through a fine screen into vats and allowed to stand for one week or longer before using. The proportion of the cement aggregates was one to six, the stone being a mixture of dark blue trap and white marble.

Water.—Water has its influence on the appearance of the surface in several ways. The amount of water has an influence on the density. When the mixture is quite dry it is impossible to compact materials well, and the resulting mortar or concrete is porous. If a sufficient amount of water is used to produce a plastic mix, the appearance [illegible] and uniform, while a large excess of water brings the fine particles to the surface and produces a little different texture from plastic. Moreover, the quantity of water affects somewhat the time of set of the cement and thereby to some extent the color.

Pigments.—Coloring matter of various kinds can be added to the mixture. Those of a vegetable origin are not permanent because they are likely to be acted upon chemically by the ingredients of the cement. Only mineral colors should be used. The amount which can be safely used is small, owing to the danger of impairing the strength of the resulting mortar. Five per cent by weight to that of the cement should be the limit, beyond which the impairment of strength is too great to justify a larger amount. Even this amount of certain colors which differ little from that of the cement like yellows and reds, do not produce a marked change from that of the neat cement. Lampblack is the principal ingredient used for darkening which, on account of its strong contrast and the fineness of its particles produces a strong contrast with a moderate amount. For lightening the color somewhat, lime is the best material to use. Coloring matters can be used in either a dry form or as a paste. It will generally be found most convenient for mixing to use the dry form, thoroughly mixing it with dry mortar before the addition of any water.

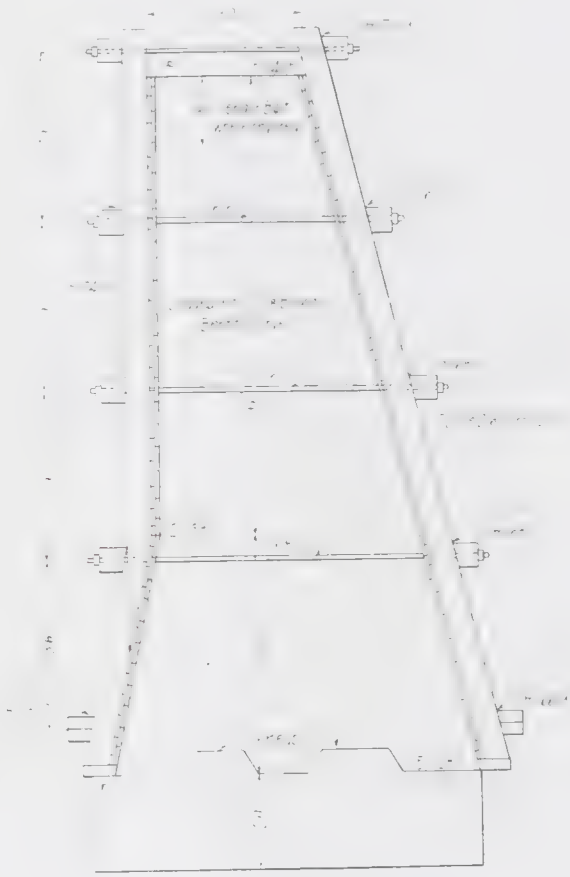

Fig. 6—Section of .Wall Form.

Molds.—Molds also have an influence upon the appearance to some extent. With rigid materials like metal or wood there is a tendency for the coarsest particles to come to the surface, and unless this is overcome by spading or proper manipulation, the surface is likely to be rough and porous, and if the stone is pushed too far back a mortar face is obtained. With rigid molds which are nonabsorbent, the surface is likely to be of a watery appearance and after hardening will have small holes in its surface where drops of water stood and later evaporated. Porous molds, such as sand or various combinations of sand and other substances, treated or untreated with chemicals, all produce a similar effect, namely a dense cement surface, as the cement is brought to the surface by the excess water which is absorbed by the molds. However, this type of mold does not remove cement from the mortar and its surface of contact is not bonded to the casting by the excess of cement which comes to the surface. This excess of cement on the surface is liable to cause hair or map cracks and in large [illegible] is subject to shrinkage more than with molds of other material. If the mold is not filled by continuous pouring an unsightly line impossible to conceal later is left where work stopped.

Mixing and Placing.—On account of map cracking and shrinking it is not wise to mix mortar richer than one part cement to two parts sand, and for freedom from these two defects it is frequently better to mix it as lean as one to four. Stone in proper proportions can be added to the mortar to get the desired textures. Thorough uniform mixing and quick placing are desirable features. The aggregates should be graded with the utmost care to get a maximum density. A concrete whose surface has to be removed should be so made that it will have an absorption of not more than 5 per cent by weight.

Treatment While Hardening.—The appearance can be modified somewhat by the treatment of the surface while hardening. If it is allowed to dry rapidly it will be of a lighter color than if kept damp and cool and allowed to dry slowly, also, the former surface will be more dusty than the latter.

Picking, Scraping, Rubbing (Unskilled Labor).—A variety of treatment can be given to the surface by the use of unskilled labor. Taking such tools as a hand pick with a single point or a pick with a face of two inches with a series of points upon it, the surface may be scaled from the concrete, entirely removing any marks of the mold or any stains from a coating placed upon the surface of the mold to prevent adhesion of the mortar, leaving the surface below of a natural cement color and exposing the sand grains and the stone of which the concrete was composed. The cost varies considerably with the age of the cement when the picking is done. When done at the age of three or four days a laborer can cover four to five times the area he can do when the cement is two or more weeks old. The texture, however, differs. Because a larger amount of material is scaled off when the material is quite green and scaled off to varying depths, and because some particles of stone are chipped out of the surface, the texture is much coarser than when done after the cement has become hard. Under the latter conditions the surface has a fine texture, and is quite uniform. A little variety can be obtained by the method in which the blow in picking is applied. By striking a perpendicular blow there is no resulting mark left on the surface by the tool, whereas with a glancing blow lines are left, and these can be made to show all parallel to one another or at various angles, and thus a little variety to the texture can be thereby given.

Another way of treating with unskilled labor is by scrubbing with water and stiff brushes, either bristle or wire brushes, while the mortar is still quite green. This removes the excess cement from the surface, obliterates the marks of the molds, and washes considerable of the cement off the surface of the aggregates, so that they appear cleaner, sometimes as clean as freshly-broken stone, and thereby obtaining a bright and pleasing effect. It is common also, in this method, to use an acid which will attack green cement rapidly and eat it from the surface of the aggregates. This type of treatment is used usually during the first 48 hours after the cement has been cast. After this age the cement resists the scrubbing and acid process to such an extent that it becomes expensive, and the best results are not obtained.

Nitric, muriatic and sulphuric acids and soap of various strengths up to the undiluted have been tried, and experience is that these agents are impracticable for the removal of vertical surfaces of *good* concrete thoroughly hardened, the action being so slow and attended with so much difficulty that hammering of one sort or another is cheaper.

Great care must be taken in successive casting to prevent marks showing (after scrubbing) where the new and old work join. The practical operation is to finish casting on some line in the building, although in certain architectural treatments this stratification is not objectionable. When it is proposed to scrub the surface of the concrete before it is more than 24 hours old, it is necessary to design the forms specially with the idea of being promptly removed without damage to the rest of the structure. This will usually save lumber, but designing for quick removal will usually add to the labor an amount sufficient to offset this. Moreover, arranging to make possible the removal of forms at certain points of the work does not necessarily get the maximum efficiency from the mixing plant, as the quantity of work may not be such as to run the plant at full efficiency for a day.

Another way of treating flat surfaces is by rubbing with pieces of limestone, water and sand, cutting away the mortar and surface of the stone, so as to expose the full cross section of the stone. This is done when the mortar is three or four days old, and is done only with the softer stones, such as marbles. This type of finish is usually known as terrazzo.

Skilled Labor.—The surface of concrete after it has become hard can be cut as natural stone would be cut, but this should be done by men who are experienced in stone cutting, and when treated in this way textures similar in character to those of natural stone can be obtained, in fact, the crandall, bush hammer, tooth tool, chisel and set can be used with such effect that at a short distance the appearance is identical with natural stone.

By cutting the material when green, it is impossible to get sharp corners. The round corners which are common in concrete are generally inartistic and crude in appearance. By allowing the material to become quite hard and using proper care, as sharp corners can be obtained as with natural soft stone such as limestone. It will thus be seen that the results to be accomplished have a controlling influence over methods to be used. In this way additions have been made of concrete to old buildings of natural stone with such a perfect matching of texture and color that it is impossible to tell the difference at 8 ft. distance.

It has been the experience of some engineers that just as cheap results can be obtained from bush hammering by common labor as by skilled. This, however, should be qualified again by the result to be obtained. On large surfaces where a coarse general treatment is desired and where the observer cannot get close to the surface, it can be tooled by common laborers when the material is quite soft. If however, the observer can come within a few feet of the surface the above described treatment is not as good as cutting by skilled labor after material has become thoroughly set. A treatment which has been used to a limited extent has been splitting blocks which have been cast in a plane so as to obtain a natural fracture, and a similar effect can be obtained by breaking off pieces of the surface by a stone set to obtain a natural fracture. In this manner the natural fracture of stone is more closely imitated, but as the whole general treatment is so unnatural to a cast material it is an inartistic treatment and is not recommended.

Sand Blast.—A finish can be obtained somewhat similar to that of scraping by means of sand blast. It is important to have the right sort of a nozzle, however, for this kind of work, and an exceedingly hard sand must be used, preferably that which has angular grains. A ½-in. diameter nozzle would produce very unsatisfactory results, because if an excess of cement came to the surface at one spot or on an edge as a joint between boards its hardness would resist the cutting of the sand while softer portions on either side would be removed, thus emphasizing the ridge. Similarly a soft spot formed by a wide crack where the cement all ran out leaving the sand behind would be cut deeper by the large nozzle. Experience has shown that a nozzle not over ⅛-in. diameter should be used so that it can be localized on small spots and that it must be held within a few inches of the surface to be cut if there is any variation in the density or hardness of the surface.

This method leaves the stone cleaner than with scrubbing and acid treatments.

Again, the age of the mortar has a large influence upon the cost of the cutting and upon the texture of the surface. Good and economical results can be obtained when the cement is between ten and fourteen days old. It requires a fairly large job to justify the cost of setting up and operating a sand blast plant. Various building cleaning companies have portable outfits which are admirably adapted for this kind of work which can be obtained in all large cities.

Chemical Treatment.—When the surface is chemically treated the materials used are usually commercial hydrochloric or sulphuric acid. The amount of dilution must be determined by experiment and will vary with the age of the concrete. The older the cement the stronger must the solution be. For cement which is about two weeks old ordinary commercial acid should be diluted with three parts of water. When but a few days old a dilution of one part acid to five or six of water will be sufficient. A mixture of the two acids will produce stronger action than the use of one alone. They also produce a vapor which will soften the surface when exposed to it in a confined chamber and permit removal of the surface with very little scrubbing. After the scrubbing is completed great care must be used to remove all traces of acid, otherwise there will be permanent discoloration of the surface.

Tools, Kind, Quality, Temper.—A new type of brush for rubbing or scrubbing green concrete surfaces which has proved very efficient in actual work is composed of ordinary wire mesh, such as fly screen, and is made by clamping together a sufficient number of sheets of wire, all of equal size, so that the exposed or rubbing edge will be at least 4 in. wide. Such a brush has proved much more effective and cheaper than the ordinary wire brush.

Effect of Cutting on Impermeability.—The waterproofness of concrete depends upon the density of the mortar. In the packing of mortar on surfaces which are to be exposed, greater care is usually taken in producing a dense uniform surface which would show a good appearance than in the packing of the whole mass of materials in the back. Therefore, before cutting, there is usually a dense skin of rich mortar on the surface which is practically impervious to moisture. When this is removed by any process the interior is more likely to absorb moisture than before. In one particular job where the aggregate was composed of coral sand and coral stone which was very porous, like cinders or blast furnace slag, after picking the concrete permitted water to drive straight through a 12-in. wall from a driving rain, whereas the wall previous to tooling was practically impervious. With a dense stone and quartz sand, a rich mixture, plastic consistency, well packed, a wall may be as impermeable after treatment as before. These facts are sometimes overlooked and cause unexpected and unpleasant results.

Effect of Cutting on Durability.—A wall which will absorb and hold moisture is liable to disintegrate ultimately by the action of frost. If it is impervious to moisture the action of frost is merely an attack upon the surface and is very much slower, being practically the same as on any surface of a solid natural stone. Therefore, in a cold climate, cutting off a skin to expose a porous mass is likely to somewhat impair the durability.

Effect of Cutting on Collection of Dirt.—It is common sense to see that roughening the surface of the cement is going to permit collection of dirt and dust blowing in the streets much faster than a surface which is smooth and dense. However, as dirt and dust is usually so like the color of the cement itself it does not produce an objectionable change, and these very fine particles can lodge in the pores of the concrete and assist in rendering them more impermeable. It is only where smoke is thrown out in large volume that the smoothness of the surface must be considered to resist a change of color.

Masonry Surface to Be Covered.—Masonry as above used includes brick, terra cotta, natural stone, concrete, mortar and plaster. The covering coat must bond to the solid material of the back and not to the dust or dirt particles on the surface and should be sufficiently substantial to hold the covering. If it is not substantial and rigid and contains cracks the surface covering is pretty sure to crack over the cracks in the back.

Metal Lath.—For outdoor purposes, it is best to use galvanized metal lath. There are various kinds, woven, welded, expanded, any one of which can be used. That having a large cross section of metal and being heavily coated with galvanizing material is likely to be the most durable, if moisture should penetrate through the plastering to this material. It should be thoroughly tied to furring at intervals not exceeding 16 ins. with galvanized wire. The furring should leave sufficient space for the mortar to push through the mesh and clinch without interference from the backing to which the furring is attached.

Preparation of Base.—The texture should be as rough as possible with recesses in the surface which will support and key on a coating which is applied, and this surface should be free from dust and dirt which would prevent the bond of union. Before coating the surface the base should be thoroughly saturated with water so as to avoid suction of moisture from the covering coat, which would impair its strength and durability.

Mixing and Placing.—The mixing must be thoroughly done and the amount of water used is less than with mortars or concrete packed in molds, as otherwise the mortar would run off the lath.

The first or scratch coat should be composed of one part Portland cement, three parts sand and one-half part hair putty. This hair putty should consist of long cattle hair or fiber, thoroughly worked into good lime putty. The second coat should be composed of one part Portland cement, two and one-half parts of sand and with not over 5 per cent lime putty. The third or finishing coat should consist of one part Portland cement to two parts of sand, with not more than 5 per cent of lime putty. (To this finishing coat may be added pebbles or other non-combustible material as may be desired to obtain a variation in the finished appearance). Where a total thickness of not more than one inch is required, it is practicable to apply it in two coats, i. e., omitting the second coat above specified. In all cases, one coat should follow the previous one as soon as it has sufficiently set to allow of so doing. This will guarantee a bond of the two applications. The finished appearance may be varied by the materials used, both as regards color and size, by the mechanical method of applying or finishing, or by a combination of any of these methods.

Joints.—Plastered surfaces are more subject to shrinkage cracks than monolithic work because a richer mixture is used and the thinness of the body of the material has less power to resist stress. Therefore, joints should be allowed at intervals where they will be as inconspicuous as possible, because as they are likely to occur anyway and are apt to be irregular in shape and position they are unsightly to the eye. If the surface is troweled smooth they are likely to show in an objectionable way. Unless the surface of the various coats are kept wet there is usually trouble from cracking. Some plasterers say that where the under coat is made lean with mortar and with plenty of lime and hair there is great deal less likelihood of its cracking. Care must also be taken to have a sufficient lap in the lathing; to have the lath well tied together and also to the furring so that there can be no settlement or sagging of the lath or the furring to which the lath is attached. The cracks can be filled with cement or by a pump spraying grout or run over with a tool which will fill them. They are somewhat sure to show on a smooth surface anyway.

Washes.—Washes of cement or lime can be applied to plastered surfaces which will fill the fine cracks and give a uniform surface to the material. Washes are frequently applied to monolithic surfaces and material cast in molds and form a rather pleasing treatment when carefully and well done. If cement is applied with a brush it is not likely to give a pleasing result but is pretty sure to be streaked and irregular in color and its color is apt to be a muddy yellowish-green, rather than the gray of cement. If the wash is made very thick and [illegible] it is plastered onto the surface and left in this condition or else lightly troweled with a steel trowel or with wooden float the appearance will be much more uniform and of a natural cement color. This is the most usual treatment given to plain monolithic surfaces, like bridge abutments, foundations and mills in inconspicuous locations.

Paints.—Paint, either oil paint or special cement paints containing no oil, can be used to good advantage in painting cement surfaces either monolithic or cast, and will give pleasing appearance. The color is simply as much in the control of the designer as paints used on wood.

Enamel.—Enamel paints may be used on cement if there is no oportunity for water or frost to get behind the enamel, which would cause it to peel off. Enamels which are baked upon a surface cannot be used as the process of baking would dehydrate the cement and cause the mortar to crumble.

Durability.—There are examples of plastered surfaces which have lasted for 15 years and are still in a perfect condition. There are numerous examples of moisture getting behind a plastered surface where this is applied to some solid back, as brick, terra cotta, stone or concrete, freezing and causing the plastered coat to peel. For this reason, plastered coats are not generally considered as durable or as desirable as a surface treatment which is monolithic with the body of the surface treated. If the surface is impermeable to moisture and there is no chance for moisture to get behind the surface from any source, the plastering should be durable. If it thoroughly keys to the face its contraction and expansion will be the same as the base and therefore will not peel, due to an unequal stress between the two materials.

Range of Colors.—The range of color in mortar by use of pigments is limited to reds, yellows blue and black. No other satisfactory color has come within the observation of the committee. Red and yellow can only be used as faint tints, as to use them in quantities exceeding 5 per cent by weight impairs seriously the strength. Blue shades are obtained by small use of lampblack, and black by larger use. The range of color in the aggregate is limited to the colors found in natural stone or other substances as previously mentioned, which is exposed later by the removal of all cement from the surface of these particles of aggregate.

Variation of Color.—With the admixture of pigments, unless extremely thorough mixing is used there will be a variation in the color of the mortar. The great difficulty, however, is the variation in color between the different batches, due to a slight error in proportioning, the variation in the quality of the pigment, or the treatment during setting and hardening. Cement setting in a hot dry place will have a lighter shade than that setting slowly in a wet damp place even if all other conditions of manufacture are identical. Where the color is obtained from the aggregate, variation is due to a variable distribution through the mass or in placing an excess of stone in one part of the mass over that in another.

Craze, Cracks, Checking.—This has been one of the most neglected subjects with which the manufacturers and users of cement has had to deal. There is little question that checking is caused by differential expansion and contraction, but years of continued and vigilant investigation has not furnished data from which definite conclusion as to the real cause of crazing in cement concrete can be obtained. The theory that cement when cured in air contracts and when cured in water expands, advanced by many, does not satisfy all the phenomena which have been observed in experiments. It is quie easy to prove that any concrete, irrespective of cement and aggregate, is never entirely free from crazing. It is well known that the greater the amount of cement the more crazing is obtained, also that careful curing greatly reduces it. With a view to bringing out discussion of this all important subject the committee takes the liberty of appending some of the phenomena observed in experiments, and conclusion reached as follows:

1. That all Portland cement crazes. The denser the concrete the more marked are the craze lines, for the reason that it is the dirt which accumulates in same that makes them so apparent, and as the body of an absorbent concrete absorbs more of this dirt than a dense concrete but uniformly over its surface. It is only the fact that the dirt collects in the craze cracks that makes them apparent on the denser material.

2. That there is quite often an exudation from cement concrete which collects in craze cracks, which when analyzed is found to contain practically all the constituents of which Portland cement is composed, showing that more or less of this material is absorbent and carried to the surface by the moisture when the concrete dries.

3. Exposure of green concrete to drafts, sun and rain, appreciably increases the amount of checking, but that no matter how carefully concrete is protected or for how long a period, it will eventually craze and check on exposure. This has been proved by curing concrete in water kept at very nearly a constant temperature for a period of two years, and that casts so made when sawed in half, thoroughly dried out, and exposed to the air, checked inside of 30 days.

4. That such crazing or checking is not confined entirely to the surface of concrete.

5. That the addition of waterproofing compound does not stop checking but by the preventing of concrete absorbing dust and dirt prevents it from showing temporarily.

6. That a thorough mix and proportioning of the aggregate so as to reduce the amount of cement necessary to make a dense concrete, materially decreases checking.

Expansion and Contraction Cracks.—Such cracks are due almost entirely to thermal stresses and can be overcome and controlled by proper reinforcement with steel in lengths of concrete up to 500 ft. and perhaps longer, but as such would be treated under the subject of concrete design.

Horizontal Joint.—In building monolithic walls where work is stopped for the day, an excess of mortar is frequently tamped to the surface and sets. The following day when soft concrete is added an excess of stone settles through the mortar to the hard surface below so that after cutting the surface a line is shown about ½-in. wide of mortar with an excess of stone directly above. This is avoided by scraping off ½-in. of the surface when the day's work is done before this has had time to set and by care in using a stiff mix in the first batch deposited next day so that the stone is held uniformly distributed in the mortar which is too stiff to permit the stone to settle through it.

Patches a Darker Color.—These seem to be caused by using a richer mixture, steel rubbed off from trowel with which applied, less surface evaporation from patches, or bringing to surface by troweling of the dark colored cement particles of the aggregates. It has been conclusively demonstrated that with due care and by addition frequently of some material to lighten the color of material put into a patch, that the patch cannot be detected even after several years of exposure.

Efflorescence.—Efflorescence is caused almost exclusively by percolation of moisture through a wall. It is not to be observed where a wall is always dry. Portland cement always contains some free lime and this is brought to the surface in solution by water and left there by its evaporation. This efflorescence has been chemically analyzed and found to be almost pure carbonate of lime. The remedy is to avoid percolation of water through a wall. If this tendency is very slight, as for instance in the wall of a building which is somewhat porous, allowing a driving storm to soak into the surface in such quantities as to later percolate to the surface bringing with it in solution lime, the appearance of efflorescence can be very much reduced or practically removed by waterproofing the surface with some compound which will prevent all absorption and percolation whatsoever.

Frozen Surfaces.—Freezing retards the setting of cement but does not destroy it. If the surface freezes the set is retarded [illegible] that the portion behind which is not frozen, setting faster, breaks the bond between the two, causing the frozen portion to scale. The remedy after the surface is frozen where the material lost has not got to be replaced, is to re-surface that material which is left. If it must be replaced the texture of the surface originally desired must determine largely the method of treatment. If this be a plastered surface it is a simple matter to roughen up the back to give a key for plaster and to place it on. If it is to be a tooled concrete surface, then a sufficient mass must be removed to enable a new facing to be placed, including aggregate of the same size and proportions as in the original work, in order to build out the face and also to have sufficient strength and stability either to stand by itself or to be properly keyed by suitable methods like the use of reinforcement, to the back.

Dusting.—These troubles are due to soft sand, unsuitable foreign material in sand, too little cement in mixture, bad mixing, too much time elapsing between mixing and finishing, finishing mixture too dry or too wet, use of "dryers" (*i. e.*, dry cement with or without sand to dry out the surface so that it can be quickly finished), permitting the surface to dry so rapidly as to impair the setting of the cement. When a thin surface is placed on one which has become hard there is liable to be dusting because there is no absorption from the concrete to take care of the excess moisture in the mortar. It has therefore got to come to the surface and in so doing it brings the soluble salts of Portland cement called laitance with it and some of the finest particles of the cement, the impalpable powder, to the surface, both of which are easily brushed off, and thirdly, because the moisture comes to the surface it cannot be troweled as soon as it ought to be, and when it is troweled so long a time has elapsed that the setting of the cement is broken up or impaired, thus materially reducing its strength. The remedy, where color is not an object, is the application of one or two coats of well boiled linseed oil. Paint is sometimes used, but is not a satisfactory material because as a rule it does not harden the dusty surface and the dust prevents its bonding to the mass below so that it scales off, leaving an unattractive appearance. In some cases the top may be ground off as in terrazzo work, until a hard surface is obtained.

Costs.—The cost of unskilled labor for picking or rubbing concrete when 6 to 24 hours old is about 1 ct. per sq. ft. If two days old, so that fiber brushes and water have to be used the cost runs from 2 to 3 cts. for actual dressing of the surface. In order to be able to remove the forms to get at the surface at these ages it will have to be designed in such a way that its price may vary from nothing to 5 cts. per sq. ft.

For a special facing material 1 in. thick of one cement, one and one-half sand and two and one-half of fine crushed stone or pebbles, placed at the same time with a coarse backing in the walls, will add about 3½ cts. per sq. ft. to the cost of the surface. This cost is independent of the method of treating the surface later.

Tooling by multiple picks by common labor when the surface is green will cost from 3 to 4 cts. per sq. ft.; when hard, from 5 to 10 cts.

The cost of the use of pneumatic tools varies materially with the size of the job and to what extent the work is scattered. For long low walls pneumatic tools will cost more than hand. For large areas like the soffit of a big arch pneumatic tools will be cheaper than hand work by one-half to one-third.

Sand blasting when the cement is one to two weeks old will cost about the same as bush hammering; when older it will cost considerably more.

Extended experience gives the following cost data: For hand tooled cast concrete four or six grooves to the inch with steel tools, the cost on a contract of tooling some 10,000 sq. ft., with skilled labor, was 15 cts. per sq. ft. the same kind of tooling with pneumatic tools about 12 cts.; the same tooling done in a factory by grinding with a special designed machine, 1 ct. This special designed machine consists of cutting wheels suspended on an arm like a pendulum wood-working saw revolved at a high rate of speed, so that concrete of almost any age could be cut without disturbing the stone in the aggregate. The cost of crandalling, being an average of many jobs, with skilled labor, is about 10 cts.; with unskilled, about 5 cts.

EARTH AND ROCK SECTION

A Comparison of Gyratory and Jaw Crushers; the Field in Which Each Is Superior.

Jaw and gyratory crushers are the two distinct types of crushers extensively used for the preliminary reduction of rock and ore. The well known Dodge and Blake crushers are the best examples of the jaw type and have been widely used for many years. Aside from some modifications in the method of applying the thrust and in the construction of the frame, these machines as built today are similar to the early designs. The gyratory type of rock breaker was introduced about 1885. Its large capacity was its most attractive feature and led to its rapid introduction. The early designs were faulty in many features. There is an improved design which has become more or less standard with the several manufacturers. This is the suspended-shaft, two-arm-spider, drop-bottom type with cut-steel bevel gears, forced oil circulation, [illegible] concaves.

Since it is possible to purchase either type of crusher in almost any size and with the assurance that the design and construction are adequate for the work intended, the choice of type [illegible] chinery as well as in millinery. The rapid development [illegible] success in meeting severe requirements have led many to advocate the complete retirement of the jaw type. It is the purpose of this [illegible] and these are generally fairly well recognized. [illegible]

Table I [illegible] glance the comparative [illegible] types over a wide range of [illegible] All the machines quoted in the table, except the two largest sizes of gyratory crushers, are standard sizes. The weights [illegible] quired power, etc., are those guaranteed by the manufacturers for average conditions with hard friable rock. The machines quoted in the table to deliver a certain-sized product are the medium sizes adapted to that product, as both larger and smaller machines, within small limits, could be adjusted to produce a certain size of material. The particulars of the 36x282-in. and the 42x345-in. gyratory crushers are only approximate, as the largest standard size manufactured is 24x198-ins. Gyratory crushers larger than 24x198 ins. have been built to special design.

Size of Feed.—Inspection of the compiled and calculated data in Table I reveals the following interesting comparisons: It develops that in each case the gyratory is a machine of greater weight, capacity and horsepower than the Blake crusher for the same size feed and product. The feed opening of the Blake type is rectangular, that of the gyratory is necessarily the segment of a ring. From this fact it follows that the weight and capacity of a gyratory crusher will increase more rapidly with an increase in the width of the receiving opening than will the Blake type. In other words, we may vary the width or the length of the feed opening in the Blake type independently of each other, while in the gyratory type the width of the feed opening controls the entire design, and the whole machine must be proportioned accordingly. This is an important characteristic and has great influence in defining the field of each type.

[illegible] Table II, which is computed from the data given in Table I, indicates a notable superiority of the gyratory type as regards efficiency of power consumption and capacity, per ton weight of crusher. In all cases tabulated, except the first (crushing from 7 to 1½ ins.), the relative capacity of the gyratory is greater than either the relative weight or required power. Referring to the third column of Table II, it appears that in this case the [illegible] the Blake crusher for the same size feed and product, but the capacity of the gyratory is 28 times that of the Blake, and the relative power required is only 1.66. This comparison [illegible] lues of capacity per installed horse- [illegible] which were computed for Table I. The gyratory is shown to vary from 0.58 ton per hour installed horsepower, in the smallest size tabulated, to 4.80 for the largest size, while the Blake has the values 0.50 to 2 for the same conditions. The greater duty per installed horsepower in the gyratory type is due to several reasons. A jaw crusher must break a rock by simple compressive force, high stresses being obtained by impact. The gyratory has the advantage of breaking a large number of pieces by beam action because of the concave shape of the shell and the convex shape of the crushing head. This action introduces both compressive and tensile stresses in the piece of rock, causing it to break with less exertion of force because the tensile strength of rock or ore is only a fraction of its compressive strength.

The gyratory is more economical of power owing to its continuous action. A jaw breaker consumes a large amount of energy in overcoming the inertia of the heavy and rapidly reciprocating parts. Another feature which helps to account for the relatively large amount of power that is installed for Blake crushers is the intermittent character of the work. The demand is irregular, and may temporarily far exceed the average, so a crusher of the jaw type must be liberally equipped with power.

[illegible]—Reference to Table I shows the marked advantage of the Blake over the gyratory type as regards the height of crusher. This is an important item, as it controls the height of buildings. In addition to the greater actual height of the gyratory it requires much clear headroom both above and below the machine for the necessary raising and lowering of the parts. The floor space occupied is about the same for either machine for a certain size feed and product.

[illegible] of the gyratory, resulting in breaking some of the rock by beam action, causes the material to be more cubical in form than the product of a jaw crusher. For this reason the gyratory usually gives the most uniform product from a given ore or rock.

Other conditions being equal, there is less [illegible] crusher, because the tendency toward a certain grind-

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[*] A paper by H. [illegible] Alaska [illegible] Mining Journal" for Sept. [illegible]

ing action cannot be entirely eliminated from the gyratory type. Owing to the conical shape of the concave liners of a gyratory they cannot be reversed when worn at the bottom. The plates for a jaw crusher can be arranged to be turned end for end when the lower part becomes badly worn. For these reasons the renewals for the gyratory type are a greater expense than in the jaw type.

Provided the feed is previously reduced to proper size, attendance is the same for one machine of either type, which gives an important advantage to the gyratory in those cases where its larger capacity enables it to replace two or more jaw crushers.

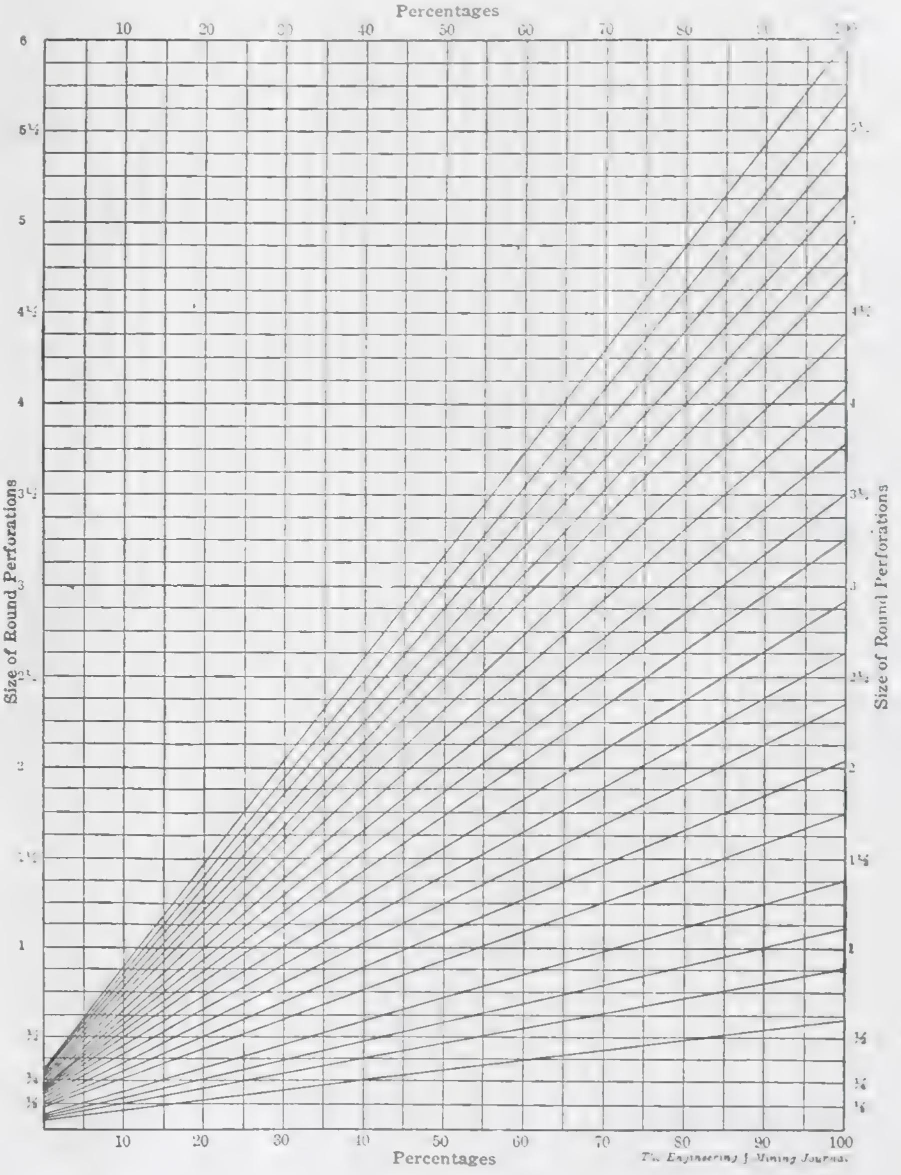
Repairs.—Repairs are more difficult to make, and possibly more frequent, with the gyratory type. The critical mechanical feature of the gyratory is the eccentric drive on the lower end of the main shaft. With hard rock and heavy feeding it requires efficient lubrication to keep the bearings cool. A well designed Blake crusher is easier to keep in order. The introduction of steel castings for the main frame of the jaw crushers has increased the strength and lessened the weight of that important part. As regards vibration during operation the gyratory is superior, as it runs very steadily.

The consideration of relative merits for a specified capacity, and the comparisons drawn therefrom are all on the basis of a given size of feed and product. It would be desirable to compare the two types on the basis of given capacity as well as size of feed and product, but this is not possible. When we designate the feed and product, the size and capacity of the appropriate crusher of each type is determined thereby, and these vary widely for the two types. The bearing that the required capacity has upon the comparison of merits, although left for the last, is all important, as will be shown.

Consider the case in the first column of Tables I and II. This is the only case of those tabulated in which the gyratory does not excel in capacity per ton weight of machine. If, however, a particular installation required the capacity afforded by the 7x56-in. gyratory (seven tons per hour), it might be selected in place of two 10x7-in. Blake crushers, because of the economy of one machine, one foundation, and one attendant. If, however, advantages are to be gained, as in small stamp mills, by dividing the work between several small crushers so as to avoid conveying the crushed material and to gain bin storage without additional height, two small Blake crushers might be selected in preference to one gyratory. It should be noted that the relative weight of the two types is not an exact index of the relative first cost, because the gyratory crushers are sold at a higher price per pound than the Blake type. There are other factors affecting first cost besides the price of the machine at the manufacturer's works.

Rock Breakers vs. Bulldozing.—Referring to the last columns of the tables, there is a most interesting case which is not generally well understood. We are dealing with large receiving openings and coarse crushing. During the last few years a demand has arisen for crushers of this magnitude in order to introduce economies in the mining and milling of ores. It has long been recognized that rock breaking is cheaper than stamp milling down to a size of about 1 in., and now it is beginning to be understood that rock breaking is cheaper than bulldozing and sledging pieces several feet in each dimension. This, of course, applies only to large-scale operations where the amount to be handled and the transportation equipment render such an installation feasible. To show the economies possible in this direction it may be noted that at the Treadwell mines in 1903* the amount of powder used in stoping was 0.34 lb. per ton of ore mined, while it required 0.85 lb. per ton mined to bulldoze this rock after it was stoped. It required one man breaking rock for each machine drill. Much labor was necessary on the feed floor of the crusher. The gyratory crushers in use did not receive large pieces. It is understood that improvements in this direction are now planned.

Returning to the tabulated features of the



The Engineering & Mining Journal.

Diagram Showing Proportions of Rock Crushed to Various Degrees of Fineness.

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*The Treadwell Group of Mines, Douglas, Alaska, by R. A. Kinzie, Trans. A. I. M. E., 1903.

TABLE I. COMPARATIVE FEATURES OF JAW AND GYRATORY CRUSHERS

Crushing from	7 to 1½ in.		10 to 1¾ in.		12 to 2½ in.		18 to 3½ in.		24 to 4 in.		36 to 12 in.		[illegible]	
Type of crusher	Blake	Gyratory.	Blake	Gyratory.	Blake	Gyratory.	Blake	Gyratory.	Blake	Gyratory.	Blake	Gyratory.	Blake	Gyratory.
Size of feed opening in inches	10x7	7x56	20x10	10x80	[illegible]	12x88	36x18	18x136	36x24	24x198	[illegible]	36x282	60x42	[illegible]
Capacity in tons per hour	4	7	12	30	5	70	60	130	85	400	160	900	300	[illegible]
Weight in tons	4	8	9	18	15	[illegible]	[illegible]	50	30	95	55	200	100	300
Hourly capacity ÷ tons weight	1	0.87	1.25	1.66	1.67	2.91	[illegible]	2.60	2.83	4.22	2.90	[illegible]	[illegible]	[illegible]
Installed horsepower	8	12	20	25	[illegible]	50	65	90	65	150	100	200	150	250
Hourly capacity, installed H.P.	0.5	0.58	0.60	1.20	0.83	1.40	0.92	1.44	1.31	2.67	1.60	4.5		4.8
Height in feet (discharge spout to feed floor)	4	5½	3	7½	5	[illegible]	6	10	6	15	7	23	8	[illegible]
Width in feet (including [illegible])	6½	10	7	13	8	13	13	13	13	20	10	27	15	30
Length in feet (over all)	[illegible]	5	9	6	10	[illegible]	12	12	12	12	15	18	16	21

TABLE II.—RELATIVE WEIGHTS, CAPACITIES AND HORSEPOWER.
The Blake Crusher being taken as unity in each case.

Crushing from	7 to 1½ in.	10 to 1¾ in.	12 to 2½ in.	18 to 3½ in.	24 to 5 in.	36 to 12 in.	42 to 16 in.
Relative weight of gyratory	2.0	2.0	1.60	1.72	3.16	3.65	3.00
Relative horse-power of gyratory	1.50	1.25	1.66	1.39	2.32	2.00	1.68
Relative capacity of gyratory	1.75	2.5	2.80	2.17	4.72	5.62	4.0

crushers with large feed opening, one is impressed at once with the enormous capacity and colossal size of the gyratory machines for this class of work. While the calculations show that the gyratory crushers in these sizes have marked advantages in efficiency, their tremendous size and cost are prohibitive unless their large capacities can be utilized. The 36x282-in. gyratory is estimated to have a capacity of 900 tons per hour to a 12-in. product, and the 42x345-in. 1,200 tons per hour to 16-ins. It would be a remarkable mining or quarrying operation that would furnish large material at such a rate, and that is why we do not hear of gyratory crushers of such dimensions. Some machines have been built larger than 24x198-in., but they are not likely to come into general use. On the other hand the large Blake crushers are commonly built and successfully installed. Their capacity is usually in excess of the requirement but, as is evident from Table I, not to the prohibitive extent that is true of the gyratory type.

Crushing Plant for 200 Stamp Mill.—As an illustration of the application of the preceding data and conclusions, the design of a crushing plant for a 200-stamp mill will be considered. Assume a wide body of hard ore, which can be mined cheaply if the ore does not have to be blasted beyond what is necessary to break it from the solid, and adequate transportation facilities are provided to convey the large material to the crushing house. I further assume that a knowledge of the character of the vein and the general conditions of mining are such that it will be desirable to provide for receiving pieces up to 36x42 ins. Assume that the stamps have a capacity of 5 tons per day, then for the 200-stamp mill 1,000 tons per day crushed to pass a 1¾-in. ring (equivalent to 1¼-in. cube) must be delivered by the proposed crushing plant. It is apparent that the ore must be crushed in stages. Since the initial crushers of large receiving opening will of necessity have a large capacity, it will be best to concentrate the crushing into one 8-hour shift, thus introducing economies in operation. This calls for a crushing capacity of 125 tons per hour.

In Table III the distribution of sizes in run-of-mine ore is obtained from experience. The percentages of the different sized particles in the product delivered by any particular crusher may be found by consulting the diagram shown in Fig. 1. For example, when crushing to pass a 6-in. ring, 81 per cent will pass a 5-in. ring, and about 20 per cent will go through a 1½-in. ring. This diagram was constructed by the Power and Mining Machinery, and is stated to be the result of the compilation of a large amount of experimental data. The results obtained are stated to have been uniform, and the diagram is recommended to be used to determine the percentages of certain sized products from any crusher, roll, or screen. The diagram is approximately correct for hard friable ore, and proper allowance must be made if the rock has any inherent tendency to break in a certain way.

Blake Preferred as Initial Crusher.—Taking the required capacities and duties as arrived at in Table III and referring to Table I, it is apparent that we would select the 42x36-in. Blake crusher for the initial breaker. This machine has excess capacity over what is required, but not such enormous excess cost and capacity as a gyratory for the same work. For the secondary crushing one 12x88-in. gyratory is strikingly superior, as it would require three 24x12-in., or two 40x12-in., or two 36x18-in. Blake crushers for the same capacity. For the final crushing two 8x60-in. gyratory crushers would be indicated.

TABLE III.—SIZE ANALYSIS.
Crushing Plant designed for 125 tons per hour.

	Tons per hour between			
	36 and 12 in.	12 and 3 in.	3 and 1¾ in.	1¾ in. and under.
Run of mine	55	40	15	15
Feed to first crusher	55	..	..	..
Product of first crusher	..	30	15	10
Feed to second crusher	.	70	..	.
Product of second crusher	..	..	30	40
Feed to third crusher	..	..	60	..
Product of third crusher	.	..	..	60

If the ore formation and conditions of mining and transportation were such that an initial crusher to receive pieces 24x36-in. was sufficiently large, it would be found, upon making a size analysis similar to that shown in Table III for 36x42-in. that one 36x24-in. Blake machine crushing to 4-in., followed by two 10x80-in. gyratory crushers each giving a product to pass a 1¾-in. ring, would meet the conditions.

In an installation of the size considered above, the crushing plant would be separate from the mill, the crushed product being delivered to the ore bins by conveyers. The large initial crusher must have a solid foundation, preferably resting directly on the ground. The large pieces to be handled make it imperative that the ore be dumped into a receiving hopper that feeds directly to the large crusher. If a gravity-plant site is not available or desirable, there is no difficulty in elevating the product of the initial crusher for further reduction.

The conclusions reached above are in accordance with the most advanced practice. The economy of breaking by crusher over bulldozing and sledging is beginning to be appreciated. Recent installations in South Africa employ large Blake crushers for initial breakers, followed by gyratory machines preliminary to stamp milling. A notable installation in the United States is that of a 60x42-in. Farrell-Bacon jaw crusher capable of breaking down to 16-in. the largest pieces of hard iron ore that can be handled by a 70-ton steam shovel. Other plants where economies have been secured by introducing large initial crushers of the Farrell-Bacon jaw type are the Granby mines, Phoenix, B. C., the British Columbia Copper Company and the Natomas Consolidated of California.

In conclusion it may be said that while each type has a field in which it is superior, no sharp lines can be drawn because of the many factors involved. It is believed, however, that with the aid of the data here presented an investigation along the lines indicated will quickly indicate the most desirable machine for any particular service.

ROADS AND STREETS SECTION

Some Notes on the Drainage of Country Roads.*

The most important principle involved in road building is that of thorough and proper drainage. The soil upon which the road bed is placed must eventually bear the loads passing over the road. The intensity of the pressure is of course not nearly so great on the soil as on the wearing surface of the road, since the severe wheel pressure becomes distributed over a much larger area, the distribution depending on the thickness, character and condition of the roadway materials. But, whatever the distribution, the load is finally transmitted to the soil.

The ability of the earth to sustain a load depends largely upon the absence of moisture in it. Most soils can be so compacted as to form a good firm foundation as long as they are kept dry, but on the entrance of water they become soft and incoherent and largely lose their sustaining power. In cold climates there is the additional damage due to freezing, but frost has no disturbing effect on dry material. Therefore, it is the entrance of water which is to be guarded against in every possible way.

Drainage consists of two kinds: surface and under drainage. Surface drainage is accomplished by using more or less impervious material for the road surface and by having the surface of such form that water falling upon it will quickly run into the gutters or ditches. The great majority of our improved country roads have a cross section which may be said to be formed of two sloping planes with their intersection slightly rounded along the center line of the road. The side slopes toward the ditches vary from ⅜ in. to 1 in. to the linear foot. For plain macadam roads having a surfaced width of 12 to 16 ft., ¾ to ½ in. to the foot is very commonly used. The earth shoulders from the stone to the ditch are usually given a slope of 1 in. to 1½ in. to the foot, which has been found to be very satisfactory. Very little has yet been done to determine the most suitable side slope for various grades. The formula $H=\frac{W(100-4P)}{5,000}$ for the crown of a roadway, where H equals the crown in feet, W equals the width of road in feet from shoulder to shoulder, and P equals the per cent of grade of the road, has probably been used more than any other in this country, but it is by no means perfect, and further investigations are needed on this subject.

The ditches and cross drains must be of ample size to care for the largest storm flow, and since the rainfall varies very largely throughout the United States, ranging all the way from over 100 ins. to a minimum of less than 3 ins. per annum, it is at once plain why the practice is so varied as to the size, shape, and grade of ditches and culverts. Wherever practicable, however, the grade of the bottom of a ditch should not be less than 6 ins. to the 100 ft. On our country roads the gutters, or side ditches, are as a rule unpaved except on steep grades where the velocity and volume of the run-off are sufficient to produce appreciable scour or erosion.

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*Extract from a paper presented to the Second International Road Congress at Brussels, by Vernon M. Peirce, Chief Engineer Office of Public Roads, Department of Agriculture, Washington, D. C.

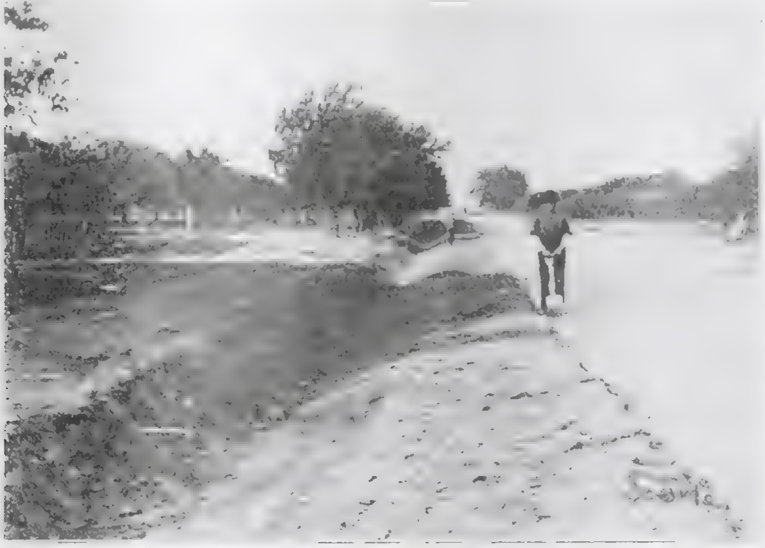
Fig. 1—Deep Side Ditch for Longitudinal Drainage.

Cross drains or culverts are constructed of wood, earthenware, iron and cement pipes, and concrete both plain and reinforced. Wood as a material for cross drains is rapidly going out of use and should be discarded entirely. For the smaller waterways terra cotta and cement pipes serve fairly well in the warmer climates. In the extremely cold sections the terra cotta and plain cement pipes are very often broken by becoming clogged in time of a thaw which is followed by a sudden, hard freeze. Iron and reinforced concrete do not seem to be injured in this way, and the latter should be used for the construction of all of the larger culverts.

All culverts which are built with any of these materials should have their ends protected by concrete construction, in order to prevent the washing away of materials adjacent to the ends or of the culvert itself. An illustration of the washing away of a corrugated iron pipe culvert is included, which shows its failure due to the lack of being provided with concrete ends.

Fig. 2—V-Shaped Drain Construction.

Under-drainage involves the removal of the ground water to a sufficient depth to prevent it from injuring the road, and this depth should be varied according to the climate and the character of the soil, never being less than 2 ft. below the elevation of the road surface. The general method of removing the ground water is by drain tile from 4 to 12 ins. in diameter, laid on a true grade, and not less than 3 ft. below the crown of the road. There may be a line of such tile on both sides of the road, a single line on one side, or a single line down the middle of the road. When the direction of flow of the ground water is found to be strongly from one side, as is usually the case in side-hill construction, a single line of pipe cutting it off before it reaches the road will be sufficient. In low and swampy land, not having a well defined under flow, and in heavy retentive soils a line of tile on each side will be necessary to properly protect the road. In the latter kind of soils the tile should be laid on about 4 ins. of coarse sand or fine gravel and then covered to a depth of at least 1 ft. with similar material. This not only insures that the joints and pores of the tile will not become clogged with the almost impervious clay, but it also gives a larger collecting area for the percolating soil water.

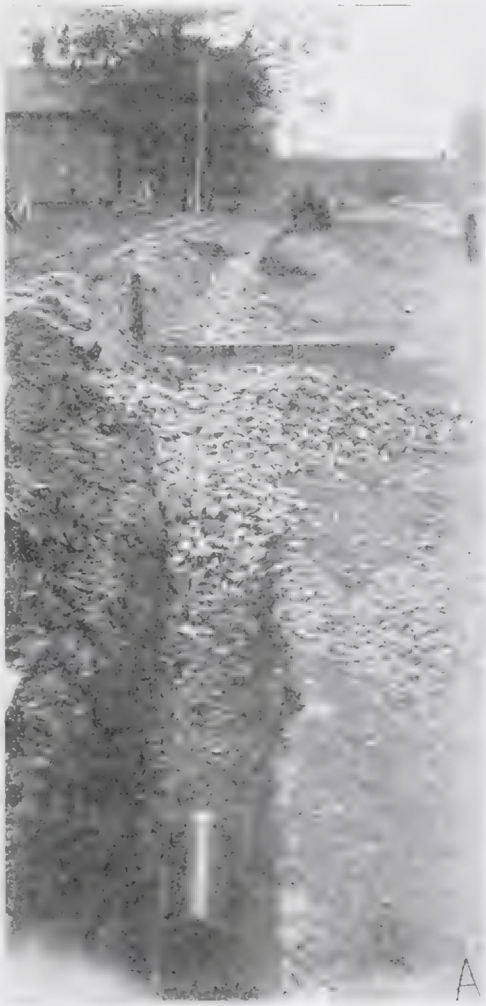

Fig. 3—Tile Under Drain at Side of Road.

One of the later methods employed to drain the subsoil, which has given satisfaction, is the construction of the V-drain. In this work the subgrade should be excavated for the full width of the surfaced roadway and from 6 to 8 ins. deeper at the sides and from 12 to 18 ins. deeper at the center than usual, thus producing a flattened V-shaped trench. This extra excavation is made in order to be filled with pebbles and boulders varying in size from ½ to 12 ins. in their longest dimensions and having the largest stones placed in the bottom of the trench, which should be graded longitudinally so that the water will run along easily. These stones do not have to be deposited carefully, but should be so placed that they may be compacted with a roller to form a suitable foundation for surfacing. The water drained by such construction should be carried to the outlets provided, through narrow trenches filled with similar sized stones, as should the water drained by all forms of sub-surface drainage be carried to the side ditches, culverts, or open waterways through their own similar forms of construction.

Details of the practice of sub-drainage vary largely in the different sections, but the employment of longitudinally tiled and V-shaped drains to collect and carry off the water is very extensive and rapidly increasing. Road builders are learning more and more from experience that as a rule it is cheaper in the end and more satisfactory to drain than to lay expensive foundations. To keep the earth dry, hard, and unyielding is necessary to secure the low cost of maintenance and long life of a road. Therefore, the water falling on the road must be carried off quickly and effectively and the water from below must be intercepted and removed before it reaches the roadbed where it can do damage.

All previous records for excavation in the rainy season were broken in the Central Division and in Culebra Cut of the Panama Canal during the month of August, when 1,377,992 cu. yds. of rock and earth were taken out of the cut and 234,404 cu. yds. from the Chagres section.

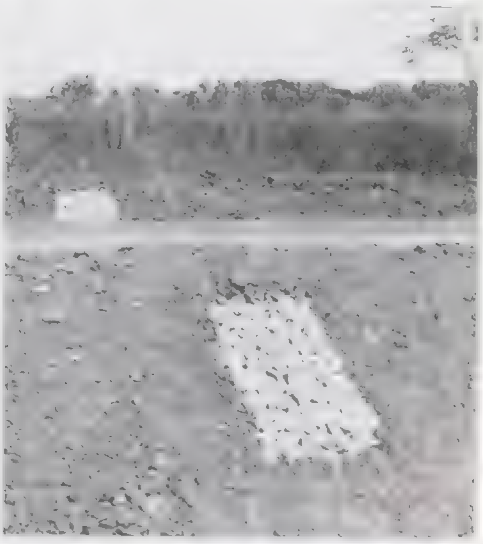
Fig. 4—Shoulder Drain Provided for Outlet for Under Drainage.

Concrete work was begun on Sept. 1, 1909, on the Pedro Miguel Locks of the Panama Canal and to date 261,964 cu. yds. have been completed. There remains 575,500 cu. yds. to be placed.

A Study Into the High Cost of Asphalt Pavement Repairs in Chicago in 1908-9.*

The Common Council of the City of Chicago, on Feb. 21, 1908, made the following appropriations:

> For repair of asphalt streets outside of contract reservation, $50,000.
>
> For repair of streets, in addition to the sum above appropriated, all income from the vehicle tax collected under the provisions of an ordinance passed Feb. 2, 1906, after deducting therefrom the cost of collection.

A further sum of $75,000 was appropriated for the restoration of excavations into the streets by contractors, plumbers, sewer builders, etc.

The legality of the Vehicle Tax Ordinance was questioned and taken to the courts for decision; and until this decision was rendered it was uncertain, of course, whether any money for the repair of streets would be available from that source. Pending the decision of the court the only sum available to the Department of Public Works for ordinary street repairs was the $50,000 appropriated by the Council, and the Department of Public Works could not (presumably) enter into contrasts involving the expenditure of a larger sum.

It had been the practice of the Department for many years to enter into contracts for the repair of the asphalt pavements of the city, and it was desired to make such a contract for these repairs for the year 1908. The Superintendent of Streets therefore requsted the Engineer of the Bureau of Streets to prepare an estimate of the quantity of repair work that could be done with the available fund of $50,000, and such an estimate was submitted by the Engineer, as shown by the first two columns of Table I. On May 15, 1908, the Commissioner of Public Works advertised for sealed proposals to make repairs to asphalt pavements during a term ending Dec. 31, 1908, according to plans and specifications on file in the office of the Department of Public Works; said proposals to be received until 11 a. m. on May 28, 1908. Six proposals were received and opened on that date. These proposals are computed and tabulated in Table I.

On May 29, Dooley advised the Commissioner of Public Works, in writing, that he could not begin work for 60 days, because he could not get his asphalt paving plant in condition for operation before that time. As the specifications under which the proposals were submitted stipulated that the work must be commenced on June 2, and must progress regularly and uninteruptedly thereafter. Dooley's proposal was, in effect at least, informal; and as it was deemed important that the work should be begun at once, the Commissioner of Public Works very properly rejected the Dooley bid.

The proposal of the McGovern Company was therefore accepted and a contract entered into with that company on June 1, 1908. But for some reason, not disclosed, the date for the completion of the work under the contract was filled in as July 2, 1909, instead of Dec. 31, 1908, as the advertisement and specifications stipulated. The McGovern Company appears to have actually begun repair work under this contract on the 6th day of June, and by the middle of July the whole of the special appropriation had been exhausted.

On the 11th day of July, 1908, the Vehicle Tax Ordinance was pronounced valid by the courts, and soon thereafter a considerable sum of money accumulated from that source, which, by the terms of the appropriation referred to above, was available for street repairs, and it might be expected that the amount received from this source applicable to street repairs, under the terms of the appropriation ordinance, would reach a large sum. There sems to have been some question whether the proceeds from the Vehicle Tax Ordinance could be used for the paymen of work done under the McGovern contract; and on July 10, 1909, the Superintendent of Streets addressed an inquiry to the Corporation Counsel. In reply, the Assistant Corporation Counsel addressed to the Superintendent of Streets the following:

> Dear Sir:—Replying to your inquiry of the 10th inst., beg to advise you that there is no reason why you cannot use a portion of the moneys derived from the Wheel Tax to pay for repair work on asphalt streets, inasmuch as the appropriation from the Vehicle Tax is "in addition to the sums above appropriated."

The Assistant Corporation Counsel did not answer the specific question submitted by the Superintendent of Streets, which was whether the Vehicle Tax fund could be applied to the payment for repairs made under the McGovern contract; but the Superintendent of Streets seems to have taken the Corporation Counsel's reply as an affirmative answer to that question and acted accordingly. The McGovern contract was therefore extended to cover the expenditure of the whole of the Vehicle Tax Fund, amounting to something like $363,000.

The advertisement leading to this contract distinctly called for proposals "for furnishing all labor, material, apparatus, or things required, and do all the work of every sort and kind necessary to make repairs to asphalt pavements during the term ending Dec. 31, 1908, according to plans and specifications on file in the office of the Department of Public Works."

The plans and specifications here referred to seem to have been made up partly of printed forms, apparently standard in the Department, and partly of typewritten matter. The typewritten matter was presumably prepared and intended to cover the special conditions and stipulations relating to this individual contract, and may therefore be regarded as taking precedence in any difference or discrepancies between the printed and the typwritten matter.

Among this typewritten matter is found a "Schedule of Quantities" to be bid upon, identical with the items and quantities named in the Engineer's estimate heretofore referred to, but before each quantity is written with a pen the word "about," thus providing some latitude in these quantities. In the body of the printed matter headed "Special and General Requirements" is pasted a typewritten slip reading:

> The Commissioner of Public Works reserves the right to extend the time for the final completion of this contract for a further period of not to exceed 90 days from and after said December 31, 1908.

Thus, both the advertisement for proposals and the typewritten part of the specifications refer to the proposed contract as expiring on Dec. 31, 1908. But in the executed contract the printed clause relating to time of beginning and completing the work contains the following:

> Said work shall be commenced on or before the 2d day of June, A. D. 1908, shall progress regularly and uninterruptedly, after it shall have been begun, excepting as shall be otherwise ordered by the Commissioner of Public Works, and be finished and fully completed on or before the 1st day of July, 1909; the time of commencement, rate of progress and time of completion being essential conditions of this contract.

The words emphasized in the above quotation are written with pen and ink in blank spaces left therefor in the printed form. The Clerk of the Department of Public Works states that these written words and figures were filled in by him at the time the contract was executed.

It appears, therefore, that the persons and companies who submitted proposals for this work did so with the distinct understanding that they were proposing to do approximately definite quantities of work within a period of time which would expire on Dec. 31, 1908, though that period might be extended not mort than 90 days by the Commissioner of Public Works. If any of the bidders had information that the contract would later be expanded to cover something like eight times as much work as was named in the original schedule, and to extend until July 1, 1909, they did not obtain such information from the public records at the time they submitted their bids. It is doubtless true that had the bidders known the extent to which the work would be extended, the prices submitted by them would have been quite different. Contractors can afford to, and usually do, bid lower prices as the quantity of work to be done is increased.

If the Department had at any time, or prior to the submission of proposals, any intention to so largely increase the work, or any knowledge that it might thus be increased, it was misleading and unfair to the bidders not so to inform them; and it was obviously unwise and unbusinesslike on the part of the Department to enter into a contract for such a large amount of work based upon proposals the makers of which were misinformed as to the magnitude of the work to be done and the time to be allowed for its execution.

It is claimed, and is doubtless true, that at the time these proposals were called for the Department could not prepare for or enter into a contract involving the expenditure of more money than was appropriated for the purpose, which in this case was $50,000, and that it was urgent that the repair of the streets should be begun without delay. The Department was, however, aware and probably expected, that a very much larger sum might become available for street repair work; and it was clearly within its power to confine this particular contract within the limits it was intended to cover, and to call for new proposals and enter into a new contract for the additional work. The subsequent history of the whole transaction shows how important and beneficial to the interests of the City such a course might have proven to be.

Another important feature of these proposals may be appropriately considered here. The typewritten specifications contain this clause:

> No bid will be accepted which does not contain an adequate or reasonable price for each and every item named in the schedule of prices.

This is a proper, wise, and very necessary condition to consider and enforce in accepting proposals for any work. It is a recognized principle that unbalanced bids are wrong, and that to accept them is unwise and dangerous. The acceptance of bids that are palpably unbalanced should be prohibited by law, as it is in many cities.

In this case, the proposal accepted by the Department of Public Works was so glaringly unbalanced that the fact could not escape attention. An excessive price was named for Class A repairs, and a merely nominal price (1 ct. per sq. yd.) was named for Class B repairs. In other words, while a price of $1.75 per sq. yd. was named for making repairs where only surface and binder were required, a price on 1 ct. sq. yd. was named where, in addition to the surface and binder,

TABLE I.—TABULATION OF BIDS SUBMITTED MAY 28, 1908, FOR REPAIRING ASPHALT PAVEMENTS.

Items.	Estimated quantity on which bids were based.	Thomas L. Dooley.		H. H. McGovern Company.		Western Const. & Maint. Co.		Parker-Washington Company.		Scully Pvg. Company.		Barber Asphalt Paving Co.	
		Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.
Repairing, Class B	27,000 sq. yds.	[illegible]	[illegible]	[illegible]	$47,250.00	$1.04	[illegible]	$1.11	$29,970.00	$1.31	$35,370.00	$2.02	$ 54,540.00
Repairing, Class A	13,000 sq. yds.	1.30	16,900.00	.01	130.00	1.40	18,200.00	1.71	22,230.00	1.42	18,460.00	3.00	39,000.00
Cement Concrete	2,200 cu. yds.	[illegible]	[illegible]	[illegible]	7,150.00	[illegible]	[illegible]	[illegible]	[illegible]	4.00	8,800.00	5.88	12,936.00
Binder Delivered	120 tons	[illegible]	[illegible]	[illegible]	480.00	[illegible]	[illegible]	[illegible]	[illegible]	3.00	360.00	7.90	948.00
Asphalt Mixture	570 tons	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.00	3,420.00	9.05	5,158.50
Totals			$54,078.00		$57,860.00		$60,565.00		$66,058.30		$66,410.00		$112,582.50
Order			1		2		[illegible]		4		5		6

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*Abstract of a report by S. Whinery, M. Am. Soc. C. E., to the Chicago Commissioner on City Expenditures.

the contractor was required to add 6 ins. of Portland cement concrete, the actual cost of which latter, if made in accordance with the specifications, would not be much less than 75 cts. per sq. yd.

Considering now the specifications under which these proposals were received and the work done, even a casual examination shows that they were indefinite, inadequate and ambiguous. It is not intended to discuss at this time the technical merits or defects of these specifications, but only those conditions and provisions which affect broadly the letting and execution of this particular work.

(a) It is not stated clearly and definitely what work was required to be done for the price named for Class A repairs. Presumably that price was intended to cover both binder and wearing surface, as the latter term is strictly defined. It is true that the schedule of quantities named a specified quantity (tons) of binder delivered on the street, and also a quantity (tons) of asphalt mixture delivered on the street. It is obvious, however, that these quantities were intended for special use, and did not purport to be the quantities necessary for making 40,000 sq. yds. of surface repairs, since neither quantity is anything like adquate for the purpose. While the term "surface course" is used in specifications to designate, in a narrow sense, that part of the pavement composed of asphalt mixture, it is usual to speak of an asphalt pavement as composed of two parts only—the "base" or foundation of concrete, and the "surface," comprising both the binder course and the asphalt wearing surface. In these qualifications, it is not made clear whether the price for Class A covers the surface course, technically speaking, or both that course and the binder. It is true that the specifications state the requirements for "surface course" and for "binder" under separate classes, and appear to name a separate price for each. But the almost universal custom of making the price for "surface course' cover both, and the fact that the quantity of binder named in the schedule was less than 6 per cent of the quantity required for the 40,000 sq. yds. of repair work, seem to indicate clearly that it was intended to follow the usual practice and to include in Class A both the binder and the asphalt surface. But later, when the work was under way, only the asphalt surface, technically speaking, was included in Class A work, the contractor being paid extra for the binder.

(b) The "Instructions to Bidders," in the typewritten specifications, contain this clause:

> Bidders must state in these proposals the name of and the source of supply of the asphalt they propose to use.

The proposal of the M. H. McGovern Co. failed to comply with this requirement, and was to that extent informal. The specifications, however, state that "the asphaltic cement hereinafter specified shall be of refined Trinidad Lake asphalt obtained from the island of Trinidad, or of an asphalt of equal quality for paving purposes;" and under this clause the Department undoubtedly had the right to control the quality of the asphalt used.

(c) The specifications seem to have been primarily framed to require the repairing to be done by the method of cutting out defective spots, removing the old material, and then replacing it with new material and surface. This method requires the use of both binder and surface in each repair. After specifying the composition of the binder and the method of placing, it requires that "it shall be rolled with a five-ton steam roller until it has a uniform thickness of 1½ ins. The upper surface shall be parallel with and 2 ins. below the final surface of the pavement."

Likewise, after describing the composition of the surface course and the manner in which it shall be laid, it is stipulated that it shall be constructed

> to such a depth that af[illegible] its ultimate compression it will have a thickness equal to the combined thickness of the present wearing surface and binder (or cushion) course, and the top thereof must conform with the surface of the pavement.

These conditions are obviously impossible, and are an example of the carelessness with which the specifications were prepared. It was evidently the intention to specify that the surface course should fill the space from the top of the binder to the surface of the old or adjoining pavement; and as the binder was to be finished 2 ins. below the surface of the completed pavement, the thickness of the surface course must necessarily be 2 ins. It was also probably the intention that the binder course should be of such a thickness as to fill the space between the concrete and a plane 2 ins. below the top of the finished pavement; and if so, its thickness would vary and could not be always made 1½ ins., as required. In any event, some thickness of binder and 2 ins. of surface course would be required.

After thus describing in detail the general method by which the repairs should be made, there follows in the specifications, under the sub-title of "Machines," a description of a wholly different method, commonly known as "skim repairs" or "surface-heater repairs," and the contractor is given the option of using this method, with the consent of the Commissioner, and where the conditions seemed suitable. This method consists in heating or melting the upper surface of the old pavement, and the removal of so much of the old surface as may be necessary to reach sound material. Over the spot thus prepared new surface mixture is placed and compressed to such a thickness as is necessary to bring the repaired surface up to the level of the adjoining old pavement. By this method the thickness of new mixture used is often not greater than ¾ in., and seldom exceeds 1½ ins.

While it is nowhere so stated in the specifications or contract, repairs made by this surface-heater method were classed and paid for as Class A repairs, notwithstanding that it is a much less costly method than the one previously described. Thus, if in the old or usual method the binder and surface course are each 1½ ins. thick, a fair and reasonable price, under ordinary conditions, is $1.25 per sq. yd.; while a reasonable price, under the same conditions, for surface-heater repairs is about 65 cts. per sq. yd., a difference of 60 cts. per sq. yd. This being so, if surface-heater repairs were to be permitted they should have been put in a class by themselves and contractors asked to name a separate price for them.

In order to use the surface-heater method, the contractor must first obtain the consent of the commissioner and the superintendent of streets, and presumably he had no means of knowing, when preparing his bid, whether this method would be permitted or not, unless he had a private understanding with the commissioner. In the absence of such an understanding, he would for his own protection base his bid upon the more expensive method, and the city would, to that extent, fail to receive the lower prices appropriate for the surface-heater work.

But this is not the worst feature of these specifications.

> When the old pavement in places contains sufficient bitumen to permit of its being heated and raked loose, then the contractor may use a machine which heats the pavement with a blast of hot air. This blast of hot air should have a passage of from 10 to 12 feet or more from the source of the heat, or the oil burner, to the pavement, so that no flame under any circumstances shall come in contact with the pavement.
>
> Under no circumstances will any machine be allowed to be used that throws a flame upon the pavement.

Only one machine fulfilling the conditions here specified is on the market. This machine is patented, and it was known by the commissioner at the time these specifications were adopted that one particular contracting firm, the M. H. McGovern Company, had secured the sole and exclusive right to use this machine in Chicago.

The restriction of contractors to the use of a single patented machine, controlled solely by one contractor, was unjustifiable. There might readily be a difference of opinion as to the respective merits of the several machines available for this work, but such opinion would not warrant the exclusion of all but one machine, when by doing so it would give one contractor a monopoly of the work and result in the loss of large sums of money to the city. In this case there was no good reason for thus creating a monopoly. The fact that some other machines in common use throw a flame upon the surface of the pavement is not a serious objection to their use; for even if the immediate surface material is thereby scorched and injured, it is raked off and discarded down to a point where the pavement is merely softened and not burned. Those who have had large experience in the use of such machines will confirm this statement. It may be and is questioned whether it is advisable to make repairs by the surface-heater method; but if that method is to be permitted at all, the conditions should be made so as to permit competition.

(d) A typewritten clause in these specifications reads as follows:

> When any opening or openings are made in any street paved with asphalt for any purpose, by any person, persons or corporation, they shall be charged five dollars ($5.00) for the first square yard or fraction thereof, and three dollars ($3.00) for each additional square yard or fraction thereof, of pavement which has reached a condition necessitating repairs because of such opening or openings.

While it is nowhere more directly stated in the contract or specifications that the contractor is to make repairs of this character, the fact that the above clause was inserted in the body of the specifications indicates that he was required to do so; and, as a matter of fact, the contractor did make these cut-repairs on the streets where he was at work. If he was required and entitled to make such repairs, then obviously no other person or contractor had the right to do so.

But the commissioner of public works had no authority to make such a contract, because the person or persons making cuts through the pavements have an antecedent right themselves to make such repairs, and it is only after their failure to do so that the commissioner has authority to employ some other person to do the work. (See Section 1868, Revised Municipal Code.) In the case of the larger corporations, they seem to have exercised this right by making special terms with the contractor for doing the work; but in the case of individual property owners having small cuts to be repaired, their right to make their own repairs or to have them done by persons other than this contractor seems to have been ignored, or at least obstructed.

The terms of payment for these permit repairs named in the clause quoted are inequitable and unjust. Regardless of the area of the repair, the contractor was to get $5 for the first square yard or fraction thereof, and $3 for each additional square yard or fraction thereof. Under this provision, the contractor, if he repaired a cut measuring or reported to measure 1 1/10 sq. yds., was entitled to $8, and if the area were 3 3/10 sq. yds. he would receive $12 for the work. This interpretation was allowed, and property owners were charged accordingly. It seems probable that the clause was awkwardly framed, and that what was intended might have been expressed as follows:

> For making such repairs, the contractor shall be paid at the rate of $3 per square yard; but the compensation for repairing any one cut shall not be less than $5.

Where the contractor must go about the streets repairing small and widely separated cuts, the work is expensive and he is entitled to a liberal price. But in this particular contract the cut-repairs were often, if not generally, made at the same time and in the same manner as the general repairs, and for this reason they cost him no more than Class B repairs; and the excessive prices charged to property owners under the above specification clause were wholly without justification.

(e) The guaranty clause usually found in specifications for asphalt pavement is omitted from these specifications. Beyond the usual general clauses stipulating that the work shall be properly done, to the satisfaction of the commissioner of public works, there is no special provision that the contractor shall make good any defects that may subsequently appear in his work within a stated period of time.

The Unbalanced Bid.—The only intelligible motive that a contractor can have for submitting an unbalanced bid is that he may gain some advantage thereby. He may know or believe that the actual quantities of the work to be done will differ materially from those upon which the bid is to be based, or he may believe or have assurance that the specifications will be applied, in his case, differently from their obviously intended meaning. In the first case, he may have information not in the possession of the city officials in charge of letting the contract, and the latter may be acting in good faith; in the second, he must depend, in most cases, on the assistance or connivance of those whose duty it is to enforce the specifications. These conditions are so well understood by every reasonably intelligent and honest city official that a bid having even the appearance of being unbalanced will not be accepted.

In this particular case, the bid of the McGovern Co. was so glaringly unbalanced that the fact could not have escaped attention. The commissioner of public works admits that he knew its character, and it is on record that the city comptroller called his especial attention to the matter. His only excuse, as given in his communication to the mayor and his testimony before your commission, was that, applying McGovern's prices to the schedule quantities of work, it was the lowest bid offered, and that such unbalanced bids had been accepted by other city departments. Neither excuse could have had any proper weight against the well-known dangerous character of unbalanced bids.

But even admitting that the work could be confined strictly to the schedule quantities, and that it was therefore permissible to accept the McGovern bid, there could be no excuse for allowing the contract to be extended beyond the schedule limits, so that the unbalanced prices could be applied to defrauding the city. The contract should have been terminated when the limits of $50,000 expenditure, upon which it was based, had been reached. The excuse given for not doing this—that street repairs were urgent and that to make a new contract would consume much valuable time—is not satisfactory. The whole time required for advertising and for executing a new contract would not have occupied more than 15 days, and the decision of the court on the validity of the vehicle tax might have been anticipated and proposals opened at any time prior to that decision.

The acceptance of this unbalanced bid, and the extension of the contract to cover about eight times the quantity of work named in the original schedule, resulted in the loss to the city of a large sum of money. Table II shows that the contractor was paid $413,247, while, if the proposal of the Western Construction & Maintenance Co. (which was the next lowest to the McGovern bid) had been accepted, the amount paid for the same work would have been only $266,064. In other words, the city would have saved $147,183 on the contract.

An ordinance should be passed by the city council, or what would be better, a state statute adopted, prohibiting the acceptance of unbalanced bids and providing severe penalties for its violation.

It is true that it is sometimes difficult to determine whether a bid is or is not unbalanced. Contractors will naturally differ in their estimate of the cost of different items of work, and the prices offered may vary within quite wide limits. But in the great majority of cases bids that are intentionally made unbalanced, and particularly such palpable cases as, for instance, the one here considered, are apparent at a glance. For six years preceding 1908, bids had been received for similar work under specifications practically identical. The highest contract price for Class A work during that period was $1.33 per sq. yd. and the average for the six years was $1.32 per sq. yd. The lowest contract price for Class B work during the same period was $1.49, and the average was $2.14 per sq. yd. When, therefore, a bid naming a price of $1.75 for Class A work and 1 ct. per sq. yd. for Class B work was received, the purpose of this bid should at once have been questioned. Had the commissioner of public works applied the criterion named in the specifications, that "no bid will be accepted which does not contain an adequate or reasonable price for each and every item named in the schedule of quantities," this bid would have been summarily rejected. Its acceptance was incompatible with any fair regard for the interests of the city.

The Extension of the Contract.—It has already been stated that the advertisement for bids distinctly stated that the contract was to run until December 31, 1908. The specifications in the executed contract (which are a part of the contract) contain this typewritten clause:

> The Commissioner of Public Works reserves the right to extend the time for the final completion of this contract for a further period of not exceeding 90 days from and after the said December 31, 1908.

But the blank space provided in the body of the contract itself in which was written the date of completion of the work was filled in with the date July 2, 1909.

The contract appears, therefore, contradictory as to the date of its expiration, and as no formal extension for the 90 days or any other periods seems to be on record, it may be a legal question worth considering whether the contract did not actually expire on Dec. 31, 1908.

The question of the legal right of the commissioner to extend the work done under the contract to about eight times the quantities and cost named in the original schedult may also be worthy consideration; particularly in view of the fact that the commissioner of public works disclaims personal knowledge that the contract was being extended to cover so much additional work.

The contract was made for the performance of definite quantities of work, set out in the "Schedule of Quantities" in the sepcifications. At the time it was made the only appropriation available to pay for the work was the $50,000 appropriated by council. The quantities of work actually to be done and its total value might be expected to vary within reasonable limits; but that the quantities and cost might be extended by the head of any department to many times those upon which the contract was based could not have been intended by council, and ought to be illegal. If it is not illegal under existing laws and ordinances, it should be made so. An ordinance should be passed making it unlawful to expend for any purpose a sum greater than the appropriation therefor, and providing that the amount expended under any contract shall not exceed the preliminary estimate of cost by more than a stated per cent (say, 20 per cent) without the special authorization, in each case, of the city council.

To the mind of one not a lawyer it would seem that this particular case should be covered by Section 1845 of the Revised Municipal Code, which reads:

> No payment shall be made on such contract for any work not specified in such contract, etc.

The word "specified," as here used, would seem to cover or embrace the quantity as well as the character of the work. It must have been the intention of the ordinance to limit the amount of money that could be expended under such a contract to the amount originally intended or provided therefor.

It appears from the printed records that the amount appropriated for the repair of asphalt streets in 1908 was:

Special appropriation	$50,000
Appropriation from Vehicle Tax.........	248,000
Total	$298,000

The records show that there was paid to the McGovern Co. under this contract for work done in 1908 the sum of $348,493.52, or $60,493.52 more than had been appropriated therefor. It may be worth noting here that the practice of the department has been, for a number of years (since 1904) to order or permit the contractor for asphalt street repairs to do a larger quantity of work than could be paid for out of that particular appropriation, the excess being paid for out of the appropriation for the succeeding year.

Method of Doing the Work.—To what extent the several bidders counted upon being allowed to do surface-heater work cannot be known, but the prices submitted by all of them indicate that they expected that the older and more expensive method of cutting out and replacing would be required. It appears, however, that McGovern was allowed to do a large part of the work by the cheaper method. Inspector Steward's estimate (see his testimony, page 6034) is that three-fourths of the whole area repaired was surface-heater work; but there is good reason to believe that a much larger percentage of the whole was done by this method. The result was that the contractor was paid $1.75 per sq. yd. for something like 200,000 sq. yds. of work, a liberal price for which would have been 65 cts. per sq. yd., involving loss to the city of over $200,000 on this item alone.

Quantity and Classification of Work Done.—According to the final estmiates upon which McGovern was paid, the area of repairs made by him under this contract was:

Class A repairs, square yards.............	229,891
Class B repairs, square yards.............	12,064
Total square yards	241,955

This quantity seems enormously large and invites inquiry as to its correctness.

The total area of asphalt pavements out of reserve (guaranty) in the city of Chicago in 1908 is not accurately known. The city records give only the length in miles of the asphalt streets in the city. As the guaranty or reserve period on all asphalt street pavements laid previous to 1906 was 10 years, only those laid prior to 1898 could be out of reserve in 1908. According to the printed reports, there were, in 1898, 68.62 miles of asphalt pavements in the city. It seems to be customary here to consider that these pavements average about 16,000 sq. yds. to the mile, and upon this basis the area of pavement out of reserve in 1908 would be about 1,100,000 sq. yds. If so, it appears that McGovern repaired in 1908-09 22 per cent of the whole area, or 1 sq. yd. out of every 4½ sq. yds. that were in the city, out of reserve, at that time. Considering that nearly as much repair work (over 223,000 sq. yds.) had been done in the preceding year (1907), it seems well nigh incredible that so large an area of repair work could have been actually done in 1908-09.

The cost of the repairs made in 1908-09 was $413,248.03, or slightly over 37½ cts. per sq. yd. for the whole of the 1,100,000 sq. yds. out of reserve in the city. Compared with the cost (on the same basis of computation) of repairing the asphalt pavements in other large cities, the result seems startling. From official figures for the years 1907, 1908 and 1909, the cost per square yard of repaving all asphalt pavements out of reserve in the Borough of Manhattan (New York city), Buffalo and Washington, was as follows:

	1907.	1908.	1909.
Borough of Manhattan..	$0.180	$0.177	$0.117
Buffalo	.0543	.0716	.0739
Washington	.028	.03	.023

The cost of repairig the asphalt pavements in the Borough of Manhattan, New York, where the streets are generally narrow and the travel heavy and concentrated, has heretofore been regarded as the upper limit; but it appears that in Chicago the cost is about double that in Manhattan.

The total area of pavement maintained (out of reserve) in Manhattan during the year 1909 was 1,905,420 sq. yds., and the total cost was $223,595.

It may be said that the above comparison is not fair; first, because the unit prices paid in Chicago were excessive, and, second, because the McGovern contract covered parts of two years. But it must be remembered that

TABLE II.—COMPARISON OF COST OF THE WORK DONE UNDER THE M'GOVERN CONTRACT WITH WHAT IT WOULD HAVE BEEN AT THE PRICES OF SOME OTHER BIDDERS.

	Quantities final estimate, to McGovern.	M. H. McGovern Company. Price.	M. H. McGovern Company. Amt.	Western Const. & Maint. Co. Price.	Western Const. & Maint. Co. Amt.	Parker-Washington Company. Price.	Parker-Washington Company. Amt.
Repairs Class A..........	229,891 sq. yds.	$1.75	$402,309.25	$1.04	$239,086.64	$1.11	$253,179.01
Repairs Class B............	12,064 sq. yds.	.01	120.64	1.40	16,889.60	1.71	20,629.44
Cement Concrete	643 cu. yd.	[illegible]	[illegible]	5.00	3,215.00	3.94	[illegible]
Binder Delivered	2,182 tons	4.00	8,728.00	3.15	6,873.30	5.30	11,564.60
Totals			[illegible]		$266,064.54		[illegible]

of the whole area covered by the final estimate for the two years, 87 per cent was done in 1908, and that a large quantity of work done in 1909 was not included in the quantity paid for; also, that the area repaired in 1907 was nearly as great as the whole area paid for in 1908-09.

Some other explanation of the disproportionate quantity and cost of repairs under this contract must be looked for.

The charge has been made that the measurements of repairs made were, in many cases, either factitious or excessive; and that the contractor was thus paid for a much larger area than he actually repaired.

It is impossible at this late date to verify these measurements on streets of heavy travel, and difficult on any streets. We have attempted to remeasure the repairs on a few streets where the conditions seemed most favorable. The results have not been uniform. On some streets we have found and verified the measurement of nearly every repair reported by the inspectors; on others we have not been able to find anything like the area of repairs charged and paid for; but even in these cases it is impossible to say with certainty that other repairs were not made which we cannot now locate. Even where every repaired spot can be located, it is difficult to certainly identify those made in 1908-9. If the time and means permitted, it might be possible to hunt out the records of repairs made in previous years, and thus eliminate those chargeable to 1908-9. It is but fair to say that in the streets where we have been able to identify individual areas of repairs, the areas reported by the inspectors, while liberal, are not notably excessive.

Classification of Work Done.—A most remarkable fact appears in the classification of the repairs made under this contract. Less than 5.3 per cent of the whole areal is reported as Class B repairs. This is so contrary to the experience of those familiar with repairing asphalt pavement in other cities as at once to attract attention. It appears to be decidedly contrary to previous experience in Chicago. Up to the year 1907 the area of Class B repairs had greatly exceeded the area of Class A repairs. Table III shows the quantity and ratio of Class A and Class B repairs made under contract in Chicago for the years 1903 and 1908-9, inclusive. It will be noted that for the first three years there were from 2½ to 3½ times as many yards of Class B as of Class A work. In 1906 Class B was one-third more than Class A. But in 1907 the ratio suddenly dropped and Class B repairs were only 4.3 per cent of Class A, while in 1908-9 the percentage of Class B repairs was 5.3 per cent.

TABLE III. QUANTITIES AND RELATIVE PERCENTAGES OF CLASS A AND CLASS B REPAIRS TO ASPHALT PAVEMENT IN THE YEARS 1903 TO 1908-9, INCLUSIVE. CITY OF CHICAGO.

Year.	Contract.	[illegible]	[illegible]	[illegible]
1903	M. H. McGovern	[illegible]	[illegible]	344.2
1904	M. H. McGovern	[illegible]	[illegible]	[illegible]
1905	W. J. Newman...	7,567	26,935	336.0
1906	T. L. Dooley.....	22,242	29,564	132.9
1907	M. H. McGovern.	214,369	9,272	4.3
1908-9	M. H. McGovern Company ..	[illegible]	[illegible]	[illegible]

Mr. Stewart in his testimony offers the explanation that the defects which called for Class B repairs had been remedied in the earlier years, and that at this particular age of the pavement the asphalt surface only was failing and required repairs. This is wholly contrary to the experience in other cities, and is disproved by our observations on many of these streets, where numerous holes extending through the concrete foundations are now found.

It is significant that in the estimate of the Engineer upon which this contract was based (see Schedule of Quantities) about one-third of the total area to be repaired was Class B work. It is still more significant that in the earlier work done under this contract quite a large ratio of the whole area repaired was Class B work. It will be observed, however, that the total area of Class B work in the final estimates to the contractor did not equal the quantity provided for in the original Schedule of Quantities; while the area of Class A work finally paid for was 8½ times the quantity named in that schedule.

The true explanation of these anomalies is doubtless found in the fact that the contractor's price for Class A work was $1.75 per sq. yd., while his price for Class B work was only 1 ct. per sq. yd.; and the conclusion is warranted that the reports of work done were manipulated so that the contractor would receive the higher price for nearly all the repairs made. It is obvious that where Class B repairs were actually made it would be greatly to the contractor's advantage to report and receive pay for them as Class A repairs. Where one sq. yd. was repaired by putting 6 ins. of concrete, 1½ ins. of binder and 2 ins. of wearing surface (which was Class B work), the contractor was entitled to 1 ct. for his work; but if this same sq. yd. was reported as Class A work, the contractor got $1.75 for it .

But the favoritism to the contractor did not stop here. His contract provided a separate price for concrete and for binder. If, in the illustration cited above, the inspector not only reported the repair as Class A, but returned the quantity of concrete and binder used as extras, the advantage to the contractor would be still greater. He would get for the yard repaired $2.51½. Thus:

1 square yard Class A repairs ..	$1.75
12½ pounds binder at $4 per ton ..	.22½
1/6 cubic yard concrete at $3.25 per cubic yards ..	.54
Total for the square yard	$2.51½

There is evidence that this method of measuring and reporting Class B work was followed.

Mr. Stewart in his testimony states that he was instructed by his superior officer that, where the thickness of the concrete and binder did not conform to the dimensions named in Class B work, he was to report the area as Class A work, and the concrete and binder as extra material, at the contract prices for these items. If interpreted literally (as it probably was), a differennce of a fraction of an inch in the thickness of the concrete or the binder would change the classification from Class B to Class A, with the concrete and binder measured as extra material.

Numerous instances where this method of classification was evidently followed have been found. Thus, on the repairing of the intersections of 44th Ave. with Monroe, Adams, Jackson, Congress, Wilcox, and Gladys Sts., extra concrete and binder were reported as used and paid for. Table IV gives the details of this work. In adjacent columns are given the actual quantity of concrete and binder paid for and the quantities of each that were theoretically required to place 6 ins. of concrete and 1½ ins. of binder under the whole surface repaired and returned as Class A work. It will be noted that the actual quantities of concrete and binder reported as used, and paid for as extra material, agree quite closely with that which would have been required for straight Class B work. There is no evidence that any concrete or binder was used for any purpose other than under the asphalt surface, reported as Class A.

Under any fair and reasonable interpretation of the specifications, the whole of this repair should have been reported as 1,187.52 sq. yds. of Class B work at 1 cent per sq. yd., amounting to $11.88.

A careful study of the facts on the ground and from the records (involving in some cases the cutting into the pavement to determine the conditions with certainty) would doubtless disclose a large quantity of the work done under this contract which was properly Class B work. It must be remembered that large areas of Class B work may have been reported as Class A work where no separate items for concrete and binder were returned and paid for.

There is a possibility, suggested by some of the facts and conditions discovered, that, through mistake or otherwise, permit repairs were sometimes paid for both as general and as permit repairs. To determine certainly whether and to what extent this was done would require a very complete and tedious investigation, which we have only been able to begin upon.

It may be deduced from Table III that the average ratio of Class A and Class B repairs for the years 1903 to 1906, inclusive, was 32 per cent of the former and 68 per cent of the latter. If the same ratio had held good for the work done under this contract, and the work had been paid for upon that basis at McGovern's prices, the result would have been:

77,426 sq. yds. Class A work at $1.75..	$135,495.50
164,529 sq. yds. Class B work at 1 cent	1,645.29
Total	$137,140.79

The actual amount paid McGovern for the work was $413,248.03.

It may be objected that in these and other deductions I have not taken into account the figures for 1907. The reasons will be obvious after a little consideration. McGovern was also the contractor in 1907. His prices were $1.09 for Class A work and $1.49 for Class B. The difference, 40 cts. per sq. yd., was less than half the cost of 6 ins. of concrete and 1½ ins. of binder required for Class B work. Also, he was using the surface-heater method in 1907, which made his Class A work very profitable even at $1.09 per sq. yd. Under these conditions, he would naturally endeavor to have as much as possible of the work reported in Class A.

Quality of the Work Done:—Much of the work done in 1908 was evidently of poor quality. Before the end of that year, large areas of the repair work were in such bad condition that the contractor was required to go back over the streets and repair these earlier repairs. The exact area of the work thus gone over a second time is not known, but Mr. Stewart in his testimony estimated roughly that it was as much as 15,000 sq. yds. In his testimony before your Commission, the Commissioner of Public Works gave as the principal reason for compelling McGovern to do a large quantity of work for which he was not to be paid the fact that a great deal of the work done the first year (1908) was unsatisfactory. Our own observations on the streets at the present time indicate that much of the work done was of poor quality.

This might have been expected from the method of doing the work. The repairs were mostly made by the surface-heater method, apparently regardless of conditions which often made that method ineffectual. That method can only be used successfully where a sufficient thickness of good material, in good condition, remains to support and make a good joint between the old and the new layer; otherwise, the new layer will be disintegrated very quickly by travel. It is also necessary that the work shall be done with skill and care.

TABLE IV.—SOME OF THE REPAIRS TO FORTY-FOURTH AVENUE, SHOWING AREA OF CLASS A REPAIRS REPORTED AS DONE, WITH THE EXTRA CONCRETE AND BINDER PAID FOR.

[illegible]	Sq. yd. Class A repairs.	Concrete [illegible] Reported and paid for	Required [illegible]	Binder, [illegible] [illegible]	[illegible]
Monroe st. ..	233.42	39.0	38.9	15.0	13.1
Wilcox av....	240.33	40.0	40.1	16.0	13.5
Adams st. ..	192.89	32.0	32.2	13.0	10.8
Jackson boul.	178.43	19.0	28.9	11.0	9.7
Gladys av. ..	229.76	33.0	38.3	15.0	12.9
Congress st..	117.69	19.0	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

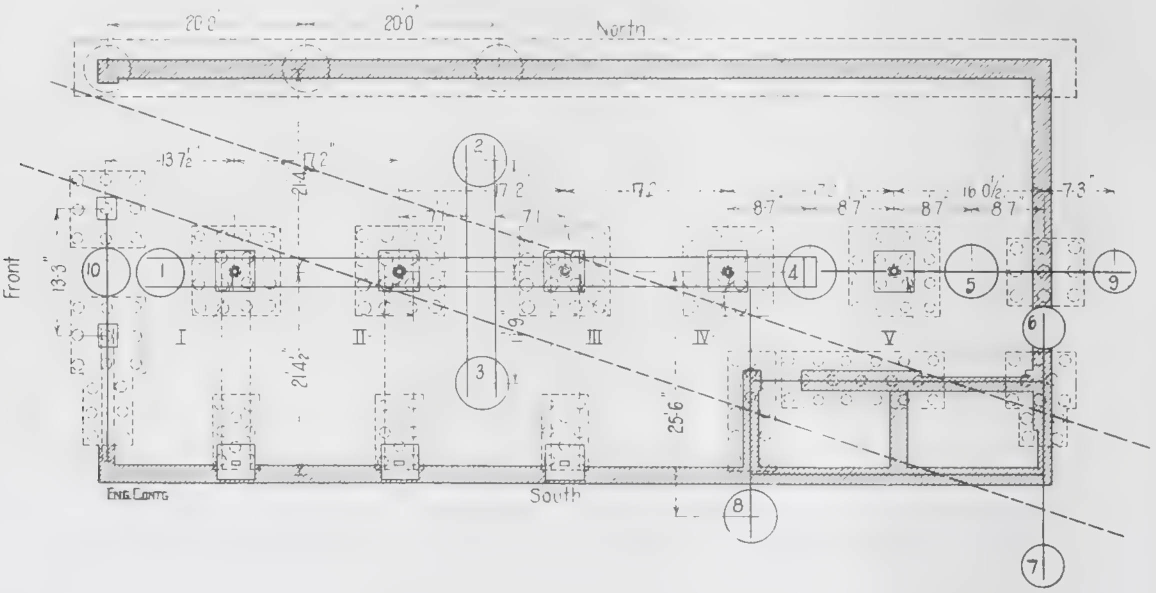
The aggregate quantities of work paid for on these six intersections were as follows:

1187.52 sq. yds. [illegible] at $1.75	$2,078.16
18[illegible] cu. yds. [illegible]	[illegible]
78 tons binder [illegible]	[illegible]
Total	[illegible]

GENERAL ARTICLES AND CLASSIFIED ITEMS

Method of Reconstructing a Building Foundation Undermined by Leakage from a Water Supply Tunnel Pierced by Foundation Piles.[*]

The property is located on the east side of Fifth Ave., near Harrison St., in Chicago, has a frontage of 90 ft., and extends back 100 ft. to the alley in the rear. The improvement of the property consists of two buildings. The building on the south side of the lot was built shortly after the fire of 1871, and is very light in construction as compared with the factory-building of more recent date. The building on the north side of the lot (Fig. 1) at the time it was constructed, followed the type of construction, known as the modern mill-construction. The floor joists are 9x16-in. Georgia pine timber, supported at the center of the building on steel girders, which in turn are carried by a row of cast-iron columns, the north wall ends of the floor joists being carried directly on the brick wall of the building. The south ends of the floor-joists south of the center row of columns are supported by I-beam girders running parallel to the dividing-wall between the old and the new building. The columns supporting these girders rest on a cantilever foundation, thus making the new building structurally independent of the old building, both of which are five stories in height. At the time the work was done the buildings were occupied by the Troy Laundry Machinery Co. The new building was erected for the use of that company, and was designed to carry rather heavy loads, the first floor being designed for a live load of 400 lbs. per sq. ft., and the upper floors for 200 lbs. live load per sq. ft.



Plan of Building Foundation Overlying Water Works Tunnel Showing Original and Reconstructed Foundations.

The foundation for the building as originally constructed consisted of piles driven to hardpan. These piles were mixed wood timber, 14 ins. at the butt, tapering to 8 ins. and varied from 50 to 55 ft. in length. Piles were driven to a depth of 50 ft. below city datum, and were capped with 5 ft. of concrete.

The City of Chicago issued the building permit for the building early in October, 1902, the work was started at once, and the building was completed and turned over to the Troy Laundry Machinery Co. early in April, 1903. Their plant, which consists of very heavy machinery, was moved into the building at once. These machines consist of lathes, planers, boring machines, drills, and grinders, vary in weight up to approximately 2 tons each. When the plant was in operation the building was given a vibratory motion of unusual magnitude.

Soon after the new building was occupied the basement floor began to show evidences of subsidence of the soil underneath it, and cracks began to develop in the concrete floor north of the center row of columns. The settlement increased daily, and it became necessary to fill the area affected to make the basement at all useful. To keep ahead of the settlement of the basement floor level, all of the cinders from the two boilers of the Troy Laundry Machinery Co. were used daily, besides a large quantity obtained from other sources. In January, 1904, the main sewer of the new building, which crosses through the center of the basement, was ruptured by the settlement that had taken place, making it necessary to move this sewer and place it upon the concrete footing of the north wall of the building. Up to Feb. 6, the only sign of settlement was about 1-in. in connection with some of the center columns. On that date the owner of the property employed Mr. John H. Sutter to make a thorough investigation of the premises, and to take charge of any repairs or strengthening of the foundations that might be required.

A careful examination of the premises showed that the settlement had reached such a magnitude that the building would soon be unsafe, and a thorough investigation was begun to ascertain, if possible, the cause of the disturbance. It was found that the floor north of the center row of columns had settled as much as 14 ft. below its original level. This cavity had been filled with cinders and water, which had either followed the piles into the hole or had come from a sewer on Fifth Ave. which was too small to take care of the storm-water sewerage of the vicinity. The water had thoroughly saturated the surrounding soil, and greatly aggravated the condition. The slope of this settlement was from the front to the rear of the building, and reached a maximum depth at a point about 30 ft. from the rear wall. The writer, at this date, was asked to assist in the investigation and to design the new supports for the building.

From data and evidence gathered, it was found that the City of Chicago had a 7 ft. water-tunnel in that vicinity known as the South-West Land Tunnel, and it was natural to assume that it had become damaged in some manner, and had caused the scouring away of the soil under the building. The city authorities reluctantly admitted that if the plans of the City Engineer's office were correct, the tunnel in question lay diagonally across the lot on which the new building had been erected. This fact, while informing those in charge of the work as to the cause of the settlement, made the situation more serious, as it was then self-evident that some of the piles driven for the foundation of the building had penetrated the tunnel, and that the water rushing through it had carried away the soil under the building and undermined it. A careful investigation showed that the top of the tunnel was at a point about 60 ft. below the grade of Fifth Ave., or about 46 ft. below city datum, and about 5 ft. higher than the average depth of the points of the foundation piles.

An abandoned working shaft, which had been used in the construction of the tunnel, was found on the west side of Fifth Ave., and this was immediately uncovered to permit a diver to make a descent to examine the condition of the tunnel. He reported that both the east and west drifts were filled with mud so high as to make it impossible for him to find the eye of the tunnel on either side. As the tunnel was filled with mud and débris, it was impossible to determine how greatly it was damaged, but it was certain that the proper conclusion had been drawn as to the cause of the settlement.

It was clear that the soil surrounding the foundation piles had become saturated with water and rendered too soft to give the required lateral resistance to hold the piles in place, and that without this support they would buckle and endanger the safety of the building. It was evident that some means must be speedily provided to control the building in case the foundations began to fail. Shoring material—including jack screws, timber drums, blocking and beams—was provided, and the work of securing the columns already affected was immediately started. The presence of the cast iron columns carrying such heavy loads made the shoring a difficult problem. The steel girders supported by these columns rested on cast iron lugs, and the danger was that any excessive unequal settlement of the columns would cause the lugs to crack and give way. To prevent failure in this manner, the entire load on the girders was removed from the columns by placing drums on each side of the columns on each floor to carry the weights supported by the girders above. The drums about the columns in the basement were carried upon heavy I beams about 25 ft. in length, the ends of these beams resting on jack screws supported on timber cribs. Provision was also made for relieving screws, to carry the load while any crib was being rebuilt or shifted, if necessary. All of the walls of the building, any portion of which was above the line of the tunnel, were placed on short drums. The work of placing these jack screws was carried on day and night.

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[*] Abstract of a paper by F. E. [illegible] sented to the Western Society [illegible] March 9, 1910.

During the operation of setting the screws it was found by the system of levels established that the walls and columns were very slowly settling. It was then decided to extend this shoring to cover a greater area, as there was a very serious lateral movement of columns and foundations combined with the settlement, to as much as 1 in. per day in many instances, and it indicated that the piles were buckling and leaning toward the holes in the tunnel. During the time occupied in putting the jack screws in place only an inconsiderable settlement of the building had occurred, notwithstanding the fact that the soil toward the front of the basement continued to settle at the same rate as previously; but shortly afterwards a sudden and rapid subsidence toward the back part of the basement started. As this was in a location where there had been no great settlement, and as the rate of this settlement was practically constant, very serious doubts were entertained by those in charge as to their ability to save the building. It became necessary to increase the bearing area by timber platforms, which were immediately put in place. These platforms were of 12-in. timbers and gave a total width of 30 ft. But even with this additional provision the settlement continued at the same rate as previously. It was evident that the walls about the elevator shaft and stair well were directly above the center of disturbance and had become seriously cracked by the stresses due to the unequal settlement of the foundation, and now began to crush and crumble. By actual measurement the settlement of the pile foundations of these walls and the footing of the dividing wall in the rear was 7 ft. 2 ins. from Feb. 12 to March 2. The settlement of the south crib supporting the shoring beams under column No. 4 was 14 ft. in the same length of time. It was decided that it would be impossible to hold these walls longer, and their removal was deemed necessary for the preservation of the floors.

The work of removing these walls was pushed so rapidly that within 56 hours after the wrecking was started all the brick work in the rear of the new building which was considered dangerous was removed. The dividing wall in the rear was removed at this time, but as the wrecking of portions of the walls in the new building about the elevator shaft and stair well was completed, it was found that the old wall in the rear was very seriously cracked, warped, and otherwise damaged. It was considered possible to hold this wall, but it was thought that the additional expense would not be justified, as in the end the wall would have to be rebuilt, and, therefore, it was also removed.

Early in the operations of getting control of the walls the settlement caused the breaking of one of the flanged joints of the steam main of the battery of boilers, which was located just south of the dividing wall in the rear. A steam pressure of 125 lbs. per square inch. was maintained on these boilers. Fortunately warning was given in ample time to shut off the steam, and none of the men engaged in the work was injured. The further use of these boilers was impossible and a temporary plant of two 100 h. p. firebox boilers was installed in the alley for immediate use.

As soon as the rear wall started to settle, the footings of the center row of columns in the new building also settled rapidly. Before the entire load was taken off of the pile piers originally supporting the columns a settlement of over 4 ft. had occurred in the case of columns Nos. II and IV, while the other columns had settled less, ranging from that down to a few inches. These figures only measured the settlement of the footings of the columns before the loads were transferred to the screws. After that was done [illegible] method of measuring [illegible] carefully was the work of turning the screws carried on and the levels of the various parts of the building adjusted that no dangerous or unequal settlement of the superstructure occurred. The building was constantly under control and held in a fixed position, so that the occupants were able to go ahead with their work, all of the shafting and other parts of the machinery being kept in line and running smoothly. The only time that the Troy Machinery Co. was forced to shut down its plant on account of this work was during the time of the temporary installation of the boilers in the alley.

The plan adopted for the new foundation was to sink caissons of adequate size, properly placed to support steel girders for carrying the walls and columns, these girders to be encased in concrete to prevent corrosion. Before the plans for the location of these caissons were drawn, the city engineer's office was requested to prepare a plat or survey showing the exact location of the tunnel with respect to the building. The caissons were planned to be located on each side of the water tunnel, so that at least 4 ft. of soil would be between the outside of the caisson and the brick work of the tunnel. The caissons varied in diameter from 4 ft to 6 ft., and were to be sunk to bed rock—a distance of about 80 ft. below city datum. The water tunnel is in hardpan. Since it was planned to leave 4 ft. of this hard clay between the caissons and the outside wall of the tunnel, it was thought that the caissons could be excavated by the usual method adopted in Chicago for such foundation work, and without removing the head of water in the tunnel.

Owing to the failure of the water tunnel the materials overlying it were completely saturated by the water escaping from the tunnel under pressure, and it proved very difficult to sink the wells in the manner adopted. The soil to be excavated had become exceedingly soft, and the entire mass of earth under the building seemed to move bodily toward the supposed location of the holes in the tunnel. The work of sinking the wells was started on the one shown on the plans as No. 2, and it was excavated to bed rock without much difficulty other than that experienced from the exceedingly soft soil encountered and the water which was prevalent throughout the basement. As there seemed to be some doubt as to the exact location of the water tunnel, lateral borings were made in this hole before it was filled with concrete; but on account of the obstruction caused by the piles of the surrounding piers, no favorable results were obtained.

Well No. 3 was tried next, and its location being in the center of one of the places of greatest settlement, it was a very difficult task to sink it through soil which was so thoroughly saturated with water. Before any progress could be made it was necessary to sink a water tight cofferdam through the cinders used to fill the sunken place. This proved very difficult on account of the depth of the water and cinders. When the original soil was finally reached, it was so soft that it swelled up from the bottom of the well, and it was necessary to drive lagging several feet ahead of the excavation in order to make any progress whatever. The excavation was discontinued many times on account of the dangerous condition and unequal settlement of the lagging above. The pressure of this soft clay was greatly increased by the pressure of the cribs supporting the shoring beams under the columns on either side of the well. These cribs at intervals settled at the rate of 1 ft. per day during the time occupied in excavating the first 25 ft. of the well. The unequally distributed pressure upon the lagging of the well caused by the proximity of these cribs made it necessary several times to reinforce the lagging before excavation could proceed; and by the time a depth of 40 ft. below city datum was reached the entire well had been laterally displaced toward the tunnel, a distance of about 2 ft. The shape of the well had changed from that of a circle to that of an ellipse, the smallest axis of which was about 4¼ ft. The reinforcing of the lagging [illegible] filling out with blocks, thus reducing the diameter, the intention being to restore the well to the proper size when filling with concrete.

The clay found at a depth of 40 ft. below city datum was considerably firmer than that above, but as it was found only on the side farthest away from the tunnel it made the conditions worse, since the lagging on that side ceased settling, while that on the other side kept on going down. It was evident from the way this stratum of firm clay was situated that the well was located at the point marking the angle of slope made by the clay as it flowed on entering the tunnel. The continued unequal settling of the lagging made it necessary to anchor it and the supporting rings to the floor beams of the first floor. At a depth of 43 ft. below city datum water broke through from the bottom of the hole on the side nearest to the tunnel. The well filled so rapidly that the workmen could not be taken out in the usual way, but floated to the top, where they were dragged out. This rapid filling of the well to about the level of Lake Michigan indicated very clearly the source of the water. After this accident the hole was filled with sand to save it from collapsing, and was abandoned.

This mishap proved that either the tunnel was not correctly located or that the clay figured upon to be between the well and the tunnel was not sufficient in thickness to withstand the pressure of the water at that depth. To sink the wells nearest the tunnel either the pneumatic process would have to be resorted to or the tunnel must be pumped out. The problem of removing the water from the tunnel caused some apprehension on the part of those in charge of the work, as it was feared that the removal of the pressure exerted by it would again start the settlement, which at this time had shown signs of ceasing. However, as the tunnel would have to be repaired ultimately, it was decided to remove the water at that time, and thus save the delay and expense of using the pneumatic process.

The gate at the shaft in this tunnel at Peck Ct. and the Lake Front park was on the lake side of the shaft, and consequently, when closed, the entire pressure due to the head of water it was under would be against the guides. It seemed doubtful that these guides could withstand this head and the gates still be tight enough to permit pumping the water from the tunnel. An attempt was made to close the gate, the intention being to reinforce it by means of jack screws extending across to the other side of the shaft. When the attempt was made to close the gate, it was found to be so twisted from some previous misuse as to be absolutely useless, and no further attempt was made to use it. A heavy timber bulkhead was built to be placed against the west heading opposite the gate. This bulkhead was lowered into the shaft and set in place by a diver, the shaft being partially filled with clay to stop small leaks. After it was set it was firmly held in place by jack screws bearing against the opposite side of the shaft.

The necessity of placing this bulkhead on the land side of the shaft removed all access for pumping out the water in the tunnel between the shaft and the building. To accomplish this an 8 ft. shaft was sunk on Sherman St. about 300 ft. east of the rear of the building. This shaft was sunk 10 ft. south of the tunnel and was connected to the tunnel by a 4 ft. cross-cut. In the meantime an attempt was made to close the gates in the water tunnel on the west side of the Chicago River which was necessary to shut off the water from the Chicago Ave. pumping station but it was found that in doing this the Western Electric Co.'s supply of water would be entirely shut off, as they had been securing their water supply from one of the shafts which would be opened for the pumping operation. They had secured this right by special concession of the City Council, and at the time they made connections with the shaft all other connections with the city water mains had been taken out, and these had to be restored before the gates could be closed. Special pipe fittings were required for this change and it took several weeks to secure them. The entire delay to further work on the abandoned wells at the building was practically three months.

In the meantime well No. 4 was tried, but it had to be abandoned on account of the soft mud encountered, and the water coming in so fast it could not be taken care of by pumps at the building. This well was situated between two pile piers. At a depth of about 20 ft. below city datum it was found that the piles of these piers had deflected so much from the vertical line in driving that nine of them were found within the circle of the well. The water encountered was clear and cold, came into the well from alongside of the piles, and was evidently from Lake Michigan. In all probability the piles which it buried were in contact with the tunnel, so that no further attempt was made at excavation in this well until the water was removed from the tunnel. Work, however, was pushed on other wells farther away from the tunnel, and a number of them were completed before the water was entirely removed from the tunnel.

The clay dug through was in all cases very soft. In the worst wells the workmen were compelled to stand on short planks in order to work effectively. The temporary connection with the city water mains required by the Western Electric Co., and the closing of the gates in the shaft on the west side of the river were completed June 18. The two pumping plants which had been provided, one at the temporary shaft at Sherman St. and the other at the Fifth Ave. shaft, were put in operation June 20. As the water was pumped out, great care was taken to keep it at the same height in both shafts, to prevent any movement of the shaft mud in the tunnel, due to difference in head in the two shafts

Work on well No. 3, which had been abandoned March 26, was resumed on June 21. The diameter of the well was increased from 5½ ft. to 6 ft. This was done to give an opportunity to straighten the well, which was in very bad condition; the old lagging was out of plumb and the whole well was out of position. It was a difficult matter to keep the new work in proper place. Sand was used to fill in the space created back of the new lagging by the movement of the old well toward the tunnel. This cylinder was completed on July 6. When passing the tunnel it was found that the lagging only just cleared the brick work of the tunnel itself.

Work was resumed on well No. 4 on Aug. 1 and was completed Aug. 15. This well overlapped the tunnel about 18 ins. and this part of the brick work of the tunnel was removed when the well was filled with concrete.

All of the work of the concrete cylinders required to support the main girders was completed by Aug. 15, and on Sept. 6 the remaining two of the row of columns in the center of the north building were landed on the permanent girder supports. The last girders of the main system of girders, those under the walls about the elevator shaft and stair well, were completed on Sept. 15 and the rebuilding of masonry was started on Sept. 28.

The city water tunnel is circular and is 7 ft. internal diameter. The masonry consists of two rings of brick laid in cement mortar, making an outside diameter of approximately 9 ft. The central line of the tunnel intersects the north line of the lot under the north building at the curb line on the east side of Fifth Ave. and the south line of this lot at the alley line in the rear of the building, thus making the path of the tunnel diagonal of the lot on which the new building was erected. The location of the tunnel in this position made it difficult to provide a system of girders to carry the columns, and have the concrete cylinders supporting the girders far enough away from the tunnel. All of the center row of piers upon which the columns originally rested were so near the lines of the tunnel that it was deemed best to provide girders which would support all of the columns of the building independent of the former foundations. The scheme finally adopted is shown on the girder plans. The grillage capping the concrete cylinders consists of I-beams resting on a circular plate equal in diameter to that of the cylinders. After this grillage was set, the space between the beams was filled with a very rich concrete. In all cases the steel girders rested directly on top of the I-beam grillage.

After the girders were set permanently and the connections made, they were encased in concrete. As all of the steel work is below the finished basement floor, great care was exercised in the placing of this concrete to protect the steel work from corrosion, and in no case is any portion of the steel work covered with less than 8 ins. of concrete. It was necessary to provide cylinder foundations, originally carried on cantilever foundations, and these cylinders were made large enough to carry the old wall adjoining the columns on the south. The foundations of this dividing wall had moved northward about 3 ins. and were evidently damaged beyond repair. As the boiler room in the rear of the old building had been entirely wrecked, it was necessary to provide a new positive foundation for boilers and columns of the building in the boiler room. Two additional cylinders were sunk for this purpose, and were located in such position as to support a portion of the rear wall as well as the columns and the boilers.

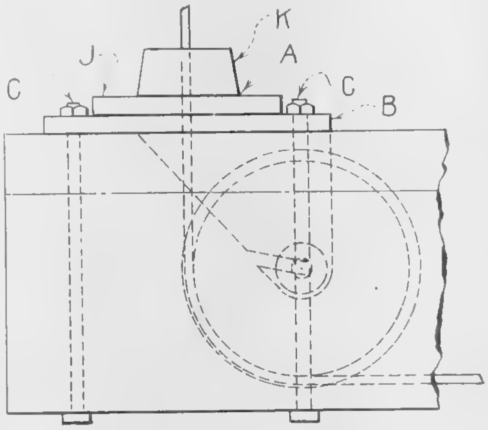

Fig. 1—Elevation of Mast Step.

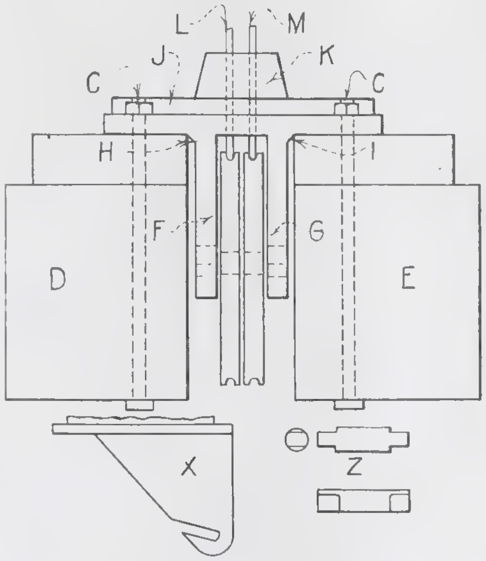

Fig. 2—Details of Mast Step.

The effects of the settlement due to the cave in of the tunnel were noticeable within a radius of about 100 ft. from the tunnel, but in no case were the settlements at this distance of a serious nature. In fact the settlement which occurred in connection with buildings back from the tunnel was no more serious than has occurred heretofore in connection with buildings adjoining a site where deep foundations have been constructed. The south wall of the south building, which is a party wall between this building and the one adjoining it on the south, settled about 1 in. The columns on the south side settled from 2 to 4 ins., depending on the distance of the columns from the tunnel. All that was done was to raise the columns to their original level and block them up.

It is a curious fact that through all of this disturbance the north wall of the north building, the front end of which is over the tunnel, showed no sign of settlement or movement during the entire work. This is a solid masonry wall, and serves as a party wall for the adjoining property on the north. The foundation on which it rests consists of piles and concrete. There are about 100 piles in the foundation and they are arranged in three rows parallel to the wall. In view of the settlement of other walls not so near the tunnel, it was assumed that this wall would settle also and provision was made for three cylinders to be put in the front end of it. However, these cylinders were never constructed, as no settlement has ever taken place. After all of the cribs were in place a force of men was put to work to clean out the tunnel. It was found that a great number of piles had penetrated the brick work and made the holes in the tunnel through which the mud had flowed. These piles were not broomed in encountering the brick work of the tunnel and in fact were in no worse condition than would be expected after a pile had been driven through 50 ft. of firm clay. These holes were all immediately bricked up, the mud cleaned out, and the tunnel allowed to fill with water. The city of Chicago paid the bills.

An Improved Mast Step for Derricks which Permits Removal of Sheaves Without Unshipping Mast.

The accompanying sketches show the essential details of a new form of mast step used on a number of derricks in the plant of McArthur Bros. & Winston for the Ashokan Dam work on the Catskill Aqueduct. This step was designed and has been patented by C. H. Peters, master mechanic for the firm named. The feature of the construction is that the sheaves can be readily removed and replaced without removing the mast or lifting the step. The construction and operation of the step may be explained, referring to the sketches, as follows:

Fig. 1 is a side elevation of the step showing it mounted on suitable timbers. Fig. 2 is an end elevation of Fig. 1 and Fig. 2X is a side elevation (reduced) of the lower portion of the mast step. Fig. 2Z comprises two different side elevations and an end elevation of the sheave pin or axle.

Referring to the drawings, *A* designates the mast step, which is preferably an integral casting. The base *B* of the mast step rests on and is secured by means of suitable bolts *C* to beams *D* and *E*, which are spaced apart and arranged opposite each other, as illustrated. Centrally under the base are a pair of correspondingly shaped depending lugs *F* and *G*. Each lug is approximately triangular in shape in side elevation, the inclined side running from a point some distance to one side of the center of the base, while the front side of the lug extends straight down from the edge of the opposite side of the base. The lower end of each lug is rounded. Near their rounded lower ends each lug is provided with a correspondingly shaped, downwardly inclined slot. The upper ends of the slots open into the inclined side of their respective lugs and at their lower or closed ends are curved or rounded, as shown.

Removably positioned in the slots is a sheave pin or axle on which are journaled two sheaves. The sheave pin near each end is abruptly cut down on opposite sides to form the flattened positions, which fit snugly in the slot, with the shouldered portions abutting against the sides of the lugs to hold the sheave pin in position. Mounted on the sheave pin and between the side of the lug and the side of the sheave are washers or spacers. The washers or spacers serve to steady the sheaves in their rotation on the sheave pin and reduce the wear that would be caused by the sheaves coming into contact with each other or with the sides of the lugs.

Each lug is provided with a beveled portion *H* and *I*, respectively, at its outer side at its intersection with the under side of the base in order to space the outer sides of the lugs from the sides of the beams to allow ample space to withdraw the sheave pin from the slots.

Above the upper edges of the base the sides of the mast step are set back to form a platform *J* and centrally of the platform is a circular flat topped projection *K*, the sides of which are inclined upwardly. Upon the projection *K* a mast (not shown) is mounted. Extended centrally through the mast step is an aperture, indicated in dotted lines in Fig. 1, having its lower opening between the lugs. Adapted to pass through the aperture and positioned in the groves of the sheaves are ropes or cables *L* and *M* for operating the derrick. Referring to Fig. 1 of the drawings, it will be noted that the sheaves are so positioned with respect to the aperture that the ropes are substantially vertical or perpendicular to the mast step.

As is readily apparent, when it is desired to remove the sheaves for any reason all that it is necessary to do is to release the tension on the ropes to allow a sufficient amount of slack when the sheave pin can be drawn back out of the slot in which it is mounted. The inclination of the slots and the weight of the sheaves are sufficient to hold the sheave pin in position in the slots.

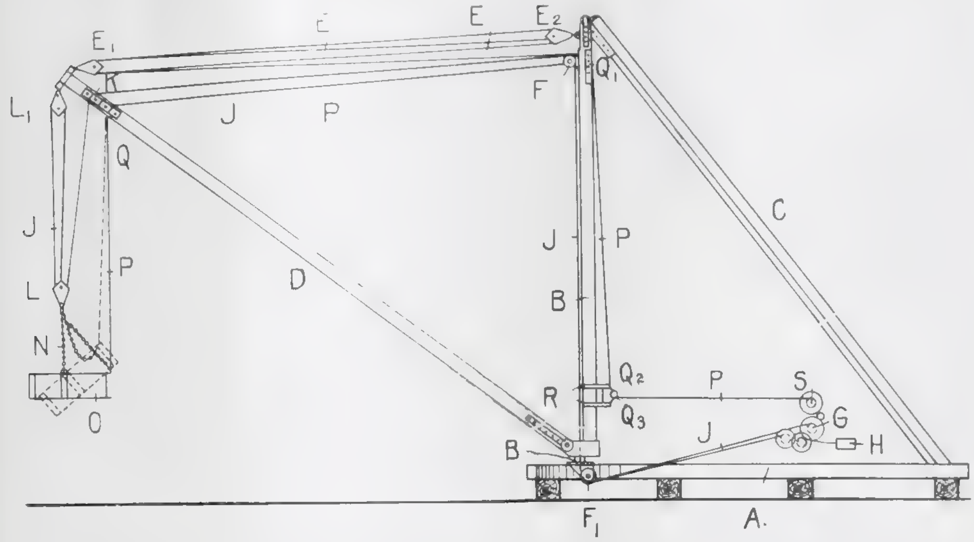

Fig. 1—Diagram Showing Arrangement of Derrick With Skip Dumping Device.

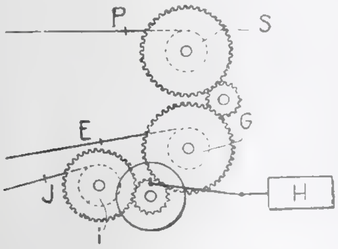

Fig. 3—Diagram of Dumping Gear.

A Skip Dumping Device for Derricks.

The accompanying illustrations show a skip dumping attachment for derricks which has been developed and used in the Ashokan dam and reservoir work for the New York water supply. This dumping attachment is patented and is the joint invention of Messrs. C. H. Peters, Harry Hart, and Samuel C. Stinecipher, of the mechanical department of McArthur Bros. & Winston, the general contractors for the Ashokan work. As will be observed from the explanation in detail which follows, the dumping device permits the skip to be tilted at any time or position of the swing.

Referring to the illustrations Fig. 1 is a general diagram showing the equipment of a derrick for self-dumping and Figs. 2, 3 and 4 show separate details. Fig. 2 is a perspective view of the skip; Fig. 3 is a side elevation of the motor gearing for driving the boom line drum, the hoisting drum and the dump line drum; and Fig. 4 is a sectional plan view of the lower end of the boom and the swivel sheave block for the dump line.

On a suitable platform *A* is mounted to turn the mast *B*. The boom *D* is hung on the lower end of the mast *B*, and the boom line *E* for supporting the outer end of the boom passes over the usual sheaves *E'*, *E''*, of which the sheave *E'* is held on the outer end of the boom *D*, and the sheave *E''* is held on the upper end of the mast *B*. The boom line *E* passes from the sheave *E'* over a double pulley *F* near the upper end of the mast *B*, and then down alongside the mast through the pivot *B'* thereof, and around a pulley *F'* to the boom line drum *G*, gearing with and adapted to be driven by the motor *H*, mounted on the platform. The motor is also geared with the hoisting drum *I*, on which winds and unwinds the hoisting line *J* passing over the pulleys *F'* and *F*, then outward over a pulley *K* journaled on the boom, the line *J* then passing around sheaves *L* and *L'*, of which the latter is hung on the outer end of the boom. The sheave *L* supports the usual chain *N* carrying the skip or bucket *O*, of the usual construction, and connected at its back with the lower end of the dump line *P* passing over a pulley *Q* held on the boom, to then pass over a pulley *Q'* held on the upper end of the mast, the line then passing under a sheave Q^2 held in a block, swiveled on brackets **R** attached to the lower portion of the mast. The dump line *P* passes from the sheave Q^2 to the dump drum *S*, connected by gearing with the motor *H*, so as to wind up or unwind the dump line *P* on the drum *S* whenever it is desired to do so.

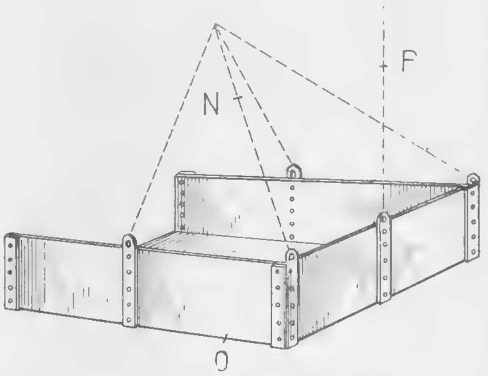

Fig. 2—Sketch of Skip.

It is understood that the usual means are provided for enabling the operator in charge of the derrick to throw any one of the drums *G*, *I* and *S* in or out of gear when using the derrick.

The boom line *E* and the drum *G* are employed to swing the boom into the desired inclined position and to hold it therein, while the hoisting line *J* and the drum *I* are used for raising and lowering the skip *O* and the load contained therein, and the dump line *P* and the drum *S* are used to tilt the skip *O* whenever it is desired to dump the contents of the skip at the desired place. As the skip is raised or lowered, the drum *S* lets out or takes up the slack in the dump line *P*, and when the skip *O* is in position to dump, the hoist line J is held stationary and the dump line P is hauled in, thus swinging the skip into dumping position.

If desired, the dump line P may be held stationary while the hoist line *J* is paid out, thus lowering the front of the skip and dumping the contents thereof.

By having the sheave Q^3 swiveled on the mast *B*, it is evident that the latter can be readily turned, to bring the boom *D* into the desired position, and at the same time the sheave Q^2 aud its block Q^3 are always in alinement with the drum *S*, thus insuring a proper winding up and unwinding of the dump line for the purpose previously mentioned.

A Pioneer Miner's Surveying Instrument for Running Ditch Grades.*

The pioneer miners were a resourceful body of men and many difficult problems were solved by them in the construction of their tunnels, ditches, and other engineering works of magnitude. Miles of ditch-grades were run with only a buckskin thong with a rock tied to it for a plummet, attached to the apex of an A-frame made of three small spruce poles. The writer remembers, when, as a lad of eight years of age, he drove gradepegs upon a ditch-survey run by his father, assisted by his (the writer's) brother, through five miles of the roughest country in northern California, with one of these "instruments of precision," and how in veneration he stood upon the brink of a deep canyon, the precipitous sides of which precluded a measurement with chain or tape, and witnessed his chief of party triangulate the distance across with accuracy and dispatch, and establish the grade with this simple contrivance with as much ease as the present-day engineer would accomplish it with his transit and stadia, or with the gradienter attachment.

The A-frame (Fig. 1) is made as follows: Construct with any light material an A-frame with the legs extending 2 ft. below the cross-bar, and having a span of from 10 to 12 ft.; at the apex drive a nail and hang a plumb-bob from it with line sufficient to permit the plumb-bob to hang below the cross-bar. This instrument is adjusted over two pegs as follows: Drive two pegs in the ground at a distance apart equal to the distance spanned by the legs of the frame; place the frame upon the pegs and note the position of the plumb-line at the cross-bar; reverse the frame and note the second position of the plumb-line between the two positions already noted, and drive the highest peg down until the plumb-

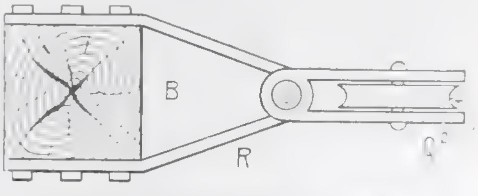

Fig. 4—Swivel Sheave on Boom

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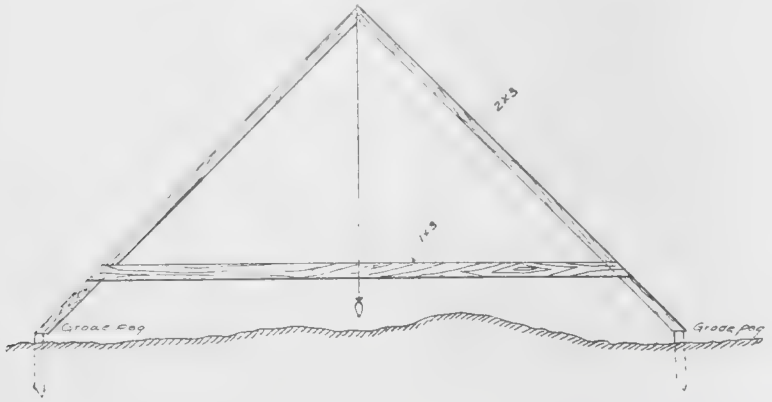
*Extract from [illegible] Mining by J. W. [illegible] the Western Society of Engineers, March 3, 1910.

line covers this midway mark on the cross-bar; the tops of the two pegs will then be at the same elevation.

Several methods are used for graduating the cross-bar to permit of grades being run, and one method is to rest the ends of both legs on the pegs after their tops have been brought to a level. Then one man at one end will raise the leg he held to certain heights measured on a rule he holds on the peg, while another man will mark the position the string occupies on the cross-bar and will mark on it the grade. Thus falls of 1/16, 1/8, 1/4, etc., of an inch per station will be obtained, the station being equal to the spread of the triangle, or base of the A-frame.

It is not claimed that the A-frame originated among the pioneer miners of California, but it was used by them to lay out some of the longest ditches and tunnels constructed in the early days of mining in that state.



Sketch of A-frame Surveying Instrument

LETTERS TO THE EDITOR.

Ladder Dredge Work on the New York State Barge Canal.

Sirs: Referring to the article on ladder dredge work in your issue of Sept. 7, 1910, the costs shown for embankment are very deceptive and should be accompanied by an explanation showing why they are so high. The timber forms to hold the dredged material were very expensive and their cost was charged up to the month in which they were built. Under the specifications the embankment could not be estimated and paid for until finished. You will note that the paid embankment is only a small part of the excavation. For instance, in November the excavation was 20,516 cu. yds. of which only 513 cu. yds. were paid for in embankment. As a matter of fact practically all the material was placed into embankment, but was not trimmed up and was therefore not estimated. During the months following all this unfinished embankment was dressed up at a cost of only a few cents per cubic yard, so that if the cost of forming embankment was distributed over the entire work, instead of being separated into months, it would be quite low.

Very truly yours,
THOS. J. MORRISON,
Resident Engineer.

Rochester, N. Y., Sept. 14, 1910.

(The costs for November to which our correspondent refers are as follows:

A total of 45 8-hour shifts were worked and 20,516 cu. yds. wer. excavated at the following cost:

Interest and depreciation	$1,102.50
Coal, 90 tons at $2.85	256.50
Labor	
Teams	00.00
Oil, grease and waste	83.07
Gasoline	9.00
Repairs	
Total	

This gives a cost for excavation of 16½ cts. per cu. yd. Labor on embankment, spreading, compacting and building dikes cost $782.50. The number of cubic yards of embankment "estimated" during the month was 513, giving a cost per cubic yard for the month of $1.52.—Editors.)

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us i. you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Stirling Boilers.—Cloth; 8x10⅜ ins.; 21 pp. The Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.

A high class catalog giving a thorough description of the Stirling boiler, with colored drawings showing the general layout, and also of detailed parts. Also arranged for burning oil.

Hardware.—Cloth; 7¼x10¾ ins.; 185 pp. Wiebusch & Hilger, 106-110 LaFayette St., New York, N. Y.

This is an illustrated catalog and price list of American and foreign hardware and cutlery. Contains various tools for building trades, contractors, blacksmiths, etc. Every article is illustrated; sizes and prices are given; a complete catalog.

Portable Fireproof Buildings.—Paper; 5½x8½ ins.; 6 pp. O. K. Harry Steel Co., Jefferson Ave. and Papin Sts., St. Louis, Mo.

This folder gives illustrations, descriptions, instructions for erecting and sizes and prices of the various fireproof portable buildings which are made by the above company. The buildings include garages, outing camps, railroad stations, contractors' housings for machinery and vehicles.

Electric Fans.—Paper; 8¼x10½ ins.; 2 pp. Sprague Electric Co., 527 West 34th st., New York City.

This catalog contains cuts and descriptions of electric fans of different types for various purposes. Diagrams with keys are given to facilitate ordering.

Electric Drills.—Paper; 3½x6 ins.; 4 pp. Sprague Electric Co., 527 W. 34th St., New York City.

A leaflet describing electrical drills.

Sargeant Rock Drills.—Paper; 6x9 ins.; 24 pp. Ingersoll-Rand Co., 11 Broadway, New York City.

A catalog giving complete descriptions of tripod and column drills, with illustrations of the drills and their various parts. Tables of dimensions, weights, etc., are given.

Burrows Ballbearing Jacks.—Paper; 7¾x5 ins.; 24 pp. Topping Bros., 122 Chambers St., New York.

This catalog illustrates screw and hydraulic jacks of from 10 to 15 tons capacity. The book also describes in detail the jacks and their various parts. Besides the jacks, several pages are devoted to track drills, clamps and tool grinders. 'Price lists are given.

Blasting Powder.—Paper; 3¼x6 ins.; 12 pp. E. I. Du Pont de Nemours Powder Co., Wilmington, Del.

This booklet gives a description of Monobel No. 1, calling attention to the excellent results to be had from the use of this explosive in certain classes of quarry and ore mine blasting.

Rail Fastener.—Paper; 6x8 ins.; 4 pp. A. S. Chilsen, Merrill, Wis.

A circular describing a recently patented rail fastener, which is designed to do away with rail spikes.

Sturtevant High Pressure Blowers.—Paper; 6¼x9 ins.; 44 pp. B. F. Sturtevant Co., Hyde Park, Mass.

This is catalog No. 175, illustrating and describing positive high pressure blowers for conveying materials, for cooling processes, blast furnaces and for various special uses. This book is full of useful information for buyers and for users. Contains details of tests with methods of making same. Notes on the installation of blowers and their care are given.

Jeffrey Bulletin, No. 42.—Paper; 6x9 ins.; 48 pp. The Jeffrey Mfg. Co., Columbus, Ohio.

This book contains photographic views of installations of Jeffrey conveyors, giving excellent ideas as to the various applications of conveyors for handling minerals. Various types of screens, as well as roll crushers, pulverizers, hoists, dump cars, lassies, electric locomotives, coal cutting machinery and crushers are shown.

What Is Asphalt?—Paper; 3x6 ins.; 12 pp. Harry Tipper, The Texas Co., 17 Battery Pl., New York, N. Y.

A booklet describing the composition of asphalt and the preparation and uses of the various Texaco materials, such as cement, filler, road asphalt, macadam binder and road oil.

The Machinery List.—Paper; 3¾x6¼ ins. A. H. Hitchcock, 1220 Caxton Bldg., Chicago.

No. 132 is the September number of this reference list for buyers of sawmill and woodworking machinery, both new and second-hand.

Cobb Building.—Circular; 7½x5¼ ins. Stone & Webster Engineering Corporation, Boston, Mass.

Illustrating the Cobb building of Seattle.

Walnut Stain.—Paper; 5½x9 ins.; 4 pp. Bruno Grosche & Co., 5 Jones Lane, New York.

Circular describing a walnut stain made of high boiling oils.

Buffalo Concrete Mixer.—Paper; 6x9 ins.; 20 pp. Buffalo Concrete Mixer Co., 22 Builders' Exchange, Buffalo, N. Y.

Latest bulletin of the company making this mixer. It gives various illustrations of the machine, with descriptions of its parts and of different work done where the Buffalo mixer has been used.

Coal Handling.—Paper; 12x9 ins.; 136 pp. Mead-Morrison Manufacturing Co., New York, Singer Bldg.; Chicago, 605 Monadnock.

This is a book of illustrations of machinery and of plants where this company's machinery is installed. It covers all coal handling machinery, electric and steam hoists, grab buckets, derrick swingers, belt hoists and suspension cableways.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association.—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H. Warder, Monadnock Block, Chicago, Ill.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

The Carterra Co. has turned over to the Hansbrough Bros., 1028 Market St., San Francisco, Cal., the contract for the construction of 2,000 ft. of quay wall. The cost of the work amounts to $222,000.—P. Sanford Ross, Inc., Jersey City, at $2.64 per cu. yd. was the lowest bidder for the dredging of the St. Johns River on the left side of the stream from Catherine St. to Hogans creek in Jacksonville, Fla. Capt. George R. Spalding is U. S. Engineer in charge of the work.—Columbia Contracting Co., Portland, Ore., was the only bidder for furnishing 600,000 tons of rock to the Columbia River jetty. The bid was as follows: 525,000 tons of rock, Class A, B and C, $1.12 per ton; 75,000 tons class D, at $1.25 per ton.—North American Dredging Co., at .1075 cents per cu. yd. was low bidder for the improvement of Bolivar channel, the work including about 777,000 cu. yds. of material.—Blows & Tuell, Tacoma, Wash., at $103,874 has been awarded the contract for the construction of the Nisqually Power Station.—Greiling Bros. Co., Green Bay, Wis., at $149,468, was low bidder for the improvement of the harbor at Racine, Wis. Maj. Charles S. Bromwell, Milwaukee, Wis., is U. S. Engineer in charge of the work, which includes the construction of reinforced concrete caissons and pile pier, removing old pier and dredging.—Commissioners of Bolivar County, Miss., will receive bids until 2:30 p. m., Oct. 12, for the excavation of the following drainage canals: Bogue Hasty; Pecan Bayou; East Bogue Hasty; Icy Bayou; West Bogue Hasty. The work includes 52.6 miles of work and 975,025 cu. yds. of excavation. W. W. Boone, Cleveland, Miss., is Chief Engineer of the Bogue Hasty Drainage District.—Flanagan & Murphy, Dauphin, Man., have been awarded the contract for the construction of a water works and sewer system. The contract price is $250,000.—The contract for the construction of the Canadian Northern Ry. tunnel six miles west of Duluth, Minn., has been awarded to Wick, O'Connell & Co., Houghton, Mich., at $90,000.—Bids have been advertised and will be received until Oct. 1 by Henry First, Chairman of the Coal Valley Rural Road Committee, Moline, Ill., for the excavating and grading of the road. The contract includes approximately 63,805 cu. yds. of excavation.—The New York, Ontario & Western Ry. Co. has awarded the contract for grading 11 miles of right of way to McDonald Construction Co., Scranton, Pa., for $200,000.—The extension of the Mexico Northwestern R. R. is now finished and opened to the new town of Pearson, in Mexico. This extension is being constructed from Terrazas to Madera, 120 miles. It will form a new railroad route through the western part of Chihuahua and will be the means of opening for development large tracts of timber and several rich mineral districts.—All previous records for excavation on the Panama Canal in the rainy season were broken in the Central Division and in Culebra Cut during the month of August, when 1,377,992 cu. yds. of rock and earth were taken out of the cut and 234,404 cu. yds. from the Chagres section.—According to the statement of the U. S. Census Bureau Sept. 17, the city of Chicago gained 28 per cent from 1900 to 1910. The bureau announced that Chi[illegible] 1910 is 2,185,283, as against 1,698,575 in 1900, and 1,099,850 in 1890. Chicago, of course, still retains its position as second city of the United States, but did not approach New York in point of increase. New York increased from 1900 to 1910, 1,329,681, or 38 per cent, the population in 1910 being 4,766,883, as against 3,437,202 in 1900.—Official announcement has been made that the Pecos & North Texas Ry., the 70 mile stretch of track between Lubbock, Tex., and Lamesa, a part of the Coleman cutoff of the Santa Fe, will be placed in operation Oct. 1.—Track laying on the Temple Northwestern Ry. started from Temple, Tex., on Sept. 13. The first ten miles will be completed by Nov. 1.—E. DeV. Tompkins, 81 E. 125th St., New York City, at $75,940, was low bidder, Sept. 10, for constructing a pier from the mainland to Cob Dock, Pier D, at the New York Navy Yard.—The Coastwise Dredging Co., at $56,980, was the low bidder, Sept. 15, for dredging in Bridgeport Harbor, Conn., for the U. S. Government. The work includes 518,000 cu. yds. of dredging, the bidding price being 11 cts. per cu. yd.—The U. S. Engineers have recently made a report upon a survey for a ship canal from New York to Philadelphia. The report states that a practicable route between deep water in New York Bay and deep water in the Delaware River has been found which does not cross any trunk line of railroad. Three branch lines are crossed. For the most important of the three, the railroad can cross at an elevation of 110 ft. above the canal surface. The other two can be carried over the canal so as to leave a clear height for shipping of 15 ft. No fixed bridges are projected. The distance from the Battery in New York City to the wharves at Philadelphia is about 80 miles. Of this distance 25 miles will be through the open waters of New York Bay, 30 miles across the State of New Jersey and 25 miles through an improved channel in the Delaware River. The approximate estimate of cost varies from $38,725,000 for a lock canal, 70 ft. summit, 125 ft. bottom width and an 18 ft. depth, to $53,632,000 for a sea level canal with bottom width of 200 ft. and a 25 ft. depth.

Some Figures on the Last Census.

According to a bulletin recently issued by the U. S. Census Bureau 29 cities, which in 1900 had an aggregate population of 10,376,[illegible] of 13,596,819. In 1890 the population of these cities was 7,904,140. The percentages of increase for this aggregate population show little change in the rate of growth during the two decades, being for the earlier one 31.3 per cent and for the later, 31 per cent. The high rate of increase is not confined to any one geographical section. Of the seven cities whose rate exceded 40 per cent two, Newark, N. J., and Bridgeport, Conn., are eastern; one, Atlanta, is southern; and four, Detroit, Denver, Kansas City and Columbus, are western. Of the two cities with the lowest rate one is eastern and the other is western. Remarking upon the facts presented, the bulletin says: "The rates of increase for Atlanta, Detroit, Denver, and Kansas city must be regarded as phenomenally high, but even more extraordinary is the high percentage for New York, which exceeds the average for 28 cities in the group by 11.4 per cent, and is itself exceeded only [illegible] City rate, moreover, has been maintained at its present high point for two decades, and may therefore be regarded as a normal rate for that city. In the bulletin 54 cities of between 25,000 and 100,000 are, given, showing an aggregate population of 2,723,498, as against 1,901,766 in 1900, a gain of 43.2 per cent. Of these 54 cities 31 show a higher rate of increase for the last decade than for the previous one. So far no decrease is noted in any of the cities.

Concrete Bridge Work on the Pennsylvania.

Something of a feat in the erection of a concrete bridge was accomplished by the Pennsylvania Railroad last month. The bridge, which was of reinforced concrete construction, was erected on the main line of the Northern Central Division, which extends from Washington to Buffalo. The bridge is in nine sections and was erected in one day, not a single train being delayed or thrown off schedule. The concrete slabs were molded previously and placed in accessible positions along the tracks. When everything was in readiness two car cranes tore up one side of the old structure and swung it to the solid ground adjoining. The concrete slabs were then swung into position and the track laid. The other side of the bridge was then handled in a like manner. This use of concrete for bridge purposes by the Pennsylvania Railroad brings to mind a remark once made by the late William Brown when chief engineer of that road. Speaking of concrete he said that he didn't believe that man could make a better stone than the Lord by taking the Lord's stone, breaking it up and sticking it together again.

U. S. Sanitary Expert for Chile.

The Chilean Government has paid the U. S. Sanitary Service a very pretty compliment. That country is preparing to reorganize its sanitary service, and has turned to this country for aid. It has requested the Treasury Department, under whose jurisdiction is the Public Health and Marine Hospital Service, to designate a hygienist of recognized competence who may be obtained to do this work. The Secretary of the Treasury will ask the Chilean Government whether it wants a man to go to Chile and remain there for only a few months, or whether it wants him to stay for several years. He will also inquire as to the compensation which Chile is willing to pay for the services of such an expert. The Secretary is willing that one of the sanitary experts of the Public Health and Marine Hospital Service go to Chile for several months, but if the services of a hygienist are required for a longer period he will ask Surgeon General Walter Wyman, of that service, to suggest a man outside of the government.

English as She Is Writ.

Judged from their letters [illegible] guage mainly to conceal their thoughts. The follow- [illegible] tractor, is a case in point. [illegible] house which it has difficulty in renting because it lacked a water supply. The directors of the bank decided to have a well driven and wrote to a contractor in a neighboring town [illegible] contractor's letter, according to the Youth's Companion, was as follows:

Mr H. Best
Barton reference determining caliber of character
Contractor
Mr E. Linskey
Selectman
Gentlemen
Per Mr. Larry Croft

I herewith transfer all possible interest of attention as may invite your interest in a Driven Well, assuring the commendable desire of favorable proceedings, plus the importance of your valuable reference solicited.

Positively definite conclusions confounded with the meaning of fact are not possible to warrant.

I assure you the cost of a splendid Driven Well many times not worth the mention, or infinitesimal.

In connection with four Driven Wells, hence, and separate from three Driven Wells, hence, I am bound to consider your wants paramount.

A comprehensive explanation per vatum on your approval.

Believe me to be your obedient servant.

I. Ducrow, Pendexter
P. O. 484

Please permit
Will advance reference from all the business men in Pendexter.
Never had any legal proceedings with my fellow man.
I. D.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

It is reported in the vicinity of Birmingham, Ala., that, officials of the Illinois Central are considering the construction of an extension of the line from Haleyville to Birmingham, a distance of 80 miles.

It is rumored in Birmingham, Ala., that a number of Ohio capitalists have plans well under way for the construction of a new railroad from Birmingham to the Warrior river, touching the stream below Tuscaloosa. The new railroad is to be an independent line and will cater to the interests of all other roads which will need trackage into and out of Birmingham and to the river incident to the freight development that is expected upon the opening of the Panama canal.

The Mobile Terminal & Railway Co. has been incorporated in Alabama, with headquarters at Montgomery and proposes the construction and operation of piers, docks and warehouses. The capital stock of the company is set at $5,000,000.

The committee of Demopolis, Ala., has succeeded in soliciting subscriptions amounting to $12,000 for the construction of the Birmingham, Demopolis & Scranton R. R., and it is believed that no trouble will be experienced in obtaining the amount required by the promoters.

Arizona.

The engineering crew of the Atchison, Topeka & Santa Fe has been instructed to survey a line from Parker, Ariz., to the North Star mine, recently acquired by the Guggenheims. The proposed road will pass through the La Paz District and, according to advices from Parker, will eventually extend to Yuma.

Arkansas.

Surveys, according to announcement reported to have been made by C. W. Dodson, General Superintendent of the Memphis, Dallas & Gulf Ry., have been completed for the construction of the extension from Murfreesboro, Ark., to Graysonia. The largest problem encountered in the work was the selection of a route out of Murfreesboro.

Board of directors of the Gulf & Magnolia Northern R. R., mentioned in our last issue, at a recent meeting held in the general offices, Hope, Ark., authorized the issuance of $250,000 of bonds. Construction work will be started as soon as some minor details are arranged. S. Q. Sevier, Hope, Ark., is President of the company.

Several cars of steel have been received at Mesa, Ark., according to information received from Stuttgart, Ark., for the construction of the Stuttgart & Rice Belt R. R. Grading work is being pushed rapidly. George C. Lewis is Vice President and J. W. Underwood is Secretary and Treasurer.

It is rumored in Stuttgart, Ark., that the officials of the Cotton Belt Ry. have under consideration the construction of an extension of its line from Almyra, on the Stuttgart-Gillett Branch to Helena, giving Stuttgart direct railroad connection with Helena and shortening the distance between the latter city and Little Rock several miles.

Announcement has been made by R. M. Foster, Stuttgart, Ark., promoter of the Central Arkansas & Eastern Ry., that the citizens of Hazen, Ark., will meet the requirements for an extension of the road into that place in the near future. He asked a bonus of $10,000 and right of way from Foster, a distance of about six miles, most of which has been secured with $7,000 of the necessary bonus.

California.

Advices from Oroville, Cal., state that M. J. Lorraine, Engineer who has been running lines for a new railroad through the Beckworth Pass and middle fork of the Feather River, has announced that he has located such a route with no grades exceeding 1 per cent and that between Beckwith and Oroville the route is 30 miles shorter than that of the Western Pacific and between the latter city and San Francisco Bay it is 60 miles shorter. No information could be obtained as to who the Engineer represented.

Owing to the fact that the Denver & Rio Grande R. R. is double tracking its line into Salt Lake City, Utah, it is rumored in that city that it is the first step toward the construction of a line from the present terminus at Marysville to Los Angeles and San Diego, Cal., for which surveys, according to reports, have been under way.

The Vallejo & Northern Ry. Co. has under construction a line from Vallejo to Sacramento, Cal. Headquarters of the company are in the Alaska Commercial Bldg., Sansome St., San Francisco. T. T. C. Gregory, who is at the head of the organization, also has offices at Suisun and Sacramento, Cal.

Advices from Stockton, Cal., state that President M. J. Gardner, of the Stockton-Jenny Lind Interurban R. R. drove the last spike Sept. 5, completing the line from Stockton to Linden.

Location surveys have been completed for the Porterville Northeastern Ry. from Porterville to Springville, Tulare county, California, a distance of 16 miles. The company, which has secured all necessary capital for the construction, is capitalized at $300,000. Contract for the line will be let at once. F. U. Nofziger, Porterville, Cal., is President and C. S. Freedland, Porterville, Cal., is Chief Engineer.

City Council of Oakland, Cal., has granted the Southern Pacific right of way for the new Melrose-San Leandro line through the Talcott property north of East Fourteenth St. in Melrose. Under the terms of the agreement the company must macadamize the space between the tracks and 12 ft. on either side of 7th St.

Board of Public Works, San Francisco, Cal., has approved the plans and specifications prepared by the City Engineer for the reconstruction of the Geary St. railway as a municipal line and also asked the Supervisors to set aside $130,000 to pay for the rails. Bids for the work will be advertised soon.

Advices from Maryville, Cal., state that the Southern Pacific will soon commence the improvement of its line from that city to Oroville. The work will include the construction of an embankment about 4 ft. in height.

The Southern Pacific will apply to the city council of Oakland, Cal., at its next session for a franchise on Occidental St., North Oakland, for the purpose of constructing a connecting line between its Oakland and Berkeley lines.

Engineers of the Humboldt & Eastern R. R., J. H. Leutell in charge, have completed 18 miles of survey, and set stakes so that railroad construction can be started at any time. Preliminary survey has been run several miles further. The completed survey, according to advices from Weaverville, Cal., is in upper Hayfork Canyon and Hayfork Valley and work is now being pushed in the lower Hayfork Canyon. The other crew is four miles from Good's Mountain Pass, near Bower's place. They have located twenty-five miles of road. In some places in the Good's Mountain region the Southern Pacific survey is right on top of the Humboldt & Eastern.

The Southern Pacific Ry., according to advices from San Francisco, Cal., has inaugurated service over the new Dumbarton Bridge which crosses the southern end of San Francisco Bay. The bridge is a steel structure, 7,600 ft. long, with double tracks. Together with the cut-off line, which runs from Newark, in Alameda county, to Redwood City, San Mateo county, it cost $4,000,000. The cut-off is primarily for freight passage and will carry all Northwestern and Eastern shipments into and out of San Francisco.

It is believed in Petaluma, Cal., that another contract will soon be let for the construction of the extension of the Northwestern Pacific toward Humboldt Bay. At the present time about 400 men are engaged in the work at that end. Steel is laid for a distance north of Willits and the balance of the 13-mile contract will be finished as soon as possible. On the Eureka end of the gap a similar state of affairs exists. A large number of men are at work and the first big tunnel has been completed. With the completion of the work now under way at Willits, there will be but a gap of less than 70 miles to complete the line from San Francisco to Humboldt Bay.

Construction work on the Vallejo & Northern Ry. has been commenced, according to the latest information received from Woodland, Cal. A corps of surveyors will in the near future begin the location of a direct line from that city to Sacramento, a distance of about eighteen miles. It is said that the surveyors will select a line that runs along a ridge of high land stretching from Woodland to the river. The Woodland-Sacramento road will be a branch of the Vallejo Northern from Vallejo to Sacramento, and it is reported will be extended to the north after the main line is finished. The only delay in the construction all along the line will be the cases over the right of way that are now in court. As soon as judgments are rendered in these, a large force will be put at work grading.

Construction work is progressing rapidly on the Hanford, Summit Lake & Southwesterr R. R., which is to run from Hanford, the county seat of Kings county, Cal., through Panoche Pass, Hollister, Watsonville and to Santa Cruz, connecting with the Ocean Shore. The line will connect with the Southern Pacific and Santa Fe systems at its Hanford terminus.

Stockholders and directors of the Los Angeles Railway Co., at a recent meeting held at Santa Barbara, Cal., took into consideration the matter of increasing the capital stock from $5,000,000 to $15,000,000. The proposition will be submitted to issue $15,000,000 in bonds to take up the present debt and for constructing new lines.

Colorado.

The North American Smelting & Mines Co. have under consideration the construction of a line from Golden, Colo., to Idaho Springs. Engineers are already in the field making surveys and it is said that bonds amounting to $2,500,000 [illegible] issued for financing the project.

Advices from Pueblo, Colo., state that about 30 grading camps with 3,000 men are working on the Rio Grande and Colorado & Southern joint double track between Pueblo and Walsenburg and it is believed that the improvement will be completed ready for operation by August, 1911.

Florida.

The contract for grading and preparing the roadbed for seven miles of track on the south end of the Tampa & Jacksonville R. R. has been awarded to J. R. Emerson and Oliver & Kite, of Gainesville, Fla. It is the plan of the contractors to start work immediately and rush the job to completion.

Georgia.

Surveys have been made for the construction of a steam railroad from Toccoa, Ga., to Acrnesville, Ga., a distance of 20 miles, and a charter will be applied for at once. Promoters have subscribed about $60,000 worth of stock and are desirous of interesting about $65,000 additional capital. J. H. Hicks, Clarkesville, Ga., is interested.

The Secretary of State has granted a commission to capitalists of Augusta, Aiken and Edgefield who propose to build the Georgia & Carolina Ry. They plan to construct a line of standard gauge road from the town of Hamburg, opposite Augusta, on the Savannah River, to the city of Spartanburg, a distance of 120 miles. The construction of the road would give the Carolina, Clinchfield & Ohio Railway a direct route to Augusta from Spartanburg. Hamburg is located on the Savannah river and thus the Clinchfield would be given a river route to the sea. The proposed capital stock is $100,000 with privilege to increase to $2,500,000. The principal place of business of the new company will be located at Edgefield. The petitioners are Allen W. Jones of Augusta, Charles C. Howard of Augusta, A. E. Padgett of Edgefield, Dan Crosland of Aiken and G. R. Coffin of Augusta.

The State Department of Georgia has granted a charter to the Vidalia & Southeastern Ry., which contemplates the construction of a road from Vidalia to Flemming, in Liberty county, on the Atlantic Coast Line railroad, a distance of approximately 70 miles. The road will traverse the counties of Toombs, Tattnall and Liberty, and will touch at Reidsville and Hinesville, the seats of Tattnall and Liberty counties, respectively. Hinesville is situated in the interior of Liberty county, some miles from any railroad, and Reidsville, too, is more or less inaccessible. The new road will connect the systems of the Seaboard Air Line, the Macon, Dublin and Savannah, and the Georgia and Florida railroad at Vidalia, with the Coast Line at Flemming, and will open up a vast territory of productive and fertile country. The company is capitalized at $250,000. F. R. Durden of Savannah, W. O. Donovan of Macon, and J. V. Kelley of Reidsville, are among the incorporators. Saffold & Larsen of Swainsboro, and W. J. De Loach of Vidalia represent the petitioners.

Illinois.

A meeting was recently held in Morrison, Ill., to discuss the matter of extending the traction line from Albany to Morrison and Moline. C. E. Peck, Albany, Ill., is interested.

Officials of the Sterling-Moline Traction Co. recently held a meeting with the business men of Walnut, Ill., in regard to the proposition of extending the line through that place. Inducements have been offered to extend the line through Ohio to Mendota, Ill.

Articles of incorporation have been filed in the Recorder's office at Belleville, Ill., by the St. Clair Traction Co. The capital stock of the new company is $2,500, and the incorporators are E. L. Thomas, David O. Thomas, C. A. Heinzelmann, L. D. Turner, Jr., and William A. Twenhoefel.

Engineers of the Elgin, Joliet & Eastern R. R. are now at work laying out the new yards to be constructed at Rossville Junction, Rossville, Ill. Arthur Montzheimer, Joliet, Ill., is Chief Engineer of the company.

Owing to the construction of bridges the Chicago, Burlington & Quincy Ry. has announced that the completion of the road to Metropolis, Ill., will be delayed about 30 days, that is, to the middle of October. Engineers in charge of the work will move from Herrin, Ill., to Metropolis, to superintend the work there and across the river.

Michael Conroy, general and railroad contractor, Stockton, Ill., announces that he has taken 20 miles of work near Alton, Ill., and is preparing to start active work at once. He also has some nice machine and wheeler work to let at good prices.

Indiana.

Neff Brothers, formerly of Milford, Ind., have started surveys for the construction of the proposed railroad between Mishawaka and Bremen.

A mortgage has been filed in the county seats of Indiana for $40,000,000 by the Chesapeake & Ohio R. R., and the company will issue bonds not to exceed that amount for the improvement of the Indiana Branch, the greater part to be done on the track between Cincinnati, O., and Peru, Ind. Next spring the officials will take up the work at Peru and continue it to Chicago. They will build in all some 200 culverts between Chicago and Peru and will install several new switches and sets of side track. They want to do all they can before winter to improve the tracks in order to secure a better outlet to Chicago and the Great Lakes for the Chesapeake & Ohio.

The construction of the double track on the Pennsylvania R. R., between Richmond and Knightstown, Ind., is considered one of the greatest engineering feats west of the Alleghanies. The cuts in some places are sixty feet deep and in others the fills are equally great. The work when completed will have cost about $1,000,000, including $60,000 for cement arches spanning the Blue River near Knightstown. F. N. Crowell, Richmond, Ind., is Division Engineer.

An agreement has been reached by the Board of Public Works and the Indianapolis Traction & Terminal Co. to extend East Michigan street car line from its present terminus at Keystone Ave.

On account of it being necessary for the Peoria & Pekin Union Ry. to construct its new bridge 7 ft. higher than the old one across the Illinois River, the Chicago, Rock Island & Pacific Ry. will have to elevate about half a mile of double track to a level 7 ft. higher, through Peoria.

Iowa.

Commercial Association of Ottumwa, Ia., has decided that the construction of the interurban between that city and Iowa City can be obtained only through an energetic campaign. Plans will therefore be laid at once for raising the necessary $100,000 for the project.

The Fort Dodge, Des Moines & Southern R. R. has announced that the branch of the Newton & Northwestern Road, running from Fort Dodge Junction to Rockwell City, Iowa, will be in operation within a month. The old road is being electrified, the poles have been set and rails have been laid and bonded as far as Gowrie.

Members of the Greater Des Moines Committee have pledged to subscribe for $200,000 worth of stock of the Red Oak & Northeastern Ry.

Surveyors of the Great Western R. R. have completed their work from Des Moines to Clarion, Ia., and have gone to new fields, it is said, in Clarion, to run a line from Osage. J. T. Frame, Clarion, Ia., is Engineer Maintenance of Way.

Kimballton Construction Co., Atlantic, Ia., has been awarded the contract for the construction of all concrete work on the new railroad to Clarinda. The contract price amounts to $18,000.

Excellent progress is reported from Belle Plaine, Ia., upon the new railway from Waterloo to Keokuk, with branches from Belle Plaine to Grinnell and Belle Plaine to Keystone, Vinton, Independence, etc. It will secure for Belle Plaine the finest and cheapest sort of electric power from the great dam now being built across the Mississippi river at Keokuk. This will generate over 200,000 electrical horse power—as much as Niagara Falls.

Rattenborg, Ross & Judd, who have the contract for the promotion on the south extension at the Atlantic, Northern & Southern will, according to an announcement made at Greenfield, Ia., commence track laying about October 1. Atlantic City, Ia., will be the headquarters of the crews.

Kentucky.

The Owensboro & Rockport Bridge & Terminal R. R. Co. has applied to the City Council of Owensboro, Ky., for the right of way down the river front of the city. Engineers have been in the field for some time and options have been secured on the right of way between Owensboro and Rockport, both in Kentucky and Indiana. The plan contemplates the building of a bridge and if the plan is ultimately successful it will give Owensboro a direct northern outlet. The council will hold an adjourned meeting to take action on the ordinance.

Surveys have been completed and are on file with maps and profiles at the office of the Chief Engineer H. H. Snyder, 41 Tod Bldg., Louisville, Ky., for the construction of 48 miles of line for the Louisville, Lincoln Farm & Mammoth Cave Traction Co. Bids will be received at once for building the line, which will extend from Mammoth Cave to Glasgow, to Buffalo Lincoln Farm and Hodgenville, Ky. Charles Vanden Burgh, Box 276, Glasgow, Ky., is General Manager of the company.

Capitalists of Liberty and Moreland, Ky., have a move on foot to erect an electric railway line from Liberty to Moreland. The papers are being circulated in Liberty and will be sent to the other city for subscriptions to stock. The intention is to sell $200,000 in stock, the amount which Engineer Merriweather has estimated for the erection of power house, build lines and fully equip with rolling stock.

According to advices from Warren, Ky., the Cumberland Railroad will build from there to Brush Mountain Tunnel and the Tye Fork spur will be built from Brush Mountain. B. C. Milner, Warren, Ky., is General Manager and Chief Engineer of the company.

Louisiana.

Surveys are under way by the engineers for the 45-mile line of the Louisiana & Arkansas Ry., projected from Jena, La., to Vidalia, La., by way of Jonesville, La. The time for letting the contracts for the work has not yet been definitely decided upon. G. Knobel, Jena, is Chief Engineer, William Buchanan, Texarkana, Ark., is President and W. H. Vance, Stamps, Ark., is Engineer of Maintenance of Way.

Announcement has been made by E. P. Fox, Manager of the proposed Lake Arthur, Jennings & Northern R. R., at Lake Arthur, La., that engineers had been secured and that the survey for the new line would be made at once, although he had not decided at which end to start the preliminary work.

City Council of Baton Rouge, La., has appointed a committee to investigate the matter of constructing a belt line throughout the city connecting the different lines in order to relieve the present congestion. The construction of a modern dock and warehouse is also under the consideration of the body.

At an election recently held in West Monroe, La., to decide on the question of voting a 5-mill tax in favor of the proposed road to Farmersville and on to a connection with the Chicago, Rock Island & Pacific, went in favor of the proposition by a large majority. The tax will run until $70,000 has been paid. Monroe will vote later on a proposition to give a bonus of $150,000. The connection with the Rock Island will be made either at Junction City or El Dorado, Ark., and the line will continue to Hope, Ark.

Massachusetts.

Officials of the Springfield Traction Co., who are contemplating the construction of an electric line into Ludlow, Mass., have asked the city council for a location there. The proposed route for the extension starts at the Indian Orchard end of the Ludlow bridge, crosses the bridge, and enters East St., running in an easterly direction to Sewall St. It runs up Sewall St., to Winsor St. and along Winsor as far as Franklin St., where the extension will end.

The resignation of Lucius Tuttle, President of the Boston & Maine R. R., and the appointment of Charles C. Mellen, President of the New Haven R. R., to act in that capacity means, according to advices from Boston, Mass., the practical consummation of the merger of that road with the New Haven, which has generally been accepted as a fact for the past year.

Maryland.

The Walbrook Improvement Association at a recent meeting on Ninth St., Baltimore, Md., decided to ask the United Railways Company not to make the proposed change in the route of the Edmonson avenue street car line, but to establish another line to connect Walbrook and Northwest Baltimore directly with Southwest Baltimore, which was to be the object of the Edmonson avenue line if the change was made.

Michigan.

It was recently voted in Bessemer, Mich., to grant a franchise for a street car line in that city connecting with the county seat and Ironwood. The franchise was granted to the parties having an option on the Ironwood-Hurley Street Car, Lighting and Water Plants.

The Lake Michigan & Kalamazoo Railroad Company has filed articles of incorporation with the Secretary of State and proposes the construction of a railroad from Kalamazoo to Benton Harbor. The capital stock of the company is $25,000. William Baker, Coloma, is president; William C. Klumb, Kansas City, is secretary and treasurer; John H. Notley, Kalamazoo, is attorney. A request for a franchise will be filed at the meeting of the Kalamazoo City Council Oct. 3.

Lake Michigan & Kalamazoo Ry. Co. will soon apply to the city of Kalamazoo, Mich., for a franchise to operate an electric line on the streets of that city. As proposed the line will run from Benton Harbor and St. Joseph to Kalamazoo along the following route: Starting at St. Joseph, it will go through Benton Harbor, then to Coloma, Watervliet, Hartford, Lawrence. Paw Paw, Alpena and into Kalamazoo. It will also strike Lake Cora and Paw Paw Lake and will pass through the main streets of all the villages along the line. On the proposed line the company owns 15 miles of private right of way.

O'Connell & Co., Houghton, Mich., have awarded the contract at $90,000 for the construction of a tunnel 530 ft. in length through a small mountain on the Canadian Northern Ry., about 6 miles west of Duluth, Minn.

The crew of the Northern Construction Co., has started work on the double tracking south on Washington Ave., from Washtenaw to Main St., Lansing, Mich. After this section has been double tracked the parts of the section needing double tracking from Washtenaw St. to Ottawa will be started, if the weather is in the least favorable.

The Michigan Central R. R. opened its new tunnel under the Detroit River between Detroit, Mich., and Windsor. A double track runs through the tunnel, which was recently completed at a cost of $10,000,000.

Track laying crew of Handy Bros.' new railroad, according to advices from Bay City, Mich., have reached the Quannicassee river. The bridge over the stream has been completed for several months, and the big machine used to lay the rails will cross the bridge and start across Tuscola county. The work will be pushed to the limit, and it is expected the rails will reach Akron within a week. Indications point to the steel bands being extended through to Caro within the next forty days.

Minnesota.

Earl Luce, President of the electric railway company which proposes the construction of a line from Central Market, Minneapolis Minn., to Watertown, Minn., has accepted the ordinance passed by the city council of Minneapolis providing that the line be completed by this winter. It is announced that 500 tons of 72-lb. rails have already been ordered.

Work has been resumed by the crew laying the steel in Bemidji, Minn., and vicinity for the Plummer-Moose Lake line of the Minneapolis, St. Paul & Sault Ste. Marie Ry. The span crosses the Mississippi River and has been completed and steel laid across. Tracklayers are on the last lap of 25 miles to complete the main line from Moose Lake to Plummer. The line, according to announcement, reported to have been made by officials, will be open for operation by October 1.

Wick O'Connell & Co., Houghton, Mich., has been awarded the contract for the construction of a tunnel six miles west of Duluth, Minn., for the Canadian Northern Railway at $90,000. The tunnel will go 530 ft. through a small mountain.

Missouri.

The Springfield & Western R. R. Co. has been organized with a capital stock of $2,000,000, and a charter secured for the construction of an electric line from Springfield to Joplin, Mo., via Benetts, Plano, Halltown, Paris Springs, Miller, Red Oak, Avilla and Carthage, with a tap from Paris Springs, via Mount Vernon to Monett and Pierce City, comprising 100 miles of trackage. Parties are to take the field as soon as they can be organized for the purpose of surveying the system. Directors and officers of the company are as follows: H. D. Mackay, President; I. N. Smith, Vice President; J. I. Woodfill, Secretary; J. P. McCammon, Attorney; M. M. Hollenback, Chief Engineer; all of Springfield, Mo.

Advices from Columbia, Mo., state that contracts for the construction work on the St. Louis-Kansas City Electric Ry. will be let in October and active work will be started this fall on the line to tap the Boone County coal fields, on which the company has secured leases covering 10,000 acres. H. V. Johnson is General Attorney of the company.

Montana.

Information received from Billings, Mont., states that excellent progress is being made on the branch line of the Northern Pacific being constructed south from Mandan, N. Dak., along the Cannon Ball River and thence west. The line has been completed as far as Flasher and will be into Mott by October 1. All the grading has been completed and the steel is now being laid.

Contractors have work under way on the Dorsey Tunnel of the Northern Pacific Ry., according to advices from Missoula, Mont., and the job will be pushed with all possible haste to completion.

Advices from Helena state that more than 600 miles of new railway track will be laid in Montana at a cost of about $25,000,000, according to an announcement made recently by prominent railway officials. Right of way has been secured for the greater part of this new mileage, and a number of parties of surveyors are in the field locating the remainder of the mileage to be constructed. One of the most important of the new lines is to be constructed as a cutoff for the Northern Pacific, extending from Glendive to Helena, a distance of 350 miles. This road will pass through Dawson, Fergus and Meagher counties, which is a new and sparsely settled section, offering many opportunities for the homeseekers. The chief purpose for the construction of this new line is to give a more direct route from St. Paul to the coast. It will parallel the Milwaukee road from Miles City to Meagher, but at an average distance of 25 miles.

Advices from Missoula, Mont., state the the Polson-Whitefish Electric Railway Company, organized last year for the construction of a trolley line between Polson at the foot of Flathead Lake to Whitefish, is progressing steadily and has secured almost all the necessary capital for the work.

The Chicago, Milwaukee & Puget Sound Railroad has completed the reconstruction of the line recently destroyed by the fire seven days before the scheduled time. Without losing a moment's time the officials of the company hurried an army of men to the scene of the trouble and a few days ago an unbroken line of steel stretched through the burned-over district. The two forces, one working from the east and one from the west, met at Bridge No. 5 on the west side of the tunnel. Division Engineer Osgood said, according to advices from Missoula, Montana: "I consider the work done in reconstructing the line in 14 days to be one of the best, if not the best, pieces of railroad repair work ever accomplished. Our original estimate on the time necessary to repair the $1,000,000 damage was 21 days, but we kept plugging away and clipped day after day from our schedule until we finished seven days earlier than we had anticipated." The first train will be run over the line some time today."

Nebraska.

Promoters of the Nebraska Transportation Co., which projected the construction of a line from Omaha to Fremont, Nebr., are now proposing to extend the project to include a line to Madison through Maple Creek Valley northwest to Fremont.

Nevada.

The Nevada Salt Borax Co. has completed surveys and secured necessary capital for the construction of its 24-mile line from Fallon, Nev., to Sand Springs, via Hill. Contract for the work will be let in about 90 days. George Otis Draper, New York, is President C. M. Clark, Fallon, Nev., is Chief Engineer, and C. W. Kinney, Fallon, Nev., is interested.

Survey is under way by W. H. Kirk, Chief Engineer, Virginia & Truckee R. R., Carson City, Nev., for the construction of a line north of Virginia City to the Union Shaft to furnish transportation.

Survey has been completed for the railroad to be constructed between Culprite, Nev., and Independence, Cal., and capitalists are now inspecting the right of way, after which, providing everything is satisfactory, construction work will be started. The line, as proposed, will pass through Lida, and will afford an opportunity for the handling of the ores of that district.

New Jersey.

Advices from Long Branch, N. J., state that the Atlantic Coast Electric R. R. has nearly completed the spur between Patten Ave. and the North Long Branch. It is believed that this spur will ultimately extend to Seabright.

The stockholders of the Newark & Bloomfield R. R., a subsidiary company of the Lackawanna, have voted to increase the capital stock to $1,600,000 from $300,000. Permission of the New Jersey Railroad Commission will have to be secured before any of the new capital can be issued. The proposed increase is for work on the road, including depressing of tracks and construction of new stations at Watsessing and Bloomfield.

New York.

The Jamestown Street Railway Co., Jamestown, N. Y., has applied to the city council for permission to lay an additional track from Third Street down Main Street to the switch opposite the Humphrey House in Brooklyn Square, and also to extend its East Second Street tracks across Main and out West Second Street to the intersection of its Cherry Street tracks. The company agrees to replace the pavement torn up.

Regarding the report from Galveston that the Missouri, Kansas and Texas and Southern Pacific companies were contemplating building large terminals at Port O'Connor, Texas, and that representatives of these two companies were now investigating the situation with the idea of obtaining an entrance to the town, it is stated at the offices of both companies in New York City that there is no foundation in fact for the statement.

Ground has been broken, according to information received from Prospect, N. Y., and work well under way on the construction of a new railroad for stone transportation from the Thomas quarry to the M. & M. R. R.

W. A. Boland, New York City, recently visited Centerville, Ia., to make arrangements for the construction of the S[illegible] Traction Company's line between that city and Albia. He announced that the work would be started in a short time.

The Brooklyn & Jamaica Bay Ry. Co., which was incorporated June 2, 1910, has filed surveys for the proposed 3-mile line from East New York to Jamaica Bay, terminating at "Old Mill" Spring Creek. Capital for the construction has been promised and contracts will be let as soon as permission can be obtained from the city. Fred W. Langston, New York, Engineer, Horace J. Subers, 25 Broadway, New York City, President, and Ogden P. Pell, 54 New St., New York City, is Secretary.

The London Construction Co., New York City, which has the contract for the construction of the Galesburg & Rock Island Traction Company's line, announces that work will be started at once. According to the contract the plan was to start crews at Galesburg and Alexis, through which place the road will pass, these crews to work toward each other, thus completing this end of the road at the earliest possible time.

Surveys and plans have been completed by the engineers of the Buffalo-Lake Erie Traction Co., for the reconstruction of the line east from the village of North East across the Big State Line Gulf and into the township of Ripley. According to the information received from Westfield, N. Y., The Thomas Fitzgerald Company of Fredonia expects to build the roadway and do the electric installation work on the new line. The contracts to be let will include a 900 foot bridge spanning the big gulf. This bridge will be one of the largest trolley bridges in the world and will equal in height and length the big Nickel Plate railroad bridge over the same gulf, which is but a short distance from the site of the proposed trolley bridge. The new road will be on private right of way, will cut out the heavy grades and dangerous track where the road now winds down into Eighteen Mile Creek gulf, crosses that stream and again winds up out of the gulf of the west side, and will give an air line route from Ripley to North East, cutting down the running time between those places at least fifteen minutes.

The Bessemer & Lake Erie R. R. will, according to advices from Buffalo, N. Y., have the new track between East Pittsburg and Conneaut Harbor completed between October 1 and 15. The new track will give the company 165 miles of double track between the two cities. H. T. Porter, Greenville, Pa., is Chief Engineer of the Company.

The New York Dock Ry. Co., which was incorporated in that city May 14, 1910, has filed an application with the Public Service Commission for a certificate of public convenience and necessity for a railroad within the property of the New York Dock Company, which extends along the Brooklyn water front for about three and a half miles, from Catherine Ferry to a point south of Atlantic Basin.

North Carolina.

The building of the Isothermal Traction Company's line from Gastonia to Asheville, N. C., is now practically assured. Preliminary work on the proposed road has reached the point where the proposition can be financed and it only remains for the directors to conclude some minor details for the funds necessary for the construction of the line. At a meeting of the board of directors M. L. Mauney, cashier of the Cherryville National bank, was elected treasurer, vice J. F. Black, resigned. Col. J. T. Gardner, of Shelby, was made second vice president, and R. B. Babington, of Gastonia, was elected to the board as the director from Gastonia. The selection of a director from Asheville will complete the personnel of that body.

Chief Engineer C. H. P. Cornell of the Southbound R. R., has announced at Winston-Salem, N. C., that it is hoped by the company to have all of the track connected up some time during October.

The Roanoke Valley R. R. Co has been chartered with a capital stock of $50,000 and proposes the construction of a railroad from Thelma on the Seaboard Air Line to a point on the boundary line between North Carolina and Virginia. The incorporators are W. N. Jones of Raleigh, N. C., D. P. Camp of Franklin, Va., and others.

North Dakota.

A survey has been completed by Engineers of Great Northern Ry. for the construction of a line from Hutchinson, Minn., to Fargo, N. Dak.

J. M. Ramsey, Mandan, N. Dak., is seriously considering the construction of an electric line from that city to Bismarck and he has opened communications with J. C. Johnson of the latter city to determine the feasibility of such a move. The promoter states that eastern capitalists are interested and will provide sufficient funds for the work at any time.

Ohio.

Riggs & Sherman Co., Toledo, O., is making surveys for the construction of the proposed electric railway from Fayette, O., via Montpelier, O., to Butler, Ind. Although no definite information can be obtained concerning the interests backing the proposition, it is rumored that H. E. Bucklin, Elkhart, Ind., who is building a line east of that city, is promoting the new project. With the exception of a stretch of about eight miles, the Bucklin road is open and in operation from Elkhart to Angola, the latter terminus being within 12 miles of the Ohio-Indiana state line, or about 20 miles from Pioneer, the western terminus of the Toledo & Western, owned by the Toledo Railways & Light Co. The T. & W. also passes through Fayette.

A conference has been held recently at Coshocton, O., concerning the construction of an interurban line between Zanesville and Coshocton and east to Uhrichsville. W. E. Sprangeler, Cleveland, O.; William B. Jackson, Chicago, Ill., and Engineer John Hanlon, Coshocton, are interested. For five years the interurban line between Zanesville and Uhrichsville has been passed before the people as a surety. The route which follows the Tuscarawas river to a point near Tuscarawas, was surveyed and a good line established. Rights of way were secured with little difficulty, but owing to certain conditions the line was never started, and there is nothing to show where the line run except blue prints. The proposed line, built from Zanesville east to Urichsville, where it strikes the N. O. T lines is in one of the thickly settled portions of Ohio. For years it has been the desire of railroad builders to establish an electric line over the route which is without apparent grade for miles and miles.

Information received from McArthur, O., states that plans are under way for the construction of an electric line from Gallipolis on the Ohio River, through 29 counties to Lake Erie at the mouth of the Sandusky River.

An agreement will probably be reached soon by the County Commissioners at Akron, O., and the officials of the Northern Ohio Traction & Light Co., with a reference to the location of the tracks on Cuyahoga Falls Ave. The county proposes to place the tracks in the middle of the thoroughfare and have pavement on both sides, the company paying for half the pavement. Charles Currie is General Manager of the Traction & Light Co.

Chicago capitalists, including C. H. Griffith and Robert Smith, have under consideration the construction of the proposed railroad from Findlay to Marion, O. They propose to operate the line with gasoline instead of electricity and thereby cut down the construction cost. This scheme has been contemplated by different parties for the past six years.

Oklahoma.

Advices from Guthrie, Okla., state that a deed of trust has been filed with the secretary of state by the Denver, Kingfisher and Gulf Railway Company, which was chartered some time ago to build northwest from Oklahoma City through the counties of Oklahoma, Canadian, Kingfisher, Blaine, Dewey, Ellis, Beaver and Texas in Oklahoma, and Lipscomb in Texas. The deed gives a mortgage on all the company's holdings to the Pioneer Trust Company of Kansas City Mo., for $2,000,000. It is signed by J. M. McDonald, president, and D. K. Cunningham, secretary. The line has been surveyed for several months.

The Oklahoma Union Traction Company, chartered to build an electric interurban between Tulsa and Sapulpa, has increased its capital stock from $100,000 to $400,000, and President A. A. Small announces the completion of the road between the two cities within six months.

The first of the grade for the Cherryvale, Oklahoma and Texas Railroad was completed during the past week, ten miles from Caney, Kan., to Wann, Okla., and the graders were moved ten miles further in Oklahoma to Delaware. The third will extend from Delaware to Nowata and the fourth from Nowata to Vinita. The laying of steel and ties will begin in October. Senator S. M. Porter of Kansas will go to Paris, France, again next month for another conference with the men who are furnishing the finances. A consulting engineer has been named in Paris, and he is now at work on plans and specifications in conjunction with the American engineer of the company. Plans for a big bridge near Nowata, over the Verdigris River, have been sent to Paris. A new town was opened during the past week between Caney and Wann, to be known as Forest City.

A surveying party is putting down the grade stakes for the construction of the proposed extension of the Missouri, Oklahoma & Gulf R. R. north from Wagoner, Okla., to Joplin, Mo., and Pittsburg, Kan., thence to Kansas City. South from Wagoner the line of the company is practically completed to Denison, Tex.

Entire control of the proposed Lawton & Fort Sill Interurban Ry. has been taken over by Simon Smith, Oklahoma City, Okla., and track laying has been started in Lawton. Grading will be started at once on the line from Lawton to Fort Sill and double track installed. The cost of the proposed line, which is 8 miles long is estimated at $200,000.

Engineers of the Clinton, Oklahoma & Western R. R., who are running a line from Butler northwest into the Texas Panhandle, reached Texmo, on the Oklahoma-Texas border. The route as surveyed goes through the southern part of the old Day County to Gem City, Tex., and across the iron bridge at Canadian, Tex., thence northwest to Ratoon, N. M., reaching the coal fields of that place. The citizens of Cheyenne, Okla., are offering inducements to the company to build through that city.

Oregon.

Advices from Goldendale, Ore., state that preliminary surveys are being made for an electric line from Lyle to Camas Prairie. Three transit parties are now in the field.

The organization of the Southern Oregon Railroad & Electric Co. is being perfected. The company was incorporated last spring with a capital stock of $5,000,000 and proposed the construction of an electric interurban line connecting the towns of Medford, Ore., Ashland and Grants Pass. The three franchises granted call for the commencement of actual construction within a year and it has been announced that building will start before the time required. Trustees of the company are J. S. Vilas, J. R. Allen and S. V. Beckwith.

A committee of Eugene, Ore., business men has started a campaign for raising $100,000 necessary for the construction of the proposed railroad from Eugene to Elmira this Fall. This line is a section of the through electric line to the coast promoted by the Lane County Asset Company, Eugene, Ore., mentioned in the last issue of Engineering Contracting.

Pennsylvania.

The Erie Traction Co., according to advices from Warren, Pa., has acquired all rights, privileges and franchises of the Erie, Cambridge Springs, Union City & Corry Traction Co., and will, as soon as arrangements can be made, commence work of constructing a line to Union City and Corry and thence to Warren

Directors of the Ephrata & Lebanon St. Railway Co., Lebanon, Pa., recently held a meeting at which it was decided to start construction work this Fall on the line, which will be about 23 miles long. It will tap a rich agricultural section in North Lancaster and Southern Lebanon, including several towns, Schaefferstown and Lincoln and hamlets like Iona, Reistville. The cost of the work is estimated at $400,000. George D. Krause, Lebanon, Pa., is President of the company.

It is reported that the McDonald Construction Co., Scranton, Pa., has been awarded the contract for the grading of 11 miles of additional double track on the New York, Ontario & Western Railway, from Pleasant Mount to Winwood. The contract is said to involve an expenditure of $200,000. C. E. Knickerbocker, Middletown, N. Y., is engineer maintenance of way.

It has been announced at Harrisburg, Pa., that work would be completed within 10 months on the branches of the Lehigh Valley R. R. in the Pennsylvania Anthracite region. The Buck Mountain branch will extend from Hazle Creek Junction to Lumber Yard, 4.85 miles. Connecting with this line at a point near Lumber Yard, the Hays Creek Branch will extend to a junction with the Lehigh Valley main line near Hays Creek, in Carbon county.

Advices from Philadelphia, Pa., state that the surveys have been completed for the construction of about 2 miles of railroad to connect the plant of the New Jersey Zinc Co., at Hazard with the zinc plant now in the course of construction below Millport.

Borough franchises and township agreements have finally been signed up by R. P. Stevens, of the Lehigh Valley Transit Co. Under the franchise just secured the Lehigh Valley Transit Company, which is controlled by E. B. Smith & Co. and Brown Bros. & Co., of Philadelphia, will build an entirely new trolley line between Quakertown and Perkasie. For ten years the Lehigh Valley Transit Company has operated its cars over the leased line of the old Quakertown Traction Company. The new line will cost $200,000 and will pass under the Reading Company's tracks at Perkasie. The time from Allentown to Philadelphia will be cut to two and a half hours. The road will connect with the Philadelphia & Western. It is claimed that after the improvements are finished the service will be equal to the fast express trains on the North Penn.

Promoters of the electric line from Hanover to Gettysburg have announced that a line from York, Pa., to Gettsburg will be constructed no later than next summer.

Governor E. S. Stuart of Pennsylvania has approved the certificate of Robert H. McAlfee, Secretary of the Commonwealth, authorizing the Buffalo & Lake Erie Traction Co. to make extensions of its line in Millcreek township, along the following streets and avenues: On Franklin Ave., from the Buffalo road northwardly to the East Lake road, and on Twelfth St., from the east line of the city of Erie eastwardly to Franklin Ave; thence returning by the same route to the place of beginning, forming a complete circuit with its own tracks; the entire distance of said extensions or branches being approximately two and one-tenth miles; said extensions being deemed necessary to increase the business of the B. & L. E. Traction Co. and to accommodate the travel of the public.

Information received from Parker, Pa., states that additional forces of men are being put to work on the construction of the new Shawmut & Pittsburg R. R., in the vicinity of Mahoning. Work has already been commenced on the abutments of the new steel bridge across the Allegheny River at Mahoning.

Directors of the Ephrata & Lebanon St. Ry. Co., at a meeting recently held in Lebanon, Pa., decided to start construction work at once on the road between that city and Ephrata, Lancaster County, a distance of 23 miles. The estimated cost of the work is $400,000. George D. Krause, Lebanon, Pa., is President of the company.

An ordinance has passed the first and second reading of the Scranton, Pa., City Council granting the Scranton & Lake Ariel R. R. Co. franchises to lay its tracks on several streets in South Scranton.

Rhode Island.

Engineers of the Southern New England Railway Co., according to advices from Providence, R. I., have run a new line for the construction of the proposed route. The new survey is as follows: through Olneyville to Narragansett Park, then between Fenner's Hotel and Spectacle Pond, through the farm of William Sprague, 3d, across Reservoir Ave., passing close by the Pilgrim Automobile Club to Theodore Helgerson's milk farm on Pontiac Ave. It proceeds across Pontiac Ave. and through the market garden of C. W. Patt & Son to the old Roger Williams Park Station of the New York, New Haven & Hartford Railroad Company. The route goes through Auburndale, and it is said that the continuation to tide water is proposed over the New Haven's road to Sassafras Point, which passes by the speedway at the park.

South Carolina.

City of Darlington, S. C., has voted to issue bonds amounting to $12,000 for the purpose of buying a right of way through the place for the new railroad which is to run from Hartsville.

South Dakota.

The presence of engineers running lines for a railroad between Rapid City and Faith, S. Dak., to which point the Milwaukee has a line under construction, has started a rumor that the Chicago, Milwaukee & St. Paul Ry. is to extend into that territory.

Town of Onida, S. Dak., according to the survey recently run by the engineers of the Chicago & Northwestern R. R. for the Gettysburg branch to Pierre, S. Dak., will be on the line.

Tennessee.

Actual construction work on the cross town line in Memphis, Tenn., will be commenced as soon as it is possible to arrange a few preliminary details.

An ordinance has been drafted by the attorneys of the Lake View Traction Co. providing for the entrance of the company's line into Memphis, Tenn., and the document will be presented to the City Council at the next meeting. E. H. Crump, Mayor, is strongly in favor of the movement.

Stock of the Chattanooga & Southern R. R., running from Chattanooga to Gadsden, Ala., has been purchased by Newman Erb and associates of New York, who will proceed immediately to improve the physical condition of the road. A connection will at once be established, and a consolidation effected with the Rome and Northern Railway, now running from Rome to Gore, Ga. The connecting link is about eight miles in length, and will be built in Walker county. Later it is planned to build another link, connecting the Rome and Northern with the Seaboard Air Line, and thus give another trunk line between Chattanooga and Atlanta.

Texas.

The Beaumont & Great Northern Ry. Co., recently purchased by William Carlisle, Atchison, Kan., is planning the construction of an extension to the line, which now runs from Trinity to Livingston, Tex., 34 miles to Beaumont and Sabine Pass. This extension, however, is not likely to be built at an early date. It is not unlikely, however, that comparatively short extensions may be made from time to time to develop timber lands. C. J. Rogan is Vice-president and General Superintendent of the line, with headquarters at Onalaska, Tex.

Capitalists of Orange, Tex., have signed articles of association for the purpose of building another railroad into that city. The road will start at a point in Louisiana, opposite Orange, running in a northeasterly direction to the Red River, where a connection and traffic arrangement has already been provided for, with lines running to all the large interior cities. When this end of the line is completed a line will have been formed, shorter than any railroad, from these inland cities to the Gulf of Mexico, west of the Mississippi River. A virgin timber section will be opened up that is second to none in the United States, and connections will be made at Orange with gulf steamers, for exporting, and with the various lines of railroad for interchange of traffic.

Grading is progressing on the new railroad from Weatherford to Bridgeport, Texas. Grading outfits are at work on each ½ mile of the 6 miles between Weatherford and Peaster. Engineers are now surveying north of the latter city.

City of San Angelo, Texas, was recently informed by A. C. Torbet, treasurer of the Gulf, Colorado & Santa Fe Ry. Co., that the remaining portion of the $40,000 bonus offered the company by the city was due. Twenty-five per cent of the bonus was paid when construction work started, and the contract specified that the balance be paid when the line was completed and in operation.

According to an announcement made recently at DeLeon, Texas, by J. P. Head, Roadmaster of the Texas Central R. R., efforts will be made to complete the extension to Sipe Springs some time in September and to Rising Star by October 1. It is probable that all the grading to Cross Plains will be completed by the time the rails reach Rising Star and if so the track laying will be pushed through.

According to an announcement reported to have been made by L. P. Featherstone, promoter of the railroad from Longview to Hughes Springs, Texas, the surveyors have nearly completed the line to the latter city.

Rapid progress is reported from Austin, Texas, on the construction of the Crosbyton & South Plains R. R. This road will be about 200 miles long and will give the extreme western part of the middle panhandle section direct outlet to Fort Worth and Dallas.

The Denver, Kingfisher & Gulf Ry. has filed a deed of trust in the office of Thomas F. Smith, Secretary of State, Guthrie, Okla., mortgaging its right of way, depots, etc., to the Pioneer Trust Co., Kansas City, Mo. According to the deed of trust the road is to run through the counties of Oklahoma, Canadian, Kingfisher, Blaine, Dewey, Ellis, Beaver and Texas in Oklahoma and Lipscomb county, Texas. The line has been surveyed for many months, and most of the preliminaries to actual construction have already been completed. The company has considerable suburban property, and its officers have repeatedly asserted that the road is undoubtedly to be built. The latest move indicates that construction is to be begun in the very near future. D. K. Cunningham is Secretary of the company.

Advices from Houston, Texas, state that a contract has been let for the construction of a section of the Cherryvale, Oklahoma and Texas from Caney, southeast by way of Wann, Okla., Delaware, Nowata and Vinita, to Silver Springs, Ark., and from there south to Fayetteville, about 150 miles. No big engineering problems will be encountered along this route. The line will have one per cent grades, with six degrees of curvature. There will be three steel bridges. Grading has been completed on ten miles.

Citizens of Luling, Texas, are strenuously objecting to the action taken by the City Council granting the San Antonio & Aransas Pass Railroad permission to extend its track from the oil mill east along North First St. to Seventh Ave. Twelve miles of the survey of the Nueces River Valley R. R. have been completed, according to information received from Beeville, Texas, four miles of which is permanent and the stakes have been driven. Engineer in charge stated that he would have the first 25 miles ready for the construction crew by October 1. Burton & Danforth of Aransas Pass are making an effort to have the road continued to that place and the Chief Engineer of the company will take the matter into consideration.

The Orange & Northwestern R. R. Co. has filed an application with the Railroad Commission at Austin, Texas, for permission to register $1,741,000 of bonds on sixty-one miles of road from Newton to Orange. The company has outstanding $461,000 of bonds and $35,000 of stock and proposes to cancel the present bonds when a new valuation is made. The company has also applied for a revaluation of the entire property, but it has been customary for the commission to allow valuations on the old lines for betterments only.

The Houston & Texas Central Ry. has granted the Bryan College Interurban Railway authority to cross the company's tracks, in order that the trolley line may be extended from its present terminus into Bryan, Texas, and along the Main Street. Work of making the extension will begin in a few days.

Attorney General's Department of the State, Austin, Texas, has approved the articles of incorporation of the Texas Southern Ry. Co., which proposes the construction of a railroad from Poteet, Atascosa County, to Pleasanton in the same county, a distance of approximately 8 miles. The capital stock of the concern is $10,000 and the headquarters are at San Antonio, Tex. The incorporators are F. R. Remington, Frank H. Burmeister, John H. Hunt and others.

The Amarillo Electric St. Railway Co., Amarillo, Texas, has work under way constructing the extension of its system to San Jacinto Heights, a distance of 3 miles. The new line will give facilities that have been long needed by the residents west of the city.

Advices from Rockport, Texas, state that construction work was started Sept. 15, on the Rockport & Tarpon Terminal R. R. This line will be part of Quanah-Rockport line, which road is to be completed within the next two years.

City Council of Beaumont, Texas, has finally adopted the resolution granting I. D. Polk and associates a franchise to use certain streets for the interurban electric railway which will be constructed from Beaumont to Port Arthur. The entrance of the road will be either over the Beaumont City traction Company's line on Milam St. or over their own right of way on Franklin St.

G. F. Cotter, Fort Worth, Texas, promoter of the Alexandria & Western R. R., announces that although nothing definite can be said as yet regarding the construction of the proposed road arrangements will be made in a few days for making public the progress of the company.

Utah.

Commissioners of Cache County, Utah, at Logan, have granted the amended franchise for the construction and operation of an electric interurban railroad from Wellsville to the Idaho State Line to Leo Neilsen and associates. The route of the proposed road is from Wellsville to Hyrum, thence along the eastern edge of the valley to Logan, touching the towns of Millville and Providence. From Logan the road goes through Greenville to the Idaho state line, passing through Hyde Park, Smithfield, Richmond and Lewiston. By the terms of the franchise Cache county is to get $5,000 shares of the company's stock, the company to be known as the Cache Valley Amusement Co. Work on the first ten miles of the road is to begin by July 11, 1911, and finished within the year, or the franchise will be forfeited. Each year thereafter the company is to construct ten miles of the line until it is finished. For each car operated the first ten years a tax of $5 is to be paid, $10 for the second ten years and $25 for the remaining thirty years, the life of the franchise being fifty years. The amended franchise reads that only electric motive power shall be used. The county officers are to be transported free of charge on all the lines and cars of the company.

It is understood in Salt Lake City that the Engineers of the San Pedro, Los Angeles & Salt Lake R. R. are making surveys for the construction of a line into Emery County and Nephi for the purpose of opening up the coal region. The line will come from Emery County side to Huntington, thence by way of Bulge Flat canyon, Gooseberry and Cabin Hollow to the summit, where a 50-ft. cut will be made across the summit at an elevation of 7,000 ft. of San Pitch canyon, where the surveyors are now camped. From there the road will proceed down the canyon to the head of Sanpete valley. An easy grade can be had to Hilltop, where it will cross the Denver & Rio Grande [illegible] thence to Water hollow, Salt creek and Nephi.

Virginia.

The improvements of the Seaboard Air Line Ry. on its Birmingham Division, for which the company expects to make an expenditure of $260,000 will include the construction of six concrete lined tunnels. W. L. Seddon, Portsmouth, Va., is Chief Engineer of the company.

An amendment has been issued to the charter of the Washington-Virginia Railway Co., Falls Church, Va., increasing the capital stock of the concern from $1,000,000 to $3,000,000.

Work has about been completed on the Holston River R. R., which runs between Persia, 6 miles east of Rogersville and Moccasin Gap, Va., and it is expected that the road will be opened for operation by the first of October. Lane Bros. & Co., Buena Vista, Va., were the contractors on the job which included 31 miles of track.

It is reported that the Norfolk & Western R. R. has awarded the contract for the construction of the branch line from its line at Ridgeway, Va., to Spray, the contract price being $100,000. It is predicted that this will cause the Southern to at once build its proposed line from Leaksville to Madison.

Washington.

Among the plans of the Oregon & Washington for the improvement of its system in Aberdeen and Grays Harbor, Wash., are those for the construction of about 15 miles of switching tracks in South Aberdeen. J. R. Holman, Seattle, Wash., is Assistant General Manager.

Eschbach & Bruce, Seattle, Wash., have finished their contract for constructing a deep cut about 4,000 ft. long, through Grandview, Wash. The work required about 4 months' time. All the dirt taken from the cut was used for the construction of the large fill of the North Coast R. R.

West Virginia.

Bids have been opened by T. Moore Jackson, Clarksburg, W. Va., head of the Middle Island R. R., for the construction of an electric line from Sisterville, W. Va., to Middlebourne. Construction work will be started within three months.

A large force has been pnt to work on the Baltimore & Ohio R. R. improvements between Sir John's Run, 6 miles west of Hancock, and Great Cacapon by Charles F. King, Fairmont, W. Va., the contractor. In this territory the Potomac at a high stage overflows the tracks and the new work is expected to prevent this. At different places along the river bank enormous fills are being made of sufficient width to permit passing and side tracks.

The Buffalo Creek & Gauley R. R., according to information received from Elkins, W. Va., has let contracts for an extension of 9 miles from Rock Camp to Rich Run, W. Va., O. P. Keeley & Co., of Elkins, W. Va., having 6 miles and Dunffield & Reed, Charleston, W. Va., 3 miles of the work. Five bridges from 40 to 100 ft. with stone abutments and temporary wooden structures are required along Buffalo Creek. Guy Bray, Clay, W. Va., is Chief Engineer of the company.

Wisconsin.

The Ryan Contracting Co., Janesville, Wis., who has the contract for the grading of the right of way for the new electric railroad between Wauconda and Palatine, has started active work and expects to have it finished by December 1. The contract price for grading was $30,000, $5,000 of which the contractor requested in stock.

The Wisconsin State Railway Commission has issued a certificate of Convenience and Necessity to the Milwaukee-Western Electric R. R. Co., authorizing the company to build a line from Beaver Dam to Fox Lake. A certificate also was issued to the Prairie Farm and Southwestern R. R. Co., authorizing the building of a road from Prairie Farm to Emerald, connecting Prairie Farm with the Wisconsin Central and Omaha roads. The distance is about 28 miles.

Wyoming.

Preliminary surveys have been completed and locating engineers are now in the field running lines for the construction of the extension of the Laramie, Hahn's Peak & Pacific R. R. from its present connection with the Union Pacific at Laramie, to Steamboat Springs, as announced some time ago by the officials of the company. J. J. Argo, Laramie, Wyo., is Locating Engineer.

Shoshoni District, Wyoming.

BY SUBSCRIBER.

MacArthur Bros. Co. expect to move their office from Thermopolis, to Shoshoni, in the near future.

John Dooling will complete his team work Oct. 1, and is progressing rapidly with his trap tunnel.

Reinhart, White and Borden will complete their contract in the Big Horn Canyon this week.

J. E. Hilton came in from Blunt, S. D., last week, with 29 teams and is making the dirt fly.

N. Farlow expects to complete his 6 miles Oct. 1, when he and J. E. Hilton will go to Powell, Wyo., to open up work for the U. S. Reclamation Service.

The line between Shoshoni and Powder River is black with teams and men, and all are moving dirt lively. The men are being paid $2.50 per day.

The correspondent of Pueblo is in error when he says the Burlington extension, Kirby to Powder River line, was temporarily shut down. We have been progressing rapidly and without delay.

Canada.

Plans have been approved by Premier Sifton, according to advices from Edmonton, Alta., for the Pincher Creek, Cardston & Montana Ry., Canada, a line which will traverse the whole Province of Alberta from the International boundary to Peace River Crossing, a distance of 700 miles. As proposed the first section will run from the boundary northwest through Cardston and Pincher Creek to the west side of section 34, township six, range two, west fifth meridian, along the south fork of Old Man River. Connection will be made with the C. P. R. at Pincher Creek, and the system will connect with the Hill lines in Montana. The promoters are New York capitalists, railway builders and coal men. At the next session of the Legislature the company will apply for an extension of the charter permitting them to construct the main line through Alberta by way of Calgary and Edmonton in the Peace River country. There will also be a branch line in the south into the Kootenay coal fields, where, it is understood, coal lands have already been secured. The company has had engineers in the field all summer, and is starting construction at the boundary.

The Ontario Ry. & Municipal Board has instructed Toronto Railway Co. to construct several extensions to its system throughout Toronto and to Rosedale and other districts.

At a recent meeting of the Railway Commission, at Vancouver, B. C., the matter of granting the Canadian Northern Ry. the right to construct a line on the right of way of the Canadian Pacific through the Fraser Canyon near Lytton and to a point 7 miles above the canyon, was taken up. The Canadian Pacific did not object to the use of their right of way through the canyon, but held that it was unnecessary for the Canadian Northern Ry. to use the additional 7 miles. The commissioners decided that the Canadian Northern would be infinitely more economical to build on the C. P. R. right-of-way, and for this purpose to nominate an independent engineer to estimate the alternative costs of construction. Both railways agreed upon C. E. Cartwright, who stated it would take him two months to go over the ground.

Location surveys and map of the proposed route of the Canadian Northern Ry. from St. Albert to Yellow Head Pass, according to advices from Winnipeg, Man., have been filed with and approved by the Minister of Railways. According to plans the [illegible] distance east of Yellow Head, runs close to the Grand Trunk Pacific. It is proposed to have 50 miles completed this year.

Johnson & Carey Co. have work under way, constructing a fill across Rainy Lake for the Canadian Northern Ry., to replace the trestle at Fort Francis, Ont. The work will involve the excavation of nearly 2,000,000 yds. of bastard granite.

Board of Control, Toronto, Ont., has granted the Canadian Pacific Ry. right to lay temporary tracks on Lake St. in pursuance of the company's plans for the new freight and passenger accommodation for that city.

Mexico.

Advices from Mexico City, Mex., state that considerable business of importance is to come before the meeting of the stockholders of the National Railways of Mexico, to be held at the offices of the company, in New York and Mexico City, October 5. One of the things to be done is the election of nine new directors. The matter of issuing bonds to carry on the work of constructing new extensions of the railroad and making general improvements will be discussed at the meeting of the directors to be held immediately following the stockholders' meeting. It is also expected that formal action looking to the merging of the Vera Cruz and Pacific and the Pan-American railroads into the government system will also be taken at the stockholders' and directors' meetings.

The Mexican Government has been officially advised, according to reports from Mexico City, by the Southern Pacific Railroad of Mexico, that the construction of that line down the Pacific slope has reached a point about ten miles south of the Santiago River, in the territory of Tepic. Under the terms of the concession the road has two more years in which to complete the gap that now exists between Yago and Tequila. It is stated that the work will be finished within the next twelve or eighteen months. The opening of the new southern division to traffic can not take place until the bridge across the Santiago River is finished. This will not be until the early part of next year. No application has been made to the government by this company for an amended concession to extend its line further down the coast to the Port of Manzanillo, and, so far as is known in official circles, such an extension is not contemplated.

According to an announcement reported to have been made by E. N. Brown, President of the National Railways of Mexico, the Texas-Mexican Ry. is not contemplating the extension of its lines into Aransas Pass or any other point.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Illinois.

The S. H. R. Robinson & Sons Co., which has the contract with the East Side Levee & Sanitary Commission, at $6,500,000, for the construction of a system of levees and drainage canals to protect East St. Louis, the tri-cities and the entire East Side from high water, are, despite the injunction proceedings pending in the circuit court at Belleville, Ill., against the Commissioners by Walter Bowman, progressing rapidly with their work and express their belief that the work will be completed within two years.

Advices from Pittsfield, Ill., state that the Sny levee commissioners are at work on a petition to be presented to the Pike county court asking for a special assessment of $250,000 to be used in clearing the Sny from end to end. The estimate shows that in this task there are 5,000,000 cu. yds. of earth to be removed, and the petition is on the basis of a cost of 5 cents per cu. yd. It is believed that it would take about seven years to complete the work with the dredge-boat owned by the district, which was purchased seven months ago at a cost of $22,000. Likely, however, another dredge-boat of equal capacity will be purchased. A recommendation to this effect was passed at a recent meeting of land owners, representing about 60,000 acres, held in Rockport. The proposition will, however, likely meet with some opposition.

Kentucky.

The Fiscal Court at Louisville, Ky., will soon advertise for bids for the first portion of work in connection with straightening Pond Creek from Oklona to West Point, a distance of 38 miles. The cost of the work is estimated at $300,000. S. F. Crecelius is superintendent of construction.

Louisiana.

✣Bids will be received until 11 a. m., Oct. 13, by Capt. Robert R. Ralston, U. S. Engineer, 3338 S. Charles Ave., New Orleans, La., for the construction of about 445,000 cu. yds. of earthwork in the Lower [illegible] Levee District.

✣Bids will be received at the office of the State Engineer, Baton Rouge, La., until Sept. 22, for the construction of the following Plaquemines Parish levees: Orange Farm levee, including a new levee and revetment, approximately 16,000 cu. yds. material, length of the revetment 1,500 ft., a deposit of $140 required and a bond of $1,300 on the work; Pelas to Buras Church Levee, including new levee, enlargement and revetment, 10,500 cu. yds. material, approximate length of revetment 2,200 ft., deposit of $160 and bond of $1,600 required.

The Johnson Syndicate has been incorporated at Jennings, La., with a capital stock of $100,000 and proposes among many things to buy, own, sell, lease, mortgage and contract to buy and exchange all kinds of real and personal property, erect and maintain pumping plants, to contract to furnish water for irrigation purposes, to buy, own, erect and operate rice mills, etc. The first board of directors is as follows: S. K. Johnson, Joyce Johnson, Sidney K. Johnson, Cullen B. Johnson and Melving F. Johnson, with S. J. Johnson, President; Cullen B. Johnson, Vice President; Sidney K. Johnson, Secretary and Treasurer.

The New Iberia Southern Drainage District Board awarded the contract for completing the canal to A. G. Thomas, at $5,950. The amount allowed for the dredge-boat was $2,500

Mississippi.

✣Sealed bids will be received by the Board of Drainage Commissioners of Bolivar County, Mississippi, at the office of Sillers & Owen, attorneys, Cleveland, Miss., until 2:30 p. m., Oct. 12, for the excavation of the following drainage canals: Bogue Hasty, 35,705 ft. long, average cut 5 ft. 28 and 40 ft. wide at the bottom, 317,250 cu. yds. excavation; Pecan Bayou, 51,300 ft. long, average cut 5.5 ft., 10, 12, 14 ft. wide at the bottom, 213,650 cu. yds. excavation; East Bogue Hasty, 70,830 ft. long, average cut 5.1 ft., 10 and 12 ft. wide at the bottom, 213,650 cu. yds. of excavation; Icy Bayou, 54,036 ft. long, average cut 4.6 ft., 10 ft. wide at the bottom, 133,690 cu. yds. of excavation; West Bogue Hasty, 66,073 ft., average cut 4.4 ft., bottom widths 10, 12 and 20 ft., excavation 146,220 cu. yds. The total length is 52.6 miles and the total amount of excavation is 974,025 cu. yds. About 15 per cent of the work is through heavily timbered land, 10 per cent through cleared land and the remaining 75 per cent is through light timber. Oak, ash, gum, elm and cypress are the predominant timbers encountered. Borings to a depth of six feet have been taken at intervals of about two miles along the route of the work and samples of the character of the soil to be encountered are on exhibition at the office of W. W. Boone, chief engineer of the Bogue Hasty Drainage District. Most of the cutting is through clay loam called "Buckshot." Some sand will be encountered. Plans and specifications are also on file at the office of the chief engineer. L. H. Gaines, J. B. Lee and William Connell are members of the Board of Commissioners of Drainage, Bolivar County, Miss. Plans are under way by T. G. Dabney, Clarksdale, Miss., chief engineer of the Tallahatchie Drainage District and A. L. Dabney, Tunica, Miss., his assistant, for the system of 1,860 sq. miles. The project includes the dividing of the whole into main drain basins and these into drainage units; diversion of Coldwater river to require excavating 8-mile canal, constructing earth dam one mile long with maximum fill of 40 feet, etc.; from mouth to canal to have 5-mile floodway to carry flow north to Mississippi river, concrete work for spillways, etc.; excavation through divide estimated at 9,160,000 cu. yds.; dam, 2,300,000 cu. yds.; floodway, 3,117,000 cu. yds.; canal to carry 20,000 second feet; surveys and plans completed; construction awaiting authorization of bonds. Sunflower Main Drain Basin, 204,000 acres in Coahoma county, is subdivided into independent drainage units; Sevier Lake unit, 22,000 acres, nearly all ready for bond issue; excavation required, 390,000 cu. yds.; preparing to develop drainage of Lake Cormorrant unit, 43,000 acres, requiring 1,000,000 cu. yds. of excavation; contemplated to ask bids on these two projects within several months, and possibly others in Sunflower territory.

Missouri.

✣Bids will be received by Board of Fire & Water Commissioners, Kansas City, Mo., until 2 p. m., Sept. 22, for the construction of bank revetment and pile dikes in the Parkville bend of the Missouri River. Plans and specifications are on file at the office of the Chief Engineer of the Water Department. E. B. Harrington is Secretary.

Montana.

✣Bids will be received by the Secretary of the Yellowstone Irrigation District until noon, Oct. 1, Sanders, Montana, for enlarging and extending the Sanders canal, involving the excavation and placing in enbankment 499,700 yds. of earth and constructing 340 ft. tunnel and culverts. Henry Gerharz Engineering Co., Billings, Mont., has charge of the engineering work.

New York.

Col. W. W. Black, U. S. Engineer in charge of the New York District, reports a survey made by the Board of the Atlantic Coastal project, a canal between New York Harbor and the Delaware River crossing New Jersey, which goes into details as to the cost of canals of the sea level and the lock system types. Of the canal 25 miles will be through the open waters of New York Bay, 30 miles across New Jersey and 25 miles through an improved channel in the Delaware River. According to the figures the cost of construction of the lock canal would be $22,500,000 and the cost of maintaining the canal, $667,000 per year. The sea level canal would cost $35,250,000, and would cost $295,000 annually for maintenance.

Texas.

Under an order of sale issued by the Fifty-eighth District Court, R. L. Wynne, receiver of the Farmers' Canal Co., at Anahuac, Texas, Chambers County, sold the entire plant and property of the company to W. B. Dunlap, representing the bondholders and the holders of the outstanding receivers' certificates, for $40,000. The property includes irrigating canal, 18 miles long, with laterals, rights of way, pumping plant, machinery, telephone line, etc. It is understood that a reorganization of the company is to be effected if the sale of the receiver is confirmed by the court.

Advices from Marfa, Texas, state that the St. Stephen Land & Irrigation Co. has been incorporated with a capital stock of $250,000. The incorporators are Rees Turpin, Sanford J. Truman and E. D. Cruise.

The Southern Land & Water Co., of Lake Charles, La., has been granted permission to do business in Texas by the State Department at Austin, Texas. The company has a capital stock of $200,000 and headquarters are at Beaumont, Texas. Walter J. Crawford is General Agent of the company.

Wyoming.

Advices from Lander, Wyo., state that J. C. Edsall, engineer in charge of the Louis Lake Irrigation project, has placed bonds of the company amounting to $1,500,000, which will provide funds for the completion of the project, which includes a dam 60 ft. high at Louis Lake, 15 miles of 4-ft. steel pipe and ditches to irrigate 45,000 acres of land. At least 5,000 h. p. will be developed and a subsidiary company will be formed, it is believed, to take up that feature of the project and also to construct an electric interurban line connecting the various towns in Lander Valley and the mines and possibly Rock Springs, Wyo.

MISCELLANEOUS CONSTRUCTIONS

California.

The contract awarded the Carterra Co. for the construction of 2,000 ft. of quay wall on the estuary between Clay and Myrtle Sts., at $222,000, has been turned over to the Hansbrough Bros., 1028 Market St., San Francisco, Cal., and machinery and equipment are already being secured for the immediate starting of the work.

James D. Schuyler, consulting engineer, has prepared plans for the installation of an improved drainage system on the Patterson ranch, near Oxnard, Cal. The work will consist of the construction of open ditches, reinforced concrete tide gates of special design and about 2,500 ft. of reinforced conduit. The work will cost about $35,000. The actual construction work will be under the supervision of Engineers Dessery and West.

District of Columbia.

✣Bids will be received until 11:30 a. m., Sept. 26, by Capt. J. S. Cowan, Signal Corps U. S. Army, War Department, Washington, D. C., for furnishing the signal corps with one switchboard, common battery, two position, in accordance with specification Nos. 544, 321-A, 430-A; drawings 688-D, 688-G-L, 688J, 688K, and 688L; also one frame, distributing and protecting; sectional angle iron, mounting 300 pairs of central energy heat coils and lightning arrester protector equipment and 500 pairs of line terminals; protectors in groups of twenty detachable from the frame and to be of the Western Electric Company's type, 84-B or equal; no self-soldering heat coils will be considered. The line terminals shall also be mounted in groups of twenty on the opposite side of the frame from the arrester equipment. The frame shall be fully equipped as stated above and in addition the following extra material must be furnished: 100 heat coils, 50 pairs of carbons and 200 mica dielectrics.

✣Bids will be received until 10:30 a. m., Oct. 14, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing condenser, motor-driven engine lathe, valve reseating machine, snatch blocks, punches and dies, rivet sets, machine bits, cold shuts for steam shovels, coupler knuckle pins, manganese steel plates, clam shell bucket, electric fans, water gauges, fire brick, lumber, etc.

✣Bids will be received until 10:30 a. m., Oct. 3, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for track material, for the upper lock at Gatun and Pedro Miguel Lock, including steel rail, splice bars, steel cross ties, bolts and nuts, tie clips, washers, steel channels and rail bonds, also track drills and hydraulic compressors, etc.

✣Bids will be received until 11 a. m., Sept. 30, by Lieut. Col. C. L. McCawley, Assistant Quartermaster, U. S. Marine Corps, Washington, D. C., for supplying the Marine Corps with 34,000 yds. 12 ounce, 22,000 yds. 10 ounce, 4,000 yds. 8 ounce khaki tent canvas; also for the manufacture of wall, hospital, shelter and storage tents, poles, pins, etc.

Florida.

The following bids were received by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for the dredging of the St. Johns River on the left side of the stream from Catherine St. to Hogans Creek: P. Sanford Ross (incorporated) of Jersey City, was the lowest bidder, this company having agreed to dredge the 44,000 cu. yds. at $2.64 per cu. yd. Among the other bidders was W. J. Cody of New York, $2.69 per cu. yd.; the Southern Dredging Co. of Mobile, $2.85 per cu. yd., and the North American Dredging Co. of Galveston, $3.90 per cu. yd. The area which is to be dredged has a width ranging from 130 ft. at the upper end to 300 ft. at a point about 100 feet below.

Illinois.

The following contracts were awarded by Maj. Charles Keller, U. S. Engineer, Rock Island, Ill., for $170,000 worth of river improvement: From Clayton to Dubuque—Captain A. Kirchner, Fountain City. Rock, $1.53 per cu. yd.; brush, 61 cents per cu. yd.; total, $40,000. From Rock Island to Burlington—Captain A. Kirchner, Fountain City. Rock, $1.53 per cu. yd.; brush, 61 cents per cu. yd.; total, $45,000. From Keokuk to Hannibal—Captain A. V. Fetter, Quincy. Rock, $1.65 per cu. yd.; brush, 65 cents per cu. yd.; total, $45,000. From Clarksville to Illinois River—Rust, Swift & Co., St. Louis. Rock, $1.55 per cu. yd.; brush, 60 cents per cu. yd.; total, $40,000.

Indiana.

✣Bids will be received until 10 a. m., Sept. 20, by Depot Quartermaster, Jeffersonville, Ind., for furnishing necessary supplies under Schedule No. 562.

✣Bids will be received until 10 a. m., Sept. 24, by Depot Quartermaster, Jeffersonville, Ind., for furnishing, under Circular No. 563, necessary supplies.

Myron C. Thomas, 1012 Gallatin St., Marion, Ind., has been awarded a contract for drilling two gas wells by the National Military Home, Ind., for approximately $1,700. Bids were opened Sept. 6.

New York.

✣Bids will be received until 10 a. m., Sept. 26, by Commanding Officer, Fort Totten, N. Y., for delivering 14,400 ft. 2-8-in. marline covered rope and 107,300 ft. of ½-in. marline covered rope.

✣Bids will be received until Sept. 30, by Col. William Black, U. S. Engineer, Room 710, Army Bldg., 39 Whitehall St., New York City, for dredging in Saugerties Harbor, N. Y.

The Snare & Triest Co., 143 Liberty St., New York city, wants aggregate for about 17,000 cu. yds. of concrete delivered on site of New York Aqueduct, two miles from Peekshill. There are quarry sites near the work. The first delivery is to be made this fall and final delivery about next August.

The following bids were received Sept. 10 by the Bureau of Yards and Docks, Navy Department, for constructing a pier from the mainland to Cob Dock, Pier D, New York navy yard; E. De V. Tompkins, 81 E. 125th St., New York city, $75,940; Riverside Construction Co., 39 Cortland St., New York, $76,233; Charles Mead & Co., 299 Broadway, New York city, $79,200; John Monks & Son, 82 Beaver Ct., New York, $79,868; Snare & Triest Co., 143 Liberty St., New York, $82,493; Holbrook, Cabot & Rollins Corp., 6 Beacon St., Boston, Mass., $86,000; American Paving & Construction Co., 211 S. 9th St., Philadelphia, Pa., $85,000; Raymond Concrete Pile Co., 140 Cedar St., New York, $94,800; New York State Construction Co., 78 Broad St., New York, $84,547.

G. B. Raymond & Co., 16 East 42d St., New York, N. Y., has been awarded a contract for furnishing 100 barrels of Portland cement to the Park Department of New York city for $1.85 per bbl. Bids were opened Sept. 15.

Oregon.

The only bid received by the U. S. Engineers at Portland, Ore., for delivering 600,000 tons of rock to the Columbia River jetty was that of the Columbia Contract Co., which is as follows: For furnishing 525,000 tons of rock, class A, B and C, for $1.12 a ton, or $588,000, and 75,000 tons of class D at $1.25 or $93,750, a total of $681,750. It is estimated that the amount of rock sought will be ample to complete the jetty to the point projected, which is thought to be definitely established as its terminus. The engineers are desirous of turning their attention to the building of a north jetty with the hope of so confining the water at the mouth of the Columbia River that the current will cause the bar to scour continuously.

Pennsylvania.

Bids were opened Sept. 15 at the office of the U. S. Engineer, Philadelphia, for dredging in the Delaware River below Philadelphia. The probable contractor is the American Dredging Co., Mariners' and Merchants' Building, Philadelphia, Pa., at 12 cts. to 18 cts. per cu. yd. The work includes the deepening and widening of the most difficult bends in the Delaware River, below the City of Philadelphia, in accordance with provisions of river and harbor bill approved June 25, 1910.

Texas.

The following bids were received by Maj. Gen. George P. Howell, U. S. Engineer, Galveston, Texas, for the improvement of Bolivar Channel: North American Dredging Co., Galveston, Texas, .1075 cents per cu. yd.; L. T. Gaylord for the Atlantic Gulf & Pacific Co., .1095 per cu. yd.; Home Dredging Co., Mobile, Ala., 12½ cents per cu. yd.; Bowers Southern Dredging Co., Galveston, Texas, 12½ cents per cu. yd. The specifications for the Bolivar channel call for the dredging of approximately 777,000 cu. yds. of material, of which 738,000 yds. is new work. The present channel extends from a point 300 ft. southwest of the northern end of the Gulf and Interstate railway transfer wharf, thence south 4,275 ft., including a turning basin. The channel was redredged to a depth of twenty-five ft. and a width of 150 ft. on the bottom, and the turning basin to a depth of twenty-five ft. and about 600 ft. wide on the bottom. The redredging was completed in October, 1909. It is proposed to redredge, widen and deepen the channel to 200 ft. and turning to 1,000 ft.

Virginia.

✣Bids will be received until 11 a. m., Oct. 8, by William M. Smith, Acting Chief of Bureau of Yards and Docks, Washington,

D. C., for pumps, piping and [illegible] for fuel, oil and gasoline storage tanks at Bradford, R. I.; Norfolk, Va.; Charleston, S. C., and Key West, Fla.

Washington.

Blows & Tuell, Tacoma, Wash., have been awarded the contract by Commissioner Lawson, at $103,874, for the construction of the Nisqually power station.

The International Contract Co., Seattle Wash., has been awarded the contract by Commissioner Lawson, Tacoma, Wash., for the construction of the intake and head works of the Green River gravity water plant. The work includes the driving of tunnels through the solid rock and placing iron pipe under the river bed. Advices from Tacoma state that contractors are drilling the tunnel of the Nisqually power plant through solid rock at a rate of 22 to 24 ft. per day or two to four ft. faster than the estimated time of the engineers. The cost of the work is $2,000,000.

A special election is to be held Oct. 8, in Tacoma, Wash., to vote on the proposition to issue bonds amounting to $1,023,000 for a fire tug, two bridges and a municipal dock.

West Virginia.

✣Bids will be received until 11 a. m., Oct. 18, by Capt. F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for constructing and delivering steel hull stern wheel towboat General Craighill.

✣Bids will be received until 11 a. m., Oct. 12, by Capt. F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and delivering steel poirce dam trestles, dams Nos. 11, 13 and 18, Ohio River.

Wisconsin.

Work will be started at once on the docks of the Minneapolis, St. Paul & Sault. Ste. Marie R. R., just east of Grassy Point bridge on St. Louis Bay. All material has been received at Superior, Wis., and nearly all the necessary dredging is reported to have been done.

Bids were received and opened by Maj. Charles S. Bromwell, U. S. Engineer, Milwaukee, Wis., for the improvement of the Racine, Wis., harbor by constructing reinforced concrete caissons and pile pier, removing old pier and dredging. Bids received for the work are as follows: (1), Hugo & Tims Co., Duluth, Minn.; (2) Greiling Bros. Co., Green Bay, Wis.; (3) The Edward Gillen Dock Dredge & Construction Co., Racine, Wis.; (4) William H. Gillen, Milwaukee, Wis.; (A) 3,448 cu. yds. No. 1 concrete in caissons, per cu. yd.; (B) 45 cu. yds. No. 1 concrete in pile pier; (C) 1,786 cu. yds. No. 2 concrete in caissons; (D) 709 cu. yds. No. 2 concrete in pile pier; (E) 2,038 cu. yds. No. 3 concrete, per cu. yd.; (F) 734 foundation piles, per pile; (G) 8,000 lin. ft. round piles in pile pier, per lin. ft.; (H) making and driving sheet piles timber furnished by the United States, 211,600 ft. b. m., per M ft. B. M.; (I) framing timber furnished by U. S., 87,000 ft. b. m. per M. ft. B. M.; (J) 12,700 lbs. wrought iron or steel drift bolts and wrought iron or wire spikes, per lb.; (K) 28,400 lbs. wrought iron or steel screw bolts and tierods per lb.; (L) 10,500 tons of 2,000 lb.-tons of stone, per ton; (M) removing 930 lin. ft. old pier, per lin. ft.; (N) dredging 50,000 cu. yds. (scow measurement), per cu. yd.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(Z)
(1)	$15	$15	$12	$12	$8	$17	$0.50	$20.00	$20.00	$0.05	$0.05	$1.65	$18.00	$0.20	$167,209
(2)	14	14	10½	11½	6½	14½	0.35	17½	20.00	0.05	0.05	1.55	16.00	0.17	148,468
(3)	16	16	10½	15	8	17½	0.37	25.00	30.00	0.06	0.10	1.95	22.37	0.23	181,666
(4)	16	16	10	15	8	17½	0.37	25.90	26.90	0.06	0.10	2.00	22.00	0.23	180,874

Canada.

✣Bids will be received until noon, Oct. 11, by T. F. Acheson, Secretary-Treasurer, Yorktown, Man., for apparatus for electric light plant as follows: Sec. 1, boilers; Sec. 2, engines, piping, etc.; Sec. 3, generators, switchboards and arc lamps; Sec. 4, transformers; Sec. 5, meters. Plans and specifications may be obtained of W. E. Skinner, Ltd., Consulting Engineer, Winnipeg, Man.

The Department of Public Works of Canada has awarded the contract for the construction of an extension to the pier at Colchester, Essex county, Ont., to Michael, Matthew J. and Patrick J. O'Leary of Ottawa, Ont., for $14,500.

No bids were received Sept. 15 by the Chairman of the Canal Committee of Dundas, Ont., for dredging the Desjardins Canal. The work involves the removal of about 27,500 cu. yds. of material. John F. Armour, Dundas, Ont., is the Engineer.

BRIDGES AND BUILDINGS

Arizona.

✣Bids will be received until 2 p. m., Sept. 27, by Territorial Engineer, Prescott, Ariz., for the construction of a bridge across the Vere River at Camp Vere. The structure will be 300 ft. in length with a 20 ft. roadway, and it will have two cantilever spans of 150 ft. each.

Arkansas.

✣County Commissioners will receive bids at the court house, Searcy, Ark., until 11 a. m., Sept. 24, for the construction of bridges across the following streams: One across Oveflow Creek, on road from Judsonia to Bald Knob. Has rock pillars already at bridge site. One over Gin Creek on road from Searcy to new bridge site on Little Red River. One across Big Creek at Smith farm on road from Searcy to Heber Springs, with rock pillars at bridge site. Also one across Cypress Creek on county line, between Lonoke and White counties, on Butlerville road to Beebe. R. W. Chrisp is County Judge.

✣Bids will be received until 3 p. m., Oct. 4, by W. T. Derrick, County Judge, Marianna, Ark., for the construction of a steel highway bridge about 420 ft. long with 16 ft. roadway across L'Anguille Lake, near Marianna, Ark. Plans and specifications can be obtained of the county clerk.

California.

At a recent meeting of the Board of Supervisors at Sacramento, Cal., W. H. Devlin, counsel for the Southern Pacific Co., presented a resolution providing for carrying out the demand of the war department engineers that the draw of the new bridge which will span the river near the site of the old Pioneer Mills be 170 ft. in the clear, instead of 150 ft., as indicated in the original plans. Under the provisions of the contract Sacramento will pay three-fourths of the cost of the overhead structure and the approach thereof, Yolo County one-fourth and the same ratio is preserved in paying the $2,000 a year, which is the fee of the Southern Pacific for maintaining, operating and repairing the structure.

Colorado.

According to information from Denver, Colo., an appraisement of the property along the right of way for the West Colfax viaduct is to be begun under the supervision of the citizens' committee of the North and West sides. The estimated cost of the viaduct is $700,000.

John F. Vail, General Manager of the Traction Co. of Pueblo, Colo., has notified the city council that his company will contribute one-fourth of the cost of the new Union Ave. bridge, providing that such share did not exceed $10,000.

The Pueblo Bridge Co. of Pueblo, Colo., has received the contract for building new bridge at Tarrington and new bridge at Lingle, and the removal of the present bridge at Tarrington for $18,500. Bids were opened by the county commissioners at Cheyenne, Wyo., on Sept. 8.

District of Columbia.

✣Bids will be received until 3 p. m., Oct. 24, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the United States Post Office at Troy, Ala.

✣Bids will be received until 3 p. m., Oct. 17, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Canandaigua, N. Y.

✣Bids will be received until 3 p. m., Oct. 14, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction of a double set of Assistant Surgeon's Quarters in conjunction with the reconstruction and additional buildings for the Marine Hospital at Staten Island, N. Y., including the mechanical equipment.

✣Bids will be received until 11 a. m., Oct. 15, by William M. Smith, Acting Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of one officers' quarters at navy yard, Puget Sound, Wash.

✣Bids will be received by William Smith, Acting Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m., Nov. 5, for remodeling gas house for employes' quarters at the United States naval hospital, Mare Island, Cal.

✣Bids will be received until 10 a. m., Oct. 12, by R. V. La Dow, Superintendent of Prisons, Department of Justice, Washington, D. C., for furnishing and delivering at the United States Penitentiary at Leavenworth, Kan., plumbing fixtures to be installed in the hospital building.

✣Bids will be received by R. V. La Dow, Superintendent of Prisons, Department of Justice, Washington, D. C., until 10 a. m., Oct. 10, for furnishing and delivering at the United States Penitentiary at Atlanta, Ga., plumbing fixtures to be installed in hospital building.

Idaho.

George Varnum and H. Whitlock, prominent holders of land on the Salmon tract, immediately south of Twin Falls, Ida., have circulated a subscription paper among other owners, as a result of which a bridge is to be constructed across the high line canal southeast of the city.

Three counties are to pay for two steel bridges to be erected near Lewiston, Ida. One of the bridges will span the Potlatch Creek near Juliaetta and the second will be located on Lawyer Canyon Creek near Kamiah. The Juliaetta bridge is on the Nez Perce-Latah boundary line and the expense of construction will be borne jointly by these counties, while the Lawyer canyon bridge is also a boundary structure and will be paid for by Nez Perce and Idaho counties. The former bridge will be 180 ft. in length and the Lawyer canyon structure is 140 ft.

Illinois.

Government Engineer Jas. R. Fuller, who has charge of the proposed rebuilding of the municipal bascule bridge at Peoria, Ill., has begun making surveys of the river channel in the vicinity of the bridge.

The Wheeler Construction Co. of Geneva, Ill., has been awarded a contract by the city council of Des Moines, Ia., for the construction of the Walnut St. bridge for $160,661.

Engineers Modjeska & Angier, 98 Jackson Blvd., Chicago, Ill., have awarded general contract to the Pennsylvania Steel Co., of Steelton, Pa., for a bridge at Celilo, Ore., for the Oregon Trunk Railroad Co., Portland, Ore. Two tons of structural steel work are to be figured for the railroad. Estimates for the same will be received by the purchasing agent for the Great Northern R. R.

Engineers Modjeska & Angier, Monadnock Block, Chicago, Ill., have completed plans for a bridge and viaduct at Portland, Ore., for the city of Oregon. Mayor Simon is receiving estimates for reinforced concrete foundation work.

E. V. Roberts at $1,008 was the lowest bidder for the construction of bridges at Otter Creek to span Coal Run and one across the creek on East Main St., on the township line, Streator, Ill.

Alderman John Geiss of Batavia, Ill., has revived the plans for a new concrete and steel bridge across the east branch of the river at Wilson St. The estimated cost of the bridge is $20,000.

Indiana.

✣Bids will be received until 2 p. m., Oct. 4, by Commissioners of Grant County at Marion, Ind., for the construction of 8 concrete arches. A. Y. Stout is Auditor of the county.

✣Bids will be received until 10 a. m., Oct. 3, by Commissioners of Vermillion County at Newport, Ind., for the construction of two bridges. H. T. Payne is Auditor.

The South Side Improvement Association of Richmond, Ind., has decided that a bridge across the White-water River, south of the Main St. bridge, should be built within the next year, and have appointed a committee to confer with the county commissioners regarding the matter. The estimated cost of the structure is $40,000.

The County Commissioners at Sullivan, Ind., have closed the contract with the Vincennes Bridge Co., of Vincennes, for the construction of five bridges for a consideration of $2,934. The bridges are the Voorhees, Creager, Hymera, Parker, Shields and minor repairs.

The Knox City Council, Vincennes, Ind., has appropriated $11,000 toward building a bridge over White River one and one-half miles south of Edwardsport. The bridge was petitioned for by the business men and farmers of Edwardsport.

A committee of about 25 business men and farmers from Cayuga, Ind., vicinity and also from Highland Township west to Newport met recently to present a petition for a new bridge across the Big Vermilion at the old Army Ford near Cayuga. H. T. Payne is Auditor of the county.

Advices from Peru, Ind., state that the Wabash railroad has had a gang at work getting ready to build a new bridge across the Wabash River at Belden, this crossing being the site of the longest bridge in the state. The new span will be of cement and will not cross the river at such an angle as the present iron structure.

The Board of County Commissioners, Franklin, Ind., has let the contract for the construction of several bridges to D. B. Hill & Co., of Indianapolis.

Olo E. Nichols, Hebron, Ind., has been awarded a contract by county commissioners at Crown Point, Ind., for the construction of the Deep River bridge for $2,075. Bids were opened Sept. 7.

Kentucky.

The Board of Public Works of Louisville, Ky., has decided to place into the partial appropriation ordinance which goes to the general council, a provision for an appropriation of $15,000 to be used in building a bridge across Beargrass Creek at Underhill St.

Louisiana.

Advices from New Orleans, La., state that Lieut. Col. Lansing H. Beach, Corps of Engineers, U. S. A., has been notified that formal service was made on Milton H. Smith, president of the Louisville & Nashville R. R., Sept. 3, in connection with the construction of a draw bridge in place of the bridge now used by the road at Chef Menteur. The company has until March 3 to construct the bridge.

Grand parish citizens living near Boyce, La., are uniting with the citizens of Rapides parish in the formation of a stock company which plans to capitalize the construction of the traffic bridge across Red River at Boyce.

Maine.

The citizens of Portland, Me., voted Sept. 12 on a special referendum bill authorizing a bridge between Portland and South Portland at Knightville over the Fore River.

Maryland.

The contract for the construction of the Poplar Grove St. bridge, Baltimore, Md., has been awarded to the Raymond Concrete Pile Co. of New York and Chicago. The bridge will be of the plate girder type covered with concrete, with reinforced concrete floors. It will be 84 ft. long, 66 ft. wide, and will span the right of way of the Western Maryland R. R. A. E. Christhilf, Chief Engineer, Street Opening Commission.

Massachusetts.

George F. Rendle has been awarded a contract in Boston, Mass., for repairing Broadway bridge for $9,972.

Boston, Mass., has awarded a contract to the New England Structural Co., for the reconstruction of Albany St. bridge for $10,296.

The new bridge which is to replace the covered bridge between Springfield, Mass., and Chester on the state highway is to be built on the upstream side of the old structure and but a few feet from the old bridge. The new bridge will be a single span arch of 110 ft. long and will be constructed of concrete, reinforced with steel.

The County Commissioners at Fitchburg, Mass., have been petitioned by the mayor and board of aldermen of that city for the right to connect 5th and Harvard Sts. with a bridge across the Boston & Maine and New Haven R. R. tracks.

The city of Boston, Mass., has awarded a contract to James P. Dwyer for installing heating and ventilating system in Curtis hall for $22,277.

Michael Ahearn has been awarded a contract by the mayor of Boston, Mass., for installing plumbing in Curtis hall of $6,237.

The mayor of Boston, Mass., has approved a contract with the Dolan Electric Co., for installing electrical system in Curtis hall for $4,417.

Minnesota.

✣Bids will be received by the City Council of Red Falls, Minn., until 8 p. m., Sept. 29, for the repairing of Clearwater bridge. Joseph Perrault is City Clerk.

The Park Board of Minneapolis, Minn., is considering the construction of a concrete bridge to carry tracks of the Hastings & Dakota division of the Milwaukee road across the canal connecting Lake of the Isles and Lake Calhoun. President W. F. Decker of the board hopes the construction of the bridge will begin this fall.

The Hillside Improvement club of Duluth, Minn., has urged the city council to have a substantial traffic and foot bridge built at 13th St.

Engineer W. F. Brooks, Mankato, Minn., has completed plans for a 200-ft. bridge over the Losuer River, Blue Earth County, Minnesota. The bridge will be of reinforced concrete and steel construction. E. Weaver is County Auditor.

The City Council of St. Peter, Minn., has awarded the contract for building a concrete abutment at the west end of the Broadway bridge to the St. Peter Stone Sidewalk Co., for $395.

Mississippi.

✣G. E. Yarborough, City Clerk, Richton, Miss., will receive bids until 8 p. m., Oct. 4, for the erection of school building. The structure will consist of two brick stories. W. H. Grace is Mayor.

The Board of Supervisors at Ellisville, Miss., have awarded to an Atlanta, Ga., firm the contract for the building of a steel bridge across Tallahoma Creek between this city and Laurel. The contract price is $2,850 and work on the bridge will begin soon.

Missouri.

✣Bids will be received until 10 a. m., Oct. 1, by Managers of the Missouri State Sanatorium at Mount Vernon, Mo., for the construction of a combined brick and concrete infirmary building. Plans and specifications are on the file at the office of H. H. Hohenschild, Architect, 309 Navarre Bldg., St. Louis, Mo., and of W. C. Root, Kansas City, Mo.

E. N. Noyes, Civil Engineer, St. Louis, Mo., has been appointed resident engineer at Dallas, Tex., for the Ira G. Hedley Co., to which the contract for the erection of the Oak Cliff viaduct has been awarded. Mr. Noyes will have charge of the work.

New Jersey.

The County Board of Freeholders, Atlantic City, N. J., have voted to widen the bridges on the Meadow Blvd., to a uniform width of 60 ft. to conform with the roadway, and to straighten a dangerous curve at the Chelsea Heights end of the boulevard.

New York.

✣Bids will be received by the Board of Contract & Supply, Albany, N. Y., until 3 p. m., Oct. 3, for furnishing all labor and materials for the erection and completion of a new police station house on the west side of North Pearl St., between Wilson St., and Livingston Ave., in Albany, N. Y. Isidore Wachsman is Secretary of the Board.

D. B. Fowler, Clerk of the town of Carlton, N. Y., has issued a call for a special town meeting to be held in Bamber's Hall, Sept. 20, for the purpose of voting on the question of appropriating the sum of $18,000, or as much thereof as may be necessary, to build a high-grade steel or concrete bridge across Oak Orchard Creek at Kenyonville.

According to advices from Brooklyn, N. Y., the Long Island R. R. Co. is contemplating the construction of a viaduct from Hammels station at Rockaway Beach to Rockaway Park. The plan is to eliminate grade crossings along the sandy peninsula of which there are two dozen or more. The viaduct will be built of concrete walls and filled in with dirt and the road bed rock ballasted.

The Town Board of Kirkwood and Conklin, N. Y., have awarded a contract to the Owego Bridge Co., for the construction of a two-span highway bridge with the use therein of parts of the old bridge, for $5,400.

The citizens of LaSalle, N. Y., have voted against the proposition of spending $3,600 for the new bridge across Cayuga Creek.

Nial Bros., Troy, N. Y., have been awarded a contract by the State Commission in Lunacy, Capitol, Albany, N. Y., for the improvement of State Hospitals as follows, for $112,830: For Central Islip State Hospital, Central Islip, L. I., N. Y., kitchen and dining room building, conduits, steam mains, feeder cables and outside sewer and water connections for new group, additional boiler capacity. North Colony, construction including heating, plumbing and electric work. For Kings Park State Hospital, Kings Park, L. I., N. Y., kitchen and dining room building, conduits, steam mains, feeder cables, sewer electric work. For Manhattan State Hospital, Ward's Island, New York city, kitchen building, steam mains and feeder cables for new cottages, construction including heating, plumbing and electric work. The estimated costs of the work are $35,000, $40,000 and $12,500, respectively. T. E. McGarr is Secretary of the Commission.

North Dakota.

The Board of County Commissioners, Bismark, N. Dak., has awarded a contract to the Fargo Bridge & Iron Co., of Fargo, for the construction of two county bridges, one to be a 90-ft. bridge, and the other to be a 50-ft. structure, for $4,750.

Ohio.

✣Bids will be received until 11 a. m., Oct. 5 by the Board of Commissioners of Cuyahoga County, O., at Cleveland, O., for the construction of a concrete bridge on Clegue Road in Dover Township under Report No. 2,470; concrete floor and extension to bridge on Dover Center Road in Dover Township under Report No. 2,701. John F. Goldenbogen is Clerk.

✣Bids will be opened Oct. 3 by H. A. Buerhaus, County Auditor, Zanesville, O., for the construction of the proposed 5th St. bridge in that city. The structure will be steel encased in concrete. The length including viaduct approaches is $15,000. D. Y. Geddes is County Engineer.

✣Bids will be received by the Commissioners of Lucas County, Toledo, O., until 10 a. m., Oct. 3, for the necessary labor and material required for the construction and building complete of two concrete abutments on County Road No. 481, over Cedar Creek. Charles J. Sanzenbacher is Auditor of the county.

The Massillon Bridge & Structural Co., Massillon, O., has been awarded a contract by the county commissioners at Girard, Kan., for I-beam channels and railing for nine bridges located in Crawford County for $1,325. Bids were opened Sept. 12.

Bids were received Sept. 6 by the County Commissioners, Portsmouth, O., and the contracts awarded for making a fill and building a riprap wall at a bridge on the Rocky Fork of Brush Creek; also for repairing the aqueduct bridge across Brush Creek, as follows: Andrew Haggerty, fill, $.24½ per cu. yd; riprap, same. Wm. Koenig, fill, $.35; riprap, $.45. Thos. Riley, fill, $.31; riprap, $.55. The contract was awarded to Andrew Haggerty. The bids for the repair of the bridge were: Joe G. Steagall, $983. H. D. Bahner, $449. The contract was awarded to Bahner.

The City Council of Cincinati, O., has been asked for an appropriation of $7,000, in addition to appropriations aggregating $18,000 which have already been authorized for the repair of the Harrison Ave. viaduct. Bridge Engineer Frank Morris has estimated that it will cost about $25,000 to put the structure in repair.

Bonds have been sold at Lima, O., for the erection of two more bridges to cost $12,000, in addition to the $15,000 bridge over the Ottawa River now nearing completion.

Advices from Dayton, O., state that the C. H. & D. R. R. has awarded a contract for a new steel bridge to replace the one in North Dayton, spanning the Miami River, and that the contract for the masonry work was let one week later.

The County Commissioners of Butler County, Hamilton, O., recently visited Elk Creek and laid off the site of the new bridge which will be built. The board has also ordered plans for a concrete bridge on the Venice road about a mile below the Columbia bridge, estimated to cost $1,000.

The Board of County Commissioners at Lisbon, O., received bids Sept. 6 for the construction of a concrete box culvert at bridge 1332 in Wayne Township. Wm. McLain of Lisbon was low bidder, at $323.

A resolution has been introduced in the city council of Cincinnati, O., providing for the preparation of plans and estimates of cost of the construction of a lift bridge over the canal at Liberty St.

W. H. Sieverling has been awarded a contract for the construction of the proposed new High St. bridge in Springfield, O., for $21,900. The bridge will be built jointly by the city and the Big Four Ry.

Petitions are being circulated in Cleveland, O., for the construction of a high level bridge on Clark Ave., early in 1911.

Oklahoma.

It has been announced in Tulsa, Okla., that the officials of the Oklahoma Union Traction Co., of that city intend to erect a bridge across the Arkansas River immediately and construct a line to West Tulsa and possibly further. This company recently increased its capital stock from $100,000 to $400,000.

The County Commissioners at Sapulpa, Okla. have let a contract for the building of the approaches to the iron bridges contracted for in Commissioner Childress' district to U. L. Vassar of Dejew for $.21 per yard for earth and $.15 per yd. for rock.

Oregon.

The residents of the Seventh ward in Portland, Ore., have decided to locate the approach of the proposed bridge at Ellsworth St., instead of across the Williamette in South Portland, having its east side approach at Division St. This change is due to the excessive cost of a bridge across the river from Division St., which is estimated by the City Engineer, J. W. Morris, at $2,000,000. It is said that a bridge from Ellsworth St. would cost approximately $500,000 less.

Pennsylvania.

✣Bids will be received until 10 a. m., Sept. 23, by the Comptroller, Charles T. Straughn of Schuykill County at Pottsville, Pa., for the construction of a steel bridge over Pine Creek in Hegins Township.

✣Bids will be received until 5 p. m., Sept 28, by J. Howard Supplee, Chairman, Highway Committee, at the office of the Commissioners of Lower Merion Township, Ardmore, Pa., for the construction of a bridge over the Pennsylvania Railroad tracks at Union Ave., Bala, Pa. W. A. McIntyre is Engineer of the committee.

✣Bids will be received by the Commissioners of Northumberland County at their office in Sunbury, Pa., until noon, Sept. 28, for the construction of the sub and superstructure of a bridge over Mahonoy Creek, near Ellis Durk's Farm in West Cameron township, Northumberland county, Pa.

✣Lawrence County Commissioners, Newcastle, Pa., will receive bids until noon, Sept. 29, for the construction and material of a plate girder bridge over Big Run in Shenengo township, Lawrence county, Pa. The structure will be 40 ft. in length with 16 ft. roadway. S. E. Crawford is Clerk of the commissioners. Thomas A. Gilkey, C. E., Newcastle, Pa., is Engineer of the commission.

Horn & Neff, Slatington, Pa., have been awarded a contract in Allentown, Pa., for furnishing all labor and material for the construction of the super and substructure of a two-span concrete encased steel girder bridge over the Ontelaunee Creek, Lynn Township, near Wanamaker, Pa., for $5,995. Bids were opened Sept. 12.

The York Bridge Co., of York, Pa., has been awarded contracts for the erection of bridges in Union County. One bridge will be built at Fry's mill over Limestone run at Lewisburg and the other in East Buffalo and is known as the Hiram Wolf bridge. The first bridge will be of heavy structural work and have a concrete floor. Another large contract on which work will be begun shortly is for the erection of a bridge at Sunbury, Northumberland County, between that city and Packer's land. It will be 20 ft. above the present structure, 4 ft. lower in height than the old bridge and 3 ft. higher than the railroad bridge. It will have a flooring of brick laid in concrete adding greatly to its weight. The cost of the bridge will be $84,300.

County Solicitor Weigle of Oil City, Pa., has been conferring with the county commissioners at Franklin, Pa., relative to the $175,000 petroleum bridge bond issue, for which they received no bids recently.

Councilman J. J. Cawley, Scranton, Pa., has taken steps toward the building of a bridge and viaduct to connect East Scranton and South Scranton by introducing a resolution in the city council providing for a bridge 60 ft. wide, extending from Harrison Ave., and Linden St., in the 17th ward to the northerly end of Crown Ave., in the 12th ward. The bridge would cross the Lackawanna and Laurel Line tracks and Roaring brook. The resolution was adopted by the council.

The County Commissioners at York, Pa., have awarded a contract to the Hartley, Ziegler Co., of York, for the rebuilding of the present bridge across the Codorus Creek at College Ave., in York, for $23,278. The condemned structure will be incased in concrete, using the steel structural work for the reinforcement. This contract is subject to the approval of the county court.

Bids were received by the County Commissioners at Wilkes Barre, Pa., on Sept. 8, for the furnishing of all labor and material for the erection of the proposed new bridge to be erected across the Susquehanna River at West planing mill and connecting Breslau on the opposite side of the river, as follows: Penn. Bridge Co., Beaver Falls, Pa., 3x, $7,000; 6a, $289,989, completed 450 days; 6b, $309,944, 450 days. M. H. Stebbins, Wellsboro, Pa., 3x, $9,500; 6a, $29,000, 490 days; 6a, $312,000, 500 days. With each bid there was a certified check for $15,000. Smare and Triest Co., Liberty St., N. Y., 3x, $5,600; 6a, $318,000; 6b, $328,000. Each style to require 480 days to complete. Thomas W. Haines, Wilkes-Barre, 7a, $119,000, 150 days; 2b, $129,000, 150 days. York Bridge Co., 2b, $151,200, 150 days; 2a, $139,900, 150 days. McClintock Marshall Construction Co., 23, $125,300; 2a, $113,100; 120 days each. Northeastern Construction Co., 6a, $294,444, 350 days; 6b, $306,141, 350 days. Bolton S. Coons Construction Co., Wilkes Barre, rolled earth filled bridge, $18,793.20. Joseph Hendler and John Gaynor, 6a, $377,103; 6b, $388,468. A certified check amounting to $19,423.40 accompanied the bids. The plans and specifications were prepared by the Scofield Engineering Co. of Philadelphia. The bridge will have seven river piers with pile foundation and enforcement. There will be six steel spans including granolithic sidewalk and brick paved roadway and hand railing.

The Town Council of North Braddock, Pa., has instructed Borough Engineer T. A. Stewart to have designs and plans made for overhead bridges across the Pennsylvania R. R. at Ann St., and at 13th St., between Braddock and North Braddock. The contract will be let shortly.

The Blair County Commissioners have awarded Fogle & Co. the contract for building a concrete bridge over Poplar Run, near Claysburg, for $3,400. The bridge will be a reinforced concrete structure, skew, 55 ft. long with a 16-ft. roadway and a five ft. sidewalk.

Ferguson & Rickard of Blairsville, Pa., have been awarded the contract for a reinforced concrete highway bridge over Cherry Run in Center Township, on the road leading from Graceton to Jacksonville. The work is to start at once and the bridge is to be completed by Oct. 15.

The Philadelphia & Reading R. R. Co. will build a new overhead bridge at Sheridan, Pa., on the Lebanon Valley branch. The contract for the substructure has been awarded to Wilauer & Co., of Philadelphia, and the superstructure to the American Bridge Co. The new bridge is to span four tracks, and will be erected west of the present structure, which spans two tracks.

The County Commissioners at Reading, Pa., have awarded the contract for repairs to the Penn St. bridge to William F. Remppis & Co., of Reading, for $763. The contract calls for the renewal of a portion of the iron work and water connections for new groups, construction including heating, plumbing and over the old W. & N. branch of the Reading R. R.

Texas.

A permit has been issued by the City Engineer of Houston, Tex., for the erection of the Southern Pacific R. R. office building on Franklin Ave. and Travis St. The building will cost about $512,793, and will be nine stories high. William Miller & Sons Co. has the contract. Jarvis Hunt & Co., Chicago, Ill., are the architects.

Virginia.

The Roanoke Bridge Co., Roanoke, Va., has been awarded a contract in Warm Springs, Va., for the construction of two bridges for $11,331. Bids were opened September 1.

The Roanoke Bridge Co., of Roanoke, Va., has been awarded contracts by the county commissioners of Giles County, Pearisburg, Va., for the construction of two bridges over New River. One of these is to span the river at Eggleston, being 550 ft. long and 16 ft. wide. The other bridge will cross the river at Narrows and will be 750 ft. long and 16 ft. wide. The bridges will cost about $30,000.

The County Commissioners at Covington, Va., have awarded a contract to the Roanoke Bridge Co., of Roanoke, Va., for the construction of four bridges throughout the county for $7,500. All the bridges will be of the steel truss construction and the material used will be fabricated at the plant of the Virginia Bridge & Iron Co., of Roanoke.

Washington.

The city of Tacoma, Wash., will hold an election Oct. 8 to vote on the issuance of $1,023,000 bonds for a fire tug, two bridges and a municipal dock.

Wisconsin.

The Beach Manufacturing Co. has been awarded a contract for the construction of a 90-ft. span bridge having concrete abutments on Ford River at Racine, Wis.

The City Council of Janesville, Wis., has called for plans and specifications for the building of new bridges at 4th Ave. and Racine St. Arrangements have also been made to advertise for proposals for the work.

Architect W. W. DeLong, Appleton, Wis., has completed plans for a bridge 16x40 ft. at Greenville, Wis., for A. Locksmith. The bridge will be of reinforced concrete construction. Estimates will be received by Mr. Locksmith.

The citizens of Janesville, Wis., have voted to bond the city for not more than $60,000 for the construction of two bridges across Rock River, one at 4th Ave., and the other at Racine St.

Canada.

✣Bids will be received until noon, Sept. 26, by Frank Lee, Division Engineer, Canadian Pacific, Winnipeg, Man., for the construction of a brick ice house in Winnipeg.

✣Bids will be received until noon Sept. 24, by J. F. C. Menlove, Secretary-Treasurer, Wallace and Virden, Man., for the supply and construction of a 60-ft reinforced concrete bridge to be erected within the town site of Virden.

Acording to advices from Mimico, Ont., the Toronto & York Radial Ry. Co. has put a large number of men at work felling trees and clearing the company's right-of-way west of the proposed site for the new bridge over the Mimico River. The land is already cleared for a distance of 1,000 ft. The new bridge will cross the Mimico a short distance above the present bridge used by the railway and the right-of-way east will be through the hills.

ROADS, STREETS AND PAVEMENTS

Alabama.

The Cherokee County Good Roads association has been organized at Center, Ala., for the purpose of constructing good roads in the county. The following officers were elected by the members of the association: President, G. P. Smith; vice-president, C. F. Stewart; secretary, T. H. Shropshire.

California.

A resolution favoring the building of a national highway between Los Angeles and New York, by way of Pasadena, Yuma, Galveston, Savannah and Washington, has been adopted by the North, Northeast and Northwest Improvement association of Los Angeles, Cal.

A stock company is to be formed at Pasadena, Cal., for the purpose of constructing an auto toll road up Mount Wilson's observatory trail.

The county board of supervisors at Riverside, Cal, have awarded the contract for the construction of the four miles of the Box Springs canyon road to Oscar Ford for $17,-

Bids opened Sept. 8 by the Park Commission, Oakland, Cal., for the paving with asphalt of roadway in Lakeside Park, were rejected as being too high. Henry F. Vogt, Secy., Park Commission.

The City Street Improvement Co., Merchants' Exchange Bldg., San Francisco, Cal., is the probable contractor for the improvement of west side of 12th St., etc., in Oakland, Cal., for $10,236. Bids were opened Sept. 7.

950

Colorado.

The contract for street grading, curbing and sidewalks in North Side improvement district No. 13, Denver, Colo., embracing territory between Jason and Tejon Sts., has been awarded to the Commonwealth Construction Co., for $70,019.

The report of the consulting engineers who were engaged by the city of Colorado Springs, Colo., to confer with City Engineer Waggener with regard to the proposed paving of the business streets of the city, has been accepted by the city council. The streets and avenues to be included in the paving district are: Cascade ave., from the south line of Platte ave. to the south line of Cucharas st.; Tejon st., from the south line of Boulder st. to the north line of Vermijo st.; Platte ave., Bijou, Kiowa and Cucharas sts., from the west line of Nevada ave. to the east line of Cascade ave.; Huerfano st., from the west line of Nevada ave. to the east end of the Viaduct; Pikes Peak ave., from the west line of North Corona st. to the east line of Cascade ave.

A good roads committee held a meeting at Boulder, Colo., recently to formulate plans for the building of a good road from Boulder to Valmont, a distance of five miles. The plan is to build west from Valmont 4½ miles to the Davidson school, and from there ½ mile to the old Arapahoe road. The estimated cost is $1,000 per mile.

Connecticut.

The following contracts were recently awarded by the State Highway Commission of Connecticut at Hartford, for state road work: Harwinton, 14,180 lin. ft. of gravel road on Naugatuck Valley trunk line to A. Vita, of Thompson, at $1.47 a lin. ft. for gravel road, $2.07 for gravel road with Telford base, $.98 for rubble drain, and $5.50 a cu. yd. for masonry.

Barkhamsted, one section of 10,236 lin. ft. of graded road with hardening surface, to Ceasar Rossi of Torrington, at $25,325; second section of 8,907 lin. ft. of similar road, to Sternberg & Cadwell of West Hartford, base at $2.60 a lin. ft.

New Hartford, 2,799 lin. ft. of macadam road to Caesar Rossi at $2.50 a lin. ft. for macadam road, $3.45 for macadam road with Telford base, and $5.50 a cu. yd. for masonry.

Enfield, 3,705 lin. ft. of macadam road on the trunk line joining the Massachusetts state line to Amos D. Bridge's Sons, Inc., of Hazardville, at $2.49 a lin. ft. for macadam, $3.49 a lin. ft. for macadam with a Telford base, $1 a lin. ft. for rubble drain, and $3 a sq. ft. for brick pavement.

Durham, 18,237 lin. ft. of macadam road on the Middletown and New Haven turnpike to Frank Amigoni & Brother of Durham at $2.27 for macadam, $2.95 for macadam with Telford base, and $1 for rubble drain.

North Branford, 15,327 lin. ft. of macadam road on New Haven and Middletown turnpike to A. Brazos & Sons, of Middletown at $1.85 a lin. ft. for macadam, $2.20 for macadam with Telford base, and $.80 for rubble drain.

Simsbury, 4,090 lin. ft. of macadam road on Main st. to Olmstead & Olmstead of East Hartford, at $2.04 a lin. ft. for macadam, $3.29 for macadam road with Telford base.

Goshen and Winchester, 9,715 lin. ft. in Goshen at $12,000, and 7,516 lin. ft. in Winchester at $8,642, both on Norfolk road, plans calling for graded road with hardening surface.

Suffield, 7,754 lin. ft. of macadam road on the Hartford and Springfield road to Olmstead & Olmstead of East Hartford at $1.98 for macadam, $3.18 for macadam road with Telford base, and $1 for rubble drain.

Bloomfield, 2,474 lin. ft. of macadam road on Blue Hills ave. let to Sternberg & Cadwell of West Hartford at $1.77 a lin. ft. for macadam, and $2.50 for macadam road with Telford base.

Delaware.

The mayor of Wilmington, Del., has requested the street department of that city to submit a plan of a proposed road or street to the Delaware river for the city, together with the probable cost of same in accordance with the plan, recommending the proper location with its width, length and materials necessary for construction.

H. C. Clark, Delaware City, Del., was the lowest bidder for the work of macadamizing a section of Port Penn road at Fort Dupont, Del., at $1.29 per sq. yd. E. A. Stockton, Jr., 1st Lieut. Coast Artillery Corps, Constructing Quartermaster, Fort Dupont. Bids were opened Sept. 12.

District of Columbia.

✣Bids will be received until 11 a. m., October 1, by William M. Smith, Acting Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for vitrified brick paving at the navy yard, Boston, Mass.

Florida.

✣Bids will be received until 10 a. m., October 4, by Clerk of St. Johns County, St. Augustine, Fla., for the construction of a road according to the plans prepared by C. M. Milburn, Engineer.

✣Bids will be received until 10 a. m., Oct. 5, by Constructing Quartermaster, Fort Dade, Fla., for the construction of brick or concrete roads and concrete walks.

The board of trustees, Putnam County Bonds, Palatka, Fla., has rejected all bids for the construction of 10 miles of hard surfaced road from the limits of the city of Palatka, over the upper Rice Creek bridge toward Bannerville. The work will be readvertised Bids were opened Sept. 2. R. F. Ensey, Palatka, is County Engineer.

Items marked thus ✣ indicate work now open for bids.

Georgia.

The following resolutions were introduced in the city council of Atlanta, Ga.: To widen and pave Marietta st. from North ave. to the Exposition Cotton mills, provided the street is paved with wood blocks by the city up to that point, and to have a preliminary survey made at once. To pave Marietta road as soon as practical, from the Exposition Cotton mills to the point where the Atlanta and Northern electric railway leaves the road, and to make the necessary survey, and to get from property holders the permission to widen it. To open a road from Marietta st. to the Johnson road, through the Sims property, to give access to Hollywood cemetery.

Idaho.

✣City Clerk of Twin Falls, Idaho will receive bids until 8 p. m., Sept. 22, for the grading and paving of the streets in Local Improvement District No. 7 with bitulithic pavement. Stuart H. Taylor, Twin Falls, Idaho, is clerk.

Illinois.

✣Bids will be received until noon, Oct. 1, by Henry O. First, Chairman Coal Valley Rural Road Committee, Moline, Ill., for excavating and grading Coal Valley Rural Road beginning at the N. W. corner of the S. W. quarter of N. E. quarter of Sec. 21, Township 17 North, R. 1 West, of the 4th P. M., thence south in center line of Sections 21, 28 and 33, to center of Section 33, constituting the 1st section of said road; second section begins at N. W. corner of Sec. 3, Township 16 North, R. 1 West of the 4th P. M., thence south along section line 1½ miles. The estimated quantities required for grading are approximately as follows: Section 1—6,600 cu. yds. earth excavation, average haul 50-80 ft.; 2,850 cu. yds. earth excavation, average haul 150-175 ft.; 3,950 cu. yds. earth excavation, average haul 200-225 ft.; 1,780 cu. yds. earth excavation, average haul 300 ft.; 5,040 cu. yds. earth excavation, average haul 425 ft.; 2,200 cu. yds. earth excavation, average haul 550 ft.: 4,830 cu. yds. earth excavation, average haul 725 ft.; 7,110 cu. yds. earth excavation, average haul 1,000 ft. Section 2—1,775 cu. yds. earth excavation, average haul 160 ft.; 5,865 cu. yds. earth excavation, average haul 200 to 250 ft.; 10,500 cu. yds. earth excavation, average haul 300-400 ft.; 6,335 cu. yds. earth excavation, average haul 650 ft.; 2,990 cu. yds. earth excavation, average haul 1,000 ft. Separate bids will be received on Sections 1 and 2. Clark G. Anderson, Moline, Ill., is engineer.

The following low bids were received Sept. 13 by the Board of Local Improvements, 302 City Hall, Chicago, Ill., for the construction of the following cement sidewalks: Avenue "L," 96th st., 104th st., 420 lin. ft., 6 ft. wide, no bids received; H. P. Larsen, 1742 N. Rockwell st., Chicago, Augusta st., Willow ave., Austin ave., 5⅓ ft. wide, 2,260 lin. ft., $.13 64-100 per ft.; Siewert-Callsen Co., Belmont ave., 41st ave., 42nd ave., 6 ft. wide, 1,100 lin. ft., $.13 8-10 per ft.; H. P. Larsen, Bismark pl., Noble st., 984 ft., east, 1,200 lin. ft., 5 ft. wide, $.13 74-100 per ft.; Pemling & Wendt, 84 La Salle st., Chicago, Byron st., Mozart st., Richmond st., 6 ft. wide, 540 lin. ft., $.17 4-10 per ft.; P. F. Biesen, 6601 Rhodes ave., Chicago, Commercial ave., 87th st., 91st st., 18 ft. wide, 5,000 lin. ft., $.37½ per ft.; Skafgard Concrete Construction Co., Costello ave., 40th ave., C. M. & St. P. Ry., 6 ft. wide, 1,200 lin. ft., $.12 3-10 per ft.; H. P. Larsen, Central Park, Elston ave., Grace st., 6 ft. wide, 900 lin. ft., $.14½ per ft.; Bairstow Supply Co., 6084 Ridge ave., Chicago, Cullom ave., Clark st., Ashland ave., 6 ft. wide, 2,400 lin. ft., $.12⅞ per ft.; T. B. Joy & Co., 3911 W. Van Buren and Bairstow Supply Co., Devon ave., 1,287 ft. east of Western ave., 271 ft. east of Robey st., 6 ft. wide, 9,000 lin. ft., $.12 6-10 per ft.; H. P. Larsen, Eberly ave., Elston ave., Grace st., 6 ft. wide, 180 lin. ft., $.21 per ft.; A. Graff, 70 La Salle st., Chicago, 15th st., Halsted st., Canal st., 4 ft. wide, 5,500 lin ft., $.13 87-100 per ft.; G. Kehl & Son Co., 1224 N. Campbell ave., Chicago, 40th st., Humboldt ave., Armitage ave., 6 ft. wide, 14,500 lin. ft., $.12 46-100 per ft.; A. Graff, 41st st., Butler st., Wallace st., 6 ft. wide, 300 lin. ft., $.17 per ft.; T. D. Joy & Co., 41st ave., 31st st., 32nd st., 6 ft. wide, 2,000 lin. ft., $.12¼ per ft.; H. P. Larsen, 45th st., Cottage Grove ave., Vincennes ave., 6 ft. wide, 1,300 lin. ft., $.14 74-100 per ft.; Harbor ave., The Strand, 92nd st., 12 ft., 7,000 lin. ft., no bids received; Demling & Wendt, Hoyne ave., 105th st., 107th st., 6 ft. wide, 3,300 lin. ft., $.15 9-10 per ft.; Bairstow Supply Co., Lawrence ave., Drainage Canal, Albany ave., 6 ft. wide, 4,000 lin. ft., $.14 7-10 per ft.; H. P. Larsen, Langdon st., Clybourn ave., Uhland st., 6 ft. wide, 280 lin. ft., $.24½ per ft.; H. P. Larsen, Larrabee st., Crosby st., Hawthorne st., 14 ft. wide, 700 lin. ft., $.14 74-100 per ft.; H. P. Larsen, Milwaukee ave., Lawrence ave., Sunnyside ave., 6 ft. wide, 300 lin. ft., $.19½ per ft.; A. Graff, McHenry st., North ave., Blanche st., 6 ft. wide, 1,590 lin. ft., $.15 37-100 per ft.; C. J. Fiske, 1743 N. 101st pl., Chicago, 99th st., 197 ft., east of Throop st., Oak ave., 6 ft. wide, 3,200 lin. ft., $.13½ per ft.; A. Graff, Oakley ave., Division st., Iowa st., 6 ft. wide, 1,650 lin. ft., $.16 37-100 per ft.; A. Graff, Otis st., Vedder st., Division st., 6 ft. wide, 1,100 lin. ft., $.15 37-100 per ft.; H. P. Larsen, Perry st., Cullom ave., Berteau ave., 6 ft., 330 lin. ft., $.17½ per ft.; T. D. Joy & Co., Quincy st., Clinton st., Jefferson st., 14 ft. wide, 3,100 lin. ft., $.12 3-5 per ft.; Demling & Wendt, Seeley ave., 326 ft. north of 105th pl., 107th st., 6 ft. wide, 2,700 lin. ft., $.14 9-10 per ft.; H. P. Larsen, 63rd st., C. & N. I. R. R., Halsted st., 12 ft. wide, 1,200 lin. ft., $.13½ per ft.; F. K. Shobe Paving Co., 524 W. 63rd st., Chicago, State st., 150 ft., north of 72nd st., 73rd st., 6 ft. wide, 540 lin. ft., $.20 per ft.; T. D. Joy & Co., Sawyer ave., Ogden ave., 75 ft. south of 21st st., 6 ft. wide, 1,900 lin. ft., $.13 per ft.; P. F. Biesen, South Chicago ave., 87th st., Saginaw ave., 6 ft. wide, 10,000 lin. ft., $.16½ per ft.; H. P. Larsen, 21st st., Jefferson st., Halsted st., 11 ft. wide, 4,500 lin. ft., $.12 64-100 per ft.; A. Graff, 39th st., Western ave., California ave., 6 ft. wide, 1,800 lin. ft., $.14 37-100 per ft.; Wellington st., Sacramento ave., Whipple st., 6 ft. wide, 159 lin. ft., no bids received; C. J. Fiske, Winston ave., 95th st., 99th st., 6 ft. wide, 9,800 lin. ft., $.13½ per ft.; Demling & Wendt, Dakin st., 56th ave., 60th Ave., 6 ft. wide, 18,000 lin. ft., $.13 7-10 per ft.; P. F. Biesen, 75th St., Cottage Grove Ave., St. Lawrence Ave., 6 ft. wide, 7,600 lin. ft., $.12½ per ft.; A. Graff, Lawrence Ave., Hamlin Ave., 40th Ave., 6 ft. wide, 21,000 lin. ft., $.15 37-100 per ft.; A. Graff, 27th St., Halsted St., Quarry St., 6 ft. wide, 3,700 lin. ft., $.13 37-100 per ft.; T. D. Joy & Co., 64th St., Paulina St., Robey St., 6 ft. wide, 40,000 lin. ft., $.13⅜ per ft.; H. P. Larsen, 24th St., 124 8-10 ft. east of Avers Ave., 40th Ave., 6 ft. wide, 2,500 lin. ft., $.19 per ft.; P. F. Biesen, 76th St., Yale St., 160 ft. west of 40th Ave., 6 ft. wide, 10,000 lin. ft., $.14½ per ft.; P. F. Biesen, 79th St., Kimbark Ave., 216 ft. west of Woodlawn Ave., 6 ft. wide, 9,000 lin. ft., $.12½ per ft.; H. P. Larsen, Byron St., Sacramento Ave., Kedzie Ave., 6 ft. wide, 10,000 lin. ft., $.13 74-100 per ft.; Thomas Johnson, 82nd St., Ontario Ave., Commercial Ave., 6 ft. wide, 10,000 lin. ft., $.12 per ft.; Skafgard Concrete Construction Co., Humboldt Ave., 515 ft. east of 47th Ave., 48th Ave., 6 ft. wide, 10,000 lin. ft., $.13 3-10 per ft.; Siewert-Callsen Co., 3865 Milwaukee Ave., Chicago, Irving Park Blvd., 48th Ave., 52nd Ave., 6 ft. wide, 18,000 lin. ft., $.13 8-10 per ft.; And. Larsen, 11,933 Princeton Ave., Chicago, 135th Pl., Indiana Ave., Forest Ave., 6 ft. wide, 6,000 lin, ft., $.13 88-100 per ft.; 17th St., Dearborn St., 1st Alley east, 14 ft. wide, withdrawn, no bid; A. Graff, Division St., Central Ave., Prairie Ave., 6 ft. wide, 9,000 lin. ft., $.14 37-100 per ft.; Lawrence Ave., C. & N. W. Ry., 56th Ave., 6 ft. wide, 4,500 lin ft., no bids received; H. P. Larsen, 60th St., Morgan St., Centre Ave., 6 ft. wide, 1,200 lin. ft., $.15 74-100 per ft.; T. D. Joy & Co., North Ave., 40th Ave., 42nd Ave., 6 ft. wide, 6,000 lin. ft., $.12⅜ per ft.; T. D. Joy & Co., 61st St., Wood St., Robey St., 6 ft. wide, 27,000 lin. ft., $.12⅜ per ft.

✣Board of Local Improvements, C. A. V. Standish, Secy., 300 City Hall, Chicago, Ill., will receive bids until Sept. 22, for the construction of pavement on the following streets and alleys: Alley from E. Ontario and St. Clair Sts., to E. Erie St. and Lincoln Park Blvd., including 570 sq. yds. brick pavement on 6 in. Portland cement concrete foundation and 2-in. sand cushion, 612 lin. ft. of new concrete curb; first alley west of La Salle Ave., from Hill to Elm St., including 220 sq. yds. of brick pavement on 6-in. concrete base, 2-in. sand cushion, 440 lin. ft. of new concrete curb; Alleys from W. Huron St., and N. Clark St., to W. Superior St. and La Salle Ave., including 340 sq. yds. brick pavement on 6-in. concrete foundation, 2-in. sand cushion, 400 lin. ft. of new concrete curb; Alley from 48th St. and Calumet Ave., to 49th St. and Grand Blvd., including 1,020 sq. yds. of brick pavement on 6-in. concrete foundation, 2-in. sand cushion, 1,200 lin. ft. of new concrete curb; Alley from 47th St. to St. Lawrence Ave., to 48th St. and Forrestville Ave., including 770 sq. yds. brick pavement on 6-in. concrete foundation and 2-in. sand cushion, 980 lin. ft. of new concrete curb; Alley from Ashland Ave. and Warren Ave. to Paulina St. and Madison St., including 930 sq. yds. of brick pavement on 6-in. concrete foundation, 2-in sand cushion, 1,200 lin. ft. of new concrete curb; Alley from Arlington Pl. and North Clark St., to Deming Pl. and Hamilton Court, including 1,860 sq. yds. of brick pavement on 6-in. concrete foundation and 2-in. sand cushion, 1,850 lin. ft. new concrete curb; Champlain Ave., from 42nd to 43d Sts., including 1,780 sq. yds asphalt pavement, on 6-in. concrete foundation, 1,200 lin. ft. granite concrete combined curb and gutter, 1,200 sq. ft. sidewalk, 5 old manholes adjusted, 4 old catch basins adjusted, 9 new covers with iron lids, 20 lin. ft. 9-in. tile pipe, 4 cast iron gratings; Graceland Ave., from Evanston Ave. to the Chicago, Milwaukee & St. Paul Ry. right-of-way, including 3,900 sq. yds. asphalt pavement, on 6-in. concrete foundation, 3,300 lin. ft. granite concrete combined curb and gutter, 150 lin. ft. granite gutters, 400 sq. ft. sidewalk, 8 new catch basins complete, 1 old manhole adjusted, 6 old catch basins adjusted, 2 new covers with iron lids, 100 lin. ft. 9-in. tile pipe, 4 cast iron gratings.

George V. Peter of Sycamore, has been awarded the contract for the Washington Blvd., and Busey Ave., pavements in Urbana, Ill., by the board of local improvements.

J. W. Stipes, Champaign, Ill., has been awarded a contract by the board of local improvements of that city for the paving of Fourth St., for approximately $27,000. The work includes the following approximate quantities: Excavation, 8,500 cu. yds.; brick pavement on concrete foundation, asphalt filler, 10,800 sq. yds.; combination concrete curb and gutter, 8,050 ft.; stone false curb, 96 ft.; stone retaining curb (new), 194 ft.; stone retaining curb (reset), 286 ft.; cast iron gutter plates, 32; steel for Boneyard bridge, 6,750 lbs.; concrete for Boneyard bridge, 60 cu. yds.; iron railing for Boneyard bridge; catch basins, 7, Style A, average depth 7.6 ft., 4 Style B, average depth 7.4 ft.; vitrified tile drain, 255 ft. of 20-inch, average depth 6.7 ft.; 655 ft. of 18-inch, average depth 5.7 ft.; 1,450 ft. of 15-inch, average depth 6.8 ft.; 850 ft. of 12-inch, average depth 7.3 ft.; 360 ft. of 10-inch, average depth 6.0 ft.; 300 ft. of 8-inch, average depth 6.5 ft. Bids were opened Sept. 12.

The common council of Chicago, Ill., has passed the following ordinances, providing for paving improvements: South Side, East 72d St., Vernon Ave., South Park Ave., etc., cement sidewalk system; South Spaulding Ave., 73 ft., N. of N. line of Fillmore St., West 12th St., public alley, with asphalt; Flournoy St., West Polk St., South Oakley Blvd., South Claremont Ave., alley, with brick; West Harrison St., Flournoy St. South Robey St., South Hoyne Ave., with asphalt; East 53d St., Indiana Ave., South Park Ave., with asphalt; East 56th St., Cottage Grove Ave., Woodlawn

Ave., with creosoted wood blocks; South Marshfield Ave., West 66th St., West 67th St., etc., with asphalt; alley, Wilcox St., West Adams St., South Campbell Ave., South Rockwell St., with brick; alley, Cleveland Ave., Hamilton Ct., Grant Pl., Webster Ave., with brick; alley, East 27th St., East 29th St., Dearborn St., Armour Ave., with brick; 97th St., Avenue M, Avenue H, with slag-macadam; alley, Hyde Park Blvd., East 52d St., Madison Ave., Washington Ave., with brick; alley, Oakenwald Ave., Lake Ave., East 44th Pl, with brick; alley, Shades Pl., Willow St., North Halsted St., Burling St., with brick; alleys, East 25th St., East 26th St., Indiana Ave., Prairie Ave., with brick; alley, East 40th St., East 41st St., Calumet Ave., with brick; public alleys, East 42d St., East 43d St., Berkeley Ave., Greenwood Ave., Lake Ave., with brick; alleys, Grant Pl., Belden Ave., Cleveland Ave., Hamilton Ct., with brick; alley, East 47th St., East 48th St., South Michigan Ave., Indiana Ave., with brick; alley, East 42d St., East 43d St., South Michigan Ave., Indiana Ave., with brick; alley, Menomonee St., Wisconsin St., Sedgwick St., Hudson Ave., with brick; alley, West 37th St., West 38th St., South State St., South Dearborn St., with brick; Perry St., Wellington St., Irving Park Blvd., with brick; alley, East 29th St., East 30th St., Vernon Ave., Cottage Grove Ave., with asphalt; alleys, Wilson Ave., Leland Ave., Sheridan Rd, Kenmore Ave., with asphalt; alleys, West North Ave., Ewing Pl., North Robey St., North Hoyne Ave., with brick; alley (School Pl.), West Madison St., West Monroe St., South Clinton St., South Jefferson St., with granolithic blocks; alleys, East 30th St., East 31st St., Calumet Ave., South Park Ave., brick; alleys, Indiana St., Illinois St., Dearborn Ave., North Clark St., with granolithic blocks; alley, North Ave., Willow St., Halsted St., Dayton St., with brick; alleys, Ontario St., Ohio St., Wells St., North Franklin St., with granolithic blocks; alleys, West Congress St., West Harrison St., Aberdeen St., South Center Ave., with brick; alley, 1st west of South Wabash Ave., East 21st St., East 22d St., with brick; Addison St., North Halsted St., North Clark St., with asphalt; South Center Ave., West 21st St., West 22d st., with granolithic blocks; West Congress St., 397 ft. west of west line of South Desplaines St., South Halsted, with brick; Crystal St., North Rockell St., North California Ave., with asphalt; North Hamlin Ave., Dickens Ave., Fullerton Ave., produced west, with asphalt; public alleys, Woodlawn Ave., Lake Ave., East 46th St., with brick; North Sawyer Ave., Fullerton Ave., Wrightwood Ave., with asphalt; North Sawyer Ave., Wrightwood Ave., Milwaukee Ave., with asphalt; south side Ewing St., South Halsted St., Blue Island Ave., cement sidewalks; south side Hammond Ave., Tell St., Eugenie St., cement sidewalks; Grace St., Bernard St., North Central Park Ave., etc., cement sidewalk system.

Indiana.

✣Bids will be received until 2 p. m., October 5, by Board of County Commissioners, Kokomo, Ind., for the building and construction of a certain free gravel road situated in Honey Creek township, Howard County. A. B. Easterling is County Auditor.

✣Commissioners of Hamilton County will receive bids until 2 p. m., Sept. 28, at Noblesville, Ind., for the construction of seven gravel roads. George Griffin is Auditor of the county.

Bids will be received until 10 a. m., Oct. 4, by Commissioners of Jasper County at Rensselaer, Ind., for the construction of five stone road improvements in Keener township. James N. Leatherman is Auditor.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 28, for the improvement of Beecher St., north side from west property line East St., to right-of-way of J. M. & I. R. R. by grading and paving the sidewalks.

✣Bids will be received until 11 a. m., Oct. 3, by Commissioners of Scott County at Scottsburg, Ind., for the construction of two gravel roads in Vienna Township and two in Lexington township. Frank Gardner is the auditor of the county.

✣Bids will be received until 10 a. m., Oct. 4, by Commissioners of Wabash County at Wabash, Ind., for the construction of two highways in Paw Paw township. J. P. Noftzger is Auditor of the county.

✣Bids will be received until Noon, October 4, by the Commissioners of Sullivan County at Sullivan, Ind., for the construction of rock road in Hamilton township. Ben C. Crowder is Auditor of the county.

✣Bids will be received until 10 a. m., October 6, by the Commissioners of Marion and Hamilton Counties at Noblesville, Ind., for the construction of a gravel road on line between said counties. George Griffin is Auditor of Hamilton County and Albert Sahm is Auditor of Marion County.

✣Commissioners of Johnson and Shelby Counties, Ind., will receive bids at Franklin, Ind., until 10 a. m., Oct. 15, for the construction of a gravel road on Johnson-Shelby County line. W. B. Jennings is County Auditor.

✣Bids will be received until 11 a. m., Oct. 15, by the Commissioners of Gibson County at Princeton, Ind., for the construction of four gravel roads in Wabash township. William T. Roberts is Auditor of the county.

The county commissioners at Sullivan, Ind., have awarded the contract for the construction of the S. O. Carty road in Cass township to Ward Hawkins of Sullivan for $8.240.

The board of public works of Michigan City, Ind., has received a petition for a cement sidewalk along the south side of Homer St., from Franklin to Washington.

The Gary Construction Co., of Gary, Ind., has been awarded a contract in that city for the construction of a portion of Pierce St., for $13,043.

The board of public works of Evansville, Ind., has awarded a contract to the Western Construction Co., for the paving of Chandler Ave., from Garvin St., to Bayard park. The board also ordered a stone sidewalk laid on both sides of Kentucky Ave., from Washington to Adams Aves.

Bids were received by the city council of East Chicago, Ind., for the construction of 21 miles of cement sidewalks throughout the city from the following: F. G. Proudfoot; W. W. Hatch & Sons; Wm. Ahlborn Construction Co., and Lavene Bros. Contract was to be let Sept. 19.

Bids have been received by the city council of East Chicago, Ind., for the paving and improving of Wegg Ave., from 148th to 150th St. The contract will be let Sept. 19. The council passed resolutions for the improvement of Block Ave., in Indiana Harbor, from Washington St., to Lincoln St., and Northcote Ave., in East Chicago from 141st St. to 145th St.

The board of county commissioners at Marion, Ind., have awarded a contract for the improvement of West Ninth St., to Davis & Booher of Windfall for $26,907. The road, which lies in Center and Franklin townships, will be constructed of crushed rock, with Beria sandstone curbing.

The following bids were received by the board of county commissioners at Jeffersonville, Ind., for the building of a free gravel road in Monroe township on Sept. 8: Clyde Sigmond, Monroe township, $6,582; William O. Sweeney & Co., this city, $6.493. The contract was given W. O. Sweeney & Co.

The County Commissioners at Crown Point, Ind., have awarded contracts for the construction of six gravel roads as follows: Nejde & Greenwald, Whiting, Ind., $4,049; Atchison road, $7,550; Cohn road, $15.900; Wm. Ahlborn Construction Co., Hammond, Ind., Ottenheimer road, $3.760; Downey & Portz, Spencer road, $16,400; Keilman road, $19,100. Bids were opened Sept. 6.

North Side Hauling Co., Indianapolis, Ind., has been awarded a contract by the Board of School Commissioners of that city for the grading, graveling and sodding of school grounds of No. 35 Madison Ave., and Raymond St., for $1,775. Bids were opened Sept. 2.

Iowa.

The city council of Fort Dodge, Ia., has awarded contract to the Bryant & McLaughlin Asphalt Paving Co., for paving First Ave., between 15th and 17th St.; 16th St., from Central Ave., to 5th Ave., south and 13th St., from First Ave., south to the Chicago Great Western right-of-way at the following bids: For asphalt paving, according to the specifications, $1.98 per sq. yd.; extra grading $.39 a cu. yd.; overhaul one cent; restoring old curbs $.20 a lin. ft.; building combined Portland cement curb and gutter, $.65 a lin. ft.; street railway paving $3.10 per sq. yd.

The Eldora, Ia., city council awarded a contract on Sept. 7 to Dearborn & Jackson of Cedar Rapids, Ia., for the proposed construction of cement concrete paving and curbing on 12 city blocks at the following prices: For cement concrete paving, $1.36 per sq. yd.; for cement concrete curbing, $.45 per running ft.

The following bids were received by the city of Dubuque, Ia., for paving work on Sept. 1: For paving Seventh St. from Main to Clay with brick, O'Farrell Contracting Co.—Curbing, per lin. ft., $.70; paving, $2.08 per sq. yd; J. M. Kenety—Curbing, $.70 per lin. ft.; paving, $1.97 per sq. yd.; resetting old curb, $.20 per lin. ft.; finished paving to be rolled with five-ton horse roller, (awarded contract); J. M. Lee—Curb, $.70 per lin. ft.; paving, $2.35 per sq. yd., or $2.10 per sq. yd. if horse roller is to be used; resetting old curb, $.20 per lin. ft.

For paving Fifth St. from Main to Locust with brick: J. M. Kenety—Curbing, $.70 per lin. ft.; paving, $2.22 per sq. yd.; resetting old curb, $.20 per lin. ft.; O'Farrell Contracting Co.—Curbing, $.70 per lin. ft.; paving, $2.15 per sq. yd., (awarded contract).

For the improvement of Bluff St. from Eighth St. north to Seventeenth St., using Sarco-compost: M. Tschirgi & Son—Sarco-compost paving, $1.48 per sq. yd.; combination cement curb and gutter, $.92 per lin. ft.; J. M. Kenety—Sarco-compost paving, $1.37 per sq. yd.; combination cement curb and gutter, $.85 per lin. ft. (awarded contract). O'Farrell Contracting Co.—Sarco-compost paving, $1.46 per sq. yd.; combination cement curb and gutter, $.91 per lin. ft.; James Lee—Sarco-compost paving, $1.48 per sq. yd.; combination cement curb and gutter, $.90 per lin. ft.

Charles Crane of Clear Lake, La., is engaged in an attempt to get a drag road established between Clear Lake and Des Moines. The plan is to build the road this year and continue it on to Minneapolis and St. Paul next year.

The city council of Council Bluffs, Ia., has decided to reconstruct and pave with vitrified brick block, having a base of concrete 6-in. thick 13th Ave., from Main St., west to the Milwaukee and Burlington tracks. A. W. Casady is city clerk.

B. C. Dilenbeck and J. E. Wilson, representing the Perry, Ia., auto club, have asked the city council of Perry to order the construction of a gravel road east from 11th St., on Willis Ave., east to the section line, and north from that point to the gravel road new constructed toward Bouton.

The following bids were received Sept. 8, at Atlanta, Ia., for the construction of paving, for which the Iowa Engineering Co., Clinton, Ia., are engineers; the work including (1) 385 ft. of false curb, (2) 152,831 lbs. of cast iron, (3) 28,643 ft. of curb and gutter, (4) 4,898 cu. yds. of excess grading, (5) 1,398 sq. yds. of brick paving, (6) 41,166 sq. yds. of bituminous concrete paving (2-in. base), (7) 3,200 sq. yds. of bituminous concrete paving (3-in. base): Zitterell & Sullivan, Webster City, Ia., (1) $.59, (2) $.05½, (3) $.69, (4) $.44½, (5) $2.01½, (6) $2.15, (7) $2.34; total, $129.388; National Construction Co., Omaha, Neb., (1) $.42, (2) $.04 (3) $.53, (4) $.43, (5) $2, (6) $2.09, (7) $2.24, total, $119.563; Capital City Concrete Construction Co., Springfield, Ill., (1) $.30, (2) $.04, (3) $.60, (4) $.50 (5) $2.03, (6) $1.93, (7) $1.93, total, $114,328; Wm. Harrabin, Iowa City, Ia., (1) $.40, (2) $.03¾, (3) $.52, (4) $.43, (5) $1.97, [illegible] $2.23, total $118,101. Mc Laughlin & Sons, Topeka, Kan. (3) $.59, (4) $.50, total $19,320. The contract for curb and gutter was awarded to Wm. Harribin for $14,894. The balance of the work was awarded to the Capital City Concrete Construction Co., for $112,036.

Kansas.

✣Commissioners of Johnson County at Olathe, Kan., will receive bids at the office of the County Clerk until October 3, for the construction of the Thorpe Road under the provisions of the Hodges Rock Road Law. The road is to be an extension of 75th St., westward to connect with Aubry Road.

The county commissioners at Iola, Kan., have been petitioned for a gravel road in Cottage Grove township, to be known as the Wisborg road.

Louisiana.

The city council of Mansfield, La., has awarded to the Stephens Construction Co., of Shreveport, a contract for the construction of three miles of concrete sidewalks.

Mayor J. P. Turregano of Alexandria, La., has been authorized by the city council to advertise for the paving of Beauregard St., from Second to Fourth, with vitrified brick, and Jackson St., from 10th to Bolton Ave., with asphalt bituminous macadam or bitulithic.

Maryland.

✣Bids will be received until noon, Sept. 30, by the State Road Commission, Baltimore, Md., at the Union Trust Bldg., for the construction of state highways aggregating 30 miles as follows: Cecil County: On the road from Elkton to the Back Creek, Delaware Cross Roads, in one section, a distance of about 3 miles (stone macadam); and from the Back Creek, Delaware Cross Roads to Chesapeake City, in one section, a distance of about 2.47 miles (stone macadam). Frederick County: On the road from the end of the Jefferson Pike to Petersville, in one section, a distance of 4.43 miles (stone macadam); and on the road between Petersville and Knoxville, in one section, a distance of 2.67 miles (stone macadam). Harford County: On the road from the Conowingo Bridge to Dublin Cross Roads, in one section, a distance of about 4.27 miles (stone macadam); and on the road from the Baltimore County line to the Belair Turnpike, in one section, a distance of about 2.7 miles (stone macadam). Worcester County: On the road between Pocomoke City and Betheden Church, in one section, a distance of about 6.2 miles (stone macadam). Anne Arundel County: On the Annapolis Blvd., from the Severn River Bridge in Annapolis to Arnold Station, in one section, a distance of about 3.02 miles (pitch macadam). Prince George's County: On State Road No. 1, from Laurel to Contee, in one section, a distance of about 1.06 miles (stone macadam); and from Paint Branch to the Maryland Agricultural Experiment Station, a distance of 0.37 mile, in one section (stone macadam).

Massachusetts.

James Doherty at $4,058, and William J. Rafferty at $4,186, were the only bidders for the repaving with macadam of Leon St., between Ruggles and Greenleaf Sts., in Roxbury, Boston, Mass.

A contract for the paving of Hancock St., in Dorchester, Mass., without advertising for bids, has been awarded by the mayor to the Central Construction Co., of that city for $25,000. The street will be paved from Columbia road to Winter St., with brick blocks.

James Doherty was awarded a contract in Boston, Mass., for building with trap rock a macadam roadway in Leon St., Roxbury, for $4,058.

Adams-Pond Co., received a contract in Boston, Mass., for laying artificial stone sidewalks in Beaumont St., Dorchester, for $2,400.

The city of Boston, Mass., has awarded a contract to James Doherty for building a macadam roadway in Ralston St., South Boston, with trap rock, for $2,607.

Jeremiah J. Sullivan has been awarded a contract in Boston, Mass., for constructing artificial stone sidewalks in Washington St., for $1,410.

Michigan.

✣Bids will be received until 11 a. m., Sept. 30, by Capt. William Brooke, Quartermaster, Fort Brady, Sault Ste. Marie, Mich., for brick pavement, concrete curbs and gutters, etc.

Andrew Gieck has been awarded contract in Owosso, Mich., for the construction of one block of brick pavement on a 6-in. concrete foundation with cement curb for $3,029. Bids were opened Sept. 15.

Minnesota.

The board of public works of Duluth, Minn., has awarded the following contracts for paving work: P. McDonnell, for paving Lake Ave., between Second and Fourth Sts., with sandstone blocks, for $9,098; The McAdams-Preston Co., for paving First alley between Lake Ave. and Third Ave. east, with sandstone blocks for $9,003.

The city council of Virginia, Minn., has been petitioned by property owners on Walnut St., for the paving of that street from Central to Cleveland Aves.

The farmers in the vicinity of Duluth, Minn., have asked the city council of Duluth for the following appropriations for improvements of roads leading into the city: For improvement of Getchell road at West Duluth, $3,000; for improvement of Sundby road, $3,000; for improvement of Farrell road, $2,000; for concrete culvert and fill over Miller's creek at Piedmont avenue, $2,500.

Advices from Cloquet, Minn., state that bids for the building of the state road between Cloquet and Carlton have been rejected, being considered too high, and the work will be delayed. The county commissioners have written the state engineer to see if plans could not be modified and thereby reduce the expense. The lowest bid received was $10,660.

The County Commissioners, Fairmont, Minn., have awarded a contract to J. G. Redding, Windom, Minn., for the construction of four miles of state road No. 2 for $6,000. The work includes grading, concrete and steel culverts. Bids were opened Sept. 9.

Mississippi.

At the request of the Road Commissioners of District No. 2, of Harrison County, Gulfport, Miss., for the issuance of road bonds in the sum of $50,000, the county commissioners have authorized the issue.

Montana.

Order has been issued by the Missoula County commissioners, Missoula, Mont., for a road to be built from St. Regis to Spring Gulch, a distance of about 6 miles.

Nebraska.

The city council of Lincoln, Neb., has created a paving district, No. 165, on 25th St., from the north line of Vineto X St., also a sidewalk district on the south side of B St., between 11th and 20th Sts.

New Jersey.

✣Bids will be received until 2 p. m., Oct. 1, by George Hartpence, Chairman, Township Committee of East Amwell Township, at Ringoes, N. J., for the construction of a macadam road from Ringoes to Ringoes Station, a distance of 2,924 ft. Grant Davis, Whitehouse Station, N. J., is Township Engineer.

Bids were received by the board of freeholders on Sept. 7 at New Brunswick, N. J., for the macadamizing of the Kingston-Aqueduct road from Monmouth Junction to the New Brunswick-Trenton turnpike, a distance of 2.56 miles, as follows: Henry Clark, 1208 Walnut St., Philadelphia, Pa., $25,240; H. N. Scott Construction Co., of Cranbury, $21,283 (this firm bid $19,000 exclusive of the asphalt binder); Russell Klockner, of Trenton, $27,238.95.

The board of freeholders at Newark, N. J., opened bids Sept. 8 for the grading and paving of Pleasant Valley Way between Bloomfield Ave., Verona, and Mountain Ave., West Orange, and have awarded the contract to Robert Doriety of 29 Highland Ave., for $29,625.

New Hampshire.

H. C. Hill, State Engineer, Concord, N. H., has awarded a contract to Stewart & Snodgrass of Berlin, N. H., for the construction of a gravel road in Gorham, N. H., for approximately $7,900. Bids were opened Sept. 9.

New York.

✣Bids will be received until 8 p. m., Sept. 27, by Frank Dinsomore, Clerk of Bronxville, Westchester County, N. Y., for furnishing labor and material for grading, curbing and paving Palmer Ave., in the village and that portion of Depot Square lying west of right of way of the New York Central & Hudson River R. R. Co. Rogers Y. Latimer, Tuckahoe, N. Y., and 5-7 East 42d St., New York City, are Engineers.

✣Bids will be received until 8 p. m., Sept. 26, by Frank Sibley, Town Clerk, Scarsdale, N. Y., for repairing or constructing the following highways and portions of highways in the Town of Scarsdale; first group, Sherbrook Road, Heathcote Road, Griffin Ave. and Fenimore Road, a total length of 1.53 miles; second group, Grand Blvd., Brambach Ave., Evart St., a total length of eighty-six hundredths (.86) of a mile, the work to be done to include grading, draining and macadamizing with bituminous macadam or repairing and resurfacing with said material the said several highways according to the specifications prepared by E. J. Wulff, C. E., and adopted by the Town Board of the Town of Scarsdale and now on file in the office of the Clerk of said Town.

✣Bids will be received by George McAneny, President, Borough of Manhattan, New York City, will receive bids until 2 p. m., Sept. 23, for 10 street improvement contracts, the largest being No. 10 as follows: For regulating and repaving with granite block pavement on concrete foundation the roadway of 11th Ave., from the north side of 27th St. to the north side of 42d St., and of 33d St., from the west side of 10th Ave. to the east side of 11th Ave. Engineer's estimate of amount of work to be done: 18,250 sq. yds. of granite block pavement, except the railroad area; 4,120 sq. yds. of granite block pavement in the railroad area (no guarantee); 21,960 sq. yds. of old stone blocks to be purchased and removed by the contractor; 3,850 cu. yds. of Portland cement concrete; 7,180 lin. ft. of new bluestone curb stone, furnished and set; 120 lin. ft. of old bluestone curb stone, redressed, rejointed and reset; 5,160 sq. ft. of new granite bridge stone, furnished and laid. The time allowed for doing and completing the above work will be 150 working days. The amount of security required will be $25,000.

✣Bids will be received until 2 p. m., Sept. 23, by George McAneny, President of the Borough of Manhattan, New York City, for three contracts for maintaining asphalt pavement, the largest being No. 3, as follows: For maintaining the asphalt pavement on the following streets in the Borough of Manhattan where the original contracts have been abandoned: Dutch St., from John to Fulton St.; Pearl St., from Broad to Whitehall St.; 45th St., from 6th to 8th Ave.; 4th St., from Lewis St. to 2d Ave.; 3d St., from Lewis St., to 2d Ave.; Lawrence St., from 126th St. to Broadway; 126th St., from Lawrence St. to St. Nicholas Ave.; 129th St., from Broadway to Manhattan St.; 6th St., from Avenue D to Lewis St.; 7th St., from Avenue C to Lewis St.; 60th St., from 1st to 3d Ave.; Lewis St., from Houston to south side of 3d St.; Lewis St., from 75 feet north of 4th St. to south side of 5th st.; Lewis St., from 30 ft. north of 5th St. to 8th st.; Astor Pl., from Broadway to 4th Ave.; 8th St., from Broadway to 4th Ave.; 1st Ave., from 59th to 60th St.; 61st to 72d St.; 74th to 83d St.; 84th to 85th St.; 86th to 91st St.; 92d to 109th St.; 120th St., from 5th Ave. to East River; Stuyvesant St., from 2d to 3d Ave.; 9th St., from Stuyvesant St. to University Pl.; University Pl., from south side of Waverly Pl. to north side of 4th St.; Mercer St., from 4th to 8th St.; Washington Pl., from Broadway to University Pl. Engineer's estimate of amount of work to be done: 28,000 sq. yds. of asphalt pavement; 100 sq. yds. of old stone pavement; 30 cu. yds. of concrete. Time allowed for doing and completing the above work is until December 31, 1910. The amount of security required will be $7,000.

✣Bids will be received by President Cyrus C. Miller, Borough of The Bronx, Municipal Bldg., Crotona Park, New York City, until 11 a. m., Sept. 27, for 9 contracts, 8 of which are for street improvement. The largest contract is No. 2, as follows: For completing the contract which was executed by W. F. Murray on April 8, 1908, and declared abandoned on May 16, 1910, for regulating, grading, setting curb stones, flagging the sidewalks, laying crosswalks, building approaches, placing fences, providing for necessary drainage, placing catch basins, manholes and steel rods in place in West Farms Road, from Morris Park Ave. to the intersection of Westchester Ave. and former Main St., in the old village of Westchester. The Engineer's estimate of the work is as follows: 1,750 cu. yds. of earth excavation; 1,100 cu. yds. of rock excavation; 32,000 cu. yds. of filling; 4,150 lin. ft. of new curb stone, furnished and set; 17,500 sq. ft. of new flagging, furnished and laid; 5,750 sq. ft. of new bridge stone for crosswalks, furnished and laid; 2,900 cu. yds. of dry rubble masonry in retaining walls, culverts and gutters; 10 cu. yds. of brick masonry; 750 lin. ft. of vitrified stoneware pipe, 12 in. in diameter; 125 lin. ft. of vitrified stoneware pipe, 15 in. in diameter; 100 lin ft. of vitrified stoneware pipe, 18 in. in diameter; 1,000 ft. (B. M.) of lumber, furnished and laid; 685 lin. ft. of new iron fence in place; 4,800 lin. ft. of guard rail in place; 800 cu. yds. of class "A" concrete; 102,900 pounds of steel rods in place; 4 manholes, complete; 9 catch basins, complete; 15 cu. yds. of rubble masonry in mortar. The time allowed for the completion of the work will be 250 working days. The amount of security required will be $17,000.

✣Bids will be received until noon, Sept. 27, by George Cromwell, President of the Borough of Richmond, Borough Hall, New York City, for five contracts for the improvement of sidewalks, the largest being No. 2, which is as follows: For furnishing all the labor and materials required for constructing flag or cement sidewalks, reflagging on Van Duzer St., between Richmond Turnpike and Hannah St.; and other streets, together with all work incidental thereto. The Engineer's estimate of the quantity and quality of the material, and the nature and extent, as near as possible, of the work required is as follows: 10,000 sq. ft. of cement sidewalk, to furnish and lay; 13,000 sq. ft. of new flagstone, to furnish and lay; 3,000 sq. ft. of old flagstone, to retain and relay. The time for the completion of the work and the full performance of the contract is 60 days. The amount of security required is $2,400.

Advices from Buffalo, N. Y., state that the following bids were opened recently by the board of public works for improvements: For paving Barton St.; German Rock Asphalt & Cement Co. lowest at $6,290 for asphalt; H. P. Burgard lowest for brick at $5,000; Ledger St.; German Rock Asphalt & Cement Co. lowest for asphalt at $6,648; Constantine Construction Co. lowest for brick at $5,300; Princeton Place; German Rock Asphalt & Cement Co. lowest for asphalt at $6,420; H. P. Burgard lowest for brick at $5,100; Rano St.; F. V. E. Bardol lowest for asphalt at $4,944; H. P. Burgard lowest for brick at $3,800; Republic St.; German Rock Asphalt & Cement Co. lowest for asphalt at $12,920; H. P. Burgard lowest for brick at $11,000; Vandalia St.; H. P. Burgard lowest for asphalt at $4,000; H. P. Burgard lowest for brick at $3,000; German Rock Asphalt & Cement Co. lowest for Medina sandstone at $4,970.

The common council of Syracuse, N. Y., has voted for the paving of Canal St., from Crouse Ave., to Beech St., and Beech St., from Canal St. to the West Shore tracks. The estimated cost is $38,800.

The board of contract and supply of Utica, N. Y., has awarded a contract for paving Rudolph Place from Humbert Ave. to South St., with sheet asphalt and artificial stone curb to the Barber Asphalt Paving Co., for $2,437, and for paving Thomas St., from Grant to Pleasant Sts., with the same material for $5,393.

The town of Scarsdale, N. Y., has awarded a contract to N. C. McCabe of White Plains, N. Y., for the resurfacing with a bituminous macadam of the highway known as the New York Post Road in the town of Scarsdale, for $18,000. J. Wulff, Engineer. Bids were opened Sept. 12.

Taylor & Ousterhouse, W. Henley St., Olean, N. Y., has been awarded a contract in Olean, N. Y., for vitrified block pavement in W. Henley St., for $35,234. The work includes 6,000 yds. of excavation, 15,000 yds. of pavement, 9,000 ft. of curb and gutter. Bids were opened Sept. 13.

The Department of Public Works, Buffalo, N. Y., received, Sept. 2, bids for paving Vandalia St., 26 ft. wide, from South Erie R. R. lands; Republic St., 24 ft. wide, from Louisiana to Hamburg; Ledger St., 24 ft. wide, from Hertel to Troost; Barton St., 26 ft. wide, from Auburn to Lafayette; Rano St., 30 ft. wide, from Riverside to end of street; Princeton St., 22 ft. wide, from Seneca to 794 ft. southerly. Henry P. Burgard Co. was low bidder for Vandalia St. work, at $3,000; for Republic St. work., at $11,000; for Barton St. work, at $5,000, and for Rano St. work, at $3,800, and for the Princeton St. work, at $5,100. The Constantine Construction Co. was low on the Ledger St. work, at $5,300. Francis G. Ward is Commissioner of Public Works, and George H. Norton, Deputy Engineer Commissioner.

North Carolina.

✣Bids will be received by the Commissioners of Streets, Louis Belden, Chairman, Wilmington, N. C., until noon, October 15, for the grading, paving and curbing of certain streets in and for the city. The work includes approximately 93,300 sq. yds. of pavement and 19,000 lin. ft. of granite curb. C. R. Humphreys is Engineer of the Commission.

Ohio.

✣Commissioners of Champaign County, Ohio, at Urbana, O., will receive bids until 10 a. m., October 1, for the work of graveling 5,280 ft. of pike on the Urbana and St. Paris Pike running from East line of Mad River township to a point one mile west. Plans and specifications are on file at the office of James Swisher, County Surveyor, Urbana, O.

✣County Commissioner of Lucas County at Toledo will receive bids until Sept. 26, for the macadamizing of Corduroy Road from Consaul St. to Momineetown.

✣Bids will be received by the Board of County Commissioners at Cincinnati, O., until Noon, Sept. 30, for the resurfacing and oiling of Cooper Ave., from Reading pike to Montgomery pike, Sycamore township, under Specifications No. 106. Stanley Struble is President of the Board and Fred Dreihs is Clerk.

✣Bids will be received until Noon, Sept. 30, by the Board of County Commissioners Cincinnati, O., for the improvement under Specifications No. 890, of the Gurley Road from Queen City Ave., to Glenway Ave., in Green Township. Fred Dreihs is Clerk of the Board.

✣Bids will be received by the County Commissioners at Urbana, O., until October 1, for the construction of the Woodstock-Mechanicsburg pike running one mile south from Woodstock. Crushed rock will be used.

The county commissioners at Canton, O., are planning on getting an early start on the permanent improvement of highways to be made in 1911. It has been announced that the county's fund for such work will be the same as for 1910, which will admit of the improvement of between eight and nine miles of combination of dirt and brick paved roadway.

Property owners in High St., Columbus, O., recently held a meeting at the Northern Hotel with Service Director Holton and City Engineer Henry Maetzel to discuss the kind of paving wanted for North High St., which this fall is to be repaved from Fifth Ave., to Olentangy Park. Wood block will probably be accepted in preference to asphalt.

The county commissioners at Columbus, O., have awarded a contract for the improvement of section 1 of the Smith-Davis road, which runs from Worthington to Elmwood and then south, a total distance of 19,000 ft., to R. E. Keys for $8,400.

The county commissioners at Cincinnati, O., awarded the contract for improvement of Harrison and New Haven road to the John Ruebel Construction Co., for $29,267. The commissioners have also decided to relet the contract awarded last April to A. Deckebach & Co., for the improvement of Dog Trot road for $14,039.

The board of control of Springfield, O., has awarded a contract to Edward Ryan of that city for paving East High St., with Trinidad Lake asphalt for $24,878, including an 18-in. cement gutter, and for paving College Ave., with the same material for $11,167.

A pike of crushed stone will be built soon on the Urbana road, beginning at the Mechanicsburg, O., line and running one mile west towards Urbana, O. Specifications are being prepared by the state surveyor at Columbus, and bids for the work will be asked for soon.

The Union county commissioners, Marysville, O., have rejected a bid of $.74 per sq. yd., for repairing the Milford Center and Irwin pike. The bid was one-third higher than the estimate. Carbovia road material is to be used.

The board of control of Dayton, O., has awarded a contract for the paving of Monument Ave., from the M. & E. canal to Keowee St., to Joel O. Shoup for $26,146. Harris brick will be used with straight cement curb. The board also awarded a contract for the paving of Germantown St., from Euclid Ave., to the old corporation line to J. E. Conley Co., for $8,614. Timball brick with combined cement curb and gutter will be used.

W. S. Gregg of Zanesville and Wilson Yardley of Newark bid $4,178 and $4,352 respectively for the improvement of the Granville road by piking. J. C. Wonders, State Highway Commissioner, Columbus, O., awarded the contract to the low bidder.

An arrangement has been entered into by the county commissioners, Lisbon, O., and the West township trustees whereby the latter will grade and widen the state road at Baird's hill west of Moultrie.

County engineer French has submitted plans and estimates to the county commissioners at Lisbon, O., for grading the Thompson park Blvd., from East End, East Liverpool, to Riverview cemetery. The engineer has been authorized by the commissioners to prepare plans and make a survey for the grading and improving of Bunker hill on the country road leading from East Rochester to New Chambersburg.

City Engineer F. E. Weaver of Hamilton, O., has filed four sets of plans with the city council for the paving of F St., from Park Ave., to Ross Ave., and State St., from Court to High St.

Thomas Evans has been awarded a contract by Public Service Director Sundmaker, Cincinnati, O., for the improvement of Harrison Ave., from Fischer's west line to the west corporation line for $84,335. The street is to be paved with granite.

The board of control of Youngstown, O., has awarded the following contracts for paving work: Paving of West Woodland Ave., to Miller Bros., $7,578; paving and sewering of Thomas St., to J. P. Morrison, $2,315; paving of Ellenwood Ave., east of Erie St., to Kennedy Bros., $3,344; paving of Broadway to the Cleveland Trinidad Asphalt Paving Co. of Cleveland, $11,328; Davis St. retaining wall to James McCarron, $1,834.

The Board of County Commissioners at Cleveland, O., have awarded the following contracts for furnishing necessary material for the repair of Lorain Road on Rocky River

Items marked thus ✣ indicate work now open for bids.

bridge approach and at Kamms Corner, Rockport: Metropolitan Paving Brick Co., Canton, O., brick; Dan Pfahl, Cleveland, sand; Cleveland Builders' Supply Co., Cleveland, cement; Cleveland Macadam Co., Cleveland, slag. Bids were opened Sept. 10.

Advices from Columbus, O., state that the contract for the improvement of section 1 of the Smith-Davis road, which runs from Worthington to Elmwood and then south, a distance of 19,000 ft., has been awarded to R. E. Keys for $8,400.

Oregon.

Advices from Portland, Ore., state that East Morrison St., will be improved with hard-surface pavement between Union Ave., and the Morrison bridge approach next year.

The city of Corvallis, Ore., has decided to macadamize Eighth St. It is proposed to put in curbs, cement walks where necessary, grade and drain the street, excavate and put in sized gravel with crushed gravel or stone.

Medford, Ore., and other towns have promised the county commissioners an appropriation of $30,000 for the construction of a fine auto road to Crater Lake.

Pennsylvania.

The council of Punxsutawney, Pa., has granted petitions for the paving of Cranberry Alley and South Jefferson St.

Petitions have been circulated in Carlisle, Pa., for the paving of West Church Ave., from the Sentinel building to Pitt St. It is expected that North Hanover St.'s paving will be done next spring.

Bids will soon be asked by the city of Wilkes Barre, Pa., for the paving of South Main St., with asphalt. It is planned to have the street ready by Oct. 15.

Tennessee.

The City Commissioners of Memphis, Tenn., have awarded contracts for a number of street improvements upon the recommendation of City Engineer J. H. Weatherford as follows: East Lockett Pl. with macadam, to M. Larkin, $1,663. Concrete culvert work on Vinton from Diana to Rembert, to Lindsey Bros., $730. East St., from Coward to Union, to Memphis Asphalt Co., $22,142.80. Concrete work on Court Ave., bayou, to Clark Construction Co., $1,970. The ordinance for the improvement of Beale Ave. from Main St. to the Illinois Central right of way passed.

The citizens of Jellico, Tenn., have voted the issuance of bonds in the sum of $90,000 for waterworks and sewerage.

Texas.

Advices from San Antonio, Tex., state that it is proposed to build a macadam road from San Antonio to Corpus Christi on the gulf, and a road from San Antonio to Herrville, 75 miles into the mountains. The various counties have practically agreed upon a bond issue.

The voters of precinct No. 1, which includes Huntsville, Tex., and vicinity, have asked the county commissioners court of Walker county to order an election on a $50,000 bond issue, to be used in building good roads in the precinct.

Advices from Fort Worth, Tex., state that the Texas Commercial Secretaries' Association recently sent out inquiries to Commercial clubs throughout the state, asking for an estimate of money to be expended on the improvements to public highways during the year 1911 and the replies received indicate that there will be approximately $20,000,000 of bonds issued for building and improving public highways during the coming year.

The county commissioners of Wise County, Decatur, Tex., have decided to gravel the Oliver Creek road at an estimated cost of $1,500. Len. Hoyl of Decatur is interested.

The Polk county commissioners, Livingston, Tex., have ordered a new public road out from Livingston and Kountze road to the county line, two miles from Fugua.

Washington.

The board of public works of Spokane, Wash., has awarded a contract to Naylor & Norlin for grading and sidewalking Seventh Ave., Pittsburg to Perry St., for $11,383.

The Eagle Transfer Co., of Wenatchee, Wash., has been awarded the contract for the construction of five miles of state road, and will commence work at once.

Wisconsin.

✣Bids will be received until 10:30 a. m., Sept. 23, by the Department of Public Works, Milwaukee, Wis., for the repaving with Kettle River sandstone blocks, on the present concrete foundation, that portion of the north side of Chestnut St., from the curb line to a point 1 ft. outside of the outer rail of the street railway tracks from 3d to 9th St. H. E. Briggs is Commissioner.

Canada.

Six money by-laws, authorizing the issue of debentures totalling $196,000 have been voted on at Regina, Sask. The money will be distributed in the following improvements: Pavements, $132,000; fire protection, $16,000; sewers and waterworks extension, $20,000; sidewalks, $59,000.

WATER-WORKS AND SEWERAGE

Alabama.

✣Bids will be received until noon, Sept. 26, by Robert Tait, City Treasurer, Montgomery, Ala., for furnishing and installing on foundations to be furnished by the city, two 4,000,000 gal. electrically driven direct connected centrifugal pumps with motor; also for furnishing and installing an electrically driven direct connected air compressor with motor in the water works pumping station.

Arizona.

Joseph McCrappin, Little Rock, Ark., has been awarded a contract in Conway, Ark., for the construction of a complete waterworks system for $56,876. The work includes 15 miles of wood pipe mains, motor-driven triplex pumps, and a 6-mile transmission line. From a concrete reservoir the town will be supplied by gravity. Dickinson & Watkins, 609 State National Bank Building, Little Rock, Ark., are engineers. Bids were opened Sept. 15.

Arkansas.

The Pouncey Paving & Construction Co., of Helena, Mont., has been awarded a contract by the city of Searcy, Ark., for constructing sewers, and P. C. Brooks Sons of Kansas City, Mo., received the contract for installing a water system. The cost of the two systems will be about $80,000.

According to advices from Batesville, Ark., the contract for the construction of a sewer system in Newport has been awarded to Noble & Gardner of Paducah, Ky., for $33,645.

California.

✣Bids will be received until 11 a. m., Oct. 6, by the Board of Public Works, Oakland, Cal., for furnishing the necessary labor and materials for the construction of a storm sewer with appurtenances in Market and Seventh Sts., from the existing intercepting sewer in Second St. to the existing sewer in West St. Walter B. Fawcett is secretary of the board.

Olmsted & Gillelen, 604-5 Wright & Callender Bldg., Los Angeles, Cal., are designing a municipal water system for Kingsburg, Cal.

The City Council of Pasadena, Cal., has let the contract for the construction of the large reinforced concrete storm sewer to be erected in that city to M. L. Hostetter of Los Angeles for $162,800.

The city of Sonoma, Cal., has sold bonds in the sum of $20,000 for the construction of a modern sewer system. The citizens are also planning the construction of a water system.

Specifications for the Pearl St. sewer in Alameda, Cal., have been prepared by City Engineer I. N. Chapman. The sewer will extend along a route from Pearl St. to the center of Harrison Ave., on the tidal canal.

The City Council of San Diego, Cal., has passed an ordinance providing for the sale of bonds for water extensions, sewer systems in various portions of the city and park improvement for the Panama-California exposition.

Colorado.

W. P. Robinson, manager of the Denver Union Water Co., Denver, Colo., has announced that the company is having plans drawn by its engineers for extensive improvements to be made to the system during the coming year. The work includes the construction of a new main on East 14th Ave., between Humboldt and Logan Sts., and a 24-in. main on Speer Blvd. The improvements will cost approximately $100,000.

Connecticut.

The Water Board of New Britain, Conn., has awarded the contract to the water company for hauling 500 tons of stone at $1 per ton, for the paving at the new reservoir in the northwestern part of the city.

District of Columbia.

✣Bids will be received until 2 p. m., Sept. 22, by Commissioners of the District of Columbia, at Washington, for furnishing fire hydrants. Cuno H. Rudolph is one of the commissioners.

Florida.

✣Bids will be received until Oct. 4 by W. M. Bostwick, Jr., chairman Board of Bond Trustees for water works and improvement bonds, Jacksonville, Fla., for the necessary labor and material for the construction of a 3,000,000 gal. covered reinforced concrete reservoir on the water works grounds. R. N. Ellis, C. E., is superintendent.

Georgia.

The City Council of Americus, Ga., is considering having a bond issue for the extention of the sewerage system of the city.

Plans and specifications to establish an electric light and water plant and a sewerage system on the county alms house property, Atlanta, Ga., were submitted to the Fulton County Commissioners by Engineer P. H. Norcross. The improvement is estimated to cost from $17,000 to $20,000.

Illinois.

✣Bids will be received until 8 p. m., Sept. 23, by J. M. Farrell, City Clerk, Princeton, Ill., for the necessary labor and material for the construction of 3,476 ft. of 15-in. double strength tile sewer having an average cut of 14 ft. and located through private property, including 12 manholes and other appurtenances. W. S. Shields Co., 1201 Hartford Bldg., Chicago, Ill., is Engineer.

The Board of Local Improvements of Dixon, Ill., awarded the contract for the construction of the North Ottawa Ave., sewer to Rink & Schnell for $2,595.

The city of Rockford, Ill., will soon construct a sewer system in the northeast portion of the city, to drain practically all the territory north of State St., and East of Longwood. It will be a concrete tunnel 6 ft. in diameter for a mile from its outlet, and a concrete tunnel of slightly less diameter for almost another mile, dwindling to 42 in. in diameter before its character is changed to the vitrified sewer pipe. The total cost of the improvement is estimated at $107,200.

Following bids were opened by the Board of Local Improvements of Chicago, Ill., Sept. 7, for the construction of a sewer in W. North Ave., from N. 48th St., to N. 64th Ave., consisting of 10,550 lin. ft. of main sewer and 860 lin. ft. of wing sewer, the former ranging in size from 2 ft. to 4½ ft. in diam., the latter from 1¼ ft. to 2½ ft. in diam.; the contract being awarded to the lowest bidder: Thos Burke, 4648 McLean Ave., Chicago, $57,393; Tirtelli & Scully, 518 W. Taylor St., Chicago, $55,613; The Ryan Co., 133 LaSalle St., Chicago (awarded contract), $52,495; American Engineering & Construction Co., 112 S. Clark St., Chicago, $54,517; Federal Improvement Co., 953 Rookery Bldg., Chicago, $61,418. The work includes 53 manholes and 56 catchbasins.

The Board of Local Improvements of Chicago, Ill., Chas. A. V. Standish, Secretary, has awarded the contract for constructing the sewers known as the Belmont Ave. and Addison St. sewer, to Dennis Cleary, 5532 Winthrop Ave., Chicago, for $129,430. The work includes 19,140 lin. ft. of sewer ranging in size from 2 ft. to 6½ ft. in diameter. Bids for the work were opened Sept. 1.

The Chicago Bridge & Iron Co., Chicago, Ill., has been awarded a contract in Toulon, Ill., for the construction of a water tank and tower in connection with the water works for $3,790. W. S. Shield Co., Hartford Bldg., Chicago, engineers. Arthur Shuin, city clerk. Bids were opened Sept. 15.

Ordinances have been passed by the common council of Chicago, Ill., for the following improvement work: Burnside Ave., Cottage Grove Ave., St. Lawrence Ave., water pipes; North Avers Ave., Dickens Ave., Humboldt Ave., sewer; North 52d Ct., Grand Ave., Humboldt Ave., sewer; West 39th Pl., South Kedzie Ave., South Sacramento Ave., sewer; Avenue H, East 107th St., East 108th St., sewer; North Avers Ave., Greenwood Ter., Alley 1st south of Wrightwood Ave., sewer; Bernard St., Elston Ave., Irving Park Boul., water pipe; Byron St., North Hamlin Ave., North 40th Ave., water pipe; Christiana Ave., Elston Ave., Irving Park Blvd., water pipe; Gladys Ave., South 48th Ave., South 50th Ave., water pipe; East 90th St., St. Lawrence Ave., Dauphin Ave., water pipe; South Peoria St., West 119th St., West 122d St., water pipe: Superior Ave., East 132d St., East 136th St., water pipe; South Michigan Ave., East 68th St., East 71st St., water pipe; South Spaulding Ave., West 38th St., West 37th Pl., etc., sewer system; Dauphin Ave., East 87th St., East 92d St., etc., drains system; North Western Ave., Montrose Ave., Lawrence Ave., water pipes; Avenue "J," Indianapolis Ave., East 106th St., water pipes; Dauphin Ave., East 90th St., East 92d St., water pipes; East 87th St., St. Lawrence Ave., Dauphin Ave., etc., water system; North 40th Ct., Lawrence Ave., Ainslie St., sewer; George St., Elston Ave., North Western Ave., sewer; Oglesby Ave., East 79th St., East 78th St., sewer; North Avers Ave., Greenwood Terrace, 90 ft. N. of N. line of Wrightwood Ave., water pipe; East 91st Pl., Langley Ave., St. Lawrence Ave., water pipes; West 105th St., Vincennes Road, Prospect Ave., water pipe; Perry St., Cullom Ave., Melville Pl., water pipe; Coles Ave., East 82d St., East 81st St., sewer; South 48th Ave., West Jackson St., West Van Buren St., sewer; Humboldt Ave., North 44th Ave., North 43d Ave., sewer; South 48th Ave., West Monroe St. as aligned west of South 48th Ave., West Jackson St., sewer; Rice St., North Western Ave., North Campbell Ave., water pipes; North Whipple St., Addison St., Elston Ave., water pipes; West 105th St., Wentworth Ave., C. & W. I. R. R., water pipes.

Following bids were opened Sept. 9 by the Board of Local Improvements, Chicago, Ill., Chas. A. V. Standish, secretary, for the laying of water service pipes and furnishing necessary fittings, castings, etc.: S. Loomis St., 87th St. to 89th St., David Walsh, $0.69 per lin. ft.; John J. Renn, $.73 per lin. ft.; Daniel Hardin, $.72¼ per lin. ft.; W. North Ave., 48th Ave., to Central Park Ave., David Walsh, $.69½ per lin. ft.; Jno. J. Renn, $.69½ per lin. ft.; Daniel Hardin, $.69 per lin. ft.

The following bids were opened Sept. 10 by the Board of Local Improvements, Chicago, Ill., for laying water service pipes and furnishing necessary fittings, castings, etc., for the following streets: Chicago Ave., Kedzie Ave. to Western Ave., Daniel Hardin, $1.11 per lin. ft.; Jno. J. Renn, $1.09 per lin. ft.; David Walsh, $1.12 per lin. ft. Bidding price exceeds assessment and is to be readvertised. North Shore Ave., Evanston Ave. to Lake Michigan: Daniel Hardin, $.72 per lin. ft.; Jno. J. Renn, $.69 per lin. ft.; David Walsh, $.74 per lin. ft.; 79th St., Center Ave. to Morgan St.: Daniel Hardin, $.74¼ per lin. ft.; Jno. J. Renn, $.73 per lin. ft.; David Walsh, $.65 per lin. ft.

Indiana.

✣Board of Public Works, Indianapolis, Ind., will receive bids until 10 a. m., Sept. 28, for the construction of local sewer in and along alley west of East St. from Raymond St. to a point 895 ft. north thereof.

A contract for constructing a sewer east of Gary and Western embankment, Gary, Ind., has been awarded to Nash & Dowdle. W. E. Blunt has been awared a contract in Gary for the construction of sewer No. 11 for $7,871.

The contract for the construction of a sewer in Holiday St., from Case St. to Vail St., in Michigan City, Ind., was awarded to W. H. Bell & Co., for $.65 per ft.

The Board of Public Works of Evansville, Ind., has awarded a contract to John L. Newman for the construction of a sewer in block 55, Lamasco, for $.78 per ft. The board also issued an order for the construction of a main sewer in Governor St. to connect with the sewer in Lincoln Ave.

Carl Theile has been awarded the contract for the laying of a 12-in. sewer from the courthouse in Huntingsburg, Ind., at Jasper to the Patoka River for $1,288.

Iowa.

✣Bids will be received until 5 p. m., Oct. 5, by E. J. Parrott, Town Clerk, Ocheyedan, Iowa, for the construction of a water works system. The work includes approximately: One 12 to 15-h. p. geared base, or geared to a power working head, gasoline engine and deep well pump. Brick or concrete building 16x18 ft. outside dimensions, 8,300 ft. of 8, 6 and 4-in. pipe, valves and hydrants, 50,000-gal. steel tank and tower 110 ft. high and 8-in. deep well 250 ft. to 300 ft. deep. Oscar Claussen, St. Paul, Minn., is consulting engineer.

✣Bids will be received until 8 p. m., Sept. 26, by W. H. Leckey, City Clerk, Hampton, Iowa, for the construction of a reservoir and a sewage disposal plant.

The following contracts were awarded at Pella, Ia., for combined water and light plant; bids opened Sept. 6: Des Moines Bridge & Iron Co., laying 18,500 ft. of 10-in. pipe, $9,269; Des Moines Bridge & Iron Co., furnishing valves, hydrants and specials, $1,150; Des Moines Bridge & Iron Co., constructing filter gallery, well and pump house, $8,600; K. A. Verhey, constructing power house, $6,390; Des Moines Bridge & Iron Co., furnishing lead and jute, $1,500; Jos. E. Bortenlanger, Omaha, Neb., furnishing engines, boilers, generators, motors and all electrical apparatus, $21,652; Jos. E. Bortenlanger, furnishing two Triplex pumps, $3,590; Jos. E. Bortenlanger, three and one-half miles transmission line, $3,750; Jos. E. Bortenlanger, city lighting, line complete, $10,152; Jos. E. Bortenlanger, secondary wiring, $3,500; U. S. Cast Iron Pipe & Foundry Co., pipe at $24.00 per ton, $15,625; total $85,178. Murray Corliss Engine, Ideal High Speed Engine, Murray Boilers and Westinghouse Generators and motors will be used. A. C. Kuyper, City Clerk. Iowa Engineering Company, Clinton, Iowa, Engineers.

The City Council of Essex, Ia., has approved the plans and specifications prepared by Civil Engineer Delbert Wheeler of Clarinda for a sewer. Bids will be asked for soon on this work.

The City Council of Muscatine, Ia., has established Sub-Sewerage District No. 20 of Main 1, commonly known as the West Hill sewer.

Plans and specifications have been prepared for the construction of a sewage disposal plant for Hampton, Ia.

Belle Plaine, Ia., is planning on constructing a sewer system in the spring at an estimated cost of $40,000. Plans and specifications have been completed.

Kansas.

The City Council of Manhattan, Kan., has sold bonds for the construction of a sewerage system.

The citizens of Hutchinson, Kan., on Sept. 8, voted the issuance of bonds for the construction of a sewer system.

Petitions are being circulated in Wichita, Kan., asking the city commissioners to build another sanitary sewer that will be as extensive and cost as much as any of the other systems in the city. The new district comprises much of the northern part of the city, a strip about five blocks wide east of the drainage canal, and a large scope of territory in the vicinity of Harry St.

Manhattan, Kan., has sold bonds for the construction of a sewer system.

Kentucky.

✣Bids will be received until 11 a. m., Sept. 27, by the President of the Board of Water Works, at the office of the Water Company, 439 3d St., Louisville, Ky., for the intake crib and screen tower. Plans and specifications for the work may be obtained of Theodore A. Leisen, chief engineer and superintendent of the Water Company, Louisville, Ky.

L. Eady of Louisville, Ky., has secured the contract for erecting the chemical filtering purification and water softening plant for the city of Georgetown, Ky., for $17,096.

The City Council of Winchester, Ky., has awarded a contract to the Lewis Co. for the construction of the sanitary sewerage system for the city for $39,418.

Maryland.

According to advices from Baltimore, Md., the Warren F. Brenizer Co. has been awarded the contract for the construction of the Piney Branch trunk sewer by the Commissioners for $27,774.

The following have been appointed members of the sewerage commission of Easton, Md., and will draft plans and take charge of the building of a sewerage system: Gen. Joseph B. Seth, Alexander Fountain and W. H. Withgot.

The following bids were opened Sept. 7 by the Board of Awards, Baltimore, Md., on Sanitary Contract No. 55, lateral sewers in District No. 14, and Sanitary Contract No. 56, sewage pumping station, coal and ash conveying plant: Sanitary Contract No. 55—B. F. Sweeten & Sons, Baltimore, Md., $67,671; William McCarthy & Co., 1007 American Bldg., Baltimore, Md., $79,628; Irwin Bros., 330 N. Gay St., Baltimore, Md., $80,575; James Ferry & Sons, Louisville, Ky., $91,366. Sanitary Contract No. 56—Dietz Engineering Co., 50 Church St., New York City, $17,360; Mead-Morrison Mfg. Co., 149 Broadway, New York City, $19,800; Guarantee Construction Co., 140 Cedar St., New York City, $20,500; Conveying Machinery Co., 120 Liberty St., New York City, $29,179. Calvin W. Hendricks is chief engineer of the Sewerage Commission, Baltimore, Md.

Massachusetts.

The Sewer Commissioners of Springfield, Mass., have awarded the contracts for construction of a sewer in Everett St., and for furnishing the pipe as follows: Fred T. Ley Co., of Springfield, for the construction work, and C. C. Coates of Easthampton, for furnishing the pipe.

Advices from Greenfield, Mass., state that R. H. Newell & Co., of Uxbridge, has been awarded the contract for the new Green Riv-

Items marked thus ✣ indicate work now open for bids.

er intercepting sewer on a bid which places the cost of construction between $35,000 and $40,000. Daniel O'Connell's Sons, of Holyoke, bid between $38,000 and $39,000 and John J. Falvey, of Somerville, entered a bid which was in the vicinity of $43,000. The time specified for completion is June 1, 1911.

Michigan.

The Board of Public Works of Eaton Rapids, Mich., awarded the contract to Freever and Swift of that city for constructing the Water and Broad St. sewer for $5.44 per rod.

According to advices from Detroit, Mich., the Grosse Pointe Farms council held a meeting recently for the purpose of discussing the proposed extension of the new Jefferson Ave. sewer from the eastern city limits of Detroit to the village of Grosse Pointe Farms, an extension of three miles. The estimated cost of the improvement is $30,000. Frederick C. Shipman of Detroit is interested.

Minnesota.

✣City Clerk of Austin, Minn., will receive bids until 8 p. m., Sept. 28 (readvertisement), for the proposed changes to water works, including 14,500 ft. of 16-in. B. S. CI. Gravity pipe line and 290,000 gal. reinforced concrete reservoir. Plans are on file at the office of the Water & Light Board and O. Claussen, St. Paul, Minn., Consulting Engineer.

✣Bids will be received until 7 p. m., Sept. 30, by N. J. Anderson, City Clerk, Thief River Falls, Minn., for the construction of sewers. Duluth Engineering Co., Duluth, Minn., engineer.

The contract for laying new water pipes in Central Division No. 2, which was recently added to the city limits of Eveleth, Minn., has been awarded by the city council to the Pastoret & Lawrence Co., for about $9,000.

The Board of County Commissioners, Minneapolis, Minn., has awarded the contract for the establishment of a water plant at the poor farm to J. F. Gleason for $2,831. A 6-in. pipe will be laid.

The city of Wilmar, Minn., has voted the issuance of bonds for the construction of a sewerage system.

The citizens of Gilbert, Minn., have decided to bond the village for $35,000 for a sewerage system and to complete the local waterworks system.

The Board of Public Works of Duluth, Minn., has awarded the following contracts for sewer work: George R. King, sewer in Gladstone St., between 40th and 45th Aves., east for $3,000; George R. King, for sewering 30th Ave., west and Superior St., for $1,034; John A. Johnson, for laying stone gutters in 3rd St., between Mesaba Ave., and 9th for $1,175; Erickson & Lindrose, for sewering 7th St., between 2nd and 3rd Aves., for $585.

The city engineer of Duluth, Minn., has been instructed to prepare an estimate of the cost of building an outlet to the Woodland sanitary trunk sewer at Tischer's creek and St. Marie St., installing a septic tank at that point.

The Woodland sewer problem, Duluth, Minn., has been settled, and the plans have been agreed upon. The sewer is to be built according to the specifications prepared by the city engineer. As laid out, it starts in Woodland and follows a devious course to the lake, costing approximately $13,000.

The sale of $300,000 worth of bonds for the permanent improvement fund was recommended by the ways and means committee of Minneapolis, Minn., to the city council. The funds to be received from both issues will be for the construction of paving, sewers and curb and gutter.

C. R. McLean, of Duluth, Minn., is the probable contractor for the [illegible] concrete settling basins in Chisholm, Minn., for $10,480. Bids were opened Aug. 17.

Mississippi.

The county commissioners of Holmes County, Lexington, Miss., have awarded a contract to D. E. McLean & Sons of Cruger, Miss., for the working of the public roads in the Cruger and Ashton precincts, District 5, for a period of four years for $3,900. Bids were opened Sept. 5.

A water company has been chartered, which will furnish water to the town of Carey, Miss., by T. H. Powers, B. Goodman and W. P. Dawson, all of Carey. The company is capitalized at $15,000.

Missouri.

The citizens of Illimo, Mo., held a special election Sept. 10 and voted the issuance of bonds to the amount of $5,000 for the purpose of installing a public sewer and other street improvements.

The board of public works of St. Joseph, Mo., has ordered the city engineer to prepare an ordinance for water mains in Edmond St., 29th to 31st Sts.

C. H. Green, of Carthage, the supervising engineer for the installation of the Carthage, Mo., municipal water system, has secured the contract for drawing the plans and specifications for the proposed municipal water plant at Pittsburg, Kan., and will have the contract for supervising the construction of the plant.

Residents of the northeast and southwest section of Springfield, Mo., have filed a petition with City Clerk G. W. Hackney, asking for relief from the conditions which now prevail. This petition was filed with a view of calling to the attention of voters of the city the importance of passing that clause in Mayor R. E. Lee's proposed bond issue which provided $100,000 for the building of septic tanks at the sewer outlets in the city.

The city council of St. Joseph, Mo., has awarded a contract for the construction of a system of drains that will connect with the Grand Ave. main sewer between 20th and 22nd Sts., and extend northeast through every part of the restricted district of Lovers' Lane Place, Kenwood Heights and adjacent tracts, to Oscar Schmidt for $6,604.

Property owners in the vicinity of Clifton Heights, St. Louis, Mo., are discussing the proposed extension of the Clifton Heights sewer.

Montana.

Plans are being worked out by which the wooden water mains now in use in the gravity waterworks system at Lewiston, Mont., will soon be replaced by iron. The change to iron pipe will cost about $75,000.

Contracts involving the expenditure of nearly $50,000 for improvements at Fort Missoula, Mont., have been awarded as follows: John P. Grady of Missoula, water distributing system, to be completed in three months, $16,000. J. P. Adamson of St. Paul, sewer system, to be completed in four months, $15,820. P. A. Harrington of Missoula, reinforced concrete pumping plant building, $3,700. Anaconda Copper Mining Co. of Butte, pumping machinery, $6,975. Miricle-Tripp Co. of Missoula, walks and curbs, $5,363.50. This means that the improvements of the Fort, which will be extensive in nature, will be completed this fall.

Nebraska.

The City Council of Grand Island, Neb., has entered into a contract with an engineering firm of Kansas City, Mo., for plans and specifications for water works improvement, and a general plan for such improvement was adopted. The plan contemplates the purchase of at least a block of real estate in the northwestern part of town for a new plant, the enlarging of the mains in the business and a large portion of the residence portion, and an increased water pumping capacity. A bond issue for the improvements will be voted upon soon by the voters.

The Omaha, Neb., Water Board has authorized an issue of $6,500,000 water bonds of the city for the purchase of the waterworks of the city.

J. P. Crick, Civil Engineer, Omaha, Neb., has been awarded the contract by the city of Florence, Neb., to draw up a complete set of plans and specifications for a sewer system extending from Briggs St., to Jackson Prospect to the settling basins and along Washington St. to the river.

The Omaha Construction Co. has been awarded a contract in Fremont, Neb., for the construction of the 17th St. sewer for $3,958. The Crane Co., of Omaha, was given the contract for 2,400 ft. of 4-in. water pipe for $30 per ton.

The City Council of Lincoln, Neb., adopted a resolution providing for the installation of the sewer from 27th St., and Randolph St., to the Antelope.

Contracts for material for the construction of the 17th St. sewer system in Fremont, Neb., have been let by the city council as follows: Crane & Co., of Omaha, $30 per ton for pipe and $.03 per lb. for fittings; Omaha Construction Co., for $3,958 for the construction of the sewer system.

Katz Craig Construction Co., of Omaha, Neb., has been awarded a contract in Cozad, Neb., for the construction of a waterworks system for $34,400. Bids were opened Sept. 2nd.

New Jersey.

✣Bids will be received until 8 p. m., Sept. 26, by City Council of Atlantic City, N. J., for the construction of the storm water drainage system for the city. The work to be done will be let in two separate contracts, separate proposals to be submitted for each, although both contracts may, at the option of the City Council, be awarded to the same bidder. Contract "A" embraces the building of approximately 200 lin. ft. of reinforced concrete conduit, 15 ft. wide by 10 ft. 6 in. high; 9,450 lin. ft. of reinforced concrete conduit, 10 ft. 6 in. wide by an average of 9 ft. high; 964 ft. of brick concrete and terra cotta pipe drains from 5 ft. wide by 2 ft. high to 15 in. in diameter, together with manholes, catch basins, storm-water inlets and the necessary timber and pile foundations. Contract "B" embraces the building of approximately 10,390 ft. of lateral drains, consisting of brick and concrete, and terra cotta pipe, from 4 ft. wide by 2 ft. 9 in. high to 12 in. in diameter, together with manholes, catch basins, storm-water inlets and the necessary timber and pile foundation. Specifications and blank forms of proposals can be obtained of the City Engineer, E. D. Rightmire, and a full set of plans can be obtained from him for the sum of $15.00, such sum to accompany the order. Specifications and plans can also be seen at the office of T. Chalkley Hatton, Consulting Engineer, Wilmington, Dela.

✣Bids will be received until 8 p. m., Sept. 27, by City Council, Woodbury, N. J., for the construction of about 7,700 ft. of 8-in. vitrified pipe sewers with manholes and flush tanks, and a pumping station equipped with duplicate rotary pumps, and electric motors, automatically controlled and about 1,100 ft. of 6-in. cast iron force main. Plans and specifications are on file at the office of Arthur Starr, City Clerk, or the office of the consulting engineer, City Wastes Disposal Co., 156 5th Ave., New York.

✣Bids will be received until 8 p. m., Oct. 3, by the City Council of Plainfield, N. J., for the construction of sanitary sewers and pumping station, according to plans and specifications on file at the office of engineer, 151 North Ave., Plainfield, N. J. The work includes the following approximate quantities: 12,140 ft. 8-in. vitrified pipe sewer, 5 to 10 ft. deep; 2,125 ft. 8-in. cast iron pipe sewer, 5 to 12 ft. deep; 1,170 ft. 10-in. cast iron pipe sewer, 5 to 16 ft. deep; 28 standard manholes; 9 special manholes; 13 flush manholes; 10 drop connections; 370 branches on 8-in. vitrified pipe sewer; 42 crosses on 8-in. cast iron pipe sewer; 14 crosses on 10-in. cast iron pipe sewer; 1,520 4-in. vitrified pipe house connections; 20 ft. 4-in. cast iron pipe house connections; 250 ft. 10-in. vitrified overflow pipe; 3,645 ft. 8-in. cast iron force main, straight pipe; 12 8-in. cast iron eighth bends; 3 10-in. flap valves; 4 10-in. sluice gates; 2 storage tanks; 2 operating vaults and buildings; also (in the same proposal or in separate bid), two pumping plants, complete, including motors, compressors and pumps, lifts or ejectors, in

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duplicate [illegible] pipe connections, complete.

The Passaic Valley Sewerage Commission of New Jersey has sent out from Newark, to the mayors and governing bodies of each municipality lying wholly or in part within the Passaic Valley sewerage district the form of contract for joining in the project for the disposal of sewage by means of a large trunk sewer, the outlet of which is to be in New York bay.

New York.

✣Bids will be received until 8 p. m., Sept. 27, by Frank Dinsmore, Clerk of Village of Bronxville, Westchester County, N. Y., for furnishing the necessary labor and material for the construction of an 8-in. sewer in Palmer Ave., starting about 187 ft. west of Front Ave. and running west along Palmer Ave. about 477 ft. to the Bronx Valley sewer, with necessary flush tanks, manholes and other appurtenances.

The citizens of Oriskany Falls, N. Y., have voted in favor of the issuance of bonds in the sum of $30,000 for the establishment of a gravity system of waterworks.

The Village Board of Westfield N. Y., called an election on Sept. 13 to vote on the issuance of bonds in the sum of $100,000 for the erection of a disposal plant and to lay mains over a large portion of the village.

Jeremiah Augar has been awarded a contract by the Board of Contract and Supply of Utica, N. Y., for constructing a sewer in Varick St., from a point about 40 ft. northerly of Columbia St., to Lafayette St., for $869.

The following bids were received Aug. 25 by the city of Canajoharie, N. Y., for the construction of the water works system, for which Vrooman & Perry are the engineers: Welles, Boughton & Co., Troy, N. Y., $49,869; W. D. Goodale, $50,896; B. G. Coon Construction Co., $58,322; John C. Tierney, $69,978; Thomas Boye & Co., $70,508. The contract was awarded to the lowest bidder. The following bids were received at the same time for furnishing material for the above work: A. Wyckoff & Son, Elmira, N. Y., $38,608, on wood stave pipe (awarded contract); Michigan Pipe Co., $40,978, wood stave pipe; Eastern Mfg. Co., $40,830, wood stave pipe; Chas. Miller & Son Co., Utica, N. Y., $8,536, on cast iron pipe; United States Cast Iron Pipe & Foundry Co., $8,598, on cast iron pipe; Donaldson Iron Co., $8,911, on cast iron pipe; R. D. Wood & Co., $8,964, on cast iron pipe.

The Woodside Improvement Association, of Woodside, N. Y., has awarded a contract for the construction of a private sewer in Woodside to Eveline Bros., of Waterford, N. Y., for $60,000. The sewer will be laid on the following streets: From Jackson Ave. and Broadway, where the main connections will be made. Thence it will be extended through Woodside Ave. to Riker Ave., through Riker Ave. to Kelly Ave., thence through Kelly Ave. to Woodside Ave. The sewer will also be laid on First, Second, Third, Fourth and Fifth Sts., Betts Ave., Greenpoint Ave., Cleveland Ave., Grand Ave., Lincoln Ave., Hancock Ave. and Cameron Terrace.

The board of public works of Geneva, N. Y., has four propositions which it wishes to submit to the voters at a special election. The propositions collectively call for an expenditure of $162,000 and are divided as follows: For the construction of a complete filtration plant and the acquiring of the land necessary, $40,000; for the construction of a new 20-in. force main from the pumping station to the reservoir and the acquisition of the necessary land, $37,000; for the construction of a new concrete storage reservoir, seventy-five ft. above the present reservoir, $30,000, and for the purchase and installing of a new pump with a capacity of 4,000,000 gallons of water daily, $35,000.

Reuben R. Lyon, acting as attorney for certain property holders in East William St., Bath, N. Y., is circulating a petition, asking for a special election to determine the attitude of pr[illegible] tive to the extension of water mains into certain new quarters of the village.

The board of trustees of Canajoharie, N. Y., called a special election on Sept. 12 to submit the following proposition to the voters for their approval: Whether $50,000 may be raised for the purpose of establishing a system of waterworks for supplying the village, this amount to be used and expended in addition to the sum of $150,000 heretofore appropriated, or whether bonds should be floated in like amount for the same purpose.

The board of contract and supply of Utica, N. Y., has approved plans for a sewer in Varick St., from Columbia St., to Lafayette St.

Ripton & Murphy have been awarded the contract in Rochester, N. Y. for the trenching and laying of pipe to supply Hemlock water to the State Industrial School colony at Rush for $6,164.

The board of contract and supply of Rochester, N. Y., has awarded a contract for a brick pavement in Genesee St. , between Brooks and Elmwood Aves., and for an asphalt pavement on the driveway in the rear of Convention Hall to Whitmore, Rauber & Vicinus for $21,541, and the Rochester Vulcanite Pavement Co., for $2,216, respectively.

Ohio.

✣Bids will be received by the Board of Trustees, of Public Affairs, Port Clinton, O., until noon, Sept. 22, for the construction of a filtration plant for the village. The work to be done includes the necessary excavation, the construction of the coagulating basins, clear water basins, filters, buildings, coagulatting devices, machinery, pipe, etc., the same forming parts of a filtration plant capable of purifying one and one-half million gals. net of water per day. Copies of the plans, proposal forms, specifications and forms of bonds and contract can be seen at the office of the Board of Trustees of Public Affairs, Port Clinton, Ohio, or at the office of the Consulting Engineer, Wm. G. Clark, 1050 Spitzer Bldg., Toledo, Ohio.

✣Bids will be received at the office of J. C. Steinicke, Clerk of the village of Nottingham, O., by the Council, until noon, Sept. 24, for the construction of sanitary sewer in Sackett Ave., from the West corporation line to a point 1,250 ft. east of Moses Aye. J. B. Davis & Son, 207 The Arcade, Cleveland, O., are Engineers.

✣Bids will be received by H. T. Marsh, Clerk of village of Oberlin, O., until noon, Sept. 25, for furnishing the necessary labor and material for the construction of a sewer on Hollywood St. in the village.

Oklahoma.

✣Bids will be received by City Clerk Alva, Okla., until 4 p. m., Oct. 4, for the construction of a steel water tank to cost $8,000. Specifications are on file at the City Clerk or City Engineer, A. K. Hubbard.

✣City Clerk of Alva, Okla., will receive bids until 4 p. m., Oct. 4, for the construction of water main extensions aggregating about 6,600 ft. A. K. Hubbard is City Engineer.

Pennsylvania.

✣Bids will be received until 2 p. m., Sept. 28, by Commissioners of Water Works, Erie, Pa., for cementing settling Basin No. 1. The work will consist in grading and cementing settling Basin No. 1 on Presque Peninsulas, the dimensions of which are 620 ft. x 430 ft. x 14 ft. deep. George C. Gensheimer is secretary of the commission.

✣Bids will be received by H. L. Donaldson, Secretary, West View, Pa., Allegheny County, Pa., until noon, Oct. 1, for the construction of main sewers and disposal plant. Trimble & Miller, Engineers, 4th Ave., Pittsburg, Pa., have plans and specifications for the work on file.

South Carolina.

✣Bids will be received until 8 p. m., Sept. 27, by City Council of Sumter, S. C., for furnishing all material and labor for the construction of a sanitary sewer extension at Sumter, S. C. The work consists approximately of 6,000 ft. of 22-in. pipe with appurtenances and one septic tank complete of steel and concrete. Plans and specifications are on file at the office of W. L. Lee, City Engineer. L. D. Jennings is Mayor.

South Dakota.

✣Bids will be received until 7:30 p. m., Oct. 5, by Board of Trustees, Bradley, S. D., for the construction of a complete sewer system of water works, including 50,000 gal. elevated steel tank on a 100 ft. steel tower; the construction of a concrete and brick pump house and fire station; the furnishing and installing of a deep well pump; a gasoline or crude oil engine; also furnishing and laying approximately 7,000 ft. of 2-in. to 8-in. cast iron water mains and setting hydrants, gates, etc.

Texas.

✣Bids will be received by the Commissioners, Galveston, Texas, at the office of John D. Kelley, City Secretary, until noon, Sept. 29, for the construction of a 30-in. cast iron water main 96 ft. long, laid at the depth of 15 ft. mean low tide, between draw bridge piers of Galveston County Causeway. A. T. Dickey is City Engineer.

Washington.

✣Bids will be received until Sept. 22 by the Board of Public Works, Spokane, Wash., for the construction of the 5th Ward Grand trunk concrete sewer. The sewer will traverse east and west the entire North Side and is calculated to drain all of that part of the city lying north of Carlyle. The pipe will begin at the corner of Illinois and Regal St. and empty into the Spokane River near Fort Wright. It will serve about one-third of the city.

Wisconsin.

✣Sealed bids will be received by Clarence Schoenike, City Clerk, Oconomowoc, Wis., until 4:30 p. m., Oct. 3, for drilling a 16-in. well 800 to 1,000 ft. deep. Certified check for $250 must accompany each bid. Specifications may be obtained from the clerk or W. G. Kirchoffer, Engineer, Madison, Wis.

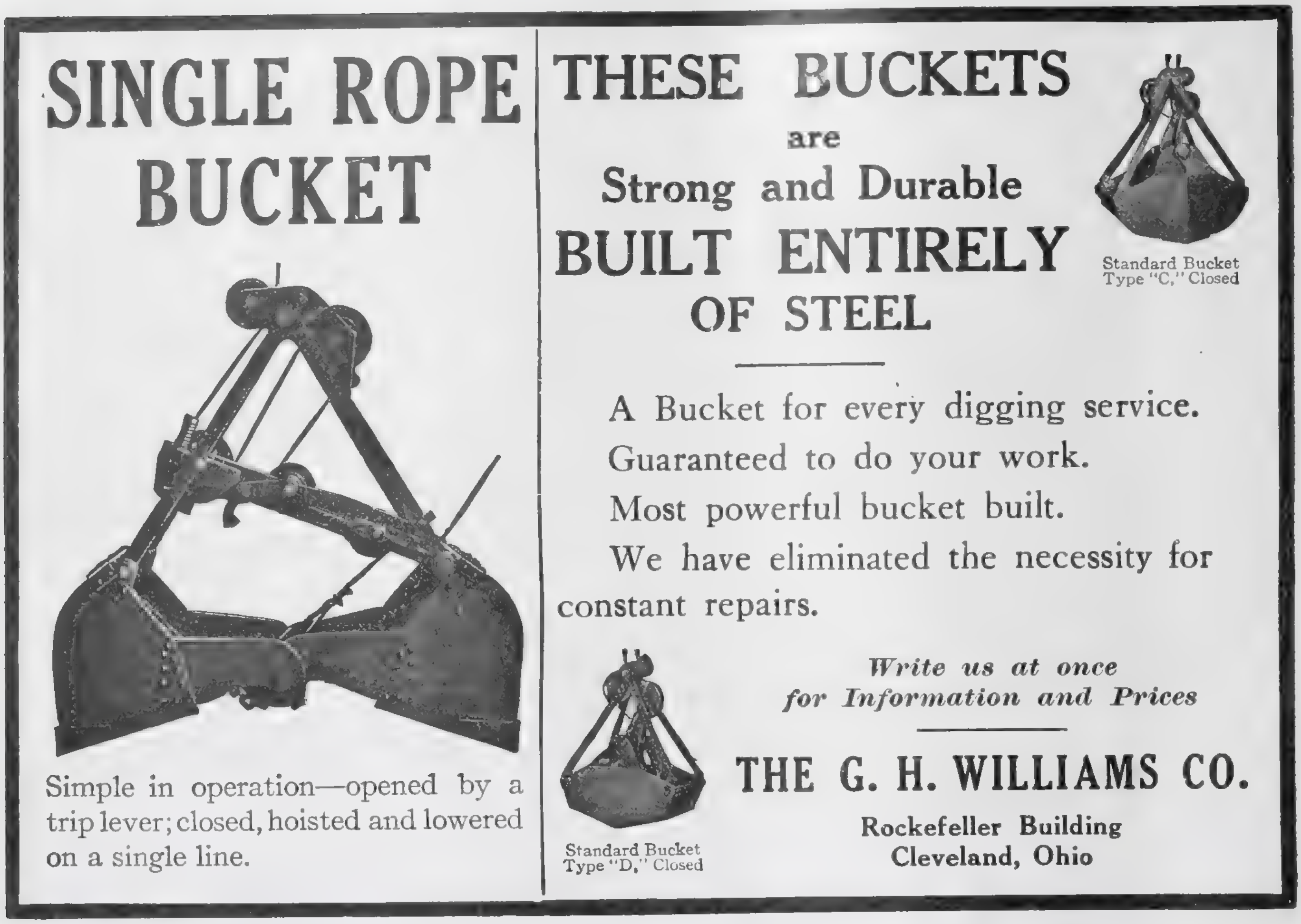
✣Board of Public Works, Waukesha, Wis., will receive bids until 2 p. m., Sept. 26, for furnishing all material and labor for the construction of the following sections of pipe sewer: Commencing at the manhole at the center of Hartwell Ave., and Grove Ave., and running thence easterly on the center line of said Grove Ave., to the east line of the Walnut Heights addition, a total distance of 331 ft. approximately, together with all the necessary Y conections and one manhole. Morgan R. Butler is Chairman of the Board.

Canada.

✣Bids will be received until 11 a. m., Sept. 21, by the Board of Control, J. T. McLaren chairman, for the construction of the following sewers at Hamilton, Ont.: Main St., from Locke St. to west end main sewer; Greig St., from Little Greig St. to Barton St.; Sherman Ave., from Brant St. to Grand Trunk Ry. tracks; Ravenscliffe Ave., both branches; Aberdeen Ave., Hyde Park Ave. to Chedoke Ravine; MacDonald Ave., from Aberdeen Ave. to Stanley Ave., and on Stanley Ave., from MacDonald Ave. to Garth St.; Chedoke Ave., Aberdeen to Hillcrest Ave.; Flatt Ave., Aberdeen Ave. to Hillcrest Ave.; Hyde Park Ave., Aberdeen Ave. to Hillcrest Ave.; Aberdeen Ave., Garth St. to Hyde Park Ave.; Glen side Ave., Garth St. to Chedoke Ave.; Hillcrest Ave., Garth St. to Chedoke Ave. Plans and specifications and other information can be obtained at the office of the City Engineer. S. H. Kent, City Clerk.

✣Bids will be received until 8 p. m., Sept. 27, by G. W. Bilbrough, Secretary-Treasurer Swift Current Sask., for the following contracts: Contract "C," power-house; contract "D," settling tank and intake; contract "E," pumping machinery (compress system); contract 'F," electrical machinery; contract "G," producer gas plant. A. W. Snider is Mayor. J. Darlington Whitmore, 104 Willoughby & Duncan Block, Regina, Sask., is Engineer.

Items marked thus ✣ indicate work now open for bids.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REINFORCED CONCRETE GIRDER BRIDGE.

Waukesha, Wis.

Sealed proposals for the construction of a reinforced concrete girder bridge will be received by the Board of Public Works on Oct. 3, 1910, at 2 o'clock p. m. Engineer's estimate: 260 cu. yds. concrete, 18½ tons reinforcing steel, 372 sq. yds. brick paving.

THE KAW VALLEY DRAINAGE DISTRICT OF WYANDOTTE COUNTY, KANSAS.
ADVERTISEMENT.
OFFICE OF KAW VALLEY DRAINAGE BOARD.

Kansas City, Kans., Sept. 12, 1910.

Sealed proposals in duplicate for the purchase of $300,000 of 5 per cent bonds of Kaw Valley Drainage District and for construction of about 662,800 cu. yds. levee work, 118,800 sq. yds. revetment paving, 10,600 lin. ft. willow mattress, 2,175 lin. ft. 3-row pile dike, 1,600 lin. ft. (2,600 cu. yds.) concrete culvert, and 5,975 lin. ft. concrete wall (3,920 cu. yds.), and other work along the left bank of Kansas River from Mattoon Creek to mouth and along right bank Turner Bridge to mouth, will be received at this office until 2 o'clock p. m., October 12, 1910, and then publicly opened. Information furnished on application.

W. H. DANIELS,
President of Board.

U. S. ENGINEER OFFICE, Wilmington, N. C., Sept. 20, 1910. Sealed proposals for dredging in Trent River, New River and Waterways to Beaufort, N. C., will be received at this office until 12 m., Oct. 20, 1910, and then publicly opened. Information on application. EARL I. BROWN, Capt., Engrs.

STORM SEWERS.

Muskogee, Okla.

Sealed proposals for storm sewer, District No. 12, will be received by the City Clerk, Muskogee, Okla., until 5 o'clock p. m., October 17, 1910.

The work consists of 2,000 cu. yds. brick or concrete masonry in three (3) foot to five (5) foot sewers. 20,000 cu. yds. of excavation and 16,000 feet of tile pipe, 12 inches to 33 inches, with all necessary manholes and other appurtenances.

The above work will be paid for by special tax warrants, payable in three equal yearly installments and bearing interest at eight (8) per cent.

Plans and specifications may be seen at the office of the City Engineer or may be secured upon payment of $5.00.

All proposals shall be made on the blank forms furnished by the city for the purpose and shall be accompanied by a certified check for $5,000.00, drawn to the order of the City of Muskogee.

The Council reserves the right to reject any and all bids.

CHAS. WHEELER, JR., City Clerk.

U. S. ENGINEER OFFICE, Duluth, Minn., Sept. 19, 1910. Sealed proposals for furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich., will be received here until noon, Oct. 19, 1910, and then publicly opened. Information on application. GRAHAM D. FITCH, Lt. Col., Engrs.

U. S. ENGINEER OFFICE, Wilmington, N. C., Sept. 14. 1910. Sealed proposals for dredging in Cape Fear River, N. C., will be received at this office until 12 m., Oct. 14, 1910, and then publicly opened. Information on application. EARL I. BROWN, Capt., Engrs.

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U. S. ENGINEER OFFICE.—Duluth, Minn., Aug. 23, 1910. Sealed proposals for furnishing and placing granite riprap at the upper entrance to Portage Lake Canals (Keweenaw Waterway), Mich., will be received here until noon, Sept. 23, 1910, and then publicly opened. Information on application. GRAHAM D. FITCH, Lt. Col., Engrs.

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Developments of the Freight Rate Hearing Regarding the Physical Valuation of Railways.

In all the hearings, so far held by the Interstate Commerce Commission the railway companies have sought to justify their demand for increased rates solely on the undoubted evidence that the cost of labor, materials and supplies has increased. Consistently with this attitude they have fought against the recognition, as having any bearing on the case, of physical value of railway property. Conversely the attorneys of the shippers have shown a plain disposition in their argument and cross-questioning to hold physical value as an important factor in deciding whether or not the railways are earning all the money to which they are entitled. At the present hearing in Chicago this contention was given definite form in petitions presented to the Commission by two important organizations of shippers. One of these petitions was read into the record over the objection of the railway attorneys and the other was laid on the table by the Commissioners. The case of the shippers as presented in these petitions may be summarized as follows:

That a determination of whether the railroads are earning as much money as they are entitled to should not be answered until the present value of the properties is ascertained.

That in determining the present value of the railroads' properties the "unearned increment" in the value of real estate should be excluded.

That the percentage of earnings of railroads should not be greater than the average earnings of principal industries in the territory supplied by each.

Specifically, these contentions are distinctly partisan; numbers 2 and 3 are decidedly radical and we do not think that they can be maintained fairly. It is not with the specific nature of these contentions that we propose to deal here, but with their revelation of the growing sentiment that a physical valuation of American railways is an essential step in adjusting their affairs with the people. We have already spoken at length on this question but the subject is one which will endure repetition.

With its new powers over railway rates the Interstate Commerce Commission will have to deal with repeated cases in which the shippers on one hand will contend that the railways are seeking returns on inflated values while the railways on the other hand will contend that based on the reproduction value of their physical properties their returns are not only moderate but often inadequate. There is but one means of deciding justly between the two contentions and that is to have a physical valuation made of the properties in question. As one of the shippers' attorneys aptly stated at the Chicago hearing: "We submit that the question of what a reasonable earning power may be, cannot be answered without finding the value of the properties, and we protest that this value cannot be obtained accurately from opinions of officials. If such opinions are accepted they should come from engineers and be contained in statements that can be verified." The Interstate Commerce Commission has repeatedly urged the advantages to be had in the work of the Commission by an appraisal of the railways. If such an appraisal was needed in the past it should be many times more necessary with the new and wider powers which the Commission has received.

The opposition to a Federal appraisal comes from two principal sources: First, the belief of Congress that its accomplishment is a task requiring many years and enormous expense, and second the fear of the railways themselves that the results of such appraisal will reduce their earnings. The first of these reasons is easily demolished. As we pointed out in our issue of Aug. 3, 1910, the experience of the several states which have made appraisals indicates that about $10 per mile will cover the cost, or say $3,000,000 for all the railways of the country. As to the question of time, it has taken from 12 to 24 months, only, for any of these states to complete its appraisal work, and it should take no longer per man per mile to do the work for the whole United States, so that the time required will be simply a question of the force employed. With a proportionately larger force 200,000 miles can be appraised in the same time as 2,000 miles. There is certainly nothing appalling in the cost named or in the time involved in getting the valuation figures available for use. A moderate hunk out of the "pork barrel" of river and harbor improvements would suffice to meet the bills for a Federal appraisal of the railways.

The fear of the railways is an obstacle which cannot be so readily set aside. Consider the contentions which we quote above of the shippers at the Chicago hearing that in determining the present value of the railway's properties the "unearned increment" in the value of real estate shall be excluded and that their percentage of earnings shall not be greater than the average earnings of the principal industries in the same territory. It is not remarkable that the railways should suspect the fairness of an appraisal the demand for which is coupled with such contentions. A fair and reasonable position toward the valuation of their lands once taken and demonstrated to the railways would, we believe, remove much of their opposition to physical valuations.

In conclusion we express our belief again that it was a mistake not to have provided for a physical valuation of railways in the Mann-Elkins bill extending the power of the Interstate Commerce Commission over railway rates. This mistake should be rectified at the next session of Congress. The valuation of railway properties is bound to come. If the Federal government does not undertake it, the individual states will do so one after another and each in its own way and with its particular purpose alone in view. Already seven states have made or are making such appraisals covering some 50,000 miles of railway as outlined in detail in our issue of Aug. 3.

A Notable Street Railway Appraisal.

In another part of this issue we begin the publication of the principal data obtained by the appraisal of some 123 miles of electric street railway in the outlying districts of Chicago. The data given cover track and power plant equipment; a succeeding issue will summarize the data on transmission, line and rolling stock. Obviously the condensation of a report of 750 pages to within the limits of space available in an engineering journal necessitates much elimination of detail, but for the main tangent track, the figures that we give are substantially complete and the same is true of the power house equipment. This appraisal is notable for several reasons. Its great detail is one, and the minuteness of the property inventory is another. It stands apart from other appraisals, however, in the determination of what is called the rehabilitation value or capital account value of the property, and this feature deserves some explanation.

The capital account value of the property has been determined on the basis of premises included in the ordinance under which the Chicago Railways Co. acquired that part of the property of the Chicago Consolidated Traction Co. inside of the city limits. Under these premises the value to be returned for the various items of the property are made the values of these items for rehabilitation purposes. In compliance with the ordinance, certain rehabilitation work must be done at once, and additional rehabilitation work within the succeeding one or two years. In case part of the property is to be rehabilitated on or before Feb. 1, 1911, the scrap or second-hand value of the property at that time is determined and to this value has been added an amount equal to the wearing value of the property from Nov. 1, 1909, to Feb. 1, 1911, which sum then becomes the present value of this item of property for rehabilitation purposes as of Nov. 1, 1909.

In case of those portions of the property that are to be rehabilitated during the year 1911, a similar procedure was adopted, two years additional wearing life being added to the scrap or second-hand value of the property as of Nov. 1, 1911. To determine the present rehabilitated value during the year 1912, three years wearing life was added.

In case of property such as track on which semi-rehabilitation is contemplated, namely, the provision of a new substructure under rails that at present are not sufficiently worn to require their removal, the going value of the property was returned as the rehabilitation value. This was done on the assumption that the Railway Company will realize the full remaining wearing value in the rail; moreover, that it would also realize the full remaining value in the ties and substructure, that is, the ties have already been depreciated to as amount which corresponds to their present condition, and that in case of removal either in the near future or at a later date, whatever life remains in the ties would be realized in the form of a small percentage of ties that can be used for track renewals elsewhere.

This method has been applied to all parts of the property which must be rehabilitated in order to comply with the terms of the ordinance. On this basis it has been estimated

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that approximately 29 miles of track would be rehabilitated before Feb. 1, 1911, and that 87 miles would be rehabilitated in 1912, and that 39.59 miles would be semi-rehabilitated, the date at which this latter work is done having no bearing on the value returned on the property. The balance of the track consisting of 15.27 miles recently rebuilt under the specifications of the Board of Supervising Engineers, and 15.21 miles of track that is considered satisfactory in its present condition, and .587 miles of track that is to be removed from the street, complete the total wreck mileage inside of the city limits.

The further requirements of the ordinance as to rehabilitation were in connection with the cars to be operated over the tracks of the company contemplated that ultimately not more than 50 closed and 50 open single truck motor cars should be operated by the company. The rehabilitation value was returned on the assumption that the company might permanently retain in operation the 100 cars above referred to, and that it may retain in operation for one year 72 cars in addition to the above, and that it might retain in operation for two years 36 cars of the above 72, and that it should immediately dispose of all remaining passenger car equipment at second-hand or scrap value. Similarly, for miscellaneous cars the company is allowed to retain such sprinklers and sweepers as are in satisfactory condition at their present value and is required to dispose of the balance of the equipment at second-hand or scrap value. The passenger cars in this case were proportioned between the lines outside the city and inside the city in proportion to small cars operated outside and inside. The miscellaneous cars that have been retained were proportioned between the lines outside and inside in proportion to track mileage. In case of power plants it is assumed that the California Ave. power plant will still operate, and for this reason is given its going value for rehabilitation purposes. In case of the Edgewater power plant, the operation of which is not economical, it is assumed that it will be discontinued as soon as substations can be provided, and for this purpose this power plant equipment was given its second-hand value as of 1911, to which was added two years' wearing value of the plant as a whole to determine the rehabilitation value as of Nov. 1, 1909.

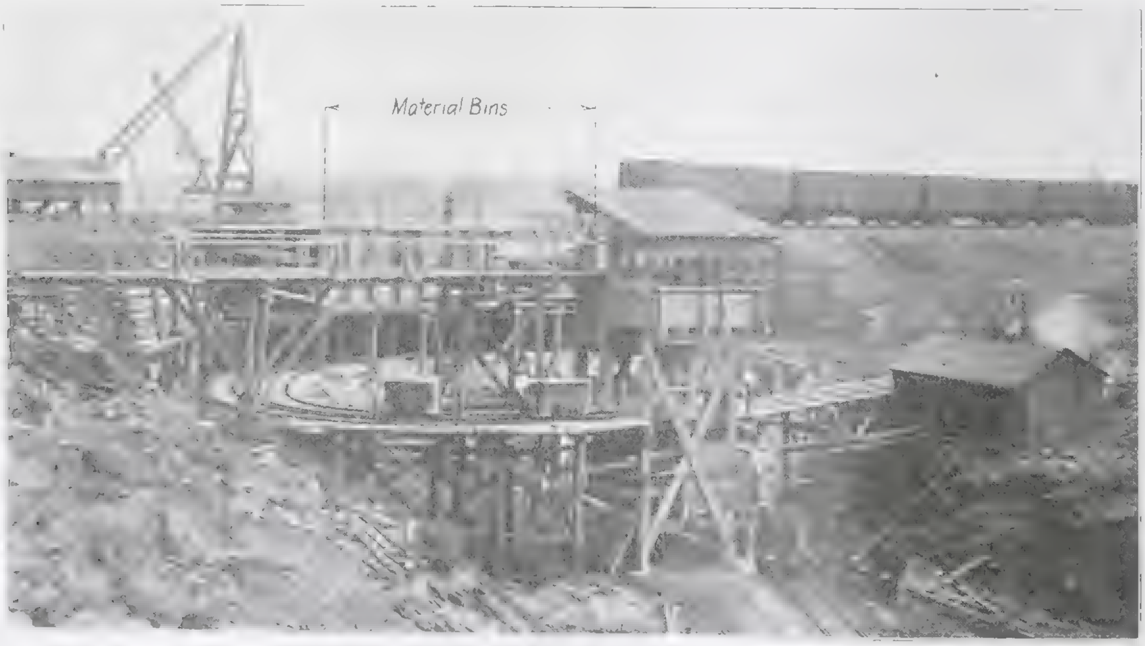
In case of paving, the present value has been allowed in case of streets recently rebuilt, as well as those streets on which track is allowed to remain in its present condition. On streets where the track is to be rehabilitated, the second-hand value of the paving has been returned as the rehabilitation value of these sections of street.

The remaining exhibits, including the Electric Power Distribution; Supplies, Tools, and Furniture; Building; and Real Estate have been returned at the same value for rehabilitation purposes as was assigned them in the case of the property as a going concern.

CONCRETE AND REINFORCED CONCRETE SECTION

An Economical Mixing Plant.

The accompanying photograph shows an arrangement for a mixing plant which was used for the construction of Lock 9, New York Barge canal. The picture shows the siding of the Delaware & Hudson R. R., crossing the center line of the Champlain Canal. The canal prism was partly excavated under the siding and the material bins for receiving material from bottom dump gondola cars were built under the railroad trestle. Part of the material was brought from a point about ½ mile distant, and the balance came from Sandy Hill near Hudson Falls. A double track, converging to a single track over the mixer, passed in a circular route between the bins and mixer. The cement house was located just outside the limits of the photograph, and the current was brought over the trestle to the house over the mixer, and dumped from there directly into the hopper. The entire mixing plant was located at the north end of the lock, the Smith Mixer being placed so as to dump into Steubner buckets which were carried on flat cars of narrow gage and hauled to the lock walls by mules. The plant was designed by Mr. C. R. Neher, Engineer for the Atlantic, Gulf & Pacific Co. at Whitehall, N. Y.



A Concrete Mixing Plant with a Circular Charging Track.

Methods and Cost of Placing Concrete in Long Wall by Chutes.

A new idea among methods of placing concrete in wall forms from a movable plant is being tried out on a long retaining wall which parallels the Illinois Central R. R. tracks between 72nd and 75th Sts., Chicago. Figure 1 shows the arrangement of the mixing plant which is placed on a flat car. A standard Ransome No. 2 outfit is used for mixing the concrete in ½ cu. yd. batches. The mixer discharges directly into a hopper which is hoisted up to proper level for dumping into a chute which leads to the forms. For operating the hoist a small 5 in. x 7-in. engine, with single drum, is used. Other plants for mixing concrete on flat cars are common, but the feature of hoisting the concrete from the car for dumping into a chute at a higher elevation is, we believe, entirely new.

In the construction of this work the excavation is done entirely by a locomotive crane which operates a clamshell bucket. The crane runs on a track which was directly on the line of the wall. As the trench was excavated the crane backed up and removed the track. The trench is about 5 ft. deep and 12 ft. wide. The banks are sheeted with 2-in. sheeting and about 18 ins. of ground water stands in the trench before concreting.

The foundation of concrete, is deposited from the mixer on the flat car, through a chute. No hoisting of the concrete is needed for this part of the wall as the track is elevated about 15 ft. above the trench and the railway embankment slopes to the edge of the trench.

After the base is in, the forms for the network are built. A section of this wall is shown by Fig. 2. These forms are built of 2-in. tongued and grooved material with 3x6-in. studding. The back forms of the wall, which is built in steps, are built complete to the top of the wall. Then, instead of concreting a long section of wall in shallow layers of concrete, a short section of wall is bulkheaded off and concreted to full height in a single day's run. For the first day's run a section 30 ft. long was taken and it is expected that longer sections will be constructed after the crew gets used to the work. The concrete aggregate is brought in gondola cars and the cement in box cars, once or twice a day, as the necessity arises. The cement car is placed ahead of the mixer car and the gondolas are placed behind it, all being on one track. The cement is handed out through the end of the cement car onto the mixer platform and the sand and gravel are wheeled on running boards over the tops of the gondola cars to the mixer. These running boards are made out of three 2-in. plank laid side by side and nailed together by cross boards underneath. To support the runways 3x6-in. pieces are laid across the car. The runways are then laid on them on each side of the car. Near the mixer car a cross runway is laid from one side to the other to aid in passing. When three cars of material, one of sand and two of gravel are used, the crew for shoveling consists of three men in the sand car and four men in the gravel car, but one gravel car being operated at a time. Twelve wheelbarrows are used, and 6 wheelers. The wheelbarrows on one side are all filled at one time and wheeled away to the mixer, leaving the other six barrows on the opposite runway to be filled.

At the mixer are two engineers, one operating the hoist and the other the mixer. Two men tend the cement, and feeding and discharging the mixer, and one man tends to discharging the hopper into the chutes. In the forms are four laborers who spread and spade the concrete, place whatever reinforcing bars are necessary at different points and also lay the conduits which come near the top of the wall.

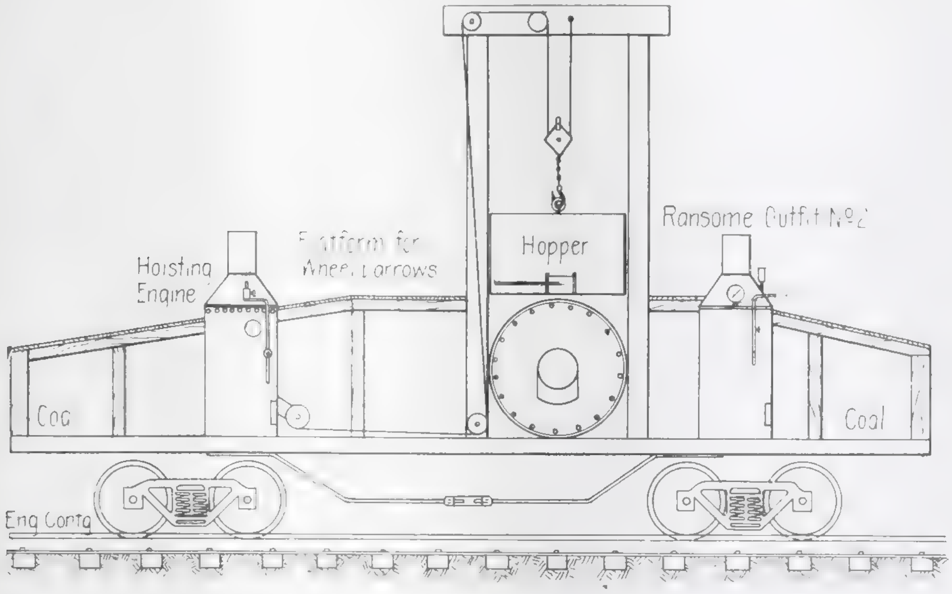


Fig. 1—Side Elevation of Car Mounted Mixing Plant.

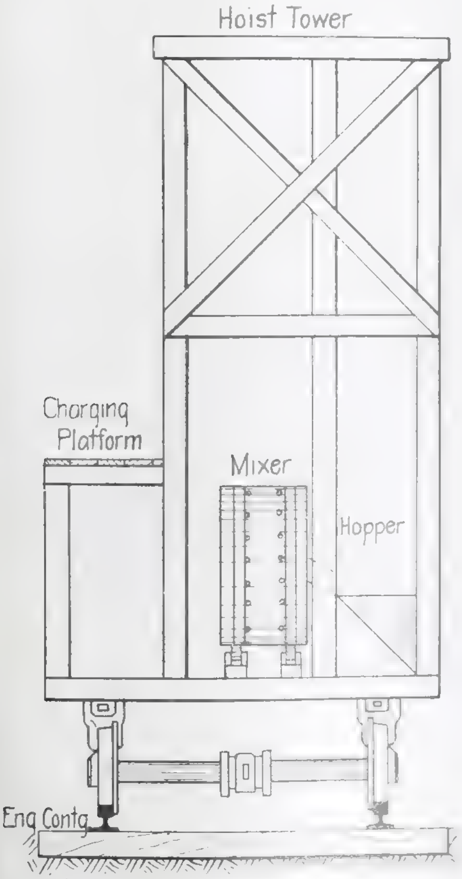


Fig. 2—End Elevation of Car Mounted Mixing Plant.

The concrete comes from the hopper through a chute to the wall. The chute is made of galvanized iron about 1½ ft. wide with sides 6 ins. high. At its lower end the concrete drops through a flexible circular chute which may be swung around in all directions thus chuting the concrete toward its desired location in the form. This chute is made of cylinders of sheet iron 15 ins. long, 10 ins. diameter at the top end and 8 ins. diameter at the bottom. They are fastened together by two ⅛-in. chains, so that when the chute is stretched to full length each section enters the next section below it, about 2 ins. By shortening the chains the length of the chute is made to fit the distance desired.

An estimate of the cost of labor placing concrete by this method is as follows, the rates given being for a 10-hour day:

1 foreman	$ 3.50
2 engineers	6.00
1 cement man	2.00
2 feeders	4.00
1 hopper man	2.00
6 wheelers	12.00
7 shovelers	14.00
4 laborers in form	8.00
	$51.50

About 15 cu. yds. of concrete are placed per hour but 2 hours may be considered as used each day for shifting cars, replacing runways, etc. This makes a day's run about 120 cu. yds.; 120 cu. yds. placed at $51.50 equals $0.43 per cu. yd.

When completed, this wall will retain the recently elevated embankment of the Illinois Central R. R. The conduits, placed in the upper part of the wall with manholes at convenient points, will carry telegraph wires.

The contractors for the construction of this wall, and various subways for streets under the railroad tracks are the Leonard Construction Co. of Chicago; Mr. W. M. Kallasch is Superintendent in charge of the work.

Siphon Spillways New York State Barge Canal.

The just use in America of siphon locks and spillways, is being made on the New York Barge Canal. The theory and method of operation of the siphon locks were explained in our issue of Aug. 10, 1910, and in the accompanying cuts we show the essential portions of one of the spillways. This spillway is located at Smith's Basin in the summit level of the Champlain Canal, which level receives the drainage from a small area of adjacent land. In times of heavy rainfall the maximum inflow to this level may amount to 700 cu. ft. per second. It was desired to provide for this volume of water and to limit the fluctuation of the water surface to about 1 ft. A waste weir of sufficient capacity to take care of this flow with a depth of 1 ft. on the crest would require a spillway about 200 ft. long. On the other hand, the siphon spillway which is but 57 ft. long between abutments will accomplish this result at a considerable saving in the cost of construction. This spillway consists of four

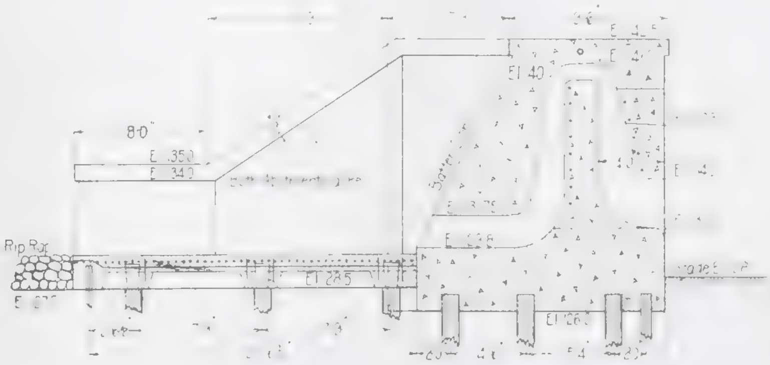


Fig. 1—Section Through Siphon Spillway.

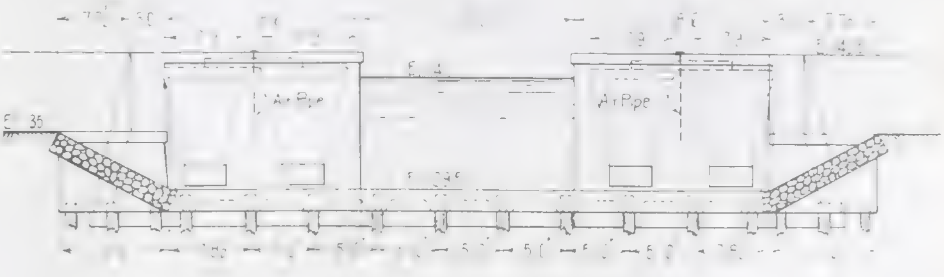


Fig. 2—Front Elevation of Siphon Spillway.

spihons and a waste weir 20 ft. long to serve as a drift gap to carry off floating debris. The siphons, Fig. 1, are each 7.75 sq. ft. in area, and acting under a head of 10.5 ft. will have a discharge of approximately 160 cu. ft. per second. The waste weir with a depth of 1 ft. of water on the crest will have a discharge of 70 cu. ft. per second, and the total discharge of the four siphons and weir will be about 710 cu. ft. per second. The inlet for the siphon is placed well below the water surface and is protected by a screen to prevent the admission of floating bodies that might happen to drift into the pipe and lodge in some of the various bends of the siphon chamber. In order to reduce the loss of head due to the entry, the inlet is flared out to double the normal area. As the siphon will not come into action until completely filled with water, it was necessary to limit the height at the crown to 1 ft. and to obtain the necessary area by increasing the width. From the crown to the outlet the siphon is practically uniform in area, changing in section from 1x7.75 ft. to 2x4 ft. This change in area was made to give better section to the masonry and also to facilitate the removal of forms in construction. At the crown of the siphon where it would be difficult to remove forms, iron castings were provided which are left in the masonry. Three vents each 6x12 in. long pierce the upper wall of the siphon at low water level. When the water has been drawn down to this level, air will enter through these vents and break the flow of water through the siphon.

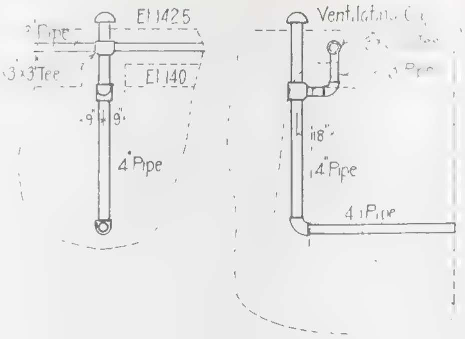


Fig. 3—Details of Siphon Operating Pipes.

The plans for the siphon spillways were prepared under direction of Mr. G. F. Stickney, Supervising Engineer in charge of the Bureau of Locks, to whom we are indebted for the above information.

EARTH AND ROCK SECTION

Trenching for a Sewer Using a Grab Bucket Excavator, with Some Data on the Concrete Work.

In trenching through sand for a sewer at Gary, Ind., a V-shaped trench with sides at the natural slope of the material is found more economic than a narrow sheeted trench. The depth of cut ranges from 3 ft. to 22½ ft. and averages 14½ ft., and from 2 to 3 ft. of the bottom is below ground water level, so that the conditions are such as would ordinarily be considered as calling for a sheeted trench. At Gary there were no restrictions on the allowable width of trench, as the work was through open country, and the decision as to methods rested entirely on questions of comparative cost. The contractor decided upon a method of bleeding the ground of the water by means of well points and opening a V-shaped cut of such width as might be necessary to get the depths required, using a grab bucket excavator. The result has been that the amount of excavation has been twice the volume required for a sheeted trench, but this 100 per cent extra of digging has cost less than timber and sheeting labor would have cost.

Briefly, the method of work is to make a cut with a grab bucket operated from a derrick running ahead of the cut, letting the sides of the cut curve to slope. The grab bucket makes the cut roughly to grade. The next operation is to sink a row of well points on each side of the trench bottom and connect them with a pump; the ground water is drawn out low enough to permit the trench bottom to be trimmed and the sewer concrete to be placed.

Figure 1 is a view of the grab bucket excavation at work. The derrick is a rig built by the contractor of old and tried timbers, and of such machinery as was at hand. The engine is 7x10 ins., with verticle boiler. A swinging engine is also used. The machine rests upon a turntable, which in turn is on rollers. When desired to move, a line is led out to a tree or stump and fastened; the other end is turned over a nigger-head on the engine and the machine pulled ahead as desired. The swinging of the boom is rapid and is accomplished by a cable which runs around the circular rail upon which the machine turns. The cable passes around this rail in the same manner as on the bullwheel of a derrick. An engineer and fireman operate the derrick. Two laborers prepare the ways for the rollers, and do the other necessary work around it, such as carrying coal and supplies. The grab bucket used is of a new type, differing from the ordinary clam shell buckets in that the differential drum is not fastened to an extension of the scoop but is carried by a separate frame. The scoops swing from hinges on this frame and when opened up an unusually wide opening is secured. The separation of the pivots gives an excellent cutting motion and it is especially noticeable that a full bucket of material is always secured when digging under water. This is unusual in such compacted material as sand under water.

After the trench has been excavated to grade by the grab and the material deposited on either side, the pump men begin the installation of the well points. Two 3-in. pipes about 100 ft. long are laid along the trench, one on each side of the immediate area to be unwatered. A valve with two nipples is located at 4 ft. intervals all along these mains and

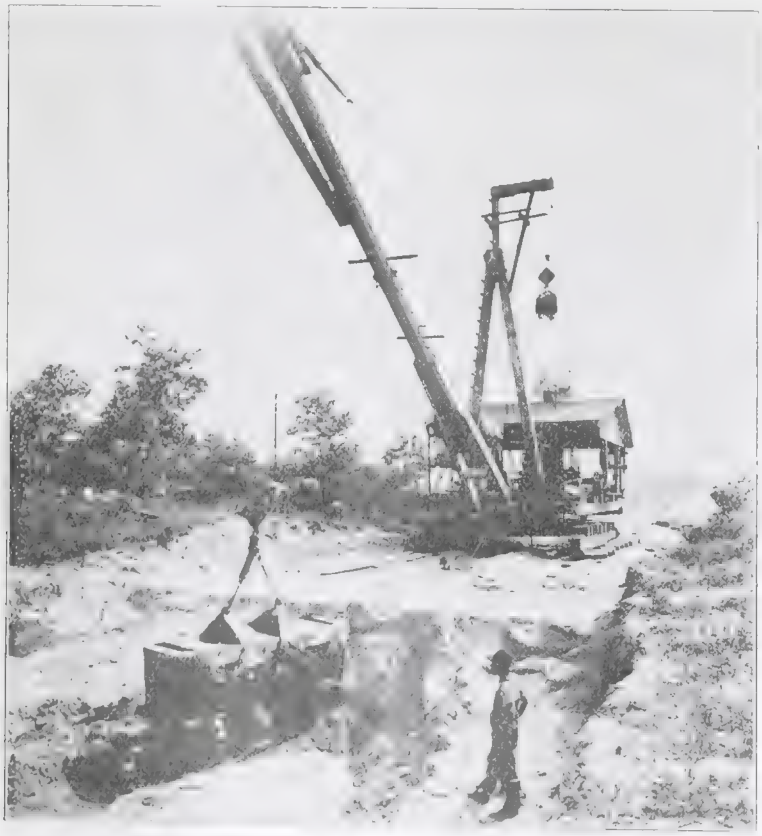


Fig. 1—Grab Bucket Excavator for Sewer Trench.

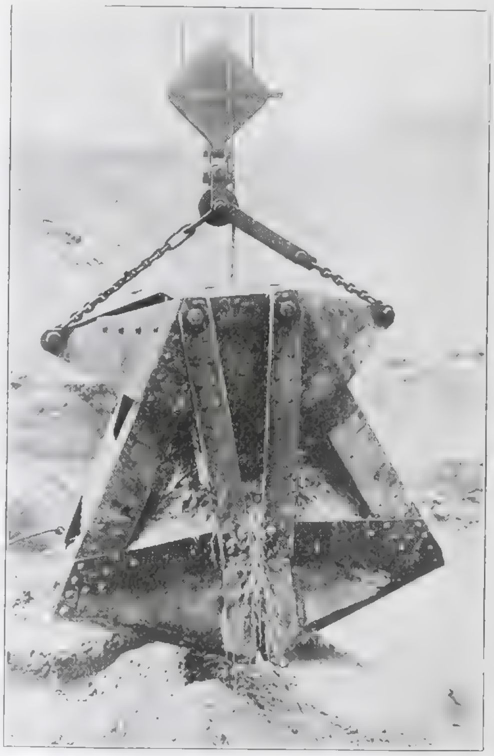


Fig. 2—View of Andresen-Evans Grab Bucket

rubber hose connections are made between the mains and the points. The points consist of 1¼-in. galvanized pipes, which are jetted into the sand at 2-ft. intervals. They have a metal point at the lower end and above the lower end for 2 ft. they are perforated with ⅛-in. holes and screened with fine wire mesh. It requires the time of [illegible] to set these points ahead of the concrete work and to pull them after the invert has been put in. A small steam pump is attached to the 3-in. mains and the elevation of the ground water is lowered below the bottom of the sewer and the ground is trimmed to the circular shape fitting the invert.

A narrow gage track parallels the work at about 100 ft. distance and is used principally on a grading contract nearby, but the contractor for the sewer work also uses it for bringing in materials for making concrete. The track runs over small hills and hollows at a level grade and advantage has been taken, at the hollows where the track is upon an embankment, for location of the ½ cu. yd Ransome mixer. At these points along the work a platform is built, level with the track, out over the bank and the mixer located on the ground at the edge of the platform. The concrete material is dumped from 6 cu. yd. narrow gage side dump cars onto the platform, shoveled into wheelbarrows for measurement and then dumped into the mixer. The mixing requires 1 foreman, 5 men feeding, 1 engineer and a man discharging the mixer into the wheelbarrows. The material is wheeled to the sewer, from 8 to 20 men being used as wheelers. When the distance is great enough to require any more men than this, the mixer is placed at a more convenient point.

Figure 2 shows the first form placed in the trench, which consists of a semi-circular frame made to fit the thickness of the invert. Concrete is laid in the trench to the lines of the frame and, as the sides are built up, 2x4 in. logging is laid from one frame to another to hold the concrete in place. After the invert is completed the lagging is placed for the arch. As shown by Fig. 2, small angles are bent to a semi-circle and bolted to the angles which are used in the invert. The lagging is laid over these angles and a band of flexible iron is fastened over the ends of the lagging to hold it in place. The lagging is 18 ft. in length, and the concrete work is done in corresponding sections. For outside forms, lagging is used and is held in place by banking sand up as each piece is set.

In trimming out the 18 ft. sections and making them ready for concrete, 8 or 10 men are used and usually will have seven or eight bottoms ready by 2 o'clock in the afternoon. While the bottom is being made ready the arch is being concreted, but the invert work is always started as soon as possible on account of the necessity of keeping the bottom dry, after trimming, until concreted. Eight men are usually employed at each bottom, on an 18 ft. section, of either arch or invert, working the lagging and spading concrete.

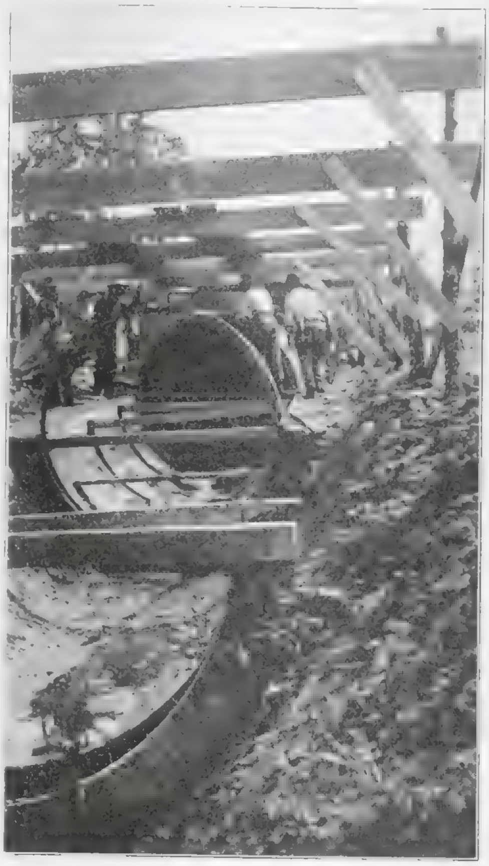
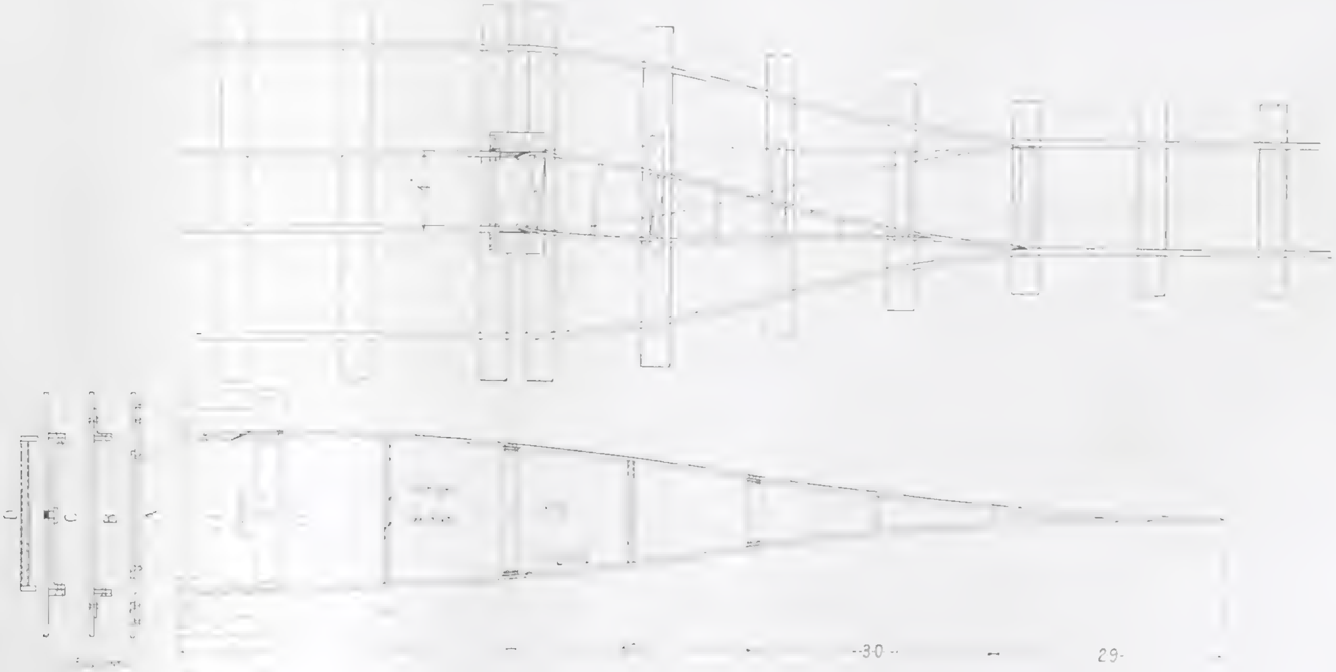


Fig. 3—View of Forms for Concrete Sewer.

The progress on the work for 10 days is an indication of the success with which it is being carried on. The average number of lineal feet of completed sewer (not back filled) was 93 ft. per day. The smallest day's work was 69 lin. ft. and the greatest was 124 lin. ft. The contractors, Byrne & Byrne of South Chicago, have their own camp on the work, where from 75 to 95 men are lodged. The essential feature of the excavating apparatus, the grab bucket, is an Andresen-Evans bucket, made by the Andresen-Evans Co., Monadnock Block, Chicago, Ill.

New Switch for Narrow Gage Tracks.

The accompanying plan shows a contractor's switch which is very simple of construction and operation. It is also quite rigid and strong enough to carry heavy loads without a great amount of wear. The idea, as shown, is in joining the two inside rails together as a switch point and shifting the point back and forth between the outside rails in the positions indicated on the plan. The ties are capped with ½-inch plates as wearing surfaces and the switch points are braced rigidly. The design is the idea of Mr. C. R. Neher, who is constructing engineer for the Atlantic Gulf & Pacific Co., at Whitehall, N. Y., and the switch has been used in the contract work of this company in a number of places.



Details of Special Contractors' Switch.

Methods and Cost of Earth Excavation with Three Types of Excavators, New York State Barge Canal.

Two types of excavators using drag buckets and a suction dredge are among the machines now being used on Contract No. 42 of the New York Barge Canal. This article gives an outline of the work in hand and the costs of handling material with each of five machines of the above types during the month of April, 1910.

The contract, which amounts to approximately $1,164,000, is for the construction of Lock No. 20 and 8.96 miles of canal, including excavation, highway bridges and appurtenances, culverts, stream entrances and incidental details. The work is mostly "land line" or, in other words, canal which is not located in any existing channel or stream.

The material handled consists largely of black gumbo, there being little or no rock on the entire contract. Work was commenced in the summer of 1909 at the western end of the contract. At this point three New Era graders, 36 wagons and slip scrapers, and 68 head of mules were employed. The erection of the larger machines was soon put under way and by spring of 1910 all the machines, of which costs are herein given, were working. These machines consist of one Heyworth-Newman dragline excavator, two electrically driven Lidgerwood dragline machines, a Field tower operating a drag bucket, and a 12-in. hydraulic dredge. All machines were operated with three shifts of 8 hours each. The Lidgerwood machines, however, were working at a disadvantage as they were moving to new points during this month and the amount of excavation shown for them is merely that skimmed off the surface while moving.

The following data show the costs of excavation per cubic yard for the month of April, 1910. These costs include labor, repairs and distribution of field office expenses:

Heyworth-Newman Excavator, 100-ft. Boom; 2½ Yd. Bucket:

1 operator	$ 4.00
1 foreman	2.00
5 laborers	7.50
1 foreman, average $85 per mo	2.83
1 pumpman	1.50
1 oiler	2.00
1 team 1 shift a day	4.50
Total cu. yds. for April	23,192
Total cost for April	$1,983.84
Total cost per cu. yd	$ 0.085

Hydraulic Dredge "Mohawk," 12-ins. suction:

1 captain, per month	$ 150.00
3 engineers, per month	75.00
3 levermen, per month	110.00
1 mate, per month	120.00
6 deckhands, per day	2.00
3 firemen, per day	2.00
8 laborers or pipemen, per day	1.60
Total cu. yds. excavated	15,557
Total cost	$1,726.30
Cost per cu. yd	$ 0.111

Two Ledgerwood Excavators, Electrically Operated, with 25 hp. Motor for Swinging and 125 hp. Motor for Hoist; 2½ Yd. Page Bucket:

1 operator, per day	$ 4.00
1 oiler, per day	2.00
5 laborers, per day	1.50
1 sloper, per day	2.25
1 foreman, $85 per mo	2.83
1 electrician, $125 per mo	4.17
Total cu. yds. excavated Mach. No. 1	2,271
Total cost	$1,667.80
Cost per cu. yd	$ 0.735
Total cu. yds. excavated by Machine No. 2	2,583
Total cost	$ 992.30
Cost per cu. yd.	$ 0.384

The two Lidgerwood machines worked only part of the time during this month, No. 1 working 13 days and No. 2 working 10 days during the month. As mentioned above both were engaged in moving to new positions and were working at a disadvantage. The yardage for these machines should be about the same as for a Heyworth-Newman machine under similar conditions. The difference in daily pay roll is, however, in favor of the electrically driven machine.

The electric power on these machines costs about 1 ct. per cu. yd. City current is used and a transformer is placed at convenient points along the line, as the machine moves ahead.

The repairs on the Heyworth machine have averaged, approximately, $400 per month. The highest amount charged to repairs for any one month is $667.

The Field tower scraper is a new machine for this class of work and is one of the evolutions of the work on the Barge Canal. It consists of a movable tower, located on one side of the canal with a cable running from it to an anchorage on the opposite side of the canal. The drag bucket is supported by and slides up and down this cable. It is pulled back and forth by an endless line. The crew and costs are as follows:

1 operator, per day	$ [illegible]
1 fireman, $75 per mo., per day	2.50
1 foreman or supt., [illegible] per day	[illegible]
1 pumpman, per day	[illegible]
6 laborers, per day	[illegible]
Total cu. yds. excavated	[illegible]
Total cost	$1,455.81
Cost per cu. yd	$ 0.096

This tower is 85 ft. high and operates a 1⅞ cu. yd. bucket with a 10x12 in. hoisting engine and 40 h. p. boiler. This machine is becoming quite popular along the canal because of its adaptability and its moderate cost.

Contract No. 42 is being handled by the Shanley-Morrissey Co., Contractors, 527 5th Ave., New York. Mr. A. L. Burtin is Superintendent and Mr. L. B. Harrison is Chief Engineer for the contractors. The work is near Utica, N. Y.

The Hydraulic Giant and Dredge Plants for Excavating Some 7,800,000 Cu. Yds. on the Pacific Division of the Panama Canal.

The excavation of some 7,800,000 cu. yds. of material from the Miraflores lock site and nearby Panama Canal prisim is to be accomplished by hydrauliking the material into sumps and then excavating these sumps by hydraulic dredges.

It is estimated that in the total area there are about 7,800,000 cu. yds. that can be excavated by the hydraulic method. The material consists of a dark loam, containing about 15 per cent of sand and some deposits of gravel in the old bed of the Rio Grande. The general elevation of the area is 8 ft. above sea level, and the average depth to be excavated is 35 ft. About 1,000,000 cu. yds. of the material will be required for the core of the west dam at Miraflores; the remainder will be discharged behind dikes to the east of the canal, thereby reclaiming 450 acres of land in the vicinity of Corozal. It is estimated that a fill of 15 ft. or more will be made in this manner. The amount of rock in the section to be excavated is placed at 1,602,000 cu. yds. When the hydraulic operations are concluded, the pits that are opened up will be pumped dry and the rock taken out by steam shovels.

The hydraulic plant involves two methods, as follows:

(a) The disentegrating and sluicing of the material into sumps, and

(b) The lifting and conveying of this disintegrated material to the place of deposit with dredging machinery mounted on concrete barges.

The central pumping station, called "Agua Dulce" from its proximity to Agua Dulce Hill, lies west of the canal, not far from the middle of the territory to be excavated. The machinery is inclosed in a temporary superstructure, divided into an engine room 50x100 ft. on the east side, and a boiler room 40x100 ft. on the west side. The station floor is 12 ft. above sea level. The machinery equipment consists of four 1,000-h.p. horizontal direct-connected triple expansion pumping engines, built by Henry R. Worthington, with 19, 30 and 50-in. steam, and 24½-in. water cylinders, and a 24-in. stroke. The four units are lined up parallel to each other at a distance of 25 ft. from center to center. Each pump is provided with a cast-iron 36-in. suction pipe reaching, with the foot valves, into a sump near by, excavated to 5 ft. below extreme low water. Each engine has its own surface condenser, built into the discharge pipe, and each condenser has a combination dry and wet vacuum pump. At elevation pl. 20, the pumps discharge into a common delivery pipe from which they are separated by a 24-in. check valve and a 24-in. gate valve. The delivery pipe has two branches, which begin at the outside, with a diameter of 24 ins., and increase in size toward the center line of the building, where they unite in a Y and connect with the 40-in. discharge main. Each unit is guaranteed to supply 7,500 gals. of salt water per minute at 150 lbs. pressure.

The boiler room equipment consists of four Babcock & Wilcox water tube boilers of the cross-drum, semi-marine type, and each one has 4,500 sq. ft. of heating surface. They are designed for 150 lbs. pressure per square inch without superheat and are set in units of one each. The steam piping is so arranged that any pump can be operated by any boiler. On one side the boilers have oil furnaces, on the other side fire doors, grates and ash pits, so that coal can be used if deemed expedient.

The discharge main is 3,600 ft. in length and consists of 2,000 ft. of 40-in., 800 ft. of 32-in. and 800 ft. of 24-in. pipe. The first 2,800 ft. are lock-bar pipe, and the remainder spiral riveted pipe. The lock-bar pipe, the product of the East Jersey Pipe Co., was manufactured in 30-ft. lengths, which are joined together by ¾-in. forged steel flanges. Five air valves are mounted at equal distances apart to prevent rupture of the pipe and to allow the escape of air while the pipe is being filled. The pipe line is provided with 12 openings, in groups of 3, for the branch line connections. The main extends nearly horizontally alongside the approach track to the pumping station at the foot of the Agua Dulce and Cocoli hills. To prevent any upward movement it is weighted down at regular stages by several tons of rock. Where bends in the pipe occur the latter is firmly anchored in place by cables held taut by rings set in concrete. In one place the pipe line crosses a wooden trestle to which it is fastened by iron belt rods. Corrosion is guarded against by the application of an asphalt compound.

The branch lines, or "take-offs," are made of 16-in. spiral riveted steel, the whole of this class of steel pipe used on the works, having been furnished by the Abendroth & Root Manufacturing Co. of Newburgh, N. Y. Each branch line consists of a section of twin pipe 800 ft. long extending to the monitors or giants, the four double lengths thus employed aggregating 6,400 ft. They are situated 800 ft. apart, the first one branching off at a point 1,200 ft. from the central pumping station. The arrangement is such that one of the branch lines can be made to serve, if necessary, as an addition to any one of the others, thereby extending the immediate zone of operations.

The hydraulic giants or monitors were made by the Joshua Hendy Co. of San Francisco and are of the latest type used in mining operations in California and other parts of the West. Each of the eight giants weighs 1,500 lbs. and consists of a base for attachment to a 16-in. gate valve at the terminus of the pipe line, a horizontal and vertical joint, and a long conical reducing piece. The frictional resistance is decreased by a ball-bearing, and a weighted lever is attached to control the direction of the jet. A deflecting nozzle is fitted to the discharge end of the giant, which permits deflections through a small angle without changing the position of the main body. The tapering piece of the giant is fitted on the inner side with two sets of guide vanes, which prevent a scattering or rotary motion of the water after it has issued from the nozzle. The nozzles used will vary from 4 to 6 ins. in diameter according to the character of the material in which they are working, and at full head the water coming through them will exert a pressure of 130 lbs. to the square inch, the equivalent of 1½ tons pressure against a bank 100 ft. away within range of the deflectors. As it is expected that the positions of the monitors will be shifted frequently, their bases are of temporary construction. The giants will operate from 8 ft. above to 45 ft. below mean tide, and will be made to wash down the material in sluices which will carry the water containing earth in suspension to the sump where the barge pumps are at work. When it becomes necessary to move a barge the giants will cut a new sump with a channel leading into it through which one or more units of the fleet may be floated. The banks will be excavated as nearly perpendicularly as possible, in order that benches may be cut in them and the banks undermined so as to cause the material to fall by gravity.

The centrifugal dredging pumps correspond in total capacity to that of the steam reciprocating pumps, and are mounted on barges built of concrete, one unit or pump to each of the three barges. Each unit consists of an 18-in. single suction dredge pump direct-connected to a Westinghouse 655-hp. induction motor. The runners for the pumps are overhung and are especially long. The manganese steel impeller on each pump has five blades and is designed to handle 10,000 gals. of salt water per minute and 300 cu. yds. of solid matter per hour, or, in other words, 110 cu. ft. of water to 1 cu. ft. of sedimentary material against a varying actual head up to 60 ft. while running at 480 r. p. m. Each pump, including base plate elbow and valve, weighs approximately 30,000 lbs. The suction pipe on each pump is 12 ft. long and 20 ins. in diameter. The motors are of the 3-phase, 25-cycle type, 2,080-volt, with automatic starting equipment. On the switchboard panels are mounted indicating and integrating wattmeters, oil-current breakers and the time limit switches. Power will be supplied by the Miraflores central station, and armored submarine cables connect the motors to the pole lines. For priming the pumps, a small motor-driven vacuum pump will be installed on each barge.

The crest of the dam at Miraflores will be 70 ft. above sea level, making the total lift for the hydraulic fill 110 ft. The dredging pumps will accomplish the lift to 60 ft., and to secure the additional lift of 50 ft. an 18-in. motor-driven relay pump, identical in type to the centrifugal dredging pumps, has been installed in a small pumping station on the west bank about midway between the dam and the central pumping station, and will be attached to one of the dredging units, being so arranged that the 20-in. suction pipe may be directly connected to the discharge pipe of the dredging pump. The discharge pipe to the core of the dam has been completed, with the exception of a small gap.

ROADS AND STREETS SECTION

Work Preliminary to Road Construction and Street Pavement Maintenance.*

I propose to show that the success or failure of a pavement is fully as likely to depend upon causes beyond the contractor's control both preliminary to the construction of the pavement and subsequent to its completion, as to perfect or faulty workmanship or materials; although, when a pavement fails to sustain traffic, the public universally, and officials generally, attribute the result to a combination of inefficiency and poor material, for which the contractor is held responsible.

At the outset I believe we shall agree that water is the great enemy of pavements, and the most common cause of their undoing, even when blocks of sandstone or other comparatively soft stone are used. The only material that is not seriously injured by the destructive influence of excessive water is granite and even that is injuriously affected.

The sources of deterioration from water may be summarized as follows:

(a) Improper sub-drainage.
(b) Excessive sprinkling or flushing.
(c) Lack of efficient cleaning.
(d) Sub-drainage, due to the absence of pavements, or to their improper construction, between and around railroad tracks.
(e) Too flat crown or grade to provide proper surface drainage.

All of these features are absolutely beyond the control of the contractor, yet they provide most fruitful sources of dispute between him and municipalities as to the responsibility for defects which develop subsequent to the expiration as well as during the maintenance periods of paving contracts.

A discussion of each of these features will be useful.

Sub-Drainage.—Perhaps there is no part of street pavement construction which is given so little intelligent consideration by engineers, or in which local custom is so blindly followed from decade to decade, as this matter of sub-drainage. And yet practically every writer on street pavement construction from John Macadam to the present day has referred to sub-drainage as the first essential to successful road or pavement construction. We find cities where the prevailing sub-soil is clay, which affords inadequate natural drainage, providing no artificial drainage for their pavements. We find other cities where the sub-soil is either sand or gravel, that affords the best possible natural drainage, providing for their pavements elaborate systems of sub-drainage that are of course wholly unnecessary. Again, we find cities adopting systems of sub-drainage in use in other cities where the sub-soil, and, consequently, the artificial drainage requirements, are radically different.

Several years ago I learned of a most glaring example of this copying process, which illustrated perfectly the lack of application of ordinary engineering, not to say "horse" sense in pavement drainage. The municipal authorities of a lake city built on sand dunes, and having few manufacturing industries or railroads, evidently feared that the local engineers were not competent to prepare the plans and specifications for expensive paving work, so they engaged for the purpose a consulting engineer from Chicago. He practically copied the standard plans and specifications of the city of Chicago. It is well known that the prevailing soil in Chicago is clay, and that the railroads and factories of the city provide large quantities of cinders, which serve the purpose of an excellent cheap filling for sub-drainage purposes. In copying the Chicago specification, in general, the engineer included the drainage specifications, which called for soft tile below the curb, and filling of cinders around the tile and to the bottom of the curb. The result was a very elaborate and expensive artificial drain system, wholly unadapted to the conditions that had to be met. The specification provided for cinders, which had to be carried over 200 miles by rail to be used in the place of the sand upon which the city stood, and which at no expense, would supply the best possible natural drainage to be procured. Evidently the engineer in this case gave absolutely no consideration to local conditions, but blindly copied and adapted what had been found good for Chicago.

As a general rule, however, the fault with drainage is due to the fact that no artificial sub-drainage is provided, when the natural drainage conditions are wholly inadequate. In such cases, the underside of the pavement is always damp, and the inevitable result is deterioration, and a tendency of the pavement to settle from its normal shape and grade.

In a certain city of Central New York, which I have had especial opportunity of studying during the past 24 years, the pavements have proved to be better than those in any other city of the United States or Canada which I have visited, although the sub-soil is generally clay, the poorest medium for natural drainage. Apart from careful construction and selection of material used in the pavement, which have not been greater than the care shown in similar work in other cities where the results have been far less satisfactory, I attribute the unusual excellence of these pavements chiefly to the elimination of water, both from the under and upper surfaces. This has been accomplished:

First: By an efficient system of sub-drainage; and

Second: By thorough dry cleaning and entire absence of wetting down the dirt by excessive street sprinkling and flushing.

The system of sub-drainage in this case, which was adopted in the year 1886 and has been strictly adhered to since, is as follows:

(1) A trench 1 ft. wide is excavated under the curb to a depth of 3 ft. below the top, or 18 ins. below the bottom of the curb.

(2) In the bottom of the trench is placed a narrow culled hemlock board for which other cheap lumber may be substituted, and the pavement side of the trench is boarded up with the same material, up to the bottom of the curb, to prevent the earth under the pavement, as it dries, from falling into the drain.

(3) On the board in the bottom of the trench is placed a line of 3-in. half round porous tile open at the bottom and with open joints.

(4) Over the tile the trench is filled to within 2 ins. of the bottom of the curb with hand placed field or cobble stone, over which is spread a thin course of finely crushed stone, slate shale, or slag—fine enough to fill the chinks in the field stone at the surface but coarse enough not to run into and fill the spaces between the pieces of field stone.

(5) Over this is spread about an inch of loam or clay (not gravel or sand), which, when dry, will hold together and not sift into the drain.

(6) Over this curb is set in the usual way. If the curb is of stone, it is bedded in either gravel or concrete; and if the curb or gutter is of Wainwright or other Portland cement type, it is laid directly over the drain. Of course the drains are connected with catch basins.

This method of construction is the best, most efficient and most economical system of sub-drainage I have ever known. No cross drains have been necessary, although the natural drainage conditions are very poor.

Systems of surface drainage of which I thoroughly disapprove, either because of inefficiency or unnecessary expense are those that include:

(a) Too shallow drains at the curb; and
(b) Trenches filled with crushed stone in the center of the road with similar cross drains at intervals.

The cross drains tend to attract water from outside the roadway and carry it under and to the center of the pavement, where it percolates into the otherwise dry sub-soil. This is not only an unnecessarily expensive system of sub-drainage, but one that is really less efficient than no drainage.

It may be set down as a fact that with any of the modern, nearly waterproof forms of pavement now in vogue, unless there are actual springs under the roadway, (an extraordinary condition that requires extraordinary treatment), the sub-soil under the pavement will be practically bone-dry if no water is allowed to percolate from back of the curb. To prevent this, a drain having a depth of 3 ft. below the curb is all that is necessary. As indicated above, if the sub-soil is gravel or sand, providing natural drainage through which water percolates, no artificial drainage is necessary.

The most frequent causes of failure in pavement construction, all of them being entirely under the control of city officials, and just as entirely out of the control of the contractor, are as follows:

1st. Inefficient or no drainage, this we have considered above in considerable detail.
2nd. Improper back-filling of trenches.*
3rd. Insufficient crown and gutter grade to carry off water and prevent pools standing near the center and in the gutters of the roadway.*
4th. Lack of cleanliness.
5th. Excessive flushing or sprinkling of streets.
6th. Inadequate pavements, or none at all, between and along railroad tracks.

These faults are of such importance as to warrant careful consideration. They directly affect pavement maintenance and guarantee from both practical and legal points of view and are not second in importance or cause of trouble to even poor workmanship and materials employed in the construction of the pavement.

The two seriously objectionable practices, lack of cleanliness and excessive watering of street pavement surfaces, generally go together because:

1st. If the street surface is not clean wetting is necessary to allay the dust, and in this way mud is formed; and

2nd. If the dust is converted into mud, the mud can be removed from the surface of the road, only by the use of an excessive quantity of water, under such high pressure as to damage the pavement.

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*Paper by George C. Warren, Boston, Mass., presented before the convention of the American Society of Engineering Contractors, held at St. Louis, Mo., Sept. 26-28, 1910.

*"Back-filling [illegible] Crowns [illegible] by Mr. G[illegible] the American Society of Municipal Improvements; copies of these papers may be obtained by addressing Mr. Warren, 59 Temple place, Boston, Mass.

Recognizing that water is the enemy of all pavement surfaces, the effort of those engaged in the improvement of road surfacing material of every kind is directed toward reducing the porosity of the roadway surfaces, and otherwise protecting them from the ravages of excessive wetting.

On the other hand, the efforts of some street cleaning interests are directed toward keeping the streets wet by various forms of sprinkling and flushing machines, without properly cleaning the surface of the pavements. Still other interests engaged in street cleaning advocate dry cleaning and are developing methods to accomplish their purpose. Their objects are feasible, but, pending the advent of machines that will efficiently and economically do the work, all municipalities should take a middle ground, and follow one of the following courses:

(a) Thoroughly wash the pavements nightly, *without* pressure, using either a washing machine or fire hose, and immediately follow the washing with hand squeegees to remove all excess of water from the gutters and slight depressions.

(b) Sweep nightly with machines, *lightly* sprinkling the pavement in advance of the sweeper, and using enough water to lay the dust but not enough to convert it into mud—exactly as a dirty floor is cleaned by light sprinkling and hand sweeping.

No one would think of wetting a floor to such an extent as to convert the dust into mud, and then expect to remove the mud by sweeping. Yet the equivalent of this is done in most cities where the attempt is made to clean the pavements by rotary brooms immediately following a thorough wetting by sprinkling wagons. After such an operation is it any wonder that covered with water and earth or sand, (a mixture that will sharpen and wear away the hardest steel) pavement surfaces are literally butchered by the grinding they receive from the wheels of the traffic.

Either of these methods specified, if carefully and properly applied, will provide a well cleaned pavement surface which will require no sprinkling through the day, if hand cleaned by patrol system by day. The adoption of such a system will insure a pavement that will always be in the best condition for horses, automobiles as well as pedestrians on the sidewalks, being free from dust and mud, and capable of sustaining traffic without deterioration.

Track Construction.—Railroad beds improperly constructed, or tracks poorly laid, are common sources of injury to pavements, and the damage will extend not for only a few feet from the rails, but sometimes across the entire width of road bed. The same undesirable results are often produced by faulty construction in the pavement itself between and along the rails. If the rails or the ties are not so securely laid as to prevent vibration the pavement, whatever may be its construction or the material used, will be sure to break and allow water to work its way through and settle beneath the pavement. I have seen, in a number of cities, first-class pavements laid outside the track area, from the rail to curb, or from within 2 ft. of the rail to the curb, while between and around the rails there would be absolutely no pavement at all. In such cases from 1 to 3 ins. of water will accumulate between the tracks during every heavy rainfall or spring thaw, and have no outlet except into and under the pavement; and if the pavement is not more or less destroyed it is only because Nature has provided conditions which permit the water to drain nearly vertically into and through the soil.

Maintenance Guarantees.—Turning more specifically to the subject of pavement guarantees and maintenance, I am firmly of the opinion that pavement guarantees extending beyond a term of one year, which is ample to test the integrity of material and construction are against the best interests of the taxpayers. In support of this view, I offer the following [illegible]

[illegible] arantees are always of doubtful legality. On assessment work, which is the basis of payment for over 75 per cent of the street pavements laid in the United States and Canada, the courts have frequently, if not generally declared maintenance guarantees to be illegal, because they provide for indirectly assessing abutting taxpayers for the cost of maintenance, which city charters usually say shall be paid for by the city at large.

2nd. There is always likely to be more or less dispute between the contractor and the city regarding the contractor's obligations to make certain repairs, especially when the damage done can even remotely be attributed to causes such as these to which we have referred as lying outside the jurisdiction of the contractor, and, similar contentions will arise between the contractor and the city as to the extent of repairs and nicety of condition of maintenance of the pavement which is proper under the guarantee. It is not an exaggeration to say that under guarantees, cities generally endeavor to require contractors to make repairs to pavement surfaces that they would not think of making at the expense of the city.

3rd. When guarantees for maintenance are required, prudent, conservative contractors always include in their bids the interest on the cash retained, and the cost of the surety company bond premiums required by the city, and a sufficient amount to cover a conservative estimate of maintenance charges. It has been calculated that if surety company bonds for five years maintenance were required on all pavements laid in the United States and Canada, the premium, always added to the contractor's bid, would each year amount to more than $1,000,000.

It has been suggested that in lieu of surety company bonds for guarantee the cities retain 5 per cent of the contract price. If this were generally adopted the cash retained by the cities would aggregate approximately $5,000,000 annually, and the interest alone on the accumulation of five year guarantee periods would amount to $1,500,000. This bond premium, or interest, contractors must add to their prices just as surely as they must increase their prices when the cost of labor and materials advance. Generally speaking, contractors, regardless of the estimated cost of maintenance, will add to what would otherwise be their contract prices the full amount retained by the city. Few contractors are sufficiently strong financially to have their capital tied up even when it is drawing interest. Such a system would drive the comparatively small, but reliable contractors out of business, and leave the field in possession of concerns that are financially strong enough to carry or negotiate for carrying the amount of money retained by the cities.

4th. Maintenance guarantees tend to produce lax inspection, or the loss of control of construction by the proper city officials, as the contractor in case of dispute or disagreement as to the methods of construction, will notify the city officials, that if he is not permitted to do the work in the way he thinks best he will not be responsible for the guarantee.

5th. Maintenance guarantees encourage the acceptance of proposals from incompetent or inexperienced contractors, and the selection of pavements of doubtful desirability. How often do we hear the statement made in connection with the awarding of street pavement contracts—"The contractor may not be reliable, or the pavement may not be successful, but we have the surety company bond, or the cash retained to back the 5-year guarantee."

In 25 years' experience in the street paving business I have seen many paving contract guarantees defaulted, but I have never seen a pavement made good through a guarantee bond or a cash retainer, when the pavement or the contractor failed, or when it was against the business interests of the contractor "to make good." There may be such cases, but if there are, they are usually the "exception which proves the rule."

Finally the best interest of the city in the construction of pavements will be conserved, as it is in all other classes of construction, by the adoption of the following policy:

(a) Decide upon the form of construction best suited for each particular case.

(b) Prepare careful plans and specifications for the work, and give the construction the closest and best expert inspection and supervision.

(c) Take entire responsiblity for the results. In the long run this policy will produce better pavements and at lower costs, than will the apparently attractive, but misleading maintenance guarantee system.

Selection of Material and Method of Street Paving.

The selection of the proper material for paving a street involves the consideration of the relative value in use of the different kinds of pavement available and their adaptability to the varying conditions to which the street is subjected. In the determination of these points a number of factors must be taken into consideration. In a paper submitted to the Second International Road Congress at Brussels, Mr. Hector F. Gullan, superintendent of the Work Department of the City and County Borough of Belfast, discusses these factors as follows:

In dealing with the construction and maintenance of roads in large cites the factors which must be present in the mind of an engineer in the choice of the method and materials which shall be adopted for providing the surface of a roadway are as follows:

(1) The conditions of traffic.

(2) The cost per annum of present maintenance and cleansing.

(3) The cost per annum of maintenance and cleansing of any proposed method of surfacing, together with first cost of road reconstruction where such a change is required.

(4) The future development of the district and consequent future requirements of the road in respect to traffic.

(5) The local requirements in respect to noiselessness and non-slipperiness under varying conditions of weather.

(6) The hygienic qualities of respective methods.

Each road, and in some cases sections of the same road, should receive special consideration.

The nature and volume of the traffic, both mechanical and horse traction, should be carefully ascertained, both as regards speed, weight (load per axle), width of tires, together with any special local conditions that may be present.

It is most important that records should be kept with the utmost care of the actual cost per annum of existing surfacing, both as regards maintenance, cleansing, and in determining the cost of any particular road surface. Owing to the varying conditions of the seasons it is necessary to take the average of at least three years' records as a basis for calculation.

Where the question of altering the form of a road surface is under consideration the cost per annum for maintenance and cleansing, together with the first cost of any reconstruction that may be required, must be determined, and a comparison drawn between the existing cost and the future cost of the proposed work.

In all cases most careful consideration should be given to the probable or possible developments that may arise in the future, not only of the road under consideration, but also of the district through which it passes.

The question of non-slipperiness and noiselessness must be carefully studied, both in respect to gradients and curves and also in regard to the localities through which a road passes—residential districts, business quarters, shops, works, warehouses and quays.

The hygienic qualities principally required in road surfacing are non-absorption and dustlessness.

The principal road surfaces now in use are:

(1) Macadam (water-bound).

(2) Tar-macadam, including "Tarmac," "Tarvia," and other kindred tar-bound roads.

(3) Sett paving.

(4) Wood paving.

(5) Bituminous asphaltic paving, including Val de Travers and Limmer asphalte.

In dealing with the question of road surfacing it is absolutely essential that the foundation should in all cases be sufficient to support such loads as it may be called upon to bear over its entire area, as any failure or partial failure of the foundation is bound to destroy the surface, no matter how carefully the materials have been selected or how skilfully the work has been done.

PRINCIPAL ROAD SURFACES.

Macadam (Water-bound).—The essentials in the formation of a good macadam road surface are: the selection of a thoroughly tough stone which has been carefully broken to pass through a 2-in. ring, and after having been rolled into position the proper amount of small stone chippings added and brushed in, which shall be exactly sufficient to close the interstices between the stones without unduly choking the road with fine material.

During the rolling operations which are necessary to thoroughly consolidate the road a certain amount of water is required, which varies according to the state of the weather, but from the result of careful experiments the author is of opinion that the quantity of water used for this purpose in many cases is considerably overdone, and that in wet weather on flat roads, little or no water is required.

In Ireland in the driest of summer weather, not more than 4 gals. of water per sq. yd. of road surface is required.

A final coating of gravel, about ½ in. in depth, greatly assists in finishing the road surface and protects a new road from the effects of traffic.

The cost of surfacing a macadam road to a depth of 2½ ins. is from 9d to 1s 6d per sq. yd., according to local conditions.

Tar-Macadam.—The results of tar-macadam surfacing are largely dependent on the manner in which the tar solution is prepared. Care should be taken that all water or volatile oils are removed and that the tar be applied to the stone at a boiling temperature. The stone should also be hard, free from all dust, thoroughly dry, and warmed to a temperature of 100° before being coated with tar. Care should at the same time be taken not to scorch the stone in the drying process.

Various systems are in operation in preparing and laying down tar-macadam with the object of obtaining a road surface absolutely impervious to moisture and having all the stones bonded together into one homogeneous mass.

The full thickness of a surfacing of tar-macadam, after having been thoroughly consolidated, should be about 4 in., a 2½-in. layer of 2-in. tar-macadam being first laid and gently rolled, this being covered with a second layer 1 in. in depth of 1 in. material, which is again firmly rolled down and finally covered with a top layer ½-in. in depth of ½-in. material, the whole road being then thoroughly rolled and consolidated.

In practice it will be found necessary to somewhat exceed the thickness of each layer to allow for consolidation.

Where the road foundation is found to be moist it is desirable to spread a fine coating of ½-in. tar-macadam before laying the 2 in. material.

After the road has been laid for about six months and the surface has become hardened a coating of hot tar thoroughly brushed in greatly improves the surface and adds to its durability.

The cost of laying a tar-macadam surface on existing foundations varies from [illegible] to 5s per sq. yd. according to local [illegible].

Sett Paving.—Sett paving for [illegible] traffic should always be laid upon a bed of concrete from 6 to 9 ins. in depth, [illegible] according to the nature of the [illegible].

A thoroughly tough, hard [illegible] should be selected for sett paving, [illegible] at the same time will not become un[illegible] under horse traffic.

To determine the toughness [illegible] the Belfast Corporation has [illegible] attrition test to which [illegible] to be used for paving purposes [illegible] and no stone is accepted whe[illegible] exceeds a certain percentage [illegible]

Stone being supplied [illegible] tested from time to time to ascertain if the quality is being maintained.

The results of this test have been found of the greatest value in determining the wearing qualities of paving stone and also for macadam. After careful observations over a period of upwards of five years it is found that the comparison between the test results and those of conditions of actual wear are most remarkable.

The standard size of setts used in Belfast is 4 in. square on head and 6 in. in depth, truly dressed on all surfaces so that the setts can be paved on either end; the setts must be squared and dressed to the exact measurements (4 in. by 4 in.), and the variations in depth must not exceed ¼ in.

The 4-in. square sett on the surface affords greater foothold for horses, while, as compared with cubes, the extra 2-in. depth in the sett secures greater power of resistance to the rolling action of the traffic and breaking of the bond.

The setts are paved upon a 1-in. bed of compo formed of 4 parts of gravel and 1 part of cement and again grouted with compo of the same strength. Seven days are allowed for the jointing to set before the traffic is permitted to pass over the new paving.

The camber of a sett-paved roadway should not be greater than 1 in 50.

In some cases the sett paving is grouted with a mixture of pitch and tar. This has the advantage of allowing the traffic to pass over the roadway as soon as the jointing has become thoroughly hardened, but owing to the varying quality of pitch there is considerable risk of the joints not wearing satisfactorily over long periods.

The cost of laying sett paving on concrete foundations is 15s per sq. yd.; without the foundations 10s per sq. yd.

Wood Paving.—Wood paving, like sett paving, should be laid upon a bed of concrete, and in the case of wood paving the surface of the concrete must be truly floated in cement to correspond with the finished contour of the roadway, and the wood blocks directly laid on to the cement surface.

The sizes of wood blocks as laid in Belfast are 9 in. by 4½ in. by 3 in. All blocks must be of thoroughly well-seasoned wood, free from shakes or other defects, and cut square to exact sizes by machinery. The blocks before being laid should be dipped to a depth of ½ in. in a mixture of pitch and tar or creosote oil, and an expansion joint left on either side alongside the curb to allow for the expansion of the wood when the roadway becomes moist. The width of expansion joint allowed is approximately one ninetieth the width of the paving. To prevent the space being filled with dirt or moisture the joint is loosely closed in with puddled clay.

The author has used both cement and pitch for grouting wood paving, with satisfactory results in both cases; but in some instances, owing to the pitch mixture not being sufficiently hard, with the vibration of the traffic in hot weather, the grouting has worked downwards and forced its way under the lower surface of the blocks, thereby raising individual blocks above the normal level of the roadway.

The advantage of pitch as against cement is that the pitch will more readily adjust itself to the expansion and contraction of the wood paving, while a cement joint has no means of doing this after the bond is broken, and the moisture, therefore, more readily finds its way into the surface of the roadway.

Again, the traffic can be at once allowed to pass over the roadway as soon as the pitch grouting has cooled, while it is necessary for 7 days to elapse to allow the cement grouting to become thoroughly set.

The author's experience in the case of hard-wood paving (Karri and Jarrah) has been that the expansion and contraction is greater and more difficult to deal with than in the case of soft-wood (Baltic red wood).

TABLE I.—COST PER MILE OF MAINTENANCE AND CLEANSING OF A 24-FT. MACADAM CARRIAGEWAY AT VARIOUS PRICES PER SQUARE YARD PER ANNUM FOR A PERIOD OF 50 YEARS.

Prices Present cost per sq. yd. per annum.	Present cost per mile per annum.	Total cost at same rate for 50 years.	Estimate, cost having increased [illegible] per cent during the period of 50 years.
s d	£ s d	£ s d	£ s d
2 0	1,408 0 0	70,400 0 0	96,800 0 0
1 11	1,349 6 8	67,466 13 4	92,769 3 4
1 10	1,290 13 4	64,533 6 8	88,733 6 8
1 9	1,232 0 0	61,600 0 0	84,700 0 0
1 8	1,173 0 0	58,650 0 0	80,643 15 0
1 7	1,114 13 4	55,733 6 8	76,633 6 8
1 6	1,056 0 0	52,800 0 0	72,600 0 0
1 5	997 6 8	49,866 13 4	68,566 13 4
1 4	938 13 4	46,933 6 8	64,533 6 8
1 3	880 0 0	44,000 0 0	60,500 0 0
1 2	821 6 8	41,066 13 4	56,466 13 4
1 1	762 13 4	38,133 6 8	52,433 6 8
1 0	704 0 0	35,200 0 0	48,400 0 0
0 11	645 6 8	32,266 13 4	44,366 13 4
0 10	586 13 4	29,333 6 8	40,333 6 8

The cost of hard-wood paving is 17s per sq. yd., while soft wood costs 15s per sq. yd., including foundations in both cases.

Bituminous asphalte paving should be laid on a sound bed of concrete truly finished to correspond with the surface of the roadway. For heavy traffic a coating of 2 in. of asphalte should be laid, and care should be taken in spreading, where joining up to asphalte already hardened, to thoroughly make good the jointing in order to prevent fractures appearing in the road surface after the work has been finished.

The cost of a 2-in. surface of bituminous asphalte paving is 15s 6d per square yard, including foundations.

LIFE OF VARIOUS METHODS OF ROAD SURFACING.

Water-bound and tar-macadam should in no case be laid on roadways in large cities called upon to withstand the heaviest forms of traffic. For suburban roads and in side streets with light traffic both methods of surfacing will be found suitable.

The life of a properly formed macadam road surface on good foundations will vary from 1 to 5 years, or under favorable conditions even longer, according to the nature and volume of traffic passing over it, and also to

TABLE II.—COMPARATIVE FIGURES ON VARIOUS FORMS OF ROAD SURFACING FOR A PERIOD OF 50 YEARS.

Method of surfacing.	First Cost: Cost per square yard including foundations.	First Cost: Interest and sinking fund per square yard per annum [illegible]	First Cost: Total interest and sinking fund per annum [illegible]	Maintenance: Average cost per square yard per annum.	Maintenance: Cost for 50 years.	Cleansing: Average cost per square yard per annum.	Cleansing: Cost for 50 years.	Renewals: Number during period.	Renewals: [illegible]	Renewals: [illegible]
	s d	Pence.	£	Pence.	£	Pence.	£		£	£
Sett paving*	15 0	[illegible]	14,874	0.5	1,456	3.5	10,267	1	[illegible]	[illegible]
Hard wood*	17 0	[illegible]	14,[illegible]	4	11,733	4.5	[illegible]	[illegible]	[illegible]	[illegible]
Soft wood*	15 [illegible]	[illegible]	12,[illegible]	4	11,733	4.5	[illegible]	[illegible]	[illegible]	[illegible]
Bituminous asphalt*	15 6	[illegible]	12,[illegible]	9 and 12	22,176	3.0	[illegible]	[illegible]	[illegible]	[illegible]

*Interest and sinking fund on loan at 3½ per cent for [illegible] years for sett paving, [illegible] cent for 10 years for hard wood paving at 3½ per cent for [illegible] per cent for 10 years for [illegible] macadam. Cost of [illegible] next seven years 9d per square [illegible] and last four years [illegible] turned lower end upwards.

a certain extent to the conditions of weather.

The increased durability of tar-macadam over water-bound macadam on good foundations may be taken in the ratio of 3 to 1.

The following is the life of paved roadways on concrete foundations all of best materials and workmanship:

Sett pavement, life 50 years; (setts supplied to Belfast standard specification once repaved lower end upwards during this period). Hard-wood pavement, life 12 years; soft-wood pavement, life 9 years; bituminous asphalte pavement, life 14 years.

COST OF VARIOUS METHODS OF ROAD SURFACING.

Owing to the varying durability of the different methods of road surfacing, in considering the question of cost it is necessary to determine a period which will afford a fair and proper comparison between one class of road surface and another. For this purpose the author proposes to adopt a period of 50 years.

In dealing with leading macadam roads it is estimated the increased cost of maintenance and cleansing will, in the course of 50 years, vary from 50 to 100 per cent more than at the present time due to the increase of wear and tear in consequence of the growing volume and weight of the traffic year by year and also to the probable increase in the cost of labor and materials in time to come.

In the consideration of the conversion of a macadam road surface into a more permanent form suitable for heavy traffic it is necessary to determine two factors—(1) the initial cost of the proposed change, and (2) the increased expenditure on the maintenance and cleansing of a macadam road surface if no such alteration is made.

At the termination of the 50-year period the concrete foundations would still be intact, and in the case of sett paving the setts would be worth, at present prices, £2,816 for dressing and repaving.

It may also be explained, for the information of the Congress, that in Great Britain the Local Government Board grant municipal authorities permission to obtain loans for the first cost of various forms of street paving, which must be repaid over stated periods, according to the class of the paving, and for the purposes of the calculations in the table these periods have been adopted.

As regards the amount of dust produced on the various forms of road surfacing, there is no doubt that a bituminous asphalte paving reduces this to a minimum. The dust produced on a well-laid sett-paved surface is also remarkably small, while wood paving, on account of the necessity of the "graveling" or "gritting" of the surface, at times produces a considerable amount of dust.

With reference to the wearing qualities of sett paving, the life of this surfacing has been determined as the result of data obtained from existing thoroughfares bearing the heaviest forms of traffic, some of which have been laid upwards of 40 years. The author again desires to emphasize the necessity of securing the toughest stone, carefully dressed, and laid with the very best material and workmanship. The number of quarries from which this class of stone can be obtained is by no means numerous, and the greatest care must be taken in the selection of the stone.

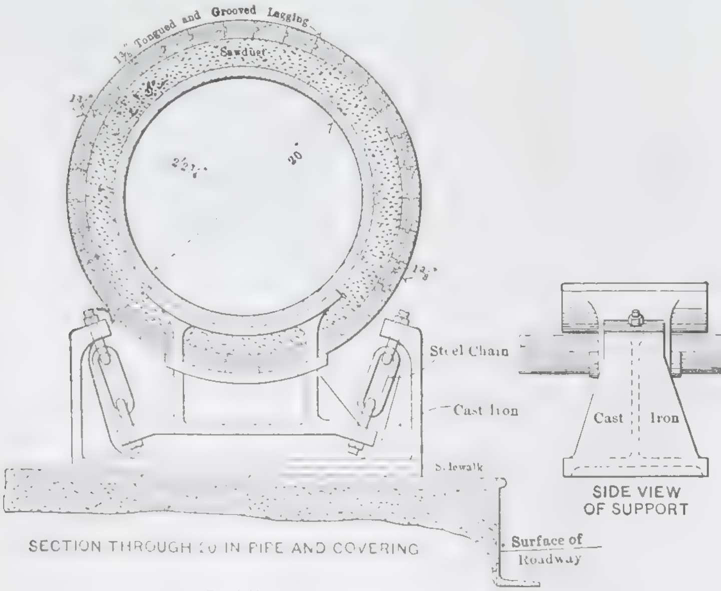
There is no doubt that this form of road surfacing is largely objected to on the question of noise, but in the case of mechanical traction this does not arise to anything like the same degree. With light motor traffic it does not obtain at all; and only in the case of heavy motors can the complaint be urged, but even this traffic does not cause anything like the amount of noise that certain classes of horse traction produce.

With the further advance of the science of heavy motor construction this objection can doubtless be largely overcome by the manufacturers of motor vehicles co-operating towards this end, both in their own interests, by the consequent reduction in the wear and tear caused by the vibration of various parts, and also in the interests of the general public.

WATER-WORKS AND SEWERS SECTION

Saddle Supports For a Water Main Carried On a Bridge Superstructure.

In constructing a bridge 773 ft. long to carry Thompson st., over the tracks of the new Sunnyside passenger yards of the Pennsylvania R. R. on Long Island, it was found necessary to install a 20-in. water main, which originally occupied the street, on the bridge superstructure. Owing to lack of headroom the pipe could not well be suspended underneath the bridge, and it was decided to mount it on the deck, and to overcome the effects due to bridge expansion on the pipe if it were laid directly on the bridge and also to avoid the use of expansion pipe joints, a special saddle mounting was devised. This saddle support is shown by the accompanying cut, and it has proved entirely satisfactory. We are indebted for the above information to a paper by Louis H. Barker, presented to the American Society of Civil Engineers.*



Saddle Support for Water Main.

Operating Costs at the St. Louis Coagulating Works.

The water supply of St. Louis is treated by congulation and sedimentation and in May, 1909, a new coagulating works was put in operation, the old works being maintained in operation, as a safeguard until Oct. 1, 1909. The following operating results and evils of the coagulating works are given in the report of water commissioner, Mr. Ben C. Adkins:

During the year in the clarification of the 32,029 million gallons of water pumped by the Low Service, there has been 13,044 tons lime and 6,649 tons sulphate of iron, of which 11,511 tons lime and 5,759 tons sulphate of iron were handled in the new house. The yearly maximum, minimum and average quantities of coagulant used in grains per gallon since the installation of the process have been as in Table I.

The cost of purification per million gallons during the past year has been $4.84, the charges being divided as shown in Table II, 3,910 million gallons of water being treated during the 46 days the old house was in service, and 28,119 million gallons in the 319 days since.

The increase in the cost of treatment this year over that of year 1908-1909 is due to the larger qualities of coagulant, particularly the sulphate of iron, required, because of the prolonged stage of high water. The item Water Anaylses has not appeared on former reports, but is a charge for the work done in the Chemical Laboratory.

The unit costs for the past year are not a true indication of the economies to be realized in the future operation of the new house. The year's service has shown the desirability of some changes in and additions to the equipment that should result in an increased efficiency, while the installation of parts originally contemplated, but not completed when the house was started up, has required a larger operating force than will be necessary when this work has been finished. The belt conveyors have, as a type, proven unsuited to the handling of the crushed lime and sulphate of iron, the dust from which collects in the casings below the belts, increasing the power required for operation, and, if not cleaned out at regular intervals, eventually choking down the machinery. This is especially noticeable in summer when the lime slakes badly in transit from the kilns and the amount of dust to be handled is proportionately increased. The scraper conveyors in the lantern, handling the same materials, have given us no trouble and it is planned now to replace all belt conveyors with others of the scraper type. The automatic starters, originally installed in connection with the conveying system, have proven unsatisfactory, and in accordance with the results developed by experimental work, plans and specifications for a type better adapted to our requirements have been prepared.

The sulphate of iron, if not thoroughly dry

TABLE I.

Year.	Lime in Gr. per Gal.			Sulphate of Iron (Gr. per Gal.)		
	Max.	Min.	Ave.	Max.	Min.	Ave.
[illegible]	9.00	4.00	6.02	5.00	0.	1.52
[illegible]	10.00	5.00	6.28	5.00	0.50	2.20
[illegible]	10.50	3.00	7.39	4.75	1.25	2.13
[illegible]	9.75	4.00	6.02	4.25	0.	2.55
[illegible]	8.00	4.75	5.58	4.25	1.75	2.41
[illegible]	8.25	4.50	5.70	4.50	1.50	2.91

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*"The New York Tunnel Extension of the Pennsylvania R. R. Sunnyside Yards," by Louis H. Barker, Proc. Am. Soc. C. E., Vol. XXXVI p. 1170.

when unloaded, cakes badly in the storage bins and must be broken up before it can be reclaimed. Such lumps as were not crushed by handling in the conveyors and elevators passing through the daily supply hopper, clogged up the orifices in the iron feeders, requiring the presence of an attendant to ensure a proper feed. The installation of grinders, of our own design, in the feed pipes leading from the daily supply hopper to the feeders, at such a height above the feeders that their accuracy was not affected, obviated this difficulty. A rejection of all sulphate not properly dried before shipments, or which has become wet because of leaky cars, will in connection with the improved unloading chutes, designed to protect the material from dampening in case of rain during the period of unloading, reduce the amount of caking in the bins if it does not entirely eliminate it.

TABLE II.

	Old House.	New House.	Average.
*Lime	$1.856	$1.938	$1.928
*Sulphate of Iron	2.400	2.087	2.125
Unloading	0.097	0.118	0.115
Operating and Maintenance (Labor)	0.418	0.295	0.310
Repairs	0.007	0.034	0.030
Water, Coal, Oil, etc	0.056	0.045	0.047
Light and Power	0.113	0.069	0.074
Water Analyses (Chemists)	0.155	0.154	0.154
Emergency Force	.....	....	0.053
Total	$5.102	$4.740	$4.836

*Under the heading Lime and Sulphate of Iron are included all charges connected with the switching of these materials from the interchange tracks at Bissell's Point and Humboldt Avenue to the Chain of Rocks.

Methods of Garbage Collection and Disposal in the Canal Zone, Panama and Colon *

The disposal of the garbage that is collected daily in the Canal Zone settlements and the cities of Panama and Colon is accomplished in several ways. The method used in the two Panamanian cities is to dump it in a waste place, where it is burned, leaving piles of ashes and other refuse which serve to build up and reclaim the land. The plan largely obtaining in the Canal Zone towns is to reduce the garbage as far as possible to char and ashes by means of incinerators. In some of the villages the garbage is hauled to out-of-the-way spots and there burned and buried; and in the towns bordering on the Chagres River, the disposition is easily made by dumping all refuse into that stream. At one point, Porto Bello, it is taken out to sea and dumped.

When measures for taking care of the garbage were first instituted, they were entirely in the hands of the Department of Sanitation. On Sept. 1, 1908, the work was taken over by the Quartermaster's Department, excepting in the cities of Panama and Colon, but the cost continues to be paid from the appropriation for sanitation. Up to Jan. 1, 1907, street sweeping and garbage collecting in the city of Panama were handled by the Sanitary Department forces, but on that date according to mutual agreement the work was turned over to the Panama Government. Under this arrangement the Department of Sanitation pays to the Panama Government the sum of $10,000 annually, which, it is estimated, represents about one-half of the yearly cost of garbage collecting and street sweeping. In Colon one-half of the cost of collecting the garbage is borne by the Panama Government, and bills for the service are presented quarterly. The work there, and in Cristobal, is under the supervision of the local health office.

Garbage cans in two sizes, one 25 ins. high and 18 ins. in diameter, and the other 19 ins. high and 15 ins. in diameter, costing on an average about $2.28 and $1.49 each, respectively, are furnished to all business places and dwellings in Colon, and all native houses, stores and employes' quarters in the Canal Zone settlements. In Panama, where the street cleaning and garbage collecting are in the hands of the municipal authorities, containers are provided by the city. These cans are strongly made, the body of 22 gage steel, and the lids and bottoms of 20 gage steel. In addition, they are strengthened with bands around the top and bottom.

East of Panama, forming a part of the outlying district of Trujillo, is a large tract of swampy ground where all the garbage collected in Panama and Ancon is dumped, the fires in the slowly burning heaps continuing day and night. As time passes the land is gradually reclaimed and when a certain height is reached the dump is extended eastwardly into the swamp. Practically the same method of handling prevails in Colon, as in Panama, the site of the dumping ground, known as the Ninth St. dump, lying to the east of the city, adjacent to the section shortly to be filled in and improved. At this point also much land has been reclaimed.

All the larger towns in the Zone are provided with incinerating plants, some purchased in the States, others built on the Isthmus from old material. The imported incinerators are nearly all of a uniform type, but of varying capacity, and most of them were made by the Morse-Bulger Destructor Co. of New York city. The towns of Miraflores, Paraiso, Culebra, Empire, Las Cascadas, Gorgona, Tabernilla and Gatun have plants of this type, while those at Balboa, Corozal and Pedro Miguel have been erected on the spot from ready-to-hand materials. The incinerator at Empire, installed about a year ago, offers the best type on the Isthmus of a small, modern plant. The original plant, which it replaced, was the first one in use on the Isthmus and had a capacity of 60 cu. yds. daily, as compared with 480 cu. yds. daily, the capacity of the new outfit. It is now doing duty at Miraflores. At the time the Empire plant became inadequate to take care of all the garbage, the plan was tried of carrying it away in railroad dump cars. The method worked successfully and shipments were made at the rate of about one car a day at a cost no higher than that of incineration. The location of the dumping ground was between Golden Green and West Culebra, but as the Central Division decided to stop dumping there this plan of disposing of the garbage had to be abandoned and the purchase of a new and much larger incinerator was made necessary.

The rapid growth of Gatun has necessitated better facilities for the disposal of garbage, and a new incinerator has recently been received to replace the small one now in use. At present some of the garbage collected in the vicinity of the spillway is thrown into the river.

The plant at Corozal, designed by the local sanitary inspector, and the one at old Balboa are representative of the locally constructed type. Their cost was small and they have given excellent results. The Corozal plant is built largely of discarded iron plates and old French rails imbedded in concrete, with a brick base for the smokestack. The interior is divided into three compartments, an ash box, a fire box and a receptacle for the garbage, which is supplied from the top by removing a loose iron plate. The method ordinarily employed in operating the incinerators is to build a wood fire to assist in drying out the garbage, which is usually in a sodden state when first received. As fast as the garbage dries it is raked over and made to fall into the furnace, where it furnishes fuel to continue the process. The gas from the garbage accumulates in another part of the furnace and also assists in the general work of reduction. The ashes and noncombustible articles fall into the ash box and from there are carried away in wheelbarrows.

At Camp Elliott there is an incinerator operated by the camp authorities. At Bas Obispo village the garbage is carted away, burned and then buried. At Gorgona much of the refuse was formerly disposed of by dumping it into the Chagres River from a platform built out into the stream. The platform was washed away during the flood of last year and refuse is now destroyed in an incinerator. At San Pablo, Frijoles and Bohio the Chagres River acts as scavenger. Bohio, the largest of the three settlements, is provided with a chute down which the garbage is thrown. At Porto Bello the plan was adopted of taking the garbage out to sea. It is carried to a small dock on the water front built for the purpose and there dumped into barrels for conveyance by boat to deep water.

Garbage collections from dwellings in the Zone are made each morning, but the hotels require two and three collections daily. In the larger settlements, specially built wagons, both of the wooden and iron box types, are used in this work. The main expense in connection with garbage disposal is its collection and transportation, and it has been customary to locate dumping grounds and incinerating plants as near a common center between the American and native sections of the towns as possible, to save haulage. The refuse from the Zone slaughter houses, which are under the control of the Department of Public Works, is taken care of by its own employes.

In Colon all garbage is carefully examined before it is burned, and lumber, well-built barrels or casks, bottles and other articles having a commercial value are saved. The money realized from this source amounts in some months to several hundred dollars and reverts to the Department of Construction and Engineering. Three of the employes on the garbage force in Colon are paid by the Atlantic Division. In the Zone, practically the same salvage methods are employed and a large amount of copper wire screening has been realized on in this way. A lot of cast-off clothing is destroyed in the incinerators, but owing to the distance from a market and to the necessity of a thorough disinfection before shipment, there would be little or no profit in handling it. In Panama, the task of sorting over the garbage is undertaken by the local authorities, and the moneys derived therefrom revert to the municipality.

A statement of the number of garbage cans emptied daily in the different settlements during the month of July, 1910, follows:

Ancon	226	Matachin	210
Balboa	256	Gorgona	518
Corozal	151	San Pablo	199
Miraflores	96	Tabernilla	235
Pedro Miguel	307	Bohio	86
Paraiso	398	Gatun	1,338
Culebra	739	Mount Hope	112
Empire	1,571	Cristobal	479
Las Cascadas	329	Porto Bello	140
Bas Obispo	224		
		Total	7,614

During the fiscal year ending June 30, 1910, there were removed from the city of Panama 6,600 cart loads of refuse, and from Colon, Cristobal and Mount Hope, 2,434 cart loads.

During the month of August the total amount of material excavated in the Central Division was 1,612,396 cubic yards, of which 434,775 cubic yards were classified as earth and 1,177,621 cubic yards as rock. Of this quantity, 1,602,738 cubic yards were removed by steam shovels; 4,844 cubic yards were blasted and washed out by high water; 278 cubic yards were removed by hand, and 4,536 cubic yards were pick and shovel excavation by contract.

The high record for the month was made by shovel No. 208, working 27 days in the Culebra District, which excavated 57,292 cubic yards of rock and earth. The second best record was made by shovel 223, working 26 days in the Culebra District, which excavated 49,739 cubic yards of rock.

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*Reprinted from the [illegible] Sept. 7, 1910.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Methods of Conducting the Valuation of the Physical Properties of the Chicago Consolidated Traction Co., with Summaries of Costs.

BY PHILIP J. KEALY.

TABLE II.—SHOWING COST OF NEW, PRESENT VALUE AND REHABILITATION VALUE OF 123.302 MILES OF TRACK.

Kind of track.	Cost new.	Present value.	Rehab. value.
Sec. A: Tangent track	$1,898,237.46	$1,230,363.04	$1,065,666.14
Sec. B: Track special work........	160,386.68	3,644.24	46,915.20
Sec. C: Track on bridges..............	4,320.93	3,242.32	3,242.32
Sec. D: Tang. track in houses and yards	9,243.10	2,618.17	1,707.32
Sec. E: Track spec. in houses and yards.........	19,023.96	6,543.07	3,685.40
Totals	$2,091,214.13	$1,289,681.84	$1,121,216.38
Per mile of track................................	16,960.00	10,459.00	9,093.06

The Traction Valuation Commission of Chicago, Bion J. Arnold and George W. Weston commissioners, has recently completed a detailed and exhaustive appraisal of the physical property of the above named company, the last of the Chicago surface traction lines to come under the "Chicago Ordinances." The appraisal is the result of several months' work of about 40 employes of the Arnold Co., under the immediate supervision of Mr. F. A. Sager, and was made on the premises hereinafter given, which in general applied to the previous appraisals made of the surface traction lines in Chicago.

The Consolidated Traction Co. comprises seven underlying companies and operates on the north and west sides of the city; about one-third of its track mileage is outside the city limits, extending to Evanston on the north and to the various suburbs on the west. This valuation, however, covers only that portion of the system within the city limits. Of the various routes operated, but two enter the loop district, the others serving in most cases as feeder lines to the Chicago Railways Co.

The appraisal, Table I, which covers all the physical property on 123.302 miles of track, gives not only the cost new and present (or going) value, but also a value termed the capital account or rehabilitation value, which is fully explained in another part of this article. All material prices are f. o. b. Chicago market prices as of Feb. 1, 1910.

For the purpose of making inventory, the property was divided into the following divisions, or exhibits:

Exhibit I. Track.
Exhibit II. Electric Power Distribution System.
Exhibit III. Rolling Stock.
Exhibit IV. Power Plant Equipment.
Exhibit V. Tools, Supplies and Furniture.
Exhibit VI. Buildings.
Exhibit VII. Real Estate.
Exhibit VIII. Paving.

These divisions were then sub-divided into various parts. For example, "Track" was sub-divided into tangent track, track special work, track on bridges, tangent track in car houses and yards, track special work in car houses and yards; and similar sub-divisions were made for the other general divisions, or exhibits.

TABLE I.—APPRAISED VALUE OF THE CHICAGO CONSOLIDATED TRACTION SYSTEM—GENERAL SUMMARY.

Exhibit.	Item.	Cost new.	Rehabilitation value.
I.	Track	$2,091,214.13	$1,121,216.38
II.	Electric Power Distribution ...	855,966.20	693,481.95
III.	Rolling Stock	[illegible]	195,118.77
IV.	Power Plant Equipment	[illegible]	117,886.81
V.	Tools, Supplies, Furniture, etc..	88,177.91	71,999.52
VI.	Buildings	338,626.20	265,417.00
VII.	Real Estate	84,228.00	84,228.00
VIII.	Paving	[illegible]	[illegible]
		$5,882,987.40	$3,286,575.13
	Legal expenses, carrying charges and contingencies, 5% ..	[illegible]	[illegible]
		$6,177,136.77	$3,450,903.89
	Conducting work, furnishing equipment and brokerage, 15% ..	[illegible]	[illegible]
	Total value	[illegible]	[illegible]

Premises.

EXHIBIT I—TRACK.

DIVISION I—A, TANGENT TRACK.

The track in this section was divided into classes, these classes being determined by the varying weights and types of rails, and by the styles of construction. Under each class an estimate was made of the cost of material and labor required to reproduce the track new at the time of this valuation Nov. 1, 1909, under the original specifications; and to this amount has been added 15 per cent for organization, engineering incidentals, etc., giving the total cost. Data were obtained from detailed examination of the track in the field, in which the length of rail, kind of joint, type of rail and substructure was determined. Additional information was obtained from the track map in the office of the Chicago Consolidated Co. and from representatives of the Consolidated Company. All distances shown are actual field measurements. The lengths of the various pieces of special work were excluded in determining tangent track distances.

In depreciating the track three factors have been considered: (1) The condition of joints; (2) the condition of ties, including ballast; (3) the wearing life of the head of the rail. From examination of the rail in place it was found that none of the rail would have to be discarded on account of broken or defective wagon treads.

The present value of the rail, excepting the joints, was determined in terms of the wearing value remaining at the present time in the head of the rail. The life of the rail is considered the period of time required for the head of the rail to wear away to a height of ⅝ ins. above the tram or the base of groove in trilby rail. The difference between this height and the height of the head above the tram or base of groove at any time constitutes the wearing value of the rail at that time.

The distance between the head and tram of all rail was determined and expressed in 64ths of an inch. To determine the height of the head of the rail at the present time, measurements were taken along the track with a specially constructed Vernier device, by means of which the actual distance between the head of the rail and the tram was obtained in 64ths of an inch. These measurements were obtained at frequent intervals on each section, sufficient number being taken for each section to determine the average height of the head of the rail. From this determined height was deducted the scrap height of 40/64 in., the remainder representing the present wearing value of the rail. In this method the depreciation of the rail is entirely independent of the life of the track substructure.

All joints were depreciated on the assumption that it would be necessary to renew them at some time in order to realize the full wearing value of the head of the rail, and it was assumed that at the time of such renewal the ends of the rail would be cut off and the life of the balance of the rail lengthened thereby.

The average life of the ties and joints was taken for all old tracks at 20 years and the normal depreciation was determined by applying this depreciation rate to the age of the property as determined.

On account of the fact that in many respects the property had not received ordinary maintenance, the Valuation Commission gave instructions to the effect that the estimated amount of this deferred maintenance be segregated in making up valuations of the property as a going concern. These instructions in no way affect the final value that would be returned in appraising the property, but include a statement as to the difference between the value of the property as it exists today and the value that the property would have had, had normal maintenance expenditures been made on the property throughout its entire life. The application of the method of indicating the deferred maintenance on track is as follows:

In case of rails, the present value of the rail has been determined by readings indicating the wear of the head, and from these readings the remaining wearing value of the rail has been computed. In case of bad alignment of rail, surface kinks, due to improper maintenance of tracks and to operation of heavier cars than those from which the track was designed, the additional depreciation due to this condition has been expressed in terms of a percentage of the wearing value.

In case of substructure and joints whereas it was estimated that with proper maintenance the life of this part of the property should be 20 years, where improper maintenance was evident one or two years were added to the age of the property as determined from the records, this being equivalent to depreciating this part of the property for a period of one or two years in excess of its actual life.

Each line has been considered separately in applying this additional depreciation and careful study was made of the various physical conditions entering into the determination. In the case of Class A and Class A-I track, which has been recently built, and corresponds to Type 2A and Type 3 of the Board of Supervising Engineers, the average life of the substructure was taken as 25 years. The welded joints were assumed to have the same life as the rail, and were depreciated with it, since the joints must be rewelded when the rail is renewed.

DIVISION I—B.

TRACK SPECIAL WORK.

Each piece of special work was measured, listed and sketched. In order to determine the cost new of the special work complete there was added to the cost of the layout the cost of ties, ballast, excavation, labor and miscellaneous items necessary to install same. The various kinds of special work now ex-

TABLE III.—VALUATION OF TRACK BY CLASSES OF CONSTRUCTION AS DESCRIBED IN SCHEDULE I.

Class.	Total mileage.	Unit cost per mile, new.	Total cost new.	Present value.	Rehabilitation value.
[illegible]	6.2085	$31,353.29	$ 194,656.90	$ 194,656.90	$ 194,656.93
[illegible]	9.0647	31,007.30	281,071.86	273,287.68	273,287.68
B	1.006	12,038.62	12,110.85	6,243.93	3,075.39
B-1	6.893	12,153.62	83,774.90	38,671.29	22,040.37
B-2	16.1957	12,200.55	197,596.45	121,332.95	119,377.75
B-3	60.6674	12,985.86	787,818.37	429,077.04	309,877.69
[illegible]	1.909	14,647.98	27,962.99	22,324.29	22,324.29
[illegible]	1.4871	13,801.08	20,523.58	15,507.14	13,619.81
[illegible]	.529	12,467.21	6,595.15	3,280.98	2,217.18
[illegible]	3.448	12,871.46	44,380.79	23,298.10	12,423.01
[illegible]	6.2505	14,015.24	87,602.26	11,274.21	11,274.21
F	7.712	15,705.07	121,117.50	61,997.37	52,080.70
F-	.995	17,617.35	17,529.26	15,401.48	15,401.48
[illegible]	.936	16,556.16	15,496.57	14,009.65	14,009.65
	[illegible]		$1,898,237.46	$1,230,363.04	$1,065,666.14

isting, their location and quality are collected on a summary sheet.

On inspection it was found that most of the track special work layouts, excepting 9-in. manganese cross-overs, were in bad shape and some of the layouts were field built. A scrap value of 24 per cent of the cost new has been placed on all special work, except the 9-in. manganese cross-overs and the new 9-in. curved rail, which layouts were put in during the summer of 1909 and have not been depreciated.

But little official information could be obtained as to the ownership of the various pieces of special work used jointly with foreign lines. A large proportion of the pieces operated jointly with the Chicago Railways Co. were included in the valuation of the Chicago Union Traction Co. of 1906, and for that reason are not credited to the Consolidated Company. A list of these layouts is shown on the track special work summary.

DIVISION I—C.

TRACK ON BRIDGES.

The cost of track on bridges includes the cost of rail laid together with that of miscellaneous track material used in bridge construction.

DIVISION I—D.

TRACK IN CAR HOUSE AND YARDS.

The track was measured in detail, and unit estimates were made of the cost to construct new. In depreciating this track a scrap value of 25 per cent of the cost new has been allowed in all houses and yards, except Edgewater house. In general this rail is badly worn, and the ties and joints are in poor condition.

DIVISION I—E.

TRACK SPECIAL WORK IN CAR HOUSES AND YARDS.

Each house layout was measured and listed and a sketch of the layout was made. The cost of these layouts was determined as in Division I—B. The condition of the car house special work is similar to that of the tangent track special work, and excepting the Edgewater house all layouts are listed at a value of 25 per cent of the cost new.

Valuation.

The total mileage of track appraised was 123.302 miles and the valuation of each type of track is summarized in Table II.

The several classes of track construction found are described in the following schedule and the valuation of each class is given in Table III.

SCHEDULE I.—CLASSES OF TRACK CONSTRUCTION.

Class.	Description.
A	9-in. 129-lb. Lorain rail, 58-ft. lengths, concrete foundation welded joints, 10 ft. 2 in. centers, type 2-A. Board of Supervising Engineers.
A-1	9-in. 129-lb. Lorain rail 58-ft lengths, crushed stone ballast, welded joints. 10 ft. 2 in. centers, type 3. Board of Supervising Engineers.
B	7 3-16-in., 85-lb. girder rail, 30-ft. lengths, no ballast, 3 ft. tie spacing, tie plates on every other tie, bonded joints, 9 ft. 6 in. centers, 7½ ft. tie rod spacing.
B-1	7 3-16-in. 85-lb. girder rail, 30-ft. lengths, no ballast, 3-ft. tie spacing, tie plates on every other tie, 11 ft. 6 in. centers, bond joints, 1½ ft. tie rod spacing.
B-2	7 3-16-in. 85-lb. girder rail, 60-ft. lengths, no ballast, 2½-ft. tie spacing, tie plates on every other tie, bonded joints, 7½ ft. tie rod spacing.
B-3	7 3-16-in., 85-lb. girder rail, 30-ft. lengths, no ballast. 2-ft. tie spacing, tie plates on every other tie, bonded joints, 7½ ft. tie rod spacing.
B-4	7 3-16-in., 85-lb. girder rail, 60-ft. lengths, cinder ballast, 2-ft. tie spacing, no tie plates, welded joints, 7½ ft. tie rod spacing.
C	7-in., 96-lb. Trilby (L 357), 30-ft. lengths, no ballast, 2-ft. tie spacing, tie plates on every other tie, bonded joints, 7½ ft. tie rod spacing.
D	6-in., 78-lb. girder (L-225), 30-ft. lengths, no ballast, 2-ft. tie spacing, tie plates on every other tie, bonded fish-plate joints, 7½ ft. tie rod spacing.
D-1	6-in., 78-lb. girder (L-225), 60-ft. lengths, no ballast, 2-ft. tie spacing, tie plates on every other tie, w[illegible] 7½ ft. tie rod spacing.
E	4½-in., approx. [illegible] -ft. lengths, no ballast, rail on chairs, 2-ft. tie spacing, 7½ ft. t[illegible]
F	8¾-in., 96-lb. gird[illegible] cinder ballast, 2½-ft. tie spacing, braced tie plates on every tie, bonded fish-plate joints, 7½ ft. ti[illegible]

Class A.—9-in. 129-lb. Lorain rail, 58-ft. lengths, concrete foundation, welded joints, Type 2A, Board of Supervising Engineers.

Estimate of cost to produce one mile of Single Track. 10-ft. 2-in. centers.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
9-in. 129-lb. Lorain rail	Ton	202.71	$39.00	$7,905.69
Tie rods	Each	910.00	.25	227.50
Joints	Each	195.00	5.00	975.00
Ties, 6 in. x 8 in. x 8 ft.	Each	1,820.00	.70	1,274.00
Tie plates	100	3,640.00	9.00	327.60
Screw spikes	100	7,280.00	2.15	156.52
Lag screws (Fetter drive)	100	7,280.00	.40	29.12
Cement	Bbl.	2,034.00	1.60	3,254.40
Sand, torpedo	Cu. yds.	969.00	1.00	969.00
Stone	Cu. yds.	1,831.00	1.50	2,746.50
Track labor (see details attached)	Ft.	5,280.00	.79	4,171.20
Teaming (see details attached)	Ft.	5,280.00	.99	5,227.20
				$27,263.73
Organization, engineering and incidentals, 15%				4,089.56
Total cost per mile				$31.353.29

Class A-1.—9-in. 129-lb. Lorain rail, 58-ft. lengths, crushed stone ballast, welded joints. Type No. 3, Board of Supervising Engineers.

Estimate of cost to produce one mile of single track. 10-ft. 2-in. centers.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail	Ton	202.71	$39.00	$7,905.69
Tie rods	Each	910	.25	227.50
Joints	Each	195	5.00	975.00
Ties	Each	2,640	.70	1,848.00
Tie plates	Per 100	5,280	9.00	475.20
Screw spikes	Per 100	10,560	2.15	227.04
Lag screws (fetter drive)	Per 100	10,560	.40	42.24
Cement	Bbl.	1,263	1.60	2,020.80
Sand, torpedo	Cu. yds.	600	1.00	600.00
Stone, crushed	Cu. yds.	2,162	1.50	3,243.00
Track labor (see details attached)	Ft.	5,280	.79	4,171.20
Track teaming (see details attached)	Ft.	5,280	.99	5,227.20
				$26,962.87
Organizing, engineering and incidentals, 15%				4,044.43
Total cost per mile				$31.007.30

Class B.—7 3-16-in. girder rail, 85-lb. 30-ft. lengths, no ballast, 3-ft. tie spacing, tie plates on every other tie, bonded joints.

Estimate of cost to produce one mile of single track. 9-ft. 6-in. centers.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 85 lbs. per yd. (delivered)	Tons	133.57	$40.00	$5,342.80
Hauling to street	Tons	133.57	1.00	133.57
Excavation (9 ft. 6 in. centers)	Cu. yds.	2,410	.50	1,205.00
Ties delivered	Each	1,760	.70	1,232.00
Tie Rods	Each	700	.21	147.00
Tie plates (braced)	Each	1,760	.18	316.80
Rail Chair Joints, complete	Each	352	1.10	387.20
Spikes	Kegs	30	4.00	120.00
Labor—Track Laying	Per ft.	5,280	.30	1,584.00
				$10,468.37
Organization, engineering and incidentals, 15%				1,570.25
Total cost per mile				$12,038.62

Class B-1.—7 3-16 in. girder rail, 85-lb. 30-ft. lengths, no ballast, 3-ft. tie spacing, tie plates on every other tie, bonded joints.

Estimate of cost to produce one mile of single track,, 11-ft. 6-in. centers.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 85-lb. per yard (delivered)	Tons	133.57	$40.00	$5,342.80
Hauling to street	Tons	133.57	1.00	133.57
Excavation (11-ft. 6-in. centers)	Cu. yds.	2,610	0.50	1,305.00
Ties delivered	Each	1,760	0.70	1,232.00
Tie rods	Each	700	0.21	147.00
Tie plates (braced)	Each	1,760	0.18	316.80
Rail chair joints, complete	Each	352	1.10	387.20
Spikes	Keg	30	4.00	120.00
Labor track laying	Per ft.	5,280	0.30	1,584.00
				$10,568.37
Organization, engineering and incidentals, 15%				1,585.25
Total cost per mile				$12,153.62

DEPRECIATION OF ONE MILE OF SINGLE TRACK

Depreciation due to joints.

		Cost new.	Scrap value.	Wearing value.
Rail cut off 3% of cost and hauling		$164.29		
3% scrap—4.01 tons at $11.00			$44.11	$120.18
Rail chair joints and bolts, 352 at 60 lbs. each		387.20		
9.43 tons at $11.00			103.73	283.47
Labor on joints at .01 per ft.		52.80		52.80
Labor:				
Placing rail, spiking, etc.	$0.09			
Surfacing	.02			
Miscellaneous and incidentals	.03			
5,280 ft. at	$0.14	739.20		739.20
		$1,343.49	$147.84	$1,195.65

Life of joint, 20 years.
Annual depreciation in per cent of wearing value, 5%.

Depreciation Due to Ties.

	Cost new.	Scrap value.	Wearing value.
Ties	$1,232.00		$1,232.00
Tie rods	147.00		147.00
Tie plates	316.80		
3 tons scrap at $10.00		$30.00	286.80
Spikes	120.00		
2 tons scrap at $10.00		20.00	100.00
Labor placing ties, .02 per ft.	105.60		105.60
	$1,921.40	$50.00	$1,871.40

Life of tie. 20 years.
Annual depreciation in per cent of wearing value, 5%.

F-1 8 25-32-in. girder rail, 96 lbs., 30-ft. lengths, stone ballast, 2-ft. tie spacing, braced tie plates on every tie, 7½ ft. tie rod spacing, bonded fish-plate joints.

F-2 8 25-32 in., 96-lb. girder (L-200), 60-ft. lengths, cinder ballast, 2-ft. tie spacing, braced tie plates on every tie, 7½ ft. tie rod spacing, welded joints.

In obtaining these values a unit cost estimate was worked out for each class of track described in the schedule. The detail computation for three classes of track B-1, D-1 and F-2 follow and illustrates clearly the methods pursued in figuring depreciation. In addition we give the unit cost estimates alone for the

A summary by items per year of the depreciation for each class of track is given in Table IV.

TABLE IV. DEPRECIATION BY ITEMS PER YEAR OF VARIOUS CLASSES OF TANGENT TRACK.

	Depreciation per mile		
Class	Joints per year.	Ties per year.	Rail per 1-64 in. wear.
A	....	.....	.....
A-1	....	$558.85	$289.36
B	$69.83	108.02	157.78
B-1	69.85	108.00	157.88
B-2	58.04	125.93	159.88
B-3	70.42	156.35	156.15
B-4	....	171.87	205.96
C	71.38	156.31	199.48
D	69.83	156.33	185.94
D-1	....	156.33	249.06
E—Scrap only.			
F	90.65	171.61	201.46
F-1	90.64	235.33	201.39
F-2	....	221.49	254.58

Track Special Work.—As there are 130 layouts under this head, each requiring a sketch plan to explain it, only typical examples are given here. A unit cost estimate was made in detail for each style of layout and the following are examples:

Costs of Building a Timber Pleasure Pier on Pile Bends.

BY BENJAMIN BROOKS*

A small pleasure pier built upon the coast of California recently, though offering no specially novel features of construction, still furnishes some data which may be of interest to the student of costs, on account of its isolated position.

The site of the pier was a prospective beach resort of which nothing had as yet materialized but some surveyor's stakes and a "pavilion." It was 10 miles from the nearest port, about 3 miles from the nearest broad-gage railway (which, however, did not connect with the port) had absolutely no roads leading to it, and was girt on one side by heavy surf and on the other by barren sand dunes.

After a preliminary trip, the writer decided to run the risk of beaching the materials on the spot and to ship the pile driver outfit through the port to the nearest narrow gage station—about 7 miles away—and team it from there to the beach.

The beach is an ideal one, 10 or 15 miles long without interruption, very flat and wide. On account of the breadth of the surf line it was thought impracticable to take soundings from a boat, but this was accomplished by setting up two flags as far apart as possible on the beach in line with the center of the pier for a back sight, measuring off a base line at right angles to this along the water's edge; and, with a transit on the far end, sighting on the range flag nearest the water. A good swimmer was then hired to go as far as possible into the surf, keeping in line with the range flags; and the transit man noted the angle of the swimmer at the point where he could just be seen when touching bottom with arms held over his head. This rough method worked well enough so that the piling was ordered within 2 or 3 ft. of the exact length.

An experienced freighting company was hired by the day to transport the pile driver outfit. The first four miles of road were perfectly level and good; the last three were simply trails over the deep, dry sand leading on to the hard beach, where, however, a small stream was to be crossed. A team of four horses and driver cost $6.50 per 9-hour day. For the first part of the journey the teams worked separately, but on the last three miles

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*Redondo, Cal.

Depreciation Due to Rail.

Rail, 97% of rail and hauling		$5,312.08	......	......
*97% of scrap, 119.56 tons at $11.00	$1,315.16			
Less 5 cts. per ft. for removal	256.08			
	$1.059.08	......	$1,059.08	$4,253.00
Labor remaining to be depreciated		686.40	......	686.40
		$5,998.48	$1,059.08	$4,939.40

*10 tons of scrap deducted because of wear.

Cost of parts not depreciated	$1,305.00
Cost of parts depreciated with joints	1,343.49
Cost of parts depreciated with ties	1,921.40
Cost of parts depreciated with rail	5,998.48
Cost of parts not depreciated	1,305.00
	$10,568.37

$1,343.49 = 12.7% of $10,568.37
1,921.40 = 18.2% of 10,568.37
5,998.48 = 56.9% of 10,568.37
1,305.00 = 12.2% of 10,568.37

Above percentage to be used to distribute to joints, ties and rails. Proper proportion of part of cost yet to be depreciated.

Parts Yet to be Depreciated.

Organization, engineering, incidentals, etc., 15%	$1,585.25
12.7% of $1,585.25 = amount to be depreciated with joints	201.33
Actual wearing value of joints	1,195.65
Total value of joints to be depreciated, 5% annually	$1,396.98
5% of $1,396.98 = $69.85 annual depreciation.	
18.2% of $1,585.25 = amount to be depreciated with ties	$ 288.51
Actual wearing value of ties	1,871.40
Total value of ties to be depreciated, 5% annually	$2,159.91
5% of $2,159.91 = $108.00 annual depreciation.	
56.9% of $1,585.25 = amount to be depreciated with rail	$ 902.01
Actual wearing value of rail	4,939.40
Total value of rail to be depreciated	$5,841.41

	Original depth of head.	Scrap depth.	Wearing depth.
7 3-16 in. Johnson L 346	77/64	40/64	37/64

1/37 of $5,841.41 = $157.88, which is amount of depreciation for each 1/64 in. of wear.

12.2% of $1,585.25 = amount not to be depreciated	$ 193.40
Cost of excavation not depreciated	1,305.00
	$1,498.40

Recapitulation—

Parts depreciated with joints	$1,396.98
Scrap value of parts depreciated with joints	147.84
Parts depreciated with ties	2,159.91
Scrap value of parts depreciated with ties	50.00
Parts depreciated with rail	5,841.41
Scrap value of parts depreciated with rail	1,059.08
Part not depreciated (excavation)	1,498.40
	$12,153.62

Class B-2.—7-3/16 in. girder rail, 85 lb. 60 ft. lengths, no ballast, 2.5 ft. tie spacing, tie plates on every other tie, bonded fish joints.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 85 lb. per yd. (delivered)	Ton	133.57	$40.00	$5,342.80
Hauling rail to street	Ton	133.57	1.00	133.57
Excavation	Cu. yds.	2,410	.50	1,205.00
Ties delivered	Each	2,112	.70	1,478.40
Tie Rods	Each	700	.21	147.00
Tie Plates	Each	2,112	.18	380.16
Spikes	Keg	35	4.00	140.00
Fish Plates (complete) 176 at 60 lbs. each	Ton	4.72	42.00	198.24
Labor, track laying	Ft.	5,280	.30	1,584.00
				$10,609.17
Organization, engineering and incidentals, 15%				1,591.38
Total cost per mile				$12,200.55

Class B-3.—7 3/16 in., girder rail, 85 lbs., 30 ft. lengths, no ballast, 2 ft. tie spacing, tie-plates on every other tie, bonded fish-plate joints, 7½ ft., tie-rod spacing.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 85 lbs. per yard	Ton	133.57	$40.00	$5,342.80
Hauling rail to street	Ton	133.57	1.00	133.57
Excavation	Cu. yds.	2,410	.50	1,205.00
Ties delivered	Each	2,640	.70	1,848.00
Tie rods	Each	700	.21	147.00
Tie plates	Each	2,640	.18	475.20
Spikes	Keg	40	4.00	160.00
Fish plates (complete): 352 at 60 lbs. each	Ton	9.44	42.00	396.48
Labor—track laying	Per ft.	5,280	.30	1,584.00
				$11,292.05
Organization, engineering and incidentals, 15%				1,693.81
Total cost per mile				$12,985.86

Class B-4.—7 3/16 in. girder rail, 85 lbs., 60 ft. lengths, cinder ballast, 2 ft. tie spacing, no tie-plates, welded joints, 7½ ft. tie-rod spacing.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 85 lbs. per yd	Ton	133.57	$40.00	$5,342.80
Hauling rail to street	Ton	133.57	1.00	133.57
Excavation	Cu. yds.	2,500	.50	1,250.00
Ties delivered	Each	2,640	.70	1,848.00
Tie rods	Each	700	.21	147.00
Spikes	Keg	40	4.00	160.00
Ballast, cinder	Cu. yds.	1,400	.90	1,260.00
Welded Joints (cast)	Each	176	4.25	748.00
Labor, track laying	Per ft.	5,280	.30	1,584.00
Labor, handling ballast	Per ft.	5,280	.05	264.00
				$12,737.37
Organization, engineering and incidentals, 15%				1,910.61
Total cost per mile				$14,647.98

Class C.—7-in. 96 lb. Trilby (L-357) 30 ft. lengths. No ballast; 2 ft. tie spacing; tie-plates every other tie; bonded fish-plate joints; tie-rod spacing 7½ ft.

Estimate of cost to produce one mile of single track.

they doubled and trebeled, the engine sinking its wagon down in the sand till it dragged. The trip required twelve team days, or $78—over $11 per mile.

Setting up the driver took three days and was done in a piecemeal manner according as the outfit arrived by team. A foreman at $5 and a crew of three men at $3 brings this setting up expense to $42.

Beaching the lumber and piles proved to be a somewhat uncertain but satisfactory method of getting them there, and much cheaper than any other way. The material comprised the deck load of a small coasting steamer. After having coaxed a few farmers in the neighborhood to appear on the beach with their teams on a certain morning to be named later, the writer left things in charge of the pile driver foreman and set out to meet the steamer at the nearest port. She was only three days late, but arrived at night so that orders could be phoned to have the farmer steamsters on hand next morning.

On the following day the weather was so thick that the steamer sailed past the wharf site twice before it could be identified from the sea; so that it was 1 p. m. before the first stick was thrown overboard. The teamsters meanwhile continued leisurely to draw their pay on the beach, as did also two expert surf boatmen in a dory hired to take lines ashore if necessary or to rescue stray timber. These latter proved unnecessary, but were a good safeguard in case of change of wind.

The first pile thrown over showed that the vessel was not anchored exactly in the right place, and she was accordingly moved. Her final position was about a mile off shore. The surf was rather heavy, the wind light and the timber took about an hour to drift in. It arrived a good deal faster than seven teams could pick it up, but the surf and wind kept it on the beach. It did not, however, all come to one place, but scattered out about 1,000 ft. wide. No attempt was made to pile it, but each piece was pulled up the beach, where it struck and left above high water mark. The last piece left the vessel about 5 p. m., and the last snaking out occupied the teams until 10 p. m. They had the advantage of a moon and free hot coffee.

The writer, on leaving the vessel, was rowed ashore and capsized in the surf by the expensive expert surf men; and, having walked four miles to a summer hotel, produced such an effect on entering the dining room clad in a borrowed bell-hop's uniform, that he still looks back upon the trip as one of the most eventful and amusing engineering outings he has ever taken.

The following costs are worked out without regard to the six hours lost in waiting for the vessel, for this delay is always likely to happen; and both teams and boats are counted as having worked from 7 a. m. until about 10 p. m. On this basis the landing and snaking to safety required:

0.090 boat hours per M at [illegible]	$0.18
0.785 team hours per M at [illegible]	[illegible]
0.64 man hours per M at [illegible]	[illegible]
Total	$0.62

The following day at daylight a few teams were engaged to sort out and gather up the lumber from the beach and pile it at the wharf site. Owing to bruised legs and other discomforts incident to working in the surf, the price of teams had increased over night, so that the cost of stacking the material was:

1.40 man hours per M at $0.25	$0.35
1.36 team hours per M at $0.50	.68
Total	$1.03

which brought the total cost of bringing the lumber to the pier site $1.65 per M. ft. B. M.

The pier was of simple construction, with bents 20 ft. apart, four piles to the bent (the two outside ones battered) under a 12x12 in. cap 16 ft. long, which was drifted and strapped to each pile. The deck was 2x12 in. on 3x12 in. joists. There was a light railing on each side.

The piledriver had 35 ft. swinging leads and 64 ft. gunwales, a 3,500-lb. hammer and an oil burning engine big enough to keep up steam under hard driving. The sand was so

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 96 lb. Trilby	Ton	150.86	$40.00	$6,034.40
Hauling rail to street	Ton	150.86	1.00	150.86
Excavation	Cu. yds.	2,410.00	.50	1,205.00
Ties, delivered	Each	2,640.00	.70	1,848.00
Tie rods	Each	700.00	.21	147.00
Tie plates	Each	2,640.00	.18	475.20
Spikes	Keg	40.00	4.00	160.00
Fish plates, complete, 352 at 60 lbs. each	Ton	9.44	42.00	396.48
Labor at 30c per ft.	Ft.	5,280.00	.30	1,584.00
				$12,000.94
Organization, engineering and incidentals, 15%				1,800.14
Total cost per mile				$13,801.08

Class D.—6 in. 78-lb. girder (L-225) 30 ft. length. No ballast; 2 ft. tie spacing; tie-plates every other tie; bonded fish-plate joints; tie-rod spacing 7½ ft.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 78-lb. Girder	Ton	122.57	$40.00	$4,902.80
Hauling to street	Ton	122.57	1.00	122.57
Excavation	Cu. yds.	2,410	.50	1,205.00
Ties, delivered	Each	2,640	.70	1,848.00
Tie rods	Each	700	.21	147.00
Tie plates	Each	2,640	.18	475.20
Spikes	Keg	40	4.00	160.00
Fish plates, complete, 352 at 60 lbs.	Ton	9.44	42.00	396.48
Labor, at 30c per ft.	Ft	5,280	.30	1,584.00
				$10,841.05
Organization, engineering and incidentals, 15%				1,626.16
Total cost per mile				$12,467.21

Class D-1.—6-in., 78-lb. girder (L-225), 60-ft. lengths, no ballast, 2-ft. tie spacing, tie plates on every other tie, welded joints, 7½ ft. tie rod spacing.

Estimate of Cost to Produce One Mile of Single Track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail—78-lb. girder	Ton	122.57	$40.00	$4,902.80
Hauling to street	Ton	122.57	1.00	122.57
Excavation	Cu. yds.	2,410	0.50	1,205.00
Ties delivered	Each	2,640	0.70	1,848.00
Tie rods	Each	700	0.21	147.00
Tie plates	Each	2,640	0.18	475.20
Spikes	Keg	40	4.00	160.00
Welded joints—cast	Each	176	4.25	748.00
Labor—track laying	Foot	5,280	0.30	1,584.00
				$11,192.57
Organization, engineering and incidentals, 15%				$1,678.89
Total cost per mile				$12,871.46

DEPRECIATION OF ONE MILE OF SINGLE TRACK.

Depreciation Due to Substructure.

		Cost new.	Scrap value.	Wearing value.
Ties		$1,848.00		$1,848.00
Tie rods		147.00		147.00
Tie plates		475.20		
Scrap—5 tons at $10.00			$50.00	425.20
Spikes		160.00		
Scrap 3 tons at $10.00			30.00	130.00
Labor—placing ties at 3 cts. ft.		158.40		158.40
		$2,788.60	$80.00	$2,708.60

Life of substructure, 20 years.

Annual depreciation in per cent of wearing value, 5%.

Depreciation Due to Rail.

		Cost new.	Scrap value.	Wearing value.
Rail—cost and hauling		$5,025.37		
*112.57 tons of scrap at $11.00	$1,238.27			
Less 5 cts. per ft. for removal	264.00			
	$ 974.27		$974.27	$4,051.10
Welds		748.00		
7.5 tons scrap at $11.00			82.50	665.50
Less remaining to be depreciated, 27 cts. per ft.		$1,425.60		$1,425.60
		$7,198.97	$1,056.77	$6,142.20

*Ten tons deduced for wear.

Parts Not Depreciated.

	Cost new.	Scrap value.	Wearing value.
Excavation	$1,205.00		$1,205.00

Total Cost of Parts Depreciated.

Cost of parts depreciated with substructure	$2,788.60
Cost of parts depreciated with rail	7,198.97
Cost of parts not depreciated	1,205.00
	$11,192.57

$2,788.60 = 24.9% of $11,192.57
7,198.97 = 64.3% of 11,192.57
1,205.00 = 10.8% of 11,192.57

Above percentages to be used to distribute to substructure and rail, the proper proportion of parts of cost yet to be depreciated.

Parts Yet to be Depreciated.

Organization, engineering, incidentals, etc., 15%	$1,678.89
24.9% of $1,678.89 = amount to be depreciated with substructure	418.04
Actual wearing value of substructure	2,708.60
Total value of substructure to be depreciated 5% annually	$3,126.64

5% of $3,126.64 = $156.33 annual depreciation.

Actual wearing value of rail	$6,142.20
64.3% of $1,678.89 = amount to be depreciated with rail	1,079.53
Total wearing value of rail	$7,221.73

	Original depth of head.	Scrap depth.	Wearing depth.
6-in. 78-lb. Johnson rail	69/64	40/64	29/64

1/29 of $7,221.73 = $249.03 depreciation due to each 1/64th inch of wear $249.03

10.8% of $1,678.89 = amount not depreciated	1,205.00
Value of excavation not depreciated	$1,386.32

Recapitulation.

Parts depreciated with substructure	$3,126.64
Scrap value of substructure	80.00
Parts depreciated with rail	7,221.73
Scrap value of rail	1,056.77
Parts not depreciated (excavation)	1,386.32
Total	$12,871.46

compact that piles sometimes collapsed under the hammer before they had reached the required 10 ft. penetration. After the driving was well under way the time of each operation was as follows:

Bent No. 6.

	Minutes.
Rigging staging for cross-cut saw men	13½
Placing battons	8
Sawing off four piles	15
Hoisting cap in position	2½
Boring and drifting cap (straps put on later)	12
Removing staging and tieing bent to previous one	5½
Pulling driver ahead	3
Placing first pile	6½
Driving first pile (81 blows)	7½
Plumbing leads	1½
Placing second pile	5
Driving second pile (83 blows)	9
Placing third pile	9
Driving third pile	6
Placing fourth pile and swing leads	5½
Driving fourth pile	6
Total for driving and capping bent	115½

Bent No. 10.

	Minutes.
Pulling driver in position	5½
Hoisting and placing first pile	3
Driving first pile (67 blows)	6½
Plumbing gins and placing second pile	5
Driving second pile (62 blows)	5
Placing third pile	2½
Driving third pile (58 blows)	5
Placing fourth pile	5
Driving fourth pile (63 blows)	3
Rigging staging for cut-off	10
Placing battons	8½
Sawing off four piles	12
Placing and drifting cap	13½
Tieing bent to previous one	5
Total for driving and capping bent	89½

Occasional delays brought this down to four bents per 9-hour day. The crew comprised an excellent foreman, a well drilled set of seven men and a team. The daily expenses of running the driver were:

Crew (foreman, $5.00; men, $3.00)	$26.00
Team	4.50
Extra man on beach	2.25
Fuel oil (including teaming of same)	4.00
Interest and depreciation on outfit	3.00
Engine oil (assumed)	.25
Total	$40.00

This gives a cost of $10 per bent. To sum up, we have a piledriver expense of $78 teaming and $42 setting up; and assuming an equal cost of removal brings this to $240. Since the pier was 800 ft. long, the piledriver charges would be 20/800 of $240, or $6 per bent.

Pile driver expenses	$ 6.00
Beaching and stacking 3¾ M lumber at $1.65	6.19
Driving and capping	10.00
Placing joists and deck, 1½ M at $4.76	7.14
Placing railing, 0.13 M at $10	1.30
Placing cap straps (estimated)	2.00
Total	$32.63

which is equal to $1.63 per foot.

This is, with the exception of oil for the pile driver and interest on it, a strictly labor cost. The time of the writer for surveys, soundings and steamer piloting is not taken into account, nor are the railway freights, fares for the crew, rent of quarters in the "pavilion," reconnaissance, and so on.

This method of landing lumber requires a wide beach and a steady wind blowing directly or almost directly on it. If the wind blows at the angle with the beach, the lumber will drift a long way before beaching, and scatter very much. A change of wind is fatal, so that not too much lumber should be afloat at a time. Anything smaller than 2x10 ins. should be fastened in square bundles to avoid breakage in the surf. Too much care cannot be taken to avoid broken legs.

Benefits Derived from the Incineration of Refuse in the City of Westmount.

BY DR. J. A. [illegible]*

The disposal of refuse has alw [illegible] perplexing problem for all cities and towns in every country. The city of Westmount has passed through several stages in its efforts to deal with the question. At first the contract system was adopted; the contractor to remove, at stated times, the kitchen refuse.

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*Medical Officer of Health, Westmount, Canada.

Class F.—8¾-in. girder rail, 96 lbs., 30-ft. lengths, cinder ballast, 2-ft. 6-in. tie spacing, braced tie plates on every tie, 7½ ft. tie rod spacing, bonded fish-plate joints.

Estimate of Cost to Produce One Mile of Single Track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 8¾-in. 96-lb. girder (L-206)	Ton	150.86	$40.00	$6,034.40
Hauling to street	Ton	150.86	1.00	150.86
Excavation	Cu. yd.	2,500	.50	1,250.00
Ties	Each	2,112	.70	1,478.40
Tie-plates	Each	4,224	.18	760.32
Tie-rods	Eacn	700	.21	147.00
Cinder ballast	Cu. yd.	1,400	.90	1,260.00
Fish-plates complete, 352 at 126 lbs	Ton	19.8	42.00	831.60
Spikes	Keg	40	4.00	160.00
Labor, track laying	Per ft.	5,280	.30	1,584.00
				$13,656.58
Organization, engineering and incidentals, 15%				2,048.49
				$15,705.07

Class F-1.—8 25/32 in. girder rail, 96 lbs. 30 ft. lengths, stone ballast, 2 ft. tie spacing, braced tie-plates on every tie; 7½ ft. tie-road spacing, bonded fish-plate joints.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail, 8-25/32 in. 96 lbs. Girder (L-206)	Ton	150.86	$40.00	$6,034.40
Hauling to street	Ton	150.86	1.00	150.86
Excavation	Cu. yds.	2,500	.50	1,250.00
Ties	Each	2,640	.70	1,848.00
Tie plates	Each	5,280	.18	950.44
Tie rods	Each	700	.21	147.00
Fish plates, complete, 356 at 126 lbs	Ton	19.8	42.00	831.60
Spikes	Keg	40	4.00	160.00
Ballast—Stone	Cu. yds.	1,400	1.50	2,100.00
Labor, track laying and ballasting	Ft.	5,280	.35	1,848.00
				$15,320.30
Organization, engineering and incidentals 15%				2,298.05
Total cost per mile				$17,618.35

Class F-2.—8 25-32 in., 96-lb. girder (L-206) 60-ft. lengths, cinder ballast, 2-ft. tie spacing, braced tie plates on every tie, 7½ ft. tie rod spacing, welded joints.

Estimate of cost to produce one mile of single track.

UNIT COST ESTIMATE.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail—8 25/32 in., 96-lb. (L-206)	Ton	150.86	$40.00	$6,034.40
Hauling to street	Ton	150.86	1.00	150.86
Excavation	Cu. yd.	2,500	.50	1,250.00
Ties delivered	Each	2,640	.70	1,848.00
Tie plates	Each	5,280	.18	950.40
Tie rods	Each	700	.21	147.00
Spikes	Keg	40	4.00	160.00
Ballast, cinder	Cu. yd.	1,400	.90	1,260.00
Welded joints, cast	Each	176	4.25	748.00
Labor track laying	Foot	5,280	.30	1,584.00
Labor, handling ballast	Foot	5,280	.05	264.00
				$14,396.66
Organization, engineering, incidentals, etc., 15%				2,159.50
Total				$16,556.16

DEPRECIATION OF ONE MILE OF SINGLE TRACK.

Depreciation Due to Substructure.

	Cost new.	Scrap value.	Wearing value.
Ties	$1,848.00	.....	$1,848.00
Tie rods	147.00	.....	147.00
Tie plates	950.40	.....	.....
Scrap, 10 tons at $10.00	.....	$100.00	850.40
Spikes	160.00	.....	.....
Scrap, 3 tons at $10.00	.....	30.00	130.00
Ballast	1,260.00	.....	.....
Deduct 25% for reclaiming	.....	945.00	315.00
Labor, placing ballast at 5 cts	264.00	.....	264.00
Labor, placing ties at 3c	158.40	.....	158.40
	$4,787.80	$1,075.00	$3 712.80

Life of substructure, 20 years.
Annual depreciation in per cent of wearing value, 5%.

Depreciation Due to Rails.

		Cost new.	Scrap value.	Wearing value.
Rail, cost and hauling		$6,185.26	.....	.....
149.86 tons of scrap at $11.00	$1,648.46			
Less 5c per foot for removal	264.00			
	$1,384.46	.....	$1,384.46	$4,800.80
Welds	....	748.00	.....	.....
7.5 tons scrap at $11.00		.....	82.50	665.50
Labor remaining to be depreciated		1,425.60	.....	1,425.60
		$8,358.86	$1,466.96	$6,891.90

Parts Not Depreciated.

Excavation	$1,250.00

Total Cost of Parts Depreciated.

Cost of parts depreciated with substructure	$4,787.80
Cost of parts depreciated with rail	8,358.86
Cost of parts not depreciated	1,250.00
	$14,396.66

$4,787.80 = 33.2% of $14,396.66
8,358.86 = 58.1% of 14,396.66
1,250.00 = 8.7% of 14,396.66

Above percentage to be used to distribute to substructure and rail, the proper proportion of parts of cost yet to be depreciated.

Parts Yet to be Depreciated.

Organization, engineering, etc., 15%	$2,159.50
33.2% of $2,159.50 = amount to be depreciated with substructure	716.94
Actual wearing value of substructure	3,712.80
Total value of substructure to be depreciated 5% annually	$4,429.74
5% of $4,429.74 = $221.49 annual depreciation.	
58.1% of $2,159.50, amount to be depreciated with rail	$1,254.68
Actual wearing value of rail	6,891.90
[illegible]ing value of rail	$8,146.58

to a plot of ground rented or purchased for that purpose. This was succeeded by a municipal system, the corporation employes doing all the work. This system might have continued indefinitely, but the question of a refuse dumping place, became a crucial one, and the Health Committee found that wherever a piece of ground for this purpose was suggested, the parties owning the property adjoining immediately threatened a claim for damages. Again the provincial health regulations do not allow the dumping of refuse within a certain distance of any dwelling house. Thus Westmount had a serious question to deal with, as wherever they went in the city they were subject to damages and the adjoining municipalities would not any longer allow the dumping of refuse within their boundaries.

The method of destroying the refuse by burning was then tried, but with poor results, and had to be abandoned owing to the furnace used not being suitable for the purpose. Dumping was again resorted and carried on for some time, but with increased trouble and complaints. In view of this and other complications, in the supply of public and private lighting, it was decided to again try the incineration method in connection with an electric lighting plant, using the refuse as fuel for the supply of steam to the lighting plant. This seemed an ideal solution of the problem, and after considerable study of the different methods in England and on the continent, it was decided to install a Destructor of the Meldrum type, of 50 tons capacity in 24 hours. This method has proved most satisfactory, as shown by the results of the past four years. In the meantime the city has grown so rapidly that it was found necessary to supplement this destructor by another one of similar capacity of the Heenan & Froude type.

The plant is situated in the southwestern part of the city in a ravine. This location was chosen on account of the natural advantages it afforded for the handling of refuse.

In this building are installed the two, three cell destructor units, two refuse storage bins or hoppers, of 25 tons capacity each, and the rotary ash screen. The roof of the building which is also used as a driveway and tipping platform is on a level with the approach to the building.

The collecting and delivering of the refuse to the storage bins is under the supervision of the road department. For this work eight units on an average are required, making two collections weekly in winter, and three collections weekly during the hot summer months. The greatest quantity of refuse is received in the winter months, owing to the large amount of ashes. During three months the ashes are collected separately from the other refuse and are passed through a rotary screen of ¼ in. mesh. By this method the fine dust is removed, which increases the capacity of the destructor over 20 per cent and the heat value of the refuse consumed.

The refuse is fed through charging doors in the roof of the furnaces, which are operated from the clinkering floor.

The products of combustion after passing through the combustion and dust settling chamber, which is also a carcass crematory chamber, then pass under a water tube boiler rated at 200 H.P. After leaving the boiler, the gases pass through a regenerator or air heater and on to the stack. The regenerator is used to heat the air for the forced draft, which is taken from the upper part of the building in such a way as to effect complete ventilation.

Through this process of burning, an average temperature of 1,700 to 1,800 degrees Fahrenheit is easily maintained in the combustion chamber, and with such temperatures complete combustion is assured.

Tests have been made from time to time to determine the value of the ordinary city refuse, as fuel, in connection with the lighting plant and from one furnace a continuous load of 200 H.P. has been carried while a mixture load of 325 H.P. was carri[illegible] at different times.

The clinker formed af[illegible] very hard nature and is valuable for cement

8 25 32-in., 96-lb. girder, original depth head, 72/64
scrap depth head, 40/64
wearing depth head, 32/64

1/32 of $8,146.58 = $254.58 depreciation due to each 1/64 inch of wear.	
8.7% of $2,159.50 = amount of 15% charge not depreciated	$ 187.88
Cost of parts not depreciated	1,250.00
	$1,437.88
Recapitulation —	
Parts depreciated with substructure	$4,429.74
Scrap value of substructure	1,075.00
Parts depreciated with rail	8,146.58
Scrap value of rail	1,466.96
Parts not depreciated	1,437.88
Total	$16,556.16

(1) CROSS-OVERS (BUILT UP).

Cross-over delivered	Unit.	Quantity	Unit cost.	Total cost.
Excavation (70'x9'x1.25')		1	$600.00	$600.00
Ballast	Cu. yds.	30	.50	15.00
Ties	Cu. yds.	25	1.65	41.25
Spikes	B. M.	1,700	30.00	51.00
Labor	Keg	1	4.00	4.00
	Hrs.	400	.18	72.00
Total				$783.25

(2) CROSS-OVERS: 9 IN. MANGANESE—10 FT. 2 INS. CENTERS. BOARD OF SUPERVISING ENGINEERS' TYPE.

Cross-over complete	Unit.	Quantity	Unit cost.	Total cost.
Ballast	Each	1	$1,100.00	$1,100.00
Ties (7 in. x 9 in. oak switch ties)	Cu. yds.	17	1.50	25.50
Spikes	B. M.	1,700	30.00	51.00
Tie plates	Keg	1	4.00	4.00
Stone for concrete	Per 100	70	9.00	6.30
Sand, Torpedo	Cu. yds.	14	1.50	21.00
Cement	Cu. yds.	7	1.00	7.00
	Bbl.	15	1.65	24.75
Total material				$1,239.55
Labor	Hrs.	600		108.00
Teaming	Hrs.	29		11.00
Total cost				$1,358.55
Excavation included in labor and teaming.				

(3) DOUBLE TRACK CROSSING: ELECTRIC OVER STEAM.

Layout, delivered, $200.00 a crossing	Unit.	Quantity	Unit cost.	Total cost.
Excavation	Each	4	$200.00	$800.00
Ballast	Cu. yds.	20	.50	10.00
Ties, delivered	Cu. yds.	17	1.50	25.50
Spikes	Each	30	.70	21.00
Wire nails	Keg	1	4.00	4.00
Hemlock plank	Lbs.	40	.03	1.20
Labor	B. M.	960	25.00	24.00
				100.00
				$985.70

(4) SINGLE TRACK BRANCH OFF; 45 TO 90 DEGREES.

Layout:	Unit.	Quantity.	Unit cost.	Total cost.
1 switch and mate $125.00				
1 frog 45.00				
Tangent rail included, 50 ft. at $0.75 37.50				
Curved track included, 75 ft. at $3.00 225.00				
Joints, 16 pair complete at $1.10 17.60				
Tie plates, 150 at $0.09 13.50				
$463.60				
Excavation				$463.60
Ballast	Cu. yds.	43	$ .50	21.50
Ties	Cu. yds.	40	1.50	60.00
Spikes	B. M.	1,200	30.00	36.00
Labor	Keg	1	4.00	4.00
				100.00
Total cost				$685.10

(5) DOUBLE TRACK BRANCH OFF; 45 TO 90 DEGREES.

	Unit.	Quantity.	Unit cost.	Total cost.
Layout complete (tie plates and joints included)	Each	1	$1,000.00	$1,000.00
Excavation	Cu. yds.	80	.50	40.00
Ballast	Cu. yds.	72	1.50	108.00
Ties	B. M.	2,500	30.00	75.00
Spikes	Keg	2	4.00	8.00
Labor				200.00
Total cost				$1,431.00

(6) DOUBLE TRACK OVER SINGLE TRACK CROSSING. SINGLE CONNECTING CURVE.

	Unit.	Quantity.	Unit cost.	Total cost.
Layout complete (tie plates and joints included)	Each	1	$1,044.16	$1,044.16
Excavation	Cu. yds.	78	.50	39.00
Ballast	Cu. yds.	64	1.50	96.00
Ties	B. M.	2,200	30.00	66.00
Spikes	Keg	[illegible]	4.00	8.00
Labor				200.00
Total cost				$1,453.16

(7) DOUBLE TRACK CROSSING. ONE CONNECTING CURVE. 45 DEGREES.

	Unit.	Quantity.	Unit cost.	Total cost.
Layout complete (tie plates and joints included)	Each	1	$1,397.00	$1,397.00
Excavation	Cu. yds.	90	.50	45.00
Ballast	Cu. yds.	74	1.50	[illegible]
Ties	B. M.	2,660	30.00	[illegible]
Spikes	Keg	[illegible]	4.00	[illegible]
Labor				250.00
Total cost				$1,890.80

(8) DOUBLE TRACK CROSSING. SINGLE TRACK CURVES IN TWO QUADRANTS.

	Unit.	Quantity.	Unit cost.	Total cost.
Layout complete delivered (tie plates and joints included)	Each		$2,088.32	$2,088.32
Excavation	Cu. yds.	15	.50	[illegible]
Ballast	Cu. yds.	[illegible]	[illegible]	[illegible]
Ties	B. M.	4,460	30.00	133.80
Spikes	Keg	4	4.00	16.00
Labor				350.00
Total cost				$2,859.62

[illegible]; the city alone in 1909 using 3,000 loads for cement sidewalks, while as much more was disposed of to contractors for various purposes.

The method of crediting the destructor with the heat value of refuse consumed is very simple and has proved most satisfactory. At different periods a 24-hour run of weighed coal only is made and from this is found the number of pounds of coal that are required to produce one kilowatt, as registered on the recording instruments. From then until the next run is made, this figure is used in calculating the value of refuse when coal and refuse are burnt at the same time. By this method the destructor is credited with the value of coal as fired, and although this value is not sufficient to meet both the operating and fixed charges of the destructor plant it reduces considerably the cost to the city of disposing of the refuse, as is shown in the following table. If there were a sufficient quantity of refuse to keep the destructor in operation during the whole year, the cost per ton for destroying the same would be much less.

	1907.	1908.	1909.
Tons of refuse	10,700	13,640	14,330
Cost per ton for destroying (operating)	$0.55	$0.52	$0.46
Cost per ton for destroying (fixed charges)	0.36	0.34	0.40
	0.91	0.86	0.86
Heat value of refuse per ton	0.36	0.31	0.40
	0.55	0.55	0.46
Cost per ton for collecting.	0.55	0.42	0.59
Total cost to the city	$1.10	$1.03	$1.05

Thus the Corporation of Westmount derived $5,732 worth of fuel from the refuse of the city during the past year of 1909.

Westmount was one of the first cities on the continent to employ the high temperature method of disposing of city refuse and has been followed in this by numerous cities both in Canada and in the United States. Although the plant is situated in close proximity to other buildings, and has been in operation for over four years, not one complaint of any kind has been received, which goes to show that this method of disposing of city refuse, is a perfectly sanitary one and has proved an ideal solution of a serious problem.

I am indebted to Mr. Thompson, superintendent of the whole plant, for the technical information contained in this paper.

(9) DOUBLE TRACK CROSSING WITH DOUBLE TRACK CONNECTING CURVES.

	Unit.	Quantity.	Unit cost.	Total cost.
Price of double track crossing with single connecting curve		......	......	$1,890.80
Additional:				
Switch and mate	Each	2	$125.00	250.00
Jump frogs	Each	10	......	......
50 ft. curved track	Ft.	......	4.45	222.50
Total cost of crossing				$2,363.30

(10) DOUBLE TRACK—THREE PART WYE.

Curved track	376.4 ft.
Straight track included	206.6 ft.
	583 ft.

	Unit.	Quantity.	Unit cost.	Total cost.
Rail layout delivered		......	......	$2,500.00
Excavation	Cu. yds.	210	$ .50	105.00
Ballast	Cu. yds.	200	1.50	300.00
Ties	B. M.	2,500	30.00	75.00
Spikes	Kegs	5	4.00	20.00
Labor	Ft.	583	.75	437.25
Total cost				$3,437.25

(11) SINGLE TRACK RAILWAY CROSSING. DOUBLE TRACK ELECTRIC OVER SINGLE TRACK STEAM. 45 TO 90 DEGREES.

	Unit.	Quantity.	Unit cost.	Total cost.
Layout delivered (tie plates and joints included)	Each	2	$200.00	$400.00
Excavation	Cu. yds.	11.5	.50	5.75
Ballast	Cu. yds.	10	1.50	15.00
Ties, delivered	Each	16	.70	11.20
Spikes	Keg	½	4.00	2.00
Hemlock planking—12 pieces, 3 in. x 10 in. x 16 ft.	B. M.	480	25.00	12.00
Nails				.60
Labor				65.00
Total cost				$511.55
For cost of jump crossing, deduct				$261.00
Net cost of jump crossing				$250.55

(12) DOUBLE TRACK CROSSING. ELECTRIC OVER STEAM.

	Unit.	Quantity.	Unit cost	Total cost.
Layout, delivered, $200.00 a crossing	Each	4	$200.00	$800.00
Excavation	Cu. yds.	20	.50	10.00
Ballast	Cu. yds.	17	1.50	25.00
Ties delivered	Each	30	.70	21.00
Spikes	Keg	1	4.00	4.00
Wire nails	Lbs.	40	.03	1.20
Hemlock plank	B. M.	960	25.00	24.00
Labor				100.00
Total				$985.70

(13) PLAIN CURVES PER FT. OF SINGLE TRACK. 7-IN. RAIL.

Rail—delivery and shop bending included	$3.00
Excavation	.25
Ballast	.41
Ties delivered	.30
Tie plates	.06
Tie rods	.03
Fish-plates and bolts	.08
Spikes	.02
Labor laying track	.30
	$4.45

Valuation of Two Street Railway Power Plants.

The two power plants formed a part of the properties of the Chicago Consolidated Traction Co., valuation of which was made as described in another column of this issue. The premises in which the power plant valuations were made were as follows:

A detailed inventory was made in each power plant of all boilers, pumps, engines, generators, piping and accessories, and was valuated in accordance with present prices.

Each piece of apparatus was inspected to determine its present condition, and a list of all heavy repairs obtained from the chief engineers of the plants.

Each machine was depreciated in accordance with depreciating factors as noted below, account being taken both of present physical condition and extent of heavy repairs made throughout the life of the machine and the character of the service performed by it.

The following annual rates for depreciation have been used as a basis of depreciating the power plant equipment. Apparatus has been depreciated at these rates down to 20 per cent of its wearing value, the wearing value being determined by subtracting the scrap value from the cost new. All power plant equipment has been considered as worth 20 per cent of its wearing value as long as it is in operating condition.

Machinery foundations	[illegible]
Coal and ash handling machinery	[illegible]
Fuel oil handling machinery	4%
Grate and stokers	[illegible]
Boilers and settings	[illegible]
Breeching and connections	[illegible]
Stack	[illegible]
Heaters	[illegible]
Water purifying apparatus	[illegible]
Pumps	[illegible]
Air compressors	4 5%
Engines	3 5%
Condensers	4%
Piping and covering	4 4½%
Generators	3 5%
Switchboard and generator leads	3%
Miscellaneous items	3 5%

NOTE: Machinery foundations have been depreciated at a percentage determined from the life of the apparatus supported.

The fixed parts of stokers depreciate very little, and the moving parts and grates very rapidly. As the moving parts are renewed and maintained in good condition, 10 per cent of the wearing value of stokers has been depreciated at 20 per cent per year for 2½ years, and 90 per cent or the fixed parts, at 5 per cent per year during the life of the machine.

Engines and generators that have been rebuilt or have had extensive repairs have been credited with the cost of repairs at the time they were made, and this cost depreciated at same rate as machines on which repairs were made.

Edgewater Power Plant, Chicago & North-Shore Street Railway Company.—The plant was originally built and put in commission in 1891. The boiler equipment then consisted of three 250-hp. Heine water tube boilers. A 350-hp. water tube boiler built by Jno. Mohr & Son, was installed in 1895. New tubes were installed in the Heine boilers in 1907, and in

TABLE I.—VALUE OF POWER PLANT EQUIPMENT. EDGEWATER. CHICAGO & NORTH SHORE STREET RAILWAY CO.

Description.	% Depreciation	Cost New.	Scrap Value.	Cost new less scrap.	Depreciation.	Recent Repairs.	Present Value.	Rehabilitation value 8/4/10
Machinery foundations	4	$ 11,184.06		$ 11,184.06	$ 4,740.80	....	$ 6,443.26	....
Fuel oil system	4	4,182.00	$ 454.00	3,728.00	869.00	....	3,313.00	$ 1,730.00
Boiler and settings	4	24,350.00	840.00	23,510.00	10,161.00	$ 2,672.00	16,861.00	9,209.00
Breeching and smoke flue	4-7	1,318.57	98.23	1,250.34	500.00	....	848.57	135.00
Stack	7	8,672.50	270.00	8,402.50	6,301.00	....	2,371.50	270.00
Heaters and purifiers 50% and total		2,395.00	403.00	1,992.00	996.00	....	1,399.00	1,200.00
Pumps	5	1,816.00	80.70	1,735.30	371.57	....	1,444.43	1,083.00
Compressed air system.	5	255.00	18.75	236.25	141.75	....	113.25	100.00
Engines	3-4	49,941.37	2,499.09	47,442.28	13,728.00	896.00	36,609.37	29,100.00
Piping and covering	4	19,247.00	1,852.00	17,395.00	4,348.75	....	14,898.25	4,567.00
Generators	3-5	44,020.00	5,800.00	38,220.00	14,036.00	7,000.00	36,984.00	20,156.00
Switchboard and general [illegible]	3	9,490.00	772.00	8,718.00	2,615.00	....	6,875.00	5,188.00
Miscellaneous	2-3	2,512.00	244.50	2,267.50	320.00	....	2,192.00	1,500.00
Total		$179,413.50	$13,332.27	$166,081.23	$59,128.87	$10,068.00	$130,352.63	$74,238.90
Engineering, organization and incidentals, 10%		[illegible]	1,333.23	16,608.12	5,912.88	1,006.80	13,035.27	7,423.80
Grand total		$197,354.85	$14,665.50	$182,689.35	$65,041.75	$11,074.80	$143,387.90	$81,661.80

Cost new per connected kw. (2,130)	92.65
Cost new per boiler horse power (2,100)	93.97
Present value per connected kw. (2,130)	67.32
Present value per boiler horse power (2,100)	68.28

TABLE II.—VALUE OF CALIFORNIA AVE. POWER PLANT EQUIPMENT. CHICAGO ELECTRIC TRANSIT COMPANY.

Description.	Dep.	Cost. New.	Scrap Value.	Cost new less scrap.	Depreciation.	Recent Repairs.	Present Value.
Machinery foundations	..	$ 17,403.50	....	$ 17,403.50	$ 6,971.40	....	$ 10,432.10
Coal and ash apparatus	7 Ave.	23,732.61	$ 1,510.00	22,222.61	5,488.82	....	16,733.79
Grates and stokers	5	14,266.82	779.00	13,487.82	4,290.50	....	9,976.32
Boilers and settings	4	54,250.00	1,200.00	54,050.00	23,250.00	....	31,000.00
Smoke flue	3½	4,651.75	100.00	4,551.75	2,389.70	....	2,262.05
Stack	5	25,825.40	535.00	25,290.40	11,760.04	....	14,065.36
Heaters	5	4,050.00	450.00	3,600.00	2,074.40	....	1,975.60
Water softening plant	5	1,986.30	80.00	1,906.30	913.00	....	[illegible]
Pumps	5	2,785.15	120.50	2,664.65	783.45	....	2,001.70
Compressed air system	4	296.77	16.50	280.27	86.30	....	138.47
Engines	3	111,300.00	4,087.00	107,213.00	42,885.00	....	68,415.00
Condensers	4	15,730.00	350.00	15,380.00	6,604.00	....	9,126.00
Pipings and covering	4½	57,552.04	4,837.13	52,714.91	16,137.13	....	41,414.01
Generators	[illegible]	97,870.00	8,351.00	89,519.00	36,291.00	$11,144.00	72,723.00
Switchboard and general leads	3	20,729.59	1,606.00	19,123.59	6,884.49	....	13,845.10
Miscellaneous	3-5	4,833.50	260.00	4,573.50	489.70	....	4,343.80
Total		$457,194.43	$24,282.13	$432,909.30	$168,808.93	$11,144.00	$299,526.50
Engineering, organization and incidentals, 10%		45,719.14	2,428.21	43,290.93	16,880.89	1,114.40	29,952.65
Grand total		$502,910.57	$26,710.34	$476,200.23	$185,689.82	$12,258.40	$329,479.15

Cost new per connected kilo watt (5,500) $91.44
Cost new per boiler horse power (4,000) 125.73
Present value per connected kilo watt (5,500) 59.91
Present value per boiler horse power (4,000) 82.37

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the 350-hp. unit in 1909. These boilers are still in use. Two 500-hp. Sterling water tube boilers were added to the plant in 1904.

The 20 in. x 41½ in. x 36 in. cross compound Corliss engine is the result of combining two simple twin engines in 1901, which were originally installed in the plant in 1891. Extensive repairs were made on this unit in 1907. A rope drive, designed by the California Engineering Co., transmits the power from this unit to two 300-K. W. General Electric generators, also installed in 1891.

An Allis 23 in. x 36 in. x 60 in. tandem compound Corliss engine was installed in 1904. This unit in direct connected to a 750-K. W. Siemens & Halske generator, installed at the same time after having been thoroughly rebuilt. The third unit is an Allis 22 in. x 42 in. x 48 in. tandem compound Corliss engine installed in 1903 and direct connected to a Siemens & Halske 480-K. W. generator. This dynamo was repaired in 1906. Both of the Siemens & Halske machines were originally in service for a period of several years at the California Ave. plant. Both tandem compound engines had been rebuilt at the time installed in 1903-4.

A Westinghouse 18 in. x 30 in. x 16 in. vertical cross compound engine was installed in 1904. This unit is bolted to a 300-K. W. Westinghouse booster. Prior to this date both engine and generator were in operation at the California Ave. station and were not overhauled when moved to Edgewater.

A 300-K. W. General Electric direct current belted generator, recently overhauled and rebuilt, is now kept at the plant for emergency.

The main steam header and leads were overhauled in 1904 and about half of the old material replaced by new. The exhaust header and feed water pipes were also new material in 1904.

The fuel oil system was first installed about fiteen years ago, but its use was discontinued later. In 1907, however, new machinery, tanks and pipes were installed where needed and oil again used as fuel. The "Best" system of fuel oil burning is employed.

Foundations are of brick and concrete.
4 Oil storage tanks.
1 Oil heater and meter.
2 Oil pumps.
1 Morris Machine works centrifugal pump with motor "Best" fuel oil burners.

The items of equipment are as follows:
3 250 hp. Heine water tube boilers.
1 350 hp. J. Mohr & Son water tube boiler.
2 500 hp. Sterling water tube boilers.
1 Concrete breeching for Sterling boilers.
1 Steel breeching for Heine boilers.
1 Self-supporting st[illegible] base.
1 1,050 hp. Berryman closed heater.
1 1,050 hp. Baragwanath closed heater.
2 72 in. x 18 ft. Horizontal purifiers.
1 Horizontal duplex feed pump (Snow).
1 Horizontal duplex [illegible] (Laidlaw, Dunn & Gordon).
2 Vertical duplex feed pumps (Blake).
1 Horizontal duplex pump (Worthington).
1 Horizontal duplex pump (Blake).
1 No. 2 Nye pump.
1 Christenden Engineering Company motor driven air compressor.
1 20 in. x 41½ in. x 36 in. cross compound Corliss engine.
1 23 in. x 36 in. x 60 in. tandem compound Corliss engine.
1 22 in. x 42 in. x 48 in. tandem compound Corliss engine.
1 18 in. x 30 in. x 16 in. Westinghouse vertical compound engine.
Black merchant and extra heavy pipe.
Cast iron fittings and valves.
Asbestos and magnesia pipe covering.
3 300 kw. General Electric generators, belted type.
1 750 kw. Siemens & Halske, D. C. type.
1 480 kw. Siemens & Halske, D. C. type.
1 300 kw. Westinghouse booster, belted type.
18 Feeder panels.
5 Generator panels.
1 Wattmeter panel.
1 15 ton Walker Mfg. Co. crane.
Power plant repair shop equipment.

California Ave. Power Plant; Chicago Electric Transit Company.—This plant was installed in 1894. The equipment then consisted of ten 300-hp. Campbell & Zell water tube boilers with Murphy automatic stokers and smokeless furnaces and four 20 in. x 40 in. x 48 in. Fraser & Chalmers cross compound Corliss engine direct connected to 465-K. W. Siemens & Halske railway generators.

The auxiliaries for these engines consisted of four Blake 10 in. x 22 in. x 15 in. duplex jet condensers. New water cylinders were placed on these pumps in 1901.

In 1904 the engines were given a general overhauling and the size increased to 24 in. x 45½ in. x 48 in. by removing the bushings from the cylinders. At the same time heavier center bearings were installed and the small generators replaced by one 750-K. W., and three 1,000-K. W. units of the same type and make. These four large unit machines were second-hand at the time and all but the 750-K. W. were thoroughly rebuilt before being put in service. The latter was overhauled in 1906. At the present time the 1,000-K. W. generator for number four is being overhauled and a spare 465-K. W. dynamo is being operated temporarily.

In 1905 a 25 in. x 48 in. cross compound Corliss engine was installed direct connected to a 1,000-K. W. rebuilt Siemens & Halske machine. This was originally a Green Wheelock engine with Hill valve gear and had been in operation at the Edgewater plant for several years prior to that date. At the same time there was added for this unit a new 12 in. x 25 in. x 18 in. Worthington vertical jet condenser.

A 24 in. x 45½ in. x 48 in. Fraser & Chalmers cross compound Corliss engine direct connected to a 750-K. W. Siemens & Halske generator was added in 1906. These machines had been in operation at the Western Ave. power plant of the Union Traction Company for several years. For this unit a 24 in. x 12 in. simplex vertical belted pump was converted into a 10 in. x 24 in. x 12 in. simplex steam pump and placed in operation.

In 1907 there were installed two 500-hp. Sterling water tube boilers equipped with Green traveling grates.

The coal apparatus consists of Harrisburg drag and bucket conveyors which were overhauled and repaired in 1907. Large coal storage capacity is furnished in the boiler room by overhead steel bunkers and in the yard by an extensive shed, 200 ft. x 22 ft. This latter was erected in 1907.

There are four Barryman feed water heaters of the closed type in the plant with an aggregate capacity of approximately 4,000 hp.

All high pressure steam and feed water piping were installed new in 1907, extra heavy pipe being used. The exhaust header and condenser lines have never been overhauled but are in good condition.

Many repairs other than those mentioned have been made as needed and the general condition of the plant was found to be good. The items of equipment are as follows:

Foundations are of brick and concrete.
Overhead steel bunkers in boiler room.
Storage shed in yard (200 ft. x 22 ft.).
Harrisburg drag and bucket conveyors.
Ash hoppers and cars.
Ash elevator and elevated track.
10 Murphy automatic stokers.
2 Greene traveling chain grates.
10 300 hp. Campbell & Zell water tube boilers.
2 500 hp. Sterling water tube boilers.
Smoke flues are of brick and concrete.
Octagonal brick stack (200 ft. x 14 ft.).
4 Berryman closed heaters (4,000 hp.).
Jewell System gravity filtration.
2 Tanks, 11 ft. diameter, 12 ft. high.
Agitating apparatus.
2 Hor. Duplex feed pumps (Worthington).
1 Hor. Duplex feed pump (Smith Vaile).
3 Hor. Duplex service pumps (Snow).
1 No. 3 Nye pump.
1 Westinghouse locomotive type compressor.
1 Crane locomotive type compressor.
5 24 in. x 45½ in. x 48 in. cross compound Corliss engines.
1 25 in. x 48 in. x 48 in. cross compound Corliss engine.
4 10 in. x 22 in. x 15 in. Blake jet condensers.
1 12 in. x 25 in. x 18 in. Worthington jet condenser.
1 10 in. x 24 in. x 12 in. Simplex vertical pump.
Black merchant and extra heavy W. I. pipe.
Cast iron condenser water lines.
Cast iron fittings and valves. .
Asbestos and magnesia pipe covering.
4 1,000 kw. Siemens & Halske generators.
2 750 kw. Siemens & Halske generators.
1 465 kw. Siemens & Halske generator.
51 Feeder panels.
6 Generator panels.
1 Meter panel.
1,000,000 C. M. generator leads.
1 20 ton Walker crane.
1 20 ton car scale.

Balboa Terminal Facilities, Panama Canal.—Terminal facilities at Balboa, the Pacific entrance to the canal, will be increased by (1) remodeling the steel pier now in use, and (2) by constructing a concrete dock along the proposed anchorage basin north of the dock, now used in sand unloading. This decision has been reached after investigations conducted by two committees appointed for that purpose. The intent of the work is to relieve the congestion in handling freight on the present docks, but it will be carried on in such a way that the improvements made will be useful in the permanent terminal that will be provided, upon the completion of the canal, for the interchange of cargo. No plans for permanent terminals have been adopted as yet, but investigations are under way at both the Atlantic and Pacific ends of the canal preparatory to the construction of "safe and commodious harbors," as provided for by the Act of June 28, 1902.

The steel pier which is to be remodeled was built for the Panama railroad and was first used in 1899. It is supported on large caissons spaced on 93-ft. centers; longitudinally, is 940 ft. long, and will accommodate three 3,000-ton ships at all stages of the tide. It is provided with ten A-frame, swing boom, traveling cranes of 1½ tons capacity. In 1907, this pier was increased from its original width of 50 ft. to 80 ft., to provide space for two railroad tracks, supported by piles, running the full length of the pier. The floor was lowered, but the crane runway along the front of the pier was not changed, so that all cargo must now be lifted over the runway or platform in and out of the ships. The cranes on this pier are light, not in good condition, and will not reach far enough over the ships to take cargo from the middle hatches.

At the time the steel pier was enlarged two wooden docks were erected immediately north of it and joined to it. One of these is 320 ft. long and is known as dock

On it are two 4-ton traveling cranes. The other dock, known as dock B, is 658 feet long and has six 4-ton traveling cranes, duplicates of those on dock A. The total length of the three docks is 1,910 ft. These cranes are designed to take cargo from the middle hatches of ships and deliver it under cover of the wharf. The total length of the steel pier, and docks A and B, is 1,910 ft., but there is no connection between them, such as makes it possible to use the cranes interchangeably. A 15-ton pillar crane at the sea end of the steel pier handles heavy cargo. Five ships can be berthed at the united docks at one time, and in 1909, an average of 1,000 tons of cargo a day was handled.

The roof of the steel pier will be raised to accommodate cranes of the type now in use on docks A and B; the steel trusses will be so reinforced as to make them capable of carrying eight cranes and a concrete slab floor under the crane runways level with the present floor. Eight new cranes of the 4-ton type will be installed in place of the 1½-ton cranes. The 4-ton cranes on docks A and B will be remodeled so as to permit a more rapid handling of cargo between the legs than is now possible. Work on the steel pier will be permanent in character.

The reinforced concrete dock will be 700 ft. long and 57½ feet wide. It is estimated that it will cost about $130,000, and that the dredging necessary to make a 300-ft. channel to the dock will cost about $200,000. This channel will be enlarged as the construction of the harbor at the Pacific entrance to the canal advances. Preliminary plans provide for 8,200 cu. yds. of excavation for the piers for the dock, 7,000 cu. yds. of concrete in the piers, 2,100 cu. yds. of concrete in the floor, 624,000 lbs. of steel reinforcement, and 25,000 cu. yds. of backfilling. The estimate of dredging necessary in front of the dock and leading to it is 2,385,000 cu. yds., but all of this will not be undertaken at the present time. The character of the new dock and the location proposed for it will make it part of the permanent harbor improvements. The construction of the dock and the dredging of its approach will be done by the Pacific Division, and the cost of the work will be charged to the appropriation now available for reconstruction and re-equipment of the Panama railroad.

LETTERS TO THE EDITOR.

Fill Dams with Hollow Concrete Cores.

Sirs: On my return from Europe I find that you have printed the article on Hollow Dams, written by Mr. Hall, which was forwarded to you by me, as having been written by me. I wish you would make a statement in one of your next issues that the article was written by Nestor L. Hall and the dam was patented by him, but the matter was forwarded to you by me and that I am not the author of it and Mr. Hall should be given the credit.

Very truly,
FRANK B. GILBRETH, Inc.
By Frank B. Gilbreth, President.
New York, Aug. 24, 1910.

The Design of Footings of Reinforced Concrete.

Sirs: The following refers to an article under the above title by Frank H. Carter in Engineering-Contracting for Aug. 17, 1910: Foregoing any attempt to say the last word on the subject it strikes me as quite in order to ask Mr. Carter to explain a few points in his "easily derived expressions."

First as to definitions. The [illegible] M [illegible] and M. As to W and W¹ [illegible] that they are defined as the identical quantity, namely, load in lbs. per square feet of footing. W¹ has got this honor in Fig. 1 and in the text W gets it.

Suspecting that this confusion might lead into trouble it really is not surprising to find that

$$M = \frac{W}{2}\left(a + \frac{b}{2}\right)^2$$

and further down

$$M = \frac{Wa}{2}\left(a + \frac{b}{2}\right)$$

From these "expressions" it would appear that

$$\frac{W}{2}\left(a + \frac{b}{2}\right)^2 = \frac{Wa}{2}\left(a + \frac{b}{2}\right)$$

$$\text{or } a + \frac{b}{2} = a$$

$$\text{or } b = 0$$

which would indicate a rather questionable design of a column base.

Mr. Carter condemns one way of calculating the moments and mentions three others which presumably look favorable to him. It would be interesting to know which one he prefers, and also what the corresponding critical section and the fiber stresses would be.

OLAV HELLELAND.
Grass Valley, Cal., Aug. 22, 1910.

Method of Cleaning a Reservoir from Silt.

Sirs: Will you kindly give me a practical opinion of how I should proceed to clean out an irrigating masonry dam of the material accumulated? The dam is 100 ft. high and contains when it is full 5,000,000 cu. m. of water. By this accumulation the bottom gate has become useless, so that the dam cannot be drained to its bottom level. At present there is about 10,000 cu. m. of material accumulated, and if not taken care of in the near future the upper gate will also become useless. Can you recommend some way to excavate this accumulated material without interrupting the water supply through the upper gates?

Yours respectfully,
"Engineering-Contractor."
San Luis Potosi, Mex., Aug. 23, 1910.

PERSONALS.

Mr. Kitchell M. Boorman, A. B., civil engineer, has opened an office as consulting engineer at No. 11 Cliff street, New York city.

Mr. Earle J. Banta has resigned his position as chief engineer of the Ohio Steam Shovel & Dredge Co., Cincinnati, O., to take a similar position with the Vulcan Steam Shovel Co. of Toledo, O.

Mr. J. C. Stevens, formerly district engineer, U. S. Geological Survey, at Portland, Ore., has opened an office at 509 Beck Bldg., Portland, Ore., where he will engage in a hydraulic engineering practice.

Mr. P. E. Stevens has resigned his position as assistant engineer in the bridge department of the Great Northern Ry. and has taken a position with the firm of Butler Bros., general contractors, St. Paul, Minn.

Capt. Edward Gillen, head of the Gillen Construction & Dock Co. of Racine, Wis., was injured last week in an accident at Cleveland, O., where his company had a contract. Mr. Gillen sustained a fracture of the skull.

Mr. T. C. Kyte has resigned his position as chief engineer of the Pine Bluff & Northern Ry. and has accepted a position with the Madeira-Mamore Ry., Porto Velho Rio Madeira, Brazil. Mr. Kyte sails from New York on Oct. 5 for Brazil.

Robert Grant, a contractor of Toronto, Ont., died Sept. 21 at his home in that city after an illness of some ten weeks. Mr. Grant had executed a number of large contracts in Toronto, the largest of these being the construction of the Queen St. subway.

Mr. William Wright and Mr. H. F. Hall have entered into a partnership under the name of the Wright-Hall Engineering Co., as consulting and mechanical engineers. They will make a specialty of the design, construction and equipping of industrial plants, railroad shops, car plants, power plants, etc. The offices of the company are in the Fisher Bldg., Chicago, Ill.

Mr. Jerome Cochran, C. E., M. C. E., consulting engineer, Houston, Tex., has accepted a position as designing engineer with the Corrugated Bar Company, National Bank of Commerce Bldg., St. Louis, Mo. Mr. Cochran was for several years with the Phœnix Bridge Co., Phœnixville, Pa., and has also been professor of civil engineering at the John B. Stetson University, DeLand, Fla.

The following changes have been made in the engineering department of the Baltimore & Ohio R. R.: Mr. C. D. Swingly, division engineer of the Connellsville division at Connellsville, Pa., has been appointed division engineer of the Pittsburgh division, with office at Pittsburgh, succeeding Mr. L. P. Rossiter, resigned. Mr. Phillip Petri, division engineer of the Ohio division at Parkersburg, W. Va., succeeds Mr. Swingly, and Mr. G. T. Warren, division engineer of the Shenandoah division at Winchester, Va., succeeds Mr. Petri. Mr. E. T. [illegible], division engineer of the Philadelphia division at Philadelphia, succeeds Mr. Warren, and Mr. J. Tordello, assistant division engineer of the Cumberland division at Cumberland, Md., has been appointed assistant division engineer of the Pittsburgh division at Pittsburgh, succeeding Mr. C. Johnston, resigned.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Chicago Concrete Mixer.—Paper, 3½x5½ ins., 12 pp. 221 Grand Ave., Milwaukee, Wis.

A new pamphlet which gives description of two new sizes of Chicago mixers and also of the old sizes, all of which have been given new numbers to designate the size. Gives table of useful information as to capacities per hour and weights of the various machines.

Second-Hand Machinery.—Paper, 3½x5½ ins.; 32 pp. Willis Shaw Machinery Co., 171 La Salle street, Chicago.

This is the September, 1910, pamphlet, which contains a list of machinery of all kinds for contractors' use which is for sale. The location of the machines is given and also a brief description indicating size and condition.

Oil Engines.—Paper; 8x10½ ins.; 12 pp. De La Vergne Machine Co., foot of East 138th St., New York.

The De La Vergne Company herewith present Bulletin No. 101, a complete illustrated description of the newest type of oil engine, Type "F. H.," which it is claimed excels in thermal efficiency any practical engine heretofore obtainable, and producing power at one-half cent per K. W. hour. Test tables are given.

Melrose Convertible Wagon Bed.—Paper; 9x6 ins.; 20 pp. American Wagon Co., State and Adams Sts., Chicago, Ill.

A practical catalog containing descriptions and illustrations of the Melrose convertible wagon bed in various positions for as many purposes.

Richter's Precision Instruments.—Paper; 6x9 ins.; 8 pp. Koleschc & Co., 138 Fulton St., New York.

A circular describing the Richter drawing instruments and draftsmen's supplies. Prices are given.

Havemeyer Steel Bars.—Paper; 5½x7 ins.; 4 pp. The Concrete Steel Co., 29 Broadway, New York.

A circular showing section of reinforcing bars made by this company and brief remarks as to advantages of this type of bar.

S. P. F. Compound.—Paper; 5¾x8¾ ins.; 6 pp. Bruno Grosche & Co., 27 William St., New York.

Folder describing and illustrating the use of S. P. F. wood preservative and waterproofing compound.

Engineering Instruments.—Paper; 8x10½ ins.; 68 pp. Bauschc & Lomb Optical Co., Rochester, N. Y.

An artistic and complete catalog recently published which contains illustrations, descriptions and prices of surveying instruments for various purposes. This is a field which the Bausch & Lomb Optical Company has entered after consolidation with Saegmuller interests, including the firm of Fauth & Co., Washington, D. C., and also a later consolidation with the Carl Zeiss Co., of Jena, Germany.

Fireproof Booths, Etc.—Paper; 3½x6 ins.; 16 pp. The Johns-Manville Co., 100 William St., New York.

This booklet illustrates portable asbestos wood and asbestos curtain booths for moving picture machines as well as other fireproof necessities for theaters and other buildings.

Vulcanite Portland Cement.—Paper; 3¼x6 ins.; 4 pp. Vulcanite Portland Cement Co., Fifth Avenue building, New York.

A folder describing method of bonding new concrete to old, and of preventing the dusting of cement floors. This folder is designated by the company as T. W. K. No. 5.

Sand Craft.—Paper; 3½x6 ins.; 20 pp. J. R. Betton, 178 Washington St., New York.

This pamphlet describes the injector sand blast apparatus, with practical directions for operation. For cleaning buildings, steel work, castings, removing paint and scale and many other similar purposes. Sizes with capacity in pounds of sand and air pressure necessary are given.

Cast Iron Pipe.—Cloth; 8x5½ ins.; 112 pp. Glamorgan Pipe & Foundry Co., Lynchburg, Va.

A very complete and useful catalog containing complete diagrams of different sizes and shapes of cast iron pipes, with prices. A discussion of the life of cast iron pipe is given from a reprint. Tables and useful information are given.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

The grand total of excavation on the Panama Canal in August was 2,813,462 cu. yds., of which 2,757,990 cu. yds. were charged to "work excavation" and 55,472 cu. yds. to "plant." The dry excavation amounted to 1,775,072 cu. yds. and was principally by steam shovels. The dredges removed 1,038,390 cu. yds. in addition to the amount pumped into Gatun Dam by suction dredges. Two large bridge contracts have been let recently. One of these called for the construction of a high level bridge at Queen st., Toroto, Ont. The contract for this bridge was let to the F. H. McGuigan Construction Co., of Toronto, Ont., at $193,000. The other contract calls for a long reinforced concrete bridge over the Eel River, 12 miles from Eureka, Cal. This contract was let to the Pacific Construction Co., San Francisco, Cal., at $245,967. The bridge is to have seven spans and is to be 24 ft. wide, and including approaches will be 2,900 ft. long.—Bids are now being asked at North Yakima, Wash., by the U. S. Reclamation Service for the excavation of about 73 miles of sub-lateral for the Treton Unit of the Yakima Project.—The past week has seen some interesting developments in projected railroad construction work in Canada. The chief feature is the announcement that the Hudson Bay & Pacific Ry. has secured all money necessary for the construction of its proposed line from Prince Albert to Hudson Bay and that construction work was to be rushed. Another feature is the statement that the Canadian Northern was to call for tenders for the construction of its line between Chilliwack and Lytton, at the junction of the Fraser and Thompson Rivers, a distance of about 90 miles. This will consist mostly of heavy rock work along the south branch of the Fraser River.—The principal railroad construction contract of the week appears to have been secured by Erickson & Peterson, San Francisco. The contract is said to call for the construction of 63 miles of road bed for the California Northeastern R. R. from Volcano Ash to Indian Reservation in California. The road will be built over the mountains and will be a difficult piece of work.—Other railroad contracts of the week include the following: Janse, McDonnell & Timothy for clearing the right of way and grading of the Cowichan Lake, Canada, branch of the Esquomalt & Nanaimo R. R.; J. G. White & Co., Inc., New York, a $150,000 contract for the erection of railroad shops at Mayfield, Va., for the New York, Ontario & Western Ry.; J. B. Orman & Co., Greeley, Colo., for construcing the first 43 miles of the Denver, Laramie & Northwestern R. R. beyond Greeley; Jones Bros., Harrison Bldg., Columbus, O., for the grading and filling of the line of the Cheasapeak & Ohio Ry. of Indiana (Chicago, Cincinnati & Louisville) across the Mill Creek bottom at [illegible] large lock and dam contracts have recently been awarded by the U. S. Government. The largest of these was the contract for constructing Lock and Dam No. 9, on the Ohio River at New Cumberland, W. Va. This contract was let to the National Construction Co., Evansville, Ind., at $912,456. The contract for dam No. 7 was awarded to the J. P. Gillespie Co. of Pittsburg, at $750,645. Work on these two dams is to be started Oct. 1. The contract [illegible] No. 17 on the Black & Warrior River, Ala., was let to B. H. Hardaway, Columbus, Ga., at $492,000.—Bids were opened Sept. 19 by the City of Oklahoma City, Okla., for a large amount of asphalt paving work. The estimated cost of this work was $984,927, and the bids received will be found under Roads and Streets in the Construction News Section of this issue.

The Man Who Couldn't Come Back.

There died last week in the charity ward of one of the hospitals in New York City a man who in the early nineties was well known in almost every large railroad construction camp in the west. His name was William Garnahan and he had as a contractor handled successfully many large pieces of construction work. His luck changed, however, and he became successively a sub-contractor, a superintendent of construction, a foreman, and in 1898 was cook in the railroad construction camp of a contractor, whom we will call Galway, because that is not his name. It was here that the event occurred which put Garnahan out of the dirt moving business forever. Galway lived on the job and for his convenience had erected a small house which he used as his headquarters. As Ganahan was a likeable sort of fellow and a good mixer of drinks, he was employed most of the time at headquarters. The contract was a large one and both the general contractor and the sub-contractors were making a good deal of money. It was the custom for several of the sub-contractors to assemble each night at Galway's office and engage in a game of poker, at which considerable sums of money were won and lost. Garnahan in his role of mixer of drinks was always in attendance at these parties and when his services were not required would sit watching the game. One day an agent for a new kind of high explosive left a 50-pound box of his goods at Galway's headquarters. In the evening Galway opened the box and showed the contents to several sub-contractors who had assembled for their usual game. The box was then placed at one end of the room and forgotten for the time being. About a week later Galway and his friends got together for another game. They had been paid for their monthly estimates, and as a result the stakes were unusually heavy, there being nearly $2,000 in the bank. Garnahan, as usual, sat watching the game. Suddenly one of the players threw down his cards and dove for the door. Galway and the others followed him, for over in one corner of the room all afire was the box of high explosive. The outer cover of the box had burned off and the flames were reaching out for the paper wrapped around the dynamite. Garnahan did not join the flight. He had planned the whole thing; he had removed the dynamite from the box and had started the fire; and now he proceeded to gather in the money the players had left. This done he took several sticks of dynamite from his coat, lighted the fuse and slid out into the darkness. Presently there was an explosion and when Galway and his men came back the house had disappeared. As never a trace of Garnahan could be found, it was concluded that he remained in the house, trying to put out the fire and so lost his life. That was the version given in the newspapers, and Garnahan, reading these accounts, was highly amused. A few days later he appeared in New York. Here his money lasted but a short time. He didn't dare go back to construction work, for, although he was supposed to be dead, he knew that some of his old acquaintances would be sure to recognize him. So he stayed around New York, getting work when he could, and finally became a bum and a panhandler. The above is his story as he told it to a newspaper reporter a few days before his death.

The Sand Hog.

Short story writers have begun to appreciate the "human interest" features of construction work, and as a consequence the last few years have seen the printing of many stories, in which idealized engineers, contractors, and workingmen played the lime light part. The structural steel workers and the rock men have been written up, and now comes a writer in the Saturday Evening Post with a verse to the compressed air worker—the Sand Hog. This verse is somewhat long so we only reprint a portion of it, as follows:

The Sand Hog.

He's fifty inches round the chest,
  His leather lungs are sound,
His heart must stand the air compressed
  In caissons underground,
With pressure hammering his ears.
  His shovel in his hand,
He works—in several atmospheres—
  And burrows in the sand.

Beneath the "lock"
  He spends his time;
He seeks bed-rock
  Through silt and slime,
And blithely takes
  His chances where
For us he makes
  A Thoroughfare!

The job would never have a start
  Without the Draftsman's wit,
The Ironworker does his part,
  The Mason adds a bit;
They do their work—remember that—
  But also please recall,
The Sand Hog certainly is at
  The bottom of it all.

When he is through
  Right on his heel
May come the crew
  With stone and steel;
But till he's done
  They wait their day,
For he's the one
  Who clears the way.

Mr. Stubbs of Kansas.

It is nothing uncommon for a politician to turn contractor, for the time being at least—politics and contractors are sometimes near second cousins in some of the eastern cities—but when a contractor gives up contracting for a political life it is unusual enough to be worthy of a note here. We will accordingly devote this paragraph to W. R. Stubbs, the present governor of Kansas. Mr. Stubbs broke into the political game in 1903, being elected a member of the State Legislature for that year. This session of the legislature was a busy one for him and before it had ended the politicians knew that something was happening. When the Republican State Convention was held a year and a half afterward, Mr. Stubbs was chairman and its dominant force. In 1905 he was returned to the State Legislature and was speaker of the House. He kas re-elected in 1907, and in 1908 he became governor. This year he will again be a candidate, and if he wins there is a more than a possibility that the U. S.

Senate in 1912 will have as one of its members a former contractor. Such in brief is his political career. As a contractor he took up the gentle art of dirt moving in 1881. At that time he was 23 years old and was farming it on his own hook at Douglas County, Kan. He owned a couple of plug teams and was reputed to have amassed an easy competency of some $500. When he had gotten in his crops that summer he took his plug teams over into Jefferson County, where the Leavenworth & Southwestern R. R. was then under construction, and put them to work on the grade, driving one of them himself and hiring a man to chase the other. Within three months he had taken a sub-contract on his own behalf and was an employer of labor. He liked the game so well that thereafter he took many small grading contracts, and by 1892 he was worth $10,000 or $15,000. In 1893 he formed the Stubbs Construction Co., and in that year he began to make his first real money, operating on the Chicago Drainage Canal. The construction company was on this job for four years and its net profits for the period were said to be in the neighborhood of $200,000. After that the company extended its operations to all parts of the United States. Perhaps the largest contract executed by the company was the construction of the Kansas City-St. Louis line of Rock Island. Along in 1905 or 1906 Mr. Stubbs became so immersed in politics that his contracting business no longer interested him, and he accordingly sold it out. At that time the company had offices in Los Angeles, Kansas City, Chicago and Omaha. Its annual contracts ran as high as $5,000,000 and it often employed more than 5,000 men.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Montgomery Traction Co., Montgomery, Ala., has been granted a franchise for extending its Cloverdale street car line for about a half mile to the campus of the Methodist College for Women near Montgomery.

The Louisville & Nashville R. R. is said to be planning to have a survey made at once to ascertain the feasibility of extending its line from Tuscumbia, in Colbert county, to Russellville.

It has been announced in Anniston, Ala., that work will begin in a short time and be completed before the end of the year on the construction of the Seaboard Ry. to that city from Jacksonville. The company has investigated terminal facilities at Anniston and rights of way for the proposed branch which are valued at several thousand dollars and which under terms of the franchise will be granted the company by the City.

The Tuscaloosa Mineral R. R. Co. has completed surveys and has received the capital for the construction of a 21-mile line to Brookwood, Ala. Construction contracts will be let soon. The chief engineer has not been named as yet. F. G. Blair, Tuscaloosa, Ala., is president.

Arkansas.

The Fort Smith & Van Buren R. R. Co., of Fort Smith, Ark., has about completed preliminary surveys for its proposed line. The company has just been granted a franchise and right of way at Fort Smith.

An announcement reported to have been made by C. W. Dodson, General Superintendent of the Memphis Dallas & Gulf R. R. Co., is to the effect that survey for the extension of the road from Murfreesboro, Ark., to Graysonia will be completed soon. Grading work will then be started and the construction of the line rushed to completion.

Engineers are now running lines for the construction of the proposed Missouri, Arkansas & Texas R. R. and have 28 miles completed in Newton County. It is believerd necessary to bore a tunnel through the mountains from which the proposed line will drop down to Mulberry Creek and thence south through Fort Smith, Ark. Manager of Business Affairs of the company at Fort Smith, Ark., has asked the city for a subscription of $25,000 to be turned over to the railroad when trains are operating.

Efforts are being made by citizens of Mena, Ark., to organize a company to build a line from Mena to Hot Springs. W. M. Pipkin and A. H. Scroggins, Mena, Ark., are interested.

Details of construction have been arranged by the officials of the Stuttgart & Rice Belt R. R. and grading work is being pushed rapidly. Material including steel is already at Mena and the outlook f [illegible] of the work is favorable. George C. Lewis, DeValls Bluff, Ark., is president of the company.

Work has been started by Ball & Peters, Little Rock, Ark., on their contract for the construction of a line of track five miles in length, from the White River Division of the Iron Mountain to a gravel pit, whence the ballast for both the new and the old line of track from Newport to Little Rock will be taken. The new track leaves the main line of the White River Division of the Iron Mountain seven miles from Diaz.

California.

The Ocean Shore Ry. Co., 52 Eleventh St., San Francisco, has petitioned the Board of Supervisors at San Francisco for a five-year extension of the permit in its franchise to construct the tracks of its Richmond and Sunset concessions as well as the right of way across the park. The grant of October 5, 1905, was conditioned upon work beginning within one year, and being completed within five. Some work has been done upon the route to conform to the first part of this obligation, and the five-year extension has been requested from next Oct. 5, when the permit by its terms will lapse.

The Santa Fe Land Improvement Co. is reported to have purchased for the Atchison, Topeka & Santa Fe Ry. the old Keller-Kerchhoff right of way extending from the heart of San Diego to Del Mar, about 19 miles north. The route shortens the distance between San Diego and Del Mar by four miles and eliminates several big grades. It is said by securing this right of way the Santa Fe will carry out the plans for the boring of a tunnel through Oledad mountain, thus enabling passenger trains to make the trip between Los Angeles and San Diego in three hours, effecting a saving of 1½ hours.

Hillyer, Stringham & O'Brien, were the only bidders for the proposed Parnassus Ave. railway franchise, the line to be a continuation of the Masonic Ave. line and start from Third and Parnassus to Judah (J) St., thence to Ninth Ave. and on to Pacheco St. in San Francisco, Cal.

The Los Angeles-Pacific R. R. Co., is to start work at once relaying and repaving the tracks of Sunset Boulevard. A contract amounting to about $500,000 has already been let for the work, which will include the installation of heavier rails.

Work is about half completed on the Rocklin cut off of the Southern Pacific from Rocklin to Colfax, Cal., a distance of about 40 miles. Construction has been under way about 2½ years and it is estimated that the necessary time for completion will be another two years. The cost is approximately $2,000,000. Erickson & Petterson, San Francisco, are the largest subcontractors, their line being from Applegate to Rocklin. They have many tunnels and many fills and bridges yet to construct. The Utah Construction company has finished its work from Applegate to Colfax. All the cuts and fills are made with the use of large steam shovels. At Applegate there is one tunnel a quarter of a mile long, while at Auburn, crossing the Auburn ravine and the Sacramento road, is to be a steel bridge 300 ft. long and 100 ft. high.

It is believed in Petaluma, Cal., that another contract will soon be let for the extension of the Northwestern Pacific toward Humboldt Bay. At the present time about 400 men are engaged in the work at the Petaluma end. Steel is laid for a distance north of Willits and the balance of the 13 mile contract will be finished as soon as possible. On the Eureka end of the gap a similar state of affairs exists. A large number of men are at work and the first big tunnel has been completed. With the completion of the work now under way at Willits, there will be but a gap of less than 70 miles to complete the line from San Francisco to Humboldt bay.

John Ward of San Francisco, foreman of a construction crew engaged in extension work on the Northwestern Pacific R. R. near Dyerville, south of Eureka, was instantly killed Sept. 14 and two members of the crew were badly injured, one perhaps fatally, when through a misunderstanding of orders a blast on the mountain side was prematurely set off. Ward was buried beneath tons of rock and debris, which were hurled from the mountain side on the workmen in the canyon below. The injured men were not directly in the path of the avalanche, but Ward was completely covered from sight.

Erickson & Peterson, San Francisco, Cal., are stated to have been awarded the contract for the construction of 63 miles of railroad for the California & Northeastern R. R. Work will begin at once, as the line must be completed in 2½ years. The road will be built from Volcano Ash to Indian Reservation, over the mountains, and it is a difficult piece of work. The amount of dirt and rock to be removed is about 65,000 cu. yds to the mile.

Colorado.

The Denver City Tramway Co., John Evans, Chief Engineer, Denver, Colo., is to have work started on an extension into Valverde as soon as the Alameda Ave., Denver, subway is completed. This subway is to extend under all the railroad tracks. It will really be a part of the Valverde line. The subway will cost $180,000 to $200,000. The tramway company is also considering building from the present terminus of its 17th Ave. line at City Park, out 18th Ave., through Dowington.

The Denver, Laramie & Northwestern R. R., W. D. Hodge, Chief Engineer, Denver, Colo., recently sold $310,000 worth of bonds in Chicago and now has over $500,000 available for construction purposes. Work on the line west of Greeley will be started at once. The work beyond Greeley will be in charge of J. B. Orman as contractor, the first contract including 43 miles of road.

The Laramie & Hahns Peak & Pacific R. R., R. D. Stewart, chief engineer, Laramie, Wyo., has given out the route by which it will reach Steamboat Springs from its present terminus at Coaldale in North Park. The road will cross the range along the south fork of Elk river to its junction with the middle fork and follow the stream to Steamboat. It is expected that the grade will average only 2 per cent and there will be one tunnel and only one switchback. It is stated that the work of construction will be vigorously pushed.

The Fairview & Intermountain R. R. Co. has filed its articles of incorporation. The company has a capital stock of $250,000 and will have its headquarters at Delta, Colo. According to the articles of incorporation, one branch of the line is to run from Delta to Cedaredge. Another spur is to go to the Fairview coal mines at the edge of the mountains. A third branch is to run from Delta along the California Mesa to its upper end, in Montrose County. The incorporators are

Charles G. Mantz of Denver, Mudge Ziegler, Henry Ziegler and Watson Ziegler of Fort Collins and B. F. Hubbard of Chicago.

It is rumored in Redville, Colo., that Bulkeley Wells and Associates are contemplating a survey for the construction of a railroad from Placerville and extending down the river to the sawmill plant of the San Miguel river canal promoters, following the river to a point north of Norwood, swinging into the Coventry and from thence to Dry Creek basin by way of Lily lands, practically lining up with the ditch survey.

Florida.

The Tampa & Jacksonville Ry., F. S. Parrigin, Chief Engineer, Gainesville, Fla., is said to be planning to rush construction work along the line of its proposed extension.

Georgia.

The City Suburban Ry. Co., of Brunswick, Ga., F. D. M. Strachan, President, has applied to the State Railroad Commission for authority to issue stocks and bonds. The application is for $100,000 issuance of common stock and $200,000 in bonds to pay off indebtedness, with a privilege of increasing bonds to the amount of $500,000.

Illinois.

Right of way is being secured for an electric railway passing through Freeburg. Edward L. Thomas and David O. Thomas, Belleville, are promoting the project.

J. W. Walsh, Davenport, Ia., of the Rock Island Southern Ry. Co., has announced that the extension of the line to Aledo, Ill., has been completed and that the work of electrifying the whole right of way is continuing. It is expected to have the main line completed within 30 days and the Aledo extension within six weeks.

The Pennsylvania R. R. is going ahead with its plans for starting work on its new $20,000,000 union station at Chicago. Arrangements have been completed under which the Chicago, Milwaukee and St. Paul will occupy the Wells St. Passenger Station as soon as the Chicago & Northwestern moves into its new structure. During construction of the union station the Chicago, Burlington and Quincy and the Chicago and Alton railroads will use the Grand Central Station, the Pennsylvania proper and the Panhandle being the only lines to remain in the Union Station. On completion of the station all the companies will use it again.

Frank H. Hamilton, City Engineer of Springfield, Ill., has been making surveys preparatory to making estimates of the city's share of the cost of the proposed subway of the Chicago, Peoria & St. Louis Ry. at Jefferson St. and Enos Ave., Springfield.

The Northwestern Elevated R. R., E. C. Noe, General Manager, 1117 Merchants Loan & Trust Bldg., Chicago, has announced plans for changes in its union loop at Chicago, and has taken figures for 1,500 tons of structural material.

Surveys have just been started for the projected line of the Springfield & Central Illinois Traction Co. The capital for construction is practically assured, and it is planned to let construction contracts early in 1911. This company projects 300 miles of road, to include a line from Springfield to Centralia, a branch to St. Louis and a branch to Mt. Carmel. Isaac A. Smith, Security Building, St. Louis, Mo., is president and chief engineer.

Officials of the Sterling-Moline Traction Co., Sterling, have taken steps for the disposition of $15,000 of stock in Morrison. The money secured will be used for building the line between that place and Denrock. It is stated that as soon as the $15,000 worth of stock is subscribed, the right of way will be secured.

The Chicago, Kankakee & Urbana Electric Ry. Co. is reported to have secured the necessary capital for beginning construction work on its proposed line, and the promoters of the company are said to have been consulting supply men and contractors with a view to having work started soon. All right of way has been secured. It is said that work will be started at Kankakee and carried south through Iroquois county, running nearly parallel with the Illinois Central to Urbana, the university city, and then will be continued to Charleston via Villa Grove. A power plant will be built at Urbana and another will be constructed at Kankakee to furnish electric power for the line. George M. Bennett, Urbana, Ill., is President.

Steps are being taken to raise funds in the various towns interested for making surveys for a projected electric railway from Sterling to Freeport, via Coleta, Milledgeville and Lanark. A branch westwardly to Savanna is also proposed. Wm. Usborne, 407 State St., Chicago, Ill., is the promoter.

It is now said that the Tampico-Hooppole Electric road, which was recently completed to Hooppole, will be extended at once to Geneseo. The J. J. Burns Construction Co., Isabella Bldg., Chicago, Ill., is interested.

The Chicago, St. Paul & Milwaukee Ry. has just accepted the ordinance passed by the City Council for the elevation of the Bloomingdale road tracks from Ashland Ave. to Lawndale Ave., a distance of 2.6 miles of double track, with numerous side tracks and industrial connections. This will include 36 subways—all 60 ft. in width, except one 100-ft. subway and one 250-ft. subway. The subways are to be paved with No. 2 granite blocks and a brick pavement and cement sidewalks are to be constructed in Bloomingdale Road alongside of the elevated tracks from Pauline St. to Central Park Ave., a distance of over two miles. The time limit for the work is five years. Plans and specifications are now being prepared. The Chicago, Milwaukee & St. Paul Ry., has also accepted the ordinance passed on July 11, 1910, for the elevation of the Evanston branch from Montrose Ave., north to the city limits. The work includes about four miles of double track at present, which will probably be four-track. The job includes 37 subways and considerable street improvement in Southport Ave., between Pratt Ave. and Kenilworth Ave. The time limit is seven years.

Work is under way for the temporary working track of the new power station for the Commonwealth Edison Co., near Chicago. In connection with the plant a double track elevated switch track will be built from a connection with the Wisconsin Division of the Chicago & Northwestern Ry. at Kimball Ave., and running east and parallel with Roscoe St., about 175 ft. north. The work will include five street subways and three alley subways, to be spanned by permanent bridges, with concrete abutments and paved with granite block paving. A sand fill will also be constructed. James O. Heyworth, 234 Michigan Ave., Chicago, has been driving the piling for the temporary track and is understood to have the general contract for the work. Sargent & Lundy, Railway Exchange Bldg., Chicago, Ill., are the Engineers.

Good progress is being made on the construction of the Cairo & Thebes R. R., and it looks as though track would be laid on the entire section between Cairo and Thebes by Oct. 15. At the middle of September about 14 miles of track had been completed and track laying from Fayville was progressing in both directions. Toward Thebes it had reached the Rock Springs bridge, which was yet to be put in, while below Fayville the track laying had progressed for about a couple of miles. There are two places in the grading where the fill is heavy. One of these is just below Beech Ridge where the track which stretches out from Cairo comes to an end. The other is where the railroad passes south of Horseshoe Lake, where the country is low.

Indiana.

The Board of Public Works of Indianapolis will shortly pass an order directing the Indianapolis Traction & Terminal Co. to extend the East Michigan St. car line from Keystone Ave., its present terminal, to Irvington.

Two-thirds of the proposed line of the Evansville, Mt. Carmel & Northern have been completed and it is expected at the end of the present year to have the entire line in operation. The road was projected by the Big Four. Construction was delayed by the business depression until last spring. It will extend from Mt. Carmel, Ill., to Evansville, Ind., 32 miles, and a junction with the Big Four is formed at the initial point. When ready for business it is understood that close traffic relations are to be entered upon by the Big Four and the Louisville & Nashville.

Construction work started Sept. 13, on the $3,000,000 car shops of the Lake Shore & Michigan Southern Ry., at Elkhart, Ind. The plant will be one of the largest of the New York Central System.

Iowa.

Progress is being made with the promotion work for the Iowa, Ottumwa & Southwestern Interurban Ry. In Iowa County officials of the company recently secured 14 miles of right of way, and in Green Township they secured stock subscriptions for $21,000. D. T. Davis, Iowa City, Ia., is interested.

Business men of Ottumwa have pledged $100,000 for building the interurban road between Ottumwa and Iowa City. Twelve miles of right-of-way out of Ottumwa and terminal facilities are now being secured. Iowa City has nearly raised its amount.

The Chicago, Milwaukee & St. Paul Ry. is to build a spur to the Waukon iron mines near Mason City, which were recently purchased by the Kansas City Structural Co., of Kansas City, Mo.

The General Construction Co., Davenport, Ia., is reported to have commenced work on its contract for extending the Muscatine North & South R. R. from Elrich, Ia., to Burlington.

The Tri City Ry. Co., J. F. Porter, president, Davenport, Iowa, is now constructing a one-mile extension on 27th street, Davenport.

A committee at Des Moines is now engaged in securing subscriptions for $200,000 of stock for the projected Red Oak & Northwestern Ry. If the committee is successful it is said that this will assure the construction of the road, as Red Oak has already pledged $100,000 and Greenfield $20,000. According to estimates by MacArthur Brothers Co., railroad contractors, Chicago, Ill., the new line will cost $22,000 per mile for the 104 miles of its length. Grading will cost over $600,000, main track will cost $751,000, and equipment $258,000, according to the same estimates. The right of way has been largely donated and but little remains to be secured.

Kansas.

Practically all of the required $50,000 bond subscription in Wyandotte County, Kan., for the Kansas City, Kaw Valley & Western Ry. Co. has been taken up by residents of the county. It is said that when the total amount has been subscribed Eastern capitalists will purchase $150,000 of bonds and construction work will be started on the trolley line between Kansas City, Kan., and Bonner Springs. Four miles of the line at Bonner Springs is in operation, The interurban line is to enter Kansas City, Kan., at Minnesota Ave. It will reach Kansas City, Mo., by the Minnesota Ave. line and the Intercity Viaduct. The Freeborn Engineering & Construction Co., Kansas City, Mo., has the contract.

Surveys have been completed and a portion of the right of way secured for the construction of the proposed Dakota, Kansas & Gulf R. R. Company's line from Beloit, Kan., to Kearney. Negotiations for the sale of bonds in the east will soon be taken up and active construction work will be started.

The Midland Valley R. R. Company's extension from Arkansas City, Kan., to Wichita is to be accomplished temporarily by the construction of a line between Arkansas City and McPherson, mentioned in previous issues of the paper, to form a connecting link between the Union Pacific and the Midland Valley in the south. The Midland Valley is one of the prominent lines south of Arkansas City, running to Fort Smith, Ark., a stretch of 355 miles. The completion of this, as a north and south trunk line, involves also the building of a stretch from Fort Smith south to a point where the Midland controls a line to New Orleans. The latest move in the project has been the coalition of Wichita interests and those of the Midland Valley. The latter has for some time been planning the last stretch of fifty miles into Wichita.

It is reported that the entire line of the Topeka & Northwestern R. R., a subsidiary company of the Union Pacific has been completed from Topeka to Marysville, Kan. The new line upon which construction work has been under way for the past five years, has been well built and has been an expensive piece of engineering. Some of the largest hills and cuts in Kansas are on the route. The Topeka & Northwestern is destined to be up to the Union Pacific standard in tracks and roadbed, as it is intended to become a part of a new freight route to the West and Northwest. By routing shipments from Kansas City over this line to Menoken, just west of Topeka where the branch leaves the Kansas main line, thence over the T. & N. W. to Marysville, and from there to Grand Island, Neb., on the St. Joseph & Grand Island, also a Union Pacific property, ninety-four miles is saved on the journey to the coast.

Kentucky.

The Lexington & Eastern Ry., John Marston, Jr., Chief Engineer, Lexington, Ky., is reported to have five corps of engineers in the field making preliminary surveys for routes for the proposed extension of the road.

Advices from Hopkinsville, Ky., state that articles of incorporation will shortly be taken out for the Kentucky & Tennessee Traction Co., which proposes to build an interurban car line, with Hopkinsville and Guthrie as the immediate terminals. The incorporators are leading business men of the section and half of them are bankers. No subscriptions will be asked for and all the money needed for the initial expenses has been raised. The line will traverse a rich agricultural section, and will touch the towns of Pembroke and Trenton.

The Somerset, Corbin & Cumberland Construction Co. has been organized at Somerset, Ky., for the purpose of making a survey and securing the right-of-way to build a new line of railroad from Corbin, on the L. & N. to connect with the Illinois Central at Hodgenville. The line road will be about 100 miles long, and will pass through a comparatively level stretch of country.

The Owensboro & Rockport Bridge & Terminal Co., of which Prof. Kennedy, Rockport is President, has been granted the right of way for the construction and operation, for the period of 50 years, of a railroad on the river front of Owensboro. The ordinance provides that the work on the road shall be started within one year from this date and that that the work shall be completed within three years. The right of way for the proposed line, will allow the construction of the line within 50 ft. north of 50 ft. southward from the crest of the slope of bank of the Ohio River, and provides that all the construction shall be on the city street levels.

The Cincinnati, Louisville, Lexington & Maysville Traction Co., W. T. S. Blackburn, President, Dry Ridge, Ky., is planning to have work started early next year on that portion of its line from Covington to Owenton, Ky., 45 miles. The total projected length of this road is 250 miles.

Louisiana.

Two committees from the City Council of Baton Rouge, La., and the Board of Trade of that city, are to secure data on the erection and operation of the belt railroads in the different cities of the country with a view to ascertaining the practicability and the cost of building a belt line in Baton Rouge, in order to make available for manufacturing purposes the property that is not now on a railroad. The committee will hold a joint session at an early date.

Final location surveys have been started by Engineer Frank Shutts, Lake Charles, La., for the proposed line of the Lake Arthur, Jennings & Northern Ry. Co. and grading will be started as soon as possible. It is expected to have the road completed by May 1, 1911. E. P. Fox, Lake Arthur, La., is General Manager of the company. The road will pass through the choice rice section of the state from Lake Arthur via Jennings, and will connect with the Frisco line at Elton, and it is the intention of the company to extend to Alexandria early next year.

Michigan.

An ordinance is to come before the City Council of Detroit, Mich., granting the Michigan United Rys. Co. of Lansing, rights through the west side of the city and over the Detroit United Ry., for a down town loop in Detroit.

The Lake Michigan & Kalamazoo R. R. Co., which projects an interurban line from Kalamazoo to Benton Harbor, has filed its articles of incorporation. The capital stock is $25,000, the incorporators and officers being: William A. Baker, Coloma, president; William C. Klumb, Kansas City, secretary and treasurer; John H. Notley, Kalamazoo, attorney. The company will ask for a franchise into Kalamazoo at the meeting of the City Council, to be held Oct. 3.

With the acceptance of certain plans of the Detroit United Ry. by the Common Council, the company will make improvements in Flint, Mich., estimated to cost $235,000. The extensions will include car barns and equipment.

The Bay City Terminal Railway Co., Bay City, has filed articles of incorporation with the secretary of state at Lansing. The company has a capital stock of $15,000.

The Grosse Ile Ry. Co., which plans a new railroad on Grosse Ile near Detroit, is making good headway in securing right of way. E. W. Voight, Detroit, Mich., is interested.

Minnesota.

Valentine Bros. Manufacturing Co., Minnesota, have petitioned the city council of Minneapolis, Minn., for permission to build a grade spur crossing 27th Ave. N. E. near Monroe Ave., to connect with the tracks of the Minneapolis, St. Paul & Sault Ste. Marie Ry.

Mississippi.

Preliminary arrangements have been practically completed for an interurban road to be built from Hattiesburg to Laurel, according to an announcement of officers of the Hattiesburg Traction Co. It is stated that one of the promoters of the new railroad will leave shortly for the Eastern money markets for the purpose of securing funds to finance the enterprise. The project is being promoted by Hattiesburg and Laurel capitalists, and the power for operating the cars will be furnished from the plant of the Hattiesburg Traction Co., which is said to have ample capacity for this purpose without installing additional machinery.

The charter of the Bonhomie & Southwestern R. R. Co., recently recorded at the office of the secretary of state, contains one unique provision to the effect that the company shall not be required to operate either passenger or freight trains on Sunday, save in desperate cases. No other railroad company charter ever recorded in Mississippi contained such a provision, so far as known.

Missouri.

Surveys have been started for the projected electric line of the Springfield & Western R. R., which is to extend from Springfield, Mo., to Carthage, and thence to Joplin. The company is backed by capitalists of Springfield, and a charter has been applied for. H. D. McKay, who built the road from Rogers to Silvan Springs, Ark., is President of the new company, and J. I. Woodfill, Springfield, is Secretary. The company is capitalized for $35,000 a mile, $20,000 stock and $15,000 bonds. The route is through Bennett, Plano, Halltown, Paris Springs, Monett, Pierce City and other towns. It is expected that work will be commenced this fall on the line.

The United Rys. Co. of St. Louis is to extend its University line west as far as Pennsylvania Ave., St. Louis.

A committee consisting of Frank Scheenen of Osage City, H. H. Schneiders of Taos and Martin Plassmeyer, Judge Jos. Eveler and Sam Schwaller of Wardsville is taking steps for securing right of way for a new railroad across Cole county, from Osage City through Wardsville, Taos, Brazito and on to Henley to a connection with the Rock Island. Capitalists of St. Louis are behind the project.

According to advices from St. Louis, Mo., surveys for the proposed line of the Missouri Arkansas & Gulf R. R., from St. Louis, south to the gulf have been indefinitely postponed. The work was abandoned in the mountainous district of Northwest Arkansas in which at present there are no railroads. Previous to going into Arkansas a small portion of the proposed line was surveyed south of St. Louis beginning near Carondelet. The road when finished would be about 566 miles long.

Final location surveys are under way on the St. Louis & Kansas City Electric Ry. and contractors have been going over the route preparatory to bidding on the construction work. The contract for the erection of bridges across the Missouri River at St. Charles and Arrow Rock, is reported to have been let to the Toledo Bridge Co., Toledo, O. for $1,147,000. D. C. Nevin, Kansas City, Mo., is president of the St. Louis & Kansas City Electric Ry. Co.

Advices from Mexico, Mo., quote R. E. Race, President of the St. Charles & Northwestern Traction Co., as stating that work on the line would in all probability begin this fall. The route runs from St. Charles to Troy, then to Laddonia, and will eventually join the Mexico, Santa Fe & Perry Traction Co., an electric line under construction.

St. Louis Items.

BY A. B. KOENIG.

B. D. Riley, at England, Ark., can use several small team outfits; has also a lot of station work to let.

List & Gifford are finishing their work near Kensett, Ark., and have moved part of their outfit to Hoisington, Kan., on the Missouri Pacific R. R.

The presence in Memphis of half a dozen officials of the Cotton Belt R. R. last week gave rise to a rumor that the company were seeking property on which they will build immense freight terminals. None of the officers would make a statement other than they were there on an inspection trip. Their presence was carefully guarded, and even then a complete list of those in the city could not be obtained. However, on the special train were F. H. Brittin, vice president and general manager, St. Louis; C. W. Nelson, assistant general manager, St. Louis; B. Adams, master mechanic, Pine Bluff; E. A. Peck, superintendent, Pine Bluff, and W. A. Waldron, general storekeeper, Pine Bluff. Mr. Britton and other officers looked at the new passenger terminals which will be used by the Cotton Belt. In doing this they were seen to inspect other property adjoining it, and those close to their movements say the Cotton Belt will purchase considrable ground in the neighborhood of the Memphis Union Station Company building and spend $300,000 on freight terminals. Since the announcement exclusively made that the road was surveying an independent line from Stuttgart, Ark., via Marianna to Memphis, and there has been gossip of big freight terminals.

The Walsh Construction Co. of Davenport, Iowa, was awarded the contract for grading the yards for the new Union depot at Joplin, Mo.

Mike Conroy has moved his outfit on the Alton & Jerseyville Electric line near Jerseyville, Ill.

With the third stone pier completed, work on the Municipal Free Bridge at St. Louis is far ahead of the contract time. Work is to start in a few weeks on the west water pier, and it will be grounded in November. By this time, the officials say work will be three months ahead of the contract.

J. H. Haliburton is still at Cayuga, Ind.

Thos. K. Skinker, who sued the Louisiana Purchase Exposition Company for $30,000 for alleged damages to the Skinker tract, occupied by a portion of the World's Fair, and for failure to restore the property to the owner until 90 days after the lease expired, got judgment for $2,401 damages and nothing for unlawful detention. Judge Homer rendered the decision Friday. Skinker alleged the exposition company left gulleys and sinkholes on the property and the ground full of drain pipes and piling. The company agreed to pay $82 a day for the time the land was held after the lease expired. Judge Homer decided that Skinker was entitled to $2,401 for the expense incurred in taking the piling and sewer pipe out of the earth, and putting the surface in shape for building purposes. The exposition company's lease expired June 30, 1905. The company paid a monthly rental for the property of $1,250.

J. H. McFarlin, general manager of the Jacksonville & Springfield Traction Line, spent a day with us last week. McFarlin reports making rapid progress with the building of their line and will have it in operation shortly.

The first electric car crossed over the new McKinley bridge here last week. This company expects to be operating cars regularly over the bridge after the 1st of October.

T. J. Dolan, secretary of the Steam Shovel and Dredge of Chicago, spent a couple of days with us last week.

M. C. Connors & Co. have a nice piece of work at Palmyra, Mo.

Labor still continues to be awful scarce in the south, with the cotton season opening and the highest price being paid for cotton picking that ever was known. The negroes have deserted the railroad work and gone into the cotton fields. There is not a railroad company that is doing any work in the south that is not short-handed and are praying for cold weather to come soon, so as to bring in some labor from the north.

J. W. Skinner is getting along nicely with his bridge work on the Iron Mountain R. R.

Montana.

It is stated in Lewistown that the officials of the Chicago, Milwaukee & St. Paul Ry. and the Great Northern Ry. have reached an agreement relative to the rights of way eastward from Grass Range for a distance of from 60 to 85 miles. The roads parallel each other from Lewistown to a distance several miles east of the Musselshell river, and their proposed routes conflicted in so many places that it was decided to make an effort to adjust the differences. It was decided to use a joint right-of-way and thus avoid any further squabbling. Together it is said, the roads will secure one right-of-way 200 ft. wide where practicable and 150 ft. wide where necessary, from Grass Range to a point in Dawson county, where the routes take different directions.

The Chicago, Milwaukee & St. Paul, according to advices from Lewistown, will, during the winter, definitely locate the line from near Terry, on the present main line, across Dawson county to the Musselshell river, and between Lewistown and Great Falls, and when work is again started, it will be with greatly increased forces and with the intention of pushing what is destined to be the main line of the Milwaukee to the coast via Lewistown, to rapid completion.

The Gallatin Valley Electric Ry. Co. has changed its name to the Gallatin Valley Ry. The company has also completed its extension from Bozeman Hot Springs to Three Forks, and is now planning extensive improvements in its street railway system at Bozeman. W. H. Penfield, Chief Engineer, Bozeman, Mont., is now making the necessary estimates and as soon as the preliminaries are completed and the material delivered, new and heavier rails will replace those now in use and new cars of the latest and most approved design will replace the present rolling stock.

The M. Tobin Construction Co., of Hamilton, Mont., has been incorporated with a capital stock of $20,000, the incorporators being Mike Tobin, Frank Tobin and C. A. Tobin, all of Hamilton.

Work is progressing ra[illegible] ed line from Leader, Mont., on the Chicago, Milwaukee & St. Paul Ry [illegible] Springs. The road is being built by John Ringling and the cost of the work is estimated at $1,500,000. It is planned to start operations over the new road by December 1.

North Dakota.

Grading work on the new line of the Northern Pacific has been completed from Dawson to Streeter and the survey from Dawson to McClusky in Sheridan County has been completed. A line is also being run northwest from Turtle Lake in McLean County, which it is expected will be ended at Berthold or in the vicinity.

New Jersey.

The Newark & Bloomfield R. R., a branch of the Delaware, Lackawanna & Western system, has filed with the Secretary of State of New Jersey a certificate increasing its capital stock from $500,000 to $1,600,000.

New York.

The Schenectady Ry. Co. has applied to the City Council of Schenectady for a franchise to lay tracks in Smith St., Veeder Ave., and Lafayette St., and to make changes in the tracks at the foot of Crescent Park.

The New York Central & Hudson River R. R. is making final plans for the electrifying of its Auburn Division between Syracuse and Geneva. The work will cost about $1,000,000 and it is proposed to have the construction work completed, the car equipment ready, and the road in operation under its new system of power, by fall next year.

The Elmira Water, Light & Railroad Co., Elmira, N. Y., will put a large number of men to work relaying the tracks on Main St. from the corner of Main and West Water St. to Third St. New and heavier steel will supplant the old rails and the switches at Church St., Second and Third Sts. will be torn up and new switches put down. Both tracks will be ballasted with crushed stone and cement grouting will be used between the ties. The work will be so substantial as to afford one of the best stretches of track to be found on any of the company's lines and will require about two months' time to complete it.

Ohio.

Advices from Upper Sandusky state that a party of promoters, headed by John Welz, have been in Upper Sandusky, making preliminary arrangements for the construction of a gasoline traction line from Findlay to Marion through Upper Sandusky.

The Western Ohio Ry. Co., Lima, O., has opened bids for the construction of an electric railway from Fostoria to Fremont, to be used for through service to Cleveland. The line will be 20.6 miles long and the contract calls for the expenditure of about $400,000.

The Canton & Youngstown Ry. Co., a new company which has for some time been projecting a line from Youngstown to Canton, is reported to have interested new capital and the prospects are said to be good for the ultimate building of the line. The name of the company has been changed to the Canton, Akron, Youngstown & Alliance Ry. Co. The proposed route to Youngstown is via Hartwell, Randolph, Atwater and Deerfield. Two routes from Deerfield to Youngstown have been selected, one is south of Berlin station through Canfield and the other north of Berlin through Austintown. The southern route, however, seems to be the most preferable because it will shorten the distance between Alliance and Youngstown, the Alliance branch connecting near Berlin. The Akron division will pass through Mogadore and connect with the Canton & Youngstown line near Randolph. The estimated cost of building and equipping the road is $4,000,000.

Robert Hoffman, City Engineer of Cleveland, O., has received preliminary plans from the Pennsylvania R. R. for the elimination of its East End series of grade crossings at Cleveland. An ordinance containing a description of the work has been prepared. The city of Cleveland will sell the $2,000,000 grade crossings bonds issued by authority of the people some time during the coming month.

The Portsmouth Street R. R. & Light Co., L. D. York, President, Portsmouth, has again taken up with the city of Portsmouth, the matter of constructing a subway at 10th and Offnere Sts. It is stated that if the subway is built the company will move its offices to the West End, and an improved terminal will be established there, much larger than the present one.

It is believed here in Youngstown that work may be started next spring on the construction of the Ohio & Pennsylvania belt line which will connect all the large plants of the Mahoning valley with the exception of those in the Crab Creek district. The company was incorporated some years ago and since that time the route has been laid out and considerable of the right of way acquired. In general, the line of the river is to be followed as closely as possible and the stream crossed three times at least. The work of getting into the various plants requires changes to be made by other roads and exchanges of property. Robert Bentley is President and S. D. L. Jackson is Vice President.

Jones Bros., General Contractors, Harrison Bldg., Columbus, O., have, it is reported, been awarded a contract by the Chesapeake & Ohio Ry. of Indiana for the grading and filling of the line across the Mill Creek bottoms at Cincinnati, O. There are several miles of high trestlework for the entrance of this line into Cincinnati and it is to be filled in and new grades established so as to connect it with the Chesapeake and Ohio terminals.

Final action has been taken by the railroad officials and the County Commissioners at Dayton, regarding a proposed overhead crossing of the Big Four at the Gloser crossing, south of Dayton.

The Chesapeake & Ohio Ry. Co., of Indiana, L. N. Jackson, engineer maintenance of way, Peru, Ind., is reported to be about ready to let a fair sized contract for the building of yards at Summit Station, which is located about five miles northwest of the McLean Avenue Station in Cincinnati. It is understood that land has recently been purchased at this point and the yards are to be made commodious enough to properly handle all the trains which will be traveling over the C. & O. Railroad of Indiana when that line has been placed in a physical condition to warrant a heavy traffic. Summit Hill is located at the top of the big hill which the C. & O. of Indiana ascends from the McLean Ave. Station in Cincinnati. It is the purpose of the management of the C. & O. to eliminate both grades wherever possible, in the work of reconstructing the five miles of road which lies between those two points.

Oklahoma.

Referees have been appointed to appraise property condemned by the Midland Valley R. R. for right of way purposes through Tulsa and Creek Counties. The right of way is to be used for an extension for Jenks, Okla., to Sapulpa.

A company has been organized by citizens of Davis, Okla., and a charter has been secured for the construction of a new railroad from Davis to Lawton, a distance of 80 miles. The capital stock is $50,000 and the incorporators are Gertrude Sober, R. C. Hope, A. O. McCord, T. H. Slaver and W. S. Lewis. The proposed road will be in Murray, Carter, Stevens and Comanche Counties.

It has been announced, according to reports from Guthrie, Okla., by O. O. Ayers, President of the Chickasha, Ardmore & Lawton R. R., that the capital for the construction of the road has been secured and that grading willl be commenced in October. All right of way for the line, which is 180 miles in length, has been guaranteed. The proposed route is as follows: From Ardmore to Chickasha. 100 miles, with a branch from a point 30 miles out of Ardmore to Lawton, Okla.

Oregon.

It is stated here in Portland that the Oregon Railroad & Navigation Co. has decided to defer the starting of work on the Coyotte cutoff in eastern Oregon. The contract for this work was let recently to Twohy Bros., Spokane, Wash., as mentioned in our Sept. 14 issue. The contract is reported to amount to about $800,000. The cutoff will shorten the main line of the Oregon Railroad & Navigation Co. about 15 miles. It is stated that the work has not been abandoned.

H. C. Henry, who has the contract for the grading work for the Oregon Trunk Line south from Madras, Ore., has established headquarters for his commissary department at Redmond, Ore. A branch commissary department has heretofore been operated at that place.

The Astoria, Seaside & Tillamook Ry. Co. of Astoria, a new company, has acquired possession of the Reed railroad grade, extending, with a connection with the Astoria & Columbia River R. R. at Clatsop City, up the Lewis and Clark River to Sable Mountain, a distance of 21 miles. The deal includes 80 acres of land in Clatsop City.

K. K. Kuney, Locating Engineer of the Oregon Trunk Line Ry., is quoted as stating that the proposed line from Bend southeast toward Burns, Ore., has been definitely located to Harney Lake about 20 miles south of Burns, and that it is ready for construction crews.

Right of way is stated to have been secured for the proposed line of the Mount Hood R. R. Co. and it is believed that grading contracts will be let at an early date. This road is to run in an eastern direction from Portland to Mount Hood. E. A. Hornbeck, Portland, Ore., is the Engineer in charge of construction.

At the annual meeting of the Oregon Short Line R. R. on Oct. 12, the stockholders will vote on authorizing an increase in the capital stock to $100,000,000, the amount now outstanding being $27,460,000, of which $27,350,700 is owned by the Union Pacific. None of the $72,539,900 new stock, it is stated, will be issued at this time. It will be used in the future, however, for the construction of new mileage, etc

The Chamber of Commerce, of Vale, Ore., C. H. Oxman, President, is working to raise $25,000 to buy the 12 miles of railroad right of way from Vale to the mouth of the Malheur Canyon, and a 20-acre tract in town, to be presented to the Harriman interests if they choose Vale as the division point and terminal for their new road across Oregon.

The Oregon Trunk Ry. has filed maps in the U. S. Land Office at Lakeview, Ore., for its right of way. The right of way designated is from a point on the summit of the Cascade Mountains, in central Oregon, running westerly and passing north of Fish Lake, thence running southwesterly, presumably along Willow Creek and Big Butte Creek, ending near Eagle Point, in Jackson County. It will run near Crater Lake National Park. It is supposed that this right of way is for an extension that will connect the Pacific & Eastern R. R. with the Oregon Trunk line, which follows the Deschutes River and will be the main line connecting numerous branches in California and Oregon.

All grading has been completed for the entrance of the Pacific & Eastern Ry. tracks into Medford, Ore., and steel will be installed at once.

Pennsylvania.

A company is being formed by business men of Dillsburg and capitalists of Philadelphia, for the purpose of building a 14-mile trolley line from Dillsburg to Dover. The proposed route is via Franklintown, Mountain Top, Wellsville, Rossville and The Pickets to Dover, connecting with the York and Dover trolley line, thus making a direct route to York. The company is to have a capital stock of $180,000. It may be noted that surveys for such a line were made several years ago, but at that time the necessary capital could not be secured. It is believed that the new company will have better luck, inasmuch as a large part of the capital stock has already been subscribed.

The Wilkes-Barre Ry. Co. has had work started on the extension of its tracks from Hughestown to Avoca. A large force of men is employed on the job, and it is expected that the new line will be opened by Dec. 1.

J. G. White & Co., Inc., engineers and contractors, 43 Exchange place, New York, have been awarded a contract by the New York, Ontario & Western Ry. Co. for the erection of railroad shops at the Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of the erection of a 10-stall roundhouse, with a 75-foot turntable, machine shop, carpenter shop, with complete power plant, storehouse, office building, oil building, sand storage, drier and loading house, and a complete coaling station with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

The Lehigh Valley R. R. has been having surveys made at Bernice, on the Bowman's Creek branch, with a view, it is said, of building a new depot and if feasible to run a line direct from Mildred toward the company store at Bernice and do away with the switchback at the old depot.

Construction work was started on Sept. 15 at Pottsville, Pa., on the proposed line of the Midland Pennsylvania R. R. The line, as projected, will be 44 miles long and will extend from Millersburg, Dauphin County, to Ashland, Schuylkill County. W. E. Harrington, Philadelphia, Pa., is President.

Good progress is being made by the Eyre-Shoemaker Co., of Philadelphia, on its contract for constructing the new line of the Baltimore & Ohio R. R. from Somerset to Acosta. The contractors have three gangs of about 400 men each at work. The gangs are located at Husband, Acosta and a point about midway between the two villages, and a small force of men, about 100, is working in North Somerset. It is stated that the road will be in operation by May 1 next. At Husband there are three steam shovels in constant operation and several miles of construction railroad have been built and small engines are constantly hauling train loads of earth from the excavation. One force of men is building all the concrete work and has derricks, stone crushers and mixing machinery in constant operation. All the culverts are being constructed of concrete. One of the cuts at Husband will be more than 75 ft. deep, and is being blasted through solid rock. This cut will be nearly a mile long. There is also a fill about 100 ft. high and half a mile long. Over one-third of this fill has been completed and the cut has been dug to a depth of about 35 ft. In the construction of the fill it is necessary to build trestle work of heavy timbers, and to lay construction track along the top so that train loads of earth may be dumped at the most advantageous places. At Acosta several deep cuts will have to be built and considerable grading is necessary. Between Husband and Somerset there will be no need of much grading. It is the intention of the contractors to push the work vigorously from Somerset, Husband and Acosta, and to join the completed work.

City Council of Northumberland, Pa., has granted the Delaware, Lackawana & Western Ry. right to close Sheetz alley, below Northway, and construction work on the new freight house and sidings, for which a large tract of land was recently purchased, will begin at once.

J. G. Vilsach, 306 German National Bank Bldg., Pittsburg, Pa., Treasurer of the Westmoreland County Ry. Co., was recently over the route of a proposed connecting trolley line between Derry and Blairsville, which would make Latrobe the western terminal of the several street railways traversing eastern Westmoreland and southern Indiana counties. It is said that the Westmoreland County Ry. will issue $100,000 of bonds for the construction of the connecting line.

South Dakota.

According to an announcement reported to have been made by F. I. Cummins, Traffic Manager of the South Dakota Central Ry., the company will soon begin extensive improvements in its terminal facilities in Watertown, S. Dak. The work as planned will include a new passenger depot at the intersection of the S. D. C. track and Kemp Ave., the principal business street, the extension of the tracks to the M. & St. L. yards, where they will connect with the B. C. R. & N., and the M. & S. L. Rys.

The construction crew on the Cheyenne branch of the Chicago, Milwaukee & St. Paul R. R. has reached Parade, S. Dak., 82 miles west of Mobridge, and it is expected that work will be completed to Faith before the cold weather. The route of the branch is from Mobridge, through Moreau Junction, Cheyenne Junction, Ducharne, Promise, Virginia, LaPlant, Ridgeview, Newponset, Parade, Eagle Butte, Lantry, Red Elm and Arrow Head.

Tennessee.

The Chattanooga Railway & Light Co., Chattanooga, Tenn., is planning to have work started at once on its Chickamauga Park line. The total cost will be about $85,000. About 500 tons of 80-lb. rails will be laid on rock ballast.

The City of Dyersburg, Tenn., will vote Oct. 11 on the issuance of $50,000 bonds to be used in purchasing stock in the new railroad which is to be built from Dyersburg to Jackson.

An ordinance is before the City Council of Memphis, Tenn., granting the Clarksville, Collierville & Covington Interurban Co. right of way over certain Memphis streets. No changes have been made in the route proposed some time ago and only slight modifications were made in the original proposition. The work of extending the tracks into the city will be started as soon as the ordinance is passed.

Texas.

Rails and other materials have been received at Greenville, Tex., and will be used in the construction of the electric car line in that city. It is reported that grading work is about to be started.

The Bryan-College Interurban Ry., O. E. Gammel, General Manager, Bryan, has filed with the State Railroad Commission a supplemental application for permission to issue bonds on some three miles of prospective line within the city of Bryan. The commission has already placed a valuation of $69,000 on the completed lines and will allow the registration of $49,000 in bonds, $20,000 of the valuation being consumed in stock. The road intends to extend within the city of Bryan to certain other school properties. Later it will extend down the Brazos Valley to certain cotton gins, where it hopes to do a flourishing freight business.

The Wichita Falls & Wellington Ry. Co., J. A. Kemp, President, Wichita Falls, has applied to the state railroad commission for authority to issue its capital stock in the sum of $15,000, being $1,000 per mile for its 15 miles of completed road, extending from the Texas-Oklahoma State line in Collingsworth to the town of Wellington. Application was also filed for authority to issue its first mortgage bonds in the sum of $285,000, or $19,000 per mile on its 15 miles; also application for approval and authority to register in the office of the secretary of state $225,000 of its bonds, or an average of $15,000 per mile. This line is now practically completed and ready for operation.

Practically all grading work for the Galveston-Houston Interurban line will have been completed by Oct. 1. Harty & Ford, contractors, having the upper 19-mile grade, will complete their work on contract time, Oct. 1, about the same time that J. C. Kelso, grading the lower 16 miles, from Clear Creek within two miles of the causeway, will complete his section. The two miles of grading between the causeway and the first section and the two-mile stretch between the upper end of the work, being done by Hardy & Ford, and the Houston city limits, have not been let, and probably will not be until the completion of the main stretches. Tracklaying was commenced on Sept. 21, and the steel will be pushed as rapidly as weather conditions permit. Orders for equipment have been placed, deliveries to be made this winter. All materials, including 120,000 ties and 5,700 tons of rails, are stored in the material yards near Texas City Junction, ready to be loaded and transported to the several portions of the line. Shell ballast is being delivered at the rate of

500 cu. yds. each day, 120,000 cu. yds. being contracted for the entire right of way. The road is being built for the Stone & Webster Engineering Corporation, of Boston, Mass., the engineering offices for the work being located in the 1st National Bank Bldg., Houston.

The City Council of Beaumont has finally passed the ordinance granting a new franchise for the Beaumont Traction Co., the same to be in lieu of the three existing franchises under which the company is now operating. The franchise as finally passed is said to not meet with the approval of the Traction company representatives and indications are that it will not be accepted by the company.

Construction crews have completed the Collegeport extension of the St. Louis, Brownsville & Mexico Ry. and it is believed the road will be operated between Buckeye and Collegeport, Texas, at once.

Lines are being run from Denison to Sapulpa, Okla., by W. L. Lackie, Assistant Engineer of the St. Louis & San Francisco Ry., who is located temporarily at Denison, Tex., to get the exact cost of construction of a duplicate railroad like the Frisco between the two points. The work is being done to show the Oklahoma Corporation Commission exactly what the lines are worth.

Grading on the line of the Brownwood North & South Texas R. R. has been completed for a distance of 17 miles and it is proposed to extend the line to Rising Star, Eastland County, Texas, a total distance of 30 miles. The line will be laid with 60-lb. rails.

The committee at Belton, Texas, appointed to raise the necessary $90,000 bonus for the construction of the Quanah, Seymour, Dublin & Rockport through that city, has appointed George A. McGregor, Belton, to take up the matter and close it up within 30 days.

The Commercial Club, of Tyler, Tex., of which H. E. Byrne is President, has received a proposition from a railroad construction company offering to construct a road from Tyler to Paris, Lamar County, and to establish machine and repair shops permanently at Tyler for a $300,000 bonus when the road is completed. It is thought that there will be no trouble in raising in the neighborhood of the amount asked, in Smith, Wood, Hopkins and other counties through which it is proposed to construct the road, together with the right of way and terminal facilities.

Tracklaying on the Temple & Northwestern Ry. has been started from Temple, Texas, and it is expected to complete the first ten miles by November 1.

Grading work out of Farwell is now underway for the Farwell, Texico & Southern R. R. J. Hicks, Chief Engineer of the road, is now engaged in the permanent survey for the remainder of the line.

J. S. McSpadden, contractor, of Fort Worth, has begun work on the Comanche extension of the Cotton Belt from Hamilton. Citizens of Comanche made a contract with the Cotton Belt by which they agreed to give the right of way and a bonus to secure the road. The contract was let to Thompson & Scott of St. Louis, Mo., who sublet the grading to Mr. McSpadden. The extension of the Cotton Belt to the Thurber or Palo Pinto coal fields will follow the completion of the Comanche extension.

Thirteen miles of line have been completed on the Brady-Menard extension of the St. Louis & San Francisco Ry. and in order to have all the work completed by December 25 the company has increased the crew and will lay an average of 15 miles of track per week.

Blassengame & Miller, who have the contract for grading the line of the street railway system in Cleburne, Texas, have started work and will rush it to completion.

It is reported to have been officially announced that the Pecos & North Texas, the 70-mile stretch of track between Lubbock and Lamesa, a portion of the Coleman cutoff of the Atchison, Topeka & Santa Fe, will be completed and ready for operation by Oct. 1.

Advices from Austin, Texas, state that Engineer Parker of the State Railroad Commission will not approve the request of the Orange & Northwestern Ry. for a new valuation and any new issue of bonds must be on the valuation made by the former engineer, with the additional allowance for improvements made and deduction for three miles of track which constituted the South Orange spur. The railroad company wanted to issue bonds amounting to $170,000.

Actual construction work on the Cotton Belt Ry. extension from Hamilton, Texas, to Comanche has been started and grading outfits are being rushed to the scene of action. The line will be 32 miles long and it is generally believed that the Cotton Belt intends to build beyond Comanche, the proposed route unknown. The line from Gatesville to Hamilton will soon be completed as the grade is at present nearly ready for steel.

Utah.

The Cache Valley Amusement Co. has filed its articles of incorporation at Logan, Utah. The company has a capital stock of $100,000 and proposes to build an amusement resort at Millville and to construct and operate an electric line through Logan between Millville and Hyde Park. The company is headed by Job White of Salt Lake, but it is said that the backer of the proposition is Howard Garrett, a theatrical man of Salt Lake. The other officers are: John E. Wiscomb, Vice President; W. J. Phillips, Secretary, both of Salt Lake and Leo Nielsen of Logan, Treasurer. These men, with George A. Hansen of Salt Lake, constitute the board of directors. A franchise has already been granted the company and construction on the electric line is to commence soon. The new Edison storage battery cars are to be used on the line, it is said.

The Colorado Fuel & Iron Co., Pueblo, Colo., has been awarded the contract for 12,000 tons of 85-lb. steel rails for the new high line of the San Pedro, Los Angeles & Salt Lake R. R.

The Salt Lake & Ogden Ry., E. A. Vail, Chief Engineer, Salt Lake City, Utah, will be double-tracked in the immediate future, from Farmington to Kaysville, and also for five miles out of Salt Lake and Ogden. The power house will be in readiness early in the year.

Citizens of Driggs, Utah, have given the Oregon Short Line Ry. a bond of $20,000 guaranteeing the right of way through that city and work will be started at once, it is announced.

Virginia.

Construction work has been started on the Cape Charles R. R., which is to be a branch road of the New York, Philadelphia & Norfolk R. R., extending from Cape Charles to Cape Charles Point, 6¼ miles in length. Charles A. Sims, Philadelphia, Pa., has the contract.

The Kanawha, Glen Jean & Eastern R. R., which has been under construction for some time, was completed late this month to a connection with the Virginia Ry. at Pax. The Kanawha, Glen Jean & Eastern R. R. is an independent line owned by the mining interests of the Loup Creek district, which turn out about 1,000,000 tons of high grade fuel annually.

The Washington-Virginia Ry., chartered last June to build a railroad between Vienna, Fairfax County, and Bluemont, Loudrun County, has filed an amendment to its charter, increasing its capital stock from $1,000,000 to $2,000,000.

The Richmond & Henrico Ry., W. S. Forbes, President, has applied to the City Council of Richmond for a franchise for an extension of trackage in the West End of the city. The Virginia Railway & Power Co. has also asked for an extension in that section of the city.

The Norfolk & Portsmouth Belt Line R. R., Geo. S. Shafer, Superintendent, Port Norfolk, Va., has announced that it will establish a terminal at Seawell's Point on property adjoining the Virginian Ry. piers. By an arrangement with the Virginian Ry. the Belt Line now circles the city of Norfolk, and the establishment of a terminal at Seawell's Point will mark the completion of the undertaking that has been agitated since 1907.

Washington.

J. D. Crarey, who is backed by Philadelphia capitalists, is asking the cities of South Bend and Raymond and the County of Pacific to grant him a franchise to build and operate an electric road between the two cities, and if the franchise is granted he agrees to begin work on the road immediately. Mr. Crarey and his associates built the electric line between Hoquiam and Aberdeen, on Grays Harbor.

Engineers of the Mt. Adams Electric Line, according to reports from White Salmon, Wash., have completed surveys as far as Robertsville where a halt will be made until the settlers of the Upper Camas Prairie country decide whether they will support the Mt. Adams road or the contemplated line now surveying from Lyle, 10 miles east of White Salmon, to the Camas district. The route of the Mt. Adams line is from the dock on the Columbia up a 3 per cent grade to White Salmon on the bluff, thence north from the Hunsaker farm to section 16, crosses Wilkins Canyon, thence to Apple Center, north to Mountain brook, on to Robertsville, circles Fulda and Laurel to Trout Lake, and back to White Salmon via Husum. At no point in the route of nearly 100 miles is the grade over 4 per cent. The cost of the road is computed at $20,000 per mile. Secretary Shepler reports $70,000 raised in lands, notes and mortgages, which will be materially increased. Two million dollars is available from outside capitalists as soon as the preliminary work is completed.

City Council of North Yakima, Wash., after much deliberation decided to extend the franchise of the North Coast Ry. The railroad company has agreed to construct at its own expense a subway under its tracks at Chestnut St.

West Virginia.

The Baltimore & Ohio R. R. has purchased land for the extension of the Paw Paw branch. This branch will cross Paw Paw Creek, run through Rivesville, W. Va., and reach the mines of the Parker Run Coal & Coke Co. and of the Virginia & Pittsburg Coal & Coke Co., which is being developed just below the Parker Run property.

The Baltimore & Ohio R. R. is contemplating the purchase of Wheeling Park, and has been running surveys for a switch from Elm Grove to the park. The company is said to be planning to purchase the park with the idea of using it as an excursion point.

Wisconsin.

The Manitowoc & Northern Traction Co., Manitowoc, Wis., may extend its line to Mishicott next spring.

The Twin City & Lake Superior Ry. Co. (Arrow Line), 440 Railway Bldg., Minneapolis, Minn., which projects a line from Minneapolis to Superior, Wis., will have clearing work started shortly, so that grading work can be begun in the spring. The company has already secured about all of the needed right of way for its line in Douglass and Burnett Counties. A considerable portion of the road is already graded.

Plans for track elevation work at Milwaukee have been submitted to engineers of the various railroads interested and to city officials. The city's plans were prepared by L. J. Klug, Assistant City Engineer.

Advices from Oconto state that J. Young & Brother have finished their bridge job for the C. & N. W. Ry. at Niagara and have moved their equipment from there to Ford River to construct a double track bridge for the C. & N. W. This job calls for 2,000 yds. of concrete and stone.

Elections held in the village of Bloomington, Wis., and the [illegible] Patch Grove, Mount Hope and Little Grant of Grant County, Wis., to vote on the proposition of bonding to raise funds for the construction of a new railroad, carried by a large majority. The route of the proposed line is from Woodman to Bloomington, via Mount Hope and Patch Grove, a distance of 22 miles.

The Wisconsin Southern R. R. Co. on Sept. 21 filed articles of incorporation in the office of the secretary of state. The capital stock is $200,000, of which $60,000 has been subscribed. The company will build from a junction of the St. Paul & Northwestern line at the village of Woodman, 23 miles to the village of Bloomington. The incorporators are W. H. H. Cash, New Lisbon; Edward Hammer, Hillsboro; John A. Cash, Hillsboro; C. E. Coon, C. J. Chapman and W. D. Christ of Omaha, Neb.

Canada.

The Canadian Pacific Ry. is reported to have received bids for constructing a branch to Comox in British Columbia.

Work has been progressing for the last two months on grading and ballasting the roadbed of the Temiskaming & Northern Ontario Ry., of the Canadian Government. Trestles have been filled in and many miles of track have been raised. During August 1,501 cars of ballast were taken from the Redwater Pit, 2,674 from the Cassidy Pit and 1,415 cars from the Wataybeag Pit. Along the section between Cobalt and Haileybury, which has been double-tracked, 1,398 carloads of ballast were used.

Advices from Belleville state that Andrew McGuin, contractor for the three miles of the Canadian Northern Ontario Ry. Toronto-Ottawa line through that city, has started on active construction work west of the river. Grading has also been commenced at Trenton and operations will soon be general on the sub-contracts between that town and Belleville.

The contract for the clearing of the right of way and grading of the Cowichan Lake branch of the Esquimalt & Nanaimo R. R. has been let to the contracting firm of Janse, Macdonnell & Timothy, who are building the Alberni branch of the same railway. This branch is to be ready for traffic early next summer.

Officials of the Hudson Bay & Pacific Ry. have been advised from London that all the money necessary for the construction of the proposed line was ready, and that work should be rushed. In addition to building a line from Prince Albert, Sask., to Hudson Bay, it has been decided to build southwesterly to Pacific Junction, Mont., to a connection with the Great Northern R. R. This latter line would lead to the belief that James J. Hill has become interested in the project. George Atwood, Prince Albert, Sask., is Chief Engineer.

Advices from Victoria, B. C., state that the Canadian Northern R. R. has signed the contract for the construction of the first section of its railway on Vancouver Island, giving connections from Victoria to Barkley Sound, in accordance with the terms of the contract with the Government. The first section is about 30 miles long, and runs to Sooke.

Arrangements have been practically completed for the immediate use by the Grand Trunk Pacific of the new line of the National Transcontinental between Winnipeg and Superior Junction. The branch from Port Arthur is completed, and there is now a thorough grain route available from Port Arthur to Edmonton and beyond. The Winnipeg-Superior Junction section had not been taken out of the hands of Contractor James MacArthur, and probably will not be taken over by the National Transcontinental Commission for some months yet.

The Dominion Railroad Commission has ordered the building of a subway under the C. P. R. R. tracks at Broad St., Regina, Sask. The plans are to be filed within 60 days and the question of the apportionment of cost between the railway company and the city will be settled by the commission after the plans have been submitted. The proposed subway, it is stated, will be one of the largest of its kind in the west, providing, as it will, according to the commission's order, for 19 tracks. The superstructure to carry these will be 400 ft. in length. About 950,000 lbs. of steel will be required for the superstructure. While no official estimate of the cost has been made, it is said that the undertaking will involve an outlay in the neighborhood of $250,000. J. E. Schwitzer, Winnipeg, Man., is Assistant Chief Engineer of the Canadian Pacific.

The Canadian Northern R., T. Turnbull, Assistant Chief Engineer, Winnipeg, Man., will during October call for bids for the construction of its line between Chilliwack and Lytton, at the junction of the Fraser and Thompson Rivers, a distance of about 90 miles. This will consist mostly of heavy rock work along the south bank of the Fraser River, including the canyon. Owing to the facilities afforded by the Canadian Pacific Ry., the successful tenderers will be able to get in outfits and supplies at comparatively little expense, and undertake construction simultaneously at many points. Mr. Mann, president of the Northern Construction Co. of Winnipeg, is expected at Vancouver shortly and will go over the route preparatory to submitting a bid. His company recently secured the contract for building the first 60-mile section between Port Mann and Winnipeg. The Canadian Northern, with regard to the second contract, will stipulate that construction work will be proceeded with during the coming winter. It is estimated that a large portion of the line through the Fraser River canyon will cost $100,000 a mile. It is probable that tenders will also be called this fall for the 90-mile section extending north from Kamloops, through the valley of the North Thompson. Early next summer will see under contract the entire section between Yellow Head Pass, at the summit of the Rockies, and tidewater at Vancouver.

The city of Toronto, Ont., has had work started on the construction of the new industrial spur line along the east bank of the Don to Ashbridge's Marsh. E. L. Cousins, Railway Engineer, formerly on the Grand Trunk staff, is in charge. The line will be used by the three railway companies on equal terms and will be operated by the companies alternately, for periods of one year, but the city retains control for all time.

The Board of Control of Toronto, Ont., may ask special legislation to purchase the Toronto Street Railway and will negotiate with the company as to the price. In the meantime the Toronto Street Ry. Co. has notified the city that it was ready to carry out the order of the Ontario Railway and Municipal Board made on May 18 last for the construction or extension of lines as follows, and which routes were selected by the company: Teraulay St., from Queen St. to Agnes St., and across University Ave., through Anderson St. and along St. Patrick St. to Bathhurst St.; Victoria St. from Adelaide to Wilton Ave., Wilton Ave. from Victoria St. and across the new bridge over the Don to a point east of Broadview Ave.; Shuter St. from Yonge St. to Victoria St., Harboard St. from Spadina Ave. to Ossington Ave.

The Canadian Pacific Ry. has entered into an agreement with the St. Maurice Valley Ry. Co., by which the last named company is to construct a line between Three Rivers, Que., and Grand Mere, a distance of 27.7 miles, and on completion lease it to the Canadian Pacific for a period of 999 years.

The Canadian Railroad Commission will, early next month, take up the matter of approving the route of the Canadian Northern R. R. into Hamilton. The application of the T., H. & B. and C. P. R.'s request for permission to lay new tracks in the east end at Hamilton will also likely be dealt with next month.

The Pincher Creek, Cardston & Montana Ry. will apply at the coming session of the Alberta legislature for an extension of the charter which will permit it to construct the main line through Alberta by way of Calgary and Edmonton, into the Peace River country. There will also be a branch into the Kootenay to tap the coal fields which it is understood the company has secured. Construction has already commenced on the first 100 miles north of the international boundary. Surveys of this portion of the line are nearly completed and $3,000 per month has been spent on surveys during the summer. Construction will also be commenced north toward Calgary and Edmonton this fall.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

The Yellow Bank Drainage District, E. M. Allin, Secretary, has disposed of $85,000 of bonds and work on the drainage of several hundred thousand acres of land in Phillips County will be started early next month. The contract for the work has been let to the O. O. McDonald Construction Co., Collinstown, La. Two large dredge boats have already been constructed for the work, which will last about two years. Work is to be started at Elaine and Wabash.

Petitions are to be circulated for the organization of a drainage district which will reclaim 150,000 acres of land in Crittenden County, Ark.

The County Court, at Jonesboro, Ark., is to be petitioned to create another big drainage district to extend 22 miles from Green to Jackson counties. This will improve hundreds of thousands of acres of land.

California.

The following bids were opened Sept. 16 at Yuba City, Cal., for levee work in District No. 2: Hammond Engineering Co., team work, 30 cts. a yd.; dredging and clearing, 12½ cts. Thor Dredging Co., dredge work and clearing, 9 cts.; dredge work without clearing, 7½ cts. American Dredging Co., dredge work only, 6.99 cts. J. H. Faulkner, team work, 27 cts.; team work and overhauling, 34 cts. S. D. Groh, team work, 21 cts.; team work and overhauling, 24 cts.

Edwin Wade, Truckee, Cal., is reported to have been awarded the contract for constructing the Highline canal of the Orland Project of the U. S. Reclamation Service; bids for the work were opened Sept. 1. Bids for the distribution system were opened Sept. 24 by the U. S. Reclamation Service.

Representatives of the Turlock Irrigation District, of Turlock, Cal., are reported to be negotiating for the purchase of a 1,000-acre tract, located east of Hickman, for a reservoir site.

Colorado.

The Lilylands Reservoir & Canal Co., according to advices from Redville, has awarded the contract for constructing one mile of canal to Randall & Walker, Telluride; Hatch & Seymour, Grand Junction, Colo., was also awarded a one-mile contract. The company will have four additional miles of canal constructed.

The Riverside Irrigation District, J. S. Campbell, Secretary, Fort Morgan, Colo., located in the counties of Weld, Logan and Morgan, Colorado, has offered for sale the entire issue of the bonds of the district authorized by a majority vote of the electors of the district at an election held Sept. 17, 1910, amounting to $300,000 and bearing interest at 6 per cent.

Indiana.

Bids will be received until 10 a. m., Oct. 3, by County Surveyor of Daviess County at Washington, Ind., for the construction of a ditch. A. F. Annen is County Surveyor.

The Board of Public Works of Fort Wayne, Ind., is formulating a scheme for rebuilding the dike along the Maumee River, near Walton Ave., Fort Wayne. Preliminary plans propose the anchoring of the concrete wall with additional steel rods, and the placing of rip rap behind it.

Bids will be received until 1 p. m., Oct. 1, by the Drainage Commssioners of White County at Monticello, Ind., for the construction of a drainage ditch. W. M. Fisher is Commissioner.

Kansas.

✣Bids will be received until 2 p. m., Oct. 12, by W. H. Daniels, President of the Kaw Valley Drainage District, Kansas City, Kan., for the construction of about 662,800 cu. yds. levee work, 118,800 sq. yds. revetment paving, 10,600 lin. ft. willow mattress, 2,175 lin. ft. 3-row pile dike, 1,600 lin. ft. (2,600 cu. yds.) concrete culvert, and 5,975 lin. ft. concrete wall (3,920 cu. yds.), and other work along the left bank of Kansas River from Mattoon Creek to mouth and along right bank Turner Bridge to mouth. Official advertisement appeared in our last issue.

Louisiana.

The Orleans Levee Board of New Orleans, La., has awarded a contract to A. Ruppel, New Orleans, at $40,174 for improving the levee from Walnut to Joseph Sts.

The construction of a drainage system covering about 64 square miles of land in Acadia Parish is proposed, and a $75,000 bond issue has been voted for the work, which will be done under the direction of the 6th Ward Police Jury, Acadia Parish, Crowley, La.

The City of New Iberia, La., has awarded a contract to A. G. Thomas, New Orleans, La., for the completion of its waterway and drainage canal. The canal was completed by former contractors up to within 2 miles or about 10,000 ft. of the basin in the city limits, when misunderstandings arose. The canal, when finished, will be about nine miles long and will be 30 ft. top and 30 ft. on the bottom, with 6 ft. of water. The operation of this canal will reclaim many thousands of acres of unreclaimed land.

The State Board of Engineers at New Orleans, La., has awarded the following contracts covering the construction of nearly 400,000 cu. yds. of levee in Iberville, Jefferson, Plaquemine and Concordia parishes: Billings levee, Iberville Parish, 35,000 cu. yds. to W. A. Pecue, 16.23 cts; Ophelia levee, Iberville Parish, 43,000 cu. yds. to J. N. Landry, 13.49 cts.; Deckbar levee, Jefferson Parish, 35,000 cu. yds. to Clark & Linnan, 22.98 cts.; Scarsdale levee, Plaquemine Parish, 26,000 cu. yds. to Lucien Caro, 21.90 cts.; Bertrandville levee, Plaquemine Parish, 13,000 cu. yds. to Michael Cullen, 14.90 cts.; Monsecour levee, Plaquemine Parish, 17,500 cu. yds. to Lucien Caro, 18 cts.; Church levee, Plaquemine Parish, 16,000 cu. yds. to Michael Cullen, 15.24 cts; Netor to Burton, Plaquemine Parish, 6,000 cu. yds. earth and 2,700 ft. wood revetment, to Wilmer C. Henritz, 18.75 cts. per cu. yd. for dirt levee and $1.34 for wood revetment. Contracts for work in the 5th Levee District have also been let as follows: Windmere levee, Concordia Parish, 25,000 cu. yds., R. T. Clark & So., 14.90 cts.; Claremont levee, Concordia Parish, 150,000 yds., Helgason Bros., 13.70 cts.; Cocodrie levee, Concordia Parish, 25,000 yds., H. F. Garbish and E. J. Barrow, 14.23 cts.

Minnesota.

✣Bids will be received until 1 p. m., Oct. 12, by L. P. Larson, County Auditor, Red Lake Falls, Minn., for the construction of ditch. No. 15, including approximately 2,100 ft. of 6-in., 1,900 ft. 8-in., 1,300 ft. of 10-in., 3,500 ft. of 12-in., 1,870 ft. of 14-in. tile.

✣Bids will be received until 1 p. m., Oct. 8, by L. P. Larson, County Auditor, Red Lake Falls, Minn., for the construction of ditch No. 47, including approximately 99,428 yds. of excavation estimated to cost $12,992; and for ditch No. 48 including approximately 321,128 yds. of excavation estimated to cost $41,128.

Peter Schwab, Winona, Minn., has been awarded the contract for extending the levee wall in front of the city water works at Winona. The wall will be built 2 ft. higher than the outer levee wall [illegible] surrounding ground will be graded to correspond with the raise. Work has been started.

Mississippi.

The Board of Mississippi Levee Commissioners, at Greenville, Miss., has authorized the issuance of $50,000 in certificates of indebtedness for the purpose of carrying on the levee work now under way. The Bank of Washington, of Greenville, took the full amount at 6 per cent.

Nebraska.

Advices from Scottsbluff, Neb., state that L. F. Williams has been awarded the contract for the erection of the diversion dam of the Enterprise irrigation district. The dam will be located above Mitchell and will extend almost across the river.

Ohio.

Bids will be received by the Director of Public Service, Zanesville, O., until noon, Oct. 3, for the necessary labor and material for the extension, repair and reinforced levee at the north end of Lee St. in Zanesville, O. M. L. J. Logsdon is Secretary.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

A prominent official of the Memphis Union Station Company of Memphis states that his company has not yet made award of contract for the construction of concrete underpass for the new $3,000,000 depot now under way. Bids were requested on Sept. 8, and some disappointment seems to exist among the engineering department that more bidders did not figure on the work.

Madison avenue, Memphis, which is to be paved with asphalt, will be let on Oct. 4. This street, when complete, will be a continuous driveway of sheet asphalt from the center of the city to the limits. Its construction has long been asked for by the citizens of the town.

About Oct. 15 Capt. Clarke S. Smith, corps of engineers, U. S. A., with headquarters in Memphis, will advertise for bids on three model steel barges, one 150-foot steamboat of steel hull, two steel dredge boats, together with a huge dry dock. The department has allowed Capt. Smith about $250,000 to spend on the work outlined above.

Sam Bush, the hustling Texas contractor, who has his outfit at present in Gatesville, Texas, has signified his wish to come back to the Mississippi River, and Sam is now on his way to Memphis, where he is going to look over some of the levee work recently awarded Roach & Stansell. Sam has made plenty of money in Texas during his stay of two years.

S. S. Morris, general superintendent of the Yazoo & Mississippi Valley R. R., with headquarters at Memphis, has asked for bids of 70,000 cubic yards of embankment work. The bids will be opened on Oct. 10. The work starts below Clarksdale and runs to a point just north of Cleveland. It will be all team work, with a light fill for the most part.

Aderholdt Brothers have sub-let a good bunch of work from Lowrance Bros. & Leonard at Sunflower Landing, Miss. Traction engines and elevating graders are being used to good advantage and the work is progressing very rapidly.

Bob Leonard was in town last week. Just came up from his large job of levee work at Helena. Bob states that all is well along the line of the new loop which he is building, and that the work will be done on contract time.

Harry Rodgers dropped in to see if the city was still here. Harry, too, is making a telling progress on his St. Francis contract.

Now that the large levee contracts recently awarded various firms in this section are now getting well under way, the scarcity of negro labor is being felt by many contractors. With large operations going on near New Orleans, Vicksburg, Little Rock and Memphis, there is little doubt that a labor famine stares the contractors in the face. The hobo has not yet started south, and many look forward to his coming to relieve the situation to a very material degree. However, there are some contractors who will not hire white labor on account of their unreliability and shiftlessness, and it is these latter who will feel most the lack of negro help.

the same happy smile he wore before he left Memphis about a year ago.

Walker Stansell, of Roach & Stansell, was in Memphis last week from his large job of Orient Railroad work, now under way at San Angelo, Texas. Walker has

George Miller, of Greenville, Miss., has taken a contract for the construction of 50,000 cubic yards of St. Francis Levee Board work near Peters Landing, Ark., and has already moved his large outfit on the work.

G. C. Weathers has moved his forces to Wilson, Ark., where he has a contract for the erection of 102,000 cubic yards of new levee, which is to be finished by Dec. 31, 1911. George states that this is ample time for him to finish, and that he is even in position now to take on some new work. George is a hustler all right.

Dresbach Brothers, of Little Rock, Ark., have taken a contract from Roach & Stansell for the construction of 90,000 cubic yards of levee work at Crosno, Mo., and their outfit is now on the way to the work from Fort Worth, Texas, where this firm has built many miles of railroad work. Dresbach Brothers have quite a large-sized outfit, which is in dandy shape.

As soon as McClavey Brothers finish their contract at Rosedale, Miss., they will move their outfit to Tyler, Mo., where they have a contract for some levee work. According to Jim McClavey, his forces should finish about Oct. 15.

Heiskell Weatherford, the hustling city engineer of Memphis, has his hands full these days with the railroads and street car company on the subway proposition. The street car company are trying to get out of paying their pro rata of the expense attending the two larger subways on Rayburn and South Third streets, while Weatherford insists that they must bear an amount of the cost in keeping with the amount of space they occupy on the streets involved. Weatherford has gone on record as saying that the work will be well under way before the first of the year, so evidently he has some means at his disposal of eventually arranging things between the street car company and the railroads.

Tom Garvin, M. A. E., Memphis, will shortly advertise for bids on the construction of a reinforced concrete culvert, 9x12 feet by 2,300 feet in length. The culvert will extend from Union avenue to Poplar street, about 200 feet west of the speedway.

All indications point to the fact that the Lake View Traction Co. will be granted a charter by the city of Memphis for the construction of track on certain streets through the city. Mayor Crump offered to give the traction company certain rights of way about a month ago, but the Mayor's proposition was declined, inasmuch as it was not all the Traction Company asked for by a good deal. Since that time, many public-spirited citizens have been prevailing upon the Mayor and various members of the council, it is rumored, and it has been presented to these gentlemen that the good of Memphis and its rapid development depe[illegible] measure, on an easy reaching of the rural districts. So now the wise ones are saying that Mayor Crump has changed his mind and is disposed [illegible] people all they [illegible] be so, work will be started at once in the city, and many contractors will find work for their outfits. The lines as asked by

Items marked thus ✣ indicate work now open for bids.

the Traction Company will provide two cross-town tracks, together with many other tracks on out of the way streets.

Texas.

Report will be made to the Commissioners of Hidalgo County, at Chapin, next month on a proposed drainage system for District No. 1 of Hidalgo County. The system will reclaim about 350,000 acres and if the plans are approved an election may be held to vote on issuing $1,500,000 of bonds. E. D. Gore is Consulting Engineer.

Washington.

✣Bids will be received until 2 p. m., Oct. 29, by Charles H. Swigart, Supervising Engineer, United States Reclamation Service, North Yakima, Wash., for the excavation of about 73 miles of sub-laterals, Tieton Unite of Yakima project.

Canada.

Steps are being taken this fall by the Dominion Department of Public Works to construct a channel through the dangerous Grand Rapids on Athabasca River near Fort McMurray in order that the rapids may be navigable for the transports that navigate the river from the Landing to McMurray.

Cassel & Greenaway, Bluevale, Ont., at $1,195, have been awarded the contract for constructing the Jermyn drain for Morris Township, the concluding 4,000 ft. tile and 4,000 ft. of open drain. Bids were opened Sept. 19 by A. Maclewen, Clerk, Morris Township, Bluevale, Ont. No bids were received on the other drains.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

Bids were opened Sept. 23 at the U. S. Engineer's office at Mobile, Ala., for dredging work, the contract being let to the Atlantic, Gulf & Pacific Co., Park Row Bldg., New York city, at 8.4 cts. per cu. yd, for dredging in Mobile River and at 5.9 cts. per cu. yd. for dredging in the bay.

California.

✣Bids will be received until 11 a. m., November 5, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for the extension of dike at the U. S. Navy Yard, Mare Island, Cal.

✣Bids will be received until 2 p. m., October 4, by H. H. North, Commissioner of Immigration, San Francisco, Cal., for the construction of twelve or less four-room cottages.

The Loon Lake Water & Power Co. has an engineering party in the field and preliminary work well along for the building of large storage dams and erecting hydro-electric power plants on the Georgetown divide. H. D. Jerrett, Georgetown, Cal., is local manager.

Advices from Georgetown, Cal., state that the Rubicon Water & Power Co. has a large force of men in the field rushing the preliminary work for its large hydro-electric power plant on the American River above Georgetown.

The Crescent Wharf & Warehouse Co., Los Angeles, has been granted permission to build a wharf 400 ft. long at the point where the California Fish Co. now has an old pier at Los Angeles.

The following bids were received Sept. 18 by the U. S. Engineer, Central Bldg., Los Angeles, for dredging in San Diego harbor: Standard American Dredging Co., 18.89 cts. and 14.89 cts. per cu. yd.; American Dredging Co., 36 cts; San Francisco Bridge Co., 23.4 cts.; the North American Dredging Co., 19.7 cts. The Standard American Dredging Co.'s bid of 14.89 cts. per cu. yd. is made with the stipulation that it be not necessary to begin work before April 1, 1911, but as it is exceedingly low and no particular rush about commencing operations, it will probably be accepted. The engineer's estimate was 25 cts. per cu. yd. The sum of $125,216.61 is available and will permit the removal of about 850,000 cubic yards of material.

District of Columbia.

✣Bids will be received until 11 a. m., October 22, by William Smith, Acting Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., for dry dock pumping equipments at navy yards, New York and Puget Sound and Naval station, Pearl Harbor.

✣Bids will be received until 2 p. m., October 3, by Jesse E. Wilson, Assistant Secretary of Department of Interior, Washington, D. C., for the construction of the manual training and arts building Howard University, Washington, D. C.

✣Bids will be received until 10:30 a. m., October 3, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 605, track material for upper lock at Gatun and Pedro Miguel lock, including steel rail, splice bars, steel cross ties, bolts and nuts, tie clips, washers, steel channels and rail bonds; also track drills and hydraulic compressors, etc.

✣Bids will be received until 10:30 a. m., Oct. 17, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under canal circular 607, hose, packing, torpedoes, diaphragm pumps, hose strainers, valves, cocks, grease and oil cups, lubricators, engine gongs, automobile bells, flue ferrules, scales, garbage cans, machinists' clamps, flue cleaners, torches, ladders, squilgees, hoes, closet chain, night latches, rasps, screws, thumb tacks, steel letters, headlight glass, carbide, harness oil, drawing paper, cover paper, manila tags, etc.

✣Bids will be received until 10:30 a. m., Oct. 1, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under circular 596, machinery to operate the stony gate valves for controlling the main culverts and machinery to operate the cylindrical valves for controlling the lateral culverts of the canal locks.

✣Bids will be received until 11 a. m., October 3, by Capt. A. S. Cowan, Signal Corps, U. S. Army, Washington, D. C., for furnishing under proposal No. 479 blue stone terminal boxes, battery renewals, conduit, safety straps, tool belts, sounders, tubes, voltmeters, clamps, insulators, relays, zincs, etc.

Florida.

✣Bids are asked until noon, Oct. 10, by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for dredging and hire of dredging plant in Anclote River, Florida, and dredging in channel from Clearwater Harbor to Tampa Bay, Florida. The dredging required at Anclote River under contract per cubic yard will be at the entrance to the river, in Section A. This section is about 3,500 ft. long. Dredging will be done to a width of 100 ft. and to a least depth of 6 ft. at mean low water. It is estimated that about 40,000 cu. yds. of material will be dredged from this section. Dredging with hired plant will be at such places in the river and at the entrance as the conditions existing at the time the work is undertaken seem advisable in the opinion of the contracting officer. This work will consist in widening and deepening the existing channel. The dredging in the channel from Clearwater Harbor through Boca Ceiga Bay to Tampa Bay is divided into 25 sections, the total yardage being 201,550.

The following bids were received Sept. 17 by Major H. Jervey, U. S. Engineer, Mobile, Ala., for dredging the Apalachicola River to St. Andrews Bay, Fla.: The Southern Dredging Co., Mobile, 12 7/10 cts. per yard; Hillsboro Dredging Co., Tampa, Fla., 23 cts., and Home Dredging Co., Mobile, Ala., 13 73/100, cts., all for the channel. For the bay the bids are the Southern, 12¼ cts.; Home, 12 23/100 cts.; Hillsboro, 18 cts., and the American Dredging Co., Galveston, 40 cts. A channel in the river 65 ft. wide at the bottom is to be dug, with 5 ft. depth at low water. The amount available is $72,000. A channel 100 ft. wide and 9 ft. deep at low water is to be dredged in the bay, while a channel of 80 ft. wide and 17 ft. deep must be built through Camels Back shoals.

Illinois.

✣Bids will be received until 1 a. m., October 4, by Commissioner of Public Works, Chicago, Ill., for furnishing alll material and labor for the installation of an induced draft apparatus, consisting of a fan and engine for same at the 68th St. Pumping Station.

✣Frank D. Chase, Architect, Western Electric Co., Chicago, Ill., will receive bids at once for 2,500 tons of structural steel for the adidtions to the Hawthorne plant of the company.

✣Bids will be received until 2 p. m., October 17, by Lieut. Col. F. E. Hobbs, Rock Island Arsenal, Rock Island, Ill., for the erection of a reinforced concrete brick storehouse at Rock Island, Ill.

✣Bids will be received until 11 a. m., October 19, by Lieut. Col. Thomas Cruse, Chief Quartermaster, Federal Bldg., Chicago, Ill., for furnishing and delivering f. o. b. at place of manufacture, 3,000 metal wall lockers of the following named sizes: 444 single, 750 double, 252 triple and 75 quadruple.

Indiana.

✣Bids will be received until 10 a. m., November 10, by the County Commissioners at Lebanon, Ind., for the furniture and fixtures of the new court house. B. F. Herdich is Auditor of Boone County.

✣Bids will be received until 1 p. m., Oct. 6, by the trustee of Eagle Township, Boone County, at Zionsville, Ind., for the construction of an 8-room school house and repairs in old. Specifications and plans are on file at the office of Layton Allen, Lombard Bldg., Indianapolis, Ind., or H. H. Avery, Trustee.

✣Bids will be received until noon, Oct. 6, by Trustee Eagle Township, Boone County, at the office of Layton Allen, Room 44, Lombard Bldg., Indianapolis, Ind., for the construction of an eight-room school house at Zionsville and repairing old building at same place. H. H. Avery is Trustee.

Iowa.

The Park Dam Co., of Eldora, Ia., is planning to have work started shortly on a $10,000 concrete dam for power development purposes. A. H. Latimer, Mason City, Ia., one of the directors of the company, recently completed a similar plant at Clermont. The Park Dam Co. will furnish electric power for Eldora.

Louisiana.

Bids were opened Sept. 19 by the City of New Orleans, La., for the construction of a concrete sea wall at Lakeside Park, West End. The wall is to be 2,700 ft. long and 14 ft. high. J. D. McGee, Greenville, S. C., at the following bid, was low bidder for the work under the city engineer's specifications: Piles in place, $7.40; sheet piling, per 1,000, $21.60; tie rods, per rod, $1.40; excavating, per cubic yard, 40 cts.; reinforcing rods, per pound, .0225 cts.; concrete on place, per cubic foot, 29.4 cts. Alternate bids per lin. ft. on the bidder's plans were as follows: Henry Monk, $26.80 per lin. ft.; Henry L. Zander,

Items marked thus ✣ indicate work now open for bids.

$29.15; James Denton, $39.24; James Stewart, $39.24; Hanna & Bixler, $35.52; Gulf Concrete Construction Co., $43; Bancroft & Ross, $34; Raymond Concrete Pile Co., $31.50; Noullet & Son, $54.70; W. N. Wren, $32. The low bidder for placing about 400,000 cu. yds. of filling behind the wall was the Home Dredging Co., Mobile, Ala., at 11.37 cts. per cu. yd.

Bids were opened Sept. 21 by the Board of Port Commissioners of New Orleans, La., for the removal of the shed on the Henderson St. wharf to the Valence St. wharf, O. Oleson. at $11,808, and H. F. Grim, $10,755, being the only bidders.

Maine.

✣Bids will be received until 11 a. m., October 5, by Capt. J. F. Gohn, Constructing Quartermaster, Portland, Me., for the construction of an ice house at Fort McKinley, Me.

The following bids were received Sept. 19 by Lt. Col. Geo. A. Zinn, U. S. Engineer, Portland, Me., for (1) placing 11,000 tons of stone in South Jetty in Saco River, Maine, (2) for placing 5,000 tons in breakwater, and (3) for placing 600 tons in Cow Island Jetty. P. H. Doyen Co., Portland. Me., (1) $1.08, (2) $1.18, (3) $1.08; Rowe Brothers Co., Richmond, Me., (1) $0.97, (2) $1.47, (3) $0.97.

Maryland.

Bids were opened Sept. 20 at the office of the U. S. Engineer at Baltimore, Md., for dredging approximately 400,000 cu. yds. in Southwest Baltimore Harbor, at Curtis Bay Channel, Md., the Sanford & Brooks Co., 24 Commerce St., Baltimore, Md., at 9¾ cts. per cu. yd. being the probable successful bidder.

Massachusetts.

✣Bids will be received until 11 a. m., October 8, by William M. Smith, Acting Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for automatic sprinklers for buildings Nos. 58, 60 and 62 navy yard, Boston, Mass.

✣Bids will be received until 11 a. m., October 15, by William M. Smith, Acting Chief of Bureau, Yards & Docks, Navy Department, Washington, D. C., for dredging at the United States Navy Yard, Boston, Mass.

C. M. Leach, P. O. Box 2285, Boston, Mass., has been awarded the contract by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the extension to building No. 32, Navy Yard, Boston, Mass., for $3,573. Bids were opened Aug. 27.

Michigan.

✣Bids will be received until noon, October 19, by Lieut. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for furnishing and placing rock in foundation embankment for breakwater extension at Marquette, Mich.

✣Bids will be received until 7:30 October 3, by Dean Thompson, City Clerk, Ludington, Mich., for the construction of the proposed city dock according to plans and specifications on file at the office of the city engineer.

✣Bids will be received until 3 p. m., Nov. 14, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete including plumbing, heating apparatus, gas piping and electric conduits and wiring of the United States Post Office at Pontiac, Mich.

✣Bids will be received until 3 p. m., Oct. 24, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, and electric conduits and wiring, of the United States Post Office at Willmar, Minn.

✣Bids will be received until noon, Oct. 19, for the construction complete including all branches of the work of an armory building at Norwalk, O. Schofield, Architects, Schofield Bldg., Cleveland, O. B. L. Bargar is Secy.

The Morrow Gas Fixture Co., Cleveland, O., has been awarded the contract for furnishing new fixtures for the new court house at Peru, Ind., for $5,985.

The Missouri, Kansas & Texas Ry. has awarded the contract for the construction of a new steel and reinforced concrete depot at Muskogee, Okla., to the Monarch Construction Co., St. Louis, Ill., at $135,000.

MacArthur Bros. Co., Chicago, Ill., who have the contract for government lock work at Sault Ste. Marie, have awarded a subcontract to Edwards Brothers for dredging the upper approach for the third lock.

Minnesota.

The following bids [illegible] were received Sept. 23 by Lt. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for furnishing and placing granite riprap at upper entrance to Portage Lake Canals, Michigan: Thomas L. Durocher, Sault Ste. Marie, Mich., $2.49; Henry F. Key, Hancock, Mich., $1.92; Powell & Mitchell, Marquette, Mich., $1.89 (recommended for acceptance); John F. Fredin, Duluth, Minn., $2.13; Northern Dredge & Dock Co., Duluth, Minn., $2.01; Great Lakes Dredge & Dock Co., Chicago, Ill., $2.55.

The Conference Committee of the City Council of Duluth, Minn., has recommended to the Council that $15,000 be set aside from the permanent improvement fund as a nucleus for a local system of municipal docks. M. B. Culum is Mayor of Duluth, Minn.

The Great Northern Power Co., W. N. Ryerson, General Manager, 15th Ave., West Duluth, Minn., has begun proceedings for the condemnation of 71 parcels of lands about Beaver Creek for the purpose of constructing a dam and storage reservoir. It will be the beginning of a series of such dams and reservoirs for the purpose of equalizing the flow of water throughout the year which supplies the company with power. The dam will be 500 ft. long and 25 ft. high, and will cost in the neighborhood of $100,000. It will be constructed of earth, with a concrete spillway. It is hoped to have the reservoir ready for filling late next summer or early next fall.

Missouri.

✣Bids will be received until 10 a. m., October 1, by Board of Managers of Missouri State Sanatorium at Mount Vernon, Mo., for the erection of a combined brick and concrete infirmary building. W. L. Gupton is Secy.

George A. Kessler, City Landscape Gardener, Kansas City, Mo., has prepared plans for a dam to be built for the Park Board of Kansas City across the Blue River near 12th St. The dam will be constructed for raising the level of the water for boating purposes in the park.

New York.

✣Bids will be received until 1 a. m., October 15, by William Smith, Acting Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for dredging at the United States Navy Yard, N. Y.

✣Bids will be received until 2 p. m., October 12, by Light House Inspector, Tompkinsville, N. Y., for furnishing delivering moorings for vessels and buoys of the light house establishment during the fiscal year ending June 30, 1911.

T. M. Smith Elevator Co., 138 Lafayette St., New York, N. Y., has been awarded a contract by the State Armory Commissioner, Albany, N. Y., for the installation and furnishing of a 3 H. P. direct connected hoisting apparatus to operate present freight elevator and a two horse power motor to operate lath and buffing wheel at the New York State Arsenal, 7th Ave., and 35th St., New York City, for $1,190. Bids were opened Sept. 8.

E. De V. Tompkins, N. E. 125th St., New York city, at $9,145, was low bidder Sept. 20 for extending the pier at the foot of Gold St., East River, Brooklyn, and for depositing about 600 cu. yds. of riprap.

North Carolina.

✣Bids will be received until noon, October 14, by Earl I. Brown, Capt. U. S. Engineer, Wilmington, N. C., for dredging in Cape Fear River, N. C.

✣Bids wil be received until 10 a. m., Octo- 10, by Earl I. Brown, Capt. U. S. Engineer, [illegible] bag Bay, South River, Bay River and water- [illegible] Bay, N. C.

Oregon.

[illegible] which C. L. Houston, of Astoria, Ore., has the contract.

Pennsylvania.

✣Bids will be received until 10 a. m., October 10, by the commanding officer, Frankford Arsenal, Philadelphia, Pa., for alteration and extension of the boiler plant.

✣Bids will be received until September 29 by Capt. F. E. Phelps, U. S. Army, retired, acting quartermaster, Pittsburg Storage and Supply Depot, Pittsburg, Pa., for furnishing 7 domes for miner street light, 12 burners, inverted, 50 mantles, inverted, and 20 mantles, Welsbach.

The Raymond Concrete Pile Co., of New York and Chicago, has been awarded the contract for placing Raymond concrete piles in the foundations of the new public school to be built at Homestead, Pa.; W. G. Eckels, New Castle, Pa., archtect. G. M. Hall Company, general contractors.

Tennessee.

The contract for the excavation for a fish pond to be located in the Lookout Valley, between Hill City and Waldons Ridge, has been awarded to Frank Patton, contractor, South Pittsburg, Tenn. The pond when completed will cover 30 acres. The work is being done by the yard and was commenced Sept. 26.

Texas.

✣Bids will be received until 10 a. m., Oct. 10, by Willett Wilson, County Judge, Port Lavaca, Texas, for the necessary labor and material for the erection and completion of the county court house to be located in Port Lavaca. Plans and specifications are on file at the office of the architects, Chamberlain & Co., Birmingham, Ala.

National Electric Supply Co., Washington, D. C., has been awarded a contract at Fort Sam Houston, Tex., for furnishing four electric desk fans for $56. Bids were opened Sept. 10.

Edward H. Schulz, U. S. Engineer, Kansas City, Mo., has recommended the acceptance of the bid of the Dubuque Boat & Boiler Works of Dubuque, Ia., $104,205, for constructing and delivering three steel hull stern wheel towboats at Gasconade, Mo., for use on the Missouri River. Bids were opened Sept. 19.

Bids were opened Sept. 14 by the Board of City Commissioners of Dallas, Tex., for removing the timber and clearing about 600 acres of land on the White Rock reservoir site. D. J. Grigsby offered to do the work in 100 working days for $30 per acre and the wood. Taylor & Akers' bid was $25 per acre and the wood, the work to be done in 240 working days.

Bids were opened Sept. 19 by Maj. George P. Howell, U. S. Engineer, Galveston, Tex., for the improvement of the Texas City channel, the following bids being received: For deepening and widening the present channel from station O to 22—L. T. Gaylord of Houston, 12½ cts. a yard; Bowers Southern Dredging Co. of Galveston, 10½ cts. a yd.; North American Dredging Co. of Galveston, 9.99 cts. per cu. yd. For extending upper end of channel 689 ft., about 85,500 cubic yards—L. T. Gaylord, 7.7 cts.; Bowers Dredging Co., 12 cts.; North American Dredging Co., 9.99 cts. per cu. yd. For maintaining channel from station 22 to end of channel—L. T. Gaylord, 50 cts. per cu. yd.; Bowers Dredging Co., $1.20 per lin. ft., and North American Co, 9.99 cts. per cu. yd. There is available about $100,000 for this work, which includes improvement and maintenance of the existing channel. This channel extends from Bolivar roads, a distance of about seven miles, to

Texas City.—A channel approximately 34,000 ft. long and 25 ft. deep and 100 ft. wide on the bottom was obtained by redredging in April, 1910. An examination made in June shows that from the outer end of the channel, a distance of about 12,000 ft., the least depth is 24½ ft. and for a distance of about 22,000 ft. the least depth is about 18½ ft. This refill in general consists of soft silt, mud and some sand. It is proposed in general to maintain a 25-ft. channel and to obtain, as far as funds available will permit, a new channel 27 ft. deep and 200 ft. wide at the bottom. The existing channel from the upper end at Texas City, a distance of approximately 5,000 ft., will be widened from 100 to 200 ft. on the bottom and deepened from 19 to 27 ft. The existing channel south of this section for a distance of approximately 17,000 ft. will be widened from 110 to 120 ft. on the bottom and deepened from an average depth of 22 to 27 ft. The total estimated quantity of material to be removed to complete the work to be done is 1,347,500 cu. yds. place measurement, of which 400,000 cu. yds. will be redredging.

Virginia.

✣Bids will be received until 10 a. m., October 11, by Capt. E. R. Tilton, Quartermaster, Fort Monroe, Va., for repairs to field officers' quarters No. 3 at Fort Monroe, Va., including repair work for construction, plumbing, heating, electrical wiring and fixtures.

W. H. French, Norfolk, Va., has been awarded the contract for dredging the Appomattox River from Petersburg down to deep water for the U. S. Government. The work is to be begun about Oct. 1, and a channel of 12 ft. in depth is to be given.

Bids were opened Sept. 19 by Lt. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for dredging Thimble Shoal, the amount available for the work being $215,000. The bids per cu. yd., scow measurement, were as follows: Maryland Dredging & Contracting Co., Baltimore, Md., 13 3/10 cts.; Daly & Hannan Dredging Co., Ogdensburg, N. Y., 20 4/10 cts.; Coastwise Dredging Co., Norfolk, Va., 14 7/10 cts.; Morris & Cummings Dredging Co., New York, N. Y., 17 9/10 cts.

Bids were opened Sept. 21 by Lt. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for dredging in harbor at Norfolk, the Maryland Dredging & Contracting Co., 803 Fidelity Bldg., Baltimore, Md., at 9.95 cts. per cu. yd., scow measurement, being the lowest bidder. The amount available is $175,500.

The following bids per cu. yd., place measurement, were received Sept. 22 by Lt. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for dredging south branch of Elizabeth River, Va., $90,000 being available for the work: Maryland Dredging & Contracting Co., Baltimore, Md., 15 5/10 cts.; Sanford & Brooks Co., Baltimore, Md., 11 9/10 cts.; Atlantic Gulf & Pacific Co., New York, N. Y., 11 47/100 cts.; Coastwise Dredging Co., Norfolk, Va., 15 8/10 cts.

Washington.

✣Bids will be received until noon, October 6, by Capt. A. Williams, U. S. Engineer, 602 Burke Bldg., Seattle, Wash. for the construction of dikes at Skagit River, Wash.

✣Bids will be received until 11 a. m., October 12, by Lieut.-Col. G. S. Bingham, Chief Quartermaster Vancouver Barracks, Vancouver, Wash., for the construction of an addition to ordnance storehouse, Fort Stevens, Ore.

The Puget Sound, Chelan & Spokane Ry. Co., a $25,000,000 corporation, with headquarters in London, New York and Tacoma, Wash., is undertaking the development of about 30 hydro-electric properties in the state of Washington, aggregating more than 300,000 HP., and the construction of 1,200 miles of railway to be operated by electric power derived from the proposed hydro-electric installations. This company has just closed a contract with the W. K. Palmer Co., Engineers, 717-720 Dwight Bldg., Kansas City, Mo., to serve as consulting engineers for the company and to take charge of all of their engineering work and supervise construction. Correspondence relative to engineering matters may be directed to the engineers at Kansas City.

West Virginia.

The contract for erecting dam No. 9, at New Cumberland, for the U. S. Government has been let to the National Construction Co. of Evansville, Ind., at its bid of $912,456. This applies for the construction work only. The contract for dam No. 7 was awarded to the J. P. Gillespie Co. of Pittsburg, on its bid of $750,645. Work on these two dams is to be started Oct. 1.

Wisconsin.

✣Bids will be received by T. G. Jeffers, City Clerk, Medford, Wis., until 7:30 p. m., Sept. 30, for 1 50-H. P. gas engine and 1 50-H. P. gas producer with all fittings and fixtures complete; also 1 500-gal. belt driven triplex power pump with necessary equipment. A check for 5 per cent of the gross amount of bid must be filed with each bid. Specifications are on file at the office of the City Clerk, Medford, and W. G. Kirchoffer, 31 Vroman Bldg., Madison, Wis., the Engineer.

The Northwestern Iron Co., of Mayville, Wis., is reported to be behind a movement for the reconstruction of the Theresa dam, which was razed about 15 years ago and has never been rebuilt. It is said that the cost of the work will be several hundred thousand dollars. The company is greatly in need of a dam to insure a steady supply of water for power purposes. It is estimated that at least 6,000 acres of land will be covered by the reservoir thus formed.

Canada.

✣Bids will be received until 11 a. m., September 30, by Chairman of the Board of Control, Winnipeg, Man., for furnishing the following supplies: 5,000 ft. of 2½-in. cotton rubber liner fire hose; 500 ft. of 3½-in. cotton rubber lined fire hose; 30 non-interfering fire alarm boxes complete; 2 15-in. electro-mechanical gongs; 2 hose sleighs complete; 2 chemical sleighs complete; reserving water tower on running gear; rubber tires and channels for water tower; 163 rubber coats; 163 pairs rubber boots; 326 pairs woolen mits; supplying and fitting cast iron cresting and finials on Fire Stations 4, 5, 6 and 7; supply of 300 tons of loose Red Top hay, to be delivered as required at the various fire stations.

The Dominion Dry Dock Co., organized recently at Montreal, with a capital stock of $5,000,000, has filed plans with the Government for its dry dock at Levis, Que., and has applied for a subsidy. According to a statement of Sir Robert Perks, one of the principal stockholders, the company will be ready to proceed with the works at Levis as soon as the subsidy is guaranteed. The plans for St. John are not yet complete, either as regards location or associate interests.

The Canadian Dredging Co., Ltd., of Midland, Ont., has been incorporated with a capital stock of $750,000.

The contract for the pulp mill of the Union Bag & Paper Co., at Cap de la Magdaleine, Three Rivers, Quebec, Canada, has been awarded to Frank B. Gilbreth, Inc., 60 Broadway, New York. George F. Hardy, 309 Broadway, New York, is the Engineer.

BRIDGES—STEEL AND CONCRETE

California.

Board of Supervisors,, Humboldt County, Eureka, Cal., have awarded the contract for the construction of a large reinforced concrete bridge over Eel River to the Pacific Construction Co., San Francisco, Cal., at $245,967. The structure which is to be 2,900 ft. will consist of seven concrete spans and will be 23 ft. wide. It will accommodate electric railway tracks as well as vehicles. By terms of contract the structure will be open for traffic January 1, 1912.

In connection with the construction of the State highway from Red Bluff to Eureka across Tehama, Trinity and Humboldt Counties, a new bridge will be constructed over the Trinity River. The structure will consist of a single 120 ft. span.

County Surveyor, Redding, Cal., has been instructed to prepare plans and specifications for the construction of a bridge across Squaw creek on the road from Kennett to Coam, and also for a structure across Salt Creek on the Redding and Shasta Wagon road near Middle Creek station.

Hyde, Hayes & Co., San Francisco, Cal., have been awarded the contract by the board of supervisors at Oakland, Cal., for the construction of a bridge across Alameda Creek at Brightside, Niles Canyon, for $8,873. Bids were opened Sept. 12.

Colorado.

Board of Public Works, Denver, Colo., have decided to adopt resolution asking the district court to appoint appraisers for the easement of the property from First Ave., west to Boulevard F. for the West Colfax viaduct.

Citizens of Clifton, White, Water, Orchard, Mesa and Palisade have petitioned the county commissioners at Colorado Junction, Colo., for an appropriation of $15,000 for the construction of a bridge connecting Orchard Mesa with Clifton.

At a recent meeting of the Commissioners of El Paso County and the State Highway Commission at Palmer Lake, Colo., it was assured that the commission would make an appropriation for the construction of a new bridge at the head of the Monument reservoir on the road to Denver. A cement bridge is strongly favored.

Delaware.

The Queen Anne Railroad Co. has contracted with the city of Lewes, Del., to construct a 50 ft. bridge across the Lewes River.

District of Columbia.

[illegible] the [illegible] improvement urged for adoption by the Engineering Department of the District of Columbia, is the construction of a bridge of masonry across Rock Creek at Q St., estimated to cost $250,000.

Illinois.

✣Bids will be received until 2 p. m., September 30, by Mark O. Rumery, Town Clerk, Oregon, Ill., for paving the Oregon Rock River Bridge with creosoted paving blocks. Official advertisement found elsewhere in this issue.

✣Bids will be received until 2 p. m., October 6, by the County Commissioners at Martinsville, Ind., for the construction of two concrete arches. B. E. Thornburgh is Auditor of Morgan County.

✣Bids will be received until 2 p. m., October 4, by the Pike County Commissioners at Petersburg, Ind., for the construction of four steel bridges. F. R. Hildeback is Auditor.

✣Bids will be received until 10 a. m., October 4, by Commissioners of Boone County at Lebanon, Ind., for the construction of two bridges. B. F. Herdrich is Auditor.

✣Bids will be received until 1 p. m., October 3, by the County Commissioners at Washington, Ind., for the construction of several bridges at Daviess [illegible] which Thomas N. Nugent is [illegible]

✣Bids will be received [illegible], October 4, by the commission[illegible] County at Rushville, Ind., for the construction of three bridges. J. M. Stone is County Auditor.

✣Bids will be received until 10 a. m., October 3, by the Commissioners of Hancock County at Greenfield, Ind., for a variety of bridge repairs and construction work. C. H. Troy is Auditor.

✣Bids will be received until 10 a. m., September 28, by the County Commissioners at Indianapolis, Ind., for the construction of the following bridges: culvert on east line, north east quarter of section 13, township 17, range 3 in Washington township; bridge over Indian creek on west line of section 28, township 17, range 5 in Lawrence township, Marion County. Albert Sahm is Auditor.

The Joliet Bridge Co., Joliet, Ill., has been awarded the contract for the construction of a concrete double arch bridge over Jackson Creek. The structure, which will be 124 ft. in length, will cost $5,200.

The Highway Commissioners of Dixon and Grand Detour Township according to advices from Dixon, Ill., recently are considering the construction of a bridge on the Seven Mile branch near Prindiville farm.

City Council has referred to the Committee an order for a viaduct over the Chicago, Peoria & St. Louis Ry., at Jefferson St., Springfield, Ill. The cost of work will fall upon the railroad. The grading and drainage work will be paid for by the appropriation of $1,500 by the city council and by private subscription.

The Joliet Bridge & Iron Co., Joliet, Ill., has been awarded the contract for the construction of a concrete bridge west of New Lenox on the Joliet township line.

The contract for the construction of a steel bridge across Dirdeen creek between Haskell and Webber Falls, Okla., has been awarded to the Vincennes Bridge Co., Vincennes, Ind., at $2,687.

The contract has been signed up by W. H. Sieverling and has been sent to the railway officials at Indianapolis, Ind., for approval, for the construction of the new bridge at East High St., over the Big Four Tracks in Springfield, O. Two-thirds of the cost of the structure will be paid by the Big Four and one-third by the city.

Board of Park Commissioners, Indianapolis, Ind., have requested that the Council of the County appropriate $85,000 for the construction of a bridge over Fall Creek on Capitol Ave.

Kansas.

The County Commissioners at Girard, Kan., have awarded the contract for furnishing the steel material for nine county bridges to the Massillon Bridge & Structural Co. Eight other bids were filed.

Kentucky.

A project is under consideration by the Business Men's Club of Newport, Ky., involving the construction of a bridge across the Licking River near Visalia.

Maine.

The following bids were opened at Augusta, Me., September 13, for the construction of the new bridge over the St. John River between Van Buren in Aroostock County and St. Leonards, N. B., including superstructure, foundations and abutments: Substructure, Eli Roy, Lewiston, $22,254; Powers Brewer, Grand Falls, N. B., $23,895; E. J. O'Kelley, Toronto, $25,145; and J. L. Perkins & Son, Fairfield, $30,589. On the superstructure the Canton Bridge Company, Canton, $51,082; Boston Bridge Company, $47,452; Pennsylvania Steel Company, $54,000; American Bridge Company, New York, $50,000; Penn Bridge Company, Beaver Falls, Penn., $40,991. The amount appropriated was $37,000; New Brunswick to spend an equal sum.

The Van Buren St. Leonard's International Bridge Commission at the office of State Commissioner of Highways, Augusta, Me., awarded the contract for the construction of a highway bridge over the St. Johns River, between Van Buren, Me., and St. Leonards, N. B., as follows: Powers & Brower, Grand Falls, N. B., for constructing the substructure, $23,896; Penn Bridge Co., Beaver Falls, Pa., for constructing the superstructure, $40,991. Bids were opened September 9. E. E. Greenwood, Skowhegan, Me., is Engineer.

City Council of Owosso, Mich., has approved the plans for the construction of the Lansing & Northeastern Ry. over Gute St.

Minnesota.

✣Bids will be received until 8 p. m., September 29, by the City Council of Red Lake Falls, Minn., for repairing Clearwater bridge.

The Security Bridge Co., Minneapolis, Minn., has been awarded the contract at $5,950 for the construction of two bridges. One of the bridges will span the Potlatch River at Juliaetta and will be constructed jointly by Nez Perce and Latah Counties. The other will span Lawyer's Canyon creek and will be built by Nez Perce and Idaho Counties, Idaho.

Mississippi.

✣Bids will be received until October 3, by the Board of Supervisors of Tallahatchie County, Miss., at Sumner, Miss., for repairing wooden bridge across Long Creek on Grenada and Cascilla public road in southern part of said countiy; also to repair wooden bridge across Dry Creek, near Shady Grove in Beat Three. John T. Neely, Clerk, has plans and specifications on file.

Missouri.

✣Bids will be received until 11 a. m., October 15, by Board of Public Works, St. Joseph, Mo., for the construction of a viaduct or subway on South Sixth St., to cross railroad track north and south of the Union Passenger station. George F. Barnes is Clerk of the Board.

The County Court, Carthage, Mo., has awarded the following contracts for the construction of bridges: Illinois Steel Bridge Co., Jacksonville, Ill., at $4,350 for bridge at Margraveford across Little North Fork in Jasper township. The structure will be 128 ft. long with 14 ft. roadway. The Vincennes Bridge Co., Vincennes, Ind., at $11,648 for the construction of the Hall Ford bridge over the Spring River. The Massillon Bridge Co., Massillon, O., at $6,312, for the Scotland bridge across Grove Creek, 160 ft. long, 20 ft. roadway, and at $3,180 for the Castle Rock bridge across Rock Creek, 80 ft. span, 18 roadway.

Montana.

The bridge over the river at Stevensville, according to information received from Hamilton, Mont., was condemned by the board, it being voted to advertise for bids for the construction of a new steel bridge over the river. This action came as the result of a petition from a large share of the citizens of Stevensville and vicinity asking that the bridge be replaced by a new one.

Clerk of Granite County, Mont., at Philipsburg, awarded the contract Sept. 13, to O. E. Peppard at $4,148 for the construction of the combination wagon bridge across the Hell Gate River at Nimrod, Mont. The structure will be of Oregon fir with 16 ft. roadway floored with 4 in. native fir.

New York.

The Town Board of White Creek, N. Y. has awarded the contract for constructing a 60-ft. reinforced concrete arch bridge over Owl Kill near Eagle Bridge, N. Y., to James Austin Mortland, White Creek, N. Y.

Citizens of Clyde, N. Y., have requested the town and village boards to investigate the probable expense of building bridge over the barge canal.

The Oswego Bridge Co., Oswego, N. Y., has been awarded the contract for the construction of a new bridge over Cooper Run, Lower Alloways Creek township.

North Dakota.

✣Bids will be received until 10 a. m., October 6, by Board of County Commissioners, Williston, N. D., for the construction of a 30-[illegible], line between Sec. 19, Twp. 154, Range 95, and [illegible] is County Auditor.

The County Commissioners, Jamestown, N. Dak., have awarded the contract for the con[illegible] the county to Hewitt Bridge Co., at $1,150.

Ohio.

✣Bids will be received until noon, October 1, by the Director of Public Service, Springfield, O., for the necessary labor and material for the construction of a concrete steel bridge on High St., over Indian Run. W. H. Mahoney is Clerk.

✣Bids will be received until noon, October 14, by the Board of County Commissioners, Cincinnati, O., for the construction under specifications No. 112 of a concrete bridge on Cleves and Warsaw pike at Hausfield farm in Delhi township. Fred Dreihs is Clerk.

County Commissioners at Hamilton, O., have had the site for the proposed new structure over Elk Creek laid out. Plans have also been ordered for the construction of a concrete bridge on the Venice Road about a mile below the Columbia bridge, estimated to cost $1,000.

The Cleveland, O., City Council still has under consideration the construction of the proposed high level viaduct of the Detroit-Superior route.

An estimate of $1,700 has been submitted to the City Council of Springfield, O., by Engineer M. J. Bahin, for the erection of a concrete bridge over Indian Run at High St. W. to replace the present wooden structure.

The Toledo & Ohio Central R. R. has placed an order with the Toledo & Massillon Bridge Co., for twenty-eight steel bridges. The cost of the structures amounted to $150,000 and they are to be in place by December 1.

Commissioners of Franklin County, Columbus, O., have decided that the old covered bridge across the Scioto River, north of Marble Cliff, be replaced with a $40,000 steel structure.

H. P. Knisely of Columbiana, O., has been awarded a contract by the Board of County Commissioners at Lisbon, O., for the construction of a reinforced concrete skew arch to replace bridge No. 40, near pumping station, at East Palestine, O., for $4,635. Bids were opened Sept. 19.

John Walsh, Center St., Carthage, O., has been awarded the contract by the board of County Commissioners, Cincinnati, O., for the construction under specifications No. 86, of a bridge and approaches thereto on the Brierly Creek road in Green township for $4,322. Bids were opened Sept. 2.

Oklahoma.

✣Bids will be received until 6 p. m., October 11, by the County Commissioners of Tulsa County, at Tulsa, Okla., for the construction of a bridge across the Arkansas River. W. L. North is Chairman of the Board.

City Council of Guthrie, Okla., is to take up the matter at its next meeting concerning the construction of the proposed Cleveland Ave. viaduct. The Guthrie St. Railway Co. and the Santa Fe Ry. are also interested in the matter.

At a recent meeting of the County Commissioners at Stillwater, Okla., the contract for the construction of a bridge across the Cimarron River, just north of Cushing, to the Weatherford Machine & Foundry Co., at $17,950. Work is to begin within 30 days and must be completed by July 7, 1911.

Oregon.

An appropriation is [illegible] ty Judge J. G. Sain, of the Court of Howard County for the construction of two more steel bridges. One of the proposed bridges is to be built one mile south of Dierks on the Nashville and Dierks road at the intersection of the Big and Little Holly creeks and the other on the Brownstown and Columbus roads at Mine Creek.

The Brooklyn Improvement Club, Portland, Ore., has indorsed the action of the South Portland Boosters' Club in regard to the lo-

Items marked thus ✣ indicate work now open for bids.

cation of a bridge over the Willamette River. The east approach has been suggested to be at Ellsworth St.

Pennsylvania.

✣Bids will be received until 10 a. m., October 3, by the Board of County Commissioners, of Lehigh County at Allentown, Pa., for the necessary labor and material for the construction of the super and substructure of a two-span, concrete encased steel girder bridge over the Otelaunee Creek near Jacksonville, Pa. J. S. Troxell is Clerk.

A contract has been awarded Carl R. Camp, Montrose, Pa., at $20,000, for the erection of a new bridge in Bucks County at New Hope.

The Supervisors of Fallowfield township, according to advices from Charleroi, Pa., have awarded the contract for the construction of a concrete beam bridge across Maple Creek to the Donora Construction Co.

The County Commissioners' Engineer Sanders and County Controller, Reading, Pa., recently met to discuss the necessity for the construction of a new bridge at Penn St. The present structure has been condemned.

Plans have been approved by the Reading Railway Co., for the construction of the proposed bridge over the tracks at Tulpehocken St., Reading, Pa.

Commissioners of Lehigh County, Pa., at Allentown, have awarded the contract for the construction of the bridge at Wanamaker's to Horn & Neff, for $5,995; alterations to the Gordon St. bridge to S. N. Weaver, $1,750, and a new bridge at Ironton to Schaeffer, Ackerman and Co., $1,350. The bids for the repairs to the Linden St. bridge were rejected the amounts going beyond the estimate. The bids are as follows: Wanamaker's, Horn & Neff, $5,995; G. H. Hardner, $9,529; Penn Bridge Co., $7,369; Butz & Clader, $9,975; Schaeffer, Ackerman & Co., $11,750; Ferro Concrete Co., $8,470; Ironton, S. N. Weaver, $1,495; Butz & Clader, $1,556; G. H. Hardner, $1,400; Schaeffer, Ackerman & Co., $1,350; Ferro Concrete Co., $1,995. Gordon St. Schaeffer, Ackerman & Co., $2,420; S. N. Weaver, $1,750. Linden St., S. N. Weaver, $3,193; Schaeffer, Ackerman & Co., $2,475.

The Viewers appointed by the County Commissioners, Wilkesbarre, Pa., to report on the necessity of a new bridge to be erected from Wyoming to Port Friffith, have recommended [illegible] The bridge as proposed will cross the river opposite Eighth St., Wyoming.

The County Commissioners at York, Pa., have decided upon the construction of a new concrete bridge at Brogueville Station across Muddy Creek as the present structure is unsafe.

At the last meeting of the County Commissioners at Uniontown, Pa., the following [illegible] The bridge [illegible] by the York Bridge Co., the contract price beirg $2,865. The bridge will be 92 ft. long, with 14-ft. roadway. The Farris Bridge Co., for the new bridge over Poplar Run, Springfield township, for $667. The bridge is to have a 35-ft. span and 12-ft. roadway. The masonry work for both Poplar Run bridge and the Mountz creek bridge was let to Nelson & Berry, of Henry Clay township, Poplar Run for $3.75 per cu. yd., and Mountz creek at $3.85 per cu. yd.

County Commissioners, according to advices received from Milton, Pa., state that the County Commissioners have awarded to the York Bridge Co., the contract for the construction of the new bridge leading to Packer's Island. Surveys have been completed and work will be started at once.

According to advices from Washington, Pa., the County Commissioners have been requested to construct a new bridge to replace the old structure across Brush Run near Claysville, Pa.

Ferguson & Richard, of Blairsville, Pa., have been awarded the contract for the erection of a reinforced concrete bridge over Cherry Run in Center township on the road leading from Graceton to Jacksonville. It is planned to have work completed by the middle of October.

All bids were rejected by the County Commissioners and Controller, Wilkesbarre, Pa., for the construction of the proposed river bridge between Plymouth and Breslau. The Engineer's estimate was $260,000 and the lowest bid received was $309,000. The plans will be modified and the work re-advertised in the near future.

Hartley-Ziegler Co., York, Pa., at $23,278, has been awarded the contract by the County Commissioners, for encasing the present condemned bridge over Colorus Creek at College Ace with concrete. Nelson & Meredith Co., Chambersburg, Pa., at $31,985, was the next lowest bidder.

State Highway Department, Harrisburg, Pa., received the following bids Sept. 16, for the construction of a cement masonry bridge at Station 918-11 on the National road in the county of Washington: Ferro Concrete Co., Harrisburg, Pa., $2,258; Reinforced Concrete Co., Pittsburg, Pa., $3,295; Robert S. Dickson, Sewickley, Pa., $2,061; Hallam Construction Co., Washington, Pa., $1,703.

The following bids were received by the State Highway Department, Harrisburg, Pa., for the construction of the reinforced concrete bridge at Station 927-80 on the National road in Washington County: Reinforced Concrete Co., Pittsburg, Pa., $2,750; Robert S. Dickson, Sewickley, $1,376; Hallam Construction Co., $1,451; Ferro Concrete Co., Harrisburg, Pa., $1,603; Reinforced Concrete Co., Pittsburg, Pa., bid $8,917, for three bridges let Sept. 16.

The contract for the necessary labor and material for the construction of parts of a bridge over the Susquehanna River between borough of Plymouth and the township of Hanover, in Luzerne County, for which bids were opened Sept. 8, has not been awarded. The work will soon be re-advertised. James M. Norris is County Controller, Wilkes-Barre, Pa.

Advices from Richmond, Texas, state that another new bridge will soon be built across the Brazos River near Orchard on the line of Fort Bend and Austin Counties.

County Commissioners at Gonzales, Tex., received bids for the construction of an iron bridge across the Guadalupe River near Hamon, from twelve companies, but the contract was not let.

Virginia.

City Council of Richmond, Va., has appropriated $2,000 for competitive designs for the construction of a new structure to replace the present Mayo's Bridge. The new structure, which was recently recommended, is estimated to cost $250,000.

Washington.

City Engineer, R. H. Thomson, Seattle, Wash., has been authorized by the Council to proceed with the construction of a new drawbridge over the west waterway not to exceed a cost of $40,000. The old structure has been declared unsafe by the government engineers.

According to information received from Seattle, Wash., the Chicago, Milwaukee & Puget Sound Ry., which suffered heavy losses from burned-out bridges in the Idaho and Montana forest fires last month, has instructed Chief Engineer E. J. Pearson to begin at once on the work of fireproofing all bridges on the lines through the forests. Bridges that cannot be filled in will be reconstructed of steel and concrete.

City Council Finance Committee of Seattle, Wash., has authorized a loan of $40,000 for the construction of the proposed new bridge across the west waterway on Spokane Ave.

The citizens of Northport have petitioned the Board of County Commissioners, Colville, Wash., for an appropriation of $20,000 toward the construction of a bridge across the Columbia River at that point.

Canada.

✣Bids will be received until 6 p. m., October 4, by Frank Ness, Secretary and Treasurer, Assinaboia, P. O. St. James, Man., for the construction of a reinforced concrete culvert on the public road at lot 60, St. Charles, south of Assinaboine River.

✣Bids will be received until noon, October 8, by John B. Laughlin, Clerk, Village of Cartwright, Man., for the construction of a steel superstructure of a 58-ft. span bridge about one mile northeast of Cartwright.

F. H. McGuigan Construction Co., Toronto, Ont., has been awarded a contract by the Board of Control, for the construction of the Queen St. east high level bridge at $193,000. The contract does not include filling and paving, which according to the estimate of the engineer will cost about $19,000.

ROADS, STREETS AND PAVEMENTS

Alabama.

[illegible] roads and outline a practical plan for their [illegible]

[illegible] the Liberty hill precinct for a distance of about six miles to connect with a main road [illegible]

Contract for the paving of Walnut St., estimated [illegible] Aves., in Florence, Ala., has been awarded to J. H. [illegible]

Contracts for the construction of seven roads, [illegible] Wright, for $4,273; Lewisburg and Walker's Chapel, to T. J. Ellard, for $1,022; Waterworks Hill, to A. F. Bearden, for $1,486; Short Creek road, to Vines & Horton, for $1,285; Shoal Creek road, to Parker & Cox, for $865; Brookside and Mineral Springs, to Wade & Bradford, for $2,041; Shades Mountain and Pool's Ford, to H. W. Parker, for $1,868.

The commissioners of Covington County, Andalusia, Ala., have awarded the contract for 48 miles of road improvements in that county at a cost estimated between $60,000 and $75,000 to O. J. Pruett and J. F. Stough of Montgomery, Ala. The road to be improved diverges in various directions from Andalusia; the longest single stretch being 18 miles.

Arizona.

Bids received Sept. 13 by Robert A. Craig, Secy. Board of Control of the Territory of Arizona at Phoenix, Ariz., for the construction of a territorial highway between the towns of Bisbee and Douglas, in Cochise County, have been rejected. New bids on the work will be received about Oct. 20.

California.

✣Bids will be received until 11 a. m., Sept. 28, by the Board of Public Works, Oakland, Cal., for the necessary labor and material for the improvement of the southern side of Grande Ave. between Harrison St. and Bay Place for the Street Department.

The County Supervisors at Fresno, Cal., have been petitioned for the construction of a road from 1,320 ft. south of the northeast corner of 15-15-12, to a point where the line would meet the Watson Ferry and Bonner station road.

The Harbor and Streets Committee of the City Council of Los Angeles, Cal., has approved the plans for the harbor highway and condemnation of land for municipal warehouses in the San Pedro district. The highway is to be 150 ft. wide and will extend from the intersection of the Wilmington and San Pedro road and Beacon St. to Crescent Ave.

A petition, signed by several of the freeholders in the Niles and Vallecitos road districts, Oakland, Cal., asking that all the portion of the county road, No. 247, be abandoned as a public highway.

Advices from Klamath Falls, Cal., state that United States engineers under the direction of Maj. I. J. Morrow, chief of the engineering corps, are busy at work in Crater Lake National park laying plans for a complete system of roads and trails in the park.

The Supervisors at Redding, Cal., have appointed County Surveyor Reading, George O'Grady and Karl Basler viewers of the county road from Kennett to Keswick. It is the purpose of the board to improve the road between Kennett and Keswick by reducing the grade in a number of places.

A petition to M. M. Crookshank of Santa Ana, Cal., chairman of the Orange County highway commission, has been placed in circulation by residents of Laguna Beach. The petition asks that the commissioners consider improving the roads along the cliff from Laguna Beach to Capistrano.

Florida.

Bryan & Co., of Jacksonville, Fla., have been awarded the contract in Perry, Fla., for the construction of from three to five miles of macadam streets for from $0.45 to $0.50 per sq. yd. The work includes grading and paving; cuts and fills of 6-in. included in price per sq. yd. of macadam. Bids were opened Sept. 19.

Georgia.

Citizens and property owners along Washington St., in Atlanta, Ga., have petitioned the Board of County Commissioners to extend the smooth bitulithic paving from Ormond St., as far out as Ridge Ave.

Illinois.

✣Bids will be received until 11 a. m., Sept. 30, by B. J. Mullaney, Commissioner of Public Works, 702 City Hall, Chicago, Ill., for furnishing and delivering at California Ave. subway under the C. B. & Q. R. R. at 20th St. 1,400 sq. yds. of No. 2 granite paving blocks from 4 to 5-in. in width; 8 to 12-in. in length and 5-in. deep with rectangular plane surfaces. Blocks are to have uniform grain and texture, without lamination or statification and free from an excess of mica or feldspar.

✣Bids will be received until 11 a. m., October 4, by Department of Public Works, Chicago, Ill., for the construction of a cement sidewalk and driveways in front of the city property on South Ashland Ave., south of 22d St. The work includes about 6,200 sq. ft. of sidewalk and 1,600 sq. ft. cement driveway.

Following are the low bidders as opened by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Secretary, Room 300, City Hall, for the improvements of the following streets and alleys: Alley between Ontario and Erie Sts., and St. Clair St. and Lincoln Park Blvd. 570 sq. yds. brick pavement on 6-in. Portland cement concrete base with 2-in. sand cushion, Jas. A. Sackley Co., $1,645; alley between 48th St. and 49th Sts., and Calumet Ave. and Grand Ave., 1,020 sq. yds. brick pavement on 6-in. Portland cement concrete base with 2-in. sand cushion, Jas. A. Sackley Co., $2,916; alley between Huron St. and Superior St., and Clark St. and La Salle St., 340 sq. yds. of brick pavement on 6-in. Portland cement concrete base with 2-in. sand cushion, Jas. A. Sackley Co., $981; alley between 47th St. and 48th St., and St. Lawrence Ave. and Forrestville Ave., 770 sq. yds. of brick pavement on 6-in. Portland cement concrete base with 2-in. sand cushion, Jas. A. Sackley Co., $2,190; Champlain Ave., 42d St. to 43d St., 1,780 sq. yds. of asphalt pavement on 6-in. Portland cement concrete base, American Asphalt Co., $4,734; Graceland Ave., Evanston Ave., to C. M. & St. P. Ry., 3,900 sq. yds. of asphalt pavement on 6-in. Portland cement concrete base, American Asphalt Co., $11,462; Parker Washington Co., $11,468; Barber Asphalt Co., $12,229.

The city of Oregon, Ill., has awarded the contract for construction of a macadam road in that town to Duffy & Hubbard of Dixon, Ill. The work includes stoning and grading. Bids were received Sept. 15.

The City Council of Quincy, Ill., has ordered the construction of brick sidewalks on the following streets, at an estimated cost of $18,035: South side of Oak, between 18th and 20th; W. side of 19th, between State and Ohio; E. side of 9th, between Cedar and Spruce; E. side of 7th, between Adams and Jackson; W. side of 7th, between Adams and Jackson; S. side of Ohio, between 4th and 3rd; S. side of Van Buren, between 5th and 6th; N. side of Van Buren, between 5th and 6th; N. side of Ohio, between 3rd and 4th.

James S. Allen was the lowest bidder for the paving of South Bartielli Ave., from Main St., to Moss Ave., in Peoria, Ill., at $7,282. The avenue is to be paved with brick.

The Springfield Construction Co. has received the contract for paving Washington St., from 4th to 2nd, and 2nd north to 4th in Pekin, Ill.

The City Council of Moline, Ill., has been petitioned for the paving of 7th and 8th Aves., from 15th to 17th St. The council will probably order the paving.

Indiana.

✣Bids will be received until 7:30, Oct. 6, by the City Council of Shelbyville, Ind., for the construction of cement sidewalks in Franklin St. and cement curbs and gutters on Walnut St. L. E. Webb is City Clerk.

✣Bids will be received until 11:30 a. m., Oct. 7, by County Commissioners at Brazil, Ind., for the construction of a road in Harrison Township. J. L. Burns is Auditor of Clay County.

✣Bids will be received until noon, Oct. 6, by Commissioners of Miami County at Peru, Ind., for the construction of two roads in Washington Township. Charles Griswold is Auditor.

✣Bids will be received until noon, Oct. 3, by the Commissioners of Lake County at Crown Point for the construction of a bridge on Pulver Road. C. A. Johnson is Auditor of Lake County, Ind

A. R. Herkless, Maple St., Rushville, Ind., has been awarded a contract in that city for the construction of 3,000 sq. ft. of cement sidewalk for $.13 9-10. Bids were opened Sept. 20.

A contract for the paving of 117th St., in Hammond, Ind., with macadam has been awarded to the Ahlborn Construction Co., for $0.88 per sq. yd.

Iowa.

✣Bids will be received until October 4, by W. E. Hayes, City Clerk, Clinton, Ia., for the construction of 2,785 sq. yds. of vitrified brick paving. R. C. Hart, Clinton, Ia., is City Engineer.

The contract for 12 blocks of concrete paving and as much curbing has been let by the city council of Eldora, Ia., to Dearborn & Jackson, of Celar Rapids, Ia., for $1.36 per sq. yd. The curbing will be put in this fall and if possible four blocks of paving will be laid.

The City Council of Muscatine, Ia., has practically decided to pave Grandview Ave., from Hershey Ave., to the railroad crossing in South Muscatine.

The contract for the paving of Market and intersecting streets in Morrison, Ia., has been awarded to James Kelley of Morrison for $20,995.

Kansas.

A mile or more of rock road is to be laid west of 4th Ave., in Garnett, Kan.

Louisiana.

The Board of Port Commissioners of New Orleans, La., has decided to construct a roadway, paved with small square stones, from the rear of St. Joseph wharf, down behind the United States Fruit Co. wharf to the roadway at Barracks St. Eingineer A. C. Bell [illegible]

The Board of Commissioners, New Orleans, La., have awarded a contract to the Etta Co., for building a roadway on the levee from St. Marys St., to Jackson Ave., with creosote block and concrete foundation for $16,001.

A good roads association has been organized in Yazoo City, La., to promote the construction of good roads. H. G. Johnson is Pres., H. S. Orr, Vice-Pres., and H. H. Brickwell, Secy.

Minnesota.

✣Bids will be received until 8 p. m., October 11, by City Council of Crookston, Minn., for paving the following streets: Houston Ave., its entire length, 6,041.3 sq. yds.; S. Ash St., from its intersection by the southerly end of Houston Ave. to its intersection by Third St., 7,143.4 sq. yds.; E. Fletcher St., from its intersection by Broadway to its intersection by S. Ash St., 1,277.5 sq. yds.; E. Robert St., from its intersection by Broadway to the northerly end of the Jerome's Addition bridge, 2,343.7 sq. yds.; E. Second St., from its intersection by Broadway to its intersection by N. Ash St., 1,666.7 sq. yds.; E. Third St., from its intersection by Broadway to its intersection by Elm St., 2,381 sq. yds. Bids are desired for asphalt, creosote blocks, Donnelite and Granitoid pavement.

E. Hawarden has been awarded a contract in Duluth, Minn., by the Board of Public Works, for the construction of a macadamized roadway from Tower Ave., to the county courthouse at the East End, by way of 12th and West 5th Sts., for $2,462. The work will require the use of 993 cu. yds. of stone.

Mississippi.

The Board of Supervisors at Meridian, Miss., has sold bonds in the sum of $50,000 for the construction of good roads throughout Lauderdale County.

Nebraska.

The Omaha Automobile club of Omaha, Neb., has petitioned the city council for road improvement on Dodge and Center Sts.

The City Council of Hastings, Neb., has awarded contracts for paving work in the city as follows: O. C. Chapin, Leavenworth, Kan., for the paving of 3rd St., from the east side of Burlington Ave. to the West side of Denver Ave., and one block on Lincoln Ave., between 3rd and 4th Sts., with brick on a concrete base for $1.97 per sq. yd.; curb, $.33 per lin. ft.; resetting old curb, $.10 per ft. M. Ford, Omaha, Neb., for the paving of Lincoln Ave., from the north side of 4th St., to the south side of 12th St., for $2.32 per sq. yd.; combined curb and gutter, $.58 per lin. ft.; old curb reset, $.10 per lin. ft.

New Jersey.

Thomas & Welsh, South Amboy, have been awarded the contract by the board of chosen freeholders of Middlesex County, Brunswick, N. J., for the construction of a gravel road beginning in Spotswood at the road leading from Spotswood to the Old Bridge and Englishtown Road and extending southerly to the road to Texas, N. J., a distance of 2.10 miles for $8,150. The work includes excavating, draining and graveling.

New York.

✣Bids will be received until 11 a. m., October 5, by Alfred E. Steers, President of the Borough of Brooklyn, Room 2, Borough Hall, for 15 street improvement contracts, the largest being No. 6, as follows: For regulating and paving with asphalt on a concrete foundation, the roadway of Malbone St., from the bridge over the Brighton Beach Railroad to Nostrand Ave., together with all work incidental thereto. The engineer's estimate of the quantities is as follows: 11,560 sq. yds. asphalt pavement outside railroad area, 5 years' maintenance; 1,210 sq. yds. asphalt pavement within railroad area, no maintenance; 1,905 cu. yds. concrete for pavement foundation outside railroad area; 170 cu. yds. concrete for pavement foundation within railroad area. The time allowed for the completion of the work and the full performance of the contract is thirty-five working days. The amount of security required is $6,800.

✣Bids will be received until 2 p. m., October 5, by George McAneny, President of the Borough of Manhattan, New York City, for 10 street improvement contracts, the largest one being No. 10, as follows: For repairing and maintaining the street asphalt pavements on the streets in the Borough of Manhattan, on which the original guarantees of maintenance have expired, or will expire during the term of this contract. Engineer's estimate of amount of work to be done: 75,000 sq. yds. of asphalt pavement, including binder course; 200 cu. vds. of Portland cement concrete; 200 sq. yds. of old stone pavement, to relay. The time allowed for doing and completing the above work will be from date of contract to December 31, 1910. The amount of security required will be $18,000.

✣Bids will be received by the Commissioner of Bridges, 13-21 Park Row, New York City, until 2 p. m., September 29, for furnishing and delivering wood paving blocks to the University Heights bridge.

The Sicilian Asphalt Paving Co., 41 Park Row, New York, N. Y., has been awarded the contract in the Borough of Manhattan, New York City, for two paving contracts as follows: No. 1, for maintaining the asphalt pavement on Broadway, from the north side of Canal St. to 14th St., where the original contract has been abandoned. Engineer's estimate of amount of work to be done: 5,000 sq. yds. of asphalt pavement, including binder course. 25 cu. yds. of concrete. No. 2, for repairing asphalt block pavement in the Borough of Manhattan. Engineer's estimate of amount of work to be done: 250 cu. yds. of Portland cement concrete, including mortar bed. 5,000 sq. yds. of new asphalt block pavement. 300 sq. yds. of old asphalt block pavement relaid. The contract was awarded for $5,650. Bids were opened Sept. 17.

The Sicilian Asphalt Paving Co., 41 Park Row, New York, N. Y., has been awarded the contract for repairing with sheet asphalt 46th St., from 8th to 11th Aves., for $21,670 in the Borough of Manhattan, New York City. Bids were opened Sept. 17.

City Engineer Wm. F. Cogley of Utica, N. Y., has presented plans and specifications to the board of contract and supply for pavements in the following streets: Mathews Ave., from Erie to Whitesboro St.; Kellogg Ave., from Whitesboro St., to Highland Ave.; Kemble St., from the West Shore Railroad to Pleasant St.

The town of Avoca, N. Y., has planned to improve and widen that part of the main road south of the village, which lies in that town.

North Carolina.

The Guilford County Commissioners, N. C., have contracted with the Indian Refining Co. for 10 miles of bitulithic road on the highway between Greensboro and High Point. The bitulithic will begin at the corporate limits of Spring Garden St., in High Point, N. C., and will be built for two cities.

Ohio.

✣Bids will be received until Oct. 15, by the Commissioners of Columbia County, at Lisbon, O., for the grading of the Thompson Park Road improvement which runs from the corporation line of East Liverpoor to the Riverview cemetery.

✣Bids will be received until noon, Oct. 4, by the State Highway Department at the office of the Hamilton County Commissioners, Cincinnati, O., for grading and macadamizing 2.9 miles of road in Whitewater Township. A certified check for $300 must be filed with each bid. J. C. Wonders is State Highway Commissioner.

✣Bids will be received until noon, Sept. 30, by Board of County Commissioners, Cincinnati, O., for the improvement of South Ave., and the Werk road from Cleves and Bridgetown pike to the Cleves and Warsaw Pike Green Township. Stanley Struble is Pres. and Fred Dreihs is Clerk.

Fritz & Rumer, Columbus, O., have been awarded the contract for the building of an inclined roadway at the Toledo and Ohio Central passenger station on West Broad St., in Columbus for about $15,000.

Commercial St., in Mingo, O., is to be widened, graded and paved. The Wheeling Traction Co. will bear part of the expense while the city will pay for the rest.

The City Council of Sandusky, O., has decided to repair the asphalt pavement on Central Ave., and has passed an ordinance providing for an appropriation of $9,600 for the purpose.

M. J. Hannon has been awarded a contract in Springfield, O., for the paving of West Main St., from Yellow Springs to the second railroad crossing by the board of control for $64,735. The street is to be paved with small brick, 2¼ by 8½ by 4 in., with cement or grout filler.

The Pike Commissioners, Columbus, O., have authorized the improvement of the road leading from Columbus to Westerville, known as the Westerville road, from the intersection of the Mifflin and Blendon Township lines and thence north to the corporation line of Westerville, a distance of four miles.

The Pike Commissioners at Columbus, O., have awarded a contract to Wilson & Yardley for the improvement, with macadam, of the road from Worthington to Dublin, a distance of 1,700 ft., for $7,120.

Advices from Akron, O., are to the effect that surveys for the construction of the Hudson road have been completed by the county surveyor and that the contract will be let soon.

Advices from Greenville, O., state that a number of macadamized roads will be constructed in Drake County this year under the direction of James C. Wonders, State Highway Commissioner.

The County Commissioners at Urbana, O., have ordered gravel placed on one mile of the pike in Adams Township running from Rosewood to Carysville.

Residents of Mahoning and Columbiana Counties are making plans for the building of a boulevard 20 miles in length, from Youngstown and Leetonia. The route to be taken is along the right of way of the Youngstown & Southern Ry. Co.

The city of Springfield, O., has awarded a contract to Edward Ryan for the paving of West Main St., with asphaltic concrete for $65,000.

The contract for the paving of several streets in Russell, O., has been awarded by the officials of the town to Jacob Scherer of Ironton, O. The specifications call for a concrete foundation, brick surface and cement curb and gutter. The streets to be improved are Ferry St., from the C. & C. depot to the river front, Belfont St., from Ferry to Houston and Houston from Belfont to Etna. The approximate cost of the work is $12,000.

The County Commissioners at Columbus, O., have awarded contracts for nearly $12,000 for improvements of two county roadways. The fill in the Clickenger Road from the Chillicothe Pike to the canal, a distance of half a mile, was let to Wilson & Yeardley of Columbus for $4,102. The roadway from Shadesville north 2,747 ft. on the Chillicothe Pike is to be graded and two hills are to be reduced. A large part of the work is at the expense of Dr. S. B. Hartman. The county's share will be done by Foley Bros., who secured the contract for $7,916.

The County Commissioners at Cincinnati, O., have awarded the contract to the John Ruebel Construction Co., for the building of the new Harrison and New Haven road, running from Harrison to the new Baltimore pike, for $99,267.

Oklahoma.

No bids were received on September 20 by the City Clerk of Hugo, Okla., W. T. Echols, for furnishing and necessary labor and materials for the construction of pavement, including grading, manholes, catch basins, laying of necessary drainage tile and curb and gutter on the following streets: Railroad St., from Jackson St. to Wade St.; Dewey St., from Jefferson St. to Wade St.; Broadway St., from Main St. to Kirk St.; Crocket St., from Duke St. to Jackson St.; Jefferson St., from Dewey St. to Broadway St.; Duke St., from Dewey St. to Crockett St.; Jackson St., from St. L. & S. F. R. R. right of way to Crockett St.; Kirk St., from Broadway St. to Dewey St.; Wade St., from Dewey St. to Railroad St.; Main St., from Broadway St. to Ethel St. H. C. Blanchard is City Engineer. The work will be re-advertised in from 30 to 60 days.

Following bids were received by Bob Parman, City Clerk of Oklahoma City, Okla., on September 19, for the construction of 16.75 miles of asphalt, a total yardage of 302,670 sq. yds.; W. C. Burke, City Engineer, is the Engineer; 11th St., Olie Ave. to Western Ave., Western Paving Co., on sheet asphalt, $2,211; F. P. McCormick, on sheet asphalt, $2,326; Shelby-Downward Asphalt Co., Ardmore, Okla., on rock asphalt, $2,180. Central Ave., 10th St. to 6th St., Western Paving Co., on sheet asphalt, $9,241; F. P. McCormick, on sheet asphalt, $9,612; Shelby-Downward Asphalt Co., on rock asphalt, $9,132. Poplar, Hudson and Avenue B, Western Paving Co., on sheet asphalt, $44,847. Seventh St., Stonewall to Lottie Ave., Western Paving Co., on sheet asphalt, $9,967; F. P. McCormick, $10,241; Shelby-Downward Co., on rock asphalt, $9,585. Linwood Blvd., Western to 10th St., F. P. McCormick Co., on sheet asphalt, $76,252. Linwood Blvd., 16th, 17th, 18th, 20th, 21st Sts., Drexel Blvd., Land Ave., Independence Ave., estimated cost $162,669, no bids received. Youngs Blvd., Linwood Blvd. to 16th St., estimated cost, $19,574, no bids received. Ninth St., Laird Ave., to East Ave., Western Paving Co., on sheet asphalt, $44,715. Francis Ave., Shartel Ave., and Dewey Ave., Cleveland Trinidad Co., on sheet asphalt, $19,175; Western Paving Co., on sheet asphalt, $19.627; F. P. McCormick Co., $20,515; Shelby-Downward Co., on rock asphalt, $19,152. Noble Ave., Robinson Ave. to Santa Fe Ry., Cleveland Trinidad Co., on sheet asphalt, $6,289; Western Paving Co., on sheet asphalt, $6.337; F. P. McCormick, on sheet asphalt, $6,520; Shelby-Downward Co., on rock asphalt, $6,174. First st., Western Ave., Pennsylvania Ave., Cleveland Trinidad Co., on sheet asphalt, $45,582; Western Paving Co., on sheet asphalt, $47,997; F. P. McCormick, on sheet asphalt, $49,288; Shelby-Downward, on rock asphalt, $46,131. Seventh St., Walker Ave. to Lee Ave., Cleveland Trinidad Co., on sheet asphalt, $6,480; Western Paving Co., on sheet asphalt, $6,574; F. P. McCormick, on sheet asphalt, $6,855; Shelby-Downward, on rock asphalt, $6,424. Robinson Ave., Avenue C, Harvey Ave., Avenue A, Western Paving Co., on sheet asphalt, $142,873. 26th St., Classen to Western, Western Paving Co., on sheet asphalt, $8,883; F. P. McCormick, on sheet asphalt, $9,093. Lee Ave., 19th St., 22d St., Western Paving Co., on sheet asphalt, $7,987; F. P. McCormick, on sheet asphalt, $8,145; Shelby-Downward, on rock asphalt, $7,616. Central Ave., Fourth St., Second St., Western Paving Co., on sheet asphalt, $5,002; F. P. McCormick, on sheet asphalt, $5,281; Shelby-Downward, on rock asphalt, $4,937. Agnew St., alley between Hickory and Exchange to Central, Western Paving Co., sheet asphalt, $16,926; F. P. McCormick, sheet asphalt, $16,767. 37th and Military Ave., Western Paving Co., sheet asphalt, $52,815. Walker Ave., Elm to Section 4, estimated cost, $15,130; no bids received. Main St., Ames to Pennsylvania, Western Paving Co., sheet asphalt, $33,610. 24th, 26th and Broadway Sts., Western Paving Co., sheet asphalt, $21,947. Walnut St., 9th St. to 13th St., Western Paving Co., sheet asphalt, $17,268; F. P. McCormick, sheet asphalt, $17,933; Shelby-Downward Co., rock asphalt, $16,657. 39th St. and Putnam Heights Blvd., Western Paving Co., sheet asphalt, $20,053. 31st St., Florida to Ames St., Western Paving Co., sheet asphalt, $4,269. The contract for this work will probably be awarded September 27.

Oregon.

The Warren Construction Co., the lowest bidders for the paving of Main and 6th St., in Klamath Falls, Ore., bid as follows: Bitulithic paving, $2.20 per sq. yd.; excavation, $.75 per yd.; fill or embankment, $.75 per yd.; concrete curbing, straight ft., $.65; concrete curbing, curved, ft., $.85; total, $133,716. The contract has not as yet been awarded.

The Western Automobile association has been formed in Portland, Ore., to promote a highway from Mexico to British Columbia. M. C. Dickinson and E. Henry Wemme are interested.

Union Ave., in Portland, Ore., is to be paved between East Oak and East Morrison Sts.

Pennsylvania.

✣Bids will be received until noon, October 10, by R. J. Cunningham, County Controller, Pittsburgh, Pa., for the permanent improvement of the following public roads: Monongahela River Road Ext. No. 1, in Forward Township, including 1,500 ft.; Brighton Road, in Ross Township, including 800 ft.; Butler Road, in Shaler Township, including 1.1 miles.

Hastings & Piper were awarded the contract by the city council of Charleroi, Pa., for grading and paving McKean Ave., from 10th St., to the borough line of North Charleroi for about $1,800.

The Common Council of Wilkes Barre, Pa., has passed ordinances providing for the paving of at least two miles of city streets.

The Road Supervisors of Fallowfield Township, Washington County, Washington, Pa., have awarded the contract for resurfacing 6,000 ft. of the Sprowls road leading to Charleroi borough, paving 400 ft. and constructing a concrete beam bridge across Maple Creek, to the Donora Construction Co. The road is to be macadamized at a width of 16 ft., and the bridge is to be a 25 ft. iron span with concrete abutments.

Following bids were opened Sept. 16 by the State Highway Commission, Capitol Bldg., Harrisburg, Pa., for the construction of 1,076 ft. of road extending from Station 351 end of the present macadam to Station 561 76, end of present paving on National road in Brownsville Borough, in the county of Fayette: Hastings & Piper, Charleroi $8,463.10, C. I. P., slag or native stone bottom, Penna.; $8,168.10, Cor. p., Clay County, Hillside block top; $8,404.10, Con. p., Clay County Hillside block top; $8,603.15, C. I. P., slag or native stone bottom, Mack, Toronto; $8,308.15, Cor. p., or Porter Hillside block top; $8,544.15, Con. p., or Porter Hillside block top. Crossen Const. Co., Brownsville, $8,823.05, C. I. P., sandstone bottom, brick not mentioned; $8,327.45, Cor. p., sandstone bottom, brick not mentioned; $8,516.25, Con. p., sandstone bottom, brick not mentioned. W. C. McCormick & Co., Uniontown, $3,979.73, C. I. P., material not specified; $5,772.05, Cor. p., material not specified; $5,925,45, Con. p., material not specified. Thos. Mechan & Sons, Mt. Airy, Phila., $7,348.48, C. I. P., limestone bottom, approved block top; $7,126.64, Cor. p., limestone bottom, approved block top; $7,263.54, Con. p., limestone bottom, approved block top.

Tennessee.

The West Construction Co. was awarded a contract by the city of Chattanooga, Tenn., for the grading of McCallie Ave., from the cemetery to the corporation line, with asphalt.

Texas.

The County Commissioners Court at Richmond, Tex., received bids recently for the construction of the Richmond-Houston shell road. The lowest bid submitted was the Texas Grading Co., $85,527. The contract has not been awarded.

Advices from Huntsville, Tex., state that the voters of the precinct of the county, including Huntsville, have asked the Commissioners' Court of Walker County to order an election on a $50,000 bond issue to be used in building good roads.

At a recent conference of delegates from Neuces, San Patricio,, Bee, Karnes, Wilson and Bexar Counties, held at Corpus Christi, Tex., it was decided to co-operate through bond issues in building an improved overland highway from San Antonio to Corpus Christi. Roy Miller is interested.

Utah.

State Road Commissioner J. W. Jenson has completed the specifications governing the construction of state roads in Cache, Box Elder, Tooele, Juab, Summit, Morgan and Rich counties, Utah.

The first mile of the proposed interstate highway linking the capital cities of Idaho, Utah and Wyoming, by a well-laid macadamized public road will be laid during the intermountain Good Roads convention in Ogden during next month.

The contract for the construction of the cement sidewalks in the new paving districts in Richfield, Utah, has been let to J. P. Christensen & Sons, of Salt Lake City, for $10,294.

Virginia.

The citizens of Warren County, Front Royal, Va., will vote some time in November on the issuance of bonds to build a permanent road, according to advices received by State Highway Commissioner P. St. Julien Wilson. This road is to be built from Front Royal to Chester Gap, at the Rappahannock County line, where it will join a road for which bonds have already been issued. The new road is to be five and one-half miles in length.

Washington.

Advices from Wenatchee, Wash., are to the effect that County Surveyor F. M. Berry is at Lake Chelan surveying a route along the south bank of the lake as far as First Creek, a distance of 30 miles.

Advices from Goldendale, Wash., state that Samuel Hill of the Maryhill irrigation and fruit tract project will build a road connecting the Maryhill section with the state aid road between Goldendale and Columbus.

Klickitat County, Goldendale, Wash., held an election Sept. 13 to vote on the question of a special levy of $10,000 by the county commissioners, the money to be used with a like amount appropriated by the State Road Commission in completing the public highway near Lyle.

The County Commissioners, Tacoma, Wash., propose to open the Kincaid-Gillam county road from the intersection with the Indian Ferry-Stuck valley to a point four miles southeast.

The State Highway Commissioner, Henry L. Bowlby, Olympia, Wash., has awarded the contract for the construction of state aid road No. 82, for which bids were opened Sept. 7, to M. P. Zindorf of Seattle, Wash. The road, it is estimated, will cost $14,000.

Wisconsin.

✣Bids will be received until noon, Oct. 4, by the County Clerk, Superior, Wis., for grading down hill south of the south ⅛ post between section 35 and 36, 45-12 and for corduroying between section 1 and 2 44-12 and building a bridge over Leo Creek. C. J. Morisett is Commissioner of Highways.

R. M. McGucken, 895 16th St., Milwaukee, Wis., has been awarded the contract by the Board of Public Works of Milwaukee, for paving the roadway with brick on concrete foundation and curbing sidewalks with stone (old curb reset) on portions of streets in Second, Ninth and Tenth Wards, as follows: Brick, $1.94; stone curb, $.60. Second Ward, 8th St., from Winnebago to Vliet St., reset curb, $.15. Bids were opened Sept. 15.

The Badger Construction Co., Ry. Exchange Bldg., Milwaukee, Wis., has been awarded the contract by the Board of Public Works of Milwaukee, for grading the roadway and paving same with permanent asphalt on concrete foundation and curbing the sidewalks with stone (old curbing reset) on Holton St., from Reservoir Ave., to North Ave., as follows: Asphalt, $2.05; stone curb, $.65; reset curb, $.10. Bids were opened Sept. 16.

The Board of Public Works of Milwaukee, Wis., has awarded the contracts for grading and paving with stone of portions of streets in 10th, 11th, 20th and 22nd Wards, as follows: A. Froemming, 1318 Humboldt Ave., alley in block 29, 10th Ward; R. H. Gumz, 831 13th Ave., alley in block 2, Mark Tyson's Subd., 11th Ward; J. H. Donahue, Bradford Ave., northwest corner Cambridge, alley block 5, Haertel's addition, No. 2, 20th Ward; A. Froemming, 1318 Humboldt Ave., alley block 1, Humboldt Heights, 22nd Ward.

The Board of Public Works of Milwaukee, Wis., has awarded the contract for the construction of asphalt pavement on concrete foundation and resetting the old stone curb and constructing cement sidewalks on Lisbon Ave., from Sherman Blvd., to North Ave., in 22nd Ward, to the Badger Construction Co., as follows: Grading, $.58; stone curb, $.60; reset curb, $.08; asphalt, $1.95. Bids were opened Sept. 15.

The Board of Public Works of Milwaukee, Wis., has awarded the contract for the construction of subgrade and permanent asphalt pavement on concrete foundation and stone curb on Second Ave., from Mitchell St., to the south line of lot 13, block 1, Mitchell's subdivision, and on Windlake Ave., from 2nd Ave., to 6th Ave., in the 11th and 14th Wards, to the White Construction Co., Ry. Exchange Bldg., as follows: Asphalt, $2.15; stone curb, $.55; reset curb, $.15. Bids were opened Sept. 14.

The Board of Public Works of Milwaukee, Wis., has awarded the Badger Construction Co., Ry. Exchange Bldg., Milwaukee, the contract for grading and paving with permanent asphalt on concrete foundation Eiring Place from 42d St. to Sherman Blvd., for $1.99 for asphalt, $.40 for cement curb and $.11 for cement walk. Bids were opened Sept. 17.

At a special meeting of the Town Council of Delton, Wis., was voted to raise $1,200 to continue the construction of the macadam road between Delton and Kilbourn.

The city of Superior, Wis., has awarded a contract to Swan Holmquist for the construction of the steel plant road at the South End for about $2,000.

WATER-WORKS AND SEWERAGE

Arkansas.

✣Bids will be received until October 15, by City Clerk of Blytheville, Ark., for the installation of a water works. T. W. Davis is Mayor.

The city of Helena, Ark., has given the waterworks company of that city notice that the town will take advantage of its option next August and purchase the plant.

The City Council of Arkadelphia, Ark., has passed an ordinance providing for the construction of a sewer system in that city at an estimated cost of $35,000. Arrangements have been made for the disposition of bonds.

California.

A petition for the laying of a se in Cleveland Ave., San Diego, Cal., has been filed with the City Clerk. The proposed line of the sewer begins at a point 100 ft. south of the south line of Van Buren Ave., thence [illegible] Maryland Sts.

Colorado.

The Town Board of Steamboat Springs, Colo., voted to authorize the issuance of [illegible] for the purchase of the [illegible].

[illegible] St., Denver, Colo., has been awarded the contract in Sterling, Colo., for the construction of four sewer [illegible] for $1[illegible]. [illegible] Sept. [illegible]

Georgia.

[illegible] City Engineer.

Illinois.

✣Bids will be opened October 5, 1910, at 11 a. m., by the Board of Local Improvements, city of Chicago, Chas. A. V. Standish, Secy., for the furnishing and laying of water supply pipes as follows: In S. 42d Ct., W. 14th St. to W. 15th St., 737 lin. ft. 6-in. cast-iron water pipe, 1 2½-in. double nozzled fire hydrant and 6-in. connecting pipe; 2 6-in. gate valves; 2 brick valve basins complete, estimated cost $1,030; in N. 69th Ave., W. Wrightwood Ave., to W. Fullerton Ave., 1,294 lin. ft. 8-in. cast-iron water pipe, 4 2½-in. double nozzled fire hydrants and 6-in. connecting pipes, 1 8-in. gate valve, 1 brick valve basin complete, estimated cost $2,042.65; W. 105th St., Wentworth Ave. to C. W. I. R. R., 1,238 lin. ft. of 8-in. cast-iron water supply pipe, 4 2½-in. double nozzled fire hydrants with 6-in. connecting pipe, 1 8-in. gate valve, 1 brick valve [illegible] $2,[illegible] [illegible] Wrightwood Ave., 850 lin. ft. of 6-in. cast-iron water supply pipe, 1 2½-in. double nozzled fire hy[illegible] 6-in. gate valve, 1 brick valve basin complete, estimated cost $1,213.75; in S. 43d Ct., W. 14th St. to W. 16th St., 1,317 lin. ft. of 8-in. cast-iron water supply pipe, 4 2½-in. double nozzled fire hydrants with 6-in. connecting pipes, 2 8-in. gate valves, 2 brick valve basins complete, estimated cost $2,195.30; in S. 43d Ave., W. 14th St. to W. 15th St., 737 lin. ft. of 8-in. cast-iron water supply pipe, 1 2½-in. double nozzled fire hydrant with 6-in. connecting pipe, 2 8-in. gate valves, 2 brick valve basins [illegible]

✣Bids will be received until 11 a. m., Sept. [illegible] City Hall, Chicago, Ill., [illegible] necessary labor and material for [illegible] of old boilers, cross wall, boiler [illegible] and breeching, and constructing [illegible] the new boiler foundations, retaining wall, pipe trench and blow off basin, [illegible] furnaces, constructing new [illegible]

The City Council of Princeton, Ill., has passed an ordinance providing for the con[illegible] outlay of sewer, to cover the east, southeast and southern portion of the city. The estimated cost of the improvement is $25,500.

The City Council of Alton, Ill., has appointed a committee to investigate and have charge of the proposed installation of a waterworks system in the city.

[illegible] electrical and other equipment for the waterworks plant at a cost of approximately $18,000.

Plans and specifications are to be made in [illegible]

[illegible] Ill., C. A. V. S[illegible] for furnishing and laying wat[illegible] with fitting connections, etc., in the following streets: Balmoral Ave., from N. Robey St. to W. Ravenswood Park, estimated cost $292; Christiana Ave., from Elston Ave., to Irving Park Blvd., estimated cost $1,171; Castell[illegible] Ave., from N. Kimball Ave. to N. Lawndale Ave., estimated cost $1,103; Byron St., from N. Hamlin Ave., to N. 40th Ave., Bernard St., from Elston Ave. to Irving Park Blvd., estimated cost $533; Burnside Ave., from Cottage Grove Ave. to St. Lawrence Ave., estimated cost $246; S. Michigan Ave., from E. [illegible] St. to E. 71st St., estimated cost $1,657; S. Peoria St., from 119th St. to 120th St., estimated cost $188; E. 90th St., from St. Lawrence Ave. to Dauphin Ave., estimated cost $1,269; Gladys Ave., from S. 48th Ave. to S. 50th Ave., Champlain Ave., from Burnside Ave. to 95th St., estimated cost $207. The entire work includes 9,142 lin. ft. 1-in. lead service pipe 4 lbs. per lin. ft.; 379 brass stop cocks 1 in.; 379 brass taps ¾ in.; 379 cast-iron shut-off boxes, 2½-in. in diameter and 5½ ft. long.

The following bids were received Aug. 25 by the City of Wheaton, Ill., Arthur L. Webster, City Engineer, for constructing vitrified pipe drains, the contract being let to C. R. Nichols, Caney, Kan., as previously stated in these columns: (1) stands for Stevens Construction Co., 602 Atwood Bldg., Chicago, Ill.; (2) for Wm. Davidson, 260 Wood Court, Wilmette, Ill.; (3) for John M. Healy Co., 911 112 Clark St., Chicago, Ill.; (4) for T. H. Iglehart, 588 Rookery Bldg., Chicago, Ill.; (5) for G. Maffioli, Rockford, Ill.; (6) for Lanyon & Clifford, Waukegan, Ill.; (7) for C. R. Nichols, Caney, Kan.:

BIDS RECEIVED AUG. 25 AT WHEATON, ILL., FOR TILE DRAINS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Open ditch, 6 ft. wide, 4 ft. deep, 1-1 slope. [illegible] lin. ft. 1,376 cu. yds. earth, per yd	$ 0.20	$ 0.25	$ 0.55	$ 0.30	$ 0.25	$ 0.20	$ 0.20
Furnishing tile:							
8-in. tile, 9,822 ft., 600 ft. Y's; per ft., incl. Y's...	.15	.13	.15	.13	.14	.13½	.14
10-in. tile, 686 ft., 40 ft. Y's; per ft., incl. Y's.....	.20	.16	.21	.16	.16	.17½	.19
12-in. tile, 2,480 ft., 130 ft. Y's; per ft. incl. Y's...	.25	.22	.26	.24	.20	.22	.22
12-in. tile, 2,002 ft., 48 ft. Y's; per ft., incl. Y's....	.35	.30	.33	.33	.35	.31	.33
18-in. tile, 1,463 ft., 30 ft. Y's; per ft., incl. Y's...	.50	.45	.40	.40	.50	.46	.47
27-in. tile, 456 ft., 8 ft. Y's; per ft., incl. Y's......	1.30	.90	1.36	1.50	1.40	1.31	1.35
Digging trench, laying pipe and backfilling:							
27-in. tile, 464 ft., 7 to 8 ft. cuts; per ft..........	.75	1.00	1.10	1.00	.60	.65	.62
18-in. tile, 1,213 ft., 7 to 8 ft. cuts; per ft.........	.75	.70	.80	.70	.50	.60	.50
15-in. tile, 2,052 ft., 7 to 8 ft. cuts; per ft.........	.75	.60	.70	.70	.50	.60	.48
12-in. tile, 1,760 ft., 7 to 8 ft. cuts; per ft.........	.65	.50	.55	.60	.40	.50	.46
12-in. tile, 330 ft., 7 to 8 ft. cuts; per ft..........	.60	.50	.45	.50	.40	.45	.40
8-in. tile, 1,360 ft., 7 to 8 ft. cuts; per ft.........	.50	.50	.35	.40	.40	.35	.34
8-in. tile, 66,372 ft., 6 to 7 ft. cuts; per ft.......	.50	.50	.35	.40	.40	.35	.30
8-in. tile, 2,348 ft., 6 to 7 ft. cuts; per ft.........	.30	.50	.35	.30	.35	.20	.28
10-in. tile, 306 ft., 6 to 7 ft. cuts; per ft..........	.30	.50	.43	.30	.35	.20	.32
12-in. tile, 880 ft., 6 to 7 ft. cuts; per ft..........	.30	.50	.50	.30	.35	.28	.34
18-in. tile, 280 ft., 6 to 7 ft. cuts; per ft..........	.40	.50	.74	.30	.35	.35	.36
8-in. tile, 340 ft., 4 to 5 ft. cuts; per ft...........	.50	.30	.30	.20	.25	.20	.26
Manholes, 30, each	[illegible]5.00	25.00	25.00	22.50	25.00	25.00	24.00
Totals	$14,815	$14,338	$14,229	$13,430	$12,585	$12,010	$11,627

The Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Secretary, Room 300, City Hall, has awarded the following contracts, the bidding prices for which were published in last week's ENGINEERING-CONTRACTING: Water service pipe in S. Loomis St., 87th St. to 89th St., David Walsh, 6828 South Chicago Ave., Chicago; water service pipe in W. North Ave., from N. 48th Ave. to N. Central Park Ave., [illegible], 3139 Indiana Ave., Chicago; water service pipe in W. Chicago Ave., from N. Kedzie Ave. to N. Western Ave., Jas. J. Renn, 367 W. Chicago Ave., Chicago, Ill.; water service pipe in North Shore Ave., from Evanston Ave. to Lake Michigan, Jas. J. Renn, 367 W. Chicago Ave., Chicago, Ill.; water service pipes in W. 79th St., from S. Center Ave. to S. Morgan St., David Walsh, 6828 South Chicago Ave.; water supply pipe, N. 53d Ave., Humboldt [illegible]

The Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Secretary, Room 300, City Hall, has awarded the following contracts for house drains: E. 75th [illegible] St., Chicago. The Burnside system as follows: Langley Ave., Burnside Ave. to E. 95th St.; Champlain Ave., Burnside Ave. to E. 95th St.; St. Lawrence Ave., C. R. I. & P. Ry. to E. 95th St., Robert Carmini.

Indiana.

✣Bids will be received until 10 a. m., Oct. 3, by the Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along alley west of West St., from McCarty St. to Wyoming St.

The city of Gary, Ind., contemplates constructing an entirely new sewer in the alley north of the Wabash tracks and between Broadway and Massachusetts St.

Iowa.

August Korneman has been awarded the contract for the construction of sub-sewerage District No. 20 of Main 1, in Muscatine, Ia., for $4,020.

Bids opened Sept. 17 in Sioux City, Ia., for the drilling of one 16-in. well, a pumping station and one electrically driven turbine pump and one horizontal centrifugal pump, were rejected as being too high.

The city of Eagle Grove, Ia., has awarded Anderson & Co., of Vincent, Ia., the contract for the construction of a sanitary sewer and drainage sewer in Dakota St., and Lincoln Ave., for $10,290. Bids were opened Sept. 19.

W. A. Edgar, Cedar Rapids, Ia., received the contract in Vinton, Ia., for the construction of 1,600 ft. of 8-in. sewer, including four manholes and one flush tank for $1.36 per ft. Bids were opened Sept. 20.

The City Council of Belle Plaine, Ia., has instructed Engineer Hart of Clinton, Ia., to come there and make surveys for sewer outlet for sanitary sewer system. The surveys, plans and specifications for the sanitary sewer system have already been made. The council plans to let the contract for the outlet this fall.

Louisiana.

The citizens of Franklinton, La., have subscribed to the amount of $2,600 for the construction of a waterworks system. D. E. Sheridan is Pres., and Paul E. Greenlaw is Secy.

Massachusetts.

The Sewer Commissioners of Northampton, Mass., have decided to construct a sewer from the Joseph Haley place in Bay State across Mill River, to the region on the west side of the river in Florence. The sewer will be 6,000 ft. in length and will cost $4,600; 10-in. pipe will be laid.

Michigan.

The voters of St. Charles, Mich., have voted to bond the town for $14,000 to construct the electric light and waterworks plant.

Minnesota.

[illegible] City Council of Gilbert, Minn., has [illegible] to recommend to the voters of the [illegible] at the special election to be held Sept. [illegible] the bonds for sewerage system be [illegible] instead of $35,000, as first planned. [illegible] M. Mouser is City Clerk.

[illegible] ✣ [illegible]

The city of Cloquet, Minn., has awarded the contract to Pastoret & Lawrence, of Duluth, Minn., for the construction of sewer and water extensions. The work includes approximately 7,400 cu. yds. of excavation; 7,200 lin. ft. of 8-in. sewer, 7,700 lin. ft. of 6-in. water main and 18 manholes. Bids were opened Sept. 19.

Missouri.

Advices from St. Louis, Mo., state that property owners in Washington Heights, first division, are taking active steps toward the construction of a sewer through that district, particularly that portion extending from Delmar Ave., south to Forest Park, 6,000 ft. west.

Seitz & Peterman Engineering Co., of St. Joseph, Mo., has completed surveys of the Third St. district for sewerage in Cameron, Mo.

Nebraska.

The City Council of Tecumseh, Neb., will probably call a special election shortly to vote on the proposition of installing a sewerage system.

New Jersey.

The North Bridgeton Water Co. has been incorporated in Bridgeton, N. J., with a capital stock of $25,000 to supply the village of North Bridgeton, County Cumberland, with pure water for domestic, sanitary and municipal purposes, etc. Pres., H. W. Evans; Treas., C. H. Gould.

The Florence Iron Works, Florence, N. J., was awarded the contract for furnishing and delivering cast iron pipe, special castings and valve box castings for the department of water supply, gas and electricity, New York, N. Y. Bids were opened Sept. 14.

New York.

✣Bids will be received by Alfred E. Steers, President of the Borough of Brooklyn, New York City, until 11 a. m., October 5, for 23 sewer contracts, the largest being No. 1 as follows: For furnishing all the labor and materials required for the construction of a sanitary sewer in W. 15th St., from Mermaid Ave. to Canal Ave.; and storm sewer in W. 15th St., from Mermaid Ave. to Canal Ave.; and tributary sanitary sewers in Mermaid Ave., from W. 17th St. to Stillwell Ave.; in Surf Ave., from W. 17th St. to W. 12th St., and in W. 15th St., from Surf Ave. to Mermaid Ave.; and tributary storm sewers in Neptune Ave., from W. 17th St. to Stillwell Ave.; in Mermaid Ave., from W. 17th St. to Stillwell Ave.; in Surf Ave., from W. 17th St. to Stillwell Ave., and in W. 15th St., from Surf Ave. to Mermaid Ave. The amount of security required is $30,000.

A company has been organized in the town of Woodside, Queens borough, New York, with a capital stock of $30,000 for the purpose of giving to the town of Woodside a complete sewerage system.

City Engineer H. C. Allen of Syracuse, N. Y., has estimated the cost of constructing the sewer system in Sunset Ave., and other streets in the First ward at $21,500.

The Village Trustees of Bath, N. Y., have sanctioned an extension of the water mains into certain streets of the village.

The citizens of East Aurora, N. Y., have voted the issuance of bonds in the sum of $18,000 to extend the water mains and improve the pumping station. The city is considering bonding itself in the sum of $75,000 for the installation of a sewerage system.

The Board of Trustees of Belmont, N. Y., has sold bonds in the sum of $3,000 for the purpose of extending the waterworks system.

The Board of Estimate and Apportionment of Schenectady, N. Y., has adopted resolutions for the laying of a portion of the sanitary sewer in Albany St. and for the widening of Eastern Ave. At the same time City Engineer J. Leland FitzGerald filed his report on the estimated cost of improving the Baker Ave. site so as to make it available for school purposes. The requirements which are necessary are as follows: Water, sewers, grading, sidewalks and street paving, which includes 800 ft. of water pipe, $8.00; 1,850 ft. of sewer pipe, $4,625; 800 yds. of street grading, $396; 480 ft. of sidewalks, $360; and paving city's portion of street, $2,285.

The Waterworks Co., of Seneca Falls, N. Y., is laying plans to supply the village of Waterloo with water.

The Vulcan Rail & Construction Co., 175 N. 9th St., Brooklyn, N. Y., is the probable contractor for furnishing and delivering 6,000 lin. ft., of 2-pipe iron railroad (No. 1, 1910). Botanical Gardens for Parks, Borough of Bronx. The company's bid was $1,272. Bids were opened Sept. 15.

The city council of Bridgeton at a meeting held on Sept. 6 authorized Clyde Potts, Civil Engineer, 30 Church St., New York, N. Y., to prepare plans and specifications for a trunk sewer covering practically all of the city. Bids will be asked for probably some time in October. Jacob B. Jones, City Clerk, John N. Glaspell, Pres., City Council.

The Board of Estimate of New York has authorized the following improvements for the borough of Brooklyn, N. Y.: Sewers in 17th Ave., from 45th St. to 46th St.; from 47th St. to 48th St., and from 53rd St. to 54th St.; and in 45th St., from 17th Ave. to West St; estimated cost, $8,300. Sewer in Foster Ave., from Ocean Parkway to Coney Island Ave.; estimated cost, $5,200. Sewer in Foster Ave., from Ocean Parkway to Gravesend Ave.; estimated cost, $5,000. Sewer in Avenue K, from Coney Island Ave. to East 18th St.; estimated cost, $18,800. Receiving basins at the following points on 14th Ave.; Northerly corner of 42nd St., northerly and westerly corners of 43rd St. and northerly corner of 60th St.; estimated cost, $600. Sewer in 16th Ave., from 53rd St. to 54th St.; estimated cost, $1,100. Sewer in 87th St., from Narrows Ave. to Shore road; estimated cost, $1,000. Receiving basins at the following points on Hegeman Ave.: Northeasterly corner of Van Sinderen Ave., northeasterly and northwesterly corners of Hinsdale St. and northwesterly corner of Williams Ave.; estimated cost, $500. Sewer in Shore road, from 97th St. to 99th St.; estimated cost, $1,400. Sewer in 81st St., from 6th Ave. to Fort Hamilton Ave.; estimated cost, $1,400. Receiving basin at the northeasterly corner of Dumont Ave. and Van Sicklen Ave.; estimated cost, $200. Receiving basins at the following points; Northeasterly corner of Nostrand Ave. and Avenue D, northeasterly corner of Nostrand Ave. and Newkirk Ave., and northeasterly and northwesterly corners of New York Ave. and Avenue D; estimated cost, $700. Sewer in Lincoln Ave. from Glenmore Ave. to Conduit Ave.; estimated cost, $800. Receiving basins at the following points on Hegeman Ave.: Northeasterly and northwesterly corners of Stone Ave.; northeasterly and northwesterly corners of Christopher St.; northeasterly and northwesterly corners of Powell St.; northeasterly and northwesterly corners of Sackman St.; northeasterly and northwesterly corners of Junius St.; northwesterly corner of Van Sindern Ave.; estimated cost, $1,200. Sewer in Baltic St., from Columbia St. to the East River; estimated cost, $3,300. Sewer in the easterly side of Ocean Ave., from Avenue G to the Long Island Railroad; estimated cost, $2,800. Sewer in Avenue C, from East 5th St. to Ocean parkway; estimated cost, $1,000. Receiving basins at the following points on East 7th St.: Southeasterly and southwesterly corners of Church Ave. and northwesterly corner of Beverley road; estimated cost, $500. Sewer in 83rd St., from 15th Ave. to 17th Ave.; estimated cost, $6,300. Sewer in Union St., from Nostrand Ave. to New York Ave.; estimated cost, $2,300. Sewers in Fort Hamilton Ave., both sides, from 37th St. to 38th St.; in 37th St., from Fort Hamilton to 14th Ave., and in 14th Ave. from 37th St. to 39th St. estimated cost, $16,800. Sanitary and storm water sewers in the following streets: West 15th St., from Surf Ave to Canal Ave.; Mermaid Ave. from West 17th St. to Stillwell Ave.; Surf Ave., from West 17th Ave. to Stillwell Ave.; together with a sanitary sewer in Surf Ave., from Stillwell Ave. to West 12th St., and a storm water sewer in Neptune Ave., from West 17th St. to Stillwell Ave.; estimated cost, $81,400. Sanitary and storm water sewers in the following streets: Mermaid Ave. from West 19th St. to West 24th St.; West 21st St., from Mermaid Ave. to Neptune Ave.; together with a storm water shed in West 21st St., from Neptune Ave. to a point about 65 ft. north therefrom; estimated cost, $44,400. Preliminary authorizations which are necessary before construction work is authorized. Sewers in 42nd St., from New Utrecht Ave. to 13th Ave.; in 43rd St., from 12th Ave., to 13th Ave.; in 12th Ave., from 42nd St. to 43rd St.; and in 13th Ave., from 42nd St. to 44th St.; estimated cost, $22,700. Sewer in 43rd St., from New Utrecht Ave. to 12th Ave., and from 13th Ave. to 14th Ave.; estimated cost, $10,200. Sewer in East 18th St., from Avenue I to Avenue J, and from Avenue K to a point about 100 ft. southerly therefrom; estimated cost, $4,500. Sewer in Church Ave., from 14th Ave. to 36th St., and in 36th St., from Church Ave. to 14th Ave.; estimated cost, $1,400. Sewer in Church Ave. from Gravesend Ave. to 14th Ave., and in 14th Ave., from Church Ave. to 37th St.; estimated cost, $12,700. Regulating and grading 79th St., from 12th Ave. to 15th Ave.; estimated cost, $11,900. Regulating and grading Appolo St., from Meker Ave. to Bridgewater St.; estimated cost, $16,100. Regulating and grading Beverley road, from Nostrand Ave. to New York Ave.; estimated cost, $2,800. Regulating and grading 80th St., from 12th Ave. to 13th Ave.; estimated cost, $6,500. Regulating and grading Blake Ave., from Hinsdale St. to Vesta Ave.; estimated cost, $1,700. Regulating and grading President St., from Washington Ave. to Rogers Ave., excepting the right of way of the Brooklyn and Brighton Beach Railroad; estimated cost, $15,000. Regulating and grading 82nd St., from 6th Ave. to Fort Hamilton Ave.; estimated cost, $1,300. Regulating and grading 19th Ave., from 79th St. to 86th St.; estimated cost, $8,300. Regulating and grading Pilling St., from Evergreen Ave. to the Long Island Railroad; estimated cost, $1,000. Grading and curbing Otsego St., from Dwight St. to Sigourney St.; estimated cost, $2,800. Grading to a width of 20 ft. on each side of the center line and curbing and flagging 97th St., from 4th Ave. to Fort Hamilton Ave.; estimated cost, $3,500. Curbing and flagging 101st St., from 4th Ave. to Fort Hamilton Ave.; estimated cost, $1,100. Curbing and flagging 92nd St., from 3rd Ave. to 7th Ave.; estimated cost, $12,200. Paving with second-hand granite block a strip 20 ft. wide in Flatbush Ave., between Avenue N and Avenue U; estimated cost, $13,000. Paving with asphalt New York Ave., from Avenue H to the southerly property line of the Flatbush Water Works; estimated cost, $24,000. Paving with asphalt, 76th St., from 2nd Ave. to 3rd Ave.; estimated cost, $5,700. Paving with asphalt, Lawrence Ave., from Ocean Parkway to 3rd St.; estimated cost, $6,400. Paving with asphalt, Pine St., from Etna St. to Ridgewood Ave.; estimated cost, $4,300. Paving with asphalt Malbone St., from the bridge over the Brighton Beach Railroad to Nostrand Ave.; estimated cost, $33,500. Paving with asphalt block Saratoga Ave., from Eastern Parkway Extension to Pitkin Ave.; estimated cost, $2,700.

North Carolina.

An agreement has been made by the East Spencer board of aldermen, Spencer, N. C., with the J. B. McCrary Co. of Atlanta, to install a waterworks system in East Spencer. The contract provides for 45 hydrants and ample mains and service pipes to reach all parts of East Spencer.

G. W. Haggert, Fargo, N. D., has been awarded a contract in Carrington, N. D., for the extension of the water mains of the water works system and for constructing sewers for $60,000. Bids were opened Sept. 9.

The James Kennedy Construction Co., of Fargo, N. Dak., and P. J. Moran of Salt Lake City, Utah were the lowest bidders for [illegible] waterworks pipe line [illegible] city of [illegible]

[illegible]

plant.

Ohio.

✣Bids will be received until noon, Oct. 11, [illegible] Clerk of the Village of Cleveland Heights, O., either at the town hall or at his office, 309 Beckman Bldg., Cleveland, O., for furnishing the necessary labor and material for the improvement of Noble Road from the center line of Bluestone Road [illegible] northerly limits of Cleveland Heights Village by laying [illegible] water mains. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., have plans and specifications on file.

Following bids were received at Port Clinton, O., on Sept. 22, for the construction of a filtration plant, for which Wm. G. Clark, 1048-50 The Spitzer, Toledo, O., is Engineer: Norwood Engineering Co., Florence, Mass., $27,565; Roberts Filter Mfg. Co., Philadelphia, Pa., $27,625; Doersbach Bros., Sandusky, O., $25,759; Pittsburg Filter Mfg. Co., Pittsburg, Pa., [illegible]

The City Solicitor of Maumee, O., has been directed to prepare a resolution submitting the question of waterworks to a vote of the townspeople at a special election.

The State Board of Health of Ohio has ordered the city of Marysville, O., to proceed at once and have plans and specifications ready by Oct. [illegible] for the construction of a sanitary sewerage system. The city will probably secure an engineer to determine the [illegible] for sewerage.

Skeeles & Campbell were the lowest bidders for the contract for the St. Elm St. sanitary sewer in Canton, O., and Burd & Downs filed the lowest bid for the Warner Ave., and East [illegible] sewers.

Director of Public Works R. F. Brown, Lancaster, O., has awarded the contract for the construction of the 24-in. West Side sewer to J. B. Clover of that city for $2,711. The sewer will be 3,242 ft. in length.

Property owners on Middle St., in Ashtabula, O., have petitioned the city council for a sanitary sewer on that street, extending 350 ft. from Spring St.

An ordinance has been introduced in the city council providing for the construction of a sanitary sewer system to accommodate the residents in the southern part of Edgemont. The territory to be drained is situated south of Bohlender Ave., between Broadway and Cincinnati Sts., Cincinnati, O.

[illegible]

[illegible] on Wood St., from Hayes Ave., to the river [illegible]

[illegible]

sewering 3rd St., and Thorne St.; Valentine Neidlinger, for sewering Water St.

The village of Marble Cliff, O., which includes Arlington, is beginning to work on its sewage plant under plans that have been approved by the state board of health.

The proposition to issue bonds to the amount of $150,000 for the purpose of purchasing the Urbana waterworks was defeated at a special election held recently. The city will now install a new municipal waterworks.

The village of Newburgh Heights, Ohio, has awarded a contract to W. A. McDowell, 331 Miles Ave., Cleveland, Ohio, for the construction of a main sewer in seven streets for $17,919, and a contract to B. W. Ernst, 7201 Superior St., Cleveland, Ohio, for the construction of sewers in all side streets. Bids were opened Sept. 3.

Gould & Mayback, Collinwood, Ohio, have been awarded a contract in Euclid, Ohio, for the construction of Lawnview Ave. brick pavement for $6,651. The work includes grade, grading, draining and paving. Bids were opened Sept. 12.

Oklahoma.

✣Bids will be received by City Clerk of Chickasha, Okla., for the extension of the sanitary sewer mains including approximately 26,640 lin. ft. or nearly 5 miles. E. E. Colby, City Engineer, has plans and specifications on file at his office.

The City Council of Lawton, Okla., has approved the contract of E. R. Kerby of struction of the Main St. sewers and sewage sedimentation tank for $4,125. Bids were received Sept. 19.

Lawton for the construction of the city dam on Medicine Creek, the building of the North Addition water system and the construction of the Squaw Creek sewer. The dam will cost $62,207; the waterworks, $38,961, and the sewers, $39,836.

J. S. Smith & Sons of Oklahoma City, Okla., have been awarded the contract for the construction of a sanitary sewerage system in Chandler, Okla.

An election was held in El Reno, Okla., on Sept. 6 for the purpose of voting bonds in the sum of $250,000 to be used for improvements, of which $187,000 will be for purchasing the waterworks system and additional water-bearing land.

The City Council of Britton, Okla., has called a special election to be held Sept. 15 for the purpose of voting on two bond issues for public improvements aggregating $50,000. It is proposed to issue bonds of $35,000 to install waterworks, and $15,000 for a sewer system.

The City Council of Guthrie, Okla., on Sept. 1 received the following bids for the construction of sewer No. 5: White & Smith, $8,893.87; J. H. Billings, $10,030; W. F. Power, $9,005, and A. W. Contway, $9,105.72 for the 5,680 ft. of sewer.

Hydraulic Engineer Alexander Potter, employed by the city of Muskogee, Okla., to make a report on the present sewer system, has filed his report with the mayor, and has recommended changes for extensive improvements.

Oregon.

The City Council of Corvallis, Ore., has accepted the bid of J. A. Saucet, amounting to $110,700, for the constructing of additional sewer to cover the Job's addition section, College Hill, and the southwestern part of the city.

Pennsylvania.

Plans and specifications are being prepared for the building of a sanitary sewage system and disposal plant in Sharon, Pa.

New Holland, Pa., voters will, at the November election, vote to see whether they [illegible] to have a new $30,000 waterworks.

Thomas Cassedy, Secretary, Central Poor District of Luzerne County, Trucksville, Pa., R. D., received bids on Sept. 8 for drilling [illegible] hole on the premises of the Central [illegible] District at Retreat, Pa., and awarded [illegible] contract to Beline Bros., for $1,770.

The Walnut Grove Water Co., Stony Creek Township, Cambria County, Pa., has been incorporated with a capital stock of $5,000. A. J. Strayer, U. E. Minerley, P. C. Strayer, Johnstown, Pa., are interested.

The Board of Public Works of Altoona, Pa., has awarded a contract for the building of a sewer in 11th Ave., and 11th alley between 23rd and 24th Sts., to J. P. Harney, the lowest bidder. Franz Engstrom is City Engineer.

The Highway Committee of the City Council of York, Pa., has decided to extend all city sewers into the stream instead of having their outlets upon the banks of Codorus Creek as at present.

Tony Caravella, Water St., Meadville, Pa., has been awarded a contract in that city for the construction of an 8-in. sewer on Steers alley for a distance of 260 ft. Bids were opened Sept. 21.

New Holland, Pa., will hold an election some time in November to vote on the proposition of installing a waterworks system at an estimated cost of $30,000.

The City Council of Lebanon, Pa., has passed a bill calling for an election on a proposition to issue $110,000 for a house sewage disposal plant.

Dr. J. B. Black, Select Councilman from the 11th ward, McKeesport, Pa., has presented an ordinance in that branch of the city council, which provides for the extension of the waterworks intake pipe above the mouth of the Barton Ave. sewer.

The Roselawn Water Co. has been organized and chartered with a capital stock of $25,000. S. Morris is president of the company, M. H. Wright, vice-president and W. Frank Vaughn, Esq., secretary-treasurer. The office of the company is at 1207 11th St., Altoona, Pa.

A charter has been issued to the Port Royal Water Supply Co. to supply water to Port Royal, Pa. The capital stock is $10,000 and the incorporators are James N. Groninger, Samuel R. Bashore, F. M. Carpenter, R. E. Groninger, C. L. Meloy, C. D. Frankhouse, V. H. Krebs, H. C. Hower, W. R. Wharton, treasurer, D. C. Pomeroy and John E. Groninger, all of Port Royal.

R. P. Bennis has been awarded the contract in Philadelphia, Pa., for the construction of the intercepting sewer along Pennypack Creek, for the new Holmesburg sewage disposal plant for $42,520. The sewer will be of vitrified pipe, laid in concrete, varying in size from 16 to 24 in., and will be 7,718 ft. in length.

The City Council of Mechanicsburg, Pa., has decided to lay a sewer pipe from Race St., to Arch St., on Main St.

Andrew Breslin of Summit Hill, Pa., was awarded the contract to build the pumping station at the old breaker cistern for $6,789 by the Summit Hill town council.

Coatesville, Pa., City Council has awarded to Fritchey & Son of Lancaster, Pa., the contract for building 2,000 ft. of brick storm sewers.

Rhode Island.

The River Pollution Commission of Providence, R. I., are discussing the removal of mud and other deposits amounting to 415,000 cu. yds. in connection with the proposed extension of the Kinsley Ave. sewer from Eagle St. The city engineer was instructed to make plans and estimates for the sewer.

South Carolina.

The Board of Paving and Sewer Commission, Greenville, S. C., has awarded the contract for the necessary labor and material for the construction of sanitary sewer extensions at Greenville to Sullivan & Long of Bessemer, Ala. Bids were opened Sept. 10.

The city of Greenville, S. C., has awarded a contract to Sullivan & Long, of Bessemer City, Ala., for sewer extension, approximately six miles, in the following streets: Echols, Johns, North Main, North, Stone Ave., Franklin St., Garlington St., Memminger St., Lawton Ave., East McBee Ave., Leach St., Hud-

[illegible] ✣ indicate work now open for bids son St., Mayfield St., Gibbes St., Hyde St., and Oscar St. Bids were opened Sept. 10.

South Dakota.

The town of Iroquois, S. Dak., will spend $2,000 in improving and extending its waterworks system.

The Board of Trustees of Leola, S. Dak., has awarded a contract to the Des Moines Bridge & Iron Co., of Des Moines, Ia., for the construction of a steel tank, with a capacity of 50,000 gals. of water, to be erected upon an 80-ft. steel tower, and for furnishing and putting in place all the hydrants and pipes in connection with the waterworks system to be installed for $5,800.

Tennessee.

Advices from Athens, Tenn., state that the Ingleside Water Co., which has just secured a charter from the state, has leased the water rights to the Ingleside Spring, with necessary lands for pumping station, reservoir, etc. As soon as the city authorities grant the necessary franchise the laying of pipes throughout the city will begin.

A new water company has been organized and chartered in Athens, Tenn., with the following incorporators: W. Gettys, H. H. Mattock, R. J. Fisher, and E. B. Madison. Water will be brought from the Ingleside Spring.

Texas.

The city of Shiner, Tex., has sold bonds in the sum of $8,000 for the extension of the water works system.

The city of Abilene, Tex., has sold bonds in the sum of $7,000 for the purpose of replacing 6-in. water mains in the business district of the city with 8-in. mains.

The City Council of Bastrop, Tex., has appointed a special committee, consisting of several aldermen and a number of citizens, with a view of putting in a sewerage system.

According to H. A. Bittrick, manager of the Taylor Water Co., the surveyors have completed the preliminary survey for the water reservoir tank to be added to the water reserve of the company in Taylor.

The city of Georgetown, Tex., has secured an option from the Georgetown Water, Power & Electric Co., for the purchase of the plant for $13,500. The city will vote within 30 days on the issuance of bonds in the sum of $50,000 for the purchase and improvement of the plant.

The City Engineer of Fort Worth, Tex., has submitted a recommendation to the city commission that a storm sewer be constructed on Jarvis St., from Lipscomb to Jennings Ave., for disposal of water that gathers on these thoroughfares. The estimated cost of the sewer is $5,500 and it is to be 982 ft. long and 4 ft. wide.

The Board of City Commissioners of Dallas, Tex., has adopted Commissioner Doran's recommendation that the city engineer prepare plans and specifications for the laying of storm sewers northeast of Masten St., and extending east to the Houston and Texas Central tracks. The approximate cost of laying these sewers, according to the engineer's estimate, is $19,000.

The City Council of Snyder, Tex., is arranging for the sale of $45,000 of waterworks and sewerage bonds recently authorized.

Engineers Fountain and Shaw, who are putting in the water works system for Quannah, Tex., are at present preparing plans and specifications for the mains for the system.

The City Council of Austin, Tex., has appropriated $8,250 for the purpose of purchasing 300 tons of 12-in. pipe to increase the water supply to East Austin. The new pipe will run up from 11th and Red River St., covering the entire eastern part of the city.

Advices from Houston, Tex., state that Engineer A. Schafli of Schafli & Porter, who recently was appointed consulting engineer for the installation of the municipal waterworks at Harlingen, Tex., states that a preliminary survey has been made and that actual work will begin very shortly. Plans and specifications are being prepared in Houston.

A survey is being made in Bryan, Tex., for the construction of a trunk sewer along Main St., to be paid for with the available funds now on hand.

The citizens of Tioga, Grayson County, Tex., have voted the issuance of bonds in the sum of $10,000 for the construction of a waterworks.

Petitions for an extension of the water mains in the east end of the Second ward, in Houston, Tex., and for an extension of the sanitary sewer on Clark St., to Koehler's store were presented to the city council.

The citizens of Vernon, Tex., have voted the issuance of bonds for the construction of a water works and sewer system.

Utah.

✣Sealed bids will be received until 7:30 p. m., Oct. 7, by Board of Public Works, Salt Lake City, Utah, for the construction of an 18-in. cast iron watermain in City Creek canyon approximate quantities being 500 ft. of 20-in. and 17,200 ft. of 18-in. pipe. Plans and specifications are on file at the office of G. F. McGonagle, City Engineer or H. G. McMillan, Chairman of the Board of Public Works. The cost of the work is estimated at $130,000.

Dale L. Pitt, 419 Newhouse Bldg., Salt Lake City, Utah, has been awarded the contract in that city for sewer extension No. 271 in Church St., and for sewer extension No. 221 in Floral Ave., for $1.11 and $.99 respectively. Bids were opened Sept. 16.

Jesse M. Smith, M. H. Ellison, George W. Loyton, E. M. Whitesides and C. J. Weaver, constituting a committee appointed by the citizens of Layton, Utah, to formulate plans for the securing of a water system for Layton, have proposed to put in a system that would cost about $16,000.

Surveys for the $100,000 addition to the waterworks system of Ogden, Utah, authorized in the bond election, will be started at once. The conduit will carry water from the Coldwater canyon to the distributing plant at 23rd St. W. H. Bostaph is City Engineer.

A. B. Corey of Ogden, Utah, has been awarded a contract for the construction of a reservoir or ice pond at Carlin, Nev., for the Pacific Fruit Express Co. The reservoir will cover 27 acres and will be completed in good time, so that the company may harvest more than one crop of ice this winter. The company will construct other reservoirs later on.

The following bids were received by the Board of Public Works of Salt Lake City, Utah, for the construction of sewer extensions: Dale L. Pitt, being the successful bidder on all the work: Extension No. 246—Hawthorne Ave., between 5th South and 6th South Sts., from 7th East to 8th East Sts; D. L. Pitt, $.79½ a ft.; C. E. Palm, $.87; J. D. Hanley, $.92; Gilkersen & Long, $89.34. Extension No. 265—Cottage court, between 6th South and 7th South Sts., running from 3rd East to 4th East St.; Pitt, $.90; Hanley, $1.04. Extension No. 268—City Ave., running north from 16th South St., between State and 2nd East Sts., Pitt, $.74; Palm, $.79.5; Hanley, $.89. Extension No. 270—In 7th South St., from 9th East to 10th East St., Charles U. Heuser, $1.85; Pitt, $1.78; Gilkersen & Long. $1.93; Palm, $1.84. Extension No. 272—In Hazel court, running north from 5th South St., between 5th East and 6th East Sts., Palm, $1.02; Pitt, $.92; Hanley $.94. Extension No. 273—In Elm Ave., running north from 5th South St., between 4th East and 5th East Sts., Pitt, $.86; Palm, $.91; Hanley, $.88.

The City Council of Provo, Utah, has passed an ordinance authorizing the sale of $90,000 worth of waterworks bonds to E. H. Rollins & Son.

Washington.

The voters of Sedro-Woolley, Wash., have ratified the sewer system which was adopted by the city council, Aug. 8. Plans were drawn by Miller & Nasten of Seattle. The election also authorized the issuance of $40,000 in bonds to pay for construction.

The International Contract Co. of Seattle, Wash., has been given the contract for building the intake and headworks of Tacoma's Green River gravity water system, Tacoma, Wash. The contract was awarded at $65,930.

P. E. Hall of Everett, Wash., has asked the city of South Bend, Wash., to grant him a franchise, extending over a period of 45 years, to furnish an abundant supply of water for domestic, manufacturing and fire protection purposes. Mr. Hall proposes to tap the south fork of the Willapa River at a point about six miles from this place.

The Pinehurst Water Co., of Everett, Wash., has been incorporated with a capital stock of $2,500. The incorporators are E. M. Metzger, W. F. Stalwell and M. Swartout.

The citizens of Toppenish, Wash., will vote Oct. 12 to decide whether or not to issue $35,000 worth of bonds for sewer work.

The Board of Public Works of Spokane, Wash., has awarded a contract to G. Burgie for the construction of a sewer on Hamilton St., Montgomery to Jackson, for $5,500; sewer on 16th Ave., Perry to Madelia, for $2,100.

West Virginia.

The contract for the building of a water dam of 30,000-gal. capacity at Keyser, W. Va., has been awarded to W. A. Liller of that town for approximately $25,000. The contract calls for the building of the dam which will enclose a lake of about 10 acres surface, and as much guard wall around same as the committee may deem necessary to prevent contamination by surface water.

The contract for furnishing and erecting two 4,000,000-gal. vertical pumping engines for the city of Parkersburg, W. Va., bids opened Sept. 14, has not been awarded. Frank Good is City Auditor.

Babcock-Wilcox Co. has been awarded the contract for furnishing and erecting two 200-hp. boiler for the city of Parkersburg, W. Va., for $8,000. Bids were opened Sept. 14.

W. M. Chisholm & Sons have been awarded the contract for furnishing the necessary labor and material for the construction of pump well, pipe gallery and foundations in Parkersburg, W. Va., for $21,200. Bids were opened Sept. 14.

Wisconsin.

The Common Council of West Allis, Wis., has opened the following bids, received Sept. 20, for sewer work: L. W. Shruth, Fargo, N. Dak., $1 per lin. ft. for laying 8-in. pipe and $1.25 per ft. for 12-in. pipe; Laun & Clifford of Waukegan, Ill., 8-in. pipe, $1.15; 10-in. pipe, $1.38; 12-in. pipe, $1.63; 15-in. pipe, $1.88; 18-in. pipe, $2.73. The Newman Sewer Construction Co., 8-in. pipe, $1.18; 10-in. pipe, $1.35; 12-in. pipe, $1.42; 15-in. pipe, $1.65; 18-in. pipe, $2.29.

The town of Walworth, Wis., will expend $18,000 for the installation of a waterworks system.

F. E. Kaminski, Watertown, Wis., has been awarded a contract in Waterloo, Wis., for laying approximately 18,000 ft. of water mains for $7,529. The work includes 31 hydrants and valves and valve boxes. Bids were opened Sept. 6.

Improvements which will cost about $150,000 are planned by the Water, Light & Power Co., of Superior, Wis.

The citizens of Monticello, Wis., have voted in favor of the proposition of installing a waterworks system, and have authorized the board of public works to go ahead with the project.

Preliminary work is being done in Stoughton, Wis., for the construction of a sewer system. The city will soon advertise for the sale of bonds for the work.

The Common Council of Waupaca, Wis., has awarded a contr [illegible] Green Bay for the construction of the [illegible] sewer for $5,100.

The citizens of Appleton, Wis., have voted to purchase the plant of the Appleton Water Works Co., at a price to be fixed by the railroad commission.

Items marked thus ✣ indicate work now open for bids.

H. S. Palmer of Eau Claire, Wis., was awarded the contract for the construction of [illegible] station for $1,600. The reservoir will have a capacity of 450,000 gals. and will be built of concrete reinforced with steel rods and wire netting. The walls will be 10 ft. high.

The city of Oshkosh, Wis., will hold an election Nov. 8 to vote on the question of municipal ownership of the waterworks [illegible] W. G. Maxcy and is appraised at $400,000.

A sewage disposal plant for Milwaukee, Wis., in the town of Lake is contemplated by a number of the prominent citizens. George C. Whipple, New York; Harrison P. Eddy, Boston, and J. W. Alvord, Chicago, who constitute the commission which was appointed to devise improved sewage conditions for the city, are preparing a report to be submitted to the city council. The commissioners will inspect the Menomonee river as far as the county line and inspect the proposed site for a disposal station in the town [illegible] beginning sittings on the preparation of their report.

H. O. Schafer of Green Bay has been awarded a contract in Waupaca, Wis., for the construction of a new sewer at the following bid: $.60 per lin. ft. for 6-in. sewer, $.68 per lin. ft. for 8-in., $1.05 per lin. ft. for 10-in. and $1.15 per lin. ft. for 12-in., $40 each for manholes and $35 each for catch basins, and $6 per cu. yd. for excavation in case rock is encountered in the work. The approximate cost of the work is $5,200.

Mulholland & Son of Kaukauna, Wis., have been awarded a contract in Algoma, Wis., for the construction of a vitrified pipe sewer about 3,394 ft. in length, for $4,909. Bids were opened Sept. 1.

Wyoming.

The Laramie Water Co. of Laramie, Wyo., with a capital stock of $1,800,000 has filed its articles of incorporation with the secretary of state at Cheyenne.

Canada.

The National Paving & Contracting Co., Winnipeg, Man., has been awarded a contract by the town of Rainy River, Ont., for the following: A—Laying 300 ft. of 15-in. sewer pipe; laying 650 ft. of 12-in. sewer pipe; laying [illegible] sewer pipe; laying 1,700 ft. of 9-in. sewer pipe; laying 350 ft. of flexible joint iron pipe; constructing 19 manholes; constructing 2 flush tanks; constructing 6 lamp holes; constructing pump house and [illegible] in. pipe; laying 1,100 ft. of 8-in. pipe; laying [illegible] plant. J. H. Wilson is Town Clerk. Bids [illegible]

S. L. McManus & Son, at $12,677, received [illegible] struction of sanitary and storm sewers and [illegible] Sept. 8.

The Town Council of Dauphin, Man., has [illegible] miles from the Riding mountains to the [illegible] miles from the Riding mountains to the town.

[illegible]

[illegible] used for the gravity system, which is nine [illegible]

George Crowe & Son of Trenton, Ont., have been awarded the contract for the construction of the Main St. sewers and sewage sedimentation tank for $4,125. Bids were received Sept. 19.

TRADE NOTES.

The Rockwell Furnace Co., 26 Cortlandt St., New York, in order to facilitate the handling of its western business, has opened an office in the Fisher Building, Dearborn and Van Buren St., Chicago, Ill.

Mr. Ernest Wiener, president of the Ernest Weiner Co., New York city, railroad specialists for all industries, returned to New York early in September from a business trip to Europe, where he spent several months.

The Pawling & Harnischfeger Co., Milwaukee, Wis., designer and builder of traveling electric cranes and hoists, announces the appointment of Mr. Arthur Fritsch as manager of its Chicago office, in the Monadnock block, succeeding Mr. W. E. Kraemer, resigned. Mr. Fritsch was formerly connected with the engineering and sales department of the Allis-Chalmers Co.

The Harold L. Bond Co. of Boston and New York city has recently furnished the American College for Girls at Constantinople, Turkey, with a complete quarry outfit of Wood rock drills and other equipment. Mr. W. W. Hibbard of Boston will superintend the work and it is his intention to quarry the stone with native labor and construct the necessary buildings.

Mr. A. R. Reiche, president of the Orenstein-Arthur Koppel Co., manufacturer of light steel dump cars and portable tracks, with general offices in the Machesney Bldg., Pittsburgh, Pa., left that city on Sept. 15 for New York, whence he sailed on Sept. 17 on the North German Lloyd steamer George Washington for Germany. Mr. Reiche expects to be absent in Europe several months. During his absence he will consult with the general officers of the company, who are located in Berlin, with regard to the enlarging of the American plant, which is at Koppel, Pa. This town was built by the Koppel Co. and is situated about 30 miles from Pittsburgh on the line of the Pittsburgh, Fort Wayne & Chicago R. R. The increase in the business has rendered the present plant too small and it will have to be increased to at least double its present capacity in order to meet the demands of the present and provide some room for future growth.

Announcement was made recently that the Port Huron Engine & Thresher Co., Port Huron, Mich., had purchased from Chas. Longenecker & Co. of New York patent rights, patterns, good will, etc., in fact everything relating to the manufacture and sale of "New York" rollers and "New York" scarifiers. The New York-Port Huron roller was designed in the year 1905-6 by Charles Longenecker, M. E., and E. T. Wright, M. E. The experience of Mr Longenecker included the designing of the Harrisburg roller and several years with that company at Harrisburg, Pa. He was vice president of the Weston Engine Co., Painted Post, N. Y., for several years after leaving the Harrisburg Foundry & Machine Co. Mr. Longenecker became a member of the firm of Julian Scholl & Co. of New York some time prior to the year 1890 and that firm took the agency of the Kelley-Springfield rollers in New York and other eastern states. After the sales agreement or territory arrangement between the Kelley and Pitts and the Harrisburg companies, Mr. Longenecker, in collaboration with Russell & Co., Massillon, O., designed and placed on the market the Russell roller; this was in about the year 1895. They continued marketing the Russell roller until the year 1901, when Russell & Co. sold their roller business to the Kelley-Pitts combination. In the years 1902 and 1903 Mr Longenecker had the sale of the Pitts roller in southern New York and in the New England states. In 1904 Mr. Longenecker began the development of the larger sizes of universal roller [illegible] Julian Scholl & Co. In May, 1905, he left Scholl & Co. and in December, 1905, he organized Chas. Longenecker & Co. and commenced the development of the New York roller and the New York scarifier. Mr. Wright's experience in the roller business commenced in England. He served his apprenticeship with the Avling & Porter Co. of Rochester, England, the first manufacturer in the world of what is [illegible]

Two "System" Books

These two books will not exactly meet your needs in every particular. No book on systematizing construction work can; but there is a wealth of suggestions in these books which can be used to advantage on your own construction work, no matter what kind it may be. We are speaking of "Bricklaying System" and of "Field System," by Gilbreth. One review of "Bricklaying System" pronounced it the only practical treatise on bricklaying ever written, and a remarkable book in that it described methods of greatly reducing the cost of laying brick, in spite of the fact that the art is as ancient as the pyramids.

The "Field System" is a series of rules and instructions for the guidance of superintendents and foremen, the object being to secure uniformity of procedure and economy of performance on general contract work.

The "Bricklaying" contains 330 pages (6x9 inches) and its price is $3.00 net, postpaid.

The "Field System" contains 194 pages (bound in leather) and its price is $3.00 net, post paid.

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Information Wanted Concerning Treatment of Concrete Surfaces.

A report has recently been issued by the committee on exterior treatment of concrete surfaces of the National Association of Cement Users, of which Mr. Leonard C. Wason, of the Aberthaw Construction Co., is chairman. It is the wish of the committee to obtain additional information from manufacturers, engineers and users of appliances and materials for coating concrete surfaces. Any information in regard to the above would be much appreciated. Correspondence in regard to same should be addressed to Leonard C. Wason, President of the Aberthaw Construction Co., 8 Beacon St., Boston, Mass.

The Decimal Scale for Construction Work.

It is generally conceded that the adoption of a single unit of measurement for engineering, architectural and construction work would not only facilitate the work of engineers, architects and contractors, but would also eliminate the chance of making errors in the transference from the engineers to the architect's scale, and vice versa. In the office of a prominent engineer in Boston for estimating all dimensions are converted from inches to decimals, this involving of course considerable amount of work, but it is proven that it pays to do this both from the avoidance of errors and in the shortening of the actual arithmetical work by using a decimal system rather than our present system of feet and inches.

It is interesting to note the opinions of prominent men connected with engineering, designing and building operations. Mr. F. W. Reynolds, of Lockwood, Greene & Co., mill engineers and architects, Boston, Mass., says:

> We believe that from the engineer's standpoint the decimal scale could be very well adopted for construction work. By this we mean that all measurements could be taken and expressed according to the decimal scale with quite as little trouble and confusion as follows the use of the scale of feet and inches. Drawings would be just as easily made and read if the decimal system was followed as under the present system. We fear, however, that unless the adoption of this system could be made compulsory, it would be the source of many errors from the confusion which would arise after drawings were sent out and into the hands of persons more familiar with the scale of feet and inches than with the decimal system.

Mr. F. W. Dean, the engineer and designer of industrial plants, gives as his opinion that the decimal scale would be a good thing if once introduced and established, but that he would hate to be the one to attempt bringing about the change.

The point of view of the civil engineer is well expressed by Mr. Leonard Metcalf, of the firm of Metcalf & Eddy, Boston, Mass. He says:

> The difficulty comes essentially from educating the contractor's foreman and men rather than the inspectors and engineering corps, as the latter are, of course, accustomed to the use of the engineer's decimal scale in all their surveying operations. I believe that in the majority of cases, more particularly large and important works, the use of the decimal scale would be possible, but greater difficulty would be encountered in its introduction in the smaller works. The fact must also not be overlooked that in such works as involve building—in iron work, castings, structural material, etc.—the manufacturers and machine shops still adhere to the English "feet and inch" scale. Under such circumstances either separate plans for details woudl have to be used, or the two different scales would appear upon the same drawing, or dimensions would be stated for both purposes in one scale only. This again would be disadvantageous from the point of view of the mechanic who has become thoroughly accustomed to the foot and inch scale, and in the majority of cases knows little of the engineer's decimal scale. You will see, therefore, that while from the engineer's point of view the change would, broadly speaking, be advantageous, from the practical point of view I fear there would be serious difficulty in its general introduction, except perhaps in general classes of work.

The opinion of Mr. L. C. Wason, President of the Aberthaw Construction Co., Boston, Mass., is interesting as being that of a man intimately connected with actual conditions in the field. His opinion follows:

> In designing and figuring we work in the decimal system, later converting the measurements into feet, inches, and fractions to correspond with the dimensions given by engineers. If engineers and architects could be induced to use decimals it would be a great boon to the profession in general, and of assistance in the execution of work. I think co-operation could be obtained from the manufacturers of rules, who would make it more difficult to get rules divided in fractions of an inch, and turn out more of these in decimals, and also who would send out advertising literature showing the advantages of the decimal system. By the co-operation of the manufacturers and the engineers and architects, I believe a result could be accomplished which would be very desirable. I am looking forward with interest to the time when the metric system will become necessary through enactment of law.

American Society of Municipal Improvements. The seventeenth annual convention of the American Society of Municipal Improvements will be held at the Chamber of Commerce rooms, Erie, Pa., Oct. 11 to 14 inclusive. The morning session of Oct. 11 will be opened with an address of welcome by Mr. M. Liebel, Jr., Mayor of Erie, to which Mr. Julian Kendrick, president of the society, will respond. For the afternoon meeting the following papers and reports are scheduled: Report of the committee on sewerage and sanitation, by Mr. George C. Whipple; "Present Use of the Septic Tank," by Prof. H. N. Ogden; "Municipal Sanitation in Cuba," by Mr. R. Winthrop Pratt; "Construction of Exposed Sewers at Leavenworth, Kan.," by Mr. Joseph O'Neil; report of the committee on garbage and street cleaning, by Mr. Louis L. Tribus. In the evening there will be papers on "European Sewage Disposal," by Dr. Rudolph Hering; "Improvements in Check Valves on Auxiliary Supplies," by Mr. J. Walter Ackerman; "Correlation of Sidewalk Grades to Curb Grades," by Mr. C. G. Anderson; "Laying Asphalt with a Surface Heater," by Mr. B. B. Colborne; papers by Mr. F. L. Olmsted and Mr. H. S. Richards. In addition the reports of the committees on water works and water supply and on park development and maintenance will be presented.

The reports for the morning session, Oct. 12, include those of committees on street paving, standard specifications, asphalt pavements, brick paving, bituminous paving nomenclature, street lighting, and fire protection. There will also be papers on "Modern Stone Block Pavements," by Mr. Wm. A. Howell; "Bituminous Pavements, Patented and Otherwise," by Mr. E. A. Kingsley; "The Economics of Modern Highway Engineering," by Prof. A. H. Blanchard; "Supervision of Municipal Work," by Mr. Will P. Blair, and "Asphalt Repair," by Mr. Henry C. Allen.

A boat ride to points of interest on Presque Isle Bay followed by a fish fry at the County Club will occupy the afternoon of Oct. 12. In the evening there will be a discussion of questions and topics of general interest.

For Oct. 13 the morning program provides for reports of committees on municipal data and statistics, taxation and assessment, municipal franchises, city government and legislation, and review. The papers are: "The Census Bureau's Municipal Statistics," by Mr. A. Prescott Folwell; "Taxation," by A. M. Heston. Automobile rides in the afternoon and a vaudeville entertainment in the evening will complete the day's schedule.

The final business session will be held on the morning of Oct. 14 and in the afternoon trips of inspection will be made to various points of engineering interest.

An exhibit by dealers in and manufacturers of municipal appliances will be one of the features of the convention.

Mr. A. Prescott Folwell, 239 West Thirty-ninth street, New York City, is secretary of the society.

The American Street and Interurban Railway Association. The twenty-ninth annual meeting of the American Street and Interurban Railway Association and its affiliated organizations will be held at Atlantic City, N. J., Oct. 10-14, 1910. The headquarters for the conventions and exhibits will be on Young's Million Dollar Pier.

The mornings will be devoted to the transaction of business and the presentation and discussion of the reports of the committees of the several organizations. At the meetings of the Engineering Association the committees will report as follows: Tuesday, way matters, shop accounting and power generation; Wednesday, equipment, heavy electric traction and power distribution; Friday, buildings and structures and standards.

For the afternoons and evenings a variety of entertainment will be provided, including a golf entertainment.

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CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Constructing a Reinforced Concrete Water Tower Using Steel Forms and Movable Steel Staging.

[illegible] recently employed in erecting a 650,000-gal. concrete water tower at Westerly, R. I., [illegible] an advance in the art of erecting structures of this [illegible] made waterproof merely by the density of the concrete itself, the methods of mixing also contain features of interest to concrete engineers.

This standpipe, Fig. 1, is designed for a [illegible] gals. It is [illegible] walls, and is [illegible]

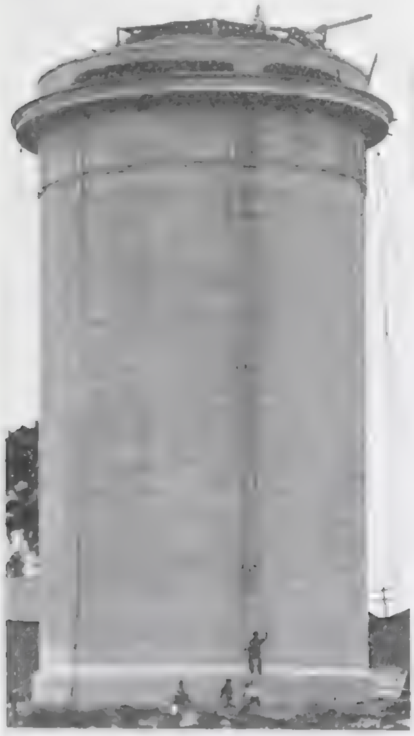

Fig. 1—Reinforced Concrete Water Tower, Westerly, R. I.

[illegible] jecting 2½ ft. and 3 ft. in height, above which [illegible]

[illegible] at the slab, with a batter of 2 ft. in 5 on the [illegible] being reached at a point 5 ft. above the top of the floor slab, and remaining at this thickness for the entire height.

The wall reinforcing consists of 12 vertical 1½ pipe columns made in 3 ft. sections connected by ordinary pipe couplings, spaced equidistant and extending from the bottom of the floor slab to the cornice. These pipe columns have drilled in them ¼-in. holes spaced the proper distance apart for attaching the horizontal reinforcing rods, Fig. 3. These rods consist of fifty 1½-in. bars in the first 10 ft. from the base, thirty 1½-in. bars in the second 10 ft., then twenty-five 1½-in., thirty-four 1¼-in., twenty-five 1⅛-in., fifteen 1⅛-in. and ten 1⅛-in. in each succeeding 10 ft.

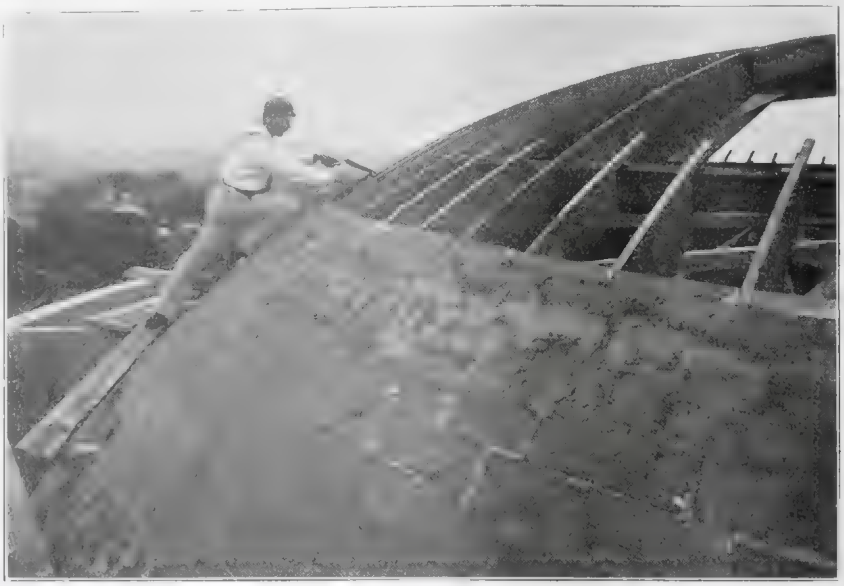

Fig. 2—Gustavno Tile Dome Roof for Water Tower.

The horizontal reinforcing bars are bent around the outside of the pipe columns and attached to them by ¼ in. round clamps as shown by Fig. 3. In the first 5 ft. 8 ins. from the bottom, the bars are doubled, being clamped to the inside and outside of the pipe column.

The steel forms, Fig. 4, are made up of 3x3 x¼-in. angles and 1⅛-in. boiler plate. The inside form is 6 ft. high and has a key section in which the plates lap about 6 ins., and on either side of the joint angles are securely riveted to the plates and connected by short turnbuckles, so that the whole form can be sprung in and reduced in diameter so as to make it possible to raise it when necessary.

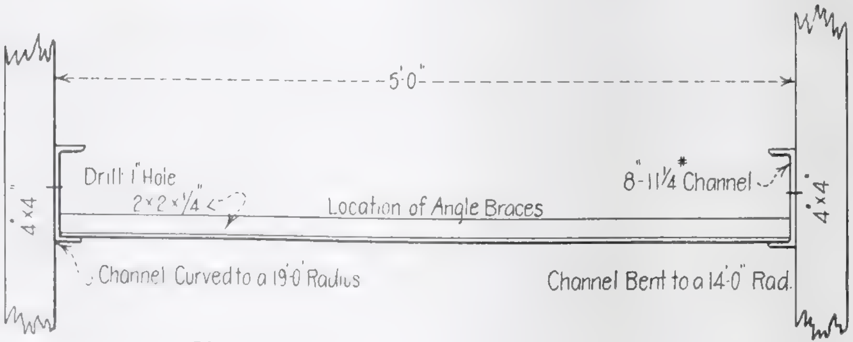

Fig. 4—Details of Angle Braces for Forms.

The outside forms are made in seven segments to the circle in sections 3 ft. high. Two complete sections are all that are used, as when one 3-ft. section has been erected and the concrete placed, the next section is placed on top of this, and by the time the concrete is

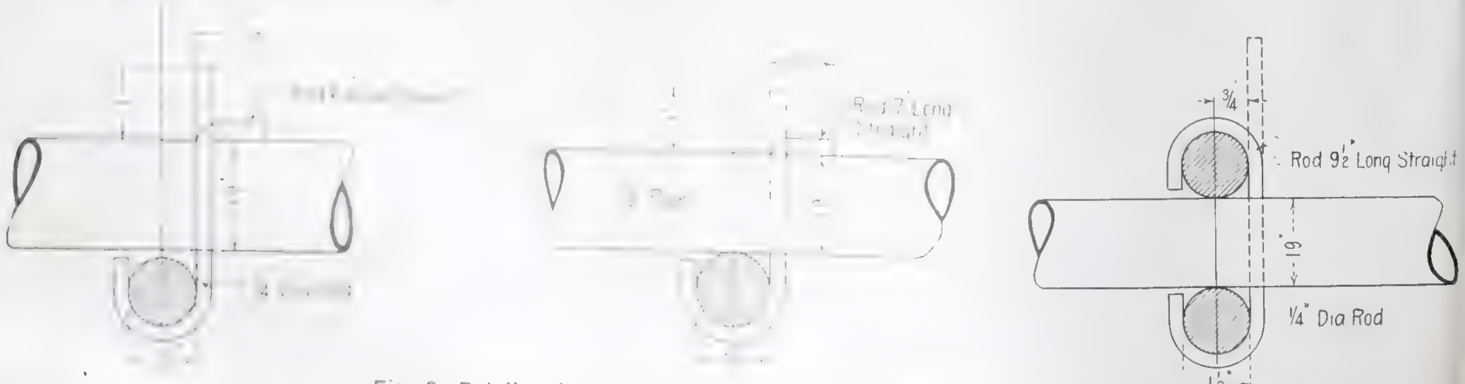

Fig. 3—Details of Reinforcement Connections for Water Tower.

placed in this section the lower form can be removed and placed on top. On the outside forms all the rivets are countersunk, and the face of the angles making joints are machined so as to secure a perfectly smooth fit, thereby securing a practically smooth finished surface.

The movable steel staging is located on the inside of the tower, Fig. 5. It consists of four 5-in. channels in the form of a cross joined at the center with a standard connection. Around these channels are bent two channels in concentric circles of 14 and 19 ft. radius braced with 2x2x¼-in. angles. The floor of this staging is covered with plank, giving a platform 5 ft. wide around the inside of the standpipe. This platform was raised as the work progressed and held in place by 4x4 in guide posts spaced 45° apart.

On the outside of the standpipe is an elevator tower, Fig. 6, for hoisting the concrete, which is mixed on the ground. Automatic dump buckets were used for hoisting the concrete, the same being dumped into a receiver supported by the elevator tower and extending over the staging so that wheelbarrows could be wheeled directly under it and loaded by gravity, and then wheeled to the point where it was to be placed. The forms and movable staging were designed by the Aberthaw Construction Co. and built by the Russell Boiler Works, of South Boston, Mass.

In mixing great care was exercised in the choice of aggregate and cement, frequent and accurate analyses to determine the voids in the sand and stone being made by means of a galvanized iron vessel of 1 cu. ft. capacity in which the voids were measured by water displacement. About the average mixture used was 1 yard of stone to 1 yard of sand, 2 5/11 barrels of cement to 1 yard of concrete and about 5 per cent of hydrated lime. The floor and the battered sides up 5 ft. were finished with a granolithic surface.

Just a little water was put in the mixer followed by about half of the required amount of stone. This was turned for a few moments until the blades were well cleaned. Sand and cement were next added, and finally the balance of the stone for the batch. The concrete was mixed sloppy but not wet enough to allow the stone to work down during handling from mixer into place. The concrete was placed very carefully, as there is no final finish on the outside surface. The steel was handled by a small derrick placed on the staging and was bent around the pipe columns and attached by hand.

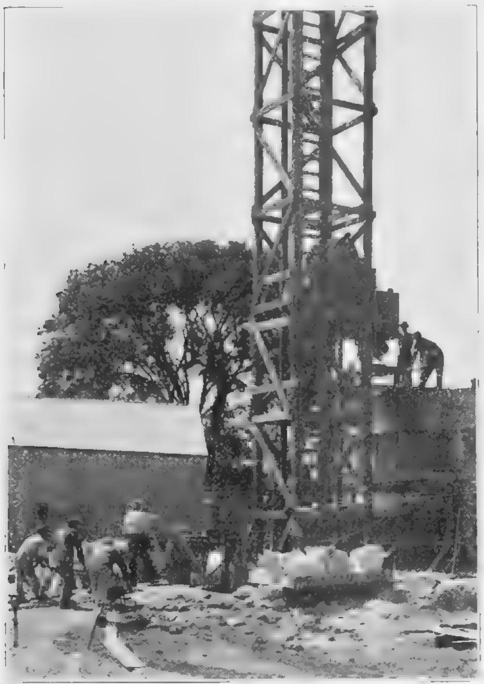

Fig. 5—Tower for Handling Concrete.

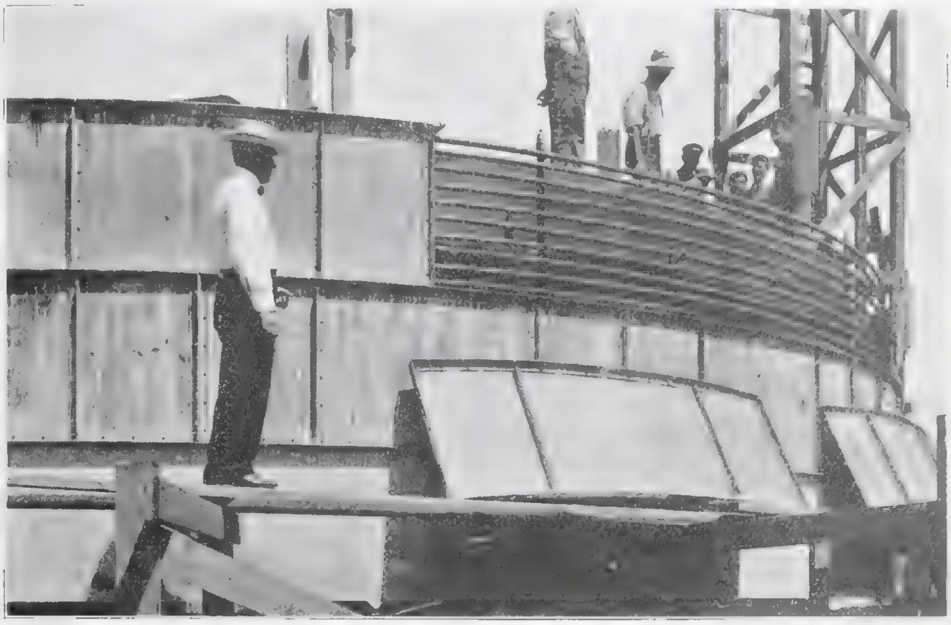

Fig. 6—View Showing Steel Forms.

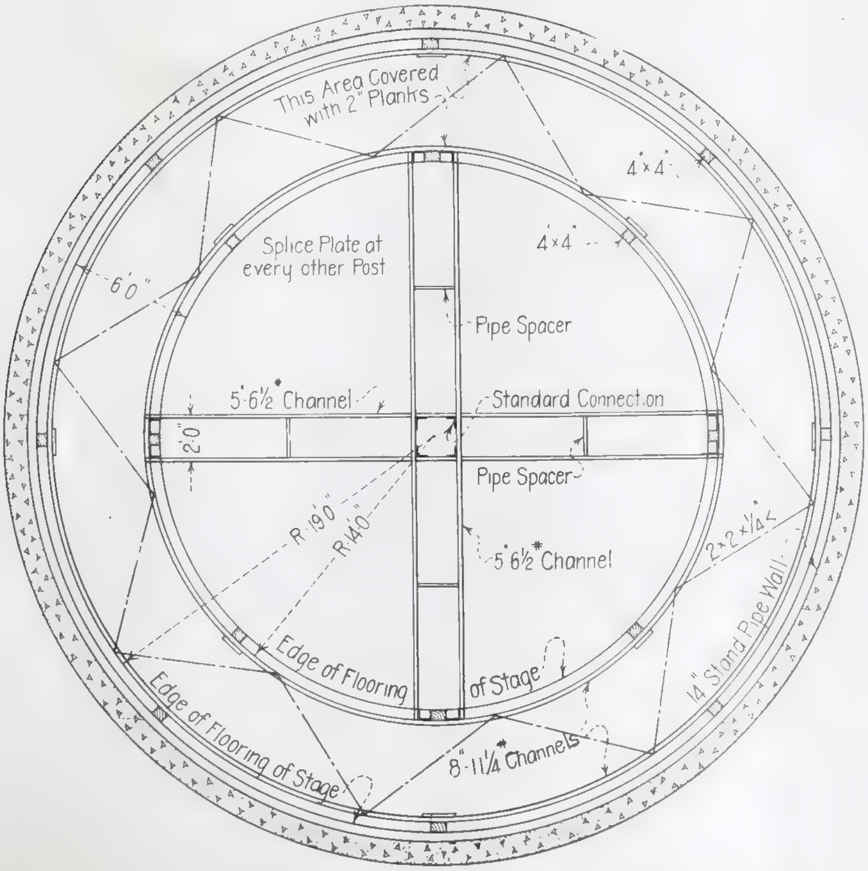

Fig. 7—Plan Showing Erection Staging.

The construction plant and the labor were so planned that each day's work consisted of moving the staging up 3 ft., placing the steel forms and the reinforcing, and concreting one 3 ft. section. To accomplish this, it was found that the following distribution of labor on the job was about a fair average for the entire work.

For each day's work the amount of labor was:

	Hours.
For handling and placing reinforcing wall	[illegible]
Forms	[illegible]
Raising staging and elevating tower	18
Receiving and checking stock	[illegible]
Mixing concrete	[illegible]
Placing concrete	[illegible]
Foreman and time keeper	18

Working a 9-hour day this meant the employment of 24 men, the majority of whom were common laborers. It was found that after the forms and steel were in place it took between 3 and 4 hours to concrete one 3-ft. section.

The entire construction plant and the forms were designed by the Aberthaw Construction Co., Boston, Mass., who are the general contractors for the entire work.

Method and Cost of Depositing Concrete by Chuting on Track Elevation at Grand Crossing, Chicago, Ill.

The construction of a subway for two streets which cross each other under the Illinois Central R. R. tracks, and the elevation of the six tracks of the railway, is now being carried on at Grand Crossing, Chicago. The separation of the street grade from the railroad grade is accomplished by lowering the streets 10 ft. and raising the grade of the tracks 7 ft.

[illegible] headroom in the subway. The subways for both streets under the tracks will be flanked by concrete retaining walls which allow a minimum width of 65 ft. between the walls. The south wall will be jogged back for stairways and waiting room space large enough to accommodate the new 75th St. suburban sta[illegible]

The railroad will be carried over the streets by a plate girder bridge with a steel-concrete floor. The bridge will be supported by steel columns resting on cylindrical concrete piers which are carried to hardpan. The concrete retaining walls which will flank the streets under the tracks will act as abutments for the bridge. A typical section of these walls is about 17 ft. in height, including a 5-foot foundation course. The top width is 3 ft. 3 ins. [illegible]

[illegible] first undertaken. The grade had [illegible] to within a short distance, and at [illegible] and the piles were driven so that their tops, when cut off, were below the ties. After this [illegible] and stringers placed under the ties from one bent to the next. Then on each side of each [illegible] bent. Directly over the streets, of course, [illegible]

[illegible] of the mixing plant and storage was of necessity confined to a small triangle which is shown in Fig. 1. The storage bins are placed under the east track. They have a capacity of [illegible] cu. yds. of sand and 100 cu. yds. of [illegible]. The cement is chuted [illegible] on this track to the cement sheds below. Each batch is drawn from the bins on the street level and is hoisted up to the Ransome mixer at the track level. After mixing, the batch is discharged into the main tower bucket, a standard Ransome bucket, and is hoisted to a hopper which is attached to the tower and is large enough to contain a full batch. This hopper discharges through a gate into the chutes which carry the concrete to place in the forms, either directly or via other hoppers and chutes, as may best be understood by reference to the accompanying photographs Figs. 2 and 3. The main tower which supports the chutes is 101 ft. high and the chutes slope at an angle of about 23° to the horizontal. At each of the other two towers shown in the photographs, hoppers are provided and auxiliary chutes carry the concrete to the forms. The chutes are made of galvanized iron in the shape of a trough 12 ins. square and reinforced on the edges with a 1½x2-in. angle. They are made in sections 10 ft. long and are suspended from ⅝-in. steel cables, strung from the towers to anchorages. The main chute is suspended from two cables placed 8 ft. apart vertically with tie-wires between. Two cables were used because of the difficulty of stretching one cable tight enough to prevent sagging when concrete was running. This way of solving the difficulty is very satisfactory.

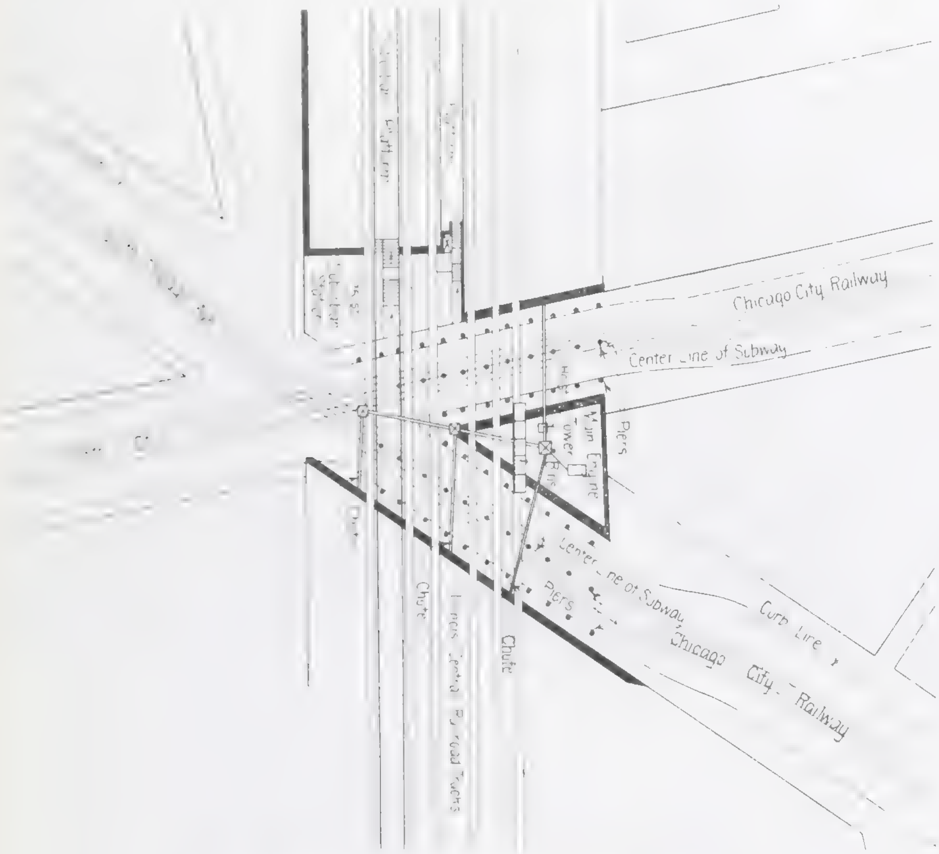

Fig. 1—Plan of Concrete Work at Grand Crossing.

At the ends of the chute where concrete is dumped into the forms, a flexible pipe is used. This consists of cylindrical sections of galvanized iron pipe 15 in. long and tapering from 10 ins. to 8 ins. in diameter. The sections are held together by two ⅛-in. chains, fastened at each side. By shortening or lengthening the chains the length of flexible pipe is made as desired. It was impossible to chute the concrete direct to all of the circular piers, but the longest haul necessary was about 25 ft.

The footing course of the walls is first concreted, and then the forms are built complete so that the walls may be run complete in 30-ft. sections. This section contains about 75 cu. yds., which is considerably less than the capacity of the mixing plant. The mixer is a No. 2 Ransome, and, when working steadily, a batch is discharged every 1¼ minutes, or in the aggregate, about 30 cu. yds. per hour, as each batch is about 18 cu. ft. of mixed concrete.

The crew necessary to manufacture concrete and deliver to the walls, without the use of buggies, consists as follows. The wages are estimated:

	Wage per hour.
2 men wheeling gravel from bins to hoist.	$ .40
1 man wheeling gravel from bins to hoist.	.20
1 man wheeling cement from storehouse..	.20
1 man tending hoist (below)	.20
1 man tending mixer at charging platform.	.20
1 hoist engineer	.35
1 man controlling lower end of spout....	.22½
2 men in hole	.45
1 foreman	.45
Total per hour	$2.67½

When Sterling carts are used for wheeling from the end of a chute, 2 to four wheelers are added and an extra man is necessary in the hole. The mixing and placing of cencrete with this plant, when running at 30 cu. yds. per hour, costs, therefore, from 9 to 12 cts. per cu. yd. This is, of course, for labor only, no overhead charges, plant charges, or supplies being considered. On account of the small section of wall placed, however, it is impossible to run the mixing plant at this capacity for a very long stretch of time.

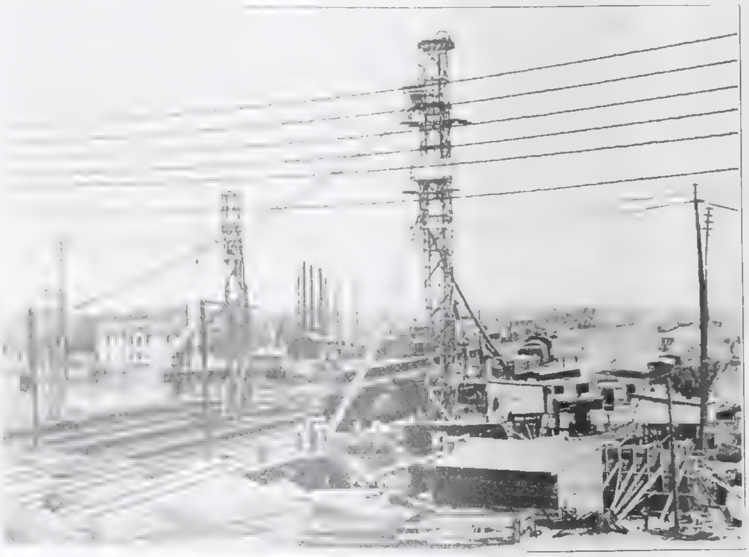

Fig. 2—View Showing Tower and Chutes.

As a comparison of the cost of spouting concrete with the cost of mixing and placing by the wheelbarrow method it is interesting to know that the old method has cost $1.50 a cu. yd. where concrete was being wheeled across busy tracks, and the present method costs only about 40 cts. a cu. yd. under the same conditions. Besides reducing the number of men necessary for the work, the use of chutes does not obstruct traffic, nor is the work hindered by the traffic. These last named figures include plant charges.

The Leonard Construction Company of Chicago is handling the work at Grand Crossing as well as at other crossings on the Illinois Central track elevation. Mr. W. M. Kallasch is superintendent. The work is being done under supervision of Mr. F. L. Thompson, Engineer of Bridges, Illinois Central R. R

Niagara Water Power.—Recent observations regarding the amount of water taken from Niagara Falls for power purposes have shown that only about 1 per cent of the average flow over the falls has been utilized.

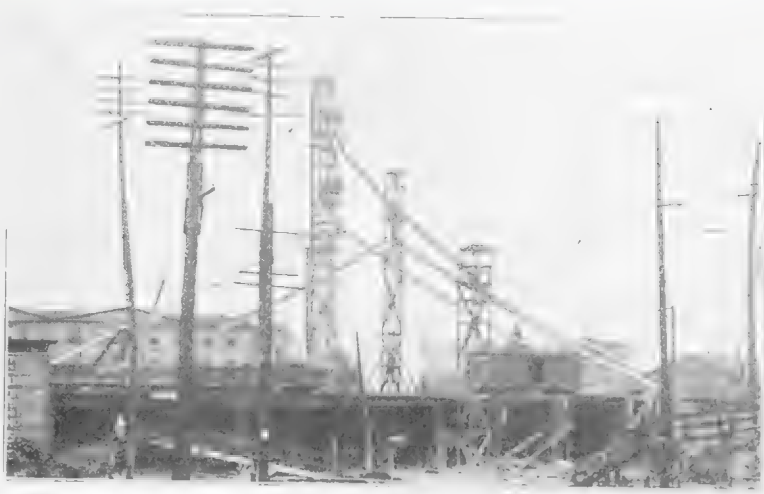

Fig. 3—View Showing Tower and Chutes.

ROADS AND STREETS SECTION

Dustless Roads of California.*

The writer takes up this subject with some diffidence since he has had less than a year's acquaintance with California and since he knows only by hearsay of the conditions which obtain outside of what is known as Southern California. As has been remarked before, California is a big state; it measures in area some 155,900 square miles and in extreme length more than 700 miles. It is thus possible for it to possess many varieties of climatic conditions. Southern California, however (and to that part of the state this discussion will be limited), may be called a dry country for perhaps eight months of each year, and during the summer months, a very dusty one. Almost no rain falls except during the period between Nov. 1 and March 1; the mean temperature in January is said to be 54° F., and in August, 72° F.

As a result of these climatic conditions, for a large part of the year the roads are absolutely dry, and except where they are oiled or watered they are extremely dusty and disagreeable to travel over. Much of the soil, particularly along the coast, is an adobe. The soil when wet is extremely unstable, but when dry it packs very hard, and where the travel is light it makes a better road surface than those composed of sand or silt, but when a considerable volume of travel used an adobe road, clouds of very fine dust are raised and the conditions become intolerable.

To lessen the dust nuisance many of the main traveled roads in times past have been surface oiled. It has been said that this oiling was done originally as much to protect fruit trees from dust as for any other purpose. In many instances the oiling was carelessly done and no particular care was given to the selection of the oil and doubtless in some cases better results would have been secured had a better grade of oil been chosen.

Asphaltic oil is very widely distributed throughout Southern California and in the vicinity of Los Angeles there are a great many wells. Most of the oil is used in its crude form or after a partial refining for fuel or illuminating purposes. The use of these oils for road purposes is, therefore, not more than secondary in importance and until recently no proper study seems to have been made to ascertain the qualities necessary for the best results in road construction and maintenance. So far it is the general opinion that the natural oils; that is, the crude oils with almost no refining, have given the best results in California, supposedly because in the refining process to get off quickly the lighter oils for illuminating purposes, the process is hastened by the use of high temperatures, resulting in the burning of the residuum. Since the residuum of the oil is the portion which is useful for road purposes, it is easy to see the cause for some of the poor results obtained. The burning of the residuum may also explain some of the poor results which have occurred from the use of California asphalts. Until the asphaltic road oil or solid asphalt ceases to be a bi-product, and until the refining is done carefully with intent to produce good asphaltic products the natural oils will probably give the best results.

Crude oils cost usually at the wells 75 cts. a barrel of 42 gals., and for refined residuums $1.10 may be taken as the average price. These prices mean $.018 per gallon for crude, and $.026 per gallon for the refined in tank car lots Some of the oil is said to contain as much as 75 to 80 per cent of asphalt.

One hears everywhere in Southern California the expression: "The oiled roads have received a black eye." The reason for this is apparent, since of the many miles seen by the writer nearly all were in an extremely bad condition. It was his good fortune to see these roads immediately after the first rain in many months. All of the inequalities of surface and ruts were marked clearly by standing water. Of all the roads so seen not one which was built according to the original California theory was in good condition. It was always said, however, that the conditions, as the writer saw them, were better than those which existed in the adobe soils previous to the oil treatment. It must be borne in mind that the oil was applied to these roads primarily to lessen the dust nuisance. In this respect alone the treatment was surely a success.

The old method of doing the work was to plow up the soil, harrow it, pulverize and apply the oil, at the rate of from 2½ to 3 gals. to the square yard, in one or more applications, as the road officer thought best, with the intent to get a sort of wearing coat, some inches in depth, thoroughly permeated with oil. Where the natural soil was sandy or gravelly the results were better than where there was only adobe, but no work of this kind was durable. Chuck holes and ruts soon developed.

It is fair to say here that the California road-builders are not unlike road officers elsewhere, at least in one particular. They seem to be of the opinion that, having once fixed up a road, no further attention need be given to it. If the ruts and chuck holes above mentioned had been properly filled when they were in an incipient condition the roads would no doubt be in better condition than they are now. The formation of ruts or chuck holes was attributed to the lack of solidarity or rigidity in the oil impregnated coating, which was doubtless true in part, and so the petrolithic roller was introduced to remedy what was thought to be the sole difficulty.

In brief, the petrolithic roller consists of a drum, about 4 ft. in diameter, having distributed over its peripheral surface a number of studs or projections, about 9 ins. in length, in rows, and staggered, the projections each having an area of cross-section of about 4 sq. ins. The rollers weigh about three tons and are usually drawn by four horses.

Perhaps the best work done at first by this process was in the vicinity of Pasadena. There the roadway, after it was brought to the established crown, was plowed to a depth of 6 ins., graded and rolled with a petrolithic roller to within 4 ins. of the finished surface so as to form a compact sub-grade. The roadway was then sprinkled, loosened and oiled with from one-half to three-quarters of the total amount to be applied to the road. The road was then plowed to a depth of 5 ins. below the finished surface and tamped with the roller to within 1½ ins. of the finished surface. With a road grader the road was then shaped to a true and even grade and a second coat and the remaining amount of oil used was applied and a layer of gravel or rock screening spread evenly upon the surface. The road was then plowed lightly and rolled with a tamping roller until it was thoroughly hard and unyielding and conforming to the desired cross-section. Any surplus oil remaining on the surface was absorbed by clean, sharp sand or stone screenings, and the road was rolled with a smooth roller. The specifications provided that the total amount of oil to be used should not be less than 2 gals. nor more than 3 gals. to the square yard of street surface and the oil was required to contain not less than 65 per cent of asphalt. It was applied at a temperature not less than 200° F.

When inspected by the writer the work above described was three years old. The soil was an adobe. No foreign material, such as stones and gravel, was introduced, and the work cost about 27 cts. per square yard. This price may be taken as a fair average cost of this kind of work under the conditions pertaining to Southern California. Much work of this kind has been done within the past two or three years, and when sand or gravel was used with the oil the results seem to have been fairly good.

The writer [illegible] amount of work in one locality where there is much sand [illegible] phaltic oil by the petrolithic process. No stones were added as the gravel is very stony, containing fragments up to about 3 ins. in diame-

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*Paper by Austin B. Fletcher, M. Am. Soc. C. E., secretary-engineer, San Diego County Highway Commission, California, presented at the third National Good Roads convention, held at St. Louis, Mo., Sept. 28-30, 1910 [illegible] years old was in fine condition. The surface is smooth and slightly elastic or "rubbery." This work, including a small amount of grading, was said to have cost about 30 cts., a square yard.

The use of the petrolithic roller, except in gravelly soils or where stones or gravel are added to the soil, has been practically abandoned. By the addition of the stones, greater stability is secured and the road does not seem to rut so easily nor to shift "under the traf- [illegible]

The following specifications for "Petrolithic Macadam" is the most recent development in this kind of work:

SPECIFICATIONS FOR PETROLITHIC MACADAM.

[illegible] including all intersections of streets and alleys, [illegible]

The street shall be plowed to a depth of not less than 6 ins. It shall then be thoroughly pul- [illegible] oughly sprinkled with water and dampened throughout.

Oil at a temperature of not less than 175° F., when it is spread, shall then be uniformly ap- [illegible] spread, the street shall be thoroughly cultivated. [illegible]

A second coat of oil at a temperature of not [illegible] after the oil is spread, the street shall be [illegible] diagonally until the oil is thoroughly mixed with the soil, and the whole mass is of uniform color and no streaks can be detected, the [illegible] of cultivating the oil into the soil as frequently [illegible] plowed across its entire width 6 ins. deep [illegible] furrow.

The street shall then be recrowned with a road grader and tamping begun with a rolling tamper, which shall be immediately followed [illegible] lower and shallower depths, the purpose of cultivating being to keep the upper layer of the [illegible] to effectively consolidate the lower part of the [illegible]

[illegible] water as often as required to [illegible] more than 3 ins., use of the cultivator may stop, but the tamping must be continued. [illegible] street shall [illegible] shoes of the rolling tamper will no longer sink [illegible] the material to crawl under the tamper feet, the [illegible] street.

A layer ½-in. thick of rock screenings or pea gravel, free from dust (maximum size, ½ in.) shall then be applied, thoroughly sprinkled and screenings rolled into the surface of the pavement, with a smooth roller weighing not less than 250 lbs. to the inch width of tire. Should an excess of oil remain on the surface after the rolling has been completed, a sufficient amount of screenings or gravel, above described, shall be spread over the surface to absorb such excess. The smooth roller above specified shall then be run over the street until the surface is smooth and firm. Any portion of the street that cannot be reached by the rolling tamper or smooth roller shall be solidly tamped by hand.

For spreading the several coats of oil herein provided for upon the roadway, the only style of apparatus that shall be used shall consist of a cylindrical distributing drum attached to the rear of the supply, or tank wagon in which the oil shall be brought upon the roadway, which cylindrical distributing drum shall be suspended near the surface of the street, and provided with openings regulated by valves, from which openings the oil shall be evenly spread upon the roadway in a number of small streams.

OIL

The oil used shall be Adilane Sunset oil, which shall contain at least 75 per cent of asphalt, and must not have been injured by overheating.

The newest development in the use of asphaltic oil for country road purposes consists in combining the upper course of the macadam road with oil. This method has been used to a considerable extent in Pasadena, and it has been generally adopted by the Los Angeles County Highway Commission in its work. In brief, the process is as follows: The lower course of macadam is constructed in the usual way, except that an attempt is made to fill thoroughly all the voids and to leave the upper surface of the lower course smooth, true and unyielding. The second course of stone is then applied to such a depth that it will be approximately 2 ins. in thickness after rolling. The stones in this course vary in size from 1½ to ¾ in. in their longest dimensions. This course is rolled thoroughly with a steam roller, and the depressions are filled with stone, as in the ordinary macadam work. Then ¾ gal. of oil is applied to each square yard, and a coat of sand or screenings is spread to a depth of ¾ in. The surface is then watered and rolled, and ¼ gal. of oil to the square yard, in addition, is applied. A light coating of screenings, ¼ in. and under in size, is then spread evenly to a depth sufficient to absorb all surplus oil and produce a uniform surface with no oil exposed and no patches of excess screenings. The road is then watered and rolled thoroughly until it becomes hard and smooth, true to [illegible] cross-section free from all hollows and irregularities.

For such work done under the supervision of the Los Angeles county commission, where the macadam is 16 ft. in width, 8 in. in depth in the center, and 6 in. at the sides, with 7 ft. of surface oiled, earth shoulders on each side, the cost runs from $8,000 to $11,000 per mile. The broken stone is now being furnished from quarries owned and operated by the county, delivered on the cars at the quarry to the contractors. The cost of the stone on the cars at one of the quarries is said to be 55 cts. per ton. The high freight rates which prevail in California account in part for the large cost per mile. About 40 miles of work of this character is already completed. The surface resembles very much sheet asphalt work, but such roads will [illegible] time, probably by surface coatings. In the [illegible] such work will prove to be very satisfactory, particularly where there is much automobile traf- [illegible]

In Pasadena, very similar work has been under traffic for two or more years, and all of these roads seen by the writer were in excellent condition.

At Point Loma, in San Diego county, work of an entirely different character has been done. There exists on Point Loma a deposit of sand intimately mixed with clay, said to contain 15 to 30 per cent of clay. The road there, several miles in length, was first properly graded, and its surface broken to a depth of 6 in. and pulverized with a harrow, all coarse material being removed. Water was then applied until the loosened material was thoroughly wet. A petrolithic roller, similar to that already described, was then employed until no impression was made by the tamper feet deeper than 2 ins.

The surfacing material referred to above as "sand-clay" mixture was then applied in two courses, the first having uniform depth of 3 ins. This course was thoroughly wet and rolled with the petrolithic roller in the same manner as was the subgrade. The second course in the amount needed to bring the roadway to the finished grade was then applied, attention being taken that the total depth of the sand-clay mixture should be 6 ins. in center and 4 ins. at the sides in depth. The second course was then wet and rolled with the petrolithic roller as previously described. When thoroughly compacted, water was again applied and a split-log drag drawn over the surface until it was true to the desired cross-section and then the surface was rolled with a smooth roller.

The resulting road is smooth and very hard. Traffic does not rut it, and when sprinkled once a week it is practically dustless, even under fast automobile traffic. This road receives careful attention, and during the wet months the split-log drag is frequently employed.

All of the different kinds of work before described result in roads which are practically dustless if they are given the proper amount of attention, but it is the opinion of the writer that combinations of asphaltic oil with sand, loam or clay, in thick layers and without the addition of gravel or broken stone to insure stability, are not a success. Such roads may be kept practically free from dust, but their surfaces are so uneven as to condemn the process.

The writer believes that the oil macadam adopted by the Los Angeles County Highway Commission is a step in the direction of smooth, dustless roads or country highways. He is in doubt, however, whether or not it would be as cheap in the long run to build these roads in the ordinary way, and after they have been under traffic for a short period, to place a thin, protective coating of asphaltic oil on them, on the theory that such coatings will have to be renewed every year or two, depending on the amount of traffic. It is his opinion that the roads as built will require surface application of oil from time to time and he is somewhat in doubt under California conditions as to which method would be the cheaper in the long run.

The method employed at Point Loma where no oil is used seems to be ideal for the conditions which exist there, and there is no doubt that this process may be employed in other places and that results approximating the Point Loma results may be secured by the artificial mixing of sand and clay in proper proportions.

Much work is being done at the present time by several of the counties in Southern California on county highway systems. The methods employed by the different counties vary to a considerable extent, but all of the counties are seeking a type of construction which will result in dustless highways, and there seems to be no doubt that within a few years the intolerable dust conditions which now exist on the country highways will be done away with.

Steam Shovel Record in Culebra District.

Sixteen shovels of the 200 class, working in the Culebra construction district of the Central Division, excavated 27,797 cu. yds. in an 8-hour day, on Sept. 15. This is an average of 1,737 cu. yds. for each shovel. The shovels were under steam 128 hours.

Dustless Roads in Europe.*

The topic of "Dustless Roads in Europe" covers rather a broad field if it is to be considered in its entirety. The writer will confine the present paper to a consideration of the salient and unique features of European practice and endeavor to point out in conclusion those characteristics of foreign methods of administration, construction and maintenance which should receive careful consideration from American engineers and officials responsible for the development of systems of improved roads in the United States.

The adaptation of certain types of pavements for trunk lines in suburban and country districts and likewise the employment of the same methods for the allaying of dust and the preservation of the road surface by both state and municipal engineers requires a readjustment of ideas and classifications. At the Second International Road Congress held in Brussels in August, Section 1, devoted to Construction and Maintenance, had subdivision A, Construction and Maintenance outside of large cities, and subdivision B, Construction and Maintenance in large cities. This subdivision proved unfortunate and at times confusing as, in certain cases, exactly the same problems were considered at both meetings due to the self-evident reasons referred to previously. In the future each type of pavement and each method of construction and maintenance should be considered from the standpoint of its inherent advantages and disadvantages and its adaptability to certain conditions.

Although rectangular stone block, vitrified brick, wood block, sheet asphalt and asphalt comprimé have been advocated by some American and European engineers for use on the class of roads which the writer believes the title of this paper covers, for the sake of brevity they will not be discussed, although their use in Europe, differing materially from practice in the United States in many cases, is deserving of thoughtful consideration. Unfortunately the nomenclature used in connection with the many problems of modern highway engineering is in a state of confusion and results in erroneous conclusions being drawn from reports and papers due primarily to the natural misinterpretation of technical terms. The writer will, therefore, make a preliminary statement relative to the types of road surfaces in connection with which bituminous materials are used. The term bituminous pavement will be used to designate a road surface constructed by either the mixing or penetration method in which a bituminous binder is employed, while the phrase, bituminous surface, will be used to imply a thin bituminous coating on the surface of a pavement or a road. Superficial tarring, the application of tarred chips or tarred sand and the use of all kinds of asphaltic coatings will come under this designation.

The so-called dustless surface has existed for many years in Europe as well as in the United States. The phrase as employed in the present era refers to roads or streets whose surfaces have been so treated or constructed as to be practically non-productive of dust when traversed by swiftly moving motor cars.

The campaign in Europe against dust and the deterioration of road surfaces caused primarily by motor car traffic was inaugurated by Dr. Gugglielminetti of Monte Carlo, who, during the past ten years, has organized "Leagues against Dust" in many European countries and with unswerving enthusiasm has worked continually to interest officials and engineers in the necessity for the suppression of dust. The results of his successful experiments with superficial tarring in 1902 at Monaca were published throughout all Europe. In the following year trials were carried out at Champigny by the engineers of the Department of Roads and Bridges of France. In the 1903 report on these trials the French engineers formulated all the basic principles of superficial tarring. Unfortunately the writer has found many instances in Europe and in the United States where these simple axiomatic rules have been ignored resulting in unsatisfactory surfaces and the uneconomical expenditure of many thousands of dollars annually.

After the world powers of Europe had been for several years developing various systems for the allaying of dust and the preservation of the road surface, the French engineers, realizing that an exchange of ideas and a dissemination of knowledge acquired, was desirable from the standpoint of economical procedure in the future, through the medium of the French Government, organized the First International Road Congress which resulted in the formation of the Permanent International Association of Road Congresses. The influence of the association upon all the European countries with the possible exception of England has been far reaching and decidedly beneficial. In many cases the conclusions and recommendations of one congress are made the basis of new construction work carried out before the succeeding congress. The permanent association should receive the hearty support of all interested in modern highway construction as only through the medium of an international organization will it be possible to economically assimilate and disseminate knowledge relative to methods employed and results secured throughout the civilized world and to satisfactorily secure an interchange of views and opinions among those interested in the economical construction and maintenance of roads adapted to all the various classes of traffic to which the modern highway is subjected.

While superficial tarring was the only method used extensively during the opening years of the twentieth century many new methods and types of construction have since been adopted especially in England. The different types of road surfaces employed in practice by the engineers of the various countries of Europe will be generally referred to before an attempt is made to point out commendable features of foreign practice.

The predominating method employed by the French engineers during the past nine years has been the use of tar as a surface coating mainly on roads of ordinary macadam. Superficial tarring has been accomplished by two general methods, application by hand and by machinery, both cold and hot tar being applied by both methods. Application by machines has been adopted for many years by some of the French engineers. Two types have been employed, the pressure spraying machine and the gravity flow machine. There are two forms of the second type, namely, those equipped with mechanical brushes and those without; the further distribution of the tar being accomplished by hand brushing in the case of the latter type. By no means is there a consensus of opinion among French engineers relative to the comparative merits of the various machines. Another subject under discussion in France which is of special interest to the motoring public is with reference to the relative value of allowing the tar coat to remain without being covered with sand, gravel or stone screenings for a period of time or to apply such coating immediately after the application of the tar. As the amount of time considered requisite by various engineers varies from a few hours to one or even two days under similar conditions it would seem desirable that complete service tests should be made to determine if the advantages claimed for the delayed application of the covering are real or imaginary. The maintenance of the macadam surface of that famous Parisian boulevard, the Avenue du Bois de Boulogne, is interesting, due to the fact that twice during the year, once in May and once in October, its surface is coated with tar. During six months of the year its surface resembles that of a perfect sheet asphalt pavement. In February and September, however, the tar begins to disappear from the surface of the traveled ways and small depressions are naturally formed in many places. It should be noted that the traffic is intense amounting from 700 to 1,000 vehicles per hour during certain periods of the day.

A unique method of surface application, which is only in an experimental state in France, is called by the inventor, "Goudronnage par le Feu." The method consists in the application of cold crude tar to the road surface and the subsequent setting on fire of the tar coat. Comment on the inconvenience caused by burning hundreds of gallons of tar on the public highway is superfluous.

Under the direction of the Technical Commission of the Department of Roads and Bridges of France many experimental sections of various types of surfaces and pavements are being constructed on the national roads. The most interesting and, in the opinion of the writer, the most satisfactory experiment thus far made was the construction of a section of asphalt macadam on the trunk line between Versailles and Paris in August, 1909. The method consisted of mixing broken stone, sand, asphalt mastic and Trinidad asphalt in a caldron. The mixture was spread to a depth of from 1¾ ins. to 2 ins. on a foundation of ordinary macadam and thoroughly compacted. The writer inspected this section in November, 1909, and again in July, 1910. At both times the surface was found to be in perfect condition and was of such a character as to provide a good foothold for horses. In addition to the experimental work of the commission many of the French engineers have experimented with palliatives and many types of bituminous and cement concrete pavements. As many of these methods are used extensively in other countries the description of the same will be deferred.

In Belgium, Italy and Switzerland two types of construction are employed, namely, superficial tarring and a pavement constructed by the Aeberli system. The methods used in connection with superficial tarring are similar to those employed in France, in fact, they were adopted from the French practice.

The Aeberli system of constructing a bituminous pavement has numerous unique features. First, by means of one machine, the broken stone is dried, cleaned and finally passed through a cold bath of crude tar. The tar coated stone is then stored in piles covered with a blanket of sand 3 to 4 ins. in thickness for a period of from three to six weeks after which it is used in the ordinary way for the construction of a bituminous macadam pavement.

Austria for the past five or six years has been experimenting with superficial tarring and various types of bituminous pavements constructed by the mixing method. The engineers of Austria, in common with those of northern England and the United States, have to contend with the disintegrating effect of the blows from horses' hoofs shod with shoes provided with calks. Those of the Austrian horses are without doubt the most disastrous in their action on road surfaces as the shoe is equipped with four calks instead of two, while the shape of the calk is that of a pyramid mounted on a prism. The resulting effect is that on warm days many bituminous surfaces are honeycombed with perforations.

In Germany, in addition to superficial tarring by hand and by various types of German machines and the construction of bituminous pavements of various types by the mixing method, the highway engineers have used very extensively both for city streets and trunk lines subjected to intense motor car traffic a type of stone block pavement known as kleinpflaster. The small stone sets used are so cut that when laid they form circular or parabolic arcs. The stone blocks are laid on a foundation of macadam or concrete with a cushion coat of sand or gravel and with joints filled with sand or gravel and in some cases grouted. Laid in circular arcs, the joints of the pavement are continually broken from the standpoint of traffic resulting in a surface much smoother than ordinary stone block and not as noisy. Hundreds of miles have been constructed throughout the empire, while its future seems assured as it is enthusiastically supported by the German engineers and the motoring public. A departure from the German practice is found in Hungary where small square blocks are laid in straight rows forming angles of 45 degrees with the longitudinal axis of the road.

The British engineers have expended large sums of money in the development of many types of bituminous surfaces and pavements adaptable to economical use on trunk lines subjected to heavy and intense traffic and in some cases as a substitute for asphalt com-

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*Paper by Professor Arthur H. Blanchard Consulting Highway Engineer. Brown University. Providence. R. I., presented at the Third National Good Roads Convention. held at St. Louis, Mo., Sept. 28-30, 1910.

[illegible] versity of opinion which exists among British engineers when it is remembered that especially in England, bituminous surfaces and pavements have been constructed for many years. However, remarkable progress has been made both from the standpoints of construction and maintenance. If the Third International Road Congress is held in London in 1913 as the writer hopes and believes it will be, many of the differences of opinion will be brought to a focus at that time. Another powerful factor which will tend to determine the relative value of many of the varying types of construction is the new Road Board of England, who will control the granting of government aid for the construction and maintenance of trunk highways. It must not be inferred that the writer considers that one remedy will eventually be found which will be applicable to all classes of roads subjected to all classes of traffic, but, as will be seen in the description of the various methods used, differences in practice exist which are susceptible of assimilation provided that comparative tests are made based on scientific principles.

One feature of English practice is materially different from the Continental practice, namely, the more general use of refined tar. This practice is not universal but has, however, new adherents each year.

[illegible] the various methods employed in England and Scotland for allaying dust and the preservation of the road surface, the use of water and the numerous palliatives wtih which the European market is flooded will not be alluded to in detail. One interesting and instructive characteristic of foreign practice will be mentioned. The use of the various palliatives by European engineers is based on the economics of dust prevention considered in conjunction with other controlling factors. Two illustrations will be cited. At the birthplace of the campaign against dust by the use of superficial tarring, namely, in the principality of Monaco, ordinary watering is used to lay the dust on the boulevards surrounding the beautiful gardens in front of the Monte Carlo Casino. The watering of these surfaces once per hour in the most scientific manner the writer has ever observed serves to allay the dust, cool the atmosphere and furnish a road surface which is in harmony with its magnificent environments. The other instance to be cited is the case of the Bois de Boulogne, which is adjacent to the city of Paris. Its engineer, although allowing one of the avenues to the race course, Longchamps, to be tar coated for experimental purposes, is a firm believer in the use of palliatives for the boulevards of the Bois inasmuch as the surfaces thus treated are satisfactory from the standpoint of aesthetics and at the same time dustless. The problem of the maintenance of the many miles of these charming avenues is an extremely complicated one which has not as yet been solved. The avenues in many cases are subjected to traffic which will rapidly disintegrate ordinary macadam treated with any of the palliatives at [illegible] vestigate the dust laying qualities of calcium [illegible] effect "that the results of the tests of calcium chloride applied in granular form by the dry [illegible] dust layer "but" the treatment has the ill effects of causing, during the winter months, [illegible] tendency to picking up, and a disintegrating [illegible] standing this, we are of the opinion that the [illegible] macadamized roads than the excessive watering [illegible]

Within the borders of England can be found [illegible] in the world. Proceeding from the simple to the complex the first type which will be considered is superficial tarring. Hundreds of miles have been so treated either by hand method or by various machines of the types used by French engineers but of British design. Two notable diversions may be found from Continental practice by a thorough investigation of English practice. One is the positive conclusion on the part of many engineers that the use of refined tar for a surface coating is economical and possesses many advantages over the use of crude tar. One advantage which is appreciated by motorists is that a road properly coated with refined tar can be opened to traffic within a few hours after treatment. Roads coated with crude tar, however, may have to be closed to traffic for two or three days. In connection with the use of refined tar it is of interest to note that a number of British engineers feel compelled to use refined material from the standpoint of the danger of damages being claimed for the pollution of fish streams by the washings from a road surface treated with crude tar. The second difference is, that the practice of some eminent English highway engineers is to omit the surface dressing of sand or screenings as the same is not considered either necessary or efficacious.

The method of using tarred sand, gravel or chips in both England and Scotland in connection with the construction of ordinary macadam and bituminous pavements is worthy of consideration. The practice of many engineers is to use the fine tarred material as a filler, rather than as a carpet or coating, thus allowing the mosaic surface of the upper layer of macadam to take the wear.

The durability of the various types of tar macadam roads constructed by the British engineers is remarkable, especially, when the character of the intense and heavy traffic to which a large percentage of the mileage of this class of road is subjected is taken into consideration. This traffic, consisting of heavy motor vans, tractors and traction engines hauling, in many instances, from one to three trailers, is unknown in the United States and on the Continent.

Bituminous pavements have of course been constructed for many years previous to the twentieth century but, at present, interest is centered on those types which have been used during the past ten years. Two methods have been used to a considerable extent, namely, the penetration method and the mixing method. Two modifications of the penetration method as usually employed in the United States will be mentioned. Pitchmac is constructed on a foundation of inferior stone which has been flush coated with bituminous material. On this foundation a layer of 1¼-in. stone, varying from 2 ins. to 4½ ins. in depth, is rolled in from one to three courses, a coat of bituminous material being applied to each course, while the surface is completed with a top dressing of chippings. The bituminous mastic used consists of pitch, creosote oil, fine sand and other ingredients. The writer, while in Liverpool, inspected many sections of pitchmac which had been subjected to severe traffic for many years, one having been down nine years, and in every case found the surface in excellent condition. The other modification of the penetration method is the Gladwell system which consists of first, lightly rolling a thin layer of 2-in. stone on a bed of bituminous mastic; second, painting with refined tar, and third, filling the voids of the surface with mastic, after which the pavement is rolled and at once opened to traffic.

In the mixing method of constructing bituminous pavements two variations from the common American practice should be noted. First, the employment of a great variety of mixers, some of which are very satisfactory in the results secured judged from the standpoints of economics and the quality of the mix. Mixing machines of both the batch and continuous types have secured the attention deserved, by British manufacturers. Unfortunately the limitations of the various machines [illegible] version from American practice is in the extensive use of slag since the first successful experiments were carried out twelve years ago. Although Tarmac or tarred slag has its limitations as is the case with all classes of pavements, the roads coated with a Tarmac surface which are found all over England are generally excellent in character. In connection with the mixing method it should be noted that asphalt either alone or in combination with tar and other materials has been successfully employed in the construction of many sections of bituminous pavements.

The introduction of Durax as a substitute for wood block, asphalt comprimé and other bituminous pavements and even for ordinary stone block in some cases has occurred during the past few years. Durax is simply the kleinpflaster of Germany with the addition of a bituminous cushion between the foundation and the stone blocks and the joints filled with a bituminous mastic. The city of Birmingham furnishes many examples of Durax pavements which have been under service for a number of years and appear to be giving satisfaction, although subjected to heavy and intense traffic.

Trackways of rectangular stone blocks averaging 12 ins. wide, 6 ins. thick and of varying lengths have been used for many years on steep hills or where the traffic is exceptionally heavy in some cities of England and Scotland. Trackways both of stone blocks and steel girders laid in ordinary macadam are now proposed by some foreign engineers as a solution of the problem of economically maintaining macadam roads subjected to motor car traffic.

Throughout the Continent and the British Isles improved roads have for many decades received the attention that their influence on the development of civilization justifies. On this side of the Atlantic the highway engineers have since the early nineties rapidly developed systems of highways in many states, the total aggregate being, however, comparatively small. Moreover the fact must be recognized that highway engineering as an applied science has, in many parts of Europe since the days of Trésaguet, Macadam and Telford occupied a more exalted position in the broad field of engineering than it has in the United States. It is not surprising, therefore, that today we should find in one European country, France, the most perfect system of macadam roads in existence when considered from the standpoint of the average quality of all its roads, national, departmental and vicinal, and, that in another, namely, England, that the engineers have successfully constructed and economically maintained with dustless surfaces a larger percentage of the total milegae of its roads than elsewhere in either hemisphere.

With a heritage of thousands of miles of well constructed macadam roads maintained in many instances by systems of maintenance more or less approaching that ideal established by the French Department of Roads and Bridges, the opening of the twentieth century found the European engineers in an enviable position to cope with the problems imposed upon them by the advent of that new type of traffic, the swiftly moving motor car. From foreign methods of constructing and maintaining the various classes of dustles surface the American engineer should be able to deduce many lessons of value.

In conclusion the writer will call attention to some of the characteristic features of foreign practice which could advantageously be adopted in certain localities of the United States.

In marked contrast to the practice in many sections of the United States, especially in our municipalities, is the well established custom of giving to one department complete control of the design, construction and maintenance of roads and pavements. The practice in many of our cities of assigning the design and construction to the city engineer and the maintenance to the commissioner of public works would not be considered good practice from the standpoint of economics.

The responsibility for the solution of engineering problems in Europe is placed where [illegible], namely, on the chief engineer. If his first solution is not financially possible or advisable another is requested, but with practically no interference on the part of laymen with the engineering features of the problem. As a direct result of the above custom three commendable features of foreign practice have become well established in many countries. First, the same thorough preliminary investigation is given to a road problem as is now given to the design of a water-works system or a sewage disposal plant in the United States. Second, the rapidly developing practice, especially characteristic of the work of the leading municipal and county engineers of England, of constructing that type of surface or pavement which is economically adaptable to local conditions and environments. Third, the development of economical systems of continuous maintenance. One feature, characteristic particularly of the French and English systems of maintenance, is of special interest to the motoring public, namely, the development of economical methods of surfacing large areas with tar or other compounds at the beginning of the summer season. In France this means that the bulk of superficial tarring is done in May and June while in England, due to the rainy season, the work extends into July. In connection with superficial tarring it is interesting to note that the fact has been established, based on the best English and French practice, that it is possible to tar paint macadam roads traversing woods without the subsequent formation of the black mud about which so much has been written.

A commendable feature of French and English practice is the construction of trunk lines with a greater width of the metaled surface than is characteristic of the American highway. This results, when considered in connection with the reduced crossfall or crown, in a highway which is ideal from the standpoint of modern traffic and more economical in maintenance due to the self evident distribution of traffic over the surface of the road.

On the Continent and the British Isles the fact has become well established that it is economical within certain limits to only use road metal of the best quality for the surface with the result that the greater part of the broken stone employed is hauled many miles, although stone of inferior quality may be at hand.

There are many engineering features in connection with the design, construction and maintenance of European roads that are worthy of duplication by the engineers of the United States, but the limitations of this paper will not permit of a discussion of technical details.

In one field of modern highway engineering, namely, the investigation of the effect of the various chemical and physical properties of bituminous materials on the adaptability of the materials for use in the construction and maintenance of roads and in the drawing of specifications covering these properties, the foreign engineers recognize that American practice is far in advance of European. The engineers on the other side of the Atlantic expect that the progress reports submitted by the engineers from the United States at the Third International Road Congress in 1913 will contain valuable information relative to bituminous pavements and surface constructed and maintained with bituminous materials supplied under specifications.

WATER-WORKS AND SEWERS SECTION

A Novel Form of Concrete Reservoir Wall Construction.

The construction of a novel form of reservoir wall for the Cobbs Hill Reservoir of the Rochester, N. Y., water-works was described by Mr. John F. Skinner, Principal Assistant City Engineer, in a paper read at the recent convention of the New England Water-Works Association. Though this structure was completed some three years ago, its design is so uncommon that at least details of its behavior are of interest. We take the following data from Mr. Skinner's paper:

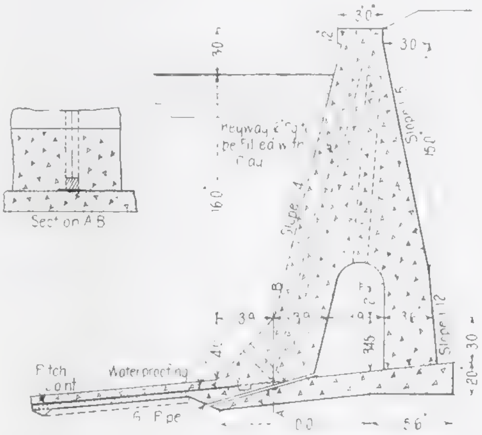
The reservoir is about 1,500 ft. long by 600 to 700 ft. wide and is a sort of irregular ellipse in shape. It was lined with concrete throughout. The bottom consisted of a 3-in. course of concrete laid continuously in long strips for convenience about 14 ft. wide. To this the waterproofing was applied, which consisted of 6 moppings of hot coal tar pitch and 5 layers of single-ply coal tar felt. Above this came the top layer of concrete 6 ins. thick, laid in 12-ft. squares with pitch joints. In anticipation of the cracking of the lower layer of concrete directly beneath the joints in the upper layer (due to change of temperature in the water) which might result in a fault and a rupture of the waterproofing layer, the lower layer of concrete was thickened to 6 ins. beneath the joints in the upper layer, and steel reinforcement was placed transversely to the line of the joint in this thickened portion. An interesting laboratory experiment extending over a long period with the temperatures changed artificially indicated this method of treatment.

The reservoir wall, constructed in separate blocks of mass concrete 20 ft. in length, rests upon a foundation course about 18 ins. in depth laid in blocks 10 ft. long. The transverse joint between the foundation blocks was offsetted 6 ins. from the joint between the wall blocks, so that a reduction in the length of a wall block, due to contraction, would not crack the foundation block beneath the joint. The waterproofing of the bottom of the reservoir was carried under the toe of the wall for 2 ft. At the joints between the wall blocks it was carried 3.5 ft. further to connect with the stop-water or key-way between the wall blocks.

This key-way consisted in a channel 8 ins. square, set diamond-wise, 1 ft. from the face of the wall, half in one block and half in the next. This opening was filled with clay and sand, rammed with a light pile driver specially constructed for the purpose.

These 20-ft. wall blocks contained 106 cu. yds. of concrete. A central passage was left through the wall which saved about 1 cu. yd. per lin. ft. This passage is for inspection, the wall being 3.5 ft. in thickness both in front and back of the opening. A tell-tale pipe 1 in. in diameter was built into the foundation weather amounts to about 20,000 gals. per day; in warm weather, it is scarcely appreciable. Recent gagings show less than 1 gal. per minute for the 3,600 lin. ft. of wall.

It was originally intended to make a concrete of screened sand and gravel, but early blocks every 20 ft. said pipe at one end, opening into the tunnel passage and, at the other end, into the sand and gravel beneath the toe of the foundation block, the purpose being to indicate by a jet of water into the tunnel if a break occurred in the lining near the foot of the wall. Up to the present time no indication of this kind has been recorded. This tunnel is 7 ft. high, and is lighted by electricity. The leakage through the joints in cold



Section of Cobbs Hill Reservoir Wall, Rochester, N. Y.

in the work this was changed to run-of-bank, the latter being uniformly good. Volumetric measurements of voids in the material were made daily during the construction of concrete and it was found that 1 bag of cement to 6 cu. ft. of sand and gravel produced a concrete a trifle denser than an artificial mixture of 1 cement, 2½ sand and 5 clean gravel. The wall blocks were generally built in two shifts, no stop being allowed until 2 ft. above top of the tunnel. Some blocks were made in a single shift. They were built alternately, the intermediate blocks being constructed after the first forms had been removed. The concrete was prepared in a Hains' mixer, dumped into yard buckets on cars hauled by locomotives and then handled by a McMyler crane. Ten forms were built for the wall blocks and used repeatedly, as 180 blocks were constructed. The material was brought to the mixer on a belt conveyor and the concrete for the bottom was hauled on an industrial track by a home-made gasoline motor.

The area of the water surface in the reservoir, when filled, is 18.6 acres, and the maximum depth of water is 25 ft. Its contents is about 144,000,000 gals. Mr. Frederick P. Stearns was consulted in the preparation of the plans and specifications, and Messrs. Dow & Smith were retained in connection with the pitch waterproofing, and Olmstead Brothers in connection with the landscaping. The reservoir has been in constant operation since its construction and has proved satisfactory both in design and workmanship.

Some Costs of Operation of the Albany, N. Y., Filter Plant.

The filter plant at Albany, N. Y., comprises eight slow sand filters constituting the original plant, and a preliminary filtration plant of 16 units each of 810 sq. ft. filtering area which was put in operation Oct. 29, 1908. In the report of H. J. Deutschbein, Superintendent, for the year ending Sept. 30, 1909, the cost of operating this plant from Oct. 3, 1908, to Oct. 2, 1909, during which period, 5,059 million gallons were filtered, was as follows:

	Total.	Cost per million gals.
Pumping Station:		
Engineers and firemen	$7,962.18	$1.57
Incidental labor	815.87	0.16
Coal	7,292.87	1.43
Oil	305.86	0.06
Repairs and supplies	1,694.73	0.33
Ice	12.95	0.02
Total	$18,084.46	$3.57
Preliminary Filters:		
Attendants	$2,337.81	$0.46
Removing, washing and replacing sand	644.29	0.13
Total	$2,982.10	[illegible]
Slow Sand Filters:		
Scraping beds	$779.41	[illegible]
Removing scraped sand from beds	2,329.03	0.46
Washing dirty sand (for labor only—water used not charged)	502.76	0.09
Restoring washed sand to filters	[illegible]	[illegible]
Forking beds to obviate compacted sand layer	274.29	0.05
Removing sand from court to storage pile	764.44	0.15
Removing ice from filter	[illegible]	[illegible]
Removing, washing and restoring 14,134 cubic yards of sand (entire sand layers in filters 1, 3, 6 and 7)	[illegible]	[illegible]
Incidental labor, repairs, etc.	546.94	0.11
Supplies	[illegible]	[illegible]
Ice	[illegible]	[illegible]
Total	[illegible]	[illegible]
Laboratory:		
Chemist	[illegible]	$0.31
Laboratory help	1,926.36	0.38

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Ice	25.90	0.01
Total	$4,330.84	$0.86
Superintendence	1,911.52	0.38
Grand total	$38,606.81	$7.63

Results of Experiments on Double Filtration at the Albany, N. Y., Water-Works.

An appropriation of $[illegible] was made by the city of Albany, N. Y., in 1905, for improvement of the water supply. When the improvements were first contemplated it was intended to increase the filtration plant by adding 4 new filters to the 8 slow sand filters in operation, but as the matter of increasing the supply came before the public, a demand came from those consumers taking water from gravity supplies independent of the filtered supply that they should also be supplied with filtered water. The problem of supplying the entire city with filtered water with the limited appropriation at hand was then considered. The average daily consumption of water throughout the city in 1904 was about 20,000,000 gals., of which about 13,000,000 gals. was filtered water from the Hudson River, and about 7,000,000 gals. was unfiltered water from gravity sources. While the capacity of the filtration plant has averaged between 13,000,000 and 14,000,000 gals. per day, at certain low water stages of the river occurring during the winter seasons when the organic matter in the water was excessively high and the filters worked least efficiently, the capacity of the filtration plant, owing to the shortening of the runs, has been limited to about 12,000,000 gals. per day. The construction of 4 more filters would have increased the capacity of the plant to an average of 20,000,000 gals. per day throughout the year, with about 18,000,000 gals. per day during critical periods. Were the entire city to be supplied with filtered water from 12 filters, it is readily seen that as great a shortage of filtered water would then occur as had already existed prior to 1904. It was therefore necessary, if possible, to find other means of increasing the capacity of the filtration plant than by additional slow sand filters if the work was to be done within the means then at hand.

In the spring of 1905 the attention of the writer was directed to the preliminary filters about to be installed at Philadelphia under the charge of John W. Hill, Chief Engineer of the Bureau of Filtration, and upon examining the results obtained with a somewhat similar water, it was decided to make a series of experiments to test the practicability of operating preliminary filters in connection with the existing slow sand filters. Experimental filters were thereupon erected in the engine room of the filtration plant pumping station. The filters were started about Nov. 1, 1905, and continued with but few interruptions until Aug. 19, 1907, a period of over 21 months.

The object of the experiments was to determine if it was possible, by means of preliminary filtration, to increase the rate of operating the existing slow sand filters from 3,000,000 to 6,000,000 gals. per acre per day and still furnish water of equally as good quality. The preliminary filter considered was of the ordinary mechanical type which, owing to the large amount of bacteria and organic matter usually present in the water, it was thought could be operated at high rates as a biological filter without the use of any coagulent. It might be well to state here that experience in the operation of the slow sand filters had shown that the most difficult water to filter and which caused the shortest runs usually occurred during the low water stages of the river when the pollution was more concentrated. The water from the back channel was also greatly affected by wind and tidal influences carrying sewage pollution from the city sewers to the intake.

Troubles from excessive turbidity of the water have been of rare occurrence in the history of the plant, as the floods are ordinarily of short duration. During the ten years' operation of the filters the highest turbidity ever reached was 600 parts per million.

The application of preliminary filtration at Albany has, therefore, to deal principally with the removal of an excessive amount of organic pollution rather than with the removal of turbidity, as was the case at Washington, where preliminary filtration was deemed of little practical value in removing the very fine clay particles. In this respect the experiments made at Albany confirm the results obtained at Washington.

The original plan in arranging the experimental filters was to pump the raw water directly into the preliminary filters and allow the effluent to pass through the sedimentation basin, which would act as an equalizer between the preliminary and slow sand filters. With this plan but one pumpage would have been required.

In the series A. to K. runs of the pre-filter and the series X. runs of the slow sand filter, which were begun on Oct. 30, 1905, and completed on Jan. 30, 1906, the raw water was pumped directly on the pre-filter. During this period floods of high turbidities (350 parts per million) were experienced on Dec. 4, 1905, and again on Jan. 24, 1906, at which time it was found impracticable to operate the pre-filter, owing to the excessive amount of suspended matter carried by the floods. The suspended matter quickly formed an impervious blanket on the surface of the sand and shortened the runs so that sufficient prefiltered water to wash the filter could not be obtained. The size and depth of the sand on the pre-filter was repeatedly changed in a vain effort to obtain a suitable size which could handle the flood water satisfactorily.

After the flood of Jan. 24, 1906, the attempt to pump directly on the pre-filter was abandoned, and the plant remodeled to allow of 12 hours sedimentation previous to prefiltration.

The experiments were started again on Feb. 17, 1906, and continued with practically the same arrangement until Aug. 19, 1907, when the plant was dismantled to make room for a new pump and engine to be installed in the station.

Preliminary Filter.—The preliminary filter was an ordinary mechanical filter made of a sheet steel tank 6.5 ft. in height, 2.6 ft. in diameter and having a filtering area of 6 sq. ft. Loss of head was measured by the difference of water level in two glass tubes, one tapped into the side of the tank above the sand and the other connected to the main effluent pipe. A constant water level was maintained by an overflow in the side of the tank 5 ins. below the top, a slight excess of water being at all times pumped onto the filter.

TABLE I.—DEPTHS OF WATER AND DEPTHS AND SIZES OF SAND AND GRAVEL IN EACH SERIES OF RUNS OF THE EXPERIMENTAL PRELIMINARY FILTER.

Series.	Depth of water. Inches.	Sand. Depth. Inches.	Sand. Effective size. Millimeters.	Sand. Uniformity coefficient.	Gravel. Depth. Inches.	Gravel. Size. Inches.
A	33	21½	0.33	2.1	9	1-16 to ¼
B	39	25½	0.35	1.6	9	1-16 to ¼
C	45¼	19¼	0.57	1.7	9	1-16 to ¼
D	29	12	0.60	1.6	32½	1-16 to 1
E	29	12	0.47	1.5	32½	1-16 to 3
F	29	12	0.41	1.3	32½	1-16 to 3
G	29½	15	0.29	1.6	29	1-16 to 3
H	27	17½	0.34	1.6	29	1-16 to 3
I	26	18½	0.37	1.5	29	1-16 to 3
J	27¼	17¼	0.46	1.7	29	1-16 to 3
K	26	19	0.40	1.5	28½	1-16 to 3
L	41	21½	0.41	1.5	11	1-16 to 3
M	41	21½	0.41	1.5	11	1-16 to 3
N	40¼	25	0.41	1.5	8¼	1-16 to 1
O	42	20½	0.38	1.7	11	1-16 to 3
P	45½	12	0.40	1.7	16	1-16 to 3
Q	47½	10	0.42	2.2	16	1-16 to 3

[illegible] W. Wallace Greenalch [illegible] of the Bureau of [illegible]

TABLE II.—SUMMARY OF RESULTS OF OPERATION OF EXPERIMENTAL PRELIMINARY FILTER.

Series.	[illegible]	[illegible]	Loss of Head [illegible]	Loss of Head [illegible]	Loss of Head [illegible]	Rate, million gals. per acre per day.	Yield, million gals. per acre per run.	Wash Water. Per cent used.	Wash Water. Time, mins.	Wash Water. Vertical rise, feet per min.	Turbidity. Applied.	Turbidity. Effluent.	Turbidity. Per cent removed.	Bacteria. Applied.	Bacteria. Effluent.	Bacteria. Per cent removed.
A	21	Nov. 11, 1905	14.1	1.13	[illegible]	88.3	[illegible]	3.5	6	0.99	15	6	60.0	3,340	430	87.1
B		Dec. [illegible] 1905	23.4	0.97	4.85	82.0	80.09	4.1	10	1.05	173	49	71.7	52,310	16,300	68.9
C		Dec. [illegible]	0.5	[illegible]	5.28	85.5	1.84	93.0	[illegible]	1.05	350	100	71.4	66,700	30,400	54.4
D		Dec. [illegible]	10.9		4.63	81.2	37.01	4.9	5	1.13	264	94	66.9	75,480	47,950	36.4
E		Dec. [illegible]			[illegible]	85.5	338.20	0.8	7	1.21	46	28	50.0	147,000	96,000	34.7
F			21.9	0.46	5.00	85.5	327.51	0.8	[illegible]	1.26	35	18	48.6	212,000	88,000	58.5
G	[illegible]	[illegible] 16, 1905	42.2	0.98	5.05	85.5	[illegible]	1.8	[illegible]	1.10	15	5	66.8	143,860	45,100	68.7
H		Jan. 10, 1906	65.5	0.89	4.81	85.5	233.53	1.0	[illegible]	1.19	9	3	66.7	178,000	61,500	65.4
I	[illegible]	[illegible]	[illegible]	0.67	5.09	84.3	46.17	5.1	6	1.00	157	26	63.4	95,100	33,600	64.7
J	12	Jan. [illegible]		0.49	4.12	84.8	17.10	8.8	5	1.01	188	88	58.2	54,050	38,200	29.4
K		[illegible] 27, 1906		0.62	4.62	85.5	264.65	1.2	10	1.03	35	18	48.6	56,500	21,550	62.1
L		Feb. 17, 1906					115.68	4.5	15	0.99	73	28	61.7	85,820	20,230	76.4
M	[illegible]	Apr. 27, 1906			5.34	85.5	244.05	1.3	[illegible]	0.98	11	2	81.8	23,350	3,100	86.5
N	120	[illegible]	36.2		5.01	85.5	129.05	2.8		0.97	15	2	86.7	7,100	1,100	84.5
O	103	[illegible]		1.75	4.97	88.6	122.91	7.1	[illegible]	1.09	46	14	69.6	102,870	9,290	91.1
P	[illegible]	Apr. 12, 1907	51.6	1.27	5.02	107.3	230.44	2.9	[illegible]	1.03	20	8	60.0	13,830	1,570	88.6
Q	[illegible]	[illegible]	71.5	0.66	5.00	89.5	266.57	2.9	[illegible]	1.36	14	2	85.8	2,260	520	77.0
[illegible] L to Q				1.42		91.0	143.62			1.09	[illegible]	11	68.2	49,800	6,600	86.7

TABLE III.—SUMMARY OF RESULTS OF OPERATION OF EXPERIMENTAL SLOW-SAND FILTER RECEIVING EFFLUENT FROM EXPERIMENTAL PRELIMINARY FILTER.

Series.	Length of run, days.	Depth of sand, feet	Depth of water, feet.	Maximum loss of head, feet.	Yield. Million gallons per acre per day.	Yield. Million gallons per acre per run.	Turbidity. Applied. Maximum.	Turbidity. Applied. Minimum.	Turbidity. Applied. Average.	Turbidity. Percentage removed.	Bacteria. Applied. Maximum.	Bacteria. Applied. Minimum.	Bacteria. Applied. Average.	Bacteria. Percentage removed.	Sand Scraped at End of Run. Depth, inches.	Sand Scraped at End of Run. Cubic yards per acre.	Sand Scraped at End of Run. Cubic yards per million gallons.
SERIES X.																	
X	32.35	3.75	3.85	4.32	4.72	152.57	90	3	12.8	97.2	111,000	130	9,040	96.5	0.62	82.8	0.54
X	37.50	3.70	3.90	4.00	5.35	204.72	45	2	9.4	96.9	133,000	15,800	52,680	99.8	0.69	93.1	0.45
X	15.65	3.65	3.95	1.90	5.34	83.57	85	2	22.5	97.5	56,000	12,000	24,870	99.5	....	....	....
SERIES Y.																	
Y	25.26	3.25	4.50	4.00	5.63	142.18	70	3	23.4	99.2	127,000	7,400	50,450	99.4	0.90	120.8	0.85
Y	31.00	3.17	4.58	4.00	5.62	174.35	220	4	40.0	97.8	29,300	2,300	9,690	98.9	1.75	235.5	1.35
Y	103.92	3.03	4.72	4.00	5.84	607.41	65	1	3.7	98.1	16,900	100	1,460	97.0	1.04	139.8	0.23
Y	66.75	3.02	4.73	4.00	5.82	388.29	3	1	1.0	100.0	1,800	48	310	91.0	0.88	113.0	0.29
Y	26.67	2.86	4.89	4.00	5.42	144.54	1	1	1.0	100.0	17,000	180	5,190	98.7	2.00	269.0	1.86
Y	38.69	2.69	5.06	4.00	5.63	217.91	7	1	4.3	100.0	126,500	600	27,630	98.8	1.37	184.9	0.85
Y	35.68	2.58	5.17	4.00	5.65	201.52	100	1	24.8	98.8	32,000	500	6,170	98.9	2.10	282.0	1.40
Y	33.04	2.40	5.35	4.00	5.65	186.65	8	1	2.6	100.0	12,400	120	1,900	98.9	....	.....	....
Averages	45.13	2.87	4.88	4.00	5.71	257.86	220	1	9.5	98.6	127,000	48	8,855	99.0	1.43	192.8	0.72
SERIES Z.																	
Z	15.37	2.40	5.35	4.00	5.40	83.03	7	1	1.8	100.0	19,500	300	2,630	98.4	Harrowed 10" deep		
Z	25.40	2.40	5.35	4.00	5.60	142.16	70	3	24.2	100.0	53,500	550	9,850	99.3	Harrowed 10" deep		
Z	42.42	2.40	5.35	4.00	5.71	242.16	90	2	11.1	95.8	6,000	175	1,270	98.3	Harrowed 4" deep		
Z	9.48	2.40	5.35	4.00	5.94	56.28	4	1	2.7	100.0	11,000	1,100	3,880	94.9	Harrowed 2" deep		
Z	26.97	2.40	5.35	4.00	5.94	160.18	5	1	3.0	100.0	12,750	125	2,770	98.8	Harrowed 4" deep		
Z	14.90	2.40	5.35	4.00	5.94	88.48	8	1	4.4	100.0	750	200	410	79.6	Harrowed 4" deep		
Z	25.71	2.40	5.35	4.00	5.94	152.75	5	1	2.5	100.0	1,250	175	470	90.0	Harrowed 4" deep		
Averages	22.89	2.40	5.35	4.00	5.77	132.15	90	1	7.7	98.4	53,500.	125	2,690	98.0	At beginning of run		

At the beginning of the experiments the wash water overflow consisted of a 2½ in. opening in the side of the tank. At the beginning of series I the overflow was changed to a conical funnel placed in the center of the tank, and which could be raised or lowered to give any desired distance above the surface of the sand.

The rate of filtration was controlled by an orifice can in which a constant head was maintained by a float valve. The rate was varied by means of annular brass discs of different sizes screwed into the bottom of the can. The different discs were carefully calibrated before the experiments were begun.

In series A to M, inclusive, the wash water and collector systems were independent of each other. The latter consisted of a 2-in. pipe tapped into the center of the bottom, the opening of which was protected by a screen, and the entire bottom of the filter covered with graded sizes of gravel on which rested the filter sand. The wash water system consisted of a 2-in. wrought-iron pipe manifold with ¾-in. brass pipe laterals spaced 4¼ ins. apart and of varying lengths to conform to the circular bottom of the tank. Slots 1/32 in. in width were sawed into the tops of these laterals, giving an area of about 2/10 sq. in. per square foot of filtering area. The manifold was tapped through the side of the tank about 6 ins. above the bottom in a manner similar to that proposed for the preliminary filters at Philadelphia. Pre-filtered water was used for washing the filter.

In series N to Q, inclusive, a single manifold system was used for collecting and washing. Fourteen brass strainers, having throats 5/16 in. in diamater and placed on the under sides of the pipes, were substituted for the slotted brass pipes used in the preceding series. The reason for this change was to prevent the excessive loss of head caused by the silting of gravel below the wash water pipes.

The depths of water over the sand and the depths and sizes of the sand and gravel in each series of runs of the preliminary filter are shown in Table No. I. The sand used in runs A to E was a practically pure quartz sand such as is ordinarily used in mechanical filters. The sand used in runs F to Q was taken from the slow sand filters of the Albany filtration plant, and was a mixture of quartz with quite a large proportion of shale. A summary of each series of runs and the average results of series L to Q, inclusive, are given in Table II.

PRELIMINARY FILTER RUNS.

Series A to K, as above stated, were ineffectual attempts to find a combination of depths and sizes of sand which could successfully filter the raw water during floods without previous sedimentation, and may be passed over without further explanation.

Series L.—For the first time water which had settled for 12 hours was applied to the pre-filter. The gravel for this series was all new and was graded in four layers, as follows: Bottom layer, 5½ ins. of 3-in. to 1½-in. gravel; second layer, 2 ins. of 1½-in. to ½-in. gravel; third layer, 1½ ins. of ⅝-in. to 3/16-in. gravel; upper layer, 2 ins. of 3/16 to 1/16-in. gravel. The second layer was 2½ ins. thick, and had an effective size of 0.41 mm. with a uniformity coefficient of 1.5. The water over the sand was 41 ins. in depth. The wash water overflow consisted of a 10-in. funnel with its rim placed 10½ ins. above the sand.

This series was begun on Feb. 17, 1906, and continued to April 26, 1906, during which period three floods were experienced. The first flood occurred on March 3rd to 6th, with a maximum turbidity of 360 in the raw water and 220 after sedimentation. The maximum turbidity in the pre-filter effluent was 60 parts per million. The second flood occurred from March 28th to April 3rd, and gave a maximum turbidity of 460 in the raw water and 260 after sedimentation, while the pre-filter effluent reached a maximum of 85 parts per million. The third flood occurred from April 11th to 18th, and gave a maximum turbidity of 420 in the raw water and 270 after sedimentation, while the pre-filter effluent reached a maximum of 110 parts per million.

Owing to the absence of a large amount of suspended matter in the applied water, the pre-filter was able to handle the flood water quite successfully, although the wash water used at times was rather high, varying from 1 to 12 per cent, and averaging 4.5 per cent. The reduction in turbidity varied from 17 to 84 per cent, and averaged about 62 per cent. The reduction in bacteria varied from about 40 to 99 per cent, and averaged 76 per cent during the series. The runs varied from 15 to 68 hours in length, with an average of 32.5 hours, and filtered an average of 115,680,000 gals. of water per acre per run while operating at a rate of 85,500,000 gals. per acre per day. The successful operation of the pre-filter during the freshets in the river showed the importance of sedimentation in removing the heavy suspended matter from the raw water before applying it to the pre-filter.

At the end of this series, the sand and gravel were removed from the filter for examination. A few mud balls were found in the sand while the gravel, below the wash water system, was found to be badly clogged with a slimy deposit which the washing, of course, could not remove.

Series N.—Before beginning this series the

TABLE IV.—COMPARISON OF MONTHLY AVERAGES OF BACTERIA PER CUBIC CENTIMETER BETWEEN THE ALBANY FILTRATION PLANT, OPERATED AT A RATE OF 3,000,000 GALS. PER ACRE PER DAY, WITH 24 HOURS' SEDIMENTATION, AND THE EXPERIMENTAL PLANT, WITH 12 HOURS' SEDIMENTATION, PRELIMINARY FILTERS AND SLOW-SAND FILTER, OPERATED AT A RATE OF 6,000,000 GALS. PER ACRE PER DAY.

	Albany Filtration Plant.			Experimental Plant.			
Month.	Raw water from back channel.	Settled water from sedimentation basin.	Pure water from filtered water basin.	Raw water from back channel.	Settled water from settling tank.	Effluent from preliminary filter.	Effluent from slow sand filter.
March, 1906	133,480	112,440	706	132,730	115,210	36,000	151
April, 1906	77,420	65,250	155	76,240	60,320	4,810	72
May, 1906	15,800	10,670	37	15,800	13,210	2,250	48
June, 1906	4,520	2,980	34	4,690	3,190	358	38
July, 1906	2,090	1,370	22	2,170	1,740	163	25
August, 1906	2,740	1,670	22	2,880	2,070	121	36
September, 1906	8,280	4,060	24	8,070	3,990	445	20
October, 1906	38,350	23,440	227	36,470	31,880	4,235	67
November, 1906	67,910	52,390	341	74,500	52,090	15,570	337
December, 1906	645,500	552,020	2,783	574,980	406,420	25,440	144
January, 1907	127,560	109,060	443	123,690	87,170	4,660	48
February, 1907	28,000	25,850	116	35,020	30,430	1,800	13
Averages	97,100	81,100	416	91,600	68,000	8,070	78
Efficiencies	....	16.48%	99.49%	....	25.76%	88.13%	99.03%
Plant efficiencies.	....	....	99.57%	....	.....	.	99.91%

TABLE V.—COMPARISON OF RESULTS OF OPERATION OF THE EIGHT SLOW SAND FILTERS OF THE ALBANY FILTRATION PLANT AND THE EXPERIMENTAL SLOW-SAND FILTER USING PREFILTERED WATER DURING THE PERIOD FROM FEB., 1906, TO FEB., 1907.

					Yield.		Turbidity.				Bacteria.				Sand Scraped at End of Run.		
							Applied.				Applied.						
	Average length of run, [illegible]	Average depth of sand, feet.	Average depth of water, feet.	Average maximum loss of head, feet.	Million gallons per acre per day.	Million gallons per acre per run.	Maximum	Minimum	Average	Percentage removed	Maximum.	Minimum.	Average.	Percentage removed.	Depth, inches	Cubic yards per acre	Cubic yards per million gals.
Albany Filtration Plant.....	[illegible]	3.05	5.45	3.97	2.75	68.75	330	4	28.0	99.5	1,320,000	600	74,880	99.52	0.86	116	1.63
Experimental Slow Sand Filter	45.13	2.87	4.88	4.00	5.71	257.86	220	1	9.5	98.6	127,000	48	8,855	98.98	1.43	193	0.72

former wash-water system was removed and a new manifold system substituted in which the strainers were placed on the lower sides of the pipes to wash the underlying gravel.

The gravel was placed in 5 layers, graded as follows: Bottom layer, 3 ins. of 1 to ½-in. in size; second layer, 2 ins. of ½ to 5/16-in. in size; third layer, 1.3 ins. of 5/16 to 3/16-in. in size; fourth layer, 1 in. of 3/16-in. to ⅛-in. in size; top layer, of ⅛ to 1/16-in. in size. The sand layer consisted of 25 ins. of sand having an effective size of 0.41 mm. and a uniformity coefficient of 1.5. The water over the sand was about 40 ins. deep, and the wash water overflow 9.7 ins. above the sand. This series was begun on May 4, 1906, and ended on Nov. 1, 1906. No floods of any account were experienced during this series, the turbidity of the applied water varying from a minimum of 2 parts per million to a maximum of 180 parts per million, with an average of 13 parts per million. The pre-filter effluent showed an average reduction of turbidity of about 87 per cent, varying from 1 to 25 parts per million, with an average of 2 parts per million. The reduction in bacteria varied from 57 to 98 per cent, with an average of 84.5 per cent. The runs varied from 8 to 76 hours in length, with an average of 36 hours. The average yield was at the rate of 129,000,000 gals. per acre per run while operating at a rate of 85,500,000 gals. per acre per day. The water used for washing averaged 2.8 per cent of the total quantity filtered.

Owing to the excessive initial loss of head which occurred near the end of this series, the sand and gravel were removed for examination and, except for the gelatinous coating on the grains, were found to be quite clean.

Series O.—At the end of series N all the sand and gravel was removed and thoroughly washed and screened to the different sizes. The gravel was replaced in six layers in the following order: Botton layer, 3 ins. of 3 to 1½-in. stones; second layer, 3 ins. of 1½ to ½-in. stones; third layer, 2 ins. of ½ to 5/16-in. gravel; fourth layer, 1 in. of 5/16 to 3/16-in. gravel; fifth layer, 1 in. of 3/16 to ⅛-in. gravel; sixth layer, 1 in. of ⅛ to 1/16-in. gravel. The sand layer consisted of 20.5 ins. of sand having an effective size of 0.38 mm. and a uniformity coefficient of 1.7. A depth of 42 ins. of water covered the sand. The wash water overflow was 11.5 ins. above the [illegible]

This series was begun on Nov. 10, 1906, and [illegible] occurred to increase the turbidity of the raw water during this period. The first flood reached its height on Jan. 5th, when the tur- [illegible] age of 70 per cent of the turbidity was removed in this series. No difficulty was experienced in operating the filter during these [illegible]

this series were generally high, and attained a maximum of 1,445,000 on December 10th. The bacteria in the applied water varied from 3,600 on Feb. 4th to 1,000,000 on Dec. 10th, and averaged about 103,000 per cu. cm. throughout the series. The bacteria in the pre-filter effluent varied from a minimum of 120 on Feb. 16th to a maximum of 126,500 on Dec. 8th, and averaged about 9,300 throughout the series. The bacterial efficiencies varied from 32 to 98.5 per cent and averaged 91.1 per cent. The runs varied from 8 to 102 hours in length with an average of 33 hours. The pre-filter was operated at an average rate of 88,600,000 gals. per acre per day and yielded an average of 122,910,000 gals. per acre per run. Water used for washing averaged 7.1 per cent of the total quantity filtered.

While the removal of turbidity and bacteria throughout this series was quite satisfactory, more or less difficulty was experienced from the clogging of the sand with organic matter, which resulted in high initial losses of head, decreased lengths of runs and increased percentages of wash water. Efforts to remove this organic matter by increasing both the vertical rise of the wash water and the duration of washing were not successful, and the initial loss of head gradually increased until March 8 when it had reached a maximum of 2.4 ft. An examination of the sand at this time disclosed the fact that each grain was covered with vorticellae and other infusoria while the interspaces seemed filled with organic matter. The filter was accordingly drained and a solution of 5 parts per million of copper sulphate allowed to stand in it for 24 hours. This solution was then removed and another, containing 10 parts per million of copper sulphate, applied and allowed to stand 48 hours. At the end of this period the filter was washed for 30 minutes, after which an examination of the sand showed that all the vorticellae and most of the organic matter had been removed. As a result of this treatment, the initial loss of head was decreased 0.74 ft. The initial loss of head soon increased again until the series was discontinued. From the experience gained it seems probable that the sand, if an effective size as small as 0.40 mm. is used, will have to be removed from the pre-filters, thoroughly washed and replaced several times a year. This, however, is a comparatively small matter, as the quantity of sand in the pre-filters is not large.

Series P.—At the end of the preceding series all of the sand and gravel was removed and new filtering material placed as follows: On the bottom, 4 ins. of 3 to 1½-in. stones; second layer, 2 ins. of 1½ to 1-in. stones; third layer, 1 in. of 1 to ⅝-in. gravel; fourth layer, 1 in. of ¼-in. gravel; fifth layer, 2 ins. of ⅛-in. gravel; sixth layer, 6 ins. of 1/16-in. gravel. On top of the gravel was placed 12 ins. of sand having an effective size of 0.40 mm. and a uniformity coefficient of 1.7. The [illegible]

The wash water overflow was 15 ins. above the surface of the sand. [illegible]

operated at a rate of 89,500,000 gals. per acre per day. The results obtained were very satisfactory. The reduction of turbidity averaged 60 per cent and the reduction of bacteria averaged 88.6 per cent. The average length of run was 51.6 hours, and the average yield at the rate of 230,440,000 gals. per acre per run. The amount of wash water averaged 2.9 per cent.

Summary of Pre-Filter Runs.—Comprise a total of 331 runs in a period of 18 months, from Feb. 17, 1906, to Aug. 19, 1907. During this period, the preliminary filter was operated at an average rate of 91,000,000 gals. per acre per day, with an average length of run of 38 hours, and yielded an average of 143,600,000 gals. per acre per run. The wash water used amounted to 4.2 per cent, or about 6,000,000 gals. per run, making the net yield 137,600,000 gals. per run.

The turbidity of the applied water was reduced from an average of 34 to 11 parts per million, silica standard, or about 68 per cent, while the bacteria were reduced from an average of 49,800 to 6,600 per cu. cm., or about 87 per cent.

EXPERIMENTAL SLOW-SAND FILTER RUNS.

Series X.—The slow-sand filter used in the Series X runs consisted of a wooden tank 10 ft. in diameter and 9 ft. 5 ins. high. A perforated 1½-in. pipe laid on the bottom of the tank in the shape of a cross formed the effluent pipe. Gravel underdrains were placed on the bottom of the tank in the following courses: Bottom course, 6 ins. of 2½ to 1-in. gravel; second course, 2 ins. of 1 to ½-in. gravel; third course, 2 ins. of ½ to 5/16-in. gravel; fourth course, 1 in. of 5/16 to 3/16-in. gravel; fifth course, ½ in. of No. 10 to No. 14 mesh sand. Over the 11½ ins. of gravel, 48 ins. of sand, obtained from one of the large filters of the Albany filtration plant, was placed in the same position as it had previously occupied. It consisted of two distinct layers, the lower of which was about 32 ins. thick and had an effective size of 0.33 mm. with a uniformity coefficient of 2.6. The upper layer was 16 ins. thick and had an effective size of 0.45 mm. with a uniformity coefficient of 2.4. The difference in size was due to the fact that many of the fine particles had been removed by washing, which increased the effective size of the upper portion of the sand in the filters. The depth of water over the sand was about 46 ins. at the beginning of this series. The water surface was maintained at a constant level by an overflow 10 ins. below the top of the tank. The rate of filtration was controlled by an orifice can in which a constant level was maintained by a float valve. Loss of head was determined by the difference of level in two glass tubes, one of which was tapped into the effluent pipe and the other through the side of the tank above the sand. The applied water flowed by gravity from the orifice can of the preliminary filter, which was placed on a trestle at a higher level.

The Series X runs of the experimental slow sand filter were begun on Nov. 5, 1905, and ended on Feb. 1, 1906, during which period the applied water was the effluent from Series A to K runs of the preliminary filter. [illegible] 1 was started at a rate of 3,110,000 gallons per acre per day and gradually increased until Nov. 24, after which a rate of 5,980,000 gals. per acre per day was maintained. The filter ripened quickly, and after Nov. 23 gave satisfactory effluents which compared favorably with the filtered water from the main filtration plant. The first run was about 32 days in length and the second about 37 days. The third run was stopped before its completion to make the necessary alterations to the experimental plant so as to provide sedimentation of the raw water before applying it to the preliminary filter. On account of the small number of runs in this series, they have not been included in the summary of results shown in Table III.

Series Y.—From Feb. 1 to 17 the experimental plant was remodeled, the former slow sand tank being used for a settling tank, and a new wooden tank used for a slow sand filter. The settling tank was divided by cross partitions into four equal compartments, each of which provided three hours sedimentation. The raw water was delivered near the bottom of the first compartment, and the partly settled water taken from the top and delivered to the bottom of the next compartment and so on to the end. This sedimentation had a very beneficial effect on the preliminary filter and enabled it to be operated successfully through all the floods which occurred during the experiments. Upon the completion of the experiments it was clearly demonstrated that the first quadrant did practically all the work, as it was found to contain about 8 ins. of silt while the second quadrant contained ½ in., the third quadrant ¼ in. and the last quadrant only a slimy covering.

The slow sand filter used in Series Y and Z was a wooden tank 4 ft. deep, 6 ins. in diameter and 10 ft. high. The arrangement of this filter was practically the same as the filter used in the Series X runs except that the gravel was 9 ins. thick, the sand 39 ins. thick and the water over the sand was 54 ins. deep.

Series Y was begun on Feb. 17, 1906, and completed on Feb. 26, 1907, a period of about one year, during which time eight runs were completed. The summary of each run is given in Table III, a monthly comparison of results of operation in Table IV, and a yearly comparison of results in Table V.

Comparing the average results of the Series Y runs of the experimental slow sand filter with the averages of the eight slow sand filters of the main plant during the same period, the following results may be noted:

(1) The average length of runs of the experimental slow sand filter, using pre-filtered water, was 80 per cent longer than the filters of the main plant.

(2) The average rate of filtration of the experimental slow sand filter, 5,700,000 gals. per acre per day, was slightly over double the rate of operation of the main plant.

(3) The average yield per acre per run of the experimental slow sand filter was 3.75 times the average yield of the main plant.

(4) The turbidities of the effluents of both filters were at nearly all times quite satisfactory, although the maximum turbidity of the effluent of the experimental plant was 4 parts per million as against 11 parts per million in the effluent of the main plant.

(5) The average number of bacteria in the effluent of the experimental slow sand filter was only 90 per cu. cm. as compared with an average of 360 in the effluent from the main plant.

(6) The maximum number of bacteria at any time in the effluent of the experimental slow sand filter was 1,050 per cu. cm. as compared with a maximum count of 13,400 in the effluent from the main plant.

(7) The total reduction of bacteria in the experimental plant averaged 99.91 per cent compared with a reduction of 99.57 per cent in the main plant.

(8) The average quantity of sand scraped from the filters of the main plant per million gallons filtered was 2.35 times the quantity of sand scraped from the experimental slow sand filter.

(9) No difficulty was experienced at any time in obtaining a schmutzdecke on the slow sand filter when filtering the effluent of the preliminary filter.

Series Z.—When the Series Y runs of the experimental slow sand filter were completed on February 26, 1907, the Series Z runs were begun to determine whether it would be practicable to operate the filter for any length of time by raking instead of scraping off the sand at the ends of the runs. This series was continued until Aug. 20, 1907, when the experimental plant was dismantled. A summary of each run and the average of all—seven in number—are given in Table III.

The runs in this series are only about half as long as in Series Y. The bacterial removal was generally satisfactory, although after May the average numbers in the effluent of the experimental slow sand filter were slightly higher than the filtered water basin of the main plant. At the end of the experiments an examination of the sand in the experimental slow sand filter showed it to be quite clean and free from bacterial or other clogging.

The results of this series seem to warrant the conclusion that harrowing may at times be substituted for scraping without impairing the operation of the filter or the quality of the effluent, although the practice of continual harrowing would not be advisable.

CONCLUSIONS.

The results of the experiments seem to warrant the following conclusions regarding the filtration of the water of the Hudson river at Albany.

1st. That, owing to the large amount of suspended matter in the raw water during floods, sedimentation is necessary before applying the water to the preliminary filters.

2d. With a preliminary filter washed by an upward flow of water, it is practicable to remove the greater part of the organic matter, bacteria and turbidity from the settled water.

3d. That it is practicable to successfully operate a slow sand filter receiving the pre-filter effluent at a rate of six million gallons per acre per day, and obtain as good results as when filtering settled water at a rate of three million gallons per acre per day.

4th. That considering the cost of the plant, double filtration will be less expensive than single filtration.

STEAM AND ELECTRIC RAILWAY SECTION

Methods of Conducting the Valuation of the Physical Properties of the Chicago Consolidated Traction Co., with Summaries of Costs.

BY PHILIP J. KEALY.

The Traction Valuation Commission of Chicago, Bion J. Arnold and George W. Weston, commissioners, has recently completed a detailed and exhaustive appraisal of the physical property of the above named company, the last of the Chicago surface traction lines to come under the "Chicago Ordinances." The appraisal is the result of several months' work of about 40 employes of the Arnold Co., under the immediate supervision of Mr. F. A. Sager. In ENGINEERING-CONTRACTING of Sept. 21, 1910, the methods employed and the costs obtained in appraising track and power house equipment were given. Following are given similar data for the electric power distribution system:

Electric Power Distribution System.—The electric power distribution system has been divided into: 2-A—Overhead Trolley Construction; 2-B—Feeder System; 2-C—Electrical Track Bonding; 2-D—Conduit System.

The report includes a detailed estimate of all poles, cross span construction, fittings, trolley wire, feeder wire (positive and negative), feeder attachments and supports, track bonding cable, wire, etc., together with special work construction at the curves and in car houses.

In arriving at the cost new of the poles, wire attachments, and all equipment whatsoever, the actual cost of the material and labor was estimated at the present time (Nov. 1, 1909), and to this was added 15 per cent for organization, engineering, and incidentals. The detailed inventory of the entire system was made by inspection, and all quantities, kinds, conditions, and character whatsoever were fully noted in detail, from which the cost has been estimated.

The depreciation of the various parts of the construction was determined by inspection, tests, and measurements. In many instances it was impossible to obtain from the company, or from any other source, correct information as to the age of the various parts of the equipment, on account of the meager information as to the dates of construction or renewals, and further owing to the insufficient maintenance of the system during the past few years, an abnormally high deprecia-

TABLE I.—TROLLEY AND FEEDER COST DATA.

Kind.	Size.	Weight in lbs. per 1,000 ft.	Wearing weight in lbs. per 1,000 ft.	Cost per 1,000 ft. with 1% sag.	Cost per foot.	Labor per foot.	Total cost per foot.
Trolley	1/0 New	319.5	.....	$ 47.11	.047	.01	.057
Trolley	1/0 (18/64 scrap)	239.0	80.5	26.55	.027		
Trolley	2/0 New	402.8	....	59.39	.059	.01	.069
Trolley	2/0 (20/64 scrap)	296.0	107.0	32.88	.033		
W.P.	2/0	522	....	76.97	.077	.01	.087
Scrap	2/0	410	...	45.54	.045		
W.P.	4/0	800	.....	117.97	.118	.01	[illegible]
Scrap	4/0	653	.	72.54	.073		
W.P.	350 M.C.M.	1,345	...	201.74	.202	.015	.217
Scrap	350 M.C.M.	1,076	...	119.54	.119		
W.P.	500 M.C.M.	1,894	..	284.07	.284	.015	.299
Scrap	500 M.C.M.	1,540	..	171.09	.171		
W.P.	1,000 M.C.M.	3,674	. .	551.04	.551	[illegible]	.591
Bare	1,000 M.C.M.	3,100		468.10	[illegible]	[illegible]	.508
Scrap	1,000 M.C.M.	3,100		[illegible]	.344		
Lead Covered 5/32 Rubber	350 M.C.M.	3,495			.506	[illegible]	[illegible]
1/8 Lead	500 M.C.M.	4,254			.63	[illegible]	[illegible]

In arriving at the above prices, quotations of November 1, 1909, were used, namely:

Bar Copper at mill	[illegible]
Solid Wire (either [illegible])	.1460 per lb. f.o.b. Chicago.
Stranded Bare Cable	.1510 per lb. f.o.b. Chicago.
Stranded W. P. Cable	.1485 per lb. f.o.b. Chicago.
Scrap Value (Copper Wire and bronze parts)	.11 per lb. f.o.b. Chicago.

tion has resulted; consequently it was found necessary to depreciate such parts on their condition as found by inspection.

The outside interest and joint ownership of poles and spans by other companies were investigated in detail and allowance made for same.

In arriving at the life of the poles, the condition of setting, thickness of metal at setting line, and the upkeep were taken into consideration. It was found necessary to apply different averages of life to the various sections as shown. The average length of life of a cedar pole was determined from pole renewals and inspection of poles in place to be 20 years. Iron poles set in concrete are figured on the basis of a 40-year life.

A summary of the electric power distribution system costs by general items and their present value is as follows:

Item.	Cost new.	Present value.
Overhead trolley	$228,711.18	$160,468.86
Feeder system	548,861.58	492,809.85
Track bonding	67,474.88	31,468.39
Conduit system	10,918.56	8,734.85
Totals	$855,966.20	$693,481.95

Overhead Trolley.—There are 129.623 miles of overhead trolley construction, the valuation of which is summarized as follows:

Item.	Cost new.	Scrap value.	Depreciation.	Present value.
Owned by companies	$207,339	$35,998	$61,803	$145,536
Outside interests	8,460	661	2,462	5,998
Net total	$198,879	$35,337	$59,341	$139,538
Org., eng. and inc., 15%	29,832	5,300	8,901	20,931
Grand total	$228,711	$40,637	$68,242	$160,469
Per mile	1,759	313	525	1,234

The unit costs used in figuring transmission line values are shown by Tables I, II, III and IV.

In appraising the transmission line the construction was separated into the following types of spans:

A. Two Trolleys—Span Construction—Two Iron Poles.
B. Two Trolleys—Section Insulators—Span Construction—Two Iron Poles.
C. Two Trolleys—Feeder Span Construction—Two Iron Poles.
D. Two Trolleys—Span Construction—One Iron and one Wood Pole.
E. Two Trolleys—Section Insulators—Span Construction—One Iron and One Wood Pole.
F. Two Trolleys—Feeder Span Construction—One Iron and One Wood Pole.
G. Two Trolleys—Span Construction—Two Wood Poles.
H. Two Trolleys—Feeder Span Construction—Two Wood Poles.
I. Two Trolleys—Section Insulators—Span Construction—Two Wood Poles.
K. One Trolley—Span Construction—Two Iron Poles.
N. One Trolley—Span Construction—One Iron and One Wood Pole.
O. One Trolley—Span Construction—Two Wood Poles.
P. One Trolley—Center Pole Construction—One Iron Bracket Pole.
Q. One Trolley—Section Insulators—Center Pole Construction—One Iron Bracket Pole.
R. One Trolley—Section Insulators—Center Pole Construction—One Iron Bracket Pole.
S. [illegible] Structure.
T. [illegible] Elevated Structure.

In inventorying the line these general types of span were estimated and also every variation [illegible] made of general type A and of 24 variations of this type. Usually these variations are in minor details and change the cost per span only a fraction, so that we give here only the itemized costs of the general types as in Table IV. In a similar way a unit cost estimate was [illegible] are 102 of these special layouts, each requiring a sketch span to explain it, we do not give the costs here.

In estimating the wearing life of trolley [illegible] lbs. In a few instances the trolley wire was found to have reached the estimated wearing value, and to be in need of removal, but still in service. The report, therefore, indicates it as having "excessive wearing value." Table V gives the various quantities and values of the total milegae of trolley wire.

[illegible] *System.*—On account of the absence [illegible] n the year of installation or renewals

TABLE II.—UNIT POLE COSTS; IRON POLES.

Size, inches.	Length, feet.	Weight, pounds.	Cost pole only.	TOTAL COST. Set in street in concrete.	TOTAL COST. Set inside curb in concrete.	TOTAL COST. Reset inside curb in concrete.	Scrap value.
4-5-6	28	503	$14.83	$20.83	$25.45	$26.28	$1.85
4-5-6	30	532	15.63	21.63	26.25	27.08	2.00
5-6	30	546	16.02	22.02	26.64	27.47	2.05
5-6-7	30	675	19.55	25.55	30.17	31.00	2.50
5-6-7	31½	955	27.25	33.25	37.87	37.70	2.75
5-6-7	31	689	19.95	25.95	30.57	31.40	2.60
5-6-7	33	731	21.11	27.11	31.73	32.56	2.75
4-5-6-7	33	722	20.86	26.86	31.48	32.31	2.70
5-6-7	35	778	22.27	28.27	32.89	33.72	2.90
4-5-6-7	40	852	24.40	30.40	35.02	35.85	3.20
5-6-7-8	40	1,052	29.95	35.95	40.57	41.40	3.95
5-6-7	45	950	27.15	33.15	37.77	38.60	3.56
6-7-8	30	829	23.80	29.80	34.42	35.25	3.10
6-7-8	31	876	25.10	31.10	35.72	36.55	3.30
6-7-8	33	916	26.30	32.30	36.92	37.75	3.45
6-7-8	35	966	27.55	33.55	38.17	39.00	3.60
6-7-8	40	1,087	30.90	36.90	41.52	42.35	4.05
6-7-8-9	40	1,273	36.00	42.00	46.62	47.45	4.75
6-7-8	45	1,273	36.00	42.00	46.62	47.45	4.77
6-7-8-9	45	1,428	40.30	46.30	50.92	51.75	5.35
6-7-8-9	50	1,602	45.04	51.04	55.66	56.49	6.00
(Bracket Type complete.) 3-4-5-6	30	913	31.00	41.62	.....	.....	3.40

TABLE III.—UNIT POLE COSTS; WOOD POLES.

Diameter of top, inches.	Length in feet.	Cost of pole.	Cost of setting (labor, material, cartage).	Total cost.	Scrap value.
6	20	$ 1.00	$2.80	$ 3.80	$1.00
6	25	2.00	3.50	5.50	1.00
6 Special.	30	1.95	3.95	5.90	1.00
7	30	4.45	4.05	8.50	1.00
8	30	6.10	4.05	10.15	1.00
6	35	4.45	4.05	8.50	1.00
7	35	6.10	4.05	10.15	1.00
8	35	7.30	4.20	11.50	1.00
6	40	6.13	4.20	10.33	1.00
7	40	7.30	4.20	11.50	1.00
8 Special.	40	7.30	4.20	11.50	1.00
6	45	7.30	4.60	11.90	1.00
7	45	9.00	4.60	13.60	1.00
8	45	9.00	4.60	13.60	1.00
6	50	9.00	5.00	14.00	1.00
7	50	12.00	5.00	17.00	1.00
8	50	12.50	5.00	17.50	1.00
7	60	16.00	5.00	21.00	1.00
Stub	30	6.10	4.05	10.15	1.00
Stub	35	7.30	4.20	11.50	1.00

TABLE IV.—UNIT COSTS OF SPAN CONSTRUCTION OF VARIOUS TYPES.

A. Two Trolleys—Span Construction—Two Iron Poles.

		Unit cost.	Cost new.	Scrap value.
2	Pole bands (solid 2-bolt)	$0.25	$ 0.50	.....
2	Brooklyns (medium, malleable iron)	.60	1.20	.....
2	Straight line hangers, W. E. Type A or equal	.40	.80	.....
2	Ears, 12 in. clinch	.25	.50	$ .20
45	Ft. 5/16 in. span wire	.008	.36	.....
	Labor		2.50	.....
			$ 5.86	.....
	Incidentals and waste at 5%		.29	.....
			$ 6.15	$ .20

B. Two Trolleys—Section Insulators—Span Construction—Two Iron Poles.

		Unit cost.	Cost new.	Scrap value.
2	Pole bands (solid 2-bolt)	$0.25	$ 0.50	.....
2	Brooklyns (medium, malleable iron)	.60	1.20	.....
2	Section insulators (Phila. type)	4.50	9.00	$1.20
45	Ft. 5/16 in. span wire	.008	.36	.....
	Labor		2.50	.....
			$13.56	
	Incidentals and waste at 5%		.68	.....
			$14.24	$1.20

C. Two Trolleys—Feeder Span Construction—Two Iron Poles.

		Unit cost.	Cost new.	Scrap value.
2	Pole bands (solid 2-bolt)	$0.25	$ 0.50	.....
2	Brooklyns (medium, malleable iron)	.60	1.20	.....
2	Wood strains, 1¼ in. x 9½ in.	.15	.30	.....
2	Solid feed hanger ears	.45	.90	$0.30
30	Ft. 4/0 W. P. wire	.118	3.54	2.19
15	Ft. 5/16 in. span wire	.008	.12	.....
	Labor		2.50	.....
			$ 9.06	.....
	Incidentals and waste at 5%		.45	.....
			$ 9.51	$2.49

D. Two Trolleys—Span Construction—One Wood and One Iron Pole.

		Unit cost.	Cost new.	Scrap value.
1	Pole band (solid 2-bolt)	$0.25	$ 0.25	.....
1	Brooklyn (medium, malleable iron)	.60	.60	.....
1	Steel eyebolt, 12 in.	.05	.05	.....
2	Straight line hangers, W. E. type A or equal	.40	.80	.....
2	Ears, 12 in. clinch	.25	.50	$ .20
40	Ft. 5/16 in. span wire	.008	.32	.....
	Labor		2.50	.....
			$ 5.02	.....
	[illegible] and waste [illegible]		.25	.....
			$ 5.27	$0.20

E. Two Trolleys—Section Insulators—Span Construction—One Wood and One Iron Pole.

		Unit cost.	Cost new.	Scrap value.
1	Pole band (solid 2-bolt)	$0.25	$ 0.25	.....
1	Brooklyn (medium, malleable iron)	.60	.60	.....
1	[illegible]	.16	.16	.....
1	Wood strain, 1¼ in. x 9½ in.	.15	.15	.....
2	Section insulators (Phila. Type)	4.50	9.00	$1.20
35	Ft. 4/0 W. P. wire	.118	4.13	2.56
12	Ft. 5/16 in. span wire	.008	.10	.....
	Labor		2.50	.....
			$16.89	.....
	Incidentals and waste at		.84	.....
			$17.73	$3.76

of feeders, and on the interchange of wire from and to the various sections, each section was inspected to determine the present worth and the depreciation of insulation fixed accordingly. It was deemed essential, after examination of the companies' records, that all feeder be shown as found on March 1, the time of inspection; and that the companies' present records be taken for work done between Nov. 1, 1909, and March 1, 1910, from which data the feeder system as of Nov. 1, 1909, was determined. A summary of the valuation of the feeder system is given in Table VI.

Bonding.—In estimating the cost of electrical track bonding, the various types of track and special work were inspected, and the quantity, size, and kind of wire, etc., used were noted in detail, and in depreciating the life of 20 years was taken. Table VII gives the amounts and values for electrical track bonding.

Conduit Line.—The small amount of conduit line was estimated as follows:

Material.	Cost new.	Present value.
7,912 feet of 6-duct conduit and 18 manholes	$9,494.40	$7,595.52
Organization, engineering and incidentals, 15%	1,424.16	1,139.33
	$10,918.56	$8,734.85

Some Costs on Sinking a Mine Shaft.

The following data* relate to the sinking of a three-compartment shaft a distance of 213 ft. from the 400-ft. level of the Corbin mine of the Boston & Corbin Copper & Silver Mining Co., Corbin, Mont.

The rock through which the shaft was sunk was a dark hornblende granite, commonly known as Butte granite. The rock section of the shaft measured about 17x7 ft., each compartment being 4x4½ ft. in the clear. For wall plates and end pieces 10x10-in. timbers were used, the dividers being 8x10. The sets were spaced 5 ft. c. to c. Only one compartment was employed for sinking; a second being used for hoisting rock from the two upper development levels; and the third as a pipe and ladderway. A double-drum, electric, geared-hoist, of Wellman-Seaver-Morgan type, with a 100-hp. Crocker-Wheeler motor, handled the cages in both compartments. A straight-sided sinking bucket of about 12 cu. ft. capacity was hung to the cage in the sinking compartment, and was used for hoisting water as well as broken rock. The flow of water was not excessive, about 35 buckets per day being hoisted.

Two Sullivan UB, 2½-in. machines, with air at 80 lbs. pressure, were used, and from 18 to 25 holes were drilled per round. This included 6 cut-holes which were blasted previous to the others. The holes were from 5 to 7 ft. deep, usually averaging about 6 ft. The firing was done by caps and waterproof fuse, and there was no trouble with the electric hoist when hoisting men before blasting. Forty per cent gelatine dynamite was used, and with a regular charge, the ordinary 10x10-in. blasting timbers afforded satisfactory protection to the lower sets. It is doubtful if this would have been the case if batteries had been used for firing. Station sets were put in at the 500 and 600-ft. levels.

The contract for sinking the shaft was awarded to three miners who agreed to furnish their own supplies and do the drilling, blasting, shoveling, and timbering. Each of these miners took charge of an 8-hour shift and had three other shaft men working with him. The timbering was perfect, the whole 213 ft. being exactly plumb. While the men were paid $4 per day for their labor, their profit check netted them a snug sum, and there is no doubt that the company was given handsome returns.

The cost per foot of shaft was as follows:

Labor, cost per foot	$32.76
Lumber, per foot	4.58
Supplies, powder, caps, fuse, candles	2.04
Power	1.57
Total	$40.95

Besides the power and timber, the company furnished top-men, engineers, blacksmiths and

F. Two Trolleys—Feeder Span Construction—One Wood and One Iron Pole.

		Unit cost.	Cost new.	Scrap value.
1	Pole band (solid 2-bolt)	$0.25	$ 0.25	
2	Brooklyns (medium, malleable iron)	.60	1.20	
2	Wood strains, 1¼ in. 9½ in.	.15	.30	
1	Insulated eyebolt	.16	.16	
2	Solid feed hanger ears	.45	.90	.30
30	Ft. 4/0 W. P. wire	.118	3.54	$2.19
12	Ft. 5/16 in. span wire	.008	.10	
	Labor		2.50	
			$ 8.95	
	Incidentals and waste at 5%		.45	
			$ 9.40	$2.49

G. Two Trolleys—Span Construction—Two Wood Poles.

		Unit cost.	Cost new.	Scrap value.
2	Insulated eyebolts	$0.16	$ 0.32	
2	Straight line hangers, W. E. type A or equal	.40	.80	
2	Ears, 12 in. clinch	.25	.50	$ .20
30	Ft. 5/16 in. span wire	.008	.24	
	Labor		2.50	
			$ 4.36	
	Incidentals and waste at 5%		.22	
			$ 4.58	$ .20

H. Two Trolleys—Feeder Span Construction—Two Wood Poles.

		Unit cost.	Cost new.	Scrap value.
2	Insulated eyebolts	$0.16	$ 0.32	
1	Globe strain, 2½ in.	.25	.25	
1	Wood strain, 1¼ in. x 9½ in.	.15	.15	
2	Solid feed hanger ears	.45	.90	$0.30
30	Ft. 2/0 W. P. wire	.077	2.31	1.35
20	Ft. 5/16 in. span wire	.008	.16	
	Labor		2.50	
			$ 6.59	
	Incidentals and waste at 5%		.33	
			$ 6.92	$1.65

I. Two Trolleys—Section Insulators—Span Construction—Two Wood Poles.

		Unit cost.	Cost new.	Scrap value.
2	Insulated eyebolts	$0.16	$ 0.32	
1	Wood strain, 1¼ x 9½ in.	.15	.15	
2	Section insulators (Phila. type)	4.50	9.00	$1.20
45	Ft. 5/16 in. span wire	.008	.36	
	Labor		2.50	
			$12.33	
	Incidentals and waste at 5%		.62	
			$12.95	$1.20

K. One Trolley—Span Construction—Two Iron Poles.

		Unit cost.	Cost new.	Scrap value.
2	Pole bands (solid 2-bolt)	$0.25	$ 0.50	
2	Brooklyns (medium, malleable iron)	.60	1.20	
1	Straight line hanger, W. E. type A or equal	.40	.40	
1	Ear, 12-in. clinch	.25	.25	$0.10
40	Ft. 5/16 in. span wire	.008	.32	
	Labor		2.00	
			$ 4.67	
	Incidentals and waste at 5%		.23	
			$ 4.90	$0.10

N. One Trolley—Span Construction—One Iron and One Wood Pole.

		Unit cost.	Cost new.	Scrap value.
1	Pole band (solid 2-bolt)	$0.25	$ 0.25	
1	Brooklyn (medium, malleable iron)	.60	.60	
1	Insulated eyebolt	.16	.16	
1	Wood strain, 1¼ in. x 9½ in.	.15	.15	
1	Straight line hanger, W. E. type A or equal	.40	.40	
1	Ear, 12 in. clinch	.25	.25	$0.10
40	Ft. 5/16 in. span wire	.008	.32	
	Labor		2.00	
			$ 4.13	
	Incidentals and waste at 5%		.21	
			$ 4.34	$0.10

O. One Trolley—Span Construction—Two Wood Poles.

		Unit cost.	Cost new.	Scrap value.
2	Insulated eyebolts	$0.16	$ 0.32	
1	Straight line hanger, W. E. type A or equal	.40	.40	
1	Ear, 12 in. clinch	.25	.25	$0.10
1	Wood strain, 1¼ in. x 9½ in.	.15	.15	
40	Ft. 5/16 in. span wire	.008	.32	
	Labor		2.00	
			$ 3.44	
	Incidentals and waste at 5%		.17	
			$ 3.61	$0.10

P. Two Trolleys—Center Pole Construction—One Iron Bracket Pole.

		Unit cost.	Cost new.	Scrap value.
2	Straight line hangers, W. E. type A or equal	$0.40	$ 0.80	
2	Ears, 12 in. clinch	.25	.50	$0.20
	Labor		2.50	
			$ 3.80	
	Incidentals and waste at 5%		.19	
			$ [illegible]	$0.20

Q. Two Trolleys—Section Insulation—Center Pole Construction—One Iron Bracket Pole.

		Unit cost.	Cost new.	Scrap value.
2	Section insulators (Phila. type)	$4.50	$ 9.00	$1.20
2	Brooklyns (medium, malleable iron)	.60	1.20	
	Labor		2.50	
			$12.70	
	Incidentals and waste at 5%		.64	
			$13.34	$1.20

R. Two Trolleys—Feeder Tap—Center Pole Construction—One Iron Bracket Pole.

		Unit cost.	Cost new.	Scrap value.
2	Straight line hangers, W. E. type A or equal	$0.40	$ 0.80	
2	Ears, 12 in. feed tap (cast lug)	.30	.60	$0.30

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*From an article by Frank J. Tuck, in the "Mining and Scientific Press," Sept. 24, 1910.

		Unit cost.	Cost new.	Scrap value.
[illegible]	Ft. [illegible] W. P. wire	.118	2.36	1.46
	Labor		2.50	
			$ [illegible]	
			.31	
	Incidentals and waste at 5%		$ 6.57	$1.76

S. Two Trolleys—Under Elevated Structure.

		Unit cost.	Cost new.	Scrap value.
2	Guide troughs, 30 in. x 12 in. x 3 in. wood	$1.50	$ 3.00	
2	[illegible]	.40	.80	
2	Ears, 12 in. clinch	.25	.50	.0.20
	Labor		1.50	
			$ 5.80	
			.29	
	Incidentals and waste at 5%		$ 6.09	$0.20

T. Two Trolleys—Under Elevated Structure.

		Unit cost.	Cost new.	Scrap value.
2	Guide troughs, 30 in. x 12 in. x 3 in. wood	$1.50	$ 3.00	
2	[illegible]	.40	.80	
2	Ears, 12 in. feed tap (cast lug)	.30	.60	$0.20
12	Ft. [illegible] W. P. wire	.077	.93	.54
	Labor		1.50	
			$ 6.83	
			.34	
	Incidentals and waste at 5%		$ 7.17	$0.74

TABLE V.—SUMMARY OF TROLLEY WIRE DETAILS.

Sec. No.	[illegible]	Miles trolley wire.	Size wire.	Years service.	Total % Dep.	Cost new.	Scrap value.	Depreciation.	Present value.
	Chicago No. Shore St. Ry. Co.								
[illegible]		6.790	2/0	[illegible]	85.7	$ 2,116.33	$ 1,183.71	$ 799.26	$ 1,317.07
2		.549	2/0	5	*	171.10	80.28	90.82	80.28
[illegible]		.549	2/0	5	79.3	171.10	95.70	59.79	111.31
[illegible]		2.977	2/0	5	79.3	927.42	518.73	324.09	603.33
		10.865				$ 3,385.95	$ 1,878.42	$1,273.96	$ 2,111.99
	North Chgo. Elec. Ry. Co.								
[illegible]		7.770	1/0	13	40.4	1,927.75	1,107.43	331.41	1,596.34
		1.490	2/0	1	23.0	467.87	261.69	47.42	420.45
[illegible]		4.79	1/0	13	11.6	1,194.22	686.04	58.95	1,135.27
		1.78	1/0	13	17.8	445.70	256.05	33.76	411.94
		3.01	1/0	new	new	748.47	429.98	......	748.48
[illegible]		8.38	2/0	5	70.2	2,609.45	1,459.52	807.25	1,802.20
		2.31	2/0	5	*	695.26	348.22	347.04	348.22
		4.13	2/0	5	97.7	1,287.14	719.93	554.16	732.98
[illegible]		4.99	1/0	13	81.3	1,237.65	710.99	428.17	809.48
		38.660				$10,613.52	$ 5,979.84	$2,608.16	$ 8,005.36
	Chicago Elec. Transit Co.								
		11.22	1/0	14	*	2,783.20	1,598.86	1,184.34	1,598.86
		.76	1/0	14	*	188.28	108.16	80.12	108.16
[illegible]		3.48	2/0	2	14.4	1,082.77	605.62	68.71	1,014.06
		3.27	1/0	15	75.	810.75	465.75	258.75	552.00
11		1.05	2/0	3	78.8	333.29	186.41	115.74	217.55
		.576	2/0	1	4.7	179.60	100.45	3.72	175.88
12		2.60	2/0	13	70.8	811.60	453.95	253.22	558.38
13		13.17	2/0	3	53.7	4,104.63	2,295.81	971.34	3,133.29
14		.77	1/0	15	33.8	193.41	111.11	27.82	165.59
		36.906				$10,487.53	$ 5,926.12	$2,963.76	$ 7,523.77
	North Side Elec. St. Ry. Co.								
[illegible]		.60	1/0	14	6.5	148.99	85.59	4.12	144.87
[illegible]		.738	1/0	15	*	183.30	105.30	78.00	105.30
17		.36	1/0	15	*	89.77	51.57	38.20	51.57
[illegible]		.569	1/0	15	*	141.24	81.14	60.10	81.14
[illegible]		1.906	1/0	15	*	473.29	271.89	201.40	271.89
[illegible]		1.03	1/0	12	*	257.28	147.80	109.48	147.80
		[illegible]				$ 1,293.87	$ 743.29	$ 491.30	$ 802.57
	Chicago & Jefferson Urban Transit Co.								
[illegible]		[illegible]	[illegible]	15	25.2	1,314.59	755.19	140.97	1,173.62
[illegible]		[illegible]	[illegible]	[illegible]	26.3	644.87	360.69	74.74	570.13
[illegible]		[illegible]	[illegible]	[illegible]	43.7	650.59	363.89	125.29	525.30
		9.45				$ 2,610.05	$ 1,479.77	$ 341.00	$ 2,269.05
	Ogden Street Ry. Co.								
[illegible]		[illegible]	1/0	11	50	$ 500.64	$ 287.60	$ 106.52	$ 394.12
[illegible]		[illegible]	[illegible]	11	40	471.41	263.67	63.10	388.31
[illegible]		[illegible]	2/0	14	40	1,102.47	616.64	194.33	908.14
[illegible]		[illegible]	2/0	14	9	504.80	282.35	20.02	484.78
[illegible]		[illegible]	2/0	1	47	469.40	262.55	97.22	372.18
[illegible]		1.9977	2/0		16	622.33	348.08	43.88	578.45
		3.069	2/0		31	956.15	534.80	130.62	825.53
		1.981	1/0		59	491.53	282.37	123.40	368.13
		16.2717				$ 5,118.73	$ 2,878.06	$ 799.09	$ 4,319.64
	[illegible] & Proviso St. Ry. Co.								
[illegible]		[illegible]	1/0		*	745.23	728.11	20.03	725.20
[illegible]		[illegible]	1/0		[illegible]	753.88	433.08	205.31	548.57
[illegible]		[illegible]	2/0		[illegible]	493.95	276.28	252.50	241.45
[illegible]		[illegible]	2/0		49	1,080.53	604.36	233.32	847.21
		[illegible]	2/0		[illegible]	266.03	148.80	2.34	263.69
		1.156	[illegible]		19	286.94	161.84	[illegible]	227.11
		13.570				$ 3,626.56	$ 2,355.47	[illegible]	$ 2,853.23
	[illegible]	130.9257				$37,136.21	$21,240.97	$9,250.60	$27,886.11

* [illegible]

TABLE VI.—FEEDER SYSTEM.

[illegible]	[illegible]	Present Value [illegible]
[illegible]		
[illegible]		
Feeder, equipment, part 1.	23,807.04	[illegible]
Feeder, equipment, part [illegible]	[illegible]	[illegible]
Feeder, equipment, part [illegible]	6,506.27	[illegible]
Feeder, equipment, part [illegible]	4,881.44	[illegible]
Feeder, equipment, part [illegible]	[illegible]	[illegible]
Feeder, equipment, part [illegible]	75.31	[illegible]
Feeder, equipment, part [illegible]	395.22	
Feeder, equipment, part [illegible]	614.78	
	1,863.73	

† [illegible]

[illegible]

carpenters. One carpenter succeeded in keeping the shaftmen supplied with timbers, and the blacksmith and helper supplied the whole mine with sharpened steel. Three other machine drills were in use in the mine besides those in the shaft. The wages paid were as follows: Engineers, $4; shaftmen, $4; blacksmith, $4; blacksmith helper, $3.50; carpenter, $4.50; top-men, $3.50.

Effect of Engine Gases on Unprotected Steel Viaducts.

BY ARTHUR SULLIVAN.*

An investigation which has been in progress for some time in the city of Chicago regarding the physical condition of viaducts located over railroad tracks, has offered an unlimited opportunity to judge and study the effect on steel of gases from engine blasts, and the many bad conditions found, fully demonstrates the necessity of proper protection for steel, against the injurious effects produced by these gases.

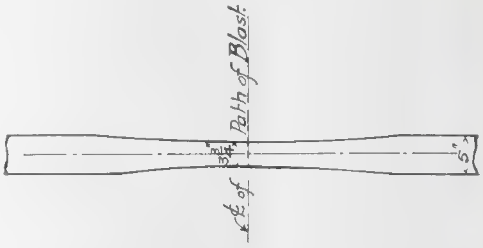

Fig. 1—Sketch Showing Corrosion of Beam Flange.

Thirty viaducts were included in this investigation. They aggregated 14,000 lin. ft. in length, and varied in age from 15 to 30 years, having an average headroom over top of rail of 16 ft., this dimension indicating that the clearance between modern locomotive stacks and the steel was about 6 ins. The amount of traffic operating under them varied but little, and over the main tracks equalled 140 trains per track in 24 hours; it was over these most used places where the greatest effect was found.

The surroundings of the structure has much to do with the resultant effect. Viaducts 20 to 30 years old, so located in the clear, that no buildings or other obstructions interfered in the least with the passage of winds blowing from any direction, showed comparatively slight reductions in sections, and this only on that portion of the structure closest to the engine stacks, namely, bottom flanges of stringers and floor beams, this reduction in most instances hardly exceeding 10 percent. On the other hand viaducts 15 to 20 years old, partially surrounded by buildings, in such a manner as considerably to detract from the full effect of the various winds, thus allowing the fumes to remain in the confines of the structure, showed very large reductions in sections, this percentage of reduction ranging from 40 per cent to 60 per cent, and in some extreme cases the webs of stringers and floorbeams of originally ⅜ in. thickness, were in spots entirely eaten or burned away. Also the range of the deterioration was greater, that is, while in the former instances the bottom flanges of stringers and floorbeams were practically the only parts affected, in the lat-

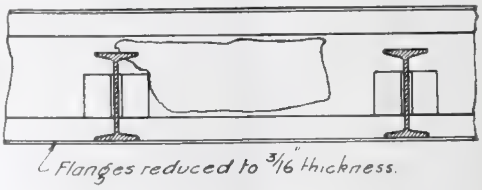

Fig. 2—Sketch Showing Corrosion of Beam Web.

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*Connected with Bridge Division, Chicago, Ill.

TABLE VII. ELECTRICAL TRACK BONDING.

Class.	Material in Place.	Kind.	Size Each.	Unit Labor.	Cost Material.	Scrap Value.	No. per Mile.	Miles per Sgl. Trk.	Total No	Total Cost New.	Total Scrap Value.	When Inst'd.	% Dep.	Dep.	Present Value.
North Chicago Electric Railway Company:															
A	Cross Bonds	2/0 St. Copper	23 ft.	$ .80	$ 1.40	$ 1.04	17	2.408	41	$ 90.20	$ 42.64	1907	15	$ 7.13	$ 83.07
A-1	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	17	4.701	80	176.00	83.20	1908	10	9.28	166.72
B-3	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	30.063	180	396.00	187.20	1897	65	135.72	260.28
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	30.063	10,582	14,285.70	1,481.48	1897	65	8,322.74	5,962.96
C	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	.024	1	2.20	1.04	1897	65	.75	1.45
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	.024	8	10.80	1.12	1897	65	6.29	4.51
In Special Work	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	...	......	602	812.70	84.28	1897	65	473.47	339.23
Ground Returns	500 M.C.M.	St. Copper	2,640 ft	17.50	613.80	447.15	...	7.109	...	4,487.91	3,178.79	1907	15	196.37	4,291.54
Ground Returns	1000 M.C.M.	St. Copper	135 ft	8.00	63.20	46.00	..	.....	3	213.60	138.00	1907	15	11.34	202.26
								37.196		$20,475.11	$ 5,197.75	....		$ 9,163.09	$11,312.02
Organization, Engineering and Incidentals, 15%										3,071.27	779.66	....		1,374.47	1,696.80
		Total								$23,546.38	$ 5,977.41			$10,537.56	$12,008.82
Chicago North Shore Street Railway Company:															
A-1	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	17	3.987	68	$ 149.60	$ 70.72	1909	5	$ 3.94	$ 145.66
B	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	1.006	6	13.20	6.24	1892	90	6.26	6.94
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	1.006	354	477.90	49.56	1892	90	385.51	92.39
B-1	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	4.926	30	66.00	31.20	1892	90	31.32	34.68
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	4.926	1,734	2,340.90	242.76	1892	90	1,888.32	452.58
In Special Work	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	..	......	313	422.55	43.82	1892	90	340.86	81.69
								9.919	......	$ 3,470.15	$ 444.30	...		$ 2,656.22	$ 813.93
Organization, Engineering and Incidentals, 15%										520.53	66.64	...		398.44	122.09
		Total								$ 3,990.68	$ 510.94			$ 3,054.66	$ 936.02
Chicago Electric Transit Company:															
A	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	17	1.016	17	$ 37.40	$ 17.68	1907	15	$ 2.96	$ 34.44
B-2	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	14.180	85	187.00	88.40	1897	65	64.09	122.91
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	176	14.180	2,496	3,369.60	349.44	1897	65	1,963.10	1,406.50
B-3	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	17.323	104	228.80	108.16	1897	65	78.42	150.38
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	17.323	6,098	8,232.30	853.72	1897	65	4,796.08	3,436.22
C	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	.400	2	4.40	2.08	1897	65	1.51	2.89
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	.400	141	190.35	19.74	1897	65	110.90	79.45
D	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	.529	3	6.50	3.12	1897	65	2.26	4.24
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	.529	186	251.10	26.04	1897	65	146.29	104.81
E	Cross Bonds	2/0 St. Copper	23 ft	.80	1.40	1.04	6	.400	2	4.40	2.08	1897	65	1.51	2.89
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	.400	141	190.35	19.74	1897	65	110.90	79.45
In Special Work	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	...	....	875	1,181.25	122.50	1897	65	688.19	493.06
Ground Returns	500 M.C.M.	St. Copper	2,640 ft.	17.50	613.80	417.15	..	1.016	......	641.40	454.30	1907	15	28.07	613.33
Ground Returns	1000 M.C.M.	St. Copper	135 ft	8.00	63.20	46.00		......	1	71.20	46.00	1907	15	3.78	67.42
								33.848		$14,596.15	$ 2,113.00	...		$ 7,998.06	$ 6,598.09
Organization, Engineering and Incidentals, 15%										2,189.41	316.95			1,199.70	989.71
		Total								$16,785.56	$ 2,429.95			$ 9,197.76	$ 7,587.80
North Side Electric Street Railway Company:															
B-3	Cross Bonds	2/0 St. Copper	23 ft	.80	1.40	1.04	6	1.645	10	$ 22.00	$ 10.40	1895	75	$ 8.70	$ [illegible]
	2-Joint Bonds	2/0 St. Copper	3 ft	.25	1.10	.14	352	1.645	579	781.65	81.06	1895	75	525.44	[illegible]
C	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	.032	1	2.20	1.04	1895	75	[illegible]	[illegible]
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	.032	11	14.85	1.54	1895	75	9.98	[illegible]
[illegible]	Cross Bonds	2/0 St. Copper	23 ft.	.80	1.40	1.04	6	3.415	20	44.00	20.80	1895	75	17.40	[illegible]
	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14	352	3.415	1,202	1,622.70	168.28	1895	75	1,090.82	[illegible]
In Special Work	2-Joint Bonds	2/0 St. Copper	3 ft.	.25	1.10	.14		.....	735	992.25	102.90	1895	75	667.01	[illegible]
								5.092		$ 3,479.65	$ 386.02	...		$ [illegible]	$ [illegible]
Organization, Engineering and Incidentals, 15%									...	521.95	57.90	...		[illegible]	[illegible]
		Total								$ 4,001.60	$ 443.92			$ [illegible]	$ [illegible]

[illegible] Jefferson Urban Transit Company.															
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$ [illegible]	$ [illegible]	[illegible]	[illegible]	$ [illegible]	$ [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 6?4 18	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11 44	[illegible]	[illegible]	8 19	21 02
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 04	1906	[illegible]	23	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9 24	1906	[illegible]	[illegible]	73 12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10 44	15 96
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	311 08
[illegible] Wire	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100 80	[illegible]	[illegible]	[illegible]	318 60
								[illegible]		$ [illegible]	$ [illegible]			$ [illegible]	$ 1 599 91
[illegible]										[illegible]	[illegible]			453.40	239 99
Total										$ 5 316 04	$ 602 66			$ 3 476 14	$ 1 839 90
Union Street Railway Company.															
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	[illegible]	5 600	34	$ 74 80	$ [illegible]	1896	70	$ [illegible]	$ 16 84
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 10	14	352	5 600	[illegible]	1 660 85	[illegible]	1896	70	1 663 44	491 41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	811	[illegible]	11 00	5 70	1905	20	1 16	9 81
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 10	.14	[illegible]	811	[illegible]	384 75	29 90	1905	20	68 97	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	3 448	21	46.20	21.84	1897	65	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	.954	6	13 20	6.24	1894	80	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.10	14	352	.954	336	[illegible]	47 04	1894	80	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	2 300	14	30 80	14 56	1896	70	11 37	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 10	14	[illegible]	2 300	810	[illegible]	113.40	1896	70	686.07	407 43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	995	6	13 20	6 24	1908	10	96	12 24
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 40	1 04	6	936	6	13 20	6 24	1907	15	1 04	12 16
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 10	14	352	936	329	444 15	46 06	1907	15	59 71	384 44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 10	14	.	.	112	151 20	15.68		65	88.09	68 11
								15 044		$ 5,390 45	$ 633 70			$ 2,961 42	$ 2,429 [illegible]
[illegible]								. .	.	808.56	95 05			444.21	364 [illegible]
Total										$ 6,199.01	$ 728.75	. .		$ 3,405.63	$ 2,793.38
[illegible] Street Railway Company:															
[illegible]	[illegible]	2-0 St. Copper	23 ft	.80	1.40	1.04	17	2.7845	47	$ 103.40	$ 48.88	1909	5	$ 2.73	$ 100.67
[illegible]	[illegible]	2-0 St. Copper	23 ft	.80	1.40	1.04	17	.3767	6	13 20	6.24	1909	5	.35	12.85
[illegible]	[illegible]	[illegible] St. Copper	23 ft	.80	1.40	1.04	6	1.967	12	26.40	12.48	1890	95	13.22	13 18
[illegible]	[illegible]	[illegible] St. Copper	3 ft	.25	1.10	.14	352	1.967	692	934 20	96.88	1890	95	795.45	138.75
[illegible]	[illegible]	[illegible] St. Copper	23 ft.	.80	1.40	1 04	6	2 0157	12	26.40	12 48	1895	75	10.44	15 96
[illegible]	[illegible] Bonds	[illegible] St. Copper	3 ft	.25	1.10	14	176	2.0157	355	479.25	49.70	1895	75	322.16	157.09
[illegible]	[illegible]	[illegible] St. Copper	23 ft.	.80	1.40	1.04	6	.7954	5	11.00	5.20	1896	70	4.06	6.94
[illegible]	[illegible] Bonds	[illegible] St. Copper	3 ft	.25	1.10	.14	352	.7954	280	378.00	39.20	1896	70	237.16	140.84
[illegible]	[illegible] Bonds	[illegible] St. Copper	23 ft.	.80	1.40	1.04	6	.0321	1	2.20	1.04	1905	20	.23	1.97
[illegible]	[illegible] Bonds	[illegible] St. Copper	3 ft	.25	1.10	14	352	.0321	8	10.80	1.12	1905	20	1.94	8 86
[illegible]	[illegible] Bonds	[illegible] St. Copper	23 ft.	.80	1 40	1 04	6	4.8965	29	63.80	30.16	1894	80	26.91	36 89
[illegible]	[illegible] Bonds	[illegible] St. Copper	3 ft.	.25	1.10	.14	352	4.8965	1,724	2,327 40	241.36	1894	80	1,668.83	658 57
[illegible]	[illegible] Bonds	[illegible] St Copper	3 ft.	.25	1.10	.14	. . .	....	93	125.55	13 02	. .	65	73.14	52 41
[illegible]	[illegible] M C M	St. Copper	1 [illegible] ft	17 50	613.80	447.15		3.1612	[illegible]	1 995 66	1,413.53	1909	5	29 11	1,966 55
[illegible] R[illegible]	[illegible] M C M	St Copper	135 ft	8 00	63 20	46 00		. .	[illegible]	142 40	92.00	1909	5	2 52	179 88
								12 8679		$ 6,639 66	$ 2 063 29	.	.	$ 3,188 25	$ 3,451 41
[illegible] and Incidentals [illegible]								. .	.	995 95	309 49			478 24	517 71
Total										$ 7,635 61	$ 2,372.78	.	.	$ 3 666 49	$ 3 969 12
Total all Companies								132.302	. . . . .	$67,474.88	$13,066 41	. .	.	$36,006 49	$31,468.[illegible]

ter cases the effect extended to the webs and top flanges of stringers and floorbeams, bottom chord sections, bases of posts and hangers, and to the bottom portion of all truss members, also pins and pin connections.

Further it was found that in spans consisting of three trusses, the effect on the chord sections etc., of the center truss, was much greater than on the same section of either outside truss. An instance being where the bottom chord of the outside truss, showed a loss of section of 30 percent to 40 percent, that of the center truss at relatively the same point was reduced fully 75 percent. This last item was of much interest, after scraping the rust and scale off, the resultant section calipered only 4x5-16 ins., the original section of this chord having been made up of two eyebars 5x1¼ in. This dimension being obtained first from the drawings and later substantiated by field examination of the similar panel at the other end of the span, this latter end not being over tracks and partially protected by an intermediate building showed slight deterioration. The metal was of wrought iron, and when taken out after having been replaced by new steel bars, was tested as follows; the bar was so placed that the point where the greatest reduction had occurred, rested close to a support, it was then struck heavily with a large flogging hammer, the metal broke and entirely separated at the first blow, the fracture indicating almost complete crystallization. Our end of the bar was then bent 180° about a 1 in. radius, at a point where it was 4¾x⅞ ins. and showed no fracture whatsoever, also the metal at this point was found soft and ductile, i. e., not brittle or crystallized as is evidenced by the fact that a sharp tempered steel point was driven into it fully 3-16 in. deep. This seems to indicate as did several other experiments of a like nature, that although the blasts of gases from engines does eat away the metal on its exposed surfaces, that portion which remains after all scale, etc., has been scrapped off is not affected, this last condition providing the section has not been over-stressed to the extent that crystallization sets in from the latter cause.

Stringers as above mentioned being the most affected by these causes, become in some cases quite dangerous, the web, particularly when I-beam sections are used, is as a rule not very heavy, and when subjected to continuous blasts is eaten away in a comparatively short time. If this loss occurs at the end of the stringer, where the shear is maximum, a serious accident is liable to result from a heavy impact load causing the stringer to fail through its inability to transmit the shear load.

Another place where the effect of these gases is constantly found, is on main sections of truss web members, particularly flanges of angles and webs of channels, at a point where the wooden chord cover joins them. These chord covers are as a rule made up of 3-in. planking, fitted tight, presumably to keep the smoke and gases from rising through the interstices and causing inconvenience to traffic. The method in this respect is very successful, in fact so much so that the fumes having reached this point and finding no outlet remain there, creating a constant chemical disturbance which rapidly deteriorates the material. An extreme case of this sort happened during the above mentioned investigation, on a riveted span. The truss hanger consisting of four angles laced together, was reduced fully 60 percent at just the point where the chord cover joined it. At the time of failure all four angles separated, thereby throwing the floorbeam load on the bottom chord; this section not being capable of properly supporting even the dead load became badly twisted and dropped fully 6 ins. out of alignment.

All members such as sidewalk stringers, lateral rods in center panels and truss counters which require only small areas, showed a greater percentage of deterioration than those of larger areas. In one case where angles of 5/16 in. thickness had been used as bridging between stringers of heavy I-beam section, this bridging had been completely destroyed, while the loss of section on the stringers did not exceed 20 per cent. Also vertical surfaces are more effected than horizontal surfaces, excepting when the latter is so close to the stack that the blast has not diffused to any extent. Further it was found that horizontal surfaces, although in the path of blast, but facing away from its source, showed relatively slight loss.

The accompanying sketches are true reproductions of specific cases which were found, and exhibit very clearly the almost unbelievable extent of the effect of these gases. Figure I shows the bottom flange of a stringer and indicates the relative loss of section of the flange area in reference to its location with respect to the path of blast. The width of the affected area can well be compared with the sweep of shot from a gun; that is, its width varies with the distance that the flange is separated from the engine stack. Figure II is an elevation of a floor beam and tends to prove the truth of the statement made in the preceding paragraph that the deterioration is proportionally more rapid on small sections than on larger ones; in this case a ⅜ in. web plate has been entirely eaten through to the extent shown, while the flanges of originally ½ in. thickness have suffered a loss of only 60 per cent.

The word unprotected, as is used in the title of this article, means, except for an occasional job of scraping and painting, which, as a rule, is poorly executed. Paint on steel surfaces subjected to this kind of blast, instead of forming a nonporous film, becomes at first a pasty substance which can be easily rubbed off with the hand and later develops into a hard brittle covering, which the vibration from traffic cracks and causes to fall away in large pieces. If proper care of this sort were observed the effect of these gases could be considerably reduced, but as this work is very difficult of operation and doubtful of quality, as well as expensive, it is usually overlooked.

LETTERS TO THE EDITOR.

Flushing Pavements With Water Under Pressure.

Sirs: The above heading is quoted from an article, page 307, of May issue of "Municipal Engineering," entitled, "Causes and Defects in Asphalt Pavements," by Isaac Van Trump, Chicago, Ill. The article includes "flushing with water under high pressure" as one of the "causes of defects in asphalt pavements which are almost entirely under the control of the municipal engineer," and adds, "it is entirely unfair to the municipality, the taxpayer and the contractor for the municipal engineer through ignorance or neglect to permit conditions to exist either during the construction or after the street has been completed, that will permanently impair the usefulness or appearance of the thoroughfare." This is sound advice from one who has closely watched the evils of the high pressure flushing system of street cleaning; but what heed does the city of Chicago pay to its and some other cities' technical advisers? In the current number of another engineering journal we find a half-page photograph of "one of Chicago's 41 new flushing machines" forcing water, from about 1 foot above it, under pressure, on the surface of the pavement. Is it any wonder that contractors and surety companies in Chicago and elsewhere are repudiating their guarantees, as shown by an able paper in 1907 by John W. Hittell, Chicago's Chief Engineer of Highways, before the American Society of Municipal Engineers.

The writer and others who have had long experience with the construction and maintenance of pavements, have condemned this injurious system of street cleaning which ruins pavements of all kinds, fills sewers with street dirt, consumes an excessive portion of water supply and is otherwise not economical.

A recent test of cleaning by high pressure flushing system in New York City shows, as reported: (a) Cost 72 cts. per 1,000 sq. yds. per cleaning, for labor and water; (b) 2 gals. water consumed per sq. yd. of pavement cleaned; (c) Cost of water, 9 cts. per 1,000 gals.

At this rate in a city having 200 miles, say 4,000,000 sq. yds. of pavement, cleaned daily (Sundays excepted), say 300 times per year, the cost would be $2,880 per day, or $864,000 per year.

The water consumption figures 8,000,000 gals. per day, at 9 cts. per 1,000 gals. = $720 per day, or $216,000 per year, or about approximately the cost of water supply of a city of 50,000 population. Knowing that the water used in flushing carries to the sewers at least 10 per cent of its bulk of street dirt and a large portion of the dirt settles in the sewers, we see the great additional cost of sewer cleaning.

Every engineer, or official, and every periodical which is interested in construction and maintenance of street pavements, should persistently and at all possible times and places raise their voices in loud acclamation against this system of "pavement ruination."

On this subject I quote the following from the St. Louis Daily News of May 20th:

"Present Method of Flushing the City's Streets Detrimental to Their Proper Maintenance—Volume of Water Employed Is Excessive —Unnecessary Expense to Tax Payer.

"From more than one source have lately reached the Daily News complaints—which would seem to be justified—with regard to the system of flushing the city's streets.

"No one can have failed to notice the tremendous force with which the water is projected from the flushing machine employed in cleaning our streets, a force sufficient to drive the sand and soil from between the interstices of the granite blocks with which some of the streets are paved and to work serious damage to those artificially constructed asphalt or bituminous surfaces. The result has been that repairs to the streets become necessary much more frequently than is at all necessary or than would be the case if a more natural system of cleaning were employed.

"Nor is this all. The volume of water consumed in street cleaning operations at the present time is excessive; and is also a source of unnecessary expense to the long-suffering taxpayer. So great indeed is the flow of water sewerwards down the gutters when the "flushers" are at work that few can get off the sidewalk without wading. With this stream goes not only all the street refuse but also much of the paving materials.

"During the past year the Street Department has curtailed the use of flushing machines and the improvement in the condition of the pavements is marked.

"Interviewed by a News reporter the Street Commissioner, Mr. Travilla, admitted that these flushing machines now in use, if employed too frequently, damage asphalt or bituminous paving. The damage to brick, granite and wood pavements is also great, causing the joints to be opened, the pavements to be loosened and steadily dislocated, uneven and need excessive repairs.

Constant patrol hand sweeping, with occasional machine sweeping and light sprinkling just before sweeping, to allay dust, has been demonstrated to be the most economical, satisfactory and efficient method not only for preserving pavements but especially for keeping streets constantly clean at all times of day.

J. W. HOWARD,
Consulting Engineer, Roads, Streets, Pavements.
New York, Sept. 30, 1910.

Rust, as Shown in the Removal of a Seventeen-Story Building.*

The Gillender Building, a seventeen-story structure at the northwest corner of Wall and Nassau streets, New York City, was built in 1896, and removed in 1910.

When built, all the columns were encased in solid brickwork. The steelwork received one coat of paint in the shop and two after erection, but on removal, showed little evidence of ever having been painted at all.

From the top to the bottom, wherever the spaces between the brick and steel were filled with Portland cement mortar, there was no rusting, but, wherever the mortar did not fill such spaces completely, rusting had begun. Generally, the under sides of the top and bottom flanges of the floor-beams had begun to show rust, while the web and upper surfaces, having been in contact with mortar, were in good condition.

The worst rusting of all was from the sixth floor down, on the northeast corner, where the columns had been against the adjoining building, on the north side. The cover-plates of these columns looked as if they had never been painted, but had stood in the open, exposed to all weather, for six or seven years. On these columns one-half, in volume, of many rivet heads could easily be removed.

This building had been erected by first-class contractors and with first-class materials; and although the rusting had not yet made the building unsafe, there is no telling how soon it would have become so.

It would seem that if the columns had been encased and filled with wet concrete there would have been little danger of rust, and they could thus have been easily protected from electrolysis. Oil or oil paints should not be placed on steel to be thus encased.

Messrs. Trowbridge and Livingston are the architects for the 39-story Bankers' Trust Building which will take the place of the Gillender Building, and Messrs. Marc Eidlitz & Son are the contractors, to whom the writer gives his thanks.

Inspecting Steel Forms.

On Wednesday, Sept. 21st, a party of about twenty members of the Boston Society of Civil Engineers went to Lowell to inspect the methods being employed there by the Aberthaw Construction Co. in the use of corrugated iron for the floor forms on the new reinforced concrete cotton warehouse being built for the Massachusetts Cotton Mills. As this work progresses some very interesting cost data is being compiled, which, according to the usual liberal policy of the Aberthaw Company, will be available for publication later. Another interesting feature of this work and a new departure in concrete work is the use of steel construction towers. These are made of standard steel shapes in sections about ten feet high, the total height of the towers on this job being about 110 feet. These towers are permanent pieces of apparatus and can be used over and over again, so that the ultimate yard-cost for concrete handled will be extremely low in spite of their high first cost.

Recipe for Making Blueprint Paper.

The following recipe was used in making blue print paper in South America where it was difficult to buy paper and even that which was purchased was very often ruined with age. The paper made with this recipe gave excellent satisfaction. Using an ounce as the unit—take 1 oz. of pure iron, dissolve in strong nitric acid, filter, wash, precipitate the iron as ferric hydroxide by ammonia, filter, wash filtrate clean and dissolve in hot citric acid, using as little citric acid as possible. Mix this with 1 oz. ferri cyanide of potassium, dissolved in a pint of water free from iron or manganese, spread on the paper with a soft brush, and hang the paper up to dry. If it is allowed to lie flat during drying the solution collects in pools that oxidize and ruin the result. The above is based on the assumption that only 25 per cent of the ferric citrate is reduced by light during printing—possibly even that is too high.

Pay as You Enter Method of Coaling Ships.—At Kingston, Jamaica, a novel method of coaling ships and of the payment of the laborers is resorted to and is a very economical and rapid method, which could be applied in other lines of work. When a ship is to be coaled a hundred or more negroes gather and wait for the signal to start. They are furnished with full baskets (about 1½ bushels each) of coal, which they carry on their heads from the coal yard to the coal bunkers, where the basket is dumped and the empty basket carried back. Each laborer receives a penny a basket, and as he passes up the gang plank with the load on his shoulders, a penny is handed him by the negro "paymaster." Of course labor is plentiful, but the prospect of receiving money each

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*A paper by T. Kennard Thomson, Proceedings American Society of Civil Engineers, Vol. XXXVI, p. 1224.

[illegible] other's heads, and the coaling of a ship [illegible]

Day's Work of Seventeen Steam Shovels

On September [illegible], 17 steam shovels working in the Culebra construction district of the Central Division, excavated 29,335 cubic yards during the working day of eight hours, an average of 1,726 cubic yards per shovel for the day. During this time the shovels were under steam 136 hours and were actually working 90 hours and 55 minutes and were waiting for cars 29 hours and 30 minutes. The other delays were due to mining, cleaning track after blasts, repairing shovels, moving shovels back, slides and similar causes.

Hydraulic Dredge Record.—The hydraulic dredge montezuma on contract 46, New York Barge Canal, has the record for the amount of excavation for any one month. This dredge, which has a 20-in. diecharge, excavated 454,706 cu. yds. of sandy material during the month of September, 1909. Of this 450,000 yards was "pay dirt," the balance being an extra cut of 2 ft. in width and depth outside the lines for which no payment was made. This dredge is operated by the Kinser Construction Company, contractors, of Chicago.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Von Geldern, [illegible] San Francisco, Cal.

Western Society of Engineers.—Secy., J. H Warder, Monadnock Block, Chicago, Ill.

PERSONALS.

[illegible] practice.

Mr. J. W. Storrs has been appointed cons[illegible]

[illegible]

Mr. Frank Mathews, until recently Assistant Engineer of the paving department of the Board of Local Improvements, City of Chicago, has been appointed Division Engineer, to succeed Mr. Joseph Moore, who recently resigned owing to ill health.

Mr. John A. Bensel of New York City has been nominated by the Democratic party of New York state as its candidate for the position of State Engineer and Surveyor. Mr. Frank M. Williams of Oneida, N. Y., the present incumbent, was renominated by the Republican party.

George Manheimer, formerly a well-known civil engineer in the state of Wisconsin, was killed Sept. 28 by a train at Manitowoc, Wis. Mr. Manheimer was one of the engineers employed in the construction of the Eads jetties on the Mississippi River. He retired from active practice in 1884. He was 58 years old.

G. H. Hughes, an American railroad contractor on the branch of the railroad running from Torreon, Mexico, into the mountains, was shot and instantly killed by his Mexican employes on Sept. 20. Hughes' Mexican foreman was stabbed in defending Hughes. The Mexicans were celebrating a fiesta and imagined they had a grievance against all Americans.

Mr. W. H. Rosecrans, formerly Chief Engineer of The Arnold Company, has opened offices at 110 La Salle St., Chicago, and 1328 Broadway, New York, and will engage in a general consulting engineering practice. Associated with him are Irving E. Brooke, Electrical Engineer; Alfred H. Marshall, Hydraulic Engineer, and H. G. Raschbacher, Irrigation Engineer, all of whom were with Mr. Rosecrans before opening his new offices.

The Pennsylvania R. R. has awarded its annual cash prizes to the following supervisors and assistant supervisors on the lines east of Pittsburg and Erie for the best track throughout the year: The first premium of $1,200, of which $800 went to the supervisor and $400 to the assistant supervisor having the best line and surface between Jersey City and Pittsburg and Philadelphia and Washington, was awarded to Supervisor George Goldie, Jr., and Assistant Supervisor R. R. Nace. who have charge of the track from 62d St., West Philadelphia, to Wilmington. The four premiums of $800 each, of which $600 went to the supervisor and $200 to the assistant supervisor having the best track on a Main Line superintendent's division between Jersey City and Pittsburg and Philadelphia and Washington, were awarded as follows: Supervisor W. F. Rench and Assistant Supervisor S. L. Church, who have charge of the track between Girard Ave. bridge, West Philadelphia, and Tullytown, Pa. Supervisor G. R. Sinnickson and Assistant Supervisor H. A. Gass, who have charge of the track between Woodbine Ave., West Philadelphia, and a point just west of Coatesville. Supervisor J. A. Buchenal and Assistant Supervisor E. C. Silvius, who have charge of the track between Durward and Longfellow, Pa. Supervisor F. L. Pitcher and Assistant Supervisor W. W. Hubley, who have charge of the track between New Florence and George Station on the Pittsburg Division. The improvement premium of $1,000, of which $700 goes to the supervisor and $300 to the assistant supervisor showing the greatest improvement in line and surface on the Main Line between Jersey City and Pittsburg and Philadelphia and Washington, was awarded to Supervisor H. E. Waters and Assistant Supervisor Frederick Evans, who have charge of the track between Baltimore and Springfield, Md.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us i. you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Air Compressors.—Paper; 6x9 ins.; 68 pp. National Brake & Electric Co., Milwaukee.

This catalog, No. 391, gives detailed information and photographs of air compressors and accessory machinery for a wide range of purposes. Both stationary and portable plants are shown. Tables of sizes, telegraph code and other useful information are given.

Good Roads.—Paper; 9x12 ins.; 60 pp. Port Huron Engine & Thresher Co., Port Huron Mich.

[illegible] with examples of machines in use and with [illegible]

[illegible] No. 6 issued previously. The book contains five chapters with standard tables, discussions of principals of reinforcement and advice concerning various subjects in design. Various types of structures are treated in classes, viz.: Slab Bridges and Flat Top Culverts, Girder Bridges, Arch Bridges, Sewers and Culverts, Tanks and Walls, etc. Other folders describe Building Design, Plastering, and give tables of prices, both domestic and export.

Chenoweth Reinforced Concrete Piles.—Paper; 11½x8½ ins.; 6 pp. Alexander C. Chenoweth, 16 Court St., Brooklyn, N. Y.

Showing illustrations of these piles, completed docks, and docks under construction.

Vulcanite.—Paper; 3¼x6 ins.; 12 pp. Vulcanite Portland Cement Co., Fifth Ave. Bldg., New York.

A booklet containing paragraphs from the specifications for a series of 13 panels exhibited at the Cement Show, Chicago, 1910. Each paragraph describes the composition of the panel.

Reinforced Concrete for Houses.—Paper; 6x9 ins.; 28 pp. Vulcanite Portland Cement Co., Fifth Ave. Bldg., New York.

This booklet presents an address on the subject of Architectural Details in Reinforced Concrete, including photographs of the various examples spoken of.

Mineral Oil Mixed Concrete.—Paper; 6x9 ins.; 8 pp. Vulcanite Portland Cement Co., Fifth Ave. Bldg., New York.

Being a paper by Albert Moyer on the above subject.

Vulcan Iron Works.—Paper; 6x9 ins.; 114 pp. Vulcan Iron Works, Wilkesbarre, Pa.

A catalog giving drawings, photographs of machinery, and installations of same where hoisting and haulage is required. Return tubular boilers, mine ventilating fans, and a general line of colliery and mining equipment are here illustrated and described.

Traveling Cranes.—Paper; 3½x6 ins.; 8 pp. Pawling & Harmeschfeger Co., Milwaukee, Wis.

A folder entitled "Four Laborers Instead of Thirty," being a short description of an installation of a crane for handling scrap iron, pig, coke and stone in a foundry.

Alternating Current Switchboard Panels.—Paper; 8x10½ ins.; 70 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4749 on the above subject has been issued by the General Electric Company. The panels illustrated in this bulletin are of the sectionalized type, and each section has a separate catalog number. These panels are in three sections, and the pages of the bulletin are sectionalized so that the user may have before him a picture of the complete panel desired, together with a full description of the equipment.

Isolated Plant—Direct Current Combination Generator and Feeder Panels.—Paper; 8x10½ ins.; 8pp. The General Electric Co., Schenectady, N. Y.

A new bulletin on the above subject, No. 4763, which supersedes previous bulletins on that subject, has just been issued.

Large Motors for Steel Mills.—Paper; 8x10½ ins.; 16 pp. General Electric Co. Schenectdy, N. Y.

Bulletin No. 4767, just issued, illustrates and describes motors designed particularly for use in steel mills. Among them are the 6,000-hp., 6,600-volt induction motors recently installed in the Gary plant of the Indiana Steel Company. The bulletin refers to both alternating and direct current motors, and contains instructions as to the data which should be furnished when making inquiries in connection with the installation of motors for such purposes.

Modern Sanitation.—Paper; 6¾x9¾ ins.; 44 pp. Standard Sanitary Mfg. Co.

This is the September number of the magazine published by this company in the interests and development of Sanitation.

Portland Concrete Piles.—Paper, 6x9 ins.; 24 pp. Portland Concrete Pile & Equipment Co., Lewis Bldg., Portland, Ore.

Describing a system of placing concrete piling with metal collapsible shell and core. Comparative costs are given.

Sperry Road Culverts.—6x9½ ins.; 4 pp. Globe Foundry Company, Port Chester, N. Y.

A folder illustrating and describing the Sperry Expansion Culvert, made of cast iron.

Automatic Gas Buoys and Beacons.—Paper; 10x13 ins.; 52 pp. International Marine Signal Co., 172 Broadway, New York.

The manufacturers of automatic low pressure acetylene gas buoys and beacons issue this catalog describing and illustrating lighted and unlighted buoys. Complete specifications, four of each type, are given with diagrams.

Tunnel Electrification.—Paper; 8x10½ ins.; 16 pp. The General Electric Co., Schenectady, N. Y.

Bulletin No. 4755 illustrating and describing the electrical equipment of the Great Northern Railway tunnel through the summit of the Cascade Mountains. Shows the ability of electric traction to increase the capacity of sections of railroads where, owing to physical conditions, operation wi h steam locomotives has reached its limit.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

Developments of the past week would seem to indicate that there is going to be a fair amount of new railroad construction work this fall. Evidence confirmatory of this statement will be found elsewhere in this issue. A considerable part of this new work is in the South. In Kentucky the Louisville & Nashville R. R. is planning some extensive construction work, and has already asked bids for the construction of the Lexington & Eastern R. R., an 80-mile line, which is to extend from Jackson, Ky., to Whitsburg, Ky. This contract is to be let in five sections and not more than two sections will be awarded to one firm. The Louisville & Nashville R. R. is also about to ask bids for the construction of 12 miles of new road from Colly Creek, Ky., southeast. In Arkansas the Meta & Arkansas Valley Railway Co. is planning a 60-mile line and proposes to let construction contracts about Nov. 1st for a portion of this line. In the same state the Little Rock & Hot Springs Electric Railway Co. is reported as being about ready to let contracts for part at least of its proposed 55-mile line from Little Rock to Hot Springs. Down in Texas the Nueces River Valley Railroad Co. is getting its affairs in such shape that it hopes to award some construction contracts by the first of next year. This road projects a 200-mile line. Down in Mexico bids were opened on Oct. 1st by H. M. Taylor, Director of Construction National Lines of Mexico for clearing, grading and masonry covering a proposed line from Penjamo to Ajuno, about 125 kilometers long.—Bids for a large contract for the construction of incinerating plants are now being asked by the City of San Francisco. The contract calls for the construction of two incinerating plants of a capacity of 120 tons each, the estimated cost being $250,000.—Several fair sized railroad construction contracts have been let recently. Among these may be noted the following: Carl Hall & Co., for about six miles of work for the Duluth & Iron Range Ry. in Minnesota; the Utah Construction Co., Ogden, Utah, for the grading work on the 10-mile branch line to be built for the Oregon Short Line R. R., from Montpelier, Idaho, to Paris, Idaho; Archie Mason, Portland, Ore., for the grading work for the Mount Hood R. R., between Montevilla, Ore., and a point beyond Gresham; Costello Bros., for constructing the Big Four R. R. yards at Evansville, Ind.—The breakwater at San Pedro Harbor, which has been under construction since 1900, was turned over to the U. S. Government on Oct. 1st. The breakwater is 9,250 feet long, and nearly 2,500,000 tons of rock were used in the sub-structure, and 232,600 tons in the super-structure. The rock alone cost $2,748,690.—A recently issued report of the State Railroad Commission of Texas shows that 976 miles of railroad are under construction in the state. This exceeds the record of the year ending June 30, 1910, the mileage constructed in that year being 738.2 miles. The mileage constructed in previous years was as follows: 1905, 208.87 miles; 1906, 313.34 miles; 1907, 517.24 miles; 1908, 325.85 miles.—Officials of the Santa Fe have announced that on Oct. 15th the second track on the Illinois division, between Chicago and Fort Madison, will be opened for passenger traffic. The track has been down and freight trains have been operated over it for two or three weeks, getting it in shape for passenger traffic. On the Missouri division all has been completed except 25 or 30 miles, about 10 miles of which will be opened for passenger service Nov. 1st. This marks one of the first steps in the progress of the railroad toward a complete system of double tracking from Chicago to the Pacific Coast.—A large amount of Government River and Harbor work is now being advertised. Bids have also been opened by various U. S. engineers for a considerable amount of this work. One of the largest of these contracts was for dredging in Duluth Harbor Basin, Minnesota. Bids for this work, which will cost about $240,000, were opened Sept. 30th, the bid of the Duluth Superior Dredging Co., Duluth, Minn., being recommended for acceptance.

The Width of Country Roads.

Governor Carroll of Iowa has come out with an excellent idea. He is advocating reducing the width of the right of way of country roads in that state. He points out that the average width of the country road is 60 ft., whereas 40 ft. is enough. As there are said to be 100,000 miles of country roads in Iowa, the carrying out of Governor Carroll's plan would result in cutting off some 265,000 acres of land and restoring them to the wheat and corn fields. The custom of having wide roadways originated in the days when land was plenty and cheap, and having been once begun the plan was continued for no better reason than that it had been so before. In the majority of country roads but a small part of the right of way is occupied by the roadway, and as a result the remainder of the road is allowed to grow up to weeds, which scatter seeds throughout adjacent fields. Many other states are in the same situation as Iowa. In Minnesota, for instance, it was required by law that country and township roads be made four rods wide, and by agreement of property owners, these roads might be six rods wide. In 1905 the law was amended so that new roads might be made three rods wide.

Lost: A Road.

Officials of Colorado, according to a press report, are doing the gum shoe act in an effort to find a highway which is lost, strayed or stolen. The road was supposed to have been constructed in 1908 in Gunnison County, and according to office files the money for the road was paid in August of that year. About $3,600 was expended for this road. A short time ago it was determined to build an addition to the road, and when it came time to make a survey for the new portion, the engineering force were unable to tell where to start. They had been instructed to begin work at the east end of the older road, but according to the press reports they could find neither east, west, north nor south ends, as the road was not where they expected to find it. Colorado is a fair sized state, and there is plenty of room there for even a good sized road to get lost in. However we don't think that has happened, nor do we think it has been stolen; probably it will be found the road has merely been misplaced.

Early Paving in London and New York.

There has been issued recently in London a book which throws much light on the early paving work of that city. This book is a history of the "Worshipful Company of Paviors of the City of London." From this book we learn that some portions of the city must have been paved previous to the year 1272, for we find that during the reign of Edward I. (1272-1307) the citizens obtained a charter exempting them from paying "pavage," a tax levied for the paving of the principal thoroughfares. Presumably as a result of this charter the charge became an imperial charge instead of a local one, and the aldermen of the wards elected "four reputable men" to look after the work of paving and cleaning each ward. In 1479 the Paviors Company secured from the Corporation of London a code of ordinances which gave it authority over the "craft or mystery" of paving. So much for the early paving work in London; as to the early paving work in New York reference should be made to "Valentine's Manual" for 1862. Owing to the very irregular manner in which the houses of old New York were constructed, in regard to lines of thoroughfare, it was necessary to make a survey and lay down a permanent line of streets before commencing to regulate and pave. Thus in February, 1656, the government confirmed the plans submittted by a surveyor, and appointed inspectors to mark out the lines of buildings to be erected. The first street paved was Brower St., now Stone st., it being resolved in January, 1658, that "whereas, the inhabitants of Brower St. have represented that said street has been for some time impassable, and they are disposed to pave it with cobble stones, as well for ornament as for use, which the magistrates acceding to, overseers shall be appointed to contract for the stones, so as to make a beginning in the spring." The expense was assessed on the residents. Within the next half dozen years most of the streets were paved in the same manner. The pavement was without sidewalks, and the water ran off along the center of the street. The first sidewalk was built in connection with the sheet-piling along the East River. But that was a local necessity and sidewalks were not customary in streets for several generations subsequent to the period now spoken of. The system of paving in existence in 1693 may be inferred from the following order, made in that year: "Forasmuch as the former orders, made for paving the streets, have been much neglected, whereby citizens and sojourners are much annoyed, and intercourse of trade among the inhabitants greatly lessened; for the better regulation thereof, it is ordered, that every inhabitant in the streets hereinafter mentioned, shall, before the 1st of August, next, cause to be paved, with pebble-stones, so much of said streets as shall front their respective premises. Bridge St., from Lucas Kierstede's to Peter Delanoy's, 10 feet from the front of each house. The whole of said street, from Peter Delanoy's to the middle of Broad St. From Mr. Cortland's corner (present Broad and Pearl Sts.) to the City Hall, 10 ft. from the fronts of the houses. From the City Hall to Martin Clock's (corner Pearl and William) 10 ft.; and so from the corner of Mr. Lewis' (William St. and Hanover square to the City Gate, 10 ft. The houses facing the wall, up to the corner of Broad St., 10 feet. The whole of Church St. (Exchange pl.). The west side of Broad St. to Ben Devall's, 10 ft. Broadway, on both sides, 10 ft. down to Mr. Smith's (opposite the Bowling Green), on the west side, and to Lucas Kierstede's on the other. Beaver St. to be repaired, 10 ft. on both sides." It will be seen that some of the principal streets in the city were, at the period named, wholly without paving, and that none of the leading streets were paved more than 10 ft. from the fronts of the houses; that there were no sidewalks then paved distinct from the pebble stone paving designed for vehicles, [illegible] pavement. [illegible] respect to its streets may also be inferred from an order made in 1691; that "the poisonous and stinking weeds before every one's door be forthwith plucked up." In June, 1703, the street newly constructed along the river was ordered to be paved (present Water St.); and [illegible] Flattenbarrack Hill (Exchange Pl.) was ordered for the first time to be paved. In 1707 Broadway was first paved, from Trinity Church to Maiden lane. The system adopted for paving, at this period, was the same as formerly, by requiring the owners to pave before their respective premises. In their default they were subjct to a penalty, which could be enforced by suit. This system continued for many years subsequently, and it is believed that, up to the time of the Revolution, the "kennel" ran through the centers of the streets; and if sidewalks existed, they were the voluntary work of the adjacent owners; we find no regulations in the public ordinances concerning either their construction or repair.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Lee Street Terminal Co. recently organized at Montgomery, Ala., with a capital stock of $20,000, has for its object the bringing of the tracks of the Mobile & Ohio R. R. into the heart of the city of Montgomery with a terminal at Lee and Moulton Sts.

City Council of Montgomery, Ala., has granted a franchise for street railway to Charles F. Woodward, Boston, Mass. According to the terms of the franchise, construction work must be started within six months.

Arkansas.

Surveys have been started at Jonesboro, Ark., of three different routes for the interurban line to Nettleton. It is generally believed that the route will be east from Jonesboro by the new First District agricultural school. It is said that material will be ordered at once from Chicago and the Main St. tracks at Jonesboro will be laid before the paving brick are laid.

W. L. Reaves has completed his grading work at the Argenta yards of the Cotton Belt and has sent part of his men and teams to Newport, Ark., for work on the Iron Mountain. The remainder of his gang was sent to points west on the Rock Island.

The Meto & Arkansas Valley Ry. Co., which projects a 60-mile line, has completed its surveys to Tomberlin. The company has secured $80,000 of construction capital and proposes to let construction contracts about Nov. 1. The company already has eight miles of line constructed. F. C. Kyte, Lonoke, Ark., is Chief Engineer and H. N. Sweet, Argenta, Ark., is President

The McGrath Construction Co. has completed its grading contract on the Iron Mountain R. R. and has removed its outfit from Kensett to a point on the Missouri Pacific in Kansas.

The Little Rock & Hot Springs Electric Ry. Co., L. Garrett, General Manager, Little Rock, Ark., is reported to be about ready to let contracts for portions of its proposed 55-mile line from Little Rock to Hot Springs.

California.

The County Supervisors of San Joaquin County have refused to grant the petition of the Stockton-Modsto interurban electric road for a franchise over the county highways. The company will now have to purchase a right of way for a distance of three miles to get into Stockton.

The Laton & Western R. R. has awarded [illegible] mile line westerly from Laton, Cal., to H. L. Gepford. S. F Cochram, Laton, Cal., is [illegible] Cal., is president.

The Gough Street Ry. Co., of San Francisco, has been incorporated with a capital stock of $60,000 and proposes to build and operate [illegible] McAllister Sts., extending south along Gough to Haight, at the corner of Market and Valencia Sts., there to connect with existing lines on McAllister and Market Sts. The proposed line will consist of about a mile of track. The directors are A. J. Pon, David Livingston and Charles Loesch, all of San Francisco.

The Northwestern Pacific R. R., W. C. Edes, Chief Engineer, San Francisco, Cal., has set [illegible] that road in 1911 toward Eureka, in Humboldt County. For extension work this year $1,000,000 is being spent. Between Willits, in Mendocino County, and Shively, in Humboldt County, there is a gap of 100 miles. The survey estimates of cost to fill in the gap are $8,000,000, or an average of $80,000 per mile. A number of miles will cost at the rate of $100,000 per mile on account of heavy tunnel work and grading. The company has a bond issue of $35,000,000, of which sum $12,000,000 is for the redemption of old outstanding securities of the subordinate companies forming the present merged corporation. No bonds for construction purpose have as yet been sold. Money for that purpose is being advanced out of the treasuries of the Southern Pacific and Santa Fe.

The Bakersfield & Ventura R. R. Co. has been incorporated with a capital stock of $500,000, the directors being as follows: Chas. T. Carnahan, John A. Ewing, Morton M. Hamma, Samuel H. Thompson, Jr., William H. Ferguson.

The city officials of Sacramento, Cal., have been notified by the Vallejo & Northern Electric Ry. Co., that it is prepared to lay its rails into the city.

It has been announced in Imperial, Cal., that construction will begin early in October on a railroad connecting Silsbee and that city. Forces are now being assembled at Los Angeles to start on the construction of the 10-mile road. It is believed that it is a section of the Santa Fe line proposed to connect the main line at Parker with San Diego and Arizona.

We are advised that the construction of the Geary St. Railway at San Francisco, Cal., will probably be undertaken by day labor. The length of the line will be 8 to 9 miles and it will extend from the ferry to the beach over Market, Geary, Pt. Lobos and other streets. Surveys have been made and the capital for the construction has been secured. The railway will be constructed for the city and county of San Francisco. Marsden Manson is City Engineer of San Francisco.

Work has been started overhauling the line and improving the entire system of the Los Angeles Pacific Co., which, according to the present estimate, will require an expenditure of $5,000,000. Preliminary work on the general improvements was preceded by the securing of rights of way for two additional tracks that will be laid between the western end of the series of tunnels and Venice. Rights of way for the tunnels have also been secured, the last having been authorized to pass under the Olive St. school, Los Angeles, Cal.

Steel has arrived at Oroville, Cal., for the proposed line of the Butte & Plumas R. R. and men are engaged in unloading it. Eight miles of roadbed have been graded and a surveying crew is now at Walker Bell Place at Berry making locations.

Work on the Brackett Road is progressing rapidly, according to advices from Modesto, Cal., and men and teams are being put to work as fast as they can be procured. There are few engineering obstructions on the road, the main one being the bridge over the Stanislaus south of Ripon, which will be made of concrete and is 240 ft. long, with the main span 140 ft. between the piers.

The County Supervisors at Visalia, Cal., have granted the Porterville Northeastern R. R. a franchise for the location of the road on Orange St. running into Porterville from the east. F. U. Nofziger is Manager of the company.

Plans are being carried out by the Southern Pacific for the double tracking of its system between Benicia and Sacramento, Cal. Fifty cars of 90-lb. steel have been shipped to Benicia to await further developments. The company has already double tracked its system from Port Costa to Oakland, Cal.

Mining interests at Copperopolis, Cal., are making strenuous efforts to induce the promoters of the Stockton-Jenny Lind Railroad to extend its line from Jenny Lind to that small town.

Colorado.

The Denver City Tramway Co., John Evans, Chief Engineer, Denver, is said to be planning to enter the interurban field. It is reported here in Denver that Greeley will be the first place to which lines will be built. To do this the Tramway company will acquire the Denver, Greeley & Northwestern R. R., which has been inert for several years, and when the line is completed it will probably be extended to Boulder.

The Automatic Transportation Co., of Buffalo, N. Y., is reported to have completed arrangements to build an elevated automatic railroad in Summit County, Colorado. The road is to cost $200,000 and it will be used to transport ores in the mountain districts and will be operated by electricity. The road will be built on steel trusses elevated above the snow line on piers, and will resemble the elevated systems of large eastern cities. The road will be twelve miles long and will run from Keystone to Montezuma and Argentine. It will connect with the Colorado & Southern for Denver and Leadville at Keystone and with an extension of the Argentine Central at the east end. The company proposes to have it completed and ready for operation early next spring.

Work is now under way driving the Vidler tunnel in the East Argentine District near Georgetown, Colo. Machine drills are being worked by day and night shifts and a gang of about 40 men is employed. The work is being done by the Argentine & Montezuma Ry. Co., and the tunnel will be made of such size that trains can be operated through it. The Argentine Central Ry., A. J. Woodruff, Secretary, Denver, Colo., is back of the project.

The capital is reported to have been secured in New York for the construction, next year, of an extension of the San Luis Southern Ry., L. D. Blauvelt, Chief Engineer, Blanca, Colo., south through Taos to Santa Fe, N. Mex.

D. D. Griffith is in the field with a crew of about 20 engineers revising the survey of the Southern Pacific from Durango to Gallup, N. Mex.

It has been announced by David H. Moffat, according to reports, that as soon as financial arrangements can be made the line of the Denver, Northwestern & Pacific Ry. will be completed to Salt Lake City and the tunnel constructed through the Continental Divide. At present the road is completed to Steamboat Springs, 210 miles from Denver. Its cost, including equipment, was approximately $13,000,000, or about $60,000 a mile. Cost of constructing the remaining 360 miles will be about half that per mile, as there are no more mountains to cross. The surveys have all been completed to Provo, the route following down the Bear River Valley in Northwestern Colorado and up the Du Chesne Valley in Utah. Moffat expects to arrange for trackage rights from Provo into Salt Lake City. Cost of the tunnel has been estimated at between $5,000,000 and $6,000,000. The survey for the Denver and Rio Grande cut-off will save that road over 100 miles into Denver. This branch, which will be about forty miles long, will follow down the Rio Grande River from a point near Orestod on the Moffat road, about sixty miles southeast of Steamboat Springs, to a junction with the Denver and Rio Grande at Dotsero.

Florida.

Plans are under way for building an extension of the Woodville R. R. in Leon County. It is proposed to extend the St. Marks branch running into Woodville from Spring Hill, several miles outside of the former, on to Crawfordville, taking in Wakulla Springs. Thos. M. Hall, Woodville, Fla., is president.

Georgia.

The Fairburn & Atlanta Ry. & Electric Co., W. T. Roberts president, Fairburn, Ga., has applied to the State Railroad Commission for authority to issue $75,000 of common capital stock and $50,000 of first mortgage bonds. The construction of the road from Fairburn to College Park is progressing rapidly and it is thought that by the first of the year that cars will be in operation. This line runs from Fairburn to Union City, to College Park. The road parallels the Atlanta and West Point.

Idaho.

The Utah Construction Co., Ogden, Utah, has been awarded the contract for the grading work on the 10-mile branch line to be built by the Oregon Short Line R. R. from Montpelier, Ida., to Paris, on the northern shores of Bear Lake. The branch is said to be the first step towards the establishment of a summer resort on the shores of this body of water.

Illinois.

Copies of the trust deed providing for a $2,000,000 bond issue for the Northern Illinois Electric Ry. Co., which proposes a line from Elgin to Peoria, have been filed in each county through which the road will pass. The line will pass through Kane, Kendall, DeKalb, Lee, Bureau, Stache and Peoria counties. E. T. King, Lee Center, is President.

Citizens of Bloomington have presented a petition to the management of the Illinois Central asking them to electrify the Champaign branch of that road and permit its operation by the Illinois Traction System.

The Chicago & Alton R. R. has let the contract for a new concrete coaling station at Bloomington, of the endless chain hoist type, to the Exeter Machine Works of Pittston, Pa. The Batavia Tank Co. will erect two tanks of 100,000 gallons each adjacent to the new coaling station.

Grading work on the extension of the electric line of the Alton, Jacksonville & Peoria Ry. has been started near Edwardsville.

Announcement is expected shortly of the taking over by the Chicago & Alton R. R. of the Toluca, Marquette & Northern road. This is a short independent line in the northern part of the state and is covered at the present time by the officers of the Clover Leaf System. The road extends 31 miles north from Toluca and connects with a branch of the St. Paul at Granville. It crosses the Dwight branch of the Alton at Custer.

The St. Clair Traction Co. has made surveys for a proposed 7-mile line from Belleville, Ill., to Freeburg, Ill. The capital for construction has not been secured as yet, and the company consequently is not ready to take up construction contracts. E. L. Thomas, Belleville, Ill., is President, and D. O. Thomas, Belleville, Ill., is Chief Engineer.

The Atchison, Topeka & Santa Fe Ry. has announced that on Oct. 15 the new double track of the road will be open for service from Chicago to the Mississippi River at Fort Madison. On the stretch between the Mississippi and the Missouri Rivers, all but 25 miles of the second track has been finished and parts of it will be open for passenger service Nov. 1. The rest of the second track work between the two rivers is largely dependent upon the completion of bridge work, that is, the substitution of two-tracked for the present single track structures, which require more work than road beds. All these bridges, however, will be finished, it is said, by July 1, when the road will be absolutely double-tracked between Chicago and Kansas City, the first line between the two points to be thus equipped. The bridge work was provided for in appropriations of more than a year ago and the material is ready for stringing across the rivers as rapidly as possible without interfering with traffic. This will mark the first step toward a complete double-track system for the Sante Fe between Chicago and the Pacific Coast. Along the parts of the road west of the Missouri River double tracking is being pushed and is progressing rapidly between Winslow and Ashford, Ariz., where the work should be finished by Spring.

Indiana.

The Evansville & Eastern Electric Ry. Co., Evansville, now operating a line from Evansville to Rockport, is reported to have surveys under way for an extension to New Albany.

It is now believed the proposed extension of the St. Joseph Valley Traction Co., L. T. Owen, Chief Engineer, La Grange, Ind., to Kalamazoo, Mich., is assured. As projected the line will branch off from the main line at Bristol. It is also stated that the entire gang of track layers will be put on the west end, which will be completed this fall and that the work of electrifying the entire system will be taken up at once.

Work is being carried on day and night on the double tracking of the Pennsylvania line through Knightstown. Beginning at the east end of Raysville there will be nine viaducts through that town and Knightstown over the street crossings. A big triple arch concrete bridge has been built over the Blue River on the east side of the town.

Iowa.

The city of Clear Lake, Ia., has voted to grant a 25-year franchise to the Mason City & Clear Lake Ry. Co. This and the franchise recently voted at Mason City covers existing lines, and the company will not build extensions until next spring. F. J. Hanton, Mason City, Ia., is General Manager.

The stockholders of the Tri-City Railway & Light Co., J. F. Porter, President, Davenport, Ia., have authorized a $20,000,000 bond issue. Of the above issue, $10,000,000 is to refund existing debts when due; $2,000,000 is for extensions and improvements during the years 1910-1911, including the building of the Muscatine interurban, and the remaining $8,000,000 is for extensions during the next 20 years. Only 85 per cent of such extensions can be paid out of the bond issue.

The Commercial Club, of Magnolia, Ia., is to place an engineer in the field to make an extended examination for a proposed electric railway for that city. Some weeks ago the club secured a favorable report from an engineer for a line to connect Magnolia with the Illinois Central and the Northwestern railroads, and also for extending the line via Logan, Beebeetown and Council Bluffs to Omaha.

The Chicago & Northwestern R. R. Co. expects to, within a short time, open its latest branch line extending from Hinton, a point a few miles north of Sioux City, on the Chicago, St. Paul, Minneapolis & Omaha, to Hawarden, Ia., on the line of the Chicago & Northwestern running up into the Dakotas. Though only a few miles in length, the line forms a cut-off which will remove the necessity of routing traffic by the present roundabout way through Alton, Ia., and will facilitate freight movement between Sioux City and the Dakotas.

Grading, according to advices from Stuart, Ia., has been commenced on the Iowa & Southwestern Ry., which is to be built from Clarinda through College Springs to Blanchard. The contract has been awarded to the Engineering Construction & Securities Co., Chicago, Ill., and the grading contract has been given to Shugart & Barnes, Des Moines, Ia.

Citizens of Magnolia, Ia., have raised a fund for preliminary work looking toward the construction of a railway to Council Bluffs via Logan, Beebeetown and Weston. The engineer will start work at once.

Surveys in charge of H. L. Jackson, Hammond, Ind., are being run for a railroad line from Des Moines, Ia., south via Carlisle, Knoxville or Dallas, Marion County, thence through Lucas County to Chariton or Russell, 8 miles eastward of Chariton to Corydon or Seymour to a connection with the Kansas City line of the Milwaukee or Rock Island.

Kansas.

Official decision has been reached by the Metropolitan Street Ry. Co., Edward Butts, Chief Engineer, Kansas City, Mo., regarding the construction of a new line in Kansas City, Kan. The line has been ordered to be built from 12th St. and Minnesota Ave. south to Orville Ave., west on Arville to 13th St. to Central Ave.

The Motor Traction Co. has been reorganized with the following officers and directors: Dr. M. M. Bremen of Roxbury, president; S. M. Law of Canton, vice president; S. A. Blue of Canton, Secretary; C. M. Gray of Canton, treasurer, and B. S. Dole of Dole's Park. The Motor Traction Co. was organized last spring by outside men, and started surveys and grading for a road out of Roxbury. The work was stopped several months since.

It is stated that the Illinois Traction System (McKinley syndicate) owners of the street railway system at Atchison, Kan., will probably begin building interurban lines out of Atchison next spring. It is proposed to build an interurban line to St. Joseph, going up the Kansas side of the river; one to Leavenworth and one to Topeka. The Leavenworth line will make connections with the present interurban line between Kansas City and Leavenworth.

The Missouri Pacific has opened for regular passenger and freight service the 10-mile extension of the Wichita-Kiowa branch from Kiowa, Kan., to Hardtner, Kan. This branch is now 100 miles in length, extending from Wichita southwest, passing through Anthony and Kiowa, at the latter point crossing the Santa Fe lines.

Surveys are now underway for the projected line of the Southwestern Kansas & Colorado Ry. The capital for construction has not been secured as yet and nothing definite has been done toward letting construction contracts. The company projects a line 300 miles long, extending due west from Hardtner, Kans. A. A. White, Hardtner, Kan., is General Manager and J. H. Titus, Arkansas City, Kan., is Chief Engineer.

Engineers are now running lines between McPherson, Kan., and Elvira. It is supposed that they are making surveys for the Union Pacific extension from Arkansas City to McPherson and that a portion of the ties now stored at Salina will be used for the extension.

Kentucky.

The Louisville, Lincoln Farm & Mammoth Cave Electric Ry. Co. on Sept. 22 filed its articles of incorporation with the State Railroad Commission. The road is capitalized at $1,000,000 and its charter is granted by Arizona. As noted previously, the company proposes to build an electric line from Louisville by the way of Hodgenville and continue it to Mammoth Cave.

The Lexington & Eastern Railway Co. (Louisville & Nashville R. R.) will receive bids on Oct. 12th for the construction of 80 miles of road from Jackson, Ky., to Whitsburg, Ky. The work will be divided into five parcels of approximately 16 miles each and contractors must bid on each parcel separately, not more than two parcels being awarded to one firm. No bid on the work as a whole will be considered. With the exception of tunnel and a few large cuts the work will be a team proposition. The contractor will be required to furnish sufficient air drilling machinery for each tunnel more than 400 feet long to insure completion on contract time and have same on the ground before Dec. 15th. All work must be completed before Dec. 31st, 1911. The width of cuts at sub-grade will be 22 feet and the width of fills under 20 feet high at sub-grade 16 feet. The Louisville & Nashville R. R. will furnish special rates for the first movement of outfits on the work and will give a reduced fare on laborers during the term of contract. Free transportation will be furnished the contractor and his superintendent. The result of the letting will be announced on Oct. 13th. J. E. Willoughby, Chief Engineer of Construction, [illegible] the bids and make awards of same.

About Oct. 15th, the Louisville & Nashville R. R. will ask for bids on the construction of 12 miles of new road from Colly Creek, Ky., southeast. The work for the most part will be a steam shovel proposition with a few small tunnels. J. E. Willoughby, Louisville, Ky., is chief engineer of construction, and will receive the bids. The exact date of the letting will be announced later.

Officials of the Chicago, Burlington & Quincy R. R. were recently in Paducah, Ky., going over the proposed route from that city to the proposed bridge opposite Metropolis, Ill., 12 miles below there. One of the officials stated the road would connect at Paducah with the Louisville & Nashville, which is to be extended to that city, but that the connection with the former will not be made until the bridge is completed, about three years hence. By closing the gap between Paducah and Middleton, Tenn., a distance of 150 miles, the Hill System would have direct connection north and south across the continent over its own lines.

Louisiana.

A proposition has been submitted to the business men of New Orleans, La., by L. S. Berg, 49 Wall St., New York City, President of the New Orleans, Mobile & Chicago R. R., to construct into that city an extension which would involve the expenditure of about $2,000,000. The road now operates from Mobile to Middleton, Tenn., with branches to Hattiesburg and Beaumont, Miss., the latter point being 100 miles from New Orleans.

C. O. Ferguson and A. R. Johnston, Homer, La., have about perfected arrangements for a new railroad to traverse Claiborne Parish, via Homer and on to Minden, provided the necessary assistance is given. The enterprise was enthusiastically indorsed at the court house of Homer, La.

Grading work has been started near Lake Arthur, La., on the proposed line of the Lake Arthur, Jennings & Northern Ry. The City of Jennings, on Sept. 27, granted a franchise to the company. E. P. Fox, Lake Arthur, La., is General Manager.

The Oberlin, Hampton & Eastern R. R. Co., of Oberlin, La., has been chartered and proposes to build a 20-mile railroad from Oberlin to Nespique. W. B. Williams is President and L. L. Williams is Secretary.

Minnesota.

The Minneapolis Northern Suburban Ry Co. has been incorporated with a capital stock of $250,000 and proposes to construct a trolley line from Minneapolis to Little Falls along the Mississippi River in Morrison county. It is proposed to build northwesterly from Minneapolis and vicinity. The incorporators are Charles Sherman, Hartford, Conn.; John J. McCarthy, Paul J. Marvin, L. L. McCulloch and William Lampert, Minneapolis.

The St. Paul Railway Promotion Co., of St. Paul, has been incorporated with a capital stock of $100,000 and proposes to construct a network of interurban lines radiating from St. Paul and also to operate telegraph and telephone lines in connection with the trolley systems. It is said that the projects planned will be financed by St Paul men. The incorporators are W. J. Hoy, H. C. Struchen, W. L. [illegible] C. E. Van Kirk, Kay Alexander, Walter L. Van Ormun, Clovis M Converse, A. C. Or[illegible]

Articles of incorporation have been filed by the Duluth, Pierre & Black Hills Ry Co. with [illegible] at Pierre, S. Dak. The company proposes the construction of a line from Pierre to Cresbard and Aberdeen through the counties of Hughes, Sully, Hyde, Faulk, Edmunds and Brown. Construction work will be started on the grade immediately. George W. Seevers, W G B[illegible] and V. C. F. Foote, Minneapolis, Minn. officers and directors of the Minneapolis & St [illegible] I. Newell, of Pierre, S. Dak

[illegible]

[illegible] when finished the men will be transferred to the main line.

Duluth and the Ranges.

BY PETER J. MEAGHER

Duluth at the present time is an interesting place for dredge contractors. There have been quite a few of them here for the past few days. The object of their visit is to enter bids for about $250,000 worth of dredging to be done in the Duluth-Superior Harbor by the United States Government. These bids were opened Sept. 30th.

Melvin Pattison, General Manager of Sales for the Brown Hoisting Machinery Co., Cleveland, O., spent a couple of days in our city recently. His firm has a contract for building a $1,000,000 soft coal dock for the Pittsburg Coal Co. of Duluth, and is very busily engaged on the same, and expect to have the contract completed by Oct. 15th.

P. G. Pastoret and W. L. Lawrence of the Pastoret-Lawrence Co., General Contractors, Duluth, came in to see us the other day. They reported that they had just been awarded sewer contracts by the cities of Eveleth, Gilbert and Cloquet, Minn. This work amounted to about $70,000. They have already started on all of these jobs, and will rush them as fast as possible so as to get cleaned up before the cold weather sets in. Their other contracts they reported were all in very good condition.

C. J. A. Morris of Morris & Shepard, General Contractors, came in to see us recently. All of their work is in very good shape.

J. P. Joel, New York representative for the Vulcan Iron Works, Wilkes-Barre, Pa., manufacturers of Vulcan Locomotives, spent a few days here with us last week.

Thomas Higgins of Higgins & McDonald, railroad contractors, who at the present time are engaged on a contract on the Canadian Northern extension into Duluth, dropped in to see the writer.

Richard Evans, railroad contractor, came in to see us a few days ago. He is working three steam shovels at the present time on the Canadian Northern extension near Duluth.

Mr. Wick O'Connell of Wick O'Connell & Co., general contractors, was a visitor recently. He reported that he had already started on his contract for a tunnel on the Canadian Northern Railway near Duluth, and everything was going nicely.

Andrew Perrin of Carl Hall & Company, was in and said that his firm had been awarded another contract for about six miles of work by the Duluth & Iron Range Railway, and that they would start on the same at once.

Charles Reis, President of the International Brotherhood of Steam Shovel & Dredge Men, and also representative of the American Locomotive Company, spent a day with us here recently. Charlie was looking fine and he said that while business was not quite as good as he expected it would be, still, it was very satisfactory.

C. E. Jamieson, railroad contractor on the Canadian Northern extension, was a caller a few days ago. His work amounts to about ten miles, and he expects to have the same completed in about six weeks.

Captain Harry Roberts of the Roberts-Kingston Contracting Co., mine strippers, was a caller recently. He said that they were working two Bucyrus shovels, double shift on their contract at the Virginia mine near Virginia, Minn., and were making excellent progress with the work.

Edward Foley, of Foley, Welch & Stewart, general contractors, St. Paul, Minn., was in the city for a couple of days this week. They have an enormous amount of railroad work under way at the present time, both in the United States and Canada, and all of their contracts are in very good condition.

The labor situation in Duluth at the present time is in a pretty good condition. There is quite a demand for laborers, but not quite enough men to fill all orders. Wages are just [illegible]

[illegible] work on the Canadian Northern Railway, near Duluth, and expected to have completed in about 30 days. His contract is mostly station work.

Missouri.

M. C. Connors & Co., who have the grading contract between Palmyra and Philadelphia, Mo., for the Hannibal & Northern Missouri R. R., have started work.

The matter of extending the Frederich Ave. car line of the St. Joseph Railway, Light, Heat & Power Co. of St. Joseph, from 26th St. to the state hospital with a view to building a double-track electric line to 102 River, ultimately, has been taken up with the Board of Public Works of St. Joseph.

The Union Terminal Co. of St. Louis has been incorporated with a capital stock of $5,000 for the purpose of operating terminal yards with tracks, roads and holdings. The incorporators are Fred H. Holbrook, T. Moore, Fred E. Breitt, E. W. Banister and W. J. Holbrook.

The lower house of the City Council of Kansas City has been considering the ordinance giving the Intercity Viaduct Freight Ry. Co., J. W. Rinehart, President, the right to lay tracks in a few streets and alleys on the west and north sides of the city to operate a switching railway.

The Chicago, Burlington & Quincy R. R. is completing plans to shorten the St. Louis-Kansas City line by an extension of the road which operates between Mexico and St. Louis to Kansas City. The new line as proposed will cross the M. K. & T. at Elliott, between Higbee and Moberly. The short line from Mexico, Mo., to St. Louis has been of little value to the company on account of disagreements with the Alton in regard to the use of trackage.

Advices from Lecoma, Mo., state that construction work has been started on the Missouri Inland & Southern R. R. This road, when completed, will run from Houston, Texas County, and intersect the Frisco at Dillon or Rolla, a distance of between 50 and 60 miles.

St. Louis Items.

BY A. B. KOENIG.

Jim Cary of Cary Bros., Memphis, Tenn., was in town last week looking for work for their team outfit.

Tom Keating of Keating Bros. spent a couple of days with us. Keating says their work at Mt. Carmel is getting along nicely and he expects to be there for at least sixty days more.

Wm. Dankliff has his outfit at work on the Northwestern R. R. at Girard, Ill. He has about 15,000 yards of reservoir to let near Staunton, Ill., and can use a 10 or 15 team outfit. Address him at Mt. Olive, Ill.

The Ware Construction Co. can use a team outfit on their job near St. Louis.

Costello Bros. were awarded the contract for building the new Big Four yards at Evansville, Ind., and are moving their steam-shovel outfit on same.

Henry Schweitzer has a part of his outfit idle at Harrisburg, Ill.

The surveyors for the new route of the Burlington from Francis to Birmingham, Mo., reached Clark on their final survey. The Burlington now has a short line from Old Monroe to Francis, and the new line from Francis to Birmingham will give the Burlington the shortest route between St. Louis and Kansas City in the State. The last survey will pass through Elliott, Mount Airy, Salisbury, Keytesville and Brunswick.

The East Side Levee & Sanitary Commission on Sept. 28 began the trial of its first condemnation suit for its right of way for the diversion channel. The suit was brought before County Judge J. E. Hillskotter of Madison County at Edwardsville, against the Bender estate. The Benders asked $1,000 an acre for the land the Levee Commissioners wanted, and the suit was brought because the Levee Commissioners thought they should not pay more than $250 an acre. The desired part of the estate embraces nine and one-half acres. It is in [illegible]teau Township. The diversion channel will run due west from the junction of Cahokia and Indian Creeks to the Mississippi River, 4½ miles.

The Board of Public Improvement of St. Louis has approved the general plans for the construction of a viaduct over the railroad tracks at Compton ave. The structure will cost $370,000 and will be of concrete and steel, the expense of construction being borne by the railroads. Detailed plans will be submitted by the railroads to the board in two weeks, and it is expected work will begin on the bridge early in spring. The work must be done under the supervision of the President of the Board of Public Improvements.

John Elder, a farmer residing on the bank of the Missouri River near the Bellefontaine bridge, has entered suit in Justice Cottle's court at Alton, Ill., against the contracting firm of Swift & Rust, which recently completed the rip-rapping of the Missouri River at this point. While working along the Elder farm the contracting company used Elder's roads and cut a few willows on the place. Elder asked them to pay for them and they refused. Elder then attached some of their implements.

H. E. Kahl of the Kahl Construction Co. informs us that he can use a 20-team outfit for machine work. Contractors of this size outfits write or wire him at once at Davenport, Iowa.

Labor still continues to be awfully scarce A few more Government Levee jobs starting up in the South since last issue and the cotton pickers in the South are in more demand. Unless the weather should become cool and labor come in from the North more freely than it has been, we don't see how one-third of the work in the South that they are contemplating doing will be done or completed.

The Board of Public Improvements of St. Louis has completed a report to the Municipal Assembly on the elimination of the Poplar St. grade crossings of the Iron Mountain R. R. It is the second part of the grade crossing reports, which eventually is to cover all crossings in the city, and is to be sent to the Assembly soon after it convenes next Tuesday. Six ways of eliminating the tracks from the surface of the street are to be recommended. The first and one most favored by the report is the removal of the tracks entirely, which was promised several months ago by the Missouri Pacific-Iron Mountain officials. The report is not yet public, but the second choice of the board is said to be to put the tracks in a tunnel, and the third is to elevate them in Poplar St. Six grade crossings now exist on Poplar St., including all the streets from Second to Seventh. The tracks were laid during the civil war under a war grant. It is planned by the road to change the course of its tracks to cross Broadway at Papin St. and swing into the Mill Creek Valley at Gratiot St. The change will enable the road to bring its passenger trains from the south in over the river route.

Scott Mitchell, Williams, Ariz., has some nice rock work to let on the Santa Fe R. R. at that point, to small outfits.

The Secretary of the Treasury has awarded the contract for the steamheating apparatus for the St. Louis Post office building to Hanley-Casey Co. of Chicago at $59,295. The Llewellyn Iron Works of Los Angeles, Cal., was awarded the contract for the elevator plant in the same building at $13,852.

W. L. Mosby wires us from Hickman, Ky., that he has nine miles of railroad work, fill 1½ to 5 ft. He will let this to either team outfits or station men.

Montana.

Sub-contracts for grading work on the Butte, Boise & San Francisco R. R. are reported to have been let with the idea of having construction started this month. This company on July 30 entered into a contract with the French-American Construction Co. of Philadelphia to build a road with branch lines from Regina, in the Province of Saskatchewan, Canada, via Butte and Boise, Idaho, to Winnemucca, Nevada, approximating in all 1,500 miles. The general offices of the Butte, Boise & San Francisco R. R. Co. and the French-American Construction Co. are in Butte, Mont. W. H. Haviland, Butte, is President of the railroad.

The grade of the Montana R. R. has been completed to the main terminals, 4 miles from Kendal and 17 miles from Lewiston, Mont., where an important town will be established. From that point two branches will be constructed, one to Dog Creek, 20 miles north, and the other to Box Elder Country, 22 miles east.

Nebraska.

It has been stated at Fremont, Neb., that work will not be started on the Fremont-Omaha interurban line until next spring. Trouble in getting the right of way and in securing the Fremont franchise caused delays.

It is rumored that the engineers under supervision of the Chicago, Burlington & Quincy R. R., who recently surveyed the right of way in the vicinity of Kearney, Neb., are running lines for the construction of a branch from Kearney to Bridgeport, a distance of 200 miles.

New York.

The State Public Service Commission will resume the hearings on the application of the Buffalo, Rochester & Eastern R. R. Co. for authority to construct a road from Buffalo to Troy Oct. 20 and 21. The estimated cost of this road is $80,000,000, and the application is meeting with much opposition from the other railroads.

In testifying before the State Public Service Commission in opposition to the application of the Buffalo, Rochester & Eastern R. R. Co., for authority to construct a railroad from Troy to Buffalo, George W. Kittredge, Chief Engineer of the New York Central Lines, stated that New York Central improvements made since 1907, under way or contemplated, involved an expenditure of $1,500,000,000, including the six-tracking of the main line. Mr. Kittridge stated that the Grand Central Terminal at New York City had cost $26,790,000 to date and is expected to cost $100,000,000; that other improvements include $18,000,000 at Buffalo, of which $8,000,000 will be used for a passenger terminal; $2,000,000 expended in Rochester and $1,400,000 contemplated; Syracuse improvements calling for $6,000,000; Rome, $2,000,000; Utica, $3,000,000, and from Utica to Albany further outlay of $1,096,000. Since 1907 $16,051,000 has been expended between Albany and New York.

The New York State Public Service Commission held a hearing at Albany on Oct. 4 on the matter of the joint petition of the New York Central R. R., the New York, Ontario & Western Ry., and the Rome & Clinton Ry. for determination as to the manner of crossing of track of the first mentioned railroad across the track of the Rome & Clinton R. R. The New York Central asks that the crossing be above grade and proposes to pay the entire cost of construction. This change of route is made necessary by the barge canal improvements in Rome.

The Long Island R. R., J. R. Savage, Chief Engineer, Jamaica, N. Y., has filed plans with the State Public Service Commission for the elimination of all crossings on the Flushing main line between the creek and Broadway, Flushing, L. I. The plans call for the elevation of the road over Lawrence and Main and its depression under Union, Bowne, Parsons, Wilson and Boerum, and overhead at Broadway. Twenty-second is to be diverted or closed. The cost is estimated at $1,077,000.

The Delaware, Lackawanna & Western R. R., G. J. Ray chief engineer, Hoboken, N. J., has submitted plans to the municipal authorities of Montclair, N. J., for proposed improvements to its terminals at that place. The plans provide for the erection of a large new terminal, with six platforms, modeled along the lines of the Lackawanna's terminal at Hoboken, N. J.; the construction of a viaduct over Grove St., to eliminate a grade crossing; the closing of Pine St.; the erection of a large new freight station near the latter thoroughfare; the double tracking of the line from Montclair to Bloomfield, and the placing of many new sidings, to accommodate the rapidly increasing passenger and freight business of this town. The alterations and improvements provided for in the plans will cost nearly $500,000.

North Carolina.

The Mica Belt Line R. R. Co. has been chartered and proposes to construct 15 miles of road from Cranberry, N. C., via Minneapolis to Plumbtree, down North Toe River, and thence to some point on the Carolina-Clinchfield R. R. between Altapass and Spruce Pine. The incroporators are T. B. Vance, T. D. Vance, R. M. Burleson, Frank and Sam Burleson and Ira Vance. The capital stock is $10,000.

The Roanoke & Mt. Airy Southern Ry. Co. has been chartered with a capital stock of $50,000 and proposes a line to run from Roanoke City through the counties of Roanoke, Floyd, Carroll and Patrick, in Virginia, and Surry, in North Carolina, to Mr. Airy. A. L. Sibert is President of the company; R. H. Angell, First Vice-President; C. G. Ogden, Second Vice-President and General Manager; L. C. Stewart, Secretary and Treasurer. The other directors are S. B. Pace, E. A. Thurman and George W. Payne. All of the above live at Roanoke, Va.

North Dakota.

E. G. Brandenburg has shipped an outfit to Jamestown, N. Dak., for work on his grading contract on the Midland Continental Ry.

Practically all the land required in the city of Devils Lake for right of way purposes has been obtained by the Minneapolis, St. Paul & Sault Ste. Marie Ry. Construction work will not be started until next year, however.

The Northern Pacific survey between Streeter and Dawson has been completed and the crew is now working west to McClusky, N. Dak., in Sheridan County, and from there will go to Turtle Lake in McLean County and run a line northwest from there.

Ohio.

English capitalists have had a representative go over the right of way of the proposed line on the Massillon-Brewster Air Line Ry. Co., between Massillon and Brewster.

The Western Ohio Ry., of Lima, O., is extending its line from Minster to Loraine, three miles. The contracts for grading have been let and grading nearly completed. Contracts were to be let Oct. 3 for the concrete masonry for bridge over the Miami & Erie Canal, and also for the trestle over Loraine River. The company will lay the track, and erect the overhead line with its own force. It is hoped to have the line in operation by Dec. 25, 1910. John W. S. Riegle, Findlay, O., is Chief Engineer.

Plans are being made to double track the Shore Line (electric) of the Cleveland, Painesville & Eastern R. R., Willoughby, as far as Willoughbeach park immediately and through to Willoughby within a short time.

The Fostoria & Fremont Ry. Co., which projects a 21.4 mile line from Fostoria to Fremont, has completed its surveys and has secured the capital for construction purposes. All arrangements for construction have been made as the company has decided to construct the line itself. F. D. Carpenter, Lima, O., is President and J. W. S. Reigle, Findlay, O., is Chief Engineer.

A resolution providing for the elimination of grade crossings in Cleveland, O., by the Pennsylvania R. R. is now before the council of that city. The plans submitted to Robert Hoffman, City Engineer, contemplate an expenditure estimated at $2,600,000, of which the city's portion will be about $800,000.

The Hocking Valley Ry. is reported to be about to let contracts for the improvements in the Walbridge yards at Toledo, which will call for an expenditure of over $100,000, and also for enlarging the South Columbus yards and the building of a new roundhouse.

Litigation now pending is holding up extensive improvements planned for the Hocking Valley Ry., F. B. Sheldon, Columbus, O., Chief Engineer. Plans for the extension from Jackson south to a junction with the C. & O. are completed as are the plans for the double tracking of the Hocking Valley north of Columbus. It is said that the estimates for the extension to the Ohio River call for an expenditure of over $6,000,000, while the double tracking north of Columbus will cost at least $4,000,000 more.

Oklahoma.

Grading on the Cherryvale, Oklahoma and Texas has been completed from Caney, Kan., to Delaware, Okla., and it is now being pushed on to Nowata and from Nowata to Vinita. It is expected that track laying will be commenced this month. Following the completion of this branch another line will be built southwest of Caney through Pawhuska, Blackburn and Guthrie, Okla. A mortgage has been filed for $20,000,000 on all the right of way through Oklahoma and Kansas to provide funds for the new work.

The Atchison, Topeka & Santa Fe Ry. is planning to construct its own terminals at Tulsa, Okla. For the past six years the road has been using joint terminals with the Midland Valley.

The Bee Line Construction Co., a Missouri organization formed several years ago to build the Blackwell, Enid & Southwestern R. R. of the Frisco system from Blackwell southwest 200 miles to Vernon, Tex., has filed notice with the secretary of state of its withdrawal from the state. Breckenridge Jones of St. Louis and Ed L. Peckham of Blackwell were among the incorporators and officers. The railroad having been built, the purpose of the construction company ceases to exist.

Advices from Pawhuska, Okla., state that for the present all work has ceased on the Osage & Western R. R., which was in the course of construction from Vinita to Enid, through Bartlesville, Pawhuska, Fairfax, Ponca City and Jennings. Headquarters of the company are at Pawhuska.

The Buffalo & Northern Oklahoma R. R. Co. has completed one survey for its projected line and has secured $500,000 of capital for construction purposes. Construction contracts are to be let about Nov. 1, 1910. The projected length of this line is 150 miles and its route is from Buffalo, southeast to McAlester, Okla. F. M. Best, Buffalo, Okla., is President, M. Tilleaux, Buffalo, is Chief Engineer, and Q. L. Zook, Buffalo, is Vice-President.

Oregon.

Archie Mason, Portland, Ore., has been awarded the contract for the grading work for the Mount Hood Ry. Co. between Montavilla and a point beyond Gresham, where an old grade, built three years ago, was started. From there to Bull Run the grade is practically completed. Work will begin at once, under the direction of Smith, Kerry & Chase, Engineers, Toronto, Ont., and it is hoped to have it completed before the heavy rains of winter set in. It is believed that the road can be made ready for operation by Aug. 1 next year. Track laying will begin as soon as possible after the grade has been established. Smith, Kerry & Chase will also supervise the building of the company's power plant near the confluence of the Bull Run and Sandy Rivers, where the eastern terminal of the road will be located. [illegible] furnish power for other purposes than the [illegible]

Advices from Grants Pass, Ore., state that the Southern Pacific Co. is storing supplies at that city for the engineering crews who are locating the line of the Grants Pass & Western R. R., and that they are being forwarded [illegible]

Engineers have located the Oregon Trunk [illegible] their way northward. A change of about five [illegible] the Williamson River and Klamath Agency, has been made to place the tracks above high [illegible] ern Pacific, which parallels the Oregon Trunk Line through the canyon, will also raise its grade five feet

According to the latest advices from Pendleton, Ore., work will be completed within [illegible] Railroad & Navigation Co.'s line between that city and Yoakum, a distance of 12½ miles. The improvements in progress involve a complete change of the main line of the O R & N. Co. between Yoakum and Pendleton; none of the old line will be used. The work shortens the present line 1.7 miles; eliminates 1,361 degrees of curvature; reduces the maximum degree of curves from 10 degrees to 4 degrees and reduces the grade from eight-tenths of 1 per cent, uncompensated, to six-tenths of 1 per cent, compensated. On the new line there will be one 500-ft. tunnel, cutting out the horseshoe bend; a high fill and a steel bridge of two 150-ft. spans with concrete piers and abutments, through the reservoir of the Furnish-Coe Irrigation Co. The cost of the work will amount to about $1,200,000.

A crew of railroad surveyors supposed to be working in the interest of the Hill System is running lines between Mule Creek and Illahee in Rogue River Valley. It is said in Gold Beach, Ore., that nothing definite can be obtained from the engineers.

The Albany & Interurban Ry. Co., of Albany, Ore., has completed surveys for its projected 70-mile line, the route of which is from Albany to Santiam River, up Santiam River by way of Lebanon and Sweet Home across the foot hills to the Calapooia River and down that stream through Holley, Crawfordsville and Brownsville, P. A. Young, Albany, Ore., is President, H. G. Fisher, Albany, is Chief Engineer and P. A. Young, Albany, is General Manager.

Pennsylvania.

A grant has been filed in the office of the Recorder of Deeds at Norristown for an extension of the Philadelphia & Western Ry., of Philadelphia, to West Conshohocken. The description shows that the proposed trolley road will reach West Conshohocken over Haverford road, old Lancaster road, Chester and Radnor road and Matson Ford road. The official name of the railroad company for which the extension is authorized is "The Terminal Ry. Co."

The construction of an electric railway in the Nippennose Valley to Antes Fort is under consideration. As proposed the line would run from Antes Fort south to Rauchtown, a distance of five miles, east 2½ miles to Jamestown and then still further east for 2½ miles to Oval and finally to Collinsville. At a meeting of the promoters at Oval a representative of the Newall Engineering Co., Empire Bldg., Pittsburg, Pa., gave a rough estimate of the cost of such a line.

The Lehigh & New England R. R., R. H. Wilbur, General Manager, 437 Chestnut St., Philadelphia, has secured the complete right of way for an extension of 31 miles from its main line at Danielsville, near Slatington, to Tamaqua. The new road will cost $3,000,000. The securing of this right of way has taken a number of years, and the completion of this preliminary work means the construction without delay of a most important railroad link in Pennsylvania. The new line will connect more particularly the collieries of the Lehigh Coal & Navigation Co. and the whole anthracite region in general with the shortest route to Boston, via the Poughkeepsie bridge route.

South Dakota.

A project is under consideration for the construction of a railroad from Chamberlain, S. Dak., to Huron. The project is being promoted by A. E. Parsons, of Darlington, Wis., who is associated with one of the strongest banks in the city, E. E. Dye, vice president of the Bank of Chamberlain, A. G. Hill, Thomas Cox and J. Q. Anderson. The Missouri Valley Engineering Co., 408 Western National Bank Bldg., Mitchell, S. Dak., has the contract for the engineering work and now has a force of 11 men in the field making surveys for the line from Chamberlain to Huron. The men expect to be in the field for three months at least in completing the sur- [illegible] points being about 100 miles. The line runs northeast through Vega, the northeast part of Jerauld [illegible] and through Beadle to Huron.

Tennessee.

Good progress is being made in securing stock subscriptions for the proposed Nashville-Gallatin Interurban Ry., and it is believed in Nashville that the road is practically assured. It is believed here in Nashville that the road will probably be extended across country to Hendersonville. H. H. Mayberry, Franklin, Tenn., is interested.

Smalldridge & Co., of Knoxville, Tenn., were awarded the contract last week by the Southern R. R. for the construction and excavation of a 14-foot subway at Lamar Ave., Memphis. The work embraces 18,500 cu. yds. excavtion and 1,200 cu. yds. reinforced concrete. The price of the contract is $13,545. Work must be begun immediately and finished by Dec. 31st, 1910. The railroad company will furnish all rail necessary for contractor's spur tracks, and will stand the cost of shifting the Southern's main line tracks, also furnishing all bridge material necessary.

Within the next 15 days, the Yazoo & Mississippi Valley R. R. will ask for bids on approximately 100,000 cu. yds. of bank work on its Clarksdale division. The work will have to be done with steam shovels, which must be furnished by contractor, while the railroad company will furnish Hart convertible cars of 30 yards capacity for the handling of the dirt, together with two standard gauge locomotives. Roadmaster Thrower, Memphis, will be in charge of the work. Exact date of letting will be announced later.

The Memphis & Pensacola R. R. Co. is reported to have spent $80,000 for surveys and is now said to be about ready to have construction work started at Meridian, Miss. Officials of the company are said to have been in conference with contractors for that purpose. As proposed the road will have two northern terminals—Memphis and Helena, Ark. Chester H. Pond, Moorhead, Miss., is president.

Texas.

We are advised that further construction work on the line of the Quanah, Acme & Pacific Ry. has been indefinitely postponed. Surveys for a 360-mile line from Paducah to El Paso have been completed. C. E. Ensminger, Quanah, Tex., is General Manager.

Judge A. P. McCormick of the U. S. Circuit Court has issued an order postponing the sale of the International & Great Northern Ry. until the third Tuesday in May, 1911. The order was granted on the application of the second and third mortgage bond holders. In his order the court refers to the so called International & Great Northern railroad law passed at the last special session of the state legislature. The order concludes with the statement that it is granted solely because the court is of the opinion that under the circumstances and in view of the law, a sale of the property at this time would be injudicious.

Announcement has been made by William Kenefick, Kansas City, Mo., president of the Missouri, Oklahoma & Gulf Ry., that it is planning for the Texas & Pacific to put its branch line running into Denison in first class shape and that if such improvement is made a Missouri, Oklahoma & Gulf freight would probably be operated to Sherman daily from Denison. This may mean the first step in an extension of the Missouri, Oklahoma & Gulf into Fort Worth or Dallas either over other lines or by tracks of its own to be laid.

A letter from Post City under date of Sept. 20 states that searching parties were engaged in looking for the body of Sam Peterson, a railroad contractor, who was murdered ten miles north of Post City a few nights ago. It is claimed that his body was dumped into a crevice on the Cap Rock. A force of 140 men has been at work for two days blasting and trying to reach the bottom of the crevice to recover the body. Three persons have been arrested on suspicion of having committed the murder.

The Greenville Railway & Light Co. of Greenville has been chartered with a capital stock of $300,000. The incorporators are S. A. Price, Albert Emanuel and H. L. Warren.

Wm. McCarty, Menard, Tex., has work well under way on his contract on the Menard extension of the Fort Worth & Rio

Grande Ry. Mr. McCarty has three of the heaviest miles of this extension, his work being located about five miles from Menard.

The Nueces River Valley R. R. Co., which projects a 200-mile line via Oakville, Cotula, Carizzo Springs and Eagle Pass, has made its surveys in part and has secured the capital for construction purposes. Construction contracts are to be let before January, 1911. Geo. A. Hull, Beeville, Tex., is Chief Engineer, and Wm. A. Frisby, Beeville, is President.

A company has been formed for the purpose of building a direct railroad line from San Antonia to Palacios. It is proposed to ultimately extend the line west to open up the rich Pecos river valley district. The road will traverse Matagorda, Jackson, DeWitt, Lavaca, Gonzales, Guadalupe, Wilson and Bexar counties. Extensions of branch lines are proposed which will cross Fayette, Bastrop and Caldwell counties. Among the incorporators and financial backers of the road are: J. D. Bonner, president of the State Guaranty Bank and Trust Co.; D. W. Dean, manager of the Coast Telephone Co. of Palacios, and J. P. Pierce, S. T. Best, D. L. Stump, W. S. Bonner and Charles Clayton. The exact right of way has not been determined upon. The road will cross the St. Louis, Brownsville & Mexico R. R. and the Galveston, Harrisburg & San Antonio R. R. If inducements are offered the road will be built to Yoakum. If not, it will pass between Yoakum and Cuero.

Good progress is being made with the construction of the Crosbyton & South Plains R. R. and it is believed that the first train can be run into Crosbyton by Dec. 1, 1910. Engineers are now in the field for an extension from Crosbyton.

The Gulf, Texas & Western Ry., B. B. Cain, General Manager, Jermyn, Tex., is reported to have received a favorable report from its engineers regarding the route for an extension from Seymour by way of Gilliland to Plainview. It is reported that clearing on that portion of the route from Vera to Truscott will be started this fall.

Articles of incorporation have been filed by the Palacios, San Antonio & Pecos Ry. Co. It is proposed to construct 160 miles of line beginning at Palacios and running to San Antonio through Matagorda, Jackson, Lavaca, Dewitt, Gonzales, Goliad, Wilson, Fayette, Bastrop, Caldwell and Bexar Counties. The incorporators are J. B. Pierce, Thomas H. Bonner, S. T. Best, H. E. Dean, W. H. Brooks, W. L. Baldwin, D. L. Stern, all of Palacios, and Marshall Hicks, of San Antonio, Texas.

It is reported in Waco, Texas, that the Santa Fe Ry. Co. is seriously considering the construction of a line into that place. People interested in the report have been unable to obtain definite information concerning the rumor.

The Brownsville road will inaugurate train service on the Collegeport branch Oct. 30. The following new stations between Buckeye and Collegeport will be opened: Beadle, Simpson and Citrus.

Thirty-five miles of the Texas Central has been relaid with 80-lb. rail, replacing lighter sections. About 5,000 tons of rail have been employed in this work. The new branch from DeLeon to Cross Plains, a distance of forty-one miles, will soon be completed.

The Attorney General's Department on Sept. 27 approved an amendment to the charter of the Abilene & Southern Ry. Co., by which the company abandons the proposed line, which was to have been built from Abilene to Ballinger, south through Concho, McCulloch, Menard, Schleicher and Sutton Counties, and, instead, proposes to build a line from Ballinger north, through Runnels, Taylor, Jones, Fisher, Stonewall, Kent, Dickens and King Counties, to follow a line already constructed to Hatchell, Winters, Bradshaw, Oralo and Abilene, thence through the towns of Hansford, Jones County, thence north to a point near the center of King County, with branch line extending from Hamlin through Fisher and Scurry Counties to Snyder, in Scurry County, a distance of 200 miles, which is the same distance as proposed by the original charter.

The State Railroad Commission has been officially advised that the extension of the Wichita Falls & Northwestern from Altos, Okla., to Wellington, Tex., 60 miles, had been finished and placed in operation. From Wichita Falls to Wellington is 135 miles. The grade on the extension of the other Oklahoma line of this road is finished from Elk City north to the Washita River, 18 miles.

The Kansas City Southern R. R. will soon have work started on the building of an extension from Lessville to Houston.

Engineers surveying the North and South R. R. from Seymour to San Antonio are, according to advices from Albany, Texas, making good progress and have located a very good grade passing through excellent country.

The Wichita Falls & Wellington R. R. has applied to the Railroad Commission of Texas for authority to issue bonds amounting to $285,000 on 15 miles of railroad just completed in Collinsworth County from Wellington to the state line, where it connects with the Oklahoma lines owned by the Kemp and Kell interests of Wichita Falls. Permission was also asked to issue capital stock to the value of $1,000 per mile. Chief Enigneer Parker of the Commission will make an inspection of the new line before any action is taken.

Mart R. Hoxie, Lexington, Tex., is quoted as stating that all arrangements have been made for capital and right of way for the proposed Taylor & Somerville Short Line R. R. and an inspection of the old survey is to be made at once.

It has been announced by F. P. Read and F. B. Rogers, in Wheeler, Texas, that the profiles of the American Central R. R. Co.'s first block will be completed by Oct. 1, after which the promoters will go east to confer with Charles L. Roberts, a financier of London, who will meet them in New York.

The Board of Trade, Baird, Texas, has appointed a committee to confer with the railroad committee of the Coleman, North & South R. R. and to offer inducements for the road to build via Baird. The committee will also confer with the northwest extension of the Cotton Belt now building to Comanche and will offer a liberal bonus and right of way for that road to build to Baird.

According to advices from Del Rio, Texas, the contractors on the Orient Ry. are making rapid progress, having constructed 15 miles of grade since June. At that rate the line will be ready for operation into Del Rio within 12 months.

A company has been organized, with a capital stock of $400,000, a good portion of which has been subscribed, by the business men of Cuero, to build the North & South R. R., which has been under consideration for some time. It will be about 180 miles long. The exact route is not yet determined. Judge R. A. Pleasants, Messrs. Lee Joseph, George J. Schleicher, Walter Reiffert, Charles Cook and Dume Houston, all of Cuero, are interested.

Despite the pessimistic reports that have floated up from Texas regarding new railroad construction in that state, the books of the railroad commission show that 976 miles of railroad are now actually in process of construction. The following lines, although financed and planned before the enactment of the International & Great Northern law, are now being built: Paris & Mount Pleasant, 45 miles; Temple & Northwestern, from Temple to Comanche, 104 miles; St. Louis & Southwestern from Gatesville to Hamilton, 30 miles; Gulf, Texas & Western, from Redham to Seymour, 15 miles; Gulf, Colorado & Santa Fe, from Lometa to Brady, 65 miles; Pecos & Northern Texas, from Coleman to Texico, 310 miles; Forth Worth & Rio Grande, from Brady to Menardville, 36 miles; Kansas City, Mexico & Orient, from San Angelo to Del Rio, 200 miles; Chicago, Rock Island & Gulf, from Findlay to State line, 15 miles; Missouri, Oklahoma & Gulf, from Denison to the State line, 10 miles; San Antonio, Rio Grande and Tampico, from San Antonio, south, 90 miles; Texas Central, from Deleon Springs to Rising Stark, 27 miles; Brownwood north and south, 17 miles, from Bartlett to Florence, 12 miles. It will be recalled that the year ending June 30, 1910, surpassed all former years as to the amount of railroad constructed in the state, the mileage being 738.2 miles. Other years, according to the report of the commission, are shown as follows: 1905, 208.87 miles; 1906, 313.34 miles; 1907, 517.24 miles; 1908, 325.85 miles.

Shipman & Denny, Consulting Engineers, 304 Scollard Bldg., Dallas, Tex., have an engineering corps in the field making surveys for the proposed line of Dallas-Palestine Interurban Ry.

Washington.

The Olympic Railway & Power Co., of Elma, Wash., has been incorporated with a capital stock of $3,000,000, the incorporators being W. F. Downs and Thorvald Hyam.

Porter Bros., Contractors of Spokane, Wash., have purchased an 11-acre tract in Portland, Ore., known as the Orissa Cannon property, located on the Columbia Blvd., at the foot of Chautauqua St. The property which has a frontage on the Oregon Railroad & Navigation Co. line will be used as a site for a warehouse, machine shop and depot for assembling their railroad construction outfit.

Tracklaying on the new Warden branch line of the Chicago, Milwaukee & Puget Sound Ry. has progressed so rapidly that an announcement has been made recently at the general offices, Seattle, Wash., that the new road will be inaugurated within two weeks. The branch is 47 miles long and opens up a large wheat belt in the Big Bend Grain Country of eastern Washington.

West Virginia.

It has been rumored that the Little Kanawha R. R., which is under option to an eastern syndicate, will be purchased outright. On account of the similar previous reports to which there was no foundation, very little attention is paid to the report.

Wisconsin.

The Chicago & Northwestern Ry. has been making a preliminary survey between Rothschilds and Mosinee with a view, it is said, of building a line between these two points.

The Chicago & Wisconsin R. R. Co. has been incorporated with a capital stock of $25,000 and headquarters at Madison, Wis. The incorporators are Allen P. Russell, Thomas W. Potts, G. N. Wiswell and J. E. Jones.

The Cincinnati Construction Co., holder of a franchise to build an electric railway from Janesville to Madison and also holding franchises to build through Janesville, Edgerton and Stoughton, has filed a bond of $5,000 with the City Clerk of Janesville. The bond was issued by an eastern company and guarantees that the streets on which the company will build will be fixed after having been torn up by the company. The franchise expires Oct. 26, and unless work has been started by that time, the franchise is void. In Edgerton and Stoughton, the company fulfilled their agreement requiring work to be started before a certain time by digging up a few rods in the streets. It is probable the same will be done in Janesville.

Good progress has been made with track elevation plans in Milwaukee and it is believed that they will be in such shape that they can be submitted to the State Railroad Commission early this month. Charles J. Poetsch is City Engineer of Milwaukee.

The State Railroad Commission has granted the Milwaukee-Western Electric Ry. Co. permission to issue stock certificates in the sum of $1,000,000 and bonds in the sum of $2,500,000. Officials of the road state they are now ready to begin construction as soon as a franchise into Milwaukee has been granted them.

Wyoming.

Construction work is to be started at once on a proposed electric railway from the city of Sheridan, Wyo., to the Government reservation near the city. The company has contracted for 1,100 tons of steel rails and has placed its orders for ties. Gravel for ballasting will be obtained from local pits. The road is to be built for Emanuel & Sullivan of Dayton, O., and Ernest Boehme, West Alzer Ave., Sheridan, Wyo., is the engineer in charge of the work.

Canada.

Arrangements are reported to have been about completed for building an electric railway from Sarnia to London, Ont. Sur-

[illegible] ago for Daniel Stewart, of London, Ont., and he obtained options on the land necessary for the line. He also obtained a charter from the Dominion Government. English capitalists are being interested in the proposition, and it is expected that work on the road will be commenced within a few weeks and the line placed in operation next year.

Joseph Bernier has applied to the Municipal Council of St. Vital, a suburb of Winnipeg, for a franchise for a street car line to run through the parish. The company, which is known as the Rural Ry. Co. of Manitoba, agrees, if given a franchise, to construct a line five miles in length from the southerly limits of either Winnipeg or St. Boniface by Nov. 1, 1911, and as far as the dividing line between the municipalities of St. Vital and Ritchot by Nov. 1, 1912.

The Canadian Pacific Ry. has surveys underway for a new branch line between Diamond City and Medicine Hat. The route being followed is from Diamond City, across the Little Bow River, north of the Bell River, and into Medicine Hat.

The Toronto & York Radial Ry. Co., Toronto, Ont., has been having surveys made in the vicinity of Mimico, with a view, it is said, of double tracking a portion of its line.

Mackenzie & Mann, Toronto, Ont., are reported to be taking steps to secure control of the London Street Ry., and also of the London & Lake Erie Traction Co., both of London, Ont.

The Canadian Pacific Ry. on Oct. 3 opened a 30-mile section, from Wellington to Cameron Lake, on the Alberni branch line.

The city of Guelph, Ont., has voted a by-law to take $85,000 preference stock in the People's Ry., and to grant a franchise for running rights over the city streets. The People's Ry. [illegible] Guelph, Berlin and Stratford, and all intermediate points. In addition, lines are to be built from Guelph south to Puslinch Lake and Hespeler, and north to Elora, Fergus and Arthur. At the next session of the Legislature a charter will be sought to allow the company to build to Goderich, to London and to Toronto. The main line of the railway will then run from Goderich to London, to Stratford, to Berlin and Guelph, making a round run of five hours' duration.

It is believed here in Vancouver, B. C., that it is now almost a certainty that the proposed branch of the Grand Trunk Pacific between Fort George and Vancouver will traverse the Lillooet District and strike the Canadian Pacific at or near Agassiz Station. The trial lines run this season from Lillooet on the Fraser to Lytton, where the river is joined by the South Thompson River, are not considered satisfactory owing to the heavy rock work and the enormous cost involved in construction. An engineering party is now working north from Agassiz. Its objective is Lillooet. It is aimed as a route where very low grades can be secured all the way from Lillooet on the Fraser to Agassiz, whence the line will parallel the Canadian Pacific into Vancouver.

It is believed that the Dominion Government will eventually decide upon Port Nelson as the terminus of the Hudson Bay Ry. Thos. Turnbull, formerly Chief Engineer of the Canadian Northern and now under the employ of the Government, has been over the proposed route and spent considerable time looking over the vicinity of Port Nelson.

The Niagara, Welland & Lake Erie Ry. Co., of Toronto, will apply to Parliament at its next session for power to construct an electric railway line from Niagara Falls to points on Lake Erie between Fort Erie and Port Dover, via Welland and Port Colborne, Ont.

Mexico.

Bids were opened Oct. 1 by H. M. Taylor, Director of Construction, Buenavista Station, City of Mexico, for clearing, grading and masonry covering proposed line from Penjamo Gto. to Ajuno, Mich., a distance of about 125 kilometers.

It is reported that the Mexican Government has served notice on the Southern Pacific to construct 40 kilometers of railroad south of Nacozari en route to Moctezuma, within the coming year as the concession from the government stipulates that this amount of work must be done each year.

According to a statement reported to have been made by Epes Randolph, head of the Southern Pacific System in Mexico, it is expected that the line to Tepic City, Mexico, will be completed by Jan. 15. The rainy season is delaying the work on the extension south of the Santiago River, but as soon as the rains cease a force of several thousand laborers will be set to work to complete the grade and track laying in the shortest possible time. The completion of the road to Tepic will finish the Pacific Slope line as provided for in the concession granted by the Government. From Tepic the route will run almost due north to Orendain, where connection will be made with the Ameca line of the National Railways of Mexico. This latter division will cross the rugged Sierra Madre Range, mounting from sea level to an altitude of more than 6,000 ft., and crossing deep and wide barrancas. It is stated that a 1 per cent grade route has been surveyed through the mountains, and that, while the cost of constructing the mountain division will be very heavy, no great engineering and construction difficulties are to be encountered. The Southern Pacific will use the track of the National Railways of Mexico between Orendain and Guadalajara, 25 miles.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

✣Bids will be received until 11 a. m., Oct. 24, by board of directors, Turlock Irrigation District, at the office of the board at Turlock, Cal., for the construction of that portion of the canal and works of said district including one diverting gate, four drops and about four miles of canal in earth on the lower extension of Lateral No. 3 of the Turlock Irrigation District, all of which is more definitely described in the special specifications on file in the office of the board of directors in the city of Turlock, Cal

[illegible] construction of the earthwork of the distribution system for the Orland project of the U. S. Reclamation Service, Hard Bros., Concord, Cal., at $10,738, being the probable successful contractors. The work includes the excavation [illegible] 18¾ cts.; class B, indurated materials, 1,700 cu. yds., at 30 cts ; class C, rock, 15 cu. yds., at [illegible] Schlecht, Orland, Cal., is project engineer.

[illegible]

[illegible] Co., of Willows, for rights of way for its [illegible] is being financed by Pittsburg capitalists.

Colorado.

[illegible] tion at Cheyenne, Wyo., is planning to have construction work started this month on its scheme. A preliminary survey of a canal to run from the Colorado-Wyoming state line to Rawlins, on the west side of the Platte, has already been made, and another on the east side of the stream will terminate in the vicinity of Walcott. A large reservoir will be located near the state line, and the water will be used for both irrigation and power for the various towns along the course of the canal. Ex-Governor Fenimore Chatterton, Cheyenne, Wyo., is interested.

Iowa.

✣Bids will be received until 2:30 p. m., Oct. 7, by the Board of Supervisors, Webster County, Fort Dodge, Ia., for the construction of a ditch and drain in Webster County Drainage District No. 21, situated in Johnson township. G. P. Smith, Fort Dodge, Ia., is engineer and J. L. Hanrahan is county auditor. The following material will be required for the said work: Main line, Sta. O to Sta. 10, 1,000 ft. of 24 in. tile, av. depth from surface 4.7 ft., av. depth from ditch 1.0 ft. Separate bid to be filed for Station O to Station 10. Length 3,200 ft., size tile 24 in., av. cut 7.7 ft. Length 1,700 ft., size tile 18 in., av. cut 7.1 ft. Length 300 ft., size tile 16 in., av. cut 6.0 ft. Length 1,000 ft., size tile 15 in., av. cut 5.1 ft. Length 1,100 ft., size tile 12 in., av. cut. 4.8 ft Length 1,200 ft., size tile 10 in., av. cut 5.9 ft. Branch One—Length 2,000 ft., size tile 14 in av. cut 6.4 ft. Length 500 ft., size tile 12 in., av. cut 6.0 ft. Length 850 ft., size tile 10 in., av. cut 5.0 ft. Branch Two—Length 800 ft., size tile 8 in., av. cut 6.0 ft. Branch Three—Length 800 ft., size tile 8 in., av. cut 5.5 ft. Branch Four—Length 950 ft., size tile 10 in., av. cut 4.8 ft. One bulkhead, 6 cu. yds. 3:1 concrete, 11 in- [illegible] from date of letting contract, and to be com- [illegible] received separately for furnishing tile on line of ditch and digging, laying and filling, and for hauling tile from nearest railroad station.

Kansas.

Prof. W. C. Hoad, Lawrence, Kans., has been investigating the channel of the Neosho river within the borders of Allen county, with a view to devising a method of levee protection against the annual floods of the river. The Neosho is almost as erratic a stream as the Delaware, and the only feasible plan, which will permanently remedy the yearly overflows, seems to be to straighten its channel.

A bill may come before the State Legislature this winter for authority to straighten the channel of Cow Creek in order to improve sanitary conditions southeast of Hutchinson.

Louisiana.

✣Bids will be opened at noon, Oct. 6, at the office of the State Board of Engineers, Court House, New Orleans, La., for the following levee work: Grand Bend levee, Rapids Parish, on the left bank of the Red River, new levee and restoration, approximate contents, 15,000 cu. yds., deposit required $115, bond required $800. Cassandria to Experiment Plantation levee. Avoyelles Parish, river side enlargement, approximate contents, 45,000 cu. yds.; deposit required $100; bond required $2,300.

The Crowley and Sixth Ward Drainage District Board of Commissioners at a meeting at Crowley, La., on Sept. 26, received ten applications from engineers in New Orleans, Opelousas, Baton Rouge, Hammond, Natchitoches, Beaumont and Crowley for appointment as engineer to the board. The naming of an engineer was deferred to a later meeting. Inquiries as to the proposed bond issue of $75,000 were received from bond brokers in Chicago and New York. The board has been advised by Major Kerr, chief state engineer, that it [illegible] bids.

✣ Indicates [illegible]

will not have to consult the State Board of Engineers except to have the plans and specifications of the proposed work approved.

The land owners in the Thornwell vicinity near Lake Charles, La., have formed a drainage district and have voted an issue of $30,000 in bonds for the construction of a drainage canal. The proposed canal will bring 15,000 acres of land into cultivation.

Mississippi.

✣Bids will be received until noon, Oct. 26, by Clarke S. Smith, Capt. U. S. Engineers, Mississippi River Commission, Third District, Vicksburg, Miss., for about 183,000 cu. yds. of levee work in that district.

Missouri.

The Fire and Water Board of Kansas City, Mo., has awarded the contract for revetment work and diking about the Quindaro pumping station to Farney & Baker, Centropolis Hotel, Kansas City, Mo., at $90,085. The work includes approximately 8,000 ft. of revetment work, 1,500 ft. 3-pile decking, and 700 ft. 2-pile decking.

Montana.

Advices from Sheridan, Mont., state W. H. Godfrey has been making surveys up Mill creek, locating reservoir sites for the Ruby Farms Company, of which N. C. Knight of Chicago, is president.

New York.

Owners of property around Manhasset Bay have organized the Manhasset Bay Improvement Co. for the purpose of dredging a canal from the present channel through the meadows to the viaduct of the Long Island R. R. An interesting plan for the organization of this company and for the construction work was adopted. This plan provides that all the respective holdings of meadow land should be deeded to a corporation, which will issue stock to the grantors in proportion to the acreage deeded. A bond issue will then be created to cover the entire holdings secured by the company, which will provide the means to carry on the work. The land reclaimed will be improved and sold by the company and the profits from the entire development will then be paid to the stockholders. The company proposes to dredge a channel of from 200 to 250 ft. wide and having a depth of ten feet at low tide. This canal would be about 4,000 ft. long, and it is estimated that the material excavated would fill the surrounding low lands to a level of about 5 ft. above tide water. The largest development fronting on the proposed channel is Kensington, the development of the Rickert-Finlay Realty Co. of New York, comprising 135 acres. Other large owners are Llewellyn H. Starkey, the Cary Great Neck Real Estate Co., Henry F. Thompson, Ella E. Combes and May E. Dale, who control more than a mile of shore front at the head of the bay.

Ohio.

John Salway, Munroeville, Ind., has been awarded the contract at Canton, O., for the construction of the main line of the Tuscarawes ditch, the contract price being $7,800. Contracts for the construction of laterals were awarded to J. S. Tice, Lake, O.; Z. I. Fry, New Berlin and N. F. Zulmer, Lake, O. The contracts for several other sections will be let later.

Oregon.

✣Bids will be received until 2 p. m., Nov. 30, by Department of Interior, U. S. Reclamation Service, Washington, D. C., Frank Pierce, acting secretary, for the construction of the Lost River diversion channel, located about 7 miles southeast of Klamath Falls, Ore.

South Dakota.

An extensive piece of drainage work is to be done in Clay County in making a new channel for the Vermilion River. The stream is about 36 miles long in the winding route it takes through the county, and it is the scheme to shorten it to 12 miles in length, at the same time giving the stream a greater fall and thus obviate the overflowing of the stream, in that the water can be carried off at a more rapid rate. It will require the removal of about 2,250,000 cu. yds. of dirt to create the new channel. The Missouri Valley Engineering Co., Mitchell, S. Dak., is in charge of the work.

The Board of Commissioners of Hanson County has established the Larsen et al drainage district. There will be about seven miles of tile from 5 to 24 in. in size. The estimated cost is $14,000. The Dakota Engineering Co. of Mitchell, S. Dak., is the engineer.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

It is expected that as soon as the underpass of the Memphis Union Station is complete, which will be about 30 days, the contract for grading for tracks will be advertised. This latter work will involve about 600,000 cu. yds. of excavation with a haul of four miles. The Union Station Co., Memphis, has perfected an arrangement with the Union Belt line to use the latter's tracks in taking the dirt away, so all the track necessary for the contractor to construct will be his spurs for steam shovels.

C. C. Tate has finished his contract with the Lake View Traction Co. for laying steel between Memphis and Lake View, Miss., and has moved his outfit to New Orleans, La. Tate is well pleased with the success of his contract, while the officers of the traction company are congratulating themselves on getting such rapid work done.

Work is expected to begin the early part of next week on the double track cross-town line to be built by the Memphis Street Railway Co on Bellevue ave. Chief Engineer Haylow states that he will expect the work to be finished within sixty days.

H. P. Streicher is making fine progress with his tar macadam streets and states that he is in position to take on even more street work. "Streich" has more city work than any firm in the South just now, but is in dandy condition to handle all that comes his way.

J. W. Williams is doing some subway work for the new union station and expects to finish next week when he will again turn his attention to street work.

Carey Brothers, who have taken contract from Bob Cheshire for the construction of a raised roadway through Hatchie River bottom in Shelby County, are hustling their forces so as to have the work done in time for the heavy fall cotton traffic. The boys state they will finish their contract before the rainy season sets in and that the farmers near Raleigh, Tenn., will have a perfect all-year-round road by February.

P. McCadden has been awarded another contract by the Cotton Belt Levee District for the construction of 50,000 cu. yds. of levee below Helena, Ark. Maj. Greenfield Quarrells, the President of the Levee Board, was so pleased with the progress which Pat made on his first contract that he had no hesitancy in awarding the contractor a second piece. The work will have to be finished by Jan. 1st.

Tom Shields, of Greenville, Miss., has been awarded a contract by the United States Engineers for furnishing about 20 teams for day work near Helena, Ark., and has already moved his outfit on the contract.

G. C. Weathers states that he will supplement his large forces at Wilson, Ark., by the addition of 25 teams this week. George will then have an outfit of about 50 teams on his Government levee contract.

Lee Mosby was in town last week from his Reelfoot Lake job. Lee seems well pleased with the progress his forces are making and will soon be in position to start his various other Government contracts.

Sam Bush hailed in from Texas as chipper as ever and is looking over some Government levee work near Tyler, Mo., with a view of moving his outfit on same. Sam likes Texas very much, but says it is mighty hard for an old levee man to stay away from the river. There is a saying in these parts that a contractor once a levee builder will always remain one and this seems true. It is peculiar what a fascination the river has for those who have once worked along its banks. Even the negro laborers would prefer to be where they can hear a steamboat whistle now and then than in the most delightful country imaginable.

Only two bids were received by Superintendent Morris of the Y. & M. V. R. R. for the work which was advertised to be let on Sept. 19th, and these two did not prove satisfactory, so as yet the work is being held up. Jake Baxter called on Superintendent Morris the other day with a view of making some sort of a deal for the contract, but to date no agreement has been reached. The work was advertised to be done on a yardage basis, while many firms thought it should be let by the day, or force account, and did not bid.

Tim Shea has been employed by J. T. Walsh & Bro. as their General Superintendent in charge of Missouri, with headquarters at Cape Girardeau, Mo.

William Beach is at present with the Lake View Traction Co., erecting a power plant at Lake View, Miss.

Jim Davenport has been made Chief Engineer of a new road being built in Mississippi, near Greenwood.

Captain Clarke S. Smith, U. S. A., has formally assumed charge of the engineering corps for the Memphis District and returned Saturday from an extensive inspection trip over the vast territory which is his to look after.

Dulaney & Foot are preparing to move on their contract for the Greenville Levee Board, near Chotard, Miss. They have just finished a large contract at Shilow.

B. F. Turner is now working for the Memphis Parkway Commission. He is repairing roads and spreading gravel.

J. T. Ellis has taken contract from Roach & Manigan for hauling crushed stone. The work will last until January.

Washington.

✣Department of Interior, U. S. Reclamation Service, Washington, D. C., Frank Pierce, acting secretary, will receive bids until 2 p. m., Nov. 1, for the construction of canals, wood stave pipe and other structures in the vicinity of Prosser, Wash.

The city of Tacoma, Wash., is to build a municipal wharf, and in order to secure plans will hold a competitive contest, in which the architect submitting the best set of plans will receive a prize, and, if he desires, will be given the position of consulting architect. The plans submitted are to call for a structure which will not cost over $120,000, will be 300 ft. long and four stories in height. There are to b facilities for handling freight and passengers. The open space must be arranged so as to be revenue producing, with the possible exception of a recreation pier. There will be a viaduct to connect South Twelfth street and Cliff avenue, and an entrance to the dock must be arranged from Eleventh street which will connect with the top story or roof of the building. W. C. Raleigh is City Engineer of Tacoma.

Canada.

Engineers of the Canadian Government will probably complete this fall all preliminary surveys of Saskatchewan River necessary to carrying into effect the proposition to make the river navigable from Edmonton to Lake Winnipeg, a distance of 2,000 miles. L. R. Voligny, government engineer in charge of the work, has now completed his program of work. Further appropriations will probably be made toward the work by the Dominion government and the proposition further carried forward next year.

Messrs. Bullen, ship repairers, Vancouver, B. C., have applied to the Dominion Government for a subsidy for a dry dock of the first or largest class, to be located at Esquimalt. It is stated that they will file plans shortly. It is believed that the Bullens are associated with some British shipbuilding yard in their enterprise, which will involve an expenditure of at least $3,000,000.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣[illegible] until 3 p. m., Nov. 7, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Postoffice at Demopolis, Ala.

The Home Dredging Co., Mobile, Ala., has been awarded a contract by the Louisville & Nashville R. R. for dredging the river in front of the Mobile Coal Company's docks at Mobile, to the channel line. The depth will be 20 ft. to the channel line, and it is expected that the improvement will cost about $30,000.

The city of Mobile, Ala., is said to be considering a plan to erect a system of steel sheds and warehouses on the river front from Dauphin St. on the south to pier 4 on the north, a distance of more than a half mile. It is said that the Southern Ry and Mobile & Ohio will join the city in extending the steel construction. The proposed improvements would cost nearly [illegible]

California.

✣Bids will received until 11 a. m., Oct. 7, by Major George McK. Williamson, Constructing Quartermaster, Fort Mason, Cal., for clearing grubbing land at Fort Winfield Scott, Cal.

✣Bids will be received Nov. 16, by the Board of Public Works, of San Francisco, Cal., for the construction of two incinerating plants, one in the North Beach District and one in the Ingleside Creek District. The capacity of each of the plants is to be 120 tons and the cost is estimated at $250,000. Marsden Manson is City Engineer of San Francisco.

J. G. White & Co., Inc., Engineers and Contractors, 43 Exchange Pl., New York, have been awarded a contract for the engineering and construction of a steam and electric power plant to be built for the Power Transit & Light Co., at Bakersfield, Kern County, California. The building will be 82 ft. by 140 ft., with substructure of concrete, self supporting steel frame, and walls of metal lath and plaster, [illegible] the usual form of construction throughout lower California, and will be designed to accommodate two 2,000 kilowatt horizontal turbines, with boilers, condensers and necessary auxiliaries. A 750 kilowatt turbine will be temporarily installed at the earliest possible date. Water for condensing purposes will be obtained from an irrigation ditch near the plant and the water for boiler purposes will be supplied from wells to be driven near the power house. As the boilers will be installed with oil burners, there will be no basement under the boiler room. The station will be designed electrically to deliver practically full load at either 60,000, 10,000 or 2,300 volts, and will operate at all the above pressures simultaneously. The estimated cost is approxi-[illegible]

[illegible] title to tide lands about Point Richmond and will probably arrange for the issuance of bonds to erect docks and warehouses. General Samuel W Backus is President of the company, and George L. Dillman, one of the engineers in the construction of the Western Pacific, is a director

Petitions are being circulated asking the city council of San Pedro to adopt a comprehensive and uniform plan of street grades between 6th St and the outer-harbor so that all streets between 6th and 22d Sts. east of Pacific Ave., may be opened to the waterfront. This improvement would involve the sloping of the bluff fronting the harbor back to Pacific Ave., a distance of four blocks, and the removal of a large amount of dirt. It is estimated that work will cost in the neighborhood of $100,000, and it is proposed to form an improvement [illegible]

Connecticut.

Bids as follows were received Sept. 23 by Lt.-Col. Harry Taylor, U. S. Engineer, New London Conn., for furnishing insulated cable (1) standing for Hazard Mfg Co., and (2) for the Standard Underground Cable Co.:

	(1)	(2)
Type "A 1" cable, armored 17,500 ft., per ft.	....	$0.38 9-10
Type "A 1" cable, unarmored, 8,900 ft., per ft.	....	.26 8-10
Type "A 2" cable, armored, 10,860 ft. per ft.	.....	.44 3-10
Type "B" cable, braided, 600 ft., per ft.	$0.16 6-10	.11
Type "C" cable, armored, 5,000 ft., per ft.	.31 7-10	26 5-10
Type "C" cable, braided, 800 ft., per ft.	.24⅛	.14 9-10
Type "C" cable, armored, 18,600 ft., per ft.	.39¾	.31 2-10
Type "C" cable, unarmored, 3,100 ft., per ft.	.30¾	.22 1-10

District of Columbia.

✣Bids will be received by Beekman Winthrop, Acting Secretary Navy Department, Washington, D. C., for the construction of one battleship No. 34, and two fleet colliers, Nos. 9 and 10. All bids must be filed by noon, Dec. 1.

✣Bids will be received until 11:30 a. m., Oct. 5, by A. S. Cowan, Captain, Disbursing Officer, Signal Corps, U. S. Army, Washington, D. C., for furnishing under proposal No. 485 three complete wireless telegraph sets, 2k.w. quenched sinking spark type for installation on shipboard and one do. for land station.

✣Bids will be received until noon, Oct. 5, by E. E. Capehart, Acting Chief of Bureau of Ordnance, Navy Department, Washington, D. C., for furnnishing 2,400 14-in. armor piercing projectiles.

✣Bids will be received until 11:30 a. m., Oct. 6, by Capt. A. S. Cowan, Signal Corps, U. S. Army, War Department, Washington, D. C., for furnishing 3,000 ft. cable, type 308; also for three miles wire galvanized iron.

✣Bids will be received until Oct. 5 by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing malelable iron castings for 12-yd. Oliver dump cars as follows: 600 truck columns, R. H., and 600 truck columns, L. H.

✣Bids will be received until Oct. 5 by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing one cast steel bevel cutter gear and pinion.

✣Bids will be received until 10:30 a. m., Oct. 27, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 608, lumber, steel cable, washer cutting machine, portable electric grinder, machine and hand taps, sellers and pipe hobs, reamers, steel sockets, twist drills, chucks, punches, dies, rivet sets, vaseline, etc.

✣Bids will be received until 2 p. m., Oct. 8, by Department of Interior, Washington, D. C., for the construction of a radial brick chimney for the power plant at Freedmen's Hospital and Howard University, Washington, D. C. Jesse Wilson is Assistant Secretary.

✣Bids will be received until Nov. 1 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing under Sch. 2948 at Mare Island, Cal., 1 grind and crank shaft lathe.

✣Bids will be received until 2 p. m., Oct. 10, by Frank Pierce, Acting Secy., Bureau of Mines, Washington, D. C., for sheet metal and structural iron parts of a coal crusher system, an electric or hydraulic lift in connection with same and various laboratory fixtures, including tables, hood, dinks, etc.

✣Bids will be received until Oct. 25 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing under Sch. 2950 at Puget Sound, Wash., miscellaneous pipe composition fittings, 720 composition unions, 480 globe valves; at Mare Island, Cal., 6 brass gate valves, 970 globe and angle valves.

✣Bids will be received until October 25 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing under Sch. 2951 at Puget Sound, Wash., 10,700 lbs. steel bolts and nuts, 504 round end scoop shovels, 800 lbs. spelter solder.

✣Bids will be received until Oct. 18 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at Brooklyn, N. Y., under Sch. 2947 1 set gasoline machinery; under Sch. 2936 at Washington, D. C., 1 milling machine; under Sch. 2935 at Norfolk, Va., 1 electric concrete mixer.

✣Bids will be received until Oct. 11 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for fitting up dispensary at Naval Home, Philadelphia, Pa., under Sch. 2934 miscellaneous.

✣Bids will be received until Oct. 11 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing under Sch. 2943, at Norfolk, Va., 7,200 hacksaw blades, 24 Renshaw ratchet drills, 1,296 files, miscellaneous hardware and tools, 192 sets machinist's hand taps; at Brooklyn, miscellaneous stove bolts, 20 doz. twist drills, miscellaneous hardware and tools, 510 pair of cast bronze hinges, 10 reams of garnet paper, miscellaneous machine screws, miscellaneous hand tools, 3,750 plate washers, 17 doz. screw wrenches; at Boston, miscellaneous twist drills, miscellaneous files, miscellaneous hardware and tools; under Sch. 2944, at Brooklyn, N. Y., 25 doz. brass squirt cans.

✣Bids will be received until Oct. 11 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing 2 stoker engines at Brooklyn, N. Y., Sch. 2932; 6 portable blacksmith forges at Norfolk, Va., Sch. 2943; 1 sensitive drill press at Norfolk, Va., Sch. 2933.

✣Bids will be received until Oct. 11 by Navy Department, Bureau of Supplies and Accounts, Washington, D. C., for furnishing under Sch. 2944 at Boston, Mass., miscellaneous brass pipe fittings; under Sch. 2944 at Boston, Mass., miscellaneous cast iron fittings; under Sch. 2937 at Philadelphia, Pa., miscellaneous plumbing fixtures; Sch. 2942 at Brooklyn, N. Y., 12,000 ft. steel or wrought iron pipe; under Sch. 2944 at Boston, Mass., 1,400 enameled conduit unions.

Hawaii.

✣Bids will be received until 11 a. m., Oct. 14, by Major E. E. Winslow, U. S. Engineer, Honolulu, T. H., for breakwater construction at Kahului Harbor, Maui, T. H.

✣Bids will be received until 11 a. m., Oct. 14, by Major M. E. Winslow, U. S. Engineer, Honolulu, T. H., for breakwater construction at Hilo Harbor, Hawaii, T. H.

Florida.

✣Bids are asked until noon, Oct. 20, by Capt. Geo. R. Spalding, U. S. Engineer, Jacksonville, Fla., for dredging in Caloosahatchee River and entrance, Florida. The work is divided into sections designated, A, B, C, D, E, and F. Section A is through the outer shoal, near buoy No. 2 at the entrance to San Carlos Bay, about 3 miles below Puntarasa, Fla. Section B is through the inner shoal in San Carlos Bay, between buoys No. 4 and No. 6, about one mile below Puntarasa. Section C is through a small shoal in the river about one mile above Puntarasa. Sections D, E and F are through a shoal in the river near Shell Point, about two miles above Puntarasa. It is not proposed to do any work at present in Section C. The total yardage is 355,000, and the amount available is about $45,000. The material to be removed is believed to be sand, mud and shell.

The contract for dredging in Biscayne Bay, Fla., for the U. S. Goverment has been awarded to the Southern Dredging Co. of Mobile, Ala., at the following prices: For sand dredging 25 cts. per cu. yd., for rock excavation $2.44 per cu. yd., place measurement.

The contract for work in Hillsboro Bay, Fla., for the U. S. Government, has been awarded to the North American Dredging Co. of Texas, Galveston, Tex., at 7 9-10 cts. per cu. yd., and Rittenhouse Moore of Mobile Ala., at 8½ cts. per cu. yd.

Georgia.

✣Bids are asked until noon, Oct. 27, by Col. Dan C. Kingman, U. S. Engineer, Savannah, Ga., for dredging in harbor at Brunswick, Ga. The project for the improvement of Brunswick Harbor, Georgia, provides for creating and maintaining a channel 30 ft. deep, at mean high water, with a width of 150 ft., in Academy Creek, and a channel 30 ft. deep, at mean high water, and 350 ft. wide, in East River. These depths and widths were obtained in April, 1909. Since then a shoal has formed at the mouth of Academy Creek and some shoaling has taken place at the lower end of the channel in East River. The work to be done will be to restore the project dimensions in these localities. The shoal in Academy Creek is approximately 1,000 ft. long, and the present depth ranges from 21 to 26 ft. at mean high water. The dredging to be done in East River is upon the edges of the channel where shoaling has taken place for a length of about 1,500 ft. The present depth varies from 25 to 29 ft. at mean high water. The estimated quantity is 60,000 cu. yds. and the amount of money available is about $10,000. The material is believed to be sand and mud.

✣Bids will be received until noon, Oct. 27, by Col. Dan. C. Kingman, U. S. Engineer, for dredging in waterways between Savannah, Ga., and Fernandina, Fla., harbor at Darien, Ga., and Sapelo Harbor, Ga. The work to be done is as follows: Waterway between Savannah and Fernandina: Dredging is to be done in Jekyl Creek and in Mud River, to provide a channel at each place 7 ft. deep, at mean low water, with a width of 125 ft. in Jekyl Creek and 100 ft. in Mud River. Harbor at Darien: It is proposed to dredge at Old River leading to the Lower Bluff Mill and at North and South Reach, to obtain a channel at each of these places 12 ft. deep, at mean low water, with a width of 100 ft. Sapelo Harbor: While the project provides for securing a channel 17 ft. deep, at mean low water, and 150 ft. wide, through the two lower shoals. The quantities are as follows: Jekyl Creek, 20,000 cu. yds.; Mud River, 35,000 cu. yds.; Darien Harbor, 45,000 cu. yds.; Sapelo Harbor, 50,000 cu. yds. The amount of money available for payment of contractors' estimates is about $28,000, divided as follows: Waterway, $10,000; Darien Harbor, $9,000; Sapelo Harbor, $9,000.

Illinois.

✣Bids will be received until 2 p. m., Oct. 10, by Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for furnishing and delivering at Rock Island the following: 2,150 hand adzes, 4,430 pick mattocks and 6,500 shovels.

✣Bids will be received until 2 p. m., Oct. 17, by Lieut. Col. F. E. Hobbs, Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for the erection of a reinforced brick storehouse at the arsenal.

✣Bids are to be opened Oct. 7, 1910, by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, for the furnishing of all material, tools, machinery, etc., for constructing a dock 66 feet long at the foot of Eastman street and the north branch of the Chicago River canal. The work will necessitate, besides the furnishing of a pile driver and crew, the following bill of material: 13 white oak piles, 40 ft. long, 144 sq. in. in section; 8 white oak anchor piles, 30 ft. long, 144 sq. in. in section; 66 pieces white oak sheet piling, 4 by 12 ins. by 30 ft.; 66 feet white Norway or long leaf yellow pine batten, 3 by 12 ins. by 20 ft.; 66 ft. 12x12 ins., white oak waling; 66 ft. 12x12 in. white oak anchor log; 66 ft. white oak cap; 66 ft. 3x12 in. fillers back of cap; 66 ft. 3x6 in. fillers back of cap; 66 ft. 4x12 in. pine stringers, mud sills; 66 ft. 6x12 in. pine stringers, mud sills; 13 anchor rods, 35 feet long, of best quality, and the necessary spikes, drift bolts, nuts, washers, etc. The work also requires some hand excavation of earth to complete the work.

✣Bids will be opened by the Commissioner of Public Works, City of Chicago, Room 705, City Hall, for furnishing and erecting two stoker engines and three chain grates stokers for the 68th street pumping station. The engines must be two-belt connected vertical automatic engines of type "E," as made by E. H. Wachs company, or of the type "VS" 5 ins. made by the B. S. Sturtevant Co., or equal, and must be made capable of using up to 175 pounds of steam. The engines and stokers are to be installed by the contractor in conjunction with the installation of the boilers and piping, which is to be done by other contractors. Bid must be in by 11 a. m., Oct. 7, 1910.

✣Bids are asked until 10 a. m., Oct. 12, by Maj. Chas. S. Bromwell, U. S. Engineer, 508 Federal Bldg., Chicago, Ill., for dredging and rock excavation in Chicago River, Illinois. The work to be done consists in the excavation of rock and non-dredgable hard pan from a point in the North Branch of the Chicago River just below Fullerton Ave. Bridge, Chicago, and up to a point about 1,600 ft. above that bridge. The total estimated quantity of material to be removed to complete the work is about 20,000 cu. yds., place measurement, and this amount will be used as a basis in canvassing bids. The materials to be removed consist generally of rock, covered in scattered sections with irregular strata of hard pan, the latter varying in thickness between 1 in. and 1 ft. and somewhat more in a few places. Where the bottom consists of hard pan averaging not more than about ½ ft. in thickness, this shall be classed with soft material, if it is found that it can be removed by means of an ordinary dredge; otherwise, that is to say, if blasting must be done, it shall be classed as rock. The cuts will average about as follows: At the bridge and thence northwardly about 1,000 ft., 3 to 4 ft.; thence sloping gradually to zero.

The Great Lakes Dredge & Dock Co., Chicago, Ill., has work under way on its $200,000 contract for construction of the foundations for two new blast furnaces to be erected at the South Chicago works of the Iroquois Iron Co., 3267 East 95th St., Chicago. The two new furnaces which the company will build will cost about $2,000,000, and it is understood that it contemplates the erection of two more. Other important changes will be made by the company in connection with its South Chicago plant. It has men at work filling in the Calumet slip and it is the purpose to remove the present south pier at the mouth of the harbor. It also contemplates the erection of a concrete dock, which will be equipped with the latest improvements in hoisting machinery and apparatus for the unloading of ore. The company also is filling in and reclaiming the land from the government pier on the south to the plant of the American Smelting and Refining Co. It is building two breakwaters to protect the new shore line. It is the intention to fill in the land to the end of the present south pier. This work alone, it is stated, will cost in the neighborhood of $350,000.

Kentucky.

The following bids were received Sept. 26 by Major John C. Oakes, U. S. Engineer, Cincinnati, O., for constructing Dam No. 13, Kentucky River, with abutment and protection wall, at Thirteen P. O., Ky., (1) standing for James Skene & Sons Co., Huntington, W. Va., (2) for Smith, Towles & Co., Thirteen, Ky., (3) for W. F. Garretson, Cincinnati, O., and (4) for Sheridan-Kirk Contract Co., Cincinnati, O.:

	(1)	(2)	(3)	(4)
Earth excavation, 55,000 cu. yds.	$0.68	$0.65	$0.39	$0.55
Rock excavation, 300 cu. yds.	3.90	4.00	2.01	5.00
Embankment, 23,000 cu. yds.	.33	.45	.325	.70
Ballast, 300 cu. yds.	1.95	2.50	1.95	4.04
Concrete, 18,000 cu. yds.	4.80	4.60	4.68	5.45
Cement, 18,500 bbls.	2.00	2.40	2.26	2.45
Paving, 300 cu. yds.	5.15	7.00	4.68	6.00
Derrick stone, 500 tons	3.90	3.00	2.00	2.00
Riprap, 500 tons	2.70	2.50	2.00	2.00
Timber, 4,500 ft. B. M.	80.00	100.00	123.50	90.00
Iron and steel, 33,000 lbs.	.07	.08	.08	.09
Placing valves, lump sum	200.00	500.00	32.50	250.00
Totals	$177,860	$183,690	$162,795	$210,912

Louisiana.

✣Bids will be received until noon, Oct. 5, by Favrot & Livaudais, Ltd., Architects, 839 Gravier St., New Orleans, La., for the construction of a 2-story school building at Bunkie, La.

Maine.

✣Bids will be received until noon, Oct. 18, by Lieut. Col. Geo. A. Zinn, U. S. Engineer, 537 Congress street, Portland, Me., for dredging in Pepperell's Cove, Maine. The work to be done consists of dredging for the purpose of providing an anchorage basin in Pepperell's Cove, Maine. The basin to be excavated will extend along the deep water of Piscataqua River about 1,700 ft., and northeasterly into Pepperell's Cove about 1,100 ft. The material to be removed is believed to be mostly soft mud, with comparatively small quantities of firmer sand, gravel and clay, the whole underlaid with stiff clay and ledge. The total estimated quantity of material to be dredged within the limits of the anchorage basin is 430,000 cu. yds. scow measurement. Over the entire anchorage, the cut to required grade ranges from zero to about 10½ ft., and the average cut to required grade is about 6 ft. As much will be removed under this contract as can be accomplished with the funds available at the unit price of the accepted bid. The cut over the area to be dredged under this contract ranges from zero to about 10.3 ft., and the average cut to required grade is about 4.7 ft. The amount of money available for payment of contractor's estimates is about $54,000.

✣Bids are asked until 1 p. m., Oct. 18, by Col. Thos. L. Casey, U. S. Engineer, Custom House, Baltimore, Md., for dredging soft material in Patapsco River, Md. The location of the area to be dredged is in the Cutoff-Brewerton bend, and in the Cutoff division below that bend, of the channels leading to Baltimore, Md. This area is about 17,400 ft. long by 600 ft. wide, and contains approximately 400,000 cu. yds. of material. The work is to be done to remove shoaling that has occurred over the section already described, to restore the channels to the project depth of 35 ft. at mean low water and width of 600 ft. at bottom, with side slopes of 1 on 3. The work will be awarded as a whole to one bidder.

The following bids were received Sept. 24, by Lt.-Col. Geo. A. Zinn, U. S. Engineer, Portland, Me., for (1) dredging 18,900 cu. yds., and (2) for removing boulders: John H. Gerrish, Boston, Mass., (1) 23.9 cts. per cu. yd., (2) $15 per ton; P. H. Doyen Co., Portland, Me., (1) 24.75 cts., and (2) $17.

The following bids were received Sept. 26 by Lt. Col. Geo. A. Zinn, U. S. Engineer, Portland, Me., for constructing breakwater at Matinicus Harbor, Me.: P. H. Doyen Co., Portland, Me., $1.66 per ton; Rowe Brothers Co., Richmond, Me., $1.54 per ton.

The contract for placing Raymond concrete piles in the [illegible] be

Items marked thus ✣ indicate work now open for bids.

erected for Besche Bros., Baltimore, Md., has been awarded to the Raymond Concrete Pile Co., of New York and Chicago.

Maryland.

✣Bids will be received until 11 a. m., Oct. 12, by Board of Awards, Baltimore, Md., for furnishing the Fire Department the following: One first-size piston steam fire engine of either the "La France" or "Ahrens" type: two combination chemical engines and hose wagons; 5,000 ft. knitted double jacket cotton rubber lined fire hose, 2½ ins. internal diameter, fitted with Baltimore standard couplings, Higbee thread; each 50-ft. section to weigh with couplings not less than 60 lbs.

✣Bids will be received until 11 a. m., Oct. 5, by the Board of Awards, Baltimore, Md., for furnishing and delivering electrical cable, transformers and switchboards.

Massachusetts.

✣Bids will be received until Oct. 8, by George P. Hawes, Jr., Post Quartermaster, Fort Warren, Mass., for furnishing 12 carbon brushes for motor, 16 carbon brushes for generator, 1 set of grate bars, 24 manhole gaskets, 6 brass nipples, 325 sea tiles, 6 pipe unions, 2 brass valves and 15 gals. store enamel.

✣Bids will be received until Oct. 8 by Lieut. George P. Hawes, Jr., Post Quartermaster, Fort Warren, Mass., for furnishing labor and material for repairs to various buildings, including carpenter work, painting, plastering, calcimining, etc.

✣Bids will be received until 11 a. m., Oct. 22, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for the construction of a pier between piers 4 and 5 at the United States Navy Yard, Boston, Mass.

✣Bids are asked until noon, Oct. 17, by Col. Frederic V. Abbot, U. S. Engineer, 25 Pemberton Square, Boston, Mass., for dredging in Mystic River, Mass. The work is located in the lower part of Mystic River and extends through the draw and for a distance of about 2,900 ft. above Chelsea Bridge, which connects the cities of Boston (Charlestown) and Chelsea. The estimated quantity of material to be removed to complete the work is 578,000 cu. yds. The work to be done is as follows: To dredge to a depth of 30 ft. at mean low water [illegible] ft. wide for a length of 200 ft. through the Chelsea Bridge draw; 160 ft. wide at the west side of the bridge and gradually increasing to 300 ft. wide at a point about 600 ft. above the bridge; and thence 300 ft. wide for a further distance of about 2,300 ft. above the bridge. To dredge [illegible] an area irregular in shape and approximately 150 [illegible] the channel above described, and about 500 ft. west of Chelsea Bridge. The material to be removed is believed to be mud, sand, gravel and clay. The work will be let to one contractor.

✣Bids will be received until noon, Oct. 19, by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for dredging in Lynn Harbor, [illegible] ern side of the inner main ship channel of Lynn Harbor, and extends for a distance of about 4,500 ft. northerly from the vicinity of the pile dolphin off Sand Point. It is estimated that approximately 265,000 cu. yds., [illegible] follows: To dredge to a depth of 15 ft. at mean low water an area on the western side of the inner main ship channel 100 ft. wide [illegible] point about 600 ft. below the pile dolphin off [illegible] above described dredging shall extend all shoals of less than 15 ft. depth that [illegible] limit of the existing channel (the [illegible]

[illegible] let to a single contractor.

The following bids were received Sept. 26 by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for dredging in Hingham Harbor, Mass., the sum of $8,700 being available for the work; (1) bid for dredging per cu. yd., scow measurement; (2) bid for removing bowlders, exceeding 2 cu. yds. each. Charles M. Cole, Fall River, Mass., (1) 37 cts.; (2) $10; Eastern Dredging Co., Boston, Mass., (1) 39.7 cts.; (2) $6; Bay State Dredging Co., Boston, Mass., (1) 41⅞ cts.; (2) $10.

Michigan.

✣Bids will be received until 3 p. m., Oct. 24, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for furnishing and delivering at Sault Ste. Marie, Mich., about 118 tons of steel, etc., for canal gates and other purposes.

The following bids per ton were received Sept. 26 at the U. S. Engineer Office, Jones Bldg., Detroit, Mich., for furnishing and delivering 9,000 tons of rock at St. Clair Flats, Canal, Michigan: J. D. Kennedy, Detroit, Mich., $1.27 (probable contractor); Oliver E. Dunbar, Detroit, Mich., $1.33⅓; Great Lakes Dredge & Dock Co., Chicago, Ill., $1.47; Great Lakes Construction Co., Buffalo, N. Y., $1.80; H. Houghten & Sons, Detroit, Mich., $1.90; M. Rabbitt & Sons, Toledo, O., $2.25.

The Board of Public Works of Grand Rapids., Mich., has awarded the contract for constructing a section of floodwall below Leonard St. on the west side to Joseph Rusche, Grand Rapids, at $88,813.

The following bids per cu. yd., scow measurement, were received Sept. 29 by Lt.-Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for dredging at Marquette Harbor, Mich., the amount to be expended being about $25,000: Zenith Dredge Co., Duluth, Minn., 19½ cts.; Great Lakes Dredge & Dock Co., Chicago, Ill., 25 cts.; Northern Dredge & Dock Co., Duluth, Minn., 19 cts. (recommended for acceptance); Duluth Marine Contracting Co., Duluth, Minn., 20 cts.

Minnesota.

✣Bids will be received until 11 a. m., Oct. 5, by Maj. D. W. Arnold, Quartermaster, Department of Dakota, St. Paul, Minn., for furnishing at the Army Bldg., St. Paul, Minn., miscellaneous quartermaster's supplies, including bolts, dampers, files, etc.

✣Bids will be received until 11 a. m., Oct. 10, by D. W. Arnold, Maj., Quartermaster, Department of Dakota, St. Paul; Minn., for furnishing a small quantity of miscellaneous quartermaster's supplies, including grate bars, 20 brushes, 200 ft. cable, 1,000 lbs. cement, 500 ft. lamp cord, 120 fuses, etc.

The City Council of Fergus Falls, Minn., has passed a resolution directing its Electric Light and Water Commission to take steps to rebuild the electric light dam which was washed out a year ago on Sept. 24.

The following bids per cu. yd. were received Sept. 30 by Lt. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for dredging in Duluth Harbor Basin, it being proposed to expend about $240,000 on the work: Northern Dredge & Dock Co., Duluth, Minn., 14 cts.; Great Lakes Dredge & Dock Co., Chicago, Ill., 9.9 cts.; Duluth-Superior Dredging Co., Duluth, Minn., 9 cts. (recommended for acceptance); Zenith Dredge Co., Duluth, Minn., 10¾ cts.; Empire Engineering Corporation, New York, N. Y., 15 cts.

Nebraska.

✣Bids will be received until 11 a. m., Oct. 10, by Capt. Malvern Hill Barnum, Constructing Quartermaster, Fort Robinson, Neb., for the installation of steel watering troughs at Fort Robinson, Neb.

New Jersey.

✣Bids will be received until 8 p. m., Oct. 13, by Board of Education of East Orange, N. J., for the necessary labor and material for [illegible]

✣Bids will be received until noon, Oct. 26 [illegible] Quartermaster, Fort Hancock, N. J., for the construction, plumbing, electric wiring and fixtures of one set of brick quarters for civilian employes at Fort Hancock, N. J.

New York.

✣Bids will be received until noon, Oct. 27, by Col. S. W. Roessler, U. S. Engineer, New York, N. Y., for the construction of a steel screw tug "Engineer," New York.

✣Bids are asked until noon, Oct. 21, by Col. Wm. T. Rossell, U. S. Engineer, Army Bldg., 39 Whitehall St., New York City, for dredging in "Channel North of Shooters Island, New York and New Jersey. The work is located at the lower end of Newark Bay, N. Y. and N. J., between the Kill van Kull and the Arthur Kill, north, east and west of Shooters Island. The approximate areas to be dredged are: 1st. A channel north and northwest of Shooters Island, 1,700 by 100 yds.; approximate yardage 740,000. 2nd. Middle ground in channel of Newark Bay, northeast of Shooters Island, approximate area 350 by 100 yds.; approximate yardage 41,000. 3rd. A part of Bergen Point, east of Shooters Island, south, east and west of Bergen Point Light on the north side of the main channel, approximate area, 200 by 50 yds.; approximate yardage 23,000. 4th. A triangular middle ground, south, west and east of Corner Stake Light, northwest of Shooters Island, approximate area 500 by 100 yds.; approximate yardage 175,000. The material to be removed is mud, sand, clay and gravel.

✣Bids will be received until 3 p. m., Oct. 10, by C. B. J. Snyder, Superintendent of School Buildings, Manhattan, N. Y., for the general construction, etc. (contract No. 2), of the Washington Irving High School on the easterly side of Irving place, between 16th and 17th Sts., in Manhattan, N. Y.

✣Bids will be received until 2 p. m., Oct. 6, by Kingsley L. Martin, Commissioner of Bridges, 13-21 Park Row, New York City, for the construction of an extension to the garage under the Brooklyn Bridge in the borough of Brooklyn.

The G. & W. Manufacturing Co., 30 Church St., New York, N. Y., has been awarded the contract for miscellaneous iron and steel work for the United States Penitentiary at Atlanta, Ga., for $61,073.

The Commanding Officer, Torpedo Depot, Fort Totten, N. Y., has awarded the contract for furnishing and delivering 14,400 ft. of 2-8-in. marline covered rope and 107,300 ft. of ½-in. marline covered rope to Hegeman & Waid, 46 South St., New York, N. Y., for $.075 per ft., and $.095 per ft. Bids were opened Sept. 26.

The B. F. Goodrich Co., 1780 Broadway, New York, N. Y., has been awarded the contract by the fire commissioners, 157 East 67th street, Borough of Manhattan, for furnishing and delivering 20,000 ft. of 2½ in. rubber fire hose; 10,000 lin. ft. of 3-in. rubber hose for the Borough of Manhattan, the Bronx and Richmond; 30,000 ft. of 2½-in. rubber hose for the boroughs of Brooklyn and Queens. The contract price was $75,600. Bids were opened Sept. 15.

North Carolina.

✣Bids are asked until noon, Oct. 20, by Capt. Earl I. Brown, U. S. Engineer, Wilmington, N. C., for dredging in Trent River, New River and waterways to Beaufort, N. C. The work to be done in the Trent River calls for the removal of 300 cu. yds. of shell rock and 65,000 cu. yds. of sand and mud. The New River work calls for the removal of 37,183 cu. yds. of sand, marsh mud and shell rock. For the waterway between New River and Swansboro, N. C., $3,000 is to be expended, the material to be removed consisting of marsh mud, sand and shells. For work on the waterway between Beaufort Harbor and New River the sum of $10,000 is available. The material to be removed consists of sand and shells.

North Dakota.

✣Bids will be received until 2 p. m., Oct. 25, by F. H. Abbott, Assistant Commissioner of Indian Affairs, Department of Interior, [illegible]

Washington, D. C., for the construction of a schoolhouse at Bismarck School, N. Dak.

Ohio.

✣Bids will be received until Oct. 12 by City Clerk, Columbus, O., for machinery to be driven by motors for pumping station of the Columbus water works department on the Scioto River. Motor driven loft lift pump and motor driven direct service pump bids will be received.

✣Bids will be received until 2 p. m., Oct. 27, by Maj. J. C. Oakes, U. S. Engineer, Cincinnati, Ohio, for the construction of one loose stone dam and shore protection in Ohio River near foot of Sisters Island.

The Detroit & Cleveland Navigation Co., Cleveland, O., is planning to expend $500,000 for dock work at Cleveland.

Oregon.

✣Bids will be received until 4 p. m., Oct. 13, by A. L. Barbur, City Auditor, Portland, Ore., for services of a naval architect to superintend and inspect the construction of a steel fireboat for the city of Portland, Ore., to cost approximately $125,000.

Pennsylvania.

✣Bids will be received until noon, Oct. 10, for the erection of a brick boiler and power house, size 97 ft. by 83 ft., to be erected at Delmont mine of the New York & Cleveland Gas Coal Co., near Export, in Westmoreland County, Pa. Plans and specifications can be had at the office of chief engineer of the Pittsburg Coal Co., Oliver Bldg., Pittsburg. F. E. Now, purchasing agent.

✣Bids will be received until 10 a. m., Oct. 6, by F. E. Phelps, Capt., Acting Quartermaster, Pittsburg Storage and Supply Depot, Pittsburg, Pa., for furnishing 60 gals. black asphaltum; 20 gals. japan drier; 1 gal. liquid glue; 300 lbs. white lead; 500 lbs. dark green in oil; 200 lbs. tuscan red, in oil; 25 gals. turpentine and 5 gals. orange shellac.

✣Bids will be received until 3 p. m., Nov. 22, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, except elevators, of the United States Postoffice and Court House at San Juan, P. R.

Rhode Island.

✣Bids will be received until Oct. 18 by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the construction of a wharf at Newport, R. I., under Sch. 2931.

South Dakota.

✣Bids will be received until 2 p. m., Oct. 18, by United States Reclamation Service, Federal Bldg., Los Angeles, Cal., for furnishing cast iron pipe, I beams, grillage bars, etc., for the Belle Fourche project at S. Dak.

The Missouri Valley Engineering Co., Mitchell, S. Dak., is now completing a hydroelectric plant for water power development at Rapid City, S. Dak., and a good part of the work is done at the city point. The work has now been transferred 12 miles up the canyon.

The contract for the concrete foundations for the new science hall of the Dakota Wesleyan University has been awarded to the Watertown Cement Product Co., of Watertown, S. Dak. The Dakota Engineering Co., of Mitchell, S. Dak., is the inspector on the work. Excavation work has also been started for a new gymnasium 56x165 ft. with boiler room 45x50 ft.

Texas.

✣Bids will be received until Nov. 24 for the construction of a 3-story brick building and 3 residences at Brownsville, Tex. Plans and specifications can be seen at the office of Cooke & Co., Theater Bldg., Houston, and Vivier Bldg., Brownsville.

The following bids were received Sept. 27 by Maj. George P. Howell, U. S. Engineer, Galveston, for improving the channel from Aransas Pass to Corpus Christi: Bowers Southern Dredging Co., of Galveston, 13.74 cts. per cu. yd.;American Dredging Co., of Galveston, 14.7 cts.; L. S. Gaynor, for the Atlantic, Gulf & Pacific Dredging Co., 14.4 cts., and the Home Dredging Co., of Mobile, 13.9 cts. per cu. yd. The appropriation available for this work is $157,900. A 12-ft. channel is to be excavated from Aransas Pass Harbor through Turtle Cove and Corpus Christi Bay to Corpus Christi. The channel through Turtle Cove, lying between Harbor Island and Mustang Island, has recently been dredged to about 9 ft. for a distance of 51,400 ft. Thence to McGloins Bluff, a distance of about 25,000 ft., the existing depth is from 8 to 9 ft. No more dredging will be required till the city of Corpus Christi is reached. Here a turning basin will be dredged 1,000 ft. square, where the existing depth averages 10 ft., and an approach channel will be dug about 5,000 ft. long, where the present depths are from 10 to 11 ft.

Virginia.

✣Bids will be received until noon, Nov. 1, by Lieut. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for furnishing cast iron brackets, gear wheels, steel shafting, etc., for devices for transmission of range data at various batteries.

✣Bids are asked until noon, Oct. 20, by Lt.-Col. W. C. Langfitt, U. S. Engineers, 920 17th St., N. W., Washington, D. C., for dredging in James River, Va. The work to be done consists in dredging channels of dimensions specified below, through bars at the following localities: Rocklanding Shoal, about 89 miles below Richmond. The area to be dredged is about 400 ft. wide and about 2⅝ miles long. The depth of excavation will be from ½ to 4 ft., and will probably average nearly 3 ft. The estimated yardage is 591,000. Material is soft mud. Dancing Point Shoal, about 60 miles below Richmond. The area to be dredged is about 400 ft. wide, and about 2 4/10 miles long. The depth of excavation will be from about ½ to 4½ ft., and will probably average about 3⅓ ft. The estimated yardage is 634,000. Swan Point Shoal, about 65 miles below Richmond. The area to be dredged is about 400 ft. wide and about 2⅛ miles long. The depth of excavation will be from ½ to 5 ft. and will probably average 2½ ft. The estimated yardage is 455,000. Material is mud and a small proportion of sand. Warwick Reach, between jetty 55 and jetty 67, about 3 miles below Richmond. The area to be dredged will average about 60 ft. in width and is about 2,000 ft. long. The depth of excavation will vary from ½ to 1½ ft., and will average about 1 ft. The estimated yardage is 10,000. Deep Bottom Shoal, about 19 miles below Richmond. The area to be dredged will average about 100 ft. in width and will be about 3,500 ft. long. The depth of excavation will vary from ½ to 4½ ft., and will average about 3 ft. The estimated yardage is 49,000. Material is principally sand, with a small proportion of gravel and a very small proportion of boulders.

✣Bids will be opened at noon, Oct. 20, by Lt.-Col. Mason M. Patrick, U. S. Engineer, Room 2, Custom House, Norfolk, Va., for dredging Pagan River, Va. The dredging to be done will consist of widening the channel opposite wharves at Smithfield, Va., and above the mouth of Cypress Creek by approximately 40 ft., and in cutting back approximately 60 ft. of the points of five bends between the latter point and a point about 2,000 ft. below Red Point. The material is believed to be mud and oyster shells. About 17,000 cu. yds. of material is to be removed.

Bids were opened Sept. 29 by Lt. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for dredging Onancock River and bar, Va., the lowest bidder being the Norfolk Dredging Co., Water street, Norfolk, Va., at 23.9 cts. per cu. yd. The contract calls for dredging sand and mud, the estimated quantity being 45,000 cu. yds.

Wisconsin.

✣Bids will be received until 2 p. m., Nov. 15, by Superintendent of the Wisconsin State Reformatory, Green Bay, Wis., for labor for a term of five years from Sept. 1, 1911, of from 50 to 200 inmates. M. J. Tappins is Secretary. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until noon, Oct. 31, by Lt. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for building pier head crib and riprap embankment for same at Ashland, Wis. Official advertisement will be found elsewhere in this issue.

Canada.

✣Bids will be received until noon, Oct. 11, by T. F. Acheson, Secy. Treas., Yorkton, Can., for the following appatus for electric light plant: Sec. 1, boilers; Sec. 2, engines, piping, etc.; Sec. 3, generators, switchboards and arc lamps; Sec. 4, transformers; Sec. 5, meters.

✣Bids will be received by the Department of Indian Affairs, Ottawa, Ont., for 15,000 No. 1 cedar railway ties, 15,000 No. 2 ties, 15,000 posts and 4,000 12-in. and up. sawlogs 10 to 16 ft. long. J. D. McLean is Secretary.

✣Bids will be received until 4 p. m., Oct. 26, by R. C. Desrochers, Secy., Department of Public Works, Ottawa, Ont., for the construction of an Examining Warehouse, Vancouver, B. C. Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Joseph Greenfield, resident architect, Winnipeg, Man.; Mr. Wm. Henderson, resident architect, Victoria, B. C., at the Postoffice, Vancouver.

✣Bids will be received until 4 p. m., Oct. 24, by R. C. Desrochers, Secy., Department of Public Works, Ottawa, Ont., for the construction of a public building. Plans and specifications and forms of tender obtained at the office of Joseph Greenfield, Resident Architect, Winnipeg, Man.; W. T. Mollard, Clerk of Works, Regina, Sask., and at the Postoffice, Strathcona, Alta.

✣Bids will be received until 11 a. m., Oct. 7, by M. Peterson, Secretary Board of Control, Winnipeg, Man., for the manufacture and delivery of a motor car for use on standard gauge railway track. Specifications and forms can be obtained at the office of the Power Engineer, Smith, Kerry & Chace, Carnegie Library Bldg., Winnipeg.

✣Bids will be received until 11 a. m., Oct. 20, by M. Peterson, Secretary, Board of Control, Winnipeg, Man., for motor and drive for 8 ft. fan as follows: One 15 h. p., 60 cycle, induction motor, silent chain drive thereto.

BRIDGES—STEEL AND CONCRETE

Alabama.

City Council of Birmingham has adopted plans submitted by city engineer for the construction of a viaduct on 1st Ave. over the grade crossing at Sloss Sheffield City furnaces and a subway on 28th St., Birmingham, Ala.

Arkansas.

Creek County, Ark., commissioners have decided to construct a new bridge over the Cimmaron River at the old Bland Crossing. The structure will, according to present plans, be about 642 ft. in length.

California.

✣Board of County Supervisors, Ukiah, Cal., will receive bids until Oct. 31 for the construction of a new bridge across Russian Gulch.

Funds have been secured by the city of

[illegible] steel and concrete structure to replace the present wooden bridge over Wolf Creek.

Idaho.

Advices from Idaho City, Ida., state that steel has been ordered for the construction of four bridges in Boise County, two being over More Creek, near Idaho City and one over Grimes Creek near Centerville and one on Squaw Creek at Sweet. The work will probably be completed by November 1.

Illinois.

Commissioners of Cook and Will counties, according to information received from Joliet, Ill., will take up the matter of constructing a new bridge over Big Run between Lockport [illegible]

At a recent meeting of the Board of Supervisors, Canton, Ill., the petition for a bridge over Nigger Creek in Union township was referred to the committee on roads and bridges.

Plans for the construction of the proposed bridge of Henry and Rock Island Counties have been completed, the estimated cost being nearly $100,000, over twice the amount which the counties had under consideration. The matter was accordingly dropped and will be taken up at some later date.

The commissioners of Tazewell County at a recent meeting at Pekin, Ill., awarded the contract for the erection of a bridge over Hoffman's Slough, west of Mackinaw, to Walter L. Porter, Mackinaw, Ill., for $2,200.

The Illinois Concrete Construction Co., Springfield, Ill., has been awarded the contract by the county commissioners for the construction of the approaches to the Illinois River bridge at Ottawa, Ill. The contract price is [illegible]

Highway commissioners of Will County at Joliet, Ill., have been requested to take up the matter of constructing a new bridge on the Will-Kankakee County line.

Capt. Swain has submitted a proposition to the City Council of Lacon, Ill., to build a new pontoon bridge over the river.

At the town election April, 1911, at Batavia, Ill., the matter of issuing bonds to the amount of $20,000 will be submitted to the citizens for a vote. The issue is to provide funds for the construction of the proposed East Wilson St. bridge project.

Indiana.

✣Bids will be received until 1 p. m., Oct. 4, by Commissioners of Dubois County at Jasper, Ind., for the construction of two bridges. M. A. Sweeney is County Auditor.

[illegible] Hamilton [illegible] preparations [illegible] construction of the county line bridge. [illegible] Marion County will pay the rest.

A. M. Lisby of Fillmore, Ind., has received a contract from the Putnam County commissioners at Greencastle, Ind., for the construction [illegible] The work includes steel superstructure, concrete substructure and 1,300 ft. of approaches. Bids [illegible]

Iowa.

Board of Supervisors, Burlington, Ia., have [illegible] cement.

Louisiana.

✣[illegible] Slack, secretary Police Jury, Madison Parish, La., at Tallulah, La., for the construction of two bridges, one over Joes Bayou at the inter- [illegible]

Maryland.

[illegible] timore, Md., has awarded the contract for the construction of the proposed new bridge [illegible]

The present structure will be removed to allow the building of the new double track bridge.

Residents in the vicinity of Creagerstown and Lewistown, according to information received from Frederick, Md., have petitioned the county commissioners for the construction of a bridge over Hunting Creek at Friendship ford.

Minnesota.

A proposition to issue bonds amounting to $25,000 for the construction of a steel bridge across the Red River between Teien and Drayton, Minn., is to be voted on and providing it is carried work will be started this fall.

Missouri.

✣Bids will be received until 2 p. m., Oct. 15, by W. H. Kirkham, ex-officio county highway engineer, Richmond, Mo., for the construction of a concrete bridge near the Wakenda Church in Section 5, Township 52, Range 26, in said county.

✣Bids will be received until 2 p. m., Oct. 15, by Ray County Court, Richmond, Mo., for the construction of a concrete bridge on line between sections 23 and 24, township 54, range 27, in said county. W. H. Kirkham, ex-officio county highway engineer.

Among the matters taken up at a recent meeting of the City Council of St. Joseph, Mo., was the report of the city engineer relative to the cost of the new viaduct over the Pere Marquette tracks on Park St. leading to Boughton Beach.

City Council of Chillicothe, Mo., has been unsuccessful in its attempt to induce the Chicago, Burlington & Quincy and the Wabash railroads to replace the old wooden bridge at Washington St. with a steel structure.

Board of Public Works, Kansas City, Mo., is contemplating the construction of a new concrete and steel bridge over the Blue River on 15th St., estimated to cost $55,000. John M. Egan, president of the Metropolitan St. Ry. Co., has offered to pay part of the cost.

The following bid for the abutment for James Road Bridge was received by the City Council of Hannibal, Mo., and referred to the committee of streets and alleys and city engineer: Hanes & Camery, concrete, $6.50 per cu. yd.; excavation, $1 for first foot and $1.50 for second foot.

Montana.

The Northern Pacific Ry. Co. will probably have the present bridge at Missoula, Mont., remodeled in order that it may accommodate three tracks. The matter of constructing a new bridge over the Rattlesnake will be taken up later.

Nebraska.

✣Bids will be received until noon, Oct. 18, by S. A. Richardson, Butte, Neb., county clerk, for the construction of the following bridges in Boyd County: One 36-ft. combination bridge, with 16-ft. roadway, over Ponca creek at the crossing near C. H. Luber's, in section 6-34-13. Also one 30 ft. combination bridge with 16-ft. roadway, over Ponca creek on or near section line between sections 34 and 35, Twp. 34, Range 14. Each of said bridges to rest on 8-rod cedar piling, 20 ft. or longer, if necessary, bids to be for bridge complete ready for dirt grading, including hand rails, painting, etc. Also for the labor of building a 40-ft. bridge with 12 and 16-ft. approaches at the crossing over Ponca creek in the northwest quarter of section 21, Twp. 34, Range 12, known as the Coleman crossing, the county to furnish material therefore. The county also reserves the right to furnish such material as it may have for the other bridges on such terms as may be agreed upon.

Information received from Omaha, Neb., states that E. F. Mitchell, superintendent of construction, Missouri Pacific Ry. Co., recently inspected the site for the construction of the company's proposed viaduct at 46th and Dodge Sts.

New Hampshire.

Officials of the Boston & Maine R. R. Co. are reported to have under consideration the matter of constructing an overhead bridge at the Vaughan St. crossing in Portsmouth, N. H.

New Jersey.

Advices from Elizabeth, N. J., state that both counties interested in the construction of the proposed bridge over the Rahway River, estimated to cost $20,000, will share the cost.

New York.

✣Bids will be received until 2 p. m., Oct. 13, by Kingsley L. Martin, Commissioner of Bridges, Park Row Bldg., New York, N. Y., for repairing the fender of the Willis Ave. bridge over the Harlem River.

Town of Rutland, N. Y., has voted in favor of replacing the present bridge across the Black River at the power plant in the village of Black River with a concrete one estimated to cost $10,000. As the town of Leray defeated the proposition, the question is now up to decide whether or not the structure will be erected jointly.

In order to ascertain the probable cost of a bridge over the railroads and barge canal in Clyde, N. Y., the town's board took the matter up with W. B. Landreth, special deputy state engineer, who informed the board that the state proposes to place a lift bridge over the canal at Glasgow and Sodus Sts. in that village.

The following bids received for widening the bridge over the Chaumont River and building a new and larger draw were rejected by the county superintendent of highways, Watertown, N. Y.: Chicago Bridge & Iron Co., for 50-foot span $8,234, for 70-foot span $12,989; Pennsylvania Bridge Co., for 50-foot span $8,889, for 70-foot span $12,989; United Construction Co., Albany, for 50-foot span $10,722, for 70-foot span $14,981. The present structure has a 24-foot draw for the passage of boats from Chaumont Bay. Recently the federal government made an inspection of the bridge that now spans the stream and later issued an order to the effect that the draw must be at least 45 feet in width. The specifications on which the bids were based call for widening the bridge 10 feet and building the new draw. The bids include the construction of a draw anywhere from 50 to 70 feet in width.

North Carolina.

The Southern Construction Co. of Burlington, N. C., has been awarded the contract by the city of Wilmington, N. C., for the construction of the superstructure of a steel highway bridge at the crossing of 6th St. over the Atlantic Coast Line tracks at Wilmington. The structure will be 142 ft. long.

Ohio.

The county commissioners at Hamilton, O., recently awarded a contract to John Conrad for the construction of a concrete bridge in Butler County. The contract price was $992.

City Council of Lima, O., has decided to postpone taking up the matter of constructing the new concrete bridge at Pine St. until next season, when the bonds for $13,000 will be issued for the purpose.

A petition has been filed with the city council by Joseph Menning asking the provision of funds for the construction of a high level bridge from Clark Ave., S. W., to Clark Ave., S. E. Cleveland, O.

According to advices recently received from Youngstown, O., property owners in the part of Coitsville township, located along North Quarry St. extension and North Center St. extension have petitioned the county commissioners for the construction of a bridge to extend from the new Wilson Ave. entrance at Lincoln Park to Gladstone St.

Oklahoma.

Citizens of Fort Gibson, Okla., and county commissioners are in favor of an immediate election to authorize the construction of the proposed $100,000 bridge over the Arkansas River. County engineer has recommended a site near the Frisco R. R. bridge on account of the solid stone foundation in the bed of the river for the piers.

City Council of Guthrie, Okla., has instructed the Fort Smith & Western Ry. Co. to repair the bridges over Pine St. and Springer

[illegible] ✣ [illegible] bids.

Ave., which have been reported in bad condition by City Engineer Hocker.

Pennsylvania.

✣Bids will be received until 11 a. m., Oct. 11, by County Commissioners, Norristown, Pa., for the construction of a stone arch highway bridge over the northeast branch of the Perkiomen Creek.

Purchasing department of the Oregon Trunk Ry. has placed an order with the Pennsylvania Steel Co., Steelton, Pa., for 5,100 tons of structural steel for the proposed bridge across the Columbia River at Celilo and for use in the construction of bridges across the Deschutes River. The contract for the erection of the structures has not been let. The substructures are now under way by Porter Bros., contractors of the Oregon Trunk. The estimated cost of the bridge across the Columbia River is $1,000,000.

The grand jury of Berks County, Pa., has decided unfavorably in regard to the construction of a new concrete bridge across the Schuylkill at Reading.

County commissioners at York, Pa., have decided to construct another bridge of either stone or concrete over Fishing Creek in Newberry township. Bids for the work will be asked soon.

J. S. McIlvain & Co., Chambersburg, Pa., have been awarded the contract for the construction of a new bridge over Pine Creek in Hegins township in Schuylkill County.

The Lehigh Valley R. R. Co. is reported to be outlining plans for the construction of a large shifting yard of 14 tracks at Hazle Creek, 3 miles south of White Haven, and erecting a bridge 90 ft. high running parallel into Mauch Chunk. The proposed work will require an expenditure of over $1,000,000.

Judge Criswell, Franklin, Pa., has approved the contract made by the county commissioners with the Penn Bridge Co. for the structure over the mouth of Big Sandy Creek. Work will be started this fall.

The county commissioners of Franklin, Pa., have received the following bids for the construction of the proposed new steel bridge over Sugar Creek near the McQuaid farm on the state road: Nelson-Merydith Bridge Co., Chambersburg, Pa., $4,188; Ferro-Concrete Co., Harrisburg, $3,500; Penn Bridge Co., Beaver Falls, Pa., $4,829; York Bridge Co., York, Pa., $4,600; Nelson-Merydith Co., for concrete bridge, $11,536.

The contract for the construction of a new bridge over Pine Creek in Hegins Township has been awarded to J. S. McIlvain & Co., Chambersburg, Pa.

Texas.

Commissioners' court of Burnet County, Burnet, Texas, has ordered an election to be held Oct. 22 to determine whether or not the commissioners' court shall be authorized to issue bonds amounting to $18,000 for the purpose of constructing two bridges across the Colorado River in Burnet County. It has been agreed by the commissioners' court in Llano and Burnet counties that each will bear half the expense in case the authority is obtained.

The Santa Fe Ry. Co. has appropriated $16,000 for the construction of a new viaduct over the tracks on Main St., Belton, Texas. The movement was the result of a recent controversy between the city and railroad officials.

Officials of the St. Louis Southwestern Ry. (Cotton Belt) and Texarkana, Texas, have taken up the matter of constructing a viaduct 1,500 ft. in length over the tracks. The cost of the work is estimated at $200,000.

Virginia.

✣The City Clerk of Princess Anne, Va., will receive bids until 11 a. m., Oct. 10, for the construction of a wooden drawbridge 190 ft. long at West Neck. Plans and specifications are on file at the City Clerk's office, office of A. J. Ackiss, Commonwealth's Attorney for Princess Anne County, Norfolk, Va., and at office of P. St. J. Wilson, State Highway Commissioner, Richmond, Va. A certified check of $100 is required.

The Board of County Supervisors at Luray, Va., has announced the purpose of building an iron bridge across the Shenandoah River at Alma, 10 miles south of Luray. Farmers of the vicinity have appropriated $1,384 for the purpose.

Washington.

✣Bids will be received until 10 a. m., Oct. 7, by Board of County Commissioners, Davenport, Wash., for the construction of the following steel bridges in Lincoln County: One 80-ft. span over Wilson Creek, between Sections 9 and 8; one 32-ft. span in Lords Valley between Sections 21 and 22; one 40-ft. span over Dry Branch of Crab Creek at Irby, on the Great Northern R. R.; one 32-ft. span in Section 28; one steel bridge between sections 34 and 35. Plans and specifications are on file at the office of the County Engineer.

WATER-WORKS AND SEWERAGE

Alabama.

A survey of the streets of Auburn, Ala., preliminary to the construction of a sewerage system for the town is being conducted by the students of the civil engineering course, under the direction of Prof. Mitcham.

The city council of Opelika, Ala., recently voted to purchase the Opelika water works plant for $29,500.

Arkansas.

The contract for the construction of the water works system of Conway, Ark., has been awarded to Joseph McCoppin of Little Rock, Ark., for $56,876.

Contracts have been let for the construction of water and sewer plant for Searcy, Ark., as follows: The Pouncey Paving & Construction Co., of Helena, for constructing sewers, and P. C. Brooks' Sons of Kansas City, for the water system. Bonds in the sum of about $80,000 have been floated for the two systems.

The city council of Arkadelphia, Ark., has passed an ordinance providing for the installation of a complete sewer system.

California.

✣Bids will be received until 11 a. m., Oct. 6, by Board of Public Works, Oakland, Cal., for furnishing the necessary labor and material for the construction of a storm sewer with appurtenances in Market and Seventh Sts., from the existing intercepting sewer in Second St. to the sewer in West St. Walter B. Fawcettis, Secy.

The following bids were received at Oakland, Cal., Sept. 21, for the construction of a storm sewer on San Pablo Ave., from 59th to 67th Sts.; Waldie Construction Co., $16,835; Michael Murphy, $16,673; Scott & Farley, $17,270; Michael Heafey, $15,618; H. Gould, $16,624; Esterly Construction Co., $20,000; Contra Costa Construction Co., 2323 Shattuck Ave., Berkeley, Cal., $15,485; awarded contract.

Plans have been made by the public utilities committee of the board of supervisors at San Francisco, Cal., for active prosecution of the work on the city water project in the Lake Eleanor district. A recommendation was adopted that $3,000,000 worth of the Hetch-Hetchy bonds be offered for sale.

The board of trustees of Martinez, Cal., is considering the installation with the new water plant, of an electric power and gasoline equipment at an approximate cost of $31,000, according to the figures of City Engineer E. C. Brown.

The citizens of San Mateo, Cal., have voted the issuance of bonds in the sum of $24,000 for the installation of a new sewer system and to the amount of $32,000 to improve the fire department.

Plans for contracts for the auxiliary water system of San Francisco, Cal., were in the following stages of completion on Sept. 17: Contract No. 33—For the construction of Jones and Clay streets distributing reservoir. Plans are completed and 87 per cent traced. Contract No. 34—For the construction of the Van Ness Avenue Pumping Station. Preliminary design for the mechanical equipment is completed. The final plans for the station building are 57 per cent completed. Contract No. 49—For laying castiron mains, conduits and appurtenances in the district bounded by 11th St., 14th St., Channel St., 7th St., and ket St. Plans completed. Specification 95 per cent completed and estimate of cost 60 per cent completed. Contract No. 56—For laying cast iron mains, conduits and appurtenances in the district bounded by Market St., 4th St. and the Bay of San Francisco. Working plans completed and traced. Specifications 70 per cent completed and estimate of cost 55 per cent completed. Contract No. 53—For creosoted wooden duct. Specifications completed. Contract No. ..—For the pipes and fittings of the Twin Peaks reservoir 95 per cent completed. M. Manson is City Engineer.

The following contracts for sewer and water mains were in preparation by the Bureau of Engineering of San Francisco, on Sept. 17: Peralta Heights—Main sewer for easterly slope. Plans, specifications and estimate of cost completed. This work will be advertised as soon as the necessary grade changes have been made. Plans for the construction of a main sewer for the Glenn Park district. Tracings completed and specifications 65 per cent completed. Contract No. 17—For the construction of section "D" of the North Point main. Working plans completed and 85 per cent traced. The plans and specifications for the construction of a sewer in 34th Ave., between Vicente St. and the Sloat Blvd., are completed and the cost estimated at $16,000. Contract No: 37—For the construction of a sewer from 48th Ave. and K St. to 45th Ave. and Fulton St. (across the park). Plans completed and estimate of cost 95 per cent completed; specifications 30 per cent completed. Contract No. 39—For the construction of the Mile Rock tunnel. Working plans completed, and 97 per cent traced and estimate of cost 25 per cent completed. North Point main section "M"—For the construction of a sewer through the southerly termination of Springdale St. to Ocean Ave. Working plans 65 per cent completed. North Point main, section "N"—For the construction of a sewer along Islais Creek from Ocean Ave. to Mt. Vernon Ave. Working plans completed and 25 per cent traced. Sewerage sewers in the Mission Flats district. Plans 95 per cent completed. Specifications 10 per cent completed. Fifth St., Howard to Channel St. Working plans 25 per cent completed.

The city of Ventura, Ca., was to sell bonds Oct. 3 in the amount of $45,000 for the installation of a sewer system.

The citizens of the East Oakland Improvement Club have asked the city council of Oakland, Cal., to expend $20,000 in enlarging the sewers on Milberry, Bruce and Commerce Sts. F. C. Turner is City Engineer of Oakland. Prof. I. D. Inskeep is president of the club.

The board of public works of San Francisco, Cal., awarded to R. C. Storrie & Co., on their bid of $98,255, the contract for the laying of section C of the North Point main sewer, while the contract for section F of the same work went to the Metropolitan Construction Co., for $100,034. McSheehy Bros. were given the contract for the general construction of the new Harrison school on their bid of $12,938.

Harvey J. Sarter, City Engineer, Sisson, Cal., has completed his surveys for a municipal water system and sewer system and has submitttd profiles with the plans and specifications for the improvements to the city trustees.

The city council of Roseville, Cal., has sold bonds in the sum of $78,500 to G. G. Blymer & Co., of San Francisco, for the construction of a complete sewer system.

Plans have been made by City Engineer Jensen for the construction of septic tank and sewer connections for the city of Hanford, for which the townspeople will vote on a bond issue. The sewer farm, south of town, is to be connected by two miles of 24-in. sewer pipe with the town. The septic tank will be about 100x200 ft. in dimensions.

The board of trustees of Monrovia, Cal., has set Oct. 14 as the date for a sewer and water bond election. The propositions to be voted upon are: $120,000 for sewer construction and purchase of a sewer farm; $50,000 for improvement of water system and completion of fire protection system.

Colorado.

The contract for the construction of the four additional sewer districts to the city of Sterling, Colo., has been let to Thomas McGovern for $11,720. The sewer to be put in covers a territory divided into four districts.

Florida.

✣The City of Clearwater, Fla., will receive bids until Oct. 15 for the construction of sanitary sewerage system, approximately 2¼ miles of pipe from 8-in. to 15-in., manholes, flush tanks, etc. Specifications are on file at Town Clerk Thos. J. Sheridan's office. Wm. J. Lyon, 305 Duval Bldg., Jacksonville, Fla., Consulting Engineer. A certified check for 5 per cent of the amount to accompany bid.

Georgia.

Advices from Atlanta, Ga., state that the [illegible] to vote on the question of issuing $60,000 in bonds to be used in digging an artesian well and to lay sewer and water mains. The pro- [illegible]

Illinois.

✣Bids will be received until noon, Oct. 20, [illegible], Lewistown, Ill., for the construction of a sanitary sewer system. There will be approximately: 11,781 ft. of 8-in. vitrified tile; 3,050 ft. 10-in. vitrified tile; 992 ft. 12-in. vitrified tile; 1,237 ft. 15-in. vitrified tile; concrete septic tank; 38 manholes; 1 lamphole; 2 single flush tanks; 8 connections for flush tanks; one-half [illegible]

✣Bids will be received by the Board of Local Improvements, City of Chicago, Room 300 City Hall, until 11 a. m., Oct. 10, 1910, for furnishing materials, tools, etc., for constructing water service pipes with fittings in Holly- [illegible] diameter, 22 brass stop-cocks of 1 in. inter- [illegible]

✣[illegible]

cost $1,038.40. Medill Ave., Kimball Ave. to [illegible] mating 300 ft. in length; average depth 8 ft.; estimated cost $161.60. E. 75th St., Stony Island Ave. to Paxton Ave., 192 drains; approximating 4,000 ft. in length; average depth 11 ft.; estimated cost $3,619.20; and the system known as the Dauphin Ave. system, comprising the following streets: Dauphin Ave., 87th St. to 92d St., 59 drains; approximately 1,200 ft. in length; average depth 8 ft. 87th St., St. Lawrence Ave. to Dauphin Ave., 65 drains; approximating 1,800 ft. in length; average depth 8 ft. 87th Pl., St. Lawrence Ave. to Dauphin Ave., 100 drains; approximating 2,500 ft. in length; average cut 9 ft. 88th St., St. Lawrence Ave. to Dauphin Ave., 94 drains; approximating 2,500 ft. in length; average cut 9 ft. 88th Pl., St. Lawrence Ave. to Dauphin Ave., 88 drains; 2,200 ft. in length; average depth 8 ft. 89th St., St. Lawrence Ave. to Dauphin Ave., 81 drains; approximately 2,200 ft. in length. 89th Pl., St. Lawrence Ave. to Dauphin Ave., 65 drains; approximating 1,800 ft. in length; average depth 80 ft. 90th St., St. Lawrence Ave. to Dauphin Ave., 61 drains; approximating 1,800 ft. in length; average depth 80 ft. 90th Pl., St. Lawrence Ave. to Dauphin Ave., 69 drains; 1,800 ft. in length; average depth 80 ft. 91st St., St. Lawrence Ave. to Dauphin Ave., 72 drains; approximating 2,000 ft. in length; average depth 80 ft. 91st Pl., St. Lawrence Ave. to Dauphin Ave., 60 drains; 1,800 ft. in length; average depth 9 ft. 92d St., St. Lawrence Ave. to Dauphin Ave., 66 drains; 1,800 ft. in length; average depth 9 ft. 92d Pl., St. Lawrence Ave. to Cottage Grove Ave., 29 drains; 700 ft. in length; average depth 8 ft. 93d St., St. Lawrence Ave. to Cotage Grove Ave., 30 drains; approximating 700 lin. ft.; average depth 9 ft. Lyon Ave., 93d St. to Cottage Grove Ave., 12 drains; approximating 200 ft. in length; average depth 9 ft. Evans Ave., 93d St. to Lyons Ave., 16 drains; approximating 300 ft. in length; average depth 8 ft. Estimated cost for whole system $17,137.80

✣Board of Water Commissioners, Mattoon, Ill., will receive bids until 4 p. m., October 5, for excavating for laying and backfilling 2,200 ft. of 6-in. cast iron water main and setting five fire hydrants. C. J. James is Secy. of the water works.

The American Engineering & Construction Co., 59 Clark St., Chicago, Ill., has been awarded the contract for the construction of the intake crib and screen tower for the Water Co., Louisville, Ky., for $69,800. The work includes concrete intake tower, with all necessary screens, sluice gates, operating mechanism and four line of 48-in. pipe to connect pumping station. Bids were opened Sept. 27.

Plans and specifications for a reservoir and water works system for the city of McLeansboro, Ill., to cost not more than $16,000 have been submitted to the city council by G. C. Harvey of Mount Carmel, Ill. The proposition will be submitted to a vote of the people about Nov. 1.

The board of local improvements of Dixon, Ill., has rejected all bids for the construction of the N. Ottawa Ave., sewer. The work will be readvertised.

Plans and specifications have been prepared by E. K. Wilson of Elgin, Ill., for the installation of a complete sewer system in Dundee, Ill. About 15,000 lin. ft. of pipe will be used, ranging in size from 8-in. to 15-in. in diameter. The system, it is estimated, will cost [illegible]

The East Moline, Ill., board of local improvements decided to accept the estimate furnished by City Engineer H. G. Paddock of Moline on the proposed extension of the sewer system in that city. The estimated cost [illegible]

Indiana.

✣[illegible] Bids. [illegible] sewer in Market St. and Jackson St. including four catch basins. Webster Marlott is Clerk.

The Marion County Construction Co., Indianapolis, Ind., has been awarded a contract in Indianapolis for the construction of the Parkway sewer for $2 per lin ft.

The Sheehan Construction Co., of Indianapolis, Ind., has been awarded the contract by that city for the construction of a sewer in the alley between Spruce and Eveson Sts. Bids were opened Aug. 19.

The board of public works of Indianapolis, Ind., has awarded a contract to Manley-O'Donnell Co., of that city for the construction of a local sewer in the alley east of Olive St. Bids were opened Aug. 19.

The city council of Connersville, Ind., received the following low bids for different work in connection with the installation of the new water system: Reservoir, Philip Hipskin & Sons, $6,136. Pumping Station, Philip Hipskin & Sons, $5,731. Removing old machinery, Philip Hipskin & Sons, $2,100. Laying water pipe, Neal & Stoll, $6,900. By Pass, Philip Hipskin & Sons, $248. Drilling wells, William Fox, $890. Electric motors, Wagner Electric Co., $1,362. Centrifugal unit, W. T. Johnson Co., $550. Steam turbine and generator, Westinghouse Electric Co., $5,775. Tubular boiler, Brownell Co., $838. Deep well pumps, Roth Mfg. Co., $2,200. Well houses, R. G. Wait & Son, $545.

Iowa.

The city of Adair, Ia., contemplates constructing a system of water works, and will hold an election some time in October to vote upon the proposition.

Bids for the sewer and water mains in the southwest section of Davenport, Ia., from 15th to 22d Aves., and 1st to 7th Sts., including an outlet through the city park connecting with the Hawk Hollow sewer, were opened Sept. 24 by City Engineer, Clark G. Anderson, as follows: Keys and MacNamara, LaSalle, Ill. The contract was awarded to the lowest bidder. Sewer, $19,319; water, $10,710; combined, $30,029. C. A. Berglund, Moline, Ill.—Sewer, $13,785; water, $9,984; combined, $23,769. F. E. Kaminiski, Watertown, Wis.—Sewer, $16,196; water, $8,500; combined, 24,696. P. J. Ryan, St. Paul, Minn.—Sewer, $16,629; water, $9,500; combined, $26,130. E. R. Harding, Racine, Wis.—Sewer, $14,369; water, $10,000; combined, 24,369.

The city council of Dubuque, Ia., has awarded the contract for the construction of the sanitary sewer in Grandview Ave., and South Dodge St., to W. T. Hassett.

P. V. Clarke has secured the contract for rebuilding the water system of the C. & N. W. Ry. at Marshalltown, Ia. Work will be commenced at once.

W. A. Edgar of Cedar Rapids, Ia., was the successful bidder for the contract of laying sewer in Cedar Falls, Ia., at $1,800.

The council of Hawarden, Ia., has awarded the contract for constructing the sewerage system in the city to Roberts & Few of Brookings, S. Dak., for $16,914. Other bids were received as follows: Lewis & Leader, Sioux City, $16,982; J. J. Donnegan of Shenandoah, $17,595; Turner Improvement Co. of Des Moines, $17,997; Tilby Bros. of Emmetsburg, $19,000.

At a recent meeting of the Logan Improvement League of Des Moines, Ia., plans were completed for a sewer in East Des Moines extending from the Des Moines River to Hull Ave., a distance of three miles.

Hans Berkland of the firm of Anderson & Co. of Vincent, was the successful bidder for putting in the two sewers for the city of Eagle Grove, Ia., for 67 cts. and $1.59 per lin. ft.

The bids for the construction of the proposed 12-in. sewer main from the intersection of Brooks St. and Illinois Ave. in Essex, Ia., to the river were as follows: Guy E. Smith of Indianola, Ia., $3,995; O. Farrell Contracting Co. of Dubuque, Ia., $3,888; W. D. Yeager of Pella, Ia., $3,781; J. A. McLaughlin of Red

Oak, $3,755, and J. J. Dunnegan, $3,462. The contract was awarded to the lowest bidder.

Contract for sewers in Charles City, Ia., has been awarded to R. C. Delahunt of Cedar Rapids, Ia. The city is asking for bids for the construction of another sewer on Jackson and Cedar Sts.

J. R. McCormick, Fort Dodge, Iowa, has received the contract from the city of Hampton, Ia., for the construction of a sewage disposal plant and a reservoir for $4,500. Bids were opened Sept. 26.

Kansas.

Plans are being formulated for the construction of a waterworks system for Mulvane, Kan. The city recently held a bond election and voted the issuance of bonds in the sum of $30,000 to finance the building of the plant.

The commissioners of Kansas City, Kan., have rejected all bids for the steel, cement and crushed rock to be used in the construction of a $60,000 filtration plant at the waterworks, as being too high. The entire construction will be done by the city.

The residents of the south and east portions of Topeka, Kan., are planning to present before the city commission a petition asking for the creation of a benefit district for the building of a sewer system along the bed of the Shunganunga creek, draining the south and west portions of the city. W. J. Rickenbacher is interested.

Kentucky.

✣Bids will be received for a 1,000,000-gal. steam turbine-driven centrifugal pump until 11 a. m., Oct. 11, by the Louisville Water Co., 439 Third St., Louisville, Ky. Each proposal must be accompanied by a certified check for $2,000. Theodore A. Leisen, Chief Engineer and Superintendent.

✣Bids will be received at the office of the Louisville Water Co., 439 Third St., Louisville, Ky., until 11 a. m. Oct. 11 for one water tube boiler. Each proposal must be accompanied by a certified check for $2,000. Theodore A. Leisen, Chief Engineer and Superintendent.

✣Bids will be received until noon, Oct. 21, by Commissioners of Sewerage, 605 Equitable Bldg., Louisville, Ky., for the construction of Section "B," Frankfort Ave. Sewer, Contract No. 74. The work consists mainly of the construction of 1,870 ft. of vitrified pipe drain, ranging in size from 12 in. to 24 in., and 1,870 ft. of 8-in. sewer, about 1,870 ft. of earth excavation, depth of cut 9 to 11 ft.; about 350 cu. yds. of rock excavation and 15 cu. yds. of concrete masonry. J. B. F. Breed is Engineer.

The City Council of Owensboro, Ky., has passed an ordinance appropriating $20,000 for the erection of a water-softening plant.

George Gardner and Will Noble, of Paducah, Ky., have secured a $40,000 contract for the laying of seven miles of sewer for the city of Newport, Ark.

Louisiana.

Mayor R. Lafleur, of Eunice, La., has recommended to the town council that an election be called on the proposition to sell the municipal water plant to a company that will install an electric lighting plant in connection.

Maryland.

The Cambridge Water Co., of Cambridge, Md., has made public plans for increasing the water supply of Cambridge. The company plans to erect a duplicating plant, bore larger wells and put in compound duplex pumps.

The citizens of Western Port, Md., on Sept. 27 voted the issuance of bonds for the public improvements as follows: For issuance of $75,000 water works bonds; for $10,000 for establishing sewerage system and laying sewers; for $10,000 for street paving; for $5,000 for new bridge across river.

The city council, Mayor J. McP. Scott, City Attorney A. C. Strite, William J. Witzenbacher, and City Clerk Edgar Mumma, of Hagerstown, Md., recently made a tour of inspection of the mountain reservoirs and the watershed with a view of discovering additional sources of water supply for the city.

A contract for the erection of a portion of the city sewerage work, Baltimore, Md., has been awarded to B. F. Sweeten for $67,371. The Dietz Engineering Co. has received a portion of the same work, amounting to $17,360.

Michigan.

The Water Board of Manistee, Mich., has decided to tunnel the river for the purpose of laying a main across the river. The tunnel will be located at the foot of Pine St., and will be 5 ft. in diameter and 24 ft. below the level of the river. The cost to the city for this work will be approximately $7,000. The David West Construction Co., of Milwaukee, Wis., has the contract.

The common council of Hartford, Mich., has awarded to M. C. Mortimer, Edward Hickey and Oscar Martin the contract for laying the new Hartford water mains for a lump sum of $2,417.

The city of Stoughton, Mich., is considering the purchase of the Yahara river water power, now owned by the Stoughton Milling Co. The property is valued at about $17,000.

Minnesota.

North Fond du Lac, Minn., is considering the proposition to buy the village water works system. The Sand Rock Water Co. has offered its holdings to the village.

The water and sewer extensions for the city of Cloquet, Minn., have been awarded to the Pastoret-Lawrence Co., of Duluth, Minn. The work, it is estimated, will cost $40,000.

Frank A. Bowman has completed the plans for the proposed sewer system for Gilbert, Minn. As now planned, the system calls for the installation of a spreading filter, a settling tank, and 4,000 ft. of pipe, a septic tank. The specifications for the system will be completed by Prof. F. H. Bass of the State University at Minneapolis.

Missouri.

✣Bids will be received by the Board of Fire and Water Commissioners, Kansas City, Mo., until 2 p. m., October 13, for the construction of an intake pier on the banks of the Missouri River near the water supply pumping station of said city at Quindaro, Kan. E. B. Harrington is Secretary of the Board.

✣City Clerk William Warden, Neosho, Mo., will receive bids until 8 p. m., Nov. 1. for furnishing material and constructing a system of sewers for Sewer District No. 1. Plans and specifications are on file at the City Clerk's office. A certified check of $500 is required. F. J. Bigham, Mayor.

Bids will soon be called for by the city of Warrenton, Mo., for the drilling of a deep well for the city's water supply. Estimated depth 400 to 500 ft. Diameter, 8 in. Specifications may be seen in the office of the City Clerk, Warrenton, Mo., or may be secured from the engineers, Fuller-Coult Co., Chemical Bldg., St. Louis, Mo.

The citizens of Columbia, Mo., have voted the issuance of bonds to the amount of $125,000 for extension and improvement of the municipal water and light plant.

The Board of Public Works of St. Joseph, Mo., has ordered prepared an ordinance for the construction of a system of sewers in District No. 112, which embraces practically all of the territory in the vicinity of Bartlett Park and the new residence district known as The Highlands. The system will cost between $7,000 and $8,000.

Nebraska.

Joseph E. Bortenlanger, of Omaha, Neb., has been awarded five of the eleven contracts by the City Council of Pella, Ia., for the work and material for the town's new $80,000 water and lighting systems. Mr. Bortenlanger's contract amounts to $42,644.

The State Board of Public Lands and Buildings has finally decided to permit the city of Grand Island, Neb., to obtain bids for the construction of both the state's portion and the city's portion of a sewer which the last Legislature appropriated $10,000 to build. It is said the city will put $8,000 into the work. One thousand feet of the sewer will be on state land and 8,500 ft. within the limits of the city of Grand Island. The Consolidated Engineering Co., of Omaha, Neb., has prepared plans for the work.

New Mexico.

The Augua Pure Water Co., of East Las Vegas, N. M., has let a contract to M. M. Sundt for the construction of a dam across the mouth of Peterson Canyon in the vicinity of Hot Springs Canyon. The new storage reservoir will hold some 60,000 gal. of water and will be used as a feeder to the present city reservoir. It will be constructed of concrete.

New Jersey.

✣Bids will be received until 8 p. m., Oct. 10, by William C. Burroughs, City Clerk, Asbury Park, N. J., for the construction of 50 manholes and 29 flush tanks in connection with its sewer system.

New York.

✣Bids will be received until 8 p. m., Oct. 21, by J. A. Riley, Village Clerk, Westfield, N. Y., for approximately 35,194 lin. ft. of 8-in. pipe; 9,764 ft. of 10-in.; 5,377 ft. 12-in.; 2,615 ft. 18-in.; 1,460 ft. 20-in.; 3,108 ft. 24-in. pipe; 143 manholes; 23 flush tanks; one disposal plant.

✣Bids will be received until 2 p. m., Oct. 11, by Percy L. Lan, President of the Board of Managers, Craig Colony for Epileptics, Sonyea, N. Y., for the alterations to the sewage disposal plant at Craig Colony for Epileptics, Sonyea, N. Y. Drawings and specifications may be consulted and blank form of proposal obtained at Craig Colony for Epileptics, Sonyea, N. Y., and at the office of the State Architect. Complete sets of plans and specifications will be furnished to prospective bidders upon reasonable notice to and in the discretion of the State Architect, Franklin B. Ware, Albany, N. Y.

The Board of Water Commissioners of Coxsackie, N. Y., is making plans for enlarging the village water supply in order to meet the increasing demand for water.

The Common Council of Geneva, N. Y., has voted to submit to the taxpayers four propositions for the improvement of the water supply system on Oct. 18, as follows: To lay an intake pipe and enlarged main at an estimated cost of $57,000; to build a reservoir of 2,000,000-gal. capacity, estimated cost $30,000; to install pumps, estimated cost $35,000, and to build a filtration plant, estimated cost $10,000.

The Board of Contract and Supply of Troy, N. Y., has awarded to the McDonough Construction Co., the contract for the construction of two sewers in the Albia District for $945 and for the construction of a sewer in Ford Ave. for $2,612.

North Dakota.

✣Bids will be received until 5 p. m., October 5, by E. R. Orchard, City Auditor, Fargo, N. Dak., for furnishing the necessary labor and material for the construction of a 12-in. lateral sewer on Fourteenth St. from alley between First and Second Aves. to Northern Pacific Ave. in Sewer District No. 2.

✣Bids will be received until 5 p. m., October 5, by E. R. Orchard, City Auditor, Fargo, N. Dak.; for the construction and materials of a 12-in. lateral sewer in Fifth Ave. from 14th St. to 15th St. in Sewer District No. 3.

✣Bids will be received until 5 p. m., October 5, by E. R. Orchard, City Auditor, Fargo, N. Dak., for furnishing all materials and labor for the construction of a 12-in. lateral sewer on 12st St. north from Ninth Ave. to 10th Ave. in Sewer District No. 1.

The city council of Carrington, N. Dak., has let the contract for a sewer system for Carrington to Gilbert Haggart of Fargo, N. Dak., for $52,534. The same bidder also secured the contract for putting in about 16 blocks of water main extensions for $7,255.

Ohio.

✣Bids will be received until noon, October 7, by Director of Public Service, Youngstown, O., for furnishing the necessary labor and material for the construction of a sewer

Items marked thus ✣ indicate work now open for bids.

[illegible] St. [illegible]

✤Bids will be received until noon, October 5, by Director of Public Service, Columbus, O., [illegible] of the following sewers: [illegible] St. from [illegible] Ave. to Harris Ave. Sewer in the alley west of Oakley Ave., from Sullivant Ave. to the alley south of Broad St.; Ray St. Palmetto St., alley north of Palmetto St.; alley north of Plum St.; alley north of Parmola St., and the alley north of Louden St., from the alley west of Oakley Ave. to Park Ave.; Logan St. from the alley west of Oakley Ave. to Park Ave.; Park Ave. from Logan St. to Fremont St., Fremont St., from Park Ave. to the alley west of Eureka Ave.; alley west of Eureka Ave., from Fremont St. to a point opposite lot No. 31, Belleaire Addition; and the alley west of Park Ave., from Fremont St. to a point opposite lot No. 95, Belleaire Addition. Sewer in Richardson Ave., from Grace St. to the alley north; the alley north of Grace St., from Richardson Ave. to Burgess Ave.; the alley west of Burgess Ave., from Grace St. to the alley north; the alley north of Grace St. from Burgess Ave. to the alley west of Ogden Ave.; the alley west of Ogden Ave. from Grace St. to Steele Ave.; and Ogden Ave., from the alley north of Grace St. to Steele Ave.

✤Bids will be received until noon, Oct. 11, by Director of Public Service, Circleville, O., for a $4,000 storm water sewer vitrified or reinforced concrete; 30 in. diameter, 1,800 ft. long. Official advertisement of the work will be found elsewhere in this issue.

✤Bids will be received by the Director of Public Service, W. H. McMillin, Clerk, Youngstown, O., until 12 o'clock Oct. 7, for furnishing the necessary labor and materials for sewering Commerce St., between Champion St. and Walnut St.

✤Bids will be received until noon, Oct. 7, by Director of Public Service, W. H. McMillin, Clerk, Youngstown, O., for the necessary labor and material for the sewering of Logan Ave., between Broadway and the city limits.

✤Bids will be received until 11 a. m., Oct. 15, by Board of County Commissioners, Cleveland, O., for laying sewer pipe on North Woodland road in accordance with plans and specifications on file at the office of Frank R. Lander, County Surveyor.

Gould & Maybach of Collinwood, O., have been awarded a contract by the village of Nottingham, O., for the construction of a sanitary sewer in Sackett Ave., from the West Corporation line to a point 1,250 ft. east of Moses [illegible] Sept. 24.

The Kennedy Heights Business Men's Club of Kennedy Heights, a suburb of Cincinnati, is planning a campaign in the interest of a proposed issue of $150,000 by the village council to provide a village sewerage system.

Advices from Akron, O., state that it is proposed to extend the Maple Ave. storm water sewer from Edgewood Ave. to Diagonal road. A resolution for the issuance of $1,000 of bonds for this purpose has been introduced [illegible].

The city council of Cleveland, O., has authorized the issuance of bonds in the sum of $100,000 for pumps at the Kirtland St. station [illegible] and Warrensville.

Oklahoma.

✤[illegible] Okla., will receive bids until 5 p. m., Oct. 10, for the construction of a water system. The system will include well, reservoir, tank and tower, pumps and pump house, and about four [illegible] required with each bid. L. J. Myers is City Engineer.

✤Bids will be received by Chas. Wheeler, Jr., City Clerk of Muskogee, Okla., until 5 p. m., Oct. 17, for the construction of a storm sewer in District No. 12. The work will consist of 2,000 cu. yds. brick or concrete ma- [illegible] file in the office of the City Engineer. A certified check for $5,000 must accompany each bid.

✤Bids will be received until 5 p. m., October 17, by Charles Wheeler, Jr., City Clerk, Muskogee, Okla., for the construction of storm sewers: 2,000 cu. yds. of brick or concrete masonry in 3-ft. to 5-ft. sewers; 20,000 cu. yds. of excavation; 16,000 ft. of 12 to 33-in. pipe.

The city council of Muskogee, Okla., has decided to employ Alexander Potter, Civil Engineer, New York, N. Y., to prepare plans for an improved water supply and sewage disposal works.

L. Y. McFarland of Bartlesville, Okla., has received a contract in Havener, Okla., for installing a waterworks system to cost $50,000.

The citizens of Eldorado, Okla., have voted in favor of the construction of a municipal water plant. Bids will be advertised for.

The city council of Muskogee, Okla., has voted to approve the report of the joint Commercial club and council committee which has been working to secure for the city an improved water supply and sewage disposal works of sufficient capacity to provide for the wants of the city when it attains a population of 100,000.

Oregon.

The city of Portland, Ore., contemplates constructing a sewer for the South East Side, known as the East 27th St. district. City Engineer J. W. Morris has estimated the cost of the sewer at $146,343. The district includes Clinton, from Marguerite Ave. to East Thirty-fifth St.; Ellsworth, from East Forty-first to East Twenty-sixth; Clinton, from East Forty-first to East Twenty-seventh; Taggart, from East Forty-first to Richmond Addition; Ivon, from East Forty-first to Richmond Addition; East Forty-first St., from Division to Ellsworth; East Thirty-seventh, from Division to Ellsworth; Marguerite Ave., from Division to Ellsworth; East Thirty-fifth, from Division to Ellsworth; Greenwood Ave., from Division to Ellsworth; East Thirty-third, from Division to Ellsworth; East Thirty-second, from Division to Ellsworth; East Twenty-seventh, from Division to Ellsworth.

Pennsylvania.

✤Bids will be received until 8 p. m., Oct. 12, by Sewer Committee, Norristown, Pa., for the construction of a sanitary sewer in Pine St. Plans and specifications may be obtained of S. Cameron Carson, Engineer of the Borough.

Advices from Towanda, Pa., are to the effect that the Meshoppen Borough Water Co., which for some time has contemplated building a new dam at its intake pipe on the Little Meshoppen Creek, has decided to make the improvement this fall. The dam will be constructed of concrete and will have a capacity of 500,000 gals.

A movement has been started by a number of taxpayers of York, Pa., to build a municipal waterworks. A committee has been appointed to inaugurate plans for the holding of a series of mass meetings. The committee consists of Rev. J. J. Stauffer, chairman; D. E. Brenneman, secretary; O. J. Dotterer, Henry Rauth and George Roe.

City Engineer J. Monroe Smith of McKeesport, Pa., has been instructed by the city council to employ a sufficient number of men and proceed at once in the preparation of plans for a sewer system at a cost not to exceed $4,000.

The city council of Carlisle, Pa., has passed an ordinance authorizing a special election to be held the third Tuesday of February, 1911, [illegible] bond issue of $90,000 [illegible] sewer, sewage disposal plant and two surface drainage systems.

South Dakota.

The city engineer of Aberdeen, S. D., has presented the preliminary plans for the sewer [illegible] south through the Moccasin, to the city council. The plans include an estimate of [illegible]

Texas.

✤Bids will be received until 11 a. m., Oct. [illegible] master, Fort Sam Houston, Texas, for the following separate jobs: Construction of a 300,000-gal. steel tank and trestle, and the construction of an extension to water distributing system at Fort Sam Houston, Texas.

The city council of Rogers, Bell County, Tex., has adopted an ordinance calling an election to be held Oct. 18 by the voters for the purpose of voting on the issuance of bonds to the amount of $14,000 for the installation of a system of water works. J. D. King is Mayor.

The Lueders Water & Supply Co., of Lueders, Tex., has been incorporated with a capital stock of $30,000. The incorporators are C. H. King, G. L. Straughan and Charles Stifflemire.

The city of Georgetown, Tex., will hold an election Oct. 17 to vote on the issuance of bonds in the sum of $45,000, of which $13,500 will be used for the purchase of the water works and light plant from Coler & Co., of New York, and the remainder will be used for betterment and improvement of the plant.

The city council of Ballinger, Tex., has ordered an election for Oct. 16 to determine whether the city shall issue $20,000 water works bonds. If carried, the money will be used for the construction of a $7,000 filtration system and the extension of the mains.

The city council of Snyder, Tex., is arranging for the sale of $45,000 of water works and sewerage bonds recently authorized, and the proceeds will be used for putting in those public utilities.

E. L. Norton of Abilene, Tex., has been awarded a contract by the city of Abilene for taking up the present water mains and laying larger ones, work to begin immediately and to be completed by Nov. 15.

The city of Dawson, Tex., has voted to issue bonds to the amount of $8,000 for the erection of a complete water supply system. Bids will be asked for and work commenced immediately.

The following bids were submitted on Sept. 20 to City Clerk C. W. Fassett of El Paso, Tex., for the construction of a sewer and garbage disposal plant: Section No. 1, Sorrenson & Morgan, $26,980; Section No. 1, Public Works Engr. Co., $27,709; Section No. 2, W. E. Anderson, $36,000; Section No. 2, Public Works Engr. Co., $36,070; Section No. 3, Sorrenson & Morgan, $31,344; Section No. 3, Public Works Engr. Co., $31,548. Contract was awarded as follows: Sorrenson & Morgan, El Paso, Sections 1 and 3; W. E. Anderson, El Paso, Section 2.

F. D. Horton of Houston, Tex., was the lowest bidder for the construction of a sewer from the intersection of 33d St. and Avenue P one-half to the east end of the United States military reservation in Galveston, Tex. The work includes 1,497 lin. ft. of 15-in. pipe, 3,000 lin. ft. of 12-in. pipe, 735 lin. ft. of 8-in. pipe, 16 manholes and accessories, and when completed will cost $5,883.

Virginia.

✤Bids will be received until 1:30 p. m., October 25, by John T. Hume, Treasurer Southern Branch, N. H. D. V. S. National Soldiers' Home, Virginia, for furnishing labor and material for drain pipe, general mess hall and barrack company "L" Drying Yard inclosure, Ice Storage Room, furnishing and installing pump in hospital, steam piping from power house to main laundry and fire department.

Washington.

✤Bids will be received until October 17 by E. S. Taylor, Clerk, Oroville, Wash., for the construction of a water works system, consisting of a well, pumping machinery, reservoir and pipe line.

Canada.

✤Bids will be received by P. E. Ryan, Secy., Commissioners of Transcontinental Ry., Ottawa, Ont., until noon, October 18, for furnishing the equipment of a round house at Lake Superior Junction, Ont., and for centrifugal pumps and motors required for the sewage pump house at the Winnipeg shops, Winnipeg, Man.

[illegible] bids.

ROADS, STREETS AND PAVEMENTS

California.

✣Bids will be received until 11 a. m., October 19, by the Board of Public Works, Oakland, Cal., for furnishing the necessary labor and material for the improvement of the northern side of 12th street from Fallon St. to Lake Shore Blvd. James W. Nelson is Secretary of the Board.

District of Columbia.

✣Bids will be received until 11 a. m., October 6, by Capt. H. L. Pettus, Depot Quartermaster, Washington, D. C., for work of resurfacing roadway at Salisbury, N. C., National cemetery.

✣Bids will be received until 2 p. m., October 11, by Department of Interior, Washington, D. C., for the necessary labor and material for the construction of 2,000 sq. yds. of more or less of granolithic sidewalk around the school reserve in block 31, north addition to townsite at Lawton, Okla.

Illinois.

✣Bids will be received until 2 p. m., October 11, by Board of Local Improvements, LaSalle, Ill., for the construction of the improvement of Chartres St. from a point 20 ft. south of the north line of Third St. to the north line of Ninth St. together with the roadway of all street and alley intersections between the points. It is estimated that the work will include the following amounts: 6,500 sq. yds. of brick pavement; 4,669 lin. ft. of sandstone curbing, 4 ins. thick by 20 ins. deep.; 125 lin. ft. of oak protection curb; 12 catch basins, 28 ins. internal diameter and 4 ft. deep, 12 catch basin covers, 2,800 cu. yds. of excavation, 400 lin. ft. of trenching and refilling, 400 lin. ft. of 8-in. vitrified sewer pipe.

Following low bids were received Sept. 27 by the Board of Local Improvements, Chicago, Ill., A. V. Standish, Secy., for the construction of concrete sidewalks: H. A. Larsen, 145 LaSalle st., Chicago., North Ashland Ave., Lawrence, 56.19 ft., south, 120 sq. ft., 23½ cts. per ft.; Connors St., Sedgwick St., Hudson Ave., 100 sq. ft., 34 cts. per sq. ft.; Cottage Grove Ave., 500 sq. ft., 15.74 cts. per ft.; South Fifth Ave., 150 sq. ft., 24 cts. per ft.; South 41st Court, 3,960 sq. ft., 13.74 cts. per ft.; North 45th Ave., 150 ft., 23 cts. per ft.; South 45th Court, 900 sq. ft., 13.74 cts. per ft.; Humboldt Ave., 1,500 sq. ft., 15.74 cts. per ft.; Langley Ave., 144 sq. ft., 23 cts. per ft.; Lincoln Ave., 190 sq. ft., 19.64 cts. per ft.; M'Lean Ave., 450 sq. ft., 14.74 cts. per ft.; Milwaukee Ave., Lawrence Ave., 1,300 ft., south, no bids received; West North Ave., 7,800 sq. ft., 12.64 cts. per sq. ft.; Norwood Park Ave., 3,600 sq. ft., 18.64 cts. per ft.; East 134th St., 750 sq. ft., no bids received; North State St., 400 sq. ft., 16 cts. per ft.; Sullivan St. 313 sq. ft., 17.74 per ft.; North Sawyer Ave., 150 sq. ft., 27 cts. per ft.; South Troy St., 4,100 sq. ft., 12.74 cts. per ft.; North Albany Ave., 130 sq. ft., 24½ cts. per ft.; Albert Graff, 70 LaSalle St., Chicago, South Canal St., 320 sq. ft., 19 cts. per ft.; West 83d St., 1,680 sq. ft., 19 cts. per ft.; South Halsted St., 3,500 sq. ft., 17 cts. per ft.; Demling & Wendt, 84 LaSalle St., Chicago, North Californa Ave., 720 sq. ft., 15.7 cts. per ft.

Indiana.

✣The Board of Public Works of Indianapolis, Ind., will receive bids until 10 a. m., Oct. 12, for the improvement of Elder Ave., from the north line of Michigan St. to south property line of Calvelage St., by grading and paving the sidewalks.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until Oct. 12, for the improvement of Capitol Ave., east side, from south property line of South St. to west curb line of Merrill St. by grading and paving the sidewalks.

✣At 10 a. m., Oct. 12, the Board of Public Works of Indianapolis, Ind., will receive bids for the improvement of New Jersey St. from the south line of McCarty St. to north curb line of Prospect St., by grading and paving the sidewalk.

✣The Board of Public Works of Indianapolis, Ind., will on Oct. 12 receive bids for the improvement of 30th St. from east curb line Sutherland Ave., north side, and from north property line Sutherland Ave., south side, to the Monon R. R. tracks, by grading and paving the sidewalk.

✣The Commissioners of Shelby County at Shelbyville, Ind., will receive bids until 10 a. m., Oct. 18, for the construction of a concrete culvert. G. B. Huntington, auditor.

✣The County Commissioners of Shelby County, Shelbyville, Ind., will receive bids until 10 a. m., Oct. 22, for the construction of a steel truss bridge with concrete floor. G. B. Huntington, auditor.

✣The Commissioners of Allen County, Fort Wayne, Ind., will receive bids until Nov. 12, at 10 a. m., for improvement of highways in Maumee township. Geo. W. Lindemuth, auditor.

✣Bids will be received until 10 a. m., Oct. 12, by the Board of Public Works, Indianapolis, Ind., for the improvement of Ketcham St. from the north property line of Walnut St. to the south property line of 10th St. by grading and paving the sidewalks.

✣Bids will be received until 10 a. m., Oct. 10, by the Board of Public Works, Indianapolis, Ind., for the improvement of first alley east of Liberty St. from north property line of Washington St. to the south property line of Court St. by grading and paving the roadway.

✣Bids will be received until 10 a. m., Oct. 10, by the Board of Public Works, Indianapolis, Ind., for the improvement of DeFrees St., south side, from east property line of Temple Ave. to the west property line first alley east of Temple Ave., by curbing outer edges of roadway.

✣Bids will be received until 10 a. m., Oct. 10, by the Board of Public Works, Indianapolis, Ind., for the improvement of Newton Ave. from the east property line of Rural St. to the west property line of La Salle St. by curbing outer edges of roadway.

✣Bids will be received until 10 a. m., Oct. 10, by the Board of Public Works, Indianapolis, Ind., for the improvement of first alley west of Arsenal Ave. from north property line of Marlowe Ave. by grading and paving the roadway.

✣Bids will be received until 10 a. m., Oct. 10, by the Board of Public Works, Indianapolis, Ind., for the improvement of Elder Ave. from the north property line of Michigan St. to the south property line of Calvelage St. by grading, graveling and rolling the roadway.

✣Bids will be received until 10 a. m., Oct. 7, by the Commissioners of Johnson County at Franklin, Ind., for the construction of a gravel road in Union Township. W. B. Jennings is County Auditor.

Maryland.

✣Bids will be received until 11 a. m., Oct 12, by Board of Awards, Baltimore, Md., for grading, curbing and paving with sheet asphalt, asphalt blocks, vitrified blocks or bitulithic, Cokesbury Ave. from York Road eastward. B. T. Fendall is city engineer.

Minnesota.

✣Bids will be received at the office of A. M. Childs, City Clerk, Crookston, Minn., until 8 p. m., Oct. 11, for the paving of the following described streets: Houston Ave., its entire length, 6,044.3 sq. yds.; S. Ash. St., from its intersection by the southerly end of Houston Ave. to its intersection by Third St., 7,143.4 sq. yds.; E. Fletcher St., from its intersection by Broadway to its intersection by S. Ash St., 1,277.5 sq. yds.; E. Robert St., from its intersection by Broadway to the northerly end of the Jerome's Addition bridge, 2,343.7 sq. yds.; E. Second St., from its intersection by Broadway to its intersection by N. Ash St., 1,666.7 sq. yds.; E. Third St., from its inter-section by Broadway to its intersection by Elm St., 2,381 sq. yds. Bids are desired for asphalt, creosote blocks, donnelite and granitoid pavement, according to plans and specifications therefore in each case on file in the office of City Engineer J. E. Carroll, and must include all curb, driveways and other cement work required in connection with such paving.

New Jersey.

✣Bids will be received until 11 a. m., Oct. 12, by Board of Chosen Freeholders, Monmouth County at Freehold, N. J., for the construction of a gravel road in Monmouth County, N. J., under the provisions of the State Aid Road Laws, known as the Adelphia and Lakewood Road (Southard Road), 4th Section thereof from the north end of the Iron Bridge over the Manasquan River northerly to the main County Road at Adelphia, a distance of 5,175 ft., or 0.98 per mile. Peter Forman is Engineer in Charge.

The borough of Tenafly, N. J., has awarded the contract for the construction of a stone road in that place known as Sylvan Ave., or Boulevard extending from the south borough line to the southerly borough line of Apine, N. J., a distance of about one and one-half miles to D. N. Snidden. Bids were opened Sept. 14.

The contract for a stone road from Smalley's Corner to Buddtown, Burlington County, N. J., has been awarded to E. C. Humphries of Hackensack, N. J., for $22,453.

The contract for paving Treat place with asphalt block on a concrete foundation, Newark, N. J., has been awarded to the Hastings Pavement Co., for $5,586.

New York.

✣Bids will be received until 2 p. m., Oct. 6, by Kingsley L. Martin, Commissioner of Bridges, Park Row Bldg., New York city, for furnishing and delivering wood paving blocks to the Williamsburg bridge.

✣Bids will be received until 2 p. m., Oct. 13, by Kingsley L. Martin, Commissioner of Bridges, 13-21 Park Row Bldg., for furnishing and delivering medina or potsdam sand stone paving blocks to the Williamsburg bridge.

✣Bids will be received until 10 A. M., Oct. 15, by Edward F. Hennessey, Town Clerk, North Tarrytown, N. Y., for the improvement of highways known as Columbus Ave., and Commence Ave. in the town of Mount Pleasant, Westchester County, New York, and described as follows: Columbus Ave., from Railroad Ave., Valhalla, northerly to highway leading to Fairlawn Cemetery, a distance of one and 66-100 (1.66) miles; and Commrce Ave., from where it crosses the New York Central and Hudson River Railroad tracks at Kensico Cemetery northerly to Broadway at Hawthorne, a distance of one and 78-100 (1.78) miles.

The board of contract of Rochester, N. Y., has awarded the contract for the new pavement on Gardiner Park between Union and Alexander Sts., to F. V. Brotsch & Son, for $5,685.

The contract for paving Stone St., in Oneida, N. Y., has been let by the board of public works to Conroy & Nixdorf for $1,312.

The town board of Oyster Bay, L. I., has awarded the contract for the construction of the East Shore road to Powers & Wheeler, the only bidder, for $7,000. The contract calls for the construction of about 3,300 ft. of road, including the grading.

North Carolina

✣Bids will be received until Oct. 15 (read- [illegible] missioners of Streets, city of Wilmington, N.

Items marked thus ✣ indicate work now open for bids.

Oklahoma.

✣Bids will be received until 10 a. m., October 15, by Capt. David L. Stone, Constructing Quartermaster, Fort Sill, Okla., for grading roads and constructing concrete walks in new artillery post, Fort Sill, Okla.

The Western Oklahoma State Road Association, Weatherford, Okla., has decided to employ an engineer to make a survey of the proposed route of a state pike. The road will pass through every town west of Oklahoma City to the Texas line, along the Rock Island railroad.

Pennsylvania.

✣Bids will be received until October 10, by Highway Commissioners, Harrisburg, Pa., for the construction of 100,000 sq. yds. of paving. It is said to be quite likely that the bids will be asked for on the estimated cost of about $1.80 per sq. yd.

Director of Public Works, C. V. Terwilliger, Scranton, Pa., has awarded to the McDonald Construction Co., the contracts for the paving of Luzerne St., Alder St., Gibson St., and Taylor Ave. The Luzerne St. paving will extend from Railroad Ave. to the Keyser Creek and will cost $51,576. The Alder St. work will cost $4,832; the Taylor St. work $3,418 and the Gibson St. work $4,181.

Texas.

✣Bids will be received until noon, Oct. 6, by special committee of the Calcasieu Parish and the Orange Commercial Club for the construction of a public highway from a point in Louisiana oposite Orange, Texas, eastward across a shallow marsh, 3.46 miles long. The work will be done by a floating dredge and dirt thrown up from either side. S. R. Shepherd, Orange, Tex., is secretary of the club.

[illegible] No. 1. This brings the total to approximately $300,000 to be expended in good roads and street paving in Abilene and Abilene precinct No. 1 in the next few months. Work will begin about Oct. 1.

City Engineer Frank Matthews, Chief Inspector A. E. Murphy, Assistant Engineer Ralph Overstreet of Taylor, Tex., have just completed the survey of 59½ miles of public highway in Precinct No. 1 of Williamson County, preparatory to macadamizing the same. The following roads have been surveyed. Taylor-Elm Grove, distance 12½ miles; Taylor-Circleville, distance 8 miles; Taylor-Lexington, distance to Lawrence's crossing, 11 miles; Taylor-Giddings, distance to Townsend's gin, 10 miles; Taylor-Coupland, distance to Coupland, 9 miles; Taylor-Rice's Crossing, distance to Rice's Crossing, 9 miles; Taylor roads surveyed seven; total distance 59½ miles.

Virginia.

Dalby & Nottingham of Norfolk, Va., have been awarded the contract by the Permanent Road Improvement Commissioner of Norfolk County for laying three miles of macadam roadway on the Cottage Toll road, extending from Norfolk to Ocean View, for $18,110. The commission proposes to construct a macadamized roadway from Norfolk to Ocean View, eventually, at an estimated cost of $60,000.

U. S. ENGINEER OFFICE, Wilmington, N. C., Sept. 14. 1910. Sealed proposals for dredging in Cape Fear River, N. C., will be received at this office until 12 m., Oct. 14, 1910, and then publicly opened. Information on application. EARL I. BROWN, Capt., Engrs.

GRADING, CURBING AND PAVING.

Jacksonville, Fla., Sept. 28, 1910.

Sealed bids will be received by the Board of County Commissioners at their office in the County Court House, Jacksonville, Florida, until 9:30 a'clock a. m., November 1, 1910, and then opened, for grading, laying curb and paving approximately twenty (20) miles of hard-surfaced county roads in Duval County, Florida, as per plans and specifications on file in the office of Gail L. Barnard, County Engineer, Room 9, County Court House, Jacksonville, Florida.

Bids will be submitted for brick, concrete, asphalt-macadam, bitulithic, or any other improved hard-surfaced road material.

Forms for proposal and instructions for submitting bids can be obtained by addressing F. J. HYDE, Chairman,
Board County Commisisoners.
GAIL L. BARNARD, County Engineer,
Room 9, Court House,
Jacksonville, Florida.

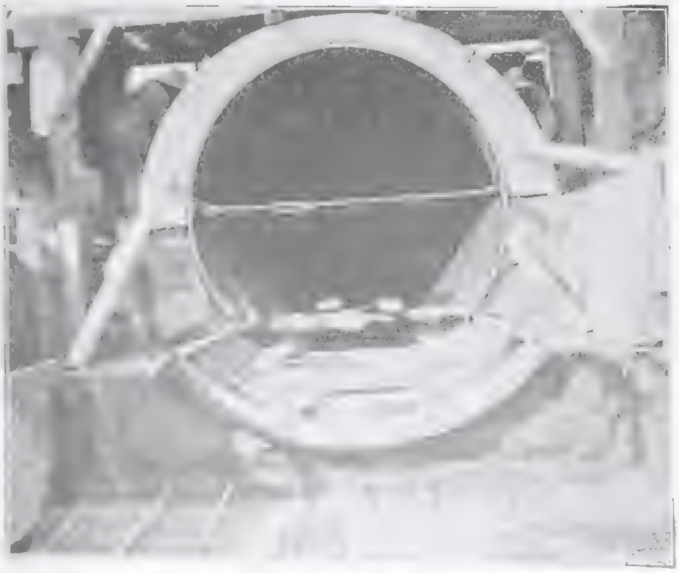
SEWER.

Circleville, Ohio, will receive bids until noon, Tuesday, Oct. 11, 1910, for a $4,000 storm water sewer, vitrified or re-enforced concrete, 30 inches, 1,800 feet. Specifications on application to JOHN W. LOWE, Dir. Pub. Ser., Circleville, Ohio.

U. S. ENGINEER OFFICE, Chicago, Ill., Sept. 12, 1910. Sealed proposals for dredging and rock excavation in Chicago River, Ill., will be received here until 10 a. m., October 12, 1910, and then publicly opened. Information on application. CHAS. S. BROMWELL, Major, Engineers.

STEEL CENTERS

The Sparger Concrete Company of Seattle, Washington, are centering their entire contract with Blaw Collapsible Steel Centers.



[illegible]

Their comment, after several months of sewer construction, is "They all have wooden forms skinned to death."

In other words The Blaw System has shown in this contract, as it has shown in over 2,000 other contracts, an enormous saving in Time, Labor and Money.

Write for Bulletins.

BLAW COLLAPSIBLE STEEL CENTERING CO.

General Offices, Pittsburgh, Pa. New York Office, Park Row Building

Engineering-Contracting

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A Method of Developing License Laws for Engineers.

This journal has never been an advocate of license laws for engineers. It has never believed in nor is yet convinced of the sufficiency or the efficiency [illegible] mistaking the fact that the sentiment among engineers is strong in favor of licensing and that this sentiment is about to find expression in efforts toward legislation. The coming winter will see several engineers license laws before state legislatures. The acts are now being drafted or will be drafted during the next few months. A condition, then, and not theory, or opinion, has to be met.

It is of the utmost importance that the broadest and wisest counsels shall prevail in drafting license laws for engineers. Whence are such counsels to come. It is evident that precedent affords scant service. There are just six states that now have laws regulating practice in engineering—counting surveying as a branch of engineering. California has a law licensing land surveyors; it is practically a dead letter. Idaho and South Dakota have license laws for land surveyors. Wyoming has an engineers' license law, but it covers only the practice of irrigation engineering; it has been, we are told, an unqualified success. Louisiana has a general civil engineering license law; it is a rather elementary attempt at law-making and its authority is questioned and it is being violated. In Florida, which makes the sixth state, the law is a farce, it requires merely that anyone calling himself a civil engineer and practicing as such shall pay a privilege fee of $10 annually. It is reasonably clear that the field of experience in licensing engineers in the United States is rather barren in lessons for the engineers' license law-makers. This much, we think, may be asserted and admitted without prejudice.

The remaining source of council is engineers themselves, either individually, or as banded into associations. The California surveyor's license law was, we believe, instigated and carried through by a local association of engineers. The Louisiana Law owes its existence also to a state society of engineers. We do not know the sponsorship for the laws of Wyoming, Idaho, South Dakota and Florida. In the five states where we recall of license laws having been attempted and having failed of enactment, these laws were due to individual initiative in four; in the fifth a local organization of engineers, membership in which is clandestine, stood sponsor. We have mentioned these instances of actual and attempted legislation in no captious spirit. They are named simply in indication of the fact that, assuming license laws to be desirable, engineers have set about securing them in a singularly inefficient manner. It seems to us that advocates of licensing may also reasonably admit this fact without prejudice.

If both precedent in legislation for engineers and practice in securing such legislation are open to the charge of inefficiency, it would seem desirable to adopt other means for securing future legislation. Does any better means suggest itself than the sponsorship of the national and local associations or societies of engineers? A license act drafted by an individual and introduced on his initiative may conceivably be a meritorious act, but it is not likely to be so representative or to have such force with the law-makers as an act drafted and introduced with the approval of an organized body of engineers. A great many more arguments might be given for cooperative action, but they will occur to everyone and are omitted here. The question now arises: What expectation may we have of aid from the societies and associations named?

In answer, let us consult precedents first. As stated above, certain of the existing state license laws owe their existence to the local organization of engineers. More significant than this, however, is the voluntary action taken last June by the American Society of Civil Engineers. This body not only signified its recognition of the growing demand for legislation regulating the practice of engineering, but it outlined certain general governing requirements for license acts, and authorized "that the Board of Direction be empowered in behalf of the Society to take up this matter with the proper authorities from time to time as may be deemed expedient, and to urge the enactment of State laws governing the practice of Civil Engineers in general conformity with the suggestion of this report, and further, that the Board appoint from the membership of the Society, a committee of three (3) in each state, to co-operate with the Board in this matter, and to act under its direction."

So much for precedents. Is there any reasonable doubt that, with a prevailing sentiment among its members for license legislation, there can be secured all necessary action from any local society?

As an example of procedure, we call attention to the action recently taken in Colorado. The association of members of the American Society of Civil Engineers of that state appointed a committee to draft the text of a license law. This draft has been thrown open to the public and is reprinted in another column of this issue. The Colorado Association asks that engineers throughout the United States as well as in Colorado, shall study this act and give their suggestions and criticisms for its improvement. With this open discussion to aid, the association will draft a final text, which it will submit to the State Legislature and urge for enactment.

We have published the preliminary text of the proposed Colorado engineers' license law, with the explanation of its purpose, for two reasons. First, it seems to us to be the most systematic and best considered effort so far made to secure a law which shall be worthy of its object, and of the profession which it concerns. Second, we wish to see engineers, widely, give the act study and make such criticism as will aid toward its improvement. If there is really a deep and earnest call from engineers to the need of legislating for their protection and welfare, it should be heard on this occasion.

On Sept. 17, 21 shovels in the Empire construction district of the central division of the Panama Canal excavated 26,611 cu. yds., principally rock, in the working day of eight hours, an average per shovel of 1,267 cu. yds. During this period, the shovels were under steam 168 hours and were actually at work 129 hours and 15 minutes, and waiting for cars 18 hours. The other delays were due to mining, cleaning track, repairing shovel, moving back, etc.

Some Notes on Jetting Concrete Piles*

The jet does not need to be in the center of the pile. It can be in one corner, or, on one side, or on the soutside, but it will cost more to sink the pile if the jet is not in the center. This center opening may be made as large as is desired, and may be filled up afterwards with concrete. Making the pile with a large hole in the center reduces its weight and its cost, while at the same time it increases its strength with the given quantity of concrete. The passage in the center of the pile can be made by using a collapsible form, an iron pipe, or by greasing a tapered stick of wood. This last has been found the cheapest in most cases. This stick of wood can be removed with an ordinary chain pipe wrench, or by inserting a crowbar through a hole in the banded end of the wooden stick.

It is most important to have a pipe line and hose that will withstand a pressure of at least 200 lbs., or preferably 250 lbs. It is surprising to find cases often where 150 lbs. pressure will not sink a pile, while 200 lbs. will sink it rapidly. The jiggling of the hammer increases the speed of the driving, but hammering is not necessary. The hose should be not less than 3 ins., and the jet should be choked down to 1 in. It is also important, for the greatest speed, to have the hole in the lower end of the pile a fairly close fit around the jet, otherwise the water and excavated material will come up the inside hole of the pile instead of on the outside. If the water and excavated material come up inside and over the head of the pile, the men will get wet and it will naturally cut down their rate of output.

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*Frank B. Gilbreth, Journal American Society of Engineering Contractors, June, 1910.

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CONCRETE AND REINFORCED CONCRETE SECTION

Method of Depositing Concrete by Chuting in a Seven-Story Building With Some Costs.

A mixing plant has been used for the construction of a seven-story concrete building at Peoria and Adams street, Chicago, which embodies many advantages. It handles a large quantity of concrete in a short time. It has a storage capacity for an ordinary day's run, and last but not least, the street is kept clear of all concrete materials. This last mentioned point will be appreciated by men who have had troubles along this line.

The building, to be known as the Schoenbrun Building, is a seven-story concrete structure with brick veneer, and will cover a ground space of 126x115 ft. The columns are 25 ins. square on the first floor and decrease to 12 ins. at the top. The reinforcement for these consists of plain square steel, varying from 1⅛ ins. for the large columns to ½ in. for the smallest. They are surrounded by a ⅜-in. spiral with a 2-in. pitch. The floor slabs are about 18 ft. square, and the beams are 10x20 ins. and are reinforced with two Kahn bars and three ½-in. twisted bars. The slabs are 6½ ins. thick and reinforced with ½-in. square twisted bars 7 ins. apart.

The mixing plant bins and hoisting tower are located on the Peoria St. side of the building at about the center. The bins, a plan of which is shown by Fig. 1, are located near the face of the building, enough space being allowed between them and the building for the hoisting tower, and a foot or more of clearance. The bins themselves cover an area of 41x18 ft. They are built of 2-in. lumber with 6x6-in. studs on 3-ft. centers and 3x12-in. wales placed about 6 ft. apart vertically. Bolts ¾ in. in diameter pass through the bins and waling timbers. At one side of the bins an equal area is taken up for a driveway for teams which drive in over a slope bottom hopper to dump material. This material hopper is located under a grating, made of 2x12-in. planks set on edge 2 ins. apart, over which horses can walk. The material is carried up to the bins by means of a belt conveyor. The conveyor elevates the material, either sand or stone, and over the bins a chute is so arranged that the material will go to its proper bin.

On the opposite side of the bins a cement storage shed is located which has a capacity of about one car of cement. The shed is used for storage only as it is generally desired to keep a wagon hauling enough for continuous use.

The tower is built up as high as desired for immediate work, and extended from time to time as the necessity arises. It contains two shafts, one for hoisting the concrete bucket and one for hoisting and placing the hopper at any desired elevation. The tower is built of four posts (4x6 ins.), braced by 2x6-in. pieces placed diagonally and horizontally as ties, thus forming panels or sections about 8 ft. in height.

The mixer is a No. 4 Marsh-Capron, made by the Marsh-Capron Co., Chicago, and is geared to a motor. As shown by Fig. 1, the elevation of the bins, the sand and stone hoppers, which are located on each side of the mixer hopper, are designed to measure out each batch. The batch consists of 16 cu. ft. of stone, 10 cu. ft. of sand and 4 bags of cement. This proportion is 1:2½:4. The cement men work on a platform which is about 18 ins. below the level of the mixer hopper, which allows the men to work without so much stooping. Water is supplied to a barrel from the city pipes and runs into the mixer through a tap near the bottom of the barrel.

A 7x10-in. double-drum engine with vertical boiler is used to run the bucket elevator from the dumping platform to the bins, and also to run the hoist. The concrete is hoisted by a ⅝-in. cable attached to an Ohio-Ceramic Co. hoist bucket, which dumps into the hopper at the top by tipping to one side.

The concrete runs from the hopper into a long chute which extends from the main tower to an auxiliary tower located in the center of the building. The long chute is 14 ins. wide and 8 ins. deep, made of sheet iron No. 16 gage. This chute, instead of being suspended by cable, is trussed underneath by two ⅝-in. cables, which are fastened at the ends of the chute and pass under the queen posts. In making this truss arrangement it was necessary to bolt 8-in. planks to the sides of the chute for its entire length, in order to help stiffen it and to provide a chord to which the queen posts could be fastened.

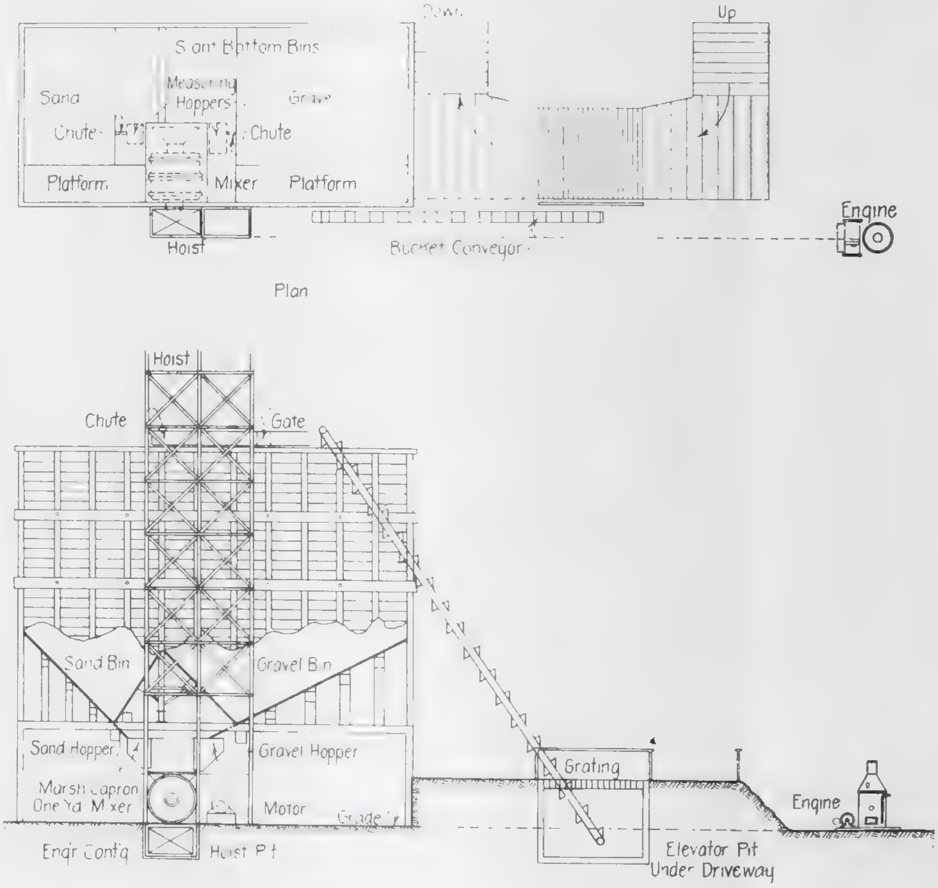
The auxiliary tower, which supports the lower end of the main chute, is built the same as the main tower but is somewhat smaller. Two horizontal booms each swinging in a half circle are fastened to opposite sides of the tower, being suspended by a small cable which runs from the end of the boom to the top of the tower. The booms are made of a 2x12-in. plank set on edge with a 2x10-in. plank nailed flat on the top edge of the 12-in. plank. This is a simple arrangement requiring a small amount of lumber and securing the necessary stiffness. To the booms the auxiliary chutes are fastened. They are suspended underneath at an angle of about 15° or 20°, or as desired. Several ⅛-in. chains are used to support them from the booms, and by lengthening or shortening the chains the desired angle of the chute is secured. At various points in the bottom of these chutes slide gates have been installed so that by opening them the concrete will drop through and into the forms, or into further auxiliary chutes, as the case may be. Each floor is thus covered by the chuting system.

The estimated cost per cubic yard and the crew necessary to operate this plant are as follows:

	Wage per hour.
1 hoisting engineer	$0.75
1 man operating sand chute	0.37½
1 man operating stone chute	0.37½
2 men tending cement	0.75
1 man dumping wagons at grating	0.37½
1 man at hopper top of tower	0.37½
2 men shifting chutes	0.75
8 men (average) spreading and spading	3.00
1 foreman	0.62½
Cost per hour	$7.35½
Average cu. yds. per hour	.37½
Labor cost per cu. yd	$0.196

This is with union labor, and the working day of 8 hours. Three hundred yards is an average day's run including all stops. A record of 250 cubic yards in a run of 5 hours has been made.

The contractor for the work is the Falkenau Construction Co. of Chicago. Mr. J. K. Thompson is superintendent.



Plan

Fig. 1—Sketch Plan of Mixing and Hoisting Plant for Concrete Building Work.

* * *

Copper sulphate to precent algæ was used in four of the reservoirs of the Albany waterworks during 1909 before the commencement of warm weather. Two of the basins were treated four times during the season, another three times, and another twice. The maximum amount of copper sulphate used during any one application was 0.32 parts per million and the minimum quantity 0.1 parts per million. The early start made with this treatment and the constant watching for the development of aquatic growths are the reasons given by Mr. H. J. Deutschbein, superintendent of the Bureau of Water, to account for the fact that no complaints regarding algæ were received during the year. The reservoirs are supplied with filtered water from the Hudson River.

Design of a 54 1-3 Ft. Span Reinforced Concrete Girder.

In order to facilitate the handling of their cars, which have an exceptionally long wheel base, it was deemed advisable by the Pierce Arrow Motor Car Co. to do away with all columns in their new garage at the Buffalo Works, and support the roof with a clear span. As the width of the new building was fixed by the width of the old garage, it was necessary to design a girder or truss with a span of 54¼ ins. from center to center of the supporting columns. The engineers, Messrs. Lockwood, Greene & Co. of Boston, Mass., worked out two types of clear span roof supports, one a plate girder encased in concrete and the other a regular reinforced concrete beam, the estimated relative cost being considerably in favor of the latter type, which was adopted.

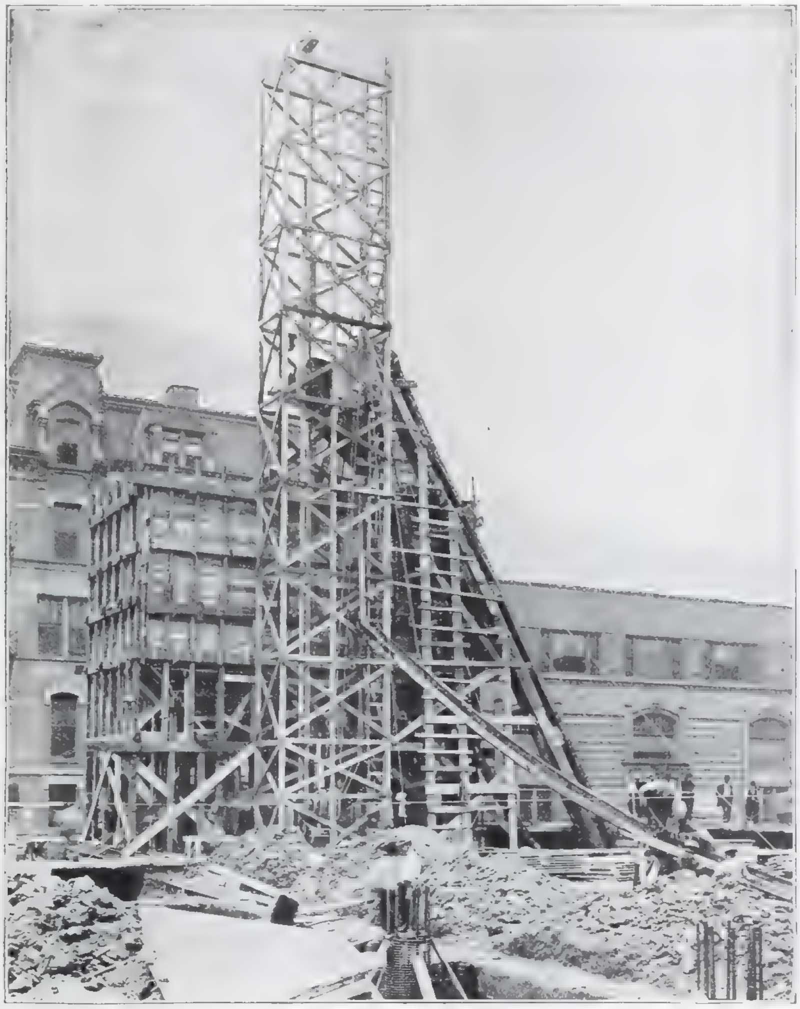
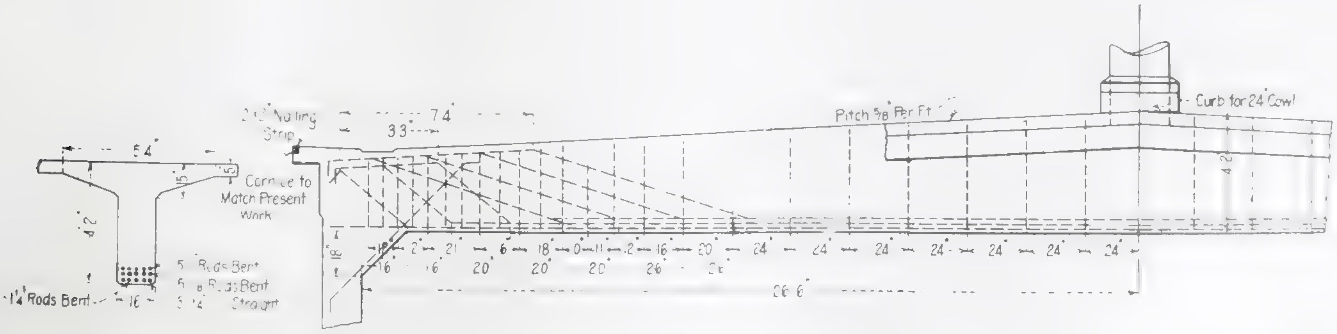


Fig. 2—View of Mixing and Hoisting Plant for Concrete Building Work.

The building laws of Buffalo specify for roofs a live load of 40 lbs. per sq. ft. The spacing from center to center of girders was 13 ft. 6 ins., the roof slab for this span being 5 ins. thick, weighing 65 lbs. per sq. ft. Allowing 5 lbs. per sq. ft. for the four-ply tar and gravel roofing, the live load would be 110 lbs. per sq. ft., each girder supporting 118,062 lbs., including its own weight.



Details of Long Span Reinforced Concrete Girder.

The bending moment was taken for a girder simply supported at both ends, $M = \frac{WL}{8}$; the maximum allowable tension on the steel 16,000 lbs. per sq. in.; compression on the extreme fibre of the concrete 650 lbs. per sq. in.; and the ratio of the moduli of elasticity of steel and concrete conspired as 15.

The mixture chosen for both girder and slab was 1 part cement, 2 parts sand and 4 parts broken stone, and after concreting, the girders were allowed to set for three weeks before removing the forms.

The width of the girder was determined by the width of the column, 16 ins. On account of the relatively great depth of girder necessary for this long span as compared with the thickness of the roof slab, the T beam section would be comparatively small unless a method were devised for transmitting the compressive stress over a wider area of the T section. This was accomplished by haunching the girder as shown in the accompanying section. It will be noted here that the haunch is 15 ins. thick at the girder, reducing to the thickness of the slab, 5 ins., at a point 24 ins. from the side of the girder, making the T section 64 ins. wide, giving a large increase to the compressive area of the beam without requiring an excessive depth.

As the miximum shearing stress allowable on the concrete is 120 lbs. per sq. in., the minimum depth of girder at the supports was determined by the equation

$$\frac{W}{2} = \text{Area of cross section} = 120$$

$$\frac{59031}{16 \times D} = 120$$

$$D = 30.7 \text{ ins., say } 31 \text{ ins.}$$

The roof pitch is ⅝ in. per foot, consequently the depth of the girder at the center would be

$$30.7 + \frac{54}{2} \times \frac{5}{8} = 47.6 \text{ ins.}$$

With this depth of girder at the center of the span, the amount of steel required would be

$$As = \frac{M}{fs\,(d½t)} = \frac{9{,}616{,}150}{16000\,(47½ \text{x} 12)} = 15 \text{ sq. ins.}$$

The reinforcement chosen was five 1¼ in., five 1⅛ in. and five 1 in. round rods with a total sectional area of 15.033 sq. ins.

The actual maximum fibre stress on the steel with this reinforcing would be

$$fs = \frac{M}{As\,(d-½t)} = \frac{9{,}616{,}150}{15{,}033\,(47½ \text{x} 12)} = 15640 \text{ lbs. per sq. in.}$$

With a beam of dimensions and reinforcing as determined above, the maximum compressive stress on the most strained fibre of the concrete would be

$$M = ½\, fs \times b \times t\,(d-½t)$$

$$fs = \frac{9{,}616{,}150 \text{x} 2}{64 \text{x} 12\,(47½ \text{x} 12)} = 609 \text{ lbs. per sq. in.}$$

This is well within the maximum allowable compressive stress on concrete of 650 lbs. per sq. in.

The question of bond stress does not have to be considered in this girder as the reinforcing rods are buried more than sixty diameters beyond the point of maximum tension and the beam is figured as a simple and not a continuous girder.

The 15 reinforcing rods are arranged in three rows of 5 rods each, the bottom row of 1¼ in., the middle of 1⅛ in., and the top row of 1 in. round rods. All of the rods, except three in the bottom row, are bent to take any diagonal tension. The point where the first rods were bent was taken at a point where the shear equaled 50 lbs. per sq. in., and there were six other bend points determined by the usual angletical methods. One feature which should be noted in connection with the diagonal rods, is the bending of the four outer sets in a different plane from the three inner sets, by this means furnishing reinforcing in two diagonal planes in the section of the beam nearest the support.

The stirrups used were ½ in. rounds, and the spacing determined by the formula

$$\frac{\text{Area of stirrups at section} \times f_s}{\text{Width of beam} \times (\text{actual shearing} - 50 \text{ lbs. per sq. in. shear})}$$

In this case at the support the stirrup would be spaced

$$\frac{2\times0.196\times16000}{16 \times (118-50)} = 5 \text{ in}$$

and at 14 ft. from the center

$$\frac{2\times0.196\times16000}{16\times(53-50)} = 13 \text{ in.}$$

As in the determination of the bend points for the horizontal rods, 50 lbs. per sq. in. is considered as the maximum shearing stress allowable without reinforcing for diagonal cracks.

This girder was designed by Lockwood, Greene & Co., Boston, Mass., the architects and engineers for the entire Pierce Arrow Motor Car Co.'s Buffalo plant.

EARTH AND ROCK SECTION

Some Records and Costs of Tunneling on the Los Angeles Aqueduct.*

There are over 28 miles of tunneling in 100 tunnels on the Los Angeles aqueduct. The work may be summarized as follows:

Saugus Division: 54,040 lin. ft.; material penetrated compact sand and gravel free from water, also soft shale; methods hand augurs and hand drills.

Elizabeth Division: 26,860 lin. ft. in one tunnel; materials penetrated, granite, schist and gneiss; methods, machine drills.

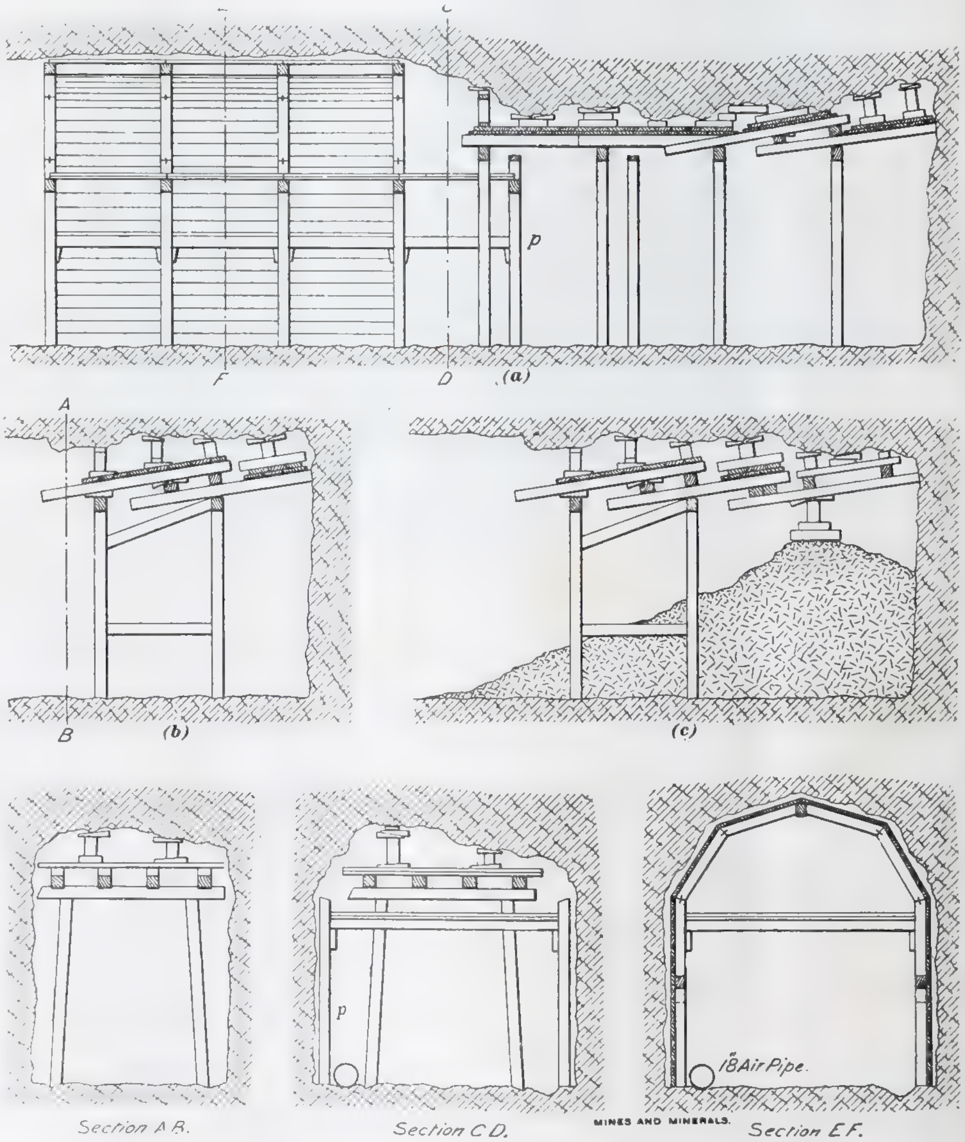
Jawbone Division: 59,448 lin. ft.; materials, penetrated, sand and gravel and some granite largely decomposed; methods, hand work.

Grapevine Division: 40,350 lin. ft; materials, penetrated, hard granite; methods, machine drills.

In soft-rock tunnels the world's best previous record for speedy driving, namely, 842 ft. in 31 days, established at the Gunnison tunnel, has been exceeded. The new record is 1,061.6 ft., established in the north portal of tunnel No. 17, Jawbone division, for the month of August, 1909, T. J. Flannigan, superintendent, and A. C. Hansen, division engineer in charge. An abstract of the official report in regard to this work shows there were 91 shifts with 9 men on a shift, and that these advanced the excavation 11.7 ft. per shift through dry cemented sand and sandstone. The work was done by hand, using 4,450 pounds of 40 per cent, dynamite and 2,372 pounds of black powder. Methods and costs were published in Engineering Contracting. Oct. 20, 1909. This is ideal material in which to break records, for the ground can be rapidly drilled by hand augers, shoots fine, can be rapidly shoveled, and the walls stand without timbering for weeks, provided the roof is carefully arched.

From this greatest speed record made in the most favorable material, we turn to examine into the records made in the next most favorable material—the black shale. Perhaps the best records in this material have been made in the second longest tunnel of the work, the San Fernando of the Saugus division, of which D. L. Reaburn is division engineer, and J. W. Henderson is superintendent. This tunnel, No. 104, has a total length of about 10,000 ft. and was driven from the two opposite sides of the last barrier ridge of the Coast Range.

The first creditable record was made at the south portal under the charge of Foreman H. E. Warden, during the month of April, 1909. The arched section excavated had a width of 13 ft., and a height of 12 ft. 3 ins. Using hand augers for drilling, and working 11 men per shift, 3 shifts per day, a total length of but 29 days, the progress made was 586.5 ft. The ground stood so well that the breast could be kept about 12 ft. ahead of the timbers. The following were the total official costs per foot of advance, exclusive of concreting: Excavation, $10.37; timbering, $3.86; total, $14.23.



Sections Showing Methods of Excavation and Timbering on Elizabeth Tunnel.

In the following month of May, a record was made at north portal of this same tunnel, in charge of Foreman Sidney Dean, which everything considered is also very creditable. The ground at this end, however, was heavy and necessitated considerable retimbering as the breast was advanced. With other conditions similar to those already detailed at the south portal, the north portal heading was driven 579 ft. in 31 days. The effect of the heavy ground in increasing the costs over those of the south portal is seen in the following average costs per ft., exclusive of concreting: Excavation, $14.11; timbering, $5.45; total, $19.56. At both of these portals 40 per-cent gelatin powder was used, of which about 10 lbs. per foot of advance was the average consumption. The crew at the faces on each shift consisted of a boss, 5 miners, and 5 shovelers.

Construction work started on the tunnels of the Grapevine division early in 1909, and, everything considered, progress to date has been satisfactory. No records have as yet been established on this division, probably because the majority of tunnels penetrate the hardest and toughest rock encountered on the aqueduct. This rock is very largely a tough seamless granite, very similar to the toughest of that encountered in the Cripple Creek drainage tunnel. The following table gives the costs in dollars of the best month's run up to the time of the writer's visit. In this tunnel the two shifts of 11 men, each succeeded in driving 9 ft. per day, thus obtaining a bonus of 3 ft. per day. There was 28.1 lbs. of powder used per ft. driven. While 270.5 ft. is small progress as compared with the spectacular achievements on other portions of the line, everything considered, it is a very fair record for two shifts per day; besides, next to the Jawbone division, the Grapevine division work

GRAPEVINE TUNNEL, SOUTH HEADING.

Classification.	Labor	Animals.	Supplies	Power.	Freight.	Cost per lin. ft.
Excavation	$3,199.54	$54.00	$1,269.22	$293.73	$253.84	$18.37
Engineering	43.64					.16
Timbering						
Totals	$3,244.18	$54.00	$1,269.22	$293.73	$253.84	$18.53

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*Condensed from a paper by R. L. Herrick in "Mines and Minerals," for October 1910.

presents more difficulties than any other, due to its rugged contour, inaccessibility, etc. In the effort to ascertain ways of increasing progress on these tunnels, the division engineer, C. H. Richards, made the only carefully detailed study on the work which has yet been made on the aqueduct tunnels. Mr. Richard's report was published in full in Engineering Contracting for June 1, 1910.

The greatest obstacle to the success of the aqueduct as a whole was believed at the start of work to be the highest barrier ridge of the Coast Range which is penetrated by the Elizabeth tunnel, whose length when completed will be 26,860 ft. The rock composing the ridge is mainly granite, which in places shades into both gneiss and schist. The granite is composed mainly of feldspars and biotite with only a small amount of quartz usually present. Its texture varies at different points along the tunnel, the finely crystalline rock usually being without joints or seams and the coarsely crystalline rock usually being full of seams. The finer crystalline rock, therefore, allows much the slower progress in tunnel driving, while the blocky ground gives about as near ideal conditions for record-breaking drives as one is apt to find.

While originally the rocks composing both sides of the ridge were doubtless similar, today they are widely dissimilar in physical character, which necessitates two widely differing methods of mining attack.

The rock so far penetrated by the south heading is hard, unaltered, and in general blocky enough to afford fine breaking qualities. It requires no timbering except one or two sets at long intervals where the roof is heavy, and there is comparatively little water encountered.

In the north heading, the rock has been shattered by scores of fissures, and in general is so kaolinized by percolating waters that it is for the most part soft, friable and frequently pasty. Considerable water enters the tunnel, and the ground is so heavy it requires timbering, except at one or two places in the tunnel of small extent where hard unaltered rock was penetrated. Long extents of heavy, treacherous ground are continually encountered, so that the timbering must be kept well up to the face.

As a result of these widely varying conditions neither the costs nor the record performances of work at one heading may be fairly taken as a criterion of the work at the other heading of this same tunnel, a fact the aqueduct supervisors would do well to recognize.

In spite of this diversity of work, however, the progress made at each heading has been surprisingly uniform, until at the end of April, 1910, 30 months after starting work, the north heading has penetrated 9,754 ft. and the south heading 9,738 ft., totaling 19,492 ft., or nearly 72 per cent of the entire length. At this rate of progress the tunnel will be finished by April, 1911, or 18 months before it was estimated at the start of work that the tunnel could be completed.

TABLE II. PROGRESS SHEET OF SOUTH PORTAL ELIZABETH TUNNEL APRIL 1910.

Classification.	Labor.	Live Stock.	Material and Supplies.	Transfer.	Energy.	Freight and Handling.	Total.	Unit Costs. Linear Foot.
Month Cost and Progress.								
(A) Engr. & supt.	$ 70.00		$ 2.83	$89.50		$ .56	$ 162.89	$ .27
(B) Excavation.	3,729.68	......	2,861.35			572.27	7,163.30	11.86
(C) Mucking	5,136.49	$ 81.00	48.58			9.71	5,275.78	8.73
(E) Drainage	44.49						44.49	.07
(F) Ventilation ...	85.10						85.10	.14
(G) Light & power	452.04		172.91		$ 1,450.02	34.58	2,109.55	3.49
	$ 9,517.80		$ 3,085.67			$617.12	$ 14,841.11	$24.56
(K) Back trimming	416.50						416.50	.69
Timbering	12.00		43.83			34.83	90.66	
Totals	$ 9,946.30	$ 81.00	$ 3,129.50	$89.50	$ 1,450.02	$651.95	$ 15,348.27	[illegible]
Total Cost and Progress.						Freight.		
(A) Engr. & supt.	$ 9,600.96	$ 149.90	$ 327.84	......		$ 42.69	$ 10,121.39	$ 1.04
(B) Excavation ..	94,468.43	......	50,841.14	......		9,766.20	155,075.77	15.92
(C) Mucking	105,744.49	1,421.30	3,345.07			589.65	111,100.51	11.41
(D) Timbering ...	6,017.48		4,209.87	......		1,085.93	11,313.28	5.70
(E) Drainage	1,393.03	......	13.03	......		1.56	1,407.62	.14
(F) Ventilation	1,481.30		3,097.86			530.27	5,109.43	.52
(G) Light & power	13,495.78		32,669.59	......		2,100.22	48,265.59	4.95
(I) Portal cut	720.49						720.49	
Totals ...	$232,921.96	$1,571.20	$94,504.40	......		$14,116.52	$343,114.08	$39.68

Powder 19.15 pounds per foot. Feet to be driven, 13,430. Estimated cost, $750,570. Feet so far driven 11,693. Actual cost so far, $343,114.—W. C. Aston, Superintendent.

For the accomplishment of this work, destined long to mark the top notch of the American tunnel driving art, two former Colorado men have earned a large part of the credit. They are C. W. Aston, superintendent of the south portal, and John Gray, superintendent of the north portal. Between these two and their crews has sprung up a friendly rivalry resulting in the shifting of the championship of America from one side to the other, as each in turn has exceeded the record month's progress of the other, as shown in Table 8.

North Portal Tunnel Driving Methods.—The north portal of the Elizabeth tunnel is located on the desert side of ridge. Tunnel driving on the north side of the ridge is an entirely different proposition from that on the south side. For almost the entire half of the tunnel the rock is shattered by hundreds of faults which have rendered the ground both blocky, and usually very heavy, necessitating the timbering of all but 300 ft. up to the time of the writer's visit. As this side of the tunnel has a down grade, the water which accumulates in considerable quantity, has to be pumped to the outside. Owing to the soft, blocky ground, which is easily shattered by comparatively small amounts of explosive, the average round at this end includes only 16 holes instead of 25, and they are drilled by two Leyner machines instead of three, as at the south heading.

The heading crew, exclusive of the shift boss on each shift, is as follows: Two machine men and helpers (4), 6 shovelers, 2 trammers, 8 timbermen and from 6 to 8 trackmen, making a maximum total of say 28. To this must be added the train motorman and outside dump man. Instead of hauling the loaded cars from the heading back to the switch where the trains are made up by a mule, the adverse grade is overcome by rope haulage, a small compressed-air hoist located a short distance back from the face being employed in the work. Of the two trammers mentioned, one runs this hoist and the other manipulates the rope. In this heading from 6 to 8 timbermen find steady employment and the work they perform is one of the main features of interest.

A careful study of Fig. 1 will make clear steps by which that condition is arrived at.

For convenience, assume the time of inspection to be at the end of a shift when the drills have been cleared away from the breast preparatory to shooting the round. Arrived at a point 100 ft. back from the breast the transition of method in roof support is found similar to that shown in Fig. 1 (*a*). The finished sets are best seen in the end sectional view through *E F*, in front of which stand the temporary supports or "false sets." These false sets support the heavy roof by longitudinal timbers resting upon them after the manner of the ordinary forepoling method, the roof being carefully supported on blocks, timber ends, etc., all carefully and tightly wedged. The situation at the breast just before shooting is shown in Fig. 1 (*b*). It will be noted that the last false set has been placed within 3 or 4 ft. of the face about to be blasted, carefully braced with timbers and the roof wedged up as tightly as possible.

Shortly following the blasting the timbermen go into the heading as quickly as possible and shore up the roof temporarily from the top of the broken material, as shown in Fig. 1 (*c*).

The posts of the permanent sets are 8"×8" squared timber, spaced irregularly from 2 to 8 ft. apart depending on the weight of the roof; those shown in the illustration are spaced on 8-ft. centers. The sets are ordinarily spread by lengths of 2"×6" plank whose ends are supported for convenience on either wedges or timber ends spiked to the posts. The posts are 8 ft. 6 ins. in length and set 10 ft. 2 ins. in the clear, while the heading is broken as nearly as possible to a width of about 12 ft. Over both sides and top arch timbers is placed 3-in. timber lagging.

In ground that stands fairly well for a day or two, this full width of 12 ft. is blasted by the rounds and the placing of false sets is, of course, an unnecessary preliminary. In the heavy ground, the width of the heading first blasted varies from 6 to 8 ft., or whatever it happens to break, and the rock is so badly shattered that the subsequent enlarging to the full section is only a matter of judicious pick work. Experience has proved that if the roof is at all times kept well supported on the timbers, so that it does not start to fall, little retimbering will be necessary, while if it once breaks loose, heavy close-set timbering will often be crushed. For this reason the timbering in the heavy ground is of vital importance to avoid delays, which mean a loss of bonus to the crews. The only time when the roof is not kept constantly supported, therefore, is the interval of from 15 to 20 minutes following the blasting during which the gases are being cleared out. The first work of the timbermen on the new shift is to shore up the roof temporarily from the top of the rock pile. By placing two longitudinal timbers, Fig. 1 (*c*), supported from the broken rock close to the side walls, and shoring up the shattered

TABLE I.—PROGRESS AT NORTH PORTAL OF ELIZABETH TUNNEL APRIL, 1910.

Classification.	Labor.	Live Stock.	Material and Supplies.	Transfers. Labor.	Transfers. Stock.	Freight and Handling.	Total.	Unit Costs. Linear Foot.
Month Cost and Progress.								
(A) Engr. & supt.	$ 150.00		$ .14	$132.50	$ 27.00	$ .03	$ 309.67	$ .55
(B) Excavation ...	3,123.40	$ 37.80	1,798.17	.	. .	359.63	5,319.00	9.48
(C) Mucking	4,572.97	32.40	110.73	.	. .	22.14	4,738.24	8.44
(E) Drainage	55.00		25.95	. .	.	5.19	86.14	.15
(F) Ventilation ...	52.50						52.50	.09
(G) Light & power.	596.92		308.30	Energy	1,380.51	61.66	2,347.39	4.17
								$22.88
(D) Timbering	2,766.88	27.90	812.22	. .	.	162.44	3,769.44	6.73
Totals	$ 11,317.67	$ 98.10	$ 3,055.51	$132.50	$1,407.51	$ 611.09	$ 16,622.38	$29.61
Total Cost and Progress.								
(A) Engr. & supt..	$ 12,296.00	$ 713.50	$ 459.91	......	. . .	74.51	13,543.92	$ 1.38
(B) Excavation ...	85,531.20	775.90	26,969.03	.	. .	5,117.02	118,393.15	12.13
(C) Mucking	113,492.20	490.17	2,011.47			327.00	116,320.84	11.92
(D) Timbering	41,999.31	238.30	16,520.31	. . .		[illegible]	[illegible]	6.53
(E) Drainage	3,668.42		502.64	. .	.	[illegible]	[illegible]	.43
(F) Ventilation ...	1,000.77		1,284.75	. . .	.	194.89	2,480.41	.25
(G) Light & power.	14,128.23		33,003.25	. .	. . .	1,756.94	48,888.42	5.01
(H) Concreting	1,105.75	343.80	30.71	......	. . .	3.84	1,484.10	. . .
Backfill	539.21		. . .	. .			539.21	. . . .
(I) Portal cut.....	1,677.61	84.30	24.06	. . . .	. . .	2.64	1,788.61	. . .
(J) North shaft...	8,345.08		3,468.50	. .	.	629.62	12,443.20	. .
(E) Equipment ...	11,750.36	32.40	69,978.24	.	.	11,831.13	93,592.13	
Totals	$295,534.36	$2,678.37	$154,252.87	......	. . .	$23,007.13	$475,472.73	$37.66

Powder 16.8 pounds per foot. Estimated cost $763,420. Cost for 9,754 feet, $475,472.—E. J. Sharpe, Superintendent.

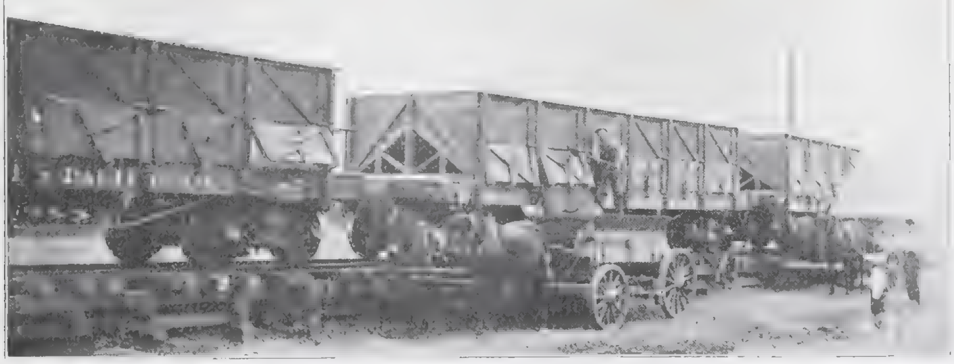

Fig. 1—View of Wagons Being Loaded from Special Stone Car.

roof by means of transverse timbers and blocking resting upon them, the timbermen interfere but little with the shoveling back from the face to allow the placing of the drills. This done, the broken rock is thrown aside to allow placing a false post on solid bottom, which post from here on takes the weight of the roof, while the simultaneous shoveling and drilling for the next round go on. The false posts used in this work are later used as permanent posts, and as their upper ends are beveled to support the roof arch, these beveled ends are placed next the floor, as shown in sectional views *AB* and *CD*, while their squared ends support the caps which consist likewise of the timbers already cut to length, which are later used as permanent posts. In this way there is no handling of heavy timbers not intended for permanent use. With the false sets to the number of six or more, placed for a distance of about 50 ft. back of the breast, plenty of leeway is allowed for the ground to work and settle for several days before the permanent sets replace them. The posts of these false sets are placed no fixed distance apart, as the width of section first broken varies considerably.

The section *A B*, Fig. 1, contrasted with that of *C D*, shows the situation before and after widening out the tunnel to its proper dimensions by means of pick work. This widening-out process starts next the permanent set and proceeds toward the face, the permanent posts *p*, shown in (*a*), being placed as fast as the section is widened. Traverse spreader timbers shown in section *C D* are now supported with their bottoms 14 ins. below the top of the posts, resting on timber ends spiked to the posts. Across these spreaders are laid two layers of 2-in. plank forming a flooring 4 ins. thick. This floor is some 2 or 3 ins. below the bottom of the caps resting on the posts of the false sets, so that it is easily laid while the false sets continue to hold the weight of the roof. Working now from the end of this floor, the wedges and blocking transmitting the roof weight to the false sets are carefully knocked out and the shattered roof rock picked down on to the floor Later on, cars are run beneath this floor, a hole is made in it by pulling out some planks, and muck is allowed to run or is shoveled into the cars.

By advancing the permanent posts *p* a foot or more forward from the false set posts as in (*a*), the arch timbers of the permanent sets may be placed as fast as the removal of the roof rock exposes their upper beveled ends. Lagging and wedging quickly follow so that the roof weight is taken up by the permanent sets shortly after its removal from the false sets, after which the posts of the latter are knocked out and carried forward for reuse or are placed as permanent posts.

As the heading is advanced at the rate of 16 to 18 ft. per day, 3 shifts, the timbering must be placed and removed by each shift, which keeps every one busy, although system reduces disorder in the heading to a minimum. It is complimentary to the methods adopted by Superintendent Gray that in spite of the hurry with which everything is pushed by the timber crew, up to this writing there has been no fatality in the heading attributable to a roof fall.

To those interested in the rivalry between the crews of the north and south Elizabeth tunnel headings, the accompanying Tables I and II will be replete with interest as well as with valuable data. These give the official costs for both headings during the month of April, 1910, when the south portal advanced the American record to 604 ft., while the north portal progressed 561 ft. in spite of exceptionally heavy ground. It will be noted that, as might be expected, the cost of explosives was the heavier for the south heading, while the cost of timbering is mainly responsible for increasing the cost per foot of the north heading to $4.36 more than the $25.25 of the south heading. It is also significant that the cost of mucking in the two headings is very nearly the same.

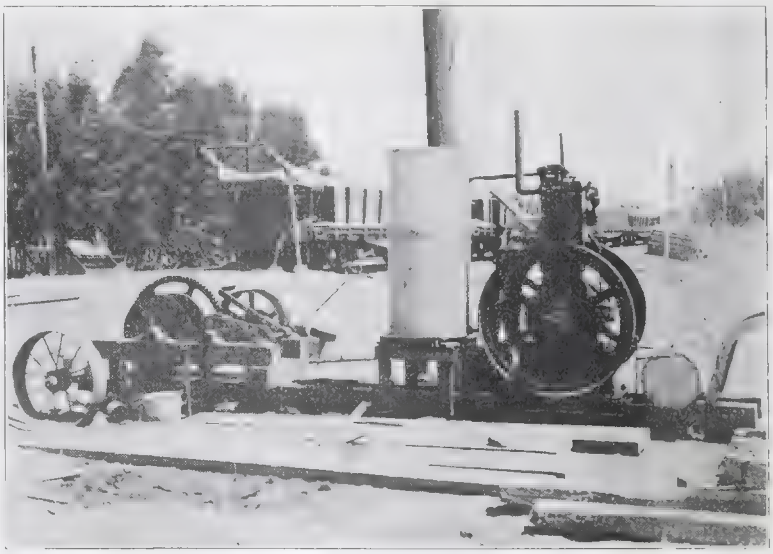

Fig. 3—View of Engine Plant for Operating Car Unloading Scraper.

Methods and Cost of Unloading Crushed Rock from Railroad Cars and Hauling the Same to the Road; A Railroad Car for Hauling Crushed Rock.

BY H. R. POSTLE.*

No problem confronting contractors has caused more thought, worry and loss than that of unloading crushed rock from railroad cars into wagons; no problem has been more baffling or has been more frequently abandoned in despair for the old costly method of hand shoveling. The writer, aided by some experiments and suggestions, has recently constructed and operated a device that is, he believes, the solution of the problem for the ordinary contractor who must have a plant adapted to small jobs, movable from place to place and adapted for all kinds of railroad cars. Unloading crushed rock ordinarily costs from 20 to 25 cts. per ton, but, by means of this apparatus, rock is being unloaded for about one-third to one-half of this amount.

The accompanying illustrations mostly tell the story. The method is to draw the rock over the end of the car, through a chute hung to the end of the car, and into the wagon by means of an ordinary slip-scraper (largest size), to which is attached a ⅝-in. wire cable connected to a hoisting drum operated by a gasoline engine.

The chute is built of 2-in. lumber and is 6 ft. wide at one end, 5 ft. at the other end, and 5 ft. long, and is supported by two legs, so that it just clears the wagons, allowing them to be driven under or moved ahead. A roller 3 or 4 ins. in diameter is mounted on the

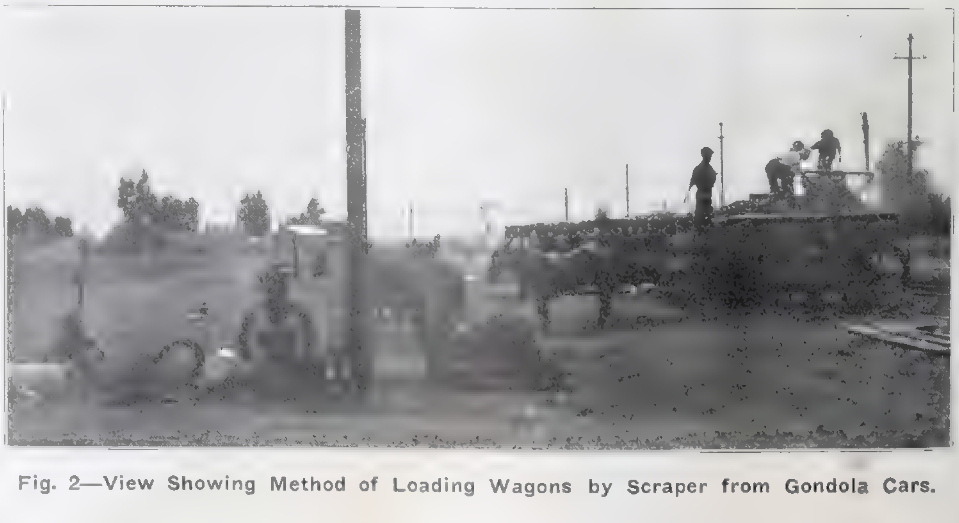

Fig. 2—View Showing Method of Loading Wagons by Scraper from Gondola Cars.

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*Civil Engineer, 336 Pacific Electric Building, Los Angeles, Cal.

outer end, over which runs the cable drawing the scraper and against which the scraper falls when dumping.

The hoist drum and gas engine are mounted on a low truck so as to be easily moved. The engine is a 10 hp. gas engine, belted to the hoist drum with an 8-in. belt. The hoist drum is 12 ins. in diameter and 10 ins. wide.

The method of procedure is to place the loaded railroad cars in one end of the switch, move each car in turn into the same position for unloading, and, when unloaded, move it to the other end of the switch. An extra length of rope is provided so that a hitch can be made to the cars to move them into position. The cars are thus moved more quickly than the apparatus can be moved from car to car.

Six or seven men are needed to unload from 200 to 250 tons of rock per day. One acts as foreman, two handle the scraper, one is engineer and the others shovel up the surplus rock which the scraper can not reach. The two men handling the scraper drag it to the farthest end of the car, signal the engineer, who throws in the clutch, when immediately the scraper starts toward the chute, gathering a full load of rock and pushing some ahead of itself, is drawn through the chute and dumps its load at the end thereof into the wagon.

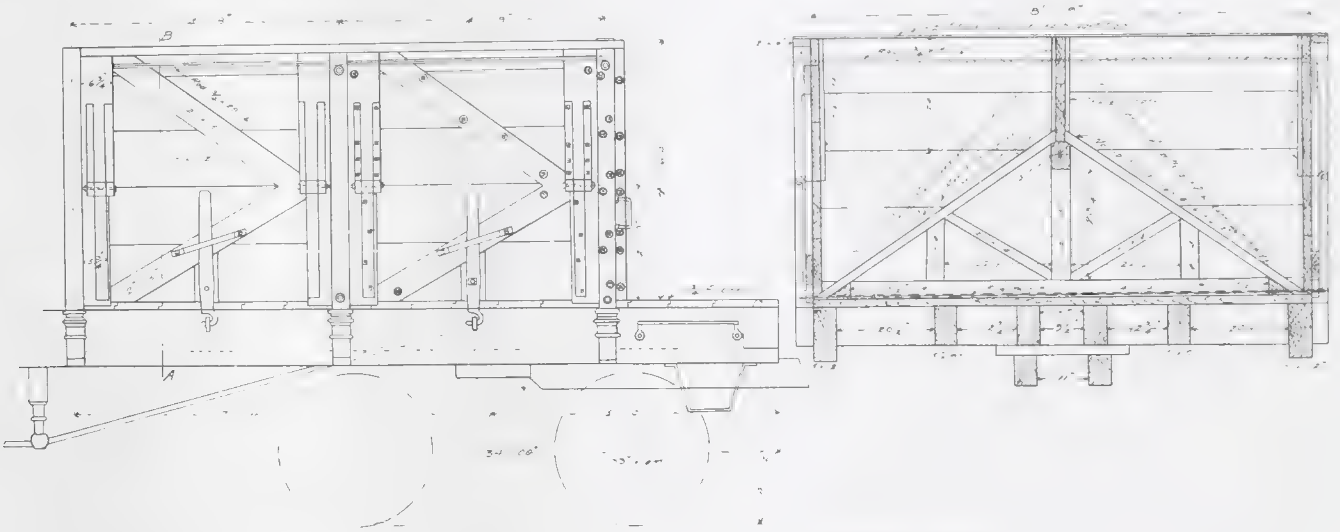

Fig. 4—Details of Special Dump Car for Crushed Stone.

The writer in loading 5 yds. (6 ton) dump wagons, found that they could be loaded in an average of 10 minutes by 12 scraper loads. About seven-eighths of a car can be unloaded by the scraper by having the two or three shovelers shovel the rock away from the sides and farther end of the car when the rock is getting low in the car.

From 200 to 250 tons per day can be unloaded for the following costs, as per Los Angeles wages for an 8-hour day:

One foreman	$ 3.50
One engine man	3.00
Two scraper men	5.00
Three shovelers	6.00
Gasoline, oil, repairs, etc.	2.50
Total	$20.00

If only 200 tons are unloaded, the cost is 10 cts. per ton. The cost of the apparatus is:

Gas engine, ten horse-power	$ 350.00
Hoist drum	125.00
Truck	50.00
Large scraper	10.00
One hundred and twenty-five feet cable	9.00
Pulley block	3.00
Total	$ 547.00

The irregularity with which cars of rock are received, makes such an apparatus especially valuable to any contractor, inasmuch as when no cars, or less than a day's run, are received, he need not have a gang of shovelers to lay off or provide for.

It will interest contractors to know that we were able to haul rock cheaper with mules than with a traction engine, using the type of wagon ordinarily manufactured and sold to be drawn in train with an engine. The particular wagon used was the Port Huron 5-yd. or 6 ton wagon; each was fitted with a tongue, two mules being hitched alongside the tongue with three abreast in the lead. With a haul of about ½ mile, each wagon made 10 trips per day of 8 hours, thus delivering on the road 60 tons of rock at a cost of $7.50 (five mules at $1.00 per day and $2.50 per day for the driver) or $0.125 per ton. To have hauled 60 tons of rock with 2-yd. wagons would have required two and a half 2-yd. wagons costing $4.25 each (two horses $2.00, one driver $2.25) or $10.65, which would make the cost $0.177 per ton, which shows a saving of $0.052 per ton by hitching more stock to one wagon and using a large sized wagon. The saving will increase with the length of haul. The coupling of two or three wagons together, or using a wagon of large capacity, with 4 to 8 head of stock is a very common California practice, and is one which the writer has failed to observe in the east. It is the writer's experience that this method of hauling, unless the haul be a long one, will generally be found to be cheaper than hauling by engines for the following reasons:

(1). To load a train of wagons quickly requires either a private or specially constructed railroad switch and loading bins, or two trains of wagons, on of which is loading while the other is on the road. Loading wagons continuously one by one does not require so much in the way of switches, bins or wagons.

(2). Most contracts demand an equipment easily and cheaply movable from one switch to another. It is seldom that all of the loading can be done at one switch, consequently expensive equipment which cannot be cheaply and quickly moved, is not justifiable.

(3). Horse equipment is better adapted to torn-up and dusty roads, which are sure to be encountered where construction work is in progress.

(4). Horse drawn wagons are more easily handled on the sub-grade where the rock is dumped. They pull in on the sub-grade easier, do less damage, dump more quickly, and pull out and turn around quicker.

(5). On very few contracts and on very few railroad switches can rock be delivered fast enough to justify the equipment required for engine hauling. The whole equipment where horse drawn wagons are used, the necessary unloading devices and the number of wagons, more easily fit the general run of contracts.

Of the numerous contracts now under construction in Los Angeles County, where $3,000,000 is being expended on macadam road construction, on only one is the rock being hauled by steam engines. It was tried on several others, but quickly abandoned.

The best device for unloading rock, one which saves all cost of shoveling from the railroad car, is the compartment type of rock car now built and used by the Los Angeles Pacific Ry. Co., an electric railroad. This car is very satisfactory and should be more generally used, but the writer, in observing road building operation from New York to Los Angeles, has never seen anything like it. The car shown in the illustration consists of a superstructure of bins framed together and set upon a 34 ft. flat car. It contains twelve 2-yd. bins, each provided with a separate door for discharging the contents of the bin. The teamster drives his wagon alongside the bin and adjusts a board between his wagon and the car, which prevents the spilling of any rock on the ground. He then, with his shovel, loosens the hook holding the door in place, which allows it to swing up and discharge the whole 2 yds. of rock into the wagon. The whole operation is consummated in about 1 minute and saves, not a part, but all of the cost of shoveling, which is 25 cts. per yard, unless all delays and bad management are avoided.

In the illustration, in order to bring the bottom of the bin the right height above the wagon, the track has been elevated by being cribbed up with ties. Where cribbing up could not be done, a shallow trench for the wagons would have to be excavated with scrapers.

Highway Commissions, quarry owners and contractors, having a sufficient yardage of rock to handle, can certainly effect a large saving in the handling of rock by building such bins. The 34-ft. car in the illustration has 12 bins and a capacity of 24 yards. A 34-ft. car could and should have 14 bins, having a capacity of 28 yards. At 25 cts. per yard, saved in unloading, $7 is saved in each carload. If a 40-ft. flat car were used, 16 bins of this size could be built, or, by slightly increasing the height, 18, carrying 36 yds. could be built, thus making the carrying capacity of the car practically that of the ordinary gondola which is generally used for rock shipments. The illustration shows the dimensions of the twelve compartment car, to build which the following bill of lumber is necessary:

Six 2-in. x 4-ins. x 18-ft, twelve 4-in. x 4-in. x 18-ft., six 4-in x 6-in. x 16 ft., four 2-in. x 16-in. x 16-ft., sixty 2-in. x 12-in. x 16-ft. Total, 2,643 ft., at $22 per ft.=$58.15.

The exact amount of bolts and iron required I have not been able to ascertain, however, the shop foreman of the L. A. P. Ry., says each car costs them a total of $250.

Methods of Disposing of Wet Clay Excavation, Panama.

Three plans have been adopted to dispose of earth and clay spoil by dumping it into the Chagres river, which carries the material down stream. Wasting material on the clay dump was very expensive in wet season because, under pressure, it slides from under the tracks. In the Central Division the excavation consists almost entirely of this material, and the proximity of the Chagres made the new schemes possible.

At Gorgena, a high trestle has been built on the bank of the stream and the spoil dumped along its edge. Water drawn from the river is forced on it through hose, and the material is thus sluiced into the stream, or wetted sufficiently to make it move slowly into the current from its own weight. Pumps operated by compressed air were used at first, but an old French locomotive has been installed, and steam will be furnished henceforth. The pump discharges from a 6-inch main located along the bank beneath the trestle, from which at regular intervals are branches to which the sluicing hose may be attached.

At San Pablo and Juan Grande, the dumping trestles are built at points where the current in the river is especially strong, so that the wetted clay as it slides into the river will be carried rapidly away.

At East Mamei a low trestle has been built out into the stream and the plan of cleaning the spoil away from this trestle by sluicing is being tried. This is in the experimental stage, and it is believed that the method will not prove as economical as the plans outlined above, unless the portable sluicing float can be used at several dumps.

The portable sluicing plant is erected on two standard flat cars, and is shifted from place to place by a locomotive, which also furnishes steam to the pumps. On one car is mounted two pumps 14x10x8 ins., and a boom by which the suction pipe is let into the river. These pumps are old stock of the reciprocating type and cannot handle muddy water as well as centrifugal pumps. The water is forced through a pipe to the second car, on which the sluicing monitors are mounted. A 3-inch nozzle directed over the end of the car can throw a stream directly down on either side. A 2½" nozzle carried over each side by a flexible hose can throw a stream in any direction, even so as to wash out under the car itself. A third 2½-inch nozzle is used to wash out the dump cars.

METHOD OF CONSTRUCTING PEDRO MIGUEL MIRAFLORES HIGHWAY.

The construction of a section of this road involves the crossing of the valley of the Caimitillo and Camaron rivers, near Miraflores. It is proposed to construct a trestle across each valley, extend the construction track along it, and make the fills from the canal prism.

The trestle over the Caimitillo valley will be about 500 feet long, and that over the Camaron will be about 300 feet. The embankment will be about 60 feet above sea level, and its width on top will be either 16 feet or 24 feet. If the 16-foot width is decided upon, guard rails will be erected along each side.

The culverts will consist of old French iron pipe, nine feet in diameter. Two parallel lines of this pipe will be used at the Caimitillo and one line at the Camaron river, which is a small stream emptying into the Caimitillo.

These culverts will be located on natural benches at one side of the streams, about 20 feet above the present channels, in order to procure a solid bed, and a special fill will be made around them.

Cost of Sinking a Mexican Mine Shaft.

The following costs of sinking a mine shaft through Andesite, at the Esperanza mine at El Oro, Mexico, are given by Mr. W. E. Hindry.* The shaft was a three-compartment vertical shaft, having two 5x5 ft. hoisting compartments and a 5x7 ft. pump and ladderway. The timbering was 10x10 ins., with 2-in. lugging sills 5 ft. c. to c. and 6 posts per set. The total depth of the shaft was 679 ft., of which 101 ft. was sunk by windlass and hand work, and 578 ft. by steam hoist and machine drills. The work was done in 1899 and the prices of materials and wages were as follows:

Materials:	Prices.
Timber per M ft. B. M.	$13.58
Wood per cord	3.15
Coal per ton	7.27
Powder, 60%, per lb.	0.14⅔
Fuse per foot	0.0055
Caps, each	0.0058
Candles, each	0.0194
Labor:	
Superintendent, per 24 hours	$4.85
Shaft men, foreign, per 8-hour shift	3.22
Shaft men, native, per 8-hour shift	0.528
Top men, per 8-hour shift	0.422
Fireman, per 8-hour shift	0.485
Hoistmen, per 8-hour shift	0.970
Blacksmiths, per 8-hour shift	1.455

The cost of excavation was as follows:

Labor:	Per lin. ft.
Superintendence	$ 2.529
Shaftmen, foreign	3.510
Shaftmen, native	7.043
Top men	0.578
Blacksmiths	0.718
Firemen	0.317
Hoistmen	0.894
Miscellaneous	0.936
Total	$16.525
Materials:	
Timber	$3.961
Wood, fuel	3.781
Coal	0.179
Powder	2.853
Fuse	0.014
Caps	0.294
Candles	0.223
Oils, grease, etc.	0.025
Miscellaneous	0.051
Total	$11.381
Grand total	27.906

The above costs are converted from Mexican money assuming the piso to have a value of 48½ cents.

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*Mining and Scientific Press, April 9, 1910.

ROADS AND STREETS SECTION

County Road Systems in the Province of Ontario, Canada

The present county road systems in the Province of Ontario may be said to date from the passage in 1901 by the Provincial Legislature of the "Act to Aid in the Improvement of Public Highways."

This act provides that a county council of any county may by by-law adopt a plan for the improvement of highways throughout the county by assuming highways in any municipality in the county in order to form or extend a system of county highways. It is provided that the roads assumed shall be leading market roads such as will best serve local requirements, but the roads assumed must form a connected system as far as possible. The County Council determines the roads to be assumed, but the by-law, with an estimate of the cost of the proposed improvement, is subject to approval by the Minister of Public works. Having been so approved, the county is entitled to receive from the government one-third of the county's expenditure on construction. That is to say if the total expenditure on a county road system is $150,000, the Province of Ontario contributes $50,000 and the county is required to raise $100,000. County Councils are permitted to raise the county's share either by an annual levy, or the issue of debentures with payments extended over 30 years. The work done on the roads is under the direction of the County Council, subject to the regulations of the Department of Public Works with respect to highways.

The chief objects of the art are: To encourage a business-like system of road management; to build a system of main roads; to create an object lesson in management and construction for township municipalities; and to aid in the more equitable distribution of the cost in that through the provincial grant and a general county tax. Cities and towns in some degree contribute to the cost. First importance is attached to the system of management of these county highway systems. The regulations of the Public Works Department require that the management be centralized in a county road superintendent (or engineer) appointed by the County Council. The requirement is merely that the system of the organization of a stock company be followed, viewing the property owners of the county as stockholders, the County Council as a board of directors and the road superintendent as a manager, carefully selected by the council because of his qualifications for the position.

On each of the works the superintendent is expected to place a foreman. This foreman receives his instructions from the superintendent as to how the work is to be done.

The regulations under which the road superintendent and foremen work do not define one fixed standard of road for the entire Province to which all county roads must be sand-papered. Differences of soil, road material, traffic, condition of road before improvement, drainage requirements and other local circumstances are to be considered by the superintendent. The superintendent is expected to make the best use of conditions as he finds them in the locality. In doing this, he is to follow the underlying principles of road construction. Where he fails to do so, he has not followed the requirements of the department in either one extreme or the other. While the regulations state general principles, there is at the same time a type which is considered most suitable for a county road.

This consists of an earth turnpike 24 ft. shoulder to shoulder of ditches. The camber or crown averages 1 in. to the foot from side to center—12 ins. in a 24-ft. road. The center is metalled with broken stone or first-class gravel from 8 to 14 ft. wide and 8 in. in center thickness after thorough consolidation by rolling. The road should have easy flowing grades with low spots filled and high places cut down. The open drains should have sufficient capacity and fall for storm flow, and tile underdrains should be laid as conditions require. Good drainage and grading are essential.

The recently issued report for 1909 by Provincial Engineer of Highways, Mr. W. A. McLean, from which these notes have been taken, states that since the passage in 1909 of the Highway Improvement Act, 17 counties out of 37 in the Province have established county road systems. To the end of 1909, the average has been equal to 15 counties, each operating for four years, in which period 1,125 miles of stone, or good gravel roads, have been built. This neglects a large amount of minor, incomplete and scattered improvements which will eventually be a part of the permanent work.

Expenditure under the act since 1902 has been as follows:

Toll roads purchased	$ 153,897.98
Sundry grants to townships, villages and towns	89,957.02
Permanent bridge construction	366,225.21
Machinery, plant, etc.	113,544.84
Road construction and supervision	1,404,497.88
Total	$2,128,122.93

Of this amount the counties have spent $1,418,748.63. The Provincial expenditure, extending over eight years, has been $709,374.30, the Province contributing one-third of the total, or $1 to each $2 raised by the counties.

Combining the items of road construction and supervision (the latter about $75,000), the total cost of road construction is $1,404,487.88. With 1,125 miles of road built, the average cost per mile has been approximately $1,250. This, as previously stated, neglects a large amount of incomplete and scattered work, so that the average cost per mile would be less.

The following notes taken from the annual report for 1909 of the Provincial Engineer of Highways will give some idea of what has been done by the various counties:

Wentworth County.—The Wentworth county system, established in 1902, the first in the Province, has, with the work of 1909, approached completion so far as macadamizing is concerned. The system comprises 140 miles of road, and about three miles are still to be macadamized. The management of this work since its inception has rested with one county road superintendent, by whom foremen are appointed both for construction and maintenance, as occasion requires. In point of organization, the system has proved very satisfactory. The metal used on the system has in general been a good quality of broken limestone, quarried and crushed by the county. The metal has been rolled to a good surface, the county owning two steam rollers.

The machinery owned by the county consists of two steam rollers, a horse roller, five stone crushers, a steam drill, scrapers, plows and minor implements, the total cost of which was $12,181.72.

With an expenditure of $69,104 for the purchase of 32 miles of toll roads; $23,225.51 for machinery, quarries, plant, etc.; $8,224.62 for bridges, there has been expended on further construction $234,281.16. These roads vary in width of grade from 24 to 30 ft., and metal from 8 to 16 ft. The wider roads are in the vicinity of Hamilton.

Simcoe County.—The Simcoe county system was established in 1903, and includes 448 miles of road. Of this there has been completed 341 miles of gravel and 23 miles of stone road. The expenditure on this mileage to the end of 1909 was, for roads, $304,952.16; bridges, $33,145.94; machinery, $9,116.90.

The machinery comprises 14 road graders, four horse rollers, three stone crushers, 20 slush scrapers, 2 gravel screeners, 12 wheel scrapers and seven rooter plows. Machinery belonging to the townships is largely used when required.

Width of grade, shoulder to shoulder of ditches, is ordinarily 24 ft., but in 1909 there was variation from 20 to 26 ft. Metal (gravel or stone) is spread to a width of 8 ft., and a depth of from 7 to 10 ins. Concrete tile and concrete arches are used for culverts, and bridges are of a permanent type, reinforced concrete or concrete abutments with steel superstructure. The county maintains a considerable number of large bridges. Attention has been given to drainage, by turnpiking with the graders, improving of open drains and use of tile underdrains.

Limestone is plentiful in the northern part of the county and gravel is fairly so in the south. For the majority of the roads gravel is used. The management is under one county road superintendent.

Lanark County.—The Lanark county road system, established in 1903, comprises 98 miles of road, or about 12 per cent of the total road mileage in the county. Twenty miles of toll roads were bought in 1903 at a cost of $19,346.60, the tolls removed and the roads included in the county system. The metalling of all these roads is nearly completed, and the season of 1910 should finish this work. The total expenditure on construction at the end of 1909 was $101,799.61, and for machinery, quarries and plant $11,332.69. Apart from culverts, there has been little expenditure on bridges.

The work is in charge of a county road superintendent who personally supervises the main work in progress and places foremen on other works, visiting these from time to time. The work to be undertaken each year is decided in council, upon the report of the road superintendent.

Crushed stone is principally used, as rock is plentiful and there is very little gravel. Field stone is generally used, being piled during the fall and winter by farmers of the locality and paid for at a rate per cord.

The machinery and plant consists of a stone crusher, engine, portable separating bin, water tank, two graders, two rooter plows, three dump wagons, with minor implements. A camp outfit comprises a caboose, five tents, with blankets, stoves and cooking utensils. It is found of advantage to have a road camp for some of the principal works, as the men and teams cannot readily find accommodation with farmers. By means of the camp, the men are always on the work ready to start as weather permits, while time and energy are not wasted in long walks three times a day.

Oxford County.—A system of county roads was first established in the county of Oxford in 1904, when certain toll roads were purchased, the tolls were removed and the maintenance of these and other main roads provided for. The special act under which this system was carried on having been found unsatisfactory, a new by-law was passed in 1907, when a system of 256 miles was assumed by the county. The total expenditure has been as follows: Roads, $159,394.18; bridges, $40,773.61; machinery, $25,791.36. Fifty-eight miles of road have been graded, metalled and fully tile drained.

The county, for road purposes, is divided into two divisions, north and south, over each of which there is a road superintendent who works under the direction of the county road committee.

The metal used consists principally of crushed gravel, procured from local gravel pits. This material is put through a crusher, screened and is received into elevated bins, from which it is loaded into wagons. By means of these elevated bins, teams do not have to stand in the pit while the wagons are being loaded with shovels, but the wagons can be loaded from the bins in about three minutes each. The saving in this way is such that the cost of crushed gravel is very little in excess of the natural pit gravel. Discarded pits in which the natural gravel is too coarse can also be used, so that the saving in length of haul is, in many cases, considerable. In a few cases, natural pit gravel has been used, while near Tillsonburg quarry stone has been brought in by rail.

The machinery used by the county consists of two steam rollers, four stone crushers, two road graders, four wheel scrapers, one 25 h.p. traction engine, one 17 h.p. traction engine, one 29 h.p. portable engine, two tank sprinklers, five spreading wagons, seven dump carts, with minor articles.

The standard type of construction consists of an earth grade 26 to 28 ft. from shoulder to shoulder, upon which is spread metal 8 ft. wide and from 8 to 10 ins. in thickness. The roads are consolidated by rolling.

Over a considerable part of this work the tile and surface drainage is completed, and of a very satisfactory type. The outlets of tile drains are set in concrete head-walls. Bridges and culverts are of good type of concrete, and for long spans concrete abutments with steel superstructure.

Halton County.—The Halton county roads system was established in 1907, and comprises 202½ miles of road, or about 30 per cent of the total road mileage of the county. This mileage is found excessive, and is to a considerable extent handicapping the progress of the work. There are a great many small bridges throughout the county and these are being renewed with concrete and steel in a permanent manner. The total expenditure on these roads has been $71,946.59, of which $37,694.43 was for roads and $24,588.82 for bridges.

The machinery owned by the county consists of one steam roller, a stone crusher, two graders and two wheel scrapers.

Gravel, crushed field stone and crushed gravel are used.

The principal work to the present time has been some broken stone road near Moffatt in Nassagaweya; some broken stone and grading in the vicinity of Acton in the same township; some gravel road in the vicinity of Georgetown; a mile of macadam near Milton; a road metalled with crushed gravel near Burlington. A considerable number of scattered stretches have been built in other localities, tending principally to the permanent improvement of the worst pieces. The stoned roads in Halton are of a better class of workmanship than are the gravel roads, owing to the more general use of the steam roller on the former. The standard type of road consists of an earth grade 24 ft. wide, metal 8 ft. wide and 10 to 12 ins. in thickness.

The work is in charge of a county road superintendent, who employs foremen on the different works as required.

Wellington County.—The Wellington system of roads, comprising 170 miles, was established on its present basis under the Act to Aid in the Improvement of Highways, in 1903. Prior to that time the county was maintaining a system of roads aggregating 144 miles. These were leading roads, converging at Guelph, constructed as trunk roads before the time of railways and, later, while Guelph was the only railway shipping point in the county. Wagon traffic over them was at one time very great, and they were built accordingly, with a very wide grade, usually about 40 ft., and metalled the full width. With the increase of railway shipping points throughout the county, and changing conditions of population, traffic, etc., a readjustment became necessary. To this end, when the system was placed under the Highway Act, extensions were made in several of the more wealthy and populous municipalities to more nearly proportion the benefit to the amount each would contribute.

The older roads of the system are wide and flat, frequently with square shoulders and sharply defined open ditches; while the new roads are in various stages, from earth roads to roads with a more or less gravelled roadbed. The work now required consists for the most part of narrowing, reshaping and resurfacing the old roads; the straightening, grading, metalling and draining of the 26 miles of new roads and the permanent construction of culverts and bridges on the county system. Gravel of a good quality is fairly plentiful and well distributed in most of the county.

County machinery consists of a steam roller, two rock crushers, three graders and minor implements. Supervision of the work is centralized in one county road superintendent.

Hastings County.—The Hastings county road system is 472 miles in length, and is principally in the southern and settled part of the county. The northern and little occupied townships are given an annual grant for road purposes in lieu of county roads.

The roadwork in Hastings is in charge of a county road superintendent who, subject to the direction of the council, has general oversight of all work performed. Under him there has been at work, during the past season, six groups of men, each in charge of a foreman. It was formerly the practice for the county to board the men in camps, but the present plan is to supply each foreman with tents, or a covered van, and a camp outfit, and allow the men to board themselves. They find their own provisions and do their own cooking.

The county owns two rock crushers, each rated at 100 cu. yds. per day. The experience is that the crushers will turn out all they can be fed, which ranges from 50 to 80 cu. yds. per day each. The county owns also a traction engine, 22 h.p., made with extra wide wheels to provide against settlement when used on soft ground. One engine is rented; so that during the threshing season, when this engine cannot be secured, only one crusher can be continued in operation.

The stone used on the roads varies considerably in quality. Field stone is generally employed. Much of it is gneiss, tough blue limestone; and in some sections a limestone that weathers badly. Gravel is also used where plentiful, and of good quality. The most satisfactory stone used is the blue limestone. It is not difficult to crush, and it packs and wears well. Care is taken to use only clean stone, and no sand or other binder is used.

Farmers living along roads to be improved place the stone in convenient piles, and when work on the road is undertaken the crusher is set up beside them, the stone crushed and hauled to the roads. Where very plentiful, the stone is crushed as a favor to the farmer; in other cases, the county pays from 7 to 10 cts. a yard for the material.

The roads of Hastings are, to a large extent, old stone roads. Many were made too wide in the first instance, and nearly all have worn and settled until they are too flat, with square and high shoulders at the sides. Reconstruction of these consists of grading, cutting off square shoulders, narrowing the roadbeds and giving a higher crown. Good drainage is sought and the rolling nature of the district affords every opportunity for a good fall to frequent outlets.

There are numerous hills in the district There is a tendency to improve these as rapidly as possible, bringing them to a permanent grade. Hills are given a noticeably higher crown than the level roads, and an effort is [illegible] to dispose of the water in such a way that washouts cannot occur.

The condition of the roads is such that work is not, as a rule, performed in long stretches. The tendency is to improve the worst sections first, gradually bringing the entire system to a proper standard.

New roads are built by first bringing the sub-soil to a permanent grade, crowning it and making suitable side drains. The earth subgrade is then covered with broken stone or gravel to a depth of 6 ins. Narrow grades are the rule, as they are found ample to accommodate traffic. Nearly all the grading and ditching is done with the grading machine. A width of 18 or 20 ft. between ditches is found sufficient, with the central 7 ft. metalled.

Lincoln County.—Lincoln county road system was established in 1904 and consists of one road, the Queenston and Grimsby stone road, 29 miles in length, running east and west from end to end of the county. This is an old macadamized road, first established as a toll road and afterwards purchased and maintained by the county. Through careless management it had become much run down, but has, under the new system of supervision been greatly improved.

The road is in charge of a superintendent who devotes his time to the work.

Prince Edward County.—The Prince Edward county road system was organized in 1907, and includes 54 miles of road. During the seasons of 1908 and 1909 good progress has been made, and it is anticipated that the entire mileage will be completed during 1910. The expenditure on this work has been: For road construction, $71,044.84; for machinery, $12,498.11, and for bridges, $6,527.65.

The county is equipped with two road rollers—one of the traction engine type—two stone crushers, graders and minor implements. Repairs are made in a central blacksmith shop equipped by the county. The operation has shown good management as regards the arrangement of crushers, bins, screens and handling of stone.

The metal used is local stone, usually quarried very conveniently to the work. This material, however, is a soft limestone that, as a rule, weathers badly. So far it has shown better lasting qualities than its appearance would indicate, and it will probably be economical to resurface more frequently rather than (at present) to import a better but more expensive stone by rail.

The work as carried out radiates largely from Picton, while one road of importance has been built out from Wellington. In this way all ratepayers are receiving more or less benefit from the work. Defects apart from the soft quality of the stone have been principally in the matter of grading and drainage—more especially on what is known as the Waupoos road. Knolls have not been cut down, nor have the surface drains been given a proper grade, so that water will, here and there, rest in pockets. In other places tile drainage was evidently needed, and more care should be given to the placing of culverts. The camber of the roads is good, and the stone is carefully rolled.

Middlesex County.—The Middlesex county system dates from the year 1906, when, under a special act, the county was authorized to carry on road improvements through the township councils. Finding the plan unsatisfactory it was repealed by the legislature and in 1907 the county passed a by-law in conformity with the Highway Improvement Act.

The system assumed by the county comprises practically the roads designated in the by-law of 1906, and includes 220 miles of road. The work on these roads is under the supervision of a county engineer, and 23 foremen responsible to him. It is customary for the county engineer to consult with the county councillors early in the year as to the work to be undertaken in the several townships during the ensuing season. The location and class of work having been decided upon, the supervision of the work devolves upon the county engineer and foreman of the division.

The system includes a number of roads which were formerly toll roads. Other roads were built by the county in a substantial manner about half a century ago. Roads of this class have wide grades and have had gravel applied in repair repeatedly, so that they have a good foundation. They have, however, become very flat, with high, square shoulders at the sides. These roads are being restored by grading away the shoulders, resurfacing with gravel and tile drainage. In some cases the roads are improved by grading and draining alone (removing the shoulders and thereby restoring the crown) without the addition of new metal.

The county is one of the largest in the Province. Local road metal consists principally of gravel, with some field stone. The gravel, however, is not uniformly distributed, and in some districts it will be necessary to bring in crushed quarry stone to properly metal the roads. The county owns one stone crusher, operated this year (1909) in the township of North Dorchester, boulder stone from the River Thames being used.

Crushed quarry stone has been used in two cases in the county, a short stretch near Appin, and another near Strathroy. In both cases the work was carried on in a somewhat experimental manner, and the results were not satisfactory, largely due to the lack of a steam roller. Crushed stone should be used in the county on roads adjacent to stations. This applies especially to the roads near London, where traffic is congested.

A considerable number of bridges have been built on the county roads, these being of a permanent character. For short spans, reinforced concrete is used, and for long spans, steel bridges, with concrete floor, and concrete piers and abutments.

A commendable feature of the Middlesex county work is the tile draining. On old gravel roads, tile drains are being placed on one or both sides of the road. The farms of the county are largely under drained and many of these drains have their outlets in open ditches along the road. It is the practice of the county to arrange with property owners to connect all farm tile with the new tile drains on the road. The county pays the cost of excavation and a 5-in. tile. The property owners contribute the additional cost of the larger tile necessary to take the farm drainage. In this way deep and dangerous open ditches are done away with and a permanent system of drainage established for all purposes.

There is a tendency to leave the graded roadway too wide. A width of 24 ft. would accommodate heavy traffic on any part of the county system, except in the immediate vicinity of London. Grading of the roads has not always been as permanently done as would be desired. To cut down knolls and fill hollows as far as practicable is necessary before the road can be permanently metalled. The uneven condition of some of the new roads contrasts very unfavorably with the roads graded by the county half a century ago.

The county urgently requires the use of a steam roller in applying metal to the roads; and has been notified that to comply with the regulations of the Department of Public Works, provision must be made for rolling. Loose crushed stone on the road, or even loose gravel, is for a long time a serious impediment to travel. Some cases were observed in the county in which gravel left on the road for two years had not been traveled on, vehicles following an up-tilted track along the side of the road.

Frontenac County.—This system of county roads had its commencement in 1907, when a toll road 16 miles in length was purchased at a cost of $22,570.82. In 1908 the county system was extended to 98 miles. Very little work was done until 1909, when 13 miles of road were surfaced with broken stone. The management of the work is under one county road superintendent.

Good stone, principally quarried limestone, is plentiful throughout the county. It is of good quality, and its uniform distribution should enable the construction of cheap roads. Much of the stone can be quarried from the roads, producing metal and reducing grades by the one operation.

The county machinery consists of a portable bin for crushed stone, a scarifier and two wagons, the outfit costing $1,655. The usual construction consists of a grade 18 to 20 ft. wide, with metal 8 to 10 ft. wide and 4 to 6 in. in depth. The expenditure to the end of 1909 has amounted to $44,675.93 for bridges, toll roads, machinery and road construction.

Lennox and Addington County.—The county system of Lennox and Addington was established in 1906, and includes 160 miles of road. The expenditure has amounted to $50,746.27 for road construction, $6,294.41 for bridges, and $9,838.69 for machinery. Returns show that 75 miles of road have been metalled with broken stone.

The standard type of construction consists of an earth grade 20 to 24 ft. wide, crushed stone spread 8 ft. wide and 6 to 10 in. in depth. The management is under two road superintendents, one for the northern part of the county, and one for the south. The machinery used consists of two stone crushers, two traction engines, two grading machines with spreading wagons and other implements.

The metal used is principally crushed field stone. Limestone from the natural bed has been used in some cases. The district is extremely hilly and broken, with numerous rocky exposures throughout the county. The metal is of a good quality, and the cost of construction can, therefore, be reduced to a minimum. Much improvement could be made on certain of the roads by quarrying stone from hills on the road for road metal, thereby reducing the grades and providing stone for crushing.

Peel County.—The Peel county system was established in 1906, and includes 102 miles of road. There has been expended to the end of 1909 for construction $77,783.82, for machinery $7,109.36, and for bridges $28,583.25.

The management is vested in a county engineer. The machinery consists of a rock crusher with rotary screen, two sprinkling wagons, two steam rollers, two graders, and minor implements.

The better class of work in this county is on Hurontario street, the Lake Shore road easterly from Port Credit, and on Dundas street easterly four miles from Cooksville. Stone is used largely from Hagersville quarries, while a less extent of road has been built with stone from Shaw. In Caledon township, pit gravel has been used. Near Brampton, crushed gravel from local pits has been used to some extent with fair results. Road construction is necessarily expensive in certain parts of the county, more especially Toronto and Chinguacousy townships, owing to the absence of local gravel or stone, road material being brought in by rail and teamed from the stations (as far as 5 miles in Toronto township). In general, these roads show good grading, with a decided camber. The county owns two rollers, and the rolling, while not complete, has been carried to a point that traffic has immediate use of the stone roads. The gravel roads of Caledon have not been rolled. In Albion township little road construction has as yet been undertaken other than bridges. The bridges in the county are concrete arches, concrete with flat tops, and concrete abutments with steel superstructure.

Continuous and Systematic Road Maintenance Work of the New York State Department of Highways.*

The moment a macadam roadway is finished then maintenance and repair must begin. There is practically no interregnum or period between the two. Under existing traffic, no matter how careful the construction, disintegration of a greater or less description begins with the opening of the road to traffic. To no other class of work does the overworked proverb "A stitch in times saves nine" seem to apply as truly as to road maintenance. Granting then that you should have a man immediately assigned to repair work upon the completion of the road, the first problem is as to the mileage of road which he can take care of. In New York state we have found that the average number of miles which the patrol should cover is from 5 to 7. Each patrolman furnishes a horse and cart or a one horse wagon capable of carrying a load of ½ cu. yd. of stone. In the construction of our roads we provide for maintenance stone to be left along the road at intervals of not to exceed one mile, and in quantities of about 50 yds. per mile.

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*A paper by S. Percy Hooker, Chairman Commissioners of the New York State Department of Highways, presented at the Second Annual National Good Roads Convention at St. Louis, Mo., Sept. 28-30, 1910.

What shall the patrolman upon taking over a new road just accepted and in perfect order do? This depends to a considerable extent upon the material of which the road is constructed. Assuming that the road is of water bound macadam and built of limestone and that the road has been accepted in dry weather, the tendency of traffic is to drive the screenings to the edge of the road. This is especially so where motor traffic is a large percentage of the total traffic and in New York state we find that on almost every highway this traffic is a large percentage. The patrolman's first duty should be to keep the screenings on a new road back *into* the roadway. This has been seriously criticised as exactly the wrong policy and people familiar with European roads have said that in those countries the duty of the patrol is to sweep the detritus away while we sweep back into the road. The critics have not analyzed the difference between the wear of the road material and the displacement of the material which has been placed upon it during construction. There is, of course, no excuse for sweeping the worn out material back, but the finer particles of stone are needed for cementation and in order to form this cement the particles must be kept upon the roadway. By the time the patrol has swept his road once or twice, there will probably be observed on curves of the road, and especially if the radius is less than 200 ft., a tendency to wear the inside of the curve and a partial raveling. This he should counteract by replacement of stones carefully smoothed out to meet the traffic and to prevent the wearing in of the shoulder at this point. He probably can find places where the tendency of traffic has been to run upon the shoulder and cut it up and these should be smoothed up with a road hone so to be sure that no water will stand in such ruts or work its way under the macadam. If a flat section has been used in construction the grass has probably started upon the shoulder in places, and perhaps there are points where the water from the road is held back so that it does not readily run into the ditch. These are cut back to allow full flow of the water. Unless the road has a small traffic or has been particularly well constructed there are probably points where there are incipient ruts. These should be immediately attended to by placing stone in each rut and seeing that each day they are drawn back into the ruts. Occasionally places will develop where the culverts are either too high or too low, and he should fill up on the side if the former or directly over the culvert of the latter. By this time his road should be "finding itself" and cementing into place and doubtless he will discover somewhere in it a tendency to "ravel." This must be met by the application of three-quarter stone or the splinter treatment. If he has been diligent he has found plenty to do and his road will go into its first winter in first class condition. The screenings will have been either absorbed in the road in the shape of cement, or again forced to the side of the road and the road, while comparatively bare and the top course showing, will be compact and cemented.

If his road has been of trap rock instead of limestone and the maintenance stone has been of the same material, he has probably had more difficulty in keeping it from raveling and it is rarely that at the end of the summer a trap road will look as hard and smooth as the limestone. In some instances with a trap road the patrolman has been obliged to use a gravelly sand to keep down the ravel, and in such instances probably the department has been reviled because it is permitting the use of "earth" upon a newly constructed stone road.

If the construction has been of the bituminous macadam type, and there has been incorporated in the road itself from 1¼ to 1¾ gals. of either asphaltic binder or one of the tar preparations, there is less immediate need of the patrol and in some instances we have appointed no one for the first year. If appointed, the patrolman can cover not less than nine miles and his work will be largely upon his shoulders, culverts and ditches unless the flush coat applies upon the road has softened under the heat in places which requires an immediate application of screenings to take up the excess bitumen. The bituminous products used while all passing the same chemical tests behave in actual use very differently and wherever there is a tendency to "bleed" and come to the surface, the need of a patrolman is even more urgent than on a water bound macadam. If this bitumen is allowed to come to the surface without a cover the road is destroyed very quickly by the passing of heavy loads upon iron shod tires, the asphalt adhering to the wheels and pulling with it the stone comprising the road itself.

Upon the first signs of bleeding if screenings are applied, this condition is avoided. The only failures we have noted so far in bituminous macadam road construction has come from the failure to properly screen the road under the maintenance and after completion. Taking the above as a fair treatment of macadam roads for the first year, what must be the succeeding year's treatment? I have no hesitation in saying that most roads with heavy traffic must receive a surface treatment of bituminous material. When motor traffic is light the patrol may be able to hold the road, but where it is heavy this must be supplemented by the application of an adhesive substance and a covering composed of wearing material. This application calls for more than the so-called patrol. The best way is probably either under a contract per gallon or per square yard and our experience has shown that the latter is preferable, because of the tendency on the part of the contractor to use an excess of oil when the haul is short and to use a minimum of covering. In no case would I advise the application of the oil immediately after the completion of a road nor until the period when it has fully cemented itself. This rarely occurs during the first season, and as a general rule it is better not to attempt oiling until after the road has passed through at least one winter. The effect of oil upon a road where the screenings may have fully filled the voids and yet not attained their full cementing value is to adhere to the latter and pull them from the road in a sort of cushion, and the resultant effect is a partial lubrication of the stone followed by a rapid raveling. The object to be sought is the adhesion of the bituminous material to the metal of the road, and this can be only procured by the removal of the dust and worn material upon the road. This is a difficult matter, especially upon limestone roads. The sweeping with revolving brooms drawn by horses is not sufficient and in the attempt to supplement this by further sweeping by hand brooms, there is a tendency to loosen the metal of the road itself. Where the horse sweeper has been followed by a sprinkling cart which washes the finer dust away from the stone, the result seems to have been best obtained, but this adds materially to the equipment needed and also to the cost of the preliminary work. It is absolutely indispensable, however, to remove the fine impalpable material from the stone. A coating of dust so fine as to be hardly observable will still act as effectually as a heavy blanket in preventing the adhesion of asphaltic oil or tar to the metal and where this is allowed there is sure to be a breaking away of the oil and cover from the road surface. An oil which contains too great a per cent of asphalt or bitumen is not advisable. First, because of the difficulty in applying it which we have attempted to remedy by applying it hot, and second, because in most instances it forms with the cover too hard a product and the tendency is to chip and break away from the road. An oil containing from 55 to 60 per cent of asphalt may be applied cold and seems to be the most advantageous. This may be applied by the ordinary sprinkling cart with an arrangement so that it drips in a thin sheet. The quantity used depends much upon the condition of the road. Some sections will absorb and require ½ gal. to the square yard, while others seem to have an excess if over ¼ gal. is used. I know of no way of determining in advance from any inspection, or a knowledge of the road, its condition or materials, what quantities may be required, and we have taken the general average as being about 2,750 gals. per mile. With a man of experience upon the oiler, who observes closely how the oil is acting, this will make a perfect job, though doubtless some portion of the mile will contain more than the average, and others considerably less. The cover should consist of some material which does not quickly wear out and which has sufficient dropping qualities to absorb the oil in a relatively short time.

Gravel, dustless screenings and iron ore tailings have been used and this season on account of the impossibility of procuring dustless screenings, three-quarter stone was used in many instances. The latter as the sole covering is not satisfactory. My present idea is that about 75 cu. yds. of three-quarter stone per mile and about 50 yds. of gravel or dustless screenings will make the best roadway. This is based upon the fact that 125 yds. of gravel or screenings applied alone is apt to make a covering that in wet weather assumes a muddy appearance and slides somewhat under motor traffic, while if the gravel and screenings are applied in conjunction with three-quarter stone the added stability of the latter prevents the mud even in hot weather.

The patrol finds his hands kept busy immediately after an oiling in applying more covering where it is deficient, in seeing to it that any tendency to break away from the road metalling is immediately corrected by applying more oil to the hole which begins to develop, and in bringing back to the center of the road the cover which has been pushed to the side of the road. The care put upon a freshly oiled road in the first weeks after oiling has much to do with the ultimate result and this care is the hardest to insure.

The greatest difficulty in systematic maintenance of improved roads in the state of New York lies in their isolation. The 2,300 miles of highway which is under the direct control of our Bureau of Maintenance and Repair is located in 60 counties, and is probably in not less than 400 different and detached sections. How to supervise this is a study in executive methods which has been troublesome in the extreme. We first divide the state into six sections, each in charge of a superintendent of repairs, and while these divisions are not strictly according to mileage there are approximately 400 miles of improved road in charge of each. The divisions are sub-divided into approximately sub-sections of about 100 miles each in charge of an inspector of highways, who is in direct charge of the patrolmen, approximately 20 in each sub-section and also of all repairs and oiling work other than resurfacing contracts. The latter are in charge of the division engineers of the construction contracts, and are considered for the time as being roads under construction. Much of success of maintenance must depend upon the patrolmen and it is almost impossible to see that a poor or indifferent patrol gives satisfactory results. If you obtain a patrol who is interested in his work, who sees the incipient trouble and without waiting for orders attempts to find a way to stop it, you will find a good road. If, on the contrary, the patrol waits for the arrival of the highway inspector in charge of his section for orders as to what he shall do, even though he is a willing worker, he is apt to have a bad road. The highway inspector covers each mile of his roadway at least once a week, but naturally enough he sees the larger troubles, but cannot see the beginning of trouble as the patrol should. The patrol furnishes the highway inspector each week with a record of his work by station, and the latter is able to check up as to whether the work has been done, but he is unable to anticipate what may happen during the ensuing week, and for this care he must rely upon the patrol.

The greatest difficulty of state maintenance is in supervision surveillance, and while we at present can think of no better system, we are anxious to improve. It would seem that as the highway inspector gets to know his road better, knows what has been done upon each road during a series of years that he will be better fitted to anticipate what may happen in the future, and be able to supply some of the brains to which we must now look to the patrol.

The cost of maintenance of improved highways is a most serious one. If our theories are correct as to what should be done to keep these roads in perfect condition, and nothing but perfect condition is now satisfactory to the traveling public, we must expect to expend from $300 to $400 per mile for regular maintenance and then to allow from $4,000 to $6,000 per mile for resurfacing at periods of from eight to ten years. This will make a cost of from $700 to $900 per mile, extending over a series of years. Assuming that the state of New York will have 4,000 miles of roadway within three years, this means that for maintenance alone the state must expend annually $3,000,000.

Road Administration and Maintenance.*

The present road system of France was founded by Napoleon. He caused many roads to be built throughout the empire, among which was the road through the Simplon Pass, begun in 1800 and finished in 1806. Prior to this, however, in 1775, the great French engineer, Tresaguet, published the first treatise on broken stone roads, and also devised the system of continuous repair, which is the secret of the present superiority of the French roads. Tresaguet was really the father of modern road building, his work having preceded that of Macadam and Telford by about 40 years.

We find that the foremost countries of Europe are more zealous than ever in their efforts at improving and maintaining their roads. The systems of maintenance in vogue, however, are quite varied, ranging from the extremely localized system of England to the highly centralized system prevailing in France.

In Switzerland the system of administration is of a local character, the various cantons having jurisdiction over the roads within their respective borders. An engineer with capable assistants has charge of the work in each canton. In the canton of St. Gall, which may be taken as representative, each engineer has under his control five inspectors or roadmasters, who are assigned to certain districts in the cantons. The engineers and their assistants are required to possess an academic education and a diploma from the polytechnic institute maintained by the government, while the roadmasters are required to have a good technical training.

As Germany is a confederation of states, it follows that the road administration of each state is conducted separately. The central government exercises very little control over the highways and contributes in no way to their construction or maintenance. In the kingdom of Saxony the highways are divided into state roads, county roads and private ways. The state roads comprise those which are built and maintained by the state, while the country roads are generally termed communicating roads, and are built and maintained at the expense of the parishes through which they lead. The system of road administration in Germany affords an ample midway between the extremes of localization and centralization.

The road system of England is local. The first English road law was passed in 1285. The statute labor system was inaugurated in 1555 by the passage of an act providing for the working of the roads in each parish by forced labor. In 1346 an act was passed authorizing a toll to be levied on some of the roads leading out from London, which was the beginning of the toll system; turnpikes or toll roads were not generally established throughout England until 1663, after which they gained considerable popularity for a time. In 1840 there were in England and Wales 104,772 miles of turnpike roads, and in 1871 a census showed that 5,000 persons in England and Scotland were engaged in collecting tolls. In 1878, however, parliament abolished toll roads in England and Scotland.

At the present time there are 149,759 miles of public highways in England. The annual expenditure on these roads for the years 1905 and 1906 was $78,059,000, or about $520 per mile. Most of the important roads of England are all in a high state of improvement, from which fact it would appear that this large annual expenditure is principally devoted to maintenance, and it would also seem that a system of roads which requires an annual outlay of $520 per mile must be imperfect and excessively costly. A possible explanation of this, however, is that in England the maintenance of public highways is left entirely to the local authorities. In most counties the maintenance of the highways devolves upon the urban councils in the urban districts and rural councils in the districts, the only exception being in the case of the main roads, the highways between large towns and are maintained by the county council.

In France the system of administration is very highly centralized. The basis of this system is the school of roads and bridges, which is maintained at the expense of the national government. From the graduates of this school are chosen the engineers to whom are entrusted the building and maintenance of the roads. At the head of this administrative organization is an inspector general of bridges and highways, under whom are chief engineers, in charge of the road work of single departments and communes. In charge of single districts or sub-divisions of departments are ordinary engineers and under-engineers, the latter being equivalent in rank to non-commissioned officers in the army. The sub-divisions are under the direction of principal conductors and ordinary conductors, after which come the foremen of construction gangs and, finally, the cantoniers or patrolmen, each having from four to seven kilometers of highway under his immediate care. The conductors go over the roads at regular intervals and direct the chief cantoniers; and complete reports are submitted to the central authorities, so that at any time the exact condition of the roads throughout France may be ascertained.

The work of this vast administrative organization is so perfect and well balanced that it accomplishes results with promptness and precision. It has produced for France a system of about 340,000 miles of the finest highways in the world, which are kept in a perfect state of repair, the average cost of such repair in 1904 being $243.33 per mile, as compared with $440.47 in England.

From the foregoing it is apparent that, while the units of administration in European countries range all the way from the localized system of England to the centralized system of France, skilled supervision is provided by each, as well as a sufficient revenue to permit of the execution of plans for improvement and maintenance. England is the most striking example of a localized administrative system, and it is an equally significant fact that England is also the most striking example of a lack of uniformity in road work and of excessive cost of maintenance. It is conceded by all authorities that the highway system of France is the most perfect and the most effectively and economically maintained of any in the world; and also that its system of administration is the most highly centralized of all the road systems. France, with a total mileage of about 2⅓ times that of England, expends about the same amount as England for maintenance annually, from which fact the inference is plain that centralization makes for efficiency and economy in public road administration.

In contrast to this, stand the varied systems of administration in vogue throughout the United States. In mileage we have a greater system of roads than has been possessed by any other nation since the world began. According to a road census in 1904, the length of all our roads is 2,155,000 miles, of which only about 40,000 miles are surfaced with stone and 108,000 miles with gravel, or about 5 per cent of the total is improved. According to a census of expenditures at the same time, we annually expend on this vast road system about $1.05 per capita, which for an estimated population of 90,000,000 would be about $95,000,000 per annum, while England with only 150,000 miles of road spends about seven-eighths as much.

When we undertake to locate the reason for this backwardness of the United States in road improvement we find that until recently all of the states were operating under practically the same road laws as prevailed in England when America was a colony, and at the present time about half of the states are operating under these laws. This system of road administration, like many of the other customs and laws of England, was adopted by the colonies and retained in force in every state in the union until less than a quarter of a century ago. It provided a system of taxation which permitted the taxes to be paid partly in money and partly in labor, and localized road work by vesting absolute authority over road matters in township or county officials, or both, no requirement being made to insure skill or knowledge of road building on the part of any of these officials. Practically no system of accounting in force and consequently no accurate idea may be obtained as to the application of the road tax; nor was there any such definite line of authority or of action established as would guarantee systematic and efficient conduct of the work.

In the early part of the nineteenth century many miles of turnpike roads were constructed in some sections of the country. The national government also at that time engaged in the construction of national highways, expending a total of about $14,000,000 for this purpose. The state of Kentucky also at the same time made appropriations for aiding in the building of turnpike roads, and New Hampshire has aided in this line of work ever since 1800. So, prior to the civil war some of the states took an active hand in a limited way in the construction of improved highways. After the close of the civil war, however, the situation with reference to our public roads was deplorable. The states gave no aid or attention to the subject and in fact many of them provided by constitutional amendment against aiding in any such work of internal improvement. In the south the movement of troops and heavy artillery had practically destroyed the turnpike roads built prior to 1861, and throughout the entire country the stringent financial conditions resulting from the war precluded the inauguration of any comprehensive scheme for the building and maintenance of public roads. Therefore, from 1860 to 1890 the public roads of the United States deteriorated rapidly and the system of working them reverted to the localized administration which was practiced in the earlier days of colonial and national existence. Under this system the township in the north and the county in the south formed the administrative unit, and local revenues in the form of statute labor were depended upon almost entirely for the construction and maintenance of roads.

This system has proven most prolific in recruiting the ranks of our road officials, which have swelled to 100,000. These road officials are, as a rule, lacking in the necessary skill and experience for the proper execution of the work of road improvement and maintenance. This is the age of consolidation and organization. Industrial companies merge their interests and thereby cut operating expenses, and from playing at cross purposes they thus put forth a united effort to attain a common end, and the results are more efficient management and increased dividends for the stockholders. In every business enterprise and in every well-directed public undertaking some measure of skill and experience is required of those who have charge of the prosecution of such enterprises. Our road work should be organized on the principle of consolidation with the view to procuring the administration of road affairs at the maximum of efficiency and the minimum of cost. A strong central organization should exist in each state to mold and shape the more or less disconcerted efforts of road officials and supervise the highway work throughout the state. The necessity for this is all the more apparent when we consider the fact that we are annually selecting 100,000 men to expend about $95,000,000 upon our $2,155,000 miles of public roads, no requirement being made of these officials as to their technical training or fitness for the work which they are to do. Some of these road officials, of course, are competent and efficient, and I do not mean to reflect upon these, nor upon any of the men appointed to a position as a road official, but it is the system to which my criticisms are directed, and this system must be reformed before any great progress may be expected in the improvement of the roads throughout the various states.

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*From an address by Logan Waller P[illegible]rector U. S. Office of Public Roads [illegible] Second National Good Roads Convention, St. Lou[illegible] Sept. 30, 1910.

Within the past 20 years a little more than half of the states have gradually broken away from this antiquated system. There had been a growing sentiment in favor of the more highly centralized system of administration, and this sentiment found tangible expression in the law passed by the legislature of the state of New Jersey in 1891, providing an annual appropriation of $75,000 from the state, to be expended in co-operation with the counties in the construction of improved highways. Since that time thirty-three states have adopted the state-aid system in some form or other and are rapidly reforming their systems of administration and the condition of their highways. Under the state-aid system road work is centralized under a state highway department, which insures uniformity and economy in administration. In some few of the states the work of the highway department is purely educational and investigative, with a view to ultimately giving these departments administrative powers. Also some of the states, notably Kansas and Missouri, have provided for skilled supervision in the counties through the appointment of county highway engineers; and in most of these states aid is given by appropriations from the state treasuries, or the labor of the state convict force is given towards carrying on road work throughout the state.

New York has gone a step further than any of the other states in reforming and centralizing the methods of administering its road affairs. Under the present law, the state highway commission has supervision, either directly or indirectly, over every mile of public highway in the state. The state is divided into six districts, each in charge of a division engineer, whose duties relate solely to the maintenance of state and county roads, they having no connection with the town highways.

The funds for these latter highways, although expended locally, are under the direction of an official of the state highway department. The improvement of the state and county highways is carried on wholly by contract, the highway commission preparing the plans, specifications and estimates, which, in the case of the county roads, are submitted to the board of supervisors of the respective counties for final approval. The state highway commission accepts or rejects the improvement when finally completed. The maintenance of the state and county roads is under the direction of the first deputy of the commission.

One of the most striking features of the work of the New York state highway department is the patrol system, with the constant supervision of each mile of completed highway. Under this system each patrolman has under his supervision approximately eight or ten miles of highway and reports directly to the engineer in charge of the section and also to the deputy at the main office. In essential features, this patrol system is very similar to that prevailing in France.

It is thus seen that New York has taken a great step forward in road maintenance, and right here I desire to lay particular stress on the necessity for maintaining the roads after they are built. A careful examination of the highway laws enacted for the last 20 years fails to reveal any adequate provision for maintenance, although large sums are appropriated for construction. An erroneous impression seems to prevail that when a so-called permanent road is constructed, it is there for all time without any further attention, and that practically all of the expense has been met in the first cost of construction. This is a very great mistake, for the best of roads will soon go to pieces under the action of traffic and weather conditions, unless properly and continuously maintained. This fact is clearly demonstrated by the attention required and the money expended for maintaining roads in the leading European countries. As already stated, the annual cost of maintaining the main and urban roads in England and Wales in 1905 and 1906 was $550.47 per mile, and the cost of maintaining all roads in France in 1904 was $243.33 per mile. In comparison with this, we have our annual expenditure of about $80,000,000, or $38 per mile, to meet all new construction work, bridge building and maintenance.

It is evident, therefore, that our road revenues are inadequate and that the general system of administration and maintenance throughout the country is inefficient. From this it follows that the fundamental reforms necessary to insure the ultimate improvement of our public roads must be along these lines; we must have more money for building new roads and provision must also be made for a definite and ample maintenance fund, together with a system of administration requiring competent and skilled supervision and immediate and continuous repair.

WATER-WORKS AND SEWERS SECTION

Some Costs of Washing Filter Sand, Using a Nichols Separator.

The following are the costs of washing all the sand in four of the slow sand filter beds of the Albany, N. Y., water purification plant. The beds had been in operation continuously for ten years, and the sand had become more or less segregated and had secured a gradual accumulation of pure clay and other particles which were not retained on the surface. More or less compacting of the sand had also occurred. The work of washing was begun with a box washer, but this, for various reasons, proved so slow and expensive that two Nichols separators were purchased for $1,550 and substituted for the earlier method. The filters cleaned were Nos. 1, 3, 6 and 7, and the Nichols washers were used for all but a portion of the washing on No. 7. The following are the figures as given in the report for 1909 of H. J. Deutschbein, Superintendent Bureau of Water, Albany, N. Y.:

Filter No. 7.—Commenced cleaning June 1, 1909. Finished cleaning July 31, 1909. Cleaned and replaced by box sand washer, 2,808 cu. yds. Cost of labor, $1,147.28. Cost per cubic yard, 40.9 cts.

Cleaned and replaced by Nichols sand separators, 1,558 cubic yds. Cost of labor, $352.30. Cost per cubic yard, 22.6 cts.

Filter No. 3.—Commenced cleaning Aug. 5, 1909. Finished cleaning Aug. 19, 1909 Cleaned entirely by Nichols separators.

Worked 24 hours a day in three 8-hour shifts. Cleaned and replaced 3,213 cu. yds. Labor cost, $723.10. Cost per cubic yard, 22.5 cts.

Filter No. 6.—Commenced cleaning Aug. 14, 1909. Finished cleaning Sept. 8, 1909. Cleaned entirely by Nichols separators. Worked 24 hours a day in three 8-hour shifts. Cleaned and replaced 3,230 cu. yds. Labor cost, $696.74. Cost per cubic yard, 21.57 cts.

Filter No. 1.—Commenced cleaning Sept. 10, 1909. Finished cleaning Sept. 25, 1909. Cleaned entirely by Nichols separators. Worked 24 hours a day in three 8-hour shifts. Cleaned and replaced 3,325 cu. yds. Labor cost, $711.40. Cost per cubic yard, 21.39 cts.

The following is a record of 24 hours' work in Filter No. 3; water pressure 65 lbs. per sq. in.; water used, 47,080 cu. ft., or 1,744 cu. yds., which for a total of 225 cu. yds. of sand washed was a rate of say 7¾ cu. yds. of water per cubic yard of sand. The amount of sand lost was 3 cu. yds., or 1.33 per cent. The cost was as follows:

24 hrs. foreman at 31¼ cts.	$ 7.50
192 hrs. labor at 22½ cts.	43.20
Total	$50.70

This gives for 225 cu. yds. a cost of 22.53 cts. per cu. yd.

Notes on Methods of Cleaning Water Mains by Scraping.*

The removal of the incrustation is generally done in either of two ways—by hand or by pressure of the water. When done by hand the work is of a simple nature. The sizes usually scraped by hand are 3-in., 4-in. and 5-in. diameters. The main in any street being set off for scraping, a full length of pipe is laid bare at a point, say, 50 to 60 yards from the commanding valve at the end of street. The pipe is then neatly cut in two places, dropping out 4 ft. 6 in. to 5 ft. length from the middle of it, and the scraper is inserted in each direction on the end of stout cane rods and gently plunged forward. During operations the water is allowed to run freely from the pipe, the washings being pumped to the surface by a small diaphragm pump. It is advisable, if the deposit is heavy, to augment the flow from pipe by a periodical dash with valve full open for a few seconds, and similarly on completion—in this way it is quite easy to scrape 100 to 125 yards of main, provided the water circulates from both ends to aid clearing. The scraping done, the piece is inserted again with the aid of two collars, the water being unavailable for use in the street for, say, four hours. This work costs 2½d. to 3d. per yard for 3-in., including all labor and materials—it would be safe to say 4-in. costs 4d. and 5-in. 4½d. per yard. The scraper used is a round bar with a chisel point made to fit the circumference of the pipe—a bow spring being fitted on one side—or a "Rastrick" scraper may be used. It consists of a ¾-in. round bar center, on which is fitted a ⅜-in. diamond shaped spring-steel coil, usually ⅜ in. smaller than bore of pipe. The method of attaching a chain to scraper and drawing it by windlass or horse-power necessitates two openings on the main, and is not to be recommended for many reasons.

Scraping of mains where the scraper is driven by the presence of the water is a work for which few golden rules can be laid down. One at least may be ventured, and that is, it will be found advantageous to spend two days in preparation for two hours' work, rather than find two or more days' work after two hours' preparation. The degree of success to be attained will depend upon the correctness of the judgment displayed—a close study and a keen appreciation of the difficulties to be encountered will invariably be repaid by good results. Next in importance is an intelligent, willing and trustworthy staff of men, with their minds on the work, without which it is impossible to proceed.

The positions to be given to the necessary hatch-boxes is a matter of vital importance, as on them depends the amount of head available for starting and the length of section to be scraped—both of which will be governed by the size of main and the nature and amount of the deposit to be removed.

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*A paper by M. Sellars, Town Supervisor, Dundalk, before the Institution of Municipal and County Engineers, Dublin meeting.

The scraper referred to in this paper is that made by the Glenfield Company, as improved by Mr. Kennedy. The setting of the blades to any size required is an important, yet a simple, matter. This scraper has been further improved of late by the addition of a second swivel-joint between the sets of knives, making the travel round bends a matter of less anxiety. The amount of freedom left in the radial cuts in the leads and leathers of the piston heads is not capable of adjustment, except by the insertion of some hay made in the form of a Rugby football of twisted rope well sewn with twine—the sewings to be done in the direction of the length of ball.

A word on the amount of head required may not be out of place. Mr. John Barr, of Kilmarnock, in a very admirable paper on the subject read before the Institution of Engineers and Shipbuilders of Scotland in 1897, gives the head necessary to drive a 5-in. scraper as 60 ft. The writer has seen a 4-in. scraper floated with less than 20 ft. in a new, clean pipe, but if work is to be done it is advisable to have much more, say an available static pressure to start with of 80 ft. to 150 ft. for sizes varying from 12 in. to 5 in., carrying a reasonable amount of incrustation, and having the length of sections suitably arranged. Smaller pipes require a larger head owing to their greater amount of perimeter in comparison to the area—the frictional loss will be greater—and the deposit carried in front of the scraper will be more confined, taking more pressure to press it forward, or, which is the equivalent, more water will be required to pass the scraper for clearing purposes.

It is possible to make a rough estimate of the head necessary in any size, and success will be attained provided the incrustation is found to be uniform; but it is advisable to have a safe margin of pressure available over and above to overcome obstructions beyond the usual, so that the scraper may be kept on the move.

The proper rate at which to drive a scraper would appear to be 4 miles per hour, at which rate its sound is easy to follow. Jerky scraping will be avoided which so often means burst pipes, and if stones be carried forward the pace will not hurt the pipes unless they are caught in the blades.

One of the most difficult conditions to obtain is that of maintaining a uniform pressure behind the scraper during the drive, or it may be expressed in another way, that of regulating the scraper to offer a uniform resistance to the pressure of the water. This can best be accomplished in the fitting of the hay ball, which regulates the necessary leak past the scraper to wash forward the broken-up nodules in front. After the drive the hay will be found to be flattened at the "poles," its brittleness will have disappeared, it will be worn to the necessary degree as it travels, allowing more water to pass as the accumulation increases; but if it loses somewhat in bulk of hay it grows dense as it gathers the fine rust particles, and generally acts as a brush. The ball is not, however, tied to the scraper.

It will be seen the further the scraper goes the more work it has to do, while the pressure becomes less owing to frictional loss.

The amount of necessary preparation already spoken of will depend on the work to be done, whether it be scraping a long line of leading main through a country district, a distribution pipe in a street, or testing a new pipe for obstruction or its full waterway. The uncertainty of the work demands that tools for almost any emergency should be at hand. Scraping, for many obvious reasons, is best done at night—full available pressure will be secured, also quietness if the main be in a road, and other distractions will generally be at the minimum.

It is usual to empty the main in front of the scraper immediately before starting, although, in rare cases, such as on long, steep inclines, it may steady the passage of scraper to have the main full and to allow the water to waste at the forward end; in any case incrustation is more easily removed when it is wet.

Scraping distribution mains through streets is by far the most trying work, as the main may be the only one serving a district, and water for the succeeding day must be provided at all costs. Too much attention cannot be given to the shutting and opening of valves on the line or branches off it. The number of turns in each should be carefully counted—this clearly demands the personal attention of the one in command.

Closing down all house services before the main is emptied will repay for the trouble; these should be opened when the scraping is done, and before the main is recharged, to ensure the connections being cleared of *debris* by the amount of water lying in the house services. The pressure before starting should be ascertained, as also the delivery from the nearest hydrant, by means of a hydrant flow gage. A pressure gage direct on the hatch-box at the driving end is indispensable, and is undoubtedly the truest indicator. This should be kept open during the drive and the variations carefully noted. In recent work carried out by the writer on 7-in. and 8-in. mains, where the static pressure before starting registered 130 ft., the hatch-box gage showed a pressure of 20 ft., varying to 40 ft. during the drive. Standpipes fitted to hydrants on the line, and left open to exhaust the compressed air until the scraper is within a short distance of them will materially aid the safe passage of the scraper.

"There is nothing new under the sun except in pipe scraping" is the pipe-scraper's motto. The unexpected invariably happens. The writer has experience of a scraper which went gaily up the hills and stuck several times on the down grades in the one drive. While the writer has had practical proof of the desirability of passing a scraper through a new pipe, he is strongly of the opinion that the scraper designed to remove incrustation is far from being the ideal design to prove the full waterway of a new pipe. The stones, gravel and wood usually found in a new pipe are things easily held by the knives of the scraper, and the result will be the scraping and tearing of the fresh coating. The cost of scraping will be governed by the trouble met with, 1⅞d. to 3d., and a short length at 6d., per yard, is the writer's experience.

Adaptability and Limitations of Hypochlorite Treatment of Public Water Supplies.*

The use of hypochlorites for sterilization purposes has now reached a stage where its field of usefulness in the destruction of objectionable bacterial life in public water supplies, filtered or unfiltered, is well understood. Until the fall of 1908, the data were scarce and more or less indefinite as regards practical application, but since that time enough history has been made to allow of the statement that a new epoch in the art of water purification has been ushered in; one which is revolutionary in character and which will always remain one of the most striking developments in the art of water purification.

The practical merits of filtration in minimizing water-borne diseases have been widely recognized and accepted for less than 20 years. The writings of antiquity disclose strikingly few references to the filtration of water for the purpose of rendering it more pure and safe for human consumption, probably the earliest reference being that which appeared in the Ousruta Sanghita, a collection of medical lore written in Sanskrit probably some 4,000 years ago. In a letter to the British Journal of Preventive Medicine, Mr. Francis E. Place, B. Sc., of Jaipur, Rajputana, India, calls attention to this reference, in which the following appears: "It is good to keep water in copper vessels, to expose it to sunlight and filter through charcoal."

As late as 1892, the efficiency of slow-sand filters was seriously questioned by a large number of medical authorities and engineers. Their arguments against filtration were very largely based upon such occurrences as the outbreak of typhoid fever in that portion of Berlin, Germany, which was supplied with filtered water from the old Stralau works. Many prominent sanitarians did not hesitate to express the conviction that filtration of impure water for municipal use was an ineffective safeguard against water-borne diseases, and altogether improper, and that public water supplies should be drawn only from pure mountain streams and ground waters. The abandonment of filtered Thames River water in favor of water from mountain streams was strongly advocated for London, and the current literature of that day on the subject showed a clear over-balancing tendency against filtration as a general proposition.

In marked contrast to the slow development of the art of water purification up to 1890 or thereabouts, is the remarkable progress in this line of municipal sanitation during the past 20 years. In 1890 less than 200,000 people in this country were being supplied with filtered water, and 90 per cent of this water came from rapid-sand filters which bore little resemblance to filters of this type built during the last ten years. In 1900 the number of people supplied with filtered water had increased to 1,860,000, and in 1904 to 3,160,000. At the present time nearly 8,000,000 people, or over 22 per cent of the urban population of continental United States, are being supplied with filtered water.

Limitations of Filtration Processes.—When the first municipal filter was built at London, England, in 1829, the only office it was expected to perform was that of a mechanical strainer in removing turbidity from the water, for the germ theory of disease had not been advanced up to that time. It was not until 1849 that this theory assumed definite proportions during the severe cholera epidemic of that year. With the recognition of the germ theory of disease came the realization that polluted water, when passed through beds of sand, was made more safe for human consumption. This, however, was not widely recognized, as before stated, and in the late eighties the art of water filtration for municipalities was on a very insecure and uncertain footing. The striking results obtained at Altona, Germany, during the cholera epidemic at Hamburg in 1892, did more than anything else to convince the sanitary world and the public in general that filtration of polluted waters was deserved of the most serious consideration in connection with efforts to minimize the death rate from water-borne diseases. The splendid work of the Altona filters during the Hamburg cholera epidemic is too well known to require repetition here.

About the time of this epidemic the Massachusetts State Board of Health, as a result of the information accumulated during the early years of the work at Lawrence, arrived at the conclusion that the purification of waters as highly polluted with sewage as those of the Merrimac River could be successfully accomplished at a reasonable cost. Cholera appeared in New York harbor in the same year, probably emanating from Hamburg, and its appearance caused the city officials of Lawrence to decide upon the construction of a slow-sand filtration plant, thereby taking a step which was to prove to be the opening of an era of practical accomplishments in the field of water filtration in America. It must also be pointed out that sand filter plants were built at Poughkeepsie and Hudson, N. Y., under the direction of Mr. James Kirkwood as early as 1874.

It is probable that the most sanguine advocates of water filtration have never firmly believed that filtration of polluted water, even when carried out with the greatest care, will render it entirely free of bacteria at all times, or do more than greatly minimize the danger from drinking such water.

The hygienic efficiency of filter plants is usually stated on a basis of the percentage removal of bacterial life from the unfiltered water. Ordinarily such removal amounts to 90 per cent and over, and it is clear that the danger in drinking polluted water is minimized in proportion to the removal of bacterial life. Filters will not remove all bacteria, and probably a fair statement of the safety of a filtered water for drinking purposes would be to say that, other things being equal, it will to a considerable extent vary with the quality of the unfiltered water. In other words, a water which is primarily but slightly polluted, after filtration will be potentially less dangerous to public health than one which is initially foully impure.

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*A paper by George A. Johnson, New York, before the Milwaukee Convention of the American Public Health Association.

Regardless of the initial impurity of a water, efforts have always been directed toward keeping as low as possible at all times the numbers of bacteria in the filtered water. In Germany the effort has been made to set and maintain a standard of purity for filtered waters of 100 bacteria per cubic centimeter, and when the filtered water contained a higher number than this the filter was to be judged inefficient and was to be shut down and cleaned. The results of the practical operation of large filtration works in this country and abroad show clearly that it is not possible at all times to live up to such a standard as this, and there will be times with practically all filters when the number of bacteria in the filtered water will amount to several hundred per cubic centimeter.

Filtration of impure waters has undoubtedly been instrumental in reducing by about 75 per cent, as an average proposition, the typhoid death rate in cities in this country using filtered water. It is by no means uncertain that there is also brought about by filtration a very material reduction in the death rate due to other diseases than typhoid fever, substantiating the theorem of Hazen.

By filtration water may be made at all times clear and free from turbidity and color, and substantially free from bacterial life. In the last two years the practical adaptability of hypochlorites in rendering filtered waters practically sterile, and, for that matter, unfiltered waters, has been clearly demonstrated. The hypochlorite treatment would therefore appear to be a finishing touch in the art of water purification, and to make available an exceedingly economical and harmless means of removing virtually the last fraction of potential danger from drinking water, whether initially impure or merely under suspicion at times.

Historical Résumé of Hypochlorite Treatment.—The use of hypochlorites for the destruction of objectionable bacteria in water and in sewage has been a matter of considerable active investigation on a small scale for some 20 years, although it was studied in connection with the deodorization of the London sewage, as reported upon in 1861 by the Royal Commission on Sewage Disposal. The investigators who have studied the action of hypochlorites on bacteria are numerous, and include such well-known workers as Ballner, Barsenge, Clark, Deiter, Dibden, Digby, Dunbar, Elsner, Fermi, Fowler, Gage, Houston, Hunermann, Kaufmann, Kellermann, Kimberly, König, Korn, Kranepuhl, Kurpjuweit, Lodi, McGowan, McLintock, Nissen, Phelps, Pratt, Proskauer, Remele, Rideal, Schumacher, Schwartz, Shenton, Sickenberger, Traube, Webster, Woolf, Zirn, and others.

The late Thomas M. Drown observed that the American Public Health Association recognized the value of hypochlorites as early as 1888, and the experience and results obtained at Maidstone, England, in 1897, and at Lincoln, England, in 1904, are too well known to require repetition. The use of hypochlorites at Worthing, England; Middlekerke, Belgium; Nice, France; Poplar, England; Havana, Cuba; Vera Cruz, Mexico; Brewsters, N. Y.; Red Bank, N. J.; Baltimore, Md.; Union Stock Yards, Chicago, Ill.; Boonton, N. J., and numerous other places, has supplied valuable information which has in all ways confirmed the earlier favorable ideas of the applicability of these compounds for general sterilizing and odorizing purposes.

Up to 1908 the use of hypochlorites in the purification of public water supplies had not received serious consideration. Most of the information then available was fragmentary and more or less indefinite in character, and the process had not gained general credence. The first demonstration in this country on a practical scale of the usefulness of hypochlorites in connection with water purification was made at the filter plant of the Chicago Stock Yards, on the recommendation and under the direction of the writer, in the fall of 1908. Following directly on the heels of the spectacular results obtained at Chicago, came the adoption of this process for the sterilization at Boonton, N. J., of the impounded and unfiltered water supply of Jersey City, with which the writer was also connected. The results obtained at these two places were given wide publicity, and almost immediately the use of hypochlorites, either intermittently or continuously, spread throughout the United States. Among its users at this time are many of the largest cities of North America, including Brooklyn and New York, N. Y.; Cincinnati and Columbus, Ohio; Harrisburg, Philadelphia and Pittsburg, Pa.; Hartford, Conn.; Montreal, P. Q.; Nashville, Tenn., and St. Louis, Mo.

The Jersey City Case.—Probably the most complete line of information regarding the chemistry of this process was secured during the litigation between Jersey City, N. J., and the Jersey City Water Supply Co., which water company was one of the first to make continuous use of hypochlorites as a germicide, as above stated. After the sterilization plant of the Jersey City Water Supply Co. had been in practical operation for several months, during which the quantity of water treated amounted to over 40,000,000 gals. daily, extended testimony was taken in the Court of Chancery before Special Master ex-Chancellor Magie, the testimony being given by Prof. H. B. Cornwall, of Princeton University; J. A. De Chuce, New York City; J. W. Ellms, Cincinnati Filtration Works; George W. Fuller and Rudolph Hering, of New York City; C. E. Garside, New York City; X. H. Goodnough, Boston, Mass.; Prof. G. A. Heulett, of Princeton University; N. S. Hill, New York City; Daniel D. Jackson, Brooklyn, N. Y.; Prof. Leonard P. Kinnicutt, Worcester Polytechnic Institute; Dr. John L. Leal, Paterson, N. J.; Dr. Ernst J. Lederle, New York City; Dr. George E. McLaughlin, of Christ Hospital, Jersey City, N. J.; Prof. William P. Mason, of the Rensselaer Polytechnic Institute; Dr. Charles E. North, of New York City; Prof. William H. Park, of Bellevue Hospital and New York Research Laboratory; Prof. E. B. Phelps, New York City; the late Prof. Franklin C. Robinson, of Bowdoin College; Prof. Wm. T. Sedgwick, of the Massachusetts Institute of Technology; Prof. F. F. Wesbrook, of the University of Minnesota; George C. Whipple, of New York City; Prof. C. E. A. Winslow, of the Massachusetts Institute of Technology, and others.

In his opinion, rendered in May, 1910, and based upon the testimony given by the foregoing witnesses, ex-Chancellor Magie made the following statements:

"From the proofs taken before me, of the constant observations of the effect of this device, I am of opionion and find that it is an effective process which destroys in the water the germs, the presence of which is deemed to indicate danger, including the pathogenic germs, so that the water after this treatment attains a purity much beyond that attained in water supplies of other municipalities. The reduction and practical elimination of such germs from the water was shown to be substantially continuous.

"Upon the proofs before me, I also find that the solution described leaves no deleterious substances in the water. It does produce a slight increase of hardness, but the increase is so slight as in my judgment to be negligible.

"I do therefore find and report that this device is capable of rendering the water delivered to Jersey City pure and wholesome, for the purposes for which it is intended, and is effective in removing from the water those dangerous germs which were deemed by the decree to possibly exist therein at certain times."

The Chemical Nature of the Process.—Much has already been written about the chemistry of the process of hypochlorite treatment in the sterilization of water, but it may be that a condensed statement at this time and in this connection may not be out of place.

Hypochlorite of lime, commercially known as "chloride of lime," or "bleaching powder," has been and is extensively used for bleaching purposes in paper mills and many textile industries. It is sold in the form of a dry white powder and is usually shipped in wooden or sheet-iron containers of a capacity ranging from 100 to 750 lbs. each. It is manufactured at numerous places in this country, as well as abroad, and its cost in large quantities is about 1⅓ cents per pound at the works. When exposed to air the powder deteriorates in strength quite rapidly, due to the absorption of moisture and carbonic acid. It is usually bought on the basis of its strength in so-called "available chlorine." The product in this country usually runs about 35 per cent pure, according to this standard.

When the hypochlorite in the powder form is dissolved in water containing carbonic acid, hypochlorous acid is liberated. This acid is a powerful oxidizing agent and in the presence of organic matter gives up oxygen in an atomic state with an amount of energy which makes this chemical as an oxidizing and sterilizing agent approach ozone in intensity of action. It is generally considered to be superior to ozone on practical grounds, for the reason that it is more easily applied and brought in contact with all parts of the water to be treated in a speedy and thorough manner, which appears not now possible in the case of ozone. There seems to be no doubt, also, that it always is materially cheaper than ozone.

The chemical itself, as bought, is a mixed salt consisting of approximately equal amounts of calcium chloride and calcium hypochlorite. When the powder is added to water the calcium chloride remains inert, but the calcium hypochlorite, being acted upon by the free and half-bound carbonic acid in water, splits up into calcium carbonate and hypochlorous acid. The decomposition of the exceedingly unstable hypochlorous acid liberates oxygen in a very active state and leaves hypochloric acid. The latter then drives off the weaker carbonic acid and unites with the calcium, forming calcium chloride. It is the liberation of oxygen in this manner that effects by oxidation the destruction of bacterial life.

The general result following the application of hypochlorite of lime to water is the destruction of the majority of the non-spore-bearing forms of bacterial life which the water may contain, a reduction in the organic color of the water, an oxidation of the organic matter proportional to the amount of the chemical applied, and a slight increase in the total hardness and total solid matter of the water. Where quantities no greater than from 5 to 15 lbs. of the powder are applied to each million gallons of water, as is the common practice, the changes in the physical and chemical characteristics of the water before and after treatment are so slight as to be barely noticeable, and are well within the limits of accuracy of the prevailing methods of analysis. The important result and greatest change is the virtual destruction of the bacterial life in the water, more particularly the germs of disease-producing origin. Included in this group are the germs of Asiatic cholera and typhoid fever.

Hypochlorite of Soda.—There is another method of obtaining hypochlorites; namely, through the electrolysis of solutions of common table salt whereby hypochlorite of soda is produced. Careful study of the relative efficiency of hypochlorite of lime obtained from bleaching powder, and hypochlorite of soda electrolytically produced from common table salt, shows that, unit for unit, hypochlorite of soda is slightly more efficient than hypochlorite of lime in the destruction of bacterial life. The process of manufacture of hypochlorite of soda is not so well understood from a chemical standpoint, however, but it appears certain that where electric current can be obtained for 1½ cents or less per kilowatt-hour, and salt for ⅓ cent per pound or less, it will prove to be a cheaper germicidal agent than hypochlorite of lime. Furthermore, its use, in some cases, may be preferable to hypochlorite of lime, because of the esthetic objections sometimes raised against the use of bleaching powder which, in the case of the electrolytic solution, should be entirely overcome. It is understood that at the water purification works of the city of Cincinnati, preparations are now being made to install electrolytic cells wherein hypochlorite of soda will be manufactured and substituted for the hypochlorite of lime used in the past.

Absence of Poisonous Features.—It has been asserted by some that free chlorine is liberated from the bleaching powder as applied to water, and that it may persist in water so treated for some time. In this connection it may be well to point out that the term "available chlorine" is a term of convenience used by the analyst to express the strength of the bleaching powder or the electrolytically prepared solution of hypochlorite of soda. This term was adopted by industrial chemists for the reason that in bleaching opperations at some places the commercial product is treated with strong acids which can break up the chemical and release free chlorine. It is a perfectly clear proposition that if free chlorine could be released from bleaching powder when applied to water, such free chlorine would immediately combine with the hydrogen of the water and from hydrochloric acid, at the same time liberating free oxygen in an atomic state. The end result, therefore, would be the same.

There is plenty of evidence of a conclusive character to show that the weak carbonic acid as found in natural waters, is incapable of releasing appreciable or even measurable quantities of free chlorine from bleaching powder. Instead of this hypochlorous acid is produced, and hypochlorous acid is not a poison. Upon its decomposition with organic matter, the chlorine which the hypochlorous acid contains combines with the alkalinity of the water and forms calcium chloride. No free chlorine within the limits of measurement of laboratory methods is found in the application of this chemical to an ordinary water supply. Efforts have been made in the past by those who did not favor the process to locate a toxicologist who would classify this treatment as a poisonous one, but such efforts have been unavailing

In the Jersey City case Prof. G. A. Heulett testified that in his examination of the Jersey City water to which had been added 10 lbs. per million gallons of bleaching powder, he was unable to determine the presence of free chlorine. It is a fact that there has been no chemical test yet devised which is capable of identifying the presence of free chlorine in an alkaline solution such as water is. Prof. Heulett stated, however, giving all possible benefit of the doubt to the plaintiff in the case, that if 10 lbs. of bleaching powder per million gallons were added to the Jersey City water, basing his assumption upon the thory of electrolytic dissociation, ti was theoretically possible for there to be present in the water after treatment free chlorine to the extent of 6.4 parts in a trillion parts of water. He admitted that he was unable to prove this assumption. It was furthermore pointed out in this case that if Prof. Heulett's theory was correct, in order for an adult to obtain a medicinal dose of free chlorine, such as has been administered in cases of typhoid fever as an inti-ferment and germicide, it would be necessary for such a person to drink a gallon of water so treated each day for 7,180 years.

Preparation of Hypochlorite Solutions.—It is the more common practice to make up hypochlorite solutions of ½ per cent strength; that is, 1 lb. of the bleaching powder to 200 lbs. of water. It is probable that solutions as strong as 4 or 5 per cent may be made without material loss of oxidizing power. But the more dilute the solutions are the more easy they are to work with, because of the deposits of quicklime formed in orifices and in pipes. At this place it is well to point out that where electrolytically produced solutions of hypochlorite of soda are used no trouble is had on account of deposits of sludge as is the case with hypochlorite of lime. This is another feature of no little importance in favor of the use of hypochlorite of soda.

As to material for solution tanks, concrete appears to be the most suitable. Iron tanks may be used, but they are attacked by the chemical and eaten through eventually, although they last a long time owing to the protection afforded by deposits of lime upon the exposed surfaces. Black iron pipes have lasted for over two years at the Boonton plant, and special bronze pumps have lasted well at a number of places. Wooden tanks are the least suitable of all, but of these, cypress seems to be the best material. White pine is reduced to a pulp in a comparatively short space of time.

When solutions of bleaching powder are used it is essential that the contents of the tank be thoroughly stirred in the beginning in order to get into solution all of the soluble portion of the powder. Afterwards stirring is of convenience in keeping the sludge well distributed, otherwise it gets bothersome as the last portion of the solution is removed from the tank. Tanks 10 or 12 ft. deep, containing a ½ per cent solution of bleaching powder, or hypochlorite of lime will show a deposit of lime sludge about 1 in. thick. This sludge contains about as much of the active agent as the ½ per cent solution does, and care should be taken in its disposal, otherwise it will cause trouble with fish.

Solutions deteriorate but little upon standing in covered tanks that are constantly stirred; perhaps some 2 per cent in a day or two.

Quite recently considerable attention has been given to the feasibility of applying the bleaching powder in dry form. If appliances can be devised that will allow of the addition to water of a suitable quantity uniformly at all times and do it in a more or less automatic manner, there is no reason to suppose that hypochlorite applied in the form of powder will not act as satisfactorily as in the form of a solution, provided there are afforded adequate facilities for complete mixing of the dry powder with the water to which it is applied. Hypochlorite of lime absorbs moisture rapidly, and this is probably a point which will be most difficult to overcome where the application is in the dry form, as the powder will tend to lump and grow pasty with time.

Period of Contact.—All of the available data indicate clearly that the germicidal action of hypochlorites is exceedingly rapid. This is due, of course, to the fact that atomic oxygen is released promptly when the chemical is applied to the water.

As a general proposition it is thought advisable to provide for a period of contact of at least one hour before the treated water is delivered to the consumer. In some cases even shorter periods have given satisfactory results. Such periods of contact are naturally provided in some cases by long pipe lines or distributing reservoirs between the point of application of the hypochlorites and the nearest consumer. It is also highly important that the chemical be quickly and thoroughly mixed with the water and this is usually effected by mechanical stirrers or baffling arrangements.

Amount of Chemical to Be Used and Best Point of Application.—The best point of application of hypochlorite to a water depends largely upon the conditions surrounding each individual problem. As a general proposition, as before stated, from 5 to 15 lbs. of the powder per million gallons of water are required to effect practical sterilization of filtered or unfiltered waters which contain normal amounts of organic matter. If the water contains abnormal amounts of organic matter, or iron in an incompletely oxidized state, considerably larger quantities of the germicide are required to obtain the best results. Each individual problem must be studied by itself and the correct dose of the germicide ascertained in the beginning.

The earliest studies with hypochlorites were directed at the total elimination of bacterial life. This is not considered necessary in the sterilization of water. The principal object is to destroy all disease-producing germs, such as those of typhoid fever, if such germs are present. This can be done without effecting the complete destruction of all bacterial life in the water, for the reason that the typhoid bacillus, as well as the colon bacillus, is less hardy than most forms of bacterial life which naturally predominate in water, and which are known to be non-pathogenic. Their removal, therefore, is not a matter of consequence as regards the sanitary quality of the water.

It is known that hypochlorite has a selective action upon such germs as the bacillus of typhoid fever and coli, and owing to their less resistant state in water, destroys them more quickly and completely than it does some of the harmless forms of bacteria common to water. It is not unusual to find that such bacteria as resist the hypochlorite treatment are spore formers and other hardy forms of non-pathogenic water bacteria.

In gauging the amount of hypochlorite to be added to a given water, the water must first be carefully studied in connection with the germicidal treatment, and the quantity of the chemical which gives satisfactory results under normal conditions ascertained as nearly as possible. When this is found it is the quite common practice to increase this quantity some 25 or 50 per cent in order to guard against sudden fluctuations in the quality of the untreated water which may increase its power of absorption of the hypochlorite. Where the germicide is added to a filtered water, such fluctuations are much less marked.

Precautions Against Under- and Over-Dosing.—It can be readily understood that if too little of the germicide is used there may result an unwarranted feeling of security, for the reason that for months on end the results may be thoroughly satisfactory with a given quantity of chemical applied and then, owing to a sudden change in the character of the water, unsatisfactory results may be obtained. For this reason it is always better to use more of the chemical constantly than is actually required under normal conditions.

Over-dosing, on the other hand, is quite as undesirable. If the attempt is made to effect complete sterilization of the water rather than to aim at the destruction of the pathogenic bacteria, then there is a strong probability that at times there will be imparted to the water an undesirable taste or odor which has been variously termed by laymen as similar to carbolic acid or iodoform. It is not believed that within working limits the presence of an excess of this chemical in the water is deleterious to health, but it is objectionable to the senses and is, therefore, inadmissible. There is no excuse for such over-dosing, for when the quantity of chemical required under normal conditions is once ascertained, by making use of a moderate excess over and above this quantity a sufficient margin of safety has been provided under all ordinary conditions.

Advantages of the Process.—Reciting the practical status of the use of hypochlorites in connection with the purification of water, it may be stated that the advantages of the process are as follows:

1. Substantially complete destruction of objectionable bacteria, particularly those of intestinal origin.
2. Reliability and ease of application of the chemical, together with the small variation in the required dose.
3. Total absence of poisonous features, either in the chemical product as applied to the water or in any of its resulting decomposition products.
4. Merely nominal cost of the chemical and its application.
5. Speed of reaction, making unnecessary any substantial arrangements as to basins other than storage facilities.
6. Substantial saving in the cost of coagulation of waters that are of sufficiently unsatisfactory appearance to require classification or filtration.
7. Permitting rates of filtration materially in excess of those possible where high bacterial efficiency is required of the filtration process in the absence of sterilization.
8. Reduced clogging of the filter beds with a consequent lengthening of the runs between cleanings, due to the destruction of various forms of algæ.

Limitations of the Process.—In making a complete analysis of the practicability of this process it is necessary [illegible] that it is not possible by the use of this germicide to accomplish certain features looked for in connection with certain styles of water treatment, as follows:

1. Inability to remove or destroy all of the spore-forming bacteria, but which kinds of bacteria are not considered to be pathogenic to man; at least those common to water.
2. Inability to remove bacteria which are embedded in particles of suspended matter.
3. Inability to remove turbidity.
4. Inability to remove appreciable amounts of color or dissolved vegetable stain.
5. Inability to remove organic matter appreciably.
6. Inability to remove swampy tastes or odors.
7. Inability to remove creosote tastes or odors coming from the cleaning of stills used in the destructive distillation of wood.
8. Inability to soften water; as a matter of fact, the addition of hypochlorite of lime usually results in a slight increase in the hard- [illegible] such as nitrite [illegible]

[illegible] ages and sh[illegible] like other t[illegible] and is in so[illegible] all for all water ills and, no doubt, with disappointing results in some cases.

The application of hypochlorite to a water, while comparatively simple, should always be [illegible] a competent analyst; otherwise, if the dose is [illegible] local conditions, there is liable to be alternately an underdose of the chemical insufficient to sterilize or an overdose which will result in [illegible]

The [illegible]

STEAM AND ELECTRIC RAILWAY SECTION

Costs and Methods of Replacing Five Miles of 1-0 Overhead Construction by 4-0 Construction.

BY F. F. [illegible]*

The change from 1-0 construction to 4-0 on this line was brought about, primarily, through the necessity of having a wire that could take care of the increased load on busy days to better advantage, and at the same time one that would have a longer life.

The line being a single track line, with three turn-outs, the bracket arm style of construction is in use. Before the change in construction a rigid arm, with a cap and cone hangers, held up the wire. The style of the new construction does not differ greatly from the old, but is heavier and is made up of more up-to-date material, the old line having been installed 14 years ago. The rigid arm of the old construction was replaced by a flexible bracket, consisting of a top iron rod brace and a lower strand of galvanized iron wire to support the hanger. This flexible support greatly decreases the possibility of damage to the insulator, because the strand takes care of the hammering and sudden jars which are produced at each passage of the trolley. Another advantage is that the trolley is not nearly so apt to leave the wire as it passes under the bracket arm. Trouble and expense of maintenance, therefore, are materially lessened.

Upon an inspection of the poles already in place, it was found necessary to replace 125 out of a total of 300.

Setting Poles. The holes were [illegible] ground men at $1.75 a day, digging on an average six holes a day. A gang of 5 linemen, at $2.75 a day, and 1 foreman, at $3.00 a day, followed the ground men, setting the poles and putting on the feeder cross-arms and necessary guy wire. The cost per pole for setting was $3.50.

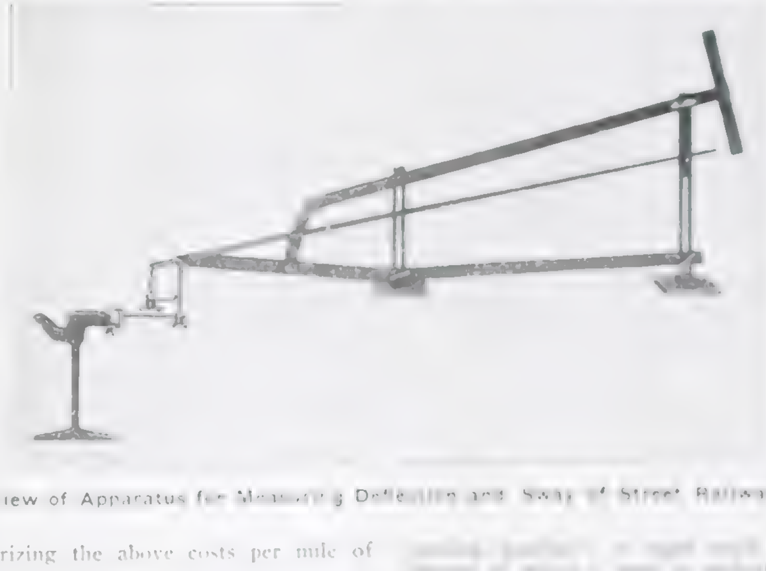
Stringing 4-0 Wire.—This work was carried on by 3 linemen, on a tower car, who made the wire fast to the poles as it was reeled off from a flat car, proceeding the tower car. Two linemen and a foreman drew the line taut with block and tackle from the ground. Four days were required for this work, using 5 linemen, 2 motormen, at $2.25 a day, and 1 foreman. The labor cost per day for stringing wire was $20.50.

Placing Brackets. — Two-inch pipe arm brackets were used, 25 sections being put up at a time and both wires temporarily fastened to them in order not to interrupt traffic. Hangers and ears were next put in place, the 1-0 wire taken down and the 4-0 clinched in the ears. This work was completed in 15 days by [illegible] day of $16.75.

Painting Poles and Cross-Arms.—Four men at $2.50 a day, painted the entire 3,000 poles in one week. The cost per pole for painting was $0.20.

The total cost of the entire work, including material was $4,401.66. A summary of the materials used follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] cross-arms	[illegible]
[illegible] pipe [illegible] brackets	[illegible]
[illegible]	[illegible]
[illegible]	97.34
[illegible] R. H. [illegible]	[illegible]
[illegible] L. H. [illegible]	[illegible]
[illegible] single [illegible]	[illegible]
[illegible] double [illegible]	[illegible]
[illegible] strain [illegible]	[illegible]
[illegible]	[illegible]
[illegible] splicing [illegible]	31.00
[illegible]	5.00
Total	[illegible]



View of Apparatus for Measuring Deflection and Sway of Street Railway Rails.

Summarizing the above costs per mile of line we have:

	[illegible]	[illegible]
Setting [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Materials as above............	3,508.9[illegible]	701.[illegible]6
[illegible]	[illegible]	[illegible]

This summary leaves $62 unaccounted for in the total of $4,401.66, given by the author, or about $12.10 per mile to be added to the above $868.31.—Editors.)

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*South Norwalk, Conn.

Method of Determining Deflection of Street Railway Rails.

[illegible] illustration, [illegible] is [illegible] that [illegible]

[illegible]

[illegible] ntly, [illegible]

[illegible] tion in the rail [illegible] e car was actually over the [illegible] y movement of the pave- [illegible] ith the movement of the [illegible] ement into the earth and the [illegible]

Value of the Properties of 665 Miles of Chicago Street Railways.

[illegible] of the preparations of the street [illegible] al report [illegible] the original relations as of [illegible] the conditions to date [illegible] tes are as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] tion from the re- [illegible] the column [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	76,993
[illegible]	[illegible]	[illegible]	2,013
[illegible]	[illegible]	[illegible]	87
[illegible]	[illegible]	[illegible]	3,246
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	7
[illegible]	[illegible]		
	Renewals	[illegible]	80
		$98,529,977.96	$148,336

Methods of Conducting the Valuation of the Physical Properties of the Chicago Consolidated Traction Co., with Summaries of Costs.

[illegible] commissioners, has recently completed a detailed and exhaustive appraisal of the physical property of the above named company, the last of the Chicago surface traction lines to come under the "Chicago Ordinances." The appraisal is the result of several months' work [illegible] der the immediate supervision of Mr. F. A. Sager. In ENGINEERING-CONTRACTING of Sept. 21 and Sept. 28, 1910, were given the methods employed and the values obtained in appraising track, power house equipment and electric power distribution. Following are given similar data for rolling stock:

In arriving at the cost new and present value of the cars and car equipment, they were divided into groups according to the type, style, maker and age. Similarly unit cost new was obtained covering all parts of the equipment, such as motors, trucks and miscellaneous car equipment. A typical car body was taken from each of these groups, and general specifications covering this type were prepared from which a unit cost for each group was obtained. From these unit costs for all parts of the rolling stock equipment, total values of cost new were determined, and to this total cost 5 per cent was added for organization, engineering and incidentals.

To determine the present value of all parts of the equipment, including car bodies, motors, trucks and miscellaneous car equipment, a thorough inspection was made, and a depreciation was applied based on their type and suitability for service. In the case of car bodies, in order to valuate the amount of the deferred maintenance, the following ruling of the commission with regard to average depreciation of car bodies was applied, namely, that 25 years should be taken as the average life of all car bodies in service a part of the year, [illegible] the summer season, or closed car bodies in service during the winter, and 20 years should be taken as the life of car bodies in continuous [illegible] applying the above average depreciation rate is considered to be the deferred maintenance.

The entire rolling stock equipment of the Consolidated Company was listed, and the [illegible]

[illegible]

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23,451.32
[illegible]	[illegible]	[illegible]	39,300.00	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	1,375.00	2,121.88
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]	3,209.59
			[illegible]	[illegible]	[illegible]

[illegible]

Group	No. of cars	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
E—1	18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
E—2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
E—3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
E—4	[illegible]	[illegible]											
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]					
E—4	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E—5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E—6		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E—7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]											[illegible]	[illegible]
						[illegible]							
A	[illegible]	Pullman	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
A—1	[illegible]	Pullman	[illegible]	[illegible]	36	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
A—2	16	[illegible]	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A—3	30	[illegible]	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A—4	12	[illegible]	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]											[illegible]	[illegible]
						[illegible]							
C	11	Pullman	17'-4"	[illegible]	45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C—1	14	[illegible]	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
C—1	1	[illegible]	18'-3"	[illegible]	[illegible]	8	16	64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
C—2	[illegible]	St[illegible]	17'-6"	[illegible]	[illegible]	8	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
C—3	10	St[illegible]	[illegible]	[illegible]	42	8	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	43											$[illegible]	$[illegible]
						[illegible]							
B—5	5	St. Louis	18'-0"		[illegible]	8	[illegible]	[illegible]			[illegible]	$[illegible]	$[illegible]
												$[illegible]	$[illegible]

equipment was then [illegible] between the portions of the line outside the city and inside the city in proportion to the number of car miles operated inside the city and outside the city by small single truck cars, this estimate leaving out of account the number of car miles operated inside and out of the city by the Consolidated Company with their rented double truck cars.

To the total present value of the property 5 per cent was added for organization, engineering and incidentals, as was done in the case of the cost new.

Table I is a summary of the cost new, pres[illegible] [illegible] planatory.

Ownership of Harbors and Waterway Terminals in the United States.*

[illegible] water system, widely nullifying the advantages of cheap water carriage. Our waterways are

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* [illegible] C.

TABLE IV—MISCELLANEOUS CARS

Group.	No. of cars	[illegible]	[illegible]	Total Dep.	Cost [illegible]	[illegible]	[illegible]
H	3	Electric [illegible] trucks		[illegible]	$[illegible]	$[illegible]	$[illegible]
I	10	El[illegible] with [illegible]	[illegible]	40	1,200.00	[illegible]	[illegible]
I—1	3	Trailer [illegible]			250.00	750.00	[illegible]
J	5	Electric [illegible] & [illegible] Sweepers with trucks	[illegible]	35	1,150.00	5,750.00	3,737.50
K	3	Electric M[illegible] Sweepers with trucks	[illegible]	[illegible]	1,150.00	3,450.00	[illegible]
L	3	Electric McGuire-Cummings Sweepers with trucks new....			1,179.00	3,537.00	3,537.00
M	3	Motor [illegible] trucks	16	[illegible]	[illegible]	2,250.00	[illegible]
N	11	Trailer [illegible] trucks	16		[illegible]	6,050.00	[illegible]
O	1	Motor Ash Car No. 34.........	16	75	[illegible]	[illegible]	[illegible]
P	1	Gondola [illegible]	[illegible]	[illegible]		[illegible]	[illegible]
Q	1	Gondola Coal Car 15'-6" long..	16	75	175.00	175.00	[illegible]
R	1	Cinder Car 22 ft.-6" long......	16	[illegible]	[illegible]	200.00	[illegible]
S	1	Motor S[illegible] truck	16	80	[illegible]	[illegible]	[illegible]
T	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
U	2	Sh[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V	1	Box M[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	50					$[illegible]	$[illegible]

[illegible]

No. of Equipments.	Motors per Equipment.	Maker.	Type	Dep.	Cost [illegible]	Total [illegible]	[illegible]	[illegible]
	2	G. E. Co.	[illegible]	[illegible]	$1,048.00	$[illegible]	$[illegible]	
184	2	G. E. Co.	G. E. 52	[illegible]	1,048.00	[illegible]	[illegible]	$[illegible]
4	3	G. E. Co.	[illegible]	[illegible]	1,572.00	7,860.00	[illegible]	
5	3	G. E. Co.	G. E. 800	50	1,674.00	10,044.00	[illegible]	[illegible]
6								
						[illegible]28.00	$[illegible]	$[illegible]
199	Organization, [illegible]					[illegible]	[illegible]	$[illegible]
	Grand total					[illegible]	[illegible]	$[illegible]

[illegible]

Number.	Maker.	Type.	Single [illegible]	Depreciation	Cost New.	Total [illegible]	[illegible]	[illegible]
229	Brill	Motor	[illegible]	[illegible]	$[illegible]	$[illegible]	$[illegible]	
12	Brill	Trailer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
19	Brownell	Motor	[illegible]	40	[illegible]	[illegible]	[illegible]	
12	McGuire	Trailer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
14	St. Louis	Trailer	[illegible]	40	150.00	[illegible]	[illegible]	
5	Bemis	Trailer	Single	40	150.00	[illegible]	[illegible]	
3	Peckham	Motor	Single	40	250.00	[illegible]	[illegible]	
						$[illegible]	$[illegible]	$[illegible]
	Organization, engineering and incidentals, 5%					[illegible]	[illegible]	[illegible]
	Grand [illegible]					$[illegible]	$[illegible]	$[illegible]

TABLE VII—[illegible]

[illegible]		[illegible]	[illegible]	[illegible]
E	11	[illegible]	$[illegible]	$[illegible]
E—1	[illegible]	[illegible]	[illegible]	[illegible]
E—2	[illegible]	[illegible]	[illegible]	[illegible]
E—4	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]
E-7	6	[illegible]	[illegible]	[illegible]
	[illegible]		$[illegible]	$[illegible]

[illegible]

TABLE IX.—REHABILITATION DETAILS. MISCELLANEOUS CAR.

		Present Value.
3	electric tank sprinklers	$ 2,880.00
10	electric plows	7,200.00
3	trailer plows	375.00
11	electric sweepers	9,517.00
3	motor dump cars (coal)	562.50
11	trailer dump cars	1,512.50
41		$22,047.00
9	miscellaneous cars at $50.00	450.00
50	Total miscellaneous cars reported	$22,497.00
	66⅔% of miscellaneous considered inside city.	
	Rehabilitation value of miscellaneous cars ⅔ × $22,497.00 =	$14,998.00

TABLE X.—MOTOR EQUIPMENTS; REHABILITATION DETAILS.

Two motors—		
Present value (G.E.800-G.E.52)		$ 524.00
Cost new		1,048.00
Depreciation		524.00
Average age, 14.5 years.		
Average annual depreciation		36.00
Two years' depreciation		72.00
100 motor equipments, present value		$52,400.00
36 motor equipments at one year's wearing value plus 2nd hand value (36+300)		12,096.00
36 motor equipments at two years' wearing value plus 2nd hand value (72+300)		13,392.00
18 outside city.		
190		$77,888.00
5 (3 motor equipments, present value)	$3,930.00	
6 (3 motor equipments, present value)	5,022.00	
	$8,952.00	
87½% of $8,952.00		7,833.00
Total rehabilitation value of motors		$85,721.00

TABLE XI.—REHABILITATION DETAILS; TRUCKS.

	Cost New.	Present Value.
Brill trucks	$265.00	$159.00
Depreciation	$106.00	
Average age, 14.5 years.		
Annual depreciation	7.31	
Two years' depreciation	14.62	
100 trucks at present value, 100×$159		$15,900.00
36 trucks, one year's wearing value, plus 2nd hand value, 36×$107.31		3,863.16
36 trucks, two years' wearing value, plus 2nd hand value, 36×$174.62		4,126.32
25 truck outside city		......
197 No. of car bodies allowed. Total		$23,889.48
54 motor trucks, 2nd hand, 54×$100	$5,400.00	
43 trailer trucks, 2nd hand, 43×$100	4,300.00	
Total value	$9,700.00	
Value inside city (87½%)		8,487.50
Total rehabilitation value of trucks		$32,376.98
294 Total number of trucks reported.		

should have adequate terminals, properly controlled, in harbors effectively organized.

Our harbor organization, as a rule, is faulty. A harbor has two prime features, "commercial" and "industrial." The commercial function deals chiefly with "through" freight, with the transshipment between rail and water lines (or between water lines) of freight not destined to or originating at the harbor itself. The industrial function, on the other hand, deals with local freight. It affords rail water connection and wharf storage for local industries and distributing houses. It affects local interests far more deeply than the mere passage of through traffic. The commercial use of our water front often interferes seriously with its industrial use. Great railroad terminals, largely used for through freight, extend along our most active frontage, crowding out its use by the local industries. In general, good harbor organization would place the through freight terminals at relatively outlying parts of the harbor, leaving the central portion more free for local business. Many harbors could do this with much local benefit, especially the important Lake ports, with their inner (river) harbors, and their outer lake frontage protected by breakwaters—an almost ideal conformation.

In addition to harbor organization, there are four prime factors in a good water terminal: (1) Adequate wharves; (2) warehouse space; (3) transshipping machinery; and (4) belt-line railway connection between general water traffic, the adjacent railroads, and, if possible, the local industries. (The depth of water is a matter of channels, not terminals.) Furthermore, these vital factors should not be under adverse or exclusive private control, especially the belt railway, which should be the public servant of the whole port.

The supply of wharves generally is somewhere near adequate. Water front warehouse space is inadequate, except at a few important ports. Modern transshipping machinery, except for bulk freight, is almost entirely lacking. Only 7 ports have anything approaching a general belt railroad, with a total main track of but 29 miles, serving directly only about 50 wharves.

Private interests control nearly all of our active water frontage. Public control exists in considerable degree only at New Orleans, San Francisco, Baltimore, and New York, and is greatly modified at New York by exclusive private leases for long terms. Out of 50 of our foremost ports, only 2, New Orleans and San Francisco, have practically complete public ownership and control of their active water frontage; 8 have a small degree of control, and 40 none at all. Out of 37 ports for which data are available (excluding New Orleans and San Francisco), only 14 have any publicly owned wharves (about 260 such wharves in all, many privately controlled under long leases). Out of 25 ports with available data (excluding New Orleans and San Francisco), only 10 have wharves "open" to general traffic, with a total of only 49 such wharves, the majority insignificant and antiquated. Out of 46 such ports (excluding the same two cities), a majority of the active frontage is privately owned in 40, and in 6 a small amount is so owned. Out of the 50 foremost ports above mentioned, there are 21 in which railroad ownership and occupancy covers over 50 per cent of the active frontage, and 12 more between 25 and 50 per cent. It is our theory that the waterways are public highways. In fact their essential terminals are largely under private control.

Two ports only, New Orleans and San Francisco, are noteworthy for their high degree of public ownership, control, efficiency and equipment. At New Orleans the active water front is admirably equipped and controlled by a state board; most of the wharves and sheds are open for general traffic, and a municipal board operates 10 miles of belt-line railway giving coordination between the waterway, local industries, and trunk-line railroads. At San Francisco there is an excellent system of wharves under state control, kept open for general traffic. The water terminal situation in these two cities is by far the best in the country.

At many large Lake ports much of the lake front is protected by government breakwaters, but almost no terminal use is made of it, in spite of the serious congestion of the inner harbors. At 4 of the most important Lake ports there is a total front of about 12 miles protected by breakwaters. On this entire 12 miles there are only about 10 active wharves, nearly all under railroad control. Of this frontage, railroads own about 7 miles, other private parties about 3, and the cities about 2. The striking lack of terminal use of such protected front seems to be due largely to adverse control, mainly by railroads, also in part to the established growth of the cities on the inner river harbors, and to litigation of titles.

There is a surprising lack of coordination between rail lines and water lines for general water traffic. We constantly see close physical proximity of rail and water lines with no commercial interconnection (except at the through terminals of the railroads themselves), and with a consequent high transfer cost. Often, indeed, rail lines are a positive obstacle to the handling of water traffic, instead of a benefit.

Terminal charges are a considerable factor in water traffic, especially "dockage," a charge on the vessel, and "wharfage," a charge on the freight passing over the wharf. Particularly on the Mississippi system, excessive landing charges have hindered traffic.

Such high landing charges, together with the absence of adequate terminals, show forcibly the extreme lack of cooperation between the localities and the federal government. The government's enormous expenditures on channels are in many cases largely neutralized by the action or non-action of the local authorities on terminals. There has been, indeed, some excellent local cooperation in channel work, as at Portland, Ore., Seattle, Cleveland and Buffalo, but the far greater need is for local cooperation in terminals. Localities should, as a rule, be required to furnish and keep open adequate terminals as a condition precedent to channel improvement by the federal government. It is their fair share of the work, and they alone can do it effectively.

There are thus five salient facts: First, that terminals are as important as channels; second, that our harbors have not fully developed their terminal frontage, nor are they properly organized or controlled; third, that railroads largely control water terminals, often to the disadvantage of general water traffic; fourth, that there is almost no linking up of the rail and general water systems at the water's edge, but rather the opposite tendency; fifth, that there is little cooperation by localities with the federal government which improves their channels.

Probably the greatest single deterrent to water terminal advance is the present adverse attitude of rail lines toward independent water traffic, in their exclusive control of frontage, in refusal or neglect to coordinate with general water traffic, and in refusal to prorate generally with water lines in through movement of traffic. Until this underlying relation of rail to water systems is adjusted on some common-sense basis of harmony, there is little hope of great advance in water terminal conditions.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Irrigation Accounting—Its Essentials and Advantages.*

That accounting can and will have an appreciable effect in securing and in even insuring the success of legitimate irrigation developments may not be apparent to those who have not fully studied the matter. Yet that is the proposition which I present to this congress as true and worthy of acceptance, and to the demonstration of which I shall devote the time given me.

Last June I had the pleasure of being present at a dinner given by the board of control to the officers of the congress. As the speeches were generally reported in the press, I am violating no confidences when I tell you that these men foresaw and feared the results of unwise irrigation enterprises. Wildcatting was the expression used, and there were sober expressions of opinion that some present tendencies, if not corrected, could only result in prejudicing the mind of the general public so that it would be increasingly difficult to sell a water right under even the soundest development in all the arid country. The speakers might well have gone further and said that probably even before that time it would be almost impossible to finance an irrigation scheme by the sale of its securities. And that brings us to consider that in the final analysis, the persons most interested in the success of irrigation are those who buy and hold irrigation bonds and those who buy and use the water rights developed thereby. Bankers and constructors must both consider these interests if enterprises are to be successful.

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*From a paper prepared for the Eighteenth National Irrigation Congress, Pueblo, Colo., Sept. 27, 1910, by N. E. Webster, Jr., of Niles & Niles, Certified Public Accountants, 111 Broadway, New York City; late Consulting Accountant, U. S. Reclamation Service.

And now what are the essentials to success in the development and construction of an irrigation project? I am talking broadly of the whole subject without regard to whether the projects are to be built by the nation, states, local districts or private enterprises under any of the forms of irrigation organization. These are important details, but they are details only. And in this connection I will say that I was for some years connected with the federal reclamation service, have been consulted and employed by Carey act and private enterprises, and have a fairly representative acquaintance among those now engaged in irrigation development by means of all these forms of organization, so that what I have to say will be drawn from experiences with and directed towards the needs of all rather than any particular situation.

There is not time now to discuss the fine points of a scheme of accounts adapted to the needs of irrigation. Moreover, the system must of necessity be devised with a special reference to the conditions of each enterprise. One will require what is unnecessary to another. Townsite development, generation of power for sale, dealing in agricultural lands, merchandising, transportation, hotel keeping, etc., are frequently associated with irrigation development and when thus connected should have provided therefor accounting methods of the most modern and progressive types. But there are phases which are common to all irrigation development which should be carefully reflected in the accounts and for which standard forms of reports should be adopted in order to secure the best results.

I think we will get the most out of this study if we divide irrigation costs into those for financing, for engineering, for construction, for selling, for operation and for general expenses. Cost statements should show the totals for a given period and to date for each class. But these costs should be analyzed further to show the expense upon different classes of work and upon different physical features.

Moreover, there should be adopted uniform methods of stating the asset and liability accounts, particularly those which are peculiar to the business of irrigation. While the experience of other lines of industry will help in deciding such questions. there are some which must be studied probably for the first time. One such problem is that of the proper treatment of the right to the control of certain water supplies obtained by appropriation from the states, and which it is proposed to sell in the form of water rights. Should such controlled but wholly or partly undeveloped water supplies be shown in the accounts as assets? Again, when water rights are sold before the completion of a project, should the estimated construction cost of these particular water rights be deducted from the sale prices and the excess carried to the credit of the loss and gain account as profits before the actual construction cost is determined, and probably when only a small fraction of the sale price has been collected? If this is new to you, it probably sounds academic and theoretical, but upon the answer to this latter question rests the determination of whether such unliquidated and to a degree problematic profits are subject to the federal corporation tax, and when. Here, as often, theory goes ahead and points the way to practice.

You will note that I am contending for a standardization of accounts, as well as for accounting per se. There is a reason for this, and one which should appeal strongly to those who are directing irrigation enterprises. It is not an accident that railroad accounts have been reduced to a standard so that each company keeps accounts essentially similar to those kept by all other companies. It did not happen that bank statements came to be presented in the same form the country over. It was not by chance that insurance companies came to use identical methods. Nor, as some may think, were these results brought about solely by the imposition of governmental control. It is true that national banks were required to report in a standard way, but the state and private banks adopted the same forms, not from necessity, but for self interest. Railroad accounts have been developed along identical lines, not because of governmental control, which is a very recent development in this matter of accounting, but because the accounting officers of the railroads have been working together, each contributing what he had found valuable and giving this to the others through the medium of their national association. Before there was any public service corporation legislation, the accounts of gas, electric light, water and traction companies had grown to be so nearly uniform, that many companies made but little change in methods in complying with the requirements of the public utility laws when enacted.

And there was a reason for this uniformity. By it each company had the opportunity of comparing or contrasting the effectiveness of its own methods with the results obtained by others, all tending to the highest efficiency and economy. This reason should be just as potent in the irrigation industry. What are the best and cheapest forms of organization and methods of work? Who knows? Ten years ago there was probably not a single contracting organization in the country that was attempting to analyze its construction costs. When a job was completed the contractor knew how much he had gained or lost; while it was going on he guessed conditions as he had originally in bidding on the work. Today, contractors are endeavoring to ascertain costs as the work progresses so that costly methods may be abandoned for more economical ones, and the final balance brought on the right side of the loss and gain account.

But some one says, "we let all our work by contract and do no actual construction ourselves." Very well, but what of the future costs of maintenance? Are they being fixed upon a basis of accurate information or of hopeful guesses? I venture the surmise that 90 per cent of the maintenance charges have been made upon no better basis than a sheer guess with an eye always to what the other fellow charges. Ten years of good accounting should give us a vastly better method of forecasting maintenance charges upon different classes of work and under varying conditions.

There was another reason why these older lines of industry developed similar accounts and adopted standard forms of reports. They found that thereby they could more readily market their securities when additional capital was required. A railroad or public utility which should go into the money market for a loan or to sell an issue of bonds, and which was unable or unwilling to exhibit balance sheets, statements of operating expenses and fixed charges, of gross and net earnings and gross and net income, would probably conclude that the money market was very tight. But your situation is likely to be about that unless you adopt the methods which obtain in these other lines of business. I have seen a letter from an eastern broker to an irrigation company whose securities he was attempting to place in which he asked the company's officers to stop writing in terms of glittering generalities about their scheme but to send him statements of figures, adding, "Nothing else goes in this town."

Moreover, in addition to the credit required by irrigation companies upon bond issues and direct loans, they are large buyers of construction materials. Are they treating themselves fairly and intelligently in developing and conserving the commercial credit to which they are entitled? Look in the rating books of the mercantile agencies. There are no ratings for irrigation companies. This may be because they are not in trade, but I think it is probably from another cause. Within a year I was with a district manager for one of the mercantile agencies when he received from an irrigation company a reply to his request for information that he might furnish to a subscriber from whom he had an inquiry. He expressed much surprise at receiving a copy of the company's latest balance sheet with other explanatory figures. But I asked whether this was so unusual as to excite comment, for I had supposed it to be a common practice for business men to furnish statements to these agencies. He replied that my idea was correct except as to irrigation companies, but that never before had he received such a statement from one of these companies, although he had frequent inquiries as to their financial standing.

These are some of the direct advantages which irrigation enterprises may secure from a wisely planned and well conducted scheme of accounts. But I think that even this is not all. If all enterprises that know they are financially sound, conservatively managed, and prepared to give value for all they get, will unite in the adoption of standard forms of reports, it will not be so very long before the financing interests will look for and insist upon having these statements, with the result that if there are such fake or wildcat schemes as some believe, they will have to disclose the fact in their reports, or bear the burden of partial discredit because of their unwillingness to submit the statements which would set forth their condition.

In conclusion, I do not wish to leave the subject without offering a suggestion as to the method by which, in my opinion, the quickest and most effective results can be secured. I believe this congress should favor and foster an association of those interested in irrigation accounts. Company officers as secretaries, treasurers, auditors, and bookkeepers should be urged to unite for the common interest. Bond banking houses should be invited to assist in the preparation of such statements as will be most valuable to them. Professional public accountants, I am sure, will be glad to help, bringing to the subject the experience gained in examinations of many other lines of business. Such an organization can work directly with the accounting officers of the companies themselves while the program of this congress should always be open for the general dissemination of the views and recommendations of the association and for discussion thereupon.

I am no prophet and do not undertake to forecast the future as to the increase or lessening of state and federal control of corporations. But if it never comes to the irrigation industry, you will have gained immensely from the practical application of scientific accounting, while if it does come, in respect of accounting at least it may be a negligible incident requiring only that you make one more carbon copy of statements you have all along been issuing.

Proposed Bill for Licensing Civil Engineers in Colorado.

Section 1. After Nov. 1, 1911, no person shall practice civil engineering in the state of Colorado unless registered and legally authorized by license from the state board of enginering examiners, as required by this act.

Sec. 2. *Practice of Civil Engineering.*—A civil engineer, within the meaning of this act, is one who practices any branch of the profession of engineering other than military. Said profession embraces the design and construction of public or private utilities, such as railroads, bridges, highways, roads, canals, river improvements, irrigation works, water supplies, sanitary systems, drainage works, foundations, structural steel works, and the development, transmission and application of power (and includes all industrial, hydraulic, municipal, structural and other works), and the inspection thereof, which require experience and the same technical knowledge as engineering schools of recognized reputation prescribe for graduation.

Sec. 3. *The State Board of Examining Engineers.*—There shall be created a state board of engineering examiners of seven members who shall be appointed by the governor, six of whom shall hold office for six years from May 1 of the year in which appointed, the seventh shall be the state engineer, as hereinafter provided, and shall serve without compensation, except necessary traveling expenses to be paid out of fees collected for the examination and license of applicants. In constituting the first board, however, to be appointed under this Act, the governor shall designate two members to serve for two years from May 1, 1911, two members to serve for four years from May 1, 1911, and two members to serve for the full term of six years from May 1, 1911, the seventh member being the state engineer appointed by the governor for the biennial period commencing in 1911. Thereafter, the governor shall appoint two members for the full term of six years, to filled the vacancies caused by expiration of term of office, and may, at any time, fill vacancies in the board caused by death, resignation or removal from office.

In constituting the first board, the governor shall designate as the six members thereof, other than the state engineer, civil engineers who are corporate members of the American Society of Civil Engineers, each of whom shall be not less than 30 years of age, and shall have been in active practice for not less than 10 years. Thereafter, the governor shall appoint as members of the Board of Examining Engineers, civil engineers who have received license to practice in accordance with the provisions of this act, and who have been in practice in this state for at least 5 years prior to date of appointment. The governor may remove any member of the Board of Examiners for misconduct, incapacity or neglect of duty.

Sec. 4. *Certificate of Appointment, Oath, Powers.*—Every engineering examiner shall receive a certificate of appointment from the governor, and, *ipso facto*, a license under this act, and, before beginning his term of office, shall file with the secretary of state the constitutional oath of office.

The board, or any committee thereof, shall be entitled to the counsel and services of the attorney general, shall have the power to compel the attendance of witnesses, and may take testimony and proofs concerning all matters within its jurisdiction.

The board shall adopt a seal which shall be affixed to all licenses granted by it, and may make all by-laws and rules, not inconsistent with law, needed in performing its duty; but no by-law or rule by which more than a majority vote is required for any specified action by the board shall be amended, suspended or appealed by a vote similar to that required for action hereunder.

Sec. 5. *Expenses.*—The fees derived from the operation of this act shall be paid into the state treasury into a special fund designated "Examining Engineer's Fund," which shall be held exclusively for the purposes of this act, shall not revert to the general fund, and, in the event of such necessity arising, the legislature shall annually appropriate amounts sufficient to pay all proper expenses incurred pursuant to this act.

Warrants for the payment of expenses incurred shall be issued by the auditor of state, upon presentation of vouchers regularly drawn and approved by the president and secretary of the board.

Within the first wek of December, after the organization of the board, and annually thereafter, the secretary of the board shall file with the auditor of state a full report of the proceedings of the board, and a complete statement of the receipts and expenditures of the board, attested by the affidavits of the president and secretary.

Sec. 6. *Officers, Meetings, Quorum, Committees.*—The board shall biennially elect from its members a president and a vice-president for the ensuing biennial term.

The state engineer shall act as secretary of the board and shall keep a record, on file in his office, of all licenses granted by the board.

The board shall hold two or more meetings in each year, at intervals not to exceed six months, pursuant to the call of the president or of any three members of the board.

At a meeting a majority of the members shall constitute a quorum.

Sec. 7. *Admissions to Examination.*—The board of engingering examiners shall admit to examination any candidate who pays a fee of $10 and submits evidence, verified by oath and satisfactory to the board, that he

(1) is more than 25 years of age,

(2) is of good moral character,

(3) has been engaged actively in civil engineering work, as assistant, for at least six years, and as such has had responsible charge of engineering work for at least one year.

(4) or, is a graduate from a school of engineering of recognized reputation, and has been engaged actively in civil engineering work, as assistant, for at least four years, and, as such, has had responsible charge of engineering work for at least a year.

Sec. 8. *Examinations.*—The board of enginering examiners may examine and license candidates, or may, in their discretion, during the first year of the operation of this act accept as proof of a candidate's capacity to perform any of the duties of a civil engineer the record, training and experience of any candidate who has practiced civil engineering within the state of Colorado for a continuous period preceding, of not less than 10 years.

After May 1, 1912, no person unlicensed by the board of engineering examiners shall practice engineering or engage in the responsible charge of engineering work, and after that date said board shall issue license only after examination.

Sec. 9. *Questions, Etc.*—The board of engineering examiners shall prepare lists of suitable questions for thorough examination in engineering, and from these shall prepare examination papers, which, at any examination, shall be the same for all applicants for license, and shall in these papers make suitable divisions, in their judgment, of technical training and experience.

Examinations for license shall be given at called meetings of the board of engineering examiners, which may be held at various places within the state, in the selection of the board, and shall be conducted exclusively in writing and in English. At the close of each examination the board shall, without unnecessary delay, examine and mark the examination papers, make official report thereon, signed by the president and secretary, in which the standing of each candidate in each branch, his general average, and the board's recommendation that a license be granted or denied shall be stated, and said report shall be filed in the records of the board.

If a candidate fails on first examination, he may, after an interval of not less than six months, nor more than one year, have a second examination without additional fee.

Sec. 10. *Licenses.*—Upon the submission of official report that an applicant has successfully passed the examinations and is recommended for license, the board of engineering examiners shall issue to him a license to practice (according to the qualifications of the applicant), signed by the president and secretary of the board, under its adopted seal, which license shall state that the applicant has given satisfactory evidence of fitness as to age, character, preliminary and enginering education, and all other matters required by this act, and that, after full examination he has been found properly qualified to practice.

Applicants examined and licensed by other state examining boards registered by the state board of engineering examiners as maintaining standards not lower than those provided by this act may, without further examination, on payment of———to the state board of engineering examiners, and on submitting such evidence as they may require, receive from it an endorsement of their licenses conferring all rights and privileges of a license issued after examination by the state board of engineering examiners.

If any person, whose registration is not legal because of some error, misunderstanding or unintentional omission, shall submit satisfactory proof that he had all requirements prescribed by law at the time of his imperfect registration and was entitled to be legally registered, he may, on unanimous recommendation of the state board of engineering examiners, receive, under seal, a certificate of the facts, which may be registered by the board or by any county clerk, and shall make valid the previous imperfect registration.

Before any license is issued, it shall be numbered and recorded in a book kept for that purpose in the office of the board of engineering examiners, and its number shall be noted on the license, and a photograph of the license filed with the record and attached to the license.

The record shall be open to public inspection, and in all legal proceedings shall have the same weight as evidence that is given to a record of conveyance of land.

Sec. 11. *Registry, Revocation of Licenses, Annulment of Registry.*—Every license to practice engineering shall, before the licensee begins practice thereunder, be registered as above. The board of engineering examiners shall have power at any and all times to inquire into the identity of any person claiming to be a licensed or registered engineer, and, after due service of notice in writing, require him to make reasonable proof, satisfactory to them, that he is the person licensed to practice under the license by virture of which he claims the privilege of this act. When the board finds that a person claiming to be an engineer, licensed under this act, is not in fact the person to whom the license was issued, they shall reduce their findings to writing and file them in the office of the board, and in the office of the clerk of the county in which said person resides or practices. Said certificate shall be prima facie evidence that the person mentioned therein is falsely impersonating a practitioner or a former practitioner of a like or different name.

The board of engineering examiners may revoke the license of a practitioner or annul his registration, or do both, in any of the following cases:

(a) A practitioner of civil engineering who is guilty of any fraud or deceit in his practice, or who is guilty of any fraud or deceit by which he was granted a license to practice.

(b) Proceedings for revocation of a license or the annulment of registration shall be begun by filing a written charge or charges against the accused. These charges may be preferred by any person or corporation, or the board of engineering examiners may, on their own motion, direct the secretary of the board to prefer said charges. Said charges shall be filed with the secretary of the board.

When such charges are preferred, the board shall designate four of their number, as a committee, to hear and determine said charges. A time and place for the hearing shall be fixed by the said committee as soon as convenient, and a copy of the charges, together with a notice of the time and place when they will be heard and determined, shall be served upon the accused or his counsel at least ten days before the date actually fixed for said hearing. If mere personal service, or service upon counsel, cannot be effected, and such fact is certified on oath by any person duly uathorized to make legal service, the board shall cause to be published for at least seven times, for at least 20 days prior to the hearing, in two daily papers in the county in which the engineer was last known to practice, a notice to the effect that at a definite time and place a hearing will be had for the purpose of hearing charges against the engineer upon an application to revoke his license. At said hearing, the accused shall have the right to cross-examine the witness against him, and to produce witnesses in his defense, and to appear personally or by counsel. The said committee shall make a written report of its findings and recommendations, to be signed by all its members, and the same shall be submitted forthwith to the board. If the said committee shall unanimously recommend that the license of the accused be revoked or his registration annulled, the board may thereupon in its discretion, revoke said license and annul said registration, or do both. If the board shall annul such registration, it shall transmit forthwith to the clerk of the county or counties in which said accused resides or practices or is registered as an engineer, a certificate under their seal certifying that such registration has been annulled and said clerk shall, upon receipt of said certificate, file the same and forthwith mark said registration "annulled." Any person who shall practice civil engineering after his registration has been marked "annulled" shall be deemed to have practiced without registration.

Sec. 12. *Certificate Presumptive Evidence. Unauthorized Registration and License Prohibited.*—Every unrevoked certificate and endorsement of registry, made as provided in this act, shall be presumptive evidence in all courts and places that the person named therein is legally registered.

Hereafter no person shall register any authority to practice unless it has been issued as a license by the board of engineering examiners.

No diploma or license conferred on a person, other than by the board of engineering examiners, shall be lawful authority for the practice of civil engineering within the state.

Sec. 13. *Penalties and Their Collection.*—Any person who, not being then lawfully authorized to practice civil enginering within this state and so registered according to the provisions of this act, shall attempt to practice, or shall so practice, and any person who shall, in connection with his name, use any designation tending to imply or designate him as a practitioner of engineering within the meaning of this act, and any person who shall have violated the provisions of this act, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine of not less than $100, nor more than $500, or by imprisonment in the county jail for not less than 10 days or more than 60 days, or by both. Any person presenting, or attempting to file as his own, the license of another, or who shall give either false or forged evidence of any kind to the state board of engineering examiners, or to any member thereof, in connection with an application for a license to practice civil engineering, or who shall practice civil engineering under a false or assumed name, or who shall falsely personate another practitioner of a like or different name, shall be deemed guilty of a felony, and, upon conviction thereof, shall be punished by imprisonment in the State penitentiary for a term of not less than one nor more than ten years, at hard labor.

Improved Forms of Steam Pile Hammers for Steel Sheeting and Concrete Pile Work.*

One of the reasons given for not using steam hammers in concrete pile work is the difficulty of regulating the blow. While this difficulty exists with the single-acting steam hammer, such as the Vulvan and the Cram types, it is not the case with later types of steam hammers. In the single-acting steam hammer the steam enters on the under side of the piston to raise the ram of the hammer a given height, whereupon the steam is automatically shut off and the exhaust opened. As soon as this happens, the weight falls. No matter what the steam pressure may be, the force of the blow is, of course, the same at all times; and an increase in steam pressure simply means quicker blows.

On the other hand, in the double-acting steam hammer, the steam not only raises the ram, but drives it down on the head of the pile, being assisted in this operation by the weight of the ram itself. The velocity, and consequently, the energy, of the blows vary in proportion to the steam pressure, and it is a very simple matter to regulate the force of the blows. The ram of the hammer not being dependent upon gravity alone, as it is in the case of single-acting hammers, is much smaller, and, furthermore, the stroke is generally 7 to 8 ins. instead of 2 to 4 ft., with the result that the hammer is lighter and shorter than the old type of single-acting hammer. Whereas the single-acting hammer cannot deliver more than 60 to 70 blows per minute, the double-acting hammer may deliver as many as 200 blows per minute. It would seem that this constant succession of rapid blows would be particularly efficient in driving concrete piles.

In our experience in driving steel sheet-piling we have found the double-acting hammer especially desirable. It is so much shorter, more compact and lighter in weight than the older type, that we have been able to use it suspended at the end of the boom of a derrick, or otherwise, without leaders. When it is considered that, in pile driving, probably not less than 70 per cent of the time is consumed in shifting and setting up the standard pile driver, it will be readily understood that considerable saving results from the elimination of its use. With the short, double-acting hammer perched on the broad top of a concrete pile there would be no trouble in operating it without side support; while if both pile and hammer are lifted into position by means of the same derrick there is a material increase in efficiency, and resultant economy in the operation of the equipment.

In this connection it may not be out of place to speak briefly of the different types of double-acting steam hammers at present on the market. There are four types of such hammers in use. Naming them in the order of their introduction in actual practice they are: (1) The Clark hammer, made by McKiernan Drill Co., New York; (2) the Arnott hammer made by the Union Iron Works, Hoboken, N. J.; (3) the Goubert hammer, made by Aug. A. Goubert, New York, and (4) the New Monarch hammer, made by Henry J. McCoy Co., New York.

There was another double-acting hammer made which was known as the Hamilton-Pierce type, of which the Goubert hammer above referred to is a modification. Only two of these hammers were made as originally designed, but both with slight changes are in use at the present time.

The Clark hammer, which may be called the first practical double-acting hammer, consists essentially of a hollow stationary piston rod and a cylinder moving up and down between two round guides attached to a head at the top and anchor weight at the bottom. The cylinder itself acts as a ram and it is thereby possible to make the hammer considerably shorter than could be done otherwise. This hammer weighs from 2,000 to 4,000 lbs., and is adapted to strike as many as 160 blows per minute. It is preferably operated with compressed air. It is especially adapted to work with a central jet, because of a cylindrical passage extending through the entire hammer, and a 2-in. pipe can work quite freely through the tubular piston of the hammer. The escaping stream of water and sand passes out through the base of the hammer, preferably into a canvas boot, and is delivered to a pump through a hose of the same material. A hammer of this type should be particularly useful in driving concrete piles with the jet in the center of the pile.

The Arnott hammer consists of a plain cast iron body forming one piece with the cylinder, valve chest and guides, and enclosing the ram and valve operating mechanism. An opening is formed at the bottom of the casting to provide jaws that fit over the top of the pile. These jaws permit of the insertion of pile caps to fit all sorts of piling, wood, steel or concrete. The piston and rod are solid, and the ram is keyed to the latter, while the valve rod is attached to the ram which slides up and down between guides machined in the solid frame. All the parts are within the heavy frame, and nothing but the inlet valve or throttle is exposed. Thus, all the machinery is protected from possible injury in handling the hammer. The Arnott hammer is furnished in six different sizes, weighing from 750 to 6,500 lbs., and it is understood that, in addition to these sizes, two more can be obtained, one weighing 300 lbs., adapted for light wood and steel sheeting, the other weighing 10,000 lbs., adapted for driving the heaviest wood and sheet piles, as well as concrete piles.

It will be noted that the essential difference between the Arnott and the Clark hammer is that in the former a movable ram is attached to the piston rod, while in the latter, as explained above, the cylinder itself is the ram. The two hammers differ appreciably in other details, and, particularly, in appearance, but the governing principle, i. e., the double action of the steam, is the same in both hammers.

The Goubert hammer is built of a heavy steel frame to which are attached the valve gear, piston and piston rod. In this machine, as is the Clark hammer, the blow is struck by the cylinder, which consists of a heavy solid steel casting sliding freely between guides that are part of the frame. The lower end of the cylinder strikes upon a loose anvil, or "dolly block," that rests directly on top of the pile. The cylinder has no permanent connection with the valve gear, but is so arranged that, at the end of the upstroke, it strikes a plunger which rotates the valve, thereby admitting steam under the piston. As soon as the cylinder strikes the blow, the percussion causes the plunger to fall, whereupon the exhaust is opened and steam admitted for the upstroke. One of the most valuable features of this hammer is it is entirely constructed of steel, the frame, valve-box and other parts usually made of cast iron, being of steel castings. The hammer is made in three sizes, weighing, respectively, 950 lbs., 3,400 lbs. and 5,000 lbs., and it may be used between leaders in a standard pile driver, or it may be suspended from a derrick. It is stated that this hammer can be arranged to drive round piles from 9 ins. to 20 ins., according to size of hammer.

The last double-acting steam hammer to be considered is the most recent. It is known as the New Monarch, and is the invention of James Hamilton. It is built on the same general idea as the Arnott hammer, that is, with stationary cylinder and separate ram attached to the piston rod, but, while the machinery in the Arnott hammer is not visible, being enclosed entirely within the frame, the machinery in the New Monarch hammer is all exposed to view and is easily accessible, though protected from injury in handling by the three sides of an open box-like frame. Two valve rods are attached to the ram and operate the valve by direct contact with two sliding cams, one for the upstroke, the other for the downstroke. An interesting feature of this valve is that the rods are at all times in direct contact with the ends of the valve spindle, for the purpose of eliminating shock and wear on the valve stem, at the same time that the rods serve as stops to the travel of the valve itself. The travel of the valve being only a fraction of an inch, rapid working of the hammer is possible. It is found that as many as 200 blows per minute can be delivered. This hammer is made in four sizes, weighing from 750 to 7,000 lbs., and it is seasily adapted to driving round piles, as well as all kinds of wood or steel sheet-piling. The frame being entirely flush and without openings of any kind on three sides, it is possible to drive close to walls without danger of having parts of the machinery ruined by particles of brick, cement or other gritty materials rubbed from the wall. Like the Arnott and the Goubert hammer, the New Monarch hammer may be used between leaders, or it may be operated while suspended from the broom of a derrick.

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*J. R. Wemlinger, Proceedings American Society of Engineering Contractors, June, 1910.

LETTERS TO THE EDITOR.

Flushing Pavements With Water Under Pressure.

Sirs: I note in your issue of October [illegible] article by Major J. W. Howard, headed "F[illegible] ing Pavements With Water Under Pressure," which appeals to me as capable of doing damage by misleading street cleaners through incorrect information.

Having had charge of the [illegible] data of the recent tests made of flushing machines, I would call attention to the fact that the figures given are not the figures of the recent test but are [illegible] or's Commission of [illegible] by that Commission [illegible] cost per 1,000 s[illegible] that the water consumption would be about 400 gals. per 1,000 [illegible] in New York [illegible] Street cleaners who have used flushing machines know that there is no necessity of flushing daily and in most cases not oftener than semi-weekly for efficient work. The water need not carry to the sewer any large percentage of the street dirt and does not where common sense methods are used. The washing of the sidewalk when flushing is not necessary and seldom is done. Very valuable tests were made of the action of flushing upon various kinds of pavement by the Superintendents of Street Cleaning in Detroit and in Cleveland and to-day these two cities are far ahead of any others in clean streets through common sense methods of washing and are adding to their flushing plant continually.

The patrol system and machine broom methods do not clean the streets nor prevent the dust from rising, are not economical nor satisfactory, as every street cleaner knows, and pedestrians are aware that at the present time the automobile traffic is bringing out the fact, well known by Col. Waring, that the dust nuisance exists after all broom methods have been used. If the housekeeper said she could keep her floors thoroughly clean by use of the broom without scrubbing we would beg to differ. Why should we believe that such work can be done in street cleaning?

I trust street cleaners will not be misled in this matter, which is of so much importance in getting results through any fear of paving contractors being able to dodge their plain duty under guarantee provisions of contract. If a pavement will be adversely affected by efficient cleaning methods, I would suggest improved qualities of pavements.

Respectfully,
EDWARD D. VERY.
Sanitary Engineer, Dept. of Street Cleaning,
New York, N. Y., Oct. 6, 1910.
New York City.

Some Hints for Promoters of Interurban Railways.

Sirs: A word of caution to some of your many readers who have projects for the construction of interurban railways in hand may not come amiss, especially from an enginer who has had a very wide range of experience in matters of this character.

Nearly all the railway schemes are simply the outgrowth of a lack of transportation facilities. Local producers of farm and other necessities are seldom treated as they think they ought to be by existing steam railroads, so they get together and devise a scheme for their better accommodation. We live in an age when the spirit of independence and self-reliance prevails, we do not take kindly to neglect of any kind, whether it be railroad facilities or anything else, and we are very apt to set about providing means for relief if we think an opportunity for doing so seems feasible. If the neglect we feel most keenly comes from the indifference of existing railroads to our needs for transportation, the interurban railway appears to offer the surest remedy.

Unfortunately the people who embark in enterprises of this character do not know how to go about getting what they want. They usually begin by "chipping in" and raising money enough to have some local surveyor make a survey of the route of the proposed road; when this is done some person who may possibly have a little financial experience in a local bank will take the plat and profiles of the line and run to New York, where he expects to find millions of dollars awaiting his arrival. Of course he is disappointed, so he comes back home and reports that the money cannot be had for such enterprises. So the matter is dropped, and everybody is discouraged. Or perhaps he will run across one of the numerous "fakers" who promise to get the money provided the promoters pay him a good-sized retaining fee. He puts up such a plausible story that in nine times out of ten the fee is paid, then the matter drags along for a year or so and everybody becomes disgusted, and the matter is dropped. That is exactly what the "faker" expected, so he is satisfied.

Every bonding house of any reliability has engineers retained as consulting advisors and will not consider the financing of any project that does not bear the approval of this engineer, and the engineer cannot give any proposition his approval unless he makes the original survey and has a personal knowledge of the details. So if an engineer having such financial correspondents is employed in the beginning, the chances are that he will be able to put the promoters of the proposed road in touch with people who will supply the funds to build it, provided, of course, he thinks the project has sufficient merit to secure his approval.

A great many excellent interurban projects are spoiled by the clumsy way they are handled, and discouraging results sure to follow. When a man wants his watch repaired he takes it to a jeweler, and if he wants a horse shod he takes it to a blacksmith; he does this because he thinks the jeweler and the blacksmith know how to do the work he wants done; but if he is interested in promoting an interurban railway he employs some local surveyor to do the most important part of the work, even if the surveyor has no financial correspondents, and possibly never located a railway line before.

The exercise of common business sense would seem to indicate the employment of an engineer who had the means of getting the road financed, and the experience to make him capable of doing the work.

Very truly,
ISAAC A. SMITH.
St. Louis, Sept. 24, 1910.

An Effort to Secure Better Gravel and Slag Roofing Work.

Sirs: The National Association of Master Gravel and Slag Roofers of America have in their membership most of the responsible roofing contractors in the larger, as well as the smaller, cities of the country. The Association clearly realizes the damaging effect that a poor tar and gravel roof has on their business. That there are such roofs they do not attempt to deny, and it is the causes that make them possible that they are fighting to remove.

One of their first points of attack was the "indefinite specification." The Association contends that the use of such specifications, calling for, say "four or five ply gravel roof laid in the most approved manner," provides an excellent opportunity for "most anything" to be used in the shape of pitch and felt surfaced with gravel or slag. To condemn a practice and not provide the cure would have been useless, and a Committee on Standard Specification was appointed. This Committee carefully inspected many large roofs in various sections of the country, and their report was, therefore, based on actual results obtained—roofs in service 15 and 20 years, and in some cases even 30 years, "without repair cost." The report recommending a Standard Specification (Specification follows) was adopted at the 1909 Annual Meeting.

A definite specification, however, would be of little benefit without a practical way of insuring a faithful compliance with it, and at the same meeting the following resolutions were adopted, which have resulted in standardizing roofing inspection:

Whereas, lack of inspection of gravel roofs has resulted in irresponsible roofers taking work at prices at which it is impossible to do good work and therefore many roofs are laid with fewer plies and narrower moppings of pitch than are specified, and

Whereas, this unfair competition has resulted in the loss of a large amount of work to our members, and has also been of great injury to the reputation of gravel roofing, and

Whereas, inspection that will insure the fulfillment of a specification is a protection to all responsible roofers.

It is Resolved, that every roof should be inspected by cutting a slit not less than three feet long at right angles with the way the felt is laid, before the gravel is applied, and that architects and owners be requested to inspect in this manner.

Whereas, difficulty of inspecting felt on the work results in a large amount of felt being used that is of a lighter weight than is specified, and

Whereas, this is unfair to all who wish to maintain a reputation for honest dealing,

Be it Resolved, that this Association request the Architects and Engineers require that all felt used on their work shall bear the manufacturer's label stating the weight per one hundred square feet single thickness.

By cutting into a roof the number of plies of felt can be easily counted, and what is of even more importance, one can see that the moppings of pitch are complete as specified. If there is difference of opinion regarding what inspection shows, and a section 6 inches wide by 2 feet long taken from the roof at right angles to the way the felt is laid is sent to the Secretary's office, together with specification under which the roof is laid, he will promptly make a detailed report on what the inspection shows. The Association through its members, and other sources, is in touch with most of the large work, and upon receipt of information to the effect that the specification is not being complied with, the matter is immediately taken up with either the owner or architect.

The Association is also actively trying to bring about a better understanding of the value of "guarantees," which have become more of a factor in roofing than in any other work. To quote from a recent editorial:

> Very naturally guarantees for five or ten years will appear in the light of a safeguard, but it should be borne in mind that they are not given because of a sublime faith the guarantor has in his roofing or because of any generous impulse on his part to protect the buyer, but they are given for one purpose only, to sell roofing.

That guarantees have actually lowered the quality of roofing is hardly disputed, for the indefinite specification, careless application, poor workmanship, lack of inspection, and a general "skinning the roof" all pass unheeded if there is only a guarantee. The Association believes that primarily one should "Buy a roof—not a guarantee," and a proper specification faithfully complied with does not require a guarantee. The calling for a long-time guarantee is evidence of the lack of knowledge on the part of the one who requires it.

Incline of the roof deck is another and very important factor. The Association is trying to have used on the proper inclines the kind of roofing most suitable. The slope or incline of the roof has much to do with determining what kind of roofing should be used in order that maximum results may be obtained.

New York, N. Y. L. B. Sibley, Secretary.
Oct. 5, 1910.

(The specification referred to by our correspondent follows: Editors.)

There shall be used one (1) thickness of sheathing of unsaturated felt, five (5) thicknesses of Tarred Felt weighing not less than fourteen (14) pounds per one hundred (100) square feet, single thickness, and not less than one hundred and twenty (120) pounds of Coal Tar Pitch, and not less than four hundred (400) pounds of Gravel or three hundred (300) pounds of Slag from ¼ to ⅝ in. in size, and free from dirt, per one hundred (100) square feet of completed roof.

The material shall be applied as follows: First, lay the sheathing or unsaturated felt lapping each sheet one (1) inch over the preceding one. Second, lay two full thicknesses of Tarred Felt, lapping each sheet seventeen (17) inches over the preceding one, and nailing as often as may be necessary to hold the sheets in place until remaining felt is applied. Third, coat the entire surface of this two-ply with hot Pitch mopped on uniformly. Fourth, lay three (3) full thicknesses of Felt lapping each sheet twenty-two (22) inches over the preceding one, mopping with hot Pitch the full width of the twenty-two (22) inch lap between the plies, so that in no case in the last three plies shall Felt touch Felt. Such nailing as is necessary shall be done so that all nails will be covered by not less than two (2) plies of felt. Fifth, spread over the entire surface of the roof a uniform coating of Pitch, into which while hot, imbed the Gravel or Slag. The Gravel or Slag in all cases must be dry.

PERSONALS.

Mr. W. C. Calvert has been appointed City Engineer of Burley, Idaho.

Mr. Robert Craig has been appointed Chief Engineer of the Lyman Irrigation Co., which contemplates the construction of two or more large irrigation systems on the Little Colorado River in Arizona.

Chas. McDonald of Guelph, Ont., has been appointed a member of Quebec Bridge Commission to succeed Mr. Fitzmaurice of England who has resigned from the commission owing to ill health and to pressure of other work in England.

Mr. Montgomery V. Case, an engineer in the employ of Mr. Ralph Modjeski, Consulting Engineer, Chicago, Ill., and Miss Maybell G. McConnell of Salina, Kan., were married Oct. 5 at Vancouver, Wash. Mr. Case is a graduate of the Civil Engineering Department of Northwestern University.

Mr. George F. Swain, M. Am. Soc. C. E., Professor of Civil Engineering at Harvard University, has been appointed to take charge of the appraisal of the property of the New York, New Haven & Hartford R. R. in Massachusetts. The appraisal was authorized at the last session of the State Legislature and was put into the hands of a special commission consisting of the railroad commissioners, tax commissioner and bank commissioner.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The principal event of past few days in structural steel construction was the opening of bids for the erection of the superstructure of the Quebec bridge. Bids were received from the following companies: The Dominion Bridge Co. of Montreal, the Canadian Bridge Co. of Walkerville, the British Empire Bridge Co. (representing the amalgamated interests of two large British companies, with works at Darlington and Birmingham) and the Phœnix Bridge Co. of Phœnixville, Pa.—The Bonticoir grade tunnel of the Catskill Aqueduct of New York city was holed through on Oct. 2. This tunnel is 7,000 ft. long and passes through the Shawaugunk Mountains south of the Rondout Siphon Tunnel.—A large sewer contract was let by the city of Spokane, Wash., the latter part of last month. The contract calls for the construction of the 5th Ward trunk sewer, and the contract price was $476,000. The contract was secured by James Kennedy, Fargo, N. Dak., and Fife Brothers.—Late dispatches from Washington state that the Interstate Commerce Commission has reached an agreement regarding definite standards of safety appliances to be attached to railway cars and locomotives, and that the order of the commission will be promulgated on Oct. 14. It is estimated that the proposed changes in equipment will cost the railroads about $50,000,000. The order will apply only to new equipment, but the commission, from time to time, will determine what the standard shall be on the present equipment.—An excellent record for tunnel driving was made on Heading 3N of the Wallkill Siphon tunnel of the Catskill Aqueduct during the month of September. The heading was advanced 523 ft. for the full section excavation. The tunnel is circular, 17 ft. diameter inside the neat line. The work during the month was in alternating layers of slate and sandstone.—The city of Aberdeen, Wash., has awarded a large contract for filling in its tidelands. The contract for the clearing and fill was let to the Tacoma Dredging Co., Tacoma, Wash., at $186,250; the contract for the drainage was let to Haukeli & Hegdale, at $9,540.—Bids for a large government contract were opened Oct. 1 at the office of the U. S. Engineers at Philadelphia, Pa. This contract called for the construction of a 200-ft. channel from Philadelphia to Trenton, the work consisting of dredging about 1,100,000 cu. yds. and the construction of 30,000 ft. of revetment bulkhead to guide the current. On the dredging work the Atlantic, Gulf & Pacific Dredge Co., Park Row Bldg., New York, bid $236,000 and the North American Dredging Co., Philadelphia, $231,960. For the revetment work, the Atlantic, Gulf & Pacific Co. bid $241,425 and the North American Dredging Co. bid $261,287. These were the only two companies bidding on all of the work.—On Sept. 23, 49 shovels in the central division of the isthmian canal excavated 68,878 cu. yds. of rock and earth in a working day of eight hours, an average per shovel of 1,406 cu. yds. for the day. During this time the shovels were under steam 392 hours and were actually at work 276 hours and 20 minutes, and waiting for cars 83 hours and 45 minutes, the rest of the time being lost in mining, cleaning track, repairing shovels, cleaning dippers, etc.—The principal railway contract of the past week appears to have been the one reported to have been let by the Minneapolis & St. Louis R. R. to Wilson Bros., for work on its South Dakota extension. Among the other railroad contracts reported are the following: Furtwangler & Smith Construction Co., Birmingham, Ala., for extending the Louisville & Nashville R. R. from Corduroy, Ala., to the plant of the Vanderburg Lumber Co., 10 miles, and Thomas D. Casale, Williamsport, Pa., for building a piece of tramroad in the Rock River District near Ralston, Pa., for the Central Pennsylvania Lumber Co.

Two Inland Waterway Schemes.

For a number of years several of the Southern states have been advocating an ambitious scheme for the securing of a continuous waterway from St. George Sound to the Mississippi River and from the Mississippi River to a connection with the Rio Grande in Texas. A special board on surveys ordered under Act of March 3, 1909, has been investigating the project and has recently made its report to the United States Board of Engineers for Rivers and Harbors. In order to secure the continuous waterway 14 projects were suggested. Of these 14 the special board of surveys recommended 9, the total estimated cost of these being about $6,650,000. The largest single project recommended was that that portion of the waterway from Bayou Teche to Hanson Canal, to Bayou Portage, to Bayou Bartholomew, to Bayou Chicot, to Big Bayou, to Weeks Bayou, to Bayou Charlin, to Bayou Petit Anse, to Vermilion Bayou, to the canal, to Bayou Chene, to Schooner Bayou, to Gueydan Drainage Canal, to Grand Lake, to Mermentau River. For this section the board recommended a 7x75-ft. channel, to cost approximately $1,867,250. A 5-ft. project has been adopted for this section, which was a somewhat different route, and is now under construction. Two channels were suggested for that portion of the waterway from St. Andrew's Bay to Choctawhatchee Bay, via the route of St. Andrew's Bay and West Bay Creek to Choctawhatchee Bay. One of these was a 7x75-ft. channel, to cost $3,321,250 and the other a 9x100-ft. channel, to cost $4,311,750. The special board of surveys did not recommend either channel. The Board of Engineers for Rivers and Harbors, with the information now before it, is not yet convinced of the necessity of undertaking at the present time the improvements recommended by the special board, other than those already adopted by Congress. However, the Board is to hold three meetings this month at New Orleans, Mobile and Pensacola, at which the advocates of the waterway will have a chance to submit their views on the necessity of the proposed improvements. The other inland waterway scheme is a much more expensive project, providing as it does for a ship canal across Scotland from the Firth of Clyde on the east to the Firth of the Forth on the west. The plan now under consideration provides for a canal 51 miles long, with a minimum width of 148 ft., and a minimum depth of 36 ft., and locks at least 900 ft. long. The cost of the canal is estimated at $120,000,000. The engineers estimate that the canal should yield a revenue of about $4,000,000 per year, or a net revenue of about $3,700,000. The construction of the canal, in so far as engineering features are concerned, does not offer much difficulty. Of the 51 miles, 31 would have to be cut through land, and the remainder would be through Loch Lomond and Loch Long. The canal would start from the Firth of Forth above Grangemouth and run down the valley of the Forth past Ben Lomond and through the Endrich Valley in Loch Lomond. It would leave the loch at Tarbet and cross the narrow neck of land to Arrochar, whence it would pass by Loch Long into the Clyde.

He Looked Him In The Eye.

When an engineer proves such an exception to the general rule of engineering prosperity as to own two steam yachts, four automobiles and a summer home on the north shore of Massachusetts, we will gladly give space to a story (if it is a good one) about him. This is the story a writer in the Sunday Magazine tells of John Hays Hammond, the mining engineer. One of Hammond's early experiences was a long journey by foot and muleback from a mine he had been working in Mexico to a railroad station on the frontier of this country. He had with him Mrs. Hammond, his sister, and his eldest child. They arrived at the station in the afternoon, and, as there was no train out till the following morning, he secured permission from the agent for his family to rest in a room that was the upper half of the station building. That evening when Hammond was sitting on a low bench on the platform and looking up to talk to Mrs. Hammond and his sister, who were sitting at the window upstairs, the agent, a Mexican, came round the corner of the house. He leaned against the wall and listened for a moment to the rather dismal strains of music an old German was extracting from a violin a short distance up the track. The Mexican had evidently been drinking heavily. "Like music?" he asked. "Yes," replied Hammond. "Well," he said insolently, "you go up there and get that fiddle and I'll play you some real music." "I like music," retorted Hammond; "but I don't like it well enough to go after that fiddle for you." Quick as a flash, the Mexican whipped out his revolver and, stepping up to Hammond, covered him. "If you don't go out and get me that fiddle," he said, "I'll blow your head off!" Hammond was sitting on the bench and looking up into the barrel of the gun. There was no doubt about the drunken man's intention to shoot. Mrs. Hammond and Miss Hammond began to cry out in fright. Hammond did not move a muscle. Fixing his gaze on the Mexican's eyes, he called out to his wife, "Don't be afraid of this cur. He won't shoot. He hasn't got the nerve to shoot!" Just at that moment he saw the revolver barrel waver the smallest fraction of an inch, as if prompted by dawning uncertainty in the Mexican's mind. It was the psychological second, and Hammond sprang forward and grasped the pistol before the Mexican could fire. Years afterward he admitted that the time he was looking into that drunken man's eyes and reassuring his wife brought him closer to death than any other experience he ever had.

City Government by Commission.

The last few weeks have seen a number of cities, principally in [illegible] join the [illegible] list of municipalities operated [illegible] commission government. So far as we know no city which has adopted this form of municipal government has expressed any desire to return to the old way of city rule. A statement covering the first six months of commission government at Keokuk, Iowa, has recently been issued by that city. This shows that many important changes have been effected even in that short time. The bonded indebtedness has been reduced; the city has a cash balance instead of a shortage and [illegible] debt, and has been drawing interest instead of paying it. More and better work has been done in the department of street repairing, and at lessened cost. Rents and fines have been collected where they had never been collected before. All this augurs well for the commission plan, in Keokuk, at least. If it works as well in other cities it will prove pretty conclusively that the application of business methods and business efficiency by responsible men can bring results even in the government of municipalities.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Furtwangler & Smith Construction Co., Birmingham, Ala., has been awarded the contract for extending the Louisville & Nashville R. R. from Corduroy to the plant of the Vanderburg Lumber Co. The contract includes ten miles of team work and trestles.

The Mobile Terminal & R. R. Co., recently incorporated with a capital stock of $500,000, is reported to have placed on the New York bond market, $175,000 of bonds. The bonds are a part of an authorized issue of $500,000. They are guaranteed by the Tombigbee Valley R. R. and the Alabama, Tennessee and Northern R. R. John T. Cochrane, Mobile, Ala., is president of the three companies. The Cochrane interests have recently purchased 24 acres of land with a 700-foot frontage on the river, immediately north of the docks of the Mobile & Ohio R. R. Co., at Mobile. It is said that the improvement contemplated is four slips, with docks on both sides, affording docking facilities of about 3,000 feet.

Arkansas

The Texarkana Gas & Electric Co., W. L. Ward, Jr., Manager, Texarkana, Ark., operating the street railway system at Texarkana, has determined on extensions which will total three or four miles in length.

Tracklaying on the Stuttgart & Rice Belt R. R., was started the latter part of September at Mena and will be continued to Stuttgart. At that time over eight miles of line was graded. It is expected that trains will be running into Stuttgart by Dec. 1. The grading is not heavy at any place, but several small bridges will have to be constructed, which will delay the running of trains a month or two longer than would be necessary if there were no streams on the 20 miles of road. The Dalhoff Construction Co., as previously noted in these columns, has the contract for constructing this road.

The Railway Committee of Helena has raised the original amount of $125,000 pledged to purchase a right of way along Ohio Street in that city for use of the Missouri & North Arkansas Ry., which road purposes to erect terminals and depots in the section to be purchased.

Surveyors of the Gulf, Magnolia & Northern R. R., which is to run northwest from Junction City to De Queen, Ark., or some point in that vicinity, have reached Magnolia.

The Meto & Arkansas Valley Ry. Co., mentioned in our last issue, has been granted a charter to complete the unfinished Meto Valley R. R. The company has been incorporated with a capital stock of $250,000, of which $39,000 has been subscribed. The incorporators are H. N. Street of Argenta, president; Charles Neimeyer of Little Rock, secretary; W. M. Kavanaugh of Little Rock, treasurer; S. M. Savage of Lonoke, vice president, and D. Fred Walin of Lonoke. The charter authorizes the company to build the line from McCreanor Junction on the Rock Island R. R. in Lonoke county, south to Tomberlin. The company is authorized to build a line of not more than 25 miles in length. Fight miles of the road have already been built. The company will maintain offices at Lonoke.

California.

Nearly all right of way is stated to have been secured for the proposed railroad from Santa Cruz to the San Joaquin Valley, passing through Panoche Pass, Hollister and Watsonville. A. P. May, Coalinga, Cal., is one of the promoters.

The Oakland & Antioch R. R. Co., of Oakland, at the end of last month, had completed the grading from Bay Point to LaFayette, and had commenced laying the track. Twenty-eight carloads of steel rails have been unloaded at Bay Point and the steamer Stanley Dollar has unloaded 22,000 ties at Point San Pablo.

The Western Pacific R. R. is planning to install ten additional tracks at its terminal at Oroville. The work will be done next spring.

The Los Angeles-Pacific Co., R. P. Sherman, General Manager, Los Angeles, has 300 men at work on the improvements of the Hollywood and Colegrove lines, the cost of which will be about $500,000. This is the beginning of general improvements of the company's entire system at an outlay of more than $5,000,000 eventually, and which will include the erection of a terminal building on South Hill street, north of Fifth street, Los Angeles, the construction of a series of tunnels through the southwestern part of the city and the four-tracking of the company's line to Venice.

A resolution has been adopted by the city council of Los Angeles, calling on the Board of Public Works to report to the council at the earliest possible date, the most practicable route for a municipal railway from a convenient point in Los Angeles, near the business district, to the water front at Wilmington and San Pedro. The city has the right under the charter to construct and operate a municipal railway. This right was conferred by a vote of the people in February, 1909, when it was approved among several other charter amendments. Homer Hamlin is City Engineer.

Buckman & Sons, Exeter, Cal., have started work on their contract for grading for the extension of the Visalia Electric R. R., of Visalia, from New Redbanks to Woodlake, a distance of three miles.

The Board of Supervisors of San Francisco has passed to print the bill granting a 5-year extension of the privileges formerly granted the Ocean Shore R. R. to extend its lines into the outlying residence sections.

The Yreka R. R., H. L. Walthers, Manager, Yreka, Cal., is said to be planning to extend its line from Yreka into Scott Valley. The proposed route from Yreka to Etna, approximately 40 miles in length, with a maximum grade of 2.2 per cent, is south up Yreka Creek to its junction with Forest House Creek, up that stream to a point where it would be necessary to drive a 3,000-ft. tunnel through the summit of the Forest House Mountain, eleven miles from Yreka. The maximum grade to the tunnel would be 2.2 per cent. Passing the summit the line would follow, in a southerly direction down Moffat Creek to the floor of Scott Creek, with a maximum grade of 1.5 per cent to Fort Jones. From there the line would go in a southerly direction to Greenview and Etna, with the latter place as a terminal. It is approximately eight miles from Fort Jones to Greenview, and seven miles from Greenview to Etna.

The Porterville Northeastern R. R. Co., of Porterville is reported to have rejected all bids for the grading of its line and may do the work itself. The lowest bid received for earth excavation is said to have been 22 cts. per cu. yd.

Nearly all the necessary right of way has been acquired for the construction of a rail road from San Joaquin Valley to Santa Cruz and it is expected by promoters to interest English capital in the project. J. B. Rodgers, former Chief Engineer of the Ocean Shore Ry. Co. and A. P. May, Coalinga, Cal., are interested.

The Southern Pacific, according to advices from Eureka, Cal., will soon start construction work on a line from Marshfield to that city. Right of way is now being secured, it is said.

Colorado.

The Denver, Laramie & Northwestern R. R. Co., has just closed up litigation which has for a long time prevented it from extending its line beyond Greeley. The company has now let the contract for 12 miles northerly from Greeley to Severance, and has started on this work and expects to finish it up by Dec. 1st. It is so late in the season that probably no attempt will be made to open up any work beyond Severance this fall. The company, however, has been working right along up in the mountains on some heavy rock work, including one tunnel, which has been progressing satisfactorily. Wm. D. Hodge, Denver, Colo., is Chief Engineer.

The Denver, Laramie & Northwestern R. R., according to advices from Denver, has won a victory over the Union Pacific in the federal court in a right of way battle in Greeley, and unless the United States Circuit Court of Appeals reverses the rulings of Judge Lewis, the new road will be unhampered in building to the Northwest. The Denver, Laramie & Northwestern wanted to cross where the Union Pacific and Colorado & Southern connects in Greeley, and it was enjoined temporarily by Judge Lewis. This injunction has now been dissolved. As will be noted elsewhere in this issue, the Denver, Laramie & Northwestern has taken immediate steps for extending its line from Greeley.

Florida.

The Tampa & Jacksonville Ry., now has under construction a 7½ mile extension, south from the present end of its line. The contract for this extension was let on Aug. 29, to Oliver, Kite & Emerson, Gainesville, Fla. F. S. Parrigin, Gainesville, Fla., is Chief Engineer.

Arthur Pew, Consulting Engineer, 50 Augusta Ave., Atlanta, Ga., is making surveys for an extension of the tram line of the Aycock Lumber Co., from Alford, Fla., ten miles southeast to lumber lands. The lumber company is now constructing with its own forces ten miles of line from Alford to Orange Hill.

Georgia.

The Irwintown & McIntyre R. R. Co., of Irwintown, Ga., has awarded grading contracts and work has been started building the line to Irwintown. The road will later on be extended to Dublin.

It is reported here in Atlanta that the Louisville & Nashville R. R. will soon take over the Atlanta, Birmingham & Atlantic Ry. The merger of the two roads would undoubtedly be an advantage to the Louisville & Nashville, as it will secure a new seaport terminal at Brunswick, where the Atlanta, Birmingham & Atlantic has built a system of docks and operates a line of steamers to Northern ports. The Louisville & Nashville touches the Atlanta, Birmingham & Atlantic system at Atlanta and at Birmingham, the new road having recently completed its trackage into its Alabama terminals from Birmingham.

Hayti.

Construction work is reported to have been started Oct. 4 at Gonaives, Hayti, on the proposed new railroad on that island, concession for which was recently granted to an American syndicate said to be headed by John B. McDonald, 90 West Street, New York City.

Illinois.

The Track Elevation Committee of the City Council of Chicago has approved an ordinance providing for the elevation of the Pennsylvania R. R. tracks from 39th to 69th Streets, and for the Englewood extension, connecting the Panhandle and the Pittsburg, Fort Wayne & Chicago Railroad. Elevation of about 4½ miles of track is ordered at an estimated cost of $4,500,000.

The Burlington Brick Co. of Burlington, Ia., has let the contract for the construction of two miles of standard gage railroad track connecting its large brick plant near Viola, Ill., with the main line of the Rock Island Southern R. R. When this spur track is completed early in December the brick company will commence to make shipments of five cars or more daily. At present the brick are hauled in wagons to the railroad.

A special railroad committee at Elgin, Ill., recently held a meeting to take up the matter of constructing an electric line from Elgin to Belvidere. Information was produced regarding the experience of Detroit, Cleveland, Indianapolis and South Bend. E. C. Faber of the Elgin Traction Co. is interested.

The Supervisors of St. Clair County have extended the franchise of the Southern Illinois Traction Co., known as the Mepham line, which is building a railway from East St. Louis to Belleville.

Indiana.

The South Bend Traction R. R. Co., of South Bend, Ind., has filed notice with the State Board of its intention to build the proposed line through St. Joseph and Elkhart Counties to Kalamazoo, Mich. Eugene Atkins is President.

Notice has been given by Edward Daniels, master of chancery, that the properties of the Southern Indiana R. R. Co. will be sold at public auction at Terre Haute on Nov. 3. The sale will be made between 12 and 1 o'clock. The notice is given pursuant to the order of the United States Circuit court which was given some time ago. At the sale all the divisions of the road will be sold, including the main branch from Terre Haute to Westport, the Sullivan branch and the Chicago Southern R. R. which was built by the former owner, John R. Walsh.

Edward Osborne, Cincinnati, O., secretary of the Cleveland, Cincinnati, Chicago & St. Louis Ry (Big Four), acting for the Board of Directors, leased the property of the Evansville, Mt. Carmel & Northern Ry. Co., now building a line from Evansville, Ind., to Mount Carmel, Ill. The lease is for 99 years. The capital stock of the company will be increased from $50,000 to $500,000 and the Big Four will issue bonds amounting to $5,000,000 to complete the new road. It is expected to have the line in operation by the first of the year.

Iowa.

The Chicago, Milwaukee & St. Paul Ry. is planning to expend about $100,000 in improving its line between Muscatine and Ottumwa.

Tracklaying on the lines of the Charles City Western R. R. within the city limits of Charles City has been about completed. Work on the interurban section of the line which is to run to Marble Rock has been delayed owing to difficulties in securing the right of way.

Advices from Oskaloosa, Ia., state that the stockholders of the Iowa Central & Western R. R. have elected as directors Edwin Hawley, F. H. Davis and T. P. Shonts, New York city, and L. F. Day and George W. Seevers of Minneapolis, Minn.

Kansas.

According to the budget of the Atchison, Topeka & Sante Fe Ry., for the two coming fiscal years, 1911 and 1912, the sum to be expended during that period, all on new work, is about $66,500,664. This money will be devoted not to new lines, but to improvements of those already built. The sum allotted as follows: Rights-of-way and station grounds, $2,424,000; grade revision and lessening curves, $5,473,000; terminal yards, $4,317,000; tracks, $2,252,000; second tracks, $15,627,000; bridges, $3,488,000; track elevation, $3,364,000; station building, $4,685,000; shops, $2,379,000; signals, blocks, etc., $2,064,000; new rails, $6,847,000; docks and wharves, $1,450,000; road bed work, $1,000,000

The stockholders of the Atchison Railway, Light & Power Company, of Atchison, Kan., have authorized an increase of the capital stock from $900,000 to $1,500,000. The stock is to be sold and the money thus derived is to be used for improvements and extension. The company was recently purchased by the McKinley syndicate, controlling the Illinois Traction System.

A. C. Wheeler, Garden City, Kan., has begun work on his sub-contract for the grading of a railroad from Westmoreland, Kan., to a connection with the Union Pacific. Coon & Co., Omaha, Neb., have the general contract for this line, to include the grading, bridge work, railroad ties, etc.

Engineers are now at work surveying the proposed line of the Southwestern, Kansas & Colorado, which when completed will connect Wichita with the coal fields of Northern New Mexico and Southern Colorado, and will be approximately 350 miles in length. It will be run directly west fom Anthony to Kiowa to Hardtner and cross the Santa Fe near Englewood. From Englewood the route of the road will depend on the bids made by Fowler, Mead and Plains for the road. From here the balance of the route will depend on the bids made by Gray and Mead counties, Haskell and Seward counties, Grant and Stevens counties, and Stanton and Morton counties. If the road follows the southern tier of counties it will run on an average of six miles north of the Oklahoma state line. A. A. White, the promoter, has been appointed general manager and E. H. Hurd of Clearwater has been appointed attorney. This company is capitalized for $1,000,000 and considerable of the stock has already been disposed of. The following directors have been appointed to serve the first year: W. S. Richardson, Aetna, Kan.; J. C. Lewis, Coldwater, Kan.; Joe Thomas, Coldwater, Kan.; Jacob Kurz, Aetna; R. W. Scott, Aetna; A. A. White, Hardtner; E. G. Tharp, Protection; M. C. Campbell, Wichita; E. H. Hurd, Coldwater; W. V. Jackson, Coldwater. The road will be controlled altogether by local men and no Eastern capital will be used in its construction.

Kentucky.

The Ohio & Kentucky Ry., M. L. Conley, General Manager, Cannel City, Ky., now operating 27 miles of line from Jackson, Ky., to Cannel City, is reported to be planning an extension to the coal fields in the mountain regions of eastern Kentucky.

The Cincinnati, Louisville, Lexington & Maysville Traction Co., which projects a 57-mile line from Covington, Ky., to Owenton, Ky., via Dry Ridge, Ky., has completed surveys and expects to let construction contracts soon. The Reliance Engineering Co., Cincinnati, O., is Chief Engineer, and W. T. S. Blackburn, Dry Ridge, Ky., is President.

Following the exclusive announcement made by us last week of the work to be let by the L. & N. R. R. on Oct. 12 for 80 miles of new road from Jackson, to Whitesburg, Ky., we list below the quantities which will be embraced in the contract:

Excavation, cu. yds.	[illegible]
Bridge masonry, cu. yds.	10,620
Culvert masonry, cu. yds.	16,536
Pile work, lin. ft.	[illegible]
Trestle timber, B. M.	[illegible]
Rip rap, cu. yds.	2,600
Tunnels, lin. ft.	6,195
Clearing, acres	130
Grubbing, acres	11
Concrete, cu. yds.	370
Steel in bridges, lbs.	[illegible]
Steel in concrete, lbs.	26,670
12-in. ballast pipe, lin. ft.	468

It is interesting to note that the L. & N. engineers do not indicate that there will be any rock, either loose or solid. The price of excavation, therefore, will have to include rock should any be found. The successful contractor must furnish bond in amount of 20 per cent on the contract.

Louisiana.

Louis J. Simons, of Houston, Tex., has purchased rails and ties for a spur railroad to be built from the town of Vinton, four miles south to the oil fields.

A communication has been addressed to the officials of twelve southern railroads, and to the commercial organizations of Toledo, Cincinnati, Chicago, Nashville, Memphis, Mobile, New Orleans, and other cities of the South and Middle West as a preliminary step looking towards the consolidation of enough of these roads and constructing the necessary links to complete a great trunk line extending from the Great Lakes to the Gulf of Mexico. It is said that Eastern capitalists stand ready to furnish $6,000,000 for the project. It is also stated that the Somerset, Corbin & Cumberland Construction Co., recently organized at Somerset, Ky., was for the purpose of beginning the first link from Somerset to Corbin, Ky. J. M. Ross, Somerset, Ky., is a leader in the movement.

Surveys have been completed beyond Jonesville, La., for the proposed line which is to be an extension of the Louisiana & Arkansas Railroad from Jena to Vidalia, La.

The New Orleans, North-Eastern R. R. (Queen & Crescent) has had surveys made for a line from the Great Northern Ry's track, at Audubon, to run into Covington.

Massachusetts.

Surveys have been made for an extension of the Milford & Uxbridge Street Ry., Walter L. Adams, Manager, Milford, Mass., from Uxbridge to Whitinsville and East Douglas and Manchaug, a distance of 11 miles. The preliminary estimate of cost is about $10,000 per mile.

The City Council of Taunton, Mass., has granted the Old Colony Street Railway Co. permission to extend its tracks on West Water Street from the Weir Stove Co., to the White-Warner factory.

The directors of the Boston & Maine R. R., J. P. Snow, chief engineer, Boston, Mass., have appropriated approximately $10,000,000 for new equipment and improvement. About one-third of this sum represents the amount to be used for equipment and the larger part of this will be expended for new passenger coaches, although a portion will go toward passenger and freight locomotives.

The Hampden R. R. Co., which proposes the construction of a 30-mile line, has secured its certificate of necessity and convenience. As proposed the line will extend from Bondsville, Mass., to Springfield, with a branch to Holyoke. The estimated cost is $100,000 per mile. Ralph D. Gillett, Westfield, Mass., is President. Fred T. Ley, a contractor of Springfield, Mass, is one of the directors.

Michigan.

The Michigan United Rys. Co., Lansing, Mich., is planning to improve its system at Kalamazoo, by double-tracking North Burdick Street from Main Street to the Michigan Central Railway tracks and installing a turnout on Michigan Avenue between Main and Academy Streets.

Work has been resumed on the extension of the Detroit Terminal R. R., at Detroit, over the D. O. & M. Tracks to a junction with the Pere Marquette tracks. The line is controlled by the Grand Trunk and the Michigan Central and will add much territory to the available factory sites of the city. The line will run just north of the new Woodward-avenue power house of the Detroit United Rys.

The Pere Marquette R. R. has been making a number of improvements to its line between Lansing and Trowbridge, preparatory to the improvements that will later be made through Lansing to North Lansing. The company intends to erect a new warehouse west of the present structure on Shiawassee Street, and also proposes a double track from near the cold storage plant in the south part of the city to its yard limits in the north end of Lansing.

Tracking laying on the Lansing-Owosso electric line has been completed from Morrice nearly into the city of Owosso, and the road is now being ballasted. The construction between Shaftsburg and Haslett has been somewhat delayed by the presence of sink holes. The Northeastern Construction Co., Lansing, Mich., is constructing the road.

Double tracking on the Grand Rapids & Indiana R. R. is being rushed and the line has been extended to Vine St. in Kalamazoo, Mich. The north yards are equipped with enough track but the south yards have always included the main line for switching; this will be done away with when the double track is installed.

Minnesota.

Foley Bros., St. Paul, Minn., general contractors for the extension of the Canadian Northern from Virginia to Duluth, now have over 1,500 men on the job. The contractors expect to work in both earth and rock the coming winter. Some 20 miles of track will be laid at the Virginia end of the extension this fall, which will be of advantage to the contractors in getting in supplies and material.

The St. Paul Railway Promotion Co., mentioned in our last issue, has placed an engineering party in the field to make surveys for an electric line to connect St. Paul and Mankato. The party will work east from Mankato, through Eagle Lake, Madison, Lake Elysian and Waterville to Faribault, thence north to Farmington and to the Twin Cities. It is expected that it will take two months to lay out the route. K. Alexander, of St. Paul, Minn., is in charge of the party. Among those interested in the company are: W. J. Hoy, of the Hoy Construction Company, of St. Paul; A. H. Stem, of Reed & Stem, architects; L. P. Ordway, of Crane & Ordway and Phil Herzog, of the Herzog Iron Works.

Good progress is being made with the construction of the Minneapolis, St. Paul, Rochester & Dubuque Traction Co's. line between Minneapolis and Northfield and it is expected that rails between the two places will be laid this fall. The grading work is nearly completed and Moiser & Ennis, the contractors, expect to finish this up by Oct. 15. It is probable that work will be started next on the section between Northfield and Rochester.

The Canadian Northern R. R., is reported to be considering building a line into Hibbing to connect with its line now under construction between Virginia and Duluth.

Mississippi.

The Mayor and Board of Aldermen of Bay St. Louis have been in conference with J. T. Jones, Gulfport, President of the Gulfport & Mississippi Coast Traction Co., in an effort to secure the extension of the electric railway across the Bay of St. Louis, into the city of Bay St. Louis.

William Connell, one of the promoters of the Mississippi Western Railroad, projected to run from Natchez to Meridian, was in Natchez recently and reported that it is very likely that a Canadian syndicate will handle the bonds of the road.

Missouri.

The Savannah-St. Joseph Interurban Ry. now being constructed from St. Joseph to Savannah, may be extended to the north. J. H. Van Brunt, St. Joseph, Mo., is General Manager.

The City Council of Jefferson City, has granted a franchise to the Jefferson City Bridge & Transfer Co., for building a street railway in that city. Col. C. W. Thomas, Jefferson City, represented the company.

St. Louis Items.

BY A. B. KOENIG.

Last Saturday the writer was taken over the new Springfield & Jacksonville Electric Line that is now being built between Springfield and Jacksonville, and is under many obligations to O. J. Lucas, the president; J. H. McFarlin, general manager, and Paul H. Bradley, the auditor of this road, who made his stay in Springfield a very pleasant one, and one that will long be remembered. The following contractors are on the line, all piling up big estimates and making rapid progress with their work: L. A. McCellend has his outfit at work at New Berlin. C. H. Hiller is near Springfield. Otto Schurtz is at work near Old Berlin, Ill. Walter Sinnott is at Orleans. Tim Crowley is finishing up two and a half miles of work, while Wm. Dankleff is moving in quite an outfit. They expect the road to be in operation Jan. 1.

According to Building Commissioner E. C. Hamler's report for September, permits were taken out for the construction of $119,550 worth of new buildings in East St. Louis from Sept. 1 to noon, Saturday, Oct. 1. Most of the permits were for residences. The total for September averages nearly $4,000 for each day. Commissioner Hamler believes all building records in East St. Louis will be broken during October and November.

Practically all of the land needed for the wagon and railroad approaches to the free bridge on the East Side authorized to be condemned in a bill recently passed by the Municipal Assembly in special session, except that owned by the Southern Ry., has been purchased direct without condemnation. A bill was introduced in the council last week by Councilman Schneiderhahn authorizing the payment of eighteen sums on options for as many pieces of land, aggregating $50,850. Eleven of the parcels of land are in the line of the railroad approach and seven are on the wagon approach. Maurice V. Joyce, special counsel for the city on the East Side, was working on the options before the recent ordinance was asked for, but was not sure he would get it all, and asked for ordinances covering everything. The land obtained by the purchase is at a good price, but is much less than was demanded by some of the land owners, who refused to give options. Joyce expressed the belief that prices would hardly have been lower by condemnation, and the time required to get the land will be saved. Almost all the land needed except that through the property of the Southern Ry., now has been acquired and the price that will have to be paid in condemnation for the balance of the land needed has been definitely fixed. The total expenditure so far for land on the East Side, already authorized, is a little more than $95,000, or about one-fourth what was paid for the land on the right of way of the wagon approach on the West Side.

The annual meeting of the stockholders of the Cotton Belt (St. Louis Southwestern R. R. Co.) was held last Tuesday at the St. Louis general offices, President Edwin Gould and Vice President Wm. H. Taylor came from New York to attend the meting. The election of the directors for the ensuing year resulted as follows: Edwin Gould, R. M. Gallaway, Howard Gould, Winslow S. Pierce, Wm. H. Taylor, E. T. Jeffery of New York, F. H. Britton, Murray Carleton, Tom Randolph of St. Louis. The directors elected the following officers: Edwin Gould, President; F. H. Britton, Vice President and General Manager; Wm. H. Taylor, Vice President; D. H. Morris, Vice President, succeeding N. A. Campbell; A. J. Trussell, Secretary; H. L. Utter, Assistant Secretary; G. K. Warner, Treasurer and Assistant Secretary. The stockholders formally ratified the action of the directors in regard to the lease of the Central Arkansas and Eastern Railroad and the purchase of the Stephenville North and South Texas Railroad. The report, which included reference to the St. Louis freight terminal and the proprietary interest of the Cotton Belt in the St. Louis Terminal Association, was approved by the stockholders.

Mike Conroy has some team work suitable for small outfits to let at Godfrey, Ill.

Big Jack McCaughey, of McCaughey Bros., informs us that they have three machines idle that they can put on work at once. Address them 3455 Magnolia avenue, Chicago, Ill.

Dick Ryan is at work on the Alton & Jerseyville Electric Line near Alton, Ill.

Rust & Swift are starting on their shore protection contract on the Mississippi river north of here.

McCann Bros. are still at Bridgeport, Ill. They report their work getting along nicely.

The J. A. Ware Construction Co., Houser Bldg., St. Louis, Mo., have a nice piece of rock work on the Missouri-Pacific R. R., in Missouri, to let.

The Board of Public Improvements of St. Louis caused the following street, alley, sidewalk and sprinkling ordinances to be introduced in the Municipal Assembly. The sprinkling bill increases the street mileage to be sprinkled to 589 miles, or ten more than last year, and the estimated cost to $294,750. It is from Feb. 1, 1911, to Feb. 1. 1912. The improvements are: Ordinance to open east and west alley between Hamilton, Hodiamont, Clemens and Cates avenues; ordinance to open Schiller place, now a private street, from Morgan Ford road to "Eiler place." Sidewalks: Page, from Hamilton to western city limits; Ridge, Hamilton to Hodiamont; Romaine, Goodfellow to Hamilton; Von Versen, Union to Belt, south side; Burd, Minerva to Ridge; Burd, Ridge to Wells; Burd, Wells to Easton; Catalpa, Maple to 469 feet south; Garfield, Clara to Goodfellow; Harris, Carter to Rosalie; Lexington, Newstead to Taylor; Leduc, Marcus to Euclid; Marcus, Bell to Cook; Minerva, Arlington to Hodiamont; Montclair, Ridge to Wells; Newhouse, Florissant to Vest; Paris, Ashland to Natural Bridge Road; Pendleton, Easton to Kennerly; Sacramento, Turner to Newstead, south side; Sacramento, Turner to Newstead, north side; Sarah, Labadie to Ashland; Spalding, King's Highway to Union; Suburban, Hodiamont to western city limits; Twenty-second, Palm to Mallinckrodt; Von Cersen, Hamilton to Hodiamont; Warne, Zealand to Conde, south side.

Montana.

Engineers of the Chicago, Milwaukee & St. Paul who have been running lines for the construction of the extension from Lewiston, Mont., to Great Falls have caught up to the Arro Creek Party and have been called in until the latter finishes cross sectioning that district.

The Nebraska Traction & Power Co., R. H. Oliver, Chief Engineer, Ralston, Neb., now operating a line between South Omaha and Ralston, is considering securing an entrance to Lincoln and terminals in that city by acquiring the line from Lincoln to Bethany Heights, a few miles out of Lincoln.

The Chicago, Rock Island & Pacific and the Lincoln Traction Co. are to install a switch at the crossing on the College View line at Lincoln, Neb., at a cost of about $10,000.

New Mexico.

V. R. Kenney, Roswell, N. Mex., is to make surveys for the proposed railroad from Roswell to Tucumcari. Reports from Roswell state that the company has sold the bonds necessary for the construction of the road. E. L. Bedell, Roswell, N. Mex., is local representative.

The Atchison, Topeka & Santa Fe Ry. is reported to be negotiating for the purchase of the St. Louis, Rocky Mountain Pacific Ry., a 106 mile line. Officials of the Santa Fe were recently in Raton, N. Mex., in conference with the officials of the St. Louis & Rocky Mountain, and later they went to the Taos Valley by auto with a view it is reported of looking over the ground with the idea of making an extension of the Rocky Mountain road from its present terminus at Cimarron. N. Mex., to the rich Taos region, now without an outlet.

New York.

The Schnectady Ry. Co., of Schnectady, has applied to the City Council of that city for franchises for the laying of tracks in Smith Street, from South Center Street to Veeder Avenue, along Veeder Avenue to Albany Street, also through Lafayette Street from Smith Street across State Street to connect with the present tracks in Lafayette Street north of State Street.

A syndicate of trolley promoters has assured the Board of Trade of Wilson, a town near Rochester, that a railway will be constructed from the Rome, Watertown & Ogdensburg R. R., to the park at Wilson, on Lake Ontario.

The Buffalo, Rochester & Pittsburg Ry. is planning improvements for its terminals at Rochester. The work will involve the expenditure of about $300,000 and will include the remodeling of the passenger station and grounds.

Public Service Commission has approved the exercise of franchises granted by the city of Auburn to the Auburn & Syracuse Electric R. R. Co., to double track East Genesee St. east of the present terminus of the tracks near the intersection of Seward Ave. to the east corporation line of the city; also to double track E. Genesee St. between the easterly end of the present double track west of Fulton St. and the intersection of E. Genesee St. and Seward Ave.

We are advised that the plans of the Long Island R. R. for the elimination of all grade crossings on the Flushing main line, between Broadway and Flushing, have not as yet been approved by the State Board of Public Service. The estimated cost is $1,077,000, and ten miles will probably be taken care of by the company forces. J. R. Savage, Jamaica, N. Y., is Chief Engineer of the Long Island R. R

North Carolina.

At the end of September practically one half of the 90 miles of line of the Winston-Salem Southbound R. R. had been completed and the rails laid. Most of the contractors on that portion of the line in Anson County will complete their work this month, and it is expected hat the road will be in such shape that the irst through trains can be run by Dec. 1.

The Seaboard Air Line R. R., is reported to be considering extending its line from Rutherfordton to Asheville. The company is said to have had several engineering corps in the field ooking over the country, and getting data on a line which would connect Asheville with Rutherfordton and then run to the seacoast at Wilmington.

The Council of State at Raleigh has been considering the matter of allowing the State convicts to grade the extension of the Lake Mattamuskeet Railway from Belhaven to Washington, twenty-five miles. The original contract was for the convicts to grade this oad from Fairfield to Belhaven, and this work s now done.

Yancey County has voted a $100,000 bond ssue to be applied toward the construction of he Black Mountain Ry., which is to connect with the Carolina, Clinchfield & Ohio at Brookfield, N. C. The Black Mountain Ry. was projected many years ago, and some grading was done on it. The new line will follow he old route, where the grading was done, and urther on for 20 miles into the Black Mountain section. It is stated that construction work on the new railroad will commence as oon as the necessary preparations are completed. It will probably be opened to traffic uring 1911.

North Dakota.

Ira Prenty has shipped his grading outfit rom the Pingree-Wilton line to Jamestown, N. Dak., and has placed it at work on the onstruction of the Midland Continental R. R. t will remain at work on this line until the weather prevents. Most of the grading on the Pingree-Wilton line has been completed, except a few small strips on which the contractors are yet working. As soon as they are hrough it is understood that they expect to ake up work on the Midland Continental. The increased force at work on that road gives romise of the practical completion of the grading this fall in time for the laying of the rails.

Practically all grading work on the Pingree-Wilton extension of the Northern Pacific R. R. n North Dakota has been finished, only a few hort stretches remaining, which will be cared or within the next month. It is expected that teel laying will be commenced this fall and hat by a year from then the line will be in peration.

Ohio.

As previously noted in these columns, Jones ros., Harrison Bldg., Cincinnati, O., have een awarded the contract for constructing the righton Yards at Brighton Station, Cincinnati, O., for the Chesapeake & Ohio Ry., of ndiana. This contract includes 600,000 cu. ds. of earth excavation and 600,000 cu. yds. f embankment.

No definite action has been taken to eliminate grade crossings in the city of Dayton, xcepting the preparation of plans. It is impossible to state when the matter will be taken p again, as the City of Dayton is unable to sue bonds for the purpose at this time. F. J. ellarius is City Engineer.

According to an address delivered before e Cleveland Engineering Society by Robert offman, City Engineer of Cleveland, the total m to be expended in connection with grade ossing elimination in Cleveland, including e cost to the railroads, will amount to more an $20,000,000. The 146 grade crossings remaining in the city are divided as follows: ennsylvania, 29; Lake Shore, 13; Erie, 17; ickel Plate, 42; Big Four, 12; B. & O., 8; heeling & Lake Erie, 23; Newburg & South ore, 2.

Council committees on harbors and wharves d steam railways, of Cleveland, have voted approve the franchise granting the Pennsylvania R. R. the right to extend its tracks along e foot of W. 54th Street and beneath the ake Shore bridge, thereby giving it direct cess to its new $3,000,000 ore docks now n ocess of construction.

Oklahoma.

Citizens of Sulphur have promised to grant a franchise for a street railway. According to the terms of the proposed franchise the street railway from Bromide Springs in Platt National Park to the Artesian Hotel is to be completed by Dec. 1. A line will be built out to Ramsey's Lake and to the new ball park northeast of the city, also out to Antelope and Buffalo Springs in Platt National Park, via the Oklahoma School for the Deaf.

J. H. Johnston, Manager of the Chamber of Commerce of Oklahoma City, has submitted a plan to that organization looking to the immediate construction of the Denver, Kingfisher & Gulf R. R. As outlined, it will provide for the immediate construction of the line from Oklahoma City through Piedmont, Kingfisher, Fairview and thence northwest toward Denver. The Chamber of Commerce has recommended the paying of a bonus of $100,000. F. C. Aunder and D. J. Cunningham of Kinfisher are promoters of the road.

The Northwest Motor Co., of Oklahoma City, has been incorporated with a capital stock of $100,000. The incorporators are L. P. Weiss, Charles E. Sockler, C. P. Weichmiler, Earl Worl and C. M. Flickinger, all of Kingfisher, Okla. The company proposes to promote the building of railroads for operation by the motor car system, instead of the trolley system.

Village of Allen in Pontotoc County, Okla., has offered the Missouri, Oklahoma & Gulf R. R. a $15,000 cash bonus for the establishment of a passenger and freight division there. The company is also offered free right of way and water for five years.

Oregon.

The Mount Hood Ry. Co., mentioned in our last issue as having awarded grading contracts, has moved its offices to the Commercial Block, 2nd and Washington Streets, Portland, Ore.

Good progress is being made with the extension of the line of the United Rys. Co., of Portland, toward Tillamook, and the track will probable be completed to Banks by Nov. 15. This will complete the extension for a distance of 29 miles from Portland, with the exception of the Cornelius tunnel, but cars will be operated on a temporary track over the summit of Cornelius Gap until the bore is through the hill. During August the tunnel work advanced 431 feet, and if the present rate of progress is continued the tunnel will be completed by Mar. 1. Rails will be laid to Glencoe, or North Plains, as the place is now named, by Oct. 15. Ballasting of track from Burlington to the tunnel was completed the latter part of September, with the exception of two light fills, and work was then in progress ballasting between Burlington and Linnton.

The Lane County Asset Co., Eugene, Ore., has completed its survey on the Eugene-Coos Bay R. R. to Glenada. The distance is 61 miles and the permanent location will reduce the distance to less than 60 miles.

Pennsylvania.

The City Council of Wilkesbarre has revived the question of the elimination of all grade crossings in the city and efforts are being made to ascertain definitely the position of the railroads entering the city. Wilkesbarre is willing to spend $1,000,000 as its share of the improvement.

Definite steps for the construction of the projected Johnstown & Altoona Street railway will probably be taken shortly after the election in November. N. W. Storey, Johnstown, Pa., is one of the promoters.

The Chambersburg & Western Traction Co. has completed surveys for its projected 7½ mile line from Chambersburg to St. Thomas, and has secured $100,000 of capital for construction purposes. It has not been decided when construction contracts will be let. R. M. Ramsey, Chambersburg, Pa., is President.

Surveys have been completed for the reconstruction of the main line of the Delaware, Lackawanna & Western R. R. between Clarks Summit and Hallstead. It is stated that two separate plans were submitted to the president of the road. One of these plans provided for the expenditure of $9,000,000, and the other provided for an expenditure of $12,000,000 The principal features of the improvement will be the straightening of the road by the elimination of curvature, the reduction of grades running all the way from 20 to 60 feet to the mile, and the abolishment of every grade crossing between Clark's Summit and two miles west of Hallstead.

The Buffalo, Rochester & Pittsburg Ry., E. F. Robinson, Chief Engineer, Rochester, N. Y., which some time ago acquired the Silver Lake Line extending from Silver Springs to Perry along the shores of Silver Lake in Wyoming County, is to improve the road bed of that line.

The American Railways Co., Philadelphia, Pa., has decided to build extensions to its lines in Altoona, through the Third and Fifth wards in that city.

Thomas D. Casale, Williamsport, Pa., has been awarded the contract for building a piece of tram road in the Rock Run District, near Ralston, for the Central Pennsylvania Lumber Co. He is also constructing an extension of seven miles to the Mina railroad on Sartwell Creek, starting from Burtville, Potter county.

Night and day gangs are being worked on the extension of the Western Maryland R. R. from Cumberland, Md., to Connellsville, Pa. At the beginning of October there were 3,569 men, 408 animals, 28 steam shovels and 56 dinkies being used on the work.

South Carolina.

The Brandiville & Bowman R. R. Co., now operating 13 miles of line, is considering extending its line to the Edisto River. Samuel Dibble, Bowman, S. C., is President.

South Dakota.

A charter has been granted the Duluth, Pierre & Black Hills Ry Co. to construct a line 124 miles long extending from Pierre to Aberdeen and estimated to cost $5,500,000. The headquarters of the company are at Pierre, S. Dak., and the directors are George W. Seever, S. W. G. Bierd, C. P. Foote, Minneapolis; Charles DeLand and John I. Newell, Pierre. This is to be the extension of the Minneapolis & St. Louis R. R., W. D. Taylor, Chief Engineer. At a recent meeting of the officials an agreement was reached whereby construction work would be started soon on a line from that city to Aberdeen over an old grade, which was built in the past by the city of Pierre. Wilson Bros., according to reports from Aberdeen, S. Dak., has been awarded the contract.

Tennessee.

Arrangements are being made for building an electric railway from Nashville to Gallatin, Tenn., a distance of 27 miles from the first division. The promoters will not take up construction matters before spring, but are now about ready for surveys and securing right of way grants. H. H. Mayberry, Franklin, Tenn., is the promoter.

Texas.

Claude V. Birkhead and associates, of San Antonio, Tex., holders of a franchise for a street railway at Austin, have filed a $20,000 bond with the city. Construction work on the line to South Austin has already been started.

The citizens of Yoakum have accepted the proposition made by L. E. Walker, President of the Quanah, Seymour, Dublin & Rockport Ry. Co., to bring that road to Yoakum. The proposition submitted is for the citizens to purchase $50,000 of the capital stock and $50,000 of the 5 per cent bonds and to secure the right of way through DeWitt County and furnish grounds for depots and terminals. It is contemplated to use the old Guadalupe Valley roadbed which is already graded from Yoakum to Victoria.

The Wichita Falls & Southern R. R is said to have decided not to make an extension to Fort Worth nor to undertake any further construction work in Texas at this time.

Ground was broken at Provident City on Sept. 30 for the construction of the Gulf Coast & Provident City R. R. This road is to be about 59 miles in length, running north from a point near Glenflora, and thence west to Halletsville or Yoakum. The short line will have three connections with other roads and will penetrate a territory 50 miles wide, at present unserved by any railroad. It lies between the Sap and the Brownsville. Carey Shaw, Houston, Tex., is a director.

An agreement has been reached by the Mitchell-Pigg Construction Co. and the promoters of the Gainesville-Bridgeport Ry., whereby the construction company will take over bonuses, profiles, etc., and start grading on the line at the Gainesville end not later than December 1, 1910. Eighteen miles of the total 56 will be completed by October 1, 1911. Mitchell-Pigg Co. reports grading on the Chicago, Westerford & Brazos Valley Road progressing satisfactorily, work already having been pushed to Boonesville.

Actual construction work on the St. Louis-Southwestern (Cotton Belt) Ry. extension from Hamilton to Commanche, Texas, has begun. It is said that about 350 teams will be employed on the job. Right of way committee has secured deeds to all the right of way except four or five tracts which will be closed in a few days. W. E. Eaton, Tyler, Texas, is Chief Engineer of the company.

The San Augustine & Neches River Ry. has filed an amendment to its charter extending the time of its corporate existence 25 years. Thist road was chartered to construct a line from San Augustine, Texas, 62 miles to the southward.

Advices from Houston, Tex., state that two new railroads are scheduled to open for operation soon. The Southern Pacific Ry company's new line from Lafayette, La., northeast to Port Allen, a point opposite Baton Rouge, which has been under construction for a number of years. The work was considerably delayed in overcoming the difficulties encountered in crossing the Atchafalaya River. The other line is the 55 mile extension of the Santa Fe on the Pecos and Northern Texas from the Coleman-Lubbock, southwest to LaMesa and the 16 miles section of the Coleman cutoff from Lubbock to a connection with the LaMesa branch.

A proposition has been submitted the business men of Lockhart, Tex., by President L. E. Walker and Chief Engineer Thomas Moore of the Quanah, Seymour, Dublin & Rockport Ry. Co., providing for the sale of stocks and bonds to carry it through Caldwell County. Survey matters were gone over and it is expected that the officials will return later to try and close the deal. Two other railroads have been chartered in Texas, showing Lockhart as a point on their proposed route.

Map of the proposed extension of the Beaumont & Northern R. R. from Beaumont to Waco, Tex., has been published. The line as planned would form a cutoff system from tidewater at Port Arthur into the plains country of Texas, and on into New Mexico or the northwest, if desired. It would prevent the necessity of going a circuitous route, over several lines of railroad, in order to reach Port Arthur and that section, as is now necessary. Practically this part of the country has no railroad facilities from the plains or from Waco, owing to the roundabout road now necessary to be followed.

Plans for the construction of the Palacios, San Antonio & Pecos Valley R. R. are about completed and construction work, it is said, will be commenced at once on the first 60 miles. The entire line will be 160 miles in length and will, according to the projected route, run from Palacios in a northerly direction to Ismay, Jackson County, where it will cross the St. Louis, Brownsville and Mexico Railroad, and it is then to extend to Edna and thence to Ezzell in Lavaca County. The counties to be traversed are Matagorda, Jackson, Lavaca, DeWitt, Gonzales, Gaudalupe, Wilson, Fayette, Bastrop, Caldwell and Bexar. The home office of the road is to be at Palacios and the work is to be directed from that end. The incorporators are J. P. Pierce, Thomas H. Bonner, S. T. Best, H. W. Dean, W. H. Brooks, W. S. Baldwin, D. L. Stump, Charles Clayton, D. W. Grant and W. S. Bonner, all prominent business men of Palacios and adjoining country.

The stockholders of the proposed Aransas Pass, Rockport & Corpus Christi Ry., have organized a company with a capital stock of $400,000 and have elected the following officers and directors: President, Walter Reiffert; R. A. Love, first vice president; George J. Schleicher, second vice president; Paul Dornbluth, secretary; Lee Joseph, treasurer; directors, C. G. Breeden, Lee Joseph, Love, Schleicher, W. Reiffert.

Utah.

The Commercial Club of Roxbury, Utah, has endorsed a proposition for the construction of an interurban line to take in Roxbury and St. Anthony and all towns between. The proposition proposes that $50,000 be subscribed in Fremont County for the project.

Grading work is now under way for the Ogden Rapid Transit Co. cutoff from Harrisville to Hot Springs on the Brigham City line. This new line will skirt the foothills south of Pleasant View and will do away with the necessity of climbing the heavy grade, at present encountered on the Hot Springs line. The cutoff will be in use early in the fall.

The Oregon Short Line, according to reports from Pocatello, Idaho, is planning to rearrange and greatly enlarge the yards at that city and to extend the double track system to Minidoka, Idaho.

The Shattuck & Edinger Construction Co., of San Francisco, Cal., and the Utah Construction Co., of Ogden, Utah, which have the contracts for the construction of the high line of the Salt Lake R. R., have sublet part of the work to the Wasatch and Sumption Construction Companies. At Caliente the Utah Construction Co. has built store houses for grain and food for both man and beast, as well as other houses for tools, construction materials and supplies. Gangs are busy making tunnels, making fills and grading. Those who have been over the ground declare the work will be completed a month before the specified time, if the progress being maintained at the present time is continued through the winter.

Among the improvements proposed for next year by the Oregon Short Line Ry. is the double tracking of the system between Farmington and Ogden, Utah, completing the line from Salt Lake to Weber capital. William Ashton, Salt Lake City, Utah, is Chief Engineer of the Railway.

Virginia.

An ordinance is before the City Council of Richmond, Va., authorizing a change in the route of the Richmond & Henrico Ry. from Marshall and 31st Street to the Fulton loop. The original franchise was granted by the council in 1902. If the new route is granted there will be two grade crossings, one over the Government road, another over the West Point branch of the Southern Railway.

The Norfolk & Western Ry., J. R. Schick, Engineer of Construction, Roanoke, Va., is reported to have taken bids for constructing 16 miles of extensions on the Dry Fork and Tug Fork lines.

Advices from Salisbury, Md., state that double tracking on the New York, Philadelphia & Norfolk R. R. between Delmar and Cape Charles is progressing nicely and it is expected to have the work completed by next summer. Double track has been extended until now there are 44 miles of double track in operation. Large concrete culverts have replaced the wooden bridges at King's creek and Princess Anne, and several smaller ones have been put in at other places; large repair shops have been erected at Cape Charles and are now nearly completed.

The Roanoke & Mt. Airy Southern Ry. Co., recently incorporated, as noted in these columns, projects a 100-mile line from Roanoke, Va., to Mt. Airy, N. C. Surveys have not been made as yet, nor has the capital been secured for construction. The Chief Engineer has not been selected. A. L. Sibert, Roanoke, Va., is President and L. C. Stewart, Roanoke, Va., is Secretary and Treasurer.

Washington.

The Jefferson County Construction Co. of Irondale, has been incorporated with a capital stock of $75,000; the incorporators including C. E. Oliphant and Tom W. Holman.

It is reported in the vicinity of Aberdeen, Wash., that either the Chicago, Milwaukee & Puget Sound or the Union Pacific Ry. have under consideration the construction of the joint Grays Harbor line from the main tracks of the Oregon & Washington near the town of Wynooche to some point north in Section 20 for the purpose of tapping rich timber country.

The Puget Sound & Pacific R. R. Co. has been chartered with a capital stock of $500,000 and principal offices at Tenino, Wash. The incorporators are George F. Clement, N. H. Truett, William McArthur, et al.

The North Coast Ry. Co., according to information received from North Yakima, Wash., will have the line in operation between Attalia, the junction point of the Walla Walla and Puget Sound branch and North Yakima, by November and between Spokane and North Yakima soon. Between Spokane and Marshall 3 miles of grade have been completed; beginning at Cheney and running southwesterly 30 miles of grade have been completed and 14 more are under way. This work is on the through line between Spokane and North Yakima and the branch line to Walla Walla. North of Kiona and on the main line to North Yakima 10 miles of grade work has been completed into Benton City, the junction of the Walla Walla and Puget Sound branch of the road. From Attalia, 28 miles west of Walla Walla, the road has been graded and ballasted to the east end of the Columbia river bridge. Material yards at Attalia have been established. On the Walla Walla branch of the North Coast the Snake river bridge, an engineering feat, is under way. This structure will be the highest span in the United States crossing any river. It is 300 feet high and 3,000 feet long. The 12 concrete piers of the Columbia river bridge have been completed, including the span pier. The approaches have been completed. Material for the bridge is on hand and it will be completed by November 1. At the present time about 3,000 men are employed by the North Coast in construction work.

West Virginia.

The Greenbrier Cheat & Elk Ry. Co., of Cass, Pocahontas county, W. Va., recently incorporated with a capital stock of $50,000, of which $10,000 has been paid in, proposes to build a railroad from Bemis, Randolph county to Webster Springs, in Webster county, with branch lines to connect with the Marlinton & Camden Ry. and with the Chesapeake & Ohio, near Clover Lick, in Pocahontas county, and with the Valley River Railway near the mouth of Valley Fork of Elk river in Randolph county. The incorporators were S. E. Slaymaker, Henry L. Condit, John G. Luke, George H. Perkins and George E. Nelson, all of New York city.

The Berkeley Springs & Potomac R. R. has been sold to R. M. Miller of Baltimore, Md., for $750,000. It is reported that Mr. Miller was acting for the Baltimore & Ohio R. R.

Wisconsin.

The Chicago & Northwestern Ry., on Oct. 1, submitted its plans to Charles J. Poetsch, City Enginees of Milwaukee, for the elevation of its tracks on the south side of the city.

In our issue of October 5 we noted the incorporation of the Chicago & Wisconsin R. R. Co. The name of the company should nave been the Chicago & Wisconsin Valley Street Rys. Co. The company was incorporated with a capital stock of $25,000, all paid in, and headquarters at Madison, Wis. The incorporators are Allen T. Russell, J. E. Jones, G. T. Wiswell, all of Wisconsin, and Thomas W. Potts of Chicago, Ill. The officers are Allen T. Russell, president; G. T. Wiswell, vice president, and J. E. Jones, treasurer.

It has been announced by capitalists of La Crosse, Wis., who are promoting the construction of a railroad from Readstown to Viroqua, that bonding propositions have been carried in every community involved, and that the company will soon be organized and preliminary work rushed through this fall.

The Prairie Farm & Southwestern Ry. Co., of Prairie Farm, Wis., has filed an amendment to its charter increasing the capital stock from $25,000 to $100,000.

Canada.

The Mayor of Hamilton, Ont. has suggested to the Dominion Power & Transmission Co., Ltd., Hamilton, that it should build a street car line on Picton or Ferrie Street to serve the growing needs of the northeast section of the city.

The Rural Ry. Co., which has applied for a franchise in St. Vitel, a suburb of Winnipeg, as mentioned in our last issue, has the following officers: Charles E. Lewis, Minneapolis, Dr. W. Z. Peatman and Joseph Bernier, of Winnipeg. The company proposes an electric suburban railway which will run from the southern limits of either St. Boniface or Winnipeg to St. Vital, five miles. The railway is to be finished November 1, 1911.

D. B. Campbell, general contractor for the grading, tracklaying and ballasting for the 80 miles of line of the Peoples' Ry. Co., has shipped outfits to Berlin, Ont., and Baden and intends to complete the grading between Berlin and New Hamburg this fall.

Roberts & Abbott, consulting engineers, Cleveland, O., have made a report on the Niagara Falls, Welland & Dunnville Ry. It is said that there will be no delay in beginning building operations. The company has a charter to build and operate an electric railway between St. Catherines, Ont. and Dunnville. Carl Gardner, City Engineer, St. Catherines, is a director.

The Spokane & British Columbia Ry., (Kettle Valley Lines), E. M. Holland, General Manager, Republic, Wash., has made arrangements for the running of surveys into Penticton.

The Canadian Pacific Ry. is planning to construct a new and comprehensive terminal scheme for Lambton, a suburb of Toronto, Ont. The proposition includes the construction of a large roundhouse and of a freight yard to accommodate more than 400 freight cars.

The Winnipeg Electric Street Ry. Co., Wilford Phillips, Manager, Winnipeg, Man., has announced its intention of extending its street car line this fall out Notre Dame Avenue, for a distance of 12 blocks. The extension will be double track.

The Canadian Pacific R. R. on October 4 placed in operation its first piece of double track west of Winnipeg, trains being started running on the new tracks between Winnipeg and Portage la Prairie, on the C. P. R. line. This stretch of double tracking is 55 miles in length. This is really the first stretch of double tracking of note westward of Winnipeg, but it may be mentioned that there is a short double line, seven miles long, known as the Kennedy cutoff, which has been in use for some little time between Brandon and Kemnay.

Late advices from Britist Columbia, regarding the Grand Trunk Pacific state that G. T. P. steel will be laid to within two miles of Kitselas Canyon before the end of the present month. Construction camps are well filled, and the men are working on towards Hazelton and over towards Aldermere.

The contractors on the sections of Trans-Continental Ry., in Canada, have been making good progress and it is expected that No. 1 section will be ready for acceptance by the end of the month. The section on contract No. 2 is now ready for operation, but details will not be completed until the end of the season. Contract No. 3 is ready to be taken over any time. The sub-contractors on section No. 4 say that it will be ready this fall. The road is advanced far enough to hold trains going 40 miles an hour. On contract No. 5, extending from the Tobique to Grand Falls, the big viaduct over the gorge through which the Little Salmon River flows and a couple of smaller viaducts will not be ready for some time. It will probably be next season before this section is ready to be taken over from the contractors. Contract No. 6, with terminals at Edmundston, could have been completed by this time, but as there was nothing to be gained by having it ready before No. 5 the work was not rushed. Taken as a whole, however, the line is rapidly nearing completion, and before the end of next season it will be ready for operation from one end to the other.

The Minister of Railways has approved the application of the Alberta Central Ry. Co. for revision of the route map from Mile 40, east of Red Deer to Sounding Creek, and for a new route map from Sounding Creek to Moose Jaw.

According to advices recently received from St. John, N. B., the Bangor & Aroostook R. R. system is rapidly nearing completion, and will be in operation by December 1. The new line parallels the St. John river for a distance of about 29 miles and is the connecting link between the towns of Fort Kent and Grand Isle. The rails are all down and the grading practically completed on the two ends of the line, but considerable heavy construction work in the middle sections is retarding the completion of the work considerably and it will be two months or more before the new extension is really ready for the formal opening.

It is said that the officials of the Canadian Northern Railway are considering a proposition to rent the proposed Hudson Bay Railroad of the government on the basis of the cost of construction.

South America.

✣Bids are asked for the construction of a railroad from the City of Ambato, Ecuador, to the Arajuno River, a distance of 117 kilometers. Particulars may be obtained from the General Consulate of Ecuador, 11 Broadway, New York City.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arizona.

The Lyman Irrigation Co. contemplates the construction of two or more large irrigation systems on the Little Colorado River. Robert Craig, St. Johns, Apache county, Arizona, is Chief Engineer.

The stockholders of the Buckeye canal at a meeting at Phoenix, Ariz., decided to enlarge the canal.

California.

Advices from Stockton state that a committee consisting of F. E. Quail, Charles B. Smith and W. H. Chestnutwood, has been interviewing property owners along the north bank of the Calaveras River from the junction of the Calaveras and the diverting canal as far east as Cherokee Lane for the purpose of obtaining rights of way for a levee to protect some 12,000 or 15,000 acres from Winter overflow.

Idaho.

Advices from Boise state that the Big Lost River Land & Irrigation Co. has purchased from Brazilla Clark of Idaho Falls his reservoir site west of Dickey stage station in upper Lost River Valley, to supplement the one at Mackay. It is stated that the latter will be completed only 40 or 50 ft. high and used as an auxiliary reservoir and measuring station. The Dickey site will impound 200,000 acre feet, will be seven miles long and 1¾ miles wide. Water is to be conducted from large streams to the southward across the bench land to Bradshaw's butte where an earth dam with concrete core will be built 4,400 ft. long, 45 ft. high, containing 250,000 yds. of impervious material resting on hard bottom. Material to be taken from sticky clay plain east of reservoir.

Illinois.

✣Bids will be received until 1 p. m., Oct. 25, by Drainage Commissioners of DeWitt Special Drainage District in the Counties of DeWitt and Piatt, Clinton, Ill., for the construction of ditch work, including approximately 100,000 cu. yds. of excavation to be moved 8 ft. from the ditch.

The Trustees of the Sanitary District of Chicago, Ill., have preparatory work well under way for Calumet Sag channel. Actual work on the channel will be started not later than next spring.

Iowa.

The Board of County Supervisors, Sioux City, Ia., will on Oct. 27, take up the question of assessing damages for the construction of the Little Sioux drainage ditch.

Kansas.

✣Bids will be received at once by Wheeler & Keleher, Garden City, Kan., for 250,000 cu. yds. of earthwork, most of which is grader work, fresno work and wheeler work, short haul, in Eastern Kansas. Official advertisement will be found elsewhere in this issue.

The Commissioners of Atchison county, Atchison, Kan., have granted a petition to establish a drainage district between Arrington and Muscotah for the improvement of the Delaware River. One other district is now being formed for improving the upper Delaware River, and two more may be established for the same purpose.

Kentucky.

R. H. & G. A. McWilliams, 169 Jackson Blvd., Chicago, Ill., have been awarded the contract at $20,300 for excavating the Pond Creek ditch from Stations 250 to 450, for the Fiscal Court of Jefferson County. Bids were opened Sept. 20 at Louisville, Ky.

The sum of $10,000 is being raised by the citizens of Hickman, Ky., for building a levee to protect West Hickman during flood times. Over $7,000 has already been subscribed. This levee will join the Government levee, which is a short distance below the city limits. The Nashville, Chattanooga & St. Louis Ry. Co. has offered to raise its tracks to a sufficient height down as far as the Mengel plants in West Hickman.

Louisiana.

The contract for drainage work in the Iberia and St. Mary Drainage District was awarded on Oct. 4 to Roger Holmes, Liverpool, London & Globe Bldg., New Orleans, La., Care of Johnson and Armstrong.

Minnesota.

W. M. Knight, County Commissioner, Minneapolis, Minn., is advocating a plan to connect Lakes Minnetonka and Waconia by dredging out Six Mile Creek. The cost would be about $9,000.

Mississippi.

The J. S. Kochlitzky Construction Co., Cape Gireadeau, Mo., has been awarded the contract at 9½ cts. per cu. yd., for constructing 20 miles of open ditches for the Crede Drainage District. This work includes about 400,000 cu. yds. of excavation. Bids were opened Oct. 7 at Greenwood, Miss.

R. B. Lawler and F. J. Mullens, large land owners of Clarksdale, Miss., have decided to construct a drainage canal in order to drain some wet land on their plantations. The ditch will be 20 ft. wide, 12 ft. deep and six miles long. The engineering department of the Tallahatchie drainage district will advise with these land owners upon the engineering features of the canal, and the same will be constructed at the expense of the land owners.

Montana.

Bids were opened Oct. 1 at Sanders, Mont., for the enlargement and extension of the Sanders irrigation canal for the Yellowstone Irrigation District, the work including the excavation and placing in embankments of 499,700 cu. yds. of earth and the construction of 340 ft. of tunnels and culverts. The contract was let to L. W. Robinson, Forsyth, Mont., at $120,000. The work includes the enlargement of the present canal of 13 miles length and its extension for 16 miles. The canal is to be completed by Oct. 1, 1911. E. F. Meyerhoff is President of the District.

New Mexico.

The Aztec Irrigation Co., which proposes to operate in San Juan county, N. Mex., has filed its articles of incorporation in Colorado. The company has a capital stock of $500,000 and will have its principal office in Denver, Colo. The incorporators are Arthur Ponsford, Giles F. Roosevelt and Charles F. Carnine, all of Denver, Colo.

North Carolina.

✣Bids will be received until 10 a. m. Nov. 21, by Drainage Commissioners, Postoffice Bldg., Chadbourn, N. C., for constructing drainage ditches in Chadbourn Drainage District. The work will aggregate 19 miles of ditches and will include about 140,720 cu. yds. of material. C. R. Humphreys is Engineer of the District.

Ohio.

J. Warren Hyser, Zanesville, O., at $4,370, was low bidder Oct. 3, for placing a concrete backing behind the Licking River revetment at Lee St., Zanesville.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

The Memphis Union Station Co. awarded the contract to Murch Brothers of St. Louis, Mo., for the construction of underpass for the express and baggage rooms of the new $3,000,000 station now under construction in Memphis. The contract will amount to approximately $100,000. The underpass is to be of reinforced concrete throughout.

The beginning of the various levee contracts in this section has created an activity not only in the labor line, but in the contractors' supply departments as well. The various wholesale houses which cater to the contractors' trade have increased their stock, anticipating the large amount of goods which will be needed in carrying on the new projects near Memphis. Dresbach Brothers and G. C. Weathers were in town last week and stocked up the steamboats going up the river with supplies and hardware for the work which these two firms have just started.

Big Bob Leonard was a passenger on the Kate Adams last week en route to his large contract near Helena. Bob is kept pretty busy these days, going from one of his projects to another, but he states that he has the situation well in hand, and is expecting a neat profit on the season's work.

Monte Gardner, the Assistant United States Engineer at Memphis is a pretty busy man these days. Monte has charge of all the government revetment in this section, together with supervising the fleet of barges, dredges and steam boats which the United States will build within the next 60 days. But Monte is a hustler and can take care of most anything that comes his way.

Jack Rison, the popular Assistant General Superintendent of the Yazoo & Mississippi Valley Railroad at this place, is enjoying a fifteen days' vacation in New York. As soon as Jack returns, it is expected that he will make award of the Tallachie district contract for his road.

Sam Bush has taken contract from Roach & Stansell for the construction of 85,000 cu. yds. of levee enlargement work near Tyler, Mo., and is rushing his outfit from Gatesville, Tex., to the scene of action. This bears out Sam's statement that he can't forsake the sound of a steamboat whistle on the mighty Mississippi.

Dresbach Brothers are hard at work on their levee contract near Lambertsville, Mo. Their outfit arrived on the work about two weeks ago from Texas, and since the date of beginning have been piling up dirt in true Dresbach fashion.

M. J. Roach has moved his camp No. 3 from Rosedale, Miss., to Benoit, where he has a contract to complete the large Buckridge levee for the Mississippi Levee Board. Charlie Siler is in charge of the outfit and states that he will finish the contract by January 1. W. J. Shackelford is the engineer in charge.

Jimmie Omberg seems to be making remarkable progress on his Union Station contract. Jimmie has placed sub-contractors on his subway excavation jobs and it is reported that Ed Manigan will do all his brick work. Tom McCabe is in charge of the steam shovels used on the work. Jimmie is in high glee over the success of his undertaking.

Bill Stephenson formerly superintendent for J. T. Walsh & Bro., has accepted a position with Roach & Stansell as their Division Superintendent at Clay, Texas, and is in charge of the construction of 50 miles of Burleson county levee. Bill is great on building levees and has the reputation of endowing dirt with aeroplane wings when it comes to making it fly into an embankment.

Ben Tally, with Jack Dempsy as man in charge, has about completed his excavation for culvert on the new Union Station contract.

Mike Roach, of Roach & Stansell, has just returned from an inspection trip through Texas, where his firm has several large levee and railroad contracts. Mike states that all is going well with his forces in the Lone Star state, and thinks that he will begin to move outfits from the levee work about December 1.

Martin Jennings was in town last week from his Rosedale contract, which is going along at a good rate of speed, according to Martin's statement.

Lowrance Brothers led the Riverton Loop contractors last month with the large estimate which their forces rolled up. The Brothers, as they are known to their friends in this section, are great workers and attribute much of their remarkable success to the personal attention which they devote to all their contracts. They are also making fine headway on their Arkansas City work.

It is reported that the following contractors from Memphis will bid on the Louisville & Nashville work to be let in Louisville, Ky., on the 12th: C. D. Smith & Co., Roach & Stansell, Jim Carey and Sam Bush. The work requires about four days for inspection and all contractors who bid on same must show that they control a sufficient force to satisfy the engineers in charge that the work can be done on contract time.

Labor still continues scarce in this section and contractors are compelled to send out their employes on a hunt for new labor, the various agencies who have heretofore been able to supply the demand failing utterly to keep the contractors full. Several contractors have had success by sending some trusty man into the country districts, but for the most part they must be content with a green class of labor, but who in time, make the better workers.

Texas.

✣Bids will be received until 1 p. m. Nov. 5 by the Commissioners of Brazos County Improvement District No. 1, W. W. Loftin, Chairman, Allenfarm, Tex., for the construction of about four miles of levee and the completion of eight miles of levee partially constructed, said levee being located in the Brazos bottom, in the south end of Brazos county. Proposal sheets, specifications, profiles and map may be obtained from T. R. Batte, Jr., improvement engineer, 806 Stewart Bldg., Houston, Tex, This construction work will consist of about 200,000 cu. yds. of earth embankment, eight acres of clearing and grubbing and 75 acres of sodding. The local land owners have already built eight miles of the levee, but did not finish same up to grade, so there will be four miles of new work and the sodding and finishing of all of the old levees. A $49,000 bond issue has been issued and approved by the Attorney General of the State of Texas.

The election to determine whether the people of Harris county shall issue bonds for $1,250,000, and with the United States government expend $2,500,000 to deepen the Houston ship channel to 25 ft., will probably be held in December.

J. M. Howe, C. E., Houston, Tex., has been making detailed surveys for a levee district in the vicinity of Chappell Hill, Tex. The district will comprise some 9,000 acres. The District will issue bonds and on their approval by the State's Attorney General will call for bids. This will probably be done about Jan. 1, 1911.

Wisconsin.

Emmett T. Bowen of Madison, Wis., has work under way on his contract for dredging eight miles of laterals of the Mt. Pleasant and Somers canal between Somers and Corliss.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

The following bids were received Sept. 30, by Major H. Jervey, U. S. Engineer, Montgomery, Ala., for cutter machinery and other accessories, for 15-inch pump dredge, Alex. Miller & Bro., Jersey City, N. J., $34,310, delivery of first lot, 40 days, second lot, 60 days, third lot, 85 days; American Locomotive Co., New York, $38,500, first lot, 75 days, second lot. 105 days, third lot, 135 days; Norbom Engineering Co., Philadelphia, Pa., $26,800, first lot, 45 days, second lot, 75 days, third lot, 112 days; Ellicott Machine Co., Baltimore, Md., $33,800, first lot, 80 days, second lot, 120 days, third lot, 120 days.

Arkansas.

Henry R. Worthington has been awarded a contract by the quartermaster of the Medical Corps at Hot Springs, Ark., for furnishing and installing one triplex pump and two motors one A. C. and one D. C. for $2,768. Bids were received Sept. 10.

California.

✣Bids will be received until noon, October 21, by Brig. Gen. Charles E. L. B. Davis, U. S. Agent, U. S. Engineer Office, 726 Chronicle Bldg., San Francisco, Cal., for dredging in Petaluma Creek, Cal.

✣Bids will be received until noon, October 27, by Charles E. L. B. Davis, Brig. Gen. U. S. Agent, U. S. Engineer Office, 726 Chronicle Bldg., San Francisco, Cal., for dredging in Oakland Harbor, Cal.

✣Bids will be received until 11 a. m., November 19, by Bureau of Yards and Docks, Navy Department, Washington, D. C., for quarters for wireless telegraph operators at the United States Navy Yard, Mare Island, Cal.

✣Bids will be received until 11 a. m., Nov. 7, by W. P. Stokey, Capt. U. S. Engineers, 723 Central Bldg., Los Angeles, Cal., for dredging Los Angeles Harbor, Cal.

District of Columbia.

✣Bids will be received until October 18, by Capt. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Zone 4689 1,000 steel taper keys for brakeshoe bolts.

✣Bids will be received until October 14, by Capt. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Zone 4762-A, two steam pile driving hammers, total weight 10,150 lbs.

✣Bids will be received until October 13, by Capt. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Zone 4593-A. one curved drawing voltmeter and 1,000 charts.

✣Bids will be received by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 2 p. m., October 14, for furnishing under Canal 4765-A, 200 pairs of rubber boots, leather sole, hip length.

✣Bids will be received until 2 p. m., October 13, by Capt. F. C. Boggs, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Zone 7546-C, 10 screw jacks, being a readvertisement of Class 28, Canal Circular 604.

✣Bids will be received until 10:30 a. m., Oct. 31, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 609, reinforcing steel bars and lumber.

✣Bids will be received until 2 p. m., October 14, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing 1,170 dipper lips.

Georgia.

Bids were opened Oct. 1 at the U. S. Engineer's office, Savannah, Ga., for dredging the harbor at Savannah. P. Sandford Ross, Inc., Jersey City, N. J., at $167,090, is the probable successful bidder on the work.

Idaho.

✣Bids will be received until 3 p. m., November 15, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the united States Postoffice at Lewiston, Idaho.

Illinois.

✣Bids will be received until 11 a. m., Oct. 11, 1910, by the Commissioner of Public Work, City of Chicago, Room 705, City Hall, for furnishing complete, six dump cars to be used by the Bureau of Streets and to be built according to specifications on file, at the Commissioner's office. The cars are to be sufficiently tight to carry ashes and street refuse (but no garbage), and must be of sufficient strength to carry a load of 54,000 lbs. The cars are to be not more than 36 ft. in length over all, and 8 ft. 6 in. in width, and are to be equipped with necessary air brakes, trucks, hand rails, draw bars and couplers of such a type as will permit them to be used on the city street car tracks.

✣Bids will be received until 2 p. m., October 20, by Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for furnishing and delivering at Rock Island one two-stage belt driven air compressor, having an approximate capacity of 200 cu. ft. of air per minute when operating at not over 160 revolutions per minute; to be of the horizontal duplex type, each air cylinder with its running gear being an independent unit; permissible floor space, 7 ft. by 4 ft. 6 in.

✣Bids will be received until 2 p. m., October 20, by Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for furnishing and delivering at the Rock Island Arsenal one 50 h.p. 50-volt compound wound double connected motor, with pulley, slide rails and starting rheostart, 400 revolutions per minute.

The Raymond Concrete Pile Co., of New York and Chicago has been awarded the contract for the foundations, including Raymond concrete piles, for the Hartman Furniture Warehouse at 39th and La Salle Sts., Chicago. Ottenheimer, Stern & Reichart, Chicago, are the architects.

Indiana.

✣Bids will be received until Oct. 17, at 10 a. m., by the Quartermaster, Jeffersonville, Ind., for furnishing miscellaneous supplies.

✣Bids will be received until 2 p. m., October 14, by S. I. Kimball, General Superintendent Treasury Department, U. S. Life Saving Service, Washington, D. C., for alterations and improvements to the Michigan City, Ind., life saving station.

Iowa.

✣Bids will be received until 7:30 p. m., Oct. 24, by J. M. Ingold, Secy., Board of Education, Cedar Rapids, Ia., for erection of an addition to the Washington High School, including plumbing, heating and ventilating and electric installation. Josselyn & Taylor Co., Architects.

Kentucky.

✣Bids will be received until Oct. 17, at noon, by the City Buyer, Louisville, Ky., for six 4-wheeled catch basin carts.

Louisiana.

Bids were opened Sept. 19 by the City of New Orleans, La., W. J. Hardee, City Engineer, for constructing a seawall at the West End of the city and for filling behind the seawall, the low bidder for each piece of work being noted in our Sept. 28 issue. For the 400,000 cu. yds. of filling behind the seawall the following bids were received: Home Dredging Co., Mobile, Ala. (accepted), 11.37 cts. per cu. yd.; Lafourche Dredging Co., 13.5 cts.; Jahncke Navigation Co., 14.25 cts.; Hampton & Reynolds, 15.24 cts.; H. L. Zander, 28 cts. For constructing the seawall the bids received were as follows: (1) Standing for J. D. McGee, Jackson, Fla. (accepted bid), (2) for Henry Monk, (3) for Hanna & Bixler, (4) for James Stewart & Co., (5) for James Denton, (6) for F. A. Noullet & Son, (7) for Henry L. Zander, (8) for W. M. Wren, (9) for Gulf Concrete Construction Co., (10) for A. L. Patterson, (11) for The Midland Bridge Co., and (12) Bancroft & Ross.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Piles, 1,300	$7.45	$6.49	$12.00	$11.00	$9.97	$9.90	$14.00	$16.50	$17.25	$15.21	$30.00	$20.00
Sheet piling and waling timbers 495,000 ft. B. M.	21.60	37.44	35.05	49.50	43.75	57.50	60.00	35.00	34.50	62.80	60.00	50.00
Tie rods, 340	1.40	2.72	2.10	1.25	2.05	2.88	3.00	1.00	1.15	11.20	1.00	10.00
Excavation, 1,400 cu. yds.	.40	.56	1.00	4.25	1.80	1.50	1.10	1.50	2.30	1.05	4.00	1.00
Concrete, 142,750 cu. ft.	.294	.32	.36	.35	.42	.39¼	.41	.55	.57½	.48	.43	.70
Reinforcing rods, 18,400 lbs.	.02¼	.04	.031	.03½	.057	.06⅔	.09	.10	.034½	.07	.04	.05
Total	$63,795	$74,977	$87,024	$95,784	$98,838	$101,667	$110,643	$121,567	$125,829	$125,945	$136,758	$156,395
Commence work, days	15	10	30	20	10	45	30	170	30	20	4	25
Complete work, days	180	275	160	200	240	180	300	180	360	365	240	200
Complete wing wall opening, days	15	30	15	40	15	30	60	10	20	60	15	30

Alternate bids on their own plans were submitted as follows: Henry Monk, $26.88 and $29.15 per lin. ft., 275 days to complete; Hanna & Bixler, $35.52 per lin ft., complete in 160 days; James Stewart & Co., $39.24 per lin. ft., complete in 200 days; F. A. Noullet & Son, $54.70 per lin ft., complete in 210 days; W. M. Wren, $32 per lin. ft., complete in 150 days; Gulf Concrete Construction Co., $43 per lin. ft., complete in 360 days; Bancroft & Ross, $34 per lin. ft., complete in 150 days; Raymond Concrete Pile Co., $31.50 per lin. ft., complete in 120 days.

✣Bids will be received until 7 p. m., October 15, by Town Council of Kentwood, La., for the erection of a school building. Plans and specifications are on file at the office of R. H. Hunt, Chattanooga, Tenn., Architect.

Massachusetts.

✣Bids will be received until noon, October 31, by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for rubble stone in the north jetty, Newburyport Harbor, Mass.

✣Bids will be received until 11 a. m., October 22, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for the improvement of Pier No. 1, at the Navy Yard, Boston, Mass.

Bids were opened Sept. 23 by the U. S. Engineer, Boston, Mass., for dredging in Hingham Harbor, Mass., Charles M. Cole, Fall River, Mass., at 26½ cts., per cu. yd., being the lowest bidder

Michigan.

The city of Big Rapids, Mich., has been securing options on land for a site for a municipal dam.

Minnesota.

✣Bids will be received until 7:30 p. m., Oct. 15, by G. M. Peterson, City Clerk, Jasper, Minn., for constructing carburetted water gas works, inclusive of producer, boiler, hydraulic condenser, scrubber, purifier, relief holders, gas and oil storage tank steam driven compressor, blower, governor and all necessary connections and appliances with street mains, lamp posts and heads.

✣Bids will be received until 2 p. m., Oct. 17, by State Board of Control, St. Paul, Minn., for the erection and completion of a Detention Hospital building, including the general contract, plumbing work and heating and ventilating and electric work and fixtures and also a contagious hospital building, including the general contract work, plumbing work and heating and electric work and fixtures and a dairy farm at the Rochester State Hospital, Rochester, Minn.

✣Bids will be received until noon, October 17, by Board of Education, Chisholm, Minn., for furnishing the necessary labor and materials for a school building to be erected by the Board. B. R. De Lorimier is Clerk

✣Bids will be received until 11 a. m., October 12, by Maj. D. W. Arnold, Chief Quartermaster, Department of Dakota, St. Paul, Minn., for furnishing and delivering at the Army building, St. Paul, Minn., 144 pints of bronze paint, 24 flue brushes, 24 tube brushes, 144 chimneys, 4 wire cutters, 12 gauges, 150 air valves, 36 radiator valves for steam, 18 radiator valves for hot water, 2 pop safety valves, 500 tire bolts, 100 yds. of canvas, 144 yds. safety chain, 4 blow-off cocks, 100 grease cups, 150 lbs. red sheet packing, 500 lbs. solder, 50 lbs. spelter, 180 rubber stoppers, 144 rubber stoppers, 500 rubber washers and 100 lbs. mineral wool.

Missouri.

✣Bids will be received until noon, November 16, by C. K. Knight, U. S. Engineer, Mississippi River Commission, Ligett Bldg., St. Louis, Mo., for construction and delivery of a 164-ft. sidewheel steamboat.

✣Bids will be received until 11 a. m., October 19, by Capt. Stanley H. Ford, Quartermaster, Jefferson Barracks, Mo., for the construction of a wagon shed.

New York.

✣Bids will be received until 10 a. m., Oct. 27, by M. Gray Zalinski, Deputy Quartermaster General, Army Bldg., New York City, for furnishing and delivering fire apparatus. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by the Department of Health, New York, N. Y., until 10 a. m., Oct. 18, for furnishing and delivering 50,000 terra cotta hollow tile blocks required for the construction of various buildings on the grounds of the tuberculosis sanatorium at Otisville, Orange county, N. Y., for the department of Health, New York.

✣Bids will be received until 11 a. m., November 12, by R. C. Hollyday, Chief Bureau of Yards & Docks, Navy Department, Washington, D. C., for furnishing and installing one electric motor driven capstan at the United States Navy Yard, New York, N. Y.

✣Bids will be [illegible] ber 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for pneumatic [illegible] at the United States Postoffice, New York, N. Y.

✣Bids will be received until 1 p. m., October 13, by Constructing Quartermaster, Fort

Items marked thus ✣ indicate work now open for bids.

Hamilton, N. Y., for the construction, including plumbing, heating, electric wiring and electric fixtures of one field officers' quarters at that post.

✤Sealed bids will be received until 3 p. m., November 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the completion of the superstructure of the new Postoffice building, New York, N. Y., exclusive of heating, electrical work, elevators and vacuum cleaning system.

✤Bids will be received until 2 p. m., October 13, by S. I. Kimball, General Superintendent, Treasury Department, U. S. Life Saving Service, Washington, D. C., for the construction of a lifeboat house and launchway at Whig Inlet, near Fire Island, N. Y.

✤Bids will be received until 3 p. m., November 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an electric elevator equipment at the United States Postoffice, New York, N. Y.

✤Bids will be received until 3 p. m., November 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for installing a heating and ventilating system in the New United States Postoffice Bldg., New York, N. Y.

✤Bids will be received until 2 p. m., October 26, by Light House Inspector, Tompkinsville, N. Y., for furnishing and delivering buoys and appendages for the light house establishment during the fiscal year ending June 30, 1911.

Ohio.

✤Bids are being asked until 2 p. m., Oct. 27, by Maj. John C. Oakes, U. S. Engineer, Cincinnati, O., as noted in our last issue, for the construction of one loose rock dam and shore protection in the Ohio River near foot of Sisters Island. The work to be done is the construction of a dam about 600 ft. long, starting from the Illinois bank of the Ohio River, about 2,500 ft. above the foot of Sisters Island and about 2½ miles above Bay City, Ill. The dam is to have the side slopes as nearly uniform as possible, a width of 10 ft. on top, and a height of 6 ft. above low water. The shore at the root of the dam is to be protected by riprap. This riprap will be about 1½ ft. in thickness, formed of rough stone set on edge. The approximate quantities are as follows: Excavation, 3,700 cu. yds.; stone, 6 to 10 cu. ft. each, 300 cu. yds.; stone, ¾ to 1½ cu. ft. each, 4,700 cu. yds.

✤Bids are asked until noon, Nov. 5, by Maj. John C. Oakes, U. S. Engineer, Cincinnati, O., for constructing dam of concrete, etc., at head of Buffington Island, Ohio River. The work consists in furnishing the material, appliances and labor necessary for the construction of one dam of piling, loose stone and concrete, about 340 ft. in length, between the head of Buffington Island and the Ohio shore, at about 3,000 ft. downstream from the broken remains of the old stone dam. The site of dam is 1¼ miles below Portland, O., and nearly opposite the siding of the Ohio River Division of the Baltimore & Ohio R. R., at Sherman, W. Va. The banks at the ends of the dam are to be protected by concrete slope walls extending about 100 ft. upstream and the same distance downstream from the axis of the dam. The thickness of these walls is to be about 12 ins. at the base and 8 ins. at the top, with a footing course about 18 ins. thick and 4 ft. wide, and a coping about 8 ins. thick and 18 ins. wide; the surface of bank protection wall will be divided into squares about 5 ft. by 5 ft. The approximate quantities are as follows: Excavation, 5,300 cu. yds., piles, 86 in number, iron tie rods, etc., 6,000 lbs., gravel filling, 450 cu. yds., stone, 9 to 18 cu. ft. each, 1,500 cu. yds., stone, ¾ to 3 cu. ft. each, 820 cu. yds., concrete, 1,720 cu. yds., extra cement, 25 bbls.

Oregon.

The City Council of Portland, Ore., has decided to submit at the November election the question of constructing municipal docks.

Pennsylvania.

✤Bids will be received until October 18, by County Controller John H. Moffitt, Washington, Pa., for drilling another gas well on either the Children's or County Home properties. According to the plans the well will be 2,500 ft. deep.

✤Bids will be received until 3 p. m., October 15, by George W. Heber, Secy., Brookville, Water Co., Brookville, Pa., for the construction of a concrete dam.

✤Bids will be received until 3 p. m., November 16, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Postoffice at Chambersburg, Pa.

✤Bids will be received until 1 p. m., October 31, by Depot Quartermaster, 26th St. and Grays Ferry Road, Philadelphia, Pa., for furnishing and delivering the following equipage and materials: 10,000 cots, 250,000 tent pins, 200 sets storage tent poles, 1,500 sets wall tent poles, 5,000 joints stovepipe, 400 stovepipe elbows, 1,500 spades, 2,000 pounds beeswax, 1,000 pounds gilling line, 1,000 square feet russet leather, 6,100 pounds manila tent line, 450 pounds G.-I. tent rings (½-inch), 600 pounds rosin, 700 pounds drab twine (5-fold), 7,500 gross bronze buttons, 3,500 gross Q. D. shirt buttons, 5,000 gross eyelets, 25,000 yards corset jeans, 11,000 spools silk twist, 15,000 pairs shoulder pads, 2,000 yards duck (15-ounce), 360 cones cotton (No. 40), 720 spools cotton (No. 36), 50 pounds O. D. linen thread, 350 gross hooks and eyes.

The Lehigh Valley Coal Co., Mauch Chunk, has awarded stripping contracts, requiring at least 10 years to finish, to Benjamin & Co., and N. S. Cuyle & Co., contractor. The work is to be done at Buck Mountain, near Weatherly. This coal company will build a large coal breaker a short distance from the new railroad yard in process of construction at Hazle Creek, above Weatherly, by the Lehigh Valley R. R.

Bids were opened Oct. 1 by Major Herbert Deakyne, U. S. Engineer, Philadelphia, Pa., for construction of the 12-foot channel, 200 ft. wide, from Philadelphia to Trenton, the work consisting of dredging about 1,100,000 cu. yds. and the construction of 30,000 ft. of revetment bulkhead to guide the current. On the dredging work the Atlantic, Gulf & Pacific Dredging Co., Park Row Bldg., New York, bid $236,100, and the North American Dredging Co., Philadelphia, $231,960. For the revetment work the Atlantic, Gulf & Pacific Co. bid $241,425, and the North American Dredging Co. bid $261,287. These were the only two companies bidding on all of the work.

Rhode Island.

✤Bids will be received until 2 p. m., October 14, by S. I. Kimball, General Superintendent, Treasury Department, U. S. Life Saving Service, Washington, D. C., for the construction of a life saving station at Green Hill on the coast of South Kingston, R. I.

South Carolina.

✤Bids will be received until 11 a. m., November 5, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of steel storage shed at the U. S. Navy Yard, Charleston, S. C.

Texas.

✤Bids will be received until 10 a. m., October 12, by Elks Building Committee, P. O. Box 527, Port Arthur, Texas, for furnishing the necessary labor and material for the erection wiring, heating, equipping and completing the Elks' Home and Opera House at the corner of Austin Ave. and Fourth St., in Port Arthur, Texas.

✤Bids will be received until 11 a. m., October 18, by Capt. Fred H. Gallup, Constructing Quartermaster, Fort Sam Houston, Texas, for furnishing metal bands, pipe coverings, fire doors and grates, packing, unions, valves, solder, bends, bibbs, expansion bolts, chain, cocks, couplings, eccentrics, hinges, wiping metal nipples, pipe rests, plugs, screws, sprinklers, supply pipes, strainers, valves, washers, etc.

The Santa Fe Dock & Channel Co. of Port Bolivar and Galveston has filed its charter. The company has a capital stock of $50,000, the incorporators being as follows: F. G. Pettibone, A. C. Torbett, J. H. Keefe and W. E. Maxon.

Utah.

✤The Utah Light & Ry. Co., 133 South West Temple St., Salt Lake City, Utah, is reported to be asking bids until Oct. 15, for its steel tower transmission line.

Washington.

✤Bids will be received until 11 a. m., October 29, by Capt. E. C. Long, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of a wharf, storehouse and two boathouses at Fort Ward, Wash.

✤Bids will be received until noon, October 14, by Capt. Arthur Williams, U. S. Engineer, Seattle, Wash., for dredging Olympia Harbor, Wash.

The city of Aberdeen, Wash., Chas. W. Ewing, City Engineer, on Sept. 28, awarded contracts for the improvement of the tidelands in the city. The contract for the clearing and filling was let to the Tacoma Dredging Co., Tacoma, Wash., and the contract for the drainage was let to Haukeli & Hegdale. The bids received on the work were as follows: Fill—Puget Sound Bridge & Dredging Co. (bonds), at $0.1685 per cu. yd., $252,750; (cash), at $0.1485 per cu. yd,, $227,700; Standard American Dredging Co., at $0.139 per cu. yd., $208,500; North American Dredging Co., at $0.164 per cu. yd., $246,000; Tacoma Dredging Co., $0.11 per cu. yd., $165,000. Clearing—Puget Sound Bridge & Dredging Co. (bonds), $36,125, lump sum; (cash), $32,750, lump sum; Tacoma Dredging Co., $21,250, lump sum; Haukeli & Hegdale, $25,995, lump sum. Drainage—Puget Sound Bridge & Dredging Co. (bonds), $16,030; (cash), $14,225; Tacoma Dredging Co., $10,280; Haukeli & Hegdale, $9,540.

West Virginia.

The following bids were received Sept. 16 by Capt. F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for constructing lock and guide walls, bear trap weirs and Chanoine weir for Dam No. 19, Ohio River, (1) standing from the Pneumatic Caisson Co., New York, (2) for the Ohio River Contract Co., Evansville, Ind., (3) for Sheridan-Kirk Contract Co., Cincinnati, O., and (4) for the T. A. Gillispie Co., Pittsburg, Pa:

	(1)	(2)	(3)	(4)
Cofferdam, 16 foot, 2,800 lin. ft.	$25.00	$20.00	$20.00	$22.00
Cofferdam, 10-foot, 1,700 lin. ft.	12.00	10.00	15.00	12.00
Common excavation, 81,200 cu. yds.	.70	.75	.60	.80
Rock excavation, 3,925 cu. yds.	3.00	3.50	4.00	4.50
Drilling bolt holes, 500 lin. ft.	1.00	1.00	.50	1.00
Fill, 55,800 cu. yds.	.50	.60	.50	.50
Riprap, 3,360 cu. yds.	4.00	4.00	3.85	4.00
Round piles, 38,200 lin ft., M ft. B. M.	.60	.60	.60	.50
Sheet piles, 513 lin ft., M ft. B. M.	60.00M	80.00M	95.00M	70.00M
Oak timber, 65 M. ft. B. M.	80.00M	100.00M	120.00M	130.00M
Concrete, 46,350 cu. yds.	6.50	6.50	7.00	7.00
Structural steel, 885,000 lbs.	.063	.07	.0807	.07
Reinforcing rods, 5,000 lbs.	06	.07	.0632	.07
Forgings, 43,000 lbs.	.085	.07	.1082	.07
Bolts, etc., 65,200 lbs.	.05	.07	.0657	.06
Iron castings, 167,600 lbs.	.04	.07	.0632	.06
Steel castings, 133,000 lbs.	.06	.10	.15	.10
Bronze castings, 1,170 lbs.	.80	.90	.80	1.00
Pipe, 4-inch, 2,050 lin. ft.	1.80	3.00	.50	2.00
Pipe, 3-inch, 1,500 lin. ft.	1.50	3.00	.40	1.50
Pipe, 2½-inch, 750 lin. ft.	1.00	2.00	.35	1.00
Pipe, 2-inch, 830 lin. ft.	.80	1.50	.30	.75
Tile drain, 850 lin. ft.	.70	.75	.20	.60
Totals	$649,739	$679,109	$707,228	$698,833

Wisconsin.

✣Bids will be received until noon, October 31, by Lieut. Col. D. Fitch, U. S. Engineer, Duluth, Minn., for the construction of pierhead crib and riprap embankment for same at Ashland, Wis.

✣Bids will be received until 2:30 p. m., October 12, by Lieut. W. E. Gilmore, Constructing Quartermaster, Rifle Range, near Sparta, Wis., for the erection of one galvanized storage shed at the camp of instruction in the United States military reservation, approximately 8 miles from Sparta, Wis.

✣As previously noted in these columns bids are being asked by Lieut. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., until noon, Oct. 31, for building pierhead, crib and riprap embankment for same at Ashland, Wis. The work to be done consists of building an open crib 32 ft. by 48 ft., placing it, driving piles to act as bearing piles for the concrete superstructure which is to be built at some future date, and then building up a riprap embankment by throwing in rock through and around the crib and filling the crib with rock. The approximate quantities are as follows: Timber, 58 M ft., B M, 36, 50 ft. bearing pile and such additional piles as contractor may deem necessary; 16,780 lbs. iron fastenings and plate; 2,575 tons rock embankment and crib filling; 350 tons rock on top of crib.

✣Bids will be received until 4 p. m., Nov. 1, by State Board of Control, Madison, Wis., for the necessary labor and material for the construction of a hospital for criminal and violent insane at the Northern Hospital for the Insane, Winnebago, Wis. Foeller & Schober, Green Bay, Wis., Architects.

✣Bids will be received until 10:30 a. m., Oct. 14, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for the construction of a new protection pier in the Milwaukee River for Chestnut St. bridge.

Canada.

The Canadian government has approved the Thompson Co.'s plans for a dry dock at Vancouver, and the company is now assured of a subsidy of 3½ per cent for 25 years on the cost of construction. The plans provide for a commercial dock of the second class under the subsidy act. It will be over 600 ft. long and will cost over $1,000,000.

The City Council of Prince Albert, Sask., has directed C. H. Mitchell of Toronto, Ont., to prepare plans and specifications for a city power development at Lacelle Falls. It is proposed to have everything ready to let the contracts by May 1 of next year. It is planned to develop 10,000 H.P. at a cost of $1,000,000. The work is to be done in stages, the initial one being to develop about 3,000 H.P. at less than one-half the total cost.

BRIDGES — STEEL AND CONCRETE

Arkansas.

Judge of Desha County, Ark., has awarded the contracts for the construction of two steel bridges, one on the Halley Road and one on the Kelso Road, to George E. James and J. S. Bowles, the contract prices aggregating $3,679.

Plans have been submitted to the Mayor of Texarkana, Arkansas, by the Chief Engineer of the St. Louis Southwestern Ry. (Cotton Belt), for the construction of a 1,500 ft. viaduct over the railway tracks at the Oak St. crossing. The estimated cost of the work is $200,000.

California.

✣Bids will be received until 10 a. m., October 22, by Board of Supervisors, Madera, Cal., for the construction of a trestle bridge 77 ft. long, 16 ft. wide in the clear, over Chowchilla River. W. R. Curtin is Clerk.

Plans have been approved by Engineer Rothenberg of the County Engineering Corps, Pasadena, Cal., for the proposed Arroyo Seco bridge to link the foothill boulevard of the good roads system with the boulevard from San Rafael Heights to Santa Monica. The Highway Commission is to subscribe $20,000 toward the cost of the structure and the San Rafael Heights Improvement Association a smaller sum, leaving the city of Pasadena and the county about $60,000 apiece to pay toward the total cost.

Plans have been completed for the bridge in Pasadena, Cal., and bonds amounting to $32,000 have been voted by South Pasadena for the purpose. The City of Los Angeles and the County and the Salt Lake R. R. will bear the rest of the expense. The structure is to be of solid concrete and the surface of the bridge will present a 50 ft. roadbed with a sidewalk on one side and a 16 ft. space for railroad on the other.

Board of Trade, Houghson, Cal., have under consideration the necessity of a bridge across the river near Empire and a committee has been appointed to take the matter up with the County Commissioners.

Illinois.

Board of Supervisors, McLean County, Ill., have authorized the Road and Bridge Committee to construct the south approach of the Kappa bridge and McLean County's unpaid portion amounting to $3,114, was ordered paid.

County Commissioners, Pawnee, Ill., have been petitioned to appropriate $1,450 for the construction of a new bridge across Sugar Creek in Woodside township, on the Fox Road.

The County Commissioners at McComb, Ill., have awarded the contract to J. C. Wigart, Bushnell, Ill., for the construction of three bridges in McComb, Ill., at $1,049.

Engineers of the Strauss Bascule Bridge Co., 134 Monroe St., Chicago, Ill., have completed plans for a steel and concrete bridge 88 ft. long, single leaf, at Quebec, Canada, over the entrance to Princess Louise docks. The Harbor Commissioners of Quebec will receive estimates.

A contract has been awarded James Labord, Freeport, Ill., for the construction of a new concrete bridge to replace the present one at the old mill, Savanna, Ill.

Plans have been prepared by the State Engineer of Illinois for the construction of a bridge over the Rock River at Colona, Ill., and have been forwarded to the Secretary of War for approval. The plans which have been adopted by a joint committee, composed of Rock Island and Henry County Supervisors estimate the cost of the structure at $60,000.

Indiana.

✣Bids will be received until 1 p. m., October 17, by Commissioners of Johnson County at Franklin, Ind., for the construction of four small bridges. The Auditor of the County is W. B. Jennings.

The Elkhart Bridge & Iron Co. has been awarded the contract at $3,464 for the construction of 8 bridges in Kosciuko County, Indiana.

Board of County Commissioners, Terre Haute, Ind., have awarded the contract for the construction of a new bridge across Coal Creek in Fayette Township to Joseph W. Lowe, at $3,000. Other bids submitted were as follows: John N. White, $3,760; Louis Seeburger, $3,840; John W. Kinser, $3,483.

John O. Wright of Clinton, Ind., for $442 and S. B. Boyse of Perrysville, Ind., for $555 were awarded contracts by the county commissioners at Newport, Ind., for the construction of two small bridges of one span each in Eugene township. The bridges will be about 24 ft. long. Bids were opened Oct. 3.

The county commissioners at Marion, Ind., have awarded a contract to E. R. Hooner for the construction of 8 concrete arches for $225 each. Bids were opened Oct. 4.

Iowa.

✣Bids will be received until 11 a. m., October 24, by Board of Supervisors Shelby County at Harlan, Ia., at the office of Albert Hansen, County Auditor, for the construction of 5 steel bridges, 70 ft. span, across Ditch No. 1. Structures to have 16 ft. roadway.

The Clarke Construction Co., has been awarded a contract by the city of Clinton, Ia., for the construction of three concrete bridges for $3,000. R. C. Hart is City Engineer.

The contract for the construction of all the bridges along the line of the Muscatine North & South R. R., between Elrick Junction and Burlington, Ia., has been awarded to J. H. Seldon, Muscatine, Ia. The structures will be mostly temporary pile bridges.

Kansas.

Board of County Commissioners, Wichita, Kan., have awarded the following contracts for the construction of steel bridges: For a county line bridge between Sedgwick and Harvey counties, 60 by 16 ft., to be of steel with concrete floor, the Wichita Construction Company received the contract, their bid being $1,525. Other bidders and their bids were: Missouri Valley Bridge Company, $1,700; Illinois Steel Bridge Company, $1,694; Carr & Martin, $1,618. For a steel bridge with wooden floor in Gypsum township, between sections 27 and 34, to be 30 by 16 ft., the Wichita Construction company's bid of $625 was accepted, the other firms' bids being: Missouri Valley Bridge company, $870; Illinois Steel Bridge company, $900; Carr & Martin, $700. For a steel bridge with wooden floor on the west line of section 18, between Delano and Attica, 55 by 16 ft., the bid went to Carr & Martin for $1,390; other bids being: Missouri Valley Bridge Company, $1,800; Illinois Steel Bridge company, $1,900; Wichita Construction Company, $1,650.

The Board of County Commissioners at Iola, Kan., have decided to submit to a vote of the people of Allen County, propositions to construct two bridges across the Neosho River, one of them at Bales Ford on the Humboldt township line, the other at a point east of Petrolia. It is estimated that the cost of the structures will amount to $8,000.

At a recent meeting of the City Commission of Hutchinson, Kan., and Emerson Carey, President of the Hutchinson Interurban Ry. Co., it was held that the portion of the new concrete bridge at Main St. under the street railway tracks should be built by the railway company. The matter of constructing Walnut and Washington St. bridges was also taken up.

Property owners of Riverside, Wichita, Kan., have appointed another committee, E. A. Kelly, Chairman, to confer with the West Wichita Commercial League with reference to building a bridge across the Big Arkansas River at Central Ave.

Louisiana.

✣Bids will be received until Nov. 2, by A. L. Slack, Secretary Police Jury, Tallulah, La., for the construction of two steel bridges, one over Joes Bayou, 116 ft. long at the intersection of Cow Bayou and another at Bozeman place, 168 ft. long. Both structures will have a 14 ft. roadway.

Maine.

Reports from Lewiston, Me., are to the effect that the contract for the construction of the substructure of the Van Buren and St. Leonards bridge has been awarded to Powers & Brewer of Grand Falls, N. B., at $23,895 and the superstructure for the same has been awarded the Penn Bridge Co., Beaver Falls, Pa., at $40,991.

Maryland.

✣Bids will be received until noon, October 13, by Highway Commission, Baltimore County, Towson, Md., for the following contracts: No. 33—Reinforced concrete bridge on Green Spring Ave., over Jones' Falls, Third district. No. 34—Reinforced Concrete Bridge on Rockdale Road over Gunpowder Falls, Sixth district. No. 35—Reinforced Concrete Bridge on West Point Road, over Norris' Run, Fourth district. No. 36—Reinforced Concrete Bridge on Graves Run Road, over Graves Run, Fifth district. No. 37—Reinforced Concrete Culvert on Corbett Road, over small stream, Eighth district. No. 38—Reinforced Concrete Culvert on Bellona Ave., near Sherwood, Ninth district. Henry G. Shirley is County Roads Engineer.

Michigan.

City Council of Menominee, Mich., has appropriated $8,700 for the building of a new bridge over the Menominee River. A similar appropriation, it is said, will be necessary from Marinette before the structure can be built. Although the subject has been discussed by that city no action has yet been taken.

Minnesota.

The Northern Pacific Ry. Co. has informed City Engineer L. W. Rundlett, St. Paul, Minn., that materials have been assembled for an immediate start on the concrete work of the proposed bridge over the tracks at Mississippi and York Sts.

County Surveyor Brooks, Mankato, Minn., is strongly in favor of the construction of a concrete arch bridge at Red Jacket.

Mississippi.

It is reported that the Louisville & Nashville R. R. has about completed arrangements looking to the reconstruction of its 2-mile bridge at Bay St. Louis, Miss. The bridge was somewhat damaged by storms of the past few years and it has been decided by the company, best to reconstruct the entire structure.

Missouri.

The South Troost Avenue Improvement Association, Kansas City, Mo., has been organized and will first take up the matter of constructing a new bridge over Brush Creek at Troots Ave. According to estimates the new structure will cost between $15,000 and $16,000.

Plans for the construction of the proposed viaduct over the tracks at Compton Ave. have been approved by the Board of Public Improvements, St. Louis, Mo. The structure will be of concrete and steel and will cost, it is estimated, $370,000. Detailed plans will be submitted by the railroads to the board shortly and it is expected to have work start on the bridge early in the Spring.

Montana.

Plans are under way by Fred Buck, City Engineer, Missoula, Mont., for the construction of a new bridge across the Rattlesnake Creek near its mouth which has been made necessary by the opening of East Front St. According to the design, the structure will be 56 ft. long without approaches and is to be a combination wood steel and concrete affair of one span. The roadway will be 24 ft. and sidewalks will be 6 ft.

New York.

City Council of Syracuse, N. Y., is to take action looking toward the construction of a new bridge at Beeche St. over the Erie Canal to replace the present structure which is reported in dangerous condition.

North Dakota.

Board of Commissioners, Burleigh County, Bismarck, N. Dak., has awarded the contract for the construction of two county bridges, one 90 ft. long and the other a 50-ft. structure the Fargo Bridge & Iron Co., Fargo, N. Dak., at $4,750.

Ohio.

✣Bids will be received until 11 a. m., Oct. 26, by Board of County Commissioners, Cleveland, O., for the construction of bridge work per Report No. 2726, concrete, bridge Berea, Middleburg township.

✣Bids will be received until 1 p. m., Oct. 18, by Board of County Commissioners, Wapakoneta, O., for the necessary labor and material necessary for the construction of 2 bridges located near the German Zion church in Logan township, one structure on Van Wert Pike; one on the angling road in Pusheta township; one bridge in Goshen township near James Morris farm south of New Hampshire. A. E. Schaffer is County Auditor.

✣Bids will be received until noon, Oct. 14, by Board of County Commissioners, Cincinnati, O., for the construction under Specifications No. 112, of a concrete bridge on Cleves and Warsaw pike at Hasufield arm in Delhi township. Fred Dreihs is Clerk.

The contract for paving the Dennisson Harvard bridge at Cleveland, O., connecting the cities of Brooklyn and Newburg has been awarded to Adams Bros.. Zanesville, O., for $50,000. The work will require about 5 months time to complete it.

Hamilton County Commissioners, Cincinnati, O., have awarded the contract under specifications No. 107, of a concrete bridge on Burns road near Stone Mill road in Colerain township to H. E. Steele of College Hill, O. Bids were opened Sept. 30.

The Davies Cement Paving Co., 3 Davies Bldg., E. Toledo, O., has been awarded a contract by the Lucas county commissioners for the construction of two concrete abutments on County Road No. 481, over Cedar Creek for $6.90 per cu. yd. Bids were opened Oct. 3.

The County Commissioners at Cincinnati, O., have awarded the contract for the construction under Specifications No. 103, a concrete bridge over Toad Creek, near the Colerain Pike on the river road in Colerain township to C. T. McDonough, Betts St., Cincinnati, for $1,433. Bids were opened Sept. 16.

The County Commissioners at Cincinnati, O., have awarded the contract to F. J. P. Brackett of Wyoming, O., for the construction under specifications No. 89, of a concrete bridge and fill on the road from Miamitown to Mt. Hope at residence of R. E. Simmons, Whitewater township. Bids were opened Sept. 30.

Plans have been approved by the U. S. War Department for the construction of the new bridge over the Muskigum river at 5th St., Zanesville, O.

The Danes Cement Paving Co., 3 Danes Bldg., E. Toledo, O., has been awarded the contract by the county commissioners at Toledo, for furnishing the necessary labor and material for the construction complete of two concrete abutments on County Road 481, south of Yondota for $6.90 per cu. yd. Bids were opened Oct. 3.

Oklahoma.

County Commissioners, according to recent advices from Cushing, Okla., have awarded the contract for the construction over the Cimarron River near that place to the Weatherford Machine & Foundry Co., for $17,956.

County Commissioners, Sapulpa, Okla., have let the contract for the construction of a bridge over the Cimarron River 10 miles above Mannford, at the old Bland Crossing. The structure according to the plans will be 642 ft. long.

Oregon.

City Council of Portland, Ore., is to sell bonds amounting to $500,000 for the construction of the Broadway bridge.

Pennsylvania.

The Commissioners of Westmoreland County, Pa., have awarded the contract for the erection of a concrete bridge over Sewickley Creek at Yukon, Pa., to Barnes & Senft, Pittsburg, Pa., for $6,965.

It has been suggested by D. L. Creveling of the Street Committee, Wilkes Barre, Pa., that a new reinforced concrete bridge be constructed to replace the present South St. bridge for which repairs had been planned.

Plans are under way by William A. Schunk, City Engineer, Scranton, Pa., for the construction of a viaduct from Mears St. near North Main Ave. to connect with the proposed Mulberry St. viaduct.

It has been announced that the Minsi Trail Bridge Co. will receive the $150,000 contract for the construction of a new steel bridge from Northampton Heights to East Bethlehem, Pa., to care for the employes of the Bethlehem Steel Co.

County Commissioners, Easton, Pa., have awarded the contract to the Pascoe Construction Co. at $1,543 to repair bridge No. 24 across the Lehigh River at Glendon. The structure will have new flooring, sides and roofing. Other bid received was that of H. D. Folkenson, $3,150.

The New York Central R. R. Co. has awarded the contract to F. J. McCain Construction Co., Mercer, Pa., for the construction of a new bridge over the Mohawk River on the Black River Division. The bridge according to plans will be of steel and will accommodate double tracks.

Texas.

A proposition to issue bridge bonds to the amount of $18,000 carried at Marlin, Falls County, Texas, Oct. 1. The object is to replace the portion of the Highbank bridge over the Brazos River destroyed by flood water last spring.

Washington.

The Oregon Trunk Ry. bridge at the crossing of the Columbia River at Celilo has been let to the Pennsylvania Steel Co. The steel will weigh 4,500 tons. One mile west of Celilo, where the bridge site has been selected, the waters of the Columbia are divided into several small and deep channels and run among walls of solid rock. Seven channels will be crossed by truss spans of steel, six of which will be 230 ft. long. The seventh and longest span will be 320 ft. in length. In addition the Government canal under construction at Celilo will be spanned and over this a draw 250 ft. long will be swung. The piers are all to be constructed on the rock islands that divide the river into its numerous channels at that point. In addition to the truss spans the construction of a long steel viaduct will be necessary and for that purpose 17 100-ft. plate-girder spans and five 75-ft. plate-girder spans will be put in place, resting on as many concrete piers.

In connection with the construction of the Oregon Trunk Line Ry. along the shore of Upper Klamath Lake, it will be necessary to construct a bridge over the strait connecting the Upper Klamath Lake and Agency Lake, in order to avoid two miles of difficult hill work.

Wisconsin.

The Chicago, Milwaukee & St. Paul is making preparations for the construction of the viaduct over its tracks on Washington Ave., Racine, Wis.

City Council of Superior, Wis., has been recommended to construct a new steel bridge across the Nemadji River between the East End and Allouez at or about where the present Fourth St. bridge now stands. The estimated cost of such a structure, which would necessarily be 2,400 ft. long, is between $75,000 and $100,000.

Wyoming.

The Union Pacific Ry. has under consideration plans for the reconstruction of its double track bridge over the Missouri River at Council Bluffs, Wyo., making it a four track structure.

Canada.

✣Bids will be received until 5 p. m., Oct. 15, by E. F. Mitchell, Chief Engineer, Room 75, McDougall Block, Calgary, Alta., for the construction of substructure and grading approaches to a bridge across the Bow River 5 miles west of Calgary for J. Hextall.

The time for receiving bids for the construction of the Quebec Bridge expired on Oct. 1, but no contract will be let until the Commission has ample time to analyze the bids. The following companies submitted bids: The Dominion Bridge Company of Montreal, the Canadian Bridge Company of Walkerville, the British Empire Bridge Company (representing the amalgamated interests of two large British companies, with works at Darlington and Birmingham), and the Phoenix Bridge Company of Phoenixville, Pa.

The contract for the construction of the high level bridge over Don at Queen St., has been awarded by the Board of Control, Toronto, Ont., to the F. H. McGuigan Co., Toronto, Ont., for $193,000. The controllers have decided to have an entirely new channel span built instead of using the present low level bridge.

Advices from The Pas, Sask., state that work is about to start on the bridge across the Saskatchewan river. Construction men are already on the scene and the road from the terminus of the track is being cleared. It is said that the concrete part of the structure will be completed by early Spring.

Wm. Newman Co., Ltd., Winnipeg, Man., has received a contract from J. F. C. Menlove, Secretary-Treasurer, Wallace and Virden, Man., for the construction of a 60 ft. re-inforced concrete bridge to be erected within the town site of Virden, for $3,800. Bids were opened Sept. 24.

ROADS, STREETS AND PAVEMENTS

Alabama.

The city of Tuscaloosa, Ala., contemplates paving its streets.

The city council of Birmingham, Ala., will award a contract at the first meeting in October for the construction of a brick roadway from Fairview to Ensley. The proposed improvement will cost about $57,000. The road will follow the South Ensley car line and will eliminate the grade through South Ensley Highlands and Palmer Terrace, and will be 18 ft. wide on both sides of the tracks.

Arizona.

✣Bids will be received until October 18, Territorial Board of Control, Phoenix, Ariz., for the construction of the link in the territorial highway between Bisbee and Douglas. This is the second advertisement for bids, as the first set were rejected as being too high.

The board of supervisors at Phoenix, Ariz., has decided to assist the citizens along the Black Canyon road in the reconstruction of that road. The estimated cost of the road is $6,000. L. M. Acuff is County Road Superintendent.

According to advices from Tombstone, Ariz., the board of control rejected all bids submitted Sept. 15 for the construction of the Bisbee-Douglas section of the territorial road The work will be re-advertised at once.

Arkansas.

✣Bids will be received until 3 p. m., October 25, by the Commissioners of Street Improvement, District No. 163, Little Rock, Ark., for the construction of pavement in that district. Bids will be submitted on wood block, asphalt and brick. L. W. Cherry, 815 State Bank Bldg., Little Rock, Ark., is Secretary. Ford & MacCrea, 339 Gazette Bldg., are Engineers.

The county commissioners at Pine Bluff, Ark., have been petitioned for the establishment of a public road from 28th Ave. and Hazel St., to intersect with the Sulphur Springs road, near Thomas S. James' residence.

County Judge James Gould has granted the petition of the property owners along the Sulphur Springs and Camden roads, southwest of Pine Bluff, Ark., in which they asked for a road improvement district for the purpose of enabling them to build a macadam and gravel road out of Pine Bluff for a distance of 12 miles. The new district will be known as Road Improvement District No. 3.

California.

✣Bids will be received until 11 a. m., October 19, by Board of Public Works, Oakland, Cal., for furnishing the necessary labor and material for the improvement of the northern side of 12th st. between Fallon and Lake Shore blvd. James W. Nelson is secy.

The board of supervisors at Stockton, Cal., has authorized the highway commission to expend a sum not exceeding $1,000 for gravel and labor on the Waterloo road north of Waterloo.

Advices from Riverside, Cal., state that the contract for the macadamizing of a portion of the Box Springs canyon road has been awarded to Oscar Ford for $17,950. The roadway is to be 30 ft. in width, and the macadamized section is to be 16 ft. wide.

Surveyor J. Norris has been employed by the Chamber of Commerce of Oroville, Cal., to find a route of a new wagon road from Oroville, in Sierra county. Two routes are suggested. One is to Woodleaf over the present county road, and from there over an old logging road to connect with a county road in Sierra county. The other is by a creek that flows from near Woodleaf to Challenge.

Petitions are being circulated by the Colegrove Board of Trade, Colegrove, Cal., for the proposed paving of Santa Monica blvd., from Sanborn Junction to Seward st., a distance of about three miles.

Following bids were received by the board of supervisors, Los Angeles, Cal., for grading and culvert work on the Monterey Pass section of the good roads project: F. E. Pendergrast, $11,000; O. C. St. John, $8,100.

County Surveyor Bert Conners has presented a plan to the members of the county board of supervisors at Eureka, Cal., calling for the bonding of Humboldt County for $1,000,000 for road improvements.

A petition is being prepared by the property owners in the Corral Hollow district of Livermore, Cal., for presentation to the board of supervisors asking that another outlet to San Joaquin County be provided. A new road will probably be built about five miles in length which will be a continuation of the present Tesla and Carnegie road on the Alameda side, extending down the Corral Hollow creek on the north side to the terminus of the present San Joaquin road near Carbona.

Colorado.

The Denver and Mountain Boulevard Association has been formed in Denver, Colo., with John S. Flower as president, W. W. Porter, of the park commission, secretary, and Col. D. C. Dodge, J. F. Welborn, vice-presidents. The association plans the construction of a road from Boulevard F, at Fort Logan, to the mouth of Turkey Creek canyon, a distance of about eight miles.

The Logan County Commissioners at Sterling, Colo., have let the contract for eight miles of new state highway, beginning at the county line on the road from Brush to Sterling, as follows: For the first four miles to C. R. Cunningham for $175 per mile and the next four miles from Merino toward Atwood to John Adams for $227.75 per mile.

Crested Butte, Colo., has raised $1,500 toward building the proposed Cement Creek wagon road.

Delaware.

The board of education of Wilmington, Del., has awarded to the George W. McCaulley & Sons' Co., the contract for a concrete pavement at No. 11 school.

Florida.

✣Bids will be received until 9:30 a. m., Nov. 1, by Board of County Commissioners, Jacksonville, Fla., for grading, laying curb, and paving approximately 20 miles of hard surfaced county roads in Duval county, Fla. Gail L. Barnard, room 9, Courthouse, Jacksonville, County Engineer, has plans and specifications on file.

Georgia.

The city of Atlanta, Ga., has signed a contract with the Copeland-Inglis Paving Brick Co., of Birmingham for considerable street paving to be done during the year, with brick.

A resolution has been passed by the city council of Rome, Ga., calling for an election for Nov. 8 to pass upon a bond issue of $275,000, to be divided as follows: $100,000 for purchase of present Shorter College buildings, for use of public schools and building ward schools: $50,000 for street paving; $50,000 for improving sewer system and $75,000 for waterworks improvements.

Illinois.

The Sangamon county board of supervisors, Springfield, Ill., has urged that the Peoria road north of the state fair ground be improved at a point near the Sangamon river.

The board of local improvements of Cairo, Ill., received the following bids Sept. 27, for the paving of Commercial ave., from Second to 34th sts.: L. W. Johnson, $110,553; John Hayes Sons' Co., Naperville, Ill., $115,503; Roy L. William, $111,589; A. W. Eisenmayer, Granite City, Ill., $124,218. L. W. Johnson of Danville, Ill., was given the contract.

W. I. Kettlewell of Iowa City, was the lowest bidder at Moline, Ill., for the improvement of the road leading from Moline to Rural town hall by grading. The work will include the removal of 34,360 cu. yds. from the first section, which runs from Milan road south 2¼ miles; 27,465 cu. yds. from the second section, running from the north line of Rural township south for 1¼ miles. Mr. Kettlewell bid $6,288 and $5,227 for both sections.

Bids were opened Sept. 27 for several pieces of street work in Glencoe, Ill., for which Windes & Marsh, Winnetka, Ill., are the engineers. Bids were received for placing stone on Green Bay road, from C. & N. W. Ry. to west village limits, the bidders on this work being as follows: (1) Standing for Fred Ebert, Glencoe, Ill., and (2) for the Schmidt Construction Co., 218 LaSalle St., Chicago:

	(1)	(2)
900 cu. yds. crushed stone, in place..	$1.75	$1.40
225 cu. yds. bonding gravel, in place.	1.85*	1.65
4,700 lin. ft. ditching, 2 ft. wide at the bottom, average depth 1½ ft	.20	.30
120 lin. ft. 12-in. 82-lb. C. I. Culvert..	1.60	2.00

*Lombard gravel to be used.

For constructing the Grove St. walk, consisting of 300 lin. ft. 5-ft. concrete walk, 4½ in. average thickness, on 6 in. cinders, Jos. Delhaye, Highland Park, Ill., at 75c. per lin. ft., was the only bidder. Mr. Delhaye, at 14 cts. per lin. ft., was also the only bidder for constructing 690 lin. ft. of similar walk on Downing Ave. For constructing the Grave street walk, between Smith ave. and the Glencoe South Limits, the following bids were received: (1) Standing for Jos. Delhaye, Highland Park, Ill., and (2) for C. T. Bartlett, 827 Greenleaf st., Evanston, Ill.:

	(1)	(2)
3196 lin. ft. 5 ft. concrete walk, 4½ in. av. thickness on 6 in. cinders, laid complete ...	$ .70	$ .725
176 lin. ft. 3-in. plank crossings....	.70	.70
15 cu. yds. concrete retaining wall..	10.00	8.00
49½ lin. ft. 18-in. tile pipe culvert..		.90

For constructing 8,950 lin. ft. of 5-ft. concrete walk, 4½ in. average thickness on 6 in. of cinders in the Sylvan Newhall Subdivision, the following bids were received: Jos. Delhaye, Highland Park, Ill., 70 cts. per lin. ft.; C. T. Bartlett, 827 Greenleaf st., Evanston, Ill., 14½ cts. per sq. ft., or 72½ cts. per lin. ft.; Schmidt Construction Co., 218 LaSalle st., Chicago, Ill., 76½ cts. per lin. ft. The largest contract was for constructing a macadam pavement with bituminous binder in Sylvan Newhall Subdivision, the bid received being as follows: (1) Thos. W. Kelly, 6159 Evans av., Chicago, Ill.; (2) Jno. A. McGarry & Co., 1001 Security bldg., Chicago, Ill.; (3) John Hayes Sons' Co., Naperville, Ill.

	(1)	(2)	(3)
9,650 cu. yds. of grading..$	.35	$ .35	$ .50
12,050 sq. yds. 3-course macadam pav't., 2 gals. bituminous cement per sq. yd.	1.48*	1.42†	1.53*†
10,800 lin. ft. sod edging, 2 ft. wide	.04	.06	.07
530 lin. ft. 22-in. vitrified tile drain	2.00	1.00	2.00
290 lin. ft. 18-in. vitrified tile drain	1.24	1.10	1.25
1,520 lin. ft. 15-in. vitrified tile drain	.87	.92	.90
2,067 lin. ft. 12-in vitrified tile drain	.79	.90	.80
1,586 lin. ft. 8-in. vitrified tile drain	.50	.80	.50
365 lin. ft. 6-in. vitrified tile drain	.40	.60	.40
3,365 lin. ft. 4-in. vitrified tile drain	.38	.45	.40
46 combination inlets and manholes	25.00	30.00	30.00
2 concrete "end walls," 3 cu. yds. each	15.00	14.00	21.00

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*"Sarco" or "Pioneer" bituminous binder.

†Indian Refining Co.'s asphalt to be used.

*†"Sarco" bituminous binder.

James Kelly of Morrison, Ill., was awarded the contract in that city by the board of local improvements for paving work for $20,900. The work is to be started at once and be completed by Dec. 1.

The town of Gilman, Ill., has begun a campaign for hard roads to be built two miles into Douglas township in Iroquois county, extending a mile north and a mile south of that city and connecting with their paved streets.

The county commissioners of Knox County, Galesburg, Ill., have been petitioned for a new highway to Little York from the intersection of West Broadway to the east end of the city limits in Little York.

The property owners on Hickory St., in Joliet, Ill., have petitioned the board of local improvements for the paving of that street with oil macadam in preference to asphalt. The estimated cost of the improvement is $28,000. John R. Cronin is Mayor. Matt Berscheidt is city clerk.

The street and alleys committee of the city council of Springfield, Ill., has made favorable recommendations for improvements estimated to cost over $100,000, as follows: Paving Edwards St. from Ninth to Twentyfist Sts.; estimated cost, $39,954; paving Reynolds St. from Sixth to Nineteenth St., estimated cost, $38,186; paving Jackson St. from Sixth to Eleventh St., estimated cost $13,501.

The board of public improvements of Decatur, Ill., has awarded contracts for street paving work to begin at once, as follows: S. A. Tuttle, for paving North College St., for $16,893; Illinois Cement Construction Co., of Springfield, Ill.; for paving Leafland Ave., for $17,465.

The engineering crew of the board of local improvements of Peoria, Ill., is making a survey of North Adams St. to secure data preparatory to the laying of new sidewalks on that thoroughfare. Sidewalks will also be laid on South Adams St.

The Board of Local Improvements, city of Chicago, Chas. A. V. Standish, secretary, room 300, City Hall, has awarded the following contracts: Constructing a concrete curb, grading and paving with repressed vitrified paving brick on a 6-in. Portland cement foundation, with a 2-in. sand cushion, the alley between E. Ontario St. and E. Erie St. and St. Clair St. and Lincoln Park Blvd., to the Jas. A. Sackley Co., 307 Chamber of Commerce, Chicago, for $1,645; constructing a concrete curb, grading and paving with repressed vitrified paving brick on a 6-in. Portland cement concrete foundation, with a 2-in. sand cushion, the alleys in the block bounded by West Huron St., West Superior, North Clark St. and La Salle Ave. (except the first alley parallel with and west of North Clark St.), to the James A. Sackley Co., 307 Chamber of Commerce, Chicago, for $981; adjusting manholes and catch basins, constructing granite concrete combined curb and gutter on cinders or sand and paving with 6 ins. of asphalt on 6-in. Portland cement concrete base, Graceland Ave. from Evanston Ave. to west line of C., M. & St. P. right of way to the American Asphalt Co., 404 Chamber of Commerce, Chicago., for $11,462; adjusting manholes and catch basins, constructing a granite concrete combined curb and gutter on cinders or sand and paving with 6 ins. of asphalt on 6-in. Portland cement concrete base, Champlain Ave., E. 42d St. to E. 43d St., to the American Asphalt Co., 404 Chamber of Commerce, Chicago, for $1,731; constructing a concrete curb, grading and paving with repressed vitrified paving brick on a 6-in. Portland cement concrete foundation, with a 2-in. sand cushion, the alley between East 48th St., East 49th St., Calumet Ave. and Grand Blvd., to the James A. Sackley Co., Chamber of Commerce, Chicago, for $2,916; constructing a concrete curb, grading and paving with repressed vitrified paving brick on a 6-in. Portland cement concrete foundation, with a 2-in. sand cushion, the alley from the south line of the first east and west alley south of East 47th St. to the north curb line of East 48th St. between St. Lawrence Ave. and Forrestville Ave., to the James A. Sackley Co., Chamber of Commerce, Chicago, for $2,190.

Indiana.

✣Bids will be received until 11 a. m., Nov. 7, by Board of County Commissioners, Vernon, Ind., for the construction of 2½ miles of pike road in Bigger Township. T. L. Thomas is County Auditor.

The county commissioners at Wabash, Ind., have awarded contract for the construction of highways in Paw Paw township to the following: Chas. M. Wales, Commerse, Mo., one road for $7,825; Alonzo Hover, North Manchester, one road for $4,445; another road for $5,890. Bids were opened Oct. 4.

Jas. M. Snyder of Frankfort, Ind., has been awarded the contract by the board of county commissioners, Kokomo, Ind., for constructing three miles of gravel road in Honey township for $7,790. The work includes grading, one reinforced concrete bridge, 12 ft. span, one steel bridge with concrete floor. Bids were opened Oct. 5.

Hurst & Sweet of Greencastle, Ind., have been awarded the contract for constructing 2¾ miles of road in Cloverdale township for $5,493. Bids were opened Oct. 3.

The county commissioners at Spencer, Ind., have awarded the contract for the construction of a macadamized road in Washington township to Hicharn & Light of Freedam, Ind., for $7,085.

Bids were received Sept. 27 by the city council of Decatur, Ind., for the paving of Mercer ave., from Winchester st., to Grant st., and Adams, from Second to 13th st., from the following, all bids being for brick block: Julius Haugh, Decatur; C. S. Brinaman, Bluffton; The Daniels-List Co., Anderson, Ind.; W. M. Birch, Muncie, Ind.; Fred Hoffman, Rochester; Trippen & Sons, Fort Wayne; and J. J. Kelleher & Co., Frankfort, Ind. The lowest bidders were Kelleher & Co., and Fred Hoffman, bidding on nine and six different grades of brick, ranging from $.99 per sq. yd., and $1.06 per sq. yd., to $1.04 per sq. yd., and $1.15 per sq. yd., respectively.

The county commissioners at Vincennes, Ind., have awarded the following contracts for road work: P. D. Green et al., gravel road, to P. W. Lenahan, for $13,275; Fred Brackman et al., gravel road, to Herbert F. Jones, for $9,500; J. J. Risch et al., gravel road, to Jas. O'Donnell, for $14,547; J. C. Lett et al., gravel road, to Jesse Williams, for $3,399.

The Marion County Construction Co., of Indianapolis, Ind., has been awarded the contract by the board of public works of that city for the paving of New Jersey St., from 30th St. to 32nd St., for $2.80 per sq. yd. Bids were opened Aug. 26.

Lackey Bros. of Indianapolis, Ind., has been awarded a contract by that city for the construction of pavement on Pennsylvania St., from east property line of 38th St., to property line of 40th St., for $1.06 per sq. yd. Bids were opened Aug. 24.

The Union Asphalt Construction Co., of Indianapolis, Ind., has been awarded the contract by the board of public works of that city for the improvement of the first alley west of Pennsylvania St., from 30th to 32nd Sts., by paving, for $2.20 per sq. ft. Bids were opened Sept. 9.

A contract for paving on 22nd Ave. in Gary, Ind., has been awarded to the Cain Construction Co., for $5,111.

M. Sapirie, Indianapolis, Ind., has been awarded a contract by the board of public works of that city for the following improvements: Cement sidewalks in Highland Place, from 21st St., to Marlette Drive; cement sidewalks in Hiatt St., from Morris St. to Miller St., cement sidewalks in 19th St., from Central Ave. to College Ave.; curbing in Locke St., from Indiana Ave. to Walnut St.; cement sidewalks in Iowa St., from Meridian St., to Union. Bids were opened Sept. 12.

The county commissioners at Marion, Ind., awarded the contract for the construction of the Elmer E. Simmons gravel road in Pleasant township to Riley O. Malott of Sweetser for $4,999. The road is three miles in extent.

The city of Fort Wayne, Ind., has entered into contracts with the Barber Asphalt Co., for paving Leith St., Meyer Ave., Harrison, Lafayette and Pontiac Sts., and with the Asphalt Block Co., of Toledo, O., for resurfacing Wayne St.

The commissioners at Mt. Vernon, Ind., have been petitioned for the construction of seven-eighths of a mile of road extension near Grafton, to cost $5,760. The road is known as the J. C. Helm, et al. road.

The board of public works of South Bend, Ind., is considering improving the Portage Ave. road from the end of the brick pavement at the Three I viaduct to the city limits.

Iowa.

The city council of Waterloo, Ia., has passed a resolution for new asphalt paving on Fourth st.

The contract for the paving of Second st., between Western ave. and Warren st., in Davenport, Ia., has been awarded to the McCarthy Construction Co., for $1.85 for asphalt. The contract for paving Second and Front sts. with creosote block was awarded to D. J. Ryan Construction Co., for $2.22.

The McCarthy Improvement Co., of Davenport, Ia., has contracted to construct 25,000 sq. yds. of asphalt pavement in Elgin, Ill., within six weeks. The company has just completed five miles of pavement in Aurora, Ill., and has left that city for Elgin with all its implements. The pavement will be laid at the following figures: 40 cts. per cu. yd. for excavating, $1.85 per sq. yd. for paving, $.40 per lin. ft. for cement gutter, and $.12 per lin. ft. for resetting curb.

The committee named by the city council of Sioux City, Ia., to cover the entire hill district for which paving had been proposed, has filed its report with the council and the same has been accepted. The report is as follows: Sixth street, from Nebraska st. to Jackson st., to be paved with concrete. Seventh street, from Nebraska st. to Jackson st., to be paved with concrete corrugated. Eighth street, from Douglas to Nebraska st., to be paved with concrete; from Nebraska st. to Jackson st., to be paved with concrete corrugated. Ninth street, from Pearl st. to Pierce st., to be paved with concrete; from Pierce st. to Jackson st., to be paved with concrete corrugated. Tenth street, from Pearl st. to Douglas st., to be paved with concrete; from Douglas st. to Pierce st., to be paved with concrete; from Pierce st. to alley between Pierce and Nebraska sts., to be paved with concrete; from the alley between Pierce and Nebraska sts. to Jackson st., to be paved with concrete corrugated. Eleventh street, from Pearl st. to alley between Nebraska and Jackson sts., to be paved with concrete; from alley between Nebraska and Jackson sts. to Jackson st., to be paved with concrete corrugated. Twelfth street, from Pearl to Douglas st., to be paved with concrete corrugated; from Douglas st. to alley between Douglas and Pierce sts., to be paved with concrete; from alley between Douglas and Pierce sts., to Pierce st., to be paved with concrete corrugated; from Pierce st. to Jackson st. to be paved with concrete. Thirteenth street, from Douglas st. to Pierce st., to be paved with concrete corrugated; from Pierce st. to Jackson st., to be paved with concrete. Fourteenth street, from Pearl st. to Jackson st., to be paved with concrete.

W. J. Kettlewell, Iowa City, Ia., has been awarded the contract by the Coal Valley Rural Road Committee, Moline, Ill., for the construction of the Coal Valley rural road for a distance of one and one-half miles. The first section of the work, which includes 34,360 cu. yds. of excavation, was awarded at $6,288, and the second section, including 27,465 cu. yds., was awarded at $5,227. Bids were opened Oct. 1.

The paving contract for the paving of Second St., between Western Ave. and Warren St., in Davenport, Ia., has been let to the McCarthy Construction Co., for $1.85 per sq. yd., and for the paving of Brady St., between Second and Front Sts., to the D. J. Ryan Construction Co., for $2.22 for creosote block.

The city council of Fort Dodge, Ia., has awarded the contract for asphalt paving in scattered sections of the city to the Bryant, McLaughlin Asphalt Paving Co.

The contract for the building of the Morrison Round Grove, Ia., road has been awarded to Ray Hardy. The work will be started at once.

Kansas.

Ransom & Cook of Ottawa, Kan., have been awarded the contract for the improvement of the J. R. Thorp and K. C. Tauboy roads, under the provisions of the Hodges Rock Road law, for $29,700. The work includes macadamizing 5⅙ miles of country road, 16 ft. wide, 12 in. deep in center and 8 in. at edges. Bids were opened Oct. 3.

Reno County, Hutchinson, Kan., has issued bonds for the improvement of its rural roads under the new law to the amount of $4,000. The money will be used to build eight miles of sand-clay road.

The Sedgwick County Commissioners at Wichita, Kan., will construct a one-half mile road of sand and clay at the west end of 13th St., at an approximate cost of $1,000.

O. C. Chapin, of Leavenworth, Kan., has been awarded the contract by the city council of Hastings, Neb., for the paving of Third St., with brick on a concrete base for $1.97 per sq. yd.

McGuire and Stanton, of Leavenworth, Kan., have been awarded a contract for paving streets at Coffeyville, Kan., for $20,000.

Kentucky.

The contract for reconstructing Third ave., from the monument to the L. & N. tracks and Green st., from Second to Third sts. with asphalt, in Louisville, Ky., has been awarded to the Barber Asphalt Co., by the board of public works for about $21,000.

Louisiana.

The board of port commissioners, New Orleans, La., has decided to improve the roadway from Canal st. to St. Joseph st., not less than 40 ft.

The city board of aldermen of Alexandria, La., awarded the contract on Oct. 5, to Gailey & Clark, for paving Gould ave., Jackson ave., and Beauregard st. The Gould ave. paving will be of vitrified brick, four blocks, at $2.85 per sq. yd. The remainder of avenue to the city limits will be of gravel at $.95 per yd. Jackson ave., from 10th to Bolton, and Beauregard, from Second to Fourth, is to be vitrified brick, at $2.75 per yd.

The city board of aldermen of Alexandria, La., received bids Sept. 21 for the construction of concrete curbing on the sidewalk along Gould Ave. The contract was let to Gailey & Clark at 40 cts. per lin. ft. Both sides of the avenue are to be curbed from the railroad to the city limits.

Maryland.

The board of estimates of Baltimore, Md., has been requested to repave Gay St., in certain sections between Baltimore St., and North Ave., by the Old Town Merchants & Manufacturers' Association.

Michigan.

Delta county commissioners, Escanaba, Mich., have decided to improve the following roads during the next fiscal year: Bark River road from Escanaba city limits to west limits of the county, $500; Cornell road, $3,500; Marquette road from the Gladstone limits north to the Marquette line, $500; Rapid river road, $100; Masonville road to connect with village of Rapid river, $1,500; Portage road in Bay de Noc township, $3,500; Nahma road, $1,500; Garden road, $1,000; Fairbanks road, $400; Bay Shore road connecting Escanaba and Gladstone, $100. The board yesterday formally adopted what is known as the Masonville road covering a distance of 2.32 miles. The Portage road of five and three-quarter miles in Bay de Noc township was also adopted as a county road, and as was the Cornell road, or 4.23 miles.

The city council of Lansing, Mich., on Oct. 3, opened bids for the $13,000 Capitol ave. paving bonds. They will probably be awarded to John Farsons' Sons & Co., of Chicago.

The city council of Lansing, Mich., has instructed the street committee to investigate the feasibility of repaving with new brick Washington ave., from Kalamazoo st. to the Grand river.

Minnesota.

The Park and Drive Association and the city of Winona, Minn., next spring will pave the Monkato ave. road from the stone bridge on the north end, to the foot of the hill on the south with brick at a cost of about $1,500.

Plans and specifications for the construction of a road upon the property recently acquired for the site of the Catholic Seminary in Mankato, Minn., have been adopted by the city council. The work will be advertised at once.

According to advices from Blackduck, Minn., the county commissioners of Itasca County will co-operate with the citizens of Blackduck in building a wagon road from Rosy, 22 miles from Blackduck to the county line.

Mississippi.

The good roads commission appointed by the Hinds county board of supervisors, Jackson, Miss., to supervise the expenditure of $200,000 on the construction of good roads in the first and second districts, has organized by electing T. H. Bryant as chairman, and Eugene Simpson as secretary. W. J. Dâvis is the other member of the commission.

Missouri.

The Callaway county commissioners, Fulton, Mo., have decided to repair the Mexico gravel road which leads out to Fulton north.

The contract to resurface the rock road from the county farm, Independence, Mo., to Little Blue was awarded by the county court to J. J. Randall for $1.40 per cu. yd. The distance is one and one-half miles, and the work will amount to about $6,000.

It is stated in Springfield, Mo., that two pieces of road will be constructed in Greene county by Engineer Hill. One of the roads will be at Ash Grove and the other at Republic.

Nebraska.

According to information from Lincoln, Neb., the Lancaster county board of commissioners propose to establish a new road west from Denton.

A petition has been circulated in Hastings, Neb., for paving Hastings ave., and another was put in circulation for paving Second st., from Elm ave. to Wabash ave., to connect with the new pavement to be laid between Wabash and St. Joe aves.

Merrick County supervisors, Central City, Neb., are preparing to build another mile of model road west of Central City, on a proposal to do the work for $900.

New Hampshire.

Wm. D. Ingalls, East Kingston, N. H., has been awarded a contract by State Engineer H. C. Hill, Concord, N. H., for the construction of a trap rock macadam road in East Kingston. Bids were opened Sept. 9.

North Carolina.

The citizens of Black Mountain, N. C., contemplated building a highway from that city to Mt. Mitchell. The proposed road will be about 20 miles in length, and will follow the main ridge of mountains from the town of Black Mountain to the Summit of Mitchell. Dr. J. C. Coggins, Black Mountain, is interested.

New York.

✣Bids will be received until 11:15 a. m., Oct. 31, by Lieut. E. H. Wagner, Constructing Quartermaster, Fort Niagara, N. Y., for constructing concrete walks, macadamized and clay roads at Fort Niagara, N. Y.

✣Bids will be received by the Board of Contract & Supply, Albany, N. Y., until 3 p. m., Oct. 17, for the improvement of Myrtle Ave., from Ontario St. to Partridge St. The work includes grading, setting granite curb, paving the carriage way with repressed vitrified shale paving blocks on a concrete foundation, laying walks of concrete, building receiving basins, and laying vitrified pipe sewers and appurtenances under each sidewalk.

The town board of North Hempstead, N. Y., has approved of the contract to macadam Beeck, Wood, and Maple sts., Great Neck and Shore road, Port Washington. The Great Neck improvement will cost $6,700, while the Port Washington work will cost $1,860. The board also approved the petition for the laying of sidewalks on North Hempstead turnpike, between Plandome and the Methodist church.

Ohio.

✣Bids will be received until October 12, by the County Commissioners, Canton, O., for the proposed Canton-New Berlin road.

✣Bids will be received until October 12, by Director of Public Service, Zanesville, O., for paving Locust ave.

✣Bids will be received until 11 a. m., October 15, by Board of County Commissioners of Cuyahoga County, O., Cleveland, O., for furnishing material for the repair of Berea and Ridge roads. John F. Goldenbogen is clerk.

The Cherry Street Business Men's club of Toledo, O., has taken steps toward the paving of Cherry st., between Bancroft and Spielbusch sts. John Henry Spielbusch is president of the club.

The county commissioners at Norwalk, O., have decided to rebuild stretches of four roads in the county. The Milan road is to be improved 4,300 ft. north from Ray's corners. The Castalia road is to be extended and rebuilt west from Bardshar's Corners. The Lake Shore road is to be improved 2,100 ft. east from the Berlin road near Huron. The state road in Vermilion township is to be improved 1,900 ft. The commissioners will advertise for bids for this work at once.

The Lucas county commissioners, Toledo, O., have let the contract for completing the unfinished portion of the corduroy road in Oregon township to McKinney Bros., and M. F. O. Sullivan for $19,432. Belle View Stone must be used in the work.

The city council of Dayton, O., has been petitioned for the paving of L st., from Brown st. to Main st., a distance of 2,150 ft., and Rubicon st., from an alley between K and L sts., a distance of 162 ft.

Petitions are said to be in circulation in Tuscarawas, Canton and Nimishillen townships of Stark county, Canton, O., for the improvement of roads.

Stark County Commissioners, Canton, O., have received a petition from Lexington township for the improvement of two roads.

State Highway Commissioner James C. Wonders of Ohio, according to advices from Columbus, O., has awarded the contract for the construction of two miles of waterbound macadam road improvement on the Winchester pike, beginning at the Bexley corporation line, to E. A. Patterson of Malta, for $12,438.

The Lexington township trustees, Alliance, O., have been petitioned for the improvement of the Harrisburg road, beginning at the east line of Section 27, and extending one mile west, and for the improvement of an extension of Walnut st., from the north corporation line of the city one mile north.

Bids were received Sept. 26 by State Highway Commissioners James C. Wonders for the improvement of the Venice road for a distance of two miles south of the Columbia bridge near Hamilton, O., as follows: J. A. Wirtz Transfer Co., and John A. Trunck, water bound macadam, $16,238; macadam with tarvia, $18,460; macadam with asphalt, $18,460; macadam with carbo oil, $18,460; Horace Shields, water bound macadam, $16,285; $18,500 for each of the other materials. All bids were rejected as being too high, and new bids will be received later.

The county commissioners at Urbana, O., have granted a petition to repair the Mechanicsburg and Woodstock pike with gravel, for a distance of one and three-quarter miles north from Mechanicsburg. The contract will be let Oct. 15 by Engineer James Swisher.

The Miami county commissioners, Troy, O., have decided to build this fall three miles of model or improved roads under the state aid plan. The preliminary work is being done by Surveyor H. E. Whitlock. The three miles have been apportioned to Piqua, Troy and Tippecanoe City, a mile out of each of the three places. The Plattsville pike will be improved out of Piqua.

One mile of the Urbana and Woodstock pike in Wayne township will be improved by graveling, beginning at the farm of Frank Miller and running east toward Cable.

The West Main St. property owners, Logan, O., have petitioned the city council for the paving of that street. It is estimated that 200,000 brick will be required for this improvement.

The city council of Hamilton, O., has passed an ordinance providing for the paving of South B St. Bids for the work will be asked for soon.

Director of Service Adam Ulmer, Bucyrus, O., has awarded the contracts for paving the Hall alley and the constructing of the Whetstone St. sewer to Hofstetter & Dawson, for $1,000 and $2,283, respectively.

City Landscape Architect Rettig, Cleveland, O., is planning a proposed boulevard along the lake front made land at the foot of the bluffs from Edgewater park to Rocky River. As soon as the plan is completed a meeting of owners of property along this route will be called.

Advices from Tiffin, O., state that the Clinton township trustees have rejected the bids for the construction of a stretch of pike on the Coe road, and will re-advertise the work.

The City Council of Covington, O., has passed a resolution providing for the paving with wood block of Madison Ave., between Seventh and 11th St., one-half of the cost to be borne by the city and the other half by the abutting property owners.

Advices from Sandusky, O., state that the Vermillion township trustees have decided to improve the state road from the corporation line to a point where an improvement has already been completed at an approximate cost of $2,000. A 12 ft. roadway will be built and it will be covered with carbo-via.

The board of county commissioners at Cincinnati, O., has been petitioned for the improvement of Langland Ave., between Montgomery road and Carthage Ave. The county surveyor has been instructed to prepare an estimate for the improvement of Dayton pike between Sharon and the Butler County line. The surveyor has also been directed to make the necessary survey for the proposed improvement of the Vogel road between the Griffin road and the North Bend road, in Green Township.

The county commissioners of Erie County, Sandusky, O., have decided to improve the roads of the county at an estimated cost of $30,000. One of the first sections of the road to be improved will be the road between Berlin and Florence townships.

The contract for the paving of Broadway from 7th to 26th Sts., in Logansport, Ind., was awarded by the board of public works to the Andrews Asphalt Paving Co., of Hamilton, O., for $97,068. The company has agreed to grade and pave the street in 65 days.

The city council of Geneva, O., has passed a resolution providing for engineering work preliminary to paving.

The city council of Cleveland, O., has passed ordinances looking toward paving 72 streets.

The finance committee of city council of Youngstown, O., has recommended the widening of Ridge Ave., onto the Market St. viaduct.

Oklahoma.

The retailers' committee of the Chamber of Commerce of Oklahoma City, Okla., has recommended to that body the macadamizing of two highways extending north and south and east and west through Oklahoma county. The committee also adopted a plan providing for a bond election to vote a bond issue of $500,000 to carry on the work.

The Western Paving Co., Cleveland Trinidad Paving Co. and Shelby-Downard Co. have been awarded the contracts for the construction of 16.75 miles of asphalt paving, a total yardage of 302,670 sq. yds., in Oklahoma City, Okla., for which bids were opened Sept. 20. The approximate cost of the work is $800,000. W. C. Burke is City Engineer. The bids for the work were noted in Sept. 28 issue of Engineering-Contracting.

Oregon.

Coos County, Coquille, Ore., will spend $200,000 this year on roads.

The contract for paving the newly created paving district in Twin Falls, Ida., has been let to the Warren Construction Co., of Portland, Ore. The bitulithic paving and curb will be laid for $51.75 per 50 ft. lot. The district embraced in the contract is as follows: Shoshone st., from Sixth av. west, to Minnidoka st., 60 ft. wide. Minnidoka st., from Shoshone st. to Fifth av. south, 40 ft. wide. Second st. south, from Minnidoka st. a point 115 southwest of the southwest side of Fourth av. south, 40 ft. wide. Sixth av. south, from Shoshone st. in Minnidoka st., 50 ft. wide. Fourth av. south, from Shoshone st. to Second st. south, 50 ft. wide. Third av. west, from Third st. west, to Shoshone st., 50 ft. wide. Second av. west, from Second st. west, to Shoshone st., 50 ft. wide. Third av. south, from Shoshone st. to Second st. south, 50 ft. wide. Second av. south, from Shoshone st. to Second st. south, 50 ft. wide. Second av. south, from Second st. south, to Third st. south, 50 ft. wide. Second av. north, from Second st. north, to Shoshone st., 40 ft. wide. Second av. east, from Third st. east, 40 ft. wide. Second st. west, from Second av. west, to Main av., 30 ft. wide. Second st. north, from Main av. to Second av. north, 30 ft. wide. Third st. south, from Second av. south, to Main av., 30 ft. wide. Shoshone st. from Fourth av. north, to Sixth av. north, 60 ft. wide. Main av. from Fourth st. east, to Fifth st. east, 60 ft. Third st. east, from Main av. to Second av. east, 30 ft. wide. The alley in block 145, from Shoshone st. to Second av. south, 17 ft. wide.

A committee of business men of Eugene, Ore., have begun work on the campaign to raise $100,000 for the construction of the road from Eugene to Elmira, this fall. Approximately $59,275 has been subscribed for the building of the road unconditionally and $9,000 more on certain conditions which have not all been met.

The city council of Milwaukie, Ore., has been petitioned for the laying of cement sidewalks a distance of 10 blocks by the property owners on Harrison St.

Pennsylvania.

Mayor William Reyburn of Philadelphia, Pa., has obtained estimates on the cost of a complete asphalt mixing plant and ascertained prices of materials needed in street repair work.

The supervisors of Hancock township, Wilkes-Barre, Pa., have awarded the contract to the H. G. Bullock Co., for paving one side of Division st., the work to be completed before Dec. 1. Metropolitan fire clay brick will be used in the work on a concrete foundation. The street will be paved from Regent st. to Carey av.

The county commissioners at Norristown, Pa., have granted the petition for the construction of the new road at Trooper, which is to be about 1,300 ft. in length, and to extend from a point about the Miller place from Ridge road to Park ave.

An ordinance providing for the paving of Stambaugh ave., from State st. to Pine Run, a distance of 700 ft. at the probable cost of $4,500 has been introduced in the city council of Sharon, Pa.

Frease & Sperling, Wilkinsburg borough engineers, Pittsburg, Pa., have let the contract to McDivitt & Steele of Wilkinsburg for the grading, curbing and paving with vitrified brick of Rebecca ave., from the present paving to the Laveen plan of lots in Wilkinsburg, and for the grading and paving of Culp way from Wood st. to Pitt st.

The merchants and property owners on South st., between Broad st., and the Schuylkill river, Philadelphia, Pa., have urged the mayor to ask for the paving of that street with a wood block pavement.

City of Harrisburg, Pa., has awarded the contracts for the construction of paving as follows: Barber Asphalt Co., Chestnut St., from 15th St. to 16th St., at $1.63 per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; Evergreen St., from Market St. to Derry St., at $1.52½ per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin ft. for granite curbing; 18th St., from Market St. to Derry St., at $1.51 per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; North St., from 15th St. to 16th St., at $1.49 per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; Harris St., from Front St. to Third St., at $1.45½ per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; Herr St., from the Pennsylvania Railroad to Cameron St., at $1.47½ per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; Cameron St., from State St. to Herr St., at $1.43 per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing; Helena Alley, from State St. to North St., at $1.55 per sq. yd. for Trinidad Lake Sheet Asphalt and $0.78 per lin. ft. for granite curbing.

The Central Construction & Supply Co.: Kittatinny St., from Crescent St. to Derry St., at $1.56 per sq. yd. for California or Pioneer refined sheet asphalt and $0.74 per lin. ft. for granite curbing; Hamilton St., from Front St. to 7th St., at $1.53 per sq. yd. for California or Pioneer refined sheet asphalt and $0.74 per lin. ft. for granite curbing; Front St., from Herr St., to Calder St., at $1.53 per sq. yd. for California or Pioneer refined sheet asphalt and $0.74 per lin. ft. for granite curbing; Calder St., from Sixth St. to 7th St., $1.53 per sq. yd. for California or Pioneer refined sheet asphalt and $0.74 per lin. ft. for granite curbing. The contracts for paving portions of Boyd, Currant, 5th, Harris, Sayford, Wallace, Chestnut and 15th have not been awarded. Chas. A. Miller is City Clerk.

South Carolina.

Advices from Walterboro, S. C., state that the U. S. Department of Agriculture has detailed an expert, through the efforts of the Colleton County Good Roads & Drainage League, to build an object lesson sand clay road in that city. H. C. Wells is the expert in charge.

Texas.

Contracts have been awarded by the board of municipal commissioners of Dallas, Tex., to D. J. Grigsby, for the paving of the following: Market st., from Jackson to Pacific, with vitrified blocks, asphalt filler, two-in. sand cushion, six-in. gravel concrete foundation, for $2.75 per sq. yd. The contract includes 5,340 sq. yds. of paving; Griffin st., from Cochran to Pacific, for $2.65 per sq. yd. The total is 6,083 sq. yds.; Main st., from Houston to Water st., for $2.75 per sq. yd. The total is 2,760 sq. yds.

The county commissioners at Lockhart, Tex., are planning the issuance of bonds in the sum of $50,000 for the construction of good roads throughout the county.

Virginia.

At the Good Roads Association, formed at Amherst, Va., on Oct. 4, with State Senator Strode at the head as president, a campaign was inaugurated for the issuance of bonds to the amount of $135,000 for improvements in macadam roads. The plan is to improve about 45 miles of public roads in addition to the 15 miles now under construction from Lynchburg to Amherst Courthouse. The convention adopted a resolution calling upon the board of supervisors to petition the Circuit Court for an election to be held in January to authorize the issue.

The state highway commissioner of Washington has promised the county commissioners at Aberdeen, $20,000, provided the county commissioners appropriate a similar amount to complete the highway from Humptulips City to Quinault lake.

The board of public works of Seattle, Wash., has awarded contract to the Erickson Construction Co., for the grading, regrading and widening to a uniform width of eight ft., of 12th av., and 12th Ave. south between Olive St. and Main St., for $336,690. The improvement is practically embankment, the greatest fill, 60 ft., to be made at the intersection of 12th Ave. and Pike St., coming to the present grade at Olive St., to the north and James St. to the south.

P. J. McHugh was the lowest bidder Sept. 20 at Seattle, Wash., for the paving of 31st Ave., South, at $37,363, and for the paving of 38th Ave., at $19,520.

Washington.

The Pierce county commissioners, Tacoma, Wash., have decided to bring a bond issue before the people in the November elections for $500,000 for the continuation of the building of the Seattle-Olympia through road. The amounts for different sections of the road are as follows: From Tacoma, by the old route to Puyallup, Orting, South Prairie and Buckley, $100,000; Tacoma to Sherlock, $50,000; Mount Tacoma road, $50,000; Lincoln avenue to Dash point, $50,000; Tacoma to King county (Seattle), via Sumner, $75,000; Tacoma to King county, Edgewood, $35,000; Gig harbor to Purdy and Springfield, $40,000.

R. S. Blome & Co., were the lowest bidders for the following paving work in Spokane, Wash., for which bids were opened Sept. 23: Paving, with granitoid, sidewalking, grading and curbing Bernard st., Pacific to Eighth av., engineer's estimate, $36,900; R. S. Blome & Co., $39,500, maintenance for five years, $1,975. Paving, granitoid, curbing and sidewalking Lincoln st., Second to Fifth av., engineer's estimate, $15,800. R. S. Blome & Co., $17,300, maintenance for five years, $865. Paving, with granitoid, curbing and sidewalking Wall st., Second to Fifth av., engineer's estimate $15,550; R. S. Blome & Co., $17,300, maintenance for five years, $865.

The bids as opened by the board of public works of Spokane, Wash., for street improvements were as follows: Grading, paving, granitoid concrete, Fifth av., Bernard to Howard st.; estimate, $20,800; R. S. Blome & Co., $21,800; John Fife, $21,500. Grading, paving, curbing and sidewalking Coeur d'Alene st., Thirteenth to Fourteenth av.; estimate, $1,400; Mitchell Bros., $1,248; J. B. Mitchell, $1,269; Abbott & Joslin, $1,400. Grading, curbing, paving and sidewalking Myrtle st., Hartson to Eighth av.; estimate, $5,200; Inland Engineering Co., $5,095; 60 days to do work. Grading, curbing, paving and sidewalking Eighth av., Perry to Ivory st.; estimate, $4,100; Mitchell Bros., $4,622, 90 days; Inland Engineering Co., $4,225, 60 days; Naylor & Norlin, $4,734, May 1, 1911; Colley & Ferguson, $5,263, seven months; James C. Kennedy, $4,864, 90 days; Abbott & Joslin, $3,680, May 1, 1911. Grading, curbing, paving and sidewalking Ninth av., Perry to Ivory st., estimate, $2,250; Mitchell Bros., $1,949, 60 days; Naylor & Norlin, $2,284, April 15, 1911; James C. Kennedy, $2,800, 90 days; J. B. Mitchell, $1,969, 90 days; Abbott & Joslin, $1,800, May 1, 1911, to complete work.

West Virginia.

The contract for the paving of Cruegger st., in Elm Grove, from the intersection of the dividing line between the town of Patterson to the Elm Grove school, has been let to George Lemmon of Wheeling, W. Va., for $.93 per sq. yd.

Wisconsin.

✣Bids will be received until 2 p. m., Oct. 13, by F. O. Phelps, County Clerk, Milwaukee, Wis., for grading Grand ave., between the city limits of Milwaukee and the Hawley road.

✣Bids will be received until 10:30 a. m., Oct. 13, by Department of Public Works, Milwaukee, Wis., for the construction of curb and sidewalks with stone, on 12th Ave., from Mitchell St. to Pearl St., in 11th Ward; Burnham St., from 14th Ave. to Muskego Ave., 11th Ward; Russell Ave., from Kinnickinnic Ave., to eastern terminus in 17th Ward; east half of First Ave., from Lincoln Ave. to Arthur Ave., 17th Ward; 21st Ave., from Scott St. to Greenfield Ave., 23d Ward; 16th Ave., from Mineral St., to Greenfield Ave., 23d Ward; 18th Ave., from Mineral St. to Greenfield Ave., in 23d Ward. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received until 10:30 a. m., October 15, by Department of Public Works, Milwaukee, Wis., for the construction of street improvements in the 18th and 20th Wards.

✣Bids will be received until 10:30 a. m., Oct. 15, by Department of Public Works, Milwaukee, Wis., for the improvement of streets with cement curb and sidewalks in the 18th and 20th Wards.

WATER-WORKS AND SEWERAGE

Alabama.

✣Bids will be received until Noon, October 17, by Robert Tait, City Treasurer, Montgomery, Ala., for the construction of a concrete sewer in Genetta Ditch from McDonough to Perry St. Plans and specifications are on file at the office of the city engineer.

The City Council of Boaz, Ala., has ordered an election for Oct. 31 to ascertain whether or not the voters of the town desire a $20,000 bond issue to be used for the erection of a waterworks plant.

The Mayor of Montgomery, Ala., has been authorized to purchase for installation in the municipal waterplant of the city, machinery which will involve the expenditure of an amount approximately $30,000.

California.

The City Board of Trustees of Oroville, Cal., has decided to re-advertise for bids for the construction of the sewer system.

A petition from residents in the northern end of Long Beach, Cal., asked that steps be taken at once by the city council, looking to the installation of sewers in that section bounded by 16th St., and Atlantic Ave.

J. W. Terrell of Chico, Cal., has been awarded the contract for the construction of the sewer system in Porterville, Tulare County. The work includes about 16 miles of sewer pipe.

Advices from San Diego, Cal., state that the La Mesa Springs Sewer association recently increased its capitalization from $6,000 to $24,000 in order that it might keep pace with the growth of the town in making sewer extensions. A septic tank will be installed to drain Parks addition in the southeast section of the town.

The contract to construct the sewer system in Tulare was awarded by the city trustees to the Stanley Construction Co., of San Francisco for $19,820. The contract to furnish the pipe was awarded to N. Clark & Sons of San Francisco for $23,163.

Shortly after the election to be held in Sacramento, Cal., in November, the electors of the city will again be called upon to vote to bond the city for $666,000 to purchase a site and construct a mechanical filtration plant.

Colorado.

The contract for the new sewer in Salida, Colo., has been let by the city council to Peter O'Brien of Denver for $53,075. Mr. O'Brien also received the contract for the completion of the main sewer on Scott St., to the river for $1,092.

Connecticut.

The Board of Contract and Supply of Hartford, Conn., has awarded contracts for sewers in Allen place and in White St. gutters in Russ St., and a conduit between Sisson Ave. and Tremont as follows: Sewer in Allen place, east of Summit St.—Beradino, Silvestri & Conti, $1,370. Next lowest, Chas. H. Slocomb, $1,504. Sewer in White St. from Hillside Ave. westerly—A. D. Ambrozio, $1,568. Next lowest, Beradino, Silvesti & Conti, $1,738. Concrete gutters in Russ St., between Putnam St. and Park terrace—Hartford Paving & Construction Co., $2,090. Next lowest, A. Danielson & Co., $2,205. Conduit from Sisson Ave. to Tremont St.—Hartford Paving & Construction Co., $12,899. Next lowest, Chas. H. Slocomb, $16,300.

The Public Works Department of New Haven, Conn., has awarded to Dwyer & Manniv four contracts as follows: Clinton Ave., sewer, from Lombard to Chatham Sts., $524; Chambers St., from Ferry to Houston, sewer, $416; Morris St., between Lamberton and Rosette, sewer, $1,358; Maltby and Grafton Sts., between Chatham and Clinton Ave.

Costa Rica.

Chavarria Mora, C. E., San Jose, Costa Rica, has the contract for 15 miles of sewers. the ditches will be made in the streets 5 to 6 ft. deep, for sewers 6 to 18 ins. in diameter. The material is clay with about 12 ins. of broken stone on top forming the present pavement. The sewer trench will pass across the ½-in. galvanized pipe house water connections about 40 to 60 ft. apart.

Georgia.

✣Bids will be received until noon, November 1, by City Council of Atlanta, Ga., for the construction and necessary materials of the Proctor Creek sewage disposal plant near Atlanta, Ga. R. M. Clayton is City Engineer. Hering & Fuller, 170 Broadway, New York City, are Consulting Engineers.

The citizens of Kirkwood, Ga., held an election Oct. 4 to vote on the proposition of issuing bonds in the sum of $60,000 for the digging of a new artesian well and the laying of sewer and water mains. The sewer main proposed to be laid will range from six to 18-in. in diameter and the water mains from six to 10-in.

Illinois.

Frank W. Rink of Dixon, Ill., has been awarded the contract in that city for the construction of the sewer on North Galena Ave., for $2,357.

The City Council of Joliet, Ill., has awarded the contract for digging the two new artesian wells to the Ohio Drilling Co., of Massillon, O., for $6,720 for one well, and $500 less for the second well, if the same machinery may be used as on the first well, making a total

Items marked thus ✣ indicate work now open for bids.

cost for digging and piping to the city of $12,940.

The President of the Board of Local Improvement of Barrington, Ill., has submitted the total estimated cost of the proposed sewer system to that body. The system will include approximately 45,000 lin. ft. of vitrified tile pipe ranging in size from 8-in. to 12-in. in diameter, 177 concrete manholes, one concrete settling tank, two sand and gravel filters and 2,000 lin. ft. of 1-in. internal diameter galvanized iron water pipe. The estimated cost is $59,290.

C. A. Berglund of Moline, Ill., has been awarded the contract in that city for the construction of a sewer in the southwest section of the city from 15th to 22nd Aves., and 1st to 7th Sts., including an outlet through the city park connecting with the Hawk Hollow sewer for $13,785. At the same time bids were opened Sept. 24, for the laying of watermains in the same section, the lowest bid being received from F. E. Kaminiski of Watertown, Wis., $8,500. Clark G. Anderson is City Engineer.

A petition was presented to the city council of Bloomington, Ill., asking that a sewer be installed in South Center St., between Front St., and the Big Four railroad. The city engineer was instructed to prepare plans and estimates of the work.

Keyes & McNamara, LaSalle, Ill., have been awarded the contract for the necessary labor and material for the construction of 3,476 ft. of 15-in double strength tile sewer having an average cut of 14 ft. and located through private property, including 12 manholes and other appurtenances, in Princeton, Ill., W. S. Shields Co., 1201 Hartford Bldg., Chicago, Ill., is Engineer. Bids were opened Sept. 23.

The Board of Public Works, Chicago, Ill., awarded the contract for setting boilers and foundation at the 68th St. pumping station, located at 68th St. and Oglesby Ave., to Nash Dowdle Co., 145 LaSalle, Chicago for $9,000; steel at $.08 per lb., and foundations at $7,800. Bids were opened Sept. 29.

Following low bids were received Oct 5 by the Board of Local Improvements, Chas. A. Standish, Secy., Chicago, Ill., for construction of sewers in the following streets: Ave. H, E. 107th St., E. 108th St., 640 lin. ft., 1 ft. diam., Fred Seip, 3057 E. 92d St., Chicago, $1,056; N. Avers Ave., Greenwood Ter., Alley 1st south, 490 lin. ft., 1 ft. diam., $681, and N. Avers Ave., Dickens Ave., Humboldt, 670 lin. ft., 1 ft., diam., $905, Stephen A. Healy, 4323 Dearborn St., Chicago; N. 52d St., Grand Ave., Dickens Ave., 550 lin. ft., 1¼ ft. diam., and N. 52d St., Dickens, Humboldt, 670 ft., 1 ft. diam., $1,744, Stephen A. Healy; Humboldt Av., N. 41st, N. 41st Ct., 340 lin. ft., 1 ft. diam., Nick Mancius & Angelo Manicini, 900 W. Taylor St., Chicago, $408; W. 34th Pl., Western Ave., 470 ft. W. of S. Western Ave., 510 lin. ft., 1 ft. diam., Nick Pontoulli, 4817 Dakin St., Chicago, $734; W. 34th Pl., Western Ave., 120 ft. W. of S. Artesian Ave., 520 lin. ft., 1¼ ft. diam., and S. Artesian Ave., W. 34th St., Boss Ave., 590 lin. ft., 7 ft. diam., $1,599, Nick & Angelo Mancini; N. Central Ave., W. Division St., Potomac Ave., 670 lin. ft., 1¼ ft diam., and N. Central Ave., Potomac Ave., Hirsch St., 670 lin. ft., 1 ft. diam., $1,909, Stephen A. Healy; W. 39th St., S. Kedzie Ave., S. Albany Ave., 675 lin. ft., 1¼ ft., diam., and W. 39th Pl., S. Albany Ave., Sacramento, 675 lin. ft., 1 ft. diam., $1,971, Stephen A. Healy; Exchange Ave., E. 85th St., E. 86th St., 670 lin. ft., 1¼ ft. diam., and from E. 86th St., E. 87th St., 670 lin. ft. diam., $2,613, John W. Bount, 2447 E. 74th St., Chicago; Exchange Ave., E. 85th St., E. 86th St., 670 lin. ft., 1¼ ft. diam., and from E. 86th St., to E. 87th St., 670 lin. ft., 1 ft. diam., 2,613, Nick & Angelo Mancini; W. 43d St., Western Ave., S. Oakley, 675 lin. ft., 2½ ft. diam., W. 43d St., S. Oakley Ave., 180 ft., east, 180 lin. ft., 1½ ft. diam., W. 43d St., 18 ft. east of S. Oakley, P., C., C. & St. L. Ry., 300 lin. ft., 1¼ ft. diam., Wing sewers, 35 lin. ft., 1½ ft. diam., $3,454, Federal Improvement Co., 959 Rookery Bldg., Chicago; Muskegon Ave., E. 85th St., E. 86th St., 670 lin. ft., 1¼ ft. diam., and from 86th St., E. 87th St., 670 lin. ft., 1 ft. diam., $1,943, Peter Fentelli, 518 W. Taylor St., Chicago, and Ole Scully, 556 Ewing St., Chicago; W. 49th Pl., Western Ave., S. Oakley Ave., 340 lin. ft., 1¼ ft. diam., W. 49th Pl., S. Oakley, Leavitt St., 645 lin. ft., 1 ft. diam., W. 50th St., Western, one block east, 380 lin. ft., 2 ft. diam., W. 50th St., Western Ave., S. Oakley Ave., 325 lin. ft., 1¼ ft. diam., W. 50th St., S. Oakley, S. Leavitt, 645 lin. ft., 1 ft. diam., W. 50th Pl., Western Ave., S. Oakley, 325 lin. ft., 1¼ ft., diam., W. 50th Pl., Oakley Ave., S. Leavitt, 645 lin. ft., 1 ft. diam., W. 51st St., Western Ave., 1st alley east, 380 lin. ft., 2 ft. diam., W. 51st St., Western Ave., S. Oakley, 325 lin. ft., 1¼ ft. diam., W. 51st St., S. Oakley, S. Leavitt, 645 lin. ft., 1 ft. diam., W. 51st Pl., Western Ave., S. Oakley, 325 lin. ft., 1¼ ft. diam., W. 51st St., S. Oakley Ave., 430 ft. east, 465 lin. ft., 1 ft. diam., Alley 1st east, W. 49th Pl., W. 50th Pl., 670 lin. ft., 1¼ ft. diam., Western Ave., W. 50th Pl., W. 51st St., 340 lin. ft., 1 ft. diam., Western Ave., W. 51st St., W. 51st Pl., 340 lin. ft., 1¼ ft. diam., Western Ave., W. 51st st., W. 51st Pl.. 340 lin ft., 1¼ ft. diam., Stephen A. Healy, 4323 Dearborn St., Chicago, $10,160.

The New York Blower Co., at $1,350, was low bidder of the bids received by the Board of Public Works, Chicago, Ill., on Oct. 4, for furnishing induced draft apparatus with engine, at 68th St. pumping station.

Indiana.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along the alley east of Capitol Ave., from Norwood St. to McCarty St.

✣Bids will be received until 7:30 Nov. 1, by Common Council, Shelbyville, Ind., for the construction of a sanitary trunk sewer system. Also for the improvement of several streets with sidewalks and gutters. L. E. Webb is City Clerk.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer in and along the alley east of Ewing St., from Nowland Ave., to the alley south of 16th St.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along Stuart St., from 23d St. to Glenn Drive.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along New York St., from Audubon Place to Bolton Ave.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along Adams St., from Roosevelt Ave. to Glen Drive.

✣Bids will be received until 10 a. m., Oct. 19, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along Pratt St., from Senate Ave. to the Canal.

✣Bids will be received until 10 a. m., by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along with appurtenances in and along New Jersey St., from 28th to 40th St.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along Keystone Ave.; from Pleasant Run to a point 20 ft. south of the south property line of Woodlawn Ave.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along LaSalle St., from Glen Drive to Roosevelt Ave.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along Blackford St. from Indiana Ave.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along alley west of East St. from Raymond St.

✣Bids will be postponed until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer with appurtenances in and along Bellefontaine St. from 13th St. to Sutherland Ave.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along McPherson St. from 13th St. to Sutherland Ave.

✣Bids will be received until 10 a. m., Oct. 17, by Board of Public Works, Indianapolis, Ind., for the construction of local sewer with appurtenances in and along the alley east of Miley Ave. from Calvelage St. to 11th St.

The Interstate Construction Co., of Hammond, Ind., has been awarded the contract for the construction of a sewer system in Laporte, Ind., for $75,000. Work on the contract has been begun.

The contract for a combination storm and sanitary sewer from West 2nd to West 4th St., in an alley between Chestnut St., and the Indianapolis division of the Pennsylvania railroad, Benton Harbor, Mich., has been awarded to Philip Hipskind & Son of Peru, Ind., for $3.43 per lin. ft. The sewer is 950 ft. long.

Iowa.

✣Bids will be received until 3 p. m., Oct. 25, by Irwin Aikin, Town Clerk, West Liberty, Ia., for the construction of sanitary sewers as follows: 955 ft. 18-in. vitrified pipe; 5,680 ft. of 15-in. vitrified pipe; 200 ft. of 16-in. cast iron pipe; 1,640 ft. of 12-in. vitrified pipe; 3,000 ft. of 10-in. vitrified pipe; 18,000 ft. of 8-in. vitrified pipe; 69 manholes; 20 flush-tanks; 1 septic tank; 2 sand filters; 1 bulkhead. Iowa Engineering Co., Clinton, Ia., Engineers.

The contract for the construction of the waterworks at Underwood, Ia., has been let to the Des Moines Iron & Bridge Co., of Des Moines, Ia., for $7,024.

M. Gossem has been awarded a contract at Cherokee, Ia., for sinking a deep well at the pumping station for $1,250. Bids were opened Oct. 4.

The city of Ocheyeden, Ia., has awarded the contract for the construction of a waterworks system, for which bids were opened Oct. 5, to the Des Moines Bridge & Iron Co., of Des Moines, Ia., for $10,251. The work includes a 50,000-gal. steel tank and tower, 120 ft. high brick building, 16x18, 8,300 ft. of 8, 6 and 4-in. pipe, etc., complete and installed. The contract for the well has not been let.

Aug. Schnell has been awarded the contract by the city of Clinton, R. C. Hart, City Engineer, for the construction of sewers in portions of 5th and 12th Aves., for $1,500. Bids were opened Sept. 26.

Kansas.

✣Bids will be received until 1 p. m., October 17, by R. P. Seyfer, City Clerk, Mulvane, Kan., for furnishing material and constructing a water works plant. J. S. Worley Co., 206 Reliance Bldg., Kansas City, Mo., is Engineer.

✣Bids will be received until 5 p. m., Oct. 17, by F. D. Brooks, City Clerk, Lawrence, Kan., for the necessary labor and material for the construction of a Main District Sanitary sewer in the south portion of Lawrence as provided by Ordinance No. 619. The work will require 2,850 ft. of 12-in. vitrified sewer pipe; 3,850 ft. of 10-in. vitrified sewer pipe; 19 manholes; 25 Y junctions.

The City Council of Clay Center, Kan., has been petitioned for an extension of the sewer eastward through blocks 1 and 2 of Dexter's third addition, to extend eastward to the present extension line.

The City Council of Junction City, Kan., has ordered the installation of a new 3,000,000-gal. Corliss engine of the latest type for the waterworks plant. The present equipment consists of two engines with a combined capacity of 2,000,000 gals.

Kentucky.

The Louisville Water Co., Louisville, Ky., on Sept. 27, opened bids for an intake tower to be erected in the Ohio River opposite the pumping station of the water company for protection to the water from the river. The following bids were submitted: Mansfield Engineering Co., Indianapolis, Ind., $98,850; Henry Bickel Co., Louisville, $105,950; American Engineering & Construction Co., Chicago, Ill., $69,800; National Concrete Construction Co., Louisville, $83,088.

Louisiana.

The City Council of Monroe, La., has decided to proceed at once with the construction on the powerhouse lot, of two additional concrete water reservoirs.

Plans are being made looking to the establishment of a waterworks plant for protection from fire, in Lockport, La. A committee has been appointed and is getting data as to the cost of a steel tower, a 20,000-gal. tank and 4-in. mains through the two principal streets.

Maine.

The United States Cast Iron Pipe Co. has been awarded the contract at Portland, Me., for furnishing 14.36 miles of cast iron pipe. T. C. Tunney of Hoboken, N. J., received the contract for laying the same. The pipe will be furnished for $22.40 per ton. Bids were opened Sept. 12.

Minnesota.

The Village Council of Gilbert, Minn., has voted to bond the city for the sum of $20,000 to secure funds to pay the cost of putting in a sewer system.

The City Council of Crookston, Minn., has awarded a $5,000 sewer outlet contract to P. McDonnell of Duluth, Minn.

The Pastoret-Lawrence Co., of Duluth, Minn., has been awarded a contract, amounting approximately to $16,190 for the construction of water and sewer extensions in Cloquet, Minn. The work must be completed by Dec. 16.

Mississippi.

The citizens of Clinton, Miss., have decided to petition the board of mayor and aldermen to issue bonds for the purpose of defraying the expense of having an artesian well sunk to obtain water for the town supply.

Missouri.

✣Bids will be received until 8 p. m., November 1 by William Warden, City Clerk, Neosho, Mo., for the construction of a system of sewers for Sewer District No. 1. John M. Sherwood is Engineer.

Advices from St. Joseph, Mo., state that contracts have been let for a system of sewers in Kenwood Heights and Lovers' Lane Place to cost between $6,000 and $7,000, and an ordinance has been recommended for a system of sewers in The Highlands and embracing the residence district in the vicinity of Bartlett Park to cost $8,000.

The engineer employed by the Board of Public Works of LaPlata, Mo., to estimate the cost of installing a waterworks and sewerage system, has submitted an estimate of $55,000 for the complete equipment, including the cost of land.

Nebraska.

The City Council of Grand Island, Neb., has passed the ordinance for the sewer main which is to be extended to the northern limits of the city in order that the Soldiers' Home and Grand Island college may be connected therewith.

New Jersey.

The city of Woodbury, N. J., has awarded the contract to B. F. Sweeten & Son of Camden, N. J., for the construction of about 7,700 ft. of 8-in. vitrified pipe sewers with manholes and flush tanks, and a pumping station equipped with duplicate rotary pumps, and electric motors, automatically controlled and about 1,100 ft. of 6-in. cast iron force main. The estimated cost of the work is $17,057. Bids were opened Sept. 27.

New York.

✣Bids will be received until 8 p. m., Oct. 28 (change of date), by Village Trustees, Westfield, N. Y., for the construction of a sewer system including approximately 25,194 lin. ft. of 8-in. pipe; 9,764 ft. 10-in.; 5,377 ft. of 12-in.; 2,615 ft. of 18-in.; 1,460 ft. 20-in.; 3,108 ft. of 24-in. pipe, 143 manholes; 23 flushtanks; one disposal plant.

✣Bids will be received by Cyrus C. Miller, Pres. Borough of The Bronx, Municipal Bldg., Crotona Park, 177th St. and 3d Ave., until 11 a. m., Oct. 15, for 12 street improvement contracts, the largest being No. 6, as follows: For constructing sewers and appurtenances in Westchester Ave., between Zerega Ave. and Castle Hill Ave., and in Glover Ave., between Westchester Ave. and Lyon Ave., and in Doris St., between Westchester Ave. and Summit north of Westchester Ave., and in Ludlow Ave., between Pugsley Ave. and Zerega Ave., and in Castle Ave., between Ludlow Ave. and Black Rock Ave., and in E. 177th St., between Ludlow Ave. and Havemeyer Ave., and in Westchester Ave., between Pugsley Ave. and Olmstead Ave. The Engineer's estimate of the work is as follows: 136 lin. ft. of concrete sewer, 3 ft. 6 in. diameter; 87 lin. ft. of concrete sewer, 3 ft. diameter; 1,748 lin. ft. of pipe sewer, 24 in.; 1,103 lin. ft. of pipe sewer, 20 in.; 2,302 lin. ft. of pipe sewer, 18 in.; 1,962 lin. ft. of pipe sewer, 15 in.; 6,325 lin. ft. of pipe sewer, 12 in.; 962 spurs; 144 manholes; 22 receiving basins; 2,800 cu. yds. of rock excavation; 200 cu. yds. of broken stone; 425 cu. yds. of Class B concrete; 7,000 pounds of steel bars in foundation; 10,500 lin. ft. of piles; 100,000 ft. (B. M.) of timber; 200 lin. ft. of drain pipe. The time allowed for the completion of the work will be three hundred and fifty (350) working days. The amount of security required will be $40,000.

Henry E. Fox, 81 E. 125th St., New York City, has been awarded the contract for laying and relaying of water and gas mains and grading and paving streets to the municipal building, New York City, for $68,000. Kingsley L. Martin is Commissioner of Bridges. Bids were opened Sept. 8.

The village of Barker, N. Y., held an election on Sept. 29 to vote on the proposition of installing a system of water works for about $25,000.

The citizens of Angola, N. Y., on Sept. 22, voted the issuance of bonds in the sum of $55,000 for the installation of a waterworks.

The citizens of Yorkville, N. Y., voted Oct. 8 on the proposition to build a sewer system for the village at an estimated cost of $22,000.

The Commissioner of Public Works of Buffalo, N. Y., has contracted with Benjamin F. Spire for constructing a 36-in brick, 20, 18, 15 and 10-in. tile sewer in east side of Fillmore Ave., and in Appenheimer Ave., between Delavan Ave., and 1,350 ft. east of Fillmore Ave., for $8,900.

Plans and maps have been completed by Chief Engineer John H. Weinberger of the Department of Highways, New York City, for the outlet sewer for the Ingleside system in Ingleside. The plans have been submitted to the board of estimates. The sewer is to be built commencing at the corner of Twenty-fourth St. and Queens Ave. in Flushing, then extending along Queens Ave. to Parsons Ave.; thence along Parsons Ave. to Laburnum Ave.; along Laburnum Ave. to Jamaica Ave.; on Jamaica Ave. to Hillside Ave.; on Hillside Ave. to Colden Ave.; on Colden Ave. to Cherry St.; on Cherry St. to Saull St.; on Saull St. to Bank St.; on Bank St. to Lawrence St.; on Lawrence St. to Washington St.; on Washington St. to State St.; on State St. to Linden Ave.; on Linden Ave. across the meadows between Flushing and College Point to 23rd St. and 4th Ave., College Point; on 4th Ave. to 20th St. and on 20th St. to the East River, where the discharge will be into the head of Flushing Bay.

The City Council of Rochester, N. Y., has started plans for the construction of the necessary purification works, sewers and pipe lines, for the discharge of Rochester sewage into Lake Ontario. It is estimated that the latter will cost about $1,000,000, and will take two years to complete.

B. G. Coon Construction Co., Wilkesbarre, Pa., has been awarded the contract by the city of Ithaca, N. Y., for clearing of a reservoir site of about 40 acres, and for the construction of an earth embankment containing about 5,000 cu. yds., also for the construction of a dam containing about 7,700 cu. yds. of concrete and requiring the excavation of about 4,300 cu. yds. of rock, and the furnishing and laying of about 9,000 ft. of 24-in. cast iron pipe. Bids were opened Sept. 28 and awarded Sept. 30. Donald J. [illegible] is City Engineer.

The R. T. Ford Co., Rochester, N. Y., has received the contract for the construction of the water and sewerage systems at Letchworth Village for $128,587. Franklin B. Kirkbride, Room 215, 55 Wall St., New York, N. Y., is Secretary of the Board of Managers of the village. Bids were opened Sept. 27.

Ohio.

✣Bids will be received until noon, Oct. 18, by John Bing, Director of Public Service, Sandusky, O., for the construction and material of a sewer in Maple Ave., from the center of Monroe St. to the center of Tyler St., thence along Tyler St. to the center of Central Ave. Joseph Loth, Jr., is Clerk.

The Elmore Water Co., of Elmore, O., has been incorporated with a capital stock of $10,000, Louis Frese being an incorporator.

The superintendent of the waterworks department of Cleveland, O., has asked the department of charities and correction to give the water department a site for a new reservoir on the high portion of the city farm at Warrensville.

The Salem Avenue Improvement association of Dayton, O., has been formed with George W. Mearick as President and Daniel Nevins Secretary. The territory embraced extends from Cottage Grove Ave., to the present corporation line and on either side of Salem Ave. The association has decided upon the following improvements: Sewers, electric lights, water and gas mains, sidewalks and brick paving in the roadway.

The Improvement Board of Urbana, O., has received the following bids for the construction of the Washburn Park sewer system: Lanyon & Clifford, $19,377; H. D. Hallet, $19,680; H. C. Patterson, $19,723; Johnson & Thompson, Racine, $19,813; Robert Nelson, Racine, $19,902.

The Service Department of Zanesville, O., has awarded a contract to Joe Brown for the construction of the Pine St. storm and sanitary sewer for $4,056. The sewer will be 1,285 ft. in length, reaching from the Muskingum river to Woodruff alley.

The Riggs & Sherman Co., engineers, Toledo, O., have been awarded the contract for preparing plans and specifications for the new sewage disposal plant to be built by the city of Delaware, O.

Oklahoma.

Plans were ordered by the city council of Enid, Okla., for an enlargement of the water system. The new improvement will be paid for out of the $55,000 bond issue recently voted.

An election will be held in Claremore, Okla., on Nov. 8 to vote on issuing bonds for erection of a city hall and completion of waterworks system.

W. F. Power of Guthrie, Okla., has been awarded the contract in that city for the construction of the East Side sewer for $9,005.

The town of Sallisaw, Okla., on Sept. 27 voted the issuance of bonds as follows: For an extension of street crossings to connect up with concrete sidewalks already built, $4,000; for an extension of the water and light service, $16,000; to install a modern system of sewers, $4,500.

Oregon.

A. Burns of Spokane, Wash., has received the contract from the city council of Salem, Ore., for the construction of the North Salem sewer system for $87,952.

The Public Works Engineering Co., of Portland, Ore., has completed the plans for the construction of the new sewage and garbage disposal plant [illegible] the plants will be commenced shortly.

The City Council of Portland, Ore., has deided to use cement in place of terra cotta pipe for the Riverside sewer district. The ordinances covering this improvement call for the expenditure of $147,000.

Pennsylvania.

✣Bids will be received until 8 p. m., Oct. 25, by W. F. Rayle, Town Secretary, Beaver Falls, Pa., for the complete surveys, plans, specifications, etc., for a proposed sewerage system and system of sewage disposal.

✣Bids will be received until 8 p. m., Oct. 19, by Council of Borough of Chambersburg, Pa., for laying and connecting cast iron water pipes, special castings, etc., 16-in., 14-in., 12-in., 10-in., 8-in. and 6-in. diameter, with caulked lead joints to form a gravity conduit about 11 miles long to be connected to the existing distribution system of the borough. John Birkinbine, Odd Fellows Temple, Philadelphia, Pa., is Consulting Engineer.

The United States Cast Iron Pipe & Foundry Co., of Pittsburg, Pa., has been awarded a contract by the water commissioners of Erie, Pa., for furnishing about 400 tons of pipe for the extension of a 12-in. main to supply the new Wesleyville watering and coaling yards of the Lake Shore railroad, east of the city. The contract was awarded at $22.65 per ton. The amount of pipe required will be 8,600 ft.

The ordinance for the extending of the sewer on 8th Ave., to a point east of Duke St., has been presented to the North York, Pa., city council and passed.

The City Council of Charleroi, Pa., has received applications from six different engineering firms for the work of preparing plans and specifications for the Charleroi and North Charleroi sewage disposal plant.

Mason D. Pratt of Harrisburg, Pa., who was retained by the town council of Greencastle, Pa., as consulting engineer in the matter of the increase of the city's water supply. has been examining the possible sources of increased supply with a view of making a definite and final recommendation as to what steps shall be taken to make a permanent increase in the water supply.

Contract for the construction of storm sewers in Wilkinsburg borough, Pittsburg, Pa., have been awarded by Frease & Sperling, borough engineers, as follows: Kelly Ave., and Ecker Way to McCrady Bros. of Braddock, and Todd and Lanar Sts., and Penn Ave., to the Sawders Construction Co., of Pittsburg.

South Dakota.

The contracts for the sinking of four artesian wells in Willow Creek, Butte township, Pierre, S. Dak., were awarded to Norbeck & Nicholas for $5,425.

Tennessee.

W. G. Kirkpatrick, engaged by the city of Chattanooga, Tenn., to prepare plans and specifications for a municipal waterworks, has reported to the waterworks commission. Mr. Kirkpatrick estimates that the plant can be installed for $1,522,000. The estimate as submitted by the expert is given in detail as follows: Pumping and electrical machinery, $152,833; boilers, $11,928; traveling cranes, main pumping station and intake pumping station, $5,600; freight elevator, head house, $3,000; tanks and standpipe for high level service, $9,115. Cast iron pipe—Distribution system, 127.3 miles mains, $379,230; raw water conduit, $55,570; in buildings and grounds, $23,491; fire hydrants, $27,800; valves, distribution system 11,332, in reservoirs, buildings and grounds, 14,245; sluice gates, $18,964; iron castings, $170. Concrete construction and general installation—In main pumping station, $17,676; at intake pumping station, $22,790; in filters and filter bldg., $11,268; in head house, $13,698; in coagulating and settling basins, $54,842; in storage reservoir, $90,680; in clear water basin, $13,148; in wash water tank and pavilion, $1,982; in grounds at purification plant, $12,296; at sub-stations, $10,800. Buildings, superstructure—Main pumping station, $27,300; intake, pumping station, $6,610; filter building. $12,879; head house, $6,495; gate house, $300; pavilion and wash water tank, $988; Lookout Mountain sub-station, $2,250; Hill City, Missionary ridge and Cameron hill sub-stations, $3,750. Chimney, $8,000; special filtration apparatus, $33,260; steam and exhaust pipe system, $7,700. Electric transmission lines—Intake, $14,819; sub-stations, $15,637. Electric wiring and lighting, $3,500. Laying water pipe—Distribution system, $271,682; raw water conduit, $89,590. Land and right of way, $45,000.

Texas.

The Taylor Water Co., L. W. Chase, Pres., Taylor, Tex., has blue prints made for the construction of a storage reservoir to conserve a supply of water during the winter season.

The citizens of Plano, Tex., recently voted the issuance of bonds in the amount of $1,500 for waterworks, $8,000 for sewerage and $1,500 for street improvement. In addition to the $8,000 voted for sewers, the citizens have subscribed $10,000 for a sewerage plant.

The Board of Municipal Commissioners of Dallas, Tex., has approved of the right of way for the South Dallas sewer. City Engineer J. M. Preston has planned a straight way of about two and one-half miles from the Trinity River to a point south of the Fair Grounds, where a lateral will be constructed to connect with the Fair Grounds park. The line in all is to be more than three and one-half miles. The size of the sewer will be 18-in. near the Fair Grounds, and to increase until it is 30-in. in diameter toward the river. The estimated cost of the work is $30,000.

The City Commissioner of Dallas, Tex., will sell bonds Oct. 26 to the amount of $650,000 for the following: $100,000 for schools; $100,000 for sewers; $100,000 for waterworks, and $350,000 for street improvements.

Assistant Attorney General Caldwell at Austin, Tex., on Sept. 24 approved for registration the $8,000 waterworks and light improvement bonds, issued by the city of Terrell, Tex.

The city council of Eastland, Tex., has decided that as soon as the town is incorporated as a city an election will be ordered for the purpose of issuing bonds to put in water works.

The city commissioners of Waco, Tex., have ordered prepared plans and specifications for storm sewers northeast of Masten St., extending to Houston and Texas Central tracks, to cost about $19,000.

The board of city commissioners of Dallas, Tex., has adopted Commissioner Doran's recommendation that the City Engineer, E. L. Dalton, prepare plans and specifications for the laying of storm sewers northeast of Masten St., and extending east to the Houston and Texas Central tracks. The approximate cost of laying these sewers, according to the Engineer's estimate, is about $19,000.

The city council of Bastrop, Tex., has appointed a special committee to ascertain the cost of a sewerage system for Bastrop.

The survey for the right of way for the South Dallas sanitary sewer in Dallas, Tex., which the city will build from the Trinity River to the Fair Grounds, has been completed. The route as proposed will be from the river, about a quarter of a mile north of the Metzler dairy and across to the Fair Grounds, running south of the Oakland Cemetery. An appropriation of $32,000 has been made for the work.

A stock company has been formed in Belton, Tex., for the purpose of putting in a complete sewerage system.

Utah.

Bids were opened last week for water works improvement for the city of Provo, Utah, Louis C. Kelsey, Salt Lake City, Utah, being the Consulting Engineer. For the reinforced concrete aqueduct the following bids were received: Holdaway Loan & Investment Co., $47,048; James Kennedy Construction Co., $51,845; Strange & Maguire, $56,465. The itemized bid of Holdaway Loan & Investment Co. is as follows:

Excavation and back filling:	Quantities	Price
Earth, cu. yd.	12,225	$ 0.40
Gravel and boulders, cu. yd.	2,396	.80
Solid rock, cu. yd.	100	3.00
Embankment, cu. yd.	794	.40
Tunneling, lin. ft.	1,450	6.00
Aqueduct, lin. ft.:		
Std. sect.	17,656	1.66
Spl. sect.	330	1.80
Riprap, sq. yd.	200	1.00
Manholes, each	18	27.00
Gatehouse, complete	1	335.00

For the pipe lines the following bids were received: James Kennedy Construction Co., Fargo, N. Dak., $46,359; Wheelwright Cons. Co., $46,681; Lynch-Cannon Engineering Co., $47,598; Strange & Maguire, $49,388. The itemized bid of James Kennedy Construction Co., is as follows:

Excavation and backfilling:	Quantities.	Price.
Earth, cu. yd.	19,314	$ 0.45
Gravel and boulders, cu. yd.	2,000	.52
Solid rock, cu. yd.	.....	....
Wire wound wood stave pipe:		
100 to 150 ft. hd., 21-in. lin. ft.	808	1.59
50 to 250 ft. hd., 24-in., lin. ft.	6,982.5	1.79
Special castings, lb.	2,765	.05
Wire wound wood stave pipe: 250 ft. hd. lin. ft.		
14-in.	960	1.13
16-in.	1,920	1.35
18-in.	3,360	1.50
20-in.	2,880	1.72
Special castings, lb.	16,700	.05
Cast iron pipe:		
8-in., lin. ft.	960	1.28
12-in., lin. ft.	1,440	2.25
Special castings, lb.	1,860	.05
Valves, each:		
8-in.	2	25.00
12-in.	3	45.00
14-in.	2	72.50
16-in.	4	90.00
18-in.	7	126.00
20-in.	6	148.50
22-in.	1	165.00
24-in.	3	265.00
Valve boxes, each	27	8.00

Wisconson.

✣Bids will be received by the Department of Public works, until 10:30 a. m., Oct. 14, for the construction of sewers in the south sewerage district, Milwaukee, Wis.

TRADE NOTES.

Mr. E. Stutz, vice-president and general manager, has retired from the direction of The Goldschmidt Thermit Company, of 90 West St., New York, and is succeeded in the management by Mr. William C. Cuntz, for the past 18 years with The Pennsylvania Steel Co.

The Scofield Engineering Co., Philadelphia, have been retained by The Browning Manufacturing Co., Cleveland, Ohio, to design and supervise the construction of a cantilever material handling bridge, which is to be built near Lockport, N. Y. Plans are in progress and work will start immediately.

Among the recent sales of the Cyclone Drill Works, of Orrville, O., are the following: Two electric outfits to Doolittle & Wilcox, Dumis, Ont., for work in limestone quarry; two blast hole drills to the Walsh Construction Co., Joplin, Mo.; four testing machines to the U. S. War Department for work on the Ohio River; one testing machine to the U. S. Reclamation Service, Easton, Wash.; one blast hole drill to Lathrop & Shea, Poughkeepsie, N. Y.; one outfit to Great Lakes Dredging Co. for work at the Soo; one traction blast hole drill to Dolese Bros., Chicago, Ill., for quarry work in Wisconsin, and one blast hole drill to Mussens, Ltd., Montreal, Que.

The Strauss Bascule & Concrete Bridge Co., with main offices at Chicago, Ill., has abandoned concrete work and the reference to it in its name, and hereafter the style of the company will be The Strauss Bascule Bridge Co. The growth of its bascule bridge work has been such as to require the entire time and attention of the organization, which has been enlarged and strengthened. During the year the large and important structures for the city of Chicago, the city of Green Bay, the city of Ottawa, Ill., and the Cape Cod Construction Co. have been completed and placed in service, while those for the Peoria & Pekin Union Ry., the Chicago & Western Indiana Ry., the National Transcontinental R. R. and the Northern Pacific Ry. are rapidly advancing toward completion. Other bridges under way are three for the Erie R. R., four for the Department of Railways and Canals of Canada, two for the Canadian Northern Ry., one for the Baltimore & Ohio R. R., one for the New York Central Lines, one for the New York, New Haven & Hartford R. R., one for the Canadian Pacific Ry., one for the Grand Trunk Pacific Ry., etc., bringing the total number of bridges under construction up to 25, and the grand total up to 40. These include three single-leaf, double-track structures of 180-ft. span and over, one of which is a double deck, and the only bridge of its kind in the world. Together with a 278-ft. double-leaf cantilever bridge of 70-ft. width, for the city of Portland, these are said to constitute a group of the largest and heaviest bascule bridges ever attempted.

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CHAS. S. HILL
C. T. MURRAY
H. P. KIRKLAND
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Recommended Specifications for Creosoted Wood Block Pavement.

At the recent convention of the American Society of Municipal Implements, held at Erie, Pa., Oct. 11 to 14, the committee on Wood Block Paving Specifications, of which Mr. A. W. Dow, is chairman, recommended for the approval of the convention, specifications drawn on the lines of those presented to the convention for Standardizing Specifications, which met in Chicago last winter. The committee changed these specifications only by making some portions of them more explicit.

This change, the committee states, was made chiefly because the Chicago specifications were so broad that they allowed too wide a scope to interpretation. The committee has the following to say regarding its suggested specifications printed on page 334.

As there is always considerable controvery on the quality of the wood, and as practically every citizen in a town constitutes himself an expert on quality and character of wood, we have thought it advisable to define rather closely the character of wood that would be acceptable.

In our specifications we have only included long leaf pine, Tamarack and Norway pine. We believe from experience, that under certain conditions, black gum wood and short leaf pine may satisfactorily be used. As these woods require somewhat different treatment, and as they can not be recommended as suitable for universal adoption, we have not included them in our specifications.

While we recommend the same oil used for impregnating the blocks as is given in the Chicago specifications, we believe that at a future date it would be advisable to broaden the specifications somewhat. The oil which we recommend is not a straight distillate product, but a mixture of a heavy distillate oil of coal tar with either a refined coal tar or coal tar pitch. On the question of this oil we would like to go on record as stating that from our experience and present knowledge, we believe that the oil recommended is more acceptable than any other oil yet suggested or used for the preservation of wood blocks.

Products made from water gas tar have not as yet the confidence of the engineers, as shown by the comments made on this subject in testimony taken in New York City somewhat over a year ago, and because of the statement in the bulletin of the United States Department of Agriculture Forestry Service No. 112, which says: "At present, despite the apparent approximation to the composition of coal tar creosotes by the creosotes from oil or water-gas tars, the known preservative value of the pure coal-tar creosotes makes them of greater market value."

The oil which we recommend has been proven superior to a straight distillate oil from coal tar in that it is less volatile when exposed in the block and that it remains in the pores of the wood much better. It is also a much better water-proofing agent. It also possesses very nearly, if not quite as high preservative properties as a straight distillate oil, and in view of the large impregnation given to wood block, we believe it amply sufficient in this respect to preserve them long after the time of their being worn away with traffic.

As to the assertion that this oil is controlled by one company, we beg to state that an investigation has shown this not to be the case; that it is easily obtained by any one not only in this country, but abroad and in Canada; and that it also has the advantage over the straight distillate oil of being cheaper in price.

As to the question of remaining in the block, it may be well for the committee to state here, in answer to criticisms that have been made lately, that experience during the past year has shown that the oil which we recommend does not ooze as readily from the block as do the straight distillate oils. We have investigated pavements where the blocks were impregnated with a very heavy straight distillate oil as well as those in which the oil recommended by us was used. In all cases the blocks had been treated with the same amount of oil, viz. 20 lbs. per cu. ft. Under like conditions it was found that the distillate oil oozed out very much more rapidly and to a much greater extent than did the oil we have recommended.

We have written specifications for laying the block both on a sand cushion and in a mortar bed. While the majority of the committee recommend the sand cushion, we feel that the mortar bed has given such excellent satisfaction, under certain conditions, that it should be specified as an alternative.

The specifications which we recommend require that the blocks be laid at right angles with the curb line; as this is the simplest method of laying and appears to give the best results under heavy traffic. While we do not mention it in the specifications, we know of many instances, especially on light traffic, residence streets, where blocks laid at 65 degrees with the curb line have given even better results than where they were laid at right angles with the curb.

In presenting these specifications, we would like to impress upon engineers the necessity of properly handling the block after they have once been manufactured. The blocks should not be allowed to dry out before they are laid. If it is impossible to lay them immediately, they should be piled in close piles so as to prevent drying out as much as possible, and before laying it is advisable to wet the block so that they will be at their maximum expansion at the time of laying. This will do away, to a great extent, with the expansion of blocks in pavements.

We have recommended the use of 20 lbs. of oil per cu. ft. of wood for impregnating long leaf pine, Norway pine, and Tamarack. We believe from experience in several western cities that it may be advisable in the future to cut down this quantity of oil to even as low as 16 lbs. This last suggestion, however, is merely made at the present time with the hope of drawing forth some remarks and criticisms.

A New Vacuum Street Cleaner.*

In constructing this new vacuum street cleaner, it has been the purpose to so construct a machine that will gather all of the street refuse, heavy material as well as the fine dust, without sprinkling, thereby saving an enormous amount of money and doing away with an extensive equipment and making a thoroughly clean street without allowing any part to be afterwards exposed to view, so that no one may breathe the many injurious germs that are contained in this kind of dirt.

The machine is propelled by the same power that operates the fan and revolves the brushes, and in selecting these operating parts, the most simple known to automobile construction have been employed. We use the two-cylinder opposed 24 h.p. motor, and the friction type of transmission, enabling us to have a great many changes of speed, and at the same time, making it impossible to strip any gears or break any parts, as it will act as a safety between the power and the driving wheels.

In moving forward, the brushes rotate so that the dirt is swept to the center, where it is brought under the suction duct, and is lifted into the fan, and as the fan draws its air over the brushes, the dust that is raised is also drawn into the fan. After leaving the fan the separation is by gravitation. The heavier dirt comes out through the first outlet, the next heavy comes through the second outlet, and so on through the other two outlets that part of the dirt that is carried beyond this point is carried, by the air, into the retort, where it takes a downward spiral motion and is taken off at the bottom of the cone. Up to this point it is an easy matter to take care of the dirt, but there is a small quantity that does not want to leave the air or refuses to be separated, for it is as light as air itself; the quantity is small, not being over 1 per cent of the total, but if allowed to escape, would make it very annoying, and has been the one stumbling block to this great means of sanitary cleaning. We, in our machine, effectually take care of this refuse by employing hydraulic means, but as the water is used over and over again its operation is so simple that it requires scarcely any attention.

This cleaner is one that will clean, with two men, as much street surface as several men could do with their present methods, and do it much better, without raising dust. It travels while working from two to six miles per hour, depending upon the amount of dirt upon the street, and can be governed by the operator at will.

The brushes are so made that they can be adjusted to clean the ordinary street in four laps.

---

*Paper by D. C. Smith, of Muncie, Ind., before the Indiana Engineering Society.

On Sept. 23, 49 shovels in the central division of the Panama Canal excavated 68,878 cu. yds. of rock and earth in a working day of eight hours, an average per shovel of 1,406 cu. yds. for the day. During this time the shovels were under steam 392 hours and were actually at work 276 hours and 20 minutes, and waiting for cars 83 hours and 45 minutes, the rest of the time being lost in mining, cleaning track, repairing shovels, cleaning dippers, etc.

A portable air compressor and drill outfit is being used by the Keystone State Construction Company for breaking up large boulders which are being removed from the basin of the Hill View Reservoir, under construction on the Catskill Aqueduct. The three Sullivan hammer drills and compressor are handled by four

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CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Construction and Contractor's Plant on the Ashokan Reservoir, New York Water Supply.

The Ashokan Reservoir is the main storage basin for the Catskill water supply of the city of New York. It is located north of the city, about 82 miles on an air line and about 14 miles west of the Hudson River in the foothills of the Catskill range. The reservoir is about 12½ miles long and varies from one-half mile to two miles in width. When full it will have a water area of 12.8 square miles and a shore line of 40 miles. The total area drained into the reservoir is approximately 240 square miles. The capacity of the reservoir is 128,000,000,000 gals. The water will have an average depth of 50 ft. and a maximum depth of 190 ft. The reservoir, at a point nearly midway between its ends, is only about ½ mile wide, and at this point the Dividing Weir and Dike is to be built, the crest of which will be 590 ft. above sea level. This weir will divide the reservoir into an east and west basin. The west basin will be formed by the building of Olive Bridge Dam across the gorge of Esopus Creek. This dam, with its earthen wings, will be about one mile long. The east basin will be formed by the Beaver Kill dikes across the valley of the Beaver Kill, the waste weir at the east end of these dikes and the dikes at the east end of the basin, called the West Hurley Dikes. The water passing over the waste weir will flow back into the old channel of the Esopus below the Olive Bridge Dam. The Beaver Kill dikes are divided, for convenience of reference, into the West, Middle and East dikes. The accompanying map, Fig. 1, shows the general location of the various structures referred to. At the junction of the West and Middle dikes, near the present station of the Ulster & Delaware R. R., called Brown's Station, the aqueduct carrying the water to New York, has its origin. Here also, leading off toward the north, is the gate chamber and the Dividing Weir. The East and West channels shown on the map are to be excavated in order to drain their respective basins toward the gate chamber. Just below the gates and headworks on the line of the aqueduct will be installed the aerating basins for removing tastes and odors, if there be any, from the water.

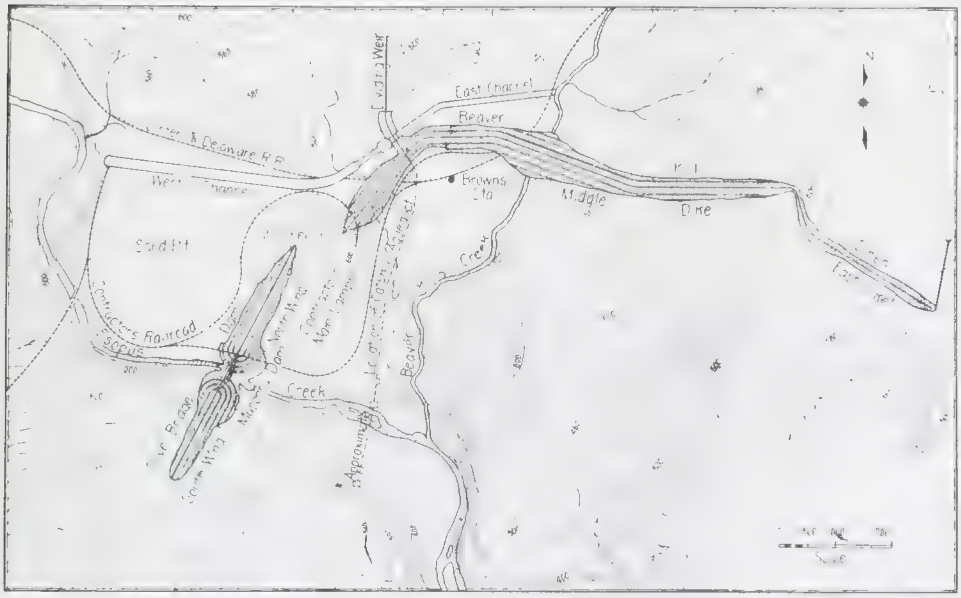

Fig. 1—Map of Main Dams and Vicinity Ashokan Reservoir.

The several hills of glacial origin that lie in the gaps in the underlying rock walls that form the reservoir basin, near the confluence of the Esopus and Beaver Kill, add to the advantages of the location of the main dams. These hills are composed of impervious boulder clay, and are of such great mass as to form substantial buttresses in the chain of dikes.

The contract for the construction of the main dams and dikes of the reservoir was awarded to MacArthur Bros. and Winston in September, 1907, for $12,669,775, and the contractors at once began shipping plant to the site and making general preparations for carrying out the work. The approximate estimate of the amount of work to be done in the 7 years allowed by the contract is shown by the following figures. These figures were used as a basis for computing bids:

Earth exacavation, cu. yds.	2,055,000
Rock excavation, cu. yds.	425,000
Earth and rock embankment, cu. yds.	7,265,000
Portland cement, bbls.	1,100,000
Concrete masonry, cu. yds.	832,000
Paving and riprap, cu. yds.	105,000
Metal work, tons	914
Clearing, acres	200
Vitrified drain tile, lin. ft.	21,500
Crushed stone (not in masonry), cu. yds.	11,000
Timber and lumber, bd. ft.	950,000

Stream control of the Esopus and Beaver Kill.

The rate at which this work is estimated to be carried to completion is as follows:

End of 9 months, 2 per cent.
End of 16 months, 9 per cent.
End of 28 months, 23 per cent.
End of 40 months, 41 per cent.
End of 52 months, 61 per cent.
End of 64 months, 80 per cent.
End of 76 months, 96 per cent.
End of 84 months, 100 per cent.

The preliminary work involved the construction of a camp for the accommodation of about 1,500 men and a large number of families; the building of a railroad for the contract work, and the installation of plant for handling the work at Olive Bridge Dam. The camp is very complete, with the object of securing healthful quarters for the employes. A water and sewer system is installed.

The organization required for carrying on construction of this magnitude is indicated by the accompanying diagram, Fig. 3. A member of the firm heads the organization as resident manager. The construction organization is headed by a General Superintendent. Under the Superintendent come the various department heads, who direct the work of the department through the assistants.

The Railroad.—The railroad organization is not shown on the diagram. This organization is separate from the construction organization, and although the railroad exists only for the purpose of serving this contract, the business is carried on with it in much the same way as if it were a public carrier. The railroad is one of the best equipped of its kind on any construction work. The main line, a double track road, runs from the junction with the Ulster & Delaware R. R. at Brown's Station to the main plant at Olive Bridge Dam, and at this point various side tracks are laid to the block yard, cement house, coaling siding, compressor plant, crusher and unloading tracks under the four main cableways which serve the dam. The line leads on from here to the Yale quarry branch, which crosses the Esopus Creek about ¾ of a mile from the dam, on a steel viaduct 85 ft. high and 390 ft.

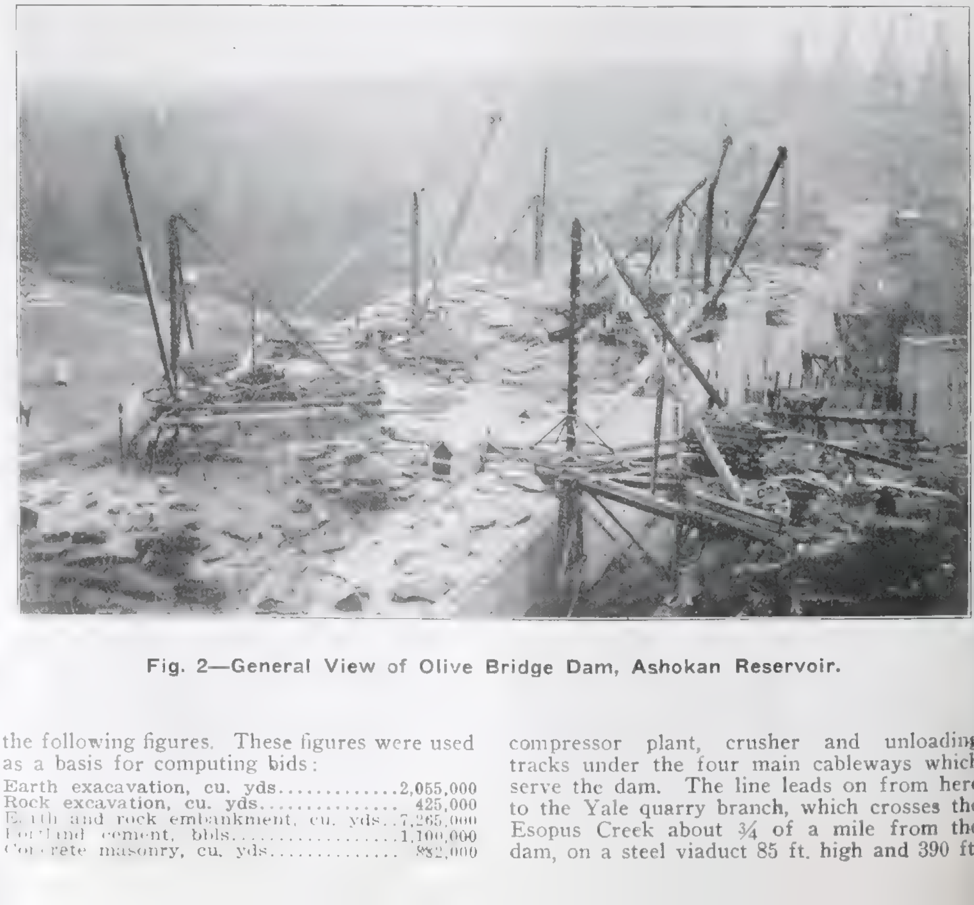

Fig. 2—General View of Olive Bridge Dam, Ashokan Reservoir.

long, and enters the quarry about 2 miles from the dam, on a switch back. The line is double tracked to the Esopus and leading off from this point is a single track branch to the sand pits. Near the power plant is a line leading to the West Dike around Winchell Hill. There are two more branches leading off this line to the north wing, one of which supplies sand, stone and cement to the concrete mixing plant, and the other delivers the earth for the embankment. The Middle dike branch leaves the main line near Brown's Station and crosses the Ulster & Delaware R. R. tracks with overhead crossings. This is double tracked between the crossings. Spurs are laid from this branch to the dividing weir, to the aqueduct, to the east discharge channel and to the bakery for unloading flour, etc.

The rolling stock of the railroad consists of nine 40 to 60-ton American locomotives of the saddle tank type, 96 flat cars equipped with air, 6 gondolas, 75 Western side dump cars and about 25 narrow gage cars with two narrow gage Porter locomotives. An American Hoist & Derrick Co.'s locomotive crane is also part of the rolling stock and was successfully used in laying track and erecting overhead bridges; in fact, hardly a day passes when it is not used for some purpose or other. The total trackage, including all branches, is about 20 miles, all of heavy rail laid on first-class ties. The maximum grade is 2.5 per cent.

Main Power Plant.—Located near the Olive Bridge dam is the main power plant, which is one of the features of interest. It consists of a battery of five 265 h. p. Babcock & Wilcox water tube boilers, which furnish steam to four air compressors built by the Ingersoll Rand Drill Co. Two of these machines are 500 h. p. each and did service at the Wachusetts dam and the Cross River dam; the other two are new and are rated at 450 h. p. each. These engines are compound condensing with the necessary inter and after air coolers. The large machines have a capacity of 3,500 cu. ft per minute and that of the smaller ones is 2,500 cu. ft. per minute. Two dynamos, one of 250 volts, 140 amperes and another 125 volts and 80 amperes are installed for furnishing current for lighting the camp. The former is directly connected to steam turbines and the latter is driven by an Erie City engine. The coal used by this plant and by the railroad is stored in bins under an overhead trestle. The consumption is about 1,400 tons monthly. The compressed air is carried by an iron pipe to nearly all parts of the work, including the Yale quarry, 2 miles distant. It is used for driving all the derrick engines, which are all 7x10 in. size, for all cableways, and various rock drills.

Olive Bridge Dam.—This dam, with its north and south wings, has a length of nearly 1 mile. The masonry part of the dam is about 1,000 ft. long and its maximum height is 251½ ft. It is about 190 ft. thick at the base, and the top, which will carry a roadway, is 26 ft. wide. The dam is composed of cyclopean masonry laid between walls of concrete blocks. These act as forms on the faces of the dam and at the expansion joints. Figure 5 shows the method of laying the large concrete blocks at the expansion joints. These joints are formed by vertical faces of the blocks offset as shown in the figure, forming keys which will work watertight with the expansion and contraction of the masonry. One side of the wall for the expansion joint is coated with an asphaltum compound to prevent a bond with the adjacent masonry.

The main feature of the plant for carrying on the work at the dam is the four Lidgerwood traveling cableways, each having a span of 1,534 ft. and a capacity of 15 tons. The towers are 90 ft. high and each contains 60,000 ft. B. M. of lumber. The tracks upon which these towers travel are 600 ft. long in three sets, one track of three rails and two tracks of two rails each. On the dam the material is handled with 16 stiff leg derricks with 60 ft. booms, 10 ton capacity, and equipped with 7 in. x 10 in. American Hoist and Derrick engines operated by air from the central power plant. The derricks are moved from place to place by cableways. They are located usually on alternate sections of the dam, which have been carried higher than the intermediate sections, and are set to serve the work of carrying up the intermediate sections. Timber landing platforms are built at or on the face of the dam for landing material with the cableways and the derricks handle the material from these.

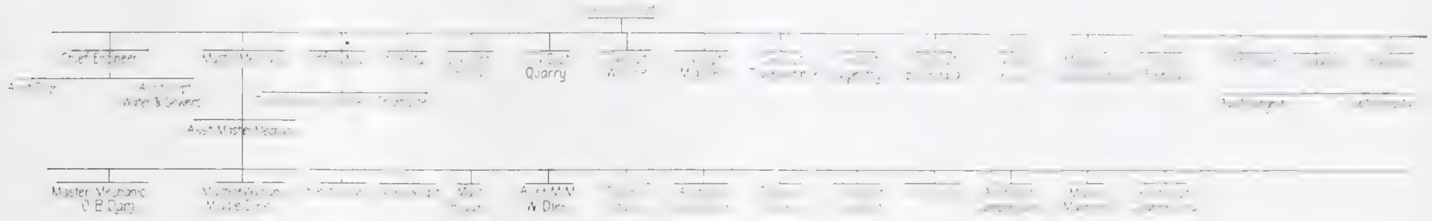

Fig. 3—Contractors' Organization Diagram, Ashokan Reservoir.

The concrete mixing plant and crushing plant is built as one building and is located at about the level of the crest of the dam and about 500 ft. from it. Beyond the mixing plant is the block yard. A system of eight tracks run along the bank from under the cableways to the cube mixers under the mixing plant. Two of these tracks pass through under the mixers to the block yard and branch off into four tracks.

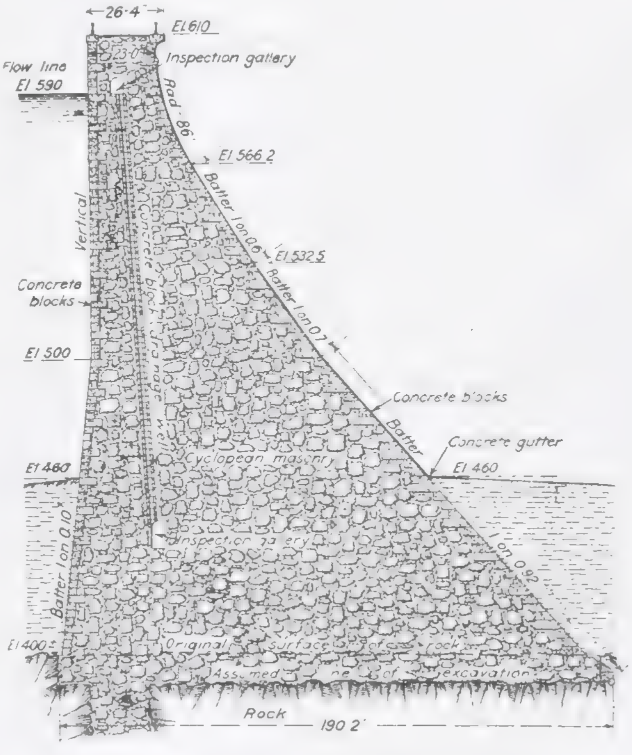

Fig. 4—Section of Olive Bridge Dam.

The mixing plant consists of four 2½ yd. cube mixers. The rock is brought in by the railroad from the quarry in large skips which are handled by a derrick from the flat cars to a No. 9 McCully crusher. The rejections from the revolving screens pass through two No. 6 Austin crushers and from these are carried by a series of belt conveyors and revolving screens to the bins over the mixers. The sand is fed from the bins through a chute to a measuring box, with split drop bottom directly over the Hains hopper which is used as a measuring hopper. The stone comes through a chute in the bottom of the stone bin on to a horizontal belt which dumps directly into the hopper. The cement comes from the cement shed on a belt conveyor which runs past each mixer, thus serving all with one belt. This is arranged so that cement may be loaded onto the belt directly from the cars. Water is fed into the mixer through the axle which passes through the corners of the cube. The axle is hollow and is perforated. A needle valve at the axle bearing, regulates the amount of water. Three men are stationed at each mixer for operating chutes and handling cement. The mixers dump directly into Steubener bottom dump buckets, which are placed on small flat cars and hauled by mules to the cableways.

The four cableways are located so that the two inside ones are suspended over the faces of the dam and the two outside ones are suspended about 50 or 60 ft. from the faces of the dam. No material is therefore passing over the heads of the workmen on the dam and the booms of the derricks on the dam are not interfered with. The inside cableways serve the work at the central portion of the dam by landing material on platforms built on the sloping face or erected from the ground at the vertical face. The outside cableways land material on cars which run on a short piece of track at right angles to the dam, carrying the material within range of the derricks.

In sending material out to the dam by the cableways, the object is to keep the concrete going to the work during as much of the regular working day as possible. In order to do this the cyclopean stone and the large concrete blocks must be supplied during other hours or during such times when concrete could not be used. Generally the noon hour is used to supply various sections with large stones or blocks and also several hours at night. In this way the concrete plant is kept going as nearly as possible on regular hours.

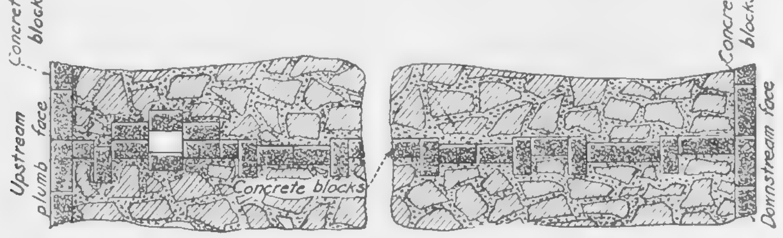

Fig. 5—Horizontal Section of Expansion Joint in Olive Bridge Dam.

When both blocks and cyclopean stone are on hand it is no trouble for two derricks serving each section to handle these and the steadily arriving buckets of concrete. The large concrete blocks are placed with derricks and each gang consists of two masons and one helper. These men will place on an average 12 blocks in eight hours.

Some notes regarding the beginning of the work on the dam are of interest. The rock bed of the dam was covered with several feet of boulders and gravel, which were disposed of in the channel of the stream below the site. Excavation in rock under the main body of the dam was carried to a depth of 29 ft. below the bed of the creek at the deepest point, while along the upstream toe of the dam a cut-off channel 20 ft. wide was carried to a depth of 40 feet. Underlying the surface blue stone, alternate layers of shale and slate were found. In the course of its geological history the shale was heavily loaded with superimposed strata. Following its unloading through a long period of erosion and the comparatively recent cutting of the Esopus gorge, the shale expanded and seams developed along the bedding planes.

The cut-off trench intercepts all seams to a depth of 40 ft. below the bed of the stream. As a still further precaution a row of 3-in. grouting holes was drilled 20 ft. below the bottom of that trench, reaching the greatest depth at which pressure tests had indicated the presence of seams.

A Cockburn-Barrow grout machine of 4 cu. ft. capacity, operated by air under a pressure ranging from 25 to 80 lbs., was used. The grout was neat cement mixed in proportions of one part by volume of cement to one part by volume of water. Thirty-one holes were grouted, and approximately 74 cu. ft. of grout, over and above the volume of the holes, were forced in.

Block Yard.—The block yard is located next to the mixing and crushing plant on the high bank above the gorge. The yard is about 500 ft. long and 100 ft. wide. Two 3 ft. gage tracks which pass under the mixing plant from the cableways here branch out into four tracks extending through the center of the yard for its entire length. Parallel to the tracks are two rows of ten guyed-derricks, five on each side. These derricks have 75 ft. masts and 70 ft. booms and are so guyed as to swing a full circle without lowering the booms. The masts and booms are trussed with ¾ in. cables. All the engines are American Hoist & Derrick Co.'s 7x10 in. They are set in a row and are operated by compressed air from the main plant. Parallel to the yard on each side are the loading tracks. The derricks are placed midway between these and the narrow gage tracks and handle the blocks from the forms to the piles, where they are seasoned, and from the piles to standard flat cars. The blocks are about 2½ ft. square in cross section and vary from 2½ ft. to 7 ft. in length. The shape also varies according to the position which the blocks occupy in the dam.

The forms for making the blocks are made of 2 in. lumber. The sides are held together with bolts which are located outside the form so as not to pass through the concrete. The form is lined with sheet steel on the side which makes the exposed surface of the block, thus insuring a perfectly smooth surface. The forms, which altogether number about 425, are set up on the two inside tracks and outside of the two outside tracks. A platform covered with sheet steel is supported on trucks which run on the two outside tracks, and is supported high enough to pass over the forms. Concrete is shoveled from this platform into the molds, and as the molds are filled the platform is pushed along to other molds. The concrete is hauled from the mixing plant by a mule. The Steubener buckets of 2½ cu. yds. capacity are handled from the little flat car to the platform. Nine men work on the platform and shovel into the forms in all directions. The crew of men working in the block yard is as follows:

1 general foreman.
9 shovelers on platform.
1 foreman on platform.
1 man driving mule.
3 men spading in block molds.
4 men cleaning and oiling forms.
12 men stripping and setting up forms.
4 engineers for the 10 derricks.
12 men loading and handling blocks.
1 foreman loading and handling blocks.

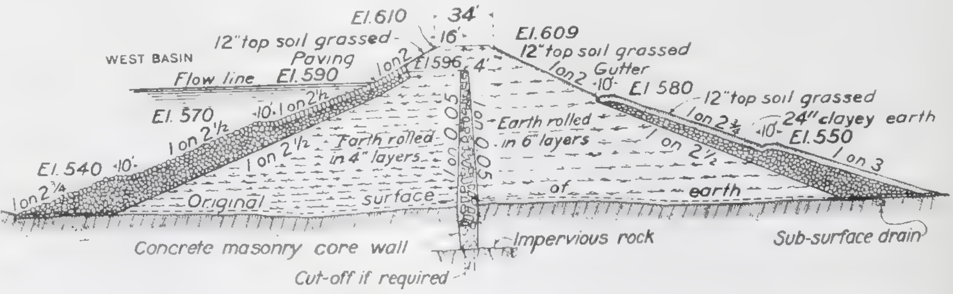

Fig. 6—Cross Section South Wing, Ohio Bridge Dam.

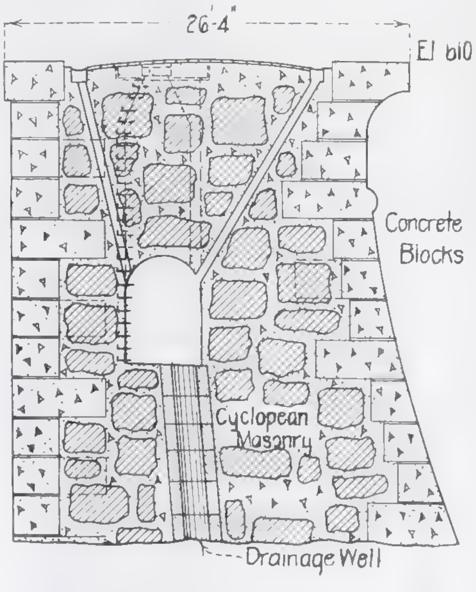

Fig. 7—Section of Upper Inspection Well at Top of Olive Bridge Dam.

This yard averages about 150 cu. yds. of blocks a day.

The Quarry.—Other sources, such as the large rock cut at the main gate chambers, supply large quantities of rock for the dam, but the Yale quarry is the main source of supply. This quarry has an almost vertical face about 40 ft. high and 1,200 ft. long. A double track spur from the contractor's railroad parallels the quarry face and a row of 10 guyed derricks serve for handling the 5 yd. skips from the quarry to the cars. Cars are placed on one track for loading and as they are loaded and taken out by the locomotives another train is left on the other track, making the work continuous. Three gangs of 12 men and one foreman each are used for loading the skips together with the help of the derricks. The 40-ft. face of the quarry is drilled in two lifts by Ingersoll-Rand air drills. The average daily output during the working season is 1,000 cu. yds. per day.

A crushing plant has also been installed here on the hillside below the quarry floor. The plant consists of a No. 7½ and a No. 5 McCully crusher with a capacity of crushing 70 cu. yds per hour. Bins for this plant are built below it and a side track runs under them for loading the cars by gravity. This crushing plant serves as an aid to the one built in connection with the mixing plant at the dam and also in case of accident to one plant, the other has sufficient capacity to keep the work going while repairs are being made to the damaged plant.

Dikes.—Leaving the description of the work at the masonry section of Olive Bridge dam, the remainder of the work consists principally of earth dams, or dikes. Each end of Olive Bridge dam terminates in a dike known here as the north and south wings. The other dikes are the east and middle and west dikes, as shown in Fig. 1. The entire area of the surface which the dike will cover is first stripped of all surface soil and vegetable matter. A vertical trench is then excavated to rock. A concrete core wall is then built in the trench, the average width of which is about 10 ft. at the bottom and 4 ft. on top. After the forms are removed the space between the concrete and the original earth is filled with clay and tamped to the original surface of the ground. At this point the embankment proper is started by spreading layers of earth 4 ins. thick on the water side and 6 ins. thick on the dry side of the dike. These layers are then rolled with 12-ton Monarch and Kelley steam rollers. The rollers are of special design, having an unusually high horsepower for their weight. The embankments have slopes of 1 on 2 above water level and 1 on 2½ below water. These slopes are, however, covered with "Class C" rubble riprap. Above water line the slope is surfaced with top soil and grassed.

The methods of building these several dikes may be described as follows:

South Wing of Main Dam.—For stripping, wagons and mules were used. The excavation for the core wall was taken out with a Page excavator and derricks.

For the concrete work a quarry was opened near the site and a No. 5 Gates crusher installed. The sand was hauled here in wagons as this section is the only one not accessible by trains. The stone, after being crushed, was carried by an elevator into a bin and from this, together with the sand and cement, was mixed in a No. 4 Ransome mixer. The concrete was hauled in small, narrow gage cars to the derricks, where it was deposited in the wall forms.

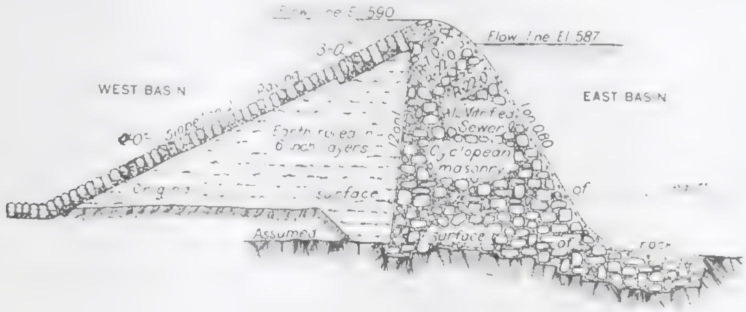

Fig. 8—Masonry Section of Dividing Weir Dam.

For building the embankment here a 70-ton Bucyrus steam shovel, working in a borrow pit near the site, is used to load the earth into dump cars of 4 cu. yd. capacity. There are 12 of these cars. They are hauled by two 18-ton Vulcan narrow gage locomotives to the embankment. When dumped and spread into layers about 1¾ times as thick as desired for the finished layer when rolled to its required thickness either 4 or 6 ins.

All stones, too large for rolling into the layers of earth, are culled out and hauled to the "Class C" embankment and placed at once on the completed slope.

The steam shovel work is facilitated by the loosening of the hard material by blasting. A Star well drilling machine is used for the blast hole drilling at this point. The crushed stone used amounts to about 150 cu. yds. a day. The maximum output of the mixing plant was 226 cu. yds. in 8 hours. About 2 miles of narrow gage track and about 40 mules and Eagle dump wagons were used for various hauling. About 1,000 cu. yds. a day of embankment have been placed. A gang of 30 to 35 men is used for the spreading, while a gang of 12 men is employed to shift the track, which has to be done continuously.

The work of building the South Wing is done under a sub-contract to Johnson & Briggs. These contractors maintain a large camp, machine shop, stables, and storehouses.

North Wing of Main Dam.—Here the soil stripping was done in the same manner as at the south wing and the excavation for the core wall was done with traveling derricks. For the concrete work there is installed a mixing plant with a 2½ yd. cube mixer. After the mixing, the concrete is delivered in cars to the derricks, where it is placed in the forms. The material for the mixers is brought by trains from the main crusher and sand pit and cement in car loads. The material is brought from the borrow pits by trains for the embankment and after being spread is rolled. The boulders encountered in the clay are placed on the rock embankment on the outer sides and this is the rule on all the dike work.

Three trains of 11 cars each are used as the haul is something over a mile. Usually three laborers are employed for each car in a train, thus making a spreading gang of 33 men and a foreman, besides the usual track gang of 12 men and foreman. Men culling stone for the "Class C" riprap usually number about four. The average daily progress amounts to about 1,000 cu. yds.

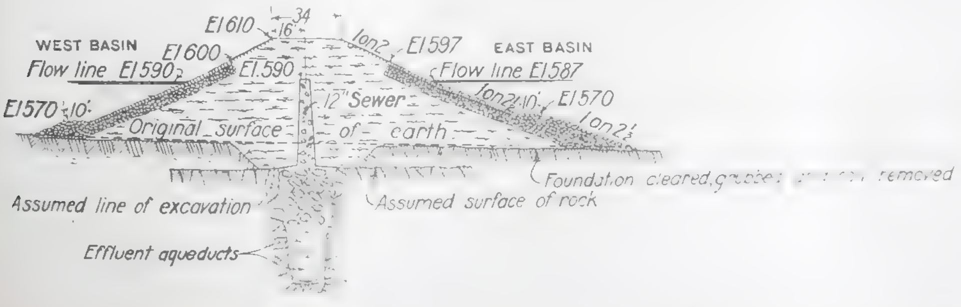

Fig. 9—Earth Section of Dividing Weir Dam.

West Dike.—This is located just east of Winchell Hill, as shown on Fig. 1. After the soil had been removed in the regular way, the core wall was excavated with a Page excavator and traveling derricks. Considerable rock had to be removed here, it being the valley of a small creek. A cable-way similar to those at the dam, with a span of 1,534 ft. was installed here and handled part of the excavation and the concrete, and is also used in building the embankment on one side of the core wall. A mixing plant with a 5-ft. cube mixer is installed here and the material supplied by trains as on the north wing. The mixed concrete is hauled in buckets on cars under the cableway and thence to the core wall. Prior to the installation of this plant considerable concrete was mixed with a portable mixer at the east and north end of the dike. Part of the material for the embankment is hauled here in Eagle dump wagons from the west channel excavation and from borrow pits and after being spread is rolled by a Monarch roller.

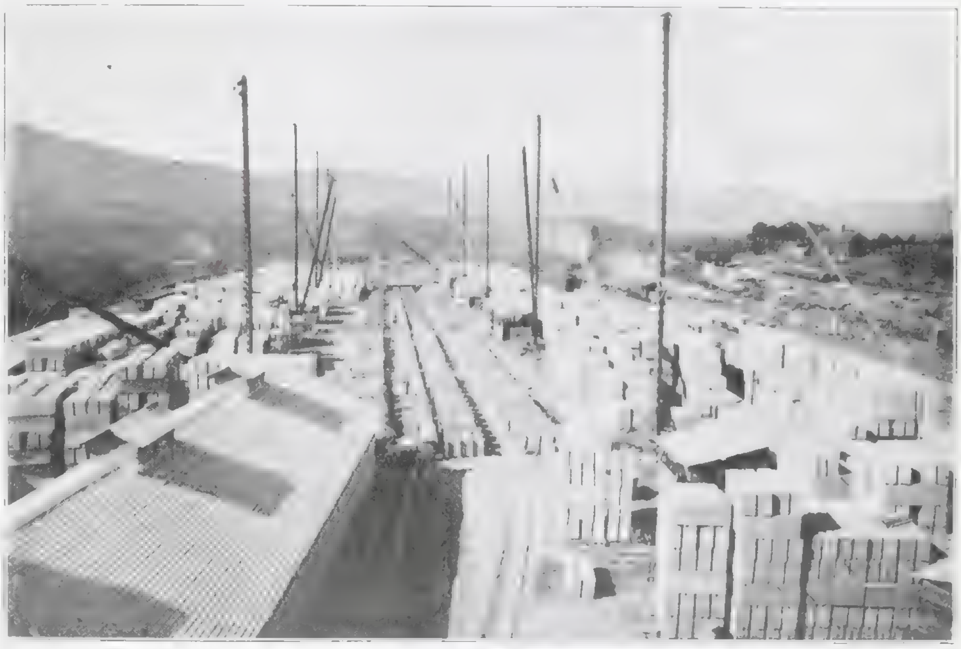

Fig. 10—View of Block Molding Yard, Olive Bridge Dam.

The haul for the wagons at this point is about 3,000 yds. for the round trip, over fair roads with some steep grades.

An average number of 16 wagons, of 1½ cu. yds. capacity are used with teams of 3 mules. They average 280 loads or 420 cu. yds. of loose material in 8 hours.

On the opposite side of the core wall the embankment material is brought in 6 yd. skips on standard flat cars. These are handled by the cableway, at the rate of about 1,000 cu. yds. a day. The skips are dumped by the engineer of the cableway without lowering to the ground. A detailed description of this device will appear in another column. A gang of 30 to 35 men is used for spreading the material, but no track gang is necessary here. For hauling culled stones, from 2 to 4 carts are continually employed.

Middle Dike.—The middle dike is the longest of the dikes and for construction purposes is divided into a west, middle and east portion. The work on the west portion was done in practically the same manner as the west dike, except that there is no mixing plant or cableway and the mixing of the concrete was done with a portable mixer. The material for same was delivered along the middle dike branch of the railroad and the material for the embankment will be delivered likewise from the borrow pits.

The middle section or Beaver Kill, being in the valley of that stream, has been a very heavy piece of dike work. The stream of the Beaver Kill has been diverted and now passes through a concrete conduit in the dike, which will eventually be closed with masonry. After the soil was removed and in order to get a foundation for the core wall, it was necessary to excavate to a depth of over 80 ft. through glacial drift. A cable-way of 1,534 ft. span and similar to the others previously described was installed and a great amount of the excavation was handled in this manner. A mixing plant was also installed with a 2½ yd. cube mixer, being supplied in the same manner as at the west dike and north wing plants. The cable-way handled the concrete from the mixer and delivered it to the core walls. A large storage bin is erected here, where stone and sand for the east portion and the east dike and waste weir is deposited, as this is the present terminus of the railroad. The sand and stone is hauled in Eagle dump wagons from here to the work. The material for the embankment is obtained from borrow pits near at hand and hauled in wagons and some is delivered under the cable-ways by trains from the various borrow pits near the dam. The greater part of the excavation on this section was done with a Page excavator and traveling derricks.

East Portion of Middle Dike.—This section of the dike lays on fairly high ground. After the removal of the top soil two traveling derricks were used for the excavation of the core wall and these same derricks were used for the placing of the concrete. Here a Chicago Municipal portable mixer was used and the concrete material was hauled from the Beaver Kill bins. For embankment material a 70-ton Atlantic shovel is used in connection with a narrow gage railroad with about two miles of track, 40 3-yd. cars and 2 Vulcan narrow gage locomotives. About 40 horses and Eagle wagons were used for miscellaneous hauling.

East Dike.—This is the eastern end of the dikes and a portion of it crosses a marsh, where considerable water was encountered in the excavation of the core wall trench after the removal of the soil. This excavation was carried on with the use of two traveling derricks, and the same derricks were used for the placing the concrete. A No. 5 Gates crusher is installed here and the stone was taken from the excavation and from a small quarry near at hand. The sand was hauled, however, from the Beaver Kill bins. A Smith mixer has been used for mixing the concrete and a battery of boilers installed with an engine for furnishing the power. A 100 h. p. air compressor was also installed and furnished air for drills, etc. For the embankment work a Vulcan and a Thew shovel are used, together with the narrow gage railroad with 2 miles of track. The rolling stock consists of 2 Porter locomotives and 50 narrow gage side-dump cars. About 90 mules and several horses are used for various purposes.

Dividing Weir.—At the intersection of the west and middle dike is the beginning of the aqueduct which will eventually carry the water to New York. At the head of the aqueduct is the gate chamber, in which will be installed the necessary valves, gates, etc. A cableway, a Lidgerwood of 1,150-ft. span, is installed here and has a head-power 100 ft. high and a tail-tower of 90 ft. A portion of the dividing weir is an earth dam, and 1,100 ft. is a masonry dam. Excavation for this masonry dam required a deep rock cut for the aqueduct section or outlet to the reservoir. This cut was about 60 ft. deep and was channeled out. Ingersoll-Rand air drills were used for drilling, and after blasting, gangs of about 12 men loaded the large skips by hand. These were then handled by derricks to the standard flat cars and the rock was taken to the crusher or for use as cyclopean stone at the main dam.

The plant already described as being in use for embankment purposes on the north wing, west dike and the west and middle portions of the middle dike may be summed up as follows:

2 70 ton Bucyrus steam shovels.
1 70 ton Atlantic steam shovel.
1 30 ton Atlantic traction shovel.
1 30 ton Ohio traction shovel.
2 Model 20, Marion traction shovels.
8 Monarch steam rollers.
1 Kelley-Springfield roller.
2 Western graders.
2 road machines.
2 Buffalo traction engines.

This same plant will also be used during the construction of the dividing weir dike later.

For the various kinds of hauling and team work at the main dam and main camp and the north wing, west dike, west and middle portion of the middle dike and vicinity there are provided the necessary wagons, 80 2 and 3 mule Eagles, some Watson and Studebaker, scrapers, both drag and wheeled, and wagons and carts of nearly every description. All of the mules for this part of the work are quartered at the main barns; there are 235 mules and about 20 horses for various purposes. These together with the horses and mules on the work at the south wing, east portion of middle dike and east dike, make a total of 64 horses and 365 mules.

WATER-WORKS AND SEWERS SECTION

The Present Utility of the Septic Tank.*

In 1896, Mr. Donald Cameron, City engineer of Exeter, England, with two others, was granted patent rights in an apparatus or invention for the purpose of dealing with crude sewage bacteriologically and bringing it into such a condition of solution and liquefaction that it could be thereafter more easily treated by filtration or irrigation or any other suitable way. Before that time, tanks of various kinds had been in use not only in England but in other countries. For twenty-five years previously, chemical treatment had been the prominent method of eliminating from sewage the suspended matters which had been found to be troublesome, both on irrigation fields and in rivers and tidal estuaries. The bane of every superintendent in charge of a sewage disposal plant has always been the vast accumulation of sludge which is generally produced faster than the land available can take care of it and which does not readily lend itself to any other method of disposal. There was no great difficulty in purifying the liquid part of sewage sufficiently so that it could be discharged into streams after the solids were removed, but to dispose of the solids—that was the trouble.

The value of Mr. Cameron's invention, the feature of his scheme which appealed to the city officials generally, was contained in this statement. "By this invention it is possible to get rid of the sludge difficulty because the sludge portion of crude sewage is entirely thrown into solution." His claim was based on experiments made in Exeter on a small tank twelve feet wide, fifteen feet long and two and a half feet deep, and was expressed as above after seven months operation. Since that time, much has been learned about the operation of sewage tanks, generally dignified by the name of septic, and the recent lawsuits over the patent rights involved as well as the papers before learned societies have produced evidence and discussion covering not merely every detail of construction and operation of the tank, but even its very name. Engineers have considered the length of time during which sewage should remain in septic tanks and many experiments have been made in order to arrive at some definite conclusion. There has also been a large amount of testimony presented from various parts of the world on the action taking place during the passage of sewage through the tank. That gases of various kinds were developed by this action was easily discovered and one of the advantages at first claimed for this treatment was that the production of those gases would be a source of revenue to the municipality, replacing, to a large extent, the ordinary illuminating gas.

During the fifteen years since the patent was issued, many of the claims which originally were made for the invention have been disproved and more extended and scientific experiments on septic action have been made. Further than this, experiments and experience both have combined to establish certain definite appreciations regarding its value and it may be not out of place here to summarize, briefly, just what a septic tank may be expected to do and just what we know it will not do.

In the first place, we know definitely that it will neither purify sewage completely nor act as a panacea in eliminating sludge. Not long ago, the writer was much interested in the enthusiasm of a western salesman who was dealing in plumbing specialties. He had found that, in order to secure sales, he must be prepared to advise customers on the subject of sewage disposal and he was spreading broadcast recommendations, vouched for by himself as facts, to the effect that the installation of septic tanks would transform sewage of any degree of pollution into what, if not drinking water, might be considered equal to the quality of the average river. This is not true and no one who has followed the experiments on tanks believes it to be true.

Nor does the septic tank do what Mr. Cameron thought it did, namely, eliminate the sludge difficulty. Inasmuch as the septic tank is after all a tank, there is inevitably brought about a certain sedimentation so that the liquid passing out of the tank is usually freed from a certain amount of suspended matter. To this extent the sewage is purified and if filtration follows, the surface of the filter and possibly the interior of the filter is relieved of the usual clogging.

It was at first thought that the liquid carrying material in solution was itself affected by septic action and that certain anaerobic changes taking place in the liquid were desirable as being necessarily preliminary to later filtration. The English chemists and biologists have been inclined to cling to this idea and to divide all bacterial processes of purification into two parts, namely, one occurring in the septic tank where liquefying and anaerobic bacteria should transform the crude organic substances into ammonias and nitrites, the other the aerobic filter bed where these organic matters already started on the road to purification might be fully nitrified. The Massachusetts State Board of Health pointed out ten years ago that this theory was not always tenable since in their experiments it happened very often that no better results were obtained on filters dealing with septic sewage than filters dealing with crude sewage. Further than this, it was pointed out by them that if the action in the septic tank proceeded too far, subsequent filtration was thereby more difficult and less complete and this belief has extended until to-day the original claim of Cameron has been almost forgotten and the fact that so far as the liquid portion of the sewage is concerned septic treatment is immaterial if not objectionable has been fully substantiated.

What, then, does the septic tank accomplish? Simply this. It manages to exert an action upon the material which is settled out of the sewage as it passes through the tank, not to the extent of destroying it all, as Cameron claimed, but to the extent of liquefying or gasifying about one-third of those solids. It was, and still is by some, believed that a septic tank never requires to be cleaned out; that in some mysterious way the bacteria destroy all the precipitating solids. This is far from being a fact, since no bacteria can act on mineral matter of which some is always present in sewage; nor can they destroy the humus-like material into which the organic material is converted. There is inevitably in a septic tank an accumulation of solids proportionate in volume to the flow of the sewage, provided such solids are retained in the tank. One can be very sure that where such an accumulation does not take place the solids are being carried out of the tank by the flow of the sewage and are being deposited in a finely divided state on the surface of the filter beds where they do more harm than if they had been carried out in their grosser and coarser condition.

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*Paper by Prof. H. N. Ogden, Cornell University, before the American Society of Municipal Improvements, Erie, Pa., Oct. 11 to 14, 1910.

The septic tank, then, is valuable in that it acts as a sedimentation tank, incidentally equalizing the flow of sewage and in that it may eliminate about one-third of the precipitated solids. Unfortunately, if the flow of sewage through the tank is so slow as to permit the destructive action to reach its maximum effect, there has been found a resulting action in the liquid of the sewage which poisons it so that subsequent treatment of the sewage is made more difficult. The odors of the plant are always increased also if the septic action is pronounced. Therefore the designer of the tank is almost at a loss to know whether the tank of small size which minimizes the action on the liquid or the large sized tank which emphasizes the action on the solids is the more desirable. The most intelligent management to-day seems to tend toward the use of small tanks through which the velocity is comparatively high and where sedimentation takes place without, however, allowing room for any accumulated solids. Such tanks are made with inverted conical bottoms at the vertex of which the deposited material is found. By connecting this vertex through a pipe with another tank at a slightly lower level, the solids may be drawn off into a special receptacle where septic action may be continued on the solids alone as long as the capacity of the second tank allows.

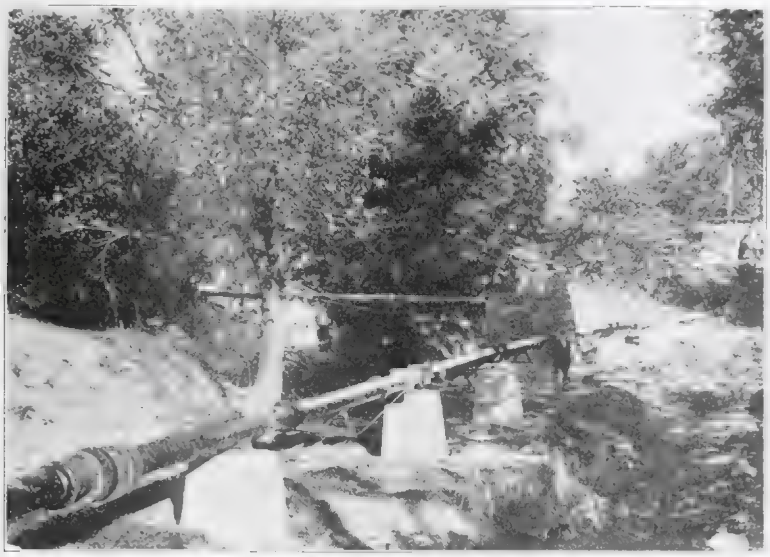

Fig. 1—View of Exposed Sewer, Leavenworth, Kan.

In the Travis tank at Hampton, this division of solid and liquid is accomplished by dividing the tank by a horizontal partition so arranged as to leave a slit or opening between the sides of the tank and the partition. By means of two valves, one opening from below this partition and the other from above, the velocity of flow through the two parts is controlled and it is managed so that the velocity through the upper part, comparatively free from suspended matter, is much greater than the velocity through the lower part which contains the organic matter on which the tank is expected to act.

In those cases where continuous operation is claimed for a period of years without any accumulation of deposited material, one may be sure of finding in the effluent small black particles which represent the inevitable loss of deposit to make up for the accumulation of new material. This fine material, as is generally the case with the solid matter acted on in the tank, is comparatively free from odor and may be dealt with far more easily than the raw sludge and this may be said to constitute another advantage of this tank treatment. Altogether, the value of the septic tank has been much modified since its invention and inasmuch as the present feeling among engineers and managers is that septic sewage is not desirable for after treatment and that in every case a tank should be emptied of sludge at least once a month provided subsequent fitration is practiced, the claims of the holders of the septic tank patent rights are not of as much interest as when the value of those patent rights was more highly considered.

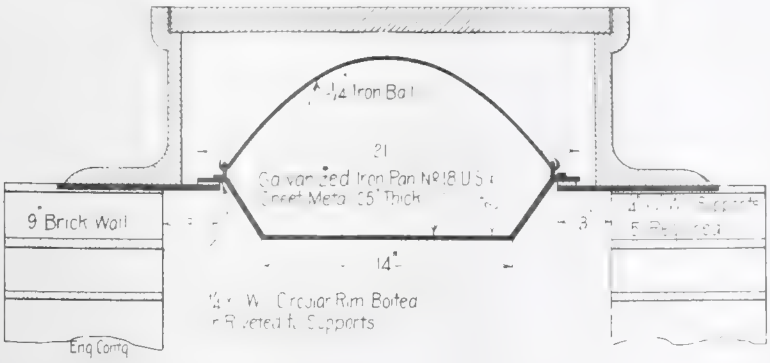
¼ Iron Bail
21
Galvanized Iron Pan No 18 U.S. Sheet Metal .05" Thick
9" Brick Wall
14"
3
¼ x W Circular Rim Bolted or Riveted to Supports
Eng Contg

Fig. 2—Manhole Top Exposed Sewer.

Some Special Construction Details of Exposed Sewers at Leavenworth, Kans.*

In designing main trunk and lateral sewers for Sanitary Sewer District Number Nine at Leavenworth, the latitude of the design was limited by a great many natural conditions. The district consists of several minor drainage areas and contains numerous creeks and "draws," making the topography very rough and broken. At points where creeks cross alleys and streets are located culverts and bridges, the crossing of which controlled the grades of the sewers almost absolutely. In addition to this, the several additions to the city comprising the district were poorly platted when originally laid out, and the arrangement of streets and alleys is bad; in some cases there are two and three alleys in one block, platted as T and H alleys; in other cases there are no alleys, and it was necessary to condemn right-of-way for sewers. In order to lay out the main trunk sewer so as to provide for lateral sewers in each block, the alignment was controlled entirely by these requirements, and the topography had to be disregarded for the most part. Being thus controlled in grade and alignment, the depth varied from very shallow to exceedingly deep work, sometimes through 12 or 15 ft. of rock. In crossing creeks and ravines it was often necessary to have the sewer above ground. These "exposed" sewers will be discussed in this paper.

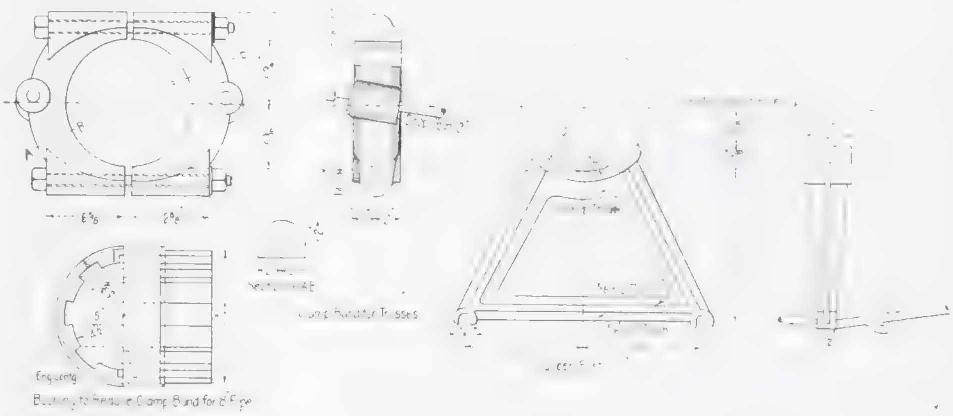

Fig. 3—Saddle Support and Trussing Details Exposed Sewer.

It was deemed best to use light weight, bell and spigot cast iron pipe supported on concrete piers, Fig. 1, and to provide for the free expansion of the pipe. To attain this end, it was provided that the piers be mounted with cast iron pier plates anchored into the concrete; on these plates were to be placed several lengths of round bar iron at right angles to the line of the sewer to serve as rollers; and fitting over the top of the plate and rollers in such a manner as to secure the rollers from falling out, but at the same time to permit them to roll on the plate with the expansion and contraction of the pipe, a saddle, Fig. 2, to fit the outside diameter of the pipe.

To avoid placing piers in creek channels where they would obstruct the flow, it was necessary to get a wider panel than 12 ft., and a truss was designed to support the intermediate joint. The truss consists of clamp bands, Fig. 3, to fit the circumference of the pipe and hold the truss rods in place, a queen post and a set of rods, as shown. In estimating the cost of the work, it was found that the com-pipe truss was less expensive than the pier with its necessary castings, so it was decided to make the panels 24 ft. instead of 12 ft., and to use a truss between each set of piers. To provide further for expansion, it was decided in cases where there was more than 75 ft. of exposed pipe in a span to place an expansion joint. The regular type of iron body, brass sleeve expansion joint was specified.

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*A paper [illegible] Leavenworth, K[illegible] the Americ[illegible] Improvements at Erie, Pa.

While the expansion in an iron pipe with a flow of sewage would be very small, owing to the almost constant temperature of the sewage, and might be taken care of by the "giving" of the lead in the joints, at the same time the loosening of the lead from expansion and contraction would cause leaks that would require attention later on, and it was considered necessary to install expansion joints.

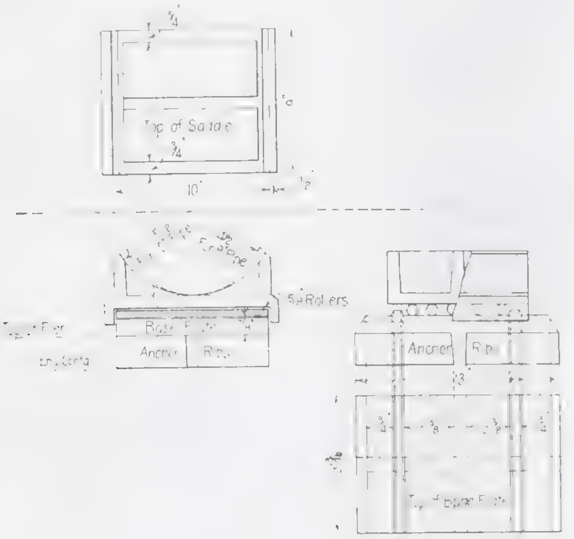

Fig. 4—Details of Saddle Support for Exposed Sewer.

In designing the special castings required for this work, every effort was made to have them simple, yet strong. To provide for different sizes of pipe, bushings were used where possible, or one casting only of a set was altered. This reduced the number of patterns required for the castings and kept the castings standard as far as possible. The castings required for the work were made by local foundries.

The unit contract prices for this class of work were as follows:

10-in. light weight cast iron pipe in place, $1.50 per ft.
8-in. light weight cast iron pipe in place, $1 per ft.
Trusses for 10-in. pipe, complete and in place, $16.50 each
Trusses for 8-in. pipe, complete and in place, $18 each.
10-in. expansion joints, complete and in place, $55 each.
8-in. expansion joints, complete and in place, $45 each.
Concrete piers 5 ft. high or under, fully equipped with castings, $22 each.
Additional height of piers, $3 per ver. ft.

Specifications for Creosoted Wood Block Pavement.

Timber.—The wood to be treated shall be either long leaf yellow pine, Norway pine, or tamarack, only one kind of wood, however, to be used in any one contract. The blocks must be cut from what is known as prime timber, namely: all timber must be sound, well manufactured, saw-butted, all square edge, and shall be free from the following defects: Unsound, loose and hollow knots, worm holes and knot holes, through shakes and round shakes that show in the surface. In yellow pine timber the annual rings must not average less than six to the inch, measured radially from the heart so as to include the greatest number of rings possible, and in no case in any 1 in. of this radius shall there be less than three annual rings. Wherever in any 1 in. of this radius there are less than four annual rings, the cross sectional area of each resin ring shall be not less than 20 per cent of the total cross sectional area of its corresponding annual ring. The blocks [illegible] age 80 per cent of heart wood and no one block shall be accepted that contains less than 50 per cent of heart wood.

Size of Blocks.—The blocks shall be from 5 to 10 ins. long, but shall average 8 ins.; they shall be 3½ to 4 ins. in depth and width, according to traffic. They may be from 3 to 4 ins. in width, but all blocks in one street shall be of uniform width. On streets of light traffic, blocks 3 ins. in depth can be used. In no case shall the width and depth of the blocks be the same. A variation of 1 16 in. shall be allowed in the depth and 1/8 in. in the width of the blocks from that specified.

Treatment.—The blocks shall be treated with a preservative oil complying with the specifications given below. The exact method of treating the blocks, while not being definitely described, shall comply with the following: The blocks shall not at any time be heated to a temperature higher than 250° F. When treated with oil the blocks shall be completely immersed therein and the oil shall be forced in the blocks under a sustained pressure of not less than 100 lbs. per square inch until the charge as a whole has absorbed an amount of oil equivalent to 20 lbs. for each cubic foot wood contained in that particular charge.

The blocks after treatment must show satisfactory penetration of the preservative oil throughout. All blocks that are in any way defective or that have been badly warped or checked in the proces of treating shall be rejected.

Oil.—The oil shall be a coal tar product, free from adulteration of any kind whatever, and shall comply with the following requirements:

(1) The specific gravity shall be at least 1.10 at a temperature of 38° C.

(2) On distillation, which shall be made exactly as described in Bulletin No. 65 of the American Railway Enginering and Maintenance of Way Association, the distillate shall not exceed 2 per cent up to 150° C. and 35 per cent up to 315° C. The mean of three determinations to be taken.

(3) Not more that 4 per cent of the oil shall be insoluble in hot benzol and chloroform.

The manufacturer of the oil shall permit full and complete inspection and sampling at the factory at which the oil is produced, of all materials, either crude or refined, entering into the manufacture of the finished product, as well as the finished product itself in order that the material used can be determined to be in accordance with the foregoing requirements. He shall also submit satisfactory proof of the origin of all material entering into the composition of the finished product.

Oil samples taken by the inspector from the treating tank during the progress of the work shall at no time show an accumulation of foreign matter, such as saw-dust and dirt. Due allowance shall be made for such accumulation [illegible]

LAYING THE BLOCK.

Cushion (Sand).—The blocks shall be laid on a sand cushion 1 in. in thickness spread on the concrete foundation. The same cushion shall be struck by templates to a surface parallel to the grade and contour of the finished pavement in such a manner that when the blocks are set and properly bedded in the sand, the tops shall conform accurately to the finished grade of the pavement. The sand used in this sand cushion shall all pass a quarter inch screen and shall be clean and sharp.

Cushion (mortar bed).—Upon the concrete foundation shall be spread a layer of mortar 1 in. in thickness and made of one part of Portland cement, of the character provided for use in the foundation, and three parts of sand. Only sufficient water shall be added to this mixture to insure a proper setting of the cement, the intention being to produce a granular mixture which may be raked to the desired grade. The mortar shall be thoroughly mixed and shall be spread in place on the foundation immediately in advance of the block laying to such a thickness that when the blocks are set and properly bedded in the mortar, their tops shall conform accurately to the finished grade of the roadway. The concrete foundation shall be cleaned and swept and shall be thoroughly dampened immediately in advance of placing the mortar bed. The mortar bed shall be struck by templates to a surface parallel to the grade and contour of the finished pavement.

Laying Blocks.—Upon the bed thus prepared the blocks shall be carefully set with the fibre of the wood vertical in straight parallel courses at right angles to the curb, except that one row of block shall be placed parallel with the curb and ¾ in. therefrom. The space thus formed between the curb and this row of blocks shall be filled with a bituminous filler having a penetration between 30 and 40 when tested at 77° F. On streets 50 ft. or more in width, a second row of blocks parallel to the first row along the curb and ¾ in. therefrom, shall be laid and the space between the two rows filled with a bituminous filler as above, thus forming a double expansion joint.

When deemed advisable by the engineer on streets for heavy traffic the row or rows of blocks parallel with the curb and the expansion joint may be dispensed with.

The blocks should be laid by setting them loosely together on the cushion coat, but no joint shall be more than ⅛ in. in width. Nothing but whole blocks shall be used, except in starting a course or in such other cases as the city may direct, and in no case shall less than one-third of a block be used in breaking joints. Closures shall be carefully cut and trimmed by experienced men. The portions of the blocks used for closure must be free from check or other fracture, and the cut end must have a surface perpendicular to the top of the block and cut to the proper angle to give a close, tight joint.

After the blocks are placed, they shall be rolled by a small steam roller until the surface becomes smooth and is brought truly to the grade and contour of the finished pavement. When laid on a mortar bed, the rolling shall be completed before the mortar has set and all mortar that has set before the blocks are in place and rolled, shall be discarded and replaced by fresh mortar.

After the blocks have been thoroughly rolled, the joints between them shall be filled by sweeping with fine clean dry sand, all of which shall pass a ten mesh sieve.

After inspection by the proper city official, the surface of the wood block pavement shall be covered to a depth of about one-half inch with fine screened sand. This sand is to be left upon the pavement for such time as may be directed by the proper city official, after which it shall be swept up and taken away by the contractor.

Inspection.—The manufacturer of the blocks shall equip his plant with all the necessary gages, appliances and facilities to enable the inspector to satisfy himself that the requirements of the specifications are fulfilled. He shall allow an authorized representative of the city to inspect all materials and all parts of the plant during the manufacture of the paving block.

STEAM AND ELECTRIC RAILWAY SECTION

Itemized Unit Costs of 98 Special Overhead Layouts for a Trolley Railway.

In valuing the physical properties of the Chicago Consolidated Traction Co., which operates some 123 miles of trolley street railway in the northern and western sections of the city the Traction Valuation Commission of Chicago* made an exhaustive survey and inventory of overhead special work at street intersections, car barns, power houses, etc. A plan of each layout was surveyed and a full inventory taken of the equipment and pole construction and an estimate made of labor erecting equipment. Altogether 103 special layouts were mapped and inventoried making the most complete schedule of such work ever published, and one which includes nearly every form of overhead arrangement found in practice. For purposes of estimating the items of materials and the costs given are of great value and at the expense of considerable labor and space we give them in the following pages rearranged for convenient use:

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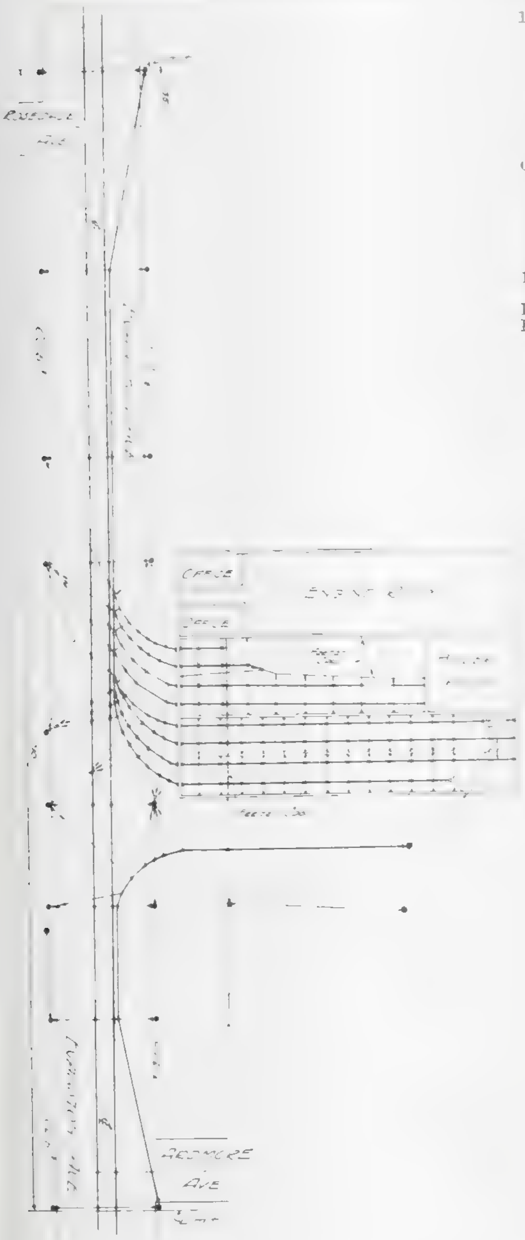
*Bion J. Arnold and George Weston, commissioners.



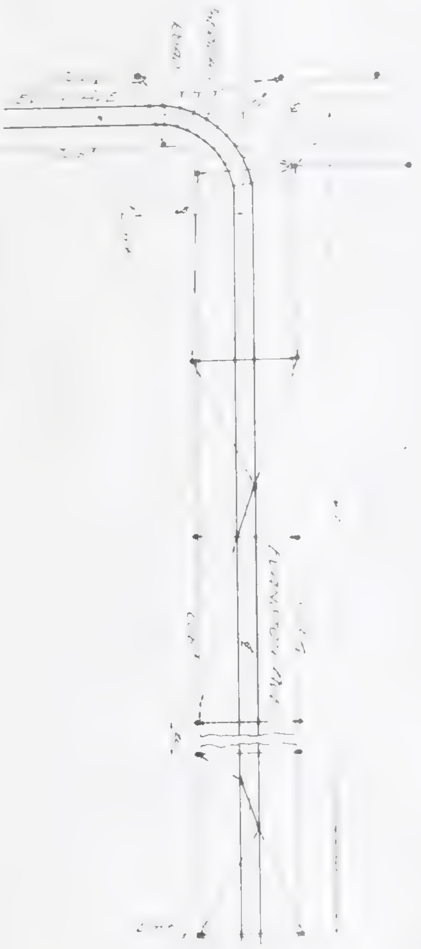
LAYOUT NO. 1.

Equipment.

Material.	Cost
24 Pole bands (solid, 2-bolt)	$ 6.00
83 Brooklyn (medium malleable iron)	49.80
15 Globe strains, 2½ in.	3.75
8 Porcelain break strains	1.20
46 Wood strains, 1¼ in. x 9½ in.	6.90
86 Straight line hangers, W. E. type A or equal	34.40
10 Barn hangers, W. E. type A or equal	4.00
11 Single curve hangers	4.40
12 Double curve hangers	5.40
4 Round top single curve hangers	1.20
23 Round top double curve hangers	8.05
9 Feeder hangers, W. E. 34,000	3.15
55 Ears, 12-in. clinch	13.75
45 Ears, 9-in. clinch	9.00
58 4-in. screw clamp ears	11.60
10 Splice ears, 15 in.	5.00
2 Double strain ears	0.90
7 Trolley frogs	23.80
1 Terminal insulator (swivel)	0.45
33 ½-in. expansion bolts	2.31
1 Insulated turnbuckle	0.60
3 Wall anchors	0.60
7 Cross-arm pole clamps	1.40
1 1¼-in. guy rod and anchor	15.00
420 Ft. ¼-in. span wire	2.73
1,175 Ft. 5/16-in. span wire	9.40
12 Ft. 2/0 W. P. wire	0.92
110 Ft. 4/0 W. P. wire	12.98
	$238.63
Incidentals and waste at 5%	$ 11.93
Total	$250.6[illegible]

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 70.0[illegible]
2 Poles	Iron	6-7-8-31′	73.10
1 Pole	Iron	6-7-8-32′	37.7[illegible]
1 Pole	Iron	5-6-7-30′	31.00
2 Poles	Iron	5-6-7-33′	62.12
10 Poles	Iron	4-5-6-28′	208.30
1 Pole	Wood	7 in.-25′	5.50
Equipment as above			250.6[illegible]
Labor on equipment			17.00
Total			$[illegible]



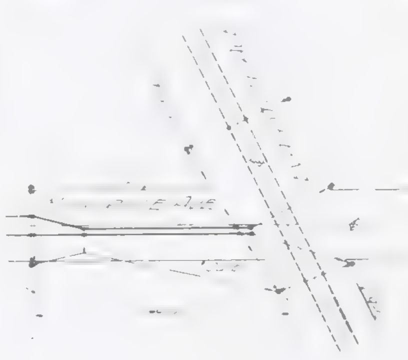
LAYOUT NO. 2.

Equipment.

Material.	Cost
23 Pole bands (solid, 2-bolt)	$ 5.75
23 Brooklyns (medium malleable iron)	13.80
1 Porcelain break strain	0.15
29 Wood strains, 1¼ in. x 9½ in.	4.35
14 Straight line hangers, W. E. type A, or equal	5.60
9 Single curve hangers	3.60
9 Double curve hangers	4.05
30 Ears, 12-in. clinch	7.50
5 Splice ears, 15 in.	2.50
1 Splicing sleeve, 10 in.	0.40
4 Trolley frogs	13.60
300 Ft. ¼-in. span wire	1.95
1,785 Ft. 5/16-in. span wire	14.28
100 Ft. ½-in. guy wire	1.65
	$79.18
Incidentals and waste	$ 3.96
Total	$83.14

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	[illegible]	$ 70.50
1 Pole	Iron	5-6-7-30′	31.00
13 Poles	Iron	4-5-6-28′	270.79
1 Pole	Wood	8 in.-35′	11.50
Equipment as above			83.14
Labor on equipment			42.50
Total			$509.43

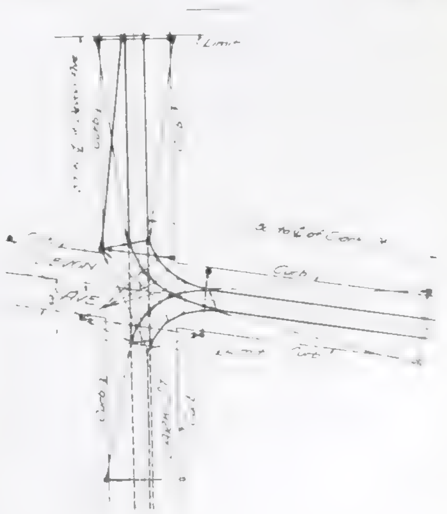


LAYOUT NO. 3.

Equipment.

Material.	Cost.
5 Pole bands (solid, 2-bolt)	$ 1.25
5 Brooklyns (medium malleable iron)	3.00
6 Wood strains, 1¼ in. x 9½ in.	0.90
2 Terminal insulators (swivel)	0.90
2 Straight line hangers, W. E. type A, or equal	0.80
1 Single curve hanger	0.40
1 Double curve hanger	0.45
4 Ears, 12-in. clinch	1.00
551 Ft. 5/16-in. stranded wire	4.41
	$13.11
Incidentals and waste at 5%	$ 0.66
Total	$13.77

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
Equipment as above			13.77
Labor on equipment			5.00
Total			$87.61



LAYOUT NO. 4.

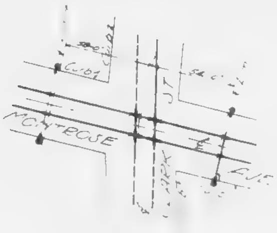
Equipment.

Material.	Cost.
10 Pole bands (solid, 2-bolt)	$ 2.50
13 Brooklyns (medium malleable iron)	7.80
1 Porcelain break strain	0.15
7 Straight line hangers, W. E. type A or equal	2.80

9 Single curve hangers	3.60
5 Double curve hangers	2.25
19 Ears, 12-in. clinch	4.75
6 Splicing ears, 15 in.	3.00
3 Solid crossovers	10.20
3 Splicing sleeves, 10 in.	1.20
6 Trolley frogs	20.40
1 1½-in. guy rod and anchor	15.00
4 Eyebolts ½ in. x 12 in. steel	0.20
970 Ft. 5/16-in. span wire	7.76
280 Ft. ½-in. guy wire	4.62
	$89.23
Incidentals and waste at 5%	$ 4.46
Total	$93.69

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-45′	$ 47.45
2 Poles	Iron	6-7-8-30′	70.50
3 Poles	Iron	4-5-6-28′	62.49
2 Poles	Wood	8 in.-35′	23.00
2 Poles	Wood	7 in.-40′	23.00
Equipment as above			93.69
Labor on equipment			60.00
Total			$380.13



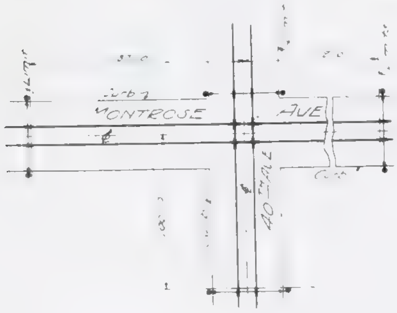
LAYOUT NO. 5.

Equipment.

Material.	Cost.
4 Insulated crossings (Philadelphia type)	$34.40
Incidentals and waste at 5%	1.72
Total	$36.12

Summary.

	New Cost.
Equipment as above	$36.12
Labor on equipment	5.00
Total	$41.12



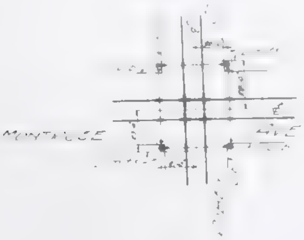
LAYOUT NO. 6.

Equipment.

Material.	Cost.
2 Pole bands (solid, 2-bolt)	$ 0.50
2 Brooklyns (medium malleable iron)	1.20
2 Wood strains, 1¼ in. x 9½ in.	0.30
2 Straight line hangers, W. E. type A, or equal	0.80
2 Ears, 12-in. clinch	0.50
3 Splicing ears, 15 in.	1.50
4 Insulated crossings (Philadelphia type)	34.40
42 Ft. 5/16-in. stranded wire	0.34
	$39.54
Incidentals and waste, at 5%	$ 1.98
Total	$41.52

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 poles	Iron	5-6-7-33′	$ 63.46
Equipment as above			41.52
Labor on equipment			7.50
Total			$112.48



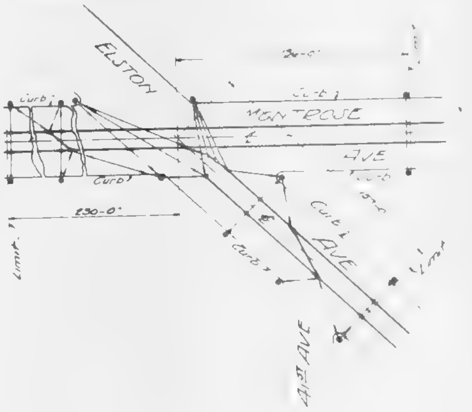
LAYOUT NO. 7.

Equipment.

Material.	Cost.
9 Pole bands (solid, 2-bolt)	$ 2.25
8 Brooklyns (medium malleable iron)	4.80
2 Wood strains, 1¼ in. x 9½ in.	0.30
9 Straight line hangers, W. E. type A or equal	3.60
4 Ears, 12 in. clinch	1.00
4 Splicing ears, 15 in.	2.00
4 Insulated crossings (Philadelphia type)	34.40
14 Ft. 5/16 in. stranded wire	1.39
	$49.74
Incidentals and waste at 5%	2.49
Total	$52.23

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Iron	5-6-7-30′	$120.68
Equipment as above			52.23
Labor on equipment			15.00
Total			$187.91



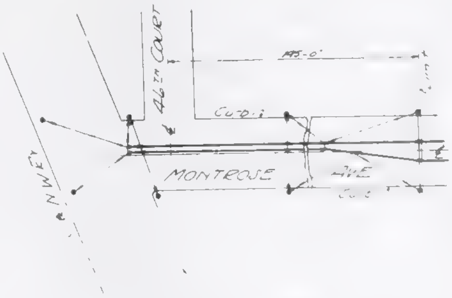
LAYOUT NO. 8.

Equipment.

Material.	Cost.
5 Pole bands (solid, 2-bolt)	$ 1.25
2 Brooklyns (medium malleable iron)	1.20
1 Brooklyn (extra malleable iron)	1.15
24 Wood strains, 1¼ in. x 9½ in.	3.60
1 Globe strain, 2½ in.	0.25
6 Insulated eyebolts	0.96
9 Straight line hangers, W. E. type A or equal	3.60
3 Single curve hangers	1.20
10 Ears, 12-in. clinch	2.50
2 Splicing ears, 15 in.	1.00
317 Ft. 5/16 in. stranded wire	2.54
41 Ft. ½-in. stranded wire	0.68
629 Ft. ¼-in. stranded wire	4.09
224 Ft. No. 6 steel wire	0.69
	$24.71
Incidentals and waste, at 5%	$ 1.24
Total	$25.95

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	5-6-7-30′	$ 60.34
1 Pole	Iron	5-6-30′	26.64
1 Pole	Wood	8 in.-35′	11.50
1 Pole	Wood	7 in.-40′	11.50
1 Stub	Wood	10 in.-35′	11.50
Equipment as above			25.95
Labor on equipment			25.00
Total			$172.43



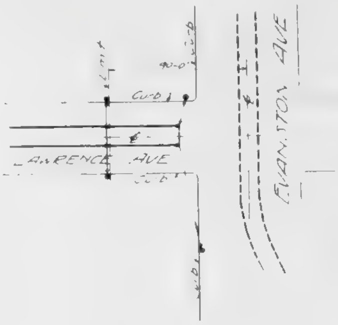
LAYOUT NO. 9.

Equipment.

Material.	Cost.
15 Pole bands (solid, 2-bolt)	$ 3.75
15 Brooklyns (medium malleable iron)	9.00
7 Wood strains, 1¼ in. x 9½ in.	1.05
2 Terminal insulators (swivel)	0.90
6 Straight line hangers	2.40
2 Single curve hangers	0.80
1 Double curve hanger	0.45
9 Ears, 12-in. clinch	2.25
671 Ft. 5/16-in. stranded wire	5.37
	$25.97
Incidentals and waste, at 5%	$ 1.30
Total	$27.27

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-31′	$ 31.10
3 Poles	Iron	5-6-7-30′	76.65
4 Poles	Iron	5-6-30′	88.08
Equipment as above			27.27
Labor on equipment			10.00
Total			$233.10

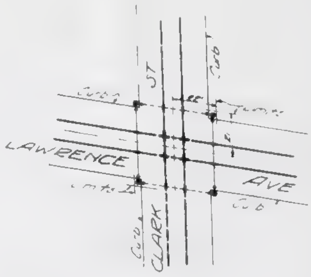


LAYOUT NO. 10.

Equipment.

Material.	Cost.
2 Brooklyns (medium malleable iron)	$ 1.20
2 Terminal insulators (swivel)	0.90
1 Wood strain, 1¼ in. x 9½ in.	0.15
1 Victor strain	0.25
92 Ft. 5/16 in. stranded wire	0.74
	$3.24
Incidentals and waste, at 5%	$ 0.16
Total	$ 3.40

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Wood	7 in.-40′	$ 11.50
Equipment as above			3.40
Labor on equipment			5.00
Total			$ 19.90



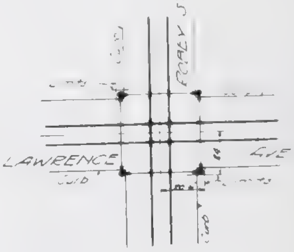
LAYOUT NO. 11.

Equipment.

Material.	Cost.
3 Pole bands (solid, 2-bolt)	$ .75
5 Brooklyns (medium, malleable iron)	3.00
6 Wood strains, 1¼ in. x 9½ in.	.90
4 Straight line hangers	1.60
1 Ear 12-in. clinch	.25
3 Splicing ears, 15 in.	1.35
1 Splicing sleeve, 10 in.	.40
4 Insulated crossings (Philadelphia type)	34.40
140 Ft. 5/16 in. stranded wire	1.12
	$43.77
Incidentals and waste, at 5%	2.19
Total	$45.96

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	5-6-7-31′	$ 51.90
2 Poles	Iron	6-7-8-31′	62.20
Equipment as above			45.96
Labor on equipment			10.00
Total			$170.06



LAYOUT NO. 12.

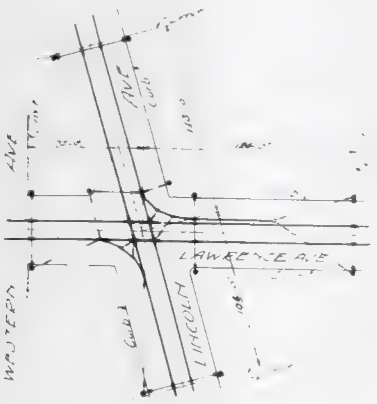
Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium malleable iron)	4.80
2 Wood strains, 1¼ in. x 9½ in.	0.30
8 Straight line hangers	3.20
4 Ears, 12-in. clinch	1.00
4 Splicing ears, 15 in.	1.80
4 Insulated crossings (Philadelphia type)	34.40
180 Ft. 5/16 in. stranded wire	1.44
	$48.94

Incidentals and waste, at 5%	2.45
Total	$51.39

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Iron	4-5-6-28′	$ 83.32
Equipment as above			51.39
Labor on equipment			5.00
Total			$139.71



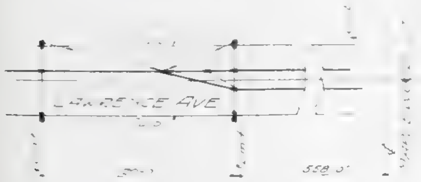
LAYOUT NO. 13.

Equipment.

Material.	Cost.
18 Pole bands (solid 2-bolt)	$ 4.50
20 Brooklyns (medium malleable iron)	12.00
15 Wood strains, 1¼ in. x 9½ in.	2.25
1 Globe strain, 2½ in.	.25
13 Straight line hangers	5.20
2 Feeder hangers, W. E. 94,907	.70
4 Single curve hangers	1.60
16 Ears, 12 in. clinch	4.00
2 Splicing ears, 15 in.	.90
3 Trolley frogs, 4 pull-off rings	10.20
1 Solid crossover	3.40
3 Insulated crossings (Philadelphia type)	25.80
1 W. I. ring, ½ in. x 3 in.	.05
900 Ft. 5/16 in. stranded wire	7.20
	$78.05
Incidentals and waste, at 5%	3.90
Total	$81.95

Summary

Quantity.	Kind.	Size.	Cost New.
In place			
3 Poles	Iron	5-6-30′	$ 66.06
5 Poles	Iron	4-5-6-28′	104.15
4 Poles	Iron	6-7-8-30′	119.20
Equipment as above			81.95
Labor on equipment			30.00
Total			$401.36



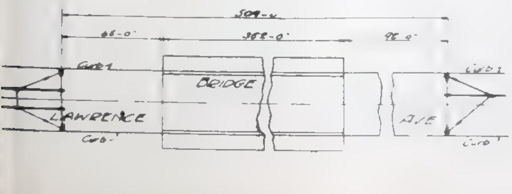
LAYOUT NO. 14.

Equipment.

Material.	Cost.
7 Pole bands (solid 2-bolt)	$ 1.75
6 Brooklyns (medium malleable iron)	3.60
7 Wood strains, 1¼ in. x 9½ in.	1.05
4 Straight line hangers	1.60
1 Single curve hanger	.40
3 Ears, 12 in. clinch	.75
1 Double strain ear, W. E. 16,212	.45
1 Trolley frog, 4 pull-off rings	3.40
1 Messenger cable clamp	.10
170 Ft. 5/16 in. stranded wire	1.36
124 Ft. ½ in. stranded wire	2.05
	$16.51
Incidentals and waste at 5%	.83
Total	$17.34

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	4-5-6-28′	$ 41.66
2 Poles	Iron	5-6-30′	44.04
Equipment as above			17.34
Labor on equipment			2.50
Total			$105.54



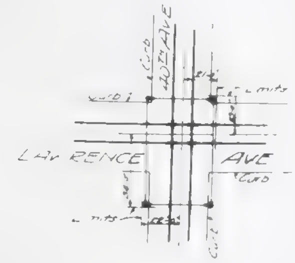
LAYOUT NO. 15.

Equipment.

Material.	Cost.
1 Pole band (solid 2-bolt)	$0.25
1 Brooklyn (medium malleable iron)	0.60
4 Wood strains, 1¼ in. x 9½ in.	0.60
3 Insulated eyebolts	0.48
3 Straight line hangers	1.20
2 Ears, 12 in. clinch	0.50
1 Splicing ear, 15 in.	0.45
3 Strain clamps, W. E. 94,546	0.60
250 Ft 5/16 in. stranded wire	2.00
	$6.68
Incidentals and waste at 5%	.33
Total	$7.01

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	$29.80
3 Poles	Wood	7 in.-30′	25.50
Equipment as above			7.01
Labor on equipment			5.00
Total			$67.31



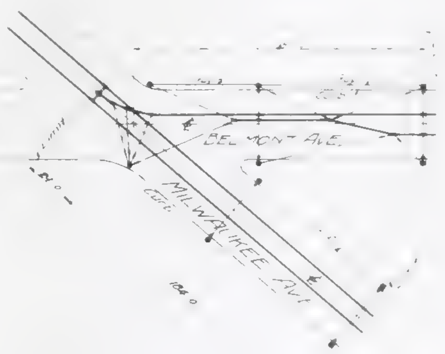
LAYOUT NO. 16.

Equipment.

Material.	Cost.
2 Pole bands (solid 2-bolt)	$ .50
2 Brooklyns (medium malleable iron)	1.20
3 Porcelain break strains	.45
1 Wood strain, 1¼ in. x 9½ in.	.15
3 Eyebolts, ½ in. x 12 in. steel	.15
4 Straight line hangers	1.60
2 Feeder hangers, W. E. 94907	.70
3 Ears, 12 in. clinch	.75
3 Splicing ears, 15 inch	1.35
4 Insulated crossings (Philadelphia type)	34.00
218 Ft. 5/16 in. stranded wire	1.74
	$42.99
Incidentals and waste at 5 %	2.15
Total	$45.14

Summary.

Quantity.	Kind.	Size.	Cost New.
2 Poles	Iron	4-5-6-28′	$ 41.66
1 Pole	Wood	7 in.-30′	8.50
1 Pole	Wood	7 in.-40′	11.50
Equipment as above			45.14
Labor on equipment			5.00
Total			$111.80



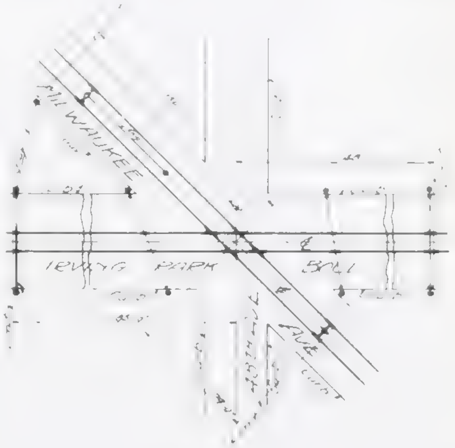
LAYOUT NO. 17.

Equipment.

Material	Cost.
13 Pole bands (solid 2-bolt)	$ 3.25
4 Brooklyns (medium malleable iron)	2.40
6 Wood strains, 1¼ x 9½ in.	.90
3 Globe strains, 2½ in. 2-eye	.75
1 Terminal insulator (swivel)	.45
2 Porcelain knobs	.30
1 Insulated turnbuckle	.60
10 Straight line hangers, W. E. type A or equal	4.00
4 Single curve hangers	1.60
1 Double curve hanger	.45
2 Feeder hangers	.70
14 Ears, 12 in. clinch	3.50
6 Splicing ears, 15 in.	3.00
75 Ft. ½ in. stranded wire	1.24
800 Ft. 5/16 in. stranded wire	6.40
1 1½ in. guy rod and anchor	15.00
	$44.54
Incidentals and waste at 5 %	2.23
Total	$46.77

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	$ 35.25
1 Pole	Iron	5-6-7-33′	32.56
8 Poles	Iron	5-6-7-30′	248.00
1 Pole (Milwaukee type)	Iron	3-4-5-6-30′	41.62
Equipment as above			46.77
Labor on equipment			15.00
Total			$419.20



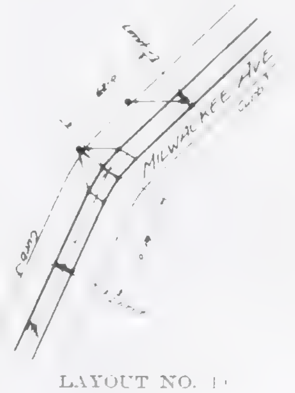
LAYOUT NO. 18.

Equipment.

Material.	Cost.
7 Pole bands (solid 2-bolt)	$ 1.75
8 Brooklyns (medium malleable iron)	4.80
8 Wood strains, 1¼ in. x 9½ in.	1.20
4 Straight line hangers, W. E. type A or equal	1.60
2 Feeder hangers, W. E. 94907	0.70
6 Ears, 12 in. clinch	1.50
6 Section insulators (Philadelphia type)	27.00
4 Solid crossovers	13.60
4 1¼ in. anchor rods and guys	60.00
500 Ft. 5/16 in. stranded wire	4.00
	$116.15
Incidentals and waste at 5 %	$ 5.81
Total	$121.96

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	$ 29.80
3 Poles (Milwaukee type)	Iron	3-4-5-6-30′	124.86
9 Poles	Iron	5-6-7-30′	229.95
Equipment as above			121.96
Labor on equipment			20.00
Total			$526.57



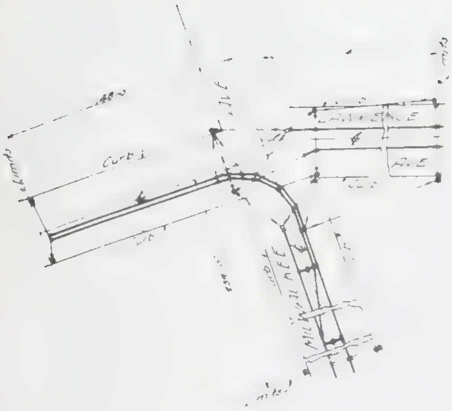
LAYOUT NO. 19.

Equipment.

Material.	Cost.
2 Pole bands (solid 2-bolt)	$ 0.50
2 Brooklyns (medium malleable iron)	1.20
3 Wood strains, 1¼ in. x 9½ in.	0.45
4 Straight line hangers, W. E. type A or equal	1.60
3 Single curve hangers	[illegible]
3 Double curve hangers	1.35
10 Ears, 12 in. clinch	2.50
170 Ft. 5/16 in. stranded wire	1.36
	$10.16
Incidentals and waste at 5%	$ 0.51
Total	$10.67

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	[illegible]
2 Poles (Milwaukee type)	Iron	3-4-5-6-30′	83.24
1 Stub	Wood	10 in.-30′	10.15
Equipment as above			10.67
Labor on equipment			25.00
Total			[illegible]



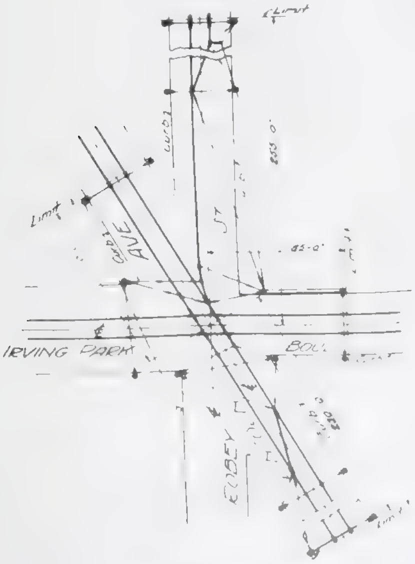
LAYOUT NO. 20.

Equipment.

Material.	Cost.
14 Pole bands (solid 2-bolt)	$ 3.50
20 Brooklyns (medium malleable iron)	12.00
13 Wood strains, 1¼ in. x 9½ in.	1.95
7 Straight line hangers, W. E. type A or equal	2.80
6 Single curve hangers	2.40
7 Double curve hangers	3.15
23 Ears, 12 in. clinch	[illegible]
2 Splicing ears, 15 in.	1.00
1 Section insulator (Philadelphia type)	4.50
2 Trolley frogs	6.80
4 Porcelain knobs	0.60
1 Messenger cable clamp	0.10
2 Turnbuckles, 12 in.	0.60
700 Ft. 5/16 in. stranded wire	5.60
	$50.75
Incidentals and waste at 5%	$ 2.54
Total	$53.29

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	5-6-7-30′	$ 31.00
2 Poles	Iron	5-6-7-30′	62.00
2 Poles (Milwaukee type)	Iron	3-4-5-6-30′	83.24
6 Poles	Iron	6-7-8-30′	211.50
Equipment as above			53.29
Labor on equipment			32.50
Total			$473.53



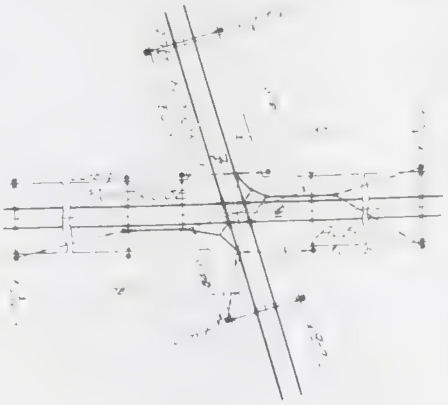
LAYOUT NO. 21.

Equipment.

Material.	Cost.
21 Pole bands (solid 2-bolt)	$ 5.25
22 Brooklyns (medium malleable iron)	13.20
32 Wood strains, 1¼ in. x 9½ in.	4.80
3 Porcelain break strains	0.45
10 Straight line hangers, W. E. type A or equal	[illegible]
3 Single curve hanger	[illegible]
2 Feed hangers, W. E. [illegible]	[illegible]
2 Section insulators (Philadelphia type)	9.00
4 Insulated crossings (Philadelphia type)	[illegible]
4 Trolley frogs	13.60
14 Ears, 12 in. clinch	3.50
3 Splicing ears, 15 in.	1.50
30 Ft. 4/0 W. P. wire	[illegible]
1,400 Ft. 5/16 in. stranded wire	11.20
	$106.34
Incidentals and waste at [illegible]	[illegible]
Total	$111.66

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
8 Poles	Iron	6-7-8-30′	$ [illegible].36
9 Poles	Iron	4-5-6-28′	229.05
Equipment as above			111.66
Labor on equipment			[illegible]
Total			[illegible]



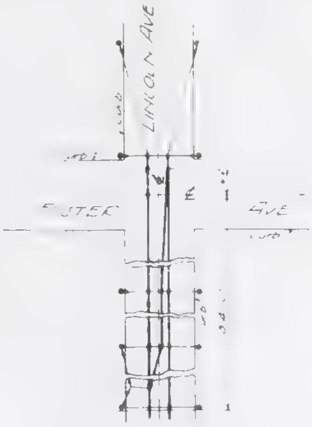
LAYOUT NO. 22.

Equipment.

Material.	Cost.
9 Pole bands (solid 2-bolt)	$ 2.25
14 Brooklyns (medium malleable iron)	8.40
12 Wood strains, 1¼ in. x 9½ in.	1.80
9 Straight line hangers, W. E. type A or equal	3.60
4 Single curve hangers	1.60
1 Double curve hanger	0.45
11 Ears, 12 in. clinch	2.75
4 Splicing ears, 15 in.	2.00
3 Splicing sleeves, 10 in.	1.20
4 Insulated crossings (Philadelphia type)	34.40
2 Trolley frogs, 4 pull-off eyes	6.80
560 Ft. 5/16 in. stranded wire	4.48
	$69.73
Incidentals and waste at 5%	$ 3.49
Total	$73.22

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	6-7-8-30′	$103.26
1 Pole	Iron	5-6-7-33′	31.73
2 Poles	Iron	5-6-30′	53.28
Equipment as above			73.22
Labor on equipment			22.50
Total			$283.99



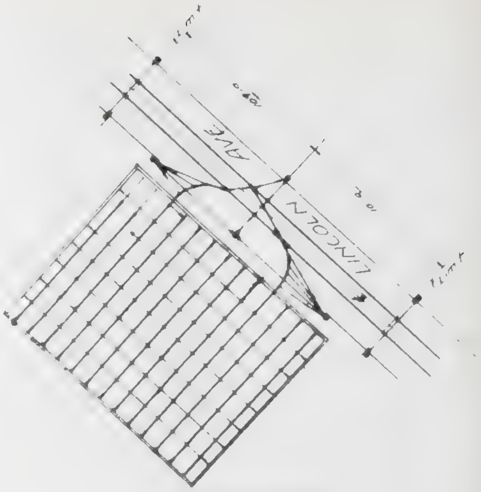
LAYOUT NO. 23.

Equipment.

Material	Cost.
10 Pole bands (solid 2-bolt)	$ 2.50
10 Brooklyns (medium malleable iron)	6.00
10 Wood strains, 1¼ x 9½ in.	1.50
4 Terminal insulators (swivel)	1.80
[illegible] Straight line hangers, W. E. type A or equal	2.80
3 Solid feed hanger ears	1.35
7 Ears, 12 in. clinch	1.75
4 Splicing ears, 15 in.	2.00
1 Trolley frog, 4 pull-off eyes	3.40
1 W. I. ring, ½ in. x 3 in.	0.05
590 Ft. 5/16 in. stranded wire	4.72
34 Ft. 4/0 W. P. wire	4.01
	$31.88
Incidentals and waste at 5%	$ 1.59
Total	[illegible]

Summary.

Quantity.	Kind.	Size.	New. Cost
[illegible]	Iron	6-7-8-30′	$ [illegible]
Equipment as above			[illegible]
Labor on equipment			12.50
Total			[illegible]



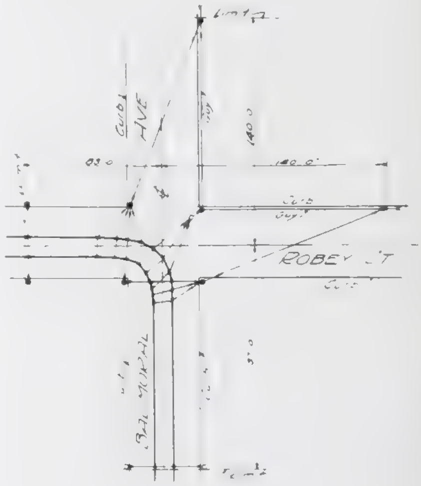
LAYOUT NO. 24.

Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
7 Brooklyns (medium malleable iron)	4.20
53 Wood strains, 1¼ in. x 9½ in.	7.95
33 Eyebolts, ½ in. x 12 in.	1.65
87 Straight line hangers, W. E. type A, or equal	34.80
8 Single curve hangers	3.20
2 Barn hangers	0.80
93 Ears, 12-in. clinch	23.25
4 Ears, 15 in. clinch	1.00
3 Splicing ears, 15 in.	1.50
1 Insulated crossing (Philadelphia type)	3.60
2 Trolley frogs, 4 pull-off eyes	6.80
1,415 Ft. 5/16 in. stranded wire	11.32
245 Ft. ¼ in. stranded wire	1.59
	$108.16
Incidentals and waste, at 5%	$ 5.41
Total	$113.57

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
Equipment as above			113.57
Labor on equipment			100.00
Total			$282.41



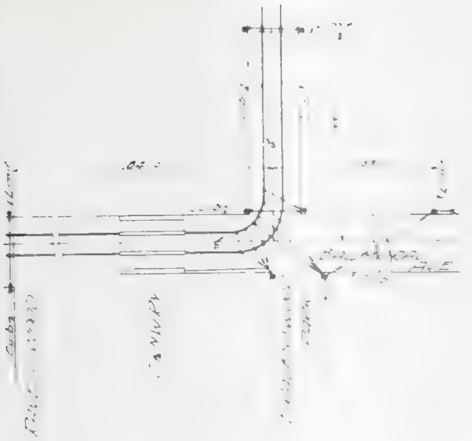
LAYOUT NO. 25.

Equipment.

Material.	Cost.
9 Pole bands (solid 2-bolt)	$ 2.25
9 Brooklyns (medium, malleable iron)	5.40
12 Wood strains, 1¼ in. x 9½ in.	1.80
8 Straight line hangers, W. E. type A, or equal	3.20
8 Single curve hangers	3.20
7 Double curve hangers	3.15
19 Ears, 12-in. clinch	4.75
4 Splicing ears, 15 in.	1.80
2 W. I. rings, 5/8 in. x 6 in.	0.10
2 1¼ in. anchor rods and guys	30.00
680 Ft. 5/16 in. stranded wire	5.44
	$61.09
Incidentals and waste, at 5%	$ 3.05
Total	$64.14

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	$ 29.80
7 Poles	Iron	5-6-7-30′	178.85
Equipment as above			64.14
Labor on equipment			35.00
Total			$307.79



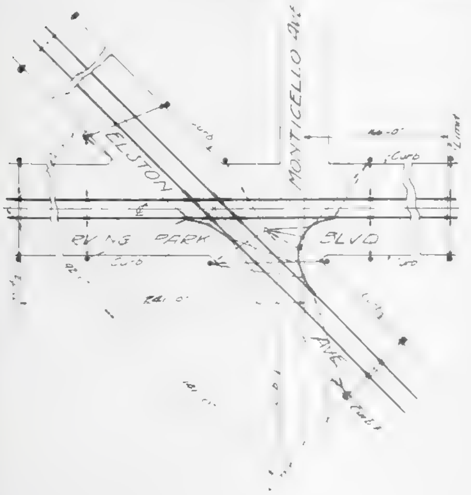
LAYOUT NO. 26.

Equipment.

Material.	Cost.
3 Pole bands (solid, 2-bolt)	$ 0.75
3 Brooklyns (medium, malleable iron)	1.80
9 Wood strains, 1¼ in. x 9½ in.	1.35
2 Straight line hangers, W. E. type A, or equal	0.80
6 Single curve hangers	2.40
7 Double curve hangers	3.15
15 Ears, 12-in. clinch	3.75
1 Splicing ear, 15 in.	0.45
4 Trolley clamps	1.20
1 Wall anchor	0.20
85 Ft. trolley tee, steel, 2½ in. x 1¼ in.	7.65
85 Ft. wood trough	34.00
2 1¼ in. anchor rods and guys	30.00
570 Ft. 5/16 in. stranded wire	4.56
	$92.06
Incidentals and waste, at 5%	$ 4.60
Total	$96.66

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-8-30′	$ 29.80
1 Pole	Iron	5-6-7-31′	25.95
3 Poles	Iron	5-6-7-30′	76.65
Equipment as above			96.66
Labor on equipment			30.00
Total			$259.06



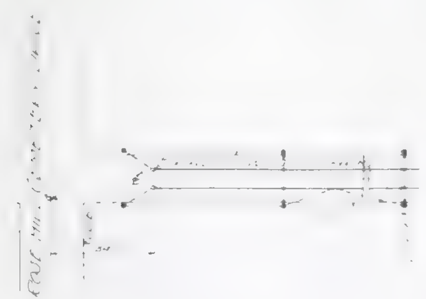
LAYOUT NO. 27.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
2 Brooklyns (medium, malleable iron)	1.20
27 Wood strains, 1¼ in. x 9½ in.	4.05
10 Straight line hangers, W. E. type A, or equal	4.00
7 Single curve hangers	2.80
17 Ears, 12-in. clinch	4.25
4 Trolley frogs	13.60
4 Solid crossovers	13.60
1 Iron ring, 4 in. x ½ in.	0.05
3 Porcelain knobs	0.45
398 Ft. 5/16 in. stranded wire	3.18
633 Ft. ¼ in. stranded wire	4.11
	$53.29
Incidentals and waste, at [illegible]	$ 2.66
Total	$55.95

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	[illegible]-6-7-30′	$ 90.51
1 Pole	Iron	5-6-7-35′	32.89
1 Pole	Wood	[illegible] in.-[illegible]′	17.50
4 Poles	Wood	6 in.-50′	56.00
1 Pole	Wood	6 in.-45′	11.90
Equipment as above			55.95
Labor on equipment			17.50
Total			$282.25



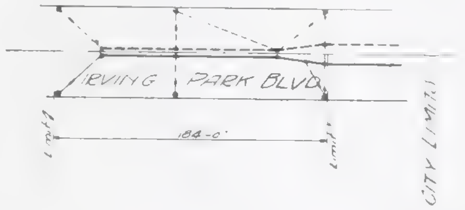
LAYOUT NO. 28.

Equipment.

Material.	Cost.
4 Pole bands (solid, 2-bolt)	$1.00
3 Brooklyns (medium, malleable iron)	1.80
2 Terminal insulators (swivel)	0.90
2 Wood strains, 1½ in. x 9½ in.	0.30
1 Straight line hanger, W. E. type A, or equal	0.40
1 Single curve hanger	0.40
1 Double curve hanger	0.45
2 Ears, 12-in. clinch	0.50
1 Splicing ear, 15 in.	0.45
310 Ft. 5/16 in. stranded wire	2.48
	$8.68
Incidentals and waste, at 5%	$0.43
Total	$9.11

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
2 Poles	Iron	4-5-6-28′	41.66
Equipment as above			9.11
Labor on equipment			7.50
Total			$127.11



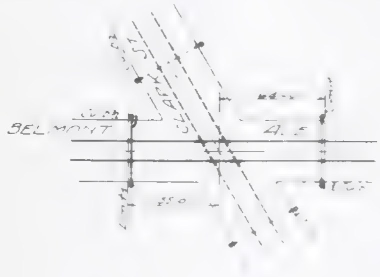
LAYOUT NO. 29.

Equipment.

Material.	Cost.
2 Pole bands (solid, 2-bolt)	$0.50
1 Brooklyn (medium, malleable iron)	0.60
4 Wood strains, 1¼ in. x 9½ in.	0.60
2 Straight line hangers, W. E. type A, or equal	0.80
1 Single curve hanger	0.40
2 Ears, 12-in. clinch	0.50
168 Ft. 3/8 in. stranded wire	1.68
82 Ft. 5/16 in. stranded wire	0.66
205 Ft. No. 8 iron wire	0.37
	$6.11
Incidentals and waste, at 5%	$0.31
Total	$6.42

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	4-5-6-28′	$41.66
1 Pole	Iron	6-7-8-35′	33.55
Equipment as above			6.42
Labor on equipment			7.50
Total			$89.13

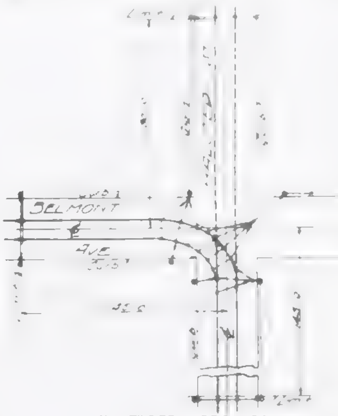


LAYOUT NO. 30.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable)	4.80
1 Wood strain, 1¼ in. x 9½ in.	0.15
8 Straight line hangers, W. E. type A, or equal	3.20
8 Ears, 12 in. clinch	2.00
4 Adjustable crossovers	18.00
142 Ft. 5/16 in. stranded wire	1.14
30 Ft. 4/0 W. P. wire	3.54
	$34.83
Incidentals and waste at 5%	$ 1.74
Total	$36.57

Quantity.	Kind.	Size.	Cost New.
In place:			
[illegible]	[illegible]	[illegible]	[illegible]
Equipment as above			36.57
Labor on equipment			10.00



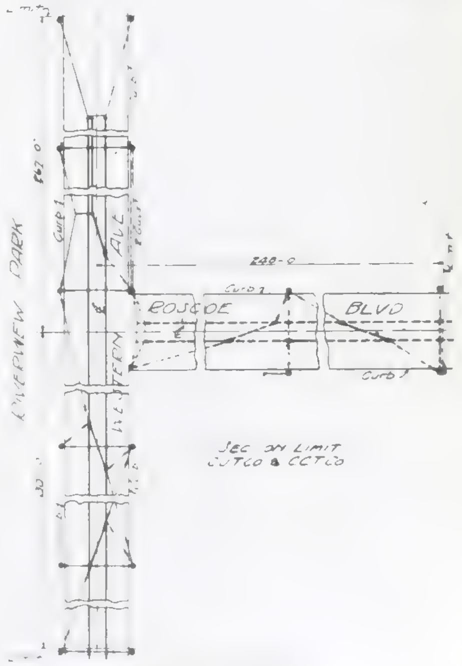
LAYOUT NO. 31.

Equipment.

Material.	Cost.
5 Pole bands (solid 2-bolt)	$ 1.25
6 Brooklyns (medium, malleable iron)	3.60
11 Wood strains, 1¼ in. x 9½ in.	1.65
4 Straight line hangers, W. E. type A, or equal	1.60
6 Single curve hangers	2.40
7 Double curve hangers	3.15
11 Ears, 12-in. clinch	2.75
5 Ears, 9-in. clinch	1.00
2 Splicing ears, 12 in.	1.00
2 Trolley frogs	6.80
1 Solid crossover	3.40
1 1¾ in. guy rod and anchor	15.00
2 Iron rings, 4 in. x ½ in.	0.10
477 Ft. 5/16 in. stranded wire	3.82
	$47.52
Incidentals and waste, at 5%	$ 2.38
Total	$49.90

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	6-7-8-30′	$105.75
1 Pole	Iron	5-6-7-30′	31.00
1 Pole	Iron	4-5-6-28′	26.28
Equipment as above			49.90
Labor on equipment			30.00
Total			$242.93



LAYOUT NO. [illegible]

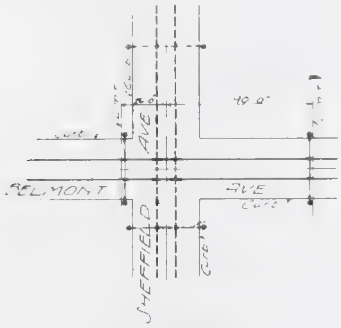
Equipment.

Material.	Cost.
5 Pole bands (solid 2-bolt)	$ 1.25
10 Brooklyns (medium, malleable iron)	6.00
30 Wood strains, 1¼ in. x 9½ in.	4.50
6 Insulated [illegible]	[illegible]
1 Steel eyebolt, ½ in. x 12 in.	0.05
10 Straight line hangers, W. E. type A or equal	[illegible]
[illegible] Single [illegible]	[illegible]
[illegible] Double [illegible]	[illegible]
5 Ears, 12 in. clinch	1.2[illegible]
5 Splicing ears, 15 in.	2.50
2 Feed tap ears, 12 in.	0.60
4 Tr[illegible]	[illegible]
[illegible] Ft. [illegible]	[illegible]
260 Ft. ½ in. stranded wire	4.29
[illegible] Ft. No. [illegible]	0.40

Lamp clusters	.00
	$54.01
Incidentals and waste at 5%	$ 2.70
Total	$56.71

Summary

Quantity	Kind	Size	Cost New
In place:			
2 Poles	Iron	5-6-7-30′	$ 51.10
1 Pole	Wood	7 in. -50′	17.00
5 Poles	Wood	7 in. -40′	57.50
2 Poles	Wood	7 in. -30′	17.00
Equipment as above			56.71
Labor on equipment			20.00
Total			$219.31

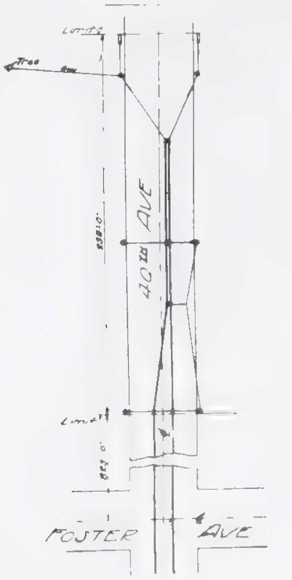


LAYOUT NO. 33
Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable iron)	4.80
6 Wood strains, 1¼ in. x 9½ in.	0.90
8 Straight line hangers, W. E. type A or equal	3.20
8 Ears, 12 in. clinch	2.00
3 Splicing ears, 15 in.	1.50
4 Adjustable crossovers	18.00
134 Ft. 5/16 in. stranded wire	1.07
30 Ft. 4/0 W. P. wire	3.54
	$37.01
Incidentals and waste at 5%	$ 1.85
Total	$38.86

Summary.

Quantity.	Kind.	Size.	Cost New.
8 Poles	Iron	6-7-8-30′	$282.00
Equipment as above			38.86
Labor on equipment			10.00
Total			$330.86

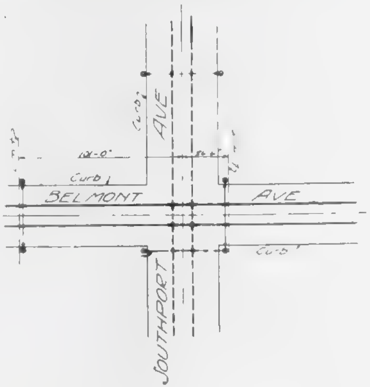


LAYOUT NO. 34.
Equipment.

Material.	Cost.
1 Brooklyn (medium, malleable iron)	$0.60
2 Insulated eyebolts	0.32
2 Wood strains, 1¼ x 9½ in.	0.30
2 Terminal insulators (swivel)	0.90
5 Straight line hangers	2.00
1 Single curve hanger	0.40
2 Ears, 12 in. clinch	0.50
2 Ears, 15 in. splicing	1.00
1 splicing sleeve, 10 in.	0.40
275 Ft. 5/16 in. stranded wire	2.20
200 Ft. No. 6 steel wire	0.62
	$9.24
Incidentals and waste at 5%	$0.46
Total	$9.70

Summary

Quantity.	Kind.	Size.	Cost New.
In place:			
6 Poles	Wood	7 in.-40′	$ 69.00
2 Stubs	Wood	10 in-25′	20.30
Equipment as above			9.70
Labor on equipment			10.00
Total			$109.00

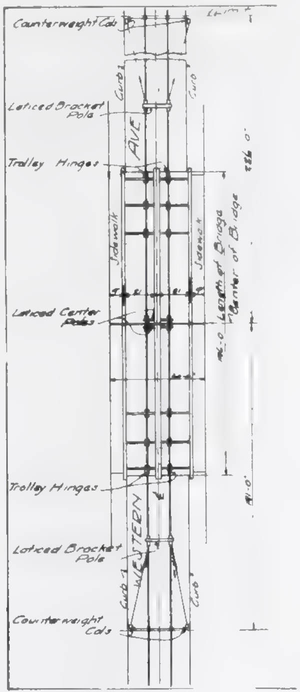


LAYOUT NO. 35.
Equipment.

Material.	Cost.
7 Pole bands (solid 2-bolt)	$ 1.75
8 Brooklyns (medium, malleable iron)	4.80
2 Wood strains, 1¼ in. x 9½ in.	0.30
6 Straight line hangers, W. E. type A or equal	2.40
2 Feeder hangers, W. E. 94907	0.70
4 Ears, 12 in. clinch	1.00
4 Splicing ears, 15 in.	2.00
2 Splicing sleeves, 10 in.	0.80
4 Insulated crossings (Philadelphia type)	34.40
1 Lightning arrester (Garton)	6.00
140 Ft. 5/16 in. stranded wire	1.12
30 Ft. 4/0 W. P. wire	3.54
	$58.81
Incidentals and waste at 5%	$ 2.94
Total	$61.75

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
7 Poles	Iron	5-6-7-30′	$217.00
Equipment as above			61.75
Labor on equipment			12.50
Total			$291.25

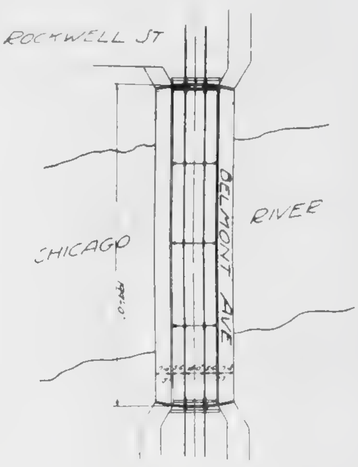


LAYOUT NO. 36.
Equipment.

Material.	Cost
4 Brooklyns (medium, malleable iron.	$ 2.40
10 Wood strains, 1¼ in. x 9½ in.	1.50
4 Hooks, 8 lbs., W. I.	0.76
4 Straight line hangers	1.60
56 Barn hangers	22.40
11 Ears, 12 in. clinch	2.75
5 Ears, 15 in. splicing	2.50
4 Trolley bridge pans, 129 lbs.	332.00
4 Trolley hinge pans, 41 lbs.	80.00
2 Male trolley pans, 11 lbs.	5.40
2 Female trolley pans, 11 lbs.	5.20
1 Steel plate anchor, 9 in. x 18 in. x ½ in.	0.75
1 Turnbuckle, 18 in. x 1 in.	0.75
15 Ft. 2½ in. W. I. pipe	2.85
80 Ft. wire, ½ in. stranded	1.32
225 Ft. wire, 5/16 in. stranded	1.80
Latticed steel poles for counter weights	332.80
4 C. I. counter weights	126.80
2 Latticed steel bracket poles	150.00
	$1,073.58
Incidentals and waste at 5%	$ 53.68
Total	$1,127.26

Summary

	Cost New.
Equipment as above	$1,127.26
Labor on equipment	30.00
Total	$1,157.26

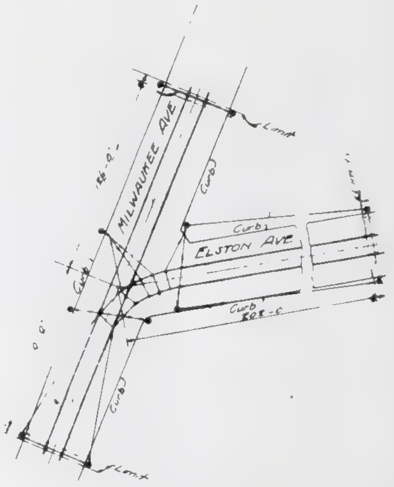


LAYOUT NO. 37.
Equipment.

Material.	Cost.
6 Insulated eyebolts	$ 0.96
6 Straight line hangers, W. E. type A or equal	2.40
36 Barn hangers	14.40
9 Ears, 12 in. clinch	2.25
5 Splicing ears, 15 in.	2.50
2 Feed tap ears	0.60
4 Trolley frogs (special draw bridge)	21.60
	$44.71
Incidentals and waste at 5%	$ 2.24
Total	$46.95

Summary.

	Cost New.
Equipment as above	$46.95
Labor on equipment	20.00
Total	$66.95



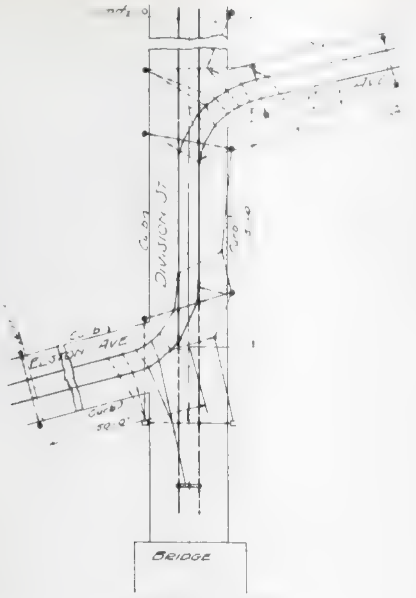
LAYOUT NO. 38.
Equipment.

Material.	Cost.
9 Pole bands (solid 2-bolt)	$ 2.25
7 Brooklyns (medium, malleable iron)	4.20
19 Wood strains, 9½ x 1¼ in.	2.85
1 Globe strain, 2½ in.	0.25
2 Sections insulator (Philadelphia type)	9.00
1 Crossover, solid, 30 deg.	3.40
2 Frogs	6.80
4 Hangers, single curve	1.60
11 Hangers, double curve	4.95
14 Ears, 12 in. clinch	3.50
2 Solid feeder ears	0.70
1 Splicing ear, 15 in.	0.50
2 Insulated eyebolts	0.32
381 Ft. ½ in. stranded wire	6.29
206 Ft. 5/16 in. stranded wire	1.65
30 Ft. 2/0 W. P. wire	2.31
	$50.57
Incidentals and waste 5%	$ 2.53
Total	$53.10

Summary.

Quantity.	Kind.	Size.	Cost New.
3 Poles	Iron	5-6-7-8-40′	$121.71
5 Poles	Iron	6-7-8-35′	195.00
1 Pole	Wood	10 in.-30′	10.15
2 Poles	Wood	6 in.-40′	20.66
Equipment as above			53.10
Labor on equipment			30.00
Total			$430.62

3 Poles	Iron	[illegible]-30′	[illegible]
1 Pole	Iron	[illegible]	[illegible]
1 Pole	Iron	8 in.-40′	11.50
Equipment as above			[illegible]
Labor on equipment			[illegible]
Total			$[illegible]



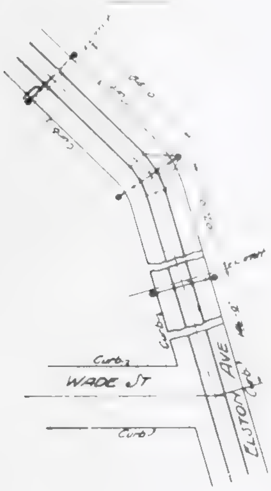
LAYOUT NO. 39.

Equipment.

Material.	Cost.
7 Pole bands (solid, 2-bolt)	$ 1.75
2 Eyebolts, insulated	0.32
12 Brooklyns (medium, malleable iron)	7.20
32 Wood strains, 9½ in. x 1¼ in	4.80
2 Crossovers (solid)	6.80
4 Trolley frogs	13.60
19 Straight line hangers	7.60
9 Single curve hangers	3.60
11 Double curve hangers	4.95
8 Splicing ears, 15 in	4.00
31 Ears, 12-in. clinch	7.75
1 Iron ring, 4 in. x 5/8 in	0.05
876 Ft. ¼-in. stranded wire	5.69
327 Ft. 5/16-in. stranded wire	2.62
	$70.73
Incidentals and waste, at 5%	$ 3.54
Total	$74.27

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84



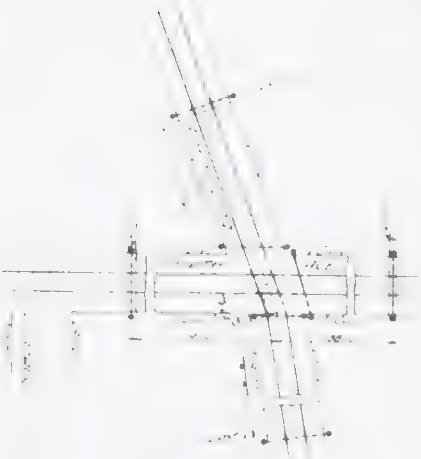
LAYOUT NO. 41.

Equipment.

Material.	Cost.
2 Pole bands (solid, 2-bolt)	$ 0.50
1 Brooklyn (medium, malleable iron)	0.60
3 Globe strains, 2½ in	0.75
2 Wood strains, 9½ in. x 1¼ in	0.30
1 Insulated eyebolt	0.16
4 Double curve hangers	1.80
2 Single curve hangers	0.80
6 Ears, 12-in. clinch	1.50
44 Ft. 5/16 in. stranded wire	3.52
71 Ft ¼-in. stranded wire	4.62
	$14.55
Incidentals and waste, at 5%	$ 0.73
Total	$15.28

Summary.

Quantity.	Kind.	Size.	Cost New.
1 Pole	Iron	6-7-8-35′	$38.17
1 Pole	Wood	10 in.-30′	10.15
Equipment as above.			15.28
Labor on equipment			12.50
Total			$76.10



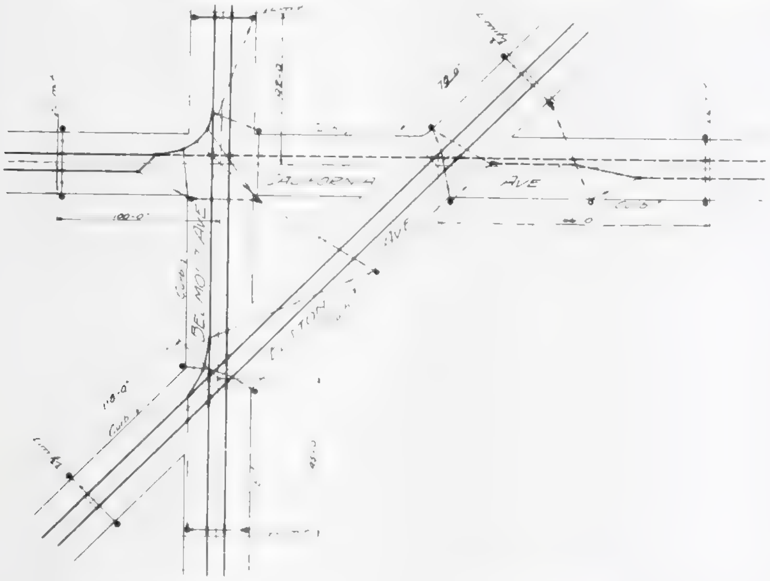
LAYOUT NO. 42.

Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
7 Brooklyns (medium, malleable iron)	4.20
6 Wood strains, 9½ in. x 1¼ in	0.90
5 Globe strains, 2½ in	1.25
7 Insulated eyebolts	1.12
7 Straight line hangers	2.80
1 Double curve hanger	0.45
1 Feed hanger, W. R. 94,907	0.35
9 Ears, 12 in. clinch	2.25
1 Solid feed hanger ear	0.45
1 Splicing ear, 15 in	0.50
1 Splicing sleeve, 10 in	0.40
2 Section insulators (Philadelphia type)	9.00
4 Adjustable crossovers	18.00
243 Ft. 5/16 in. stranded wire	1.94
	$45.11
Incidentals and waste at 5%	$ 2.26
Total	$47.37

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
6 Poles	Iron	5-6-7-30′	$181.02
7 Poles	Wood	7 in.-50′	119.00
1 Pole	Wood	7 in.-30′	8.50
Equipment as above			47.37
Labor on equipment			22.50
Total			$378.39



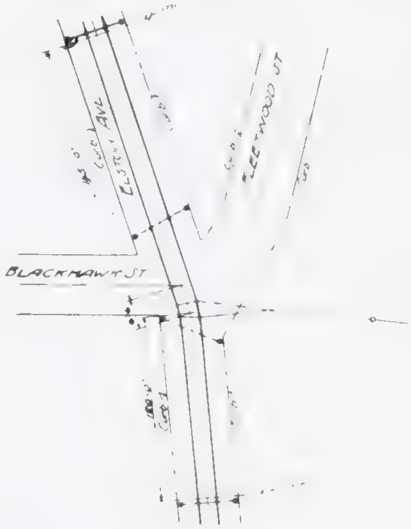
LAYOUT NO. 40.

Equipment.

Material.	Cost.
10 Pole bands (solid 2-bolt)	$ 2.50
8 Insulated eyebolts	1.28
2 Steel eyebolts, 5/8 in. x 18 in	0.10
16 Brooklyns (medium, malleable iron)	9.60
26 Wood strains, 1¼ in. x 9½ in	3.90
6 Globe strains, 2½ in	1.50
1 Terminal insulator (swivel)	0.45
17 Straight line hangers	6.80
2 Double curve hangers	0.90
4 Single curve hangers	1.60
2 Feeder hangers, W. E. 94,907	0.70
18 Ears, 12 in. clinch	4.50
8 Splicing ears, 15 in	4.00
3 Splicing sleeves	1.20
5 Section insulators (Philadelphia type)	22.50
4 Solid crossovers	13.60
4 Adjustable crossovers	18.00
2 Insulated crossings (Philadelphia type)	17.20
4 Trolley frogs	13.60
1,130 Ft. 5/16 in. stranded wire	9.04
28 Ft. 4/0 W. P. wire	3.36
	$136.27
Incidentals and waste at 5%	$ 6.81
Total	$143.08

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	6-7-[illegible]	$ 50.92
1 Pole	Iron	5-6-7-33′	31.73
6 Poles	Iron	5-6-7-30′	181.02
2 Poles	Wood	7 in.-50′	34.00
3 Poles	Wood	7 in.-45′	40.80
1 Pole	Wood	6 in.-30′	5.90
5 Poles	Wood	8 in.-45′	68.00
1 Pole	Wood	8 in.-40′	11.50
1 Pole	Wood	8 in.-35′	11.50
Equipment as above			143.08
Labor on equipment			50.00
Total			$628.45



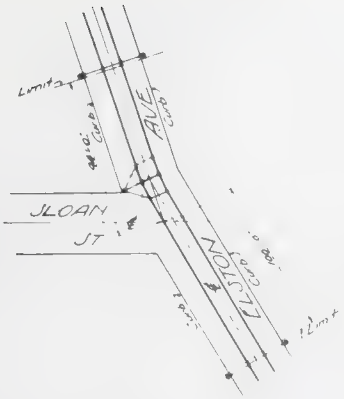
LAYOUT NO. 43.

Equipment.

Material.	Cost.
5 Insulated eyebolts	$ 0.80
6 Wood strains, 9½ in. x 1¼ in	0.90
2 Globe strains	0.50
1 Brooklyn (medium, malleable iron)	0.60
6 Straight line hangers	2.40
2 Double curve hangers	0.90
2 Single curve hangers	0.80
2 Solid feeder ears	0.90
10 Ears, 12 in. clinch	2.50
25 Ft. 2/0 W. P. wire	1.93
191 Ft. 5/16 in. iron stranded wire	1.53
89 Ft. ¼ in. iron stranded wire	0.58
1 1½ guy rod and anchor	15.00
	$29.34
Incidentals and [illegible]	[illegible]
Total	$30.81

Summary.

Quantity.	Kind.	Size.	Cost
In place:			
6 Poles	[illegible]	[illegible] in. x 50′	$102.00
2 Poles	[illegible]	[illegible] in. x 30′	17.00
1 Pole	Wood	[illegible]	13.60
Equipment as above			30.81
Labor on equipment			15.00
Total			$178.41



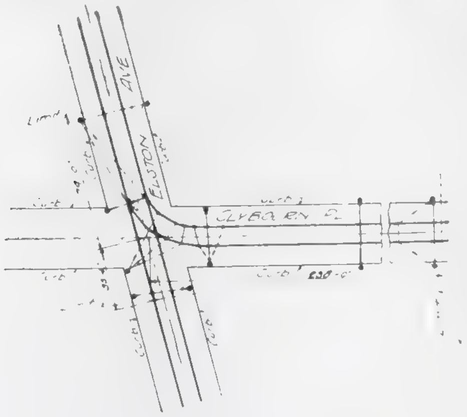
LAYOUT NO. 44.

Equipment.

Material.	Cost.
1 Insulated eyebolt	$0.16
4 Double curve hangers	1.80
2 Single curve hangers	0.80
6 Ears, 12-in. clinch	1.50
3 Globe strains	0.75
90 Ft. ¼-in. span wire	0.59
	$5.60
Incidentals and waste, at 5%	$0.28
Total	$5.88

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Wood	6 in.-30'	$ 5.90
Equipment as above			5.88
Labor on equipment			10.00
Total			$21.78



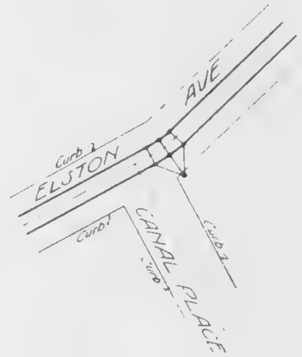
LAYOUT NO. 46.

Equipment.

Material.	Cost.
11 Pole bands (solid 2-bolt)	$ 2.75
7 Brooklyns (medium, malleable iron)	4.20
12 Wood strains, 9½ in. x 1¼ in.	1.80
5 Globe strains, 2½ in.	1.25
7 Insulated eyebolts	1.12
1 Porcelain knob	0.15
2 Messenger clamps	0.20
9 Hangers, straight line	3.60
5 Hangers, double curve	2.25
5 Hangers, single curve	2.00
7 Ears, 15 in. clinch	1.75
11 Ears, 12 in. clinch	2.75
2 Trolley frogs	6.80
1 Solid crossover	3.40
1 Section insulator, W. E. 100,166	4.50
130 Ft. ½ in. stranded wire	2.15
190 Ft. 5/16 in. stranded wire	1.52
377 Ft. ¼ in. stranded wire	2.45
	$44.64
Incidentals and waste at 5%	$ 2.23
Total	$46.87

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
7 Poles	Iron	5-6-7-30'	$211.19
3 Poles	Wood	7 in.-50'	51.00
2 Poles	Wood	7 in.-30'	17.00
Equipment as above			46.87
Labor on equipment			35.00
Total			$361.06



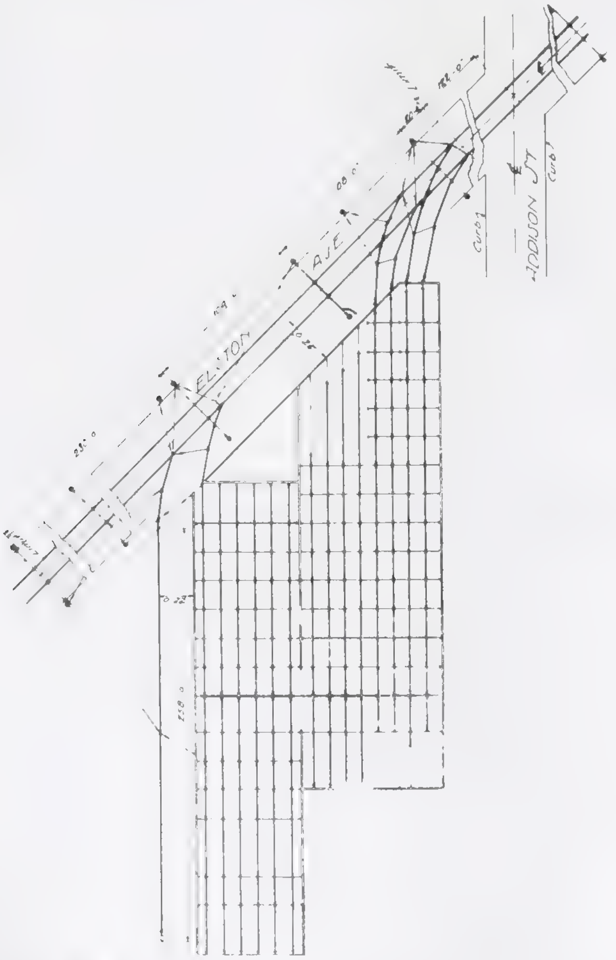
LAYOUT NO. 47.

Equipment.

Material.	Cost.
1 Pole band (solid 2-bolt)	$0.25
1 Brooklyn (medium, malleable iron)	0.60
3 Wood strains, 9½ in. x 1¼ in.	0.45
4 Double curve hangers	1.80
2 Single curve hangers	0.80
6 Ears, 12 in. clinch	1.50
70 Ft. ¼ in. stranded wire	0.46
	$5.86
Incindentals and waste at 5%	$0.29
Total	$6.15

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	5-6-7-30'	$30.17
Equipment as above			6.15
Labor on equipment			15.00
Total			$51.32



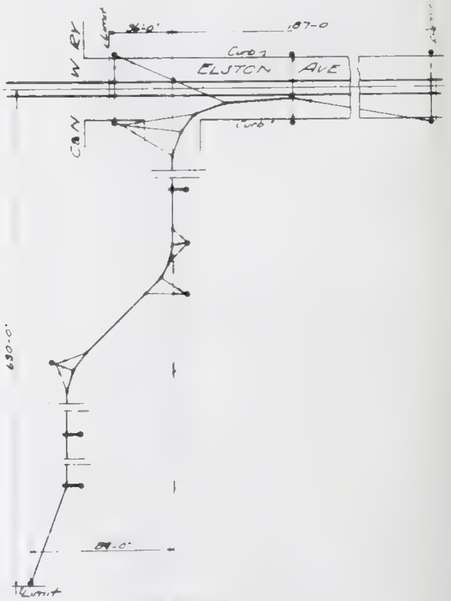
LAYOUT NO. [illegible]

Equipment.

Material.	Cost.
4 Pole bands (solid 2-bolt)	$ 1.00
8 Insulated eyebolts	1.28
62 Steel eyebolts, ½ in. x 12 in.	3.10
67 Brooklyns (medium, malleable iron)	40.20
35 Wood strains, 1¼ in. x 9½ in.	5.25
13 Globe strains, 2½ in.	[illegible]
169 Straight line hangers	67.60
5 Single curve hangers	[illegible]
2 Double curve hangers	0.90
9 Feeder Hangers	3.15
1 Barn hanger	0.40
112 Ears, 12 in. clinch	28.00
2 Solid feed hanger ears	0.90
42 Splicing ears, 15 in.	21.00
47 Screw clamp ears, 4 in.	9.40
3 Splicing sleeves, 10 in.	1.20
2 Adjustable crossovers	[illegible]
13 Solid crossovers	[illegible]
6 Trolley frogs	[illegible]
98 Ft. 4/0 W. P. wire	11.56
90 Ft. 2/0 W. P. wire	6.93
2,070 Ft. 5/16 in. stranded wire	16.56
533 Ft. ¼ in. stranded wire	3.46
180 Ft. No. 8 solid iron wire	0.32
	$304.46
Incidentals and waste at 5%	$ 15.22
Total	$319.68

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
[illegible] Poles	Iron	6-7-8-30'	[illegible]
1 Pole	Iron	4-5-6-28'	[illegible]
1 Pole	Wood	7 in.-50'	[illegible]
6 Poles	Wood	7 in.-45'	[illegible]
Equipment as above			[illegible]
Labor on equipment			[illegible]
Total			[illegible]



LAYOUT NO. 48.

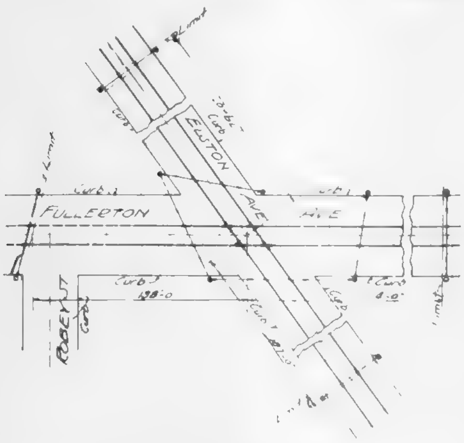
Equipment.

Material.	Cost.
3 Insulated eyebolts	$ 0.48
4 Steel eyebolts, ½ in. x 12 in.	0.20
2 Brooklyns (medium, malleable iron)	1.20
1 Globe strain, 2½ in.	0.25
18 Wood strains, 1¼ in. x 9½ in.	2.70
8 Straight line hangers	3.20
11 Single curve hangers	4.40
1 Double curve hanger	0.45
16 Ears, 12 in. clinch	4.00
2 Ears, 12 in. feed tap	0.60
2 Solid feed hanger ears	0.90
3 Splicing ears, 15 in.	1.50
3 Single brackets (Form 2)	8.25
34 Ft. 4/0 W. P. wire	4.01

Material.	Cost.
222 Ft. 5/16 in. stranded wire	1.78
305 Ft. ¼ in. stranded wire	1.98
	$35.90
Incidentals and waste at 5%	.$ 1.80
Total	$37.70

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Wood	8 in.-30'	$ 30.45
3 Poles	Wood	8 in.-35'	34.50
7 Poles	Wood	6 in.-40'	72.31
Equipment as above			37.70
Labor on equipment			30.00
Total			$204.96



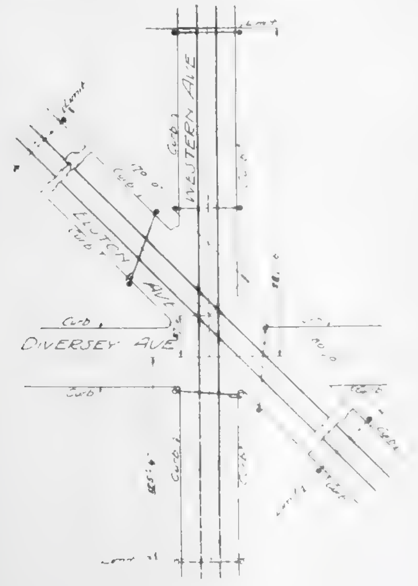
LAYOUT NO. 49.

Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
3 Insulated eyebolts	0.48
1 Steel eyebolt, ½ in. x 12 in.	0.05
8 Brooklyns (medium, malleable iron)	4.80
9 Wood strains, 1¼ in. x 9½ in.	1.35
10 Straight line hangers	4.00
9 Ears, 12 in. clinch	2.25
1 Ear, 15 in. clinch	0.25
2 Splicing ears, 15 in.	1.00
2 Section insulators (Philadelphia type)	9.00
4 Insulated crossings	34.40
362 Ft. 5/16 in. stranded wire	2.90
	$61.98
Incidentals and waste at 5%	..$ 3.10
Total	$65.08

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 Pole	Iron	4-5-6-35'	$ 23.87
3 Poles	Iron	4-5-6-28'	62.49
2 Poles	Wood	8 in.-40'	23.00
1 Pole	Wood	7 in.-45'	13.60
2 Poles	Wood	7 in.-30'	17.00
Equipment as above			65.08
Labor on equipment			20.00
Total			..$225.04



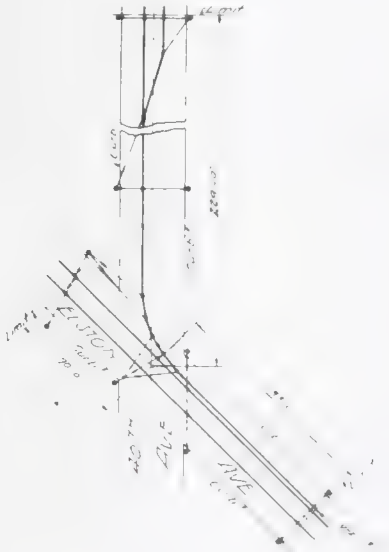
LAYOUT NO. 50.

Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
13 Eyebolts ½ in. x 12 in.	0.65
6 Wood strains, 1¼ in. x 9½ in.	0.90
6 Brooklyns (medium malleable iron)	3.60
3 Globe strains, 2½ in.	0.75
4 Insulated crossings (Philadelphia)	34.40
8 Straight line hangers	3.20
4 Solid feeder ears	1.40
6 Ears, 12 in. clinch	1.50
2 Splicing ears, 15 in.	1.00
37 Ft. 5/16 in. stranded iron wire	1.90
80 Ft. 4/0 W. P. wire	9.44
	$60.24
Incidentals and waste at 5%	.$ 3.01
Total	.$63.25

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-35'	$ 76.34
5 Poles	Iron	5-6-7-30'	150.85
3 Poles	Wood	7 in.-30'	25.50
2 Poles	Wood	7 in.-50'	34.00
1 Pole	Wood	8 in.-35'	11.50
1 Pole	Wood	8 in.-40'	11.50
Equipment as above			63.25
Labor on equipment			22.50
Total			$395.44



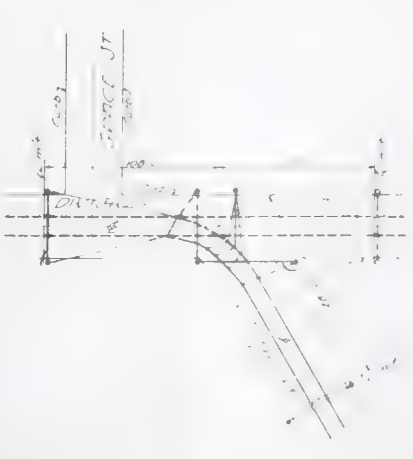
LAYOUT NO. 51.

Equipment.

Material.	Cost.
10 Insulated eyebolts	$ 1.60
2 Brooklyns (medium, malleable iron)	1.20
10 Wood strains, 1¼ in. x 9½ in.	1.50
3 Globe strains, 2½ in.	0.75
11 Straight line hangers, W. E. type A.	4.40
6 Single curve hangers	2.40
13 Ears, 12 in. clinch	3.25
2 Ears, 15 in. clinch	0.50
5 Splicing ears, 15 in.	2.50
1 Trolley frog	3.40
1 W. I. ring, ¾ in. x 4 in.	0.05
243 Ft. 5/16 in. stranded wire	1.94
300 Ft. ¼ in. stranded wire	1.95
	$25.44
Incidentals and waste at 5%	$ 1.27
Total	$26.71

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
1 pole	Iron	6-7-8-35'	$ 38.17
3 Poles	Wood	7 in.-50'	51.00
2 Poles	Wood	7 in.-40'	23.00
1 Pole	Wood	6 in.-40'	10.33
4 Poles	Wood	7 in.-30'	34.00
Equipment as above			26.71
Labor on equipment			30.00
Total			$213.21



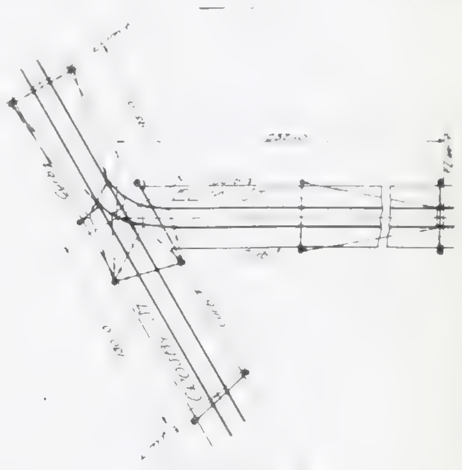
LAYOUT NO. 52.

Equipment.

Material.	Cost.
11 Pole bands (solid 2-bolt)	$ 2.75
11 Brooklyns (medium, malleable iron)	6.60
19 Wood strains, 1¼ in. x 9½ in.	2.85
5 Hangers, straight line	2.00
4 Hangers, single curve	1.60
4 Hangers, double curve	1.80
2 Hangers, feeder	0.70
14 Ears, 12 in. clinch	3.50
2 Ears, splicing	0.90
500 Ft. 5/16 in. stranded iron wire	4.00
50 Ft. 4/0 W. P. wire	5.90
1 Section insulator (Philadelphia type)	8.60
1 Trolley frog	3.40
1 Solid crossover	3.40
	$48.00
Incidentals and waste at 5%	.$ 2.40
Total	.$50.40

Summary.

Quantity.	Kind.	Size.	Cost New.
1 Pole	Iron	6-7-8-30'	$ 29.80
5 Poles	Iron	5-6-7-30'	127.75
Equipment as above			50.40
Labor on equipment			25.00
Total			.$232.95



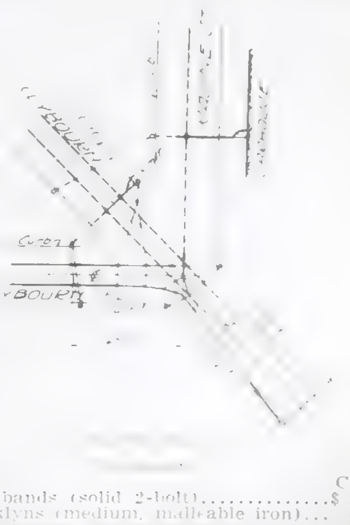
LAYOUT NO. 53.

Equipment.

Material.	Cost.
15 Pole bands (solid 2-bolt)	$ 3.75
17 Brooklyns (medium, malleable iron)	10.20
28 Wood strains, 1¼ in. x 9½ in.	4.20
9 Hangers, straight line	3.60
3 Hangers, single curve	1.20
3 Hangers, double curve	1.35
13 Ears, 12 in. clinch	3.25
2 Ears, anchor clamp	0.90
2 Trolley frogs	6.80
1 Solid crossover	3.40
1 Iron ring, 3 in. x ½ in.	0.05
1,385 Ft. span wire, 5/16 in. strand	11.08
33 Ft. W. P. wire, 4/0	3.89
	$53.67
Incidentals and waste at 5%	$ 2.68
Total	$56.35

Summary.

Quantity.	Kind.	Size.	Cost New.
1 Pole	Iron	6-7-8-30'	$ 29.80
9 Poles	Iron	5-6-7-30'	229.95
Equipment as above			56.35
Labor on equipment			25.00
Total			$341.10



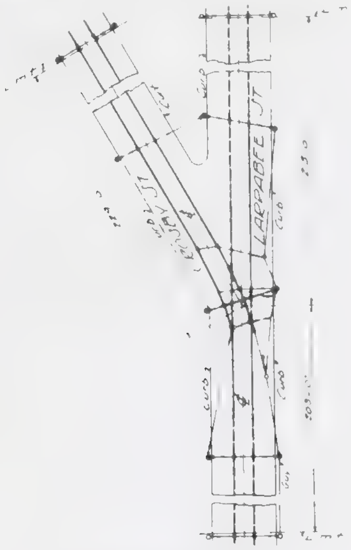
[illegible]

Material.	Cost.
11 Pole bands (solid 2-bolt)	$ 2.75
11 Brooklyns (medium, malleable iron)	6.60
[illegible]	[illegible]
[illegible]	1.60
[illegible]	1.60

2 Double curve hangers	0.90
1 Feeder hanger, W. E. 94,907	0.35
9 Ears, 12 in. clinch	2.25
3 Ears, solid feed hanger	1.35
2 Ears, 15 in. splicing	0.90
1 Adjustable crossover	3.40
1 Iron ring, ½ in. x 4 in.	0.05
1 Trolley frog	3.40
243 Ft. 5/16 in. stranded iron wire	1.94
211 Ft. ¼ in. stranded iron wire	1.37
2 Lightning arresters (Garton)	12.00
1 Section switch, 400 ampere, S. P. S. T.	7.00
[illegible] Ft. 4/0 W. P. wire	8.50
	$58.21
Incidentals and waste at 5%	$ 2.91
Total	$61.12

Summary.

Quantity. In place	Kind.	Size.	Cost New.
1 Pole	Iron	6-7-8-30′	$ 29.80
6 Poles	Iron	5-6-7-30′	153.30
Equipment as above			61.12
Labor on equipment			17.50
Total			$261.72



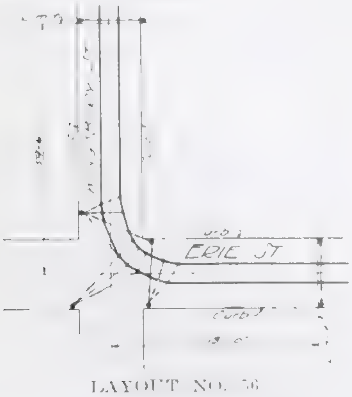
LAYOUT NO. 55.

Equipment.

Material.	Cost
14 Pole bands (solid 2-bolt)	$ 3.50
14 Brooklyns (medium, malleable iron)	8.40
18 Wood strains, 9½ x 1¼ in.	2.70
7 Hangers, straight line, type A. W. E.	2.80
2 Hangers, single curve	0.80
2 Hangers, double curve	0.90
10 Ears, 12 in. clinch	2.50
3 Ears, solid feed (hanger)	1.35
2 Ears, 15 in. splicing	0.90
1 Hanger, feeder	0.35
2 Trolley frogs	6.80
1 Iron ring, 4 in. x ½ in.	0.05
820 Ft. guy wire, 5/16 in. strand	6.55
[illegible] Ft. W. P. wire, 4/0	4.13
	$41.74
Incidentals and waste at 5%	$ 2.09
Total	$43.83

Summary.

Quantity.	Kind.	Size.	Cost New.
1 Pole	Iron	6-7-8-30′	$ 29.80
6 Poles	Iron	5-6-7-30′	153.30
Equipment as above			43.83
Labor on equipment			25.00
Total			$251.93



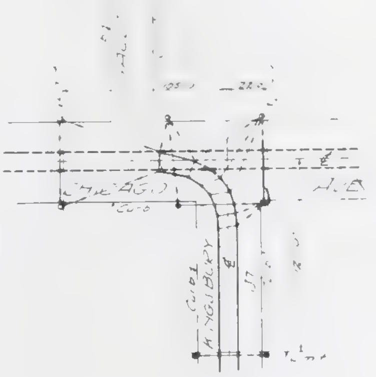
LAYOUT NO. 56.

Equipment.

Material.	Cost
5 Pole bands (solid 2-bolt)	$ 1.25
5 Brooklyns (medium, malleable iron)	3.00
12 Wood strains, 9½ in. x 1¼ in.	1.80
4 Straight line hangers	1.60
7 Single curve hangers	2.80
7 Double curve hangers	3.15
18 Ears, 12 in. clinch	4.50
340 Ft. Wire, ¼ in. stranded	2.21
100 Ft. wire, 5/16 in. stranded	0.80
	$21.11
Incidentals and waste at 5%	$ 1.06
Total	$22.17

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
4 Poles	Iron	5-6-7-30′	$120.68
Equipment as above			22.17
Labor on equipment			25.00
Total			$167.85



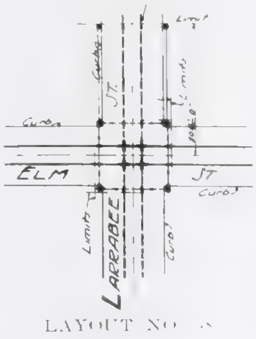
LAYOUT NO. 57.

Equipment.

Material.	Cost
9 Pole bands (solid 2-bolt)	$ 2.25
9 Brooklyns (medium, malleable iron)	5.40
20 Wood strains, 9½ in. x 1¼ in.	3.00
8 Straight line hangers	3.20
5 Single curve hangers	2.00
18 Ears, 12 in. clinch	4.50
2 Ears, solid feed hanger	0.90
1 Ear, 15 in. splicing	0.45
1 Solid crossover	3.40
2 Right hand frogs	6.80
270 Ft. wire, 5/16 in. stranded	2.16
315 Ft. wire, ¼ in. stranded	2.05
32 Ft. wire, 2/0 W. P.	2.46
	$38.57
Incidentals and waste at 5%	$ 1.93
Total	$40.50

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
4 Poles	Iron	5-6-7-30′	$120.68
Equipment as above			40.50
Labor on equipment			25.00
Total			$186.18



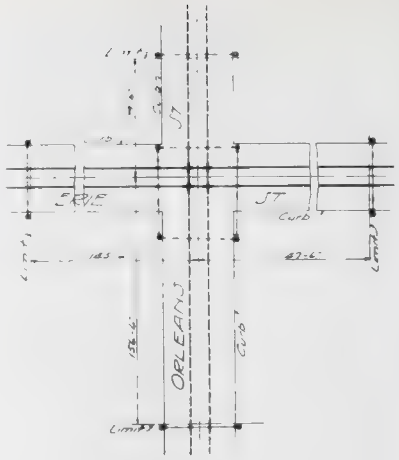
LAYOUT NO. 58.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable iron)	4.80
8 Wood strains, 1¼ in. x 9½ in.	1.20
8 Straight line hangers, W. E. type A	3.20
7 Ears, 12 in. clinch	1.75
1 Splicing ear, 15 in.	0.45
4 Insulated crossings (Philadelphia type)	34.40
160 Ft. 5/16 in. stranded wire	1.28
	$49.08
Incidentals and waste at 5%	$ 2.45
Total	$51.53

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
6 Poles	Iron	5-6-7-30′	$153.30
Equipment as above			51.53
Labor on equipment			12.50
Total			$217.33



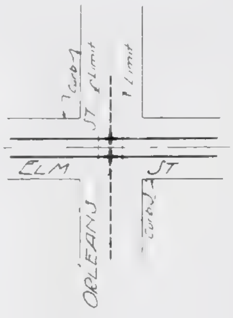
LAYOUT NO. 59.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$2.00
8 Brooklyns (medium, malleable iron)	4.80
8 Wood strains, 1¼ in. x 9½ in.	1.20
8 Straight line hangers, W. E. type A or equal	3.20
7 Ears, 12 in. clinch	1.75
1 Splicing ear, 15 in.	0.45
217 Ft. 5/16 in. stranded wire	1.74
	$15.14
Incidentals and waste at 5 %	$ 0.76
Total	$15.90

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
4 Poles	Iron	5-6-7-30′	$120.68
Equipment as above			15.90
Labor on equipment			5.00
Total			$141.58



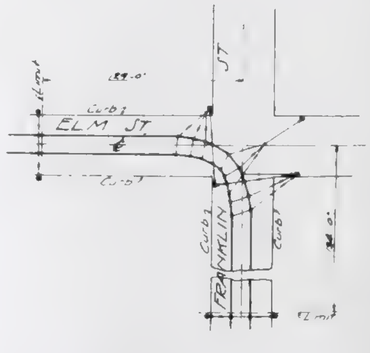
LAYOUT NO. 60.

Equipment.

Material.	Cost.
2 Insulated crossings (Philadelphia type)	$17.20
Incidentals and waste at 5%	8.60
Total	$25.80

Summary

	Cost New.
Equipment as above	$25.80
Labor on equipment	2.50
Total	$28.30



LAYOUT NO. 61.

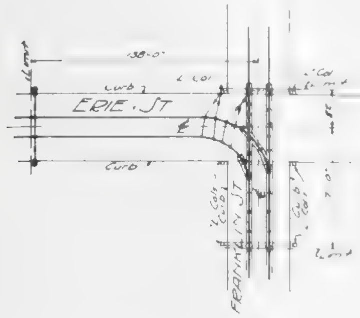
Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
6 Brooklyns (medium, malleable iron)	3.60
13 Wood strains, 1¼ in. x 9½ in.	1.95
4 Straight line hangers, W. E. type A	1.60
8 Single curve hangers	3.20
8 Double curve hangers	3.60
20 Ears, 12 in. clinch	5.00

1 1¼ in. x 40 ft. guy rod	[illegible]
495 Ft. 5/16 in. stranded wire	3.96
	$39.41
Incidentals and waste at 5%	1.97
Total	$41.38

Summary.

Quantity. In place	Kind.	Size.	Cost New.
4 Poles	Iron	[illegible]	[illegible]
Equipment as above			41.38
Labor on equipment			25.00
Total			$168.[illegible]



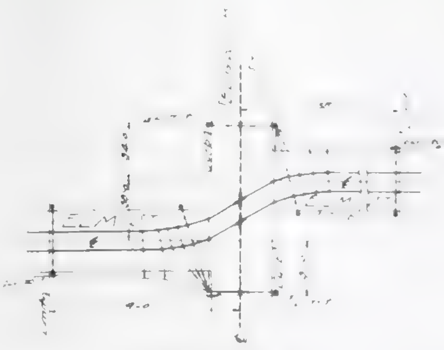
LAYOUT NO. 62.

Equipment.

Material.	Cost.
2 Brooklyns (medium, malleable iron)	$ 1.20
4 Wood strains, 1¼ in. x 9½ in.	0.60
2 Straight line hangers	0.80
4 Single curve hangers	1.60
4 Double curve hangers	1.80
31 Barn hangers	12.40
41 Ears, 12 in. clinch	10.25
8 Porcelain knobs	1.20
1 Solid crossover	3.40
2 Trolley frogs	6.80
250 Ft. trolley trough	100.00
12 Hangers for trough	12.00
72 Ft. B. M. 3 in. x 6 in. lumber	2.88
12 Ft. B. M. 3 in. x 3 in. lumber	0.48
30 Ft. B. M. 1 in. x 12 in. lumber	1.20
	$156.61
Incidentals and waste at 5%	$ 7.83
Total	$164.44

Summary.

	Cost New.
Equipment as above	$164.44
Labor on equipment	25.00
Total	$189.44



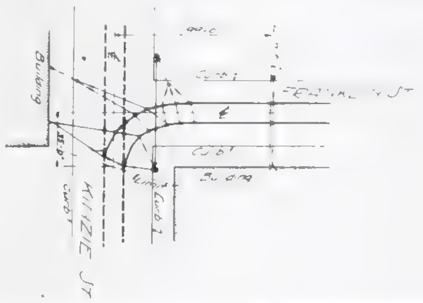
LAYOUT NO. 64.

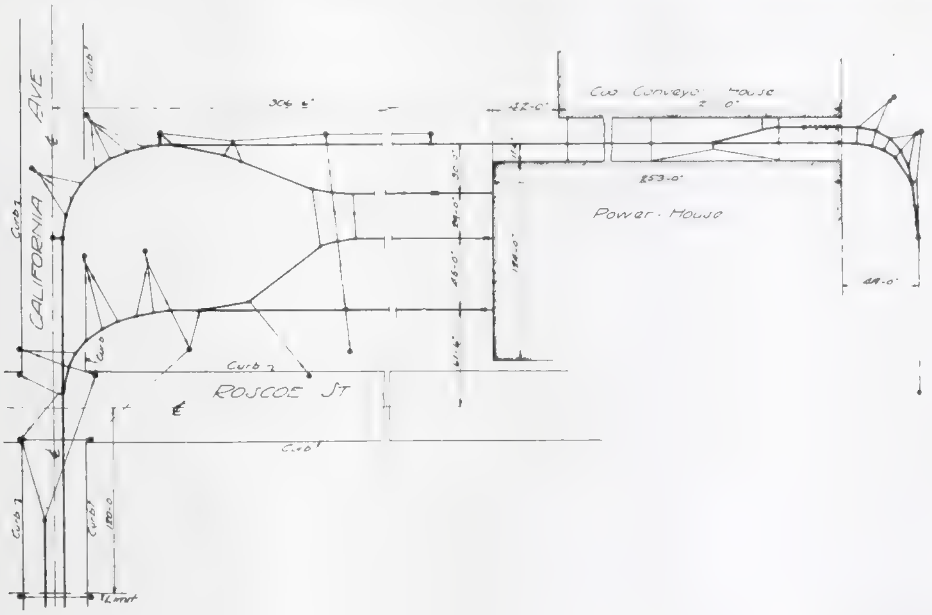
Equipment.

Material.	Cost.
17 Pole bands (solid 2-bolt)	$ 4.25
17 Brooklyns (medium, malleable iron)	10.20
21 Wood strains, 1¼ in. x 9½ in.	3.15
9 Straight line hangers, W. E. type A	3.60
9 Single curve hangers	3.60
9 Double curve hangers	4.05
1 Feeder hanger	0.35
2 Insulated crossings (Philadelphia type)	16.80
950 Ft. 5/16 in. stranded wire	7.60
	$53.60
Incidentals and waste at 5%	$ 2.68
Total	$56.28

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
10 Poles	Iron	5-6-7-30'	$255.50
Equipment as above			56.28
Labor on equipment			50.00
Total			$361.78





LAYOUT NO. 63.

Equipment.

Material.	Cost.
2 Pole bands (solid 2-bolt)	$ 0.50
6 Brooklyns (medium, malleable iron)	3.60
44 Wood strains, 1¼ in. x 9½ in.	6.60
2 Terminal insulators (swivel)	0.90
15 Insulated eye bolts	2.40
1 Porcelain break strain	0.15
13 Straight line hangers	5.20
26 Single curve hangers	10.40
4 Double curve hangers	1.80
5 Barn hangers	2.00
47 Ears, 12 in. clinch	11.75
1 Splicing ear, 15 in.	0.45
7 Single brackets, W. E. Form 2	19.25
3 W. I. rings, ⅝ in. x 4 in.	0.15
32 Ft. trolley trough	12.80
1 Glass insulator, T. G.	0.08
1841 Ft. 5/16 in. stranded wire	14.73
2 1¼ in. guy rod and anchor	30.00
	$122.76
Incidentals and waste at 5%	$ 6.14
Total	$128.90

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
1 Pole	Iron	5-6-7-8-40'	$ 40.57
1 Pole	Iron	6-7-8-35'	38.17
6 Poles	Wood	8 in.-35'	69.00
2 Poles	Wood	8 in.-25'	11.00
8 Poles	Wood	7 in.-30'	68.00
Equipment as above			128.90
Labor on equipment			75.00
Total			$430.64

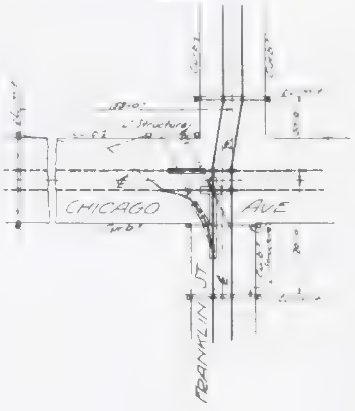
LAYOUT NO. 65.

Equipment.

Material.	Cost.
2 Pole bands (solid 2-bolt)	$ 0.50
5 Brooklyns (medium, malleable iron)	3.00
11 Wood strains, 1¼ in. x 9½ in.	1.65
5 Straight line hangers	2.00
4 Single curve hangers	[illegible]
6 Double curve hangers	[illegible]
15 Ears, 12 in. clinch	3.75
2 Trolley frogs, 4 pull-off	6.80
2 Iron rings, ½ in. x 4 in.	[illegible]
1 Solid crossover	[illegible]
2 steel eye bolts	0.10
450 Ft. 5/16 in. span wire	3.60
2 C. I. wall anchors, 5 lb.	0.40
	$29.60
Incidentals and waste at 5%	$ 1.48
Total	$31.08

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
3 Poles	Iron	5-6-7-30'	$ 90.51
Equipment as above			31.08
Labor on equipment			25.00
Total			$146.59



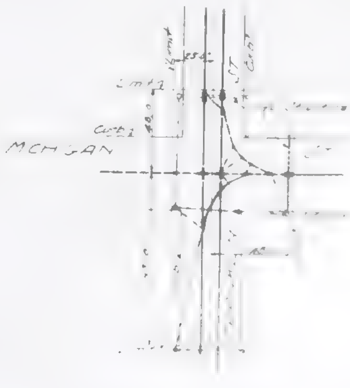
LAYOUT NO. 66.

Equipment.

Material.	Cost.
3 Pole bands (solid 2-bolt)	$ 0.75
4 Brooklyns (medium, malleable iron)	2.40
4 Wood strains, 1¼ in. x 9½ in.	0.60
2 Straight line hangers	0.80
1 Single curve hanger	0.40
21 Barn hangers	8.40
22 Ears, 12 in. clinch	5.50
2 Splicing ears, 15 in.	0.90
2 Trolley frogs	6.80
1 Iron clamp hook, 4 lbs.	0.12
3 Trolley guide troughs	4.50
12 Hangers for trolley trough	12.00
140 Ft. wood trough	56.00
200 Ft. 5/16 in. stranded wire	1.60
4 Solid crossings	13.60
50 Ft. B. M. 3 in. x 6 in. lumber	2.00
60 Ft. B. M. 2 in. x 10 in. lumber	2.40
24 Ft. B. M. 2 in. x 12 in. lumber	0.96
	$119.73
Incidentals and waste at 5%	$ 5.99
Total	$125.72

Summary.

Quantity. In place:	Kind.	Size.	Cost New.
2 Poles	Iron	5-6-7-30'	$ 60.34
Equipment as above			125.72
Labor on equipment			25.00
Total			$211.06



LAYOUT NO. 67.

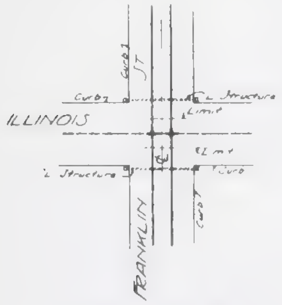
Equipment.

Material.	Cost.
4 Pole bands (solid 2-bolt)	$ 1.00
6 Brooklyns (medium, malleable iron)	3.60
10 Wood strains, 1¼ in. x 9½ in.	[illegible]
2 Straight line hangers	0.80
4 Single curve hangers	1.60

Material.	Cost.
6 Barn hangers	[illegible]
12 Ears, 12 in. clinch	[illegible]
2 Splicing ears, 15 in.	0.90
4 Trolley frogs	13.60
3 Solid crossovers	10.20
2 Section insulators (Philadelphia type)	17.20
3 Trolley guard troughs	1.50
2 Clamp hooks, 1 lb.	0.24
270 Ft. 5/16 in. stranded wire	2.16
	$63.85
Incidentals and waste at 5%	$ 3.19
Total	$67.04

Summary.

Quantity.	Kind.	Size.	Cost New.
4 Poles	Iron	5-6-7-30'	$120.68
Equipment as above			67.04
Labor on equipment			20.00
Total			$207.72



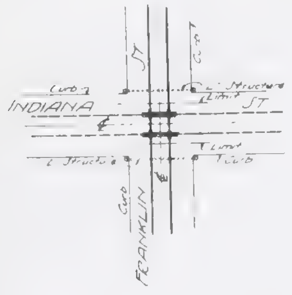
LAYOUT NO. 68.

Equipment.

Material.	Cost.
2 Insulated crossings (Philadelphia type)	$17.20
Incidentals and waste at 5%	0.86
Total	$18.06

Summary.

	Cost New.
Equipment as above	$18.06
Labor on equipment	5.00
Total	$23.06



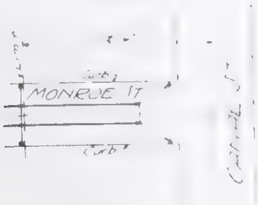
LAYOUT NO. 69.

Equipment.

Material.	Cost.
7 Barn hangers	$ 2.00
3 Ears, 12 in. clinch	0.75
3 Splicing ears, 15 in.	1.35
4 Solid crossovers	13.60
36 Ft. trolley trough	14.40
4 Hangers for trough	4.00
	$36.10
Incidentals and waste at 5%	$ 1.81
Total	$37.91

Summary.

	Cost New.
Equipment as above	$37.91
Labor on equipment	5.00
Total	$42.91



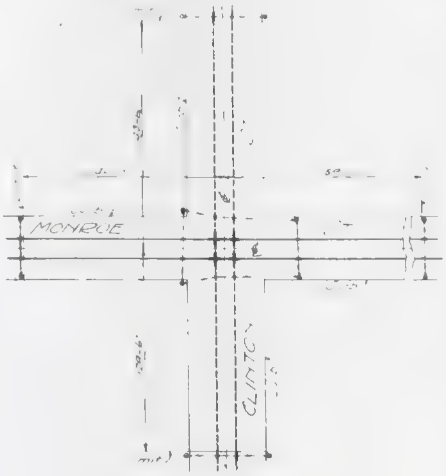
LAYOUT NO. 70.

Equipment.

Material.	Cost.
4 Pole bands (solid 2-bolt)	$1.00
6 Brooklyns (medium, malleable iron)	3.60
57 Ft. 5/16 in. stranded wire	0.46
	$5.06
Incidentals and waste at 5%	.25
Total	$5.31

Summary.

Quantity.	Kind.	Size.	Cost New.
In place;			
2 Poles	Iron	6-7-8-30'	$68.84
Equipment as above			5.31
Labor on equipment			2.50
Total			$76.65



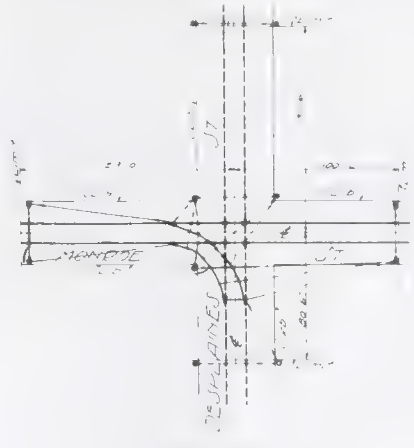
LAYOUT NO. 71.

Equipment.

Material.	Cost.
10 Pole bands (solid 2-bolt)	$ 2.50
8 Brooklyns (medium, malleable iron)	4.80
8 Wood strains $1\frac{1}{4}$ in. x $9\frac{1}{2}$ in.	1.20
1 Globe strain 2½ in.	0.25
8 Straight line hangers	3.20
8 Ears, 12 in. clinch	2.00
8 Ears, 15 in. splicing	0.90
4 Solid crossovers	13.60
215 Ft. 5/16 in. stranded wire	1.72
	$30.17
Incidentals and waste at 5%	$ 1.51
Total	$31.68

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Iron	5-6-7-30'	$120.68
Equipment as above			30.17
Labor on equipment			10.00
Total			$160.85



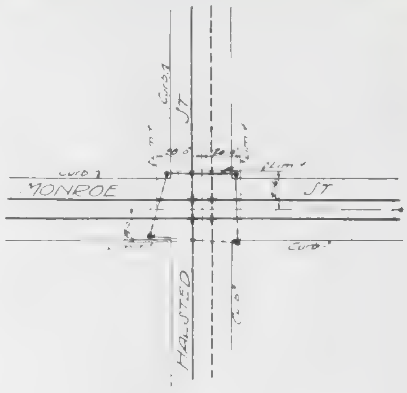
LAYOUT NO. 72.

Equipment.

Material.	Cost.
12 Pole bands (solid 2-bolt)	$ 3.00
16 Brooklyns (medium, malleable iron	9.60
25 Wood strains $9\frac{1}{2}$ in. x $1\frac{1}{4}$ in.	3.75
3 Globe strains $2\frac{1}{2}$ in.	0.75
11 Straight line hangers	4.40
4 Single curve hangers	1.60
4 Double curve hangers	1.80
1 Feeder hanger	0.35
19 Ears, 12 in. clinch	4.75
5 Ears (solid feeder hanger)	2.25
9 Ears, 15 in. splicing	4.05
2 Solid crossovers	6.80
4 Trolley frogs	13.60
557 Ft. wire, stranded ¼ in.	3.62
228 Ft. wire, stranded 5/16 in.	1.82
61 Ft. W. P. 4/0	7.20
	$69.34
Incidentals and waste at 5%	$ 3.47
Total	$72.81

Summary.

Quantity.	Kind.	Size.	Cost New.
7 Holes	Iron	5-6-7-30'	$211.19
Equipment as above			72.81
Labor on equipment			35.00
Total			$319.00



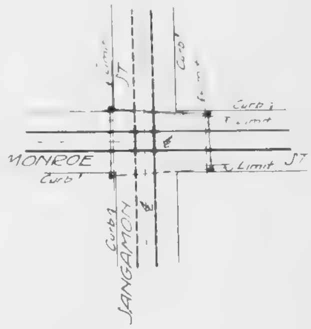
LAYOUT NO. 73.

Equipment.

Material.	Cost.
10 Pole bands (solid 2-bolt)	$ 2.50
10 Brooklyns (medium, malleable iron)	6.00
8 Wood strains, $9\frac{1}{2}$ in. x $1\frac{1}{4}$ in.	1.20
1 Globe strain, $2\frac{1}{2}$ in.	0.25
6 Straight line hangers, W. E. type A	2.40
6 Ears, 12 in. clinch	1.50
2 Ears, (solid feeder hanger)	0.90
1 Ears, 15 in. splicing	0.45
4 Insulated crossings (Philadelphia type)	34.40
149 Ft. 5/16 in. stranded wire	1.19
27 Ft. 4/0 W. P. wire	3.19
	$53.98
Incidentals and waste at 5%	$ 2.70
Total	$56.68

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Iron	5-6-7-30'	$120.68
Equipment as above			56.68
Labor on equipment			15.00
Total			$192.36



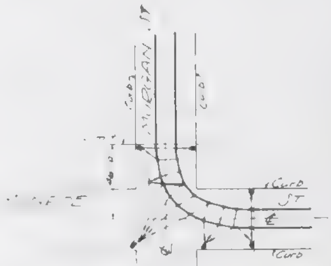
LAYOUT NO. 74.

Equipment.

Material.	Cost.
4 Insulated crossovers	$34.40
Incidentals and waste at 5%	$ 1.72
Total	$36.12

Summary.

Quantity.	Kind.	Size.	Cost New.
Equipment as above			$36.12
Labor on equipment			5.00
Total			$41.12



LAYOUT NO. 75.

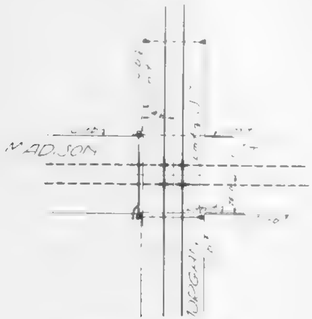
Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable iron)	4.80
11 Wood strains, $1\frac{1}{4}$ in. x $9\frac{1}{2}$ in.	2.10
4 Straight line hangers	1.60
7 Single curve	2.80
9 Double curve	4.05
15 Ears, 12 in. clinch	3.75
7 Splicing ears	2.25
2 $\frac{1}{2}$ in. x 4 in. iron rings	0.10

338 Ft. ¼ in. stranded wire	[illegible]
117 Ft. 5/16 in. stranded wire	[illegible]
	$29.59
Incidentals and waste at [illegible]	[illegible]
Total	[illegible]

Summary.

Quantity.	Kind.	Size.	Cost. New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
4 Poles	Iron	5-6-7-30′	120.68
Equipment as above			27.92
Labor on equipment			30.00
Total			$247.44



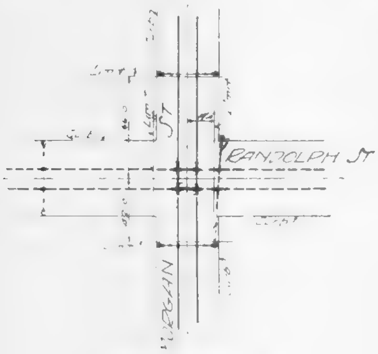
LAYOUT NO. 76.

Equipment.

Material.	Cost.
4 Insulated crossovers	$34.40
Incidentals and waste at 5%	$ 1.72
Total	$36.12

Summary.

	Cost New.
Equipment as above	$36.12
Labor on equipment	5.00
Total	$41.12



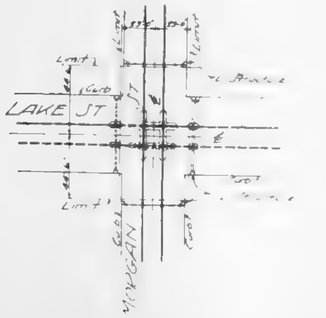
LAYOUT NO. 77.

Equipment

Material.	Cost.
2 Splicing ears, 15 in.	$ 0.90
4 Splicing sleeves, 10 in.	1.60
4 Insulated crossings (Philadelphia type)	34.40
	$36.90
Incidentals and waste at 5%	$ 1.85
Total	$38.75

Summary.

	Cost New.
Equipment as above	$38.75
Labor on equipment	5.00
Total	$43.75



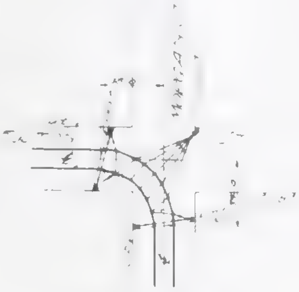
LAYOUT NO. 78.

Equipment.

Material.	Cost.
1 Wood strain, 1¼ in x 9½ in.	$ 0.15
12 Barn hangers	4.80
11 Ears, 12 in. clinch	2.75
2 Ears, 15 in. splicing	0.90
4 Iron hooks, ½ in. x 2 in. x 10 in.	0.20
80 Ft. wood trough	32.00
18 F. B. M. timber, 3x3 in.	0.72
4 Insulated crossings (Philadelphia type)	34.40
	$75.92
Incidentals and waste at 5%	[illegible]
Total	[illegible]

Summary.

	Cost New.
Equipment as above	$79.72
Labor on equipment	[illegible]
Total	[illegible]



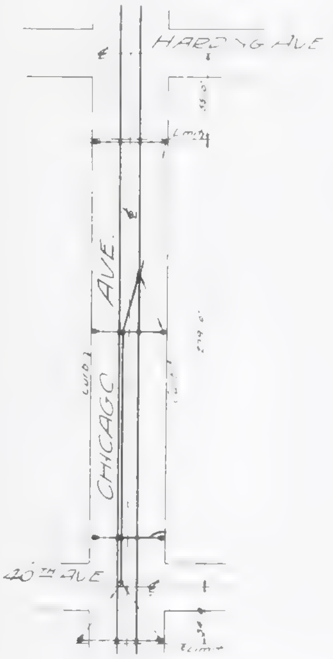
LAYOUT NO. 79.

Equipment.

Material.	Cost.
6 Pole bands (solid 2-bolt)	$ 1.50
6 Brooklyns (medium malleable iron)	3.60
10 Wood strains, 1¼x9½ in.	1.50
11 Double curve hangers	4.95
5 Single curve hangers	2.00
16 Ears, 12 in. clinch	4.00
2 Rings, iron, ½ in. x 4 in.	0.10
401 Ft. 5/16 in. stranded wire	3.21
	$20.86
Incidentals and waste at 5%	$ 1.04
Total	$21.90

Summary.

Quantity.	Kind.	Size.	Cost. New.
In place:			
3 Poles	Iron	6-7-8-30′	$103.26
2 Poles	Iron	5-6-7-30′	60.34
Equipment as above			21.90
Labor on equipment			30.00
Total			$215.50



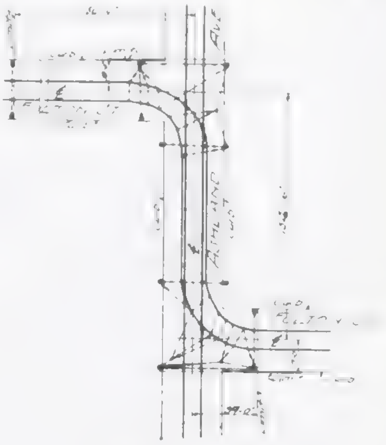
LAYOUT NO. 80.

Equipment.

Material.	Cost.
9 Pole bands (solid 2-bolt)	[illegible]
12 Brooklyns (medium, malleable iron)	7.20
14 Wood strains, 1¼ in. x 9½ in.	2.10
5 Straight line hangers	2.00
2 Double curve hangers	0.90
1 Feeder hanger W. E. [illegible]	0.35
7 Ears, 12-in. clinch	1.75
1 Ear, 15-in. splicing	0.50
2 Solid feed hanger ears	0.90
1 Trolley frog	3.40
29 Ft. 2/0 W. P. wire	[illegible]
[illegible] Ft. 5/16-in. stranded wire	[illegible]
124 Ft. ¼-in. stranded wire	0.81
	$28.45
Incidentals and waste at 5%	$ 1.42
Total	$29.87

Summary.

Quantity.	Kind.	Size.	Cost. New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 70.50
6 Poles	Iron	5-6-7-30′	186.00
Equipment as above			29.87
Labor on equipment			[illegible]
Total			[illegible]



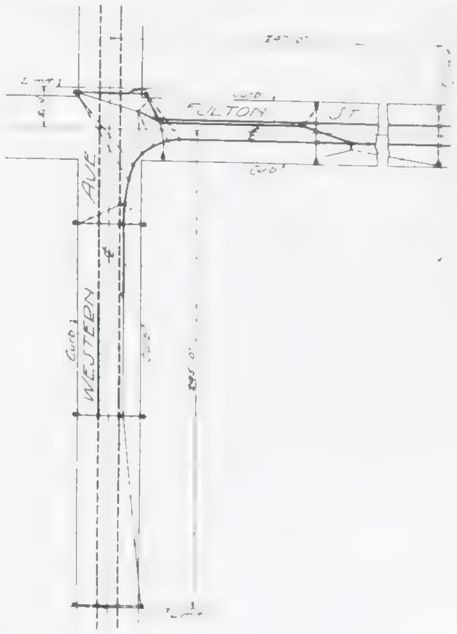
LAYOUT NO. 81.

Equipment.

Material.	Cost.
18 Pole bands (solid 2-bolt)	$ 4.50
18 Brooklyns (medium malleable iron)	10.80
23 Wood strains, 1¼ in. x 9½ in.	3.45
1 Globe strain, 2½ in.	0.25
19 Straight line hangers, W. E. type A	7.60
11 Single curve hangers	4.40
14 Double curve hangers	6.30
38 Ears, 12 in. clinch	9.50
17 Ears, 15 in. splicing	7.65
2 Solid crossovers	6.80
2 Four-way frogs	10.00
4 Iron rings, ½ in x 4 in.	0.20
	$71.45
Incidentals and waste at 5%	$ 3.57
Total	$75.02

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	6-7-8-30′	$103.26
7 Poles	Iron	5-6-7-30′	211.19
Equipment as above			75.02
Labor on equipment			60.00
Total			$449.47



LAYOUT NO. 82.

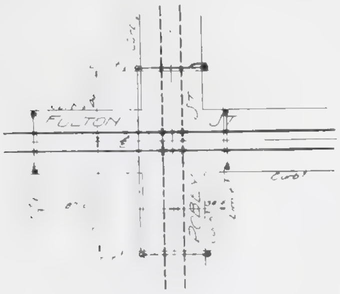
Equipment.

Material.	Cost.
16 Pole bands (solid 2-bolt)	$ 4.00
12 Brooklyns (medium, malleable iron)	10.80
22 Wood strains, 1¼ in. x 9½ in.	[illegible]
1 Terminal insulator (swivel)	0.15
13 Straight line hangers, W. E. type A	5.20
6 Single curve hangers	2.40
3 Double curve hangers	1.35
17 Ears, 12 in. clinch	4.25
2 Solid feeder hanger ears	0.90
8 Ears, 15 in. splicing	3.60
1 Splicing sleeve, 10 in.	0.40
1 Trolley frog	[illegible]
348 Ft. 5/16 in. stranded wire	2.78
119 Ft. ¼ in. stranded wire	[illegible]
203 Ft. 3/8 in. stranded wire	2.03
39 Ft. ½ in. stranded wire	0.64
246 Ft. No. 8 solid iron wire	0.44
30 Ft. [illegible] W. P. wire	[illegible]
	$52.40

Incidentals and waste at 5%	$ 2.62
Total	$55.02

Summary.

Quantity.	Kind.	Size.	Cost. New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
9 Poles	Iron	5-6-7-30′	271.53
Equipment as above			55.02
Labor on equipment			27.50
Total			$422.89



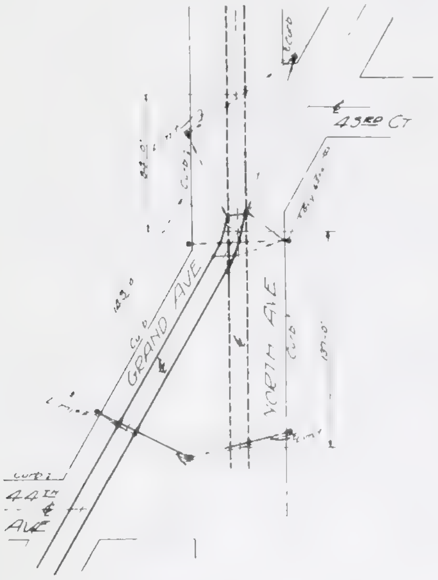
LAYOUT NO. 83.

Equipment.

Material.	Cost.
2 Pole bands (solid 2-bolt)	$ 0.50
2 Brooklyns (medium, malleable iron)	1.20
2 Wood strains, 1¼ in. x 9½ in	0.30
2 Straight line hangers, W. E. type A	0.80
10 Splicing ears, 15 in	4.50
1 Splicing sleeve, 10 in	0.40
4 Insulated crossings (Philadelphia type)	34.40
110 Ft. 5/16 in. stranded wire	0.88
	$42.98
Incidentals and waste at 5%	$ 2.15
Total	$45.13

Summary.

	Cost New.
Equipment as above	$45.13
Labor on equipment	7.50
Total	$52.63



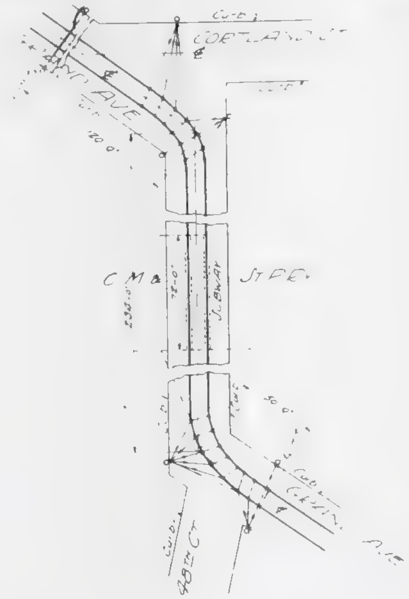
LAYOUT NO. 84.

Equipment.

Material.	Cost.
12 Pole bands (solid 2-bolt)	$ 3.00
11 Brooklyns (medium, malleable iron)	6.60
17 Wood strains, 9½ in. x 1¼ in	2.55
6 Straight line hangers	2.40
1 Single curve hanger	0.40
2 Double curve hangers	0.90
5 Ears, 12-in. clinch	1.25
2 Ears, 15-in. splicing	1.00
2 Ears, solid feeder	0.90
2 Trolley frogs	6.80
1 Solid crossover	3.40
2 Section insulators (Phila. type)	9.00
268 Ft. wire, ¼-in. stranded	1.74
169 Ft. wire, 5/16-in. stranded	1.35
65 Ft. wire, 3/8-in. stranded	0.65
85 Ft. wire, 2/0-in. W. P	6.55
	$48.49
Incidentals and waste at 5%	$ 2.42
Total	$50.91

Summary.

Quantity.	Kind.	Size.	Cost. New.
In place:			
5 Poles	Iron	6-7-8-30′	$172.10
2 Poles	Iron	5-6-7-30′	60.34
1 Stub	Wood	15 in.-12′	10.15
Equipment as above			50.91
Labor on equipment			15.00
Total			$308.50



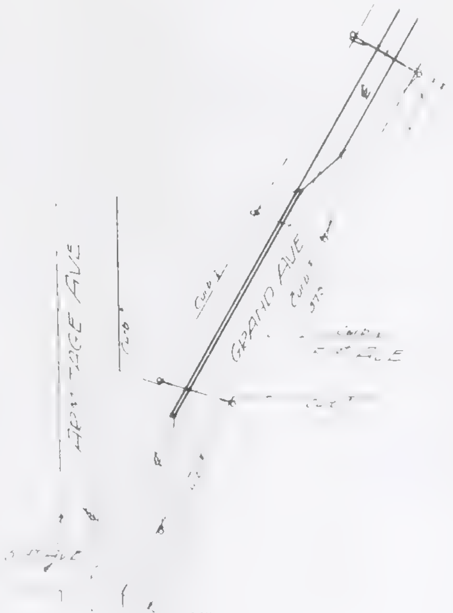
LAYOUT NO. 85.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable iron)	4.80
21 Wood strains, 9½ in. x 1¼ in	3.15
4 Straight line hangers	1.60
12 Single curve hangers	4.80
2 Double curve hangers	0.90
28 Ears, 12-in. clinch	7.00
1 Ear, 15 in. splicing	0.50
2 Ears, solid feeder	0.90
144 Ft. wood trough	57.60
144 Ft. trolley, Tee, 2½x1½ in	12.96
682 Ft. wire, ¼ in. stranded	4.43
135 Ft. wire, 5/16 in. stranded	1.08
10 Ft. wire, 2/0 W. P	0.77
	$102.49
Incidentals and waste at 5%	$ 5.12
Total	$107.61

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
6 Poles	Iron	5-6-7-30′	181.02
Equipment as above			107.61
Labor on equipment			30.00
Total			$387.47



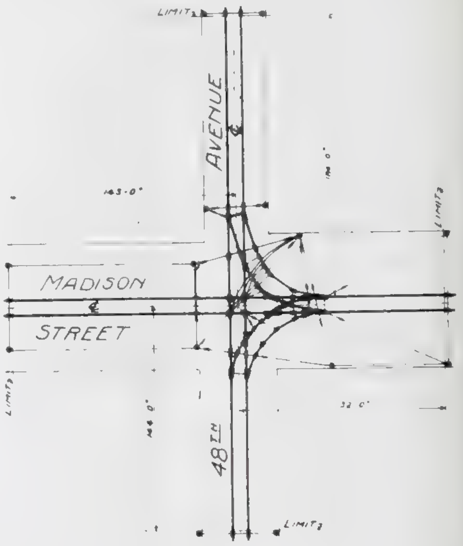
LAYOUT NO. 86.

Equipment.

Material.	Cost.
8 Pole bands (solid 2-bolt)	$ 2.00
8 Brooklyns (medium, malleable iron)	4.80
12 Wood strains, 9½ in. x 1¼ in	1.80
2 Terminal insulators (swivel)	0.90
4 Straight line hangers	1.60
2 Single curve hangers	0.80
2 Double curve hangers	0.90
7 Ears, 12 in. clinch	1.75
2 Ears, solid feeder	0.90
157 Ft. wire, ¼ in. stranded	1.02
271 Ft. wire, 5/16 in. stranded	2.17
36 Ft. wire, 2/0 W. P	2.77
	$21.41
Incidentals and waste at 5%	$ 1.07
Total	$22.48

Summary

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	6-7-8-30′	$ 68.84
6 Poles	Iron	5-6-7-30′	181.02
Equipment as above			22.48
Labor on equipment			5.00
Total			$277.34



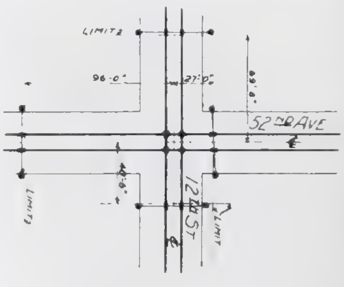
LAYOUT NO. 87.

Equipment.

Material.	Cost.
1 Brooklyn (medium, malleable iron)	$ 0.25
4 Globe strains	1.00
22 Wood strains, 1¼x9½ in	3.30
12 Straight line hangers	4.80
8 Single curve hangers	3.20
8 Double curve hangers	3.60
25 Ears, 12 in. clinch	6.25
5 Ears, 15 in. splice	2.50
2 Solid feeder hanger ears	0.90
6 Eyebolts	0.30
6 Eyebolts, insulated	0.96
8 Trolley frogs	27.20
9 Solid crossovers	30.60
440 Ft. ⅜ in. guy wire	4.40
700 Ft. 5/16 in. guy wire	5.60
30 Ft. 4/0 feeder tap	0.35
150 Ft. No. 14 W. P. wire	0.27
1 Lamp bank (5 lamps)	2.50
1 Snap switch	0.50
	$ 98.48
Incidentals and waste at 5%	$ 4.92
Total	$103.40

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
6 Poles	Wood	7″ top-30′	$ 51.00
Equipment as above			103.40
Labor on equipment			65.00
Total			$219.40



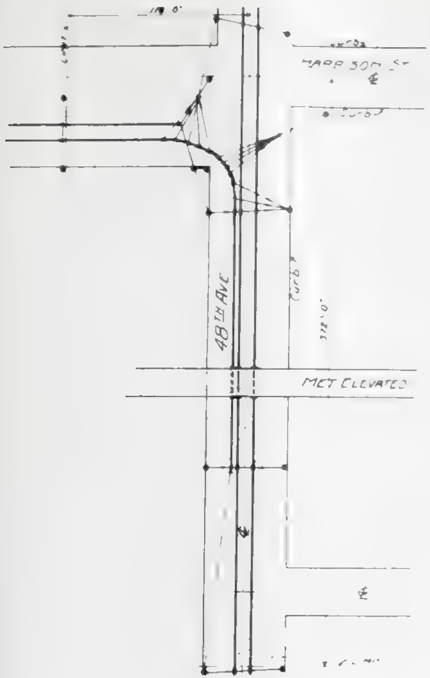
LAYOUT NO. 93.

Equipment.

Material.	Cost.
4 Insulated crossovers (Philadelphia)	$34.40
Incidentals and waste, at 5%	1.72
Total	$36.12

Summary.

Quantity.	Cost New.
Equipment as above	$36.12
Labor on equipment	5.00
Total	$41.12



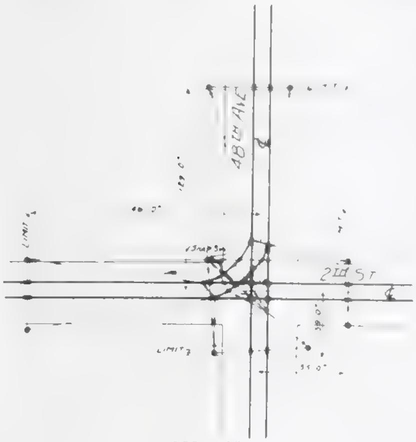
LAYOUT NO. 89.

Equipment.

Material.	Cost.
3 Brooklyns (medium, malleable iron)	$ 1.80
16 Wood strains, 1¼x9½ in.	2.40
5 Insulated eyebolts	0.80
5 Eyebolts	0.25
6 Straight line hangers	2.40
10 Single curve hangers	4.00
1 Double curve hanger	0.45
12 Barn hangers	4.80
27 Ears, 12 in. clinch	6.75
5 Ears, 15 in. splice	2.50
152 Ft. lumber (B. M.)	6.08
6 C. I. trolley trough clamps	6.00
280 Ft. ⅜ in. guy wire stranded	2.80
525 Ft. 5/16 in. guy wire stranded	4.20
3 Iron rings, 3x¾ in.	0.15
	$45.38
Incidentals and waste at 5%	$ 2.27
Total	$47.65

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
9 Poles	Wood	[illegible] top-30′	$ [illegible]
Equipment as above			47.65
Labor on equipment			[illegible]
Total			$[illegible]



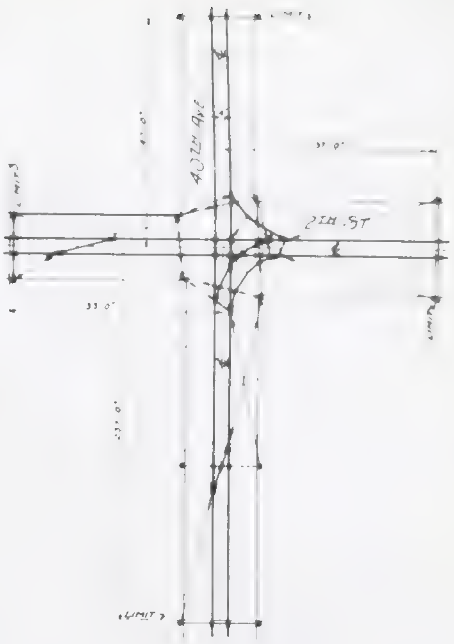
LAYOUT NO. 91.

Equipment.

Material.	Cost.
2 Brooklyns (medium, malleable iron)	$ 1.20
19 Wood strains (1¼ in. x 9½ in.)	2.85
5 Insulated eyebolts	.40
2 Eyebolts	.10
6 Straight line hangers	2.40
2 Single curve hangers	.80
4 Double curve hangers	1.80
11 Ears, 12-in. clinch	2.75
13 Ears, 15-in. splice	6.50
4 Trolley frogs	13.60
1 Solid crossover	3.40
5 Insulated crossovers (Philadelphia)	43.00
1 Lamp bank (5 lamps)	2.50
235 Ft. ⅜-in. guy wire (stranded)	2.25
800 Ft. 5-16 in. guy wire (stranded)	6.40
120 Ft. No. 14 W. P. wire	.22
1 Snap switch	.50
1 Iron ring, 3 in. x ¾ in.	.05
	$90.82
Incidentals and waste, at 5%	$ 4.54
Total	$95.36

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Wood	7″ top-30′	$ 34.00
Equipment as above			95.36
Labor on equipment			37.50
Total			$166.86



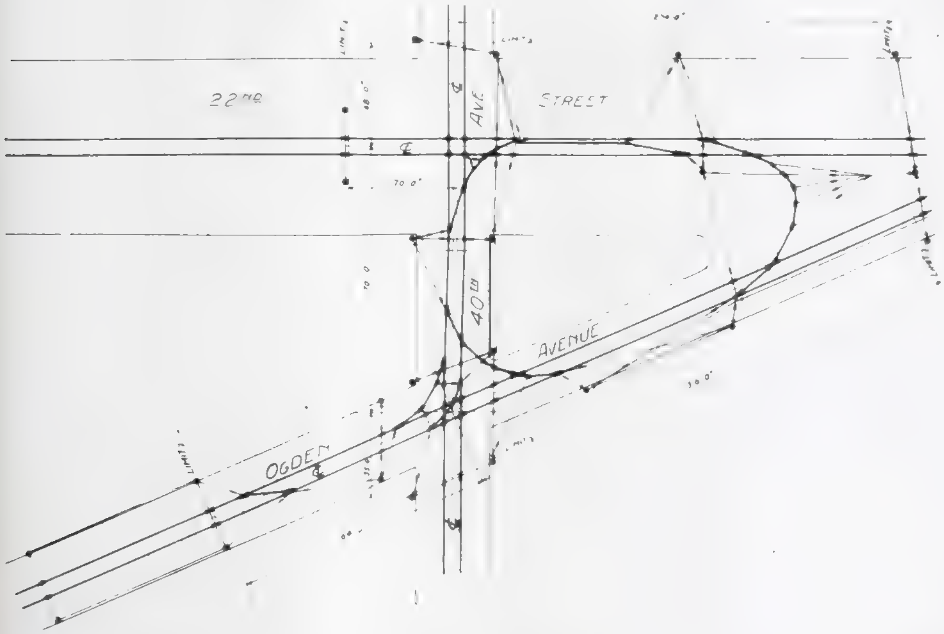
LAYOUT NO. 92.

Equipment.

Material.	Cost.
14 Pole bands (solid, 2-bolt)	$ 3.50
14 Brooklyns (malleable iron, medium)	8.40
32 Wood strains, 1¼x9½ in.)	4.80
2 Globe strains	0.50
2 Insulated eyebolts	0.32
11 Straight line hangers	4.40
5 Single curve hangers	2.00
5 Double curve hangers	2.25
17 Ears, 12-in. clinch	4.25
4 Ears, 15-in. splice	2.00
8 Trolley frogs	27.20
6 Solid crossovers	20.40
5 Section insulators (Philadelphia)	22.50
2 Insulated trolley frogs	9.00
450 Ft. ⅜-in. guy wire (stranded)	4.50
1,225 Ft. 5/16-in. guy wire (stranded)	9.80
	$125.82
Incidentals and waste, at 5%.	$ 6.29
Total	$132.11

Summary.

Quantity.	Kind.	Size	New.
In place:			
2 Poles	Wood	7″ top-30′	$ 17.00
6 Poles	Wood	5-6-7-30′	153.30
Equipment as above			132.11
Labor on equipment			52.50
Total			$354.91



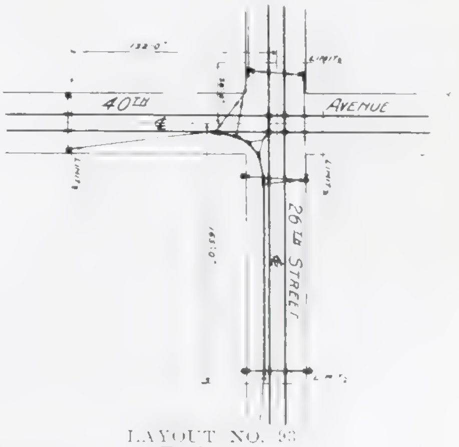
LAYOUT NO. 90.

Equipment.

Material.	Cost.
23 Pole bands (solid, 2-bolt)	$ 5.75
24 Brooklyns (medium, malleable iron)	14.40
52 Wood strains (1¼x9½ in.)	7.80
1 Globe strain	0.25
3 Insulated eyebolts	0.48
19 Straight line hangers	7.60
11 Single curve hangers	4.40
3 Double curve hangers	1.35
31 Ears, 12-in. clinch	7.75
12 Ears, 15-in. splice	6.00
13 Trolley frogs	44.20
16 Adjustable crossovers	72.00
2 Section insulators (Philadelphia)	9.60
1 Terminal insulator (swivel)	0.45
240 Ft. ½-in. guy wire (stranded)	3.36
115 Ft. ⅜-in. guy wire (stranded)	1.15
2,225 Ft. 5/16-in. guy wire (stranded)	17.80
	$204.34
Incidentals and waste, 5%	10.22
Total	$214.56

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Wood	7″-30′	$ 17.00
10 Poles	Iron	5-6-7-30′	255.50
Equipment as above			214.56
Labor on equipment			102.50
Total			$589.56



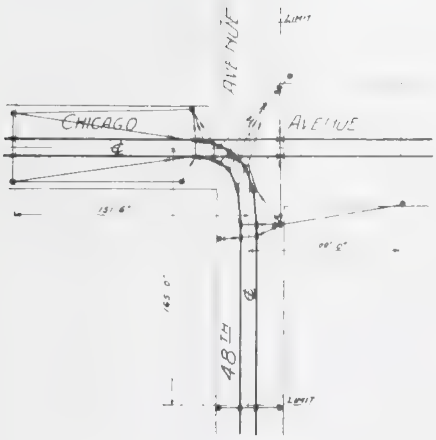
LAYOUT NO. 93.

Equipment.

Material.	Cost.
9 Pole bands (solid, 2-bolt)	$ 2.25
11 Brooklyns (medium, malleable iron)	6.60
15 Wood strains (1¼x9½ in.)	2.25
1 Eyebolt	0.05
11 Straight line hangers	
4 Single curve hangers	
15 Ears, 12-in. clinch	
1 Trolley frog	3.40
4 Adjustable insulated crossovers (Philadelphia)	
600 Ft. 5/16-in. guy wire (stranded)	
	$63.50
Incidentals and waste, at	3.18
Total	$66.68

Summary.

Quantity.	Kind	Size.	Cost New.
In place			
6 Poles	Iron	-6-7-30′	$153.30
Equipment as above			66.68
Labor on equipment			27.50
Total			$247.48



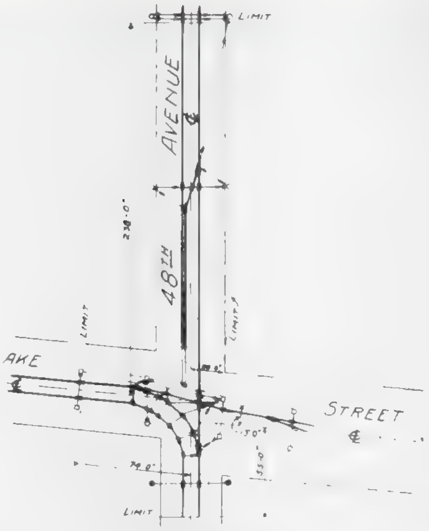
LAYOUT NO. 94.

Equipment.

Material.	Cost.
7 Pole bands (solid, 2-bolt)	$ 1.75
7 Brooklyns (medium, malleable iron)	4.20
17 Wood strains (1¼x9½ in.)	2.55
1 Straight line hanger	0.40
8 Single curve hangers	3.20
8 Double curve hangers	3.60
17 Ears, 12-in. clinch	4.25
2 Trolley frogs	6.80
1 Solid cross-over	3.40
2 Section insulators (Philadelphia)	9.00
35 Ft. guy wire ½ in. stranded	0.58
230 Ft. guy wire ⅜-in. strandeu	2.30
795 Ft. guy wire 5/16-in. stranded	6.36
	$48.39
Incidentals and waste, at 5%	2.42
Total	$50.81

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	5-6-7-30'	$ 76.65
2 Poles	Wood	8" top-35'	23.00
1 Stub	Wood	10'	3.80
Equipment as above			50.81
Labor on equipment			27.50
Total			$181.76



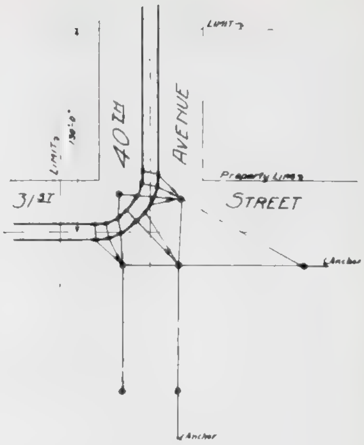
LAYOUT NO. 96.

Equipment.

Material.	Cost.
3 Pole bands (solid, 2-bolt)	$ 0.75
15 Brooklyns (medium, malleable iron)	9.00
17 Wood strains (1¼x9½ in.)	2.55
5 Straight line hangers	2.00
8 Single curve hangers	3.20
5 Double curve hangers	2.25
3 Solid feeder hanger ears	1.35
14 Ears, 12-in. clinch	3.50
4 Splice ears, 15 in.	2.00
1 Solid cross-over	3.40
3 Trolley frogs	10.20
1 Section insulator (Philadelphia)	4.50
2 Insulated eyebolts	0.32
11 Clamp hooks, W. I.	1.10
560 Ft. 5/16-in. guy wire stranded	4.48
28 Ft. 2/0 W. P. wire	2.16
	$52.76
Incidentals and waste at 5%	2.64
Total	$55.40

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
2 Poles	Iron	4-5-6-30'	$ 43.26
1 Pole	Wood	7 in.-30'	8.50
1 Pole	Wood	7 in.-35'	10.15
Equipment as above			55.40
Labor on equipment			32.50
Total			$149.81



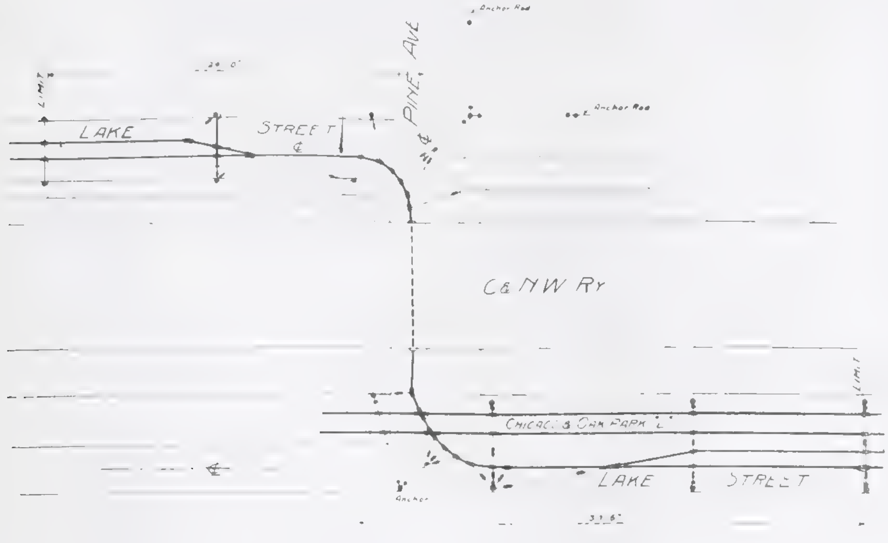
LAYOUT NO. 97.

Equipment.

Material.	Cost.
9 Wood strains (1¼x9½)	$ 1.35
1 Insulated eyebolt	0.16
3 Eyebolts	0.15
2 Straight line hangers	0.80
7 Single curve hangers	2.80
4 Double curve hangers	1.80
14 Ears, 12-in. clinch	3.50
3 Ears, 15-in. splice	1.50
2 Anchors	20.00
20 Ft. 1½-in. W. I. pipe	1.00
430 Ft. ⅜-in. guy wire (stranded)	4.30
475 Ft. 5/16-in. guy wire (stranded)	3.80
	$41.16
Incidentals and waste, at 5%	2.05
Total	$43.21

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
4 Poles	Wood	7"-30'	$ 34.00
2 Poles	Wood Stub	7"-20'	7.60
Equipment as above			43.21
Labor on equipment			25.00
Total			$109.81



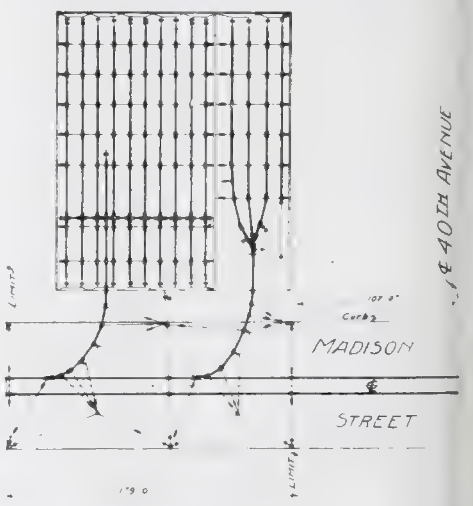
LAYOUT NO. 9[illegible]

Equipment.

Material.	Cost.
10 Pole bands (solid, 2-bolt)	$ 2.50
13 Brooklyns (medium, malleable iron)	7.80
21 Wood strains (1¼x9½ in.)	3.15
8 Straight line hangers	3.20
19 Barn hangers	7.60
9 Single curve hangers	3.60
3 Double curve hangers	1.35
2 Solid feeder hanger ears	0.90
34 Ears, 12-in. clinch	8.50
8 Splice ears, 15 in.	4.00
2 Trolley frogs	6.80
2 Insulated cross-overs (Philadelphia)	17.20
7 Insulsated eyebolts	1.12
2 1¼ in. guy rod and anchor	[illegible]
2 4x¾-in. rings, W. I.	0.10
1 Heavy 10x1¼-in. ring	[illegible]
2 Anchors, 1-in. rod	20.00
160 Ft. lumber, B. M.	6.40
800 Ft. 5/16-in. guy wire	6.40
120 Ft. ⅜-in. guy wire	1.20
130 Ft. ½-in. guy wire	2.14
	$134.46
Incidentals and waste at 5%	6.72
Total	141.18

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
6 Poles	Iron	[illegible]	[illegible]
4 Poles	Wood	[illegible]	[illegible]
1 Pole	Wood	[illegible]	[illegible]
[illegible]	Wood	[illegible]	[illegible]
Equipment as above			141.18
Labor on equipment			[illegible]
Total			[illegible]



LAYOUT NO. 98.

Equipment.

Material.	Cost.
9 Pole bands (solid, 2-bolt)	$ 2.25
51 Brooklyns (medium, malleable iron)	30.60
57 Wood strains (1¼x9½ in.)	8.55
2 Globe strains	0.50
1 Insulated eyebolt	0.16
22 Eyebolts	1.10
88 Straight line hangers	35.20
12 Single curve hangers	4.80
1 Double curve hanger	0.45
7 Barn hangers	2.80
17 Solid feeder hanger ears	7.65
96 Ears, 12-in. clinch	24.00
18 Splicing ears, 15 in.	9.00
4 Trolley frogs	13.60
10 Solid cross-overs	34.00
3 Turnbuckles, 12 in.	0.90
4 W. I. rings, 3 in. x ¾ in.	0.20
2,070 Ft. 5/16-in. guy wire stranded	16.56
300 Ft. ½-in. guy wire stranded	4.95
150 2/0 W. P. wire	11.55
	$208.82
Incidentals and waste at 5%	10.44
Total	$219.26

Summary.

Quantity.	Kind.	Size.	Cost New.
In place:			
3 Poles	Iron	5-6-7-30'	$ 76.65
2 Poles	Iron	6-7-8-30'	59.60
Equipment as above			219.26
Labor on equipment			145.00
Total			$500.51

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The past week has seen a notable picking up in the amount of large railroad construction contracts. In addition to the railroad work which is noted elsewhere on this page, the following contracts have been let recently: M. N. Sikes, Livingston, Ala., for constructing an extension of the Sumter & Choctaw R. R. from Edna to Robjohn, Ala.; John S Lamb, Thomasville, Ga., for constructing 1½ miles of line through the city of Valdosta, Ga., for the Georgia & Florida Ry.; the McCarthy Improvement Co., Davenport, Ia., for a 30,000 to 40,000 cu. yds. grading contract for an extension of the Tri-City Ry. Co.; the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., for the equipment for use in the Hoosac Tunnel, which is to be electrified by the Boston & Maine R. R.; the Canadian Construction Co., Quebec, Canada, for the construction of the proposed line of the Cleveland, Barberton, Coshocton & Zanesville Electric Ry. Co.; Winston Bros. Co., Minneapolis, Minn., for the grade work for the Pierre, Duluth & Black Hill Ry., a subsidiary company of the Minneapolis & St. Louis Ry.; J. N. Gillis & Son, Brewton, Ala., for a 5-mile spur track from Aquilla to Red Creek, Ala., for the Washington & Choctaw R. R.—The city of San Francisco is planning to start work soon on the reconstruction of the Geary st. municipal electric railway, and is now calling for bids until Nov. 16th for the necessary rails. The city will probably do the work with its own forces.—The contract for a large reinforced concrete viaduct over the Trinity River to connect the city of Dallas, Tex., with Oak Cliff, a suburb, has been let to Corrigan, Lee & Halpin, Kansas City, Mo., at $425,000. Another large bridge contract let recently was the one secured by the Mt. Vernon Bridge Co., Mt. Vernon, O., for constructing the 5th St. bridge at Zanesville. This contract amounts to $209,985.—The Kaw Valley Drainage Board, Kansas City, Kan., has readvertised the work of improving the Kaw River. The new bids will be received until Oct. 24th. This is a large piece of work and includes 662,800 cu. yds. of levee work, 5,975 lin. ft. of concrete wall, 118,800 sq. yds. of revetment, etc.—A large contract for dock work was let early this month at Boston, Mass. This contract called for the reconstruction of Pier No. 6, at South Boston, and was awarded to the Holbrook, Cabot & Rollins Corp., 6 Beacon St., Boston, Mass., at $760,000.—At the annual meeting of the stockholders of the Oregon Short Line R. R., on Oct. 12th, it was unanimously voted to increase the capital stock to $100,000,000.—At the annual meeting of the Norfoik & Western Ry., held on Oct. 13th, an increase of $50,000,000 in the common stock was voted, as well as authority for the creation and sale from time to time of convertible bonds to the aggregate of $50,000,000.—The National Railways of Mexico is preparing to begin construction at an early date on its proposed line between Tampico and Matamoros, near the mouth of the Rio Grande, where it will make connection with the Frisco system. The survey for this prospective road is practically finished, and plans are now in the hands of the Government for approval. The line will be about 300 miles long.—Announcement has been made that the Russian government is preparing to spend more than $67,000,000 in building an inland waterway to connect the Baltic Sea with the Caspian and Black Seas. There are two steps in the undertaking. The first is to join the River Drina with the Dnieper at Vitebsk and Orsha. The second is to connect the Drina with the Volga, using the Rivers Mesha, Obsha, Warusa, Moskva, and Oka. The total length of the route will be 1,525 miles.

The Civil Engineers.

A few weeks ago we commemorated in verse the achievements of the "Sand Hog"; before that we had given space to the halting efforts of the hobo poet, and now the civil engineer gets "his." The really excellent verses that follow are entitled "The Army of God-Knows-Where." They were written by Mr. Alfred Damon Runyon and were printed in the Bohemian Magazine.

No bands are playing gaily when they're going into action,
No crowds are cheering madly at their deeds of derring-do;
They are owing small allegiance to any flag or faction—
Their colors on the sky-line and their war cry, "Put it through!"

Ahead of bath and Bible and of late repeating rifle,
The flags can only follow to the starting of their trail;
They heard the leagues behind them, every mile the merest trifle;
They mark the paths of safety for the slower sail and rail.

Their standards kiss the breezes from the Arctic's cooling ices
To where the South Pole's poking out its undiscovered head;
You can see their chains a-snaking through the lands of rum and spices—
And East and West you'll always find their unrepining dead.

No time for love and laughter, with their rods upon their shoulders,
No time to think with vain regret of home or passing friends.
They are slipping down the chasms, charging up the mighty bowlders,
The compass stops from overwork; the pathway never ends.

They slit the gullet of the earth; disgorge its hoarded riches
(But life's too short for them to stop and snatch a rightful share);
They've a booking on the Congo putting in some water ditches;
A dating to take tea with death; they make it by a hair!

You will find their pickets watching in the unexpected places;
You will hear them talking freely of The-Things-That-Can't-Be-Done;
Oh, the Faith they speak so strongly and the Hope that's in their faces—
It lights the gloom of What's-the-Use as brightly as the sun!

No bands are playing gaily and no crowds are madly cheering;
No telegraph behind them tells their deeds of derring-do;
But forward goes the legion, never doubting, never fearing—
Their colors on the sky-line and their war cry, "Put it through!"

Something Doing.

Somebody said that the prospects for railroad construction work this fall were mighty slim. Look at it d[illegible] Oklahoma, said this pessimist, the railroad law in that state has put a crimp in the construction of new railroads; down in Texas the International & Great Northern decision has knocked out a lot of projected work; and now comes the freight rate case before the Interstate Commerce Commission and battle axe., about all the extensions the big railroads had laid out for this fall. Oh, no, said the pessimist, there won't be anything doing in railroad construction work this fall. But he was mistaken, as the following brief summary of the happenings of the past few days shows: The Lexington & Eastern Ry. Co., a subsidiary company of the Louisville & Nashville R. R., opened bids on Oct. 12 for the construction of 80 miles of road from Jackson, Ky. to Whitsburg, Ky. The work was divided into five sections of 16 miles each, and not more than two sections were to be awarded to one contractor. The Norfolk & Western R. R., on Oct. 17 awarded contracts for the construction of 15 miles of new track in the coal fields of West Virginia. The aggregate cost of this work is said to be about $1,500,000. The work was divided up among seven contractors. On Oct. 17 the Harriman, Knoxville & Eastern R. R. Co. opened bids for the construction of roadbed, masonry drains, etc., for 17½ miles of single track road extending from Harriman, Tenn., in a northeastern direction toward Knoxville. Announcement was made on Oct. 7 that the contract for the construction of the Fernley & Lassen R. R., had been let to Erickson & Peterson, San Francisco, Cal. This road is to be 100 miles long and is to extend from a connection with the Salt Lake Division of the Southern Pacific at a point between Wardsworth, Nev., and Fernley, Nev., 100 miles noth. Another large contract in the western part of the United States was for the construction of the 80-mile section of the Northwestern Pacific Ry., from Eureka to San Francisco. Information as to the successful contractors on this work is not available at this time, but it is pretty certain that the MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., and the Utah Construction Co., Ogden, Utah, got good slices of it.

Early Plans for New England Railroads.

Editors have always been active in the construction of new railroads—on paper. As early as 1827 they were working at their task, as is shown by a little pamphlet issued that year. This pamphlet is entitled "Remarks upon the Practicability and Expediency of Establishing a railroad on one or more routes from Boston to the Connecticut River." The pamphlet was written by the editor of the Boston Daily Advertiser, and in it he endeavors to figure the relative cost for the construction of a railroad as compared with the cost of building a canal over the same route from Boston to the Connecticut River. He estimates that the canal could be built for $3,000,000, while the railroad would cost about $12,000 per mile, or $1,059,000. A northern route had been surveyed for a canal by way of Fitchburg, Mass., and Aburnham, by which the distance was just 100 miles. The entire lockage of the canal, according to the survey, would have been 1,959 ft. This the editor of the Advertiser took to be the distance necessary to mount the elevations, and he reasoned that if the ascent and the descent of the railroad amounted to 1,959 ft., [illegible] was overcome by the gradual inclination of the road, no part exceeding 25 ft. per mile, there would still remain 759 ft. to be overcome by some auxiliary power. A committee of the House of Representatives of Massachusetts had also been considering the project, and in his pamphlet the editor states that the committee in its report to the House had suggested the expediency of forming the rails for this propos[illegible] slabs of granite laid upon a solid foundation with a bar of iron 2 ins. in width and ⅜ in. in thickness put on top of the granite for the wheels of the wagon to run upon. The cost of the granite was estimated at 12½ cts. the running foot, making the cost of stone and iron a mile for a single pair of rails $3,000, exclusive of the grading and embankment work. The editor gives some interesting figures to show that the cost of transportation by the railroad would be made less than by stage coach. At that time the stage coach runs from Boston to Springfield, Mass., were made with eight relays of horses, each relay covering a distance of about 12 miles. It required four horses to a relay to draw a coach containing six to ten passengers. To make this journey, the passenger had to be pent up in the coach from 2 o'clock in the morning on a most fatiguing road until 7 or 8 o'clock and often later at night. The cost of the journey for each passenger was $4.50 to $6.00. The editor figured it out that on the proposed railroad eight horses could take the place of 32, and that each horse would travel 12½ miles in an hour and a half, making the total time of travel from Boston to Springfield, allowing for stoppages, 13½ hours. He estimated that it would cost 35 cts. for each passenger for labor on the part of the horses. He then doubled the cost of transportation for a passenger "to cover expenses in case of going partially loaded, and also, to secure a profit for the proprietors," and added $1 to the charge for each passenger for toll, thus making the total fare $1.70, as compared with $4.50, which was the least rate for any passenger by any of the stage routes then in operation. The editor estimated that by the proposed railroad the expense of the labor of the horses would be reduced to one-fourth part of that required in traveling on the common roads, and that the load, while traveling at the same rate of speed, might be increased four fold. Another pamphlet on early New England railroads which has recently come to light gives the proceedings of a convention held at Windsor, Vt., in 1836, to take preliminary measures for a railroad through the valleys of the Connecticut and the Passumpsic River to the St. Lawrence. At this convention the committee on correspondence reported that the cost of a railroad from Hartford, Conn., to the Canadian line would be $1,995,000, or $7,000 a mile, for a double track. To convince the people of the advantages of a railroad their attention was drawn to the fact that there were 90 towns each six miles square, situated on both sides of the Connecticut River and the Passumpsic River, between Hartford and the Canadian frontier. These towns together contained 2,073,600 acres. It was figured that the railroad would raise their value 25 per cent, so that a farm worth $2,000 before the railroad was built would be worth $2,500 afterwards, an increase sufficient for paying for the cost of constructing the road.

Some of the arguments put forward for the building of the road were that the capitalists in the railroad company should have 6 per cent returns, that the inhabitants of the valley would use it in going to, and coming from the markets, and that a tour to the White Mountains would be sought for.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Surveys have been started for the proposed railroad of the Cahaba Valley route from Selma to Birmingham. The engineers are working from Selma to Centreville and from West Point to Blocton and into Bessemer and Birmingham. George Clark, Birmingham, Ala., is in charge of the surveys.

The Chattanooga Southern R. R. is reported to have made surveys for an extension to the plants of the Southern Iron & Steel Co., at Gladsden, Ala.

Atlantic Coast Line R. R. has placed an order for 15,000 tons of steel rails with the Tennessee Coal & Iron Co., and is planning to place a further order for 5,000 more tons.

The E. M. Gates Lumber Co. of Yellow Pine, Ala., owner of the Washington & Choctaw R. R., has awarded a contract to J. N. Gillis & Son of Brewton, Ala., for a spur track five miles long from Aquilla to Red Creek, Ala.

M. N. Sikes, Livingston, Ala., has been awarded a contract by the Sumter & Choctaw R. R., for an extension from Edna to Robjaton, Ala. Mr. Sikes could use two or three small outfits on the work.

California.

Bids will be received until Nov. 16, by the Board of Public Works, of San Francisco, Joseph L. McCormick, secretary of the Board, for contract No. 1 the furnishing and delivering steel rails for the reconstruction of the Geary Street Municipal Electric Ry. On Oct. 1 the status of the other plans as prepared by the Bureau of Engineering for work on the Geary Street railway were as follows: Contract No. 2—For furnishing and delivering tie bolts. Plans and specifications prepared. Contract No. 3—For furnishing and delivering rail bonds. Plans and specifications 85 per cent completed. Contract No. 4—For furnishing trolley and feed wires. Plans and specifications 60 per cent completed. Contract No. 5—For furnishing and delivering special track work. Plans and specifications 60 per cent completed. Marsden Manson is City Engineer of San Francisco, Cal.

Construction work is well along on the Butte & Plumas R. R., which the Truckee Lumber Co. is building from Oroville to its timber land and according to a statement of Chief Engineer Dunbar, at Oroville, tracklaying will be started by the end of the month. Some 300 men are now at work grading, and building culverts and trestles. The company will build and operate only 25 miles of the 50 miles of road this year. The other half will be built next summer.

The Tidewater & Southern R. R. Co. has filed its articles of incorporation and proposes the construction of an interurban line running from Stockton to Modesto and from there to Turlock, together with a branch line beginning near Atlanta and running to Ripon. John A. Mehling, J. A. Coley, K. C. Brueck, George E. Minges, George F. Chuler, Byron A. Pearce and T. J. Wisecarver are directors.

Engineers of the Los Angeles-Pacific Ry. have started work on the surveys for the proposed line from Hollywood to San Bernando Valley through Cahuenga Pass. The preliminary line, which is being run to estimate the cost, will pass through Cahuenga Pass to San Bernando Valley and Santa Barbara and on to the town of San Fernando. Actual work will be commenced as soon as the cost can be determined.

Grading on the right of way of the Sacramento & Sierra R. R., which will connect Sacramento with the timber belt of the Sierra Nevadas and run a branch line to Auburn is progressing. Crews are now busy in Placer County, Cal. and are working northward. It is stated that the grade has been completed to a point 4½ miles southeast of Loomis, Placer county.

The San Pedro, Los Angeles & Salt Lake R. R. Co. has awarded a contract to the Colorado Fuel & Iron Co., Pueblo, Colo., for furnishing 12,000 tons of standard 85-lb. rails for the new high line now under construction.

The Porterville Northeastern Ry. Co., which plans an 18½ mile line along the north bank of the Tule River from Porterville has completed surveys and has secured the capital for constructing a line. Construction contracts are to be let at once. C. S. Freeland, Porterville, Cal., is Chief Engineer and T. U. Nofziger, Porterville, Cal., is President.

The Northwestern Pacific R. R. has taken bids for the construction of 80 miles of line, closing the gap between Eureka and San Francisco. The road lies through a rough country and the estimated cost of the 80 miles of line is said to be about $8,000,000. The Utah Construction Co., Ogden, Utah, and MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., are believed to have been awarded the work.

Colorado.

The Atchison, Topeka & Santa Fe Ry. is planning to make a number of changes in its yards at Pueblo.

The La Junta Electric Co. has been purchased by John F. Vail, Pueblo, general manager of The Pueblo & Southern Traction & Lighting Co., and this is said to be the first step toward the construction of an electric railway down the valley from Pueblo to La Junta.

The Hecla Junction & Box Cano R. R. Co. has been organized with $100,000 capital to restore the Hecla branch of the Denver & Rio Grande and extend it to stone quarries and mines in Box Canon and a lease has been secured on the property for two years. The road which is narrow gage, was used 15 years ago for transporting ore from the Calumet iron mine but was washed out by a cloudburst and never restored. The headquarters of the new company are at Salida, Colo., and the incorporators are: David Heaton, J. H. Hunt, W. W. Roller and George Sullivan.

The Grand River, Meeker & Salt Lake R R. Co., recently incorporated with a capital stock of $10,000,000, proposes the construction of a railway, from a point on the Rio Grande and Colorado Midland lines, to the east of New Castle, in Garfield county to Meeker, in Rio Blanco County and thence along the White River to Salt Lake. It is reported here in Denver that grading work will be started this month and that the line into Meeker will be completed within a year. The capital for this portion of the line which will cost about $2,000,000, is said to have been secured, and all right of way obtained. The total length of the proposed road is 350 miles and surveys of the entire route have been made. The incorporators of the company are Alfred Muller, William D. Lippitt, William P. Simmington, Arthur Friedman and John T. McClure, all of Denver.

Georgia.

The St. Mary's & Kingsland R. R., L. Johnson president, St. Mary's, Ga., is to extend its line from Kingsland through Camden, Charlton, Pierce and Ware counties to Waycross, and thence through Ware, Clinch and Berrien to the point near Sparks or Adel on the Georgia, Southern & Florida Ry.

The Georgia & Florida Ry., W. A. Swallow, chief engineer, is reported to have taken over the Sparks and Western R. R., which is being constructed from Sparks, Ga., to Moultrie. Ga. It is said that the transfer will take place on December 15, 1910.

The Georgia & Florida Ry. has awarded a contract to John S. Lamb, Thomasville, Ga., for constructing 1½ miles of line through the city of Valdosta, Ga.

Idaho.

Construction work is progressing nicely on the contract recently awarded the Utah Construction Co., Ogden, Utah, mentioned in our issue of Oct. 5, for building the 10-mile branch of the Oregon Short Line from Montpelier, Idaho to Paris. Sub-contracts have been awarded Walton & Nelson and K. L. Molen, who already have camps established.

It is reported that the Chicago & Northwestern Ry. Co., is making arrangements whereby a line will be constructed from Lander, Wyo. to Pocatello, Idaho, where a connection will be made with the Oregon Short

Line, providing a passage [illegible] the southern part of Idaho, to Tidewater, eliminating the expense of constructing a line. Thousands of ties and tons of track material are being piled up along the Lander Line. It is believed that the road will build west from the Lander terminal into the Snake River valley, probably down the south fork of that river, and then south in the valley to Pocatelo, Ida.

Illinois.

The McCarthy Improvement Co., of Davenport, Ia., has been awarded the grading contract for the extension of the Tri-City Ry. Co., in Moline on 27th street, to a connection with the 4th avenue car line. The grading work will require the moving of 30,000 to 40,000 cu. yds. of dirt.

Preliminary surveys are reported underway for the extension of the recently completed Tampico-Hooppole line to New Bedford. According to present plans it is proposed to build from Tampico southeast to New Bedford and later to Manlius. The length of the extension would be about 10 or 12 miles, and the construction cost would be low. The J. J. Burns Construction Co., Isabella Bldg., Chicago, Ill., is interested.

The Rock Island Southern R. R., J. W. Walsh secretary, Davenport, Ia., is said to be planning to extend its lines in the early spring. It is reported that right of way is being purchased between Monmouth and Burlington to extend the line to the latter city as proposed. The road will run from Monmouth to Macomb, thence to Oquawka and across the Mississippi into Burlington. A bridge would be built across the river at Oquawka.

The Commercial Club of Elgin, John Newman president, is considering the question of connecting Elgin with the Illinois Central and the Elgin, Joliet & Eastern by means of the construction of a belt line. This would provide railroad connection between Joliet, Aurora and Elgin. The estimated cost is between $200,000 and $250,000.

The Chicago & Eastern Illinois R. R. has made surveys at Woodlawn for a switch track to be built into the yard of the Woodlawn Clay Co., near the main line.

The Pennsylvania R. R. Co. has purchased from the Western Electric Co. about five acres of land lying between its tracks in Stewart Ave., Chicago, to the river on the east and from Polk St. The land is to be used for an extension of the Pennsylvania freight terminals, it being the intention to occupy it immediately, the removal of the buildings at that place now being under way.

The Quincy Street Ry. Co. of Quincy, Ill., has filed its articles of incorporation with the County Recorder. The capital stock is given as $50,000. The directors are as follows: W. B. McKinley, H. E. Chubbuck, W. A. Martin, W. J. Achelpohl and W. H. Carnahan. Most of the above are connected with the Illinois Traction Systems.

Mike Conroy, Godfrey, Ill., has about 50,000 cu. yds. of good machine work and about 50,000 cu. yds. of good Wheeler work to let. The work is located between Godfrey and Jerseyville, Ill.

Iowa.

A proposition has been submitted to the town of Cumberland, Ia., by promoters, to construct a railroad from Atlantic to that place.

Surveyors of the Chicago, Rock Island & Pacific R. R. are running lines for the construction of the proposed road from Des Moines to Allerton, Ia. With no serious delay it is expected to have the line constructed within a few months into Chariton.

Advices from Sydney, Ia., state that the branch railway line from Sydney Junction to the I. C. R. station at Sydney, over which the S. & L. trains have running rights is to be laid with 80-lb steel. The stretch of road which is about ¾ miles long is to be thoroughly repaired, new ties, new rails and new ballast to be used in its reconstruction.

Kansas.

The City Commissioners, of Kansas City, Kan., have been petitioned to pass an ordinance providing for a cross-town car line on 13th street, south from Quindaro boulevard to Central avenue.

The State Railroad Board has authorized the Kansas City, Kaw Valley & Western Ry., which proposes to build an interurban line from Kansas City to Topeka via Bonner Springs and Lawrence, to issue $1,500,000 in stock and $2,500,000 in bonds to build the line. The company will absorb the Bonner Springs line, five miles in length, and the eight miles of grade already built. The stock issue is limited to $20,000 per mile and the bond issue, to $35,000 a mile. Bonds in the sum of $2,500 per mile can be issued upon the acquiring of the right of way; $15,000 when the roadbed is graded and bridges built, $10,000 when the tracks are completed; $4,000 when the overhead work is completed, and $3,500 when the entire line is completed and in operation. J. W. Freeborn of Kansas City is president.

Wheeler & Keleher, Garden City, Kan., have about 250,000 cu. yds. of earth work—grader work, fresno work and wheeler work with slight haul—in eastern Kansas to let.

It is expected that the Atchison Railway, Light & Power Co., of Atchison, Kan., will put engineers in the field this fall to make surveys for its projected interurban system. A part of a $75,000 bond issue which the company has received authority to issue will be used for the interurban line.

The Board of Directors of the Wichita, McPherson & Gulf Ry., at a recent meeting in Wichita, Kan., authorized C. H. Brooks, to make an application to the State Charter Board for bonds and stock to be issued for the road. As proposed the line will be built from Wichita to Arkansas City, and thence to McPherson or Solomon City, connecting with the Union Pacific.

Special election is to be held Nov. 8, at Santa Fe, Kan., to vote on issuing bonds amounting to $2,000 per mile for the construction of the proposed line of the Garden City, Gulf & Northern R. R. E. A. Tennis, Garden City, Kan., is general manager.

Kentucky.

The necessary amount has been raised for making the surveys and securing the right of way for the proposed new railroad from Somerset to Corbin, Ky. The Somerset, Corbin & Cumberland Construction Co., of Somerset, Ky., has been organized to make the surveys. J. W. Rose, Somerset, Ky., is interested.

Mason & Hanger Co. have 16 miles of good cart and car and scraper work to let at Jackson, Ky. Contractors wanting work should apply to S. B. Mason, Jackson, Ky. This work is on the Louisville & Nashville extension noted in Oct. 5 and Oct. 12 issues.

Louisiana.

The Bogalusa Public Service Co., of Bogalusa, La., has been incorporated with a capital stock of $500,000, and proposes to build and operate electric railways in and around Bogalusa. The incorporators include: C. W. Goodyear, Jr., J. K. Breeden and C. J. Wade.

Advices from Lake Arthur, La., state that the Lake Arthur & Jennings Northern Ry., is pushing work on the bed between the two cities and grading at the same time. The management believes that within the next 60 days there will be trains operating between Lake Arthur and Elton, a distance of 36 miles.

Maryland.

Surveys are to be started shortly for the projected electric railway from Salisbury, Md., to Nanticoke Point. The necessary capital for beginning work on the road is reported to have been assured by foreign capitalists, but it is said that the road will be operated under a charter granted sometime ago to Salisbury parties. The Industrial Engineering Co., Drexel Bldg., Philadelphia, Pa., is the engineer.

Massachusetts.

The Boston Elevated Ry., Geo. A. Kimball, chief engineer, Boston, Mass., has filed plans with the State Railroad Commission for the remodeling of the Sullivan Sq. elevated station at Boston. The changes are made necessary by the proposed extension of the elevated structure to Malden and to accommodate the eight-car trains which are to be run through the tunnel.

The Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., has been awarded the contract for the equipment for use in the Hoosac Tunnel which is to be electrified by the Boston & Maine R. R. The tunnel is 1¾ miles long, exclusive of approaches. The total length of the electrification work is 7 miles.

The Berkshire Street Ry. Co., Pittsfield, Mass., has petitioned the State Railroad Commission for appoval of the extension of its line from Great Barrington through Sheffield to Ashley Falls, on the Connecticut State line. The company has secured the location from the select-men of Sheffield. The line at present extends to Great Barrington. This extension is in accordance with the terms on which the New York, New Haven & Hartford R. R. was permitted by the Legislature to purchase the Berkshire trolley lines.

The Hampden R. R. Co., mentioned in our last issue, is going ahead with its plans for its proposed 30-mile line. The company has petitioned the City Councils of Springfield and Holyoke for hearings on its proposed route in these places. The company is said to be planning to have construction work started this fall if right of way matters can be settled. Ralph D. Gillett, Westfield, Mass., is president.

A considerable part of the $10,000,000 recently voted by the directors of the Boston & Maine R. R., J. P. Snow, chief engineer, Boston, Mass., will be used in relaying a large part of the system with new rails. The electrification of service through the Hoosac Tunnel will also call for a large expenditure. Among the other improvements to be made are the following: Bridges on the line of the western section, from Fitchburg to Greenfield, are to be strengthened to accommodate the new and heavier engines, and the part of the programme previously laid out for the strengthening of the bridges of the east section from Greenfield will be carried out. An appropriation of $200,000 has already been made for thus purpose. On the nothern part of the White Mountain division from Woodsville to Fabyans, repairs on bridges will be made. Twenty-five miles of track, making a double track, are to be laid between Ayer and Nashua on the line of the Worcester, Nashua and Portland division, to accommodate the Bar Harbor, Portland and New York traffic. Extensive repairs are also to be made on the Saugus river bridge, and it is also planned to change the location of the trackage at Portsmouth, N. H., and the bridge over the Piscataqua river, on account of the bad curve in the present tracks and the river current. The appropriation provides for the enlargement and centralization of the railroad yards at Fitchburg, a new station at Canterbury, and a general increase of the trackage facilities in the freight yards along all of the lines. These will include larger freight yards at Lynn, North Lexington, Peabody and Berlin, with added tracks. The freight houses at Berlin and Peabody also will be enlarged.

The State Board of Railroad Commissioners has been holding a hearing on the plans for locating the proposed Boston & Providence interurban electric railroad through the town of Hyde Park. The hearing was continued until Oct. 28.

Michigan.

The Michigan Central R. R., G. H. Webb, Chief Engineer, Detroit, Mich., is said to be planning to extend its D. & C. branch from East Jordan to Charlevoix.

Minnesota.

The Duluth, Winnipeg & Pacific Ry. Co. will it is said begin laying rails on the Virginia end of the line Oct. 20 and work will be rushed rapidly to completion. Chief engineer H. J. Hazen, Duluth, Minn., is reported to have [illegible] 2,000 [illegible]

[illegible] City Council of St. Paul [illegible] to give the Twin City Rapid Transit Co., Minneapolis, permission to build a line across Franklin avenue in Minneapolis, connecting in St. Paul with the Rondo-Maria line, which will be extended through Merriam Park to the river by way of St Anthony avenue. The construction of the line would be expensive as it would involve the construction of a new bridge and a considerable amount of filling

Duluth and the Ranges.

[illegible]

Thomas Walsh of the Johnson-Carey Co., who have the contract for the heavy rock work including the tunnel, on the Canadian Northern, near Duluth, was a caller and said that this work was progressing very nicely, and that they had already started on their large rock contract for the Canadian Northern Railway in Canada.

A. Read, the contractor, dropped in to see us, and reported he was quite busy at the present time on several concrete jobs on the Range.

A. F. Jenkins, president of the Milburn Co., New York, manufacturers of Milburn Lights, was a caller on us last week. He said that the demand for their product was very satisfactory.

J. P. Joel, representing the Vulcan Iron Works, manufacturers of locomotives, returned from a trip over the Range, and spent two days with us here. He then left for [illegible]

C. J. A. Morris of Morris & Shepard, general contractors, was a caller, and reported that their railroad work on the Great Northern Ry in North Dakota was shut down. At the present time they are engaged in building a concrete bridge at Minneapolis, for the Great Northern Railway Company.

C. E. Jameson, who is working on the Canadian Northern extension near Duluth, was a caller. His work is progressing nicely, but he could use a few more men

[illegible]

[illegible] Co., concrete contractors, are doing some concrete work for the Canadian Northern. [illegible]

J. D. O'Connell, the Duluth contractor who [illegible] the same At the present time he is engaged [illegible] and will complete them this fall

[illegible] Minn

[illegible]

Missouri.

[illegible]politan Street Ry. Co., of Kansas City, Mo., asking for a street car line to the Sugar Creek and Clay City districts. The petitioners ask for a loop line extending from Fairmount Park to Sugar Creek and on to Cement City, returning by way of Independence.

Grading work is well along on that portion of the line of the Hannibal & Northern Interurban R. R., between Palmyra and Bethel. Two new grading camps were recently estab- [illegible]

Louis Houch, Cape Girardeau, Mo., president of the Chester, Perryville & Ste. Genevieve Ry., an 85-mile steam line, is planning to build an extension to Hickman, Ky., via Charleston. Another extension to Pilot Knob, via Farmington, is also proposed.

The Metropolitan Street Ry. Co., of Kansas City, [illegible] extension of the Roanoke line from its present terminus, 39th street and State line, six blocks west to Marshall avenue, Rosedale. Permission to make this extension was granted by the Rosedale council several months ago.

Preparations are being made by the Missouri Kansas & Texas Ry. for the construction of the spur into the Union Depot from the Main line west of Chitwood, and it is expected by the officials to have the branch ready for operation by January. The spur is to be three miles long. Recently the contract was let to the Walsh Construction Co., of Davenport, Ia., for the grading. The M., K. and T. is doing the culvert work, the greater portion of which has been completed. Due to the numerous deep divides, the culverts are of frequent occurrence, some being of exceptionally large dimensions. As soon as the contracting company completes the grading, the M., K. and T. will begin immediately the construction of the track

The St. Joseph Railway, Light & Power Co., J. H. Van Brunt, General Manager, St. Joseph, Mo., is planning to begin work early in November on a new car line to the northwest part of the city.

St. Louis Items.

[illegible]

H. H. Marsh, of Engineering-Contract, surprised us last Friday afternoon with a visit. We are sorry that he had only a little while to stay, as we found Marsh one of the best entertainers we have met so far from Chicago, and hope his visits won't be so scarce in the future

The East St Louis Levee and Sanitary Commission approved the letting of the contract for the building of concrete conduits for the natural drainage north of the canal into the canal to the Cooper & Gates Bros. Co. of St Louis There was a full attendance of the Commissioners at the meeting. Colonel J A Ockerson is the consulting engineer for the commission

Mike Conroy, at Godfrey, Ill., still has some nice team work left on the Alton and Jerseyville Electric line This work is suitable for small outfits

The Board of Local Improvements of East St. Louis [illegible] a public hearing on Oct. [illegible] ement of 27th st., and five [illegible] pl., which will cost approxi- [illegible] Pl. are in Gray's subdivision of the district [illegible] and Carondelet Belt [illegible] the other work [illegible] and the [illegible] Improvements [illegible] the State St. un- [illegible] the boulevard, re- [illegible] Belleville, 14 miles. The estimated cost is $277,000. Although this ordinance was drafted and agreed to by the members of the Board of Local Improvements and was indorsed by Mayor Cook and Corporation Counsel Clarence E. Pope, the City Council, by a strict party vote, rejected it and sent it back.

W. C. Williams secured a nice team job from the List & Gifford Construction Co. the other day

W. M. List, of List & Gifford, came in from the south and left here for their new work at Joplin, Mo. List & Gifford have about 4,000 yds. of rock station work to let there. Address them care of Connor's Hotel.

After a controversy of several months the Board of Local Improvements of East St. Louis last week disposed of the matter of paving 38th St. by ordering that brick instead of creasote wood blocks, be used. City Engineer William J. Crocken's estimate of cost for the work using brick, was less than $17,000, while the cost of the wood blocks amounted to more than $22,000. After disposing of the matter the board passed a resolution announcing that all petitions henceforth must be filed before the matter up for consideration is settled. In other words, the board will not again reconsider a decision it has made.

The L. J. Smith Construction Co. have started ballasting several new branches of the Missouri Pacific R. R. in Kansas during the past week.

The Arkansas State Board of Railway Incorporators on Oct. 15th granted the Mena & Hot Springs R. R. Co. a charter and refused the Kansas City Southern a renewal of the charter to build over the same territory. The new company has an authorized capital of $800,000, of which amount $155,000 has been subscribed. The proposed line will be 77 miles long, through Polk, Montgomery and Garland counties, connecting with the Gurdon branch of the Iron Mountain and Rock Island at Hot Springs. George Legate, Eugene Cox, W. P. Parks, W. M. Pipkin, A. H. Scoggin, John Thompson of Mena are among the stockholders.

Labor still continues to be awfully scarce in this part of the country. Several of the railroads in Arkansas are putting on convicts on their extra gangs on account of the scarcity of both colored and white laborers. The Government is also short of labor on their river improvement work in the south. No trouble for all the laborers in the country to get work if they come to St. Louis or Memphis.

In the Oct. 5th issue we stated that John Elder, a farmer living at West Alton, Mo., had entered suit against the firm of Swift & Rust for the use of a road, also cutting a few willows on his farm. We find upon investigation that Elder was indebted to Rust & Swift and withdrew his suit, paying costs of same

Mississippi.

The Yazoo & Mississippi Valley R R (Illinois Central R. R.) has 34 miles of railroad embankment in the Tallahatchie District to be widened. The crown is to be made 18 ft. wide instead of 16 ft. as at present. The yardage per mile runs as low as 500 to as high as 4,500 per mile. This is between Tutwiler and Greenwood, Miss. The earth for widening this embankment is to be taken out of pits along the embankment and on the right of way, which right of way is 50 ft. wide on each side of the center line of the track. Earth is to be taken from pits so that they will drain at all points where it is possible to do so. The work is in charge of D. W. Thrower, Roadmaster, Illinois Central R. R., Memphis, Tenn

Montana.

The Billings Traction Co., of Billings, Mont., has filed its articles of incorporation. The company is incorporated with a capital stock of $100,000, the incorporators being C. J. Eddy, A. W. Paterson and J. A. Connolly. [illegible] Muskogee, Okla

Nebraska.

The Lincoln Traction Co., Lincoln, Neb., is said to have decided to postpone beginning surveys of the route for its proposed interurban line between Lincoln and Auburn until later in the season when the crops in the fields through which the route passes will have been harvested.

The Nebraska Transportation Co., C. W. Baker, manager Ramage Bldg., Omaha, has secured right of way to Fremont for a proposed electric line from Omaha. The company also plans a road to Norfolk, branching off from the other line at Elk City, twenty miles from Omaha.

Nevada.

G. M. Fraser, traffic manager of the Nevada Copper Belt R. R., Mason, Nev., is reported to have stated that steel sufficient for 10 miles of track has been ordered of the Pueblo, Colo. mills and track laying will be commenced immediately on its delivery.

Erickson & Peterson, San Francisco, Cal., are stated to have been awarded the contract for the construction of the Fernley & Lassen R. R. This road is to leave the Salt Lake Division of the Southern Pacific at a point between Wadsworth, Nev., and Fernley, Nev., and is to extend north to Oregon for a distance of 100 miles. The road will run through Washoe County, Nev., and Lassen County, Cal.

New York.

The citizens of Dunkirk have voted to grant a franchise to the Dunkirk, Allegheny Valley & Pittsburg R. R. (Lake Shore & Michigan Southern R. R.) to construct a track at grade over Lincoln ave., Railroad ave., Buckner, Lord, Hoyt, Nevins, and Townsend sts., and Roberts road, and extending northerly to the Nickel Plate Co.'s line.

The State Public Service Commission has granted the Union Ry. Co., 204 E. 128th st., New York City, a franchise for the 167th St. crosstown trolley line in The Bronx. The Board of Estimate, of New York City, previously had passed favorably on it. The new line will start at Westchester Ave. and pass through 167th St. to Simpson St. From there it will traverse 169th St., Franklin Ave., 168th St., Webster Ave., and then back to 167th St. again and thence to Jerome Ave., all in New York City.

At the annual meeting of the stockholders of the Champlain & Sanford R. R. Co., held last week at the office of the company, 13 North Pearl street, Albany, the old directors were re-elected as follows: Charles N. Hyatt, MacN. Miller, Guy D. Hills, Andrew Thompson, David A. Thompson, Lewis R. Parker, Sydney T. Jones, Edward Easton, Jr., Edward M. Griffiths.

Steps are being taken by the Merchants on lower State street, at Schenectady, to have the proposed railway terminal built at the foot of State street.

North Dakota.

Information recently received from Washburn, N. D., states that a party of surveyors are now running lines for the construction of the Northern Pacific extension from Turtle Lake to Berthold, which is said to have been under consideration for some time.

Ohio.

The Wabash R. R. is reported to be about to resume construction work on its line from Zanesville to Parkersburg. Henderson Bros., West Virginia contractors, are said to have an outfit at Sayre Station ready to begin work.

The Pennsylvania R. R. has recently resurveyed the route for a cutoff from Smith's Ferry to a point on the Fort Wayne, near Alliance, by which a heavy grade near New Kensington would be avoided. The route runs northwesterly from Smith's Ferry to New Kensington, through West Beaver Valley. It is designed for the expeditious movement of fast freight. A section was graded some years ago, but was halted in 1907 and never resumed. In order to aid the plan, the Pennsylvania purchased a short while ago the tunnel on the line of the Sandy & Beaver Canal between Smith's Ferry and Kensington. It is said that the tunnel will make it easy to run a cut between Dungannon and Hanoverton. The cutoff, if built, will form a part of the Cleveland & Pittsburg.

The A. & A. Short Line Ry. Co., of Alliance, O., which is projecting a line between Alliance and Akron, has filed notice of the increase of its capital stock from $10,000 to $800,000.

The City Ry. Co., of Dayton, O., at present operating 30 miles of line has applied to the County Commissioners for a franchise right to construct, maintain and operate a street railroad, partly within and partly without the city of Dayton. The application relates to the proposed extension of the Kammer Avenue line westwardly to Brooklyn Avenue in Westwood, thence northwest to Hoover avenue, with the right to turn into private property for the purpose of making a loop. The road is to consist of double tracks. E. D. Grimes, Dayton, is president of the City Ry. Co.

The Hocking Valley R. R., according to reports, intends to construct a direct physical connection with the Chesapeake & Ohio Ry. This result will be accomplished either by the extension of the present 18-mile Wellston & Jackson Belt branch of the Hocking Valley from Jackson to a point about six miles east of South Portsmouth, Ky., on the Chesapeake & Ohio, a distance of 30 miles, or by the use of trackage rights on the Cincinnati, Hamilton & Dayton for 20 miles from Wellston on this same branch of the Hocking Valley to Gallia and the construction from this point of 40 miles of road to the Chesapeake & Ohio at Huntington, W. Va. In both cases a bridge will have to be built over the Ohio river.

The Cleveland, Barberton, Coshocton & Zanesville Electric Ry. Co. is reported to have let a contract for constructing its proposed line to the Canadian Construction Co. of Quebec. It is said that a meeting of the directors of the road will be held at Cleveland, O., on Oct. 22, when final arrangements will be made for beginning construction work.

Construction work on the Fostoria & Fremont R. R. is well under way. Grading is practically completed; contracts for ties, poles and rails have been awarded and materials are being received. It is hoped to have the road in operation early in 1911. The road is 21.4 miles in length, beginning at Fostoria and passing through Amsden, Kan., Burgoon and Havens and terminating at Fremont, O. The construction of this line will connect the Lake Shore Electric R. R. with the Western Ohio Ry. system, making it possible to operate cars from Dayton, O., to Sandusky and Cleveland, O. Seventy pound steel will be used outside of municipalities. The line is a direct one, capable of very high speed. For the present the power will be furnished from the Fremont, O., plant of the Lake Shore Electric Ry. One substation will be erected at Burgoon, O. F. D. Carpenter, of Lima, O., is President, T. D. McDonel is Secretary-Treasurer, and John S. W. Riegle, Findlay, O., is Chief Engineer.

Oklahoma.

The Clinton & Oklahoma Western Ry. recently completed, between Clinton, Okla. and Butler, 40 miles, has finished surveys of the route of the proposed extension from the latter place to Shattuck. Col. C. C. Godman, Fort Smith, Ark., is president.

The Midland Valley R. R., C. Kaighn, Engineer, Muskogee, Okla., is to at once extend its Glenn Pool branch line into Sapulpa, a distance of 10 miles.

Good progress has been made with the promotion work for a railroad from Wichita Falls, Tex. to Lawton, to connect with the Frisco system at the latter place. T. C. Poole, Oklahoma City, Okla., is promoting the project. Mr. Poole is reported to be closely allied with C. G. Jones, who has built four railroads in Oklahoma.

Construction work has been started on the Cherryvale, Oklahoma & Texas R. R. at Verdigris river and it is expected that grading will be rushed and it will be a short time until actual work will be in progress in Nowata, Okla.

City of Okmulgee, Okla., has submitted a proposition [illegible] Oklahoma & Gulf Ry., whereby the company will construct a line to that place providing a bonus of $30,000 is subscribed and the necessary right of way granted between Coalton and Okmulgee. The matter has not been definitely settled as yet.

It has been announced in Buffalo, Okla., by H. Leon Miller, promoter of the railroad proposed to run east and west through that section of the state that preliminary surveys will be commenced at once, and that $25,000 per mile has been subscribed between Buffalo and Lava.

Oregon.

The Oregon & Washington Ry. tunnel under the Peninsula near Portland, was holed through on Oct. 3. The tunnel is 5,425 ft. long and has been under construction since August, 1909. The Pacific Bridge Co. and Robert Wakefield were the contractors.

Surveys have been started by W. W. Harmon, Resident Engineer of the Pacific & Eastern R. R., at Medford, Ore., for the pjoposed interurban electric railway, franchises for which in Ashland, Medford and Grant's Pass have been granted to John R. Allen, 49 Wall St., New York, President of the Pacific & Eastern.

The Lane County Asset Co. of Eugene, Ore., has called its crew of engineers in from the western part of the county and they will begin at once the preparatory surveys for the construction of the line from Eugene, Ore., to Elmira. First a line will be run directly west of Eugene, out from Fifth street, to determine the exact location of the grade to be made to Elmira, then the work of cross sectioning will be taken up and if weather conditions are favorable the grading will be started this fall.

Orders are said to have been issued by General Manager of the Southern Pacific, Portland, Ore., to install 90-lb. rails to replace the 75-lb. steel between Portland and Roseburg.

Grading work on the Mount Hood Ry. has been resumed and some 200 men are on the work. Archie Mason, Portland, Ore., has the contract. J. M. Stanley has been awarded a subcontract for clearing half a mile of the line through heavy timber.

Pennsylvania.

Approval by the State has been given to proposed extensions of the Sunbury, Lewisburg and Milton Ry. Co., embracing six miles of new trolley road touching Sunbury, and two extensions of the Sunbury & Northumberland Electric Ry. Co., of Sunbury, extending 1½ miles from Northumberland to Tuckahoe Springs. It is intended to make the extensions in the spring and preparations will be completed in the next few months.

South Carolina.

The Augusta Northern Ry. has construction work underway on its projected line from Ward, S. C., to Saluda, S. C., a distance of ten miles. The Independent Construction Co., Ward, S. C., is now engaged in the grading work.

South Dakota.

It is generally believed that construction work will be started shortly on rebuilding the old grade between Aberdeen and Pierre. The work will be done for the recently incorporated Pierre, Duluth & Black Hill Ry., which is understood to be a subsidiary company of the Minneapolis & St. Louis Ry. It is estimated that 124 miles of road will be constructed at a cost of about $5,500,000 through Hughes, Sully, Hyde and Faulk counties, extending from Pierre to Cresbard and thence to Aberdeen through Edmunds and Brown Counties. Winston Bros. Co., Minneapolis, Minn., are reported to have the contract.

Tennessee.

The Harriman, Knoxville & Eastern R. R. Co., understood to be an L. & N. R. R. proposition, asked for bids for Oct. 17 for the construction of a roadbed, masonry drains and other work necessary for building approximately 17½ miles of new road from Harriman, Tenn., in a northeasterly direction toward Knoxville. The approximate quantities are as follows:

Excavation, cu. yds.	477,930
Clearing, acres	88
Grubbing, acres	29
Concrete, cu. yds.	3,920
Cast iron pipe (laying), lin. ft.	1,272
Lin. ft. piles, lin. ft.	12,530
B. M. in timber structures, ft. B. M.	146,930

The road will be of single track and the cuts for same will be 22 ft. at sub-grade, while the embankment will be 16 ft. The road runs along Emory River for part of the way and the cliffs overhanging this section will not be allowed to be blasted with excessive amounts of heavy explosives, inasmuch as this is a navigable stream and the debris must be taken care of and not allowed to go into the river. Bonds in amount of $40,000 will be required of the contractor who is awarded the work. W. J. Clarke, of Harriman, Tenn., is Chief Engineer.

Texas.

Work has been started at Somerville, Tex. by President H. H. Fielder and Engineer C. W. Quinn, locating the projected line of the Houston, Somerville & Western R. R. It is said that construction work will be started at Somerville and continued west to Dimebox, Lexington and Taylor.

The Palacios, San Antonio & Pecos Valley Ry. Co., recently chartered for the purpose of building a line from Palacios to San Antonio, has secured the right-of-way over part of its proposed lines. Preliminary surveys were started on Oct. 15 and a locating party will be sent out soon. Construction work will be commenced as soon as the first 35 miles can be located. H. L. Montandon, Palacios, Tex., is Chief Engineer, J. P. Pierce is President, Thomas H. Bonner, Vice-President and Treasurer and H. W. Dean, General Manager.

It is believed here in Austin that the Missouri, Kansas & Texas R. R. will shortly build an extension from Smithville to Bloomington, where it will make connection with the new Port O'Connor route of the Brownsville. The line will extend for 90 miles across some of Texas' richest territory and by securing trackage rights to tidewater at Port O'Connor will give the road two valuable connections to the gulf.

J. S. Woods has placed 66 teams at work at Lockney on his contract for grading the A. L. R. & E. P. Ry., from Lockney to Silverton. According to the terms of the contract the road is to be completed to the latter place by Feb. 15, 1911.

The San Antonio Traction Co., A. M. Courtney, Superintendent Maintenance of Way, has work underway on building the 2-mile extension of the East End loop at San Antonio. The work will be completed next month.

The Beaumont & Great Northern R. R., R. C. Duff, General Manager, Houston, Tex., is reported to have let a contract for building an extension from Trinity, in Trinity County, northwest to Weldon, in Houston County, a distance of 20 miles.

The Longview & Junction City Street Ry. Co., of Longview, Tex., is reported to be considering constructing an interurban line out of Longview.

It is reported in Paris, Texas that the Santa Fe Ry. Co. is contemplating relaying the line between Dallas and Paris with heavier steel. Nothing definite has yet been done on account of the scarcity of laborers owing to the cotton picking season.

Engineers working in the vicinity of Gladstone, a small town on the Colfax, Union County border, northwesterly towards Schomberg on the Santa Fe main line, give rise to rumors in Raton, N. Mex. that the Santa Fe is making actual preparations for the construction of a line connecting by direct route Denver, Colo., and Galveston, Tex., with Raton as a division point.

The Texas Railroad Commission has been informed by the Santa Fe., that it will begin the operation of its line from Lubbock, in Lubbock county to Lamesa, in Dawson county, at once. The new line is 70 miles in length and is an extension of the line which runs south from Amarillo.

The Texas Southern R. R. Co., recently chartered, has completed its organization and has elected the following officers: President, F. T. Parks, San Antonio; vice-president, H. G. Martin; secretary, Frank H. Burmeister, Tilden, Tex. The company proposes to build an 8-mile line from Poteet to Pleasanton.

Survey has been completed for the Stamford & Eastern Ry., from Stamford to Throckmorton and on to the coal fields in Young county, and the location surveys are now within a few miles of Throckmorton. As soon as blue prints can be made and contract let, construction work will be started and pushed through to completion. W. T. Andrews is president of the company and P. G. Burns is chief engineer.

Contractors on the Temple Northwestern R. R. are now closing the last two miles of grading between Temple and Gatesville, and track laying is being pushed.

The opening of the new Collegeport branch of the St. Louis, Brownsville and Mexico R. R. of the Frisco was celebrated at Collegeport on Oct. 11.

The Cotton Belt is reported to have abandoned the proposed extension of its line to Sweetwater. The reason for this is reported to have been given by an official as follows: "As long as the present law is in force, making open accounts prior lien to first mortgages, we can not undertake further extensions."

Utah.

The City Council of Provo, Utah, has granted a franchise to the Evans-Chipman syndicate to build and operate an electric railway line through the city. According to the terms of the franchise the road must be in operation through the city within three years.

Residents of Harrisonville have petitioned the county commissioners, asking that steps be taken to force the Ogden Rapid Transit Co. to change its roadbed from the side to the center of the county road to the north and grade either side properly.

At the annual meeting of the stockholders of the Oregon Short Line R. R., on Oct. 12, it was unanimously voted to increase the capital stock to $100,000,000. The old Board of Directors was re-elected with the exception that Marvin Hughitt of Chicago was chosen to succeed P. A. Valentine. The following were elected directors: Oliver Ames, Samuel Carr, Oliver W. Mink, Boston; Gordon L. Buck, Alexander Miller, William Rockefeller, J. H. Schiff, W. V. S. Thorne, New York City; Marvin Hughitt, Chicago, and Henry C. Frick, Pittsburg.

The Union Pacific Ry. Co., is contemplating the further improvement of its line through Echo Canyon, Utah. The main feature will be the elimination of curvature which will mean many miles of new grading, mostly sidehill work.

Virginia.

The Norfolk & Western R. R. has awarded contracts as follows for the construction of 11¼ miles of track to be known as the Cedar Bluff extension: Rinehart & Dennis Co., Washington, D. C., two miles; Walton & Co., Falls Mills, Va., 2½ miles; W. O. Lipscomb, Roanoke, Va., two miles; A. H. Valz, Staunton, Va., two miles; P. J. Millett, Paris, Ky., 2¾ miles. Another extension, known as the North Fork Branch, to consist of four miles was awarded as follows: Vaughan Construction Co., Roanoke, two miles; Carpenter & Boxley, Roanoke, two miles. The cost will be about $1,500,000, and work will be started at once on all the contracts.

The Holston River R. R., the new coal-carrying branch of the Southern Ry., extending from Moccasin Gap, Va., to Bull's Gap, Tenn., a distance of 47 miles, was formally opened to traffic on Oct. 17.

The Whiting Lumber Co., of Philadelphia, Pa., which recently purchased extensive holdings at Robbinsville, N. C., is planning to construct a railroad through that place into its timberlands. In connection with the plan the Southern Ry. is to complete the 15-mile link in the new line between Knoxville and Bushnell, a point on the Murphy division.

At the annual meeting of the Norfolk & Western, held on Oct. 13, the present Board of Directors was re-elected, and was authorized to acquire the property of the Big Stony Railway Co. and make a contract for the use of the terminal facilities of the Norfolk Terminal Ry. Co. An increase of $50,000,000 in the common stock was voted, as well as authority for the creation and sale from time to time of convertible bonds to the aggregate of $50,000,000. The directors re-elected the present officers.

The Carolina, Clinchfield & Ohio Ry., M. J. Caples, General Manager, Johnson City, Tenn., is reported to be about to let a contract for the extension of the road from Dante, Va., to Elkhorne, Ky.

West Virginia.

The Baltimore & Ohio R. R. has secured all material for the double tracking of its Wheeling division. Most of the material is now on the ground and the company is planning to go ahead with the work. The work is to be started between Fairmount and Grafton. Very little grading will be required, it is said.

At a recent conference between President J. T. Blair, of the Little Kanawa syndicate lines, Vice-President James Shoonmaker, of the Pittsburg & Lake Erie R. R., and a representative of the Pennsylvania R. R., it is said that decision was reached that steps be taken at once toward opening up the 90,000 acres of coal land owned by the syndicate in West Virginia. To do this it is proposed that a line be built at once from Fairmont, W. Va., to the Pennsylvania line, there to connect with the Monongahela R. R., owned jointly by the Vanderbilts and the Pennsylvania R. R.

Plans have been approved for the development of coal fields of 90,000 acres in West Virginia controlled by the Little Kanawha syndicate. The plans call for the building of a railroad to connect with the system reaching Pittsburg, thus affording an outlet for the product. Fifty per cent of the stock of the Little Kanawha syndicate is held by the Pittsburg & Lake Erie R. R., 25 per cent by the Pennsylvania R. R. and 25 per cent by the Baltimore & Ohio.

Wisconsin.

The City Council of Madison has granted a franchise to the Chicago & Wisconsin Valley Street Ry. Co., which proposes to build an interurban road from Wausau to Madison, by way of Stevens Point and Portage. The headquarters of the company are at Madison and Allen T. Russel is president.

A franchise is to be asked at Kenosha, Wis., for building an electric railway to the center of the city. This is part of a plan for a line from Kenosha west to Lake Geneva, touching at the summer resorts. It is planned to make the company a co-operative one, and many farmers in the county have agreed to take stock. J. K. Orvis, Waukegan, Ill., who is at the head of the building of an electric line from Marengo, Ill., to Lake Geneva, is at the head of the Kenosha plan.

The city officials of Milwaukee and engineers of the Chicago, Milwaukee & St. Paul Ry., and the Chicago & Northwestern Ry., held a conference Oct. 15, to decide on the methods of be followed in elevating the railroad tracks on the South Side at Milwaukee. Charles J. Poetsch is city engineer.

Rasser & Whittaker, who have a contract on the Chicago & Northwestern Ry., near Monroe, Wis., have moved into winter quarters and have opened an office in the Monroe County Bank Bldg., at Monroe.

The Wisconsin & Northern R. R., W. Cambier, chief engineer, Oshkosh, Wis., has been granted a concession to construct five additional miles of road through the Menominee Indian Reservation.

Canada.

The company which is promoting an electric railway from Ottawa to Brockville, Ont., has elected Andrew Haydon, Ottawa, Ont., president, and H. C. Woods, Montreal, Que., secretary. It is understood that the work on the road will be commenced immediately after the plans and surveys are completed. The work will be started from both ends of the line.

The Canadian Pacific Ry. Co. has taken over the charter of the St. Mary's & Western Ontario Ry. Co., and by that means has secured an entrance into the city of Stratford. The charter provides for a line from Stratford to Grand Bend, a summer resort on Lake Huron. This line will run in a southwesterly direction, passing St. Mary's, where the C. P. R. has a line at the present time, within about three miles, and continuing on through Exeter and other smaller places to the lake. Then from some point on this line, presumably Stratford, it is said a line will be built in a northwesterly direction to Linwood, a small junction point on the Toronto-Goderich line of the Canadian Pacific. It is said that the necessary land for right of way and terminals has been purchased and plans prepared for the rushing forward of the construction of the line with all possible despatch.

The Canadian Pacific Ry. is said to be planning to double-track at once between West Toronto and Lampton, and also to construct at an early date a number of siding between Lampton and West Toronto to relieve the congestion in the downtown yards at Toronto.

The British Columbia Government has refused an application of the Grand Trunk Pacific Ry. for permission to permit the employment of Asiatic labor in the construction through British Columbia. It was urged that such is the labor situation and so acute the feeling against the utilization of other than white labor that it has been found impossible to carry on construction in British Columbia beyond the completion of the present contract held by Foley, Welch & Stewart to a point 238 miles east of Prince Rupert. It was stated that the contractors had declined to take on any more work from British Columbia, claiming that owing to present conditions they are even now losing hundreds of dollars daily under their contract. It was urged that under the contract between the company and Province of the 27th of December, 1908, relating to the exclusive employment of white labor in constructing, a reservation was made by which the Government might sanction an abrogation of the white labor clause in the event of a sufficiency of white labor not being found available. It is stated that if permission were accorded for the employment of Asiatic labor the company would enter into an undertaking not to employ such labor while white labor was available, and, further, to give employment to all the white labor offering for the purposes of construction work at the current rate of wages.

The Canadian Northern Ry. is to establish a repair plant and shop at Parry Sound, and will proceed next year with the erection of an elevator with a capacity of at least 500,000 bushels.

McMillan Bros., Winnipeg, Man., have started work from the Entwistle end of his 70-mile contract on the main line of the Canadian Northern Ry., west of Edmonton. Work is to be carried on all winter. Sub-contractor Phillips now has 300 men at work near Entwistle.

The Canadian Pacific Ry. is to construct a dam on Bigstone Creek, near Red Deer, to form a 1,000,000 gallon reservoir.

The British Columbia & Alaska Ry. will, it is said, soon apply to the Canadian Parliament for incorporation. It proposes to construct a railroad from Lytton along the Fraser river to Fort George, following the Stewart river to Texlin and to Dawson.

Plans are now in the hands of the Department of Railways, Ottawa, Ont., for the construction of the Canadian Northern extension from Springfield to East Selkirk and it is expected that after their approval construction work will be started immediately.

The Minister of Railways has approved the application of the Toronto & Eastern Ry. Co. for approval of its route map from Oshawa to Cobourg and also to Lindsay and Port Perry.

Mexico.

The National Railways of Mexico has entered into a contract with the State of Durango to built a railroad from Uiterrez, State of Zacatecas, to Durango, State of Durango. The line will pass through the mining districts of Sombrerete and Chalchihiuites.

The National Railways of Mexico, H. M. Taylor, director of construction, City of Mexico, is making preparations to begin construction at an early date on its proposed line between Tampico and Matamoros, near the mouth of the Rio Grande, where it will make connection with the Frisco system. The survey for this prospective road is practically finished, and plans are now in the hands of the Government for approval. The line will be about 300 miles long.

Engineers of the Mexican Union Ry., W. C. Potter, president, Aguascalientes, Mexico, have surveys under way for an extension from Repriso, the present terminus, to Ures, about seven miles beyond La Colorado.

A company has been organized at Torreon to take over the concession and lines of the Chinese Street Car Co. The company plans to take over the street cars and put in operation this line which was constructed two years ago. The company is to be capitalized at $200,000 and an effort is being made to place all of this stock with Torreon capitalists and business men.

At a recent meeting of the stockholders of the National Railways of Mexico the board of directors was authorized to issue until the time of the next general meeting prior lien bonds and general mortgage bonds of the company to the amounts which in its judgment are deemed necessary under the prearranged plan for betterments.

Jose Mondragon, City of Mexico, started grading work early this month on his contract for the extension of the National Railways from Oaxaca to Tiacolula. The contract was let Sept. 2, and the masonry work was started two weeks later. It is also understood that this contract also includes the construction of the branch line to the smelter at Magdalena. The Tlacolula extension is 30 kilometers in length and will, when completed, bring the Totolapan mining district within easy reach of the railroad.

It is reported in Chihuahua that a party of American engineers, in the employ of the Mexico Northwestern Railway Co., B. H. Bryant, Chief Engineer, Casas Grandes, Chihuahua, Mexico, recently left Minaca looking for a feasible route from that place to the port of Agiabampo, Sinaloa. It has been currently reported for some time that it was the intention of the Northwestern Co. to extend the present line to the coast at an early date, and it is believed that these engineers have been employed to make the preliminary survey.

The state of Durango has granted a subsidy of $600,000 for the construction of the National Ry.'s branch within that state. The new line is to be 60 kilometers in length and is to be completed within one year from the date of the approval of the plans by the government. It is expected that the plans will be approved at an early date.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

Surveys have been completed for the Beaver Bayou Drainage District, comprising 50,000 acres of land in Phillips County, and construction contracts for the ditches will be let soon. Two large ditches are to be dug. The district adjoins the Yellow Banks District. The contracts for the latter district were let on July 25, and work is now under way. Winters & Dove, Fort Smith, Ark., are the engineers for both districts.

Advices from Morrillton, Ark., state that G. H. Burr, C. E., has completed the final survey of the Point Remove Drainage District, in Conway County, and active work in digging the canal will begin about Jan. 1. The territory embraced in this district consists of 18,000 acres of very rich alluvial soil, and the canal to be dug, while only five miles in length, will be one of the widest and deepest drainage canals in the state and will divert the waters of Point Remove Creek, a stream that drains a large watershed in Conway, Van Buren and Pope Counties. The channel of the canal will run for half a mile through the center of the celebrated Fish Lake, located on a fish and game reservation, and owned by the Morrillton Fishing & Hunting Club.

Colorado.

✣Bids will be received at the office of The Pueblo-Rocky Ford Irrigation Co., 601 N. Main St., Pueblo, Colo., until 5 p. m., Oct. 20, for the construction of a rock-fill storage dam, situated on the Cucharas River, 14 miles below Walsenburg, Colo. Distance from railroad, four miles; estimated yardage rock-fill of completed dam, 230,000 yds. Concrete facing and outlet tube, 3,000 yds. concrete; height 125 ft. to spillway.

California.

Lawery & Falconer have been awarded the contract for raising and repairing the levee near the Hock Farm in Levee District No. 1, near Yuba City. The contract price was 30 cts per cu. yd., and about 15,000 cu. yds. of earth will be handled.

A. F. Niedt, Reno, Nev., has been awarded the contract to construct three concrete dams on the West Walker River, near the California line. They are for private irrigation projects and will cost about $13,000.

The Old Fort Reservoir & Irrigation Co. has filed final maps and estimates with the State Engineer at Denver. According to the plans the dam, which will be located 1½ miles west of Fort Morgan, will be 65 ft. high in place of 55, as originally planned, and the Old Fort reservoir will have a capacity of 110,000 acre ft. From this reservoir the water will be carried through a canal 98 miles long and costing $1,250,000, to the Haxtum reservoir in the northwest corner of Phillips County. The Haxtum reservoir will have a capacity of 20,000 acre ft. and will cost $150,000. From this reservoir 19 miles more of canal will be built to carry the water over the 100,000 acres of land in Phillips and Sedwick counties, which the owners stand ready to bond as soon as irrigation districts can be formed. In addition to the water for irrigation, the dam above Fort Morgan will develop 5,000-h. p. during the flood season, and a minimum of 1,000-h. p. when the water is at its lowest.

The East Denver Municipal Irrigation District, comprising 60,000 acres northeast from the eastern limits of Denver, has voted a $3,000,000 bond issue for the purpose of taking over the English High Line ditch, the Antero reservoir, the Terminal and Abbott sub-reservoir, and completing extensions of the main line ditch and laterals.

The tunnel of the Cripple Creek Deep Drainage & Tunnel Co., of Cripple Creek, was advanced 342 ft. during the month of September and the cross-cut from the tunnel to a point under the El Paso mine shaft was driven 75 ft. The total length of the bore is now 15,045 ft., and between 600 and 700 ft. remain to be driven before the main watercourse is reached. T. R. Countryman is the engineer.

Illinois.

✤Bids will be received until 1 p. m., Oct. 22d, by Drainage Commissioners, Nixon Special Drainage District, Dewitt and Macon Counties, Clinton, Ill., for furnishing labor and materials for the construction of ditches and five retaining walls for Sub-districts Nos. 2, 3, 4, 5 and 6. The work in a general way consists in the digging trenches and laying of the following tile approximately: 6,518 ft. 20-in. tile; 8,940 ft. 16-in. tile; 1,500 ft. 15-in. tile; 1,900 ft. 14-in. tile; 960 ft. 12-in. tile; 200 ft. 10-in. tile. The retaining walls contain approximately as follows: three of 10 cu. yards; two of 8 cu. yds.

Kansas.

✤The Kaw Valley Drainage Board, Kansas City, Kan., has rejected the bid of Robert Russell for the entire improvement of the Kaw River from the mouth to the western limits of the drainage district at Turner, Kan. Mr. Russell's bid was on the proposition submitted by the board to do the entire work and take the bonds as pay. At the time the board advertised the work it was believed that the $1,750,000 bond issue voted by the district to improve the river could not be sold immediately and, wishing to hurry the work as fast as possible, they agreed to let the contractor take his pay in bonds. The board now has the assurance that the issue can be disposed of for cash, and their action in rejecting the bid was followed by a resolution to readvertise the work, the successful bidder to be paid in cash. The bids on the new proposition will be opened Oct. 24. The improvements, on which bids will be opened Oct. 24, include the building of levees and concrete-faced revetments on both sides of the Kaw River from the mouth west to Turner, Kan., a distance of five miles. The contracts for dredging the river and removing the solid obstructions will be let later. The engineers for the board believe that the river will practically clear its own bed of loose obstructions after the levees are built, and the new course of the flow determined.

Louisiana.

✤Bids will be received until noon, Nov. 1, by the Board of Commissioners of the Caddo Levee District, Shreveport, La., for the construction of the levee work in Caddo Parish, on the Red River right bank, as follows: Upper Rush Point levee, approximate contents 35,000 cu. yds.; Beaird levee, approximate contents 12,000 cu. yds.; Robson levee, approximate contents 30,000 cu. yds.

✤Bids will be received until 11 a. m., Oct. 31st, by Capt. Robert R. Ralston, U. S. Engineer, 3338 St. Charles Ave., New Orleans, La., for the construction of about 36,000 cu. yds. of earthwork in the Lafourche Levee district.

Bids were opened Oct. 6 by the State Board of Engineers at New Orleans, for a number of small levee contracts. For the Schexnaydre levee Mike Mitchell was the only bidder, he offering to do the work at 29.75 cts. a cu. yd., but this was regarded as excessive and the contract was not let. For the Orange Farm levee there were four bidders, (75,000 cu. yds.). George H. Conrad bid 20.23 cts. a cu. yd. The others bidders were: Wilmer Henritzy, at 21.89 cts. a cu. yd.; Pat H. Lyons, at 24 cts. a cu. yd., and B. W. Borne, at 26.75 cts. a cu. yd. The Pelas to Buras Church levee contracts (14,000 cu. yds. distance and 15,000 ft. of rivetment), was bid on by four of the contractors. Pat L. Lyons bid 25.48 cts. a cu. yd. and $1.20 for the revetment. Other bidders were: Mike Mitchell, 27 cts. per cu. yd. and $1.27 per ft. for the revetment; George H. Conrad, 33 cts. per cu. yd. and $1.34 per ft. for the revetment; John L. Buras, 26.50 cts. per cu. yd. and $1.19 per ft. for the revetment. For the Grand Bend levee there were two bidders. George Wilson was the lowest; he bid 12 cts. a cu. yd. Irwin McInnis bid 12.50 cts. per cu. yd. Geo. Wilson was also the lowest bidder for the Cassandria to Experiment plantation, bidding 14 cts. per cu. yd. Other bidders were: M. Bettery, 19.19 cts. per cu. yd; Steward & McInnis, 15 cts. per cu. yd.; J. R. Babbitt, 17.40 cts. per cu. yd., and Francis T. Constant, 15.70 cts. per cu. yd.

Michigan.

MacArthur Brothers Co., Fisher Bldg., Chicago, Ill., and 11 Pine St., New York, has been awarded the contract by the U. S. Government, for making improvements in the St. Mary's River at the falls, Sault Ste. Marie, Mich. The work consists in the construction of a part of a new navigation channel, leading to the proposed new third and fourth locks on the American side, and construction of a new head-race, controlling works and ice passages for the Edison Sault Electric Co., the present head-race belonging to this company being in the way of the construction of the new canal. The items of work and the estimated quantities are as follows, the largest being Class B, dry work, navigation canal:

Class A, dredging navigation canal, cu. yds.	47,700
Class B, dry work, navigation canal, cu. yds.	275,000
Class C, dry work, head race and forebay, cu. yds.	15,000
Class D, dredging, head race and forebay, cu. yds.	15,000
Channeling, sq. ft.	36,600
Crib placing and framing, timber, cu. ft.	154,000
Crib filling, cu. ft.	13,000
Construction and removal of west cofferdam, head race and forebay	Lump sum price
Construction of new north dike, lin. ft.	1,900
Concrete (exclusive of cement), cu. yds.	22,000
Furnishing and delivering cement, bbls.	27,500
Furnishing and delivering vitrified paving brick, number brick	15,000

At the present time, this work is all under water, but it is proposed by the construction of cofferdams to unwater the same, and do this work in the dry. The total amount of the contract, based on the above quantities, is $675,288. Work is to be completed within 18 months from date of starting.

Missouri.

The City of Kansas City, Mo., has $15,000 available of the $75,000 bonds voted to create a public levee and is ready to go ahead with the construction work.

Montana.

Robinson & Co., according to advices from Billings, Mont., have started work on their contract for the enlargement and extensions of the Sanders irrigating ditch, which, when completed, will reclaim about 14,000 acres. The canal taps the Yellowstone River at a point in the vicinity of Myers, and proceeding toward the east on the southern side of the Yellowstone, approaches to within about 10 miles of Forsyth. At present about 5,000 acres are irrigated by this canal, and in extending it some exceptionally heavy rock work will be necessary and some exceedingly deep cuts will have to be made. The work will take about 12 months.

Ohio.

Petitions have been filed with the County Commissioners at Springfield, asking that Mad River be dredged from the Tremont Bridge to the Koblentz River. The cost is estimated at $3,000 per mile.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

Shelby County is practically rebuilding all of its roads and when finished will have one of the best systems of roads in the South. Much of this improvement is directly traceable to the movement for good roads which is being agitated in this section. W. F. Gill, with offices in the new Court House, Memphis, is the Superintendent, and is prosecuting the work as much as possible. The contractors who have the largest outfits at work are E. C. and D. P. Prescott, R. M. Gill and J. G. Galloway.

J. A. Williford is getting on nicely with his city work and states that he will soon be in position to stock up with some new contracts. J. A. knows how to handle dirt to good advantage and has an up-to-date outfit.

H. J. and W. A. Roper have made a lot of money this year on work for the city and report very satisfactory progress on all contracts, with prospects of doing an even greater amount of work during the coming season.

Andy Outzen, who for many years has been one of the largest and best known railroad and levee contractors in this section, has retired from construction work and has purchased 2,000 acres of farm land near Earle, Ark., to which he and his two sons will devote their entire attention. Although Andy was a great success in his former line, he says he is going to do even greater things at farming. He paid $40,000 for the tract which he now is working.

W. A. Shippey has about finished all his Texas work and has moved his several outfits to Arizona, where he has some extensive railroad contracts. Bill still maintains headquarters in Memphis and has not as yet settled his suit with the United States government for the canal work he was doing in Alabama.

Capt. Clarke S. Smith, who is in charge of the United States Engineers at this place, left Saturday night for Pittsburg, Pa., where he will inspect the progress of the huge steel dredge boat being constructed for Vicksburg Harbor and vicinity.

General Superintendent Morris of the Y. & M. V. R. R. has stated that his road will not now let contract for the construction of 70,000 cu. yds. of bank work near Clarksdale, Miss., owing to the fact that he was not able to secure satisfactory bids. It is probable that the work will be done by company forces.

George Lacy of Arkansas City, Ark., is looking for a small sub-contractor with about ten teams to build about 20,000 cu. yds. of levee work near Arkansas City. George states he is willing to pay 33 cts. per yard for this work.

Lowrance Bros., it is stated, will clear $60,000 on their work near Arkansas City. The work was let this spring by Capt. Smith in the Vicksburg government levee district, and most all of the other contractors were afraid to handle same, owing to the fact that the land through which the levee is being built is very swampy. But the Lowrance boys were game and all indications point to the fact that their bravery will be most handsomely rewarded.

One of the largest bank revetment operations which was ever undertaken in this section is now being constructed near Old Town, Ark. The mat of stone and willows is just about to be lowered into the water and Superintendent Barrett, who is in charge, predicts a great success for same in holding the caving bank at that place.

Luther Kerr, one of the cleverest assistant engineers in the United States army, and who maintains his headquarters at Memphis, is whipping all his large levee contracts in this section into good running order. Work has been started on practically all that was let this season and the indications point to the fact that high water next spring will not catch the government forces napping.

Alle Bartee is well pleased with all his city contracts and by the first of the year will be in position to assume new and large operations. Alle is a born hustler and one has to go some to keep up with his marvelous powers of rushing work.

Assistant City Engineer Jones wears a long smile these days. He may well do so, for success has crowned all his efforts in the construction line. He has had a big problem to face in getting the numerous streets which contracts covered, well started and it has been necessary for him to watch all details of the varied forms of pavement which is being put down.

Texas.

The Drainage Commissioners of the Pearland District at Angleton, Tex., have awarded the contract for ditching in the district to B. Arpen & Co., at 13.8 cts. per cu. yd.

Washington.

✣Bids will be received until 2 p. m., Oct. 29th, by Charles H. Swigart, Supervising Engineer, Department of Interior, United States Reclamation Service, North Yakima, Wash., for the construction of about 40 miles of laterals, Tieton Unite of Yakima project, near North Yakima, Wash., involving 230,000 cu. yds. of material.

Canada.

L. P. Brodeur, Minister of Marine, has announced that work of deepening the St. Lawrence Channel to a depth of 35 ft. will be proceeded with at once.

Mexico.

John F. Hebert, of New Orleans, La., is promoting a project for the cultivation of 886,000 acres of Mexican land in the States of Sinala and Tepic. It is said that a company is to be formed by St. Louis capitalists, and will have a capitalization of $1,000,000, which will be used in the development of the agricultural and mineral resources of the properties. About 120,000 acres of the land is in timber and the remainder is under cultivation by the native ranchers.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until 1:30 p. m., Oct. 28, by Lieut. Edwin F. Barlow, constructing quartermaster, Fort Morgan, Ala., for the construction of coal shed, railroad track and trestle at Fort Morgan, Ala.

Arizona.

✣Bids will be received until 3 p. m., Oct. 28, by Lieut. G. G. Bartlett, constructing quartermaster, Shipple Barracks, Ariz., for the construction of a powder magazine at Shipple Barracks, Ariz.

Arkansas.

The Helena Rock Co., of Helena, Ark., has been incorporated with a capital stock of $25,000, and will operate stone quarries in Cleburne County, about five miles below Heber, Ark. The company owns a sandstone quarry there which will be known as the "Libbie Quarry." The officers of the company are as follows: President, S. S. Faulkner; vice-president, Sebastian Straub; treasurer, W. N. Straub; secretary and general manager, J. B. Miles, Jr.

California.

✣Bids will be received until 11 a. m., Oct. 19, by Maj. G. McK. Williamson, constructing quartermaster, Fort Mason, Cal., for the construction of a brick ordnance shop at Fort Winfield Scott, Cal.

✣Bids will be received until 11 a. m., Nov. 7, by Capt. W. P. Stokey, U. S. engineer, 723 Central Bldg., Los Angeles, Cal., for dredging at Los Angeles Harbor, Cal.

✣As noted in our last issue, bids are being asked by Capt. W. P. Stokey, U. S. engineer, 723 Central Bldg., Los Angeles, Cal., until 11 a. m., Nov. 7, for dredging in Los Angeles Harbor, Cal. The work to be done is to dredge in Los Angeles Harbor, Cal., to deepen the channel at the entrance to the inner harbor to a depth of 30 ft. below mean lower low water over such uniform width as the funds available will permit, from Station "O" on the 30-ft. contour in the outer harbor to Station 56, which is 600 ft. northerly of the United States Coast and Geodetic Survey Station on Deadman's Island. The sum of $140,000 will be available for this work. The work will include the removal of all obstructions to navigation, including wreckage, lumber, piles, boulders, gravel, rock or other material which may be found within the limits of the work as it progresses. The dredged material is to be deposited at sea in depths of 10 fathoms or more of water, or it may be wasted on the ocean shore of Terminal Island not less than 4,000 ft. north of Deadmans Island, at such points as the contracting officer may designate, or it may be used in reclaiming land if securely confined to the satisfaction of the contracting officer. About 500,000 cu. yds. may be deposited on the Government reservation east of the east jetty and north of Deadmans Island.

Charles W. Corbaley, Los Angeles, Cal., has been awarded a contract for concrete piling for a pleasure wharf to be built near Los Angeles for A. R. Fraser. The contract amounts to $175,000. Plans for the pier were made by Eager & Eager, architects, Los Angeles.

Mayor Windham, of Long Beach, Cal., has asked the City Council to appropriate money for the building of a warehouse on the municipal docks on the harbor front for the storage of merchandise. The council was also asked to instruct the board of public works to begin work on the sunken track that is to be constructed on the docks, for the convenience of the different railroads that will be engaged in hauling to and from that structure.

The Tacoma Dredging Co., Tacoma, Wash., at 0.89725 per cu. yd., has been awarded the contract for dredging the Los Angeles Harbor. Bids for this work were opened Sept. 10 at the U. S. engineer's office, Los Angeles. The work includes dredging channels to 20 ft. depth from turning basin into East and West basins respectively, about 2,200,000 cu. yds. in all. For dredging at entrance to 30 ft. depth, bids were rejected and work readvertised Oct. 8. Dredging to 30 ft. inside entrance is to be done with Government dredge "San Pedro."

The Standard American Dredging Co., San Francisco, Cal., at 14.89 cts. per cu. yd., was awarded the contract for dredging in San Diego Harbor. Bids for this work were opened Sept. 8 by the U. S. engineer. The work includes dredging 360,000 cu. yds. on outer bar and 100,000 cu. yds. on middle ground just within entrance.

Connecticut.

✣Bids will be received until 11 a. m., Oct. 25, by Capt. F. T. Arnold, Constructing Quartermaster, New London, Conn., for the construction of a pumping station including building, pumps, gasoline engine, surface wells, connections, etc.

District of Columbia.

✣Bids will be received until 3 p. m., Nov. 22, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Lewistown, Ida.

✣Bids will be received until 10:30 a. m., Nov. 7, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 610, hose, hose couplings, oil cups, cocks, curb boxes, saws, carpenters' braces, chucks, punches, reamers, track gauges, carpenters' levels, sprinkling cans, awning pulleys, cabin door hooks, screen door latches, feather dusters, metallic tapes, hames, emery cloth, bunting, sponges, shellac, poplar and basswood lumber.

✣Bids will be received until 3 p. m., Nov. 19, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office and Custom House at Eagle Pass, Texas.

✣Bids will be received until 11 a. m., Oct. 26, by A. S. Cowan, Capt. Signal Corps, U. S. Army, Washington, D. C., for furnishing 50 miles field wire, 11 strand, and 3 miles of field wire twin conductor.

✣Bids will be received until 2 p. m., Nov. 8, by Department of Interior, Office of Indian Affairs, Washington, D. C., for furnishing and constructing employes' quarters and an addition to the brick workshop at Genoa Indian School, Neb.

✣Bids will be received until 2 p. m., Oct 26, by Commissioner of District of Columbia, Washington, D. C., for furnishing 1,218 ft. of 30-in. sheet steel pipe.

✣Bids will be received until 2 p. m., Oct. 19, by Commissioners of the District of Columbia, Washington, D. C., for wiring for electric light system and clock and bell system at Western High School No. 117.

✣Bids will be received until 11 a. m., January 7, 1911, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the dredging at the United States naval station, Honolulu, Hawaii.

✣Bids will be received until 11 a. m., Nov. 19, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a sea wall at the U. S. navy yard, Nolfolk, Va.

The following bids were received at the Treasury Department, Washington, D. C., Oct. 10, for the construction of the public building at Macon, Mo.: Northern Construction Co., Milwaukee, Wis., $60,000; Latimer & Bening, Kansas City, Mo., $56,939; A. Anderson & Co., St. Louis, Mo., $61,450; King Lumber Co., Charlotteville, Va., $63,770; M. Yeagerson, Danville, Ill., $56,353; Hiram Lloyd Building and Construction Co., St. Louis, Mo., $57,953; C. A. Wilson, Kansas City, Mo., $60,000; Conner Bros., Lowell, Mass., $58,500.

Florida.

✣Bids will be received until noon, Oct. 25, by H. S. Thomas, Engineer, Tampa, Fla., for the construction of the Tampa Union Station. Plans and specifications are on file at the office of M. Riddle, general superintendent Atlantic Coast Line, and R. E. Boswell, superintendent Seaboard Air Line Railroad, Jacksonville, Fla., and at the office of H. S. Thomas, Engineer, Tampa Union Station Co., of Tampa, Fla., and with J. F. Leitner, Architect, Wilmington, N. C.

Illinois.

The City Council of Momence, Ill., has decided to construct a dam across the Kankakee River at that place. About $3,000 has been subscribed for the work.

Only one bid was received Oct. 11th by B. J. Mullaney, Commissioner of Public Works, Chicago, Ill., for furnishing six dump cars for the Bureau of Streets. This bid was rejected and the work readvertised.

The following low bids were opened Oct. 7th by the Commissioner of Public Works: B. J. Mullaney, Chicago, Ill., for the construction of docks at the foot of Eastman St.: Great Lakes Dredge & Dock Co., Chi- [illegible] per ft., total $1,640; Fitzimons & Con approximate length, 66 lin. ft., $26 per ft., total $1,716. It has been recommended that the contract be awarded to the lowest bidder.

The Raymond Concrete Pile Co., of New York and Chicago, has been awarded the contract for the concrete piles and foundations for the Macmillan building, at 25th and Prairie Ave., Chicago. H. R. Wilson & Co., architects; J. W. Snyder, general contractor.

Following low bids for furnishing cement to the Water Pipe Extension Department were opened Oct. 13th by B. J. Mullaney, Commissioner of Public Works, Chicago, Ill.: Meacham & Wright, 206 La Salle St., Chicago, Utica natural cement, at 69 cents per bbl.; $1,380 for 2,000 bbls. Lehigh Portland cement, $1.80 per bbl., $180 per 100 bbls.; Wm. E. Dee, 108 La Salle St., Chicago, "AA" Portland cement, at $1.75 ner bbl., and $175 for 100 lbs.; Knickerbocker Ice Co., 171 La Salle St., Chicago, Utica natural cement, 77 cents per bbl., and $1,540 per 2,000 bbls; Medina Portland cement, $1.80 per bbl and $180 per 100 bbls.

Following low bids for furnishing chain grate stokers for 68th St. pumping station were opened Oct. 7th by B. J. Mullaney, Commissioner of Public Works, Chicago, Ill.; Illinois Stoker Co., 204 Dearborn St., Chicago, $3,510; Green Engineering Co., 115 Adams St., Chicago, $4,100; Laclede Clay Products Co., Chicago, $3,969.

Indiana.

✣Bids will be received until 10 a. m., Oct. 21, by Board of Public Works, Indianapolis, Ind., for the furnishing, erecting and installing permanent fixtures, counters, etc., in new city hall building.

✣Bids will be received until 10 a. m., Oct. 21, by Board of Public Works, Indianapolis, Ind., for the construction of a concrete fire cistern.

Louisiana.

✣Bids will be received until 11 a. m., Oct. 26, by Lieut. Col. Lansing H. Beach, U. S. Engineer, Room M., Custom House, New Orleans, La., for furnishing and delivering creosoted piles and walling timbers on the river bank or wharves in Southwest Pass, Mississippi River.

Massachusetts.

✣Bids are being asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 a. m. Oct. 22, as previously noted in these columns, for constructing a pier between piers 4 and 5 at the U. S. Navy Yard, Boston, Mass. The work covers the construction of a pile and timber pier 75 ft. wide and about 340 ft. long, together with a railroad track down the center of same and a railroad track on shore to connect with the existing yard railroad system. The estimated cost is $45,000.

✣Bids will be received until noon, Nov. 12, by Frederick V. Abbot, U. S. Engineer, Boston, Mass., for the furnishing of riprap stone at Lovell's Island and Long Island, Boston, Mass.

The Holbrook, Cabot & Rollins Corp., 6 Beacon St., Boston, Mass, has been awarded the contract for reconstructing Pier No. 6 at South Boston, for the State Board of Harbor and Land Commissions. The contract price was $760,000.

Michigan.

✣Bids will be received at this office until 3 p. m., Nov. 10, by Col. C. McD. Townsend, U. S. Engineer, Jone Building, Detroit, Mich., for the construction of a rubble mound break water at Mission Point, Mackinac Island, Mich.

C. G. Hart, Honor, Mich., has a water power site and electric light and power proposition and would like to get in touch with contractors who handle that class of work.

The Grand Rapids-Muskegon Power Co., Grand Rapids, Mich., is said to be planning to expend $200,000 for extending its lines and for other purposes.

Minnesota.

✣Bids will be received until Oct. 21, by Maj. D. W. Arnold, Chief Quartermaster, Department of Dakota, St. Paul, Minn., for furnishing 50 cutter bolts, 200 machine bolts, 1,000 fire brick, 300 lbs. fire clay, etc.

✣Bids will be received until 11 a. m., Oct. 19, by Maj. D. W. Arnold, Chief Quartermaster Department of Dakota, St. Paul, Minn., for furnishing one boiler, standard horizontal tubular 60-in. diameter by 16 ft. length, without dome containing 44 4-in. diameter tubes and constructed for 125 lbs. working pressure.

The Carnegie Fuel Co., of Duluth, which recently purchased the Lowry dock property in West Duluth, plans to spend about $1,000,000 in improving it. Of this amount probably $400,000 will be expended during the fall and winter. The plans include a coal dock to have a storage capacity of 1,000,000 tons, and a large hard coal warehouse.

The Zenith Dredge Co., of Duluth, has been awarded a sub-contract by the Duluth Dredge & Dock Co., for work on the anchorage basin in Duluth Harbor.

Mississippi.

✣Bids will be received until 7:30 p. m., Nov. 1, by C. M. Fairley, City Clerk, Moss Point, Miss., for furnishing 40,000 to 50,000 barrels of clam or oyster shells, 6,000 to 8,000 yds. of gravel delivered on the dock in Moss Point.

Missouri.

✣Bids will be received until 11 a. m., Oct. 19, by Capt. Stanley H. Ford, Jefferson Barracks, Mo., for the construction of wagon shed at the barracks.

✣Bids will be received until noon, Nov. 16, by Lieut. C. H. Knight, U. S. Engineer, Mississippi River Commission, Liggett Bldg., St. Louis, Mo., for the construction and delivery of a 164-ft. sidewheel steamboat.

Montana.

Nelson & Pedersen, Butte, Mont., have been awarded the contract for constructing retaining walls on the north bank of the Missoula River, at Missoula. The contract price is $6,000.

New Jersey.

✣Bids wil be received until noon, Nov. 9, by Maj. P. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Tuckerton Creek and Toms River, N. J.

The following bids were received Oct. 3, by Col. Wm. T. Rossell, U. S. Engineer, New York, for (1) dredging in Arthur Kill, N. Y. and N. J.; (2) dredging in Raritan Bay; (3) for dredging in Shrewsbury River, and (4) for dredging in Woodbridge Creek, N. J.; Taylor Dredging Co., Ft. Communipaw Ave., Jersey City, N. J., (1) 14 cts., (2) 15 cts. P. S. Ross, incorporated, 277 Washington St., Jersey City, N. J., (1) 20.9 cts., (2) 23.9 cts. William Beard & Co., 21 State St., New York, N. Y., (1) 19 cts., (2) 21 cts. United States Dredging & Contracting Co., 75 Montgomery St., Jersey City, N. J., (1) 24 cts, (2) 19½ cts, (4) 68 cts (rejected). The International Contracting Co., 17 Battery Place, New York, N. Y., (1) 17 cts., (2) 23 cts. The Newburgh Dredging Co., Newburgh, N. Y., (3) 25 cts. (accepted). R. G. Packard Co., 130 Pearl St., New York City, (1) 17 4-9 cts., (2) 19 4-9 cts. Morris & Cummings Dredging Co., 17 State St., New York, N. Y., (2) 12 4-11 cts. (accepted). Columbia Dredging Co., 68 Broad St., New York City, (1) 13½ cts. (accepted). The amounts available for the work are as follows: Arthur Kill, $9,000; Raritan Bay, $16,000; Shrewsbury River, $8,000; Woodbridge Creek, $3,000.

New York.

✣Bids will be received until 10 a. m., Oct. 27, by M. Gray Zalinski, Deputy Quartermaster, Army Bldg., New York City, for furnishing and delivering fire apparatus.

✣Bids will be received until Oct. 20, by General Depot Quartermaster, New York City, for furnishing under Quartermaster Schedule No. 136 for furnishing miscellaneous supplies.

✣Bids will be received until noon, Nov. 17, by Col. W. M. Black, U. S. Engineer, 710 Army Bldg., New York City, for dredging and rock removal in Port Chester Harbor, N. Y. and in Echo Bay, N. Y.

North Carolina.

✣Bids will be received until noon, Nov. 12, by Capt. E. I. Brown, U. S. Engineer, Wilmington, N. C., for dredging in Smith's Creek Harbor, Moorehead City, and harbor at Beaufort, N. C.

Ohio.

✣Bids will be received until noon, Oct. 26, by Maj. John C. Oakes, U. S. Engineer, 415 Custom House, Cincinnati, O., for the construction of revetments, guide walls, etc., on Muskingum River.

✣Bids will be received until noon, Nov. 15, by Maj. J. C. Oakes, U. S. Engineer, 415 Custom House, Cincinnati, O., for the construction of two maneuver boat hulls, three flat boats and two dump scows.

Pennsylvania.

✣Bids will be received until 4 p. m., Oct. 19, by Board of Water Commissioners, Harrisburg, Pa., for furnishing the pumping machinery for the new high service pumping station at Reservoir Park: Gas or electric power pumps are specified to be in two units each of 1,000,000 gal. capacity.

Tennessee.

Plans are now being drawn for the proposed dam across Nolachuckey River, near Erwin, Tenn. R. E. Ladshaw, Spartanburg, S. C., is interested in this project.

Texas.

The following bids were received Oct. 8 by Maj. G. P. Howell, U. S. engineer, Galveston, Tex., for jetty work at Aransas Pass, Tex., (1) standing for David M. Picton & Co., Galveston, Tex., and (2) for Charles Clarke & Co., Galveston, Tex.:

	(1)	(2)
South jetty, 9,300 tons riprap	$3.08	$3.65
Completion, 3,400 tons in cast	4.09	3.88
North jetty, 20.000 tons riprap	3.49	3.58
Repairs to north jetty, 2,000 tons cap blocks	4.20	3.85
Total	$120,750	$126,335
Rebedding old blocks in jetty:		
Use of plant, per hour, alongside of north jetty	$10	$11
Extra labor for each additional number of crew per hour	.35	.30

The Union Channel & Dock Co., of Rockport, Tex., has been incorporated with a capital stock of $10,000, the incorporators being Charles F. Hoff, Charles G. Johnson and Fred Percival.

The City Council of New Braunfels, Tex., has decided to build a dam across the Guadalupe, creating approximately 400-h. p. The major part of this power will be utilized by the city and the surplus may be leased for industrial purposes. The dam will cost about $75,000 and a bond issue to that amount will be made.

The A. M. Blodgett Construction Co. expects to start work about Oct. 20 pouring concrete for the concrete arches of the Galveston causeway. During the week ending Oct. 8 the last of the 14 piers on the island side of the center pier was completed and the work of finishing up the remaining few on the mainland side will be complete by the end of October. The big pier and the largest one on the entire contract is the pivot pier on which is to be stationed the lift bridge. As this pier, in addition to bearing the weight of one end of an arch, must also bear the weight of the bridge, extra labor and precautions are being taken. Embedded in this pier will be the water main and conduits for the necessary piping signal wires, etc., which will pass down under and across the channel.

Virginia.

✣Bids will be received until 11 a. m., Oct.

Items marked thus ✣ indicate work now open for bids.

22, by Capt. Warren W. Whiteside, Constructing Quartermaster, Fort Myer, Va., for the construction of an addition to officers' quarters No. 1, old signal corps post, Fort Myer.

✣Bids will be received until 1:30 p. m., Nov. 10, by John T. Hume, Treasurer, Southern branch, N. H. D. V. S., National soldiers' home, Va., for furnishing labor and material for the construction of three barracks.

Washington.

✣Bids will be received until noon, Oct. 22, by Capt. A. Williams, U. S. Engineer, Seattle, Wash., for dredging Hammersley Inlet, Wash.

The Cascade Trading & Construction Co., Seattle, Wash., has been awarded the contract for building six small wing dams along the west bank of the Nooksach River, south of Ferndale, from Whatcom County. The contract price was $3,062.

The Star Sand Co., of Portland, Ore., has applied to the City Council, of Vancouver, Wash., for a franchise to build a 2-story concrete building, warehouses and docks at the foot of Main St. The improvements are to cost about $100,000.

The Board of Public Works, of Bellingham, Wash., has under consideration an application of Jeremiah Neterer, of Bellingham, for permission to construct a wharf from Roeder Ave. The cost is estimated at $30,000 to $40,000.

West Virginia.

✣Bids will be received until 11 a. m., (eastern time) Oct. 29, by Capt. F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and delivering about 8,000 barrels of American Portland cement for dam No. 26, Ohio River.

The National Contracting Co., Evansville, Ind., has started preliminary work on its contract for the construction of Dam No. 9 at New Cumberland, W. Va., for the U. S. Government. About 50 men will be employed at first under the direction of Superintendent J. C. Thomas, and in the spring a force of 250 will be put at work. It is planned to begin the construction of the coffer dam this fall and then complete it in time to begin the active construction work on the dam not later than early spring. As soon as Dam No. 8 below East Liverpool, is completed, which is expected to be on or about Nov. 1, the force of employes will be transferred to the scene of the new operations. The actual construction of Dam No. 8 is practically finished, only a portion of the upper bear trap remaining to be completed. The Dam No. 9 contract amounts to $912,456. The T. A. Gillespie Co., of Pittsburg, Pa., has also been shipping in machinery preparatory to beginning work on its contract for constructing Dam No. 7 at Midland, Pa. This contract amounts to $750,000.

Wisconsin.

A committee of the Commercial Club has recommended to the City Council of Superior, Wis., that the city purchase a $125,000 site on the Superior Bay front for a municipal dock.

Canada.

✣Bids will be received by P. E. Ryan, Secy., Commissioners of Transcontinental Ry., Ottawa, Ont., until noon, Nov. 8, for the construction, etc., of freight sheds and store houses at Lake Superior Junction, Ont., Reddit, Man., and Springfield, Man., the sheds to be completed before March 1, 1911.

The following contracts have been let by the Department of Public Works of Canada: Wiarton, Colpoy's Bay, Ont., breakwater extension, contractors, Kastner & Porter, of Wiarton, at $13,990. Prince Edward Island dipper dredge, contractors, John Burns & Wm. Walters of Ottawa, at $21,350. British Columbia Dredge, contractors, Wm. Simons & Co., Ltd., of Renfrew, Scotland. Agents for Canada, John Reid & Co., 231 Board of Trade Bldg., Montreal.

Plans for the Esquimalt & Nanaimo Ry's. wharf at Port Alberni have been accepted and building is soon to be commenced and continued throughout the winter season. H. J. Cambie, Victoria, B. C., is chief engineer of the Esquimalt & Nanaimo Ry.

BRIDGES—STEEL AND CONCRETE

Arizona.

The Missouri Valley Bridge & Iron Co. has been awarded the contract for the construction of a steel bridge at Camp Verde for $18,390. The bridge will be a three-span structure of 100 ft. each. Bids were opened Sept. 27.

Arkansas.

The Levying Court at Clinton, Ark., has made an appropriation of $6,000 with which to construct an iron bridge over the north fork of Little River at Shiriey.

Advices from Camden, Ark., state that the Ouachita County Levying Board has provided an appropriation amounting to $40,000 for the construction of the proposed steel bridge over the Ouachita River.

California.

✣Bids will be received by City Clerk, Chico, Cal. until October 22, for the construction of a concrete bridge across Little Chico Creek. The work will be paid for jointly by city and county.

Board of Public Works, San Francisco, Cal., is reported to be advocating the construction of bridge over the channel at Fourth St. The work according to the plans proposed would require an expenditure of $150,000.

Plans have been filed with the Board of County Supervisors, San Francisco, Cal., by the County Engineer for the construction of a bridge over Plunge Creek and another over the San Antonio Wash near Chino. The cost of the work is estimated at $3,000.

Colorado.

✣Bids will be received until 4 p. m., Nov. 7, by the City Clerk, Pueblo, Colo., for the construction of a new bridge across the Arkansas River on Union Ave. Plans and specifications are on file at the office of D. P. Gaymon, City Engineer.

Connecticut.

Park Commissioners, Hartford, Conn., have taken up the resolution referred them by the Common Council relative to the construction of the proposed foot bridge from Riverside St. to Pope Park connecting Russ and Mortson Sts. and Putnam heights.

Town Council of Manchester, Conn., at a recent meeting appropriated a sum not to exceed $4,000 for the construction of a new concrete bridge to replace the present structure over Hop River at Prospect St., which has been adjudged unsafe by the Superintendent of Roads.

Board of Public Works, Waterbury, Conn., has been recommended to construct new bridges or repair many of the old structures which are reported unsafe.

Georgia.

A company has been formed at Columbus, Ga., which proposes the construction of a steel bridge across the Chattahoochee River between West Columbus and the city property. Zach Hagedorn, West Point, Ga., is interested in the project.

Kansas.

The question as to whether or not Sedgwick County, Kansas will issue bonds amounting to $20,000 for the construction of the proposed concrete bridge over the Arkansas River on West Thirteenth St., Wichita, Kan., will be submitted to the voters at the November election.

Idaho.

Plans have been prepared for the construction of a new bridge across the Boise River at the site of the present Ninth St. bridge at Boise, Idaho. The new bridge will be 320 ft. long and 20 ft. wide with 6-ft. walk outside. W. L. Cuddy is Clerk of the Board of County Commissioners, Boise, Idaho.

Illinois.

✣The Sanitary District of Chicago is advertising for sealed proposals to be received up to 12 M on October 26, 1910, at its office at 1500 125 Monroe St., Chicago, for the reinforcement of Kedzie Ave. and Western Ave. bridges across the Drainage Canal in the city of Chicago, to provide for street railway tracks thereon. The work on Kedzie Ave. bridge consists of removing all of the existing six lines of stringers, shortening of five lines of same slightly, and replacing them in new positions in the floor; also furnishing and placing four lines of new track stringers, and some miscellaneous work. The work on Western Ave. bridge consists mainly of furnishing and placing four lines of new stringers under the present floor without disturbing the floor or the existing stringers and without interupting street railway and other traffic. A deposit of $400 is required with each bid on the work on Kedzie Ave. bridge and of $200 with each bid on the work on Western Ave. bridge. Plans and specifications may be obtained from the Chief Engineer of the Sanitary District upon deposit of $5.00 therefor, this deposit to be refunded if the plans and specifications are returned within 10 days after opening of bids. C. R. Dart, Bridge Engineer.

The Highway Commissioners have awarded the Clinton Bridge Co., the contract at $1,877 for the construction of a new bridge across Nigger Creek on the Greenbush Road one mile northwest of Avon, Ill.

The Illinois State Commission is considering the construction of a reinforced concrete bridge at Batavia. The structure according to plans under consideration will require an expenditure of $25,000.

Board of County Supervisors recently visited the site for the proposed bridge over Nigger Creek in Lewistown, Ill.

A movement has been started by John Love, President of the Love Bros. Structural Iron Co., Aurora, Ill., toward constructing a concrete bridge across the Fox River at Illinois Ave., connecting the west side thoroughfare with Pierce St. on the East side. It is reported that $15,000 is already available for the purpose.

The East Batavia Improvement Association, East Batavia, Ill., will, at its next meeting, take up the matter of constructing a new bridge at East Wilson St.

Indiana.

✣Bids will be received until 2 p. m., October 29, by the Commissioners of Rush County, at Rushville, Ind., for the construction of three concrete bridges. Jesse M. Stone is Auditor of the county.

✣Bids will be received until 10 a. m., November 7, by Commissioners of Hancock County at Greenfield, Ind., for the construction of three bridges.

County Commissioners, Goshen, Ind., have adopted plans for the construction of the proposed new steel I-beam bridge over the St. Joseph River at Bristol, Ind.

Iowa.

Preliminary arrangements are reported under way by the Chicago, Milwaukee & St. Paul Ry., for the construction of a concrete bridge over Muscatine slough in the south end of Muscatine, Ia. The structure will support double tracks and will replace the present trestle.

Michigan.

Advices from Detroit, Mich., state that all bids received at the Commissioners office were too high and therefore rejected. The city has appropriated $26,500 for the structure which will be located at 14th Ave. The Michigan Central R. R. Co. will pay for the abutments.

Minnesota.

The Chicago, Milwaukee & St. Paul Railroad officials have under consideration the construction of an overhead crossing over the tracks a mile from Rapidan station, Minn.

Missouri.

Plans are under way by the St. Louis-Kansas City Electric Railway for the construction of a bridge across the Missouri River. The headquarters of the company are at 1015 Commerce Bldg., Kansas City, Mo.

The Vallejo & Northern R. R. Co. and Northern Electric Co., have awarded the contract to the Missouri Valley Bridge & Iron Co., Kansas City, Mo., for the construction of the piers and abutments of the electric railway bridge to be constructed across the river at Sacramento, Cal. The contract price was $126,300.

Montana.

The County Commissioners, Thompson, Mont., have awarded O. E. Petpard, Missoula, Mont. the contract for the construction of three steel bridges in Sanders County, one of which will be at Plains, one at Thompson and the other at Trout Creek. The contract price was $125,650.

The following bids have been received by the City Council of Missoula, Mont., for the construction of the proposed bridge at that city: S. Birch & Sons Const. Co., Salt Lake City, Utah, $9,000; Olson & Johnson, $9,090; C. H. Chilcote, $9,880; Security Bridge Co., $12,500; C. G. Sheeley, Pocatello, Idaho, $17,200. Olson & Johnson were awarded the contract.

New Jersey.

Surveyors have completed soundings and surveys for the construction of a bridge from Longport to Ocean City, N. J., a distance of about 1 mile. The cost of the improvement is estimated at $250,000 and will be borne by the Pennsylvania R. R.

Board of County Freeholders, according to advices from Mays Landing, N. J., has authorized a bond issue amounting to $60,000 for the rebuilding of three large bridges across the meadows from Pleasantville to Atlantic City.

New Hampshire.

Directors of the Boston & Maine Railroad hav appropriated approximately $10,000,000 for the improvement of its system, a large portion of which will be spent on bridges. Among the bridges to be strengthened in order that the heavy type of locomotives may be run over practically the whole system are those on the northern part of the White mountain division and on the western part of the Fitchburg division between Greenfield and Rotterdam. On the Worcester, Nashua and Portland divisions new bridges will be built and several on the southern division will receive attention. Extensive improvements will be made to the Saugus river drawbridge near Lynn and to the Nobles Island bridge at Portsmouth, N. H., particularly. Between Ayer and Nashua about 25 miles of double tracking will be done.

New York.

✣Bids will be received until 2 p. m., Oct. 20, by Kingsley L. Martin, Bridge Commissioner, for the construction of gates and laterals for the Westchester Ave. bridge over the Bronx River in the Borough of the Bronx New York City.

Plans and specifications are being prepared by State Engineer Frank M. Williams, Albany, N. Y., for the construction of a new iron single span girder bridge over the Erie Canal at South Washington St. in Rome, N. Y. The structure will have double driveways paved with wooden blocks and concrete sidewalk on each side.

Plans have been prepared by John L. Harper, Engineer of the City of Niagara Falls Bridge Commission for their portion of the new bridge over the New York Central Railroad tracks at Eleventh St. and as soon as the plans for the superstructure are filed by the railway, Board of Estimate and Apportionment will be requested to make a provision for the work of issuing bonds.

Taxpayers of Albion, N. Y., have petitioned the town of Carlton to construct a new steel or concrete bridge across Oak Orchard Creek at Kenyonville and one across the same stream at Two Bridges and to appropriate $18,000 and $10,000 for the structures respectively.

The Owego Bridge Co., Owego, N. Y., has been awarded the contract at $3,350 for the construction of two steel bridges on High Point Road in Forsyth County, N. C. One structure will be 60 ft. long and 16 ft. wide over Fiddler's Creek and the other 40 ft. long and 16 ft. wide over Willard's Creek. Dean & Reynolds, Winston-Salem, N. C., Engineers.

Ohio.

✣Bids will be received until 11 a. m., November 2, by County Commissioners, Cleveland, O., for the construction of bridge work per Report No. 2732, Steel ties, Denison-Harvard Viaduct, Newburg township. J. F. Goldenbogen is Clerk.

✣Bids will be received until 10 a. m., Oct. 22, by County Commissioners, Urbana, O., for furnishing the necessary labor and material for the construction of substructure of the Steinberger Bridge No. 159 in Mad River township. C. E. Russell is County Auditor.

✣Bids will be received until 11 a. m., October 22, by Board of Commissioners, Seneca and Sandusky Counties, O., for the necessary labor and material for the construction of the last abutment and wing walls,' for a bridge over Green Creek, Sandusky-Seneca County line. J. H. Lennartz, Tiffin, O., is County Auditor.

Board of Commissioners, Fremont, Sandusky County, Ohio have agreed to construct a bridge across Raccoon Creek at Spring St., Clyde, O.

The Mt. Vernon Bridge Co. has been awarded the contract at $209,985 for the construction of the bridge at Fifth St., Zanesville, O. The structure will require approximately 4,000,000 lbs. of steel.

The County Commissioners, Columbus, O. will submit for vote at the coming election a proposition to issue bonds amounting to $30,000 for the construction of three bridges in Franklin County. One over the Scioto at Casparis Stone Co., another over Little Walnut in East Broad St. east of the city and the last over the Scioto at King Ave.

The Council Committee of Public Improvements, Toledo, O., has declared by resolution its opinion that the old Cherry St. bridge should span the river between Ash and Consaul Sts. The resolution provides that when the first half of the new structure is completed the old one will be removed.

The West End Business & Improvement Association, Lakewood, O., is to hold a meeting to take up the matter of constructing a new bridge across Rocky River.

Advices from Coshocton, O., state that the County Commissioner rejected all bids received for the construction of the Jacob Balo Concrete bridge in Virginia township.

Oklahoma.

Plans for the bridge across the Arkansas River at Hyde Park to connect Fort Gibson and Muskogee by trolley and wagon road were submitted to the Commissioners by the county engineer. The cost of the structure which will have 12 150 ft. spans resting on concrete abutments is estimated at $135,000.

Pennsylvania.

✣Bids will be received until 11 a. m., Oct. 20, by Board of County Commissioners, York, Pa., for the erection of the following bridges: Concrete bridge at site designated in Case No. 3, April sessions 1908. Structure is to have 35-ft. span, 14-ft. driveway and will be over Muddy Creek near Brogueville Station in Chanceford township; concrete bridge over Fishing Creek, near Yocumtown, Newberry township, structure to have 30 ft. span, 14 ft. driveway. W. H. Stine is Clerk of the Commissioners.

✣Bids will be received until noon, October 20, by R. J. Cunningham, County Controller, Pittsburgh, Pa., for the filling of approaches to county bridge No. 7 over Sewickley Creek in Marshall township and for raising parapets of bridge No. 1. Parks run in Glen Osborne borough.

At a recent meeting of the Board of Public Works, Reading, Pa., Engineer Ulrich presented plans for the construction of the proposed bridge across the Lebanon Valley tracks at Tulpehocken St. The structure, which, it is estimated, will require an expenditure of $40,000, may not be built for some time.

Commissioners of Atlantic County, Atlantic City, N. J., have awarded the contract to the Nelson-Meredith Co., Chambersburg, Pa., for the construction of three concrete bridges the full width of the roadway and a concrete retaining wall to permit the straightening of a dangerous curve, where the boulevard enters Chelsea Heights. The costs of the structures are $16,900, $10,150 and $12,200 and the retaining wall $12,400.

P. J. Lawler has been awarded the contract by the commissioners of Lower Merion Township, Ardmore, Pa., for the construction of a bridge over the Pennsylvania Railroad tracks at Union Ave., Bala, Pa., for $6,395. The work includes abutments, steel plate girder and I beams encased in concrete. Bids were opened Sept. 30.

Tennessee.

The Chicago Rock Island & Pacific Ry. Co., according to reports is contemplating the construction of a steel bridge over the Mississippi River at Memphis, Tenn. The structure according to plans proposed would necessitate an expenditure of about $3,000,000.

County Judge T. B. Whitehurst, Selmer, Tenn., has awarded the contract for the erection of a steel bridge over Cypress Creek, on the Ramer and Pocahontas public road, 9 miles west of Selmer, to the Vincennes Bridge Co., Vincennes, Ind., for $1,630. Specifications provide for a 60 ft. span with 15 ft. approach on either side.

Commissioners of Lauderdale, Ripley, Tenn., and Crockett Counties, Tennessee, have under consideration the matter of building a bridge to connect the two counties.

Texas.

Bonds amounting to $12,000 have been voted by McCulloch County, for the construction of a bridge across San Saba River at Voca; $8,000 for bridge across Brady Creek in Brady, the county seat; $9,000 for bridge across Colorada River at Waldrip; $10,000 for bridge across Colorado River at Stacy.

The contract has been awarded Corrigan, Lee & Halpin, Kansas City, Mo., at $600,000 for the construction of the reinforced concrete viaduct over Trinity River connecting Dallas and the suburb Oak Cliff, a distance of about 1 mile.

The Commissioners Court, Gonzales, Texas, has awarded the contract for the construction of the steel bridge across the Guadalupe River between Hamon and Dreyer, to F. H. Alsbury & Co., Houston, Texas, for $8,000.

City Board of Commissioners, Palestine, Tex., have adopted a resolution to construct a substantial bridge across Crawford St at the branch near the Palestine Lumber Co. yards.

It is reported that the Beaumont & Great Northern R. R. Co., will find it necessary to construct a 60 ft. girder bridge on the proposed extension from Trinity to Weldon, Tex. R. C. Duff, Houston, Texas is General Manager of the company.

Virginia.

✣Bids will be received until October 25, by P. St. John Wilson, State Highway Commissioner, Richmond, Va., for the construction of a 37-ft. steel bridge over Whispering Creek in Buckingham County.

✣Bids will be received until October 26, by P. St. J. Wilson, State Highway Commissioner, Richmond, Va., for the construction of steel bridge 71 ft. long over Willis River in Cumberland County.

✣Bids will be received until October 27, by P. St. John Wilson, State Highway Commissioner, Richmond, Va., for the construction of a 89-ft. steel bridge over Elk Creek in Grayson County.

Wisconsin.

A petition is being circulated among the property owners of Grand Rapids, Wis., providing for the construction of a new bridge over the Wisconsin River just below the Consolidated Paper Mill. It is said that the expense will be shared by the property owners.

The contract for the construction of the proposed concrete bridge over Fox River at the foot of Broadway, Waukesha, Wis., has been awarded to the Walter Blake Construction Co., Fond du Lac, Wis. at $4,960.

Canada.

City Council of Ottawa, Ont., is to appoint a committee to take up the matter of securing an appropriation for the construction of a bridge across the Canal at Bank St.

The Island Committee have recommended to the City Council of Toronto, Ont., the construction of a new bridge over the Lagoon to Turner's Baths rather than fill in the Lagoon.

City Council of Montreal, Can., is to appoint a deputation to interview the management of the Canadian Pacific Ry. regarding the reconstruction of its bridge across the St. Lawrence near Lachine, to allow the construction of a separate road for vehicles, automobiles, foot passengers, etc.

ROADS, STREETS AND PAVEMENTS

Alabama.

The City Council of Montgomery Ala., has ordered the paving of Moulton St., with a concrete preparation.

Arkansas.

The directors of Road District No. 3, Pine Bluff, Ark., the district recently organized for the purpose of paving about 10 miles of the Sulphur Springs road, have received the report and the estimated cost of the contract from the engineer, Major W. J. Parkes. The estimated cost, $46,000, is based on an 8-in gravel road, 18 ft. wide, with a berm of 2 ft. on either side. Bids for the work will be advertised for in the near future.

California.

Wilkins & Redding have been awarded the contract for furnishing 2,100 yds. of crushed rock for the streets of San Rafael, Cal., for $2.15 per cu. yd.

The County Commissioners at Montesano, Cal., have ordered the Union Pacific Ry. Co. to repair and rebuild the county road on the south side, where the road was appropriated by the company for its own use.

A petition asking that a new road be opened in the vicinity of 40th St., between Cypress and Magnolia Ave., in Oak Park, Sacramento, Cal., has been received by the county commissioners. C. M. Phinney is County Surveyor.

Connecticut.

The Lane Construction Co., of Meriden. Conn., has been awarded the contract for building the new road in the town of Vernon, Conn. The new road is 7,280 ft. long and extends from the Vernon Center station.

Florida.

The County Commissioners at St. Augustine, Fla., awarded the contract for clearing and grading the new road to Elkton to H. Lowe.

The Edwards Construction Co., of Tampa, Fla., was low bidder for the construction of brick or concrete roads and concrete walks, for which bids were opened by the Constructing Quartermaster, Fort Dade, Fla., on Oct. 5.

Georgia.

The citizens of Thomasville, Ga., are contemplating paving the principal streets of the city.

The people of the eastern part of Douglas County, Douglasville, Ga., are organizing a good roads club to build, if possible, a road from the eastern county line to Douglasville.

Illinois.

✣Bids will be received until Oct. 20th, by Commissioners of Highways, Eagle, Ill., for the construction of a gravel road in said town. Charles P. Gaut is Town Clerk.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., Oct. 25th, for 29 contracts for the construction of cement sidewalks.

✣Bids will be received by the Commissioner of Public Works, City of Chicago, Room 705, City Hall, until 11 a. m., Oct. 22d, 1910, for paving Elston Ave. with granite blocks, from the south line of Division St. to the foot of the approach leading to Division St. The work must comply with specifications on file at the Commissioner's office.

✣Bids will be received until noon, Oct. 19, by Capt. M. E. Saville, Constructing Quartermaster, Fort Sheridan, Ill., for the construction of roads, walks, retaining wall, drains, etc., at Fort Sheridan.

The city of Decatur, Ill., has awarded contracts to S. A. Tuttle for paving work to be done next year.

Property owners in Jefferson Ave., Aurora, Ill., have asked the city council to order the paving of that street from Claim St., to Front St., with asphalt. Petitions will probably be circulated shortly for the paving of Union, Grove and Front Sts.

Residents of East State St., DeKalb, Ill., are talking of paving that thoroughfare in the spring. The pavement will connect with the hard roads lately made.

Indiana.

✣Bids will be received until 10 a. m., Oct. 21, by Board of Public Works, Indianapolis, Ind., for the improvement of Maryland St., from the west property line of Shelby St., north side and from west curb line, Shelby St., south side, to east sidewalk line Noble St., by grading and paving the sidewalk.

✣Bids will be received until 7:30 p. m., Nov. 1, by Common Council of Shelbyville, Ind., for the construction of a sanitary trunk sewer system. Also for improvement of several streets with sidewalks, gutters, etc. L. E. Webb is Clerk of the city.

✣Bids will be received until 1 p. m., Nov. 7, by Commissioners of Benton County, Fowler, Ind., for the construction of four stone roads in York township. Lemuel Shipman is Auditor.

✣Bids will be received until 10 a. m., Nov. 7, by Board of Commissioners of Hendricks County at Danville, Ind., for the construction of three roads in Center and Union townships. W. H. Nichols is Auditor.

✣Bids will be received until noon, Nov. 9, by Board of Commissioners, Jasper County at Rennselaer, Ind., for the construction of five stone road improvements in Keener township. James N. Leatherman is Auditor.

✣Bids will be received until 10 a. m., Nov. 9, by Board of County Commissioners, Wabash, Ind., for the construction of two gravel roads in Lagro township. J. P. Noftzger is Auditor of Wabash County.

✣Bids will be received until 1 p. m., Nov. 9, by Board of County Commissioners, Wabash County, Wabash, Ind., for the construction of a gravel road in Lagro township. J. P. Noftzger is Auditor.

✣Bids will be received until 2 p. m., Nov. 10, by Board of County Commissioners, Rushville, Ind., for the construction of gravel roads in Ripley, Noble, Posey and Anderson townships. Jesse M. Stone is County Auditor.

Beal & Bell have secured the contract from the county commissioners at Logansport, Ind., for building the Merriman road between Washington and Tipton townships for $4,979. The other bids received were: Walter Girton, $5,555; Samuel Cotner, $5,378; Justice & Briggs, $5,406; H. A. Barnes, $5,500; Fred Grover, $5,291; V. Merriman was appointed superintendent.

The County Commissioners at Princeton, Ind., have awarded the contract for the building of the six miles of gravel roads in Wabash township to the A. E. & W. Construction Co., of Evansville, Ind., for $9,970.

Bonds have been sold by the city of Princeton, Ind., for the building of the Armstrong system of improved roads and the Main and Broadway St., brick paving, aggregating $53,280. The work will not be started until next spring.

Benjamin Oilar was the successful bidder at Indianapolis, Ind., for the improvement of the Eylens road, his bid being $4,620. The road will be built in Wabash and Tippecanoe townships.

Iowa.

The City Council of Clinton, Ia., has awarded the contract for the paving of 3rd Ave., to Thomas Cary & Son for $5,726. William E. Hayes, City Clerk.

A resolution has been passed by the city council of Carroll, Ia., ordering the city attorney to draft an ordinance for the paving of the business streets of the city with brick and concrete. The contemplated paving includes the following streets: On 5th from Court to Northwestern passenger depot, on West; on Main, from 4th to 6th, 6th from Main to Adams St., on Adams from 4th to 6th.

The Board of Supervisors at Waterloo, Ia., has agreed to pave the bridge over the Cedar River in Cedar Falls early next season with creosote blocks. Bids will be advertised for in about two months.

Kansas.

Petitions are being circulated in Sedgwick County, Wichita, Kan., for the construction of 15 miles of good roads. C. A. Messer is County Engineer.

The town of Abilene, Kan., has sold bonds amounting to $40,000 to the farmers in the immediate vicinity for paving purposes.

Kentucky.

George A. Scheer, Treasurer of Clark County, Winchester, Ky., has sold bonds in the sum of $10,600 for the construction of a few miles of free gravel road in Wood township.

Louisiana.

The Dock Board of New Orleans, La., has decided to pave a road back of the wharves from Thalia to Caliope and from St. Joseph

Items marked thus ✣ indicate work now open for bids.

to Bienville St. The proposed road will be paved with Belgian blocks and the entire distance will be approximately 2,500 ft.

Maryland.

The State Road Commission at Baltimore, Md., awarded contracts for a number of new roads in different sections of the state as follows: Frederick County, between Knoxville and Petersville, 4.43 miles, Coblens and Clift, $32,605; between Petersville and Jefferson, 2.67 miles, M. J. Grove, $51,596; Hartford, between the Conowingo bridge and Dublin Cross roads, 4.24 miles, J. E. Spencer, $34,737; between the Baltimore County line and Belair turnpike, 2.76 miles, J. E. Spencer, $26,122; Cecil, between Elkton and Back Creek road, 3 miles, Juniata Paving Co., $31,646; between Chesapeake City and Back Creek road, 2.47 miles, S. S. Andrews, $28,005; the Annapolis Blvd., between the Severn river bridge and Arnold's Station, 3.2 miles, F. M. Duvall, $46,520.

The County Commissioners of Anne Arundel County, Annapolis, Md., have awarded the first contract for the building of a section of the Baltimore-Annapolis boulevard to F. M. Duvall for $46,523. The road is 26 miles long and the cost will be in the neighborhood of $396,000. The contract awarded to Mr. Duvall calls for the construction of 3.2 miles between the Severn River bridge and Arnold Station on the Annapolis Short Line. Other bids received were as follows: B. F. Conolly & Co., $61,220; Harper & Voigt, $47,589; Thomas Meehan, $50,350.

Michigan.

According to Assistant Prosecuting Attorney Aldrich, the proposed Wayne County, Detroit, Mich., bond issue of $2,000,000 for good roads is in accord with the state enabling act.

Missouri.

C. B. Spencer, division engineer of the St. Louis & San Francisco R. R., has announced that his road will spend from $20,000 to $30,000 for paving the team tracks at the Frisco freight station at 12th and Santa Fe Sts. Contracts are now being let for the work.

The County Court at St. Joseph, Mo., on Oct. 11, received bids on country roads, aggregating $37,500. The work includes macadam and grading, amounting to $30,000; bridges, bridge repairs and culverts, amounting to about $7,500. The work is to be done before winter. Contracts were awarded as follows: Saxton road, macadam, from Ewing bridge to the Garrettsburg road, one mile, to Michael Costello, at $1.12 per lin. ft. Hyde Valley road, from Sparta road west to the city limits, one-half mile to Michael Costello, $1.34 per lin. ft.; grading and macadamizing of the South 11th St. road, from the Detention Home road to the Sparta road, three-quarters of a mile, to M. Costello, at $1.14 per lin. ft. for macadam and 13½ cts. per cu. yd. for grading; grading and macadamizing county farm road, from terminus of present macadam to the county farm gate, one-half mile, to E. P. Olson, at $1.39 per lin. ft. for macadam and 16 cts. per cu. yd. for grading; grading and paving the Maxwell road, from Maxwell schoolhouse to Andrew County line, one mile, to E. P. Olson, at $1.10 per lin. ft. for macadam, and 16 cts. a cu. yd. for grading; culvert at Kirschner's to DeBois Concrete & Construction Co., $311; culvert and fill west of Spring Gardens, same company, at $774; culvert north of K. T. Moore's to O. C. Trapp, at $383; bridge at Isaac Lawers, $420; bridge at Third fork, east of Isaac Clark's, $355, and bridge at W. D. Pyne, $395, to H. J. Mayer & Son; bridge at John Banker's, $160; bridge at Garrettsburg, $370; bridge on Platte River, south and east road, $980, to Empire Bridge Co.; culvert and fill at Starmer's, $595, and 16 cts. a yd. for grading; culvert and fill at Bauman's, $325; 16 cents a cu. yd. for grading, to E. P. Olson and Schmidt; culvert and fill at John Adams', $319, and 16 cts. a yd. for grading; culvert and fill at P. Landis', $319, and 16 cts for grading, to E. P. Olson and Schmidt; culvert and fill half-mile east of Matney Station, $249, to Miller & Arnold; culvert and fill, one-half mile north of John Craig's, $600; culvert and fill at J. H. Stampers', $800; culvert and fill at John Halter's, $230, to H Kerns.

Montana.

The City Council of Helena, Mont., on Oct. 3, ordered the city of Helena to advertise for bids for the paving of Helena St., and also created a special improvement district for the purpose of puting in an 8 ft. concrete walk on Helena Ave., from Main St., to the Northern Pacific right of way.

Nebraska.

The City Council of Seward, Neb., has ordered the issuance of bonds to the amount of $10,000 for paving purposes.

The President of the Park Board, Omaha, Neb., has been authorized to sign a contract with the Krantz Turner Co., for grading the southeast boulevard near Riverview park and the Northwest Blvd., near Fontenelle park. The grading will cost about $10,000.

A petition is being circulated in Fremont, Neb., by L. P. Larson for the paving of the alley half way between Main and Park, from 6th to 2nd Sts.

New Hampshire.

✣Bids will be received until 1 p. m., Oct. 27, by H. C. Hill, State Engineer, Concord, N. H., for the construction of a trap rock road in Portsmouth, estimated to cost about $4,000.

New Jersey.

✣Bids will be received until 8:15 p. m., Nov. 7th, by Lloyd Thompson, Town Clerk, Westfield, N. J., for improving certain streets. According to the estimate of A. W. Vars, 121 Prospect Ave., Town Surveyor, the work is as follows: Contract No. 1—4,000 cu. yds. of excavation; 4,910 sq. yds. of six (6) in. macadam; 10,200 sq. yds. of four (4) in. macadam; 2,000 sq. yds. of macadam resurfaced; 3,860 lin. ft. of concrete curb and gutter; 1,600 lin. ft. of underdrain; 330 lin. ft. of culverts. Certified check, $500. Bond, $7,500. Time of completion, Aug. 1st, 1911. Contract No. 2—3,630 sq. yds. of 6-in. macadam, "Tarvia X" binder; 4,500 sq. yds. of 4-in. macadam, "Tarvia X" binder; 7,080 sq. yds. of macadam resurfaced "Tarvia X" binder; 5,700 lin. ft. concrete curb and gutter; 1,660 lin. ft. of vitrified brick butter on concrete base; 205 lin. ft. of culverts; 1,020 lin. ft. of curb reset on concrete; 380 lin. ft. of new curb set on concrete. Certified check, $500. Bond, $8,000. Time of completion, Sept. 1st, 1811. Contract No. 3. 980 lin. ft. of vitrified brick gutters on concrete base; 100 lin. ft. of culverts; 1,150 lin. ft. of curb reset; 1,610 lin. ft. of new curb; certified check, $200. Bond, $1,000. Time of completion, June 1, 1911.

The Burlington county board of freeholders, Mount Holly, N. J., has awarded the contract to gravel the portion of the Mount Holly and Jobstown road from the former place to Chambers Corner, a distance of about three miles, to Aaron M. Mathis, of New Gretna, for $3,385.

New York.

✣Bids will be received until 11 a. m., Oct. 26th, by Alfred E. Steers, President, Borough of Brooklyn, N. Y., for nine contracts for street improvement, the largest being No. 2, as follows: For regulating and repaving with asphalt pavement on a concrete foundation the roadways of East New York Ave., from Rockaway Ave. to Sackman St., and Sackman St., from East New York Ave. to Liberty Ave., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 6,690 sq. yds. of asphalt pavement, outside of railroads area, five years' maintenance; 125 sq. yds. of asphalt pavement, within railroad area, no maintenance; 20 sq. yds. of old stone pavement, to be relaid; 930 cu. yds. concrete for pavement foundation, outside of railroad area; 20 cu. yds. concrete for pavement foundation, within railroad area; 3,040 lin. ft. new curbstone, set in concrete; 390 lin. ft. old curbstone, reset in concrete; 22 noiseless covers and heads for sewer manholes. The time allowed for the completion of the work and the full performance of the contract is 35 working days. The amount of security required is $4,800.

✣Bids will be received until 11 a. m., Oct. 20th, by Lawrence Gresser, President of the Borough of Queens, New York City, for fourteen street improvement contracts, the largest being No. 10, for repaving with granite block on a sand foundation the roadway of Jackson Ave., from Trains Meadow Road to Woodside Ave., in the 2d Ward, Borough of Queens. The time allowed for doing and completing the above work will be 75 working days. The amount of security required will be $13,000. The Engineer's estimate of the quantities is as follows: 13,000 sq. yds. of new granite block pavement, including sand bed laid with sand joints and 1 year's maintenance, outside the railroad franchise area. 2,600 sq. yds. of new granite block pavement, including sand bed laid with sand joints and no guarantee, within the railroad franchise area; 2 new standard sewer basins, complete; 80 ft. 12-in. salt glazed culvert pipe, in place.

The town of Scarsdale, N. Y., awarded the contract to E. L. Exbeck of White Plains, N. Y., for repairing or constructing the following highways for $18,000: Sherbrook Road, Heathcote Road, Griffin Ave., and Fenimore Road, a total length of 1.53 miles, and the contract to Tony Richards, White Plains, N. Y., at $10,175, for the following: Grand Blvd., Brambach Ave., and Ewart St., a total length of .86 miles. Bids for the work were opened Sept. 26.

Wm. J. Fitzgerald, 547 W. 45th St., New York City, has been awarded the contract at $80,748, by the President of the Borough of Manhattan, New York City, for 10 improvement street contracts, the largest being No. 10, as follows: For regulating and repaving with granite block pavement on concrete foundation the roadway of 11th Ave., from the north side of 27th St. to the north side of 42d St., and of 33d St., from the west side of 10th Ave. to the east side of 11th Ave. Engineer's estimate of amount of work to be done: 18,250 sq. yds. of granite block pavement, except the railroad area; 4,120 sq. yds. of granite block pavement in the railroad area (no guarantee); 21,960 sq. yds. of old stone blocks to be purchased and removed by the contractor; 3,850 cu. yds. of Portland cement concrete; 7,180 lin. ft. of new bluestone curb stone, furnished and set; 120 lin. ft. of old bluestone curb stone, redressed, rejointed and reset; 5,160 sq. ft. of new granite bridge stone, furnished and laid. The time allowed for doing and completing the work will be 150 working days. Bids were opened Sept. 23.

The President of the Borough of Manhattan, New York City, has awarded the contract for maintaining asphalt pavements to the Vulcanite Paving Co., 30 Church St., New York City, for $24,535. The largest contract being No. 3 as follows: Dutch St., from John to Fulton St.; Pearl St., from Broad to Whitehal St.; 45th St., from 6th to 8th Ave.; 4th St., from Lewis St. to 2d Ave.; 3d St., from Lewis St., to 2d Ave.; Lawrence St., from 126th St. to Broadway; 126th St., from Lawrence St. to St. Nicholas Ave.; 129th St., from Broadway to Manhattan St.; 6th St., from Avenue D to Lewis St.; 7th St., from Avenue C to Lewis St.; 60th St., from 1st to 3d Ave.; Lewis St., from Houston to south side of 3d St.; Lewis St., from 75 feet north of 4th St. to south side of 5th St.; Lewis St., from 30 ft. north of 5th St. to 8th St.; Astor Pl., from Broadway to 4th Ave.; 8th St., from Broadway to 4th Ave.; 1st Ave., from 59th to 60th St.; 61st to 72d St.; 74th to 83d St.; 84th to 85th St.; 86th to 91st St.; 92d to 109th St.; 120th St., from 5th Ave. to East River; Stuyvesant St., from 2d to 3d Ave.; 9th St., from Stuyvesant St. to University Pl.; University Pl., from south side of Waverly Pl. to north side of 4th St.; Mer-

Items marked thus ✣ indicate work now open for bids.

cer St., from 4th to 8th St.; Washington Pl., from Broadway to University Pl. Engineer's estimate of amount of work to be done 28,000 sq. yds. of asphalt pavement; 100 sq. yds. of old stone pavement; 30 cu. yds. of concrete. Time allowed for doing and completing the above work is until December 31, 1910. Bids were opened Sept. 23.

North Carolina.

State Engineer W. L. Spoon of North Carolina has stated that surveys have been made from Linvale to [illegible] of about 30 miles, for the proposed automobile highway over the Blue Ridge Mountains from Asheville to Alta Pass. The approximate cost of the road is $75,000.

Ohio.

✣Bids will be received until 10 a. m., Oct. 21, by County Auditor, Napoleon, O., for the necessary labor and materials for the improvement of seven roads in Henry County.

A movement is on foot in Wooster, O., for the paving of Nold Ave., from Bever to Spink St.

The Leetonia, O., City Council will pave Columbia St., and have sold bonds amounting to $8,500 to the Walcup Co., of Cleveland for that purpose.

Samuel L. Rice was low bidder for improving Sinton St., from Front to Gallia in Portsmouth, O. Mr. Rice's bid was $5,131 for Portsmouth block laid on a concrete base with a tar filler. The other bids received were as follows: Kaps Bros., Portsmouth block, $5,363; Kelley Bros., Pebbles block, $5,264; S. Monroe & Son, Portsmouth block, $5,265; J. A. Grimes, Portsmouth block, $5,638.

Contracts have been awarded by the county commissioners at Urbana, O., for graveling some of the county's pikes, as follows: Rosewood and Craysville pike, one mile west from Rosewood to C. R. Caland for $545; Urbana and Westville pike one mile west from the east Mad River township line, for $782; Woodstock and Mechanicsburg pike one mile south from Woodstock for $926; William Craig, for graveling the Urbana and Milford pike, one mile west from the Dugan near the Ludlow road.

The County Commissioners at Cincinnati, O., have awarded the contract for the improvement of the Lawrenceburg and Elizabethtown pike to B. Niehaus for $18,585. Other contracts awarded by the commissioners were as follows: Improvement of Race Ave., in Green Township, N. Ruebel, $4,522; improvement of the Gurley road, Green township, N. Ruebel, $8,554; improvement of South Ave., and the Werk road, J. Nickoson, $7,750; improvement of the Walton Creek road, R. S. Flynn, $1,437.

The Board of Control of Dayton, O., upon the recommendation of Service Director Ely awarded the contract for the improvement of Katherine St., from Chapel Road to the north terminus by grading and graveling to Hecker & Kirchner, for $1,278.

Pearl Ave., property owners, Lorain, O., are agitating a movement for the paving of that thoroughfare from East 28th St., to East 33rd St.

The City Council of Elyria, O., has decided to pave the following streets: West River St., from the undercut to Third St.; Tremont St., from Chestnut St., to West Ave.; and Chapel St., from Broad to Second Sts. The council also decided to pave Broad St., from the Topliff Hotel to East Ave., and to repair the pavement from East Ave., to the East Broad St. bridge, also west from the Topliff Hotel to West Ave.

A bond ordinance authorizing the issuance of bonds to the amount of $33,500 for the purpose of paying the city's portion of the cost of the improvement of Ellen Ave., between University Ave., and Stetson St.; Jail alley, between Main and Sycamore St., and Elmore St., between Calhoun St., and Spring Grove Ave., has been passed by the city council of Cincinnati, O.

The City Council of Columbus, O., will draw up a new ordinance, annuling the existing $70,000 contract for the improvement of North High St., from 5th Ave., to Doddridge St. The contract was originally given to the Andrews Asphalt Co., of Hamilton, O., on Aug. 30. The work will be re-advertised and awarded this year.

The Caledonia and Martel pike improvement was sold by the county commissioners at Marion, O., to Oberlander & Oberlander, for the crushed stone at $4,750 and the Carba-Via Co., for the tar binder at $3,976. The pike will be improved from Slick's corners to the Caledonia corporation line, a distance of three miles. The improvement will be of tar macadam.

Oregon.

Petitions have been circulated in Portland, Ore., for the paving of Lombard St., between Glenn and Albina Aves. Petitions have been signed for the improvement of Albina Aves., between Lombard St., and Killingsworth Ave.

The City Council of Baker City, Ore., has accepted the bid of Warren Construction Co., of $2.25 per sq. yd. for bithulithic paving on Bridge, Auburn, Resort, North Main and Second Sts.

Advices from Wenatchee, Ore., state that State road No. 7 has been located by State Highway Commissioner Bowlby. The road will run from Wenatchee down the Columbia River to the Colockum creek and along the Colockum over the mountains to Ellensburg.

Pennsylvania.

✣Bids will be received until noon, Oct. 27, by County Controller R. J. Cunningham, Pittsburgh, Pa., for the improvement of the following highways in Allegheny County: Ardmore Road from Wilkinsburg borough along the line of the Ardmore St. Ry. Co., through and along properties of John McKelvey, Sweeney heirs, East Wilkinsburg Improvement Co., and the Westinghouse Electric Manufacturing Co., to North Braddock borough line, a distance of 2½ miles, more or less. Guys Run road: From a point on the improved Freeport road, at property of P. G. Kountz estate, thence through and along lands of P. G. Kountz estate, A. H. Seiffer, George Bowman, H. E. Sarver and others to a point on said Guys Run road, near property of George or Edward Bowman, a distance of 1.4 miles, more or less.

The Borough Council of Punxsutawney, Pa., has passed an ordinance providing for the paving and curbing of Penn St., from Mahoning to Penn to South Gilpin St.; South Jefferson St., from Penn St., to Liberty St.; Cranberry Alley from Findley St., to Gilpin St., and the lower end of Cherry St., from North Findley St.

The Paving Committee of the City Council of Butler, Pa., has awarded two contracts for street paving. The contract for the paving of Sleppy St., being awarded to Tony Morelli, and the East Penn St. paving to John Schaffner.

The Board of Public Works of Altoona, Pa., has changed the specifications for paving operations in the city. The board has decided to adopt the "batch" system of mixing.

Frank H. Craven has presented an ordinance to the city council of Philadelphia calling for the paving of the following: West Philadelphia thoroughfares — Girard Ave., from Lancaster Aves. to the bridge over the Pennsylvania R. R. tracks at Belmont Ave.; Girard Ave. from Parkside Ave. to the west end of the Girard Ave. bridge over the Schuylkill River and 52nd St., from Warren St. to Parkside Ave.

W. C. McCormick of Uniontown, Pa., has been awarded the contract for the improvement of that part of the National pike that lies between the Girard hotel and the borough line, in the vicinity of Brownsville. This stretch of road is 1,076 ft. long.

Tennessee.

The City Commissioners of Memphis, Tenn., awarded the contract for paving McLemore Ave., from Mississippi Blvd., to Rayburn Blvd., with asphalt to the Barber Asphalt Co., of Chicago. The contract was immediately sublet to the Memphis Asphalt Co.

Texas.

All bids for the repaving of Main St., from Ervay to Central Ave., in Dallas, Tex., were rejected by the board of municipal commissioners on Oct. 5. New bids on slightly changed specifications, for vitrified brick, wooden blocks, asphaltic concrete, bitulithic and rock asphalt will be sought.

Street Commissioner Maddox of Houston, Tex., has asked for an appropriation of $304,100 for repairs to city streets, bridges and culverts, engineering expenses incidental to the paving of streets and laying of water and sewer mains.

The City Commissioners of Port Lavaca, Tex., have instructed Engineer T. H. Clement to make a survey and take levels of a number of streets for improvements petitioned for.

The following bids were recently received by the Board of Local Improvements of Dallas, Tex., for the permanent paving of Pearl St., from Live Oak to Ross: John C. Underwood, for 4-in. creosoted pine blocks, $3.29 per sq. yd., without maintenance; foundation of 5-in. gravel, concrete, cushion of sand and filler of asphalt $3.45 with 5-year maintenance; for 3½-in. block $3.08 per sq. yd., without maintenance; $3.25 for 5-year maintenance. D. J. Grigsby, vitrified blocks, $2.75 per sq. yd.; creosoted 4-in. blocks of wood, $3.39, and for 3½-in., $3.14, all without maintenance. Texas Bithulithic Co., vitrified block, $2.75, without maintenance; $2.85 for 5-year maintenance; creosoted wooden blocks, 4-in., $3.37, without maintenance; $3.50 for 5 years, 3½-in. blocks, $3.34 without maintenance, $3.35 for 5 years; for bithulithic, without maintenance; $2.22 for Jacksboro surface rock, $2.36 for Arkansas Trap Rock, and $2.41 for Llano granite with 5-year maintenance, the respective rates are $2.30, $2.44 and $2.49.

The Board of Municipal Commissioners of Dallas, Tex., has adopted resolutions calling for bids upon specifications for the paving of Holmes St., between Grand Ave. and Pennsylvania, and of Grand Ave., between Holmes and Ervay Sts. Brick, asphalt, bithulithic, wooden blocks and asphaltic concrete are the materials upon which bids are called for.

The issue for $25,000 bonds for the First Justice's precinct in Austin County, Bellville, Tex., was carried by a large majority.

The Ellis County Commissioners, Waxahachie, Tex., propose to construct 200 miles of graveled roads by a bond issue of $550,000, recently approved by the attorney general.

Utah.

James Wood of Murray, Utah, has been awarded the contract by the city of Midvale, Utah, for the construction of paved sidewalks to the amount of about $5,000.

Washington.

The County Commissioners at Bellingham, Wash., have signed an authorization to the state highway commission to survey and build state road No. 6, which will be a boulevard from Blaine to the Skagit County line.

The Board of Public Works of Spokane, Wash., has rejected all bids for paving 7th Ave., from Bernard St. to Howard St., with concrete; 5th Ave., Howard St. to Monroe St., with asphalt, and Hamilton St., from S. F. & N. tracks to DeSmet Ave., with asphalt. The bids were rejected owing to the lateness of the season and the high price of cement.

Wisconsin.

✣Bids will be received until 10:30 a. m., Oct. 21st, by Department of Public Works, Milwaukee, [illegible] of streets by grading and macadamizing roads in 14th, 17th and 21st Wards. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received until 10:30 a. m., Oct. 21st, by Department of Public Works, Milwaukee, Wis., for improving streets in 14th, 17th and 21st Wards, by constructing cement sidewalks. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received until 10:30 a. m. by the Department of Public Works, Milwaukee, Wis., for furnishing all the material and labor for the grading and paving with stone the alley running northeasterly and southwesterly through block 3, Martin's subdivision in the 11th Ward. H. E. Briggs is Commissioner of Public Works.

No bids were received Oct. 3 by the board of public works of Superior, Wis., for the paving with plain macadam of Main St., to Connors Point.

John O. Jones, of Racine, Wis., was low bidder of the bids opened in Kenosha for the work of paving a mile of street. Mr. Jones' bid amounted to about $40,000.

Canada.

The City Council of St. Thomas, Ont., proposes to pave the following streets next year: West Broad St., hill, Tremont St., Chapel St., and West River St., from the undercut to 3rd St. The improvements prior to paving, such as making fills, establishing sewer connections, etc., must be made this fall.

WATER-WORKS AND SEWERAGE

Alabama.

The North Birmingham water and light plants, North Birmingham, Ala., is to undergo extensive improvements, according to advices from that city. The committee appointed by the city council has recommended improvements to cost $38,575. as follows: Reservoirs, old and new, $4,670; Filter, $18,000; Sloss quarry water, $6,050; pump, $2,500; compressor, $3,500; generator and switch board, $950; arc transformer and switch board, $645; fire plug valves, $860; valve boxes, $600; line rebuilding, $800.

Resolutions urging that necessary steps be taken at once for a municipal water plant for Greater Birmingham were drafted and adopted at the monthly meeting of the Birmingham board of trade. Roy McCullogh is secretary of the board.

California.

✣Bids will be received until 11 a. m., November 2, by Board of Public Works, Oakland, Cal., for furnishing necessary labor and materials for the construction of a sewer in 14th Ave. and Bruce St. from East 24th St. to East 38th St. James W. Nelson is Sec'y.

✣Town Engineer Fisher of East San Jose, Cal., has submitted to the board of trustees plans and specifications pertaining to the sewer to be built on Chace Ave., from Lendrum Ave., to McKee road. The plans were adopted and Clerk Charles O. Russell instructed to advertise for bids to be received Oct. 25.

George F. Kernaghan, water commissioner, Pasadena, Cal., has had plans prepared for the development of 6,500 miner's inches of water in the water shed back of Pasadena. The plan embraces taking over the Tejunga watershed, from which Los Angeles at present gets much of its water supply. The water will be conveyed to the north of Pasadena at an elevation of 1,500 ft. by means of a conduit of a total length of 15½ miles. From this point the water will be at an elevation to command Pasadena, Altadena, South Pasadena, Alhambra, Sierra Madre, Monrovia, Glendor, Azusa, Covina, Claremont, Lordsburg, Pomona, Ontario, Eagle Rock, and the territory surrounding these towns.

The city council of Stockton, Cal., has closed a deal for the purchase of 200 acres of land to be used for the disposal of city sewage.

The town of Sonoma, Cal., is about to begin the installation of its $20,000 sewer system. Bonds have been voted and preliminary plans have been adopted.

The citizens of Corning, Cal., on Oct. 4 voted in favor of the proposition of installing sewerage and water systems.

The city council of Long Beach, Cal., has passed an ordinance declaring intention to put in sewers in the eastern end of the city, draining Alamitos Ave., and all streets west to a point where sewers are already in. The sewers are to extend as far north as Eighth St., from Second St.

Members of the board of trustees of Healdsburg, Cal., and representatives of the Chamber of Commerce have made a tour of the septic tank systems which have been constructed in St. Helena, Soldiers' Home and Napa County Infirmary to obtain information relative to the construction of the same kind of a system in Healdsburg.

The city board of trustees of Sacramento, Cal., passed ordinances calling elections to vote for or against bonding the city for $666,000 for a municipal filtration plant, and for $75,000 to be used to purchase a right of way at the mouth of the Sacramento river, so that the stream at that point might be widened to give increased flow and lower the flood plane.

Colorado.

The Crystal Creek Water Co., has been organized at Mancos, Colo. The incorporators are J. R. Paterson, J. W. Osbin, A. F. Hallford.

The city of Rocky Ford, Colo., has let a contract for drilling another artesian well on the edge of the town to C. H. McVey. It is estimated the well will reach a depth of 900 ft. and will cost between $2,000 and $3,000.

Georgia.

✣Bids will be received until 7:30 p. m., November 1, by O. R. Bennett, City Clerk, Eastman, Ga., for the construction of approximately 9 miles of 8 to 12-in. sewer, terra cotta pipe, with necessary manholes and flush tanks. Plans are on file at the Council Chamber, Eastman, and at the office of Arthur Pew, 619 Temple Court Bldg., Atlanta, Ga., Consulting Engineer.

The town of Kirkwood, a suburb of Atlanta, Ga., has voted the issuance of bonds in the sum of $60,000 for the installation of sewers and water mains for the town.

Idaho.

The city of Pocatello, Ida., has sold bonds to the amount of $164,788 for the construction of a modern system of storm and sanitary sewerage.

Illinois.

✣Bids will be received until 8 p. m., Oct. 20, by Board of Local Improvements, Alvah I. Rogers, Secy., Waukegan, Ill., for the following improvements: Doc. No. 377—A system of sewers in Sheridan Road and other streets, estimated cost about $19,500. Doc. No. 382—Water supply pipe in First St. Doc. No. 383—Water supply pipe in Maple Ave. Doc. No. 384—Sewer in Philadelphia Ave.

✣Bids will be received until 2 p. m., November 11, by Commissioners of the Eldred Drainage and Levee District, Carrollton, Ill., for brick building for pumping plant which they are erecting and frame dwelling for engineer. Leroy McFarlan, Jr., is Secy. Harman Engineering Co., 120 Fredonio Ave., Peoria, Ill., Engineers.

Following low bids were opened Oct. 10, by the Board of Local Improvements, Chas. A. V. Standish, Secy., Chicago, Ill., for constructing house drains in the following streets: Hollywood Ave., Southport Ave., Clark St., Malachy Murphy, 5315 Wabash Ave., Chicago, at $0.22 per ft.; Michael Doran, 4612 Emerald Ave., Chicago, Kedzie Ave., 26th St., 39th St., at $0.45 per ft.; Simon Ryan, 2927 Congress St., Chicago, Medill Ave., Kimball Ave., Central Park Ave., $0.27 per ft.; Carmino Roberts, E. 75th St., Stony Island to Paxton Ave., $0.53¾ per ft.; Simon Ryan, Dauphin Ave., E. 87th St., E. 92d St., $0.26 per ft.; E. 87th St., St. Lawrence Ave., to Dauphin, $0.28 per ft.; E. 87th Pl., St. Lawrence to Dauphin, $0.27 per ft.; E. 88th St., St. Lawrence to Dauphin, $0.27 per ft.; E. 88th Pl., St. Lawrence to Dauphin, $0.27 per ft.; E. 89th St., St. Lawrence to Dauphin, $0.38 per ft.; E. 89th Pl., St. Lawrence to Dauphin, $0.27 per ft.; E. 90th St., St. Lawrence to Dauphin, $0.27 per ft.; E. 90th Pl., St. Lawrence to Dauphin, $0.28 per ft.; E. 91st St., St. Lawrence to Dauphin, $0.27 per ft.; E. 91st Pl., St. Lawrence to Dauphin, $0.25 per ft.; E. 92d St., St. Lawrence to Dauphin, $0.26 per ft.; E. 92d Pl., St. Lawrence to Cottage Grove Ave., $0.27 per ft.; E. 93rd St., St. Lawrence to Cottage Grove Ave., $0.30 per ft.; Lyon Ave., E. 93rd St., Cottage Grove Ave., $0.32 per ft.; Evans Ave., E. 93rd St., Lyon Ave., $0.30 per ft.

The city of Macomb, Ill., recently awarded the contract for setting boilers at the new waterworks to Robert E. Johnson of that city for $1,150.

The village of Kingston, Ill., has voted the issuance of bonds to the amount of $4,000 for the installation of a waterworks system. The village will get its water from the Stewart place south of town where there is a 6-in. well.

The town council of Herrin, Ill., has purchased a site for the new reservoir to be constructed. City Engineer Adams has designed a basin which when completed as he has planned will impound 50,000,000 gals.

The board of local improvements of Princeton, Ill., has created a sewer district at the north end of the town in the vicinity of the Douglas school.

The village board of Catlin, Ill., has awarded the contract for the new storm and sanitary sewer for $2,700. The profile calls for the construction of a sewer from the Pratt Hill south of the village, down Sandusky St., to the Jones branch, north of town, a distance of almost a mile.

N. F. Townsell of Streator, Ill., has been awarded the contract by the village of Depue, Ill., for sinking an artesian well at that place to a depth of approximately 1,300 ft., for $2.15 per lin. ft. The pipe is to be furnished to complete the same for the sum of $1,198. Bids were opened Oct. 7.

Indiana.

✣Bids will be received until 10 a. m., October 21, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers in and along the alley north of Lincoln St., from second alley west of Leonard St., to a point 977 ft. west.

✣Bids will be received until 10 a. m., October 21, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers in and along Euclid Ave., from Michigan St. to a point 1,130 ft. north thereof.

✣Bids will be received until 10 a. m., October 21, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers in and along alley west of West St., from McCarty St. to Wyoming St.

The contract for the construction of a sewer, 320 ft. long, on Sixth St., from the sewer on Cherry St., in Evansville, Ind., has been awarded to Ben. Newman & Co.

Work has been begun by City Engineer Freel of New Castle, Ind., on the plat and profile for the sewer which will enclose the Bowery Brook. The sewer will be about 56-

in. at the largest point, and the drainage canal, to be constructed, will be about two miles long.

R. L. Sackett of the Purdue University, Lafayette, Ind., has been secured by the city of Kokomo, Ind., to give practical suggestions relative to the establishment of a complete and uniform system of sanitary sewage.

Iowa.

✣Bids will be received until 9 a. m., Oct. 24, by Neal Jones, City Clerk, Des Moines, Ia., for the construction of a 12-in. No. 1, vitrified clay pipe sewer on East 13th St., from the present sewer on Guthrie Ave. to a point 640 ft. north.

✣Bids will be received until 8 p. m., Oct. 20, by Otto P. Geiger, City Recorder, Dubuque, Ia., for the construction of a 30-in. tile pipe storm sewer in 27th St. and Couler Ave. for the Bee Branch sewer in Washington and 27th St. west of Couler Ave. thence east to Diagonal St. including necessary manholes, catch basins and inlets. The work includes, according to the engineers estimate, approximately 1,170 ft. 30-in. tile pipe, 75 ft. of 16-in. tile pipe; 110 ft. of 12-in. tile pipe, 3 manholes, 8 catch basins and 2 inlets.

✣Bids will be received until 3 p. m., October 25, by Irwin Aikin, Town Clerk, West Liberty, Ia., for the construction of the following sewers; 955 ft. 18-in. vitrified pipe; 5,680 ft. of 15-in. vitrified pipe; 200 ft. of 16-in. cast iron pipe; 1,640 ft. of 12-in. vitrified pipe; 3,000 ft. of 10-in. vitrified pipe; 18,000 ft. of 8-in. vitrified pipe; 69 manholes; 20 Flushtanks; 1 septic tank, 2 sand filters; 1 bulkhead. Iowa Engineering Co., Clinton, Ia., Engineers.

The Ottumwa, Ia., city council has decided to purchase the plant of the waterworks in that city and operate the plant in the future under municipal ownership. The consideration is $280,000.

Mayor D. L. Murrow of Corydon, Ia., has received from the Iowa Engineering Co., of Clinton, Ia., the plans and specifications for the complete sewer system for the city. The city is also selling bonds for the construction of the sewer system and the waterworks.

The board of public works of Davenport, Ia., has received the following bids for the construction of a sewer in West 10th St., between Hilltop Ave., and the lateral sewer in Warren St. The Independent Construction Co., 81c per lin. ft., Glaspell & Hubbell, 83c per cu. ft, and Hydraulic Concrete Construction Co., 69c per lin. ft. The board will recommend to the city council that the contract for the work be awarded to the latter company.

City and Civil Engineer R. C. Hart of Clinton, Ia., is preparing plans, specifications and an estimate of cost of the outlet for the new sanitary sewer system at Belle Plaine, Ia. The sewer plans have been made and the estimated cost is about $40,000.

The contract for the construction work on the new sewerage disposal plant of Hampton, Ia., has been let to J. T. McCormick of Fort Dodge for $4,500. Plans and specifications have been prepared by M. Tschirgi of Dubuque, Ia.

Kansas.

Prof. W. C. Hoad of the state university and sanitary engineer for the state board of health, Topeka, Kan., is making a final report of the sewage proposition for the southeast part of Parsons, Kan. It is now proposed to carry the sewage to Big Labette creek, southeast of the city limits, about two miles and a half, where the septic tank will be constructed. The system, it is estimated, will cost about $50,000.

City Commissioner of Streets and Public Improvements, W. G. Tandy of Topeka, Kan., is planning the construction of a new 5 ft. sewer to handle the sewerage of the entire western portion of the city, and to replace the main now in use at an estimated cost of $30,000.

Louisiana.

The Police Jury of La Salle Parish, Jena, La., contemplates providing water and sewer pipes for the new Courthouse and jail. A contract was entered into with C. W. Stewart to install the water works plant back of the jail on the north side of the Courthouse square. The sewerage pipe will be extended 11,000 ft. to the banks of Homps Creek. The plant and sewerage pipe will cost $1,582. Henry E. Hardtner is President of the Jury.

Maryland.

Mayor George Edward Schell of Frederick, Md., favors the building of a new reservoir with a capacity of 8,000,000 or 10,000,000 gals., to prevent shortage of water in the dry season.

Michigan.

✣Bids will be received until 2:30 p. m., Oct. 27, by Board of Trustees, Caro, Mich., for the materials and construction of sewers. The work will include approximately 10,055 lin. ft. of 8-10-12-15-in. sewer with necessary manholes and flush tanks. Jos. Walton is Clerk. Riggs & Sherman Co., 613 Nasby St., Toledo, O., Consulting Engineer.

Langley & Jeynes of Detroit, Mich., were the lowest bidders on the stretch of the Fairview sewer from Fairview Ave., to Connor's Creek in Detroit; their bid being $59,469 for 3,466 ft.

The councils of Grosse Pointe Park and Grosse Point, Mich., are considering the proposition of combining the municipalities to build a trunk sewer to empty into the Detroit sewers. Robert Trombly is President of the village council of Grosse Pointe Park.

Minnesota.

The water, light and power commission of Chisholm, Minn., has awarded the contract for erecting the piers under the new settling basins in connection with the city's water supply to Joseph Cummings for $3,118.

E. Boulett of Virginia has been awarded the contract for putting in sewerage and water mains for Marble, Minn., the contract to be finished by Jan. 1, 1911.

City Engineer Bowman of Gilbert, Minn., has submitted his plans to the village council for the proposed sewer system. The plans will be submitted to the state board of health for approval.

The board of public works of Duluth, Minn., has awarded contracts for 11 sanitary sewer jobs, which will cost about $10,000, as follows: Eighth alleys between Ninth and Eleventh Aves. east, Erick Norquist & Co., $1,166; Sixty-first alley between Polk and Sherburne Sts., Pastoret-Lawrence Co., $2,056; Wyoming St. between Fifty-fourth and Sixtieth Ave. east, Gust Hiner, $1,090; Juniata St. between Fifty-fourth and Sixtieth Ave., E. Engle, $1,168; Restormel alley and Atlantic Ave., E. Engle, $1,132; Princeton Ave., between Oxford and St. Andrews Sts, J. E. Johnson, $1,530; Wicklow alley and Michigan Ave., J. D. O'Connell, $495; Glenwood St. between Fifty-fourth and Fifty-eighth Aves., Johnson & Johnson, $844; Glenwood alley between Fifty-seventh and Sixtieth Aves, E. Engle, $735; Restormel St., with outlet in Second St., G. Hiner, $1,704; Regent St. between Fortieth and Forty-second Aves., Pastoret-Lawrence Co., $1,407.

Mississippi.

A resolution has been introduced in the city council of Bay St. Louis, Miss., recommending the issuance of bonds in the sum of $75,000 for sewerage, drainage, streets and electric lights.

W. G. Kirkpatrick, waterworks expert of Jackson, Miss., is preparing an additional report showing how the city of Chattanooga, Tenn., can construct the proposed municipal waterworks plant within the amount of the bond issue of $900,000 which was made for the purpose.

Missouri.

The citizens of Shelbina, Mo., are agitating the installation of a sewerage system.

New Jersey.

The lowest bid for the construction of a pumping station to be added to the sewage disposal system in Plainfield, N. J., were James A. Christie and Miele & Bruno, of Newark. The council passed a resolution ordering the issuance of $30,000 street improvement bonds. Bids will be received on Oct. 30.

New Mexico.

The city council of Deming, N. Mex., has decided that the proposition of installing a sewer system should be given to a general vote of the people.

New York.

✣Bids will be received until noon, Oct. 29th, by Martin E. McClary, President of the Board of Managers, New York State Hospital for Incipient Tuberculosis, Raybrook, N. Y., for employes' building, including the entire construction, heating, plumbing and electric work.

✣Bids will be received until 11 a. m., Oct. 26, by Alfred E. Steers, President of Borough of Brooklyn, New York City, for 14 sewer construction contracts, the largest being No. 1, as follows: For furnishing all the labor and materials required for the construction of a sewer in 63rd St., from 8th Ave. to 10th Ave., and in 63rd St., from 14th Ave. to 13th Ave., and an outlet sewer in Fort Hamilton Ave., both sides, from 63rd St. to 62d St. The Engineer's preliminary estimate of the quantities is as follows: Thirty lin. ft. of 18-in. pipe sewer, laid complete; 335 lin. ft. of 15-in. pipe sewer, laid complete, including all incidentals and appurtenances; 2,240 lin. ft. of 12-in. pipe sewer, laid complete, including all incidentals and appurtenances; 1,300 lin. ft. of 6-in. house connection drain, laid complete, including all incidentals and appurtenances; per lin. ft., 65 cts.; 30 manholes, complete, with iron heads and covers, including all incidentals and appurtenances; 2 sewer basins, complete, of either standard design, with iron pans or gratings, iron basin hoods and connecting culverts, including all incidentals and appurtenances.

✣Bids will be received until 11 a. m., Oct. 25, by Department of Public Works, Buffalo, N. Y., for the construction of a 15 to 12-in. tile dry weather sewer in Mississippi, Elk and Ohio Sts., between Perry and Main Sts., including about 1,808 lin. ft. sewer; also for the construction of a 15 to 12-in. tile sewer in Norris St. between Hertel Ave., and North end of Norris St. including about 1,293 lin. ft. of sewer. The time allowed for completion of the work is 100 and 60 days respectively.

The Winfield Taxpayers' Association, Winfield, N. Y., has decided to incorporate, and build a private sewer for that village. Shares have already been subscribed for to the amount of $10,000.

The board of health of Rockville Centre, L. I., contemplates installing a sewerage system. It is estimated that the approximate cost of installing a satisfactory disposal plant, with the necessary laying of pipe, manholes, basins and everything necessary in connection therewith, would entail an expenditure of about $175,000.

North Carolina.

The following bids were received Oct. 14th by Captain Earl I. Brown, U. S. Engineer, Wilmington, N. C., for about 1,810,000 cu. yds. of dredging: Bowers Southern Dredging Co., Galveston, Tex., $7.95, recommended for acceptance; Chas. Vivian & Co., Islip, L. I., N. Y., $11.40; Coastwise Dredging Co., Norfolk, Va., $9.20; Atlantic Gulf & Pacific Co., New York, N. Y., $10.50.

North Dakota.

The city council of Grand Forks, N. Dak., contemplates deepening Red River in order to insure a better water supply for the city. The proposition if carried out will result in removing a sandbar at the source of Red Lake River. The sandbar is about 1,500 ft. in length and it is estimated that it will cost about $2,000 to remove it.

Ohio.

✣Bids will be received until noon, Oct. 22d, by the Board of Trustees, Athens State Hospital, O., O. Fordyce, Secy., for furnishing and installing two 150 h. p. boilers, 22-ft. 8 O' standpipe system of steam and water piping, also hydrotherapeutic plant. Osborne Engineering Co., Cleveland, O., engineers.

✣Bids will be received until Oct. 25, at noon by the Director of Public Service, Bellefontaine, O., for the construction of Section 1 and 2 of the sanitary sewer system of Bellefontaine, O. The work, according to the estimate, is as follows: Section 1.—30,701 lin. ft. 8-in. to 24-in. sewer, 81 monholes and drop manholes, 13 flush tanks, 7 6/10 tons iron pipe, 118 cu. yds. concrete—together with the necessary excavation and embankment. Section 2—46,110 lin. ft. 8-in. to 18-in. pipe, 151 manholes and drop manholes, 15 flush tanks, 9 6/10 tons iron pipe, 195 cu. yds. concrete—together with the necessary excavation and repaving.

✣Bids will be received until October 25, by Director of Public Service, Bellefontaine, O., for the construction of the proposed sewerage system, estimated to cost $90,000. Riggs & Sherman are Sanitary Engineers.

✣Bids will be received until noon, Oct. 25, by H. H. Canfield, Clerk of Cleveland Heights, O., 309 Beckman Bldg., Cleveland, O., for furnishing the necessary labor and material for the construction of a 6-in. water main in Bluestone Road from the west line of Noble Road to the east line of Cleveland Heights village.

✣Bids will be received until noon, November 8, by Lewis Hall, Clerk of Village of Carthage, O., for furnishing the necessary labor and material for the construction of the entire system of sanitary sewers for the village.

A petition is now being circulated in Newell, O., asking for a completion of the sewer along the lane between Harrison and Grant, from Fourth to Sixth Sts.

A resolution has been introduced in the city council of Wooster, O., providing for the issuing of bonds in the sum of $30,000 to cover the expense of installing the new water supply system at the Blomington reservoir.

Superintendent George Cotter of the water department, Springfield, O., has estimated the cost of laying a force main to give the city better water service and protection at $20,000.

The citizens of Dayton, O., will soon be asked to vote the issuance of bonds in the sum of $600,000 for the installation of the new waterworks system. The estimated cost of the system is divided as follows: Construction, $225,000; purchase of land for wells, reservoir, right of way, etc., $80,000; improvement of distribution system and extension of mains. $250,000, and water towers and accesories, $45,000.

Shafor & Dill have been awarded the contract in Dayton, O., for the construction of sanitary sewers in districts 4 and 5 and 6. The firm's bid for sewers in 4 and 5 was $7,570, and for district 6, $2,121.

Service Director Herbert of Canton, O., has asked the city council for several improvements, among them being the purchase of land to use for the drilling of wells for the new auxiliary pumping station, to be built under the recent $125,000 waterworks appropriation.

The city council of Ashtabula, O., has instructed the service department to prepare plans and specifications for the construction of a sewer in Middle St.

The city council of Upper Sandusky, O., has awarded the contract for the construction of a sewer to P. Drake & Sons of Marion for $3,970.

The board of control of Elyria, O., has recommended to the city council the construction of a sanitary sewer on East Ave., from Depot St., to Fourth St.

Oklahoma.

City Engineer Clonts of Muskogee, Okla., has completed the base line survey for the proposed intercepting sewer to carry the city's sanitary sewage to the Arkansas River. The survey shows the distance from South Main St., along the proposed route of the sewer to the point selected for it to empty into the river to be approximately seven miles.

The city of Alva, Okla., on Oct. 4, awarded a contract to Lund, Keenan & McCarthy of Blackwell, Okla., for waterworks extensions for an amount aggregating $5,634. On Oct. 6 the city awarded the Chicago Bridge & Iron Works the contract for furnishing and erecting a steel tank of 300,000-gal. capacity. A. K. Hubbard is city engineer.

Assistant Attorney General Moore, bond attorney for the state of Oklahoma has approved bonds of the city of Lawton, Okla., which were voted to the amount of $280,000. Of the issue $200,000 is for waterworks, $40,000 for waterworks mains extension and $40,000 for sewer extensions.

Oregon.

The city council of Roseville, Ore., has instructed the city clerk to advertise for bids for the construction of the sewer system. Bonds in the sum of $78,500 have been sold for this purpose.

Pennsylvania.

The borough council of Olyphant, Pa., has adopted the plans with an approximate cost of $3,638, for constructing the South Valley Ave., sewer.

Assistant Director of Public Works, William R. Knight of Philadelphia, Pa., has received bids for the construction of 18 branch sewers in different parts of the city at an estimated cost of $30,000. Most of the work will be done in West Philadelphia.

The borough of West View, Allegheny County, Pa., rejected all bids received Oct. 1, by H. L. Donaldson, Secretary of the borough, for the construction of main sewers and disposal plant. Trimble & Miller, Fourth Ave., Pittsburg, Pa., are Engineers.

Rhode Island.

The construction of a filtration plant at Warren, R. I., to bring to an end the contamination of oyster beds in Warren river and adjoining sections of the bay has been urged by the Warren town council.

South Carolina.

✣Bids will be received by Building Committee, Y. M. C. A., Greenville, S. C., until noon, Oct. 30th, for the construction of a new Association building at Greenville. F. F. Capers is chairman of the committee. Wilson & Sompayrae, Columbia, S. C., are architects.

The city council of Sumter, S. C., has accepted the bid of Berghaus & Moffatt of $10,630 for the construction of a sewer system. The contract has been awarded on conditions that the septic tank be built separately.

An agitation is on foot in Greer, S. C., for the installation of a waterworks plant.

South Dakota.

The citizens of Carter, S. Dak., on Oct. 7 voted in favor of the proposition of issuing bonds in the sum of $8,000 for the construction of a municipal system of waterworks.

Texas.

The citizens of Lufkin, Tex., have voted the issuance of bonds for the installation of a waterworks system.

The citizens of the Sixth ward in Houston, Tex., have asked Mayor H. B. Rice to order the completion of the sewer system in that ward. It is estimated that the work will cost $71,000.

City Engineer Trammel's estimate of the cost to protect the Fort Worth, Tex., pumping stations from the floods which may result from the construction of the Trinity river levee is $26,000. The estimate gives four separate methods of protecting the plants, and bear different relative factors of safety for the protection of the Holly plant. They are: First—Suggested by the state engineer and drainage commissioner: Earthwork, 17,000 cu. yds., at $.25, $4,250; concrete wall, 5,000 cu. yds., at $6, $30,000; second, sloped banks and levee, paved 800 ft. in front of the waterworks plant: Earthwork, 27,000 cu. yds. at $.20, and paving nine ins. thick, 900x800 ft., at $6, $13,333; third, same as the second methods, except the omission of one-third of the paving, $5,400; earthwork, 27,000 cu. yds., at $.20, $8,888; fourth, earthwork, levee, 22,200 cu. yds., at $.25, $5,550.

The Belton Sewerage Co., of Belton, Tex., has collected 50 per cent of the capital stock and filed its charter with the secretary of state for approval. It is expected that work will begin on the sewer system at once, and that it will be completed by next March.

Austin, Tex., contemplates purchasing the sewer plant from the Austin Sewerage Co., at a price, said to be $100,000.

The city council of Pecos, Tex., has decided to call an election soon to vote on the issuance of bonds to the amount of about $25,000 for the installation of a sewage system.

The city commissioners of Galveston, Tex., have awarded A. C. Fallingant the contract for the laying of the 33rd St., sewer extension from its present terminus to the government reservation at 39th St., and Avenue U for $6,556.

The plans and blue prints of the new sanitary sewers for Memphis, Tex., prepared by E. L. Dalton of Dallas, Tex., have been received by the city council. The system will require 7,880 ft. of 12-in. pipe, 15,570 ft. of 8-in. pipe, and 32,820 ft. of 6-in. pipe, 15 manholes, and 106 lampholes. The estimated cost of the system is $21,000.

Utah.

The James Kennedy Construction Co., of Salt Lake City, Utah has been awarded the contract for both the aqueduct and supply mains for the Provo, Utah waterworks at $51,845 for the former and $46,359 for the latter, for which bids were opened Oct. 6. The itemized bid of the successful contractor appeared in our Oct. 12 issue. Louis C. Kelsey, Salt Lake City, is the Engineer.

The special water bond committee of the city council of Park City, Utah, has sold bonds to Ullen Sutherlin & Co., of Chicago, Ill., to the amount of $50,000 for the construction of a waterworks.

Plans and specifications for the new conduit to be built from Coldwater canyon to the new city reservoir in Ogden, Utah, have been completed. The city will advertise for bids at once, for the construction of the pipe line, which will run through Ogden canyon for one mile, necessitating the construction of several short tunnels through solid mountains of rock to lay the pipe.

The city commissioners of Salt Lake City, Utah, are considering plans for a new sewer through 12th South St., from Main St., to the Jordan river. The plans now under consideration are for an 8-in. or 10-in. pipe, with a catch basin, to be constructed on the bank of the river.:

The Following bids were received by the Board of Public Works of Salt Lake City, Utah, for building the new city creek high line: P. J. Moran, $109,739; Moran Construction Co., of Ogden, $125,600; Doyle U. Schwartz, $128,177; J. W. Perrcival, $140,926; Strange & McGuire, $113,716; Libby & Forbes, $11,796; J. P. O'Neill & Co., $124,556. The contract will probably be awarded to P. J. Moran.

Virginia.

The Committee on Streets, Richmond, Va., recommended to the City Council the award of the contract for certain sewer work as follows, all the awards made exclusive of furnishing cement required on the work: Virginia Ave., sewer to Stamper, Ragland & Co., Richmond, for $80,489; Dooley Ravine, sewer; all bids rejected; Leigh St., sewer from 34th and Leigh Sts., to National Cemetery Road, to J. B. Chewning for $14,475; sewer in Bloody Run Ravine, from 31st and Franklin Sts. to Williamsburg Ave., to H. L. Driscoll & Co., for $7,536. All the above are local firms. Chas. E. Bolling is City Engineer.

Washington.

According to information received from North Yakima, Wash., the reclamation service has decided to raise the level of Lake Kachess 35 ft. to provide sufficient water for a high line ditch. The plans include the construction of a 60 ft. dam.

The citizens of Sumas, Wash., are planning the installation of a complete sewer system. Prof. Tom Brown and Dr. E. F. Clark are interested.

The Board of Public Works of Spokane, Wash., on Sept. 23, awarded the contract for the construction of the trunk sewer in the 5th ward to the James Kennedy Construction Co. of Fargo, N. Dak., and to Fife Bros., for $476,000.

The Atlas Construction Co., at $4,000, was awarded the contract by the board of public works of Everett, Wash., for the construction of a sewer in the alley between Colby and Hoyt Aves., and Hewitt Ave., and Wall St.

The citizens of Yacolt, Wash., have voted to issue bonds to the amount of $10,223 for the installation of a municipal gravity water system. The capacity of the reservoir will be 4,500,000 gals. The fall will be 254 ft.

The Washougal Water Co., of Washougal, Wash., has been incorporated with a capital stock of $10,300. The incorporators are H. H. Carpenter, Albert Goot and M. Webber.

K. Sauset of Bellingham, Wash., has been awarded a contract by the city of Corvallis, Ore., for the construction of a trunk sewer three miles long, leading out of Corvallis for a considerable distance. The sewer will be 22 ft. under ground and will cost, when constructed, $50,000.

West Virginia.

✣Bids will be received until 8 p. m., Oct. 5, by Frank Good, City Auditor, Parkersburg, W. Va., for the furnishing labor and material for the following contracts for water works: Contract No. 7 provides for superstructure for pumping station; Contract No. 8 provides for a radical brick chimney. Contract No. 9 provides for laying cast iron water pipe. Contract No. 10 provides for cast iron water pipe and special castings. Contract No. 11 provides for gate-valves and boxes, check-valves and air-valves. Certified checks for the following amounts, payable to the City Treasurer of Parkersburg, W. Va., must accompany each proposal for Contract No. 7, $500; Contract No. 8, $100; Contract No. 9, $500; Contract No. 10, $200; Contract No. 11, $50.

The board of control of Wheeling, W. Va., awarded the contract for driving the tunnel to the river bed for the 36-in. intake pipe and for laying the main to L. C. Hallock & Son for $15,313.

The city waterworks and sewerage board of Clarksburg, W. Va., has awarded the contract for the construction of sewage improvements, which will be a part of a new waterworks and sewerage system, to John I. Dick of Scottdale for about $20,000.

Wisconsin.

✣Bids will be received until 10:30 a. m., Oct. 22, by Board of Public Works, Milwaukee, Wis., for the necessary labor and material for constructing house drains and water service connections in the 18th and 21st wards.

✣Bids will be received by the Commissioner of Public Works, City of Chicago, Room 705 City Hall, for furnishing and delivering to the Bureau of Streets 400 dozen street brooms of special design to comply with specifications on file at the Commissioner's office. Bids will be opened 11 a. m., Oct. 20th, 1910.

The village board of North Fond du Lac, Wis., has decided to have the proposed purchase of the waterplant submitted to the voters at the regular election, Nov. 8.

The city of Marinette, Wis., has rejected all bids for the sewer from River to Jefferson Sts. The bids submitted are said to have been in excess of the figures of the city engineer.

North Fond du Lac, Wis., is considering the proposition to buy the village waterworks system.

The contracts for the Harrison Blvd., and East Washington St. sewers have been let by the city council of Wausau, Wis., to Lutz & Haase for $.86 per ft., with an additional charge of $4 per cu. yd. where solid rock is encountered.

Peterson & Russell of Waukesha, Wis., have been awarded the contract by the board of public works of that city for the construction of an 8-in. vitrified pipe sewer for $249. Bids were opened Sept. 26.

W. T. Kirchoffer, consulting engineer of Madison, Wis., has been employed by the city of Beloit, Wis., to make the surveys, plans and maps for the new sewer district to be laid out in the city north of the present districts A and B.

Canada.

✣Bids will be received until 4 p. m., Nov. 7th, by R. C. Des Rochers, Secy., Department of Public Works, Ottawa, Ont., for the construction of an extension to the wharf at Providence Bay, township of Carnarvon, Manitoulin Island, Algoma, Ont.

The citizens of North Vancouver, B. C., voted Oct. 1, the issuance of $40,000 in bonds for sewer construction.

The city of Rouleau, Sask., has voted to borrow $45,000 for the installation of a waterworks system.

Bids were opened Sept. 21 by the Board of Control of Hamilton, Ont., for constructing sewers, the contracts being let as follows: Main St. sewer, City Engineer, at $2.25 per ft.; Greig St. sewer, E. Carroll, Hamilton, Ont., at 54 cts. per ft.; Sherman Ave. sewer, City Engineer, at 83 cts. per ft.; Ravenscliffe Ave. sewer, E. Carroll, at 89 cts. per ft.; Aberdeen Ave. sewer, City Engineer, at $1.19 per ft.; MacDonald Ave. sewer, City Engineer, at $1.59 per ft.; Stanley Ave. sewer, City Engineer, at $1.88 per ft.; Chedoke Ave., City Engineer, at 96 cts. per ft.; Flatt Ave., J. J. Armstrong, Hamilton, Ont., at 97 cts. per ft.; Hyde Park Ave., City Engineer, at 94 cts. per ft.; Aberdeen Ave., City Engineer, at $1.09 per ft.; Glenside Ave., J. J. Armstrong, at 90 cts. per ft.

The waterworks extension debenture by-law has been voted in favor of by the citizens of Niagara-on-the-Lake, Ont.

The city council of Ottawa, Ont., has received the report of Allan Hazen of New York City, engaged to investigate the city's water supply. The engineer finds that the present supply, taken from the Ottawa River, is somewhat polluted by sewage, etc., and recommends, as a permanent and pure source of supply, McGregor's Lake, in the Gatineau River district, north of the city. The cost of installing the system is estimated at $2,400,000. As an alternative Mr. Hazen recommends a filtration plant at a cost of $2,300,000.

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CHAS. S. HILL . . . . Editors
C. T. MURRAY . . . . Editors
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Is Labor Working for a City More Efficient than Labor Working for a Contractor?

The city usually pays more for its supplies and labor than a contractor, but the greater efficiency of its labor under proper supervision, and due to the higher wages, affects to some extent this handicap.

The above statement is quoted from a letter published by a city engineer of a large Canadian city. We quote it because it is unique among reasons for doing public work by day labor. Saving the contractor's profits, better work, avoidance of law suits, employment of local labor, adaptableness to changes of plans have all been named by advocates of day labor as reasons for its adoption. The claim that labor working for a city is more efficient than labor working for a contractor has not, however, come to our notice previously. Were the author of the quotation an American we should set him down as a bit of a wag, but he is Canadian and, as we happen to know, is very serious in his assertion. Therefore, and also because we have examined at various times the other claimed advantages of day labor work and may as well exhaust the list, we shall give this new claim attention.

Looking at the quotation the strict logician might urge that it begged the question—"proper supervision" including only such examples as affirmed the assertion. What the author really means by "proper supervision" is no more, we imagine, than honest and capable supervision. His assertion then is: Given honest and capable supervision, labor working for a city is more efficient than labor working for a contractor because the city pays higher wages. Let us look at this statement in the light of reason and experience.

It is a reasonable assumption that better pay should bring better work, but experience proves that the one does not always follow the other. Under modern industrial conditions wage rates are the result of so many complex forces that they have ceased to be indices of the degree of efficiency of labor. We do not, however, need to depend upon abstract reasoning: there is the evidence of actual experience. American cities generally pay higher rates of wages than do contractors. This is undoubtedly true where account is taken of sick leave, holiday and vacation allowances of time under pay, which are universal in city work practice. Yet the investigations of the Boston Finance Commission's engineers showed that labor working for a city was decidedly inefficient. It was shown that not only was the unit cost of say sewer construction by city labor greater but that city laborers did not, man for man, lay as many bricks per day as did contractors' laborers getting smaller wages. Substantially the same results were disclosed by the engineers of the Chicago Commission on City Expenditures. And there have been a score of other examples mentioned in these columns during the past eighteen months. So common is this experience that the inefficiency of labor working for a city as compared with labor working for a contractor or a private corporation is almost a by-word.

The pertinence of this evidence can of course be denied: It is excluded, it may be claimed, by the proviso of "honest and capable supervision." It is not, it may also be said, the experience of Canadian cities. There is doubtless a point to these claims. Canadian experience with day labor work, while not wholly familiar to us, does, we are inclined to believe from what we know, afford greater justification of the system than does American experience. The Canadian city, we know, goes about its task in a different manner from American cities. For any piece of work plans and specifications are prepared with care and on these bids are asked and the city engineer puts in a bid in competition with the contractors who may bid. If the city engineer's bid is lowest or is low enough to make it seem to the city officials most economical of all the bids, he is "awarded" the work and prosecutes it with city plant and forces. We are not certain that this is universal practice but it is frequent practice and it has decided merits if we may judge from reports. Apparently too Canadian cities are exceptional also for an absence in their public works of politics of a certain kind familiar in American cities. It may be admitted that these conditions count for efficiency in day labor work; labor working for a city where they exist will doubtless be more efficient than labor working for a city where they do not exist, but the question of the comparative efficiency of labor working for a city and labor working for a contractor is not answered.

The statement that labor working for a city is more efficient than labor working for a contractor is certainly contrary to experience in American cities. It is contrary to reason to expect that it can as a general proposition be otherwise. There is something more than honest and capable supervision required to put the city manager on a parity with the contractor in securing efficiency. Unless the city's manager has been a contractor he seldom has the training and experience of the contractor. If his training and experience are equal he does not have the incentive that the contractor has to wrest efficiency from his men. The contractor is impelled by the incentive of monetary reward; every extra fraction of efficiency he gets is money in his pocket and every fraction that he loses is money out of his pocket. No mild desire of the city manager to "make good" can equal this incentive of financial reward or failure.

Blasting in Wet Ground.—Where a blast is to be fired in wet ground, soap or tallow should be smeared over the safety fuse at the place where it enters the blasting cap in order to keep the charge in the latter perfectly dry. Oil or grease should never be used for this purpose as they are likely to soak into the fuse and destroy the efficiency of the powder which it contains. A cap crimper should always be used with a safety fuse and blasting cap. This tool is inexpensive and will wear for years. Crimping caps with a knife or teeth is an exceedingly dangerous and ineffective method and is often responsible for expensive misfires.—Engineering and Mining Journal.

Appropriation will be made at the coming session of the Canadian Parliament for the commencement of work on the new Welland Canal. The original idea was to enlarge the present canal from Port Colborne, 10 miles, and then construct a cutoff. Surveys, however, are said to have disclosed a dangerous bed of quicksand on the route of the cutoff, and an entirely new canal is now proposed. It would start about six miles west of Port Colborne and have its outlet at the mouth of the Jordan River, a distance of 22 miles.

Fireproof Buildings?—Complete reports of building operations in 1909 are only now available and in building circles there is much gratification over the fact that of the total expended, some $930,000,000, over 73 per cent was for "fire-resisting" building, an unusually high percentage.

Experts now explain, however, that that figure is misleading, in that many take it to mean "fireproof" buildings. By "fire-resisting" it appears the authorities mean anything that is not wholly of wood, frame construction. Houses of brick walls and tin roofs, though all their floor and partition construction be of wood, are so-called, buildings that could only "resist" fire a very little while. As a matter of fact, the really "firepoof" construction, that is, buildings with walls of stone or brick and all the framing of steel protected with hollow fireproofing tile or concrete protection, only amounted to 14 per cent of the whole. And in most of these the owners only aimed at protecting the structure, they did not enclose the stairs and elevators, protect the windows, nor do half the very necessary things to save the lives and contents in those buildings. The hollow tile or concrete will protect the steel and the external walls will not burn, nor the roof, but the tenants' furniture and papers and property can all be destroyed. These men have occupied those buildings under the impression that they are safe, and they are fairly so as far as the owners' interest is at stake, but not in so far as the tenants' interests are concerned. Of the really fireproof, absolutely fireproof construction, where fire can do but a very small percentum of damage to buildings or contents, only a handful were built in 1909, scarce 3½ per cent of the entire expenditure. And the disquieting feature about it all is that while our population has increased 74 per cent in thirty years, our fire losses have increased 134 per cent in the same period!—American Contractor.

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CONCRETE AND REINFORCED CONCRETE SECTION

Method and Cost of Lining a Mine Shaft with Concrete.

BY R. H. WORCESTER.

A coal company in the Southwest has recently lined with concrete a 200-ft. vertical shaft, 10x15 ft. clear on the inside, to be used as a return air course. The shaft was sunk and partially timbered about a year ago and then allowed to fill with water. The level of the water varied greatly, depending on the precipitation, and consequently, when the shaft was unwatered and connected up with the mine some months later, the timbering was found to be in bad shape. The first plan was to reline the shaft with timber, preferably treated, more effectively to resist the destructive action of the warm, moist, return air. Creosoted timbers would have cost $4,000 f. o. b. Dawson, New Mexico. These figures are based on sets spaced 5 ft. 10 ins. c. to c. of long leaf yellow pine, each set consisting of two wall plates, two end plates and one divider, all 10x12 ins., and six 10x10 in. posts, with 3-in. lagging. Concrete was suggested as a lining, and though we then thought the first cost might be excessive, we decided that a lining, which would be permanent, would pay in the end. To the writer was assigned the problem of designing and installing this lining.

A vain search was made for some precedents on concrete shaft linings, but none, excepting very elaborate installations in eastern coal fields and in northern Michigan—using a patented, collapsible steel form—could be found. The wooden form shown by Fig. 1 was devised, installed and subsequently improved upon as noted.

We figured that a 5-ft. lift should be made every day and, therefore, decided on a rich mixture which would set up hard enough over night for the forms to be raised the next day. We do not anticipate any pressure through settling of the ground, for the major portion of the overburden consists of horizontal layers of very hard slate and sandstone, and ample pillars will be left around the bottom of the shaft. We decided that the lining should be reinforced to resist the swelling and sloughing of known layers of soft shale and slate which had been submerged for several months, but on removing the lagging, this doubtful ground was found to be in such good condition that we only placed reinforcing, as specified on the drawings, in the bottom and at one other place—near the top—on the east side only, where there was a large mass of loose shale. For the balance of the shaft we used ⅜-in. horizontal and vertical rods spaced 12 ins. c. to c.

The layout of the surface plant, the concrete bucket and chute, and the crew are shown in Fig. 2, the chute being at the extreme right. Old 1¼-in. wire cable was attached to each corner of the movable platform, as shown on the drawing. On the surface the two cables on each end of the platform were passed between two sets of beams, each consisting of two pieces of 3x12 ins., spaced 2 ins. back to back, and extending across the short side of the shaft. The lower sets of beams were made fast to the head frame stringers, while each upper set was fastened to the hook of a chain hoist. The latter were hung from beams supported by plumb posts. The ropes were held vertically by means of clamps resting an bearing plates. The upper clamps being fast, pulling on the chain hoists raised the upper sets of beams and the platform. It took about 15 minutes to make a 5-ft. lift and leave everything ready for the next raise. The clamps were home made affairs, each consisting of two pieces of ½-in. x 8-in. iron drilled in the corners for 1-in. bolts. A groove was forged in each half so that the clamp almost encircled the rope. When the clamps were worn smooth, it was necessary to tap each set of clamps for a ⅞-in. set screw. If the electric hoist had been strong enough to raise the platform, we should have used it.

An A-style head frame and an electric hoist, used in sinking, were in place. To give equal drift all around on the concrete bucket, the head frame was moved north till the rope hung in the center of the shaft. The old deck and rock chute were removed and a new deck laid. An old shed had to be torn down and the ground about the shaft leveled off and wagon roads made. The cost of these items is shown on the sheet entitled "Preliminary Surface Work," and all of the other items covered by the costs on that sheet are listed. The cost of dismantling all of the plant, excepting the cement platform, is also shown on this same cost sheet. The centrifugal pump was first installed 300 ft. up the creek and later moved up 1,100 ft. more when the first source of water ran dry. The steel measuring box included in these costs was discarded after a few trials, and the wheelbarrow loads of rock and sand were dumped directly into the mixer. The box, though worked with blocks and tackle, was too heavy and cumbersome. The hopper to the mixer was so small that the men dumping the wheelbarrows had to be very careful or else they would discharge part of the load clear of the mixer, and it was enlarged. Rapid work required two men dumping the barrows. Figure 3 shows the construction of the concrete bucket and chute.

The view (Fig. 2) shows the gang, which was distributed as follows: 1 foreman, who spent all of his time in the shaft except when concrete was being placed; 3 shaft men—miners—who spent all of their time in the shaft; 1 man who worked on the cement platform while concreting and at other times either in the shaft or on rock and sand; 2 men who stood at the mouth of the shaft, landing the bucket and guiding it back down again. (While being filled, the bucket stood upright in a hole directly under the end of the mixer; one of these men dumped the mixer,

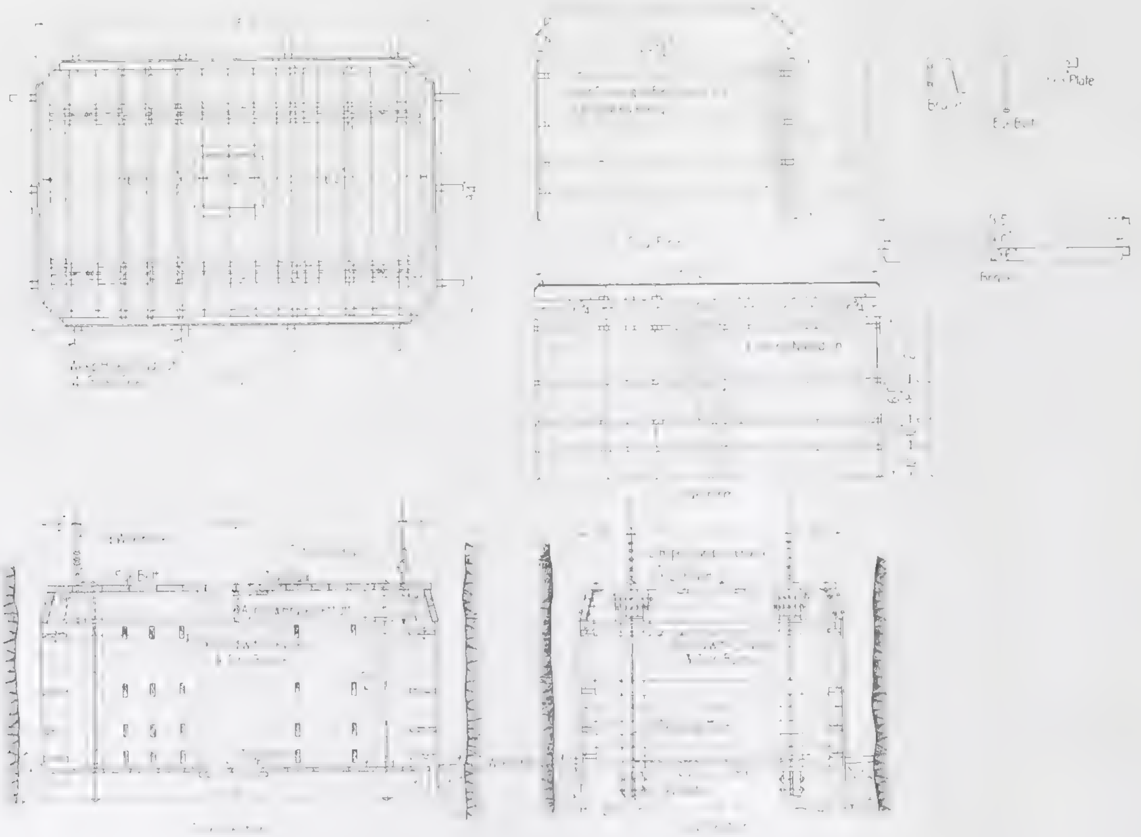

Fig. 1—Movable Platfrom and Forms for Lining a Shaft With Concrete.

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*Chief Engineer Stag Cañon Fuel Co., Dawson, New Mexico.

while the other had to help load the rock barrows); 1 man on sand and 2 men on rock; 1 hoist man and 1 man to run the mixer. Usually there was an extra laborer, who worked on the sand and rock or carried cement. At the time the photograph was taken, there were two extra men who were kept busy replenishing the rock supply. The 10x6-in jaw crusher had been out of commission for a couple of weeks with a broken pitman.

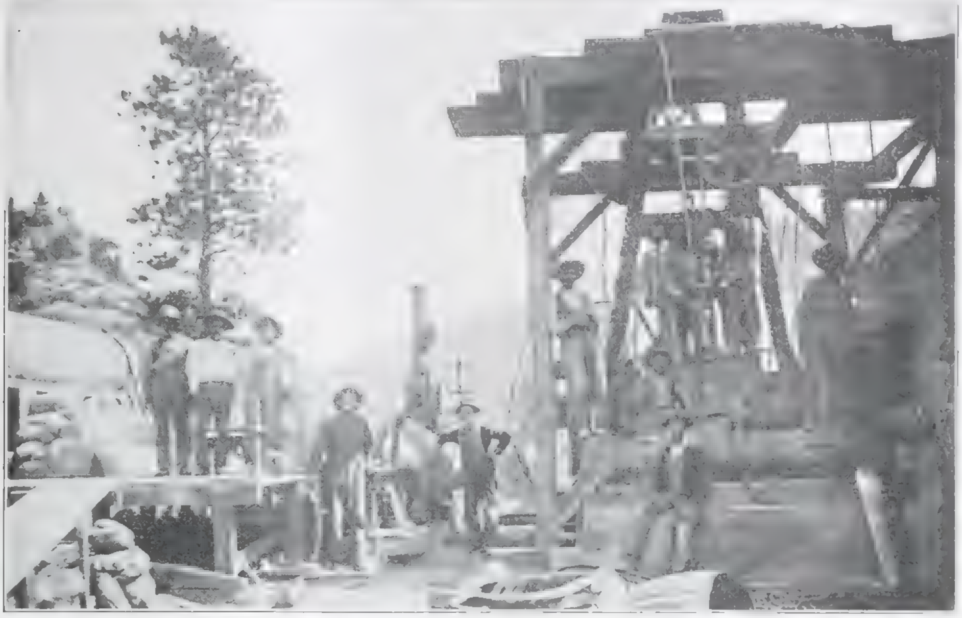

Fig 2—View of Head Plant for Lining Shaft With Concrete.

The shaft men and the foreman were all very busy all of the time, but the balance of the gang was busy only while concreting. It must be borne in mind that the shaft is located two miles from the main works, so the gang needed for concreting had to be at the shaft all the time. They were kept occupied as much as possible in getting out sand and rock, or in disposing of the timber and rock hoisted out of the shaft. The men were paid for a 10-hour shift, although they worked only 9½ hours, and an hour less on Sundays.

The foreman was so determined to put in a 5-ft. lift every day that he made the men work overtime on 12 days to finish the lift. Pulling timbers and removing rock consumed so much time that it was often late in the afternoon before we started to concrete. The power was shut off every evening at 5:30 because of the mines' electric system of shot firing, and did not come on again until about seven. Concreting was frequently delayed through lack of water. We were a mile away from the town's water system, so it was necessary for us to carry water in the tank when the local supply failed us.

The foreman, with three laborers, started on the job May 26. There was some surface concreting and then 46 cu. yds. were placed in the bottom of the shaft. This concrete is shown by Fig. 3. The costs relating to this part of the work are shown apart from those relating to the work done after the moving platform was put in play. The height of the concrete in the bottom varied from 14 to 16 ft., there being a shallow sump. The bottom forms were put in place by the shaft men and the foreman. A carpenter worked below one day and made the arch segments on top on another. Aside from the carpenter, the foreman was the only man in the lot experienced at such work. The bottom was very wet overhead and underfoot.

Placing concrete from the moving platform was started on June 27, and including that day and 39 working days at the shaft which followed, there were made 34 lifts of 5 ft. each and one of 3 ft., which brought the lining up to 13 ft. of concrete placed around the top of the shaft about a year previous. The cost of this 13 ft. has not been considered.

The first set of timbers was reached on July 3, 48 ft. above the floor of the entry, and although the men had had several days' experience with the forms, they missed the lift. Once more, on July 13, a lift was lost on account of the timbers. The three consecutive days, July 20-22, were lost on account of the large [illegible] before on the east side of the shaft. Eighteen sets were removed to place concrete, and there were three more sets, including the collar, lagged all around, in front of the 13 ft. of concrete at the top of the shaft. These last sets were pulled out with the hoist on the same day that the final concrete was placed. The sets consisted of 8x8-in. pine posts, wall plates, and end pieces, with 3-in. lagging, 10x15 ft. inside of timbers. The only cross pieces were near the top, and they were all cut out to let the concrete bucket pass. The total vertical height of the lagging was 100 ft.

When the shaft was sunk, knobs of hard rock were left in the corners. These were only cut out enough with stone hammers and moyles to make room for the reinforcing. We wished it to be continuous. Especially in the bottom, and at a number of places up the shaft, these hard nubbins projected as much as a foot inside the face of the timbers. If we had timbered the shaft, it would have been necessary to cut out rock in only a few places.

Small rock and muck were shoveled through the doors in the platform to the bottom of the shaft, while the larger rocks—anything over 5 lbs.—and the [illegible] surface.

The concrete was supposed to be a 1:2:4 mix, but a [illegible] Rock and sand were measured in wheelbarrows. The rock was used just as it came from the crusher and contained considerable fines, as the machine could only crush soft pieces. It was all sandstone.

At the bottom of the shaft, when the time of raising and lowering the bucket was the big item, we tried to double up on the loads, but the hoist couldn't handle it.

The concrete was mixed [illegible] run readily out of the bucket, yet was not sloppy. Hence a cover was not needed on the chute used in placing the concrete; so we cut it off and also tapered the sides from a height of 9 down to 4 ins. Without the cover it was much lighter and the shaft men could readily see if any concrete had hung up in the bucket.

To discharge the concrete, the bucket was stopped high enough above the platform to give about a 20 degree slope to the chute, which was then attached. The bucket and chute were drifted over till the end of the latter lapped the form and then the catch in the back part of the bucket was knocked out. This catch was easily made and it never worked loose, and neither could it be pulled out if the bottom of the bucket struck anything. The concrete slid out of the bucket and down the chute with considerable force. There was no tamping and yet the forms were filled except in a very few places. There was absolutely no question about the concrete setting up hard enough over night for the forms to be moved the next morning. The shaft was very wet and quite cool.

Before raising the forms, the braces were taken out and laid on the bottom deck and then the wedges were pried out and laid down. The end and side forms were next pulled in and then everything was in readiness for hoisting. The foreman soon found a better method of bracing the forms. Posts were substituted along the sides in place of the struts, and two posts were put up at each end. The drawing (Fig. 1) shows this change; also the placing of four rods, with clevises and turnbuckles. It was a hard task to bring the top of the forms together without these rods, but with them it was an easy

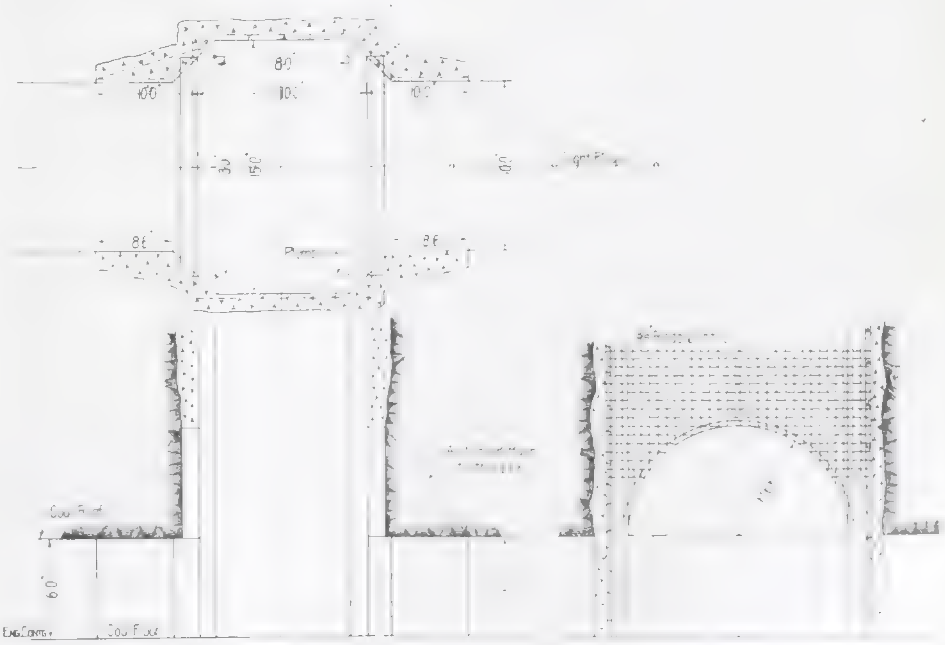

Fig 3—Details of Concrete Work at Bottom of Shaft.

one. The wedges should have been made smaller, and there should have been wedges in the end forms also. The forms never ceased to take up water and, consequently, grew heavier and heavier. It would have been difficult to cut down the end forms, so we let them go. Their swelling made the ends wider at the top than they were at the bottom. This increase in width is of no consequence in a shaft to be used solely for ventilation. About 4 ins. were taken out of each side form. The forms should have been carried a little above the top deck, then it would have been easier to place the reinforcing, to place the topping off batches on each lift, to clean off the top of the old concrete before placing new, and to set up the forms, for distance pieces could then have been placed along the edge of the top deck and the back of the forms brought to them. It was necessary to nail scabs on the corners to keep them tight. Note that the corners were framed to allow clearance at the ends of the end forms when the side forms were moved toward the center. Vertical pieces of plank should have been bolted along the sides of the wedges to give the men something to pry on. As it was, they had only the crack between two pieces of flooring. On account of the repeated use of nails and bars, the forms were "all in" at the finish. It was not found necessary to use anything on the forms to prevent the concrete from adhering to them.

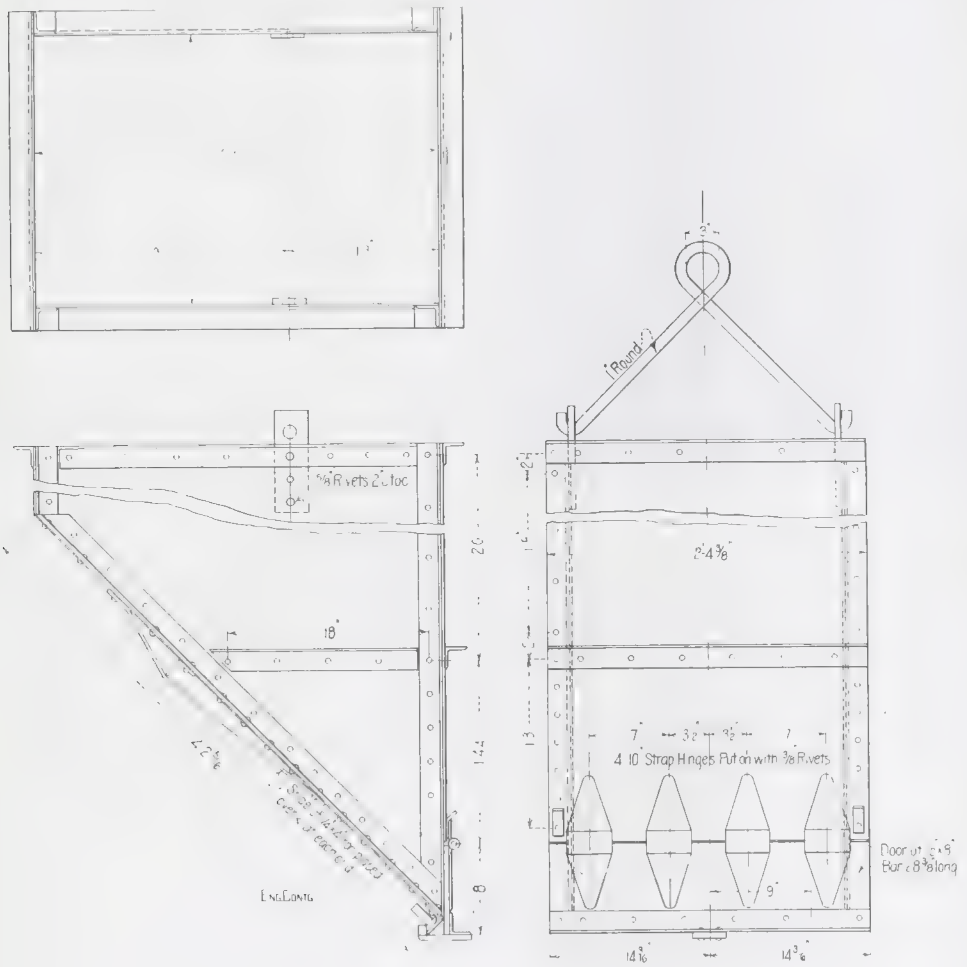

Fig. 4—Details of Concrete Bucket for Lining a Shaft.

The vertical reinforcing was cut to 6-ft. lengths. This allowed the rods to project 1 ft. above the concrete. New rods lapped the old 1 ft., and they were wired together with No. 20 gage annealed steel wire. The horizontal reinforcing was woven about the vertical rods; this method proved to be very quick.

Weep hole pipes are shown on Fig. 1. It was soon apparent that not a drop of water was coming through the weep holes, so they were discarded. Toward the end of the job it was discovered that all of the water was coming in at one place near the top of the shaft on the north side. The water bearing seam happened to coincide with the top of a lift. First a layer of large stones was placed on the day-old concrete, and these stones were covered with a layer of crushed rock and then one of sand. When starting the next lift, a layer of rather dry concrete was deposited on the sand.

At first wires were used for plumbing. These were very hard to work by on account of the water falling down the shaft. The cables were hanging taut in the shaft all of the time, so we used them with satisfactory results. As the shaft will never be used with guides for hoisting, it was essential that it be plumb. The greatest variation each way from center was not over a couple of inches.

The appended cost sheets will give an idea of how the money was spent. From July 12 on, the mixer man filled out the form shown on p. 355. Previous to that date the time of the men was distributed according to daily notes made by the writer. The rush on the other work prevented our keeping separate accounts for each item. The time of the hoist man was distributed in accordance with the time of the men working in the shaft. Except for a few hours when the mixer man was working on some specified repair job, his time was charged straight against the time of concreting. He was at the shaft on June 15, 16 and 22, and then came back on the 27 of June to stay till the concreting was finished.

All materials are charged at book values excepting 1,100 ft. of new 2-in. pipe, which was used for about 2 weeks and then taken back into stock. The lumber in the bottom forms was used but one time and then taken in the mine, where it was used in timbering. The cement platform was made of new lumber and the boards are in good shape, as are also the timbers which supported the moving platform on surface. The items covered by each material are listed. The cost of a team was 28 cts. per hour. The wages paid the teamsters are all noted.

COST DATA.

The distribution of materials and supplies and their cost were as follows:

Item.	Cost.
2,110 sacks cement (no credit for sacks)	$1,244.05
Reinforcing	277.66
Tools	60.79
Water supply line	83.15
Forms and platforms	253.88
Buckets, chutes and measuring box	55.12
Lighting	24.55
Supplies	23.90
Clothes, oilskins and rubber boots	29.54
Total	$2,052.64

Axes, drills, saws, bars and hammers are covered by the item tools. The item water supply line includes pipe, valves, jettings, copper wire, power line, poles, insulators and foot valve but includes 1,100 ft. of 2-in. pipe for extension. The item forms and platform covers all lumber, bolts, nails, washers, etc., used in the construction of these articles. The item lighting includes incandescent light globes, waterproof sockets, tape and wire. The item supplies covers all lubricating oils, grease, packing, rope, waste and miners' oil.

The cost of labor is separated into 11 items and each is given in detail and finally all are summarized in the following tabulations:

(1) The cost of securing rock and sand as described above was as follows:

Item.	Cost.
Ch. engr., 13 hrs. at $175 per mo.	$ 7.58
Draftsman, 8 hrs. at $90 per mo.	2.40
Machinist, 6 hrs. at 35 cts.	2.10
Machinist, 12 hrs. at 20 cts.	2.40
Teamster, 549 hrs. at 22½ cts.	123.52
Teamster, 595 hrs. at 20 cts.	119.00
Laborer, 802 hrs. at 17½ cts.	140.33
Laborer, 1,179 hrs. at 20 cts.	235.80
Laborer, 245 hrs. at 25 cts.	61.25
Labor repairing crusher	23.70
Total	$718.08

In addition to this total there was for animal hire $320.32, making a grand total of $1,038.40, or a cost of $1.77 per cu. yd. for 586 cu. yds. of concrete.

(2) Preliminary work as indicated above, included such items as moving head frame, clearing away rubbish around shaft, installing mixer, centrifugal pump, water tank, mixing platform, and bucket chute, and making concrete bucket and chutes and work on seep holes. Preliminary work is itemized as follows:

Item.	Cost.
Ch. engr., 55 hrs. at $175 per mo.	$ 32.06
Draftsman, 64 hrs. at $90 per mo.	18.81
Shaftman, 40 hrs. at 40 cts.	16.00
Machinist, 73 hrs. at 53 cts.	38.69
Machinist, 6 hrs. at 40 cts.	2.40
Machinist, 3 hrs. at 27½ cts.	0.82
Machinist, 78 hrs. at 25 cts.	19.50
Pipeman, 28 hrs. at 30 cts.	8.40
Pipeman, 23 hrs. at 22¼ cts.	5.17
Hoistman, 50 hrs. at 32½ cts.	16.25
Carpenter, 70 hrs. at 40 cts.	28.00
Carpenter, 70 hrs. at 30 cts.	21.00
Teamster, 15 hrs. at 20 cts.	3.00
Teamster, 6 hrs. at 22½ cts.	1.35
Teamster, 5 hrs. at 25 cts.	1.25
Laborer, 30 hrs. at 17½ cts.	5.25
Laborer, 210 hrs. at 20 cts.	42.00
Electrician, 20 hrs. at 32½ cts.	6.50
Foreman, 150 hrs. at 50 cts.	75.00
Shaftman, 70 hrs. at 35 cts.	24.50
Machinist, 5 hrs. at 30 cts.	1.50
Blacksmith, 22 hrs. at 35 cts.	7.70
Blacksmith's helper, 25 hrs. at 20 cts.	5.00
Total, 1,118 hrs.	$380.15

To this total has to be added $7.28 for team hire, making a grand total of $387.43, or 60 cts. per cu. yd. for 586 cu. yds. of concrete.

(3) Making movable forms on top, making platform below, and assembling whole cost as follows:

Item.	Cost.
Draftsman, 42 hrs. at $90 per mo.	$ 12.30
Shaftman, 45 hrs. at 42 cts.	15.00
Shaftman, 30 hrs. at 35 cts.	10.50
Blacksmith, 5 hrs. at 35 cts.	1.75
Machinist, 28 hrs. at 40 cts.	11.20
Blacksmith's helper, 35 hrs. at 20 cts.	7.00
Machinist, 27 hrs. at 20 cts.	5.40
Blacksmith, 46 hrs. at 30 cts.	13.80
Carpenter, 30 hrs. at 45 cts.	13.50
Hoistman, 20 hrs. at 32½ cts.	6.50
Foreman, 30 hrs. at 50 cts.	15.00
Teamster, 2 hrs. at 22½ cts.	4.50
Teamster, 8 hrs. at 20 cts.	1.60
Ch. engr., 50 hrs. at $175 per mo.	28.20
Total	$149 25

To this has to be added $2.80 for team hire, making a grand total of $152.05. This sum is chargeable to concrete laid from platform, which was 540 cu. yds. This gives a cost per cu. yd. of $0.281. There were 300 sq. ft. of concrete surface molded by the movable forms so that the cost per sq. ft. for the above items was 50 cts.

(4) The work of excavation required at the bottom preliminary to the concrete work comprised the following items of cost:

Item.	Cost.
Shaftman, 65 hrs. at 35 cts.	$22.75
Shaftman, 75 hrs. at 40 cts.	30.00
Blacksmith, 1 hr. at 37 cts.	0.37
Hoistman, 30 hrs. at 32½ cts.	9.75
Total, 171 hours	$62.87

(5) The cost of erecting forms for the 46 cu. yds. of concrete work at the bottom of the shaft, including placing reinforcement, was as follows:

Item.	Cost.
Shaftman, 145 hrs. at 40 cts.	$ 58.00
Shaftman, 65 hrs. at 35 cts.	22.75
Hoistman, 55 hrs. at 32½ cts.	17.87
Carpenter, 20 hrs. at 40 cts.	8.00
Foreman, 75 hrs. at 50 cts.	37.50
Draftsman, 30 hrs. at $90 per mo.	8.70
Teamster, 11 hrs. at 20 cts.	2.20
Total, 401 hours	$155.02

To this total has to be added $3.08 for team hire, making a grand total of $158.10. This sum divided by 46 cu. yds. gives a cost per cubic yard of $3.433. For 667 sq. ft. of surface the cost was 23.7 cts. per sq. ft.

(6) The cost of concreting the bottom, 46 cu. yds., was as follows:

Item.	Cost.
Shaftman, 50 hrs. at 40 cts.	$20.00
Shaftman, 25 hrs. at 35 cts.	8.75
Mixerman, 30 hrs. at 27½ cts.	8.25
Hoistman, 25 hrs. at 32½ cts.	8.12
Foreman, 25 hrs. at 50 cts.	12.50
Laborer, 75 hrs. at 17½ cts.	13.12
Laborer, 110 hrs. at 20 cts.	22.00
Laborer, 15 hrs. at 25 cts.	3.75
Total, 345 hours	$96.49

This gives a cost per cubic yard for 46 cu. yds. of $2.10.

(7) The cost of removing the bottom forms was as follows:

Item.	Cost.
Shaftman, 30 hrs. at 35 cts.	$10.50
Shaftman, 50 hrs. at 40 cts.	20.00
Hoistman, 30 hrs. at 32½ cts.	9.75
Foreman, 20 hrs. at 50 cts.	10.00
Total, 130 hours	$50.25

The cost per cubic yard for 46 cu. yds. was, therefore, $1.092.

(8) The work under heading comprises raising and setting forms, removing rock, placing reinforcing and removing timber while concreting from platform. The cost was as follows:

Item.	Cost.
Shaftman, 307 hrs. at 35 cts.	$107.45
Shaftman, 614 hrs. at 40 cts.	245.60
Hoistman, 308 hrs. at 37½ cts.	100.10
Foreman, 308 hrs. at 50 cts.	154.00
Laborer, 562 hrs. at 20 cts.	112.40
Blacksmith, 10 hrs. at 35 cts.	3.50
Blacksmith's helper, 3 hrs. at 30 cts.	0.90
Blacksmith's helper, 8 hrs. at 20 cts.	1.60
Mixerman, 30 hrs. at 27¼ cts.	8.25
Laborer, 93 hrs. at 17½ cts.	16.27
Total, 2,243 hours	$750.07

For 540 cu. yds. of concrete placed from the moving forms this gives a cost of $1.39 per cu. yd.

(9) The cost of placing 540 cu. yds. of concrete from the movable forms was as follows:

Item.	Cost.
Shaftman, 208 hrs. at 40 cts.	$ 83.20
Shaftman, 104 hrs. at 35 cts.	36.40
Mixerman, 368 hrs. at 27½ cts.	101.20
Hoistman, 103 hrs. at 32½ cts.	33.47
Laborer, 258 hrs. at 17½ cts.	45.15
Laborer, 398 hrs. at 20 cts.	79.66
Laborer, 92 hrs. at 25 cts.	19.00
Foreman, 104 hrs. at 50 cts.	52.06
Moving pump and pipe line, 69 hrs.	20.32
Hauling water in tanks	4.65
Total, 1,736 hours	$475.11

For 540 cu. yds. this gives a unit cost of $0.891 per cu. yd.

(10) The cost of hauling cement to the work was as follows:

Item.	Cost.
Teamster, 52 hrs. at 20 cts.	$10.40
Teamster, 67 hrs. at 22½ cts.	15.07
Additional animal hire	33.32
Total, 119 hours	$58.79

The cost for hauling 2,110 sacks was 2.8 cts. per sack and for 586 cu. yds. of concrete it was 10 cts. per cu. yd.

(11) The cost of superintendence was $38.99 or 6.6 cts. per cu. yd. for 586 cu. yds. of concrete.

DAILY SHAFT REPORT.

Date ....

Started concreting ....

Stopped concreting ....

Number of batches..........

.... Hrs ....

Removing timbers ....

Raising forms ....

Removing rock ....

Surface men helping shaft men on timbers..

....

Man's No.......... Hours..........

Removing rock ....

....

....

How many teams were out? ....

It will be observed that the concrete work divides itself into bottom concrete and shaft lining proper. This permits of three summaries: (1) bottom concrete, 46 cu. yds.; (2) shaft lining, 540 cu. yds., and (3) total concrete, 586 cu. yds.

The cost of 46 cu. yds. of bottom concrete was as follows:

Item.	Per cu. yd.
Preliminary surface work	$ 0.66
Securing rock and sand	1.77
Hauling cement	0.10
Excavation	1.366
Bottom forms, making and erecting	3.433
Concreting	2.100
Removing bottom forms	1.092
Superintendence	0.066
Total	$10.587

The cost of 540 cu. yds of concrete in the shaft lining proper was as follows:

Item.	Per cu. yd.
Preliminary surface work	$0.66
Securing rock and sand	1.77
Hauling cement	0.10
Movable form construction	0.281
Work in shaft	1.390
Converting	0.891
Superintendence	0.066
Total	$5.158

TABLE I.—DISTRIBUTION OF DAILY WORK IN SHAFT WHILE PLACING CONCRFTE FROM PLATFORM.

Occupation.	Rate. cts.	Raising & Settling Forms. Hrs.	Raising & Settling Forms. Amt.	Removing Rock. Hrs.	Removing Rock. Amt.	Removing Timbers. Hrs.	Removing Timbers. Amt.	Placing Reinforcing. Hrs.	Placing Reinforcing. Amt.	Sharpening Tools, Etc. Hrs.	Sharpening Tools, Etc. Amt.	Totals. Hrs.	Totals. Amt.
Shaftman	..35	70	$ 24.50	109	$ 38.15	96	$ 33.60	32	$11.20			307	$107.45
Shaftman	..40	140	56.00	218	87.20	192	76.80	64	25.60			614	245.60
Hoistman	..32½	70	22.75	110	35.75	96	31.20	32	10.40			308	100.10
Foreman	...50	70	35.00	110	55.00	96	48.00	32	16.00			308	154.00
Laborer	10	...	......	317	63.40	245	49.00					562	112.40
Blacksmith	35	...	......	...	.....	.	.....			10	$3.50	10	3.50
Blacksmith	30	..	......	.	.....	..	....			3	.90	3	.90
" helper	...20	...	......	.	.. ..	...	....			8	1.60	8	1.60
Mixerman	.27½	...	....	18	4.95	12	3.30					30	8.25
Laborer	....17½	...	....	32	5.60	61	10.67	..		..		93	16.27
Totals	... ...	350	$138.25	914	$290.05	798	$252.57	160	$63.20	21	$6.00	2,243	$750.07

For the total 586 cu. yds. the cost, including materials, was as follows:

Item.	Total.	Per cu. yd.
Labor	$2,901.75	$4.95
Animal hire	372.96	0.64
Materials	2,052.64	3.50
Total	$5,327.35	$9.09

In conclusion Table I, showing the distribution of daily work in the shaft while placing concrete from the platform is of interest.

Specification For and Cost of Finishing a Concrete Building Wall by Brushing.

A brushed finish was required in constructing the concrete walls of the Tuberculosis Hospital at Rockville, Ind. The contractors, Brubaker & Stern, give the following data regarding the work in a paper before the Indiana Society of Engineers:

No special material was used to secure this effect. Precaution was taken, however, to make the mixture as uniform as possible, and the forms were well spaded to bring the pebbles next to the forms. The foundations of the various buildings ranged from 3 to 6 ft. in height. The forms of the face were taken down when the concrete was 24 hours old, and the entire surface, thus exposed, was brushed immediately before the cement set hard. They used plain water for most of the work, and only a few times did they have to resort to acid. After the men were broken in they became quite expert, and they had no trouble in getting a good effect.

The contractor informed us that the work cost him approximately 2 cts. per sq. ft. in addition to the cost of the concrete wall; that is, the extra cost, in obtaining the brushed surface, was 2 cts. per sq. ft. The specifications for the work follow:

Forms.—Forms are to be built in sections and so arranged that each section can be taken down at the proper time, to give access to the face of the concrete. Molds are to be nailed onto the face of the forms to carry out the design as called for in the details. Lintels over doors and windows are to be run separately, and the forms are to be built accordingly.

The proportions are to be as specified above. The gravel must be screened and the mixture must be absolutely uniform to get the proper effect. Concrete is to be dumped into the forms in layers and kept level. An entire section of the forms must be run at one time, and the concrete must be well spaded to bring a uniform mixture to the face of the walls.

Forms are to be taken down in 24 hours, during warm, dry weather; otherwise, to remain as much longer as conditions require. The surface is then to be brushed with wire brushes and water till all of the cement has been washed off, leaving the pebbles or stones exposed and in good relief. If necessary, a small amount of muriatic acid should be added to the water. The best brushes for this purpose are a fine brush, No. 177, and a coarse brush, No. 1082. Care must be taken that the pebbles are not dislodged. If the concrete is too soft to permit brushing, the work must be delayed a sufficient length of time. The returns to the window and door jambs must be treated in the same manner.

Method and Cost of Constructing a Small Reinforced Concrete Roof.*

A building in course of construction in South Bend, Ind., has on the top story a public hall covering the full size of the building, about 62x66 ft., and the owner conceived the idea of a roof garden in connection with this hall and called on the writer to design a roof which would answer his purposes not only to take the live load desired, but which would be waterproof and at the same time sightly.

The framing of the roof skeleton consists of three roof trusses which set about 16 ft. on centers and transversely to the roof trusses are lines of steel beams resting from hangers attached to the top chord of the trusses, the beams being about 6 ft. on centers. The concrete roof beams are therefore supported on four sides, 6 ft. one way and 16 ft. the other, but the roof is designed and built as a monolith, reinforced in both directions.

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*Abstract from a paper by A. J. Hammond before the Indiana Society of Engineers, 1910.

The entire concrete floor slab rests on its outer edges on the brick walls and expansion is provided for by an annular space 1 in. wide, extending entirely around the slab, the slab itself resting on galvanized strips which were heavily oiled. The slab is 3½ ins. in thickness for 6-ft. spans and the reinforcement consists of cup bars ⅜ in. in diameter, spaced 6 ins. on centers and lapped about 50 diameters, while transversely, to take care of expansion, are also placed cup bars ⅜ in. in diameter, spaced 12 ins. c. to c. and having the same efficient lapping.

The concrete was composed of a natural gravel obtained from extensive pits near South Bend, which was practically free from loam and dirt and graded from coarse sand to pea gravel and larger, but no large stones or pebbles were found.

As tested, the gravel showed about 20 to 22 per cent voids and, in order to use a concrete uniform through the entire thickness of 3½ ins., so that a mortar coat could be worked up and made a smooth finish when floated and troweled, the mix decided upon was 1 part of Medusa Portland cement and 3¾ parts gravel.

The concrete was thoroughly mixed in a mechanical mixer, using what may be termed a wet mix, and when floated and troweled presented a fairly good sidewalk finish, and after the forms were removed from under the slab, a good smooth surface was found.

The excess of cement to fill the voids was used not only for the purpose of making a strong concrete, but also to have the natural concrete as nearly waterproof as possible.

In addition, however, to this condition of providing against leakage, the surface will be coated with a waterproofing compound called Liquid Konkerit, furnished by Toch Brothers, which has the natural cement color, but so far no leakage of any description has been discovered.

The roof has a pitch of about ¼ in. to the foot, which is the same pitch as is commonly used in sidewalk work, and the result is practically a flat surface, making a desirable floor for the roof garden.

As the contractor had named a minimum price of 35 cts. per sq. ft. for the roof exclusive of the trusses or beams, it was decided to do the work by day labor, allowing the contractor $5 per day for his general supervision.

The cost of the roof is covered by the following items, which, under more favorable conditions, could be materially reduced as, on account of scarcity of labor, some carpenters had to be impressed for this work.

Common labor was paid 25 cts. per hour; carpenters were paid 35 cents per hour; cement finishers and engine men were paid 50 cts. per hour.

Labor erecting scaffold and forms	$ 146.35
Cost of labor on cement roof	230.45
For use of mixer, hoisting engine and supplies	69.85
Lumber for forms and galvanized iron	122.28
Contractor's time	115.00
Steel bars	97.46
Gravel	49.50
Cement	141.75
Waterproofing	60.00
Total	$1,032.64
Credit for flooring	30.00
Total	$1,002.64

Based on 4,000 sq. ft. of roof surface, this shows a cost of 25 cts. per sq. ft., or a saving of $400 on the contractor's bid.

EARTH AND ROCK SECTION

Methods of Conducting Test Borings and of Sinking Shafts for the Hudson River Crossing of the Catskill Aqueduct.

The Hudson River is the most important barrier encountered by the Catskill aqueduct in its course southerly from Ashokan Reservoir to New York City. In consequence, much study has been given to the problem of locating the point of crossing the river for the aqueduct. Studies were made involving the exploration of the river from Pegg's point, about two miles north of the village of New Hamburg, to Anthony's Nose, in the Highlands. As the location is affected by the location of the land sections, of the aqueduct, at the valleys of the tributary streams, much time was also given to the study of those valleys. Crossings by shield tunneling methods; by concrete-jacketed steel pipes sunk in a dredged trench, and by reinforced concrete tunnel built in sections on shore, launched, sunk in a trench and joined under water, were considered, but a pressure tunnel sunk deep in solid rock was adopted and is believed to be the cheapest type for any depth less than 3,000 to 4,000 ft. below the river surface. A preliminary study was also made of a bridge supporting four steel pipes 8 ft. in diameter, to cross the river near Constitution Island, but this was found to be more expensive than any other type, as maintenance charges would be high, and there would be many other serious objections. The pressure tunnel is the most economical construction, involves the least maintenance, is the safest and most durable type.

Wash borings were begun in 1905 to determine the best location for the pressure tunnel and 226 holes on 14 cross sections of the river were made. These indicated that the depth of the rock in the gorge was very great and the layer of material overlying the rock was so great as to make wash boring impracticable.

By reference to Fig. 1, which shows the complete borings to date, the description of the borings may be readily followed. This description is prepared in part from notes on the work by the editor and partly from a paper presented by Messrs. Samuel D. Dodge and Wm. B. Hoke, assistant engineers of the Board of Water Supply, on Sept. 25, 1910, before the Municipal Engineers of New York. The paper deals in great detail with the studies and explorations made to determine the depth of the gorge at Storm King mountain, the point at which the crossing is to be made.

On account of the great hydraulic pressure which will be exerted on the interior of the siphon tunnel under the river and also on account of the great exterior pressure, during construction, by the waters of the Hudson River above, it was deemed necessary to locate the tunnel under at least 150 ft. of sound bedrock.

Vertical Borings From Scows in the River Wash Borings.—The wash borings proved to be unreliable for determining the location of bedrock in this class of material. They gave a level profile at a depth of about 160 ft., indicating bedrock, which was later proved to be the top layer of gravel in hardpan. These borings were carried on from a small scow equipped with a derrick, hand winch and pump. A 1-in. pipe water jet was forced down inside a larger pipe which acted as a casing, kept the hole open, and allowed the samples of material to pass up with the water from the bottom of the jet pipe.

The force consisted of 1 captain, about 4 deck hands and 3 men for boring. The following table is a record of the wash boring done:

No. of holes at Storm King line	18
Aggregate length in water	905 ft.
Aggregate length in earth	1,746 ft.
Average progress per day in earth	175 ft.
Average progress per day in earth and water	265 ft.
Contract price for water and earth per ft.	$0.90

Core Borings.—The core boring contract was let to the American Diamond Rock Drilling Co., but was done by the assignees, the Phoenix Construction Co. The equipment in use at present by the company is a pile driver scow 35x100 ft. with leads 60 ft. high; a double 7x10-in. engine with 12-in. drums, and two 12x7x12-in. pumps with a capacity of 100 gals. per minute at 120 lbs. pressure and using a 60 h. p. boiler. The casing wash pipe is 18-in. and 14-in. steel welded pipe, and 10-in., 8-in., 6-in., 4-in., 2½-in. and 2-in. extra heavy screw joint, wrought iron drive pipes with long sleeve couplings. A diamond drilling machine is included with 1⅞-in. rods and diamonds for two bits. The scow is anchored by 6 or more anchors located at the bow, the stern and the four corners. The anchors weigh from 2 to 3 tons and are attached to the scow with 400 or 500 ft. of wire cable.

Fifteen river holes were made by this plant and some of the difficulties may be realized by the record of holes drilled. Of the 15 holes, six successfully reached solid rock, one was lost by the falling of the casing, two were abandoned because of conditions at the bottom, two were abandoned because the information they could furnish was supplied by other holes, one was knocked over by the scow and two were knocked over by passing vessels. The work was interfered with by storms and waves from large steamers which caused an up and down motion of the scow, making work on the casing impossible. In the fall a number of storms caused considerable delay and usually about 5 months is lost during the winter on account of the ice. In closing up the work the pipe is cut off below the depth required for navigation and left to be found by divers again in the spring.

The method employed in sinking the hole is to put down the largest size casing first with as little driving as possible and when this size is down as far as possible, to put down the next smaller size inside of the first pipe and to repeat the operation until bedrock is reached. It is important not to have such a great length of pipe in contact with the soil that the frictional resistance will prevent its being raised, as this operation is necessary when blasting is done near the bottom of the pipe.

The casing is raised and lowered by a cable which passes from the hoist engine over a sheave at the top of the leads. The pipe is added to as it goes down in 20-ft. lengths, the new piece being suspended by the fall line while being screwed to the standing casing. Care is taken to screw the pipe together till the ends meet inside the sleeve couplings so that the hammer blows on the pipe will not strip the threads. The first casing (18 ins. in diameter) is very heavy and sinks without much trouble for about 50 ft. into the mud and silt bottom of the river. It is then driven by light blows of the hammer to refusal, a 4-in. pipe is lowered inside and a stream is pumped in with considerable force, stirring up the material and bringing it up to the top. The hammer at the same time continues to tap the pipe lightly, a hole being made vertically through the hammer to accommodate the jet pipe. The bottom of the jet pipe is kept near the bottom of the casing and not so far below as to force the material out under the edge of the casing. In clay it is possible to allow the jet to go some distance below the casing, but with gravel and sand the position of the jet must be regulated to within a few inches.

In large casings the water returning from the jet has little velocity and only the finer material is carried up, leaving the gravel and heavier material, which must be taken out by a bailer.

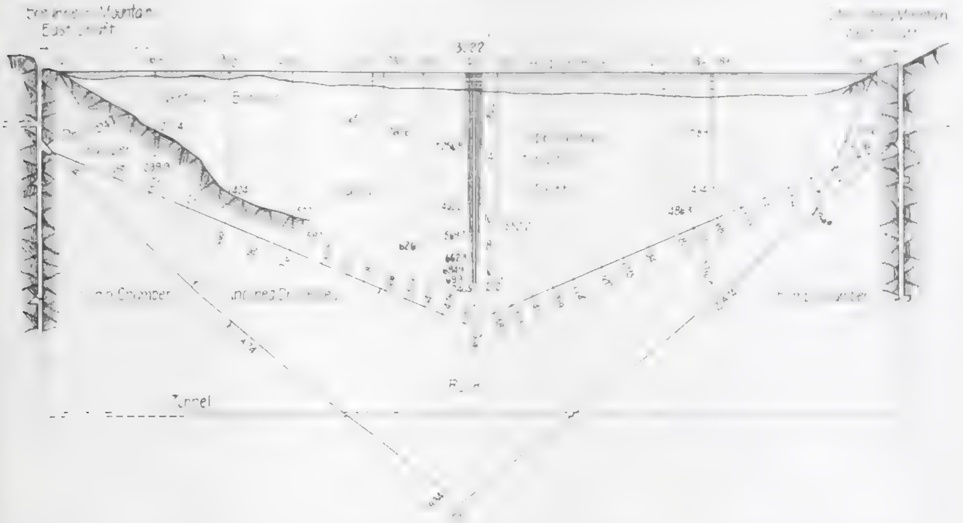

Fig. 1—Section of Hudson River Crossing of Catskill Aqueduct Showing Diamond Drill Borings.

When it is impossible to use a bailer an V-faced chopping bit is used to break up the gravel and cobble stones. This bit is placed on the end of the long line of drill rods and churned up and down. By the action of the bit the nature of the obstacle is generally indicated—a stone of moderate size breaks up after a time and the casing can be driven down with light taps of the hammer. If a lot of small stones is encountered the chips from them come up freely, and if a large boulder is encountered the casing rebounds when driven and it is then necessary to use the diamond drill and to blast. Blasting is also resorted to in case it is difficult to advance through a nest of small stones. The effect of blasting in this case is to force the material back and break up the stones close by, leaving a hole which the casing must be forced into immediately before the stones fall in and fill the space. The charge is put down in bundles of from 2 to 5 sticks according as the 2½ or 4-in. pipe is used. The sticks of dynamite are strung end to end on the exploding wire, which is carefully measured off so as to reach the bottom. The casing is lifted so as to be at least 10 ft. above the dynamite. The charge is fired by a battery and the casing immediately driven down.

The dynamite mostly used is 60 per cent Forcite but at times 93 per cent nitroglycerine and 7 per cent nitroglycerine is used. It has been found that a hydrostatic head of 500 ft. will force in the plug of an ordinary exploder and render it useless. In the deep holes therefore a special exploder covered with gutta percha has been used. A number of exploders are always used to insure a fire. In difficult ground a charge is from 4 to 20 sticks of Forcite. The record shows one place where 8 shots were fired and 3 failures of shots were made, using altogether 21 lbs. of dynamite and 76 lbs. of gelatine.

In raising the casing a heavy ring is slipped over the end and a clamp is fastened to the casing above it. The ring is then brought up against the clamp and its projections, with a series of blows. Another method is by pulling upon the casing until the scow deck is nearly under water, then suddenly releasing the hold and catching it again as the scow leaps up. The limiting power of the pile driver determines the depth to which the line of casing may reach, and when it is no longer possible to raise the casing it is then necessary to use the next smaller size of pipe.

A sediment of sand and gravel often gives trouble by collecting between the casing and the jet pipe and also between casings. This is very apt to occur when the jet has too little force and when the casing is large. In the casing the sand gives trouble by forming a cushion and decreasing the effect of the chopping bit. When between casings the sand increases the friction when necessary to raise for firing a shot. Many times it has been necessary to withdraw an entire line of casings in order to free the jet pipe.

In cases where drill rods or pipe have become disjointed by excessive pulling or by gradual unscrewing, it is sometimes possible to recover them by screwing another pipe on to the top of them, but more often a cone-shaped recovering tool is used. This has cutting threads and is manipulated until its end goes into the broken pipe or casing and is then turned until sufficient threads are cut to have a firm hold and the whole thing is lifted. In case a small pipe is to be recovered the cone-shaped cutting tool is reversed so as to have its base down and cutting threads on the inside of the cone.

If a very short piece of pipe, a bit, or other metal is lost in the hole it is forced out of the way if possible by blasting. This is very difficult, however, as the tendency is for any such obstacle to fall ahead of the casing and persistently stay in the way of the jet and the chopping bit.

Another trouble which it has been necessary to cope with is the deflection of the casing by contact with the side of a boulder.

If the pipe is dented or deflected by passing a boulder the resistance is soon increased to such an extent as to make further progress impossible. A deflection also makes impossible the rotary motion of the diamond drill rods, which necessarily come into play when bedrock is reached, so whenever there is a suspicion that the casing is going out of line, it is removed, the bent portion taken off and a blast fired at the point of difficulty. If the casing is badly bent and driven so far as to render its removal impossible the only chance for saving the hole lies in cutting the casing with a rotary cutting tool. The casing is then raised and the bent part fished out or blasted out of the way.

This condition was encountered 588 ft. in depth at one hole where a large amount of dynamite and five weeks' time were consumed in a futile effort to get past the detached piece of pipe.

Among the tools not already mentioned, which have been contrived to meet special occasions, are the "gouge" and the "spear." The gouge is a cone-shaped tool used to spread the crumpled edges of a casing to gain clearance for a smaller casing. The spear is used to recover a piece of pipe by passing through it and catching hold of the bottom edge by its hinged barb.

Diamond Drilling.—When it is believed that a large boulder is in the way the drilling machine is set up. This machine must have a stationary support. A small platform was finally devised (after using other methods) and was supported on wooden brackets clamped directly to the casing. The casing is held in place by four anchor lines. The platform is just large enough to accommodate the machine and give the men space to work. The boiler, pump and other materials are kept on a scow and the boiler is connected with the machine by a flexible hose. When it is believed that bedrock has been reached a good deal of preparation is made to get the casing seated so that sand can not wash under its edge from the outside. The chopping bit is worked on the rock until the casing is sunk for several inches into the rock and all openings between the casing and the rock are grouted.

After there is proof of bedrock having been reached, the pile driver leaves for another location and a small scow is substituted to act as tender until the diamond drilling has been completed.

The bit used for this work is 2 1/16 ins. in diameter and brings up a core of 1½ ins. in diameter. Four diamonds are set on the outer edge and four on the inner edge, about 12 carats of stones in all. A 10-ft. core barrel is above the bit, which holds the core by means of a spring collar. Usually the diamonds have to be reset before 10 ft. of core has been obtained and therefore the length of core barrel does not limit the amount drilled before pulling. The rods are 1⅞ ins. in diameter with flush joints. The hole through them is 1½ ins. in diameter except at the unions where it is only ⅜ in. in diameter. The rods are in 10-ft. lengths but in being taken out they are unjointed only at every second joint. The drilling machine has [illegible] 1,000 ft. It consists of a geared spindle driven by a steam cylinder, which rotates the rods and feeds them down the hole. It has also hydraulic cylinders for producing and regulating the pressure of the bit against the rock. Water is forced through the rods to cool the bit and wash away the cuttings. The drill runner watches carefully the return of the wash water as seams are sometimes encountered through which the water escapes, allowing the cuttings to collect about the core barrel until it is wedged tight, or leaving the bit uncooled, in which case such a heat is generated as to destroy the diamonds. A diamond is sometimes torn out of its setting at a seam

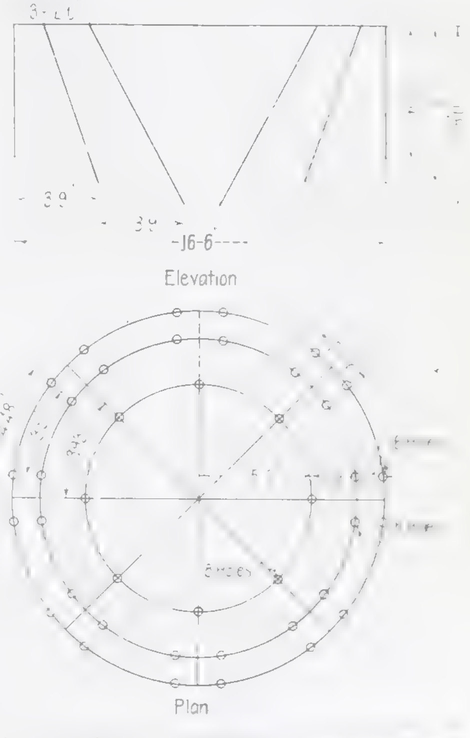

Fig. 2—Diagram Showing Arrangement of Holes for Sinking Shaft.

or from breaking up of the core and at once becomes a menace to the other diamonds. As soon as this is discovered work is stopped until the diamond is recovered. A blank bit covered with soft wax is lowered into the hole and the diamond is often recovered by adherence to the wax. In cases where a bit is twisted or broken off and a wax bit fails to get the pieces, it is sometimes necessary to start at the top with a larger sized bit and ream out the hole to a point below the obstacle, which is then brought up with the core if no further trouble has occurred.

The following table gives the record of diamond drilling in bedrock. Speed was much greater in the shallow holes than in the deep ones. The time used in making preparations for the diamond drilling, such as setting the platform, is included in calculating the results shown in the table and as in some cases the distance drilled was small, this largely affected the results.

Number of borings	15
Aggregate length in water	767 ft.
Aggregate length in earth	1,656 ft.
Aggregate length in bed rock	202 ft.
Av. progress per shift, earth	2.3 ft.
Av. progress per shift, bed rock	2.2 ft.
Av. progress per shift, water, earth and bed rock	2.7 ft.
Av. progress per shift, earth in boring No. 24, 749 ft. deep	1.6 ft.
Av. progress per shift, earth and water boring No. 24, 749 ft. deep	1.8 ft.

The force consisted of 1 foreman and 3 or four men.

Test Shafts.—These shafts have been in progress on the east and west banks of the river since 1907. They are 3,022 ft. apart and were designed primarily to explore the site for the river crossing but were so located and constructed that they could be used as a part of the completed siphon. The major part of both shafts is 16 ft. in diameter, although the upper part of the west shaft is rectangular.

On Sept. 14, 1910, the east shaft had reached Elevation—963 and was timbered to Elev.—930 and the west shaft had reached Elev.—865 and was timbered to Elev.—822. The average progress including all operations has been 38.9 ft. per month in the east shaft and 41.2 ft. per month in the west shaft. The maximum progress in one month has been 69 ft. in the west shaft and 65 ft. in the east shaft. The difference in average progress is accounted for by the larger quantities of water handled at the east shaft.

Popping Rock.—One very interesting feature of the work at the west shaft that has recently developed is the manner in which practically solid homogeneous granite yields to the enormous pressure exerted on the sides as the shaft is sunk. Rock walls apparently perfectly solid after having been exposed for several days will pop with an explosion like a gun, and fragments of rock weighing from 100 to 500 lbs. will fly off the face.

This proves nerve racking indeed to the man at work in the bottom. These explosions cease after the rock has been exposed for a certain length of time but continue to follow us as the sinking progresses. The condition has been operative for the last 300 or 400 ft., but it has grown steadily worse until now the method of timbering has been changed from wooden sets put in at intervals of 75 to 100 ft., to circular steel ribs and sheeting (4 ft. centers) carried close to the bottom of the shaft. As excavation progresses these sections are so constructed that they are hung one from the other and lagged close with steel plates ⅝ in. thick. At intervals of 20 ft. a number of 1½-in. pins are placed in the rock under the segmented rings to form a support for the structure as well as a foundation for the floor for the backfilling of rock which is packed closely behind the sheeting. This structure will remain in the shaft when, after completion, it is concreted.

Drilling Method.—In sinking the shaft [illegible] the west bank of the river, a novel and efficient method of drilling was adopted by the engineer in charge. The shaft is circular, 16½ ft. in diameter. Three circles of holes were drilled, the inner circle being of 5-ft. radius with 8 holes. The second circle of 7-ft. radius with 16 holes and the third of 8-ft. 3-in radius with 16 holes. The inside holes are located on the circle and one the 45° lines from the center, and the other holes are located on their respective circles 1 ft. each way from the 45° lines. See Fig. 2.

Two bars are fastened together at right angles and four drills mounted, one on each end of the bars. These machines are set on the bar so that the four outside holes can be drilled from one position. The one inside hole is drilled by moving the drill in toward the center a few inches. After each drill has completed its five holes the bars are loosened (not from each other), swung horizontally 45° and tightened into position for the balance of the holes which are drilled in the same manner, moving the drill on the bar only once. When firing a shot it was necessary only to turn the drills parallel to the bars and clamp them there and hoist the outfit as one piece to a couple of hundred feet above the bottom.

Inclined Borings.—The difficulties of reaching and determining the rock surface of the gorge by means of the vertical borings made it seem wise and a probable saving in time to make inclined diamond drill borings, starting from points about 250 ft. below the river level in each shaft and drilling toward the center of the river and crossing each other at a point somewhere near the center. The information gained from these borings shows that the drills have passed through solid granite rock for their entire length. The upper inclined borings have crossed each other at an elevation of —955 while the deepest vertical hole directly over this point has proceeded to a depth of —749 without having reached the rock surface. It is therefore evident that the surface of the gorge lies at some point between these elevations, and the elevation of the proposed tunnel may be definitely located from the information thus furnished.

The contract for making the two lower holes was let to Sprague & Henwood, of Scranton, Pa., and the first hole was started in the east shaft on June 1, 1909. A Sullivan diamond B drill, with a capacity for 3,000 ft. of hole, was used, the angle of the hole being 43° from the horizontal. Holes were started with 2½-in. bits reducing to 2 ins. and later to 1⅜ ins. As a precaution against a large flow of water the drilling was carried on through a 3-in. gate valve attached to a 3-in. pipe. The first 7 ft. of the hole was drilled with a 4-in. bit to provide a seat for the pipe, which was grouted in.

Eight diamonds were used in setting the bit, four to cut hole and 4 to cut core and all to cut ahead. All were set to a minimum clearance, projecting only 1/64 in. outside. The 60 ft. of rods immediately following the core barrel were of the same size as the bit, 2 11/16 ins. in diameter, being made so in order to keep the hole as nearly straight as possible. At 177 ft., however, a survey was made which showed that the hole was turning downward. Smaller rods were then substituted for the 60 ft. of guide rods in the hope that the sag of the smaller rods in the hole would tend to turn the bit to proper line. Another survey at 280 ft. showed that the hole was going straight and continued on this line to 641 ft. Here a change to a 2-in. bit was made and, either by chance or by forcing the rods, the hole started an upward turn.

This upward curve continued and seemed to be increased by the use of a tapered core barrel, together with forcing the rods until at 1,398 ft. a survey showed an inclination of 37° 20′. From this point the hole began another downward turn to the end.

A small quantity of water began to flow in this hole at a very small depth.

This increased till 641 ft. was reached and the reduction to a 2-in. bit was made. The flow then was 50 gals. per minute from the open hole. At 734 ft. the flow had increased to 90 gals. per minute. Here, as a result of back pressure and failure of the drill runner to keep his pump going hard enough to force water through the drill rods, the bit was burned fast in the rock. The rods were detached from the bit and the 2½-in. hole was extended from 641 ft. to 734.3 ft. by reaming. The 2-in. bit was thus recovered as core with the steel and diamonds fused into the rock.

In order to shut off the water flowing from the hole a 2½-in. flush joint pipe or casing, with several chip diamonds set in the end was turned into the hole until the end was burned fast into the bottom as the bit had been. This reduced the flow to 5 gals. per minute. However, in the next 350 ft. the flow again increased to 180 gals. per minute, spouting a stream 10 ft. from the mouth of the hole into the drill chamber. With this flow the pressure was so great as to force the last 100 ft. of rods out of the hole when pulling core.

Another flush joint casing was then put in, telescoping the first casing and extending to a depth of 1,234 ft. and reducing the flow to 10 gals. per minute. The hole was drilled to a length of 1,834 ft. and the water increased again to 70 gals. per minute, which was calculated to be the limit of flow from the then long hole. At 1,834 ft. the bit was again burned into the rock and over two months were spent in the attempt to remove it. The hole was finally given up, however, and about $1,500 worth of diamonds and 600 ft. of small rods were lost. Moreover, this hole having failed to reach the depth or "zone" described in the contract, the contractors also lost a bonus of $3.50 a foot for each foot over 900 ft.

The hole from the opposite side of the river was drilled with more success. This was started on an angle of 38° from the horizontal. The maximum water flow was only 5 gals. per minute and the hole was driven far enough to carry it horizontally past the hole from the opposite side of the river, although 80 ft. below it.

Under a second contract with the same parties another set of holes was started in the spring of 1910 and was completed on Aug. 23d. These holes were inclined about 23° and

TABLE I—RECORD OF INCLINED DIAMOND DRILL BORINGS.

	First Set.		Second Set.	
	East Hole	West Hole	East Hole	West Hole
Work started	May 24, 09	July 20, 09	Mar. 29, 10	
Drilling began	June 1, 09	July 29, 09	Apr. 5, 10	Apr. 20, 10
Drilling finished	Dec. 15, 09	Mar. 31, 10	Aug. 4, 10	Aug. 23, 10
Elapsed time of drilling—days	198	214	122	127
Working time, days of 3 eight-hour shifts	167	192	85	107
Actual drilling time, 8-hour shifts	331	429	214	279
Feet drilled per actual drilling shift	5.54	4.78	7.72	5.92
Feet of 4" hole and per cent 3" core recovered	7.2—47%	8.0—75%	8.5—78%	7.1—76%
Feet of 2¾" hole and per cent 2" core recovered	633.8—79%	711.3—91%	715.5—84%	772.4—83%
Feet of 2 1-16" hole and per cent 1[illegible]" core recovered	593.0—41%	754.5—76%	927.4—48%	872.6—68%
Feet of 1 7-16" hole and per cent 1 1-16" core recovered	600.0—27%	572.8—22%		
Total depth of hole	1834.0	2051.6	1651.4	1652.1
Total core recovered and per cent of depth drilled	1013.2—55%	1360.3—66%	1052.1—64%	1245.0—75%
Elevation of top of hole	[illegible]	—251.2	—279.7	—245.8
Elevation of bottom of hole	[illegible]	—1564	—965	—961
Inclination below horizontal at top	43° 0′	38° 0′	22° 53′	23° 40′
Inclination below horizontal at bottom	38° [illegible]	44° 47′	23° 35′	25° 55′
Maximum variation of inclination	7° 15′	7° 20′	2° 52′	2° 27′
Minimum water flow from open hole in gallons per minute	180	5	120	25
2½" flush joint casing used—feet	735	none	724	723
2" flush joint casing used—feet	499	none	none	none

aimed at the center of the gorge about 900 ft. below the river surface.

As with the first holes these also tended to increase in slope. The hole from the east bank flowed 120 gals. per minute at the finish, this being much more than that flowing from the west hole, as was the case with the two previous holes. Less water flowed from the upper east hole, however, than from the lower one, which is contrary to what might be expected on account of the lesser distance to the river. These holes crossed each other at an elevation of 955 ft. below the river. As with the lower holes, there was no indication of open seams and no intersection with bedrock surface, thus fulfilling the prediction of the geologists that the gorge, while not less than 500 ft. deep, did not extend further than 1,000 ft. below the river surface.

Table I shows the records of the work done. The force required included one drill runner at each hole with one or two helpers; two helpers being required for pulling the rods and when rods had to be pushed into the hole against the flow of the water.

Surveys.—Two methods of determining the depth of and inclination of the holes were used, known as the hydrofluoric acid test and the pressure gage test.

The first method consists in the use of a small glass bottle half filled with a dilute solution of hydrofluoric acid. The bottle is placed in a cylindrical water tight steel shell about 1 ft. long and bored to fit the bottle. This is lowered into the hole and allowed to remain about ½ hour or more.

The solution is diluted to about 1 part of acid and 9 parts of water so that the bottle is required to lie in a stationary position for some time to show a definite line of etching. The angle of the etched line on the inside of the bottle with the line of the side of the bottle showed the inclination of the hole. The angle was read by attaching the bottle to a pivot which operated a needle over the graduated scale of a protractor. Owing to the effect of capillary attraction, however, the observed angle was not the true angle, a minus correction of from 4° to 8° being necessary for angles from 26° 24′ to 52° 05′ respectively. A correct diagram was made by taking readings on tubes exposed to known slopes.

The pressure gage consisted of an arrangement of two steel cylinders, one within the other, the inner one being filled with mercury and having a calibrated glass tube leading from it to the air-tight chamber of the outer cylinder. The hydrostatic pressure on the outer casing forced the mercury into the inner tube from which it could not return, thus recording the highest pressure. This scheme was excellent in principle but did not work well in the conditions under which it was used. Only the highest pressure could be recorded and higher pressures than that of static head might be recorded.

The work of making the test borings for the aqueduct is being carried on by the Board of Water Supply of New York. Mr. J. Waldo Smith is Chief Engineer and Mr. Robt. Ridgway is Department Engineer of the Northern Aqueduct Department. Mr. Wm. E. Swift at Cornwall, N. Y., is Division Engineer in charge, and Mr. Wm. B. Hoke and Samuel D. Dodge are Assistant Engineers directly connected with the work.

A New Type of Dragline Scraper Excavator with Erection and Operating Costs.

A dragline scraper excavator having novel features is used on one of the New York State Barge Canal contracts held by the Atlantic, Gulf & Pacific Co., New York city. This excavator is known as a Field Tower Scraper, being named from its inventor, the superintendent for the company at Comstock, N. Y. As shown by Fig. 1 the essentials of the excavator are a movable tower, a cableway and hauling lines and a special scraper bucket. The tower carries a double drum engine. From one drum a line passes up the tower and over a sheave located from one-fourth to one-third its height and thence down to the bucket. This is the hauling line. The second line passes up and over a tower head sheave and thence to a pulley block on the opposite of the prism. This pulley block rides on a ½-in. cable about 200 ft. long, stretched parallel to the prism between two deadmen, moving along the cable as the tower moves. This second line is the cableway on which the scraper bucket travels back and forth across the canal, being pulled toward the tower by the hauling line and sliding back by gravity.

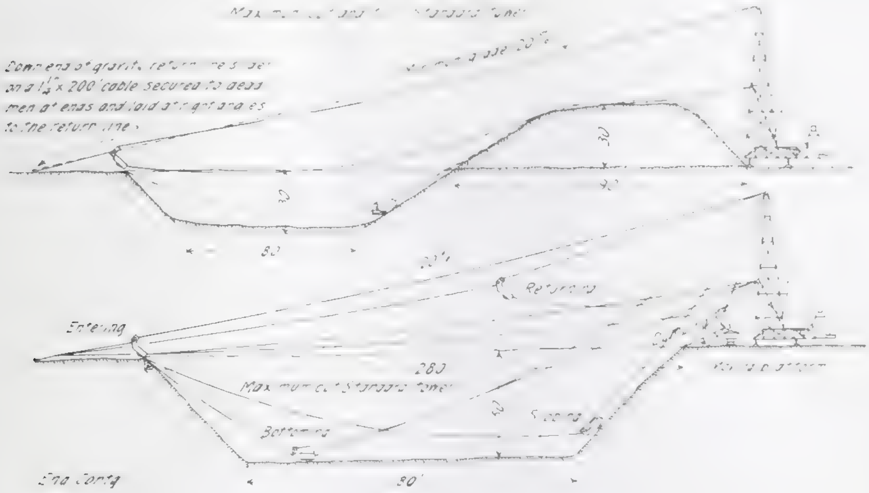

Fig. 1—Sketches Showing Operation of Field Tower Excavator.

The Tower.—The tower is a framed timber structure of height suitable to cover the width of the excavation for which it is intended (the standard tower being 75 ft. in height.) This tower rests on a trussed platform or car which carries the hoisting engine, coal and other supplies. The tower is rigidly secured to the truss and guyed by back stays to the projecting back end of the platform. The platform or car runs on four solid double flange cast steel wheels, 16 ins. in diameter and 4 ins. tread. The track con-

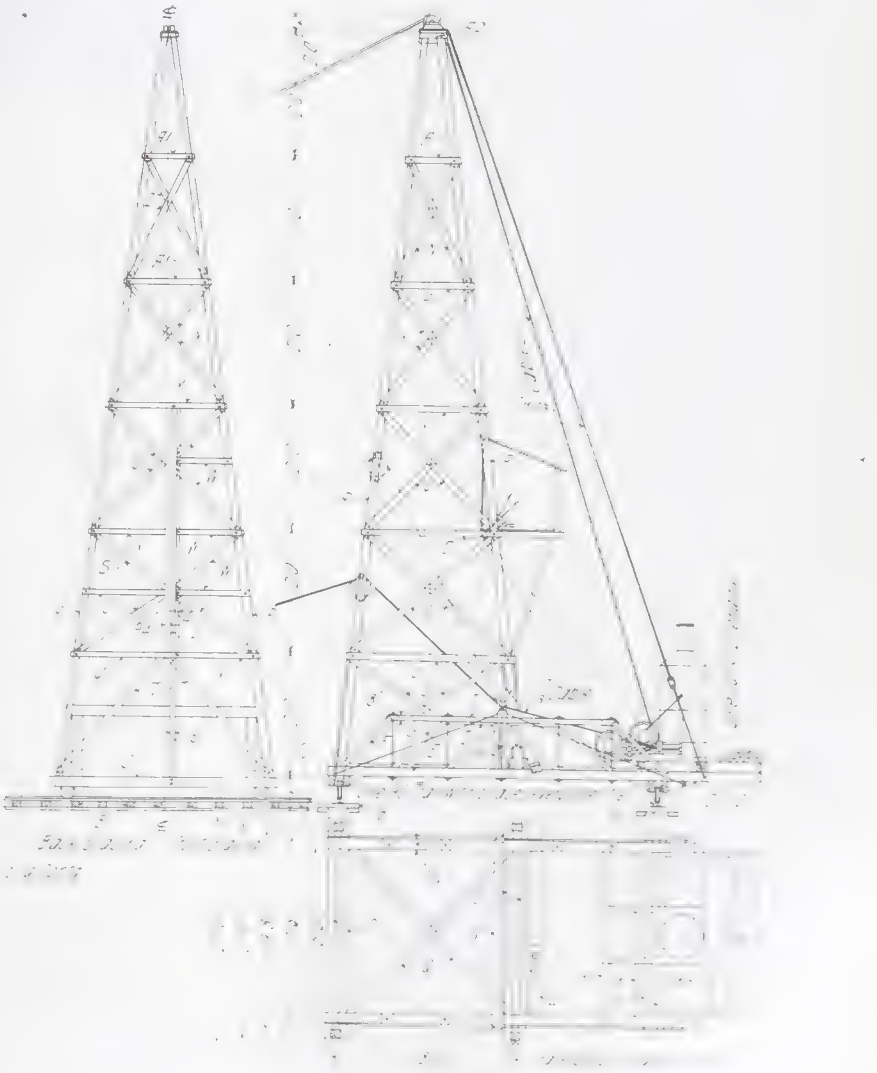

Fig. 2—Details of Tower for Field Tower Excavator.

of two 90 lb. rails each spiked to 6x8 in. x4 ft. ties spaced 2 ft. apart and bolted to two 4x10 in. x30 ft. planks. The engine may be any good make, 10x12-in. engine with double drums and two nigger heads. The hauling line is ⅞ in. and return cable is ¾ in.; 18-in. sheaves are used.

The tower is moved forward or back by a 1½ in. manila line secured to a dead-man suitably placed, passing through sheaves secured to the platform and around the nigger head. The track is also moved ahead by the same means, the dead-man being dispensed with and line passing around the end of a boom which is a part of the tower. The line around the nigger head is operated by the fireman.

The operator's cabin is placed up about one-third the height of the tower in full view of the work, and the engine is manipulated by suitable levers and brakes connecting the operating cabin with the engine.

Scraper Bucket.—The distinctive feature of the excavation is the scraper bucket which is shown by Fig. 3. This bucket has a capacity of 48 cu. ft. level full, but in ordinary material it will "crown up" to 2 cu. yds. capacity. Particularly easy and certain control are claimed for this bucket. These advantages are brought about by the combination of two sheaves placed at the rear end of the scraper at right angles and vertically to it, the return line passing reversely over the upper and under the lower sheave, while the bottom of the scraper is fitted with two curved cradles or shoes, resulting, in connection with the pulling line, in such control of the cutting edge that the scraper can be sustained at any vertical angle at the will of the operator.

Cost Data.—The meagre first cost of this plant is in the hoisting engine and cable which are all standard commercial designs and usable for other purposes. The following is an estimate furnished us by the Atlantic, Gulf & Pacific Co., of the cost of a tower scraper plant including everything:

5,080 ft. B. M. lumber at $38 per M......	$ 193.04
360 ft. B. M. white oak at $45 per M..	16.20
540 lbs. iron bolts and nuts at 6 cts..	32.40
120 ft. ⅝-in. wire rope backstays	13.20
2 ⅝-in. turnbuckles	.80
1 headblock sheave and bearing....	10.00
1 hauling sheave and bearing........	4.00
1 8¼x10 Lidgerwood double drum hoisting engine*	1,089.00
1 scraper bucket, complete with cutting edge, sheaves, etc...........	300.00
Labor erecting based on condition in Northern New York, carpenters at $2.50 per 8-hour day............	200.00
Total	$1,858.64

The following is an estimate of the operating cost of the plant also furnished by the Atlantic, Gulf & Pacific Co.:

Item.	Cost per month.
Wire rope	$160.00
20 tons coal at $4........................	80.00
Oil, waste and repairs....................	15.00
Total	$255.00

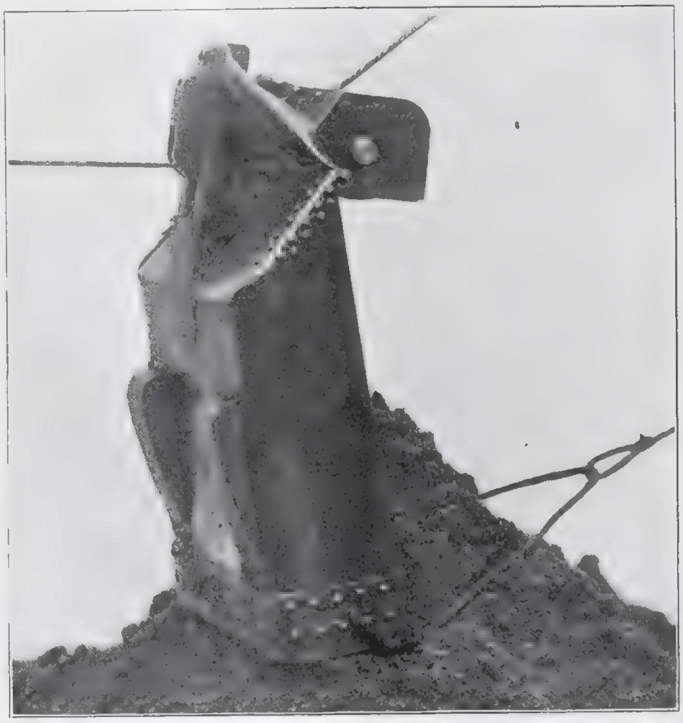

Fig. 3—Scraper Bucket for Field Tower Excavator.

To this is to be added the labor cost. Each shift requires the following force:

1 foreman at 37½ cts. per hour	$ 3.00
1 engineer at 37½ cts. per hour	3.00
1 fireman at 22 cts. per hour..............	1.76
1 signal man at 25 cts. per hour..........	2.00
5 laborers at 20 cts. per hour	8.00
And an additional 4 laborers at 20 cts. per hour..............	6.40
Total	$24.16

Assuming 26 working days and two shifts per day, the labor cost for one month is $1,256.32 which, added to $255 given above, makes a total cost for operation of $1,511.32. Assuming interest on plant at ½ per cent per month we have an additional $9.30, making the grand total $1,520.62. Assuming an output of 700 cu. yds. per day we get a cost per cubic yard of 8.4 cts. In our issue of Sept. 28, 1910, we gave the actual cost of operating one of these excavators on the Barge Canal work near Utica, N. Y., and the figures per cubic yard were 9.6 cts. This cost included, however, a proportion of the field office expenses. In regard to the life of the cables used the Atlantic, Gulf & Pacific Co. writes:

"While the life of the wire rope used depends almost entirely upon the character of material to be excavated; in clay and loam, the plant working two eight-hour shifts per day, 26 days each month, excavating approximately 700 cubic yards per day, will use 800 to 1,000 ft. of wire rope per month." Loeschen's red strand "Hercules" wire rope is considered.

BILL OF MATERIAL FOR FIELD TOWER.

Mk.	No.	Size.	Length. Ft.	In.	Ft. B.M.	No.	Size of bolts	Washers
A	1	4"x12"	30	0	480	44	⅝"x10" wood.	88 cut.
B	2	6x8	4	0	352	16	1x20	32 cast.
C	4	8x12	22	0	504	8	1x20	16 cast.
D	[illegible]	6x12	22	0	264	8	1x24	16 cast.
E	2	12x12	36	0	864	8	1x16	16 cast.
F	4	8x12	8	0	256	8	½x6'-6" long.	14 1"x6"x12"
G	8	6x12	[illegible]	0	336	2	1½x7'-6" long.	4 1"x10"x12"
H	1	4x10		0	67			2 1"x12"x12"
I	2	3x10	5	0	150	4	2"x19'-0" long.	
J	2	8x12	22	0	352	12	1"x20" wood.	24 cast
K	3	12x12	18	0	648	4	1"x20" wood.	[illegible] cast
L	1	10x12	18	0	180	8	1"x14" wood.	16 cast.
M	1	3x12	16	0	48			
N	1	10x10	20	0	167	[illegible]	1"x14" wood.	
O	1	8x8	[illegible]	0	128	1	1"x12" wood.	[illegible] cast
P	1	2x[illegible]	8	0	27	8	1"x16" wood.	16 cast.
Q	2	8x10	22	0	322			
R		[illegible]x8			[illegible]00	1[illegible]0	½"x8" wood	300 cut.
						[illegible]4	½"x12" wood.	48 cut
S	[illegible]	3x[illegible]	[illegible]	0	360			
T	4	6x6	16	0	192			
U	8	3x6	18	0	216			
V	1	6x6	19	0	57			
W	1	3x16	10	0	210	16	⅝"x14" wood	
X	1	6x6	12	0	36	150	½"x9" wood	350 cut.
Y	11	3x6	16	0	264			
Z	8	3x6	14	0	168			
A¹	8	3x6	19	0	[illegible]			
A	1	12x12	3	0	36		¾"x16" & 2 ¾"x3'x4'	
"	4	4x8	3	0	32	1	¾"x2'-6"	
"	1	4x12	6	0	24	2	¾"x3'-3"	18 cast.
"	2	4x8	3	0	[illegible]		¾"x20"	
Housing 1" and 2"x4"					3000			
					[illegible]			
Wheel boxes						[illegible]	¾"x17"	36 cast.
Idler						[illegible]	¾"x12"	
Cable clips						1	¾"	
Turnbuckles with eyes						[illegible]	¾"	
Back stay						[illegible]	⅝" cable	

Lever connections not included.

Sand Blasting Concrete Surfaces, and Cost.—The Missouri Sand Blast and Cleaning Co. of Chicago has recently made successful experiments in roughing the surfaces of sample concrete blocks, made from materials which are being used in the construction of a bridge at Lake Bluff, Ill. The bridge is being built in connection with the new United States Naval School and is about 285 ft. long, 60 ft. wide and about 100 ft. above the bottom of the ravine which it spans. Experiments showed that a very good surface could be obtained in a short time with air at 50 to 55 lbs., and that best results are more easily obtained on concrete a month old or more than on green concrete. The proper surface cutting is obtained by holding the nozzle at an angle with the surface and by varying the distance between the nozzle and the surface about 1,000 sq. ft. a day is easily covered, and with good men a maximum area of 2,000 sq. ft. could be done. An estimate of the cost of this class of work is as follows:

	8-hr. day.
1 tuck pointer	$ 4.8
1 laborer	2.5
1 engineer	5.0
Gasoline and sand	8.0
Machine, interest and depreciation........	5.00
Incidentals	5.0
Total	$30.3

Assuming an average day's work of 1,000 sq. ft. this amounts to 3 cts. a sq. ft.

ROADS AND STREETS SECTION

Surface Treatment of Roads in a Residential City.

In a residential city the problems encountered in the surface treatment of roads for dust prevention and road preservative purposes differ somewhat from those encountered in similar work on a country highway or even on the roads of a park system. The city of Newton, Mass., essentially a residential city, was one of the first municipalities in this country to undertake the systematic surface treatment of its roads. Under the direction of its street commissioner, Mr. Charles W. Ross, experiments with different preparations have been conducted for several years, and as a result much valuable data on this kind of work have been obtained. In a paper presented at the Third National Good Roads Convention, held at St. Louis, Sept. 28-30, 1910, Mr. Ross sets forth the experiences of the city in the surface treatment of its roads as follows:

Newton, Mass., has about 37,000 inhabitants, with 9 miles of telford, 82 miles of macadam and 115 miles of gravel road. You can see by this that a large percentage of our streets is macadam; they were built on a good gravel foundation, and I can say that we compare favorably with the average city. Our city has experimented several years with different preparations, and I think it would be hardly fair to say that any one surface preparation on the market is superior to any other, for our choice must be governed by the conditions of traffic. In the first place, if you have a good gravel road, properly crowned, it must be surfaced with a material suited to the kind of traffic it carries. The best way to decide this is by actually counting for 24 hours two or three times during the season the number of motor-driven and horse-drawn vehicles passing over the road. If the majority are horse-drawn, a preparation of heavy asphalt oil covered with sand or fine stone screenings and spread on the surface of the road will be the best to keep down the dust. It will make the road nearly waterproof and will not be slippery during rainy or frosty weather and gives a good footing for horses. If, on the other hand, preparations are to be used for motor-driven vehicles, the several heavier asphalt oils and different preparations of tar can be used to good advantage.

First, we will consider the lighter preparations, costing, say, from 3 to 6 cts. per square yard for the season, and giving to the surface of the road a finish which is almost waterproof. We have used a great quantity of Dustoline, Terracolio, Tarvia B, Speare's Road Binder, Gulf and Standard emulsion oils, and many other preparations on the market that are good under certain conditions. They give very good satisfaction in the village, where people walk across the street a great deal. You can benefit the surface of your street, also save the watering and even if it costs a little more you have a finished surface which is dustless 24 hours in the day.

If you treat a macadam road with tar or any of the heavier asphalt oils costing 7, 10, 12 or 15 cts. per square yard, a great saving is made in two years, for you save the surface of your road as well as get rid of the dust. In 1907 we treated a section of a road where the old macadam surface had become badly worn. It was spiked up and covered with a light grouting of Portland cement mortar mixed in the following quantities: Two parts sand, one part cement. This was spread evenly over the entire surface; it penetrated the sand in such a way as to bind the whole material together, and was then smoothed off with street sweepers' large brooms. The road was closed for about four days, giving the cement time to set. After that it was opened to traffic and was used for about one year. The surface was then swept with an ordinary horse street sweeper and covered with a thin coating of Tarvia A, which was heated to a temperature of 80°. We used about ¾ gal. Tarvia to the square yard. It adhered readily to the cement and has made a smooth and satisfactory surface for three years and remains today in first-class condition. On a small portion of this same street a second coating of cement grout was applied, covering it with Tarvia A, to see if the materials would adhere and make a satisfactory surface. The experiment was successful.

In the spring of 1908 one of our principal streets was so badly out of shape that it required a new surface of about 3 ins. of stone. This was put on an area of 6,290 sq. yds. at the following cost:

	Per sq. yd.	Total.
Labor and teams	$0.1987	$1,250.08
Crushed stone, 500 tons	.0970	610.55
Screened gravel	.0002	14.85
Use of steam roller	.0334	210.00
Tarvia A, 10,890 gals	.1290	816.75
Totals	$0.4583	$2,902.23

At about this same time another street having an area of 9,821 sq. yds. was treated in like manner, except that it was thought best to give it a much thinner coating of stone. This street was spiked up with the roller, and the crushed stone and Tarvia rolled on the surface in the same manner as described previously.

	Per sq. yd.	Total.
Labor and teams	$0.1105	$1,085.88
Crushed stone, 546 tons	.0568	557.90
Use of steam roller	.0369	362.50
Tarvia A, 767 gals	.0822	807.52
Totals	$0.2864	$2,813.80

A third roadway, measuring 39,205 sq. yds., and used exclusively for automobiles, was rebuilt at the following cost:

	Per sq. yd.	Total.
Labor and teams	$0.0841	$3,298.47
Crushed stone, 521 tons	.0133	522.90
Screened gravel	.0010	38.30
Use of steam roller	.0148	571.25
Tarvia A, 31,424 gals	.0601	2.356.79
Totals	$0.1733	$6,787.71

After this treatment had been applied an experiment was made by taking a small quantity of Texas asphale, J brand, and heating it to a temperature of about 400°, so that it would run freely through the sprinkler of a watering pot. Less than ¼ gal. to the square yard was used at an additional expense of about 2¾ cts. per square yard. The surface has not only been less slippery than the Tarvia road, but it stopped the tar from boiling out on the surface in hot weather, and is as smooth as when it was first applied. It seems to seal over the tar and hold it so tightly that it does not deteriorate with the action of the weather. Records have been taken which show that on an average from 1,500 to 2,000 autos pass over this road in 24 hours, and yet it has not been cut by the chains of the autos and is in perfect condition today.

On another road this year we tried a preparation of the 90 per cent heavy Standard oil. This was heated to a temperature sufficient to make it flow freely through the sprinkler of the oil distributor and put on to the surface of an old macadam road. The road was first spiked up and then covered with 2 ins. of screened stone taken from an ordinary gravel pit, and varying in size from 2 ins. down to ½ in. The small stones filled in the spaces between the larger ones. The whole was rolled smooth and hard, then the oil was applied hot and it readily penetrated the entire mass, taking about 1½ gals. per square yard. This was covered with a coating of screened gravel which had passed through a ½-in. screen and was thoroughly rolled with a steam roller and opened to traffic within 12 hours after it was completed. I have no doubt that this is making a very satisfactory road for heavy teaming. It is dustless as well as perfectly hard and smooth at the present time. Another road was treated exactly in the same manner, using asphaltoilene. Of the two, this road seems to be a little more elastic.

I merely speak of these preparations being applied in this way to show that the mixing process is not always necessary, as I believe the penetration treatments have given us as good results as any of the mixing preparations, and the application is cheaper.

Last year dustoline was tried on about 40,000 sq. yds. of one of the main thoroughfares, and the cost was less than 3 cts. per square yard for the season. Tarvia B was used in one of the residential sections of the city, covering an area of 70,000 sq. yds. at a cost of 3¼ cts. per square yard.

Several streets surfaced with macadam, having varying grades, up to a maximum of 9 per cent, all of them having both a heavy horse-drawn and automobile traffic, were selected for a trial of the liquid asphalt treatment.

A quantity of sand was heated to a temperature of about 200° F., then dumped in a pile and leveled. The liquid asphalt was poured over the hot sand in the proportion of 1 gal. liquid asphalt to 1 cu. ft. of sand, and the whole mass turned with shovels or mixed in a concrete mixer. This work was done at the pit. The mixture was then carted to the street to be surfaced, and spread on the roadway to a depth of less than ¼ in., being raked evenly with 14-tooth wooden lawn rakes. Rolling was not considered necessary, and the street was kept open for traffic at all times. This treatment cost about 3 cts. per square yard. It also has the advantage of leveling up and building up the surface of the road, and each new application provides a new wearing surface. This work was done in the summer of 1909, and is in perfect condition today, without any further expense.

We have had very good results by using gravel from an ordinary gravel pit and running it through a ½-in. screen, putting in a little over ½ gal. of asphaltoilene to 1 cu. ft. of gravel. It is better to heat the oil or the gravel before mixing unless applied in the summer time. If done at this season there is no need of heating. A large pile of material can be prepared and ready to use at very short notice. We found it best to apply this after a heavy rain, as all the depressions in the road will show little pools of water, and if these are filled with this mixture and the surface raked with a wooden rake it will become as smooth as it was when first built. We have found this patching process very satisfactory, as in many cases it saves the expense of resurfacing the entire street. After the patching is completed the street can be resurfaced with a coating of heavy asphalt or Tarvia, which will make a new surface at a comparatively small expense.

This year we have used a large quantity of the heavy asphalt oils, Tarvia A and B, and also some of the heavier standard oils. All the preparations came to us in tank cars and were heated and unloaded in the following manner: The car was connected with a small steam boiler and was heated to a temperature of about 100° F. This allowed the material to flow through the hose at the bottom of the car after the car had been placed on a trestle about 10 ft. above the level of the ground. This material was then run into a Studebaker tank wagon. It is a steel tank, holding about 550 gal., and contains 40 2-in. perpendicular tubes which pass through the tank. Underneath this tank there are two large burners supplied with kerosene oil, which is forced in by pressure. This heats the oil to the desired temperature, and a thick, heavy asphalt oil can be melted and applied in this manner. There is a firebox that extends the whole length of the tank, which gives an even heat right through. The oil is applied through a sprayer or spreader, which is perforated, and the oil trickles down on to the surface of the road in very fine streams and covers the road thoroughly by going over it once. In my opinion this is a very desirable way of putting on any heavy asphalt oil, as the material can be readily heated and applied in large or small quantities by valves which regulate the flow. We have found this wagon very useful in our work this year and I believe will be one of the most useful appliances for its purpose. It can be regulated so that it will put on as small a quantity as 1/6 gal. to the square yard.

After the oil was applied the road was covered with a light coating of sand, which dried out very readily, and we were able to use the road within a very few hours after the application of the sand coating. In applying the oil it is better to take half of the road at a time, leaving the other half open for traffic. This saves driving on to the oil by the teams spreading the sand and also the liability of teams getting spattered with the fresh oil. One of the roads treated this year covered an area of 19,194 sq. yds., the cost being:

	Per sq. yd.	Total.
Asphaltoilene, 6,415 gals. at 7½ cts.	$0.0251	$481.13
Sand, 79½ cu. yds.	.0033	63.60
Labor and teams	.0085	163.25
Totals	$0.0369	$707.98

This price is as small as any of the work done this year, as it has cost as high as 5½ and 6 cts. But this difference in price is accounted for by the long distance that the material has to be hauled and the increased quantity used.

On another section we used Tarvia B. The area treated was 41,288.69 sq. yds. at this cost:

	Per sq. yd.	Total.
Labor and teams	$0.0075	$309.33
Sand, 92.5 cu. yds.	.0017	74.00
Use of roller	.0010	40.00
Tarvia, 10,057 gals.	.0122	502.85
Freight	.0009	36.00
Totals	$0.0233	$962.18

Road Drainage.*

Roads are good in summer because they are dry. Roads become axle-deep with mud in spring and fall, because they are waterlogged. Water accumulates on the surface and under the surface of the roads in fall, winter and spring, until the soil is of a semi-fluid condition. Acted upon by frost, the expansion of this water in the soil leaves it loose, open and porous. Whatever other quality a good road may have, it must be well-drained either naturally or artificially.

Past expenditure on roads, and the present ordinary methods of expenditure, have been of but temporary service, for the reason that roads have been left in an incomplete condition, with little if any drainage. Traffic during one or two springs, when the roads are in a water-logged and flat condition, cuts through the surface covering of gravel or stone. The mud, under pressure, oozes through gravel and stone, and the road is churned and flattened back to its original state.

Roads in Canada today are bad for the same reasons that they were bad in England a century ago, before the time of macadam. They are drainless quagmires, swallowing the stone and gravel placed on them. Townships commonly spread stone on their roads and speak of them as being "macadamized." To macadamize our roads means, in the first instance, that we must thoroughly drain them by surface and under-drainage. The essential principle of a macadamized road is drainage. This was the principle advanced and introduced by macadam and it is the one so commonly neglected throughout Canada today.

Roads with a high grade are not necessarily well drained. It has been the practice to excavate from the sides of the road, and throw the earth in the center of the road allowance, to raise and level the grade. Unless the excavations on the side of the road have a continual fall to outlets in such a way that the water will flow away, they are not drains. Excavations without outlets are merely elongated ponds, which hold the water and permit it to soak into and soften the roadway. In this way mud is formed underneath the roadway, and mud below the surface is just as injurious as mud on the surface. Drains must cause the water to flow away, not soak away. As soon as water falls on the road allowance, it should be made to flow down grade until it is entirely drawn from the roads.

Specifications covering the construction of old toll and company roads built through Ontario half a century ago, usually required that the open drains by the side of the roadway should not permit the water to rise within 2 ft. of the surface of the road. These open drains are dangerous for traffic, are expensive to excavate and maintain. To overcome the necessity of these high grades, thrown up much in the manner of railway grades, the modern practice is to use tile under-drainage. Tile underdrains have practically the same effect as deep open drains in lowering the water line; or, what is the same thing, they have the same effect as throwing up a high grade similar to a railway grade. They keep a stratum of dry soil underneath the gravel or stone placed on the road surface.

Tile underdrains are not intended to carry away surface drainage. Surface water must still be carried away in open gutters. The object of tile drains is to keep water from rising into the roadbed from below. The manner in which water rises in the ground may be compared to water being poured into a pail. In order to prevent this water rising to the surface of the pail and flowing over the top, it can be kept to any level by cutting holes in the sides of the pail. Tile drains are similar to these holes cut in the side of the pail. The soil above the tile drains is kept in a reasonably dry state, strong enough to support the gravel or stone covering, and the traffic that may come over the road. Water enters the tile from below, not from the top. It must be emphasized that these tile drains are not intended to carry away surface water, but to reduce the level of the water line in the way described.

Complete drainage of a road requires that the roadway built for traffic shall be turnpiked; that is, thrown up to a greater or less height above the natural level of the ground. The surface of this grade must be given a crown or camber to turn the water from the surface of the roadway to the open drains. The open drains must be of a sufficient capacity to carry the water which will naturally enter them, and they must have a continual fall to free outlets. Wherever the soil is of a wet and waterlogged character, at any season of the year, tile underdrains should be used. In addition to this, one of the chief objects of the gravel or stone placed on the surface of the road, is to form a strong, smooth and water-proof coating, such as will prevent water entering the road surface from above; but will, instead, turn it to the side drains.

If a well-crowned clay road could be kept smooth and free from ruts during fall and spring, it would not cut up to any extent. It is too soft and weak to prevent the forming of wheel tracks, which quickly deepen to ruts when full of water. To give the clay a stronger surface, gravel or stone is spread over it. This gravel or stone does not permit wheel tracks and ruts to form so quickly, so that water is turned to the side drains. To preserve a gravel or stone road, it should receive constant care, to see that the wheel tracks and ruts are kept flush, and the surface smooth, so that the flow of water to drains will not be interfered with. It is this neglect of the wheel tracks forming in gravel and stone roads, that so quickly causes their destruction. The difference between the better class of roads in Canada, and those of England, France and Germany, is not so much in the method of construction as the fact that, in these countries, constant attention is given to the repair and maintenance of the roads, so that ruts and wheel tracks are never formed.

When undertaking the construction of a road, the first thing to consider is the outlet for drainage. The road should be carefully studied with this in view, and when the different outlets crossing or adjacent to the roads are determined all grading and drainage should be carried on with a view to these outlets, so that the slopes of the road and drains will be uniform and in a proper direction.

Open drains should be on each side of the travelled roadbed. Their capacity should be in proportion to the amount of water entering them from the adjacent fields and slopes. The side slopes of drains should be in the proportion of 1½ ft. horizontal to 1 ft. vertical. The bottoms of these drains, wherever practicable, should be at least a 1 ft. or 1½ ft. wide, and the tops of drains should seldom be less than four feet wide. As previously stated in this article, carry these drains with a constant fall to free outlets, so that there are no pockets or depressions along the bottom of the drains to hold water.

When constructing tile drains, they should be placed at least 2½ ft. below the surface of the road. In porous soil, one tile drain along the side of the road will be sufficient in heavy clay soils, a tile drain on each side of the road should be used. If the soil is a stiff clay, and very wet, the effectiveness of the drains can be greatly increased by filling the excavation over the tile with gravel. Where tile are laid in quicksand, the joints may be wrapped with strips of cotton to keep out the silt; or it is good practice to surround the tile with a coating of sawdust. Where the bottom of the drain is too weak to support the tile, inch boards may be laid along the bottom, and the tile placed on these. The size of tile used will depend on the amount of water entering them, but less than 4 in. diameter is seldom to be recommended. Five-in. tile are preferable in almost any case, as they are not so apt to be obstructed through inequalities in laying the tile, and they give a better circulation of air. Tile should have a minimum fall of three inches in one hundred feet, but one foot in one hundred is much more satisfactory. On level ground the tile may be laid below the bottom of the open drains. On slopes of hills where the covering over the tile will be washed out when laid beneath an open drain, the tile should be laid under the shoulders of the road. On hills, in addition to the tile laid longitudinally with the road, blind drains should be extended diagonally into the center of the road, to tap any springs or wet spots that may exist.

Roads when completely consolidated should have a minimum crown of 1 in. to the foot from the center of the road to the inside edges of the open drains. That is, from shoulder to center, a roadway 24 ft. between open drains, should have a crown of 12 in. This crown is for a fully consolidated road, not for new gravel or stone roads on which the metal is left without rolling. A new road of this kind or even when consolidated should be too high to commence with, otherwise it will soon get too flat. Every tendency to wear and the forces of nature is to flatten out the roadway. If not given an excessive crown at the commencement, it will be more difficult to maintain the road.

Roads should not have a greater width from shoulder to shoulder of drains than traffic requires, as every extra foot of width increases the difficulty of drainage. A width of 24 ft. from shoulder to shoulder of drains will serve almost all conditions of traffic. A width of 20 ft. or even 18 ft. will, in the majority of cases, be found cheaper to build, and much cheaper to maintain. While the extra cost of construction may not be an important factor, yet future maintenance and repair, to keep the road surface well drained and free from ruts, is most important in this regard.

Hill drainage by means of tile has been found to be one of the most successful ways of drying hills that are commonly wet and soft in the spring. In many cases it is the only practicable cure. By laying a tile drain along one or both sides of the hill, the ordinary drainage of the hill is cared for, and the blind drains extended into the heart of a spring or seepy spot, will prevent the annual breaking up of the roads in the spring.

Tile drains are useful not only on wet, clay soils, wet loam soils, but also in wet sand. Tile underdrains in a sand road cause it to dry up quickly in the spring, so that traffic does not cut so deeply into the dead sand. This sand, which remains hard and firm in the spring, does not become loose during the drought and hot seasons of summer, so that sand roads when under-drained, do not become so heavy in dry weather.

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*From the last annual report of W. A. McLean, Provincial Engineer of Highways, Province of Ontario, Canada.

Drainage is the essential principle in the construction of any road or kind or high class pavement. The chief thing is to get the water away from the road, and to prevent it entering the road, both from above, from the sides and from below. Every step in the construction of a road may be considered in the light of drainage. In this regard the rolling of roads with a steam roller is most important, as it at once compacts the surface covering, and makes it smooth, hard and water-proof. Loose gravel or sand on the road surface permits water to soak through it. The soil under the gravel or stone is then softened and settles under traffic. In this way the permanence of such a road is greatly reduced. A road which has been constructed and consolidated by means of a steam roller has over it a distinct crust of gravel or stone, clean and free from soil oozing up below.

To build a road successfully, it has to be constructed in long sections, otherwise drainage outlets are neglected or overlooked. Townships and all municipalities should drain their roads, and grade them in sufficiently long stretches to insure that they will be straight, of uniform width, and that the drainage will be thorough and complete.

Old gravel and stone roads are frequently destroyed in an effort to crown them, by grading the soft material from the shoulders and sides to the center of the road, covering the old gravel or stone bottom with sod, loam and clay. Grading machines are a very useful implement, but used in this way they have been the innocent cause, through their operators, of doing an immense amount of injury to the road. This sod and soft material should be turned away from the road, not drawn to the center. It should be thrown across the open ditches, should be used to level the sides of the roads; or in many cases the property owners along the road will be glad to haul it away for the purpose of making fills on their farms and farm yards. The grading of old stone roads in this way has been neglected throughout the Province. Money is being lost annually by failure to cut away the sides of these old roads in such a way that they have proper surface drainage. If, when the sides are cut away, the stone is still flat or rutted, the proper method of construction is to renew the stone surface by the addition of a new covering of gravel or stone. There are many details of road construction which require careful consideration, but they almost always revolve upon the necessity for complete drainage.

The Economics of Modern Highway Engineering.*

This discussion of the economics of modern highway engineering will be restricted to the consideration of the general situation relative to the economical use of the various methods employed in the construction and maintenance of roads and streets subjected to modern traffic.

One of the most important problems confronting every highway engineer to-day is the determination of the most economical and efficacious methods of construction and maintenance to be employed on the various roads and streets for which he is responsible.

The rapid increase in the rate of adoption of the motor vehicle, both passenger and commercial, has materially complicated the problem in many instances. Unfortunately some of the basic principles of economical highway design have been forgotten or at least neglected in the strenuous endeavor to abate the dust nuisance and construct a surface which would not be disintegrated by either horse drawn vehicle traffic or motor car traffic.

That the economical solution of the problems is rendered difficult by the lack of sufficient scientific data based on practical experience is self-evident. Nevertheless present practice is susceptible of marked improvement as there are to a certain extent limiting conditions governing the use of practically all of the various types of surface and pavements. By those conversant with the practice throughout the United States in the use of bituminous materials and the various dust palliatives in the construction and maintenance of roads and streets which have received attention because of the disintegration of the surface by motor car traffic or from the standpoint of dust prevention it will be readily admitted that the employment of the method and material economically adaptable to local conditions is the exception rather than the rule.

If the conception of any engineering problem is not based upon the fundamental principles of the science pertaining thereto and if all the multiple interdependent variable factors are not given due consideration its successful solution is practically an impossibility.

Before citing several instances of uneconomical and economical solutions it seems necessary, in order to avoid a misunderstanding of technical terms, to define two phrases which will be employed in this discussion. The term bituminous pavement will be used to designate a road having the upper course constructed by either the mixing or penetration method in which a bituminous binder is employed, while the phrase, bituminous surface will be used to imply a thin bituminous coating or film on the surface of a road or pavement. Superficial tarring, the application of tarred sand or tarred chips and the use of all kinds of asphaltic coatings will come under this designation.

As the first illustration will be cited, the case of the adoption of a bituminous pavement which would cost 40 cents per square yard over and above the cost of ordinary macadam for a street which could have been economically maintained if properly built of ordinary macadam and treated annually with a light application of either an asphaltic or a tar compound. The first application might cost from 4 to 6 cents per square yard while the annual application and repairs thereafter would amount to a yearly charge of from 3 to 4 cents per square yard. Until it is fully demonstrated that the type of bituminous pavement mentioned above has a life of more than ten years under the conditions noted and that the annual average maintenance charge will not be greater than 1 cent per square yard the advisability of selecting ordinary macadam with a bituminous coating is not debatable from the standpoint of economical maintenance. If, however, it had been possible to construct a bituminous pavement at an excess cost of 12 cents, as the writer was able to do as late as 1908 while Deputy Engineer of the Rhode Island State Board of Public Roads, it would have been self-evident that this type of construction would have been preferable from the standpoint of economics provided that the pavement had a life of five years which a recent examination indicates as a conservative estimate. Engineers interested in the economic relationship between a pavement and ordinary macadam will find on able treatment of the subject under the heading "Comparison du Pavage et de l'Empierrement au Point de Vue du Prix de Revient Annuel," by M. H. Heude, Inspector-General of the Department of Roads and Bridges of France. The above paper was published in the Annales des Ponts et Chaussees for 1908.

The indiscriminate advocacy of bituminous pavements for all classes of roads and for many classes of city streets which are subjected to motor car traffic is as unsound as the contention of some engineers that the periodical application of light oil to the surface of a macadam road is a satisfactory and economical prescription for the preservation of the surface and the alleviation of the dust nuisance irrespective of the location of the highway and the amount and character of the traffic to which it is subjected. Between the above limits are found many conflicting opinions which will not bear the searchlight of the investigator.

What are the reasons for the present situation in many localities in the United States? Why is not the practice of some of the leading municipal and county engineers of England duplicated in every state, county, and city throughout this country? The writer has in mind one county adjacent to London whose engineer, after considering the design of a given section of highway with the same care and deliberation which characterizes the work of American engineers when designing a mile of railroad or a bridge, is able to determine within reasonable limits whether it is economically advisable to use a wood block pavement, a bituminous pavement constructed by the mixing method, a bituminous pavement constructed by the penetration method, an ordinary macadam road with a bituminous surface or merely an ordinary macadam road. As a result all the various types of roads and pavements mentioned above are found on the main trunk lines in this county each used under conditions where it is economically adaptable in view of the present knowledge relative to limiting conditions. An investigation of current highway engineering practice throughout the United States will reveal the following characteristics, all of which are applicable to some localities while one or more are influential in shaping existing conditions in many instances:—

First:—Political interference in the selection of the men placed in control of highway work and with the work of design, construction and maintenance of roads and streets.

Second:—The interference by controlling bodies of laymen in the legitimate work of the highway engineer.

Third:—Division of responsibility in the supervision of highway work particularly in municipalities, but also applicable to some states as for instance, those in which the state department supervises the design and construction while the responsibility for maintenance is placed upon the county or town.

Fourth:—The comparatively small number of well-trained highway engineers who have devoted the requisite time and energy to the many new problems which have arisen during the last decade.

Fifth:—The comparatively infinitesimal amount of investigation which has been considered necessary as preliminary to the design of a road or street or a system of highways. This condition is due to a lack of appreciation of the relationship existing between the results of such investigation and the economics of construction and maintenance. Even when such relationship is recognized by the engineer, the controlling body rarely allows sufficient time or is willing to grant an adequate appropriation for a thorough study of the problem.

Sixth:—The general meagerness of detail knowledge of the many different materials on the market and the varied methods in connection with which they may be used. The engineer must not confine himself to a consideration of the crude and many times expensive methods which have been in vogue but must base his decision on the use of the most economical method of performing the work which naturally will include an investigation of all machinery adaptable to this class of construction work and of the practicability of designing new apparatus suitable to the case under consideration. It is likewise desirable that the engineer should have a wide acquaintance with methods and materials used in both the allaying of dust and the construction of bituminous pavements and surfaces which knowledge has been secured through other channels than by a perusal of the advertising literature with which the country is flooded. At the present time when the chemical and physical analysis of bituminous materials and the effect of the various properties on the adaptability of the material for use in the construction and maintenance of roads and streets is in its infancy it is not to be expected that the engineers will be able to draw up specifications for every case which will secure the most economical and efficacious material for the purpose and at the same time eliminate all undesirable materials but on the other hand in view of the progress which has been made during 1909 and 1910 the number of mistakes should be materially reduced.

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*Paper by Professor Arthur H. Blanchard, Consulting Highway Engineer, Brown University, Providence, R. I., presented at the 17th Annual Convention of the American Society of Municipal Improvements at Erie, Pa., Oct. 11-14, 1910.

Seventh:—A confusion of ideas on the part of many as to the reasons for the success or failure of various methods considered both from the standpoint of road preservation and dust prevention. For example, a bituminous pavement built by the mixing method with the most efficacious binder manufactured may disintegrate within a year after construction due to the neglect of but one item, for instance, that of preventing a layer of dust from accumulating on the surface of the bituminous coated road metal before the same is rolled. Failures of this type of pavement are usually laid to poor binding material while in reality there are a score of reasons for unsatisfactory work of this type. It is well-known that many kinds of bituminous pavements under certain conditions are very dusty due to self-evident reasons. If the traffic consist largely of horse-drawn vehicles and the adjoining streets are of ordinary macadam it is useless to expect a street protected from the action of the wind and bordered by trees and curbs to be free from dust without artificial cleaning or the application of some form of dust palliative. The dusty condition of many bituminous pavements and bituminous surfaces on our city streets has unfortunately led to conclusion that bituminous pavements and surfaces are not dustless under any conditions. To those who have motored over hundreds of miles of bituminous surfaced roads which were dustless the above opinion, so commonly expressed, appears absurd. One other illustration will be mentioned. In certain cases the periodical watering of macadam surfaces has proved efficacious both from the standpoint of laying the dust and as a road preservative. Based on the above results some engineers have advocated ordinary watering as a universal remedy for all classes of macadam roads and streets irrespective of the traffic to which they are subjected or a consideration of the economics of the public.

Eight:—Many authorities are seeking for a panacea for the treatment of all classes of roads and streets. It must, however, be constantly borne in mind that is impossible to economically treat all highways by the same prescription just as it would be considered to-day absurd to follow the former practice of some of the municipal engineers of the old European cities and pave all the streets with stone blocks.

Nine:—Non-observance of the relationship between the adaptability of various methods and the variability in the cost of labor and materials, and the accessibility of new bituminous materials and machines.

The self-evident desirability of a thorough discussion and an exhaustive study of the economics of modern highway engineering influenced the writer to prepare this brief presentation of the status of the administration, design, construction and maintenance of roads and streets subjected to modern traffic.

WATER-WORKS AND SEWERS SECTION

Labor Cost of Laying 16 Miles of 20-Inch Cast Iron Water Main at Cheyenne, Wyo.

BY M. V. MOULTON*

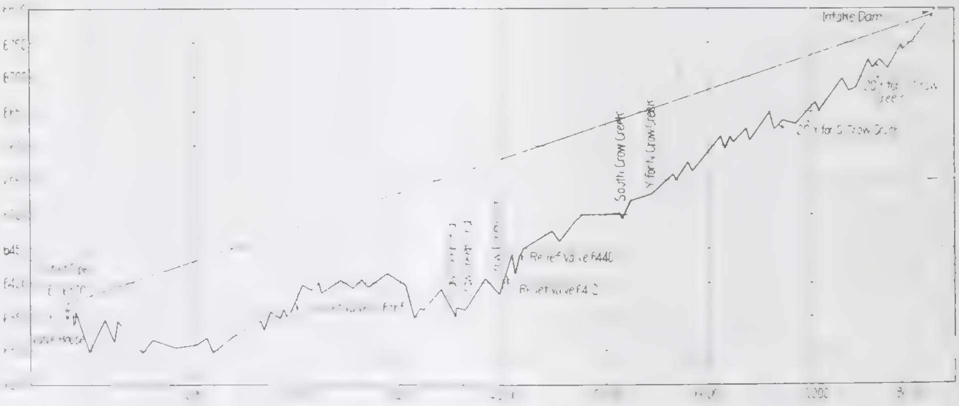
On June 15, 1909, bids for the construction of water supply mains, for the city of Cheyenne, were opened by the city clerk; the Bash & Gray Contracting Co. of Joplin, Mo., being the lowest bidder on the 20-in. supply main, was awarded the contract for said supply main at 39 cts. per lin. ft. This price per linear foot included trenching, laying, calking, testing, backfilling and everything necessary for the completion of the job. All materials were furnished by the city of Cheyenne, and all labor, tools, testing equipment, etc., were furnished by the contracting company.

This 20-in. pipe line was constructed from the diversion dam, to the Round Top distributing reservoir, a distance of 15.78 miles. The line was designed for an open flow at the distributing reservoir, and under these conditions the maximum regular working pressure does not exceed 88 lbs. per sq. in., making a light weight pipe eligible therefor. Class A pipe, manufactured under the New England Water Works Association specifications, was selected and used for the entire 20-in. line, the regular weight of a 20-in. Class A pipe being 1,610 lbs. subject to 4 per cent variation. The above maximum working pressure does not include any water hammer that the pipe may at times be subjected to, but a hydrostatic test of 150 lbs. per sq. in. having been made both at the factory and in the field, gives a factor of safety of 62 lbs. per sq. in., which was deemed sufficient to take care of any water-hammer that might occur.

Messrs. Bash & Gray started actual construction on Aug. 25, 1909. The work was begun near the intake, the 20-in. valve being set while the diversion dam was under construction. At about 120 ft. from the intake a small quantity of solid (granite) rock was encountered. From Round Top to a point 3½ miles west occasional pockets of a cemented sandstone formation were encountered. Extra allowance for this rock excavation was made to Bash & Gray by the Water and Sewerage Committee.

The first 13,000 ft. of trenching was done by a No. 0 Municipal Trenching Machine; this machine was driven by a four cylinder gasoline engine and was capable of digging a trench 28 ins. wide and 7 ft. deep. Much loose rock was encountered in this 13,000 ft. resulting in frequent break-downs. On Oct. 27 a No. 1 steam driven municipal machine was brought onto the work to increase the rate of trenching, which had proved to be the controlling factor in the progress of the work. This machine was capable of digging a trench 28 ins. wide and 10 ft. deep. The cost data show the average rate of these two machines and will also be a fair index to the nature of the trench excavation. On some of the sharp hills, cuts from 10 to 15 ft. were necessary, the average cut for the entire line was 5.25 ft.

This machine-dug trench had to be widened and deepened at the bell points to allow free access for yarning and calking, considerable hand grading and straightening of the trench had to be done also before the pipe could be properly laid. All this was hand work and is included in cost data under hand grading and bell holes.



Profile of 16-Mile Pipe Line at Cheyenne, Wyo.

The pipes were lowered and entered by means of a derrick, formed by two A-shaped forms connected by a beam, each end equipped with a rope windlass and two single blocks; one man at each windlass lowered a pipe and the pipe last laid was driven home with the pipe that was still swinging from the derrick. This derrick was pulled ahead by a pony. From 15 to 20 pipes an hour could thus be placed by a gang of 7 men, though the average daily progress did not equal this rate.

After the pipes were properly graded and lined, the joints were spaced and yarned so as to give a leading of uniform thickness and of 1¾ ins. depth. Ordinarily two ropes of jute packing containing 3 and 4 strands respectively were sufficient, though the variation in bells required a corresponding variation in the amount of jute.

In pouring the joints care was taken to have the lead sufficiently hot to insure a good joint at one continuous pouring, the heavy melting pot was kept within a distance not to exceed 50 ft., the lead was carried and poured from an ordinary cast iron tea kettle. The average lead per joint for the entire line was 31.65 lbs.

The calking was done with a pneumatic hammer, a small gasoline compressor, maintaining a pressure of not less than 65 lbs. per sq. in., supplied the hammer. This compressor was mounted on an ordinary wagon truck.

The pipe was tested in sections of variable length. The maximum pressure being 150 lbs. per sq. in., this pressure was supplied both by a pump and gravity, until the latter became sufficient in itself, then the tests were wholly gravity tests. Under this method a given section of pipe might be subjected to several successive pressures, but each succeeding gravity test would give a lower pressure on the given section, consequently not endangering a previously tested section. A total of 7 pipes were broken by testing, in some cases cracked pipes which had escaped inspection had been laid and in other cases faulty pipes a ccounted for the above breakage. A total of 8 pipes were broken by a freeze-up which resulted from the negligence of the contractor to drain the pipe line after a test had been made. In addition to the above breakage a total of 262 lin. ft. was cut off of a total of 176 pipes. This was the combined breakage by railway transportation and by hauling along the line.

Twenty-four Ts for air valves were placed in the line at the high points where air pockets are likely to accumulate. [illegible] blow-off specials were placed at the [illegible] depressions where sediment may accumulate. Three Ys for relief valves were placed at the approach of long pockets of standing water (see profile) where water-hammer might occur on refilling the pipe. Two of these have been equipped with the relief valves, the third was plugged Twenty-seven sleeves were used in the entire line. One 20-Y was placed for the proposed North Crow Creek connection and two Ys for the proposed South Crow Creek connection, the location of the South Crow line not having been definitely decided upon a Y was placed at each of two surveyed lines.

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*Assistant City Engineer, Cheyenne, Wyo.

Considerable difficulty was encountered in the excavation of the first 2½ miles on the upper end of the line. Large loose boulders were in some places so numerous that hand trenching had to be resorted to. Ground water was encountered in the meadows below the intake.

The crossing under South Crow Creek was accomplished by digging a drainage ditch, which allowed the pipe to be laid almost to the creek, the stream was then diverted around and across the pipe, already laid, and the laying was continued under the old stream bed. No pump was used at this crossing, the seapage water was handled with buckets.

Considerably more difficult were the three crossings of Crow Creek, near Silver Crown. An attempt to cross the first crossing during the first part of January had to be abandoned because of the difficulty of confining the water to definite channels, during such extreme cold weather.

On March 15 work was resumed and the three crossings then completed within a period of 18 days. A 4-in. centrifugal pump handled the seapage. This pump was driven by a single cylinder gasoline engine equipped with friction clutch gear. The sumps for the pump were at the lowest grade points of the respective crossing and the pipe was laid up to the sumps and then the creek was diverted to flow across the pipe which had been calked.

Quicksand was encountered in the first and third of these crossings. The trench through the creek beds was made wide, giving the bank a slope that would prevent caving. This was excavated with teams and slip scrapers, except where quicksand did not permit the use of teams.

The accompanying profile shows the nature of the country and the amount of vertical curvature in the line. In some cases 1/64 and 1/32 bends were used where abrupt changes in either grade or alignment occurred, but in most cases the horizontal and vertical curvatures were taken up by deflecting each pipe a small amount. A 7° curve was the sharpest used. The total length of the line as chained on top of the pipe is 83,328.5 lin. ft. The fall from intake to outlet is 417 ft. The last test was completed May 15, and the backfilling, which was done with the straight drag scrapers, was completed June 9, 1910.

The costs of the work are summarized in the following tabulations:

ITEMIZED LABOR COST OF LAYING 83,328½ FT. OF 20-IN. CAST IRON WATER MAIN

Item.	Total.	Per lin. ft. Cts.
192¼ dys. No. 0 excavator at $10	$ 1,922.50	*5.24
146 dys. No. 1 excavator at $16	2,336.00	†5.84
2910 dys. E. & C. bell holes at $2.50	7,275.00	8.73
949.8 dys. laying pipe at $2.50	2,374.50	2.84
199 dys. yarning at $3.50	696.50	0.79
190 dys. lead heating at $2.75	522.50	0.68
174½ dys. pouring at $2.75	479.87	0.58
219 dys. caulking at $3.50	766.50	0.92
237½ dys. helper at $2.50	593.75	0.71
116 dys. testing at $3	348.00	0.42
304½ dys. refilling at $7.50	2,284.00	2.74
453 dys. foreman at $4	1,812.00	2.18
410 dys. teams and teamsters at $5	2,005.00	2.40
147 dys. blacksmith, at $4	588.00	0.70
Pumpmen	119.00	‡99.2
Total	$24,123.12	

*Figured on 36,700 lin. ft. †Figured on 39,600 lin. ft. ‡Figured on 1,200 lin. ft.

EXTRA WORK IN LAYING 83,328½ FT. OF 20-IN. CAST IRON WATER MAIN.

Item.	Total
Rock excavation near intake	$[illegible]
Rock excavation west of Round Top	[illegible]
Cutting off 176 pipe	[illegible]
Extra fill near intake	162.30
Extra depth of trench	[illegible]
Diverting creek	[illegible]
Replacing broken pipe	330.00
Hauling pipe	131.43
Total	$2,357.32

Adding these two totals gives $24,123.12 + 2,357.32 = $26,480.44, which divided by 83,228.5 lin. ft. gives a cost of 31.8 cts. per lin. ft. The contract price was 39 cts. per lin. ft.

The wages paid did not always correspond to the scale adopted therein, but in most cases the average wages paid will be about the same as those given. An exception is the cost of teams for backfilling, the actual cost of teams for refilling during May and June being $9.50 for a team and two men. Final estimate, including all previous estimates and extras allowed Messrs. Bash and Gray, was $35,246.62, making the actual cost to the City of Cheyenne a little more than $.42 per lin. ft. The average weight of the 20-in. pipe was 1,631 lbs., and the cost of the pipe delivered on the line, including hauling, transportation and cost of material, was $29.70 per ton, or $2.02 per lin. ft., making the total cost of the line when completed $2.44 per lin. ft.

Diffusion and Digestion of Sewage in New York Harbor.

One of the chief tasks of the Metropolitan Sewerage Commission of New York* was to determine the capacity of the harbor waters for assimilating sewage. For this purpose extensive analytical studies were undertaken to show the conditions of assimilation under various circumstances. The studies made included over 5,000 analyses of water or solid deposits. Samples from all parts of the harbor were examined chemically, bacteriologically and microscopically. All stages of tide and all seasons of the year are represented in the results. Based on these studies the Commission presents in its report an extended discussion under the title given above. We reprint this discussion here.

Freedom from evil consequences attending the discharge of sewage and other wastes into New York harbor depends upon the bodily transportation of the refuse matters from the harbor to sea by means of tidal currents and the assimilation of the remainder by the water itself. It has been found that, owing to a backward and forward oscillation of the tidal currents the sewage is not carried promptly to sea, and it is evident that the ultimate disposal of the impurities must depend largely upon the phenomenon of assimilation.

COMPOSITION OF THE POLLUTING WASTES

The term sewage is used in this chapter to mean the wastes which flow from dwelling houses, factories and streets through the municipal drainage systems of New York and neighboring municipalities. In a general way, sewage may be considered to contain about 998 parts of water and two parts of foreign matter; the last being about equally divided between animal and vegetable refuse. Sewage contains, beside human feces, numberless solid and liquid wastes of human and animal origin. Among the visible ingredients are garbage, matches, corks, bits of paper and cloth, and particles of human excrement.

Quantity of Fecal Matter Produced.—The quantity of solid excrement produced by an average human adult has been taken by Roechling ("Passage of Excreta Through House Drains," *Journal of the Royal Sanitary Institute*, July, 1909, p. 216) to be ¼ lb. for each discharge. The specific gravity of feces this author takes at 1.067, and from this he estimates that the [illegible] of a human discharge is about 0.0234 imperial gallons. This is diluted with from 100 gals. to 200 gals. of water. Estimating the present population of New York at 4,500,000 people there is discharged every day about 560 tons of fecal matter. To transport this material away by rail would require a trainload of about 28 ordinary freight cars.

Sewage is never constant in quality or quantity. The sewage from a residence section differs from that from a manufacturing district. The sewage produced in any locality varies both in quality and quantity at different hours of the day, different seasons of the year and with the weather. Being of such changing composition it is obviously impossible to give figures which will carry an exact idea of the chemical or physical properties of the sewage of New York and its neighboring municipalities. A sufficient knowledge of the composition of the sewage can be had from figures which have been compiled for other cities.

Composition of Sewage. — Winslow & Phelps[1] consider that 800 parts per million of total solids is a liberal figure for American cities and is exceeded by few. These authors state that, of the total solids, it may be said roughly that from 60 per cent to 70 per cent are in solution either liquid or colloidal, the remainder being insoluble matter in suspension. As to the nature of the solids, about one-half is matter which can be driven off by ignition in the laboratory, and is consequently assumed to be chiefly organic matter. The remaining non-volatile residue is mineral matter.

About 50 per cent of the organic solid matter in sewage is dissolved and the remainder is held in suspension. Of the mineral solids in sewage 75 per cent are present in a dissolved state. In a sewage containing total solids to the extent of about 800 parts per million, Winslow & Phelps estimate that 500 parts per million of solids are in solution and 300 parts are in suspension. Of the organic solids, amounting to 400 parts per million, 200 parts are in solution and 200 parts in suspension. Of the organic matters present, either in solid or liquid state, 150 parts per million are nitrogenous and 250 parts are not nitrogenous. The total carbon amounts to 200 parts, the total nitrogen to 15 parts, and the fats, etc., to 50 parts per million. This sewage is supposed to represent the liquid wastes of a population which uses an average of 100 gals. of water per capita per 24 hours.

Composition of New York Sewage.—The composition of New York's sewage is shown by Table I which has been made up by assuming New York's water consumption at 120 gals. per capita per day and prorating on this basis the various figures given by Winslow and Phelps above mentioned.

TABLE I.—COMPOSITION OF NEW YORK SEWAGE.

(Parts per Million.)

Determination.	Total.	In solution.	In suspension.
Residue on evaporation	670	420	250
Mineral and ash	330	250	80
Organic and volatile	340	170	170
Nitrogenous	120		
Non-nitrogenous	210		
Fats, etc.	42		
Total carbon	[illegible]		
Total nitrogen	[illegible]		

Weight and Bulk of Sewage Solids.—It is not necessary that the composition of the sewage which is discharged into New York harbor should be accurately known in order to form a conception of the burden of pollution which is put upon these waters. The aggregate quantity of the impurities constitutes the chief matter of interest.

The quantity of sewage impurities can be estimated in several ways. According to figures brought together by George W. Fuller, before the International Engineering Congress held at St. Louis, 1905, Trans. Am. Soc. C. E., Vol. LIX, p. 160, the average result of analyses of the sewage of ten cities for which figures are available indicates that the impurities are equivalent to 42.3 tons of dry solid material per year for every 1,000 inhabitants. Winslow and Phelps's figures prorated for New York conditions of 120 gals. per capita per day and reduced to Mr. Fuller's basis represent 46 tons of dry solid material per year per 1,000 inhabitants.

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*This commission was created to study the conditions of sewerage and sewage disposal in the metropolitan district of New York and to formulate a general plan or policy for protecting and improving the sanitary conditions of New York Harbor. The commissioners were: Geo. A. Soper, Jas. H. Fuerlis, H. DeB. Parsons, Charles Sooysmith and Linsly R. Williams.

[1] "Investigations of the Purification of Boston Sewage," United States Geological Survey Water Supply and Irrigation Paper No. 185, p. 13.

The 1905 population in the metropolitan district was found by census to be 4,128,396 for New York and 1,203,387 for New Jersey. According to the estimates of this Commission the total number in 1910 is 6,150,000. Assuming 90 per cent of the population is connected with the sewers, the total number of persons whose sewage enters the harbor or its tributaries is 5,540,000. The aggregate quantity of sewage material discharged per year is equivalent to 255,000 tons. About one-half of this is capable of putrefaction or already advanced to some extent toward that condition.

One ton of dry suspended matter is equivalent to about 50 tons or about 55 cu. yds. of wet sludge. On this basis the population of the metropolitan district empties into the harbor each year the equivalent of 12,800,000 tons of sludge, having a bulk of 14,000,000 cu. yds. The area of the various tidal waters in the vicinity of New York above the Narrows is about 50 square miles. The sludge formed each year if spread out over this area would cause a deposit of about 3½ ins.

The suspended matters in sewage consist of bits of feces, toilet paper, newspaper, coagulated soap, street wastes, kitchen refuse, floor sweepings, etc. Feces, as ordinarily discharged contain about 35 grams, or .077 pound, per person per day of matter which will remain suspended in sewage. This amounts to 14 tons per 1,000 persons per year. Toilet and newspaper entering the sewers may be estimated at 8 tons per 1,000 inhabitants per year. Each person may be assumed to use .01 pound of soap per day and in doing so to remove at least four times this amount of suspended matter with grease and other material. On this basis about 11 tons of suspended matter are produced per 1,000 persons per year and emptied into the sewers. The street wastes which enter the sewers, consist of organic and inorganic dirt derived largely from feces and urine and an almost infinite number of comminuted solid matters. Table II shows the amounts of these matters which mav be estimated to enter the waters of New York harbor through the sewers.

TABLE II.—ESTIMATES OF THE QUANTITIES OF STREET WASTES WHICH ENTER NEW YORK HARBOR ANNUALLY FROM THE METROPOLITAN DISTRICT.

Material.	Tons.
Inorganic street dirt	18,300
Organic street dirt	26,200
Total	44,500

Prorating the above amount of street dirt among the 5,540,000 inhabitants in the metropolitan district assumed to be connected with the sewers, there are obtained 8.3 tons per 1,000 persons annually. Table III summarizes these figures.

TABLE III SUSPENDED SOLIDS IN SEWAGE.

Material.	Tons per 1,000 inhabitants annually.	Tons entering New York Harbor annually
Feces	14	77,600
Toilet paper and newspaper	8	44,300
Soap and washings	11	60,900
Street wastes	8	44,300
Miscellaneous	4	22,200
Total	45	249,300

Appearance of Sewage. When a sample of sewage is taken from a New York sewer and put into a clear bottle, the sewage has a dirty gray color, with an unpleasant, rather musty odor. It contains small pieces of newspaper and toilet paper and finer particles of suspended matter ranging in size much as do the grains of ordinary building sand. Most of the particles will pass through a screen having a mesh of ⅛ in., the largest particles at the surface being excluded. The small solid particles are composed of fecal matter and paper broken up by friction within the walls of the sewers and small pieces of fibre, cloth, a few glumes and mineral detritus.

Upon standing, many of the particles settle out, causing a dirty, grayish, slimy sludge to accumulate upon the bottom of the bottle. After all the particles have settled out, the liquid which remains in the bottle looks like water which has been used for washing where a good deal of soap has been employed. If allowed to stand for a few hours at ordinary summer temperature, the sewage becomes putrid.

If greatly diluted or put upon a sufficient area of land sewage does not putrify nor give off offensive odors. In either case the decomposable organic substances are gradually converted into harmless and inoffensive compounds. The offensive odors of putrefaction are produced only when the natural purifying agencies are overtaxed. All methods of purifying sewage aim to resolve the substances which are capable of putrefaction into such shape that they may be dealt with separately, under conditions which are within control.

It is popularly supposed that the presence of human excrement forms a prominent ingredient of sewage, but this is not the case. It is a subject of frequent remark among visitors to sewage disposal works that comparatively little human excrement is visible. The reason for this is that particles of solid excrement large enough to be easily distinguished are broken up in passing through the plumbing of the houses and the sewers and diluted to such an extent that they are no longer recognizable.

The Bacteria in Sewage.—Sewage contains large numbers of bacteria. One of the principal sources of these germs is the excreta of human origin which the sewage contains. Saphrophytic germs, that is, micro-organisms concerned in the decomposition of organic wastes, are also very numerous. The number found in one cubic centimeter of sewage averages from a few hundred thousand to many millions.

As pointed out by Friedenwald & Leitz[1], the germs contained in the human intestine are of comparatively few species. Strasburger[2] found that the total numbers of bacteria produced by a normal person on an average diet was one thousand million per day. One-third of the dry substance of feces is bacteria. On this basis the number of bacteria produced each day by the inhabitants of the metropolitan district would be about six thousand million million.

The Solids of Sewage.

The solid matters which are carried by the sewage may be divided into three classes: First, the solids which sink soon after the sewage is discharged into the harbor; second, those which continue to float for some time on the surface of the water; and, third, those which are long carried in suspension in the body of the tidal streams.

It is evident that particles do not always remain in one or another of these divisions. Many which at first float gradually become broken up or watersoaked and sink beneath the surface of the water, and thus pass from the second to the first division or to the third.

In the third class are the colloids and finely divided particles of suspended matters. The colloids may be precipitated by sea water. When allowed to settle from sewage the precipitated colloids and solid matters form sludge or, as usually termed in the investigations of the Metropolitan Sewerage Commission, black mud.

Accumulations of sewage deposits are exceedingly difficult to handle except by pumping. When raised in the bucket of a dredging machine much of it flows back into the water from which it was taken. The United States Government in dredging Ambrose channel, now the principal entrance to New York harbor from the sea, made use of suction dredges and pumped large quantities of sludge which had accumulated there, into seagoing vessels which transported the black and often offensive mud to the open ocean.

THE SOLIDS WHICH SINK.

The sewage particles which sink as soon as the sewage is discharged into the harbor water find a lodgment on the bottom which is permanent or temporary according to a number of circumstances. Among these circumstances the weight of the particles, the velocity of the tidal current into which they are discharged and the smoothness or roughness of the bottom are the most important factors.

Extent of Bottom Pollution. — Analyses which the Metropolitan Commission has made of New York harbor have shown that deposits of sewage solids exist not only in the immediate neighborhood of sewer outfalls but at considerable distances from the sources of contamination in New York harbor. The bottom of the inner harbor is, for the most part, covered with a slimy, black, offensive mixture of detritus in which sewage solids are a prominent ingredient.

The only parts of the harbor which are not contaminated by sewage sludge are those where the tidal currents are too swift to permit deposits of any sort to form. Most of the bottom of the Lower bay, the upper Hudson and the Long Island Sound approaches to New York are covered with sand, silt and unpolluted mud; the investigations upon which these statements are made have been extensive. Over 1,500 samples have been collected from the bottom and carefully analyzed to determine the extent of the pollution of the harbor bottom by sewage. The bottom has been penetrated to a depth of 10 ft. and samples have been collected which showed that sewage solids had been deposited to at least that depth. It is not too much to say that wherever tidal conditions permit sediment of any kind to accumulate pollution with solid sewage particles takes place.

In some places extensive banks of black sludge containing sewage refuse occur. So far as known these banks have not yet seriously impaired the use of the main harbor channels for navigation, although it seems probable that if a careful estimate of the nature and quantities of material dredged every year could be made it would show that an appreciable amount of expense is chargeable to sewage sludge.

The dredging which is done to keep open the slips, ships' basins, canals and creeks in the metropolitan district is partly attributable to sewage deposits. The cost of removing this material is large. About 350,000 cu. yds. are yearly dredged from the water of Manhattan Island by the Dock Department of The City of New York alone. A part of the material removed from the Ambrose channel in the Lower bay during the construction of that entrance from the sea consisted of sewage sludge. Considerable doubt existed at one time concerning the origin of this material, but investigation has led to the opinion that the material was of sewage origin and that it was carried to its place of deposit by the waters from the Upper bay.

Power of a Current to Move Sewage Particles.—A slight current has sufficient force to move the light sewage particles which settle upon the bottom. This is well illustrated by the fact that deposits do not take place in the main tidal channels of the large rivers nor upon a large part of the flats in Upper New York bay although suspended matters are undoubtedly present in the water. The currents over the flats attain a velocity of about 1 ft. per second at ordinary tides and this apparently is sufficient to keep them free of sewage debris.

As is well known, the capacity of water to move solid matter from a condition of rest on the bottom of a stream varies with the sixth power of the velocity of the stream. If the velocity is doubled the increase in the force which is capable of moving a particle from a condition of rest on the bottom is multiplied 64 times. This power of a stream to move or roll solid matters along the bottom accounts, in part, for the formation of sand bars at the mouths of rivers, as well as for the movement of gravel and other heavy solids along the beds of streams. The solid material carried by sewage which accumulates near the mouths of sewers and forms sludge banks where the currents are weak is continually being moved from place to place by stronger currents sufficient to set in motion solid sewage particles. It is equally clear that the currents are capable of keeping in motion many of the particles which are so moved.

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[1] "Bacterial Content of Feces," American Journal of the Medical Sciences, November, 1909, p. [illegible]

[2] Zeit. f. Klin. Med., 1902, Band XLIV, S. 413.

Disintegrating Effect of Water on Sewage Solids.—In addition to the mechanical effect of currents other forces are at work which prevent the accumulation of larger deposits than now take place in the immediate vicinity of sewer outfalls. Among the substances which subside are masses of solid, organic particles which are broken up by the mere lubricating or dissolving power of the water. A slight movement is sufficient when applied at the right place and moment to separate the loosely bound aggregates of sewage solids into their constituent parts.

Hydrolysis of Sewage Solids.—Once solid matters have accumulated upon the bottom to a depth of a few inches, changes in their constitution take place through the action of bacteria. The essential action here is the breaking down of solids to form liquids. This action proceeds rapidly beneath the surface of the bottom. It takes place chiefly in the absence of oxygen. It is due in part to bacterial activity and in part to the action of enzymes.

The liquefaction of solids in the absence of oxygen is a phenomenon of putrefaction and is attended by the production of offensive-smelling gases. The gases take the shape of bubbles and rise to the surface. In so doing the bubbles break open the accumulations of solid matter and carry black masses of deposits to the surface. Bubbling is a constant phenomenon between the slips of Manhattan Island. So active is it in places that the water sometimes takes on the appearance of effervescence, with a sound like rain falling upon the water.

Actively assisting in the mechanical disintegration of sewage sludge at the bottom of the harbor are a multitude of minute animals and plants including the infusoria. These propagate in vast numbers in the sludge and by their activities tear apart and render still more minute particles of solid matter which contain enough organic material to serve them as food. Some of these organisms require a considerable supply of oxygen and live at the surface of the deposits while others are able to exist with a very small supply of it and do their work beneath the usrface.

Odors from Deposits.—The odors caused by the putrefaction of deposits upon the bottom of New York harbor are the most intense and offensive of any odors produced by the discharge of sewage into the harbor. These odors are capable of imparting a peculiar offensiveness to the water. Offensive, also, and more prevalent, is a peculiar, greasy, nauseating odor. This greasy odor is noticeable along the whole shore line of the inner harbor, particularly near beaches.

The odor of fresh sewage is generally musty and not unlike that sometimes noted in damp cellars and other enclosed places which are in need of proper ventilation. This musty odor is doubtless produced by molds, enormous growths of which have been found by the Metropolitan Sewerage Commission in some of the sewers of Manhattan. Sewage air is usually warm and saturated with moisture, for which reason the odors present are especially apparent. The odor of sewage should be familiar to the people of New York for the sewers are ventilated through manholes and catch basins in the streets and some of these streets are daily crowded from curb to curb with people. Many large buildings discharge spent steam into the sewers with the result that clouds of vapor possessing the nauseating odor of cooking sewage are discharged into the streets.

Where for any reason the sewage is not promptly discharged from the sewers but stands either in contact with harbor waters, as in the case of tide-locked outfalls, or because the sewers have not proper grades to cause the sewage matters to run out promptly, pronounced and offensive odors of putrefaction are often given off. If a sewer is of moderate length, as are most of those in the metropolitan district of New York, and of proper grade, the sewage does not become putrid in the sewer for it is discharged too soon after it is produced to enable the fermentative changes involved in putrefaction to advance far. Substances exist in the sewage which are capable of putrefaction and are actually offensive, but the offensive properties of these substances are not transmitted to the whole mass of sewage unless the latter becomes stagnant. In fact they are diluted and rendered less obnoxious for the time being. It is after the sewage solids have been deposited upon the harbor bottom and decomposition has set in that the putrefactive changes become most pronounced and the most offensive odors are given off. The quiet arms of the harbor, such as the creeks and spaces between the long piers, most of which are veritable sewage traps, are the principal places where offensive odors are produced

THE SOLIDS WHICH FLOAT.

Referring now to the second class of solid sewage particles, we will consider the matters which float upon the surface. These impurities are objectionable because they add to the total organic content of the water and on account of their appearance. During calm weather fields of grease, floating sewage matters and wood may be seen in New York harbor. These fields are often many acres in extent and sometimes a mile or more long. They preserve their integrity with remarkable persistence and are not easily broken up by ordinary winds or waves or the movements of passing vessels. There is usually little difficulty in detecting solid human excrement in these floating masses.

Composition of the Floating Matters.—The floating particles of sewage are not necessarily composed solely of matters which are lighter than water. Sewage solids are often made up of aggregates, most of whose ingredients are heavier than water but which contain enough gas to keep them at the surface.

There is a more or less constant deposit of solid matter from sewage particles at the surface, some of the disintegrating particles joining the mass of material which flows in the body of the current and some descending to the bottom. The ceaseless mechanical action of the waves, the attrition which the floating particles experience in contact with other floating solids, the impact of the water against piers and other obstructions and the destructive effects produced by vessels, all help to disintegrate the solids and resolve them into smaller masses. The effect of these forces is plainly discernible in New York harbor. While large pieces of excrement are nearly everywhere observable, by far the greatest number of solid matters are of comparatively small size.

Although solid matters are broken up into smaller particles by mechanical action, actual liquefaction of solid matters does not take place so much at the surface, as at the bottom of the water. Fermentative action occurs only in the deposits which settle at the bottom and in water whose oxygen is entirely exhausted.

The water within a few feet of the surface is usually more heavily charged with bacteria and offensive matter than the water at greater depths. This, apparently, is due to the fact that polluting matter enters near the surface and to some extent remains there.

Appearance of the Discharging Sewage. Where a sewer discharges into the harbor a marked discoloration of the water usually occurs. The water contains a great number of visible particles of paper, feces, and other solid matters. The size of these particles varies from scarcely distinguishable objects up to solid masses six inches or more in length and several inches in diameter. The water, which is generally of an olive, slightly turbid appearance, becomes a brownish gray and decidedly turbid. The surface which is discolored is sharply separated from the surrounding water. As the current of harbor water carries the sewage away from the outfall, this discolored area expands. To all appearances it keeps its integrity well but it eventually loses its characteristically turbid hue by intermixture with the water beneath.

Some mixture between the sewage and harbor water takes place from the outside edges of the discolored area, but diffusion proceeds chiefly, apparently, from the bottom of the mass of sewage. The surface of the discolored area is covered with a film of grease. This greasy film is persistent; it lasts much longer than the discolored area with which it is at first associated. Eventually the grease becomes broken up by the waves and eddies, but it remains upon the surface in detached films varying from a few square inches to many acres in extent.

Beneath the surface of the water long after the brownish turbidity has disappeared are small particles of paper and great numbers of minute white flakes. These flakes consist largely of insoluble soaps which have been produced by the chemical combination of soluble soaps from the sewage with the calcium and magnesium salts of the sea water.

Transporting Power of the Currents.—Sewage particles which float upon the surface are carried from point to point by the tidal currents and by the action of wind. The currents cause a dispersion of the floating solids to a certain extent, but it is remarkable how long a mass of sewage matters may remain intact upon the surface. The solids may be carried several miles without losing their characteristics. Some remains of fruits and vegetables, as well as matches, cigar ends, and other large light solid matters from the sewage float on the surface indefinitely.

Large quantities of driftwood come to the shores, carried there apparently by the action of the tidal currents and by the wind. Much driftwood is collected by poor persons and used for fuel. There are places on the shores of New York harbor where this supply of fuel is practically inexhaustible.

On the south shore of Staten Island and on the west end of Coney Island the driftwood is collected into piles and burned at the water's edge in order to get rid of it. There is often a peculiarly disagreeable greasy odor to these accumulations.

Effect of Winds.—The wind, which exercises an important influence upon the rise and fall of tide in New York harbor, has a decided effect upon the movement of floating objects. A strong westerly wind causes floating matters to flow to and along the easterly shores, and conversely, when the wind blows from the east a concentration of floating sewage matters is cast upon the western shores of the harbor. A moment's reflection will show that the solid matters which are cast ashore or brought near it by the wind are likely to remain there owing to the fact that they become sheltered from all winds except those which are capable of forcing the floating matters nearer to the land. The effect of wind upon floating objects is twofold:

First, The wind exercises a direct propelling effect upon objects which lie in part above the surrounding water, as a ship is moved under sail; second, the wind causes a general movement of the whole surface of the water, which, in turn, carries floating solid matters along with it. This second effect is as pronounced as the first.

Movement of Solid Particles Toward the Shore.—It has frequently been noted in the studies of the movement of floats set adrift by the Metropolitan Commission that floating solid matters sometimes go ashore. The cause of this shoreward movement was at first thought to be due to wind. This was found to be an insufficient explanation to account for all the strandings and it was then for a time believed to be caused by the movements of vessels. Vessels, it will be noted, cause a movement of water toward shore both when they approach and when they leave a dock.

ple and the central feature of the second stage is the oxidation of the ammoniacal nitrogen to nitrous and nitric acids.

Since the self-purification of sewage polluted harbor water is so largely a matter of oxidation it is desirable to consider the extent to which the dissolved oxygen can be exhausted without serious consequences. This inquiry involves a consideration of the rate at which the oxygen is replenished from the atmosphere, for it is evident that after reducing the amout of dissolved oxygen to a certain point the rate of draft must not exceed the rate of replenishment.

Normal Quantity of Oxygen in Harbor Water.—The amount of dissolved oxygen present in the water of a tidal harbor consisting of half sea water and half land water is 6.20 cubic centimeters per liter at 18° C. According to Letts and Adeney, the oxygen can be reduced to 3.45 cubic centimeters per litre, temporarily, at least, without danger of killing fish. Below this point it is unwise to exhaust the oxygen, due reference being had not only to the importance of fishing interests but also to the necessity of maintaining a wide margin of safety against the exhaustion of oxygen and the consequent production of putrefactive odors.

The rate of absorption of oxygen from the atmospheric air varies, according to Letts and Adeney, between 0.08 c. c. per liter per hour for sea water and 0.03 c. c. per liter per hour for land water at ordinary summer temperatures, and may be taken as 0.055 c. c. per hour for water such as that in the harbor of New York when the latter contains equal parts of sea water and land water.

The experimental conditions under which the above data are founded were obtained in breaking the surface of the waters either by a discharge of air three inches below the surface or by a mechanical stirrer. The waters of New York harbor are not ordinarily so much broken by the wind action. Assuming, however, that these favorable conditions do obtain it appears that an admixture of sewage which would not cause a greater draft upon the oxygen than 0.55 c. c. per liter per hour would not cause exhaustion and lead to putrefactive changes.

Theoretically Permissible Draft Upon the Oxygen.—As a practical result of their studies, Letts and Adeney concluded that the dissolved oxygen in harbor waters is generally not in danger of being completely absorbed in forty-eight hours if the waters are mixed with sewage in proportion not greater than five per cent, provided that the solid matters have been separated by simple subsidence and the sewage does not contain appreciable quantities of directly oxidizable substances. This opinion is in accord with American experience where sewage has been discharged into rivers.

The studies made in America have shown that to avoid exhaustion of oxygen the dilution must be in the proportion of, at least, 20 to 25 parts of water to one part of ordinary sewage, although there may be conditions where nuisance may arise where the dilution amounts to nearly 50 parts of water to one part of sewage.

Whether sea water will absorb more sewage than land water without producing a nuisance has not yet been definitely determined in a practical way, although it seems certain that land water, gallon for gallon, is capable of disposing in a normal manner of more sewage than will sea water. It is worth bearing in mind in this connection that sea water, when saturated with oxygen, contains nearly 20 per cent less oxygen than land water under the same conditions.

Amount of Oxygen in the Water of New York Harbor.—The investigations of the Metropolitan Sewerage Commission of New York have shown that a substantial reduction in the normal amount of dissolved oxygen exists in the waters of New York harbor. As might be expected the draft upon the oxygen is greatest in the inner part of the harbor, that is, north of the Narrows, where the proportion of sewage to water is greatest.

In the Hudson river, above the city limits, in the East river beyond Hell Gate, and in the harbor outside the Narrows the quantity of oxygen available for the disposal of sewage matters is normal or nearly so.

In some of the more restricted parts of New York harbor there is practically no dissolved oxygen to be found in the waters. The waters of Newtown and Gowanus creeks are practically devoid of oxygen, as are those of Wallabout canal and the Passaic river.

More significant still, because of the larger body of water involved and the greater importance of the neighboring territory affected, is the condition of the Harlem river. The Harlem near its confluence with the East river has less than one-quarter of the amount of dissolved oxygen which it should possess and the river is markedly deficient in oxygen from end to end.

Zones Where Oxygen Is Depleted.—With reference to the three main channels into Upper New York bay, there is found a gradual decrease of dissolved oxygen as one proceeds from the ocean inward. First, with respect to the main ship route, *i. e.*, via the Lower bay, Narrows, Upper bay and Hudson river. Table VII shows the depletion in regular order to the Upper bay and then a better condition proceeding up the Hudson.

TABLE VII.—DISSOLVED OXYGEN IN THE HARBOR WATER PROCEEDING FROM THE LOWER BAY UP THE HUDSON RIVER.

Channel.	Per cent saturated with oxygen.
Lower bay	97
Narrows	83
Upper bay	67
Hudson to Spuyten Duyvil	72
Hudson north of Spuyten Duyvil	83

Table VIII shows a very decided depletion up the Harlem with an improved condition out of the Sound end of the East river. The actual figures for the Harlem and the lower East river are already at, or very close to, the absolute limit required by fish life.

TABLE VIII.—DISSOLVED OXYGEN IN THE HARBOR WATER PROCEEDING FROM THE LOWER BAY UP THE EAST RIVER.

Channel.	Per cent saturated with oxygen.
Lower bay	97
Narrows	83
Upper bay	67
East river to Hell Gate	65
Harlem river	55
East river to Throgs Neck	86

TABLE IX.—DISSOLVED OXYGEN IN THE HARBOR WATER PROCEEDING FROM THE LOWER BAY UP THE PASSIAC RIVER.

Channel.	Per cent saturated with oxygen.
Lower bay	97
Narrows	83
Kill van Kull	79
Newark bay	76
Passaic river	6.4

The above figures are averages of the oxygen found at various depths and of conditions of tidal currents. Samples were taken in the center of the channel.

Fish cannot thrive in water when the oxygen dissolved therein has been reduced to about 55 per cent saturation, from which fact it is to be noted just how bad the East and Harlem rivers have grown to be.

Considering the waters as a whole, somewhat less oxygen is found at the surface than through the depth of the water, but the difference is generally not great.

Samples taken on flood tide show the influence of bringing in the water laden with dissolved oxygen. In practically every case the waters of a flood current have more dissolved oxygen than those of the corresponding ebb current. Table X shows that with the exception of the Harlem and Sound end of the East river there is from 4 to 18 per cent more oxygen to be found in flood currents than in ebb currents.

The Supply of Oxygen.—The absorption of atmospheric oxygen by water proceeds very rapidly from the surface downward when once the oxygen has penetrated the surface, according to Letts and Adeney. These authors found that as soon as oxygen was dissolved by the water at the surface it was drawn rapidly throughout the depth of water, the reason apparently being some unexplained process of gravitational streaming. The dissolved oxygen shows practically no tendency to accumulate near the surface, but passes almost as quickly through it as it is dissolved. In consequence of this peculiar phenomenon the aeration of sea water is nearly always uniform through its depth. There is a slight tendency in land water for the oxygen to accumulate at the top.

TABLE X.—DISSOLVED OXYGEN IN THE WATER DURING EBB AND FLOOD CURRENTS.

Place.	Per cent saturated with dissolved oxygen. Flood.	Ebb.
Lower bay	100	95
Narrows	92	74
Upper bay	78	64
Hudson river to Spuyten Duyvil	76	66
Hudson river above Spuyten Duyvil	84	83
East river to Hell Gate	69	60
East river, Hell Gate to Throgs Neck	80	92
Harlem river	55	56
Kill van Kull	82	78
Newark bay	78	74
Arthur Kill	100	73

Sewage Saturation and the Production of Odors.—By whatever process the oxidation of sewage matters proceeds, that progress is satisfactory only so long as a sufficient supply of oxygen is available. When the dissolved oxygen becomes exhausted, putrefactive changes set in and with these offensive odors are produced. These odors are particularly disagreeable when putrefaction takes place in the presence of sea water. In this case the avidity of the micro-organisms for oxygen is so great that various compounds of oxygen, which under ordinary circumstances are stable, are destroyed for the oxygen which they contain. As a consequence of this action gases, of which sulphuretted hydrogen is an example, are released. These gases escape in bubbles from the water and often give rise to offensively smelling odors as already noted. As compared with fresh water streams, lakes and other bodies of inland water, New York harbor is not a favorable place for the disposal of sewage so far as this question is concerned.

Relation Between Diffusion and Digestion of Sewage.—It is evident from the foregoing, that, in order to employ the great volume of water flowing in and out of New York harbor so as to dispose of sewage without producing a nuisance there is required the fulfillment of, at least, two main conditions:

First, the practicability of diffusing the sewage with the water.

Second, the quantity of sewage must not be too great for the quantity of water into which it is discharged.

The presence of minute particles of suspended matter in the volume of the main tidal currents is in itself the least objectionable feature connected with the disposal of sewage by diffusion. But the accumulation of these small particles form extensive and foul-smelling masses of sludge and render large arms of the harbor water black and foul smelling.

Large particles which float upon the surface are offensive to the sight and break up to form the smaller particles which are carried in suspension. They add to the accumulations of sludge on the bottom. Yet the total quantity of the large suspended particles is not great when compared with the total quantity of solid organic matter carried beneath the surface.

The heavy particles carried by sewage, notably sand and other solid substances which rapidly deposit near sewer outfalls, are for the most part inorganic in composition and contribute but little to the offensiveness of the water. Yet as Dunbar* has remarked, it may be a mistake to regard mineral matter like sand as unobjectionable because of its inorganic composition. The mineral particles are covered with organic matters which are putrescible. When sand from sewers accumulates in quantity it may give rise to extremely unpleasant odors.

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*Principles of Sewage Treatment by Prof. Dr. Dunbar, 1908, p. 47.

The grease which flows upon the surface or is deposited upon the harbor bottom gives rise to peculiar and unpleasant odors and is unsightly in appearance, but its worst effect is local. It is not to be compared in offensiveness with solid floating particles of excrement, or in potential harm with the other organic impurities which are in solution and suspension in the harbor waters.

The organic matters which are in solution and the solids which are capable of producing these organic matters under suitable conditions of putrefaction constitute the principal objection which may be raised against the discharge of sewage into New York harbor, except in so far as public health is directly connected with this subject. This connection lies chiefly in the bacterial condition of the water and the uses to which the water is put by the public in bathing and cultivating oysters and will not be dealt with in this chapter.

The whole problem of the disposal of sewage into New York harbor, therefore, resolves itself largely into a question of how and to what extent diffusion and digestion may be carried on with the certainty of producing uniformly satisfactory results. The remaining portion of this chapter will, therefore, be devoted to a discussion of some of the principles of diffusion and to a brief description of a number of experiments made by the Metropolitan Commission in order to obtain a better knowledge of the circumstances under which the diffusion and digestion of sewage in New York harbor can be made to take place.

Experimental Studies of the Diffusion and Digestion of Sewage in New York Harbor.

The relation between diffusion and digestion of sewage in water is close, although it is by no means always obvious. A thorough intermixture of the sewage with the water is indispensable for the assimilation of the liquid organic matters, but it is not necessary in order that a rapid liquefaction of the organic solids should take place.

DIFFUSION OF SEWAGE IN NEW YORK HARBOR

Setting aside for the present the question of mechanical transportation of sewage particles from a sewer outfall through the displacing action of tidal currents, we will proceed to consider some general facts concerning the dispersion and diffusion of sewage in water.

Definition of the Terms Dispersion and Diffusion.—The term dispersion implies a separation and scattering of solid particles, while diffusion refers especially to an intermixture of liquids. When dispersion and diffusion proceed satisfactorily the water of a harbor which receives sewage becomes uniformly charged with the solid and liquid sewage matters. When diffusion and dispersion do not take place satisfactorily the sewage may flow in a mass upon, alongside or within the natural body of water.

It is sometimes erroneously assumed that diffusion is everywhere and at all times proceeding rapidly in natural bodies of water and that sewage becomes intermixed and invisible as soon as it reaches the water into which it is discharged. The fact is that no such rapid and general intermixture of water and sewage ordinarily takes place.

Effect of Discharging Sewage at the Surface.—Where sewage is discharged at the surface of a harbor diffusion proceeds slowly. The sewage flows away upon the surface and, in the absence of currents capable of producing diffusion, a stratum of heavily contaminated water lies at the surface, while the main body of water flowing below remains relatively unpolluted. There are many examples of this method of discharge, with all its unsatisfactory consequences in the city of New York and neighboring municipalities.

Effect of Discharging Sewage Below the Surface.—When sewage is discharged beneath the surface of harbor water it usually rises to the top close to the point where it is discharged. It spreads out upon the surface as though it had been discharged there. Only the action of comparatively rapid currents of tidal water or the discharge of small quantities of sewage at great depths below the surface is apparently capable of producing sufficient diffusion to prevent the appearance of sewage upon the surface. Judging by the experience of the few cities which have attempted to discharge sewage beneath the surface of harbor waters the advantages gained by this method of disposal are likely to be commensurate with the increased expense of pumping the sewage and constructing the sewer outfalls. The experiences of Boston and the Metropolitan Sewerage Commission of Massachusetts in discharging sewage beneath the surface of Boston harbor point to an example which should be avoided.

There are three outlets from the Boston and Metropolitan sewerage systems and all are located in the outer harbor. The Boston outlet is at Moon Island; the outlet for the north metropolitan district is at Deer Island, and the outlet for the high level, or south metropolitan district, is at Peddocks' Island.

Conditions at the Boston Outlets.—At the Moon Island outlet about 40,000,000 gals. are discharged from the storage tanks in about two hours on each outgoing tide. The discharge takes place at the surface of the water. The harbor becomes discolored over an area of about 1,000 acres.

At the Deer Island outlet a continuous flow of 48,000,000 to 72,000,000 gals. of sewage a day covers an area, at the ebb tide, about 1¼ miles in length by 2/5 of a mile at the widest place. The outlet is at low water or a little below it. Under average conditions the area covered is about 250 acres.

The Peddocks Island outlets are located in a deep tidal channel where the current flows at a maximum velocity of nearly four miles per hour. The Moon Island and Deer Island outlets discharge into maximum current velocities of about two and four miles per hour respectively. The sewage rises rapidly from a depth of 30 ft. below the surface of the harbor water at low tide and is imperfectly dispersed and diluted before it reaches the top.

Immediately over the outlet on an occasion when the Metropolitan Sewerage Commissioners of New York visited it, the sewage boiled up like a large spring, the agitation being violent over a circular area of a diameter of 15 ft. The odor was noticeable at a distance of 500 or 600 ft. from the outlet. The quantity of sewage being discharged on this occasion was about 40,000,000 gallons per day and the population served about 400,000. The sewage had been passed through deposit sewers and coarse screens to take out such suspended matters as could be removed in this way before the sewage was discharged into the harbor.

The water in the vicinity of the outlet had a grayish appearance. There was much floating matter consisting of balls of grease, scum, shreds of paper and similar refuse which could be seen for several hundred feet from the outlet in all directions, and on the leeward side of the outlet, 1,000 ft. away. The sleek on the surface of the water was plainly noticeable for at least one mile in the direction in which the tidal current was running. The location of the outlet was indicated by the smoothness of the water and by a flock of gulls which hovered about it.

Ascent of Sewage in New York Harbor.—From a theoretical standpoint it is evident that diffusion between two such liquids as sewage and harbor water may be materially affected by the difference in specific gravity which exists between the two. Some idea of the extent of this effect can be had from the fact that a cubic foot of land water is about 1¾ lbs. lighter than an equal volume of sea water. In consequence of this difference, every cubic foot of sewage which is discharged beneath the surface of sea water will be urged toward the top with a force of about 1¾ lbs. The upward moving force is less than that stated according to the proportion of land water to sea water which is present in the harbor.

It is possible to approximately express the rising velocity of a volume of sewage discharged beneath the surface of a quiet body of water of greater specific gravity by the mathematical formula

$$V = K\sqrt{2gh}$$

in which V is the velocity of the ascending sewage, and h is the head corresponding to the buoying force. From this formula it is evident that the rate of ascent varies as the square of the difference in specific gravity. An important point to remember here is that the velocity of ascent will be doubled when the buoying force is multiplied four times.

It is impracticable to calculate the velocity of ascent by means of this or any other formula without knowing the shape of the ascending column of sewage. The rate of ascent will depend upon the frictional resistance which the ascending column of sewage offers to the surrounding body of water and, consequently the shape of that column must be known in order to calculate the rate.

Flotation Experiments With Solid Objects.—In order to get a better idea of the rate of ascent of sewage in harbor water a series of experiments was made by the Metropolitan Commission with solid wooden balls released at a sufficient depth beneath the surface of a quiet body of water to enable the rate of ascent to be noted accurately.

The balls were about 4 ins. in diameter. They were coated with shellac so as to be impervious to water and were weighted so as to have the specific gravity of land water. Four series of experiments, including the observation of 18 balls, were made in mixtures of land and harbor water with the following results: The rate of ascent was 0.30 ft. per second in 75 per cent land water, 0.45 ft. per second in 44 per cent land water and 0.50 ft. per second in 16 per cent land water. These rates probably show the maximum velocity which can safely be expected when the rising substance is sewage.

Experiments on the Ascent and Diffusion of One Liquid in Another.—A number of experiments were made by the Metropolitan Commission to obtain practical information concerning the circumstances under which sewage would and would not diffuse in harbor water. In general the method used in making these experiments was as follows. The water or sewage to be discharged was strongly colored with a dye. The discharge was then regulated to take place in a continuous stream under prearranged conditions as to velocity and volume beneath the surface of the water with which it was to diffuse. The discharging current having been made visible by the dye it only remained to study the phenomena of diffusion by observing the colored water.

Various dyes were experimented with in order to determine the most suitable for this use. It was desirable that the dye should be not only bright and clear when mixed with sewage or water but it should not be so altered in color through dilution or through chemical action with matters present either in the sewage or the water into which the sewage was discharged as to become indistinguishable. It was necessary that it should not add materially to the specific gravity of the water. The dye should not cause a precipitation of any of the matters with which it came in contact and it should not be so expensive as to preclude its use on a large scale.

After many tests two dyes, one known as uranine and the other special scarlet, were selected. The uranine, a sodium salt of fluorescin, was found to be particularly suitable. This dye could be detected by sight in dilutions of one to 30 million parts of water. When a bucketful of dyed sewage was thrown upon the surface of the harbor it could be seen at a distance of ¼ mile. It might remain visible for 20 minutes or more.

The quantities of colored water or sewage discharged varied between 300 gals. and 56,000 gals. according to the requirements of the experiment. The harbor water varied somewhat in salinity. It usually contained about

25 per cent land water and 75 per cent sea water.

The current into which the water or sewage was discharged varied from a little less than 1 ft. per second to 3 ft. per second.

Most of the large scale experiments were carried on near Robbins Reef in Upper New York bay. A few were made near Mt. St. Vincent in the Hudson river and three were carried on at the Sound entrance to the East river near Stepping Stones Light.

In all the experiments the specific gravity and temperature of the sewage and water dealt with were determined by a salinometer devised by the commission. The details of each experiment were timed and recorded. Sketches were made with suitable measurements to show the adjustment of apparatus and the phenomena observed. Each experiment was carefully and fully reported with the inferences and opinions which it seemed safe to draw from the results.

The first experiments were made in the Commission's laboratory upon a small scale. Later, in order to carry out these experiments on a larger scale, a tank courteously placed at the Commission's disposal by the management of the New York Aquarium was used. The Aquarium tank measured 8 ft. in length, 4 ft. in depth and 4 ft. in width. It had a plate glass side through which the phenomena of diffusion and other conditions in the tank could be observed. The tank was supplied with land water and harbor water, according to the requirements of the experiment.

The experiments on the largest scale were made with boatloads of dyed water and dyed sewage. The dyed water was contained in casks of several hundred gallons capacity. Three of these casks were located upon the Commission's floating laboratory and connected with a steam pump which was capable of discharging the dye through a suitable hose at any required depth.

In one instance a small tank steamer was used and in another a pontoon holding 60,000 gals. with an 8-in. centrifugal pump were employed. In these largest scale experiments most of the Commission's employes took part as observers. Most of the observers were located on boats which were used in carrying on the experiments, but in some cases an observer was placed upon a lighthouse or other point of vantage at a considerable elevation above the water in order to observe any effects which might escape the observers closer at hand. The total number of experiments made was 103. Of these, 63 were on a large scale.

Facts and Opinions Drawn from the Experiments.—Following are some of the principal facts and deductions drawn from these studies.

Sewage when discharged into sea water rises in a mass unless intermixed through the mechanical action of currents.

Sewage rises through sea water because of the difference in specific gravity between the two liquids. Differences in temperature produce differences in specific gravity, and it is this latter difference which need alone be considered in studying the conditions under which sewage will rise.

Sewage appears to be practically in equilibrium when discharged into a mixture of about 85 per cent land water and 15 per cent sea water; that is, it will not rise or fall through the water into which it is discharged.

When sewage is allowed to stand at the top of a perfectly quiet body of water diffusion occurs at once if the water is land water, but not until after 48 hours if the water is a mixture of equal parts land water and sea water.

When sewage is discharged through an orifice into and beneath the surface of a quiet body of water currents are set up in the latter which help produce an intermixture between the two fluids. The force of these currents varies directly with the velocity of the discharging current and the volume of discharge.

Sewage discharged through an orifice into and beneath the surface of a quiet body of water of the same specific gravity does not mingle instantaneously with the surrounding water. Some diffusion takes place from the outside edges of the discharging stream but intermixture proceeds chiefly after the discharging stream has lost its initial velocity. In other words, time is an important factor in the mixing process.

If directed vertically upward, the discharging stream flows toward the top in a gradually enlarging column. At the top the sewage spreads out thinly upon the surface. Diffusion gradually takes place downward from the surface.

If discharged horizontally, the inflowing sewage at first preserves its integrity for a considerable distance, depending upon the initial velocity at the orifice, and then rising upward spreads out in a layer at the surface. Diffusion takes place in this case downward, from the gradually enlarged column and from the surface layer.

Sewage discharged into a quiet body of harbor water consisting of 40 per cent land water and 60 per cent sea water rises toward the surface, irrespective of the direction of discharge from the orifice, and spreads out upon the surface in a large thin layer. Discharged in a horizontal direction, at a velocity of one and one-third feet per second, the upward motion is not retarded perceptibly.

The inflowing volume is larger and longer when the discharge is horizontal than when the discharge is upward or downward, and for this reason a horizontal discharge of sewage facilitates diffusion.

Of the 66 large-scale experiments about one-half were successful in showing conditions which should be avoided in discharging sewage beneath the surface of harbor water. In 29 cases the sewage came at once to the surface; in 31 cases no effect was visible; in 6 cases the result was doubtful. The sewage was discharged at depths varying between 5 and 62 ft. below the surface of the water.

In one case, at Robbins Reef, when 600 gals. of water were discharged at a depth of 40 ft. into a current of 1 ft. per second it came to the surface. In another instance when 15,600 gals. were discharged at the same place and under what seemed to be similar conditions it did not apepar on the surface.

The sewage used in the experiments just described was obtained at the mouth of one of the principal sewers of New York. The water in all but the large scale experiments was taken from the city of New York public water supply; that used in the experiments where boatloads were employed was from the public drinking water supplies of Communipaw, N. J., and Stapleton, S. I.

There was nothing unusual about the sewage employed to distinguish it from other samples of fresh, normal sewage which might have been obtained in this or any other American city. Such difference as might exist between the sewage and clean water, which was sometimes used in the experiments in place of sewage, could affect the results only in so far as they altered the specific gravity of the fluids considered. The specific gravity of the samples of sewage and water experimented with as sewage was the same in every case.

The grease and gas which would help carry sewage to the surface and the solid and semi-solid matters which would help take it down were not taken into account in these experiments. These substances were too variable and uncertain in composition and effect to reckon with. At the same time it is evident that in some cases the gas produced or entrained in sewage may exert a decided effect in carrying sewage to the top of a natural body of water below whose surface the sewage is discharged, while the grease, not being miscible with the water or entering into chemical combination with any of its ingredients, would rise to the surface and remain there. In so far as these conditions would be likely to affect the result of the experiments they would make diffusion more unsatisfactory than the experiments indicated.

DIGESTION.

Digestion experiments were undertaken in order to show the rate at which sewage solids became liquefied in the harbor water. They showed, among other things, that the rate depends upon the condition of the water into which the solids are placed. The solids disappear more rapidly in polluted water than in clean water.

Conditions Under Which the Experiments Were Made.—The most instructive experiments, and the only ones which need be mentioned here, were carried on by putting various organic solid substances in receptacles which were then placed in trays, with suitable weights and sunk in the water. The receptacles were several inches in diameter, made of glass or metal, and were covered with wire netting in order to prevent the bodily removal of the solid substances by fishes. The receptacles and the trays which contained them had sides high enough to prevent active currents from meeting the solid matters and yet not so high as to prevent a proper circulation of water. The solid objects were allowed to remain submerged for varying periods of time in order to give them a sufficient opportunity to disappear by digestion. The experiments were carried on in the New York Aquarium and in the open harbor water at the Battery.

Facts and Opinions Drawn from the Experiments on Digestion.—The experiments carried on in the relatively clear waters of the aquarium and in the polluted water of the harbor gave different results. Objects of solid organic composition that would rapidly decompose in sewage, sewage sludge or water badly polluted by sewage, when placed in comparatively pure water remained almost unattacked. A period of time which was sufficient for the solids to entirely disappear in polluted water or sludge was insufficient to produce visible effect when placed in clean water.

Much of the organic matter placed in the water at the Battery became completely decomposed in three or four weeks. Part of the residue showed signs of beginning decomposition. Proteid and albuminous substances were most easily decomposed and carbohydrates disappeared almost as readily. Fats were not much changed and bones and egg shells were unchanged. Glumes and fibrous matters seemed to be in almost the same condition as when put into the water, and the same was true of hair. Hemp, cotton and wool fibres were broken up into finer pieces, but otherwise unchanged. Human feces entirely disappeared as such. Tissue toilet paper was completely dissolved in three weeks. Newspapers proved very resistant and could plainly be distinguished at the end of three months.

During the course of the experiments it was found that sewage sludge deposited from the water into the receptacles which were placed in the harbor water at the Battery. The sludge was soft and oozy at the surface and more concentrated as the depth increased. The top layer was of a dirty, grayish brown color. Below the surface the sludge was black. The difference in color between the surface and the sludge beneath the surface has frequently been noticed in the commission's studies of the deposits on the bottom of New York harbor. The black coloration is due apparently to the formation of sulphide of iron brought about by the deoxidation of iron compounds by anaerobic bacteria. The grayish surface layer is probably produced by an oxidation of the inorganic matters and of the iron sulphide. This oxidation is caused by the activities of bacteria which have the power to abstract dissolved oxygen from the water and unite it to partly mineralized substances.

In appraising the properties of the Chicago Consolidated Traction Co., the following were the costs assumed for paving: Cedar block, $1.50; granite block, $3; brick, $2.30; hemlock plank, $0.75; cobblestone, $1.50; creosoted block, $2.50; granite blocks (second hand), $1.25 per square yard.

STEAM AND ELECTRIC RAILWAY SECTION

Methods of Constructing Cast Iron Culverts to Prevent Pulling Apart and of Repairing When Pulled Apart.

How to prevent iron pipe culverts from pulling apart in soft ground and how best to repair them when pulled apart was made the subject of investigation during the past year by a committee of the American Railway Bridge and Building Association. This committee made its report to the association at the convention held in Denver, Colo., last week, and from it we extract the following statements of practice:

W. C. Cushing, Chief Engr., M. of W., Penn. Lines.—In placing cast iron pipe, 24 ins. or more in diameter, build under each joint a block of concrete, 12 ins. thick, 24 ins. wide, and 48 ins. long, parallel with the track. The pipe should be laid in position before the concrete is placed, so that it will get a good bond on the hub of the pipe. The ground around the pipe, for its full length, should be carefully tamped. We recommend that where pipes are put in under tracks in service the stringers supporting the track be left in place for several months, until the ground has become well settled around the pipe, before the full weight is thrown on it.

In slips, the best method of holding the pipe in place is to carry the small concrete piers to the bottom of the slip, if this is not too deep. In cases where the slips have been deep, we have driven pile foundations, three piles in a row, spaced 2 ft. on centers, parallel with the track, and spaced 4 ft. to parallel with the pipe. The top of the piles were concreted and the pipe laid on the concrete.

R. G. Develin, Asst. Engr., M. of W., Penn. R. R.—In one case where a movement of the embankment separated a 24-in. pipe culvert, it was repaired as shown by Fig. 1. On sections where pipe culverts have much pull they are clamped together by 3x¾x16-in. straps, as shown by Fig. 2. No strap is placed at the bottom, as it is desired to keep the bottom smooth.

D. C. Zook, Penn. Lines West.—Where the ground is only moderately soft our method is to lay a close floor of ties running at right angles to the pipe. On this the pipe is laid on a saddle made by placing a timber on each side, clamped to fit snug against the pipe. We usually, when the pipe is 3 ft. or more in diameter, use a piece of timber about 12 ins. square.

When, in our judgment, the ground is too soft to allow this mode of construction we drive two-pile bents at about 6 ft. centers, our pipe being 12 ft. long. We cap those piles and on this foundation lay our pipe, supporting it between bents with the saddle already mentioned made of 12x12 in. timber fitted up to each side of the pipe and securely fastened to the cap. The object of the timber is to afford additional bearing to the pipe and prevent it from crushing.

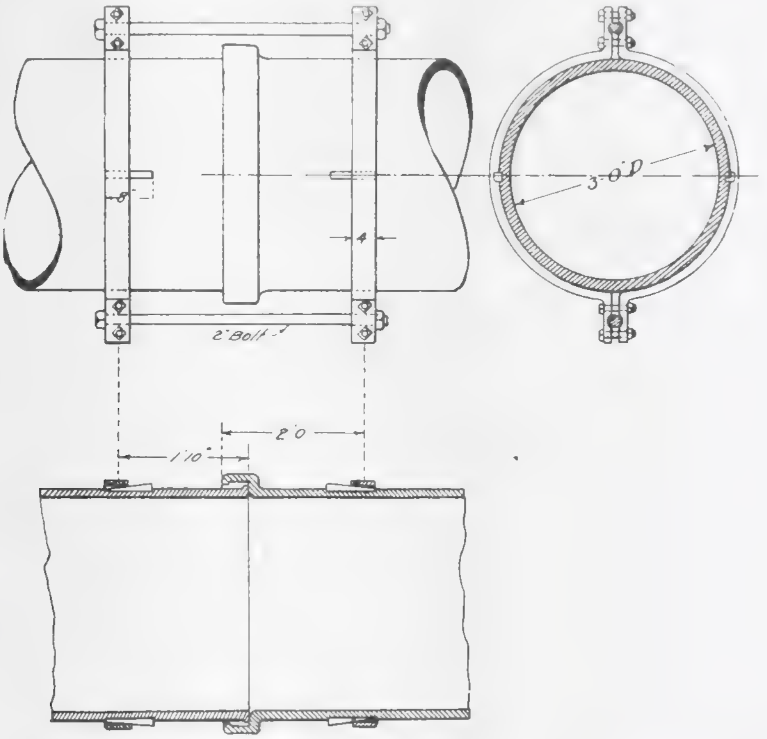

Fig. 1—Method of Clamping Joint Cast Iron Culvert, Pennsylvania R. R.

S. C. Bowers, P. C. C. & St. L. R. R.—For cast iron pipe 24 ins. or more in diameter we put under each joint a block of concrete 12 ins. thick, 24 ins. wide, and 48 ins. long, the latter dimension parallel with track. The pipe should be placed in position before the concrete is put in, so that the concrete will get a good, hard bond on the hub of the pipe. Care should be taken in laying the pipe in all kinds of ground, to tamp up under it the full length. Most of the pipe that goes out of position does it before the ground gets thoroughly settled. This happens more frequently where the pipe is near the surface of the ground, and the longer the stringers are left in the track the better it is for the pipe, as it gives the ground a chance to settle before all the weight is thrown on them. Where it can be done pipe should be laid during March or April and the stringers left in until July. This plan will save considerable tamping for the section men and still give them time to get their track in good shape for fall inspection.

In slips the method of holding pipe has to be determined by the depth to terra firma. On this division we had a case of pipe pulling apart in a slip where solid ground was about 6 ft. below the bottom of the pipe. We excavated down to the rock and into it about 6 ins. and built up small concrete piers under the joints. The pipe had pulled apart about 2 ft. before this was done. The work was done early in 1908 and there has been no trouble since. Where slip is too deep to excavate, piles should be driven, 3 in a row, 2 ft. on centers parallel with track and 4 ft. on centers parallel with pipe. Then concrete should be placed on top of these and the pipe laid in the concrete. This method was used in 1907 at a slip on this division and there has been no movement since. This is not only a preventive from pulling apart but also keeps the slip from moving.

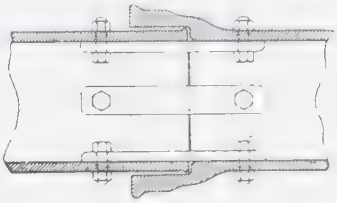

Fig. 2—Joint Fastening for Cast Iron Pipe Culvert, Pennsylvania R. R.

B. F. Gehr, P. C. C. & St. L. R. R.—My experience with laying cast iron pipe in soft ground is to place a cement pier just back of each bell; and, if under a heavy fill, also at the center of the pipe section, on a uniform grade. If the soil is such that it is necessary to build cement piers and there is still fear of settling a small amount under the track, it is well to leave the line of pipe crowning in the center. In addition, holes may be drilled in ends of the pipe and ¾ in. rods may be run through from the inside and bent over on the outside. I would use four clamps at each joint [illegible] according to the size of the pipe. This arrangement will prevent the sections from pulling apart. A good method of repair when pipes are pulled apart is to draw them together with a steam boat ratchet or screw buckle.

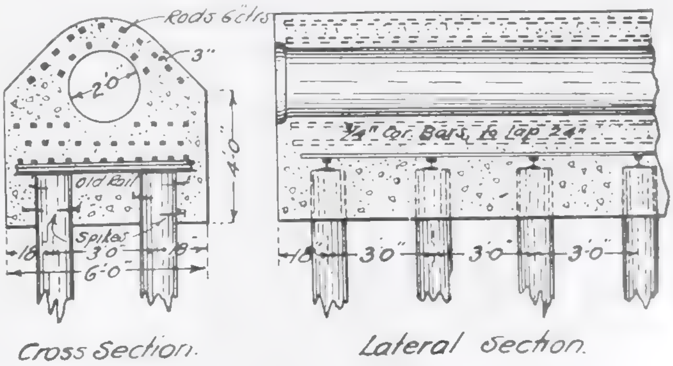

Fig. 3—Concrete Incased Cast Iron Pipe Culvert.

R. H. Reid, L. S. & M. S. Ry.—Where we have placed iron pipe in extremely soft ground we have sometimes driven piles on both sides of the culvert line, capping these piles crosswise under the pipe, just back of the bell, so as to form a two-pile bent under each 12 ft. section of iron pipes; or, if the conditions warrant, we put two bents of two piles each under each section of pipe and place the pipe on saddles, the saddles being cut out to fit the curve of the pipe. We then fill in carefully over the pipe. In addition to this, where we have found it necessary, we have placed iron rods entirely through the pipe on the inside, with hooks over each end of the pipe with one or two turnbuckles in the rod for drawing them up tight. Fig. 4.

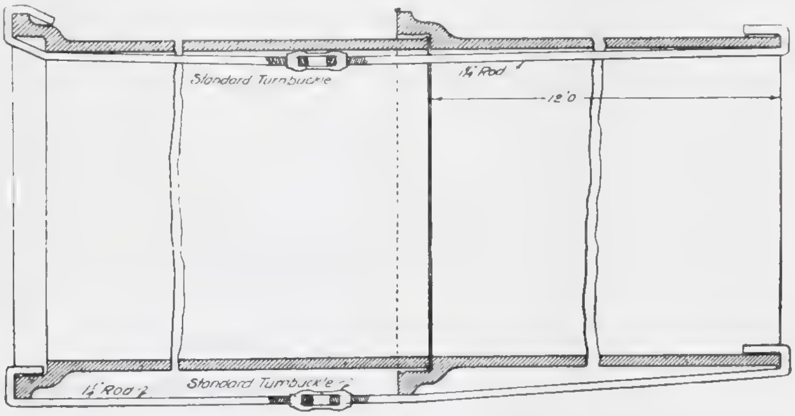

Fig. 4—Turnbucket and Rod Clamp for Cast Iron Pipe Culvert.

In other cases of soft ground where the conditions have not been bad enough to require pile bents, we have placed old ties or old bridge stringers for saddles and have laid the pipe directly on them, clamping the pipe together with rods, as above mentioned. In one or two cases we have drilled holes in the pipe near the end and fastened the sections together with iron straps bolted through the e holes. Where pipe culverts have pulled apart in soft ground, it is generally necessary to dig out one or two sections at each end, depending upon conditions, and close up the joints by resetting the pipe; and, if conditions seem to require it, place the iron rod clamp through the pipe culvert, as above noted. These methods have given general satisfaction and are still in use.

J. H. Roach, Div. Engr., L. S. & M. S. Ry.—I have in mind a waterway constructed of 24 in. cast iron pipe in soft ground under a 100 ft. embankment, and Fig 3 is a sketch showing the pipe as actually built. The character of the natural ground and its action when under heavy loads was well known before the work was started, and on account of the high fill to be placed over the pipe it was deemed necessary to take every precaution possible to prevent the pipe from settling and pulling apart after the fill was completed. Accordingly, 50-ft. white oak piles were driven for a foundation and the pipe was encased in concrete reinforced with bars placed longitudinally, to take care of the longitudinal tension likely to result when the fill was made. After the structure was completed, the fill for a height of about 25 ft. above the pipe was placed in position in layers about 4 ft. thick with teams and scrapers, which compacted it well. Later the fill was carried up to grade in the usual way, and, although stakes placed in the natural ground north of the north end of pipe showed a movement of about 12 ins. to the north and a rise of from 1 to 2 ft., there was no appreciable change in the grade or alinement of the pipe.

C. A. Stelle, Div. Engr., W. & L. E. R. R.—We have, on different occasions, used two methods. One has been in use for some time at Fremont, where the filling is settling next to the river. In this we have put a 1¼ in. rod through the 48 ft. of 24-in. pipe and a heavy iron bar at each end. We then screwed the sections together. This was done several years ago and the plan has been successful, although once the thread on the rod stripped and allowed the pipe to part. We, however, replaced this rod, and have had no further trouble.

At several other places on our line where the pipe had been placed on soft ground, I have used, in one instance, old car sills, laying about three of these sills in the bottom of the ditch, and placing the pipe on the same, thus providing against one section dropping below the other.

J. P. Canty, B. & M. R. R.—It has been our practice when installing iron pipe under tracks to drive two rows of plank sheeting parallel to line of culvert and about 12 ins. farther apart than the outside diameter of the bell end of the pipe between which, after excavation has been made to proper depth, a floor of concrete about 6 ins. thick is laid. Upon the latter the cast iron pipe is placed, and the space outside of the pipe, between it and sheeting, is filled with concrete. We also cover the pipe on top to depth of 6 ins. with concrete. The culvert pipe is thereby enclosed in a concrete casing that is square on the outside, the dimensions being about 12 ins. greater than outside diameter of the pipe. As an additional precaution the plank sheeting is sometimes left in place.

With concrete heads on these culverts, the foundations of which are carried about 3 ft. 6 ins. below the bottom of the culvert opening, we have had no trouble. The length, height and thickness of head walls will, of course, depend upon the height of the fill behind them. Cases where pipes were broken under the track or pulled apart have not bothered us, as I now can recollect, except in places where there have been comparatively low fills. In these situations we simply put temporary stringers under rails, resting on the earth at the ends of sufficient size to carry the load for the opening desired, and, after excavating down to the pipe relaid it as outlined above. In deep fills, where extremely long piles would be necessary to make an opening down from the track for such cases, I would advise tunneling from the end of culvert, if it was not possible to remedy the trouble from the inside of culvert pipe.

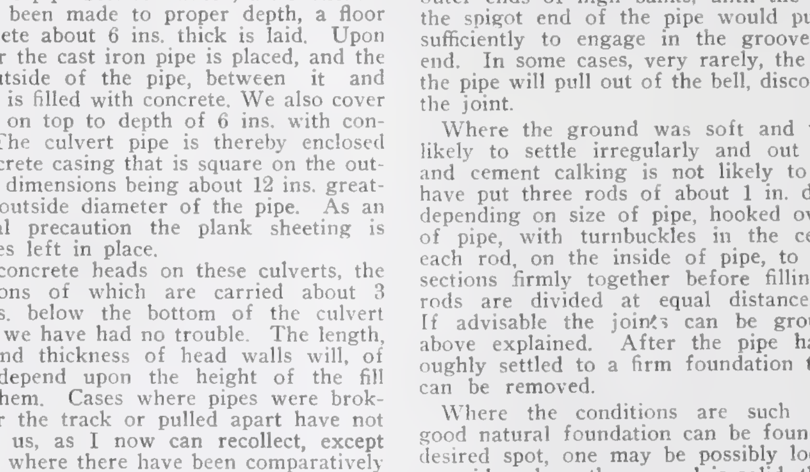

Fig. 5—Sketch Showing Method of Pulling Together Parted Cast Iron Pipe Culvert.

It may be pertinent to this subject for me to state that, with concrete casings, as described, I have found that tile pipe apparently answers the purpose as well as cast iron, even when the top of the culvert is comparatively close to the ties.

G. A. Wright, Illinois Traction System.—About the best thing to prevent pipe from pulling apart that I know of is to fill the chime of the bell end with good, rich cement mortar, well packed in. This will hold the sections together under ordinary conditions. I have found it necessary, in some places, to put rods from end to end, with strong hooks to reach over the ends of the pipe and turnbuckles to draw them up tight. In some places where one or two joints have been added to the pipe already laid to widen the bank for second tracks or sidings, I have placed these rods on the inside of the pipe. These pipes added for wider fills I have found the hardest ones to hold to place, as the new fill generally slides down the slope of the old one and carries the pipe with it.

As to repairing them when pulled apart, I have pulled them back with a heavy chain and steamboat ratchet. In some cases I have found it necessary to excavate down to the top of the pipe and alongside to about the center of diameter, before being able to move them. The rods used were made up in 12 ft. lengths, and these sections were coupled together with welded eye. Old bridge rods were utilized for the material.

A. S. Markley, C. & E. I. R. R.—After laying pipe in place fill the bell around the spigot end of the pipe full of grout made of one part cement and three parts sand. Care should be taken that the grout is well mixed and stirred up while pouring, so that the sand and the cement will not separate. Care should also be taken that a clay roll or pipe jointer is held firmly against the bell of the pipe, to prevent the grout from escaping through an open seam. This method has been our practice for the past ten years, and has proved very successful. Previous to using this method, in a good many cases, joints of pipe would partly separate, more particularly those on the outer ends of high banks, until the bead on the spigot end of the pipe would pull apart sufficiently to engage in the groove in bell end. In some cases, very rarely, the ends of the pipe will pull out of the bell, disconnecting the joint.

Where the ground was soft and the pipe likely to settle irregularly and out of line, and cement calking is not likely to hold, I have put three rods of about 1 in. diameter, depending on size of pipe, hooked over ends of pipe, with turnbuckles in the center of each rod, on the inside of pipe, to pull the sections firmly together before filling. The rods are divided at equal distances apart. If advisable the joints can be grouted, as above explained. After the pipe has thoroughly settled to a firm foundation the rods can be removed.

Where the conditions are such that no good natural foundation can be found at the desired spot, one may be possibly located to one side, where the ground is solid, thus saving the expense of preparing a foundation with concrete or piles, as the case may warrant.

The only successful way of repairing pipe that is pulled apart under heavy banks is to dig them out and reset them. Under light banks, with open joints near the ends, I have jacked the ends up in line and pulled them together with crab and block and fall, either by anchoring the same at opposite ends of the pipe or by using jacks instead. Where the pipe has crushed under heavy banks I have lined them with one row of brick, laid rollerways, in cement mortar. Such was done where the pipe was sufficiently large to take care of the water after lining.

W. F. Beyers, C. & N. W. Ry.—Figure 5 is a sketch showing a method of pulling together separated culvert pipe.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The formal opening of the new international bridge at the Brownsville-Matamoras crossing of the Rio Grande to through passenger traffic took place Oct. 20. The first passenger train to cross the new bridge was a Kansas City, Mexico and Orient special of cars bearing President A. E. Stillwell of that road and a party of capitalists on their way to the City of Mexico.—As was expected, no bids were received Oct. 20 by the Public Service Commission of New York City for the construction, equipment and operation of the Tri-Borough Subway under the private capital form of contracts. Bids are to be opened to-morrow, Oct. 27, for the construction of the subway by sections with city money; and it is expected that a number of contractors will submit bids on this basis.—The grand total of excavation on the Panama Canal in September was 2,687,088 cu. yds., of which 2,621,731 cu. yds. were charged to "work excavation" and 65,357 cu. yds. to "plant." The dry excavation amounted to 1,717,986 cu. yds. and was principally by steam shovels. The dredges removed 969,102 cu. yds. in addition to the amount pumped into Gatun Dam by suction dredges.—The McCall Ferry power development on the Susquehanna River was officially placed in service on Oct. 14. This plant is to develop 135,000 H.P. by a 53 ft. dam, built across the Susquehanna River.—The successful bidders on the 80-mile extension of the Lexington & Eastern Ry. from Jackson to Whitesburg, Ky., are reported to be as follows: Mason & Hanger, Frankfort, Ky., 16 miles; W. J. Oliver, Knoxville, Tenn., 16 miles; Luck Construction Co., Roanoke, Va., 16 miles; Jones Bros., Columbus, O., 16 miles; Lane Bros. Co., Baltimore, Md., 16 miles. Among the other railroad construction contracts let recently are the following: Robert I. Plunkett, Coffeyville, Kan., for the construction of an interurban line between Coffeyville and Nowata, Okla.; Carpenter and Boxley, Roanoke, Va., for a change of line between Cirtsville and Harper Hill, W. Va., two miles, for the Virginian Ry., the contract including 250,000 cu. yds. of excavation and 5,000 cu. yds. of masonry; C. L. Bondurant, Hickman, Ky., and W. L. Mozley, Memphis, Tenn., for clearing and grading for the last 10 miles of the Chicago, Memphis & Gulf R. R., from Tiptonville, Tenn., to Hickman, Ky.; Balch & Co., Rice Lake, Wis., for constructing a 5-mile extension of the main line of the Superior & Southeastern Ry. in Wisconsin.—A large contract for extending the breakwater at New Haven, Conn., for the U. S. Government has been let to the Breakwater Co. of Philadelphia, Pa., and Cleveland, O. The contract amounted to over $1,000,000. The same company has also been awarded a $600,000 contract for extending the east breakwater at Cleveland.—Several pieces of railroad construction work have been resumed the past week. Among these may be noted the Southern Traction Co. of Illinois, which after two years' delay has recommenced construction work on its 30 miles of track in East St. Louis, Ill., St. Louis and Belleville.—Present indications are that several new railroads will start something in the construction line this fall or early next year. One of the most promising prospects is the South Dakota Interurban Ry. Co., which projects a line approximately 200 miles long, extending from Sioux City, Ia., to Chamberlain, S. Dak. Another new railroad for which there seems to be good prospects for letting contracts early next year is the Birmingham & Northern Ry. This railway projects a 47-mile line from Dyersburg, Tenn., to Jackson, Tenn., and has already secured $200,000 stock subscriptions by the cities and towns on the route.—The Necaxa Dam No. 2 of the Mexican Light & Power Co. has been completed. This is a hydraulic fill dam, and into its construction went 5,000,000 tons of rock and 20,000,000 cu. yds. of earth.

The Common Labor Question

In many sections of the country this year, contractors have been much handicapped in their work by the scarcity of unskilled labor. The same condition has prevailed in Canada, both in railroad construction work and in general contract work. In British Columbia, in particular, the labor situation has been such that it is reported that the contractors have refused to take additional work on the Grand Trunk Pacific in that Province, claiming that owing to the present conditions they are even now losing hundreds of dollars daily on their contracts. In an effort to remedy this condition the Grand Trunk Pacific Ry. Co. recently applied to the Provincial Government for permission to employ Asiatic labor in the construction of its line through British Columbia. The company stated in its application that if permission was granted for the employment of Asiatic labor the company would enter into an understanding not to employ such labor while white labor was available, and would further agree to give employment to all the white labor asking employment at the current rate of wages. The Provincial Government refused to grant the application. In many of the larger Canadian cities general contract work has been much handicapped by the scarcity of common labor. This has been particularly so in Toronto and the City Engineer of that city has suggested that the Canadian Government suspend or abolish the regulation which requires that each immigrant in order to secure entrance to Canada be the proud and happy owner of $25. He thinks that if this regulation was done away with, European labor would rush into the country and the various works under way in Canada would be greatly benefited.

Nitro-Glycerin.

To the powderman who carries dynamite in his pant's pocket, thaws it in the oven of the cook's stove, and opens the case with an ax, we commend this story of the first trip of nitro-glycerin to the city of New York: In 1865 a young man, representing a German concern of Hamburg, arrived in America with samples of nitro-glycerin, for the purpose of introducing its use among miners. This agent made his headquarters at a hotel on Greenwich street, New York, and conducted his operations from that point. Unhappily, he met with no success. In the end he was forced to leave the hotel with his bill unpaid, and his baggage was confiscated by the management. Quite complacently, too, that same ill advised management retained possession of a large can filled with nitro-glycerin. This perilous asset was left haphazard beneath a counter in the office of the hotel. One day a guest used it as a footrest while he polished his shoes. Having observed red fumes escaping from the tin, he called the attention of the proprietor to this curious phenomenon. The bamboozled Boniface was minded to take no risk; so, for the sake of safety from the mysterious menace, he threw the can into the street. Instantly there was a tremendous explosion. Nobody was killed.

The International Road Congress.

The American delegates at the recent International Road Congress at Brussels have presented a petition to the Secretary of Agriculture asking that his department consider the advisability of the United States Government becoming a member of the Permanent International Association of Road Congresses. At the recent Congress at Brussels the American delegates were present by direct invitation of the Belgian Government, the United States as a nation making no contribution for meeting the expenses of the Congress. As a result the delegates from this country in some respects did not have the same status as the delegates from the countries that were members of the Permanent Association. The two International Road Congresses that have been held so far have accomplished much good, and from them American engineers have obtained much valuable information regarding road construction practice in other countries. In some features of road work European practice is ahead of the practice in this country. This is particularly true in the matter of road administration and road maintenance. There are also many engineering features in connection with the design and construction of European roads which are worthy of duplication by the engineers of this country. On the other hand American practice is admittedly in advance of European practice, in the investigation of the effect of the various chemical and physical properties of bituminous materials on the adaptability of the materials for use in the construction and maintenance of roads, and in the drawing of specifications covering these properties. It will thus be seen that while our engineers gain much from the collaboration with foreign engineers, made possible by the Road Congresses, they also give something in return. The advantages of membership in the Permanent Association of Road Congresses are so many that it is to be hoped that the Department of Agriculture will have no hesitation in approving the petition, so that Congress at its coming session can be asked to appropriate the small sum necessary to place the delegates from this country to the 1913 Congress on the same status as the delegates of the other countries.

Employers Liability Commission.

The National Employers' Liability Commission [illegible] its first meeting last week and effected its preliminary organization. The commission was created for the purpose of making a thorough investigation of the subject of employers' liability in case of injury to or the death of workingmen or working on, and the proper compensation. This is one of the first definite steps toward securing a national employer's liability law. Several states have commissions looking to the securing of such laws, and New York state has an employer's liability law in active operation. The National Commission is to report through the President to Congress not later than the first Monday in December, 1911, and in submitting its report must recommend to Congress such legislation as it deems admissible. It is to be hoped that the legislation recommended by the commission will be fair both to the employer and the employe.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Tuscaloosa Mineral R. R. is reported to have engineers in the field near Tuscaloosa making new surveys for an entrance to that city.

Arkansas.

The Arkansas, Oklahoma & Western R. R., M. Hays, Chief Engineer, Rogers, Ark., will soon complete its line from Rogers to Huntsville, after which the directors will take definite steps for extending the line to Little Rock.

The proposed line of the Gulf, Magnolia & Northern Ry. has been located from Hope, Ark., to Monroe, La., and at a recent meeting of the stockholders of the road, the directors were authorized to proceed with construction work. S. Q. Servier, Hope, Ark., is President.

There now remains about 20 miles more of railroad construction before De Queen and Hot Springs is connected. The DeQueen & Eastern R. R. has been completed to within 16 miles of Star of the West, and the Caddo Lumber Co., which owns a long trip of timber land near Glenwood to within a few miles of Star of the West, is extending its road toward the latter place. It expects to complete the line by Jan. 1. The Glenwood Lumber Co., owns a large tract of timber land, extending from Glenwood to a point near Hot Springs, a portion of which is now traversed by a railroad. A gap of 16 miles between Dierks and Star of the West and one of about four miles between Hot Springs and the Glenwood Lumber Co.'s timber is practically all that now separates DeQueen from connection with Hot Springs by rail.

The Mena & Hot Springs Ry., which projects a 77-mile line from Mena, Ark., east via Wormble to Hot Springs, has made its surveys. The capital for construction has not been secured as yet, and no date has been set for awarding construction contracts. John Thompson, Mena, Ark., is President, and A. H. Scoggin, Mena, is Secretary.

California.

The Mojave & Bakersfield R. R. Co., has been incorporated with a capital stock of $9,000,000. The directors are E. E. Calvin, Vice-president Southern Pacific; W. R. Scott, of the Southern Pacific, and William Hood, San Francisco, Cal., Chief Engineer of the Southern Pacific. These directors have paid in of the capital stock the sum of $85,000. According to the incorporation papers, the proposed road is to run from Bakersfield to Mojave, a distance of 85 miles, and will connect with the existing terminals of the Southern Pacific at those two places. The reason for the formation of the new company according to a quoted statement of one of the directors, is: "We want to determine if it will be more profitable to build a new line at a lower grade over the mountains than to double-track along the present line. In order to procure the proper data for the purpose it is necessary to have a new company."

Announcement has been made that the proposed electric railway between Fresno and Clovis has been financed and that construction will be started as soon as all of the right-of-way is secured. About 75 per cent of the right of way has now been obtained. S. N. Griffith, Fresno, is the promoter. Mr. Griffith also has plans underway for another interurban electric road, to run out about 50 miles from Fresno.

The Diamond Match Co., according to advices from Stirling City, has been making surveys for a logging road at Parker, the second station below Stirling City. This contemplated road will be about 1½ miles long and will tap some fine timber which will be used in the early Spring and late Autumn when the snow is too deep for logging at Ramsey Bar.

The West Sacramento Co., of Sacramento, organized for the purpose of improving the property owned by the Northern Electric Co. on the west end of the proposed bridge crossing from the Sacramento to the Yolo side of the river has filed a trust deed to the Mercantile Trust Co. of San Francisco to secure the issue of $2,000,000 in 20-year bonds bearing interest at 6 per cent. The plans of the company include the erection of storehouses, machine shops, blacksmith shops, paint shops, car barns, repair shops, a pattern shop, a carpenter shop, freight and passenger depots, switching and yard trackage, offices, sub-stations, a river storehouse, wharfage and other structures. This industrial center will be at the southern boundary of Broderick, Yolo county, and directly opposite the foot of M St., Sacramento. A. D. Schindler, Alaska Commercial Bldg., San Francisco, is General Manager Northern Electric Co.

The Oakland & Antioch electric railway now under construction between Oakland and Bay Point, has made surveys for a line along the north edge of Rock Ridge and has secured right of way. Easy grades for the line are said to have been secured through Rock Ridge by the boring of a short tunnel through the hill. The Bay Point Construction Co. has grading work now underway between Bay Point and Lafayette.

Excellent progress is being made with the surveys for the Humboldt & Eastern R. R., and it is expected that practically all of this work will be completed before winter.

The Yreka R. R. Co. is planning to build a 44 mile extension from Yreka to Scott Valley. Surveys for the extension have been made, but no construction work will be done at present. H. Walther, Yreka, Cal., is Manager.

Colorado.

The Negos-Philippine Lumber Co., composed of Denver and Los Angeles men, has completed the first unit of its lumber plant at Cadiz, Philippine Islands, and is now engaged in constructing a logging railroad. The company has concessions from the Philippine Government embracing 50 square miles of timber land with a government valuation of $22,000,000. Frank W. Brand, Denver, Colo., is President; J. F. McFarland, 218 Boston Block, Denver, is also interested.

The promoters of the new railroad through Plateau Canon into the Plateau Valley are reported to have sold enough bonds to go ahead with the construction of the road. It is said that the grading of the road bed will be carried on at least as far as Atwell Bridge, this side of Mesa this fall and winter. J. J. Yeckel, Grand Junction, Colo., is the promoter.

The Fairview & Intermountain Ry. Co., has filed its articles of incorporation at Delta, Colo., the principal incorporators being Charles G. Mantz, of Denver, Colorado; Mudge Ziegler and Watson Ziegler, of Fort Collins, Colo., and B. F. Hubbird, of Chicago. The principal object of the corporation is to construct a railroad to be operated by either steam or electricity, from Delta to Cedaredge; from Delta to Fairview coal mines; from Delta to the upper end of California mesa, with branches and spurs. The capital stock of the corporation is placed at $250,000.

Florida.

Advices from West Palm Beach, Fla., state that the West Palm Beach Farms Co. has awarded a contract to C. T. McCrimmon to construct 20 miles of track north and south through that company's lands.

The Louisville & Nashville R. R. has plans prepared for the erection of a new steel and concrete depot and freight shed at Pensacola, Fla. It will cost $270,000.

The Atlantic Coast Line R. R., E. B. Pleasants, Chief Engineer, Wilmington, N. C., is reported to have let a contract for the building of a branch line from Haines City to the Caloosahatchee river via Avon Park. It is stated that work will be begun at once.

A new railroad is reported to be projected by H. M. Flagler in Florida. It is said that this road will skirt the heads of the Everglades and cross over to Sanford, running from that place either to Fort Pierce or West Palm Beach.

The Tampa & Jacksonville Ry. Co. has let a contract for extending the road 7 miles from its present terminus at Fairfield in the direction of Dunnellon, where a connection will be made with the Tampa Northern. It is intended as soon as practicable to complete the road from Sampson City to Jacksonville. F. S. Parrigin, Gainesville, Fla., is Chief Engineer.

Georgia.

The Carnesville Ry. Co. of Carnesville has been granted a charter, with a capital stock of $200,000, and proposes to build and operate 20 miles of track from Toccoa southeast to Carnesville, passing through Mize and Red Hill. The incorporators are W. S. Erwin, J. H. Hicks, E. S. Hunnicutt, G. W. Edwards, W. G. Davis, J. C. Andrews, H. H. Parker, W. R. Whiting, W. P. King, S. J. Oliver, L. F. Lenhardt, J. W. Landraro and J. R. Hill.

A committee, of which C. W. Rawson, Albany, Ga., is chairman, has applied to the city council of Albany for a franchise for an electric street car line in that city. It is planned to organize a local company to operate the line.

The Pelham & Havana R. R., A. C. Felton, Jr., president, Cairo, Ga., has begun grading on the extension of the line from Calvary towards Havana, Fla.

Idaho.

In connection with a new dam on the Boise River which the U. S. Reclamation Service proposes to install in connection with the Payette-Boise project it is proposed to construct a railroad from Barberton to a point 25 miles up the canyon of the Boise River to the dam site. The line would be used for handling supplies used in the construction work. F. W. Hanna, Boise, Idaho, is project engineer.

Citizens of Eastman, Ga., have inaugurated a movement to build a railway to Americus. This new link would afford Americus a new outlet to the coast via the Southern railway, a connection long desired.

Advices from Boise, Idaho, state that it is reported there that the Chicago & Northwestern Ry. in its determination to obtain a Pacific coast terminal and build from Lander, Wyo., to Puget Sound, will cut southwest to Pocatello in southeastern Idaho, and join the Oregon Short Line, thus going through the southern part of Idaho, and thence to tidewater without the expense of building its own line. The Short Line has already arranged to build a cut-off from Winza, just west of Pocatello, through central Idaho to Boise, and on into

Oregon, which will give it two main trunks running across the state. It is believed to be the intention to build west from the Lander terminal into the Snake River Valley, probably down the south fork of that stream, and then south in the valley to Pocatello

Illinois.

The city of Troy, Ill., has granted a franchise to the St. Louis & Eastern Traction Co. for constructing and maintaining its line through that city. The company has now obtained practically all right of way from Granite City to Highland for its proposed line. A. W. Crawford, Hillsboro, Ill., is interested.

The Alton & Mississippi River Belt Ry. & Transportation Co. has been incorporated with a capital stock of $25,000 and principal office at Chicago and proposes a line to be constructed from a point in St. Clair county, on the eastern inner harbor line of the Mississippi River, opposite the city of St. Louis, Mo., through St. Clair and Madison counties, to the city of Alton. The incorporators and first board of directors are John W. Bissell, Julius H. Quasser, Henry L. Stern, Herbert J. Friedman and Michael Feinberg, all of Chicago.

The Commercial Club of Morrison has appointed a committee, of which H. S. Green is chairman, to secure right of way for the proposed interurban line from Morrison to Albany.

The Chicago & Northwestern Ry. is now securing right of way in St. Charles and Elgin townships for the proposed double tracking of its line from Elgin to Lake Geneva.

The Southern Traction Co. of Illinois, after being delayed during the past two years, has recommenced construction of its 30 miles of track in East St. Louis, St. Louis and Belleville. The road is to be operated by electricity and runs through good coal and manufacturing districts of Illinois. It will have its freight and passenger loops in the downtown district of St. Louis, connecting with the St. Louis municipal "free" bridge. About half of the grade is finished and some track laid in East St. Louis and Belleville. The estimated cost of the roadbed is $700,000. The East St. Louis Engineering Co., Cahokia Bldg., East St. Louis, Ill., is engineer for the East St. Louis and St. Louis work. Harper Bros., Sexton Bldg., East St. Louis, Ill., are engineers for the Belleville work.

The Chicago & Alton R. R., is planning to build freight yards near the asylum at Bartonville. The tract of land was bought some years ago. The Alton owns 51 per cent of the Peoria Terminal road, the interurban between Pekin and Peoria and it is thought they will utilize the terminal facilities to get into Peoria.

Indiana.

Grading work has been resumed on the St. Joseph Valley Traction Co.'s line east of Bristol and the force is now working toward closing the gap toward Middlebury. It is stated that cars will be running on the line from Elkhart to Angola by June next. R. C. Jones, La Grange, Ind., is general manager.

The Southern Michigan Ry. Co. of South Bend, now operating 35 miles of line, is reported to have practically decided to build an extension to Buchanan, Mich., if it finds that it can build a bridge over the St. Joseph River at Niles at a reasonable cost.

The Evansville, Mt. Carmel & Northern Ry. Co. of Evansville has filed notice of increase of capital stock from $50,000 to $500,000. W. C. Brown is president.

The Indiana Northwestern Traction Co. has asked the town of Rensselaer and Marion township to vote a subsidy. This is the line being promoted by Eugene Purtelle of Chicago, Ill. A subsidy of 1½ per cent is asked to aid the proposed line, which will take in Remington and Rensselaer, in Jasper county, and will run from Rensselaer parallel with the Monon northward to Chicago. An election to vote on the proposition will likely be called.

Iowa.

The St. Paul & Des Moines R. R., H. L. Jackson, chief engineer, Des Moines, is reported to have started surveys for a new line from Waterloo to Garden City, through Eldora. As proposed the road will start from Waterloo and will run west into Hardin county, making Eldora its principal objective point and joining the main line at Garden City, in the extreme west part of the county. The same company has also made a survey from Charles City to Hampton.

The Waterloo, Cedar Falls & Northern R. R., L. S. Cass, president, Waterloo, Ia., has made plans to extend its interurban line from Cedar Falls to Dike, in Grundy county, a distance of about 10 miles, and thence ultimately to Grundy Center and Marshalltown. The Commercial Club of Cedar Falls will select the new route to connect Cedar Falls with Waterloo, will secure the right of way and locate two new town sites. Several routes have been surveyed between Waterloo and Cedar Falls.

It now looks as though the Rockwell City branch of the Fort Dodge, Des Moines & Southern, from Rockwell City to Fort Dodge Junction, will be in operation by Dec. 15. The old light rails of the Newton & Northwestern are being replaced with heavy steel.

The South Dakota Interurban Railway Co., with headquarters in Sioux City, Ia., is about to undertake the construction of a steam railway from Sioux City to Chamberlain, S. D. The line will be approximately 200 miles long. Some preliminary work was done on this line about a year ago. The W. K. Palmer Co., engineers, 712-720 Dwight Building, Kansas City, Mo., has been engaged to make the complete final location of this line and to take charge of all of the engineering work connected with the proposed railway.

The Chicago Great Western R. R., is reported to have made surveys for a line to Bellevue, where it is also said the company will construct a bridge across the Mississippi river.

The Fort Dodge, Des Moines & Southern R. R., J. L. Blake, General Manager, Boone, Ia., has purchased the Crooked Creek R. R., which runs from Lehigh to Webster City. It is said that the Crooked Creek R. R. will be electrified and a spur built.

Kansas.

Business men of Tipton, Kan., are to raise $10,000 and a like amount is to be subscribed by the farmers between Tipton and Downs in order to have the Missouri Pacific Ry. open a branch road between the two towns.

A meeting of the shippers of Hutchinson, Kan., was held at the Commercial Club rooms in that city to consider a proposition of organizing a stock company in Hutchinson to build a railroad from Hutchinson to Patterson, about 20 miles. This road would connect with the Frisco railway and also with the new road which is being promoted to be built north from Wellington, through Wichita to McPherson and Salina, connecting the Midland Valley Ry. in Oklahoma and the Union Pacific at Salina. L. A. Beebe is secretary of the Commercial Club of Hutchinson.

It is now expected that the Topeka and Northwestern branch of the Union Pacific between Topeka and Marysville, Kan., will be opened for traffic on Nov. 1. This branch has been under construction for the last five years. It is to be made a part of the new freight route to the west and northwest, reducing the distance to the coast by almost 100 miles and cutting down the running time by several hours.

Plans for the elevation of the railroad tracks over Douglas Ave. at Wichita, Kan., have been completed by the railroad, and it is believed that everything will be ready for construction work within a few weeks. The plans call for two abutments containing 1,300 cu. yds. of concrete and piers containing 220 cu. yds. The steel superstructure is to consist of two 40-ft. spans and two 16-ft. spans

The construction of an interurban line from Fort Scott to Pittsburg, Kan., or Mulberry, Kan., is proposed, and the promoters of the company have already asked for a charter. C. E. Cory and Col. L. H. Phillips, Fort Scott, Kan., are interested.

Officials of the Illinois Traction System (McKinley syndicate), which recently secured the franchises and properties of the Topeka, Wichita and Atchison electric lines, formally applied to the state railroad commissioners on Oct. 13 for the purpose of securing permission from the board to issue bonds for the construction of an electric interurban line connecting Atchison, St. Joseph, Leavenworth and Topeka. H. E. Chubbuck, Peoria, Ill., is general manager of the Illinois Traction System.

Robert L. Plunkett, Coffeyville, Kan., is reported to have been awarded the contract for constructing an interurban line between Coffeyville and Nowata, Okla. The road will leave Coffeyville by way of South Coffeyville and will run parallel to the Missouri Pacific, passing through Elliott, Lenapoh and Delaware, to Nowata. J. A. Wetteck and J. B. Pollard of Nowata, Okla., are interested.

The Santa Fe system has appropriated $8,000 to be used for the rearrangement of tracks at Coffeyville, Kan.

A new track 2,610 ft. long will be constructed at Emporia, Kan., by the Santa Fe system. The work is to cost approximately $5,000.

The Winnipeg, Salina & Gulf Ry. Co., with headquarters at Salina, Kan., proposes to construct a railway line from Omaha, Neb., via Oak to Chester, Neb., thence to Belleville, Kan., and thence to Salina, Sterling, and Pratt, and to the southwest corner of Barber County, Kan., thence to Alva, Okla., Fairview, Okeene, and to Oklahoma City. They also propose to run branch lines from Salina, Kan. to Kansas City, and from Alva, Okla., to Des Moines, New Mexico. The W. K. Palmer Co., engineers, 717-720 Dwight Bldg., Kansas City, Mo., has been retained as engineers to make all surveys, and have entire charge of engineering work, in connection with this project.

Kentucky.

The Louisville & Nashville R. R. will let a contract on Nov. 5 for the construction of nine miles of line from Whitesburg to the mouth of Potters Fork, Ky. The work contains 400,000 cu. yds. of excavation, which will for the greater part be steam shovel work.

The Kentucky-Tennessee Traction Co. is planning to at once put engineers in the field so that all preliminary work can be completed by Dec. 1 and construction contracts let by Jan. 1. The company proposes an interurban line connecting Hopkinsville, the Western Kentucky Insane Asylum, then along the Nashville pike via the Salubria sulphur and mineral springs, thence via Pembroke, Trenton and Guthrie, Ky., the junction of the St. Louis & Nashville, Memphis division and Elkton branch of the L. & N. railroad. It has been the intention of the company to extend the line into Nashville and later to the coal fields of Christian and adjoining counties north of Hopkinsville, Ky. The capital stock of the company has all been subscribed, and practically 80 per cent of the right of way secured. Charles Van den Burgh of Hopkinsville, Ky., promoter of the Louisville, Lincoln Farm & Mammoth Cave Traction Co. from Glasgow, Ky., to Hodgenville, Ky., is also the promoter and general manager of the Kentucky-Tennessee Traction Co.

The O. C. Flynn Lumber Co., according to advices from Campton, Ky., is now building a broad gage railroad from Lombard, a station on the L. & E. R. R., to its timber, which will take the company about five years to saw ready for the market. The company owns 2,640 acres of land in Powell County.

C. T. Bondurant, of Hickman, Ky., and W. L. Mozley, of Memphis, Tenn., have been awarded the contract to clear the right of way and do the grading for the last ten miles of the Chicago, Memphis & Gulf R. R. from Tiptonville, Tenn., to Hickman. The contract specifies that the work must be completed by Jan. 1, 1911.

Tracklaying in the Harlan extension of the Wasioto & Black Mountain R. R. was commenced on Oct. 13. The company expects to lay a mile of track a day. The rails have been laid to Dry Branch, a distance of 20 miles from Harlan. It is estimated that the track will be completed to Poor Fork, which is within one mile of Harlan, by Nov. 15.

Contracts for work on the Lexington & Eastern Ry., noted in our issues of Oct. 5 and 12, have been let as follows: Mason &

Hanger, Frankfort, Ky., 16 miles; William J. Oliver, Knoxville, Tenn., 16 miles; Lane Bros. Co., Baltimore, Md., 16 miles; Jones Bros., Columbus, O., 16 miles; Luck Construction Co., Roanoke, Va., 16 miles. The work extends from Jackson to Whitesburg, Ky., and includes the following: Excavation, cu. yds., 1,632,877; bridge masonry, cu. yds., 10,620; Culvert masonry, cu. yds., 16,536; Pile work, lin. ft., 20,660; Trestle timber, B. M., 250,000; Rip rap, cu. yds., 2,606; tunnels, lin. ft., 6,195; Clearing, acres, 130; Grubbing, acres, 11; Concrete, cu. yds., 370; Steel in bridges, lbs., 750,000; Steel in concrete, lbs., 26,670; 12-in. ballast pipe, lin. ft., 468.

The Somerset, Corbin & Cumberland Construction Co., of Somerset, Ky., has raised the money to make a survey and secure right of way for its projected line. The company wishes to secure an engineer and also wishes to enter into correspondence with financiers regarding the financing of the proposition. The company projects a 42-mile line from Somerset to Corbin and from Somerset to the Cumberland River. Later it is expected to extend the line west to a connection with the Illinois Central at Hodgenville, Ky. J. M. Ross, Somerset, Ky., is interested.

Louisiana.

Good progress is being made with the work on the Terry, Janesville & Southern R. R., which is being built for Frank Janes from Terry's Switch to within one mile of Boueff River, a distance of six miles. At the middle of October the four miles of track had already been laid, and the dump had been thrown up within two miles of Boeuff River.

The Oberlin, Hampton & Eastern Ry. Co. of Oberlin has been chartered in Louisiana with a capitalization of $50,000,000. The road will run from Oberlin in an easterly direction to a point on the Nez Pique, traversing a part of Lake Charles parish never entered by a railroad.

Maine.

The town of Skowhegan, Me., has voted to raise $15,000 to aid in the construction of a railroad from that town to Athens Village. It is stated that the promoters of the road are now assured of $75,000, which probably means that the road can be bonded and the rest of the money required to build the line can be raised. The road will cost about $200,000. Harvey D. Eaton, Waterville, Me., is interested.

At the annual meeting of the stockholders of the Maine Central, Washington County and Somerset Rys. on Oct. 19, the directors of each road elected Charles S. Mellen, president of the New York, New Haven & Hartford and Boston & Maine, as president. In each case Lucius Tuttle, who resigned as president of the Maine railroads a short time ago when he retired from the Boston & Maine presidency, was elected chairman of the board of directors, a new office. The Maine Central stockholders voted to ratify the action of the directors in purchasing the Sebesticook & Moosehead Railroad.

Massachusetts.

The New York, New Haven & Hartford R. R. has had engineers in the field making a survey from Boston to Worcester, via Needham and South Framingham, with a view to determining the feasibility of a new line between those points. The plan, as at present contemplated, is to effect a connection between the Needham branch of the New Haven and the northern division, which runs into South Framingham. The engineers are also working on a route from South Framingham to Worcester, which would connect the Worcester terminus with its extensive eastern Massachusetts system. To connect Needham and South Framingham, it would be necessary to build about eight miles of track and 17 miles to connect South Framingham with the present line of the New Haven, presumably at or near Millbury, the old road being then followed into Worcester.

Michigan.

Regular operation of Michigan Central passenger trains through the recently-completed tunnel under the Detroit river, connecting Detroit with Windsor, Ont., began Oct. 16. Freight trains have been running under the river for some time.

The Saginaw & Flint Ry., Flint, now operating a 39-mile electric railway, proposes to build an extension from the Frankenmuth division to Harbor Beach. The proposed new line will take in several small villages.

Officials of the Saginaw & Flint Electric Ry. Co., of Saginaw, Mich., are to hold a conference soon with citizens of Vassar, Caro and other points in Tuscola County and the Thumb. with a view to extending the Frankenmuth division of the road into that territory.

Minnesota.

Plans are reported under consideration for building an electric railway from St. Paul across the Canadian border toward Winnipeg. A. E. Lewis of St. Paul is said to be at the head of the syndicate.

The Chicago & Northwestern Ry. is making good progress with the construction of its new cutoff between Milwaukee and Minneapolis and St. Paul, which will be practically a new line across the state. It consists of two new links, one from Sparta to Wyville, a distance of 23 miles, and another from a few miles north of Milwaukee to Wyville, 141 miles. The grading of this division has been almost completed. The link between Sparta and Wyville will give a through line from La Crosse to Necedas. By using the new cutoff, together with the present trackage across the state, a much shorter route will be made from Milwaukee to the Twin Cities. A total of 177 miles of new line will be constructed and 224 miles of track will be reballasted and relaid. The branch between Milwaukee and Wyville is being built by the subsidiary concern of the Northwestern, known as the Milwaukee, Sparta & Northwestern Ry. Co., and will cost over $1,000,000. A large sum also will be expended for new terminals at the Milwaukee end of the line.

The Canadian Northern Ry. is reported to be considering building a line into Hibbing, Minn., to connect with a line now under construction from Virginia to Duluth.

Mississippi.

Proposition has been made to a committee of citizens of Jackson, Miss., by J. Numa Jordy for the construction of a railroad from Jackson to Carthage, a distance of 47 miles. The citizens of Jackson are asked to pledge $50,000 to build a bridge over Pearl River, a few miles above the city. A. C. Crowder, Mayor of Jackson, is a member of the committee.

Missouri.

The United Rys. Co., of St. Louis, Mo., has announced its intention to extend the University Line at St. Louis from its present terminus to Pennsylvania Ave., building a loop. It is expected that a through line of cars will be in operation from Fourth St. to Pennsylvania Ave. sometime during the year 1911.

The Kansas City Southern Ry. has had surveys underway between Mount Washington and Sugar Creek, near Independence, with a view of laying a switch. The present track has a steep grade.

The St. Louis & San Francisco R. R. is to build a sea wall along the levee at Cape Gireadeau, Mo.

The upper house of the City Council of Kansas City, Mo., has referred to the public improvements committee an ordinance requiring Metropolitan Street Railway Co. to construct a double track in 12th St. from Jackson to Winchester.

F. M. Dawdy, Bosworth, Mo., has about completed his railroad work at that place and will shortly have an 8-team outfit idle.

The St. Francois County R. R. Co., has been chartered with a capital stock of $250,000 and proposes to build a road connecting with the Iron Mountain at Delassus, St. Francois County, and extending by way of Farmington to Esther, in that county. The road is projected for the handling of mineral in that county. The incorporators are: Peter Giessing, M. P. Cayce, Edward Klein, W. F. Doss, W. R. Long, John Giessing, Wm. R. Taylor and Wm. M. Horlan. The latter owns the bulk of the stock.

Nebraska.

The Omaha & Western Iowa Traction Co. has filed its articles of incorporation at Pierre, S. Dak., and proposes the construction of a line of railway from Omaha, by way of Council Bluffs, to Sioux City, a distance of 90 miles, at an estimated cost of $10,000 a mile, the line to operate in the counties of Harrison, Monona and Woodbury, in Iowa. The company will have nominal headquarters at Pierre and a branch office for the transaction of business at Omaha. The capital is $250,000 and the incorporators are C. E. Brown, M. E. Gallian, C. Desmond McDonough, Daniel J. Avery of Chicago and James S. Sebree of Pierre.

Steps are being taken for the construction of a railroad from Yankton, S. Dak., to Omaha, Neb. The Yankton Southern Ry. has been formed for the purpose of constructing the line, and the company is said to have made good progress with its promotion work. W. L. Bruce, Yankton, S. Dak., is Engineer and Wm. J. Fantie, Yankton, is President.

New Jersey.

A public hearing was held at Montclair, N. J., on Oct. 21 on the plans of the Delaware, Lackawanna & Western R. R. for its proposed improvements in that city. As noted in our Oct. 5 issue, the plans provide for the erection of a large new terminal, with six platforms, modeled along the lines of the Lackawanna's terminal at Hoboken, N. J.: the construction of a viaduct over Grove St., to eliminate a grade crossing; the closing of Pine St.; the erection of a large new freight station near the latter thoroughfare; the double tracking of the line from Montclair to Bloomfield, and the placing of many new sidings.

It is now said that the proposed extension of the West Jersey & Seashore R. R. (Pennsylvania R. R.) from Rennsgrove through Pennsville toward Salem will be built only to Fort Mott.

The Interstate Rys. Co., a holding company, is said to be making arrangements to lease the Trenton Street Ry. Co., of Trenton, to the J. G. White Co., Inc., New York City, which recently leased the Wilmington and Chester lines.

The Borough Council of Chatham, N. J., has granted a franchise to the Morris County Traction Co., Morristown, N. J., to operate its cars on Main St. The company proposes to run its line to Summit from East Main St. on a private right of way and to build a bridge over the Passaic River.

New Mexico.

Final arrangements are reported to have been completed for the construction of the Roswell-Tucumcari R. R. It is said that Sundstrom & Stratton, railroad contractors, 90 West St., New York City, have taken up the proposition. E. L. Bedell, Roswell, N. Mex., is interested.

New York.

The Hudson River & Eastern Traction Co., of Ossining, N. Y., has applied to the State Public Service Commission for authority to issue $50,000 of additional common stock and $850,000 additional first mortgage bonds. The company is now engaged in operating an electric railroad in the town of Ossining and intends to complete the construction of its line from its present terminus in the Camp Woods in the town of Ossining to the village of White Plains, a distance of approximately 14 miles. It is stated that this will require an expenditure of $621,000.

Final surveys for the projected line of the Scranton & Binghamton R. R. Co. are now under way. This company recently filed a mortgage for $10,000,000 in order to secure a bond issue. The line is now being laid out between Montrose and Binghamton by way of Franklin Forks, Lawsville, Corbettsville, Conklin and thence to Binghamton.

In a hearing before the State Public Service Commission on the application of the Buffalo, Rochester & Eastern R. R. Co., for permission to build its line an official of the Lehigh Valley R. R., stated that his railroad had arranged for the expenditure of $12,000,000 in improvements, some of the work being at present under way. He stated that the latter amount included $1,750,000 for a passenger station at Buffalo.

As was expected, no bids were received Oct. 20 by the Public Service Commission of New York City for the construction of the Tri-Borough Subway under the private capital form of contract. On Oct. 27 the commission will receive bids for the construction of the subway by sections with city money, and it is expected that several contractors will bid at this time.

North Dakota.

It is reported that construction work on the Hastings & Dakota Division of the Chicago, Milwaukee & Puget Sound Ry. has been shut down for the winter. About 1,600 men have been employed on this work. Steady progress has been made and the lines extending from McLaughlin, S. Dak., to Hamlin, Wash., having a combined mileage of nearly 200 miles, are practically completed.

It now looks as though the Chicago & Northwestern Ry. would continue the construction of its Rosebud line in South Dakota from Dallas to Colome and Carter during the winter unless the weather prevents. It is expected the line will be completed as far as Colome before Thanksgiving.

Ohio.

An ambitious scheme, according to reports from New York City, is now being framed up by which control of the Wheeling & Lake Erie and the Wabash-Pittsburg terminal will be secured by the New York Central Lines and a new air line route will be built direct from Cleveland to Baltimore and tapping the Pittsburg district en route. The plan includes: The purchase of the Wabash-Pittsburg terminal properties by New York Central or Affiliated lines, which would solidly establish the New York Central in the Pittsburg district. Control of the Wheeling & Lake Erie by New York Central, thereby securing for the Vanderbilt system another outlet to the lakes and a bigger share of the vast tonnage to and from the Pittsburg district. Joint control with the Rockefeller interests of Western Maryland, giving New York Central an outlet at Baltimore and an air line route to the Great Lakes at Cleveland, Lorain, Huron and Toledo with enough traffic possibilities. Ownership of the Virginian Ry., through purchase by Lake Shore, which with the latter's recent purchase of Hocking Valley's holdings of Toledo & Ohio Central and Kanawha & Michigan stock enabling the New York Central lines to connect with the Virginian by constructing seventy miles of new road from the western terminus of the Virginian railway to the southern terminus of the Western Maryland at Durbin; the investment of $20,000,000 in West Virginia and Pennsylvania coal lands by a syndicate headed by the Morgan interests with the chief object of shipping bituminous coal from Baltimore to the Mediterranean and importing iron ore from Spain as westward freight.

The Chesapeake & Ohio R. R. has notified the county commissioners that it will eliminate grade crossings on Bridgetown and Crookshank roads at Summit, where the company has purchased a large tract of land for the purpose of establishing extensive freight yards. The railroad company proposed to do away with the two grade crossings by building a viaduct on Bridgetown road and providing a new roadway for Crookshank road to connect it with Muddy Creek road on both sides of the track.

Good progress is being made with the $500,000 contract for straightening curves and eliminating grades at Sidney, O., for the C., H. & D. This contract will be finished by the first of next year.

Oklahoma.

The construction of a street railway at Ponca City is proposed. Frank Hatten, Ponca City, is interested.

Oregon.

From the progress now being made it is expected that the extension of the Pacific & Eastern R. R. to Butte Falls will be completed Nov. 5. Immediately thereafter train service will be opened between Medford and that point. For the present the trains operate between Medford and Eagle Point. The distance from Eagle Point to Butte Falls is 20 miles, and this stretch will tap a rich section of pine timber.

Construction work is being rushed on the new line of the Astoria Southern Ry. from Astoria, Ore., and Contractor Cobb expects to finish the first eight miles of the road this fall.

Track laying on the Oregon Trunk Line, from the Columbia River south was started last week and it is expected the work will be completed as far as Crooked River within the next 70 days. The force is laying about 1½ miles of rails daily.

Pennsylvania.

Final land purchases are reported to have been made for changing the course of the Mahoning River from Bessemer to below Mahoningtown, well on toward Moravia. The Pittsburg & Lake Erie, the Baltimore & Ohio and the Pennsylvania lines are all concerned in the work, the object of which is to swing the course of the Mahoning River from its present location over to the west to skirt the base of the hills upon the North Beaver side. At present the river runs practically in the center of the level land between the high hills on either side. When the course of the stream is changed, it will give a vast amount more land, suitable for railroad uses and yard purposes. The changing of the river's course will be considerable of an undertaking and will occupy many months. First a new channel will have to be excavated and then the water must be forced from its natural channel.

It is reported at Carlisle that the electric railway completed from Carlisle to Newville will be extended to Shippensburg, a distance of 22 miles from Carlisle.

The Wilmington & West Chester Ry. Co., Lewis Dalmas, Morris Bldg., Philadelphia, Pa., President, is reported to have made arrangements for the construction of its proposed trolley line from Wilmington to West Chester. It is said that the line will be built upon the Concord turnpike for its entire length northward from Wilmington and from near the Pennsylvania line to West Chester the railway will be laid upon a private right of way, just at the edge of the road. The line will pass through Talleyville, Brandywine Summit camp grounds, Elam, Brandywine Summit and other little settlements along the road from Wilmington to West Chester. This right of way was secured more than a year ago, it is stated.

Progress is being made with the grading work on the Midland Pennsylvania R. R., a new line projected to run from Millersburg, Dauphin County, to Ashland. Grading work is now under way toward Millersburg, where a connection will be made with the Pennsylvania R. R. This will enable the contractors to easily get supplies and materials to this work. The Pinkerton Construction Co., Land Title Bldg., Philadelphia, Pa., are the contractors.

The Sunbury & Selingsgrove Shore Ry. Co. has applied to the Borough Council of Northumberland for a franchise for belt line circling the town.

The Pennsylvania R. R. is reported to be securing right of way for the construction of a spur line from Marianna to Hockney. Surveys for the line have been made.

The Ferguson & Edmondson Co., Brookville, Pa., have work under way on its contract for double track work between Ashland and Nankin for the Erie R. R.

The Philadelphia & Reading Ry., has awarded a contract to John McMenamin, Arcade Bldg., Philadelphia, for the construction of embankments between Richmond and Somerset Sts., Philadelphia, on the Richmond branch of the railroad. The price paid for this work will be about $125,000, half of which will be borne by the city and half by the company.

South Carolina.

The Greenville-Knoxville R. R., W. H. Patterson, President, Atlanta, Ga., is said to be planning to immediately begin the construction of a short extension from Riverview to the Drake Inn property. The road is also preparing to build terminal facilities in Greenville, in the way of shops and passenger and freight stations. This work will begin within a few days.

Tennessee.

It is rumored in Gallatin, Tenn., that the Grand Belt Interurban Ry. Co., chartered to construct and operate an electric interurban railway between Gallatin and Nashville, had made satisfactory arrangements with a party of capitalists to take over the bond issue to an amount sufficient to enable the company to build and equip the line and put the same in first class condition. The proposed route of the road is via the Long Hollow Pike, Goodlettsville and the Dickson Pike, to a connection with the Nashville Street Ry.

Subscriptions amounting to $200,000 have been made for the Birmingham & Northwestern Ry. Co., and steps for the financing of the road are now in progress. The company proposes a 47 mile line from Dyersburg, Tenn., to Jackson, Tenn., and expects to let construction contracts about Jan. 1, 1911. The chief engineer has not been secured as yet. R. M. Hall, Dyersburg, Tenn., is President.

Texas.

The Temple Northwestern Ry. at the middle of October had completed the grading of its roadbed from Temple to Gatesville, a distance of 35 miles, with the exception of two miles. Material for bridging was on the ground and about six miles of steel had been laid. A proposition is now being considered to build an extension from Gatesville north to an intersection with the Texas Central at Iredell or Hico, the line to be built midway between the Santa Fe main line and the Stephenville North & South Ry. The Temple Northwestern had also 20 miles of grade completed between Gatesville and Hamilton.

H. H. Fielder of Dallas, Tex., promoter of the Houston, Somerville & Northwestern R. R., is to make a proposition to the city of Taylor relative of an entrance to that city. A proposition has also been made to the Board of Trade of Taylor by L. E. Walker, Quanah, promoter of the Quanah, Rockport & Gulf R. R., with reference to the building of the road through Taylor. It is proposed to build a railroad from Quanah to Rockport, a distance of 500 miles.

The citizens of Belton, Tex., have raised a bonus of $90,000 to aid in the construction of the Quanah, Dublin Seymour & Rockport R. R.

The Stone & Webster Engineering Corporation of Boston, Mass., now building an interurban railway between Galveston and Houston, has made a preliminary survey for a proposed electric railway to run north and south through the most populous part of Texas, to connect Dallas and Houston. The line will be about 265 miles long. It is believed that active construction of this new line will be started soon after completion of the line between Galveston and Houston. The new railway will connect with the latter line and with that of the North Texas Traction Co., operating between Dallas and Fort Worth. The engineering offices of Stone & Webster in Texas are in the 1st National Bank Bldg., Houston, Tex.

The St. Louis & San Francisco is said to have selected the route for its line to San Antonio. According to a map it runs from Brady due south to Comfort via Katemcy, Mason, Loyal Valley and Fredericksburg, making connection with the San Antonio and Aransas Pass at Comfort.

The Pecos Valley Southern R. R., W. L. Carwile, President, has secured the rails and ties for the immediate extension of its line south from Saragosa to a point beyond Balmorhea. From the latter town the road will be extended five miles to a point at the foot of the Davis Mourtains. The charter of the Pecos Valley Southern R. R. calls for a terminus at either Marfa or Alpine, and it is understood that a survey has been made to cross the Davis Mountains, and one or the other of the two Southern Pacific points will be made the terminal point of that end of the line.

The Union Terminal Ry. Co. of Rockport, Tex., has been chartered and proposes a line to run from Rockport to Aransas, thence to Navy City and Port San Antonio, over Shell Banks and Harbor Island, a total distance of about 24 miles, including the branches. The capital stock is fixed at $25,000. The officers of the company are: Charles T. Hoff, president; W. D. Newburry, secretary; Thomas E. Mathis, treasurer, all of Rockport; W. H. Verner, Aransas, first vice president, and S. B. Rorenson second vice president. The directors are: Dr. A. Bailey, Rockport; C. A. Cleringer, Rockport; O. C. McLeod, Aransas, and C. L. Grubbs, Aransas Pass.

The Santa Fe system proposes spending $7,000 in the near future for additional trackage at Wadsworth, Tex.

A steel tank and crane will be erected by the Santa Fe system at Alvin, Tex., at an estimated cost of $5,500.

The Santa Fe system proposes to build adequate track facilities at the Beaumont, Tex., wharf in the near future. The work will cost upward of $12,000.

The Santa Fe system proposes to spend $8,000 for track improvement in Fort Worth, Tex. The work consists principally of crossover construction.

The sum of $2,800 has been appropriated by the Santa Fe system for rearrangement of its tracks in McGregor, Tex.

The Railroad Committee of Sonora, Sutton County, has accepted a proposition of the Kansas City, Mexico & Orient Ry. to build a line to that city. The city will give a bonus of $50,000, 200 acres of land and terminal facilities.

The Texas City Terminal Ry., Texas City, Tex., is reported to be planning to build five additional miles of switch tracks at Texas City.

Smith Bros., Crockett, Tex., have the contract for constructing an extension of the Beaumont & Great Northern R. R., from Trinity northwest to Weldon, a distance of 20 miles. Among the subcontractors on the work are, J. S. Moore, Trinity, Tex.; J. E. Harding, Trinity, Tex.; Richard Rooh, Trinity, Tex.; Day & Avery, Trinity, Tex., and L. E. Loch, Trinity. No more of the work is to be sublet.

Utah.

Good progress has been made in grading for the Bingham-Garfield R. R. from Garfield to Utah Copper properties in Bingham. The grading will be completed, in so far as the open air work is concerned, not later than Nov. 15. This will give the contractors an opportunity to confine their work to driving tunnels and doing other work with which winter weather conditions will not interfere. The Utah Construction Co., Ogden, Utah, is the general contractor for this railroad.

It now looks as though the Denver & Rio Grande R. R. would start early next spring on the connection of its line between Nephi and Santaquin. The line has been surveyed and it has been found that no heavy grade will be needed and the line can be constructed within 60 days. It would traverse a good valley, and at Nephi would tap one of the best towns in that portion of the state. The route is surveyed to leave the Tintic branch between Payson and Santaquin and thence in a direct line through the settlements to Nephi, striking that city a mile east of the present station, connecting with the Sanpete Valley road as it runs through the street of the city.

The Oregon Short Line R. R. has made surveys for construction of second track between Ogden and Farmington Utah, and has had under contemplation the early construction of same. It is not likely, however, that construction will be undertaken for at least another year.

Virginia.

The Rinehart & Dennis Co., Evans Bldg., Washington, D. C., is now organizing its forces for work on its contract on the Norfolk & Western Ry., noted in our last issue. This contract is for Sec. 6 of the extension of the Indian Creek Branch and includes 300,000 cu. yds. of unclassified excavation and 8,000 cu. yds. of concrete masonry. Two shovels and other plant in proportion and concrete outfit will be used on the work, which will cover about 15 months.

P. J. Millett, Paris, Ky., has been awarded a contract for work on the Cedar Bluff extension (Jaeger branch) of the Norfolk & Western Ry. This contract includes 300,000 cu. yds. of excavation, 2,500 cu. yds. of concrete masonry and 1,500 cu. yds. of stone masonry. The masonry work may be sub-let. The award of the above contract was noted in our last issue.

The Washington, Alexandria & Mount Vernon and the Washington, Arlington & Falls Church electric railways have been merged into the Washington-Virginia Ry. Co., which has charters for the construction of additional lines in Virginia. It is generally believed that negotiations will be continued with the Gould line, which now extends to Ashland, Va., and that connections with that line will be accomplished within the next year.

David W. Flickwir, Roanoke, Va., is driving a 4,700 ft. tunnel for the Norfolk & Western Ry. The work is in connection with the extension of the Dry Fort Branch to connect with the Clinch Valley District at Cedar Bluff.

Washington.

The Northwest Engineering & Construction Co., of Spokane, Wash., has been incorporated with a capital stock of $50,000, the incorporators being E. B. Miller, D. Headington and M. F. Setters.

The Spokane & Inland Empire R. R. Co., of Spokane, has applied to the City Council of Spokane for a franchise to lay tracks and operate cars on Sinto Ave., beginning at Washington and running west to Adams, then north to Cleveland Ave., there connecting with tracks already laid. Another application was made for a franchise, the route to be as follows: Beginning on Cleveland Ave. and Elm St. the tracks to run west on Cleveland to Belt, north to Alta Ave., west to Latah (also known as Nettleton), north to Dalton, west to Seneca (also known as Cochran), to Courtland Ave., connecting with the present right of way.

The Seattle-Tacoma Short Line R. R. Co., of Seattle, which projects an interurban line between the two cities named, is stated to have let the contract for eight miles of road from Youngstown to Lake Burien to Homer Crosby.

The Willapa Harbor & Coast Ry. Co., recently incorporated with a capital stock of $10,000,000, proposes the construction of a railroad over the following route: Beginning at Portland, running thence in a northerly direction by such route and upon a water grade as may be selected, crossing the Columbia and Willapa Rivers to the new townsite of Willapacific, thence running down the right bank of the Willapa and up the left bank of North River to Brooklyn and from there to Tacoma. The directors of the company are John L. Myers, J. W. Kleeb and Fred H. Brown, all of South Bend, Wash.

The Chicago, Milwaukee & Puget Sound Ry. now has permanent surveys under way for its line on the west bank of the Columbia River, extending southward from the Beverly crossing of that stream. The line from the Beverly bridge across the Columbia River to Richland will be 52 miles in length. Practically all the right of way for the extension has been obtained. The work will be done by Contractor H. C. Henry, who built the St. Paul's coast extension from St. Joe, Idaho, to Seattle. Henry's contract will aggregate more than $1,500,000.

West Virginia.

The Baltimore & Ohio R. R. Co. has awarded the contract for the 7,000,000 bricks required for the new Kingwood tunnel. The contract went to the Thornton Fire Brick Co., whose offices are in Grafton and whose works are in Thornton, W. Va. The cost of the bricks will be about $75,000.

The Cherry River Boom & Lumber Co., of Richwood, W. Va., has commenced construction on a branch railroad which will connect its plant at Richwood with the mines at Baxter. The road will be six miles long and will be used to transport fuel from the mines to the plant at Richwood.

Construction work has been started at Valley Falls on the double tracking of the Wheeling division of the Baltimore & Ohio R. R. between Fairmont and Grafton. The distance is seven miles and the work will be mostly side cutting, containing very little rock.

Carpenter & Boxley, 405 Watt, Rettew & Clay Bldg., Roanoke, Va., as noted in our last issue, have been awarded the contract for two miles of work on the North Fork Branch of the Norfolk & Western Ry., near Gary, W. Va. The work consists of about 100,000 cu. yds. of excavation and 2,500 cu. yds. of masonry. Part of this work might be sublet.

Carpenter & Boxley, Roanoke, Va., on Oct. 17, were awarded the contract for the change of line between Cirtsville and Harper Hill, W. Va., for the Virginian Ry. The work consists of about 250,000 yds. of excavation and 5,000 yds. of masonry. This piece of work covers about two miles.

The Butler Construction Co. of Clarksburg, W. Va., has been incorporated with a capital stock of $10,000 and will engage in general contracting. The incorporators are: Osman E. Swartz, E. B. Templeman, R. Fallow, Charles B. Alexander and Jos. E. Stealey, all of Clarksburg, W. Va.

The Greenbrier, Cheat & Elk River R. R., the incorporation of which was mentioned in our Oct. 12 issue, proposes the construction of a line 75 miles long from Bemis, W. Va., to Webster Springs, W. Va., via the Cheat and Elk Rivers. Connections will be made with the Chesapeake & Ohio Ry., the Western Maryland Ry. and the Baltimore & Ohio. The country through which the road will pass is rough, and there will be one tunnel 800 ft. long. S. E. Slaymaker of New York is President.

Wisconsin.

The stockholders of the Milwaukee-Western Electric R. R. Co., Majestic Bldg., Milwaukee, Wis., have passed a resolution providing for the raising of a mortgage of $5,000,000 and the issuance of $2,500,000 of the amount at once, so that the construction work on the line can be begun early in the spring. The board of directors was empowered to proceed immediately with the building of the first division of the proposed line. This will be from Milwaukee to Fox Lake, with branch lines to Waukesha from Sussex and to Randolph from Fox Lake. The second division from Fox Lake and Randolph to Markesan and Green Lake will be built the following year.

The plans for track elevation work on the south side at Milwaukee are to be presented shortly to the State Railroad Commission for approval. Officers of the Milwaukee and the Northwestern roads and the city have agreed on the plan for the work, with the exception of a few minor details.

The U. S. Government Indian Bureau, Washington, D. C., is said to be considering building several miles of railroad on the Menominee reservation to handle timber destroyed by the forest fires last summer. The mill at Neopit is now so far away from the timber that in order to handle it some arrangement will have to be made.

The directors of the Grant Ry. Co. met recently at Bloomington, Wis., and decided to at once make a survey of the proposed route preliminary to preparing estimates upon which contractors could bid for the job.

The Superior & Southeastern Ry., J. E. Glover, President, New Richmond, Wis., has awarded a contract to Balch & Co., Minneapolis, Minn., for constructing a 5 mile extension of the main line. The line now extends 10 miles from Grandview, where the Willow River Lumber Co. is carrying on its logging operations, with several miles of branch lines

The Wisconsin Southern R. R. Co., which

was recently incorporated w[illegible] stock of $200,000, proposes to build [illegible] from Woodman, a junction of the St. Paul and Northwestern lines, 23 miles to the village of Bloomington, in Grant county. The promoter of this line is W. H. H. Cash of New Lisbon, Wis.

Wyoming.

Track laying has been started on the electric railway system at Sheridan, Wyo., and it is expected that the first section will be completed next month.

Canada.

Mackenzie & Mann, Toronto, Ont., owners of the Canadian Northern system, have acquired the charter for a railway from Prince Albert, Sask., to Nelson. This charter was granted at the last session of the Canadian Government.

The Portland Canal Short Line Ry. Co., a Mackenzie-Mann project, is to apply to legislative assembly of British Columbia at its next meeting for amendments to its charter. The legislation now sought is to authorize the company to extend its line from the terminus at present provided for (some 16 miles out of Stewart, B. C.), in a general easterly direction to the eastern boundary of the province at or near where the Peace River intersects the boundary, from which point it would naturally be extended under an Alberta charter to connect with the existing Canadian Northern services at Edmonton. A dominion charter will also be sought for this new road.

Vancouver parties are to apply for a charter for a company which proposes the construction of a scenic railway from North Vancouver to the top of Grouse Mountain. Three routes have been laid out and the cost of the road is estimated at $200,000 to $250,000. W. A. Macdonald of Cowan, Macdonald & Parkes, attorneys, Vancouver, B. C., represented the applicants for the charter.

The Lachine & Jacques Cartier Ry. Co., which, at a recent session of Parliament secured a charter for the construction of a line between Lachine, Que., and the eastern section of Montreal, has applied to the Public Utilities Commission for permission to lay tracks along Iberville St., Montreal, as well as to cross the present lines of the M. S. R.

At the coming session of the Canadian Parliament the following railway companies will apply for an extension of their charters: The Walkerton & Lucknow Ry. Co., the Guelph & Goderich Ry. Co. and the Ottawa Northern & Western Ry. Co.

The Manitoba & Northwestern Ry. Co. will apply to the Canadian Parliament for an extension of time for the construction of the following lines: From Yorkton to Prince Albert; from Russell to the northern or western boundary of Manitoba: from a point between Portage la Prairie and Arden to the northern or western boundary of Manitoba: from between Westbourne and Beautiful Plains to Lake Dauphin or Duck Mountains; from between Theodore and Isinger to township 32, range 18 or 19; from Bredenbury to Kamsack.

The Canadian Pacific Ry., according to a statement of William Whyte, Vice President, will probably not take up the building of the proposed Sedgewick-Strathcona cutoff on the Winnipeg line, which now joins the Calgary and Edmonton at Wetaskiwin until next year. This is one of the important branches to be constructed owing to its reducing the distance from Winnipeg to Strathcona on the C. P. R. to within twelve miles of the new connection of the Grand Trunk Pacific.

The Canadian Pacific Ry. is to apply at the next session of the Canadian Parliament for an extension of time for the construction of the following railways: From Lanigan to Prince Albert. From Wilkie northerly and westerly to the Lacombe branch. From Outlook to the Lacombe branch. From Estevan to Forward on the Weyburn branch. From a point in townships 6, 7, 8 or 9 westerly to Lethbridge. From Teulon to Marsh Point. Authority will also be asked by the Canadian Pacific to make the terminus of its Lauder branch at Weyburn and to increase its bonding power in respect to its Toronto-Sudbury branch.

The Kootenay & Arrowhead Ry. Co. is to apply to Parliament for an extension of time for the construction of a line from Gerrard and Arrowhead and by way of Vancouver and Lulu Island Ry. for its branch lines.

The South Ontario Pacific Ry. Co. will ask for authority from the Canadian Parliament to construct a line from Guelph Junction to Hamilton.

The Campbellton, Lake Ontario & Western Ry. will ask Parliament for authority to construct a line from a point on the line operated by the C. P. R. between Smith's Falls and Sharbot Lake to Cobourg.

The Monach Ry. Co., which projects a line to connect Toronto with Barrie, Collingwood and other towns, is seeking an entrance to Toronto by way of St. Claire Aye. Wm. H. Price, Toronto, is attorney for the company.

The Georgian Bay & Seaboard Ry. Co. is to ask authority from Parliament to connect with the Ontario & Quebec Ry. at a point between Burketon Junction and Havelock.

Good headway is being made by the Canadian Government in determining the final route of the proposed Hudson Bay Ry. from The Pas to Hudson Bay. Survey party No. 1, in charge of Engineer W. J. Clifford, has returned from its work on that section of the line known as the first section, located between The Pas and Landing Lake, a distance of about 200 miles. The two other survey parties in the field, in charge of Engineers F. P. Moffat and J. P. Gordon, are rushing the work in their respective sections as fast as possible and before another year has passed the government hopes to be in possession of enough detailed information to allow the commencement of construction on the railroad.

The Algoma Central-Hudson Bay Ry. Co. has offered for sale in Paris, France, stock to the value of $750,000. This company has head offices in Sault Ste. Marie, Ont., and a capital of $10,000,000, $500,000 of ordinary and $500,000 of preference shares, besides which an issue of $6,750,000 in debentures is authorized.

Assurances have been given that at the forthcoming session of Parliament an appropriation will be made for the commencement of the construction work on a new Welland Canal. The original idea was to enlarge the present canal from Port Colboune 10 miles and then construct a cutoff. Surveys, however, are said to have disclosed a dangerous bed of quicksand on the route of the cutoff, and an entirely new canal is now proposed. It would start about 6 miles west of Port Colborne and have its outlet at the mouth of the Jordan River, a distance of 22 miles.

The Canadian Pacific Ry. will apply at the coming session of the Canadian Parliament for parliamentary sanction for the construction of several branch lines in the west, including the following: From Boissevain, Man., to Lauder, Man.; from Lanigan, Sask., to Prince Albert, Sask.; from Outlook to a junction with the Lacombe branch of the Calgary & Edmonton Ry.; from Estevan, Man., to Forward, on the Weyburn branch.

The Canadian Northern Ry. is going ahead with its plans for its line from Toronto to Hamilton and it is probable that construction work may be started next year. Several route maps have been placed before the Board of Railroad Commissioners, the latest map being for a number of level crossings in the city limits of Toronto on the right of way Mackenzie & Mann have long held in the north end of the city, commencing at the head of Avenue road and proceeding in a generally westerly direction to Lambton and then southerly to the Grand Trunk lines across country.

The Grand Trunk Pacific Ry. is reported to be making arrangements to purchase the Brandon, Saskatchewan & Hudson Bay R. R. for use as a feeder for its main line.

The members of the Transcontinental Ry. Commission and C. M. Hays, President of the Grand Trunk Pacific Ry., recently spent some time in Quebec looking over the proposed site of the Transcontinental terminals and the available localities for the erection of work shops for wharf extensions.

Mexico.

George Webb is now working nearly 500 men and teams grading the Kansas City, Mexico & Orient 58 kilometers west of Bocoyna.

A corps of engineers of the National Railways of Mexico has arrived at Tampico for location work on the long talked of line from that place to Mexico City. It is announced on good authority that construction of this road will be started as soon as the locating work can be done and formal approval given it by the government. This line was started a few years ago by the Mexican Central Railroad and about 25 miles of track laid, but when that road passed into the hands of the National Railways of Mexico work was suspended. It is considered probable that the old survey will be adopted for the new line, as it was approved by the Mexican Central after many different lines had been run, all with the view of locating as short a route as possible and at the same time obtaining a feasible and low grade over the mountains. In order to reach the City of Mexico the road will have to mount from sea level to an altitude of more than 7,000 ft., within a distance of about 30 miles. This proposed line between Tampico and the City of Mexico is to be a link in the new through route from Brownsville, Tex., on the Rio Grande border. It is said that it has not yet been fully determined whether the proposed line between Brownsville and Tampico will be built by the Frisco or the National Railways of Mexico. The matter is to be considered at a conference in the City of Mexico between officials of the Frisco and the National Railways of Mexico.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

A drainage district has been organized in Lincoln County, Arkansas, which contemplates the reclamation of 4,000 acres of fertile land just south of Jefferson County. Engineers of Pine Bluff, Ark., will have charge of the work.

California.

A special election is to be held Nov. 18 at Sacramento to vote funds to raise the north levee to a height to correspond with the rest of the levees of the city.

Colorado.

The Mammoth Irrigation District, Charles B. Flynn, Secretary, Hartman, Colo., will on Oct. 29 receive bids for the purchase of $3,296,900 of bonds of the district.

Advices from Crawford state that Fred Hotchkiss, C. E., has completed surveys for a proposed reservoir site on the Smith Fork [illegible] of water and will furnish water for the Smith Fork country. The Clipper Ditch Co., who has been having this survey made, will [illegible] mine on the advisability of building this reservoir.

P. J. Jones, of Greeley, has filed a map and statements of Farmers' reservoir No. 5 with the county recorder. The proposed reservoir will [illegible]

Items marked thus ✣ indicate work now open for bids.

and is to cost $725,000. The water supply will be through the tunnel and ditches of the Greeley Poudre system, and the reservoir will have a capacity of 3,500,000,000 ft. The land to be irrigated lies north and east of Greeley.

Idaho.

✣Bids will be received until 9 a. m., Dec. 1, by Jesse E. Wilson, acting secretary, Department of Interior, U. S. Reclamation Service, Washington, D. C., for furnishing 234 lateral head gates for the Boise project, Idaho. Information can be obtained from U. S. Reclamation Service at Washington, D. C., or Boise, Idaho.

Indiana.

Harry N. Pharr, C. E., Memphis, Tenn., has started surveys for the Patoka-Wabash levee, which is to extend from a point near Dongola, north of Oakland City, to New Harmony, Ind. The length will be in the neighborhood of 80 miles, and the levee will protect about 125,000 acres of fine bottom land. The cost of building has been estimated at $2 per acre, or in the neighborhood of $250,000 for the entire levee. The plans provide for a dike on both sides of the Patoka river from Dongola to the point where it empties into the Wabash near East Mt. Carmel, thence down the Wabash to New Harmony. The levee was petitioned for by V. P. Bozeman of Poseyville, and other land owners in Posey and Gibson counties. The levee commissioners are Andrew G. Wheeler and Gerhard Sollman of Gibson county, James Hardison, Pike county, and Robert W. Highman, Posey county. Embree & Embree, of Princeton, Ind., are the attorneys.

Iowa.

✣Bids will be opened Oct. 28 at Burlington, Ia., for some additional ditch work to be done in Des Moines County Drainage District No. 1. The work includes about 7,800 cu. yds. of excavation in the "Yorkanut" drain, about 266,600 cu. yds. in Yellow Springs and Rocky Hollow drains, and approximately 6,300 cu. yds. in three other short drains. The system was designed by the Harman Engineering Co., Peoria, Ill., and that company will supervise the construction of the work.

M. J. Kelly, according to advices from Dubuque, has begun work on his contract for building the levee along the Missouri River, in Lewis township. His bid was 12 cts. per square yard for approximately 8,500 yds. in section 1, 17 cts. per yard for 17,000 yds. in section 2, and 15 cts. per yard for 8,500 yds. in section 3.

Kansas.

✣Bids are asked until noon, Oct. 28, by George Throckmorton, county clerk, Burlington, Kan., for the raising and strengthening of Johnson Levee No. 1, Coffey county, Kan. Work is to be commenced by Nov. 15, 1910, and completed by April 15, 1911.

Louisiana.

The taxpayers of the First Drainage District of the Eighth Ward, Lafayette, La., have voted a 5-mill special tax for 20 years for purposes of drainage. Bonds will be issued and the work begun immediately.

Mississippi.

The Drainage Commission of Bolivar county has awarded contracts for the construction of 52½ miles of drainage ditches. R. H. & G. A. McWilliams, 169 Jackson blvd., Chicago, Ill., secured contracts involving 587,000 cu. yds. of excavation, and N. C. McGinnis & Co., Bement, Ill., received contracts involving 376,000 cu. yds.

Missouri.

J. C. Carroll, Kansas City, has work well under way on his contract for building the Island Slough levee in Sugar Tree township. The levee will be about four miles in length and it is estimated that 60,000 cu. yds. of dirt will be moved, and that the work will be completed before the first of next year.

New York.

✣Buffalo Dredging Co., D. S. Morgan Bld'g., Buffalo, N. Y., will receive bids at once for the excavation and embankment, including 700,000 cu. yds., at Hinckley, N. Y.

D. C. Stephens, contractor for the Canaseraga creek improvement for the State Water Supply Commission, has sublet a portion of the dredging work under his contract to Forestall & Downey, of Milwaukee, Wis.

Ohio.

S. Van Bird, county surveyor, Springfield, Ohio,. has been making estimates of the cost of improving the Mad River channel in Mad River township.

Oregon.

✣Bids will be received until 2 p. m., Dec. 15, by Jesse E. Wilson, acting secretary, Department of the Interior, U. S. Reclamation Service, Washington, D. C., for the construction of the Los River diversion works, located from 6 to 10 miles southeast of Klamath Falls, Ore. The work consists in constructing a concrete diversion dam, culverts, bridge, etc., involving 5,500 cu. yds. of concrete and 40,000 cu. yds. of excavation and embankment. Particulars can be obtained at Washington, D. C., Portland, Ore., or Klamath Falls, Ore.

The Rogue River Valley Canal Co., of Medford, Ore., successors to the Fish Lake Water Co., has filed with the Government Land Office, at Lakeview, right of way maps for the reservoirs and canals in connection with the irrigation project at Fish and Four-Mile lakes. The lands involved are located in the vicinity of Odessa. The company proposes to enlarge the reservoirs located at Fish and Four-Mile lakes in order to meet increased demands for water.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

C. D. Smith, senior member of the firm of C. D. Smith & Co., left on the 22d for New York, where he will bid in the interest of his firm on another large sub-way contract which is to be let by the City of New York. When it comes to scientific bidding, Charlie Smith is there with the goods and it is expected that he will return to Memphis with his pocket bulging with another New York city contract. Pat Hannon is also interested with Charlie in the sub-way construction and the two together make a pair which is hard to beat.

Pat McCadden was in town last week from his Old Town, Ark., works and is enthusiastic over the great work which his forces are doing. Although a little under the weather from chills, Pat was not daunted in the least and returned to his contract on the Kate Adams last Monday.

Dresbach Brothers are making some fine progress on their Lambertsville, Ark., levee job for the United States Government. Both the boys are hustlers and they state they will score their usual success on the work in which they are at present engaged.

Capt. Clarke S. Smith of the United States Army engineering corps is back on the job again and is delighted with the way in which all his contracts are progressing. Capt. Smith is to be in Vicksburg on the 26th of this month, where he has to award about 200,000 cubic yards of levee work to the low man. There will be a number of Memphis contractors who will bid on the latter work, and it is supposed that the interest will be very keen in the letting.

M. J. Roach left last Friday to look over the work which Capt. Smith will let on the 26th. Mike will, of course, bid in the interest of Roach & Stansell and the other contractors will have to "go some" to beat Mike out when he sets his heart on a certain piece of work, for they say that Mike is one of the best in the business when it comes to close bidding.

J. H. Weatherford, the hustling young city engineer, is authority for the statement that work on Madison avenue, which is to be laid with concrete foundation and asphalt top, must begin not later than the first of November. H. P. Streicher has the contract and is making all preparations to comply with the wishes of the city engineer.

Harry Pharr, at one time the chief engineer of the St. Francis levee board, has been appointed chief engineer of a large levee district in southern Illinois. Harry states that his district has some very pretty work to offer to contractors and he is at present busy preparing plans and specifications for his work, which will be let within the very near future.

Owing to the lack of labor in Memphis and the fact that the labor agents here are just as willing to supply the planters as they are the contractors, some of the largest firms have determined to institute a labor agency of their own. That is, they will send out their own men in search of hands, and as this plan has been found to be most effective, it is expected that many will send their men into the country and induce the farm hands to come to the city and engage in the works contingent to Memphis.

Jack Rison of the Illniois Central has returned to Memphis after a most pleasant trip through the East. Jack says that just now he cannot tell when his road will have any work to let, but that the chances are favorable for a large amount to open up during the first of the season.

O. E. Gammill has just been awarded a contract for building a levee and ditch in Burleson County, Texas, and has already moved his outfit on the job. His headquarters are Bryan, Tex.

Texas.

✣Bids are asked until 1 p. m., Nov. 19 (change of date from Nov. 5) by the commissioners of Brazos County Improvement District No. 1, W. W. Loftin, Winnipeg, Allenfarm, Tex., for the construction of about four miles of levee and the completion of eight miles of partially constructed levee. This work will consist of 200,000 cu. yds. of earth embankment, 45 acres of sodding, 8 acres of clearing and grubbing, together with several drain ditches, small bridges and culverts. Bonds have been issued to the amount of $49,000, and the same have been approved by the Attorney General of the state of Texas. The successful bidder is to take the said bonds in payment for the work. T. R. Batte, Jr., 806 Stewart Bldg., Houston, Tex., is the engineer. This work was noted in our Oct. 12 issue.

The commissioners of Wharton county, Wharton, Tex., have ordered an election, November 10, to vote on issuing $350,000 of bonds for installing a drainage system in the vicinity of El Campo. Surveys have been made, and as there is much interest in the question, it is believed that the bond issue will be voted. It is proposed to open up Tres Palacios Creek 60 ft. wide, affording drainage for 125,000 acres.

The large levee along the Brazos River in Burleson county, opposite Bryan, is nearing completion, and will, in a short time, be finished up. It is 27 miles long and protects 50,000 acres of fertile land. O. E. Gammill, builder of the Bryan-College interurban, who subcontracted a part of the levee work, has finished his contract and his outfit has been shipped to Crowley, La., to engage in irrigation canal work.

The San Benito Land Co., S. A. Robertson, manager, San Benito, Tex., has purchased 5,000 acres of land east of San Benito. The canals of the San Benito Land & Water Co. will be at once extended at a cost of $100,000 to water this tract.

The commissioners court at Galveston has made provision for the issuance of $70,000 bonds to cover the work to be done in drainage district No. 1, which is known as the Dickinson district. These bonds take the place of the previous issue of $116,000.

Wisconsin.

✣The board of drainage commissioners, according to advices from Marinette, Wis., are calling for bids until Nov. 1, for completing a system of drainage ditches. Ralph Skidmore is commissioner.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

A contract has been awarded by the U. S. Engineer at Mobile, Ala., to Sidoine Krebs and T. C. Gatti, of Pascagoula, Miss., for 61 pontoons to be built for use of the dredge Pascagoula. The dimensions of the pontoons are to be 25 ft. 4 in. long, 4 ft. wide and 5 ft. deep. The contract price is $8,546.

The wharf committee of the city council of Mobile, Ala., has definitely decided on several river front improvements. They will consist of bulkheading the length of several city blocks, the driving of 45-ft. piling, and the laying of a new 10-ft. plank wharf over the entire distance. The entire city river front is to be filled to a level with the plank wharf.

The building committee of the Masonic home committee of Montgomery, Ala., has awarded the contract for the erection of the new home to the Interstate Construction Co. of Mobile, for the sum of $54,449, and has entered into a contingent contract with the same people to complete the two wings and the administration building at a total cost to the fraternity of $105,000.

Arizona.

The sum of $40,000 has been appropriated by the Santa Fe System to be used on the Arizona division, to provide riprapping between mile-posts 588 and 591.

California.

✣As previously noted in these columns, bids are being asked until noon, Oct. 27, by Brig.-Gen. Chas. E. L. B. Davis, U. S. agent, 726 Chronicle Bldg., San Francisco, for dredging in Oakland Harbor. The work consists in dredging the Oakland Harbor channel from the most westerly 30-ft. line of low water in San Francisco Bay to the Webster St. bridge, Oakland. The channel will be dredged to a depth of 30 ft. and width of 300 ft. over a length of 24,400 ft., involving a total yardage of approximately 1,289,200 cubic yards. The work is divided into two sections, section A and section B. Section A extends from San Francisco Bay to the Western Pacific Railway pier, 6,000 ft. in length. All excavation will be on the north side of existing channel. The estimated quantity of material is 182,000 cu. yds. Section B extends from the Western Pacific Railway pier to the Webster street bridge, 18,400 ft. in length. The material to be taken out is on the north side of the existing channel. The estimated quantity of material is 1,107,200 cu. yds. The material to be removed is believed to be hardpan and soft material.

Colorado.

James Stewart & Co., Denver, Colo., has been awarded the general contract for the construction of the Burns Theater at Colorado Springs. The building will be four stories high and cover a ground space of 180x120 ft. It will be of reinforced concrete, with the exterior of terra cotta and brick, and will be fireproof. It will cost about $230,000.

Connecticut.

The Breakwater Co., of Philadelphia and Cleveland, O., has been awarded a government contract for constructing the extension to the breakwater at New Haven, Conn., at $1,030,895. The company has also received the contract for an extension to the east breakwater at Cleveland, O., at over $600,000.

Delaware.

✣Bids will be received until noon, Nov. 15, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Mispillion River, Del.

District of Columbia.

✣Bids will be received until 10:30 a. m., Nov. 14, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 611, Electrical material, including fittings, fixtures, insulating material, line material, hardware, tools, rubber gloves, wire, electric and steel cable, etc.

✣Bids will be received until 10:30 a. m., Oct. 31, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing two concrete handling outfits.

Hawaii.

✣Bids will be received until 11 a. m., Nov. 2, by Maj. E. Eveleth Winslow, U. S. Engineer, Honolulu, T. H., for dredging in Honolulu Harbor, T. H.

Illinois.

✣Bids will be received until 2 p. m., Nov. 11, by Commissioners of Eldred Drainage & Levee District, Carrollton, Ill., for brick building for pumping plant. Harman Engineering Co., Peoria, Ill., Engineers.

✣Bids will be received until 3 p. m., Nov. 23, by James Knox Taylor, Supervising Architect Treasury Department, Washington, D. C., for the extension, etc., except elevator, including plumbing, gas piping, heating apparatus, electric conduits and wiring system of the United States Post Office at Rock Island, Ill.

The cities of Sterling and Rock Falls passed resolutions favoring the establishment of public docks along Rock River front. Similar resolutions are to be introduced in the councils of all cities along Rock River from Sterling to Janesville, Wis.

Indiana.

✣Bids will be received until 10 a. m., Oct. 29, by Depot Quartermaster, Jeffersonville, Ind., for furnishing miscellaneous quartermaster's supplies.

✣Bids will be received until 10 a. m., Nov. 10, by the Depot Quartermaster, Jeffersonville, Ind., for furnishing under Schedule No. 567 miscellaneous supplies.

Kentucky.

The board of public safety of Louisville, Ky., has awarded a contract to the James Clark, Jr., Co., for an underground fire alarm system. The contract is for $26,971.

Louisiana.

✣Bids will be received until 11 a. m., Nov. 5, by R. R. Ralston, Capt. U. S. Engineer, 333 St. Charles Ave., New Orleans, La., for furnishing about 13,000 tons of rock for New Orleans Harbor.

✣Bids will be received until 11 a. m., Nov. 14, by Lieut. Col. George B. Davis, Constructing Quartermaster, 416 Hibernia Bldg., New Orleans, La., for the construction of brick wall furnishing new iron gates, etc., at Chalmette, La., National Cemetery.

All bids received Sept. 9 by Lt. Col. Lansing H. Beach, U. S. Engineers, New Orleans, La., for building lock and dam and lock keeper's dwelling on Bayou Teche, La., were rejected, and the work will be done by hired labor. At the opening of bids on Sept. 9, the following bids were received: General Contract Co., New Orleans, La., solid wall, $205,878, reinforced wall, $190,110; Richard M. Murphy, New Orleans, La., solid wall, $221,968, reinforced wall, $210,358. The approximate quantities for this work on which bids were asked were as follows: Reinforced concrete incl. steel (lock walls) (alternative bid) 580 cu. yds.; excavation, 40,000 cu. yds.; foundation piles, 48,260 lin. ft.; guide piles, creosoted, 6,100 lin. ft.; sheet piles, wooden, 166,250 ft. B. M.; sheet piles, steel (alternative bid) 18,475 sq. ft.; back filling and embankment, 7,469 cu. yds.; concrete, 8,480 cu. yds.; concrete, reinforced incl. steel (wing walls) 138 cu. yds.; reinforced concrete incl. steel (abutment—alternative bid) 191 cu. yds.; valves, cylindrical, No. 4; structural steel, 14,510 lbs.; steel reinforcement (lock floor) 60,000 lbs.; bolts and special irons, 20,702 lbs.; cast iron, 41,750 lbs.; timber in permanent construction, 132,490 ft. B. M.; timber, creosoted, 96,389 ft. B. M.; timber in gates, 36,254 ft. B. M.; timber shoring, 10,000 ft. B. M.; riprap filling, 2,614 cu. yds.; bank protection, riprap, 500 sq. yds.; gage tile (4 gages) 76 lin. ft.; mattress protection, 2,011 sq. yds.; lockkeeper's dwelling, complete, No. 1; tile drain, 350 lin. ft.; walks and concrete paving, 90 sq. yds.; capstans, No. 2; bank protection, concrete (alternative bid) 500 sq. yds.

Maryland.

✣Bids will be received until 11 a. m., Nov. 12, by Beekman Winthrop, Acting Secretary, Navy Department, Washington, D. C., for completing power plant at the United States Naval Academy, Annapolis, Md.

✣Bids will be received until 11 a. m., Nov. 12, by Beekman Winthrop, Acting Secretary, United States Navy Department, Washington, D. C., for constructing a wooden pier at the U. S. Naval Academy, Annapolis, Md.

The following bids were received Oct. 18 at the U. S. Engineer's Office, Baltimore, Md., for excavating 400,000 cu. yds. in the Cut-Off channel leading to Baltimore, for which an appropriation of $75,000 was made in the River and Harbor bill by the last Congress. The Maryland Dredging & Contracting Co. bid 15 cts. per cu. yd.; Coastwise Dredging Co., 16 2-10 cts.; P. Sanford Ross, 16 7-10 cts.; Sanford & Brooks, 16½ cts.

Massachusetts.

✣Bids will be received until noon, Nov. 17, by Col. F. V. Abbot, U. S. Engineer, Boston, Mass., for riprap stone in dike on House Point Island Flats and in breakwater at Long Point, Provincetown Harbor, Mass.

Michigan.

✣Bids are asked until 3 p. m., Nov. 10, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for constructing a rubble mound breakwater at Mission Point, Mackinac Island, Mich. The work to be done consists in building the rubble mound foundation of a breakwater at Mission Point, Mackinac Island, Mich., and furnishing all necessary plant, labor and supplies for the work. The estimated amount of riprap required is about 18,000 tons. The depth of water along the line of the proposed breakwater ranges from 5 to 21 ft.

New Jersey.

✣Bids are asked until 3 p. m., Nov. 9, by R. D. Argue, Secretary Board of Education, Newark, N. J., for the construction complete of the Montgomery School, to be completed Aug. 15, 1911. Bids may be for one or more items: Masonry, steel and iron, carpentry, roofing and sheet metal, painting, plumbing, electrical heating and ventilating, lighting fixtures and vacuum cleaning.

✣Bids will be received until noon, Nov. 17, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Racoon Creek, New Jersey.

✣Bids will be received until noon, Nov. 22, by Col. W. T. Russell, U. S. Engineer, 802 Army Bldg., New York City, for dredging in Keyport Harbor, Matawan Creek, Raritan and South Rivers, Shoal Harbor and Compton Creek and Cheesequake Creek, N. J.

✣Bids are asked until noon, Nov. 8 (instead of Nov. 9, as noted in our last issue) by Maj. R. R. Raymond, U. S. Engineer, for dredging Tuckerton Creek and Toms River, N. J. The material to be removed is believed to be sand and mud. For the Tuckerton Creek work, the sum of $10,800 is available; for the Toms River work, $9,000 is available.

New York.

✣Bids are asked until noon, Nov. 1, by the

Items marked thus ✣ indicate work now open for bids.

State Armory Commission, F. A. McNeely, Secretary, Albany, N. Y., for repairs, improvements and betterments to Troop B. armory, Albany, N. Y., consisting of mason work, carpenter work, painting, etc.

✤Bids are asked until 3 p. m., Nov. 7, by the Board of Control and Supply, Isidore Wachsman, Secretary, Albany, N. Y., for furnishing all materials and labor necessary for the entire work of erecting and completing a new police station house on the west side of North Pearl St., between Wilson St. and Livingston Ave. in the city of Albany.

✤Bids will be received until 2 p. m., Nov. 2, by Capt. M. G. Spinks, U. S. Constructing Quartermaster, Fort Totten, N. Y., for furnishing and installing 24 storm sash and 3 storm vestibules on north side and east end of two double non commissioned officer's quarters, Nos. 158-159 and 164-165 at Fort Totten, N. Y.

✤Bids will be received until 3 p. m., Dec. 1, instead of Nov. 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction of the new post office building at New York City.

✤Bids will be received until 3 p. m., Dec. 1, instead of Nov. 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the electric elevator equipment in the new Post Office building at New York, N. Y.

✤Bids will be received by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., until 3 p. m., Dec. 1, instead of Nov. 3, for the pneumatic door operating system in the New York City Post Office.

✤Bids will be received until 3 p. m., Dec. 1, instead of Nov. 3, by James Knox Taylor, Supervising Architect Treasury Department, Washington, D. C., for the heating and ventilating system in the New York Post Office, New York City.

The harbor commissioners of Niagara Falls, N. Y., have prepared plans for a city dock to cost about $33,000.

North Carolina.

✤Bids will be received until noon, Nov. 12, by Capt. Earl I. Brown, U. S. Engineer, Wilmington, N. C., for dredging in Smith Creek, Harbor at Morehead City and harbor at Beaufort, N. C.

Bids were opened Oct. 14, at the U. S. Engineer's Office, Wilmington, N. C., for dredging approximately 1,810,000 cu. yds. of earth as a part of the Government's project for an ultimate depth of 30 ft. of water on the Cape Fear bar and river, the lowest bidder being the Bowers Southern Dredging Co., of Galveston, Tex., at 7.95 cts. per yard.

Ohio.

✤Bids will be received until noon, Nov. 3, by Board of Trustees, Girls' Industrial Home, Columbus, O., for the construction of a brick laundry building. S. D. Webb is Secretary.

Bids are asked until 11 a. m., Nov. 16, by John T. Goldenbagen, Clerk County Commissioners, Court House, Cleveland, O., for labor and material necessary for the elimination of the grade crossing of the Penna. and W. & L. E. R. R., Dunham Road, in Bedford Township, by the construction of an overhead bridge across the said railroads on Dunham Road between Granger Road and Bedford Road. Certified check for $1,000 required with bid.

✤The City Hall Commission of Cleveland, O., is now calling for bids for the first work in connection with the construction of the new city hall. The first contract, for which bids will be opened Nov. 3, calls for the drainage work. Bids for the excavation and foundation work will be opened about Nov. 10. A. B. Lea is Director of Public Service of Cleveland, O.

✤Bids will be received until 10 a. m., Oct. 27, by F. C. Gerlach, Secy. Board of Trustees, Boys' Industrial School, for furnishing the necessary labor and material for the light, heat and power plant of the Boys' Industrial School at Lancaster, O.

✤Bids will be received until noon, Oct. 26, by Director of Public Service, City Hall, Cleveland, O., for wrecking and removing buildings on the proposed city hall site.

✤Bids will be received until 2 p. m., Nov. 19, by Lieut. Col. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging Newport Harbor, Rhode Island.

Pennsylvania.

The Scofield Engineering Co., Philadelphia, has been retained to draw plans and specifications, also supervise the construction of a three story and basement warehouse, to be built at Hazleton, Pa., by the Lattimer Supply and Machinery Co. of Lattimer Mines, Pa.

The Scofield Engineering Co., Philadelphia, has been retained by the Peoples Saving and Trust Co., Hazleton, Pa., to draw plans and specifications, also supervise the construction, of a three story and basement warehouse, which is to be constructed in Hazleton. Work will begin immediately.

Texas.

✤Bids will be received until 11 a. m., Nov. 17, by P. W. Guiney, Constructing Quartermaster Fort Sam Houston, Tex., for the construction of about 7,000 ft. of woven wire fence, with gates, etc.

The following bids were received Oct. 10, by the city commissioners of Dallas, Tex., for the completion of the White Rock reservoir timber clearing. Newcum & Wiley bid $19 per acre for clearing; H. A. Wisdom & Co., $19.75; E. R. Merrill, $13.50; United States Bonding & Guaranty Co., $21.

Virginia.

✤Bids are asked until 11 a. m., Dec. 3, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for coal and ash handling apparatus for the central power station at the United States navy yard, Norfolk, Va.

✤Bids will be received until 1:30 p. m., November 15, by John T. Hume, treasurer, Southern Branch, N. H. D. V. S. National Soldiers' Home, Va., for furnishing the necessary labor and material for the installation of an electric elevator in the quartermaster's store house.

Washington.

Plans have been prepared by City Engineer W. C. Raleigh, of Tacoma, Wash., for remodeling the Alaska-Pacific dock with a view to converting it into a temporary municipal dock if bonds proposed for this project are authorized by the people at the election, Oct. 29. If the money for the purchase of the property is forthcoming, immediate construction work will be begun, it is announced, and the dock placed in readiness for use within a very short time.

Wisconsin.

✤Bids will be received until noon, Nov. 23, by Lt. Col. G. D. Fitch, U. S. Engineer, Duluth, Minn., for building rubble mound breakwater at Superior Entry, Wis. Official advertisement will be found elsewhere in this issue.

✤Bids will be received until 10:30 a. m., Nov. 18, by Department of Public Works, Milwaukee, Wis., for the necessary labor and material for constructing and erecting a fire engine house at the southeast corner of Broadway and Martin St. in the 7th Ward, Milwaukee, Wis. H. E. Briggs is Commissioner of Public Works.

✤State Board of Control, Madison, Wis., will receive bids at once for one 700-gal. high lift turbine pump and one 100-h.p. steam engine. Certified check for $200 is required. M. J. Tappins is Secretary of the Board. W. G. Kirchoffer is Engineer.

Wyoming.

✤Bids will be received until 9:30 a. m., Oct. 28, by Capt. F. S. Armstrong, Quartermaster, Room 3, Keefe Hall, Cheyenne, Wyo., for the construction of a steam heating plant in subsistence storehouse No. 65 A., Fort D. A. Russell, Wyo.

Canada.

✤Bids will be received until 4 p. m., Nov. 8, by R. C. Des Rochers, Secy. Department Public Works, Ottawa, Ont., for the construction of a wharf and stone approach at Gravenhurst, Muskoka Township, District of Muskoka, Ont.

✤Bids will be received until 4 p. m., Nov. 2, by R. C. Des Rochers, Secretary Department of Public Works, Ottawa, Ont., for the construction of an armory at High River, Alta. Plans and specifications can be obtained at the office of W. Somerton, High River, Alta, or J. J. O'Gara, Esq., Calgary, Alta.

✤Bids will be received until noon, Nov. 8, by P. E. Ryan, Secy. Commissioners of Transcontinental Ry., Ottawa, Ont., for the construction, etc., of freight sheds and storehouses at Lake Superior Junction, Ont., Redditt, Man., and Springfield, Man., the freight sheds to be completed on or before March 1 and the storehouses on or before June 1, 1911.

✤Bids will be received until 4 p. m., Nov. 15, by R. C. Des Rochers, Secy. Department of Public Works, Ottawa, Ont., for the excavation of a part of a channel above the completed sluices of the Temiskaming dam on the west or Ontarion side of the Ottawa River. Plans, specification and form of tender can be seen and forms of tender obtained at this department, at the offices of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto; J. L. Michaud, Esq., District Engineer, Merchants Bank Bldg., St. James St., Montreal, and on application to the Postmaster at Temiskaming, Que.

✤Bids will be received until 11 a. m., Nov. 2, by the chairman of the Board of Control, Winnipeg, Man., for supply of 25,000 carbons for series alternating inclosed arc lamps. M. Peterson is secretary.

✤Bids will be received until noon, Nov. 7, by W. D. Spence, City Clerk, Calgary, Ont., for supplying to the city of Calgary rails, cars, equipment and overhead material for extensions to the municipal street railway.

✤Bids will be received until 4 p. m., Nov. 8, by R. C. Des Rochers, secretary, Department of Public Works, Ottawa, Ont., for the construction of a wharf and stone approach at Gravenhurst, township of Muskoka, district of Muskoka, Ont.

The contract for a $70,000 police station and court house at Fort William, Ont., has been let to M. H. Braden of that city. Work will commence at once, and is to be completed by April 1.

The committee on works of the city council of Toronto, Ont., has adopted a recommendation to engage the services of Rudolph Hering of New York at a fee of $3,000 to advise the corporation relative to the whole question of garbage disposal and destruction.

BRIDGES — STEEL AND CONCRETE

Arkansas.

The Legislature has instructed the St. Louis, Iron Mountain & Southern, a subsidiary line of the Missouri Pacific Ry., to build a viaduct over Seventh St., Argenta, Ark.

Advices from Paragould, Ark., state that arrangements have been made by the county judge of Green county, Ark., to begin at once the repair of the bridges damaged by recent floods. It is estimated that the damage amounts to about $8,000.

California.

Reports from Salinas, Cal., state that the board of supervisors have been presented with plans and specifications for the construction of the proposed new road and a bridge to span the Pajaro River near Aromas. L. G. Hare is county surveyor.

It has been announced at San Francisco, Cal., by the engineering department of the Southern Pacific Ry. that plans have been perfected by the Sacramento Southern R. R. for the construction of a bridge over the San Joaquin river at Antioch.

Plans have been completed by City Engineer Van Ornum, Pasadena, Cal., for the construction of a new bridge to be built at the intersection of Fair Oaks Ave. and Columbia St., to replace the old structure. An agreement will be made between the Santa Fe and Salt Lake roads and South Pasadena.

Plans have been prepared by the city engineer of San Diego, Cal., for the construction of the proposed suspended foot bridge over the Spruce St. canyon between Brant and Front Sts. The structure will be 400 ft. in length, swinging 70 ft. clear of the ground from steel towers on concrete foundations. Property owners will bear the expense which will amount to $4,000.

Officials of the San Diego & Arizona Ry. have awarded Charles W. Coberly, Los Angeles, Cal., the contracts for the construction of two steel bridges over the Tia Juana river and Mantanuco creek. The contract calls for the completion of the structures by December 1.

Colorado.

The Santa Fe System has decided to build a new 132 ft. heavy truss bridge to cost approximately $21,500, to replace the old bridge now standing and known as No. 158, Colorado Division.

Indiana.

Information reported from Michigan City, Ind., states that the contract for the construction of the New Dunham township bridge has been awarded to Rochester Bridge Co., at $997 for superstructure, and William Steigley at $997 for the substructure.

County commissioners, according to advices from Newport, Ind., have awarded the contracts for the construction of the Dry Branch bridge in Eugene township, and Dead Man's Hollow bridge in Eugene township, to S. B. Royse, Highland township, and J. O. Wright of Clinton, at $555 and $442, respectively.

County commissioners, Indianapolis, Ind., have awarded the contract for the construction of the bridge spanning Fall creek on the county line to John M. Scott, for $4,844.

The county commissioners, Newcastle, Ind., have awarded the contract for the construction of the W. D. Pierce bridge in Liberty township to the Pan-American Bridge Co., at $1,425.

Board of county commissioners, Evansville, Ind., has awarded the following contracts for the repair of the county bridges: Rebuilding the Fulton Ave. bridge, J. W. Bedford, $1,525; for new girders and a floor on the First Ave. bridge, Taylor & Kremp, Jasper, Ind., $2,600; for the construction of a new bridge to replace the Farquhar bridge, Taylor & Kemp, $1,400.

Illinois.

Advices from Fulton, Ill., state that the highway commissioners have awarded the contract for the construction of the bridge on Lunt St. to Union Iron Works, Clinton, Ia., at $1,865.

Advices from Highland Park, Ill., state that the contract for the construction of the proposed Cook Lake County line bridge has been awarded to Jay Rossiter, Chicago, Ill., at $3,980.

Commissioners at Avon, Ill., have awarded the contract for the construction of the 20-ft. steel bridge to the Wieger Construction Co., Bushnell, Ill., at $535. The structure will have concrete backing and a wood floor.

The Paris Bridge Co., Paris, Ill., has been awarded the contract for the construction of the proposed bridge over the Hanks ford, at $3,929.

Commissioners of Livingston county at Pontiac, Ill., have awarded the contract for the construction of a bridge over Pike creek, in Pike township, to the Continental Bridge Co., at $1,289.

Iowa.

City council of Cedar Rapids, Ia., is to take up the preliminary matters concerning the construction of the proposed new bridge at Third Ave. at once. It is believed that the financing of the project can be arranged with the Cedar Rapids Clearing House Association.

City council of Des Moines, Ia., has authorized City Engineer George Dobson to prepare plans and specifications for the placing of the bridge at First St. and Seventh St. over the Racoon River, at North St. over the Des Moines river.

Kansas.

The board of county commissioners, Junction City, Kan., has awarded the contract for the construction of the bridge over Goose creek to the Topeka Bridge & Iron Co., at $2,450. The structure will be a reinforced concrete arch with 45 ft. span.

A committee has been appointed by the residents of Riverside park, Wichita, Kan., to determine what can be done toward building a bridge across Little river at the head of Bitting Ave.

A report is now being prepared by H. C. Perkins, Leavenworth county surveyor, Leavenworth, Kan., of the bridges throughout that district in need of repairs. It is estimated that the work will require $25,000 for three years.

Kentucky.

Advices from Bowling Green, Ky., state that the fiscal court voted to build a new bridge over Drakes creek at Simmons ford. The new structure, according to the plans proposed, will cost in the neighborhood of $4,500. Bids for the work will be advertised later.

It is said that a contract has been let by the fiscal court of Hancock county, Ky., for the construction of a $3,000 bridge over Lead creek in the lower end of Hawesville.

Louisiana.

Contract is to be let at the next session of the board of supervisors, New Orleans, La., for the construction of the proposed bridge known as Hickman bridge over Red creek on the Bond and Poplarville roads. Plans and specifications are now on file at the office of the clerk.

Michigan.

County commissioners, Detroit, Mich., have rejected all bids received Oct. 8, for the construction of the proposed new 14th Ave. bridge, as all figures exceeded the appropriation of $26,500. The work will be readvertised.

Minnesota.

Bids will be received until 10 a. m., Nov. 14, by A. H. Freeman, County Auditor, St. Peter, Minn., for the reconstruction of a ditch No. 30, including approximately 18111 yds. of excavation.

✣Bids will be received until Oct. 31, by W. H. Bishop, Supt. Red Lake Training School, Red Lake, for the construction of a steel bridge across the Clearwater River, in Clearwater County, Minn.

Missouri.

Reports from Springfield, Mo., state that the mayor has recommended the sale of a portion of a city lot to provide funds for the construction of the concrete bridge over Jordan creek on Boonville St. The cost of the structure is estimated at $5,000, and of this amount, the Springfield Traction Co., according to terms of franchise, must pay $1,500.

Plans and estimates have been received by board of public works, St. Joseph, Mo., from the Consolidated Engineering Co., Omaha, Neb., for the construction of the proposed viaducts and subways in South Sixth St.

Montana.

County commissioners are contemplating the construction of a new bridge over the Missoula river at Nine-Mile, and recently took a trip from Missoula, Mont., to that place for the purpose of investigating the feasibility of such a project.

Advices from Hamilton, Mont., state that when bids for the construction of the bridge across the Bitter Root river at Stevensville were opened by the county commissioners recently, it was found that the lowest bid was $12,000. As it is unlawful to appropriate more than $10,000 for one purpose without submitting the proposition to the citizens for vote, and the time required for such action would mean a great delay, it has been decided to ask the residents in the vicinity of the structure who would be most benefited, to subscribe the $2,000.

Nebraska.

According to statements made at Central City, Nebr., funds for the construction of the new bridge across the Platte river at Havens, will be raised by individual subscriptions, and work will be started soon.

New Jersey.

✣Bids will be received until 2:30 p. m., October 28, by Board of Chosen Freeholders at the Hotel in the village of Layton, Sussex County, N. J., for the necessary labor and material for the construction of an iron bridge in Layton. John J. Van Sickle is Chairman of the Board.

Board of freeholders, Trenton, N. J., has adopted resolution directing the county supervisor to proceed with the work of repairing a number of roads and to expend the following amounts: Edinburg-Windsor, $2,500; Pennington-Hopewell, $949.56; River road, $502.66; Edinburg-Dutch Neck, $499; White Horse road, from Liberty street to Cedar lane, $140.80; Brunswick pike, from Spruce street to Harney's Corner, $72; Mercerville-Edinburg, $8,000.

County freeholders of Cape May county, Cape May C. H., N. J., have instructed the engineer to prepare plans for the construction of the proposed new drawbridge over Grassy Sound channel, at Holly Beach.

A resolution was recently passed by the freeholders of Cape May county, authorizing the director of the board to confer with the director of the board of chosen freeholders, Atlantic county, N. J., for the purpose of arranging a joint meeting to take action toward the construction of the proposed bridge over Great Egg Harbor Bay, between Beesleys Point and Somers Point.

The board of freeholders, Trenton, N. J., has appointed a special committee to take up the matter of constructing a new bridge over the water power at Riverdrive Ave.

New York.

✣Bids will be received until 2 p. m., October 27, by Kingley L. Martin, Commissioner of Bridges, Borough of Manhattan, New York City, for the construction of the toll houses, police shelters electrical work, etc., for the Queensboro bridge over the East River between the Boroughs of Manhattan and Queens.

Advices from Albany, N. Y., state that State Engineer Williams has approved plans for the erection of a concrete bridge on the Burdick road, leading northerly from Higginsville, Oneida county, to be known as the Burdick bridge over the Barge canal, on Contract 4.

Bids were opened at Watertown, N. Y., by H. S. Ball, county superintendent of highways, October 11, for the erection of a drawbridge at Chaumont over Chaumont creek. Three bids were received as follows: Seberzer Lift Bridge Co., Chicago, 50 ft. space $7,490; 70-ft. space, $11,300. Chicago Bridge & Iron Co., 50-ft. space $8,200; 70-ft. space, $12,300. Pennsylvania Bridge Co., 50 ft. space $8,789; 70-ft. space, $12,789. The contract for the 50-ft. bridge was let to the Seberzer Lift Bridge Co., of Chicago, for $7,490.

State highway commission has notified Town Superintendent William Cress, Herki-

Items marked thus ✣ indicate work now open for bids.

mer, N. Y., and Supervisor Fred W. Sauer, that the dry bridge between that village and West Canada creek on the Herkimer-Little Falls road, is unsafe, and county engineer will order the structure replaced by a new one. The town will be compelled to stand the expense.

Ohio.

✣Bids are asked until 11 a. m., Oct. 28, by James R. Marker, chief engineer, state board of public works, Columbus, O., for the construction of a culvert under the Miami & Erie canal at Crawford's run, in the city of Hamilton, O.; also for the construction of a concrete revetment wall adjacent to Crane Island in Buckeye lake, in Licking county, Ohio.

Citizens of North Dayton, O., have been urging for some time the construction of a bridge of concrete and steel across the Mad river at Keowee St., and a delegation recently called upon director of service, but nothing definite resulted, although plans for such a structure were informally considered.

The Northeast Civic League, Toledo, O., has been organized and will urge Paine Ave. as the proper site for the bridge when it is removed from Cherry St. The league's reason for such a move is that Paine Ave. is located more centrally in the Birmingham district, and will better accommodate the residents of Birmingham and Ironville.

The contract for the construction of the Bixby bridge across the Arkansas river, has been let to the Canton Bridge Co., Canton, O., for $68.970. As planned, the structure will be 2,200 ft. long. Other bidders for the work were as follows: The Kansas City Bridge Company, $71.000; Vincennes Bridge Company, Vincennes, Ind., $72.650; Missouri Valley Bridge Company, $73,885; Illinois Steel Company, $71.988; Central States Bridge Company, $75.000; the Monarch Engineering Company, $77,000; Diline Construction Company, $69.990

Board of county commissioners, Urbana, O., have received plans for the construction of the proposed bridge over the traction line on the Hickory Grove road south of the infirmary, prepared by the Ohio Electric Company. No action toward the approval of the same has been taken by the board as yet.

Oregon.

Residents of South Portland, Portland, Ore., are advocating the construction of a high bridge over the Willamette river at Meade St. The structure as proposed at Meade St. on the west side, and Ellsworth St. on the east side, would have a clearance of more than 140 ft. above low water mark.

Pennsylvania.

✣Bids are asked by D. F. Lebo, clerk county commissioners, Harrisburg, Pa., until noon, Oct. 29, for the repair of abutments and piers and girders for the approach to bridge over Swatara creek near Hummelstown. Plans and specifications are on file in the office of the county commissioners.

✣Bids will be received at the office of John D. Hitchman, Controller, Pleasant, Pa., until 11 a. m., October 27, for the construction of a reinforced concrete bridge spanning Indian Creek.

✣Board of County Comissioners, Williamsport, Pa., will receive bids until noon, Oct. 27, for the construction of a steel girder bridge over Bear Creek at that place.

Advices from Northampton Heights, Pa., state that plans have been completed for the construction of the proposed new bridge connecting Northampton Heights and Bethlehem, Pa.

The Toledo-Massillon Bridge Co has been awarded the contract for the construction of a three-arch stone bridge over the Perkiomen creek near Schwenkville, Pa., at $6.10 per cu. yd.

City Engineer of Harrisburg, Pa., will take up the matter with the Reading Railway officials of constructing the proposed bridge at Thirteenth St., for which the city voted an appropriation of $25,000. It is thought a center pier will be constructed dividing the proposed structure in two spans, thus lessening the cost involved by the cost of a wide span. The railway will also pay $25,000 toward the work.

Texas.

Advices from Brady, Tex., state that at the special election recently held, four bridges were voted on and all carried—one across the Colorado at Stacy, another at Waldrip, one across the San Saba at Voca, and one in Brady across Brady creek. An aggregate cost of $42,000 is called for.

Contract has been let by C. W. Kimball, county judge, Texarkana, Tex., for the construction of a steel bridge over McKinney's Bayou near Mandeville to Austin Bros., Dallas, Tex., at $2,200; and for a wooden bridge over Day's creek to W. A. McColm of Texarkana, at $515.

The county commissioners court; Beaumont, Tex., has finally closed an agreement with the Gulf Refining Co., of Port Arthur, whereby the refining company is granted a permit to remove the steel bridge over Taylor's Bayou a mile and a quarter up stream to make possible the dredging of a turning basin in that stream. It is conditioned that the structure be replaced and practically reconstructed and rehabilitated, upon which work the county will appropriate $5,000.

Virginia.

Board of Aldermen, Richmond, Va., have authorized the committee on streets to receive competitive designs for the construction of the proposed reinforced concrete bridge across the James river on the site of Mayo's bridge to cost with approaches $350,000. The structure will be 60 ft. wide.

✣Bids will be received by City Clerk, Independence, Va., until 1 p. m., Oct. 27, for the construction of a bridge over Elk Creek. W. A. Childrey & Co., Engineers.

Wisconsin.

City Engineer Poetsch has recommended the construction of a new structure to replace the old Buffalo St. bridge in Milwaukee, Wis., in preference to the new one proposed at Oneida St.

Canada.

✣Bids will be received until noon, Nov. 7, by W. D. Spence, City Clerk, Calgary, for the erection of steel bridges, one across the Elbow River at Second St. east.

Advices from Ottawa, Can., state that the street railway extension committee will hold a meeting to take up the matter of constructing the proposed elevated bridge over the canal at Bank St. The structure will be of concrete, 40 ft. wide, having a 76-ft. main span 32 ft. above the water.

At a conference held at Belleville, Oct. 17, by railway committee of the city council and representatives of the Canadian Northern Ry. and the harbor commissioners, it was decided to allow the Government railway commissioners to assume the whole responsibility connected with the placing of piers in the Moira river for the Canadian Northern Railway bridge at Belleville, Ont.

Mexico.

Advices from Tampico, Mex., state that soundings are being taken in the Panuco river to ascertain the advisability of constructing a government bridge to span the Panuco river near the station of Tamos.

ROADS, STREETS AND PAVEMENTS

Arkansas.

Engineer has reported the estimated cost of construction of the proposed road by Road District No. 3 on the Sulphur Springs and Camden Roads at $46,000. Bids for the work will be received at Hot Springs, Ark., in the near future.

California.

At a recent meeting at the University Farm Schools, George W. Pierce, Davis, Cal., spoke concerning the necessity of constructing a road between Sacramento and Davis, a distance of 13 miles across the Yolo Basin.

A survey has been completed by S. J. Norris, for the proposed wagon road between Oroville and Downieville, Cal., and submitted to the Chamber of Commerce of the former city. It is thought that the County Supervisors can be prevailed upon to call an election for a bonds issue to provide funds for the work.

Delaware.

✣Bids are asked until noon, Nov. 1, by Francis A. Price, New Castle County State Highway Commissioner, Wilmington, Del., for building a macadam road on what is known as the Paper Mill Road leading from the town of Newark toward the Curtis Mills, a distance of 0.134 mile.

Florida.

The County Commissioners at St. Augustine, Fla., have awarded a contract to H. Lowe for clearing, grading and ditching for the Ellston Road.

Georgia.

A resolution has been passed by the City Council of Atlanta, Ga., by the request of the Copenhill Improvement Club, providing for the construction of pavement on Highland Ave., from the Southern R. R. Crossing to the city limits

Illinois.

Board of Trustees and the Board of Local Improvements, Evanston, Ill., have awarded the contract for the improvement of the Green Bay Road to Fred Ebert, Glencoe, Ill., at $3,123.

Bids were opened Oct. 18, 1910, by B. J. Mullaney, Commissioner of Public Works, City of Chicago, for furnishing and delivering granite screenings. The Wisconsin Granite Co., 138 Washington St., Chicago, were low bidders at $2.23 and $2.27 per cu. yd. f. o. b. cars team track L. S. & M. S. R. R. and I. C. R. R. They have been awarded the contract.

Thos. D. Jay & Co., Chicago, Ill., was awarded the contract for constructing the concrete driveways and sidewalks in front of the city property at Ashland Ave., S. of 22nd St., by B. J. Mullaney, Commissioner of Public works. City of Chicago. The bid was $1,109.60.

City of Peoria, Ill., has awarded the contract for paving Adams St. from Hamilton to Bridge with creosote wood block, to Brewster & Evans at $34,491. An entirely new concrete foundation is to be laid, 6-in. depth and the block to be set in 2-in. sand cushion. By the terms of the contract the work is to be completed before January 1.

Iowa.

City Council of Davenport, Ia., has been petitioned to grade Carey Ave., between Locust St. and High St. The matter was referred to the Street Committee and the Board of Public Works. Another petition was filed and referred to the Paving Committee and Board of Public Works providing for the construction of brick pavement on 8th St. east of Farnam St.

A meeting was recently held at Creston, Ia., at which uniform plans were discussed for

Items marked thus ✣ indicate work now open for bids.

the construction of the Blue Grass road across the state from Council Bluffs to Burlington passing through Ottumwa.

Plans are under consideration at Carroll, Ia., for the construction of considerable street paving work next year.

Indiana.

Advices from Bloomfield, Ind., state that the County Commissioners have awarded the contracts for the construction of gravel roads as follows in Green County: The Harvey L. Elliott road in Washington township, to Frank Musselman of Newberry, for $4,605; the John R. Clayton road in Stockton township to Thos. E. Slinkard of Lyons, for $11,111.11; the Charles M. Moody road in Stockton township, to Fred Carpenter and R. M. Stafford of Lyons, for $4,600; and the Raleigh Dayhoff road in Jefferson township, to Samuel Hays of Worthington, for $5,298.

The Board of Public Works, Vincennes, Ind., has awarded the contract to Edward Pennington, for the improvement of Broadway from 14th St., to the city ditch by constructing concrete walk at 8 cts. per sq. ft. and stone curb at 36 cts. per lin. ft.

Kansas.

At a meeting held Oct. 14, by the Montgomery County Good Roads Association, at Coffeyville, Kan., definite plans were adopted for the construction of an oiled dirt road between that city and Independence, a distance of 20 miles.

Louisiana.

✣Bids will be received until 11 a. m., Nov. 18, by George B. Davis, Acting Quartermaster, 416 Hibernia Bank Bldg., New Orleans, La., for the construction of roads and walks at Jackson Barracks, La.

✣Bids will be received by R. J. Boudreaux, City Clerk, Crowley, La., for the construction of 33,000 sq. ft. of 6-in. concrete street crossing

At a special meeting of the Lake Charles, La., City Council the contract for the construction of an additional mile of concrete sidewalks mostly in short sections, was awarded P. B. Ligon & Son, Beaumont, Texas.

Michigan.

Board of Commissioners, Menominee County, Mich., have granted the petition and adopted as a county road the Bay Shore road. An appropriation has been made amounting to $2,000 and $4,000 will be set aside later for the improvement of the highway.

Minnesota.

✣Bids will be received until 2 p. m., Oct. 31, by Board of Public Works, St. Paul, Minn., for curbing Van Buren St. from Asbury Ave., to Pascal Ave. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Oct. 31, by Board of Public Works, St. Paul, Minn., for the curbing of Van Buren St., from Albert Ave., to Pascal Ave. R. L. Gorman is Clerk of the Board.

Missouri.

✣Bids will be received until 2 p. m., Oct. 28, by Board of Public Works, Kansas City, Mo., for the reconstruction of macadam pavement on Wabash Ave. from the south line of 12th St. to the north line of 15th St.

✣Bids will be received until 2 p. m., Oct. 28, by Board of Public Works, Kansas City, Mo., for the construction of creosoted block pavement on Twelfth St. from the Missouri Pacific Ry. to the Kansas City Southern Ry.

✣Bids will be received until 2 p. m., Oct. 28, by Board of Public Works, Kansas City, Mo., for the construction of asphalt pavement on Topping Ave., from the south line of Scarritt Ave. to the north line of St. John Ave.

✣Bids will be received until 2 p. m., Oct. 28, by Board of Public Works, Kansas City, Mo., for the construction of artificial stone curbing on Seventh St., Fremont Ave., Euclid Ave., Houston Ave., 12th St. P. R. Stinson is Secretary Board of Public Works.

✣Board of Public Works, Kansas City, Mo., will receive bids until 2 p. m., Oct. 28, for furnishing all the materials and doing all the work necessary to complete the following city impovements consisting of the construction of artificial stone sidewalks on portions of Vine St., Flora Ave., Cottage Ave., 21st St., Lawn Ave., 26th St. and 28th Sts. P. R. Stinson is Sec'y of the Board.

The Board of St. Louis County, Mo., at Duluth has fixed a levy for next year at $1,062,000, $250,000 of which is for roads.

Contracts have been awarded as follows for the construction of 4½ miles of macadam roads in Buchanana County, Mo., by L. M. Stallard, County Highway Engineer at St. Joseph, Mo.: Maxwell road, one mile, $1.10 a lin. ft., E. P. Olsen; county farm road, three-fourth mile, $1.39 a lin. ft., E. P. Olsen; Saxton road, one mile, $1.12 a lin. ft., Michael Costello; Hyde Valley road, three-fourths mile, $1.34, M. Costello; Detention home road extension, one mile, $1.14, M. Costello.

Nebraska.

✣Bids will be received until noon, Oct. 28, by Roscoe C. Ozman, City Clerk, Lincoln, Nebr., for the construction of street improvement. The following is the approximate estimate of the work: Vitrified brick paving, class B, 1 year guarantee, $2.15 per sq. yd.; artificial stone curbing, 55 cts. per lin. ft.; extra grading, 50 cts. per cu. yd.; extra concrete, $1.00 per cu. yd.; extra broken stone, $2.25 per cu. yd.; extra sand in place, $1.15 per cu. yd.; cement grouting for brick paving, 13 cts. per sq. yd.; asphalt filler for brick paving, 25 cts. per sq. yd.; paving pitch, 20 cts. per sq. yd.

The City Council of Hastings, Neb., has awarded the contract for the construction of pavement on 2nd St., between Wabash and St. Joe Aves. to O. C. Chapin, Leavenworth, Kan., at $2.04 per sq. yd. The council at the same meeting also created a new paving district including Hastings Ave., between 4th and 12th Sts.

The Dodge County Board of Supervisors, Fremont, Nebr., has awarded the contract to A. F. Bailey for the construction of the grade of the Platte River road from the bridge to the city limits.

Bids for the repaving of Broadway, Omaha, Nebr., were opened and referred to the City Engineer for tabulation. Three bids were received. The specifications required cash offers per sq. yd. for the old granite blocks. E. A. Wickham & Co., Omaha, $1.99 per yd. for paving and 40 cts. for old blocks; M. H. Ford & Co., Cedar Rapids, Ia., $2.09 per yd. for paving and 40 cts. for old stone; George D. Orr, Galesburg, Ill., $2.07 per yd. for paving and 35 cts. for old stone.

New Jersey.

✣Bids will be received until 8 15 p. m., Nov. 7, by City Council, Westfield, N. J., for the improvement of certain streets under the following contracts: Contract No. 1—4,000 cu. yds. of excavation, 4,910 sq. yds. of six (6) in. macadam, 10,200 sq. yds. of four (4) in. macadam, 2,000 sq. yds. of macadam resurfaced, 3,860 lin. ft. of concrete curb and gutter, 1,600 lin. ft. of underdrain, 330 lin. ft. of culverts. Certified check, $500.00. Bond, $7,500.00. Time of completion, August 1, 1911. Contract No. 2—3,630 sq. yds. of 6-in. macadam, "Tarvia X" binder; 4,500 sq. yds. of 4-in. macadam, "Tarvia X" binder; 7,080 sq. yds. of macadam resurfaced "Tarvia X" binder; 5,700 lin. ft. concrete curb and gutter, 1,660 lin. ft. of vitrified brick gutter on concrete base, 205 lin. ft. of culverts, 1,020 lin. ft. of curb reset on concrete, 380 lin. ft. of new curb set on concrete. Certified check, $500.00 Bond, $8000,00. Time of completion, September 1, 1911. Contract No. 3—980 lin. ft. of vitrified brick gutters on concrete base, 100 lin. ft. of culverts, 1,150 lin. ft. of curb reset, 1,610 lin. ft. of new curb. Certified check, $200.00. Bond, $1,000.00 Time of completion, June 1, 1911. Forms of proposal, specifications, and contract may be obtained at the office of A. W. Vars, Town Surveyor, 121 Prospect Street, Westfield, N. J. Lloyd Thompson, Town Clerk.

✣Bids will be received until 10 a. m., Nov. 10, by Committee on Roads and Assessments of Board of Chosen Freeholders, Newark, N. J., for grading and paving with Telford pavement the following streets: Gregory Ave., in the Town of West Orange, beginning at Mount Pleasant Ave., and running to Luddington Ave., a distance of 8,846 ft. Union Ave., beginning at Jerolamon St., in the Township of Belleville, and running to the Avondale Road in the Town of Nutley, a distance of 6,133 ft. Also for coating with macadam. Green Brook Road, in the Township of Caldwell, beginning at Pier Lane and running to the North Caldwell Line, a distance of 1,333 ft.

North Dakota.

City Council of Fargo, N. Dak., is considering tearing up the pavement on 2nd, 3rd and 4th Aves. and either repaving the thoroughfares or leveling them off in order to make travel over them possible.

Advices from Devils Lake, N. Dak., state that the Board has been petitioned by Oluf Hagen et al. for the laying out of a road on the township line between Sec. 31 and 32, Lawton Township.

Ohio.

✣Bids will be received until 11 a. m., Nov. 2, by Board of County Commissioners, Cleveland, O., for the change of grade on Broadview Road No. 1 and No. 4 from Hood Ave. to a point 400 ft. southerly from Tampa Ave.

✣Bids are asked until noon, Nov. 18, by Fred Dreihs, Clerk County Commissioners, Cincinnati, O., for the following county work: Under Specifications No. 87—For improvement of change in River Road through lands of Wm. Knollman and Fred Kinsler, in Crosby township. Bond for $500 required with bid.

✣Bids are asked until noon, Nov. 4, by the Directors of Public Service, John J. Wenner, Clerk, Cincinnati, O., for furnishing the necessary labor and materials for the improvement of Pogue Ave. from Cohoon St. to its Western Terminus, by grading, setting limestone curbs, paving the roadway with brick and constructing the necessary drains and inlets. Certified check for $500 required with bid.

✣Bids will be received until 11 a. m., Nov. 2, by Board of County Commissioners, John F. Goldenbogen, Clerk, Cleveland, O., for changing the grade on Broadview Road No. 1 and No. 4 from Hood Ave. to a point about 400 ft. southerly from Tampa Ave. F. R. Lander is County Surveyor.

✣Bids will be received until 11 a. m., Oct. 29, by Board of County Commissioners, Cleveland, O., for grading and improving Ledge Hill on Som Center Road. Frank Lander is County Surveyor.

✣Bids will be received until 5 p. m., Nov. 1, by J. McHattie, Town Clerk, Petrolia, Ont., for the constructon of about 6,500 yds. of vitrified brick pavement with cement curb and gutters in the Town of Petrolia, Ont.

The restraining order recently granted by the Mahoning County Court, Alliance, O., to prevent the Patterson St. road from being elevated near Sebring has been dissolved and the work will be resumed.

City Council of Lockland, O., has awarded the contract for paving Wayne Ave., with brick to the Kirchner Construction Co., Cincinnati, O., at $40,000. The improvement will extend over 3,500 ft.

Resolutions were adopted by the City Council of Canton, O., declaring necessary the paving of Marion St., Gibbs St., and South Court St., from 9th St. to Cedar St. City Engineer estimated the cost of paving East 8th St. from Cherry St. to the corporation line at $32,829.

Property owners of Canton, O., have petitioned the County Commissioners to pave Lexington Road on one side of the roadway from Alliance north for two miles; Alliance road for a distance of 2 miles; Harrisburg Road 2 miles.

City Council of Marion, O., determined at the last meeting to lay over until next spring the resolution to pave Bine St. to the South line of the Big Four R. R. right of way from Center St.

The following were low bidders for the construction of street paving in Youngstown, O.: McKinnie street paving, S. H. DeGroot,

Items marked thus ✣ indicate work now open for bids.

[illegible], Rayen Ave paving, Westrumite material, Kennedy Bros., $16,211.10, asphalt, Cleveland-Trinidad Co., $17,272.10; Hine St. paving, M. P. Connelly, $12,891.50.

The following bids were received by the County Commissioners and State Highway Commissioner J. C. Wonders, Columbus, O., at the commissioner's office, for the improvement of the Canton-New Berlin Road from the Canton corporation limits to Edgefield: H. P. Knisely, Columbiana, $20,374.90; Peter Hahn & Son, Canton, $21,895; Ohio Engineering Co., Elyria, $20,500; W. H. Stanton, Canton, $22,040; Philip Diffenbacher & Son, Massillon, $21,434; S. A. Palmer, Marietta, $22,560; McGinty Construction Co., Minerva, $22,274; F. A. Downs, Canton, $21,800. The county surveyor's estimate of the cost was $22,932.22.

A resolution has been adopted by the common council of Lancaster, O., authorizing the city engineer to draw plans and specifications for the construction of pavement on Ewing St.

County commissioners, according to advices from Marion, O., have determined to improve the LaRue and Agosta pike for about 6 miles out of the city. Part of the work will be done with tar macadam, and the remainder of the distance will be stone road, the latter will probably be completed this winter.

A donation has been offered the city officials of Cleveland, O., embracing the most picturesque section of the valley of Euclid creek about 10 miles east of the public square with the condition that a roadway be put through the valley and the whole be made a part of the outer boulevard chain which has been under discussion for some time.

The contract for the construction of one mile of Chillicothe pike was recently awarded by the Scioto county (Ohio) commissioners, to Kap Bros., at $8,632. Brick will be the material used.

Board of control, Zanesville, O., on Oct. 14 awarded the contract for the paving of Locust Ave. to Adams Bros.' Contracting Co., at $5,133. Work will be started on the improvement as soon as the contractors can ship their outfit from East Palestine, where a big contract is being completed.

At a recent meeting of the Chamber of Commerce, Elyria, O., the Osborn Engineering Co., of Cleveland, O., submitted a report on the roads in Elyria, Carlisle, Eaton and Ridgeville townships.

The board of control, Hamilton, O., received bids October 20, for the paving of South B and North Sixth Sts. and East Ave., from the following firms: Thomas P. Strack and the Barber Asphalt Company, of Cincinnati; W. S. Pace and Carpenter & Anderson, of Chicago; Reily & Filer, of Toledo; Andrews Asphalt Paving Company of this city, and the Louis Drach Construction Company of Cleveland. The contracts, which will amount to about $100,000, will be awarded in a few days.

The county commissioners, Toledo, Ohio, have awarded the contract for the improvement of Brown road, in Jerusalem and Oregon townships to Garrigan Bros., at $2,300.

Citizens have petitioned the city council of Ashland, O., to improve Diamond Highway by paving, grading and curbing. Brick is mentioned as the material.

City council of Akron, O., has adopted resolutions declaring it necessary to pave South High St., south, Rhodes Ave. from East Exchange St. south, and Broad St. from the end of the present paving to Kent St.

State highway department, Columbus, O., will, it is said, receive bids until January 2, 1911, for the macadamizing of the Venice road.

Oregon.

It has been decided by the city council of Portland, Ore., to withhold authority for laying more hard surface streets until it has been determined how long a time it will require for the completion of the work already ordered.

At the November election a proposition is to be submitted to the citizens of the State of Oregon authorizing the counties to issue bonds for the construction of roads.

Bids were received by the city executive board, Portland, Ore., for the improvement of streets as follows: Flanders st. from Twenty-third to Cornell, bitulithic pavement, Warren Construction Co., $4,116; East Forty-seventh street district, grading, concrete curbs and walks, Giebisch & Joplin, $5,521; Houghton st. from Woolsey to McKenna, grading and concrete curbs and walks, St. Johns Sand & Gravel Co., $8,588; Lane st. district, concrete pavement, Giebisch & Joplin, $14,194; Macleay boulevard district, grading and concrete curbs and walks, Portland Concrete Pile & Equipment Co., $13,856; Powell street from East Twenty-first to East Twenty-sixth, grading and concrete curbs and walks, Giebisch & Joplin, $3,457; Oregon Hassam Paving Co., $3,827; M. Hansen, $3,167; East Twentieth st. from Hawthorne to East Harrison, Hassam pavement, Oregon Hassam Paving Co., $10,241; Vista av., Hassam paving, Oregon Hassam Paving Co., $23,684.

Pennsylvania.

The following bids were received by director of public service, Philadelphia, Pa., for the construction of wood block pavement in Arch St., between Front and 21st St., and in 12th St. between Market and Chestnut Sts.; E. W. Vare, $3.49 per sq. yd., $181,573; George W. Ruch, $3.19 per sq. yd., $116,870; Barber Asphalt Co., $2.99 per sq. yd., $109,430.

City highway department, Harrisburg, Pa., received bids Oct. 13, for the construction of 79,853 sq. yds. of pavement and 67,099 lin. ft. of curbing, included on 54 streets. The Barber Asphalt Paving Co., and the Central Construction & Supply Co., of Harrisburg, Pa., were the lowest bidders, the first being lower on granite, and the latter on granolithic. It is thought that the work will be divided between the two firms.

County commissioners have agreed to advertise for the improvement of several new sections of road throughout the Washington sections of road throughout Washington County, Pa. One important stretch extends from Meadowlands to the borough line of Houston, and it is proposed to use brick for the work.

Merchants and business men of North Hanover St., Carlisle, Pa., between Square and Louther Sts., a distance of two squares, are considering petitioning the city council to pave the street with vitrified brick.

Contracts for the subgrading, curbing and bitumen macadamizing of Monitor Ave., from the Brighton road to the right of way of the Pittsburgh, Ft. Wayne and Chicago Railroad, and for walks, steps and stone fence in the park at Ben Avon station, Pittsburg, Pa., have been awarded by the Ben Avon borough council. The latter improvements will require about 270 cu. yds. of grading above the walks and steps, 2,110 sq. ft. of concrete walk, 520 lin. ft. of concrete steps, 570 ft. of stone fence and other material, and will be almost an exact duplicate of the approach to the station on the other side of Spruce run. This contract has been let to J. K. Wymard. The Monitor Ave. work will require about 958 cu. yds. of grading, 1,743 ft. of curb, 2,022 sq. yds. of bitumen macadam and 396 sq. yds. of block brick gutter. This contract was awarded to Thomas Sweeney.

Texas.

Advices from Austin, Tex., state that Ellis county has issued bonds amounting to $550,000 for the improvement of its public highways.

A proposition is under consideration for bonding Victoria county for $200,000 or more for road building. The county seat is at Victoria, Tex.

At a meeting held at Cuero, Tex., Oct. 13, by representatives of Calhoun, Victoria, De Witt and other counties, an organization was effected to promote the construction of a 60-ft. unobstructed highway extending from San Antonio to Port Lavaca.

City council of Houston, Tex., has been petitioned by citizens for the construction of shell pavement on Harrington St. from Maury to Hardy Sts. The matter has been referred to the city commission.

Road District No 1, of Brown county, which was the first district in the state to take advantage of the law authorizing bond issue for road improvements, and which voted $100,000 road bonds in May, 1909, will vote on an increased issue of $50,000 with which to carry the graveled roads out to the district line, on Nov. 11. The move for the increased issue originated with the farmers, and is primarily a farmers' move, though it is believed the town, which pays 80 per cent of the taxes, will indorse the issue almost unanimously. D. F. Johnson, secretary, Brownwood, Tex.

Utah.

Advices from Logan, Utah, state that at the coming election, a proposition will be submitted to the people to vote a 2½-mill tax for two years, amounting to a total of about $53,000, for the improvement of roads.

Active work on roads in Wasatch, Carbon and Uintah counties, Utah, which will form important links in the proposed state road from Logan on the north, to St. George on the south, will be begun soon. Each county has appropriated the necessary $2,000 for the work.

Vermont.

In his annual report, recently made, to the State Legislature, C. W. Gates, Franklin, Vt., State Highway Commissioner, recommends the purchase of portable road building machinery and drilling outfits, to be used in the several counties in towns or groups of towns as may be needed.

The public service commission, according to advices from Montpelier, Vt., has instructed the Central Vermont Ry. Co. to do the following work in the village of Brattleboro, Vt.: Lay out and construct a new highway on the rock bluff extending from the south line of Bridge st. near the corner of the Brattleboro House, southward about 375 ft. to a point directly west of the present passenger station; thence eastward by a steel bridge, over the tracks and yard of the Central Vermont Railway; thence northward from the east end of said bridge, by an inclined plane, or ramp, to Bridge street. Lay out and construct a new highway extending from the west end of said bridge southward to connect with Vermont street at a point about 275 feet south of the Central Vermont freight house.

Virginia.

✣Bids will be received until noon, Oct. 31, by City Clerk, Portsmouth, Va., for the regulating and paving of certain streets in that city. The approximate quantities are estimated as follows: 71,350 sq. yds. of pavement, 32,544 lin. ft. of new curb, all granite, or 28,196 lin. ft. thereof to be concrete combined curb and gutter, and 4,348 lin. ft. thereof to be concrete curb. V. O. Cassell, Jr., is City Engineer.

The street committee of the city council of Richmond, Va., has recommended the construction of pavement and curb on Main St. for four or five blocks west of Vine.

The board of control, Norfolk, Va., has recommended the finance committee to repave Bank St. between Freemason and Queen Sts., at a cost of $10,092; also replace the 8-in. water mains with 12-in. pipe at an additional outlay of $4,500.

Washington.

✣Bids will be received until 11 a. m., November 5, by Capt. E. C. Long, constructing quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of road, walks, drains, crossings, etc., at Fort Ward, Wash.

County Engineer, Montesano, Wash., has recommended that the county raise approximately $280,000 for the improvement of roads.

The board of county commissioners, Bellingham, Wash., have awarded two contracts for the construction of the Woodlawn road around the north sho[illegible]ke Whatcom, from Silver Beach to Woodlawn, a distance of about 2 miles. The road is divided into four sections. Worthen & Sattherwaite were awarded the contract for two sections of the work and the Cascade Trading & Construction Company was awarded the contract for the other two sections. The road will cost about $8,000.

County commissioners, Bellingham, Wash., have passed a resolution authorizing the state highway commissioner to survey across the county and establish road No. 6, in Whatcom county as the northern end of the state boulevard from Oregon to British Columbia.

County Engineer, Bellingham, Wash., has been instructed by the board to secure right of way for the county road across state land on Van Zandt dyke in section 34, township 39 north, range 5 east.

West Virginia.

City council of Elm Grove, W. Va., has awarded the contract for the construction of pavement on Kruger St. from Dusch's Corner to a point near the local public school, to George W. Lemmon, Wheeling, W. Va.

Canada.

On New Years Day a special election will be held at Toronto, Ont., to allow rate-payers to vote on $100,000 for good roads leading into that city.

Advices from New Westminster, B. C., state that the sum of $6,500 is to be spent on the macadamizing of the main road from Lulu Island to that city, which is at present nearly impassable.

WATER-WORKS AND SEWERAGE

Alabama.

Council Committee has decided to employ an expert to investigate the condition of the water plant in North Birmingham, Birmingham, Ala., and it is expected that improvements suggested will be taken up immediately.

City Council and Mayor of Cullman, Ala., have under consideration the matter of constructing a complete sanitary sewerage system.

Arkansas.

It is reported that J. McCoppin, Little Rock, Ark., has been awarded the contract for the construction of sewers in District No. 1, Morrilton, Ark.

California.

✣Bids are asked until 10 a. m., Nov. 9, by the Board of Public Works of Oakland, Cal., Jas. W. Nelson, Secy., for furnishing the necessary labor and materials for and in the construction of a storm sewer, with appurtenances in Market and 7th Sts., from the existing intercepting sewer in 2nd St. to the existing sewer in West St. Bond for $3,000 required.

✣Bids will be received until Nov. 7 by J. H. Stineman, City Clerk, Roseville, Cal., for a complete sewer system, consisting of septic tank, contact beds and 42,275 ft. of 6-in., 2,640 ft. of 8-in., 13,151 ft. of 10-in. and 9,984 ft. of 12-in. vitrified pipe.

The contract for laying the extension of the sewer system on Carpenter St., Grass Valley, Cal., has been awarded James Stead by the Board of City Trustees at 18 cents per foot.

Board of Health has advised the city council of Los Angeles, Cal., to order the construction of a sewer along 36th Pl., from Wesley to Santa Monica Ave., and also the extension of the Avenue 29 sewer from its present terminus to Barranca St.

The Contra Costa Construction Co. has started work on their $10,000 contract for the construction of a large concrete storm sewer in San Pablo Ave., from 59th to 67th Sts., Oakland, Cal.

Colorado.

A mass meeting has been held by the residents of the south side to urge the city council of Colorado Springs, Colo., to construct seven blocks of sewer in that part of the place.

Connecticut.

A contract has been awarded the recently incorporated A. W. Bryne Co., Hartford, Conn., for the construction of the pipe line from the Glastonbury reservoir through Hillstown, to the bridge in Burnside by the East Hartford fire district.

Florida.

The Logan Concrete & Engineering Co. has been awarded the contract for the construction of a 3,000,000-gal. reservoir in the water works yard at Jacksonville, Fla., for $57,500. Bids were received for the work as follows: Logan Concrete and Engineering Co., Jacksonville, company's plans, $53,400; board's plans, $57,500. J. D. McGee, South Carolina, $54,850. Bryan & Co., Jacksonville, $62,137.50. F W Long & Co., Jacksonville, $74,145 Municipal Engineering and Construction Co., Chattanooga, $59,436. W. T. Cotter, Jacksonville, $62,500.

Board of Health and city officials have under consideration the construction of a new sewerage system for Ocala, Fla.

Georgia.

✣Bids will be received until 11 a. m., Nov. 15, by Capt. G. Vidmer, Constructing Quartermaster, Fort Oglethorpe, Ga., for the construction of a sterlizing plant at that post.

An election will be held at Dublin, Ga., Dec. 6, for the purpose of obtaining the assent of two-thirds of the qualified voters to the issuing of bonds to the amount of $30,000, $25,000 of which will go to the improvement of lights and sewers and $5,000 to street paving.

The Water Works Department, Atlanta, Ga., has expended $210,000, its allottment of the first sale of bonds for the improvement of the system and a meeting has been called by the finance committee to discuss the matter of providing another $300,000 for the necessary work.

Illinois.

Board of Local Improvements of Pekin, Ill., after a recent hearing on objections to the plans for the proposed Third District Sewer improvement, overruled and adopted the said plans as feasible.

Charleston, Ill., Board of Local Improvements have decided it necessary to construct a sewer in 11th and Harrison Sts. Work will be started as soon as the contract is let.

Bonds amounting to $5,000 for the installation of a water works plant at the village of Beecher, Ill., have been sold and work of laying mains will be commenced at once.

Board of Local Improvements, Barrington, Ill., has under consideration the extension of water mains on Walnut St. to the village limits and the installation of a sanitary sewer system.

A petition has been filed with the Board of Local Improvements, Joliet, Ill., for the construction of a sewer on Granite St., from Raynor to Wilcox Ave. The matter was referred to City Engineer Stevens.

Following are the low bids and bidders as opened by the Board of Local Improvements, City of Chicago: Chas. A. V. Standish, Sec'y, Room 300, City Hall, for furnishing and laying water supply pipes in the following streets: N. 53rd Ave. from Humboldt Ave. to Fullerton Ave., 1,340 lin. ft. of 8-in. cast iron pipe, $1.24½ per ft., valve basins, $30 each, total $1,728.30. Malachy Murphy, 5315 Wabash Ave. N. Avers Ave., Greenwood Terrace, to a point 90 ft. n. of n. line of Wrightwood Ave., 850 lin. ft. of 6-in. cast iron pipe, 90 cts. per ft., valve basins, $30 each, total, $795. Malachy Murphy, 5315 Wabash Ave. S. 42nd Ct., W. 14th St. to W. 15th St., 737 lin. ft. of cast iron pipe (6-in.), 91 cts. per lin. ft., total $700.67. Angelo Mancini, Chicago. S. 43rd Ave., W. 14th St. to W. 15th St., 737 lin. ft. of 6-in. cast iron pipe, 91 cts. per lin. ft., valve basins, $30 each, total $700.67. Angelo Mancini, Chicago. S. 43rd Ct., 14th St. to 16th St., 1,317 lin. ft. of 18-in. cast iron pipe, $1.18½, valve basins, $30 each, total, $1,620.69. Tutelli & Scully, 518 W. Taylor St. W. 105th St., Wentworth Ave. to C. & W. I. R. R., 1,238 lin. ft. of 8-in. cast iron pipe, $1.21, valve basins, $30 each, total $1,527.98. Malachy Murphy, 5315 Wabash Ave. N. 69th Ave., Wrightwood Ave. to Fullerton Ave., 1,294 lin. ft. of 8-in. cast iron pipe, $1.24 per lin. ft., valve basins, $30 each, total $1,634.56. Angelo Mancini, Chicago.

✣Bids are asked by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, until 11 a. m., Oct. 28, 1910, for furnishing all tools, machinery, labor, material, etc., necessary for the removal of old steam piping system and installation of new system as follows in the 68th pumping station: The piping system is such as is necessary for three 350 horse power horizontal water tube boilers including the removal of all old or temporary piping, the steam connection to the induced draft apparatus and also to open feed water heater and Ventura or Worthington feed water meter and such other work as is necessary to complete the piping of the plant. The piping varies from 2 ins. to 10 ins. in diameter and shall be designed for a working pressure of 175 lbs. of steam, gage pressure. All valves and piping shall be tested before shipment to a hydrostatic pressure of 275 lbs. per square inch and prove tight.

The following contracts have been awarded to date in connection with the rebuilding of the 68th St. pumping station by B. J. Mullaney, Commissioner of Public Works, City of Chicago. Removing old boilers and furnishing new ones, Babcock & Wilcox Co., 567 W. Lake St., Chicago, Ill. Contract price $12,-998. Building new boiler foundations, etc., Nash Dowdell Co., 145 La Salle St., contract price, $9,000. Remodeling north half of boiler room, Jno. J. O'Brien Co., contract price, $27,562.

Bids will be opened by the Board of Local Improvemnts, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, November 2, 1910, at 11 a. m., for the construction of sewers in the following streets: 990 lin. ft. of 12-in. tile pipe sewer in S. 48th Ave. from Monroe St. to Jackson Blvd. with an average cut of 10.5 ft., 7 manholes and 9 catchbasins; 710 lin. ft. of 12-in. tile pipe sewer in S. 48th Ave. from Jackson Blvd. to Van Buren St., with an average cut of 10.5, 4 manholes and 4 catch basins; 680 lin. ft. of 12-in. tile pipe sewer in Humboldt Ave. from N. 44th Ave. to N. 43rd Ave. with an average cut of 8.0, 4 manholes and 1 catchbasin; 670 lin. ft. of 15-in. tile pipe sewer with an average cut of 9.5 ft., 10 manholes and 15 catchbasins; 670 lin. ft. of double strength 20-in. tile pipe sewer in Oglesby Ave. from E. 78th St. to E. 79th St. with an average cut of 12 ft., 5 manholes and 6 catchbasins; 340 lin. ft. of 12-in. tile pipe sewer in Spaulding Ave., from W. 38th St. to W. 37th Pl., with an average cut of 11 ft.; 330 lin. ft. of 12-in. tile pipe sewer in W. 37th Pl., from the center line of Spaulding Ave. to a point 290 ft. west, 6 manholes and 5 catchbasins; 420 lin. ft. of 12-in. tile pipe sewer in 75th Pl., with an average cut of 9 ft.; 610 lin. ft. of 12-in. tile pipe sewer in Stony Island Ave. on the west side between 75th St. and 76th St., with average cut of 12 ft., 10 manholes and 16 catchbasins [illegible] streets to be known as the 111th St. system;

Items marked thus ✣ indicate work now open for bids.

2,320 lin. ft. of 24-in., double invert back sewer on 111th St., between Eggleston Ave. and Halsted St., with an average cut of 13 ft.; 335 lin. ft. of 30-in. brick sewer with a double ring in 113th St. from Stewart Ave. to Eggleston Ave. with an average cut of 13 ft.; 6660 lin. ft. of 24-in. brick sewer with a double invert in 113th St., from Eggleston Ave. to Powell Ave., with an average cut of 14.5 ft.; 670 lin. ft. of 12-in. tile pipe in Eggleston Ave., from 112th St. to 113th St., with an average cut of 10.5 ft.; 660 lin. ft. of 15-in. tile pipe sewer in Eggleston Ave., from 113th St. to 114th St., with an average cut of 9 ft.; 495 lin. ft. of 12-in. tile pipe sewer in Eggleston Ave. from 114th St. to alley north of 115th St., with an average cut of 8 ft.; 1,330 lin. ft. of 12-in. tile pipe sewer in Butler St. from 111th St. to 113th St., with an average cut of 9.5 ft.; 660 lin. ft. of 15-in. tile pipe sewer in Butler St., from 113th St. to 114th St. with an average cut 9.5 ft.; 495 lin. ft. of 12-in. tile pipe sewer in Butler St. from 114th St. to alley N of 115th St., with an average cut of 8 ft.; 1,325 lin. ft. of 12-in. tile pipe sewer in Parnell Ave., from 111th St to 113th St., with an average cut of 10 ft.; 495 lin. ft. of 12-in. tile pipe in Parnell Ave. from 114th St. to alley north of 115th St., with an average cut of 8.0 ft. Work includes 69 manholes and 100 catchbasins.

Following are the low bidders and bids as opened by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, for laying and furnishing water service pipes in the following streets. Hollywood Ave., Clark St. to Southport Ave., David Walsh, 6628 South Chicago Ave., Chicago; Balmoral Ave., Robey St. to Ravenswood Park, 408 lin. ft. of lead water service pipe with brass fittings, etc., $287.64. Jas. J. Renn, 367 W. Chicago Ave.; Burnside Ave., Cottage Grove Ave. to St. Lawrence Ave., 240 lin. ft. of lead water service pipe with fittings, $189.60, David Walsh, 6628 South Chicago Ave.; Bernard Ave., Elston Ave. to Irving Park Blvd., 624 lin. ft. of water service pipe, total $492.96, Jas. J. Renn, 367 W. Chicago Ave.; Byron Ave., N. Hamlin Ave. to N. 40th Ave., 108 lin. ft. of lead water service pipe, $97.20, Jas. J. Renn, 367 W. Chicago Ave.; Costello Ave., Kimball Ave. to Lawndale Ave., 1,273 lin. ft. of lead water service pipe, total, $1,056.59, Jas. J. Renn, 367 W. Chicago Ave.; Champlain Ave., Burnside Ave. to E. 95th St.; 243 lin. ft. of lead water service pipe, total, $185.90, Jas. J. Renn, 367 W. Chicago Ave.; Christian Ave., Elston Ave. to Irving Park Blvd., 1092 lin. ft. of lead water service pipe, total, $813.54, Dan'l J. Hardin, 3139 Indiana Ave.; Gladys Ave., 48th Ave. to 50th Ave., 503 lin. ft. of lead water service pipe, total, $349.69, Jas. J. Renn, 367 W. Chicago Ave.; Michigan Ave., 68th St. to 71st St., 1,400 lin. ft. of lead water service pipe, $826, David Walsh, 6628 South Chicago Ave.; 90th St., St. Lawrence Ave. to Dauphin Ave., 1,617 lin. ft. of lead water service pipe, total, $954.03. David Walsh, 6628 South Chicago Ave.; Peoria St., 119th St. to 122nd St., 192 lin. ft. of lead water service pipe, total $158.40, Jas. J. Renn, 367 W. Chicago Ave.

✣Bids will be received by the Board of Local Improvements, City of Chicago, Chas. A. V. Stanish, Sec'y, Room 302, City Hall, until 11 a. m., November 2, for furnishing water service pipes, Buffalo boxes, brass stop cocks, etc., and laying same in the following streets: Ave. J., Indianapolis Ave. to E. 106th St.; Dauphin Ave., E. 90th St. to E. 92nd St.; Lunt Ave., Clark St. to a point 520 ft. E. of Sheridan Rd.; Rice St., Western Ave. to Campbell Ave.; Western Ave., Montrose Ave. to Lawrence Ave.; N. Whipple St., Addison St. to Elston Ave. and a system of streets, 87th St., St. Lawrence to Dauphin Ave., E. 88th St., St. Lawrence Ave. to Dauphin Ave.; E. 89th Pl., St. Lawrence Ave. to Dauphin Ave., Dauphin Ave., 87th St. to 90th St.

Indiana.

✣Bids will be received until Nov. 10, by Board of Public Works, Richmond, Ind., for the construction of 24-in. sewer pipe, 950 ft., including a small amount of rock excavation. H. M. Hammond is President of the Board of Public Works. F. R. Charles is City Engineer.

Iowa.

At a special municipal meeting held in Adair, Ia., recently, the citizens voted in favor of the construction of a water works system to cost approximately $20,000. Work will be started as soon as the contracts are let.

Kansas.

✣Bids will be received until 2 p. m., Oct. 28, by the Board of Public Works, Kansas City, Mo., for the construction of sewers in Sewer District No. 311, Sewer Division No. 2. P. R. Stinson is Secretary Board of Public Works.

✣Bids will be received until 2 p. m., Oct. 27, by Board of Fire and Water Commissioners, Kansas City, Mo., for the furnishing and delivering of following supplies for water works department: 114 tons of straight hub spigot cast iron pipe; 15 tons of standard hub spigot cast iron pipe; 29 tons of flagged specials. E. B. Harrington is Secretary.

✣Bids will be received until 5 p. m., Nov. 7, by W. F. Sams, city clerk, Chanute, Kan., for the installation of three 3 h. p. boilers for the construction and laying of approximately 9 miles of 4-in. and 16-in. water mains.

A meeting was recently held in Wichita, Kan., to take up the matter of constructing a new main sanitary sewer, having its source near 25th and Arkansas or Waco Ave., thence southerly to 14th St. and east to Mathewson Ave.

Petitions are being signed by property owners to submit to the City Commission of Topeka, Kan., providing for the creation of the Shunganunga sewer district.

The plans and specifications for the water works system for Scandia, Kan., have been completed and delivered to the Council at that place. Bids will not be called for until the bonds are sold. The J. S. Woley Co., Reliance Bldg., Kansas City, Mo., is the Engineer.

Maryland.

✣Bids are asked until 11 a. m., Nov. 2, by the Sewerage Commission of Baltimore, Md., C. W. Hendrick, Chief Engineer, for constructing sanitary lateral sewers in District 34, the work including 26,450 ft. 8-in. to 22-in. terra cotta pipe sewer, 2,750 ft. brick and concrete sewer, 27-in. diameter; 15,000 lin. ft. 6-in. house connections.

✣Bids will be received until 11 a. m., Nov. 2, by Board of Awards, Baltimore, Md., for the construction of sanitary lateral sewers in District 34. The work includes the following approximate quantities: 26,450 lin. ft. 8-in. to 22-in. terra cotta pipe sewer, 2,750 ft. brick and concrete sewer 27 ins. diameter, and 15,000 lin. ft. 6-in. house connections. J. Barry Mahool is president of Board of Awards.

Massachusetts.

✣Bids will be received until 3 p. m., Nov 3, by Water Board, Brookline, Mass., for furnishing and installing a vertical triple expansion pumping engine, capacity of 2,500,000 gallons in 24 hours, high service pumping station, Brookline, Mass.

Michigan.

Residents of Ann St., Marquette, Mich. have filed a petition for the construction of an extension of the sewer in that thoroughfare and the sewer committee has been instructed to prepare specifications and estimates of the work.

Plans have been adopted by the Common Council and the Board of Public Works. Allegan, Mich., for the construction of the south side sewer. As proposed the sewer will empty into the river above the dam.

Property owners in West Ishpeming, Ishpeming, Mich., are contemplating applying to the city council for the extension of a water-main to that location. The improvement would require the construction of a 1-mile pipe line to connect the suburb.

City Council of Laurium, Mich., is considering the installation of a purification plant and septic sewer system for that place. The cost of the work according to the estimate of plans under contemplation would be about $5,000.

Citizens on Industrial Ave. have filed a petition with the Common Council of Flint, Mich., for the extension of the storm water sewer on Industrial Ave. to North St. The matter was referred to the sewer committee.

City Council of Lansing, Mich., has been petitioned to extend the water works system on Ballard St. and Oakland Ave. and by the Board of Education for the mains to the southeastern part of the city.

Minnesota.

✣Bids will be received until 8 p. m., Oct. 29, by V. N. Roderick, City Clerk, Brainerd, Minn., for the construction of a new sewer in District No. 4 in the city of Brainerd, Minn.

✣Bids will be received until 8 p. m., Oct. 29, by V. N. Roderick, City Clerk, Brainerd, Minn., for the construction of a new sewer in Sewer District No. 5. V. N. Roderick is City Clerk.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Dayton Ave., from Syndicate Ave. to Hamiline Ave. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Bradley St. from Jenks St. to a point 100 ft. north of the north line of Case St.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Geranium St. from Rice St. to Sylvan. R. L. Gorman is Clerk of the Board of Public Works.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Conway St. from its present terminus just west of Maria Ave. to a point 80 ft. east.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Whitall St. from Burr St. to De Sota St. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Stellar St. from Atwater St. to a point 190 ft. south of the south line of Atwater St. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Syndicate Ave. from Selby Ave. to Hague Ave. and on Hague Ave. from Syndicate Ave. to a point east. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Audubon St. from Warsaw St. to Drake St., on Armstrong St. from Warsaw St. to Drake St. and on Drake St. from Audubon St. to Lee Ave.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Louisa St. from Gorman Ave. to South Robert St.

Bids will be received until 5 p. m., Nov. 5, by City Council of Albert Lea, Minn., for the necessary labor and material for the complete construction of a sanitary and storm water sewer along certain streets and alleys in the city of Albert Lea. The following is an approximate amount of work to be done and materials to be furnished in the construction of said sewer: 317.5 ft. 10-in. and 18-in. double sanitary and storm water sewer, 10-18 ft. deep; 28.3 ft., 18-in. single storm water sewer, 10-12 ft. deep; 20 ft., 10-in. single sanitary sewer, 10-12 ft. deep; 660 ft., 8-in. single sanitary sewer, 6-12 ft. deep; 503 ft., 8 and 15-in. double sanitary and storm water sewer, 6-1 ft. deep; 28 ft., 15-in. single storm sewer under 6 ft. deep; 220 ft., 8-in. and 10-in. double storm and sanitary sewer, 6-8 ft. deep; 127 ft., 10-in. single storm water sewer under 6 ft. deep; 272 ft., 6-in. catch basin connection pipes; 96 lin. ft. connection pipes for seven chimneys; 4 storm manholes 5-10½ ft. deep complete with ring and cover; 5 sanitary sewer manholes 6.5

Items marked thus ✣ indicate work now open for bids.

ft to 11.8 ft deep complete with ring and cover, 1 double sewer manhole 6.4 ft. deep with cast iron plate, ring and cover; 1 drop to manhole at St. Mary's St., 5.7 ft. deep; 6 catch basins; 47 house "Y" branches.

City Engineer of St. Paul, Minn., has requested an appropriation of $122,800 for the construction of sewers as follows: Jefferson St. and Hamline Ave. system, $75,000; extension South St. sewer to Trout brook, $25,000; St. Anthony Park, north system, $10,000; Cretin and Finn Ave. system, $10,000, and miscellaneous, $2,800.

Council of Bemidji, Minn., has awarded the contract for the construction of a new septic tank to Thomas Johnson, of that city, at $2,250.

Mississippi.

✣Bids will be received until Nov. 9, by Board of County Supervisors, Yazoo City, Miss., for the boring of an artesian well. S. S. Griffin is Clerk.

Missouri.

Plans have been completed and filed with the City Council of Cameron, Mo., for the construction of the proposed sewers in the new district and arrangements will be made at once for the installation of the same.

The W. K. Palmer Co., Engineers, 717-720 Dwight Bldg., Kansas City, Mo., has been engaged to prepare plans and specifications for improvements in the water works plant of the City of Norfolk, Neb., and for the construction of a new and complete municipal electric lighting plant and system for that city. Further information can be secured from the engineers.

Montana.

Plans and specifications prepared by the City Engineer have been adopted by the City Council of Bozeman, Mont., for the enlarging of the city water works reservoir. The plans contemplate the excavation of about 13,000 cu. yds. of earth which will increase the capacity of the reservoir from about 1,000,000 gals. to about 5,000,000 gals. The estimated cost is $12,000.

Nebraska.

✣Bids will be received until 11 a. m., Nov. 4, by Constructing Quartermaster, Fort Crook, Nebr., for the construction of a reservoir and well at Fort Crook, Nebr. Lieut. A. W. Lane is Constructing Quartermaster.

Advices from Wymore, Nebr., state that City Engineer Meeker has reported to the City Council favorably concerning the installation of the proposed water works system for that place. The cost of the improvement, it is said, will range between $55,000 and $60,000.

City Engineer has been instructed by the City Council of Lincoln, Nebr., to furnish plans and estimates for the construction of storm sewers voted by special election last Spring. The sewers are to be located in North 26th at 17th and Washington, N and 4th Sts., on B.

Commercial Club of Creighton, Nebr., and John A. Bruce, representing the Consolidated Engineering Co., Omaha, Nebr., are conferring with a view of installing a sewerage system for the city. It is thought that on account of the city's situation the cost of the improvement would be low compared with other cities.

City Council of Grand Island, Nebr., has awarded the contract to H. J. Cathroe, Omaha, Nebr., for the construction of a sewer to the Soldiers' Home connecting that institution with the city's sanitary sewer system. The contract price was $12,100, of which the state paid $10,000.

New Jersey.

✣Bids will be received until 8 p. m., Oct. 28, by Mayor and City Council, Borough of Hohokus, N. J., for the construction of a water supply system for that place. The approximate quantities are estimated as follows: 15,000 lin. ft. of C. I. pipe in size from 4 to 10 in. in diameter together with necessary fittings, specials, hydrants, valves, etc., etc. John DeVore is Clerk of the Borough.

✣Bids will be received until 8 p. m., Nov. 14, by City Council, Atlantic City, N. J., for the construction of the storm water drainage system for the City of Atlantic City, N. J. The work will be let in two separate contracts as follows: Contract "A" embraces the building of approximately 200 lin. ft. of reinforced concrete conduit, 15 ft. wide by 10 ft. 6 in. high, 9,450 lin. ft. of reinforced concrete conduit 10 ft. 6 in. wide by an average of 9 ft. high, 964 ft. of brick concrete and terra cotta pipe drains from 5 ft. wide by 2 ft. high to 15 in. in diameter, together with manholes, catch basins, storm-water inlets and the necessary timber and pile foundations. Contract "B" embraces the building of approximately 10,390 ft. of lateral drains, consisting of brick and concrete and terra cotta pipe, from 4 ft. wide by 2 ft. 9 in. high to 12 in. in diameter, together with manholes, catch basins, storm, water inlets and the necessary timber and pile foundation. E. D. Rightmire is City Engineer.

Town Council of Bloomfield, N. J., rejected all bids received for the construction of reinforced concrete pipe storm drain in the Watsessing Section, recently recommended by Ernest Baechlin, Town Engineer.

City Council of South Amboy, N. J., has passed an ordinance providing for the issuance of bonds for the construction of sewers in that city.

The State Board of Health has approved plans for the construction of sewers in Trenton, N. J., on Morgan Ave., Hayes Ave., Cadwallader Park, and Division St.

Common Council of Trenton, N. J., has passed a resolution providing for the construction of a sewer in Wilson St., from a point near Reservoir St. southerly to Calhoun St., then westerly in the latter street to Bellevue, connecting with Sewer No. 7 and also a sewer in Calhoun St., from a point near Pennington Ave. to Wilson St. Harry B. Salter is City Clerk.

New York.

✣Bids will be received until 11 a. m., Oct. 31, by President of Borough of Queens, New York City, for the construction of sewers under eight separate contracts, the largest being Contract No. 2, as follows: For constructing a sewer and appurtenances in Lefferts Ave., from Ulster Ave. to Rockaway Road, and a storm water sewer and appurtenances in Rockaway Road from Lefferts Ave. to Panama St., 4th Ward. The engineer's estimate of the quantities is as follows: 1,000 lin. ft. 8 ft. 6 in. reinforced concrete sewer, 1,280 lin. ft. 8 ft. by 9 ft. reinforced concrete twin sewer, 1 junction chamber, complete as shown on plan, 12 manholes, complete. 50 cu. yds. rock excavated and removed, 5,000 ft. (B. M.) timber for foundation, 10,000 ft. (B. M. timber for bracing and sheet piling. The time allowed for completing the above work will be 200 working days. The amount of security required will be $50,000.

✣Bids will be received until 2 p. m., Nov. 2, by Department of Water Supply, 13-21 Park Row, New York City, for furnishing and delivering cast iron pipe, special castings and valve box castings.

✣Bids will be received until 2 p. m., Nov. 2, by Department of Water Supply, H. S. Thompson, Commissioner, 13-21 Park Row, New York City, for furnishing, delivering and laying water mains and appurtenances in various streets in Borough Park, Lefferts Park, Mapleton and Coney Island Districts, Borough of Brooklyn.

Board of Contract and Supply, Rochester, N. Y., let the following contracts for public improvements: Ellicott and other St. sewer to H. N. Cowles, $18,547.70; Troop St. cement walks, $143.25; Magee Ave., cement walks, $395.50; Pinnacle road sewer, $339.25; to Henry Schoenfeldt; Schley place sewer, Nicola Desiderio, $658.

At a special meeting of the town board of Cheektowaga, N. Y., the matter of establishing a sewerage system in the populated sections of that city at once, was discussed.

Plans are being prepared by Clyde Potts, 30 Church St., New York City, for the construction of sewers and sewage disposal works for Easton, Md.

A special election was recently held at Yorkville, N. Y., to vote on the proposition to bond the village for $22,000 for the construction of a sewer system in that place.

North Carolina.

✣Bids will be received until 3 p. m., Nov. 18, by Lieut. R. O. Edwards, Constructing Quartermaster, Fort Caswell, N. C., for the construction of sewers and cisterns.

Advices from Rockymount, N. C., state that the City Council has under consideration the construction of sewage disposal plant.

Ohio.

✣Bids will be received until noon, Nov. 1, by John J. Wenner, Clerk Director of Public Service, Cincinnati, O., for the construction of main and lateral sewers and drains with their appurtenances in Wise Alley from Cutter St. to Linn St.

✣Bids will be received until Nov. 1, instead of Oct. 25, by the Director of Public Service, Bellefontaine, O., for the construction of Sections 1 and 2 of the Sewerage System. Riggs and Sherman Co., Consulting Engineers, 613 The Nasby, Toledo, O.

✣Bids will be received by the City Hall Commissioners, Cleveland, O., until noon, Nov. 3, for furnishing necessary labor and material for the construction of a drainage sewer around the City Hall site. Edward A. Roberts is Clerk.

✣Bids will be received until noon, Nov. 1, by Director of Public Service, Cincinnati, O., for the construction of main and lateral sewers and drains with their appurtenances in Kuhlman Ave. from Glenway Ave. to Laclede Ave. from a point 132 ft. west of the west line of Kuhlman Ave., to the summit, about 110 ft. east of Kuhlman Ave. John J. Wenner is Clerk.

City Council of Lancaster, O., has instructed City Engineer to prepare plans and specifications and profile for the construction of the proposed Frederick St. sewer.

City of Wilmington, O., has under consideration the construction of a drainage and sewer system and E. G. Bradbury, C. E. Columbus, O., has estimated the cost of the work at $90,000.

City Engineer of Lancaster, O., has been instructed by the City Council to draw a profile for the construction of a sewer in the William Cox addition.

Board of Control, Hamilton, O., at a recent meeting awarded the contract for the construction of a sanitary sewer in 8th St. to Wirtz & Trunck at $1,551; also for the construction of a sanitary sewer in 9th St. from Hanover to Rigdon Sts., at $1,585.

City Council of Youngstown, O., at a recent meeting, passed an ordinance providing for the construction of sewers in Main, Dot and Stambaugh Sts.

The following were the low bidders for the construction of sewers in the city of Youngstown, O.: Raysen Ave. sewer, W. E. Gartland, $3,942; Lansing Ave. sewer, A. O'Horo, $485; Starr St. sewer, Hannon Bros., $1,275; Loga Ave. sewer, W. E. Gartland, $15,529; Ardale and Wirt St. sewers, W. E. Gartland, $11,462.

An ordinance has been passed by the City Council of Niles, O., providing for the construction of a sewer in Hartzell Ave., having connections with the Robbins Ave. sewer.

At a recent meeting of the City Council of Marion, O., it was decided to make certain changes in the resolution to construct a sanitary sewer on Miami and McKinley Sts. and Park Blvd. in that place.

At the November election in Dayton, O., citizens will vote on the proposition of issuing bonds amounting to $600,000 for the improvement of the city water service. As proposed the work will include the purchasing of necessary land, drilling of wells, construction of reservoirs, water towers and accessories.

At a recent meeting of the village council, Lowellville, the matter of installing a water works system in that place was taken up. The Lowellville Water Co. has a franchise to operate, but considerable opposition has turned up.

Items marked thus ✣ indicate work now open for bids.

Oklahoma.

✤Bids will be received until 2 p. m., Nov. 3, by Board of Trustees, Manitou, Okla., for furnishing the necessary labor and material for the construction of pipe line including the following approximate quantities: 3,700 ft. of 6-in. cast iron pipe; 8,400 ft. of 4-in. cast iron pipe; 10,000 ft. of 6-in. wood pipe, hydrants and valves, stand pipe, 20x75 ft. J. M. George is City Clerk. O. E. Noble, Hobart, Okla., is Engineer.

✤Bids will be received until 8 p. m., Nov. 1, by Ben Huddleston, City Clerk, Checotah, Okla., for the sale of $40,000 of sewer bonds for the city.

Oregon.

Bids were received by the Executive Board Portland, Ore., for the construction of sewers as follows: East 36th St., from East Yamhill to Belmont, Bechill Bros., $3,031. East 56th St., from East Yamhill to Belmont, Paquiet, Giebisch & Joplin, $3,816; John Keating, $2,805. East 26th St. district, Bechill Bros., $1,081; John Keating, $1,041. East 34th St. district, John Keating, $1,247; Bechill Bros., $1,255. Riverside district, George Gordon, $129,783; W. Lind, $132,533; K. G. Lundstrom, $155,739; Jeffery & Bufton, $132,734; Paquett, Giebisch & Joplin, $140,522.

At an election held Oct. 4 at Newberg, Ore., the City Council was authorized to install a sewer system. A Portland Engineer has made an estimate of the cost which is $80,000. The council intend to start construction work as soon as the necessary bonds are sold.

It is believed in Salem, Ore., that the municipality will take over the water works plant before long.

The Kenilworth Improvement Club will, at its next meeting, attempt to settle the matter of installing a sewerage system to connect with the Holgate branch sewer of the Portland, Ore., system.

Pennsylvania.

✤Bids are asked until 3 p. m., Oct. 31, by John A. Affleck, President of the Water Board of Harrisburg, Pa., for furnishing all material and building the new pumping station in Reservoir Park.

City Council of Newcastle, Pa., has awarded the following contracts: Moody Ave. sanitary sewer, Burns Bros., $388; Old Long Ave., sewer, F. M. Mayberry, $345; Morton St. sanitary sewer, F. M. Mayberry, $756; Garfield Ave. grading, A. R. Huston, $1,276.

Board of Water Commissioners, Harrisburg, Pa., have awarded the contract for supplying the machinery for the new pumping station in Reservoir Park to the Birdsboro Steel Foundry and Machine Co. at $15,000. Contracts for laying 8-in. waste pipe in 5th St., Green to 3rd, 4th to 5th, 6th to Jefferson and Emerald from existing lines to 5th St. and in 2nd from Seneca to Emerald were awarded to M. F. Saul.

State Board of Health will, it is said, take immediate steps toward compelling the town council of Pottstown, Pa., to provide the borough with proper sewerage system and disposal plant.

Borough Council of North York, York, Pa., has decided to carry out the original plans for the construction of a sewer on 8th Ave. to relieve the unsanitary condition of that highway.

Advices from Carbondale, Pa., state that the Street Committee has reported favorably on the general sewer ordinance. It is estimated that the improvement will cost about $55,000 and will include the installation of sewers on all established city streets.

South Carolina.

City Council of Charleston, S. C., has under consideration the construction of a new water works system and a resolution has been passed to appropriate the amount necessary for the employment of an expert water engineer to make an estimate of the cost and investigate the feasibility of such a move.

South Dakota.

✤Bids will be received until 8 p. m., Nov. 7 by L. L. Ness, City Auditor, Mitchell, S. Dak., for the necessary labor and material for the construction of the following sewers: Branch E, 366 ft. 8-in. pipe and 2 manholes; Branch F, 750 ft. 8-in. pipe and 2 manholes; Branch G, 1,768 ft. 8-in. pipe, 366 ft. 12-in. pipe and 5 manholes; Branch H, 1,828 ft. 8-in. pipe and 5 manholes; Branch J, 1,922 ft. 8-in. pipe and 4 manholes; Branch I, 1,265 ft. 8-in. pipe and 2 manholes; Branch K, 1,098 ft. 8-in. pipe and 3 manholes; Branch L, 932 8-in. pipe and 2 manholes.

Advices from Highmore, S. Dak., state that preparations rapidly are being made for the construction of a municipal waterworks system for which the city council recently awarded the contract. In connection with the system there will be erected a 50,000-gal. standpipe. Water for the system will be furnished by new wells, which have been sunk at a point about two miles south of town. The water will be piped from there to the standpipe. The system is to be constructed for $14,500, and the terms of the contract require that it be completed and ready for operation not later than June 1 next.

Tennessee.

The contract for the construction of the proposed sewer in McCallie Ave., between Highland Park Ave. and Hawthorne St., has been awarded I. C. Mishler, Chattanooga, Tenn. The bids received for the work were as follows: L. C. Mishler, $4,013; Noll Construction Co., $4,262; West Construction Co., $4,624; L. C. Smallwood, $4,822; T. B. Gillespie, $6,463.

Mayor and Board of Aldermen, Lynnville, Tenn., have, it is said, let the contract for the installation of a water works plant at that place. It is also stated that work has already been started.

Petition has been signed by citizens of Lonsdale, a suburb of Knoxville, Tenn., and plans have been made for the extension of the city water system into that place, providing the petition and plans meet with approval the work will probably be started within a short time.

The city of San Augustine, Tex., has voted to issue bonds for installing a water works.

Property owners on East Elm St., Dallas, Texas. have petitioned the City Commission to order the construction of a sewer extension from Crowdus St. in Lingo.

Capitalists of Marion and Seguin, Texas, are making arrangements to install a water works system for Marion. It is proposed to place a stand pipe at McQueeney, 6 miles east of Marion on the Guadalupe River and force the water from that place by gravity pressure.

Bonds amounting to $16,000 have been issued by the city of Center, Texas, providing funds for the extension and enlarging of the present water works system which is now under construction.

City Council of Hearne, Texas, is to take up at the next meeting the matter of installing a water works system and it is thought that the matter will be submitted to the taxpayers for vote in the near future.

The contract for the installation of a sewerage system at Fort Crockett, Texas, bids for which were received Aug. 22, has been awarded Kelso & Vautrin at $16,950. The contractors are required to finish the work within 150 days after the signing of the contract.

A committee has been appointed by citizens of the 6th Ward to interview the Mayor of Houston, Texas, regarding the construction of more sanitary sewers in that section of the city. Of the $700,000 of bonds recently issued, $70,000 was to be spent for improvements in the 6th Ward. Only $19,000 has been expended so far.

Utah.

City Council at the last meeting in Ogden, Utah, awarded the contract for the construction of a sewer in District 108, Goddard and Wall Aves., to J. P. O'Neill Construction Co.; for laying drain pipes on Madison Ave., McKay & Reed. The contract prices were $4,500, $466 and $1,513 respectively.

Virginia.

The Sewer Committee of the City Council of Roanoke, Va., has awarded the contract for the construction of certain sewers to R. M. Bibb at $2,221.

The Ordinance Committee, Norfolk, Va., reported favorably concerning the issuance of bonds for the construction of a water works plant and the election will be held to vote on the matter.

City Council of Richmond, Va., has apportioned the following amounts from the bond issue for sewers: $33,560 for the construction of sewers in Lombardy, East Grace, 20th, Broad between 20th and 21st, and in West Leigh Sts.; $38,488 for a sewer in Davis Ave., and in Sycamore, Dance, Chaffin and Taylor Sts; $39,684.75 for a sewer in Meadow, Rowland, Williams and Colorado Sts. Apportioning $68,160.38 from the same fund for a sewer in Hampton, Ashland and other streets, the last two being two main branches of the proposed Dooley sewer.

Washington.

City Council of Puyallup, Wash., has decided to construct a drain ditch to carry away the water that floods West Main St. after a hard rain. This drain is to empty into the large storm sewers that were recently laid under the pavement on West Pioneer St.

The Prosser Water Co., of Prosser, Wash., has been incorporated with a capital stock of $30,000. George D. Longmuier, John Chisholm and E. E. Benson are the incorporators.

A plan has been suggested in Tacoma, Wash., to extend a system of watermains along the water front leading from a large elevator reservoir and supplying water to every mill and factory in the city and incidentally furnishing fire protection for that section of the city. Lorenzo Dow is interested.

Wisconsin.

At a meeting of the Village Board of North Fond du Lac, Fond du Lac, Wis., it was decided to have the proposed purchase of the water works plant submitted to the voters at the regular election, Nov. 8.

Common Council of Prescott, Wis., has passed a resolution directing the City Clerk to call a special election for the purpose of submitting to the voters the question of issuing bonds for the construction of water works and connecting sewers. R. H. Price is City Clerk.

The W. S. Shields Co., Consulting Engineers for Wauwatosa, Wis., are supervising the construction of part of Section 3 of the sewer system including 2,635 ft. of 12-in. vitrified tile in West Milwaukee Ave. and Church Sts.

Wyoming.

City of Laramie, Wyo., will vote at the November election on the proposition to issue bonds amounting to $15,000 for the improvement of the sewer system.

Canada.

Acting under the recommendations of the water engineering experts employed by Winnipeg, Man., in 1907, Controller McArthur, will bring in a by-law at the next meeting of the City Council providing for the submission to the people of a proposition to construct a new water system estimated to cost $10,000,000 and which will supply daily 48,000,000 gals. of water.

At a regular meeting of the City Council of St. Catharines, Ont., report of the finance committee was adopted, relative to the submission to the people of a by-law providing for the construction of a new 24-in water main from Decew Falls to that city. The cost of the work, it is estimated, will be about $75,000.

It has been decided in Vancouver, B. C., that in order to proceed with the general sewerage scheme for South Vancouver it will be necessary for rate payers to petition for the improvement.

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The New York Workmen's Compensation Law is Not Unconstitutional.

Nowadays any new legislation which escapes attack as to its constitutionality must be particularly well intrenched or particularly negligible. It is not strange, therefore, that the recent act relating to compensation of workmen in certain dangerous employments in New York State has been before the courts charged with being unconstitutional. As will be remembered by those who read the text of the act published in our issue of Aug. 31, 1910, it is a radical reversal of the common law. The common law affords no avilable remedy for injuries occasioned by industrial accidents not attributable to the negligence of the employer. By virtue of the new act the employee is entitled to recover according to a fixed scale of compensation without establishing that the employer is at fault in any way. In a word by the new law a man working at any of certain employments named as dangerous is entitled to certain payments for any injury suffered in that employment which is not brought about by his own "serious or wilful misconduct."

In the case in question a switchman working for a railway company suffered injuries in the prosecution of his work without negligence on the part of the company and also without serious and wilful misconduct on his own part, but solely by reason of a necessary risk or danger of his employment. He demanded compensation for those injuries according to the provisions of the new law. Prior to the enactment of this law he would have been without remedy. The railway company refused payment on the contention that the new law is unconstitutional. Several counts were cited in support of this contention, but the main count was that the new law imposes liability without fault which is contrary to common law.

In passing judgment on this contention, Judge Pound of the Supreme Court, said:

> The Legislature may alter or appeal the common law. It may create new offenses, enlarge the scope of civil remedies and fasten responsibilities for injuries upon persons against whom the common law gives no remedy.
>
> It would seem to follow that it might make those who employ workmen in dangerous callings insurers to some extent of the safety of such workmen. The common law imposed upon the employee entire responsibility for injuries arising out of the necessary risks or dangers of the employment. The statute before us merely shifts such liability upon the employer. That the Legislature has the power to deal with the question of employers' liability on a basis other than fault is not clear beyond peradventure, but every presumption is in favor of the constitutionality of the act, nor do I find its constitutionality so doubtful as to warrant this court in holding that such action is not within the constitutional powers of the Legislature.

The decision would seem to amount to this: While the power of the Legislature to deal with the question is not clear, the presumption is in favor of the constitutionality of the law. Under the circumstances we risk little in saying that there will be work for the higher courts before the "workmen's compensation law" of New York as it has come to be known will be acceded to by employers.

The Argument For Single Track Wagon Roads With Turnouts.

Less than 10 per cent of the total steam railway mileage of America is double tracked. Traffic sufficient to warrant double track railways exists only in a very few localities as yet. Not a single railway running from the Mississippi valley to the Pacific has two tracks throughout its length.

Why is it, in the face of this fact, that highway engineers commonly adopt a wagon road pavement 16 ft. or more in width—a double track road—for the standard of good road construction? Is the traffic on American wagon roads so dense that it can not be economically handled on a single paved trackway with paved sidings or turnouts? Do wagons move at such speeds as to make it dangerous to operate a single track wagon road without telegraphic communication between sidings?

Long before the automobile became a factor in road designing there existed the same practice of making the 16 ft. macadam road the standard. So it can not be said that engineers have recently been forced to adopt the double track highway in order to reduce the danger from accidents.

What then is the reason for the existence of a standard double track highway in a country where the standard railway is still single track? We believe the reason is to be found in the fact that the railway engineer designs a railway to make money for its owners, whereas the highway engineer designs a highway to please the public regardless of whether it is to be a money making structure or not. Let it be understood that we are speaking now in general terms of highway engineers as a class and not of the exceptions. Certainly it can be gainsaid by no one who is familiar with improved roads built by the various state highway commissions that we err in calling the 16 ft. paved roadway the standard of construction.

In a series of eleven articles on the theory of economic road location and design (Engineering-Contracting, April 14 to June 23, 1909) we endeavored to apply to road building the same economic principles that have been so effectively used by engineers in railway work. In the eighth article (June 2, 1909) of that series we urged the adoption of an 8 ft. pavement with turnouts 50 ft. long spaced about 400 ft. apart, as the standard for general use in building country roads. Of course the roadbed should be graded 18 to 24 ft. wide between ditches, but the paved trackway should be made only about 8 ft. wide, until such time as the traffic becomes dense enough to warrant double tracking the road. The earth shoulders on each side of this single trackway should be plowed, pulverized with a harrow, and tamped into a dense mass with a rolling tamper of the petrolithic (or "sheep's foot") type. Often it is desirable to mix sand and clay to make these earth shoulders, but frequently the natural soil is of a character that compacts sufficiently well under the rolling tamper. The editor recently tested a portion of a natural earth road bed made in San Diego county, California, where the rolling tamper had been used, and found that it had been so compacted by the projecting tampers or "sheep's foot" that it weighed 129 lbs. per cu. ft.

Where such a surface can be made with natural soil no special turnouts need be provided, but if the natural soil is sand that will not compact, paved turnouts should be built at intervals sufficiently close together to enable loaded wagons to pass without a running off onto the soft shoulders and without undue delay in waiting for one another.

The tendency of the average highway engineer is to regard any road that is fairly well traveled as being a road needing a paved double trackway. How often is a traffic census taken before designing a wagon road? We venture the guess that such a census is not taken once in a hundred times. What railway president would sign an "authorization for expenditure" to double track a railway, or even to make any expenditure for reducing grades and curvature on a single track line, unless statistics of existing traffic were placed before him? Railway betterments are not made unless an engineer's estimate shows that the betterments will show a profit. Highway betterments are usually made without any such estimate, unless we may call a guess an estimate. It is true that the country is so sorely in need of better highways that almost any guess as to the economic desirability of some improvement is apt to be correct. But in an engineer's lexicon there should be no such word as guess. Even when a wagon road is to be built into an entirely new region, an *estimate* should be made of the probable amount of traffic that it will carry within the ensuing five years, and upon this *estimate* the solution of the problem should be made, not upon a mere *guess*.

Fortunately the great majority of highway problems relate to bettering existing earth roads where the traffic can be closely predicted for several years in advance. Hence there is no excuse whatever for failure to apply the principles of engineering economics to the design of road betterments. Let us be done with "hot air" generalizations about the crying need for good roads, and let us, as engineers, prove in each specific case not only that some sort of improved highway is economically justified, but that we *know* precisely what sort of highway is required. Let us be done with our standard widths, our standard thicknesses, our standard maximum grades, our standard nonsense generally, and design our highways to fit the particular conditions in each individual case. There has been far too much engineering effort put forth in road standardizing and far too little in treating each road as a problem in itself. Many a highway engineer, for example, has accepted a 5 per cent maximum grade as the standard from which nothing short of a ruinous construction cost would cause him to depart. Yet there are roads innumerable where the traffic warrants no attempt to reduce the grade below 8 or 10 per cent. So, too, in the matter of width, density of traffic should be the determining factor. Added paved *width* of road does not make it a whit easier to pull a farm wagon to market, while added paved *length* does.

Let us put more railway engineering into our highway practice, and design our road improvements precisely as we should were the expenditures subject to the review of a railway president or a board of directors who would ask to be "shown" before authorizing the work.

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CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Computing Reinforced Concrete Flat Slabs.*

Without question one of the most useful as well as one of the least understood types of construction is the reinforced concrete flat slab. This construction was discussed by Mr. Angus B. McMillan in a paper† read before the annual convention of the National Association of Cement Users, held in Chicago in February, 1910, in which a number of solutions for this problem are presented. The fact that Mr. McMillan's summary indicates a variation of about 400 per cent between the lowest and highest amounts of steel used under the various methods of computation where the same problem is under consideration fully indicates that there is at least no accepted method of computation in general use. Without going into the details of the various methods it may be generally stated that nearly all of them use as a basis the idea that a slab deflects in the form of a warped surface. It might be said that it is assumed that the slab droops around each column in an umbrella form, the curve being reversed as it approaches the center of the span until it meets the corresponding curve from the next column.

In the writer's mind, where the flat slab is designed on columns equidistant in each direction, that is, the panels being square, and where the load is absolutely uniform all over the entire floor there is probably no question about the slab reflecting into the form of a warped surface, as described above. However, when a panel is oblong, and the thickness of the slab uniform, there will probably be a greater stiffness in the direction of the shorter span and the deflection will not necessarily take the form of a warped surface. The greater deflection in the slab may take place along a line perpendicular to the center of the long span. This argument is presented to put the problem in another light. It is not the idea to say that it is impossible for the oblong flat slab to assume the warped surface, but it is intended to say that it may be possible that it may not under all conditions take the form of a warped surface.

Another point of view which must be considered is that if we grant that the flat slab under a uniform load will assume the form of a warped surface when it deflects, are we at liberty to take this fully into account in making our calculations? Take, for example, a slab supported upon four sides by girders. In this case there can be absolutely no question but what the slab under a load does assume a warped surface, for the deflection along both spans is the same, and, since the girders are considered practically non-deflecting and the center of the slab does deflect, there can be no other condition but that the slab is warped and dished under the load. Building departments and engineers throughout the country do not give slabs supported upon four sides very much credit for this warping. Probably the most usual concession given by a building department is that the load may be considered carried in the direction of the two spans, that is, where the panel is square one-half of the load is carried each way, and after determining the amount of steel required under these conditions, the amount actually required may be considered as equal to three-quarters of that figured, the bars being gradually increased in spacing toward the ends of the span. This, the reader must remember, is a concession made only where there is absolutely no question that the only form that the slab can assume under deflection is that of a warped surface. In a flat slab where there are no beams along the center lines of the columns, as noted above, it is not certain by any means that the slab under a load will deflect in the form of a warped surface, and under these conditions the attitude of engineers and building departments certainly ought not to be more liberal than where a slab deflects as it would when supported by girders on four sides.

Another condition which probably in a large number of slabs under test has come into play, is the fact that the flaring caps in the columns are so perfectly a part of the slab and column at the same time that a large part of the strength of the slab is due to the fact that it is fixed about the columns, and, that through a moment of resistance in the columns the slab is materially strengthened. In other words, an eccentricity is created in the column by means of its continuity with the slab. A proper engineering design would not contemplate this eccentricity in the columns, unless the columns were designed to take it, which, in the interest of economy, can not be done.

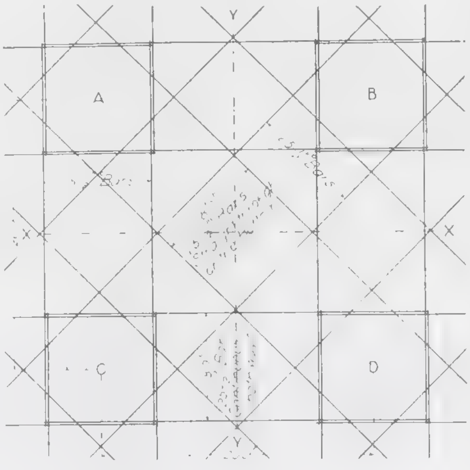


Fig. 1.

It seems to the writer that under the conditions discussed, a fair solution of the problem would consider the entire dead plus live load as being carried in the direction of the long span, where the length is greater than one and one-half times the breadth, the bending moment, however, being calculated on the most liberal basis consistent with good engineering. When a panel is square, it ought to be fair to go to the extreme limit and consider that the bending moment at the center of the span is equal to $WL/24$, W being the entire dead plus live load. This is equivalent to considering half the load carried in each direction, but using the more conservative factor 1/12 instead of 1/24, thus giving credit for deflection in two directions.

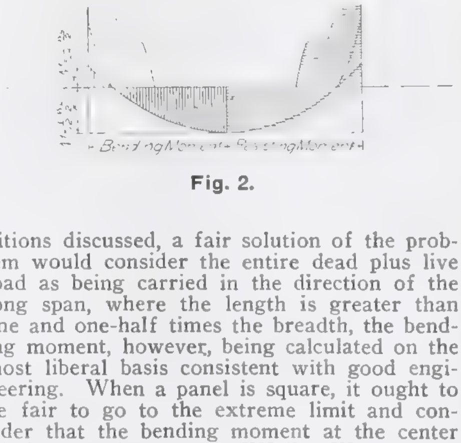


Fig. 2.

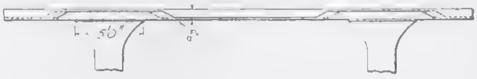


Fig. 3.

When a panel is oblong to the extent of one and one-half times its width the whole load should certainly be carried on the long span, using a formula for bending moment giving M equal to not less than $WL/12$ at the center and $WL/24$ at the support.

For panels only slightly oblong it is a question whether the proportion of load carried by the long span can be properly considered as equal to the proportion usually considered in slabs supported on four sides.

The illustrations given herewith represent a flat slab where the columns are spaced 20 ft. on centers each way, and where the design is made for a live load of 200 lbs. per square foot. A plan, Fig. 1, is given showing the arrangement of the bars, their number in each band and the widths of the bands. A moment diagram, Fig. 2, is given taken along the center line of columns, AB. A section, Fig. 3, is taken along the same line indicating the arrangement of reinforcement constituting the band AB, but not indicating the bars in the diagonal bands. In the moment diagram a parabolic moment diagram indicates the location of the moment when it is considered that one-half of the load is carried in the direction of each span, the bending moment M being considered as equal to $(1/12)\ (WL/2)$ at the center of the span and $(1/24)\ (WL/2)$ at the point of support. This negative moment of $(1/24)\ (WL/2)$ at the support, however, is based on a strip of the same width as that considered at the center of the span, and since the width of the column cap resisting negative moment is only about 40 per cent the width of the panel, the total negative resistance which must be provided per foot of width of cap must be at least 2½ times this amount.

In order to design a slab and reinforcement to resist these bending moments, a strip 1 ft. in width running from A to B is assumed having a span of 20 ft., and a live plus dead load of 307 lbs. per square foot. Using a stress in the steel of 16,000 lbs. per square inch and an extreme fiber stress in the concrete of 600 lbs. per square inch, it will be found that a net depth of 7½ in. at the center of the span is necessary, that the steel required at the center of the span must be doubled over the column, and that since the entire strength of the concrete at 600 lbs. per square inch has been developed at the center of the span the compressive resistance must be increased enough to take care of the negative moment of resistance at the point of support. The cross section through the slab along the line AB indicates how this steel is bent to the exact form and how the overlapping ends coming from each side of the column give over the column double the amount of steel that is supplied in the center of the span. The moment diagram shows on the right the positive moment of resistance at the center of the span and the negative moment of resistance toward the point of support as it is created by the doubling of the reinforcement at the top of the slab, and the increasing of the compressive resistance of the slab due to the influence of the flaring column cap and the diagonal reinforcement of the slab. It will be seen by the resistance diagram, on the right, that the shaded area amply covers the moment diagram.

Having determined the amount of steel required per foot of width in the band AB, the next step is to determine the width of this band. As it is considered that the slab might fail by deflecting along the line YY, it will be seen that concrete will be put into compression and steel will be put into tension along lines perpendicular to YY no matter whether the point considered is within the band AB or in one of the bands AD or CB. The fact that the steel through the center of the panel is placed diagonally does not necessarily mean that the lines of stress in the concrete must be diagonal, for since the line YY may be along the line of maximum deflection, the lines of stress will be perpendicular to YY. So far as concrete compressive stresses are concerned this is simple, and so far as the steel is concerned it is simply necessary to resolve the tensile stress in each bar into its components, parallel and at right angles to YY. The sum of the components of the two bands AD and CB perpendicular to YY must be the tensile resistance required for that portion of the panel not covered by bands *AB* and *CD*. In a square panel it will be seen that 0.707 of the stress in any bar running diagonally will be equal to its component perpendicular to the line *YY*. Since we have two diagonal systems crossing this portion of the panel the total stress perpendicular to the line *YY* will be equal to 1.414 times the tensile strength of either system. Consequently, if we adjust the bands *AB* and *CD* to such a width that the strip between them must be equal to 1.414 times the width of the band *AB* and place the same amount of steel in all four bands, we have supplied the proper amount of steel to resist bending along the line *YY*.

---

*A discussion before the National Cement Users' Association by Louis F. Brayton, Stone & Webster Corporation, Portland, Ore.

†Engineering-Contracting, March 23, 1910.

In the system here illustrated it is customary to have the bars in the rectangular bands bent and continuous at both ends, while the diagonal bars are straight and run through on the bottom. The rectangular continuous bars are erected first, the diagonal bars being afterward threaded under the negative bars over the column. A study of this system will show that every bar is either carried directly or indirectly over the column cap.

Attention is called to Fig. 4, showing the reinforcement used, in which the shear is largely taken care of in the steel.

With the arrangement given it will be found that the double continuous rectangular reinforcement in a square panel will almost exactly equal in length the diagonal distance between column centers, consequently whether the diagonal steel be carried through the column continuously, or whether it be spliced with broken joints, the amount of steel required for the entire panel will be equal to four times that required for one band having a length equal to the diagonal distance between centers of columns.

Following is the solution of the problem already stated, considering the half load carried in each direction and the bending moment at the center of the span equal to $(1/12)(WL/2)$.

Panel, 20x20 ft.; live load, 200 lbs. per square foot; dead load, 107 lbs. per square foot; stress in concrete, 600 lbs. per square inch; stress in steel, 16,000 lbs. per square inch.

M (at center) $= (1/12) \quad (wL^2/2) = 5{,}110$ ft.-lbs

Net depth of slab = 7½ ins.; total thickness, 8½ ins.

Area of metal per foot width = 0.6 sq. in.; area of metal for width of 8⅓ ft. = 8⅓ × 0.6 = 5 sq. ins. Bars required per band = 25 ½-in. round; spacing, 4 in. center to center. Total steel in panel, 100 ½-in. round bars, 28½ ft. long; total weight at 0.667 lb. per foot = 1,900 lbs.; weight per square foot = 4.75 lbs.

It may be noted that when a square slab is designed on a basis as set forth above, L being the distance from center to center of columns, and w being the total dead plus live load per square foot, the weight of steel required in the slab per square foot may be closely determined by the following formula:

$0.135\,L\sqrt{w}$ = weight of steel per square foot.

Applying this to the above problem we have $0.135 \times 20 \times \sqrt{307} = 4.73$ lbs. per square foot.

It is interesting to compare the above design with various designs given by McMillan. For purposes of comparison McMillan's table with the above result added is reproduced here.

Method.	Thickness of slab.	Stress in steel, lb. per sq. in.	Steel in panel, lb.
1. Cantilever	8 in.	16,000	2,189
2. Turneaure and Maurer	12 in.	16,000	1,931
3. Grashof	8 in.	16,000	784
4. Mensch	8 in.	16,000	2,120
5. Turner (a)	8 in.	16,000	549
5. Turner (b)	8 in.	13,000	718
6. McMillan	8 in.	16,000	1,084
7. Brayton	8½ in.	16,000	1,900

The writer believes that the system shown, particularly in its detail, has advantages which are apparent to most engineers in that the shear or diagonal tension in the slab is very materially assisted by the arrangement of the reinforcement, and the bars, because of being bent mechanically, are positively located so that they take care of the negative bending moment.

The bending of these bars economically done by means of a right and left double bar bender at a very low cost puts four bends in a bar at once and ensures the bending of the bar to exact detail. Springing the bars into place, or allowing them to sag under their own weight, leaves a great deal to the contractor and causes a lack of confidence in the engineer that the reinforcement will be placed exactly as he intended it. Circular cracks running around the top of a column in a slab are utterly impossible when the steel is as exactly placed as it is shown in the photograph. The fact also that only two systems of steel occur in the top surface means that the effectual depth is not materially decreased as it is where it is necessary to carry all four systems to the top surface.

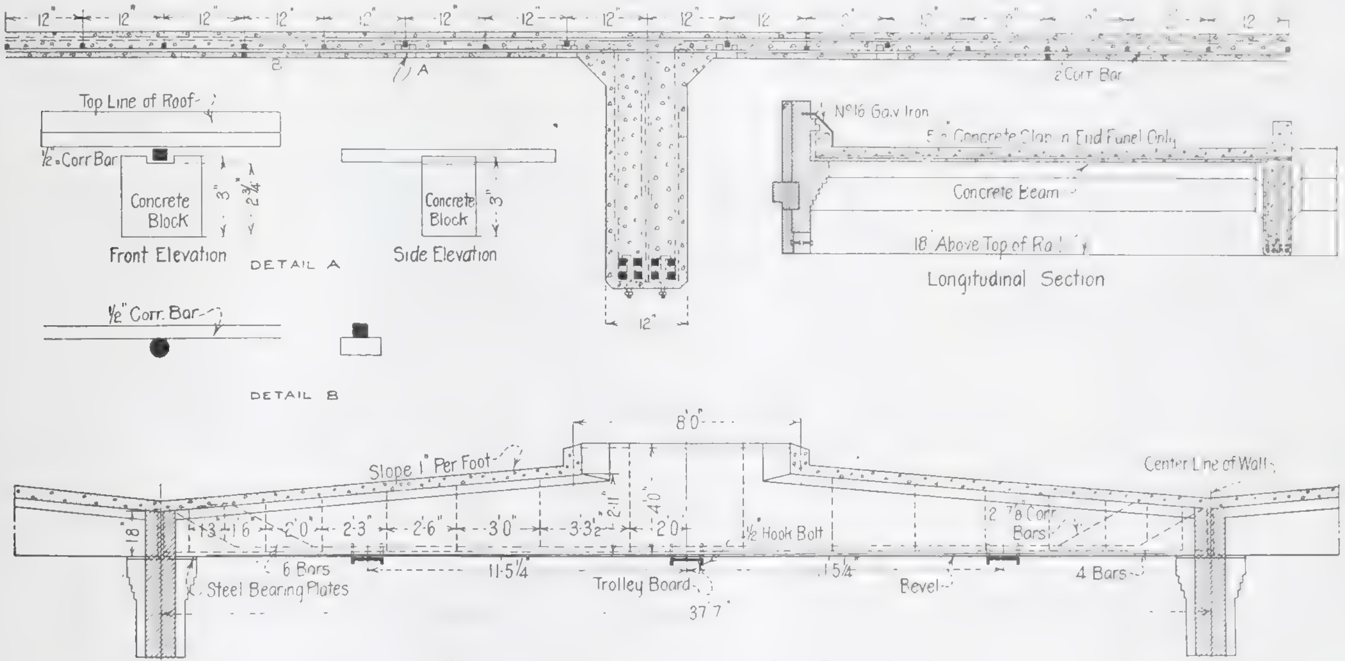


Fig. 1—Reinforced Concrete Car Barn Roof.

Cost of Concrete Work in Two Car Houses and a Substation for the Chicago City Railways Co.

The buildings described were built during 1908-9 in Chicago, Ill. The work was done according to the plans of and under the direction of the Board of Supervising Engineers Chicago Traction, Mr. Bion J. Arnold, Chairman, and Mr. George Weston representing the city. Mr. Harvey B. Fleming represented on the Board the Chicago City Railways Co.

CAR HOUSES.

The general plans of the Board of Supervising Engineers call for double ended car houses divided into longitudinal bays by fireproof partitions. The exterior walls are of brick. The columns and walls have concrete footings and the floors are of concrete. The pits are open and have concrete walls and floors. Between pits the floors are reinforced concrete and the roof is reinforced concrete slab and girder construction with skylights along the center of each bay nearly the whole length.

Sixty-Ninth St. and Ashland Avenue House.—This car house was built during 1908. It is 485x265¼ ft., divided into six car storage bays and one repair bay by six longitudinal partitions. Each bay has three tracks with a pit under each track. In the storage bays the pits are all 288 ft. long and in the repair bay they are 176 ft. long. The roof construction is shown in detail by Fig. 1. The concrete work comprised foundation footings and walls, floors, pits, wells and floor and roof slabs and girders. The cost of the concrete work was as follows:

For 1,776 ft. of 1:3:6 plain concrete in footings and foundation walls the cost including forms was $11,181 or $6.30 per cu. yd. The cost of 380 cu. yds. of 1:3:6 concrete in pit walls, including form work, was $3,026, or $7.96 per cu. yd. The pit floors, containing 1,287 cu. yds., cost $9,515 or $7.40 per cu. yd. The cost of pit floors per square foot was 13.6 cts. There were also 12,200 sq. ft. of cement walk and 1,186 ft. of curb. The walks were 4½ ins. thick, of 1:2½:5 concrete, with a ¾-in. top coat of cement and granite screenings; the cost was as follows:

Item	Total	Per sq. ft.
Materials	[illegible]	[illegible]
Labor	[illegible]	0.123
Total	$2,1[illegible]	$0 179

The curbing was 2 ft. deep by 6 in. thick and the cost of 1,186 lin. ft. or 43.9 cu. yds. was:

Item	Total	Per lin. ft.	Per cu. ft.
Material	$151	$0.127	$ 3.44
Labor	463	0.390	10.54
Total	$614	$0.517	$13.98

The cost of 89,935 sq. ft. of roof, including 168 girders, of the construction shown by Fig. 1 can be given in more detail. There were in this roof 2,365 cu. yds. of 1:2½:5 concrete. The cost of concrete materials and labor concreting was as follows:

Item	Total	Per cu. yd.
5,075 bbls. cement at $1.21	$ 3.721	$1.57
1,675 cu. yds. sand at $1.60	2,680	1.14
1,635 cu. yds. stone at $1.40	2,289	0.96
Labor concreting	7,227	3.06
Total	$15,917	$6.73

The cost of reinforcing rods and labor placing was as follows:

Item	Total	Per cu. yd.
329.900 ft. ½-in. bar at 1.62 cts.	$ 5,344	$2.22
14,629 ft. ½-in. stirrup at 1.84 cts.	269	0.12
153,605 ft. ⅞-in. stirrup at 1.75 cts.	2.689	1.14
Labor on reinforcements	2,788	1.18
Total	$11,090	$4.66

The cost of incidentals and labor for forms was as follows:

Item	Total	Per cu. yd.
91 M. ft. B. M. hemlock at $18	$ 1.638	$0.69
149 M. ft. B. M. pine at $20	2,980	1.26
Spikes, bolts and wire	500	0.21
Labor on forms	12.632	5.34
Total	$17,750	$7.50

Summarizing the above figures and extending them to include cost per square foot we have the following:

Item	Total	Per cu. yd.	Per sq. ft.
Concrete	$15,917	$6.73	$0.177
Reinforcement	11,090	4.66	0.123
Forms	17,750	7.50	0.197
Total	$44,757	$18.89	$0.497

Archer Ave. and Rockwell St. House.—The dimensions of this house are 309x490 ft. and it is divided into seven bays by longitudinal fireproof walls. The concrete construction comprises foundation walls, pits and roof of the design shown by Fig. 1.

The foundation walls of 1:3:7 concrete cost for 1,953 cu. yds. as follows:

Concrete	Total	Per cu. yd.
1,894.41 bbls. cement at $1.22	$2,311.18	$1.183
839.79 cu. yds. sand at $1.43	1,200.00	0.614
1,972.53 cu. yds stone at $1.54	3,037.70	1.555
Labor, mixing and placing	2,874.18	1.471
Total concrete	$9,423.06	$4.823
Forms.		
Lumber	$ 627.67	$0.321
2 rolls No. 10 wire at $2.23	4.46	......
2,000 18-in, form clamps at 4¾ cts.	95.00	......
500 26-in. form clamps at 5¾ cts.	28.75	......
125 25-in. form clamps at 5½ cts.	6.85	0.134
500 keys for form clamps at 3 cts.	15.00	......
48 kegs of nails at $2.36	113.30	......
Labor building and removing	2,588.30	1.321
Total forms	$3,479.33	$1.776
Supplies.		
7.65 tons coal at $4.15	$ 31.75	......
5 gals. cyl. oil at 48 cts.	2.40	......
10 gals. eng. oil at 23 cts.	2.30	......
10 lbs. lubricant at 12 cts.	1.20	......
Total supplies	$ 37.65	$0.019
Grand total	$12,940.96	$6.618

The pit tracks are supported by cast iron columns on each side and these columns have concrete footings. The cost of these footings which are of the usual stepped pedestal type was as follows:

Item	Total	Per cu. yd
270 bbls. cement at $1.22	$ 329.40	[illegible]
118 cu. yds sand at $1.40	168.74	0.694
241 cu. yds. stone at $1.54	371.17	1.525
Labor mixing and placing	453.75	1.867
Coal and oil	1.85	0.007
Total	$1,324.88	$5.448

The following was the cost of 211 cu. yds. of concrete in the side and end walls of the pits:

Concrete.	Total	Per cu. yd.
235 bbls. cement at $1.22	$ 286.70	$1.35
105 cu. yds. sand at $1.43	150.15	0.72
209 cu. yds. stone at $1.54	321.86	1.52
Labor mixing and placing	214.52	1.02
Total	$ 973.23	$4.61
Forms.		
16 kegs nails at $2.40	$ 38.40	$0.18
½ roll wire	1.00	0.05
Lumber	108.50	0.51
Labor erecting	647.38	3.06
Labor removing	121.30	0.57
Total	$ 916.58	$4.37
Grand total	$1,889.81	$8.98

The floor work of the building comprised the floors between tracks for the end sections of each bay not occupied by the pits; the floors for store room, shops and other service rooms; the pit floors and the reinforced concrete floors between pits. All these floors except the reinforced concrete floors between pits are of the usual concrete basement floor construction:

End floors (63.630 sq. ft.).	Total	Per sq. ft.
1,684 bbls. cement at $1.22	$2,054.28	$0.03
744 cu. yds. sand at $1.43	1,063 92	0.01
1,190 cu. yds. stone at $1.54	1,832.60	0.02
Labor	3,980.00	0.06
8.45 tons coal at $4.15	35.00	0.0005
32 tons coke at $5.25	168.00	0.02
38 loads manure at $2	76.00	0.001
Oil	4.10	0.00006
Total	$9,213.90	$0.14156

Service floors (11,921 sq. ft.).

	Total	Per sq. ft.
239 bbls. cement at $1.22	$ 291.58	$0.025
105 cu. yds. sand at $1.43	150.15	0.015
155 cu. yds. stone at $1.54	164.78	0.015
Labor	1,154.00	0.095
1,380 cu. yds. cinders at 30 cts.	414.00	0.032
1 ton coal at $4.15 and oil	4.70	0.0003
Total	$2,179.21	$0.1823

Excluding the cost of cinders we have a cost of 11.33 cts. per sq. ft.

Office floors (8,793 sq. ft.).	Total	Per sq. ft.
120 bbls. cement at $1 22	$ 146.40	$0.016
53 cu. yds. sand at $1.43	75.79	0.008
107 cu. yds. stone at $1.54	164.78	0.018
Labor	842.00	0.095
1,010 cu. yds. cinders at 30 cts.	303.00	0.035
Coal and oil	3.90	0.0004
Total	$1,535.87	$0.1724

Excluding the charge for cinders we have a cost of 10.58 cts. per sq. ft.

Pit floors (58.559 sq. ft.).	Total	Per sq. ft.
1,377 bbls. cement at $1.22	$1,679.94	$0.028
609 cu. yds. sand at $1.43	870.87	0.014
940 cu. yds. stone at $1.54	1,447.60	0.024
Labor	4,078.04	0.069
6.675 tons coal at $4.15	27.70	.....
28 tons coke at $5.25	147.00	0.002
43 loads manure at $2	86 00	0.001
56 gals. gasoline at 12½ cts.	7.00	.....
Oil	3.24	.....
Total	$8,347.39	$0.1422

Reinforced concrete floors (37,048 sq. ft.).

	Total	Per sq. ft.
1,126 bbls. cement at $1.22	$1,373.22	$0.037
497 cu. yds. sand at $1.43	710.70	0.019
822 cu. yds. stone at $1.54	1,265.88	0.034
37,048 sq. ft. wire netting at 17 cts.	629 82	0.017
Labor on concrete	2,295.00	0.061
Form lumber	281 60	0.007
Labor erecting forms	2,271.15	0 061
Labor removing forms	371.50	0.010
7.05 tons coal at $4.15	29.25	0.001
18.05 tons coke at $5.25	97.12	0 002
23 loads manure at $2	46.00	0.001
Oil	2.80	0.0001
Total	$9,374.05	$0.2501

The roof construction, as previously stated, was substantially that shown by Fig. 1. The cost of 121,881 sq. ft. or 2,869 sq. yds. was as follows:

Item	Total	Per cu. yd.
Concrete materials	$11,779.00	$4.11
Labor on concrete	10,280.45	3.58
Small concrete blocks	80.00	0.02
Total concrete	$22,139.45	$7.71
Form lumber ($9,531.04—$3,321.75 salvage)	$ 6 209 29	$2.16
Butts, washers and nails	458.80	0.15
Labor erecting forms	19,221.80	6.69
Labor removing forms	4,728.10	1.64
Labor moving forms to storage	629.00	0.21
Total forms	$31,246.99	$10.85
Reinforcement	$ 7,886.65	$2.74
Wire	57.20	$0.01
4 kegs round rods	12.00	0.004
Labor on reinforcement	3,954.05	1.37
Total reinforcement	$11,909.90	$4.13
Coal	$ 80.00	$0.02
Cylinder oil	3.58	0.001
Engine oil	3.44	0.001
Imperial lubricant	1.80	0.001
Tar paper	40.30	0.01
Manure	25.00	0.008
Total supplies	$ 154.12	$0.05
Grand total	$65,550.46	$22.74

This gives a cost per square foot of roof of 53.7 cts. Neglecting the salvage in lumber the cost is 56.42 cts. per sq. ft.

SUBSTATION.

The substation was built during the fall and winter of 1908-9. The building is of dark pressed brick so designed as to be an ornament to the neighborhood in which it is located. The construction is fireproof throughout, with book tile roof carried on structural steel trusses. A wainscot of chocolate colored brick extends to a height of 6 ft. around the interior walls, and above this wall is faced with buff pressed brick.

All windows have metal frames and sash, glazed with wire glass; sash are pivoted and provided with operating devices. The floor of the operating room is of reinforced concrete with red, octagon encaustic tile wearing surface. Around all machines a cast iron covering has been placed Particular pains have been taken with the laying of the tile floor on account of the difficulty had with tile floors in substations previously built, in that if a proper bond was not obtained between the tile and the concrete surface the tile separated from the concrete and bulged up. All tile have been laid in pure Portland cement under a rigid specification and guarantee.

The building is 60 ft. wide by 120 ft. 7 ins. long over all, and the operating room has a clear height of 32 ft. to the under side of the steel roof trusses. The basement is 10 ft. 6 ins. high and is provided with a large air chamber located directly beneath the transformers and reactances. An air pressure is maintained in this chamber by 4 motor-driven fans located in the basement in front of the rotary foundation walls in a row lengthwise of the building, the discharge from these fans being through openings under the floor in the passageway beneath the converters. All high tension bus bar and potential and current transformers are housed in standard pressed brick structures in this air chamber.

The concrete work comprises footings for walls and piers, building walls, rotary converter walls, basement floor and drives, station floors, partition walls and battery shelves. The costs of these various items of work were as follows:

Wall and Pier Footings.

	Total	Per cu. yd.
234 bbls. cement at $1.21	$ 283.94	$1.32
110 cu. yds. sand at $1.60	176 00	0.82
197 cu. yds. stone at $1.55	305.35	1.42
Labor placing concrete	647.78	3.01
Total concrete	$1,413.07	$6.57
Form lumber	$ 60.00	$0.28
Labor on forms	55.40	0.25
Total forms	$ 115.40	$0.53
Grand total	$1.528.47	$7.10

Building Walls.	Total	Per cu. yd.
272 bbls. cement at $1.21	$ 329.12	$1.45
116 cu. yds. sand at $1.60	185.60	0.83
187 cu. yds. crushed stone at $1.55	289.85	1.28
Labor on concrete	472.00	2.08
Total concrete	$1,276.57	$5.64
Lumber for forms	$ 336 00	$1.48
Nails, etc.	41.00	0.18
Carpenter work on forms	460.20	2.04
Removing forms	142.55	0.63
Total forms	$ 979.75	$4.33
Miscellaneous labor	$ 55.50	$0.24
Grand total	$2,311.82	$10.21

Basement Floor and Drive.

	Total	Per sq. ft.
353 bbls. cement at $1.21	$ 427.13	$0.08
146 cu. yds. sand at $1.60	233.60	0.04
91 cu. yds. stone at $1.55	141.05	0.03
Labor placing concrete	1,077.70	0.21
Labor finishing floor	247.05	0.05
Total concrete	$2,126.53	$0.04
170 cu. yds. cinders at 25 cts.	$ 42.50	$0.008
Manure	10 20	0.0019
Miscellaneous materials	66.21	0.012
Carpenter labor	155.91	0.029
Labor placing cinders, etc.	590.31	0.11
Total	$ 865.13	$0.165

Grand total	$2,991.66	$0.576
Station Floor.	Total	Per sq. ft.
286 bbls. cement at $1.21	$ 346.06	$0.079
121½ cu. yds. sand at $1.60	194.40	0.045
108 cu. yds. stone at $1.55	167.40	0.038
Labor placing concrete	720.50	0.160
Patching floor	35.00	0.008
Total concrete	$1,463.36	$0.33
Lumber for forms	$ 197.85	$0.045
Beam clips	30.00	0.007
Bolts	45.50	0.010
Miscellaneous	45.60	0.010
Labor building forms	2,006.56	0.460
Labor erecting forms	274.10	0.063
Labor cleaning forms	115.10	0.026
Labor removing forms	284.93	0.065
Total forms	$2,999.64	$0.686

Grand total	$4,464.00	$1.016

The cost of water-proofing 1,040 sq. yds. of foundation walls, footings and floors was as follows:

Item.	Total	Per sq. yd.
177 rolls felt at $1.30	$ 230.10	$0.221
39 bbls. tar at $3.80	128.70	0.123
Maps, etc.	16.87	0.016
Labor	359.90	0.346
Total	$ 735.57	$0.706

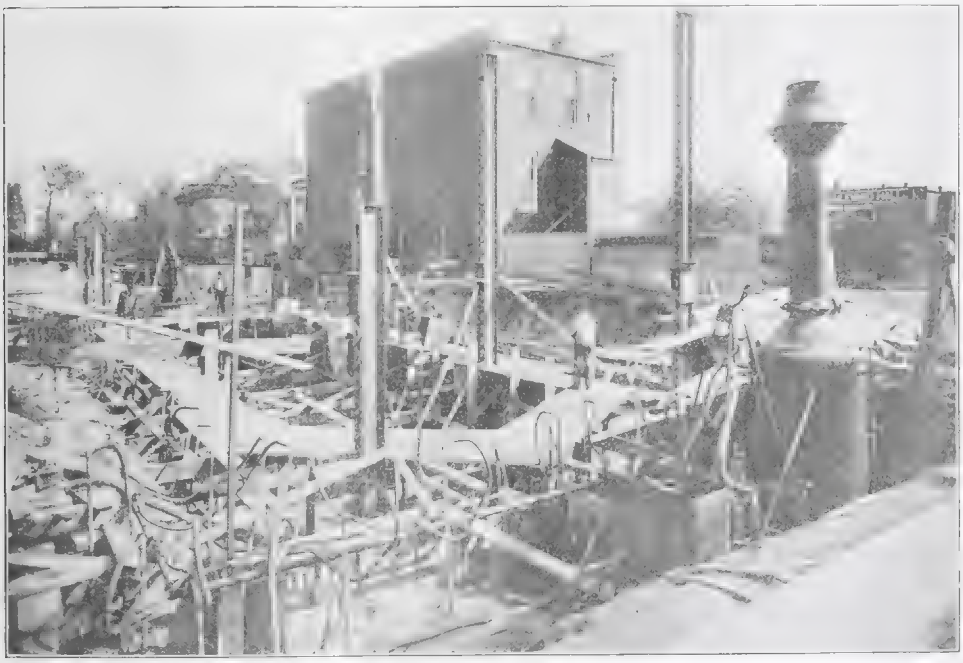
None of the above costs include engineering, superintendence or overhead charges. While the wages by items are not available they were union wages for 1908, which run about as follows per hour: Enginemen, 70 cts.; carpenters, 60 cts.; finishers, 56¼ cts., and common labor, 37½ cts.

Perhaps the most interesting of the various costs given are those of roof work. The character of this work is indicated clearly by the drawings of Fig. 1. In one case the unit cost was $18.89 per cu. yd. and in the other case $22.74 per cu. yd., and of the total cost about 70 per cent and 50 per cent, respectively, and chargeable to form work.

EARTH AND ROCK SECTION

Methods and Costs of Excavating and Concreting a Swimming Pool.

A swimming pool recently built in the annex to the Sinai Temple, Chicago, was excavated under rather difficult conditions, owing to the water encountered and the nature of the soil, which was clean sand. The excavation for the basement of the building was carried 8 ft. below the street level and that for the pool was carried 14 ft. deeper, 11½ ft. of which was below the level of the ground water. The area containing the pool was enclosed by 3-in. tongued and grooved sheeting, the lines of sheeting being 71x32 ft. This area was 11 ft. greater each way than the inside dimensions of the pool and allowed for the walls which were 1 ft., 6 ins. wide at the top and 3 ft., 6 ins. wide at the bottom. The sheeting was driven by hand with a wooden maul, two men being kept at this work while the excavation was being carried on.


View Showing Well Point Arrangement for Bleeding an Excavation Pit.

In order to keep the site unwatered a point system was used. A 3-in. main was laid around the upper edge of the excavation and 1¼-in. points about 16 ft. long were placed every 3 ft. along the inside of the sheeting and connected by hose to the 3-in. main. The 1¼-in. points consist of galvanized iron pipes having solid cone-shaped points at the lower ends. From the lower ends up for 36 ins. they are perforated with ⅛-in. holes and screened with fine wire mesh. As the excavation proceeds the points are lowered and are kept just low enough to unwater the site as low as the excavation has proceeded. It is necessary to have one man looking after the points, giving them a twist once in a while to keep the particles of sand from clogging the wire mesh. Two Nye pumps, size No. 6, were used, one being set at each end of the work. These pumps were attached to the main so that each pump handled the water from half of the area. Toward the end of the work, however, the water was held back by the concrete floor and only one pump was necessary. A gage on each of the pumps showed them to be creating over 30 ins. of vacuum at every stroke.

The work was all done by hand. The material was shoveled to a scaffold and on to the bank behind the sheeting and then again shoveled back to make space for more. The material in the center of the pit had to be thrown from these toward the edge before being shoveled onto the scaffold thus making four handlings for that part. When the excavation had reached about 3 ft. depth, 12x12-in. braces were set in to hold the sheeting.

They were placed about 8 ft. apart, on centers, and butted against 8x18x8-in. wailing timbers.

In concreting, a Smith ½-cu. yd. mixer, operated by steam, was used, and plank runways led from the mixer out over the work. Sterling buggies of about 7 cu. ft. capacity were used for transporting the concrete. A floor 12-ins. thick was put in and walls battered on the outside, from 3 ft., 6 ins. at the bottom to 1 ft., 6 ins. at the top. The walls varied in height from 4 ft. to 9 ft., 6 ins. The forms used consisted of 1x6-in. sheathing and 2x6-in. studding placed 16 ins. on centers.

The number of laborers used on the work varied considerably as this job was only a part of the work on a larger building and men were put on and taken away as necessity required. The largest number used on the excavation at any one time, however, was 25 men. Common labor at 37½ cts. per hour was used for excavating and concreting and carpenters at 62½ cts. an hour built the forms. The costs of all labor was accurately distributed and resulted as follows:

96 points at $1.00 each	$ 96.00
2,500 sq. ft. sheet piling at $0.07	175.00
800 cu. yds. excavation at $0.20	160.00
70 cu. yds. floor slab at $0.65	45.50
150 cu. yds. walls at $0.75	112.50
3,000 sq. ft. forms at $0.04½	135.00
Total labor cost	$724.00

The pumps were worked continuously in 3 shifts of 8 hours each. The cost of the labor, pumping amounted to about $800.

One foreman at $8 per day was also charged to the work.

A coat of Hydrolithic waterproofing cement is now being put on the interior surfaces, after which a veneer wall of white enameled brick will be laid. The Thompson-Starrett Co., of Chicago, are the contractors for the work.

We are indebted to the superintendent, Mr. A. Crane, for the costs given.

Methods and Records of Prospecting With Core Drills in Arizona.*

All the data used in this article are taken from the drill log of one of the copper companies in the Miami district, Arizona. The first 10 holes, drilled by two No. 23 traction Star drills (1,000-ft. machines), are cited as examples.

A soft schist and a decomposed granite are the principal rocks encountered in this district, although a soft dacite is also of some importance. The holes to which the following figures apply, were driven 400 to 600 ft. in depth. The country is mountainous, necessitating much road building. The country rock is badly fissured; is soft as a whole, but containing hard streaks varying in thickness from 5 to 15 ft.; consequently much caving is encountered. A 10-in., or larger, bit is used to start the hole; next in order follow bits approximately 7⅝-, 6¼- and 4½-ins. The drill cuttings are sampled every 5 ft.

Time Consumed in Various Operations.—Table I gives the actual time employed in the various duties. Under drilling and sampling, in column two, are included such items as measuring, bailing and delays of any sort lasting not more than 15 minutes. In the last column is tabulated the amount and size of casing lowered into each hole. Table II except for the first three columns, consists of the figures given in Table I, worked out to percentages.

The average rate of drilling was 21.08 ft. per shift. This is high for the district. It may be attributed to good supervision and to the fact that all these figures represent day work. The average advance, barring accidents such as "fishing," is higher for a shallow hole, as the actual time consumed in bailing a deep hole, putting in greater length of casing, raising and lowering the tools, measuring, etc., is more. Friction also hinders much in deep drilling.

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*An article by A. H. [illegible] in "Engineering and Mining Journal" for Oct. 22, 1910.

TABLE II.—PERCENTAGE DISTRIBUTION OF TIME.

Hole	Total Hours	Average feet per shift	Drilling and sampling Per cent.	Repairing Per cent.	Moving Per cent.	Lowering casing Per cent.	Removing casing Per cent.	Delays Per cent.	Repairing Per cent.	Delays Per cent.
1	468	15.3	66.5	3.50	2.20	7.10	4.05	13.7	6.20	20.6
2	348	18.9	65.5	3.02	1.58	3.84	3.44	18.9	4.63	28.9
3	384	19.2	72.0	3.47	1.89	1.3	0.78	18.3	4.82	25.4
4	360	16.6	77.8	0.28	1.10	4.17	3.34	13.2	0.36	17.0
5	240	20.75	77.6	3.54	5.20	2.3	2.08	5.43	4.55	7.0
6	234	22.3	70.0	2.35	5.55	....	....	22.0	3.36	31.50
7	210	23.8	76.3	2.96	10.0	2.48	0.83	7.5	3.90	9.85
8	228	22.4	71.3	2.04	7.02	1.31	2.62	14.9	2.88	21.2
9	168	24.0	75.6	6.10	8.34	....	...	7.45	8.70	9.85
10	150	27.6	68.3	0.67	15.3	...	....	16.02	0.99	23.60
Average	279	21.08	72.09	2.79	5.81	3.21	2.45	13.74	4.04	19.49

The columns concerning casing are seen to be directly affected by the length of casing lowered into the hole. Removing casing is always a shorter operation than lowering it. Delays, repairing, casing and casing removal increase out of proportion, with great depth of hole, and in the order named.

In Table III, under column two, is tabulated the total advance at the end of each successive shift. This advance is an average of the total daily advance of the 10 holes. The last two columns are derived from the first two. The average speed, as given in column four, has been plotted against the total shifts and the total distances are given in the accompanying diagram.

Fast Drilling in Shallow Holes.—When drilling is commenced (called spudding) the speed for the first 100 to 150 ft. is better than at any other period. From the diagram it is evident that delays, incident to moving and setting up, affect adversely the early averages. The high speed drops somewhat as depth is attained, and the curves continue evenly until a sudden break in both is observed. This is due to the first string of casing, with its attendant delay, being lowered into the different holes. The curves now continue evenly, dropping gradually as greater depth is attained. A second break, due to the lowering of the second string of casing, is followed by a third gradually decreasing the average.

The curves shown are characteristic of this district. A different kind of rock, a less mountainous country, different style of "setting up" and lower wages might give an entirely different curve. The record of each hole as given begins from the time the casing on the last hole is removed. All delays incident to dismantling, moving and setting up are thus chargeable to the new holes and affect the beginning of the curve.

Economic Conditions.—In summer, a light corrugated roof is placed over the drill platform; in winter, none. A seasonable change in the curve could thus be expected. Due to the intense heat of this district during the summer season, the sharpening of a large bit calls for a rest which causes greater delay. The drill crew is paid $6 and $4.80 per day of 12 hours. Where wages are lower, a lower drilling efficiency is obtained. A crew drilling day shift only do 50 to 60 per cent more than a crew working double shift (12 noon to 12 midnight and vice versa.) A fishing job, lasting from an hour to a week or more, plays havoc with the drill record. A management trying to stint, not only lowers the average, but increases the cost per foot of hole drilled as well. An extra driller or helper on two or more machines is always useful, and does not increase the cost per foot of hole. He will be of use in casing, in moving the machine, and in the upkeep of the drills, thus prolonging their life while increasing the first-cost charge per foot of hole drilled. A team should always be at hand; an accident will cause a temporary shutdown until the repair parts can be obtained. When holes are driven deeper than 600 ft., the average advance falls off rapidly.

In general, it may be said that the "average" curves will be effected by the kind of rock, contour of the ground, wages, season and weather, and the personnel of the management.

In Table IV are tabulated average speeds for three different sized bits. A 10-in. string of tools weighs 2,181 lbs.; a 7⅝-in. set, 1,994 lbs. and a 6¼-in set, 1,773 lbs. A 10-in. bit in a run of 5 ft. cuts out about 450 lbs. of rock; a 7⅝-in. bit, about 260 lbs. and a 6¼-in. bit, approximately 180 lbs. It would therefore seem that the smaller bits with almost the same weight of tools, cutting out only 60 per cent and 40 per cent of the material cut by a 10-in. bit, would give much higher rates of speed, but this is not the case.

This paradox, excepting delays due to depth as mentioned above, may be accounted for by the following reasons: As smaller casing is introduced, the same-sized rope and tools (2-in. manila cable and 4-in. auger stem) are continued in use. These, dragging against the sides, and in the smallest casing forming an air cushion, tend to lower the speed. Moreover, ground water is encountered in all the holes at depths of from 150 to 250 ft. Once the tools strike permanent water, and it must be borne in mind that casing seldom keeps out this underground flow, the speed diminishes. Figures are not available to give the percentage decrease in speed. The relatively high speed of spudding is another determining factor in raising the average speed of the largest-sized bit.

TABLE III.—AVERAGE DAILY FOOTAGE OBTAINED IN 10 DRILL HOLES.

No. Shifts.	Total Advance, Ft.	Daily Advance, Ft.	Average Speed, Ft.
1	5.8	5.8	5.8
2	24.9	19.1	12.05
3	42.4	17.5	18.1
4	84.9	42.5	22.47
5	116.5	31.6	24.49
6	138.0	21.5	24.05
7	159.1	21.1	23.67
8	184.9	25.8	23.94
9	208.3	23.4	23.88
10	231.3	23.0	23.78
11	254.0	22.7	23.67
12	270.4	16.4	23.03
13	286.7	16.3	22.49
14	302.2	15.5	21.97
15	322.3	20.1	21.81
16	342.1	19.8	21.68
17	364.4	22.3	21.72
18	380.6	16.2	21.36
19	391.7	11.1	20.74
20	402.5	10.8	20.20
21	414.2	11.7	19.72
22	435.0	20.8	19.77
23	451.3	16.3	19.63
24	460.0	8.7	19.18
25	469.0	9.0	18.65
26	486.5	17.5	18.72
27	501.8	15.3	18.58
28	511.8	10.0	18.28
29	528.8	17.0	18.25
30	536.7	7.9	17.90

TABLE IV.—AVERAGE RATE OF CUTTING OF VARIOUS BITS.

	Speed with 10-in. Bit.		Speed with 7⅝-in. Bit.		Speed with 6¼-in. Bit.	
Hole.	Average feet drilled.	Average feet per shift.	Average feet drilled.	Average feet per shift.	Average feet drilled.	Average feet per shift.
1	220	20.0	100	16.6	122	18.7
2	240	24.0	212	19.3	...	....
3	143	20.4	319	19.9	...	....
4	200	14.3	105	17.5	85	21.2
5	140	20.0	145	24.2	...	....
6	75	25.0	300	27.3	...	....
7	312	31.2	65	22.0	...	....
8	125	20.8	185	31.0	...	....
Aver.	...	21.96	...	22.33	...	19.95

TABLE I.—DISTRIBUTION OF TIME IN HOURS

Hole.	Drilling and sampling. hr.	min.	Repairing. hr.	min	Moving. hr.	min.	Lowering casing. hr.	min.	Removing casing. hr.	min.	Other delays. hr.	min.	Depth feet.	No shifts	Casing lowered. feet.	inches.
1	310	40	16	25	9	30	33	20	19	00	64	05	595	39	342 455 545	7⅝ 6¼ 4½
2	227	35	10	05	5	35	13	20	12	00	65	45	550	29	339 400	7⅝ 6¼
3	276	20	13	20	7	20	5	00	3	00	70	20	615	32	272 300	7⅝ 7⅝
4	280	00	1	0	4	00	15	00	12	00	47	40	500	30	300 412	7⅝ 6¼
5	186	15	8	30	12	30	5	30	5	00	13	00	415	20	254	7⅝
6	163	30	5	30	13	00	..	..	.	.	51	30	435	19.5	...	...
7	160	00	6	15	21	00	5	15	1	45	15	45	417	17.5	336	7⅝
8	162	10	4	40	16	00	3	00	6	00	34	10	425	19.0	232	7⅝
9	127	00	10	15	14	00	..	..	..	.	12	30	336	14.0	...	...
10	101	55	1	00	23	00		..			24	05	345	12.5	...	...

Cost of Drilling Holes in Concrete.—The following costs on drilling holes in concrete are given by Mr. J. R. Taft, Assoc. M. Am. Soc. C. E., in the Engineering Record. The figures include only the labor cost with a proportion of the labor at the central compressor plant. About 600 holes 32 ins. deep and 1½ ins. in diameter were made in a number of viaduct piers, near New York City. The drillers made all their own connections and extended the ¾-in. air line from pier to pier (about 75 ft.). About 40 to 50 per cent of the drillers' time was consumed in preparing to drill. The average penetration per hour was 4.7 lin. ft., which is used as a basis in calculating the following table:

	Cost per lin. ft. drilled.
One bridgeman drilling at 56¼ cts. per hr.	$0.120
31 per cent blacksmiths' time at 43¾ cts. per hr.	0.029
31 per cent blacksmith helpers' time at 21⅞ cts. per hour	0.012
14 per cent compressor engineers' time at 56¼ cts. per hour	0.017
Supervision	0.011
Total labor	$0.189
Drill steel broken, lost, etc., 0.025 ft. at 50 cents	$0.012
1-7 of 2,400 lbs. soft coal at $4 per ton	0.019
Oils, waste, etc., negligible	0.000
Total material	$0.031
Grand total	$0.220

Some 270 lin. ft. of hand drilling done on the work showed an average penetration of 1.77 lin. ft. per hour based on the total time worked.

Costs of Granolithic Finish on Concrete Floors.—From various results obtained by the Aberthaw Construction Co., of Boston, Mass., for the cost of finishing concrete floors with granolithic finish, the following table has been prepared:

Finisher at 50c per hr.	$1.00 to $1.30
Mixing and placing concrete	.42
Cement, 1.11 bbls. at $1.40	1.55½
Sand, 3½ cu. ft. at $1.00 yd.	.12
Fine stone, 3½ cu. ft. at $2.00 yd.	.25
Total	$3.34½ to $3.64½

ROADS AND STREETS SECTION

Tests of Creosoted Wood Paving Blocks.

Some interesting tests have been made by Messrs. Waring and Halstead of the class of 1909 in Civil Engineering at Purdue University to determine the relative strength and swelling of natural and treated larch and tamarack paving block. The results of these tests were given in a paper by Prof. W. K. Holt of Purdue University, at the last annual meeting of the Indiana Engineering Society, and the matter that follows has been taken from Prof. Holt's paper:

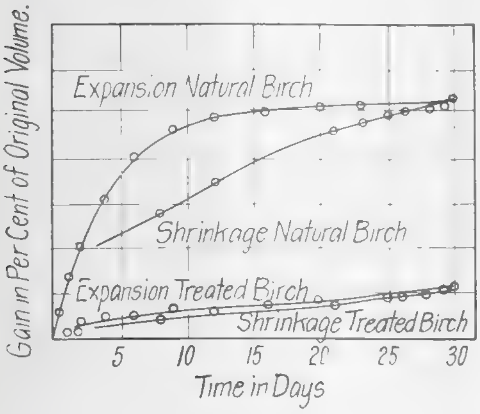


Fig. 1.

TABLE I.—(TESTS OF 1907.)
Strength in Natural Condition.

	Compression, lbs. per sq. in.	Moisture.	Indentation, lbs. per sq. in.	Abrasion, maple =100.	Moisture.
Larch	10013	5.5%m	1882	362	5.5%m
Birch	12016	6.2%m	2012	223	3.1%m

Effect of Treatment.

		Relative.		Relative.		Relative.
Natural Larch..	10113	100	1882	100	362	100
Treated Larch..	7685	76	1764	93	684	190
Natural Birch...	12016	100	2012	100	223	100
Treated Birch...	8690	72	1704	84	414	185

The blocks were received from the Kettle River Quarries Co. creosoting plant, Sandstone, Minn., through the courtesy of Walter A. Buehler, engineer of the company. All the blocks used in the tests were air seasoned before treatment. The specific gravity of oil at 20° C. was 1.071; oil solid at 25° C.; water 5.2 per cent. The blocks were stored since treatment in a closed shed.

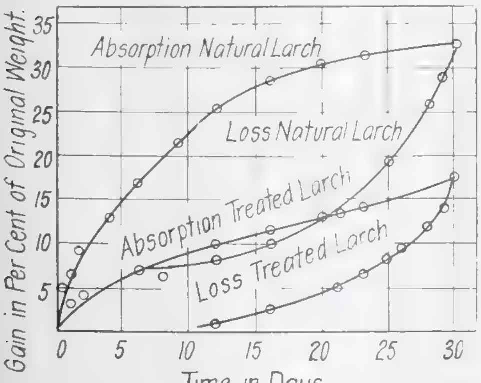


Fig. 3.

The analyses were made in a retort; thermometer stationary; bulb ½ in. above oil at beginning of distillation. The results of the analyses follow:

Fractions.	Oil in birch. Per cent.	Oil in Larch. Per cent.
Up to 170°C............	.37	.10
170 to 200°C............	1.64	1.65
200 to 210°C............	3.81	3.61
210 to 235°C............	39.74	40.34
235 to 315°C............	26.35	26.58
315 to 355°C............	10.10	8.93
355° (Residue)	16.99	18.79

Impregnation, lbs. per cu. ft.: Birch, 22.1; larch, 20.04.

Tests were made for absorption, expansion, shrinkage, indentation, compression and abrasion. For the first three named all the blocks were air dried before testing. For the last three named tests, half the blocks for each test was air dried at about 70° F. and half were soaked in water for 40 days.

The blocks used in the absorption and expansion test were approximately 4x4x8 ins. Each block had eight brass headed tacks with shanks shortened, driven into the sides and ends with the head flush to the surface of the block. The tacks in the ends of the block were centered by means of intersecting diagonals. Those driven in the parallel sides were driven on the center lines, one from each end about 1 in. and one in the exact center of these sides. Measurements were taken with calipers for the distance between the heads of the respective tacks.

For absorption all that was necessary was to obtain the weights in grams from time to time. Dimensions of blocks were measured to thousandths of an inch, and weights in grams were recorded. Then the blocks were entirely immersed. The readings at first were made frequently and gradually the frequency was diminished until the blocks had obtained approximately a uniform weight and volume, when the test was stopped. The results (Figs. 3 and 4) show that the treated blocks absorb much less water and therefore have less expansion than the untreated blocks.

The shrinkage test was started in the same way as the expansion test, but the blocks were allowed to remain immersed only half the time. Upon removing from the water at the end of this time the blocks were allowed to air dry at about 70° F. Measurements and weights were recorded frequently at first and afterwards with decreasing frequency. The results obtained showed that the natural blocks decreased in weight and volume at approximately twice the rate as the treated.

The blocks were indented on the end of the grain by a right cylinder with a diameter of ½ in. and a height of ⅜ in. When the machine had indented this entire distance of ⅜ in., the surface of the wood came into contact with another right cylinder having a diameter of 2¼ in. Just before this contact the reading was recorded.

The compression tests on the ends of the grain were made on specimens 1¼x2x4 in. in size, sawed from the main block before testing. The maximum load was recorded.

The abrasion test was made upon 4x4x8 in. blocks sawed in half, giving approximate cubes 4x4x4 ins. Air dried maple with approximately the same cross section as the block tested was the base of comparison. The blocks were placed in an abrasion machine, the maple on one side and the block to be tested on the other, with the grain always vertical and with the same pressure acting on each block. The abrasive agent was garnet paper. After a revolution the blocks were removed and the amount worn off was recorded.

TABLE II.—(TESTS OF 1909.)
Strength in Natural Condition.

	Compression, lbs. per sq. in.	Moisture.	Indentation, lbs. per sq. in.	Abrasion, maple 100.	Moisture.
Larch	7700	12.1%m	1730	419	10.6%m

Effect of Treatment.

		Relative.		Relative.		Relative.
Natural Larch..	7700	100	1730	100	419	100
Treated Larch...	647	84	1419	89	437	102

The results for three of the most important tests are tabulated in Tables I and II, as averages of all the individual tests. The results of shrinkage and absorptions are shown in Figs. 1 to 4.

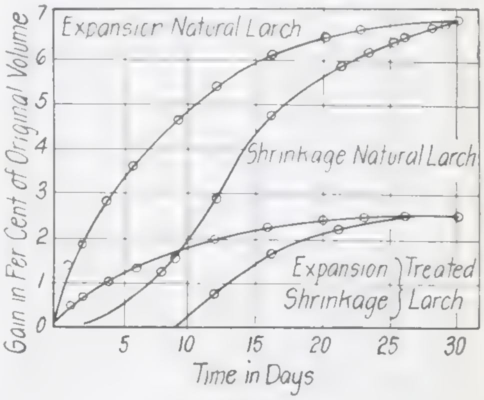


Fig. 2.

The results show that the strength of treated blocks is less than the natural blocks by about 20 per cent.

The abrasion is not as yet standardized, and the results are quoted without conclusion.

Treating the blocks diminishes greatly the absorption, expansion and shrinkage. The definite values are displayed in Tables I and II and in Fig. 1.

Since the strength of a wooden paving block is of minor importance compared to its resistance to decay and absence of swelling, it appears that the latter qualities have been attained with an unimportant loss of strength.

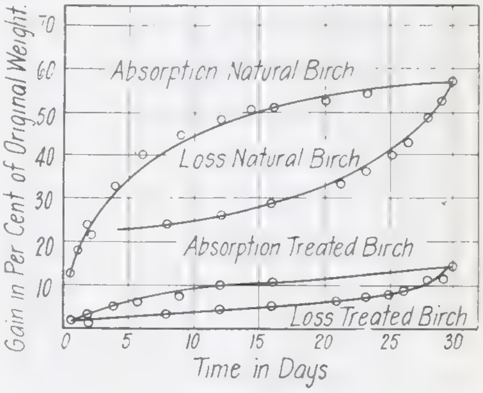


Fig. 4.

Distribution of Mining Power and Costs.—The general opinion at the present time is that the use of machinery has displaced the use of human labor to a considerable extent. The following table as worked out by the United States Coal and Coke Co., of Gary, West Virginia, shows that whatever amount of labor may have been displaced by machines, the cost of human labor and the percentage of work done by it still overbalances the mechanical power. That is, at least, as far as the mining industry is concerned.

	Cost per cent.	Energy per cent.
Labor cost per ton...............	87.6	[illegible]
Total live stock expense..........	4.0	[illegible]
Mechanical power	4.7	35
Explosives	3.7	[illegible]
	100.0	100

Experiments in Binding Gravel and Crushed Gravel With Tar and Asphalt and in Constructing a Water Bound Road of Gravel.

Darke County was one of the first counties in Ohio to begin the work of building gravel roads under the laws of 1865 and succeeding enactments. Gravel well suited for road-building was found in most parts of the county, which permitted these roads to be built at a low cost. Under these conditions the county has constructed 744 miles of gravel roads. The application of the county commissioners of this county for state aid for the year 1909 to be used in repairing the roads was their first effort to take advantage of the state appropriation. They applied again for the appropriation for 1910 to be used in the same manner. In the spring of 1910, the board of commissioners made application to change their method of applying the state appropriation and, instead of using the money for repairs asked for the improvement under the state-aid law of three separate sections of roads.

Desiring to secure the best possible results from the use of the local road-building materials, the State Highway Department of Ohio decided to experiment with tar and asphalt in binding the Darke County gravel before preparing specifications for these roads. It was also desired to determine if the gravel could be water-bound after the manner of binding crushed stone in the water-bound macadam roads. A section of road opposite the Fair Grounds at Greenville was selected by the county commissioners and the surveyor as a suitable place for this experiment, and work was begun on July 20th and completed by August 13th. A bulletin recently issued by the State Highway Department gives a description of this work, and from this bulletin the notes that follow have been taken.

Nine hundred gallons of Tarvia "X" and the same amount of Indian Refining Co.'s Asphalt were used in the experimental work. The gravel was furnished by the Greenville Gravel Co. free of charge on board cars at their plant. The asphalt was also furnished free of charge by the Indian Refining Co. The roller used was hired from the city of Greenville and weighed 15 tons without water or coal. It was not satisfactory for this work, as it has been found that better results can be obtained with a 10-ton roller, but it was the only roller available. The width of the surface treated in this experiment is uniformly 16 ft..

In this work the Tarvia was applied at a temperature of from 340° F. to 400° F., and the asphalt at a temperature of from 400° F. to 450° F. There was a good bed of gravel in the old road, and this was prepared to receive the top course by spiking up the surface with the steam roller and harrowing and grading to bring it to the proper cross-section, after which it was thoroughly rolled and watered. Beginning at the north end of this experimental section, the first 80 ft. in length was treated in the following manner:

Washed gravel from 1 in. to 2 ins. in diameter was spread on the surface to a depth of 3 ins. The gravel was then rolled and about 1½ gal. of Tarvia "X" per square yard was applied. It was then covered with ½-in. to 1-in. gravel to a depth of about 1 in. This was allowed to stand until the next morning and was then rolled until buckling commenced. Three-fourths of a gallon of Tarvia per square yard was then poured over the surface and a covering ½ in. thick of gravel from 1 in. to ½ in. in size was applied. The next morning it was rolled for 1½ hours, when it began to show signs of buckling. More gravel was applied at places where the Tarvia was bleeding, in sufficient amount to take up the Tarvia.

The second section, lying south of and adjoining the first-described section, was 72 ft. in length, and was constructed in the following manner:

The bottom course, composed of ½-in. to 1½-in. washed gravel, was spread to a depth of 3 ins. and treated with the same amount of Tarvia and in the same manner as described for the bottom course of the first section. The second course, composed of ¼-in. to 1-in. washed gravel, was spread to a depth of 1 in., and rolled as in the first section. Thirty-two feet of the north end of this section was poured with 1 gal. per square yard of Tarvia mixed in equal parts with unrefined coal tar; the remaining 40 ft. was treated with 314 gals. of the asphalt binder per square yard. The part which received the tar was covered to a depth of ¾ in. with ⅛-in. to ½-in. washed gravel, more being added where bleeding appeared. The asphalt-treated part was covered with ½-in. boulder chips to a depth of ½ in. This section was rolled the next morning the same as described for the first section.

The third section adjoining the second section on the south, was eighty-eight feet in length, and was constructed as follows:

The bottom course, composed of 1-in. to 2-in. crushed boulders 3½ ins. deep, was placed in the same manner as in the first section, and poured with 1¾ gals. of Tarvia "X" per square yard. This was covered to a depth of ¾ in. with ⅛-in. to ¾-inch gravel, and rolled the next morning in a manner similar to the rolling of the first section. Three-fourths of a gallon per square yard of Tarvia "X" was then added and the surface covered to a depth of ¾ in. with ⅛-in. to ½-in. washed gravel. This was rolled two hours without signs of buckling. Gravel was added where bleeding appeared.

The fourth section was 130 ft. long. The bottom course was composed of 1-in. to 2-in. washed gravel, with 30 per cent of broken boulders, spread to a depth of 4½ ins. It was poured with two 2½ gals. of asphalt binder per square yard, and was then covered to a depth of 1⅓ ins. with ½-in. to 1½-in. washed gravel. It was rolled the next morning, but buckling commenced in about one-half hour and the rolling was stopped. It was then poured with ¾ gal. of asphalt binder per square yard. The north 80 ft. of this section was covered with ⅛-in. to ½-in. washed gravel; the remaining 50 ft. was covered with 1¼-in. to 1-in. boulder chips. This was rolled the next morning and buckling commenced in about one-half hour.

The fifth section, which was built of 1-in. to 2-in. crushed boulders, was 130 ft. in length. The bottom course was spread with the above material to a depth of 4 ins. This was partly filled with a clay filler, and the filling was completed with limestone dust rolled in with the steam roller until all of the voids were completely filled. This section was then thoroughly watered and rolled until a grout appeared on the surface. On the second day it was again watered and rolled thoroughly, and sand was added during the process of rolling. This section rolled down and became very hard and compact.

The sixth section, which was constructed of 1-in. to 2-in. washed gravel, to which 30 per cent of crushed boulders had been added, was 100 ft. in length. It consisted of one course 4 ins. deep, and was slightly filled with clay in the manner described in the fifth section. The filling was completed with limestone dust, which was thoroughly watered and rolled. The rolling was continued until a grout formed over the surface, and the road was again rolled on the second day. In appearance this section is similar to the fifth section.

In addition to the rolling above mentioned, the roller was run over the completed work each day until the last section was finished. One month after completion the road was in perfect condition except two or three small spots that had raveled in the part where unrefined tar had been mixed with the Tarvia.

The total cost of the experimental roadwork was $669.70.

Progress Report on the Experimental Road Work of the Ohio Highway Department.

During the summer of 1909 the State Highway Department of Ohio, of which Mr. James C. Wonders is Commissioner, undertook some instructive experimental work on the use of various preparations for preventing dust and for binding the surface of macadam roads. This experimental work is of particular value because the various preparations were used on the same road and are consequently subjected to the same conditions of traffic. Each of the materials tested were given a section 400 ft. long with a 16 ft. roadway, the sections being connected and forming a continuous road. A description of these experiments covering the work up to January, 1910, was given in our issue of July 6, 1910. A supplemental report on this work was issued in September by the Ohio Highway Department. The conditions of the various sections at that time are described in the report as follows:

Experiment No. 1—Glutrin.—Except for a brownish discoloration, this work has the appearance of water-bound macadam. Undoubtedly the application of Glutrin hardened the surface at the time it was applied, but by the end of the winter this condition had disappeared. Good results could doubtless be obtained by the application of this material each year.

Experiment No. 2—Standard Asphalt Binder.—This section is in good condition. The asphalt has exuded to the extent that it covers about one-half of the surface and shows plainly the marks of the horses' shoes.

Experiment No. 3—Pioneer Asphalt.—In this section all of the pieces of stone are perfectly bound. No excess of binder is in evidence, the surface is smooth, and its whole condition is excellent.

Experiment No. 4—Tarvia "X."—The stones are all well bound in this section, and no excess of tar appears on the surface.

TABLE I—WEAR ON EXPERIMENTAL ROAD ONE YEAR AFTER ITS CONSTRUCTION.

Section.	8 ft. east.	4 ft. east.	Center line.	4 ft. west.	8 ft. west.
1. Glutrin	.07 ft.	.07 ft.	.00 ft.	.00 ft.	.00 ft.
2. Standard Asphalt	.02 ft.	.07 ft.	.06 ft.	.08 ft.	.09 ft.
3. Pioneer Asphalt	.07 ft.	.07 ft.	.05 ft.	.03 ft.	.03 ft.
4. Tarvia "X"	.02 ft.	.04 ft.	.04 ft.	.05 ft.	.03 ft.
5. Tarvia "B"	.08 ft.	.04 ft.	.03 ft.	.00 ft.	.00 ft.
6. Indian Asphalt	.01 ft.	.03 ft.	.01 ft.	.03 ft.	.02 ft.
7. Ugite	.04 ft.	.05 ft.	.05 ft.	.03 ft.	.05 ft.
8. Fairfield Asphalt	.04 ft.	.04 ft.	.04 ft.	.05 ft.	.00 ft.
9. Asphaltoilene	.05 ft.	.04 ft.	.04 ft.	.05 ft.	.03 ft.
10. Rock Asphalt	.00 ft.	.00 ft.	.02 ft.	.03 ft.	.04 ft.
11. Carbo-Via	.03 ft.	.09 ft.	.07 ft.	.08 ft.	.07 ft.
12. Concrete Macadam	.04 ft.	.05 ft.	.05 ft.	.01 ft.	.00 ft.
13. Taroid	.02 ft.	.01 ft.	.03 ft.	.00 ft.	.00 ft.
14. Petrolithic	.03 ft.	.01 ft.	.06 ft.	.00 ft.	.00 ft.
15. Limestone Concrete	.04 ft.	.06 ft.	.02 ft.	.00 ft.	.00 ft.
16. Gravel Concrete	.00 ft.	.00 ft.	.00 ft.	.00 ft.	.01 ft.
17. Water-bound Macadam	.01 ft.	.03 ft.	.03 ft.	.01 ft.	.01 ft.

TABLE II—DAILY TRAVEL ON EXPERIMENTAL ROAD FROM JULY 31ST TO AUGUST 13TH, 1910, BETWEEN THE HOURS OF 7:00 A. M. AND 8:00 P. M.

Days.	31	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
One-Horse Buggy	132	88	65	62	88	72	105	98	77	57	83	74	77	86	1,164
Two-Horse Carriage	2	3	2	1	3	1	1	2	0	0	3	0	1	1	20
One-Horse Wagon	16	46	58	46	43	39	83	11	45	57	63	48	50	74	679
Two Horse Wagon	1	16	26	22	29	21	17	2	14	27	24	29	27	23	278
Runabout Automobile	63	39	28	27	27	21	19	30	24	14	27	31	36	28	409
Touring Car	70	55	59	45	66	45	53	83	61	14	44	65	70	40	770
Motor Cycle	21	5	8	5	12	14	5	9	4	1	11	8	1	6	110
Horseback Rider	6	1	1	4	2	0	2	0	3	2	6	0	9	3	39
Total	311	253	247	212	270	213	285	235	228	172	261	255	271	256	3,469

Experiment No. 5—Tarvia "B."—This was the only bituminous surface treatment applied, and the result far surpasses our expectations. A thin coat of tar remains over the surface of the road. Its appearance is fine and it has been more nearly dustless than any of the other tar or asphalt-treated sections.

Experiment No. 6—Liquid Asphalt.—On this section the stone forms the wearing surface, but it is all firmly bound in place. Its condition is very similar to that of Experiment No. 3.

Experiment No. 7—Ugite.—In the construction of this section the binder was applied on part of the work in one coat and on the remainder in two coats, but at the present time no difference in its condition can be observed. The stone now furnishes the wearing surface; each piece is firmly bound and the condition of the section is very satisfactory.

Experiment No. 8—Fairfield Asphaltic Cement.—This section is in perfect condition, with the surface very similar to that of Experiment No. 3.

Experiment No. 9—Asphaltoilene.—About one-half of the surface of this section is covered with the binder, and on the remaining part the stone furnishes the wearing surface. Where the binder covers the surface of the road, the imprints of the horses' shoes show in a manner similar to that of a sheet asphalt pavement on an extremely warm day. The part thus covered is dustless and provides an ideal road surface.

Experiment No. 10—Wadsworth Macadam.—This section is surfaced with Kentucky rock asphalt, and at the present time is in as fine a condition as the best sheet asphalt pavement, and it is in better condition than when first constructed.

Experiment No. 11—Carbo Via.—This section is in good condition, in appearance being very similar to Experiment No. 4.

Experiment No. 12—Concrete Macadam.—This section has the appearance of a water-bound macadam, and the addition of the cement to the binder has not produced any apparent benefit.

Experiment No. 13—Taroid.—The traveled surface of this section is in excellent condition. There seems to have been an excess of tar used as it has been bleeding at the sides until the surface of the ground is covered to a width of about two feet.

Experiment No. 14—Pethrolithic Pavement.—With the beginning of the warm weather this summer, the asphalt exuded on the surface of this section to such an extent that vehicles avoided it, traveling in the ditches on both sides of the road. Its condition became so objectionable and so many complaints were received that we were obliged to have it repaired. It was accordingly covered to a depth of about 2 in. with screened gravel ranging in size from ⅛ in. to 1 in., which was well rolled with a 10-ton macadam roller. The cost of this repair, exclusive of the rolling, was $50.15. At the present time the road is rutted by the vehicles that pass over it. Outside of the line of ruts the gravel still covers the surface.

Experiment No. 15—Limestone Concrete.—A few places at the joining of different days' work in this section are beginning to show the effects of wear. About one-half of the section is in a very good condition, and it indicates that a satisfactory road could be produced by the methods used in its construction.

Experiment No. 16—Gravel Concrete.—This section is in good condition and shows but very little signs of wear. The surface is sufficiently rough to afford a good footing for horses. The transverse cracks that developed last winter do not up to this time show any greater wear than the other parts of the road, the cracks showing only as lines across the surface. This section is dustless, and it is one of the most interesting of these experiments.

Experiment No. 17—Water-Bound Macadam.—The automobile travel has removed all of the binder that was left on the surface of this section. The larger stones in the macadam provide the wearing surface. They are all perfectly bound and the condition of the road is satisfactory.

In order to provide a record of the wear on the different sections, levels were taken over the road soon after the completion of the work. The points at which the levels were taken were carefully located so that it is possible to ascertain the amount of wear by releveling at any time. Readings were taken on the center line, and at 4 ft. and 8 ft., both east and west of centers, at five stations on each section, making a total of 25 readings on each section of 400 ft. The work was releveled in September of this year, and the result shows approximately a year's wear. The wear is shown in hundredths of a foot in Table I. and the amounts are the average at five points in each section.

A census of the travel was also taken from July 31st to August 13th, 1910, and the result is shown in Table II.

Standard Specifications of the Road Commissioners of Wayne County, Michigan, for a Single Course Concrete Road for a Trunk Road.

The road work in Wayne County, Michigan, is being done under a systematic plan, covering a period of years, and contemplate first: the improvement of the main highways leading into the city of Detroit, from the county line to the city limits; second, the main highways, radiating from the smaller communities of Wayne County; third, the connecting up of the main highways with the secondary highways, thus forming a network of roads over the entire county. The construction of this system of highways is done under the direction of a Board of County Road Commissioners of which Mr. John S. Haggerty, Detroit, Mich., is chairman.

For several years the County Road Commissioners have been constructing concrete paved roads, and at the present time have completed or underway about 15 miles of this type of highway. The concrete paved roads so far constructed in the county have stood up so well under traffic and the maintenance repairs have been so small that the Road Commissioners have practically abandoned the building of macadam roads for the main highways. Below we give the main sections of the standard specifications used in Wayne County for a single course concrete road for a trunk road:

Commencement of Work.—The work embraced in these specifications shall be begun not later than .... 19..... and carried on regularly and uninterruptedly, unless the Board shall otherwise direct, and with such force as to insure its completion within the time specified in the contract. The contractor will give the Board ten days' notice before commencement of work, also notice that he has on hand or available the necessary material to uninterruptedly carry on the work to completion. After the work shall have been commenced, if the same shall be interrupted and delayed by the contractor from any cause whatever, it shall rest with the discretion of the Board whether or not an inspector, at the expense of the contractor, shall remain in charge of the road during such interrupted or delayed period.

Tiling.—The first work to be done will be the laying of a course of 3-in. land tile on the northerly side of said road, distant four feet southerly from and parallel with the southerly rail of the electric railway, and at the depth shown on plans. Before the filling back is permitted the tile must be covered their entire length and one-half their circumference with a layer of tar paper, to keep sand and other material from washing through the joints.

Open Ditching.—An open ditch must be dug along the southerly side of said road beyond the southerly earth shoulder, location and dimensions of said ditch being shown on plans. This work may be done either before or after the roadway proper; but if done before, the ditch must be kept free and clear from rubbish and refuse during the construction of the roadway proper, and left in as good condition in every way as it would have been if done after the concreting and building of shoulders.

Grading.—The contractor shall do all the excavating and filling necessary to bring the subgrade to the required elevation shown on plans and designated by grade stakes. After the subgrade has been prepared, and before any materials are drawn therefrom, it shall be rolled with a steam roller weighing at least ten tons.

Concrete.—Concrete shall consist of one part of cement, two parts of sand, and four parts of pebbles, evenly and thoroughly mixed; parts of cement, sand and pebbles to be determined by measurements.

Mixing.—All concrete shall be mixed in mechanical batch mixers, which the contractor shall furnish, of type to be approved by the Board; and measurements of all material shall be taken in manner to be approved by the engineer.

Placing the Concrete in Position.—Before placing the concrete, 2-in. x 6-in. plank shall be placed on edge and staked in line with the outer edge of the pavement, the upper edge of said plank to conform to the finished grade of the road. The workmen shall place the concrete in position in the pavement where directed, and it shall be well tamped.

Finishing the Surface.—The contractor shall employ at least two men, whose special duty it shall be to use a strike board having a curvature corresponding to the crown of the road, so that the top can be properly stroked off. At night, and at any other time when the work is discontinued for a time, all the work must be completed up to an expansion joint, hereinafter provided for. In other words, no section of the pavement will be allowed to be left unfinished for a longer period than 20 minutes if work thereon has been started. In the work of placing the concrete in position, and in finishing the surface, and in all other work done under the contract, all foot and other traffic, both of employes and otherwise, must be kept off the top of the concrete until it has thoroughly set, and the contractor must provide such bridges and other devices as will effectually carry out the provisions of this paragraph.

Protection of Concrete After Laying.—After the concrete is laid, and until it has thoroughly set, it shall be protected from the sun by a canvas or other suitable covering, in manner to be prescribed by the engineer. When, in the judgment of the engineer, the concrete is sufficiently hard to warrant, this covering shall be removed, and the concrete covered with a layer of sand or gravel, about 1 in. in depth, or such other devices as may be approved by the engineer, and sprinkled and kept damp for at least 7 days, to prevent the surface of the concrete from drying out while setting, which covering shall be left on the concrete for a period of 7 days, and then removed and taken away from the road or otherwise disposed of in manner to be approved by the engineer.

Expansion Joints.—To allow for expansion, the pavement shall be built in sections 25 feet in length, with two thicknesses of 4-ply tar paper completely separating the sections at right angles to the line of the road.

Crossings Over Sub-grade.—Before any concrete pavement is constructed, and after the sub-grade has been prepared, the contractor shall provide sufficient planks at his own expense and place and maintain crossings over said sub-grade when the same is wet or muddy, unless he shall be excused therefrom, in writing, by the engineer. Crossings for foot passengers shall be placed at each cross street to accommodate the public.

Shoulders.—After the pavement is laid, earth shoulders must be built on each side thereof, of sufficient width to bring the total width of the road from berm to berm up to 24 ft., as shown on plans. These shoulders must be built in layers not exceeding 6 in. in depth, and each layer must be well packed before the next layer is placed. When completed the shoulders must be rolled as directed by the Board, with a roller to be approved by the Board; but such rolling will not be permitted until the concrete has thoroughly hardened, and in any event not until at least ten days have elapsed after the laying of the concrete opposite.

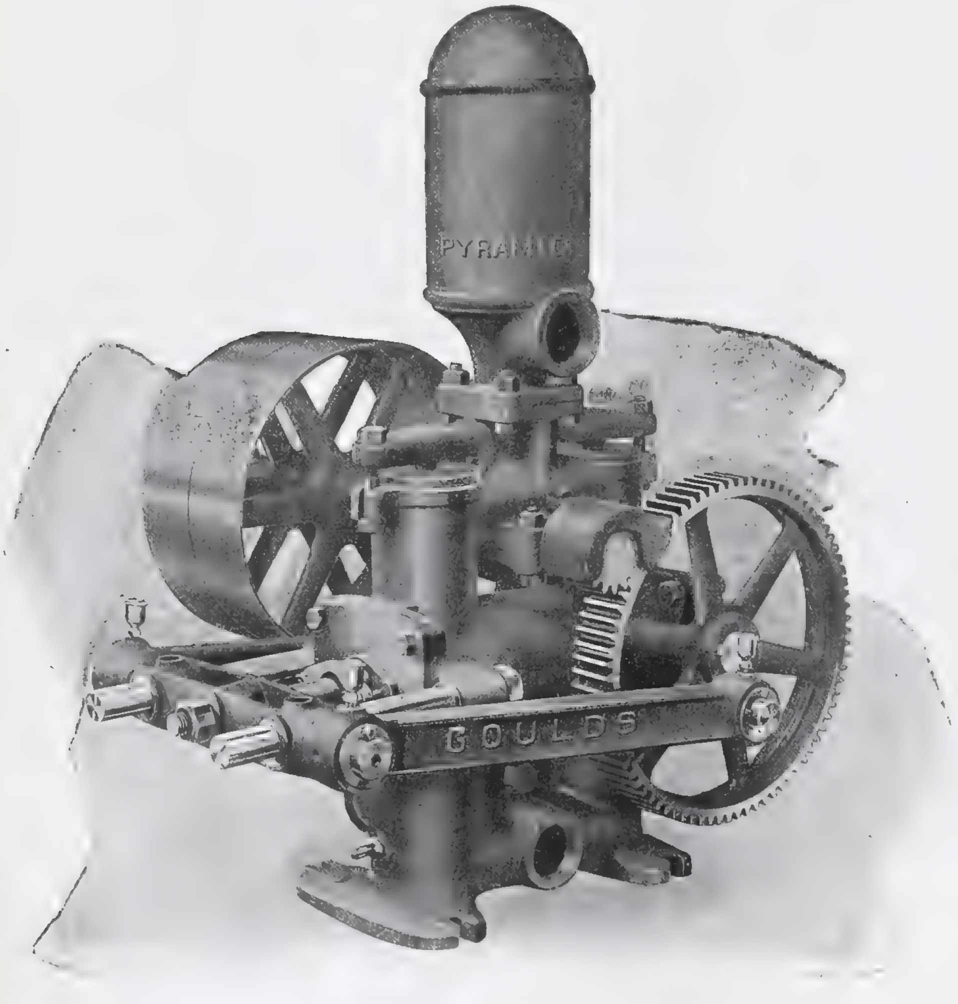
Material on Road.—Material delivered on the road in connection with the work must be neatly and compactly piled along the sides in such manner as to cause the least inconvenience to the public and the adjacent property owners. Private drives and road crossings must be kept open as far as practicable, and planked when directed, to the satisfaction of the engineer. Shade trees and other improvements shall be protected by the contractor from all damage by stone or otherwise.

Surplus Earth.—All earth not needed for filling or shoulders or otherwise in connection with the work, must be disposed of by the contractor in manner to be approved by the engineer, at some point not further distant from point of origin than 1,000 ft.

WATER-WORKS AND SEWERS SECTION

An Improved Double-Acting Piston Pump.

The rapid extension of electric power circuits and the introduction of gas and gasoline engines, affords ideal power and opportunity to economically install a medium priced power pump for general water supply or other pumping duties. To meet this demand the Goulds Manufacturing Co. of Seneca Falls, N. Y., has recently placed on the market "The New Pyramid" Double-Acting Piston Pump which is an evolution from the original pump of the same name, but designed along similar lines. The waterways have been largely increased and made more direct. It is much more compact, its general construction much more rugged and its efficiency greatly increased.



Improved Double Acting Piston Pump.

The base, cylinder, bearings, and one cylinder head are cast integral giving a remarkably stiff and rigid construction. One cylinder head being cast on to the cylinder removes all possibility of leaking or blowing out the packing at this point. Casting the bearings as a part of the cylinder keeps the gearing absolutely in line, greatly decreasing the wear and proportionately increasing the life of the pump. The cylinder is brass lined, and is provided with large suction valves just below the bore of the cylinder; these valves are easily accessible through two hand holes, the covers of which can be removed by backing off one bolt. The discharge valves are above the cylinder and reached through hand holes located at either side of the air chamber. To remove the hand hole plates, it is simply necessary to loosen one bolt, slip this bolt out of place, freeing the clamp holding the valve cover in position. With this construction there is no possibility of the valve cover caps rusting into position. On the forward end of the cylinder are cast two substantial lugs. Into these lugs are pressed and secured by heavy nuts, two machine turned steel rods to act as a guide for the crosshead. This construction takes the lateral strain from the cylinder head and eliminates the tendency to work out cylinder head packing.

The front cylinder head is so machined as to have a large projection fitting into a corresponding recess in the cylinder, and as this projection is turned at the same time the hole of the stuffing box gland is bored, the piston rod must run absolutely in line with the bore of the cylinder, eliminating cutting of the rod. The stuffing box on the cylinder head is provided with a bolted bronze gland, making it very easy to keep the packing tight at this point. The side rods are heavy grey iron castings of substantial construction and are so designed as to give a straight line thrust from the crank pin to the crosshead.

The power end of this pump consists of a pinion shaft supported on a long double bearing in the center of the pump directly under the air chamber. The construction of this bearing is such that no outboard bearing is required. The lower half of this pinion shaft bearing is made extremely long and is provided with an auxiliary cap at the outer end next to the pulleys which gives a second bearing for supporting the shaft. This cap is arranged with a large oil pocket which is readily filled by raising the cover between the main bearing and the auxiliary bearings, oil from this reservoir being fed to the bearings by means of wicks. This construction makes it possible to operate the pump for months without oiling at this point. Both gear and pinion are cast iron, machined all over, and the teeth are cut from the solid metal, insuring quiet operation and long life. This pump is geared 5 to 1. The crank bearing cast on the rear end of the pump is of ample size and provided with a large oil pocket and cap. Both crank and pinion shafts are of high carbon steel carefully finished all over. All bearings are lined with high grade bearing metal. The piston rod is of high carbon steel brass cased. The general construction of the pump is such that it combines ample power and large capacity in a very compact form.

A Review of Practice in Methods of Refuse Disposal in American Cities, With Figures of Cost and Efficiency.

AMERICAN CREMATORY SYSTEM.

The first recorded efforts to burn city refuse in America was at Governors Island, New York, in 1885. This furnace was followed in 1886 and 1887 by others whose builders followed the lines of the English furnaces. The "Smith-Siemens" furnace at Wheeling, W. Va., using natural gas for fuel; the "Beehive" furnace at Allegheny City and Detroit, and the "Fryer" Destructor at Montreal, were the earliest forms.

The invention of Mr. Andrew Engle, Des Moines, 1887, was, however, the original American type which found greatest favor, and of which the largest number were installed in the ten years following. This was a rectangular brick structure, with a high steel or brick chimney, and with a covering house, approaches and platforms so arranged that the carts might discharge directly into the charging holes at the top. At the rear was placed the first or "primary" fire, the heat from which passed to the front end, over thick layers of mixed waste piled upon transverse bars. At the front end was placed a secondary fire, over which the gases and smoke from the combustion of the material on the bars passed on their way to the chimney, and, returning beneath these transverse bars, these gases heated the material from the under side. The waste was charged through ports in the roof, one of which was made large enough to receive the carcass of a horse or other large animal. The free water or liquids passed through the transverse grate bars to the bottom of the furnace where it was evaporated. The central idea of this invention was to burn the material placed on transverse grates by a heavy primary fire, and then to reheat and reburn the smoke and gases of combustion, with the assistance of the secondary fire. This principle

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*Extracts from a paper by William F. Morse read before the Sanitary Section of the Boston Society of Civil Engineers and printed in the Journal of the Association of Engineering Societies for September, 1910.

and form of construction was adopted by many other builders of crematories, and in the years following a large number of incinerators and crematories were installed.

Two years ago the speaker had occasion to inquire into the number of municipal garbage cremating furnaces in use since 1885. It was found that some 160 patents had been taken out, under which about 188 furnaces and incinerators had been built for municipal purposes, besides some 20 plants for the disposal of refuse or rubbish only. It was also found that 108 of these municipal furnaces had been discontinued or abandoned for reasons of insanitary operation, large expense for repairs and maintenance, and inability to perform the stipulations of the contract. Since this inquiry was made, down to the present time, there have been installed in this country some eight furnaces of the older types, and two of a new form, differing widely from the others. During the same time about seven of the older forms of crematories and incinerators have been permanently retired from use.

The destruction by fire of masses of garbage containing 65 to 75 per cent of moisture means the breaking down of the tissues and the release of volumes of gas compounds. These are to be destroyed or transformed into CO_2 only at a continuous temperature of 1500°F. Once the gases are released by the primary fire, it is well-nigh impossible to retain them, or to reheat them to the point of ignition, unless by special apparatus not a part of the crematory and incinerator construction.

The secondary fires employed on the exterior of the incinerators for the destruction of gases have proved inefficient. From an engineering standpoint this construction is a failure. The crematories and incinerators will burn material at low temperature, but it will not be destroyed in a proper way until radical changes have been made in the design of construction. This applies to the whole system of crematories and incinerators now used in American practice. We have built 200 and we have abandoned or destroyed one-half of that number. Today the whole crematory system is in process of being remodeled on the English destructor system of forced draft, and the end is not in sight. This means that after 20 years of experiment the crematory system has proved unsatisfactory, and must give way to something better. We shouldn't go on repeating the mistakes of the past.

THE REDUCTION PROCESS.

Some twenty-five years ago there was introduced into the United States a method of treating garbage for the recovery of the grease, and the manufacture of the residuum into a form of low-grade fertilizer. The first plant was built in Buffalo, in 1896, where a company was formed to manufacture grease and fertilizer from city refuse. The process as first practiced may be briefly described as a system of cooking for a period of from six to eight hours in cylindrical tanks under steam pressure, the garbage taken from the households of the city and as far as possible separated from ashes and rubbish and other foreign matter. During this cooking process the garbage is macerated and then discharged from the digester in the shape of pulp containing grease, water and oil from animal matter. The water is allowed to escape and the remainder is then treated with naphtha which dissolves the grease. The tankage remaining is subjected to a drying process by which the moisture is driven off, and when thoroughly dried is ground up as the base of a fertilizer. The separation of the grease and water is then completed and the naphtha recovered for subsequent use. The oil or grease obtained by the process is a dark, thick liquid containing many impurities, and a considerable percentage of naphtha, and is sent to market in this crude form.

The "Vienna" or "Merz" process, as introduced by the Buffalo Reduction Co., was subsequently adopted by several cities, and expensive works were erected upon the presumption that the results to be obtained in grease and tankage would justify the company in accepting a small payment from the city for its work. Plants were built under these patents in Chicago, Milwaukee, St. Louis, St. Paul and Denver, and some other cities. After unsuccessful experiment for several years all these plants, with two exceptions, were abandoned and closed for various reasons. A solvent process was first introduced at Providence by the Simonin Co. and subsequently at Cincinnati and New Orleans, but after a few years of unsuccessful work was abandoned.

The plants now operating by the solvent or extractor process are very different from those first installed. They are successful in removing a larger proportion of the grease, and by better manufacture the tankage is made readily marketable. But it has been found that the plants are extremely liable to explosion and fires from the extra-hazardous risks necessary in work of this kind.

Shortly after the introduction of the reduction process in Buffalo a new method of treating garbage for the recovery of the oil was brought out in Boston. This was called the Arnold process, one of extraction of grease by steam only, recovery of grease being made by pressure, and the separation of the grease by flotation from the water. The first plant built in Boston was unsuccessful because of the nuisance created, and it was closed up by order of the board of health. The second Arnold installation was made on a point of land extending into the harbor. After a short period of operation the plant was also removed on complaint of nuisance. The plant was reestablished in Spectacle Island and has since been in continuous operation.

Following the installation of the Arnold process in Boston, the municipalities of New York, Philadelphia, Newark and Baltimore adopted the same means of disposal of their garbage. Meanwhile, other companies employing somewhat similar means of treatment by the reduction process were organized in different parts of the country, and the work has been carried on with varying degrees of success in Detroit, Toledo, Cincinnati, Washington, St. Louis, New Orleans, Paterson, N. J., and some smaller cities.

Since the original construction there have been built, in all, some forty-five different plants, of which number more than one-half have been abandoned, burned down or have passed out of use by other means. Nearly every one of the reduction plants in the United States has at some period of its operation been subjected to accidents, sometimes attended by loss of life. The exceptions to this are the later and more modern plants, built more carefully and with greater consideration of fire risks.

In all cases, with one exception, the reduction process has been the property of private companies which have received from the cities payment for the treatment of the garbage, and have retained as well the value of the marketable products of the plant. This has created a demand for the grease, which is used by foreign manufacturers, and for the tankage, which is used as a base for fertilizer in this country.

The business has been conducted entirely on a commercial basis. It has been impossible to obtain accurate and reliable information concerning the workings of plants, costs of maintenance and operation, etc. The cities have been forced to pay amounts varying from $0.50 to $2.65 per ton for reduction, and have also given franchises for terms of from five to ten years, because of the supposedly excessive cost of construction and operation of the works. The competition in the construction of plants has been limited to two or three builders. It has been carefully given out, and is generally believed that no city of less than 100,000 population can afford to install a garbage reduction plant because of the large sum required for construction. It was also advanced by the reduction companies that this process was absolutely the only sanitary method of garbage disposal; the only one safe from the danger of infection and contagion.

These conditions prevailed up to about five years ago, at which time the city of Cleveland bought outright a reduction plant, and with the aid of experts so changed and improved the system that it has been proved possible to conduct it at a profit to the city. The works are located some seven miles outside of Cleveland, on a line of railway, and the garbage is conveyed on this line in a special form of car. The method employed is a combination of the solvent and of the digester processes. The cuts herewith show the exterior of the buildings, and the special form of car used for conveying the garbage; the digesters in which the garbage is treated by steam and the percolators where the naphtha process is introduced for the purpose of removing the grease and oil. The results of this work may be briefly stated as follows:

The official public reports made by the city of Cleveland show that in five years' operation of a municipal reduction plant, with an expenditure the first year of $80,000, and at the end of five years a total expenditure of $225,000 for the buildings and machinery, surprising results have been attained. The city began with a revenue of about 7 per cent upon its investment, which represented a profit of 16 cts. per ton. The next year it was 14 per cent, and the year following it was 22 per cent, which means about $1.46 per ton. So it continued until 1909, when the actual revenue from tankage, grease and other salable materials is said to have amounted to $100,000. Under ordinary conditions, with a total garbage collection of not more than 45,000 tons a year, this would represent 40 per cent upon the present valuation of the investment. At the present time the reports from the city of Cleveland show that the net profit per ton which may be recovered from ordinary garbage is about $3.46. Apparently the possibilities of profit in the garbage reduction trade are very great.

The example of Cleveland has been followed at Columbus, Ohio, where a municipal garbage reduction plant built and operated by the city has just gone into service. The garbage is collected in steel wagons, discharged at a central loading station into steel cars drawn over the city's own railroad to the works located next to the sewage disposal station, 1½ miles south of the city limits. The cars are run into a building and dumped on a concrete floor where a separation is made of the cans, bottles, rags, etc. A conveyor takes the garbage to an adjoining building containing six digesters, and steam is turned on for sufficient time to macerate the material and separate the grease, which rises to the top of the digester and is removed to tanks for further separation and purifying for market. The water is reduced by evaporation to a thick consistency called "stick," which contains the fertilizing properties, and is afterwards mixed with the tankage. The solid portion from the digesters is passed through a roller press which removes the water, and being mixed with the "stick," is then ready for sale.

The operation is almost wholly automatic, only hand labor being used at the beginning to remove the rubbish and for shoveling the garbage into the conveyor, and later handling the tankage at the mixing tank. With these two exceptions this is a closed process, the garbage being exposed to the air only during the stage of conveying from the dumping house to the digesters and later from the roller presses to the mixing tank. This reduces the danger of nuisance from the escape of odors, but does not altogether avoid the chance of odors being created within the building. This plant is said to have cost for the building $100,000, and for the complete equipment of machinery $150,000 more. The capacity of this plant is 80 tons per day, though at present about 60 tons are treated. It is anticipated that the revenue will approach if not equal that derived from the Cleveland works in proportion to the quantity treated. If this be the case there is no reason why other cities should not follow the example of Cleveland and Columbus, and enjoy the profits arising from the reduction service.

As before stated, the great difficulty arising from the operation of a reduction plant has been the nuisance of odors produced at one or another stage of the process. By a system of fans and scrubbers, and a method of destroying the odors by high temperature, some plants have succeeded in abating this nuisance in a large degree. Two new methods of reduction have lately been presented, one of them consisting mainly in the introduction of methods which carry on the treatment continuously in closed steam receptacles. One of these plants was invented by Mr. F. Wiselogel, and is at present in the hands of the United States Construction and Utilization Co., of Rochester, N. Y. By this process the garbage is not released until the completion of the extraction of grease and oil; the tankage is dried by rotary presses, the residuum being taken out in shape for market as a fertilizer base.

The plant at Vincennes, Ind., which was constructed under this method, after several years' operation, was destroyed by fire and a new plant has taken its place. The constructors are to install a similar plant at East St. Louis. It has been found perfectly possible to treat garbage in small amounts of 5 to 25 tons by this method, thus bringing the process within reach of the smaller cities. This Wiselogel method is the result of many years of experiment on the part of the inventor.

Another process of a somewhat similar character has been in use in New Bedford. This is called the "Wheelwright hot-water extraction process," managed by the International Continuous Filter Press Company, of Providence. In this method also there is no release of the material until the process is complete. This New Bedford plant was constructed two or three years ago, under a ten years' contract with the city. At present it is not operated to more than half of its capacity. It costs the city of New Bedford $4.16 per ton to collect and dispose of the garbage. If we assume that it costs $2 a ton to collect the garbage, then it costs $2.16 a ton to dispose of it. There is no doubt that the work is well done—but it is too costly. It is understood that the city of Bridgeport has also adopted the Wheelwright process, and is about to install a plant for the treatment of from 20 to 30 tons of garbage per day.

THE BRITISH DESTRUCTOR SYSTEM.

The destruction of "towns' refuse"—the English term for municipal waste—began in London about 1870, by the Messrs. Mead, dust contractors at Paddington, who built the first closed furnaces for disposal of refuse. Because of defects in construction, these were unsuccessful and were discontinued. The idea was taken up by others, and in 1876 the first destructor was built by Mr. Alfred Fryer at Manchester. This term "destructor" has come generally into use as describing the several forms of English apparatus used for incineration of refuse. The two original cells which gave life to the whole destructor principle are still in use at Manchester.

Mr. Fryer's destructor was of the "cell" type; an oven floored with inclined fire grates, fed through top charging ports, the gases of the combustion passing through side ports to a main flue connected with the chimney. The cells were built in pairs, placed back to back, arranged in rows, all being connected with the main flue. The operation was by natural chimney draft, very high stacks being required to obtain the necessary power. Since the combustion in these early plants was slow and imperfect, it was found necessary to introduce a fume-cremator in the path of the gases, and later a horizontal steam boiler was placed in the main flue to obtain power.

In 1885 the fan was first used for forced draft, an improvement that had far-reaching effect. In 1887, the Horsfall destructor embodied a number of improvements, including the water-tube steam boiler, the exhaust fan and the use of a steam jet blower for the distribution of air through heavy boxes of cast iron, placed at the sides of the fire bars.

The Fryer destructor was improved and changed by the makers, Messrs. Manlove Alliott & Co., and has kept its position in the foremost line of progress. The Warner "Perfectus" destructor, also of the cell type, has several installations in England.

In 1891, there were some 200 cells at work, destroying 500,000 tons of refuse annually. The Beaman and Deas Cell Destructor appeared in 1893 with other improvements, raising the capacity of the cells to 15 to 20 tons each per day, and developing greater steam power.

The first radical departure from the cell type was made by the Meldrum destructor in 1894. This was the Meldrum continuous grate, with divided ash-pits, and included the regenerative air-heating system for supplying the air for combustion at high temperature by means of steam jets under the fire bars. The introduction of a powerful blast of air heated to 350° F. under each separate grate greatly increased the rate of combustion and preserved the principle of alternate charging of one section or grate, while the adjoining sections were at the highest temperature. The enlargement of the combustion chamber provided for the maintenance of the temperature at a nearly uniform rate, and the complete combustion of the gases before their entrance to the boiler. There was also provision made for the settlement and detention of the fire dust, in the bottom of the combustion chamber and below the generator, in a special dust-collecting chamber. With the aid of these improvements the Meldrum Simplex Destructor obtained a commanding position, installing in the first sixteen years of its work upwards of 110 plants, of which some 90 were in Great Britain and Ireland, the others being distributed in various parts of the world.

The Heenan Destructor was evolved from furnaces patented in 1897 and 1901, and assumed nearly its present form in 1902 when built at Barrow, England. As at present constructed, the Heenan Destructor has the continuous grates with closed ash-pits, the air regenerative system with the delivery of the heated air beneath the grates by a fan or blower instead of steam jets. The roof of the furnace is undulating, comprising a series of shallow reverberatory arches over each grate, the purpose being to create eddies or currents of hot air deflected upon the adjoining grates. The air supplied for combustion is heated by the regenerator to about 350° F. and delivered under the ash-pits, at a pressure of 2 to 3 ins. water gage, by a powerful fan driven by steam engine or electric motors. The ventilating systems of air ducts from all parts of the building are connected with the intake of the fan, insuring the removal of dust and preventing its escape to the outside of the works. The clinker removed through the front doors of the furnace is dropped to a lower level below the clinkering floor, where it is held in cooling chambers until nearly all the heat contained in the clinker has been returned to the furnace.

In the latest example there is a supplemental hot-gas duct by which the hot gases from the clinker chambers are passed by means of steam jets through the back wall of the furnace. The purpose of this is to partly dry out the moisture from the refuse as it stands on the back hearth before it is raked over on the fires.

Since its construction in nearly its present form in 1902, the Heenan Destructor has undergone many changes, the improvements being for obtaining a higher rate of combustion, greater development of steam power, the more economical operation with less exposure of the workmen to the high temperatures in operating the furnaces, and the cooling and more perfect ventilation of all parts of the enclosing building. There have been built, or are now under construction, sixty destructors of the Heenan type since 1902.

THE ENGLISH DESTRUCTORS IN AMERICA.

The first installation of the British cell destructor on this continent was at Montreal in 1894, when one closely following the original Fryer model went into service, and is still in use. This was followed by a large plant of the same type at San Francisco, but no other installations for municipal service were made.

It was not until 1906 that the first destructor of the modern high-temperature steam-raising form was built by Meldrum Brothers at Westmount, a suburb of Montreal. The published reports of the trials for the acceptance of this destructor made in 1906 showed conclusively that the destructor system could be applied under American conditions and obtain very nearly the same results as in the British installations. The trials showed that from 30 to 50 tons of mixed waste, garbage, ashes and refuse could be consumed without additional fuel, developing 200 h. p. of steam at 125 lb. pressure, with an average temperature of 1,900° F. in the combustion chamber, at a cost of 80 cents per ton including all labor for operation, fixed charges and sinking fund. The net cost for labor was 31 cents per ton, and the revenue in steam power delivered to the electric lighting stations was approximately $5,000 per year. The continuous operation of this plant for four years has been so successful that another destructor of the same capacity has been installed.

Following the example of Westmount, another Canadian city, Vancouver, obtained tenders for a destructor plant of 40 tons daily capacity. This contract was awarded to Messrs. Heenan & Froude, of Manchester, England, the destructor going into service in January, 1907. The reports of May, 1909, showed the disposal of the maximum quantity of waste of low calorific value at a cost of 91 cents per ton, including all operating costs and fixed charges and a net cost of 46 cents per ton after deducting revenue. This city has since contracted for another destructor plant of 140 tons capacity, the steam power from this to be used in several departments of municipal work.

The success of these Canadian installations led to a more thorough examination of the value of destructor methods for American towns, and in 1907 a destructor of the Meldrum type was installed at Seattle, Wash., by Mr. R. H. Thompson, city engineer. This was the first English destructor built in the United States, and included some special features which have since been adopted in other installations. It is reported that the city will shortly install two other plants of the Meldrum type for disposal of all the waste. The table following gives a condensed report of the operation of this destructor for the years 1908-09.

The value of residuals from a destructor is well shown by the use made of the clinker in Seattle. When the destructor was first built, it was inclosed in a wooden house of light construction. This has now been replaced by a structure of concrete blocks made from the clinker accumulated in the year's work. Many buildings have been built abroad from clinker concrete, but this is the first instance of its utilization for this purpose in this country.

The destructor at New Brighton (borough of Richmond and New York City) was the outcome of an extended survey of many British destructors abroad, and a thorough study of local conditions made by Mr. J. T. Fetherston, superintendent of street cleaning, Borough of Richmond, in 1906-07. The tenders of Messrs. Heenan & Froude, of Manchester,

TABLE VIII. — REPORT SEATTLE DESTRUCTOR.

Destructor Meldrum, 1 Unit, 4 Cells, Front Feed. Rated Capacity, 67 Tons Mixed Refuse in Twenty-four Hours.

	10 Months, 1908. Feb. to Dec.	12 Months. 1908-09. Dec. to Dec.
Total tons burned	16,340.6	23,111.8
Total tons burned per month	1,634.0	1,925.1
Total tons burned per day	63.	74.
Composition:		
Ashes, per cent of whole quantity	40.2	44.2
Manure, per cent of whole quantity	14.1	2.7
Garbage, per cent of whole quantity	23.4	33.9
Rubbish, per cent of whole quantity	21.5	19.5
Average cost per ton	$0.79	$0.748
Returns from clinker and power		0.2715
Net cost per ton	$0.79	$0.4765
Average evaporation per lb. of refuse	1 lb.	0.90 lb

Equipment:
1 B. & W. boiler, 2,201 sq. ft. surface.
1 270-kw generator.
Power used for:
1 pump (1,000,000 gallons) for fire protection.
1 crusher and screens for clinker.
Collection: By licensed garbage men entirely under private control.

England, were accepted for a four-grate Heenan destructor with a capacity of 60 tons per day, to develop 200 h. p. of steam, to operate without nuisance and to destroy the unseparated waste without other fuel. This plant being easily accessible from all parts of this country has received more attention than any other American destructor and has been frequently described and illustrated by the engineering papers. At present the capacity of the plant has not been fully reached, as the average quantities are about 30 tons per day. The evaporation of water per pound of waste consumed at the tests made in 1908 was 1.3 lb. per pound of refuse. There is no present use for the steam power, though it will be utilized in the near future. Because of no revenue from the power, the operating costs are large, being reported in 1909 at $1.28 per ton of refuse consumed. The electric generating plant now being installed will presently afford power for lighting some of the city's stables, and for running the city construction and repair shops. The borough has made plans for the erection of a large destructor plant at Clifton, with a capacity of 90 tons, and another at Tottenville, the extreme southern point of the island, with a capacity of 20 tons. The plans include the erection of new stables for the Street Cleaning Department, cottage and buildings for the superintendents of the various departments of street service and the destructor work.

The adaptation of the destructor method for the disposal of waste from industrial establishments is illustrated by the work of a Meldrum destructor built for the General Electric Co. at Schenectady, N. Y., in 1908. This plant of two grates was specially designed for the combustion of 25 tons per day of combustibles, paper, wood, shavings, sawdust and a large amount of box material, barrels, etc., which could not be utilized. There is a 250 h. p. water-tube boiler which is in connection with the main steam line of the works. The great heat from the combustion of this dry material compels an overload of 25 to 33 per cent to be carried by the boiler, the temperatures of the combustion chamber ranging from 1,900° to 2,800° F. No complete series of tests have been made, but the preliminary trials showed an evaporation of 2 to 3.5 lbs. of water per pound of waste consumed. The clinker is very heavy because of the presence of large amounts of iron in the waste. The operation demonstrates that industrial waste of a great manufacturing plant can be converted into power with a moderate cost for initial plant, and the certainty of obtaining a revenue in steam that will more than repay the costs for operating and the fixed charges on construction.

A Heenan destructor has been installed at Buffalo at the refuse utilization station, owned and operated by the city in conjunction with the sewage pumping station. This destructor will be operated by the rejected parts of the light refuse that are left after the salable percentages are sorted out and sent to market. The steam power from the destructor will be employed in the sewage pumping station adjoining the destructor building, saving the fuel and labor heretofore necessary for the boiler plant of the sewage works.

The city of Montgomery has contracted for the erection of a refuse disposal plant which will include a reinforced concrete building, radial brick stack, and four-grate Heenan destructor with 200 h. p. boiler. The steam power from this station will be utilized in the operation of the municipal water pumping station.

The latest installation of the destructor system is at Milwaukee, where a large plant having a capacity of 300 tons per day has just gone into service. Milwaukee in past years has had an extended and unfortunate experience with various means of waste disposal, having had three crematories, two reduction processes and the usual unhappy dumping in water and on land. The destructor now installed replaces the larger crematory of the Engle type built in 1901, with a rated capacity of 120 tons. This crematory was unfortunately located, involving large expense for transportation of the garbage; repairs and the operating costs were excessive.

In designing the plant, Messrs. Hering and Fuller, the consulting engineers in charge, introduced many new features, chiefly those connected with the reception and handling of the waste; the removal of free water by drains in the floor of the storage hoppers; a complete system of ventilating air ducts from all parts of the building; the separation of the charging, firing and clinking work from the machinery rooms; the conveying of clinker from the building; and the arrangement of the electric generators and other machinery in the most compact form, with utmost economy of room. There has probably never been built a disposal plant of the same capacity that occupies so little ground, nor one where the operation of the works is done with so small percentage of hand labor.

The destructors are of the Heenan type, built in 4 units of 6 grates each, with four 200-h. p. water-tube boilers connected with a central main flue leading to the chimney of radial brick 154 ft. high and 10 ft. interior diameter. The furnaces are top fed, through containers or charging hoppers holding 1 cu. yd., operated by the fireman from the floor in front of the furnace. The clinker is withdrawn through the front doors in the furnace and falls through trap doors into clinker cars on the basement floor. The cost of this plant for foundations and framework of buildings, the destructors, boilers and machinery equipment under the contract of the Power Specialty Co., of New York, was $175,000. The building and appurtenances were $20,000; the chimney, $4,500; the engineering and inspection fees, $5,000; and extras, $4,485; making, in round numbers, $208,985 as the total cost exclusive of the ground. The tests for acceptance of the plant were made under three conditions of extreme summer refuse, extreme winter refuse, and average annual refuse. Table VII gives the average analysis of the waste as burned under these conditions. The results of these tests showed that about 10 per cent more refuse was destroyed than was called for in the contract; that the steam requirements were exceeded by about 30 per cent and that the operating costs were from 20 to 25 per cent less than the conditions of the contract. All other points of contract conditions, the average temperature maintained, the combustion of 60 lbs. of waste per square foot of grate per hour; the residual thoroughly burned and free from organic matter, and no nuisance from dust or odors created during the operation, were completely fulfilled.

At the present time there is no opportunity to use the steam power or utilize the large amounts of clinker produced. Undoubtedly in the near future a way will be found by means of which the revenue from these items will be placed as it belongs, to the credit of the destructor. The results obtained compare favorably with those reported from the destructors operating in Great Britain, and as the plant contiuues in use and the men become more expert in its management, there will be a decrease in the net operating expenses.

The city of Portland, Ore., after some four years of effort to obtain satisfactory tenders, has accepted the proposals of a local construction company for the installation of a large disposal station with a capacity of 150 tons per day. The designs for this plant, made by the Public Works Engineering Co., follow the construction of the English continuous-cell destructors in all important details, with some additions and modifications intended to give a larger capacity, greater steam development, with no more initial cost for the plant. It is understood that this installation has been completed and is about to go into service.

The review of the work of destructors and their coming installation in this country indicates a strong movement toward the establishment of disposal stations that will utilize all waste products of the community. It was about twenty years ago that Lord Kelvin pointed out the possibility of converting waste material into electrical energy, by which means each inhabitant might be furnished with an 8 c. p. electric light during the time this was needed for illumination. This was thought to be a fanciful and imaginative supposition, but succeeding years have shown that it is not altogether an impossibility. Whether a part of the waste be utilized by one or another form of reduction process, or by the combustion of all and the employment of steam power and the residuals, it is now a demonstrated and practical thing, and there is no more useful way of turning into the pockets of the taxpayers the values of the municipal waste now thrown away.

TABLE IX.—TEST COST OF OPERATION OF MILWAUKEE REFUSE INCINERATOR AVERAGE ANNUAL REFUSE.

Tons incinerated during test		126.81
Labor required:		
One feeder, 37 hr. at 25 cts.	$ 9.25	
Three firemen, 37 hr. at 25 cts.	27.75	
¼ engineer's time, 37 hr. at 37½ cts.	3.[illegible]	
Total cost		$40.47
Cost of labor per ton		31.9 cts.
Steam from and at 212 degrees to operate fan engine and feed pump per ton		219 lb.
Cost of steam used per ton, at 4 cts. per 100 lb.		8.8 cts.
Total cost to incinerate one ton		40.7 cts.
Total steam generated from and at 212 degrees fahr. per ton		2,680 lb.
Value of steam per ton of refuse burned at 4 cts. per 100 lb.		107.2 cts.
Net profit per ton of refuse burned		66.5 cts.

DISCUSSION.

Mr. Morse.—I neglected to say that I had several analyses of clinker made, and I find the proportions to be: Silica, 40, 60 to 65 per cent; lime, from 7 to perhaps 15 per cent; and of compounds of iron, oxides and similar compounds, somewhere about 8 or 9 per cent, and of magnesia, 7 or 8 per cent. Roughly speaking, those are the constituent parts. When it comes from a destructor, this is a very hard material that comes out in chunks. I have seen 30 to 40 tons taken out in the same condition. At that time, it has a high temperature,—1 200 to 1 500° F. and upwards,—but the temperature rapidly falls on exposure to the air. In volume it is much larger in its new condition than it was before. Then, after it has been allowed to stand and disintegrate, it is broken up and ground up into any size desired, so that you may be able to get clinker of any shape to use for concrete. In Westmount, they first tried this experiment. At first they gave it away. Now they have a demand for it for one purpose or another. It is probably not advisable to use it in all classes of concrete work, but it is possible. Also it ought not to be in contact with any iron work, because there may be more or less sulphur, which attacks the iron. But for all purposes of sidewalks and bottom fillings for roads, or wherever there is use for a rough character of stone, it is eminently suitable and useful. They are carrying on a series of experiments at New Brighton for the purpose of determining what can be done with clinker—grinding it up and making brick and cement from the clinker itself. I saw a briquette set in a day, while it ordinarily requires from seven to eight days for a cement briquette to set. And it is stronger than the cement itself. There is a certain composition which will make a stronger setting than any composition of sand and stone of which we now know. In other words, the crushing strength is greater than that of the ordinary briquette. I believe this is to be possible, that 20 or 30 per cent of the total weight of residuals from all destructor plants will be useful for all sorts of municipal rough work, and would represent, roughly speaking, at least 50 cents per ton. So there is an asset to the credit of the clinker that should be taken into account. With the experiments going on here and in Europe—for this same process is being carried on by a number of countries—I believe that we shall arrive at a point where every particle of clinker will find a useful purpose, and not only pay for itself, but provide a revenue. At the present time it can only be said that for all rough work it is eminently useful and finds a satisfactory market.

The present cost of destruction in the New

Brighton plant is somewhere about $1.28. That is very high, and it is because the plant is conducted not entirely for the purpose of destruction, but also for experimental purposes. And the capacity of the plant has never been reached yet. In other words, only about 30 tons are burned, whereas the plant has a capacity of about 60 tons. In ordinary work of this kind the larger the plant the less the operating cost, and when a plant has reached its capacity, the cost per ton is less than when it was operating below its capacity. I may say that, under ordinary conditions, the cost of operation without any rebate from power and clinker would be from 78 cents, as in Westmount, to $1.28, as in New Brighton. They are now installing engines for electric service, and in a month or two we shall have returns which will show the application of the rebate to be recovered. It has never exceeded 80 cents at Westmount, and at the present time it is slightly less than that. At Vancouver it varies somewhere between 60 and 70 cents—I am not quite sure of the figures. In other words, the returns from rebates to be recovered from power and clinker are large. As to the approximate first cost to dispose of Boston refuse by destruction, Mr. S. A. Greeley made a calculation based on 20 or 30 destructors, and according to his tabulation the cost ran from $250 per ton up to $1,000, and the average was about $600 per ton of waste consumed. For instance, take a 50-ton plant; that would represent about $30,000 for the destructor plant only. Multiply that by the amount of waste in Boston and the result will be the approximate cost of a destructor plant here. Say a 300-ton plant is recommended—to give a concrete example; that would be, at the rate of $600 per ton, $180,000 for the initial cost of construction and installation. Add the cost of the ground and you have the cost of the whole plant. The Milwaukee plant cost $200,000 to install. That is practically at the rate of $600 per ton. I doubt if that could be repeated, because conditions are very exceptional. You might put it down that the cost of installation of a plant would be somewhere between $600 and $800 per ton, and above that you could go into concrete and fancy construction, which means higher cost. The destructor people, I believe, put the cost at between $600 and $1,000 per ton,—the initial cost. And it is a permanent plant. The initial cost does not represent so much when you consider the plant will last from twenty-five to thirty years.

Mr. Guy C. Emerson.—I have been into the matter of garbage reduction and incineration somewhat extensively during the last two years, and I am not as optimistic as Mr. Morse in the matter. I am not prepared to dispute the statements presented, but I want to warn the gentlemen present that whenever they go looking for figures they will find some peculiarity, either of natural conditions or something else, and very often a peculiarity of municipal bookkeeping that influences the result. The municipal plant in Montreal impressed me favorably. I was delighted to see the amount of coal they were saving by the destruction of refuse, but when I came to inquire why they needed two more boilers they said, "We use those all the time and only use the garbage when we can get steam for it." But I didn't find out how much it cost to run those boilers and how much the running of the refuse-fired boiler interfered with the operation of the other two.

In looking over the figures for Cleveland, the recent committee on refuse disposal were very much surprised by the profits shown, as stated by Mr. Morse tonight. But we found items that were a matter of opinion. In the opinion of the Cleveland managers, they were properly a credit to the working of the plant. We had serious doubts that such credits were warranted. We also found different conditions in every city. Cleveland, I am told,—I have not seen the plant,—has a plant located seven or eight miles from the city. In Boston a plant of that kind would be absolutely impossible. We are surrounded here by a population perhaps as large as that of Boston itself, and we should have to go perhaps 30 or 40 miles into the country before we could find a place where a municipal reduction plant would be tolerated. The islands of the harbor are perhaps the only available locations, and Mr. Merrill's company seems to have them pretty well tied up.

In the matter of revenue to be derived from the products of incineration, the conditions in Boston are also somewhat different from those of other cities. Boston, as you all know, is a territory where sand and gravel are very cheap. They can be had almost for the taking away. Nobody, so far as I am aware, claims that for any purpose of construction, excepting perhaps for the building of concrete floors, where a peculiarly light material of concrete is needed, the clinker from an incinerator plant has as great value as gravel or crushed stone. Our commission were not prepared to recommend that any returns could be secured in Boston, or that some expense would not be incurred for disposal of clinker.

If any person has occasion to make up an estimate of the cost of refuse disposal in any city, I advise him not to take as a guide, without careful investigation, the figures advanced for any particular city, but to go into the matter very carefully and make it, as both Mr. Morse and Mr. Merrill have suggested, an engineering problem for the specific locality they represent. And in that way they will get an idea of the problem and figures that will be more nearly correct. They may take the experience of other municipalities as to methods rather than as to expense.

Every incinerator plant I have investigated has claimed a certain price per ton for incineration. None of them has yet shown as low a price in actual operation. In the case of one plant I visited not long ago, if I remember correctly, the builders gave a guaranty of less than 50 cts. per ton for the disposal of refuse. The superintendent in charge said they were disposing of it for something like $1.25 a ton. He thought if they had enough refuse to run the plant to its full capacity they might reduce the cost to 84 cts., and this condition seems almost universal. I am a little bit curious to see what is going to be the ultimate financial result of the guaranties and the bonds which the companies have been giving, when, so far as I know, none of them has reached the proposition which it guarantees, but at the present time they simply hold forth hopes and expectations.

GENERAL ARTICLES AND CLASSIFIED ITEMS

The Design of Retaining Walls, Adapted from Georg Christoph Mehrtens, "Vorlesungen Ueber Static der Baukonstructionen und Festigkeitslehre."

BY GEORGE M. PURVER, C. E.*

Design of retaining walls is based on the following assumptions: (1) The back fill is made up of homogeneous, compressible particles possessing friction but not cohesion. (2) The surface of rupture is a plane. (3) The thrust on back of wall resulting from weight of sliding prism and resistance of plane of rupture makes an angle F' with the normal to back of wall, where F' is angle of friction of earth on back of wall.

A Theorem by Rebhann.—(Fig. 1A.) The limiting plane of rupture bisects the area bounded by the back of wall, surface line, thrust measure, and the natural slope.

Construction: Draw $ic = E$; $ef = G$; $if = Q$; then if ic is the limiting plane of rupture and cd makes angle B with the perpendicular to ih, area ibc = area icd.

Proof: If ic takes position ic', ef is reduced by ff' and angle fif' = angle between the perpendicular to ic and ic' respectively; take D angle that Q makes with the perpendicular to any line of rupture, then D can vary from O to F, angle of natural slope; and when $D = F$, ic takes position of limiting plane of rupture; the difference between two consecutive D's = angle cic' — angle fif', which becomes O when angle cic' = angle fif'; but area ibc/ area $icc' = ef/ff'$ and area fie/ area $fif' = ef/ff'$, hence area ibc/ area fie=area icc'/ area fif'; but $ic = if$ and area icc' = area fif', hence area fie = area ibc.

Draw cd making an angle B with the perpendicular to ih; draw im making an angle F with if, then angle fik = angle mih, angle fik + angle ife = 90°, angle mih + angle cih = 90°, hence area ibc = area icd.

Amount of Earth Thrust.—(Fig. 2A.) Construction: Make $dm = cd$, then cdm is thrust triangle; its area times w, weight of earth per cu. ft., times 1 ft., length of wall, = E, earth thrust.

Proof: Area cdm/ area $cdi = dm/di = ie/fe = F/G$; $G = w.l.$ area $ibc = w.l.$ area cdi, hence $E = w.l.$ area cdm.

Stability.—(Fig. 3A.) Stability depends upon resisting capacity of base ai. The amount of resistance of base is proportional to the resultant R of earth thrust E and weight of wall P. By decomposing R into H and V we find that (1) V should not exceed allowable pressure on base. (2) H should not be less than tan. F', where F' is the angle of friction between base and wall, factor of safety at least 1½ to 2. (3) At no point in the wall should the allowable stress be exceeded.

In designing, determine weight and natural slope, assume material dry as clay, loam, or sand; for wet material increase weight and reduce natural slope. For back fill sand and gravelly soil are best, as they allow water to percolate and detain their weight. Supporting soil is considered elastic; highly compressible soil is the most dangerous. It is advisable to have R pass the center of base; it must fall within the middle third.

A Theorem by Rebhann. Auxiliary Line.—(Fig 4A.) A line Ss that makes with the straight back of the wall an angle $F + F'$ is parallel to the direction of the thrust measure cd.

Proof: Draw ce perpendicular to ix and cg parallel to bi, then angle gce = angle $g'ib$, angle ecf = angle hix, angle $deg = B + F - A$, but angle $A = B - F'$, therefore angle $x = F + F'$.

A Theorem by Poncelet.—(Figs. 5A and 6A.) The thrust measure cd and auxiliary line Sb, drawn through b, cut the natural slope ih so that $id^2 = if.ih$.

Proof: Fig. 5A. Draw dl parallel to ic, then area ibc = area cdi, area icl = area cdi, hence area ibc = area icl and $bc = cl$; $id/ih = cl/ch = bc/ch = fd/dh = (id - if) / (ih - if)$; $id.ih - id^2 = ih.id - ih.if$. Hence $id^2 = ih.if$.

Construction: Fig. 5A. (1) Draw auxiliary line through b, erect a perpendicular at f, lay off $id = if'$, and draw cd parallel to Sf, then ic is the limiting plane of rupture and cd thrust measure.

(2) Fig. 5A. Draw fp parallel to bh; pp' perpendicular to bl; $ip' = lr$; rd parallel to bh.

(3) Fig. 5A. Draw fk parallel to bi, kk' perpendicular to bh; $bm = bk'$; md parallel to bi.

(4) Fig. 6A. Tangent ig to semicircle on fh, $id = ig$.

(5) Fig. 6A. Semicircle on $h'h$, sh' auxiliary line, bu perpendicular to $h'h$, $h'c = h'u$.

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*146 East 8th, St., Brooklyn, N. Y.

(6) Fig. 6A. Semicircle on bh, tangent $h'g'$, $h'c = h'g'$.

A Theorem by Holzhey.—(Fig. 7A.) Through point p draw line pn parallel to auxiliary line and pe parallel to natural slope to intersect back of wall or its continuation, then $i'e^2 = es.en$.

Construction: Semicircle on en or es according as n or s is farthest from e; ss' perpendicular to en, $ei' = es'$, then $ei'^2 = es.en$.

Proof: Draw $i'k$ parallel to natural slope, which will intersect nd and sf parallel to auxiliary line, and sk continuation of sp in points f, d, k;

(1) $i'd^2 = i'f.i'k$; $i'd^2 - i'd.i'k = i'f.i'k - i'd.i'k$; $i'd\ (i'd - i'k) = i'k\ (i'f - i'd)$:

(2) $i'd/i'k = fd/dk = sp/pk = es/ei'$:

(3) $es/ei' = i'd/i'k$:

(4) $i'n/i's = i'd/i'f$; $es.i'n/ei'.i's = i'd^2/i'k.i'f\ es\ (i'e + en)\ /ei'\ (ei' + es) = l$.

Hence $ei'^2 = en.es$. This relation holds for any point of a straight or a curved surface line. In case of a straight surface line, s coincides with b. In case of a curved or broken surface line, transform ibp into an equivalent triangle isp and use vertex s as before.

This theorem enables us to find the plane of rupture through any point on the surface line.

Compensating Surface Line for a Uniform Load Not Extending to Back of Wall.—(Fig. 8A.) Let uvw surface line of a uniformly distributed load reduced to weight of earth of height H'. Plane of rupture cannot continue beyond e, where it takes direction ed, so that the only effective superimposed load is $uvde$; to establish ie we must substitute for the outline uvw its equivalent ukl, so that for any plane of rupture, area $ibuvde$ = area $ibukge$.

Make vw parallel to kl, find y.

Draw another plane of rupture ig'; let $ee' = m$, $gg' = n$; then $2mH' = (n + m)y$; $2H' = \frac{n+m}{m}y$; $\frac{n}{m} = \frac{H+y}{H}$; $\frac{n+m}{m} = \frac{2H+y}{H}$; $2H' = \frac{2H+y}{H}y$; assuming $bb' = y$; then $y^2 + 2Hy = 2H'H$; $(y + H)^2 = H(2H' + H)$; i. e., $y + H$ is the third proportional to H and $H + 2H'$.

Compensating Triangle for the Superimposed Load Not Extending to Back of Wall.—(Fig. 9A.) Construction: Draw $h'n$ parallel to ai at the distance $H + 2H'$ from it; bn parallel to iv and locate n, then area ibv = area inv; draw in to find s'. From s' draw $s'f$ parallel to auxiliary line; semicircle on ih, etc., thus finding thrust measure cd and plane of rupture ic.

Proof: Since bn parallel to iv, area inv = area ibv; area inc = area $ibvwc'c$. This is true for any po ition of plane of rupture; now, area inc / area $isc = in/is' = (H + 2H')/H$; construct triangle ieg;

$ei = E^b$ total earth thrust on back of wall;
eg = weight of sliding prism $ibvwcc'$;
ig = resisting pressure on plane of rupture;
gg' = reduction in G for changing c to k;
then eg/gg' = w.l. area inc/w.l. area $icnk$ = area inc/ (area ick + area $inck$) = area inc/area $ick\ (l + 2H'/H) = H$, area $inc/(H + 2H')$ area ick; by making $ig = ic$, area ieg/area igg' = area icd/area ick, therefore area icd = area inc $H/(H + 2H')$, but area inc/area $is'c$ = $(H + 2H')/H$, hence area icd = area $is'c$; i. e., point s' can be used in determining plane of rupture for the superimposed load. The

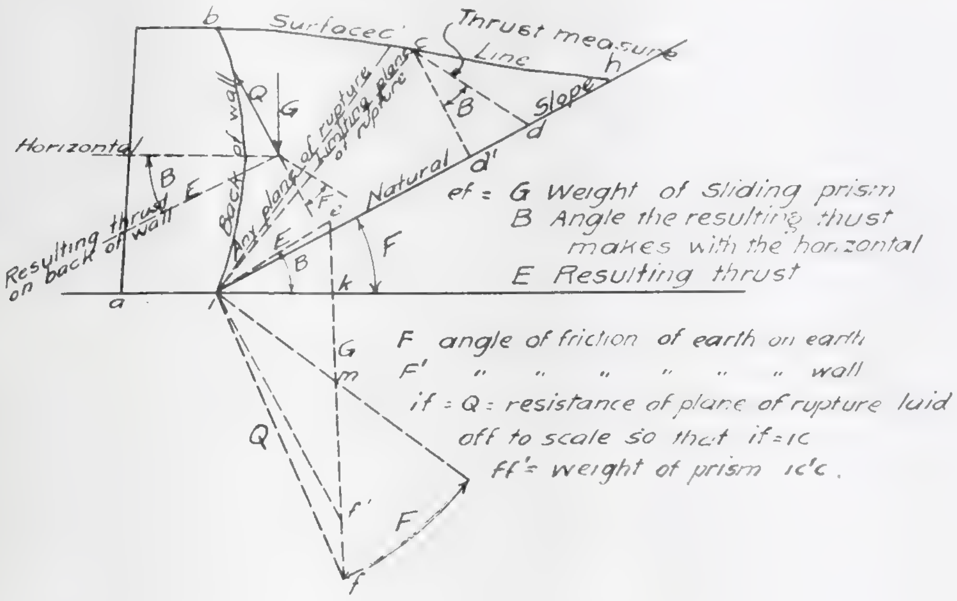

b
Surfacec' c
Thrust measure
Line
h
Q
G
Back of wall
Any plane of rupture
Limiting plane of rupture
B
Slope
d
Horizontal
B
E
d'
Natural
F
F
e
Resulting thrust on back of wall
ef = G Weight of sliding prism
B Angle the resulting thust makes with the horizontal
E Resulting thrust
a
i
k
B
G
m
F angle of friction of earth on earth
F' " " " " " " wall
if = Q = resistance of plane of rupture laid off to scale so that if = ic
ff' = weight of prism ic'c.
Q
F
f'
f

Fig. 1A.

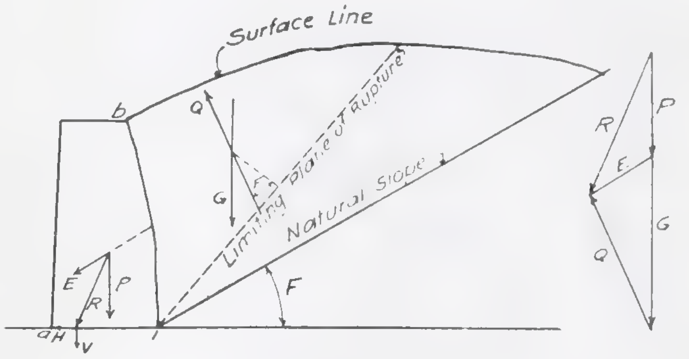


Fig. 3A.

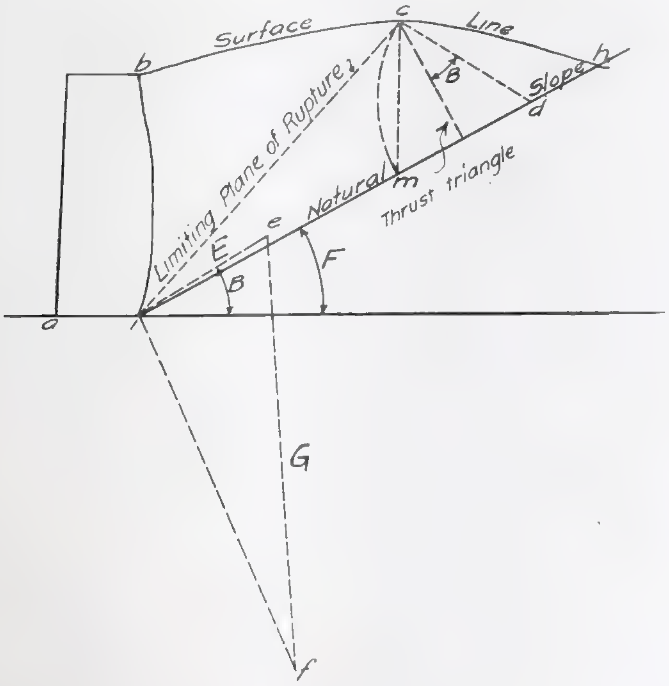


Fig. 2A.

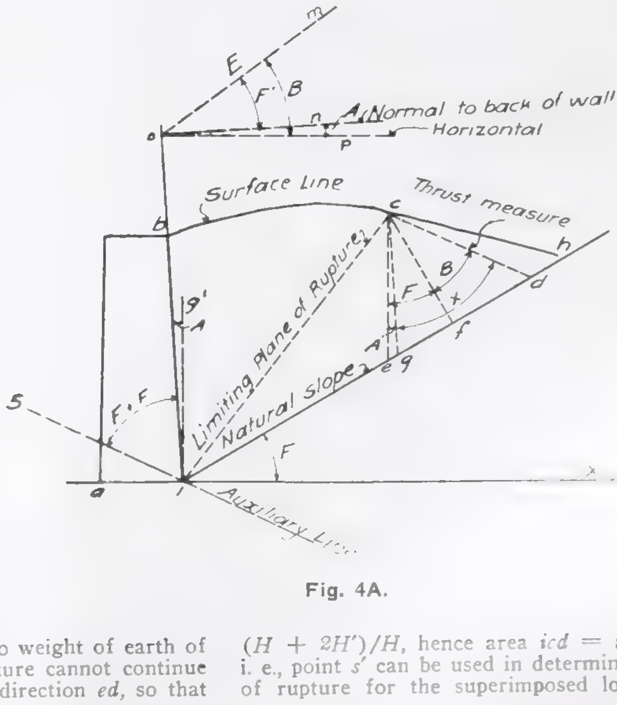


Fig. 4A.

thrust triangle for this case must be drawn separately.

Construction: (Fig. 10A.) Find *c* as before, then join **n** and *h*; through *c* draw **uk** parallel to **in**; make **dm** = *cd*, then area *vdm* is thrust triangle for the superimposed load; E° is the thrust. $E^\circ = w.l.$ area *vdm*.

Proof: $E^\circ/G^\circ = ie/eg = cd/id = md/id =$ area cdm/area icd = area **cdm**/area isc, but area inc/area $isc = (H + 2H')/H$; $E^\circ/G^\circ =$ area cdm/area $inc.H/(H + 2H')$, but $G^\circ = w.l.$ area *inc*. hence $E^\circ = w.\ l.$ area **cdm** $(H + 2H')/H$, by drawing **uc** to intersect natural slope in *k*, thrust triangle **udm**/area **cdm** $= uk/ck = ni/si = (H + 2H')/H$, hence $E^\circ = w.l.$ area **cdm** $(H + 2H')/H = w.l.$ area **udm**.

Superimposed Uniform Load Extending to the Back of Wall.—In this case point *v* coincides with *b* and the compensating line limits the sliding prism **isc°**, which is similar to the sliding prism **ibc**, drawn without superimposed load, so that plane of rupture **ic** and **ic'** for **E** and E° must coincide. $E^\circ/E = c'd'/cd = id'/id - (H + y)/H$, but $(H + y)^2$

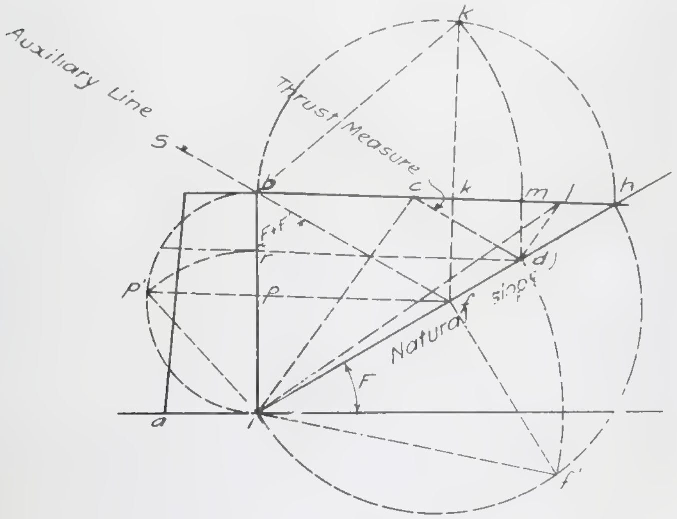


Fig. 5A.

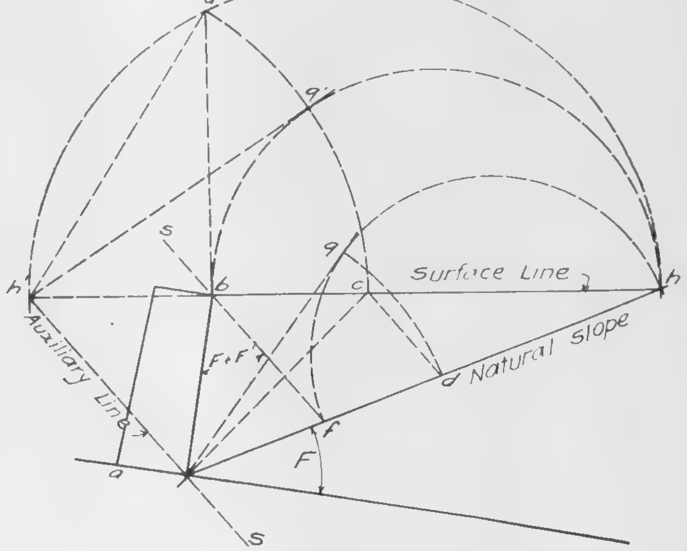


Fig. 6A.

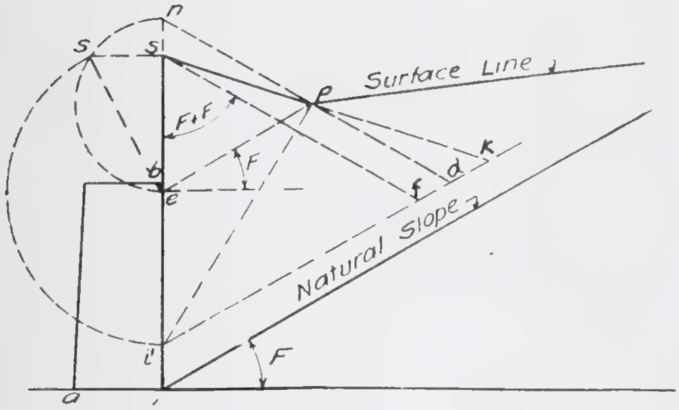


Fig. 7A.

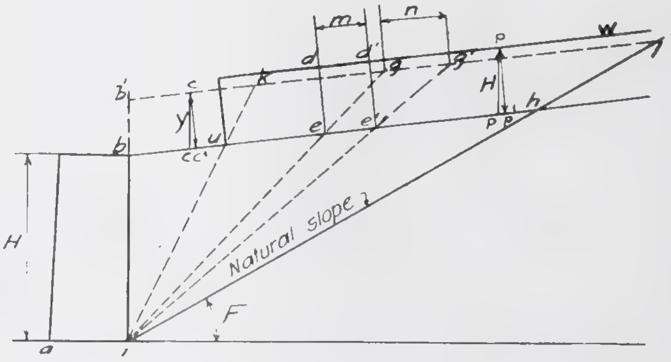


Fig. 8A.

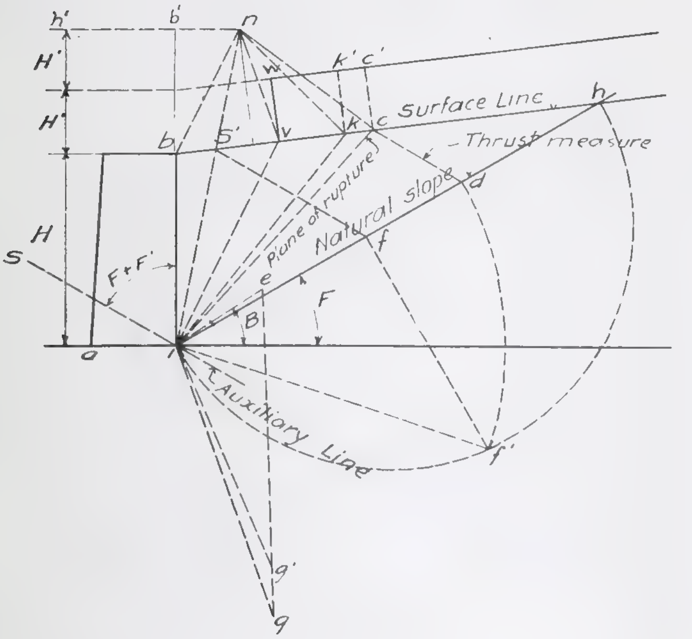


Fig. 9A.

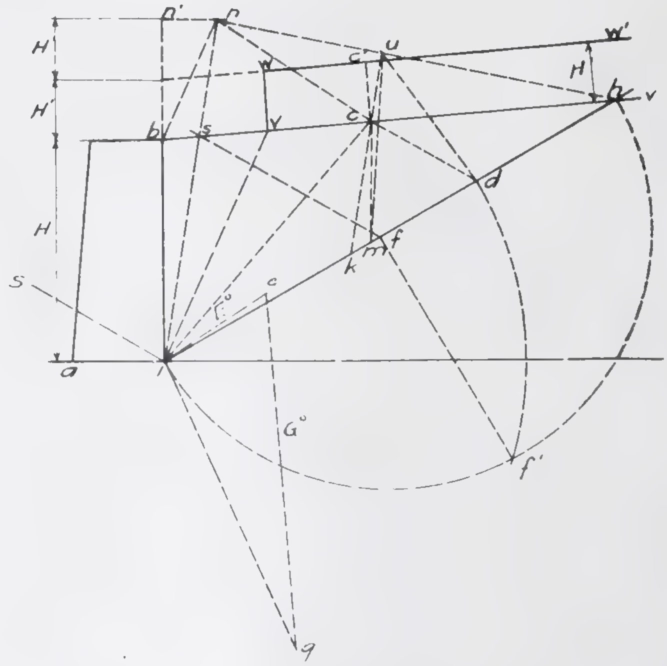


Fig. 10A.

$= H(H + 2H')$, therefore for full loading $E^\circ = E(H + 2H')/H$.

Earth Thrust on a Curved or Broken Back of Wall.—(Fig. 11A.) The wall is subdivided by horizontal lines, and earth thrust determined for each section separately. The earth thrust E is found as before, and E', E°, etc., by a theorem demonstrated below. The amount and direction of the resultant is then established from the force polygon.

Surface Line Straight, No Superimposed Load.—(Fig. 12A.) For the upper portion E_1 draw auxiliary line through i' and find $c'd'$ thrust measure; $c'd'm'$ thrust triangle; E_2 can be found from force polygon E_1, E_2, Q resisting thrust of the plane of rupture ic and G weight of the sliding prism $ii'bc$. Let $G' + G^\circ = G$: E_1 is decomposed into E_{1-2} and g, then force polygon is $(E_2 + E_{1-2})$, Q, and $(G - g)$. To find E_2, first find $E' = E_{1-2} + E_2$, hence $E_2 = E' - E_{1-2}$. E' can be found from sliding prism $ii'bc$ reduced by g, which is transformed into an equivalent triangle with vertex resting on surface line, isc. Draw $c'd'$ parallel to Si, then $w.l.$ area $c'd'e' = g$.

Proof: Triangle $E'Q_1G'$ is similar to triangle $i'c'd'$ or equal to it if $Q_1 = i'c'$; triangle $d'c'e$ is similar to triangle $E_1E_{1-2}g$, since angle at $Q_1 =$ angle $d'c'e$; therefore $g/G_1 = ei'/i'd' = (w.l.\ \text{area}\ ed'l/2)/w.l.\ \text{area}\ i'd'l/2$, where l is height of triangle $c'd'e$. To find triangle isc, subtract from area $ii'bc$, area $i'd'e$. (Fig. 13A.)

Construction: Transform triangle $c'd'e'$ into equivalent triangle ibk: $e'e^\circ$ parallel to $d'c'$, $e'd^\circ$ parallel to bh', $e^\circ n$ parallel to ib; draw nc'; area $e^\circ c'n =$ area $c'd'e'$, because area $c'd'e' =$ area $e^\circ c'd' =$ area $e^\circ c'n$; now area $d^\circ bl =$ area $c'd'e'$, $d^\circ k$ being parallel to $i'l$; hence $d'k$ is parallel to $i'l$, and area $d^\circ kl =$ area $d^\circ kl'$; also area $i'bk =$ area $c'd'e'$. After area $ii'bh$ is reduced by area $c'd'e'$ and transformed into an equivalent triangle ish, draw sf parallel to Si, semicircle on ih, etc., to determine plane of rupture ic and the thrust triangle cdm. From this triangle find E', which is the resultant of E_2 and E_{1-2}; $E_2 = E' - E_{1-2}$. Since the angle A is less than 180°, E' makes a greater angle with the horizontal than E.

Superimposed Vertical Concentrated Load.—(Fig. 14A). If plane of rupture for c strikes bi, proceed as in Case 8. If P is so far from b that plane of rupture falls below i', proceed as follows: Find g as before. This weight is constant for all positions of plane of rupture that strike ii' and could be represented by area $i'bk$; $g = w.l.$ area $i'bk$. Transform triangle $i'kc$ into an equivalent triangle $i'e'c$ with vertex on continuation of back of wall, ke' parallel to $i'c$, and determine plane of rupture: ce parallel to Si, cg parallel to natural slope, semicircle on ge, $e'f'$ perpendicular to ge; $gd'=f'g$; then cd' is plane of rup-

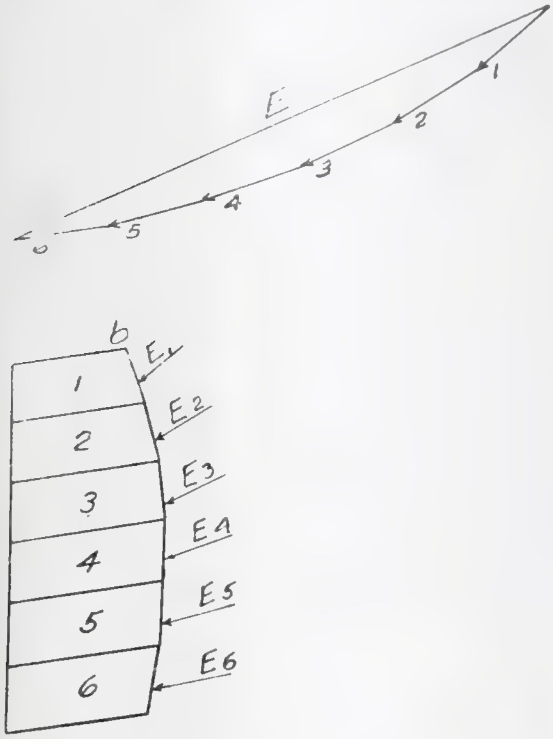


Fig. 11A.

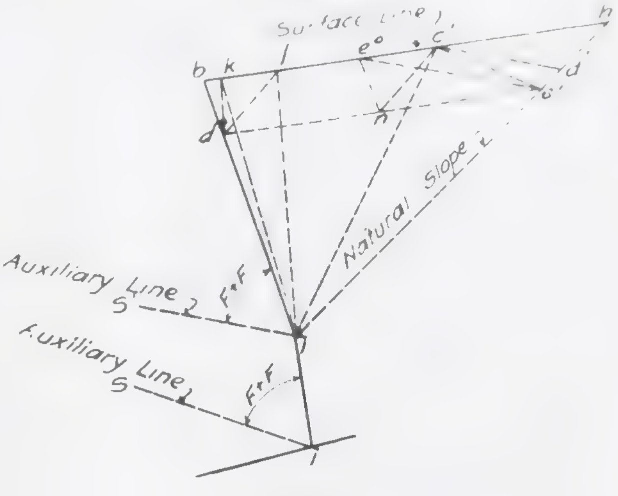


Fig. 13A.

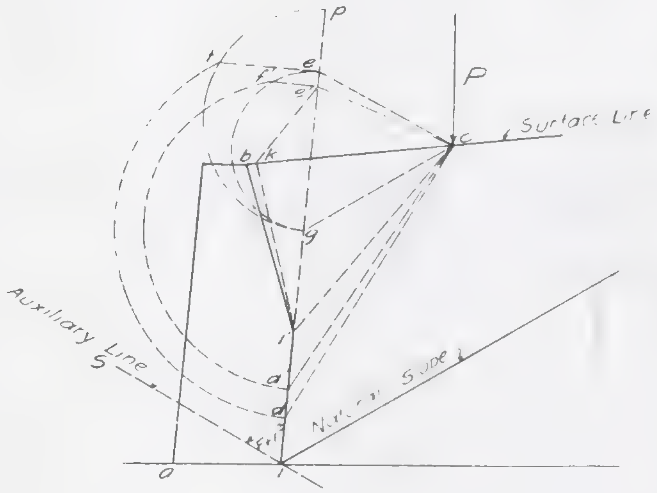


Fig. 14A.

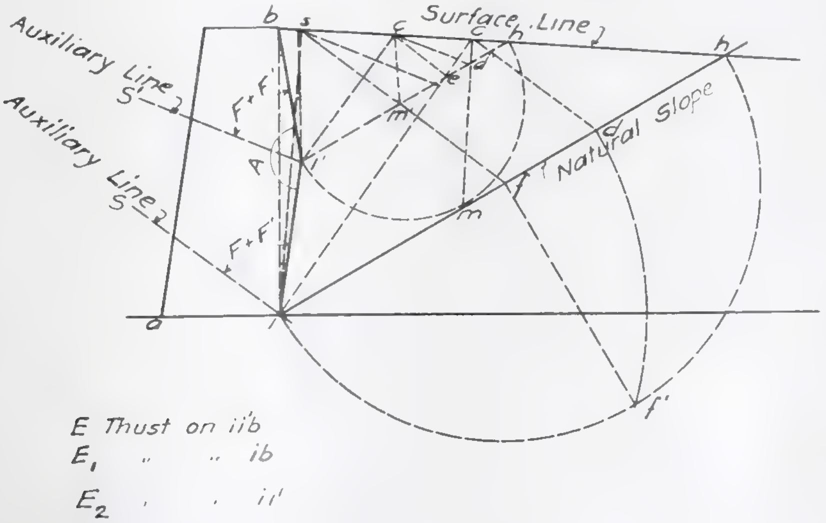
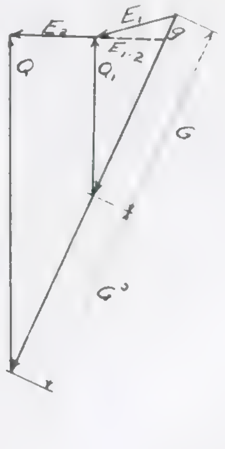


Fig. 12A.



ture, P not considered. E' is determined through the corresponding thrust triangles. Transfer triangle $ee'p$ on ce' so that $e'p$ is on continuation of ie; semicircle on gp, ef perpendicular to ip, $gd = fd$, then cd is plane of rupture for P included.

A Theorem.—In determining where the plane of rupture due to a concentrated load at b, *Fig.* 7B, ends on back of wall, any point c on the surface line is available as long as area $l.w.cbp$ = area $l.w.c'b'p' = P$.

Construction: Construct any triangle as $bp'c' = P$; $c'e'$ parallel to auxiliary line, semicircle on bp'; fe' perpendicular to bp', $bd^\circ = bf$; $c^\circ d^\circ$ parallel to auxiliary line to intersect bc°, which is parallel to natural slope; make $c^\circ m^\circ = c^\circ d^\circ$, then $c^\circ d^\circ m^\circ$ is thrust triangle.

Proof: Construct another triangle as $bpc = P$; i. e., $l.w.$ area $bc'p'$ = $l.w.$ area bcp; then $\frac{bp'}{bp} = \frac{bc}{bc'}$; $\frac{be}{be'} = \frac{bc}{bc'}$, hence $\frac{bp'}{bp} = \frac{be}{be'}$, or $bp'.\ be' = bp.be$. When bc is infinitely small, a line through c *parallel* to natural slope will strike b and semicircle will be on bp; so that $(bd^\circ)^2 = be.bp$, but $(bd^\circ)^2 = be'.bp'$, hence $be.bp = be'.bp'$.

Point of Application of Earth Thrust; Straight Back of Wall and Straight Surface Line.—(Fig. 15A.) Transform thrust triangle into an equivalent triangle ibk, with ik parallel to earth thrust direction, or any direction. Since all thrust triangles are similar, line ik' represents the thrust E of point i'; thus each line parallel to base of triangle ibk is a measure of the E at the point where it meets the back of wall. Point of application of l of partial thrust E' on bi' is where $s'l$ parallel to ik passing through center of grav-

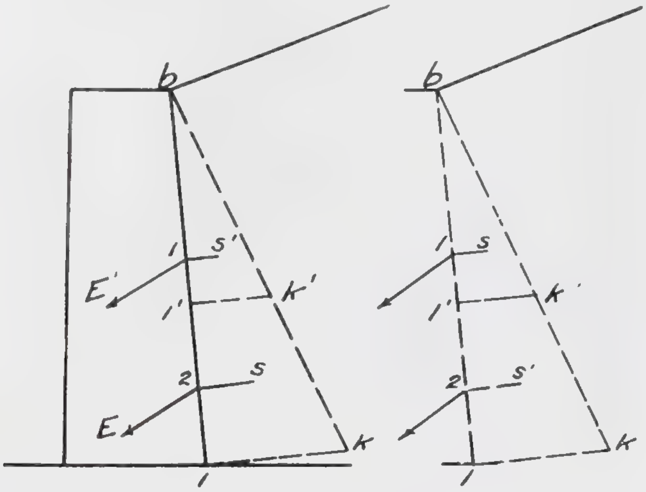


Fig. 15A.

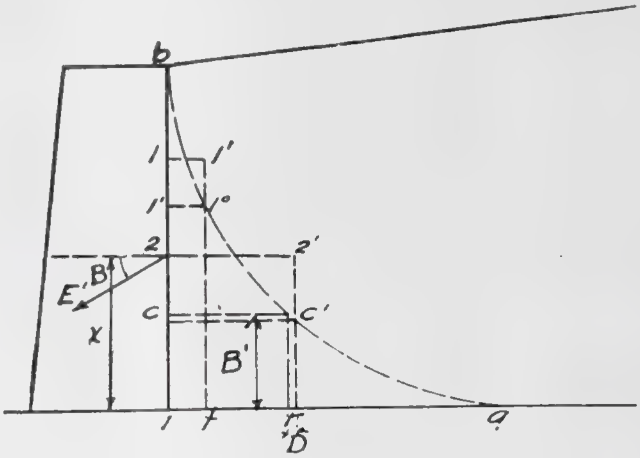


Fig. 16A.

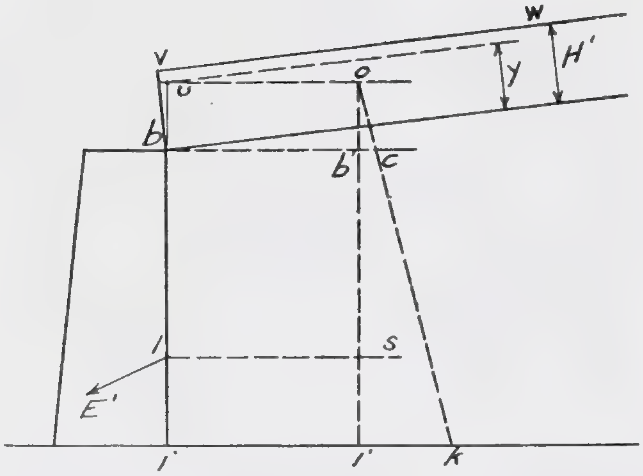


Fig. 17A.

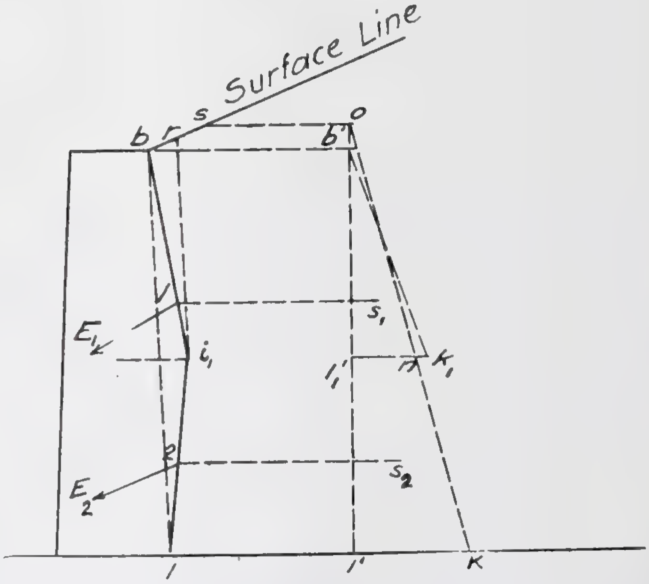


Fig. 18A.

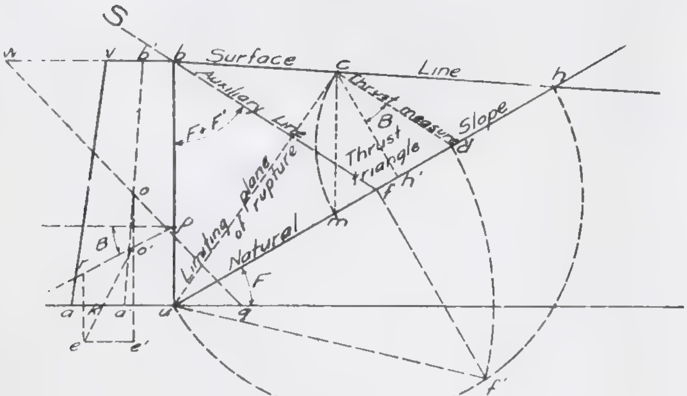


Fig. 1.

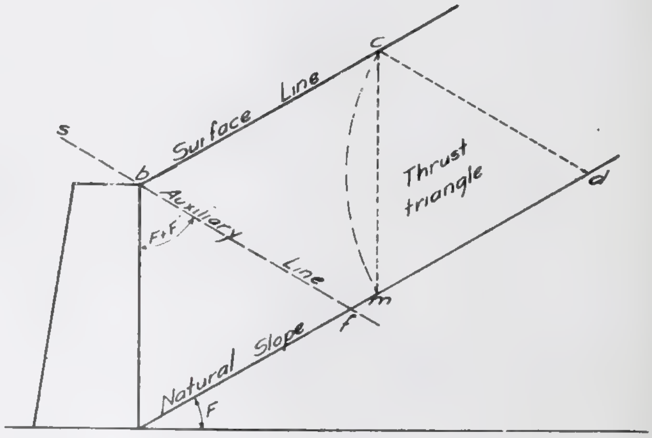


Fig. 2.

ity point s' of triangle $bi'k'$ strikes back of wall. Point of application of E on ii' is on a line through c. g. of trapezoid $i'k'ki$. Hence it follows that on a straight back of wall E is applied through the upper part of the lower third of back of wall.

At each point i', Fig. 16A, lay off an ordinate equal to thrust on bi', then ba is a parabola, because thrust triangles are to each other as squares of their sides equal squares of corresponding wall heights.

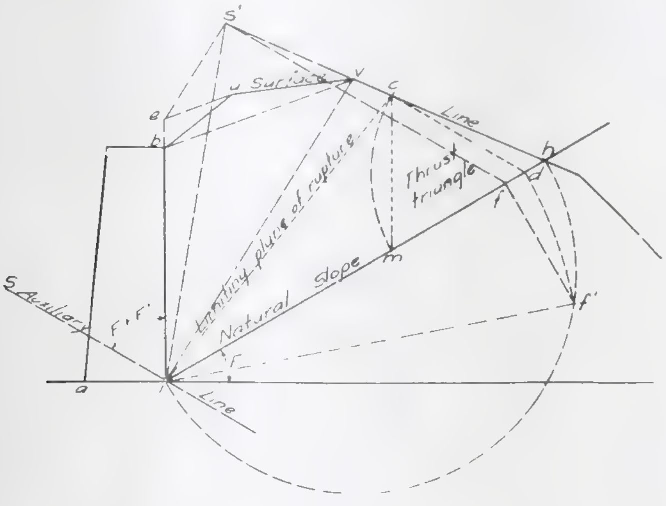


Fig. 3.

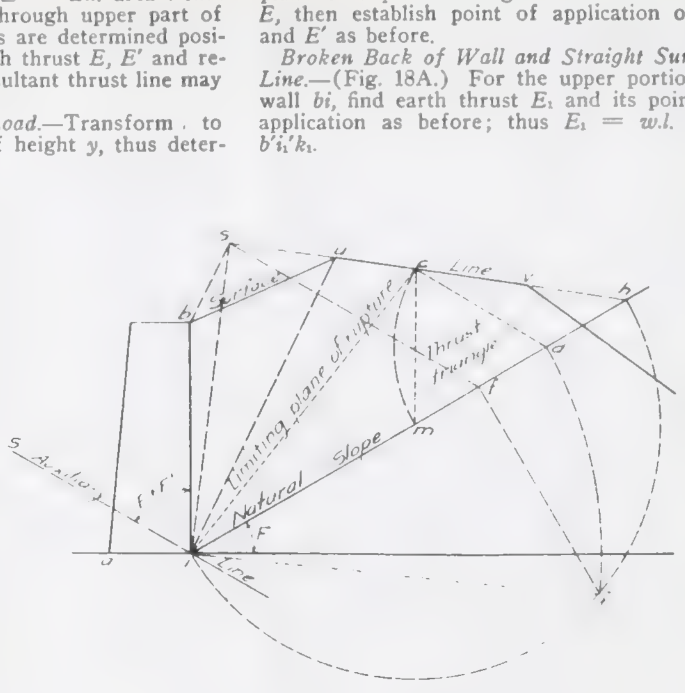


Fig. 4.

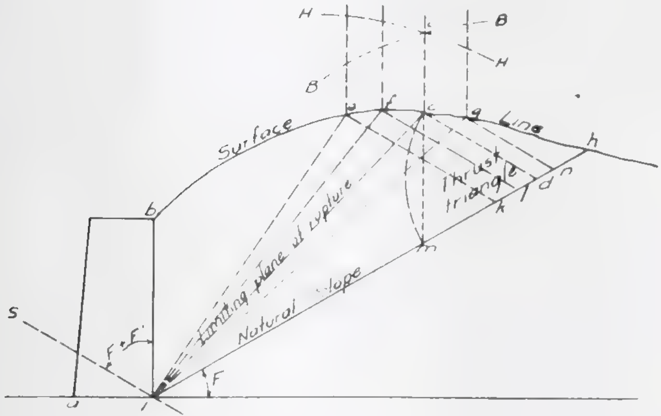


Fig. 5.

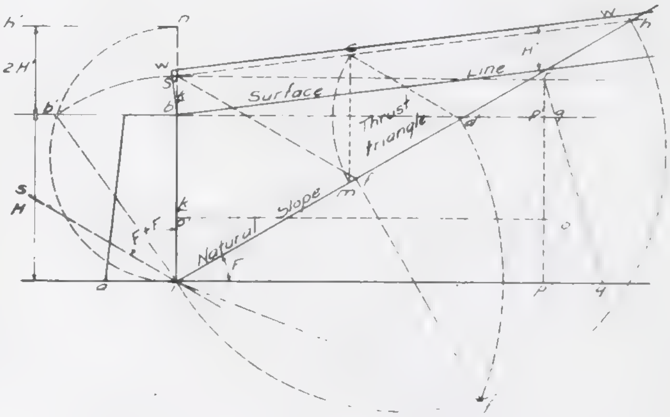


Fig. 6.

To find point of application 2 of earth thrust E' on $i'c$; $i'i°$ and cc' correspond to thrusts on bi' and bc. Let the ordinate adjoining to cc' differ from it by D. Static moment of D around i, $= D.B' \cos B$, as there is no lever arm for the component in direction of back of wall. Static moment of the partial thrust on $i'c = \Sigma\, D.B \cos B'$. Summation of partial areas $B.D$ is graphically represented by $ti°c'r$; this moment $M =$ moment of E; $M = E.x. \cos B = \cos B$ area $(ti°c'r)$; graphically $E = cc' - i'i°$, hence $x =$ area $ti°c'r/(cc' - i'i°)$; i. e., in order to obtain height x, point of application of E, transform area $ti°c'r$ into an equivalent rectangle of height x and width tr. This could be accomplished through transformation of area bounded by the curve $i°c'$ and $tr = cc' - i'i°$. Since area $bi'i° = ⅓$ area of rectangle on $i'i°$ and $i'b$, the above proposition is proved again.

Back of Wall Straight, Straight Surface Line, and Uniformly Distributed Load.—(Fig. 17A.) Transform the full load into equivalent earth of height y. Construct a triangle at any place $oi'k$ equivalent to area of thrust triangle with superimposed load: $w.l.$ area $oi'k = E$. Its vertex must be on a horizontal through u, which is intersection of back of wall prolonged and compensating line. On ob' at $y/3$ from b, acts earth thrust $E = w.l.$ area $ob'c$; $b'c$ is horizontal through b; earth thrust E on bi strikes l, which point passes through center of gravity line of trapezoid $i'kb'c$; ls is horizontal; $E' = w.l.$ area $b'cki'$. Direction of E passes through upper part of lower third of ui. Thus are determined position and amount of earth thrust E, E' and resultant E, so that the resultant thrust line may be drawn.

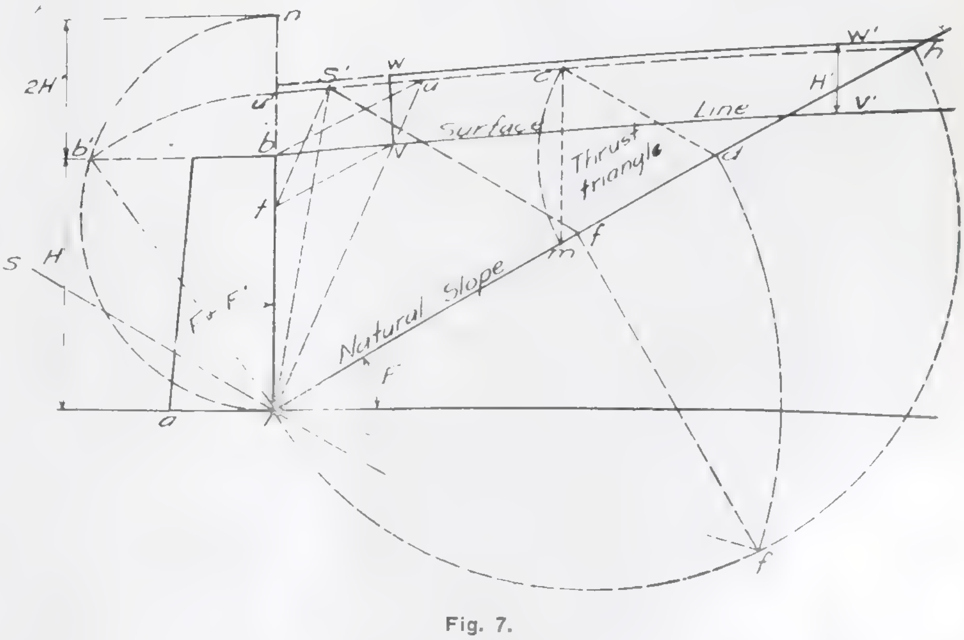


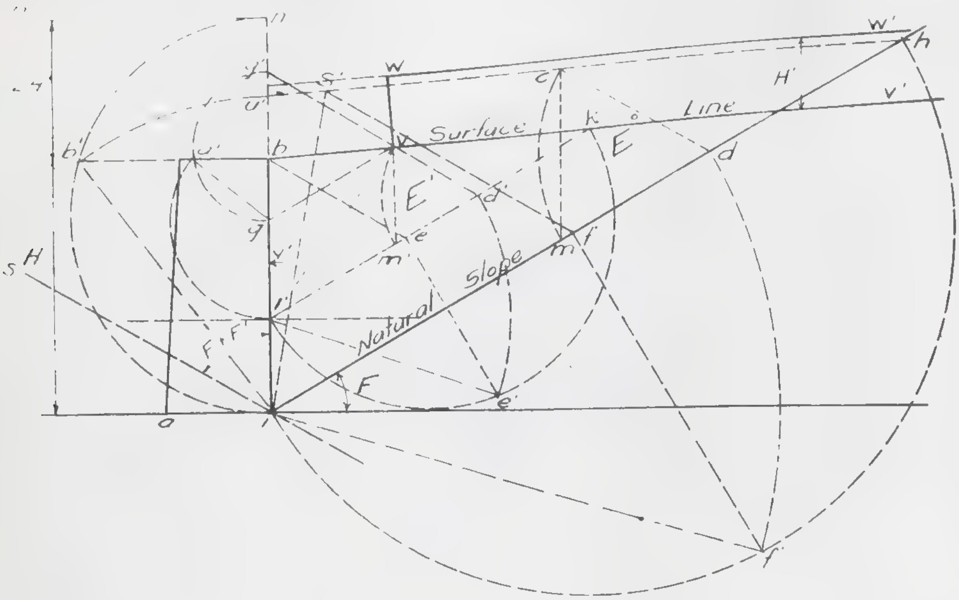
Fig. 7.

Partial Uniform Load.—Transform to equivalent earth load of height y, thus determining plane of rupture vi' for the beginning of the load, also the corresponding thrust E_1; then transform area $ii'vh$ into equivalent triangle ish; its vertex s on the horizontal line through u will serve to determine the second plane of rupture through i' and earth thrust E, then establish point of application of E_1 and E' as before.

Broken Back of Wall and Straight Surface Line.—(Fig. 18A.) For the upper portion of wall bi, find earth thrust E_1 and its point of application as before; thus $E_1 = w.l.$ area $b'i_1'k_1$.

Let E' earth thrust which forms a force polygon with Q resistance of sliding plane and G-g weight of sliding prism. Transform area ii_1bc into equivalent area isc, which is by g less than [illegible] parallel to ib;

then area ii_1bc = area *irc*. Find point *s* by making *w.l.* area *irc-g* = *w.l.* area *isc*; on horizontal through *s*, place vertex of triangle *oi'k*, equivalent to *w.l.* area *oi'k* = *E'*; part of triangle on i_1n represents the amount of component E_1 in direction *E'*; let us call it E_{1-2} hence *w.l.* area $oi'_1n=E_{1-2}$ but $E_2=E'-E_{1-2}$ i. e., *w.l. area* $i'_1nki'=E_2$. Point of application 2 of E_2 is on the horizontal that passes through center of gravity of trapezoid i'_1nki'



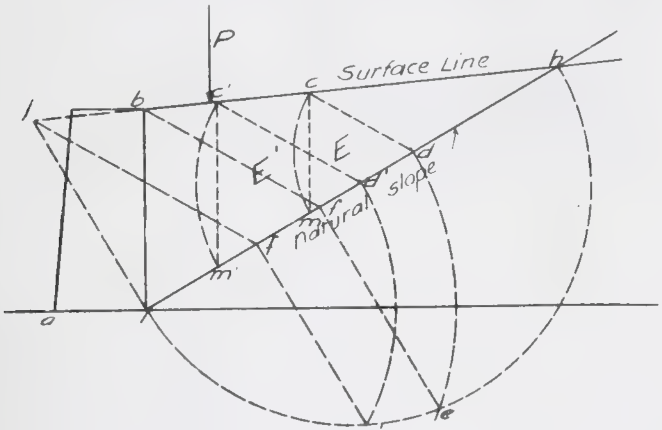


Fig. 9.

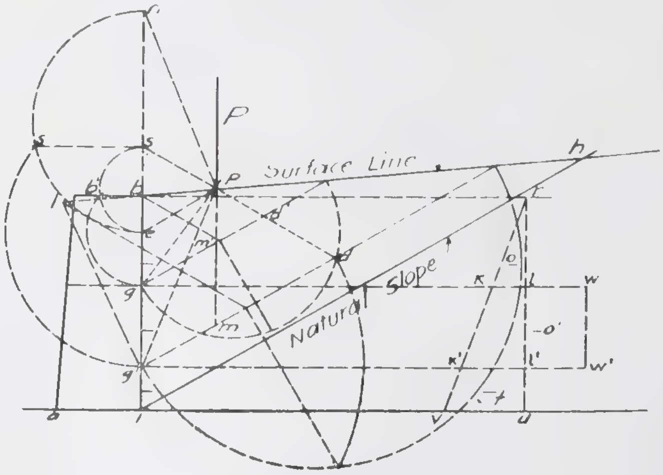


Fig. 10.

Application of General Principles to Various Cases.

- I. Back of wall straight.
  - A. No superimposed load.
    - 1. Surface line straight.
      - a. not parallel to natural slope, Case 1.
      - b. parallel to natural slope, Case 2.
    - 2. Surface line broken.
      - a. limiting plane of rupture does not meet intersection of two segments of surface line, Case 3.
      - b. limiting plane of rupture does meet intersection of two segments of surface line, Case 4.
    - 3. Surface line any curve, Case 5.
  - B. With superimposed load.
    - 1. Uniform load.
      - a. Load extended to back of wall. Case 6.
      - b. Load not extended to back of wall, Case 7.
    - 2. Concentrated load.
      - a. Load at any point, Case 8.
      - b. Load at back of wall, Case 9.
- II. Back of wall broken. See general.

Case 1 (*Fig. 1*)—Amount of earth thrust *E* on back of wall. Lay off $ud^2=uh.uf$; Semicircle on *uh*, auxiliary line *Sf* through *b* to intersect *uh*; *ff'* perpendicular to *uh*, *ud* equal to *uf*; *cd* parallel to *Sf*; *md* equal to *cd*; *E*= area *cdm.w*, where *w* is weight of 1 cu. ft. of earth.

Point of application of thrust, *up*=*ub*/3.

Direction of thrust on back of wall, *ch'* perpendicular to *md*, draw *pr* making angle *B* with the horizontal.

Resultant of thrust of earth and weight of wall, and point where it strikes base. Determine *o*, center of gravity of section *aubv*: *vw*=*au*; *ug*=*vb*; draw *wg*; bisect *bv* at *b'* and *au* at *a'*; join *b'a'*; *o* is intersection of *wg* and *b'a'*. Then draw a vertical through *o* to intersect *pr*; *ro'*=thrust of earth; *re*= weight of wall 1 ft. long; join *o'* and *e*; then *k* is the point required, *o'e* the resultant, *o'e'* vertical component, *ee'* horizontal component of *R*.

Case 2 (*Fig. 2*).—Amount of earth thrust on back of wall: From any point *c* on *bc* draw *cd* parallel to *sb*; *md*=*cd*; then *dcm* is thrust triangle. Now proceed as in Case 1.

Case 3 (*Fig. 3*).—Amount of earth thrust on back of wall. Establish by trial which side of surface is intersected by the limiting plane of rupture, bearing in mind that area *ibuvci* = area *cidc*.

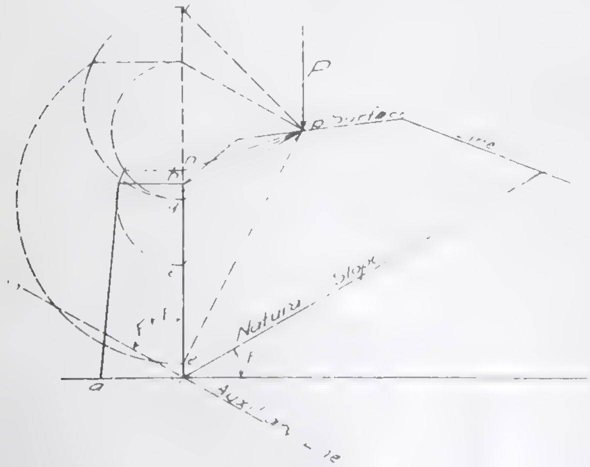


Fig. 11.

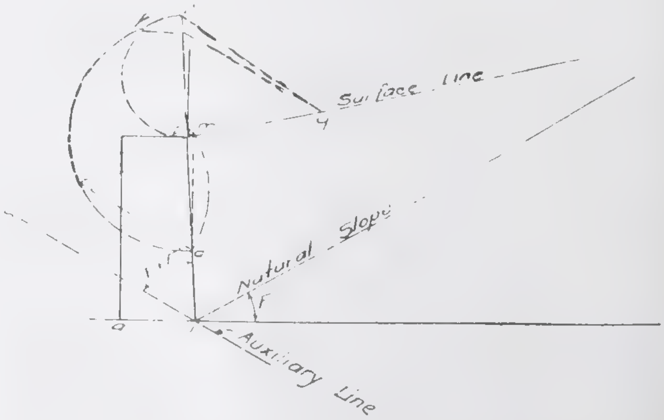


Fig. 12.

(1.) Suppose plane of rupture intersects vh; construct triangle $is'v$ equivalent to polygon $ibuv$; ue parallel to bv; eS' parallel to iv to intersect vc prolonged. Now construct $id^2=if.ih$; $S'f$ parallel to Si, semicircle on ih, ff' perpendicular to ih, $id=if'$; dc parallel to Si to meet segment of surface line; $md=dc$. Then dcm is thrust triangle; now proceed as in Case 1.

(2.) *Fig. 4.* Suppose plane of rupture intersects uv. Semicircle on ih, after prolonging uv to intersect ih; $S'f$ parallel to Si; and proceed as in Case 1.

Case 4.—Assume either segment as intersected by plane of rupture and proceed as in Case 3.

Case 5 (Fig. 5).—Amount of earth thrust on back of wall. Draw auxiliary line Si. Assume various positions of plane of rupture as ie, if, ig; through e, f, g, draw lines parallel to Si; calculate the corresponding areas ibe, iek; ibf, ifl; ibg, ign; transfer them as ordinates to the points e, f, g, and draw curves HH, and BB representing areas of the right and left wedges. A point on the line bh directly under c', intersection of the curves, locates the limiting plane of rupture. Through c draw cd parallel to Si to intersect ih; lay off $dm=dc$; dcm is thrust triangle. Now proceed as in Case 1.

Case 6 (Fig. 6).—Amount of thrust and point of application. Let bww' be surface line of a uniformly distributed load reduced to weight of earth of height H'. Draw a horizontal line $h'n$ at a distance $H+2H'$ from ai to intersect ib prolonged. Construct $iS'^2=in.ib'$; semicircle on in, bb' perpendicular to in $iS'=ib'$. Draw $S'h$ parallel to ww', and construct $id^2=ih.if$, where $S'f$ is parallel to Si; make dc parallel to $S'f$; $md=cd$; Then cdm is the thrust triangle for computing thrust on iS' due to earth and superimposed load combined. Its point of application is at k where $ih=iS'/3$. Construct any right triangle rpg with vertex on horizontal line through S' with area = thrust. Draw bp' parallel to $S'r$; then area $p'g'gp.w.l$=thrust on back of wall ib. Its point of application is at o' where o is center of gravity of $p'g'qp$ and oo' is drawn parallel to bg'. Thrust on bS'=area $p'g'r.w.l.$ Its point of application is at k' where $bk'=bS'/3$.

For direction of thrust and resultant see Case 1.

Case 7 (Fig. 7).—Amount of thrust. Let vww' be the surface line of a uniformly distributed load reduced to weight of earth of height H'. Prolong ib to intersect $h'n$ drawn parallel to ai at a distance $H+2H'$ from it. Construct $iu'^2=in.ib$: semicircle $on.in$; bb' perpendicular to in; $iu'=ib'$. Draw uh parallel to ww'. Now reduce area $ibvuh$ to an equivalent triangle $iS'h$; vt parallel to ub; tS' parallel to vu; hence $iS'h$ is equivalent to $ibvuhi$. Construct $id^2 = ih.if$; $S'f$ parallel to Si; etc. See Case 1, establishing thrust triangle cdm which determines total amount of thrust $E°$, its direction and limiting plane of rupture.

To determine thrust on portions of wall, see Fig. 8.

Draw iv plane of rupture through point v. From v draw vg parallel to ih', vg' parallel to Si and make $gi'^2=gg'gb$: semicircle on gg'; ba' perpendicular to gg'; $gi'=gg'$. Construct thrust triangle $vd'm'$, see Case 1, which determines thrust E' on $i'b$. Superimposed load does not effect this thrust. Its point of application is at v' where $i'v'=ib/3$. Thrust on $ii'=E_2=E°-E'$. For point of application see Case 6.

Case 8 (Figs. 9 and 10).—Amount of thrust. With P neglected, construct thrust triangle cdm Case 1. Then with P considered construct triangle ibl with vertex l on prolongation of surface line and with area $w=P$. Construct $id^2=ih.if'$ and thrust triangle $c'd'm'=E'$. Then in Fig. 10, find plane of rupture through p. P neglected, see Fig. 8, and corresponding thrust triangle $pd'm'$; Hence thrust on gb = area $pd'm'.w = E$.

Find plane of rupture through p, P considered. Construct triangle phn with vertex on prolongation of back of wall. Draw $eg'^2=en.es$, see Fig. 8, and corresponding thrust triangle $pdm=E'_0$. Thrust on bg, not affected by $P_1=E'$.

Thrust on gg, *affected by* $P_1=E_2=E'_0-E$.

Thrust on $g'i$, not affected by $P=E_3=E_0-(E_2+E)$

Point of application. Construct triangle rvu equivalent to triangle cdm and area $iww'l$ = area pdm — area $pm'd'$. O is center of gravity of rkl, o' same of trapezoid $kww'k'$ and o for trapezoid $k'l'uv$.

Surface line broken. Transform portion above straight line bp into equivalent triangle bpn' with n' on continuation of back of wall, and use point n' instead of b. Fig 11.

Case 9 (Fig. 12).—Amount of thrust. Construct any triangle bgp with vertex on continuation of back of wall, and area $bgp.w.l=P$. Then draw $bd^2=bp.be$ and thrust triangle dcm; semicircle on bp; ge parallel to Si; cf perpendicular to bp; $bd=bf$; bc parallel to ih; dc parallel to Si; $cm=cd$. Point of application at o, where $io=ib/3$.

TABLE FOR ALLOWABLE PRESSURE ADAPTED BY THE PUBLIC SERVICE CONVENTION, FIRST DISTRICT, STATE OF NEW YORK.

The following allowable pressures are for static loads only. All live loads shall first be increased to equivalent static loads by formula.

Allowable Static Pressures on Masonry.

	Per sq. ft.
Granite (cut stone)	80K.
Limestone (cut stone)	60 K.
Sandstone (cut stone)	40 K.
Rubble	30 K.
Concrete (1-3-6)	50 K.
Concrete (1-2-4)	60 K.
Brickwork, Portland cement	40 K.

For a wall height (h) exceeding eight times its thickness (t) the above pressures (P) should be reduced by the following formula:

$$P. = \frac{P\,(1.1)}{1 + \dfrac{h^2}{600\ t^2}}$$

Allowable Static Pressures on Soils.

	Per sq. ft.
Sound ledge rock	150 K.
Hardpan or compact gravel	20 K.
Coarse sand or gravel	12 K.
Clean sand or dry clay	8 K.
Clay, moist	4 K.
Silt	2 K.

The above allowable static pressures are for most favorable conditions. For questionable soils these pressures should be reduced 50%. In deep foundations, friction and buoyancy may be allowed for in computation.

Piles.—Designed for 40K Each (Static).

The actual sustaining value in equivalent static load to be ascertained in the field as follows:

1st. When pile is driven to refusal and supports by end bearing without side friction allow 1,400 lbs. per sq. inch net section properly reduced for column length when not stayed.

2d. When driven to resistance by hammer blows: $p = \dfrac{3\ wh.}{d + 1}$

3d. When driven by water jet or by hammer in soft material. $p = (Sa + R)l$.

p. = Safe static load per pile, in pounds.
w. = Weight of hammer, in pounds.
h. = Height of fall of last blow, in feet.
d. = Penetration under last blow in inches.
s. = Skin surface of pile under soil in square feet.
l = Length of pile in ground.

"Sal." represents the resistance due to skin friction.

"Rl." represents the value of end bearing for 12-in. diameter at point of pile.

For loam and silt	A. = 1.7	R. = 47
For moist clay	A. = 7.4	R. = 96
For sand or clay	A. = 19.2	R. = 213
For coarse sand and gravel	A. = 29.0	R. = 300

l not over 23″ 0″.

Some Provisions in Two Recent Franchises for Operating Municipal Service Utilities.*

The states of the Union are gradually adopting the principle of expert supervision of the formation and operation of public service corporations by state boards, for the almost uniformly satisfactory service rendered by those which have been established has demonstrated the practicability of the plan, and notable success in some states has shown that it is possible in practice to approach complete satisfaction to those satisfied with legitimately liberal returns.

The influence of the work of the state public commissions in the few states in which they have been established had been felt throughout the country, and in states not so favored this has been shown by the improved form of certain provisions in ordinances granting franchises to local service corporations.

The character of some of these provisions will be illustrated in this paper by quotations from two franchises recently granted, one of them after consultation with the writer and the other with the aid of William H. Bryan. While these provisions are not extensive they are advances and are signs of the course the advance is taking. The first is an ordinance which has been accepted by the Taylorville Railway, Light, Heat and Power Company and under which it is at present operating. A similar ordinance, varying only in details to conform with differences in condition is now under discussion between the city of Taylorville, Ill., and the Taylorville Gas & Electric Company, the principal point of difference being the rate proposed for the supply of gas.

The ordinance now in force grants the Taylorville Light, Heat and Power Company, the right to construct overhead and conduit lines for the distribution of electricity in certain streets for which petitions of the residents have been received, and also the right to lay pipes in all streets for the distribution of steam for heating purposes.

The character and mode of maintenance of poles, wires, pipes, conduits, cables, etc., are prescribed, also the quality and sufficiency of all machinery, materials and workmanship, restoration and repair of streets, conformity to future improvements, etc. Rates are prescribed, and it is provided that the rates shall be the same for the same amount of service to all consumers, and that the lighting service shall be metered if the consumer so requests. Special contracts for heating schools and auditoriums of all sorts are provided for. Form and method of presentation of bills is prescribed, also testing of light meters and fee therefor. The late special session of the Illinois State Legislature established an optional commission form of city government, which, when adopted by a city, prohibits discriminations in rates for any purpose or to any consumer unless expressly authorized by enumeration in a city ordinance. The following section is of particular interest.

Section 12. Either party shall have the right to have either or all of the above and foregoing rates revised and determined after sixty days' notice to the other, but not oftener than once in five years, during the existence of this grant; but it is expressly agreed that no changes in the maximum rates hereinbefore established or to be hereafter established shall be made by said company, without the consent of the City Council of the city of Taylorville, expressed by ordinance duly passed and approved, and no changes shall be made as herein provided until after a period of five years.

If either party shall give notice as herein provided for a change in the maximum rates and the said city of Taylorville and the said company fail to agree upon what shall be taken and held to be a proper maximum charge for electric current for light, heat and power, or steam heat, or either of them, the same shall be submitted to a board of engineers consisting of three disinterested electrical engineers, to be selected by the city and by the engineers, to be such manner as may be mutually agreed upon, but no one of whom shall be considered nor be a representative of the interests of either the city or the company, which said board of arbitration shall investigate the question of the reasonableness of the charges contained in said notice, and make a report thereof to the City Council and said company, which said report shall be binding upon the parties thereto as to the reasonableness of the charges submitted to such board for investigation and report.

And should such board find that a change should be made in such maximum charge or either or any of them, the City Council shall, by proper ordinance, fix the maximum charge for electric current for light, heat, or power or steam heat, or any or either of them, as found by said board of arbitration, which said maximum charge for such electric current and steam heat shall be and remain the maximum charge for such electric current and steam, for the period of five years next succeeding, and until changed as herein provided, and the costs and expenses of such arbitration shall be borne in equal parts by the said company and the said city of Taylorville. And both the city and said company shall render such aid and assistance to said board of arbitration as they require to enable them to reach a decision with regard to the rate or rates under consideration.

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*A paper by Charles Carroll Brown, consulting engineer, Indianapolis, Ind., before the American Society of Municipal Improvements, Erie, Pa., Oct. 11 to 14, 1910.

Provided, however, that such board of arbitration shall not take into consideration the value of any franchise granted by the city of Taylorville to said company, or to any person, persons, company or corporation, and owned or controlled by said Taylorville Railway, Light, Heat and Power Company, its successors or assigns, in considering the reasonableness of the rates charged by said company.

It is provided that tne company shall furnish free current for lighting the public library, city hall, fire department building and water works pumping station, and street lines therefor, the city to furnish the fixtures within the buildings, also space on poles and in conduits for city fire and police alarms and telephones, which use is non-transferable. A street lighting contract is also included, fixing rates and measure of quality of such service.

The franchise is not exclusive. It includes the usual clauses indemnifying the city for all sorts of damages from construction, operation and maintenance, and forms of bond therefor and for failures in service, or other violations of the terms of the franchise.

It is also provided that there shall be no assignment or transfer of the franchise to any one else engaged in the same business in the city. The term of the franchise, in accordance with Illinois laws, is twenty years, at which time the company is required to remove its poles, wires, etc., from the streets, unless a new franchise is granted by the City Council.

The other franchise referred to is one for the water works of Mexico, Mo. This franchise is also for a term of 20 years. It provides for a system of water mains as shown on an official map, for furnishing water for the citizens through the mains, for water for fire protection through 78 fire hydrants to be paid for at the total rate of $3,120 a year, for future additional hydrants at $50 a year each, for additional intermediate hydrants at the cost of furnishing and moving them, for reservoirs and wells and purification of water, for a water tower, buildings and machinery, extensions of mains, fire streams, rates, telephones and fire alarm. The city is given water free for its public offices, a hose house, seven public drinking fountains for man and beast and one in a park and for flushing sewers, each flush tank to discharge not oftener than four times in twenty-four hours. The ordinance contains the following provisions of special interest.

Section 15.—Failure of Supply.—If at any time the supply of water as hereinbefore stipulated is shut off from any cause whatever (except through the fault of the city) the rental of the fire hydrants shall cease during such suspension. If at any time the grantee shall fail (except through unavoidable accident or providential hindrance) to furnish an adequate supply and quality of water as provided in the ordinance, the city may impose such reasonable penalties as it may deem the situation justifies, such penalties, however, to be subject, on the grantee's demand, to review in the courts before enforcement.

Section 17.—Purchase by City.—The city shall have the right to acquire by purchase all the property of the grantee actually used and useful for the convenience of the public, at any time after the expiration of fifteen (15) years from the passage and approval of this ordinance by public vote, upon giving one year's notice to the grantee, and upon paying therefor in cash the then cost of duplication, less depreciation, of said property, with ten per cent (10 per cent) additional thereto as compensation for earning power, franchise value, going value, contingencies, and all other intangible values of every nature whatsoever. If the grantee and the city should not be able to agree upon the cost of said duplication, less depreciation, they shall select a disinterested and competent appraiser, to make such valuation. If the said parties can not agree upon such the city shall select one appraiser, and the grantee shall select another appraiser and the two appraisers so selected shall make the valuation. If they cannot agree upon such valuation, then they are to select a third appraiser, and the grantee shall select another appraiser, and the two appraisers so selected shall make the valuation. If they cannot agree upon such valuation, then they are to select a third appraiser, and if they cannot agree upon a third appraiser such third appraiser shall be selected by the judge of the circuit court of Audrain county, Missouri. Thereupon the appraiser, or appraisers, so selected shall ascertain by majority vote the then cost of duplicating said property, less depreciation. Such appraisal shall be binding upon both parties, and the city shall thereupon have the right to purchase the said property at such appraised value, plus 10 per cent, as above stipulated.

It is, of course, impossible for a City Council in an ordinance of this nature to produce the same effect which it is possible for a state public service commission to produce in the Taylorville ordinance makes a strong effort in regulation of service and of rates, but the this direction, and if it will call to its aid experts who can determine the reasons for failures of the company to fulfill its obligations and the best methods of making the necessary improvements, it can go far toward keeping an unwilling company within bounds. There is no ambiguity regarding the character, quality and amount of service required, so that a company intending to give good service knows exactly what is required of it. The only penalty provided for failure to comply with the terms of the ordinance, other than assessment of damages arising from construction or operation, is revocation of the franchise, a step so serious that it will scarcely be taken unless the company is extremely derelict in the performance of its duties.

The provision for revision of rates, quoted in full above, is a step in the right direction, but has one or two rather serious defects. One of these may prevent the revision. If the parties fail to agree upon a method of appointing the board of engineers there is no method of forcing the submission of the question to such a board or of securing its appointment. The party objecting to a change of rates can thus defeat the revision by simply refusing to agree to any proposition for the appointment of the board. It is questionable whether the restriction of the membership in the board to electrical engineers is wise unless the term is construed in a rather large sense and may be considered to include competent engineers or others with sufficient knowledge of the electrical problems involved to make them available for the service. Most of the questions involved are not, strictly speaking, within the province of the electrical engineer, as such, although their application to the work in hand may require some knowledge of the technique of electric lighting practice. The provisions governing the appointment of the appraisement board for the sale of the water works plant at Mexico, quoted in full above, are more completely applicable, so far, at least, as the method of appointment is concerned. It remains to be seen, whether the provision requiring both city and company to furnish such aid to the board of engineers as they may require will give them the authority to call for books and records enough to get the complete knowledge of the plant and its operation which is necessary if the most equitable rates are to be determined.

It is interesting to compare the provisions in the two ordinances regarding intangible values. The Taylorville ordinance provides that no allowance shall be made for the value of the franchise in determining the reasonableness of the rates charged by the company. The Mexico ordinance combines earning power, franchise value, value and contingencies in one item, which it arbitrarily fixes at ten per cent of the cost of duplication of the plant, less depreciation. In these items are usually found the excuses for excessive capitalization, the preliminary estimates of value of franchise, growth of business and the like, giving color, from the promoter's standpoint, to the issue of capital stock to represent them. Franchise value without doubt belongs to the community whose growth gives the value and the increase in value which is so large a part of the promoter's stock in trade. Going value, earning power, depend upon the competence of the management and upon its ability to take advantage of all the opportunites to develop business. They may very properly be considered as belonging to the company and, if their values can be determined, they should be credited to the company. The process of determination of these values is one requiring the most expert investigators, which very few cities and practically no small cities, can afford to employ, even if the officials know where to find them "with no strings to them." The Mexico franchise solves the difficulty by fixing definitely the percentage to be allowed for them all. The Taylorville franchise reduces one very properly to zero and leaves the determination of the others to the board of engineers. This is one reason for doubting the propriety of excluding from that board experts on the financial side of the question because they cannot be classed strictly as "electrical engineers."

The Taylorville franchise provides no definite method of determining the extent of violations of the contract included therein. The Mexico franchise provides, as quoted above, for reference of the matter to the courts in case the imposition of penalties by the city for violations is considered by the company to be unjust.

These franchises have the advantage over the one presented for discussion last year in that they are both in operation. They contain some of the same provisions. That form of franchise was accepted by the most interested party, the company, but was not adopted by the City Council, mainly for reasons not connected with the technical feature of the franchise. It carries there modern phases of franchise building still farther than the examples here quoted. Reference may be made to the paper by the author on "A Modern Franchise for a Public Service Corporation" in the proceedings of the society for 1909.

The best such franchise is, however, merely a substitute, it is to be hoped for temporary use, for control by a state public service commission. Legislatures have found it necessary to limit the period of franchises to 20, 25, or other longer periods of years because they were confessedly unsatisfactory and there seemed to be no other way of holding them in check. Such limitation for a business which is by nature continuing is wasteful, and results in rates high enough to pay not only the legitimate charges for operation, maintenance, interest, etc., but also an additional sum to equal the risk that the plant must be abandoned when the franchise period has expired. The state commission is able to get around this difficulty if it has the power to grant permits for operation of franchises for indefinite periods, during good behavior, or until conditions so change that changes in the terms of the franchise must be made. It would be a very exceptional city which could undertake the same procedure. No cities except the largest have the experts necessary to establish a public service commission in every city, as was proposed in the bill offered in the Illinois legislature last winter. Fortunately these provisions were cut out of the "Commission Form" law which was passed. The state can employ these experts and keep them sufficiently employed in the oversight of the public service corporations in the state to retain them permanently in its service. The state commission is more nearly independent of local conditions than any commission appointed by the local authorities can be. It owes no allegiance to either party. The state commission is therefore, the logical result of the agitation for more thorough supervision of public service, whether operated by municipality or by private company. Until a state has such a commission it cannot expect to secure much better results than can be attained under such a franchise as that granted by Taylorville.

LETTERS TO THE EDITOR.

Operating Blast Hole Drills with Common Laborers.

Sirs: The writer has visited many railroad contracts and quarries throughout the United States in the interest of drilling equipment for blast holes and has talked with a great many superintendents regarding the production of stone, and it is surprising the number of concerns that have not been able to solve the problem of drilling and blasting, which is due entirely to their lax method of handling that end of the business.

The big majority of men in charge of this class of work seem to consider that the drilling and shooting of material is of minor importance and place in charge of the work men who are totally ignorant of the proper drilling and spacing of holes or the proper handling of explosives, and the also equally important item of operating the drills successfully in order to get the maximum number of feet per day.

The steam shovel is manned by a competent engineer and cranesman, the locomotive by a skilled engineer; in fact, everything necessary for the handling of material is in charge of experienced men. But when it comes to the production end, this is too often dependent upon the cheapest labor obtainable.

If there is no material to be handled, the entire outfit is at a standstill; if the material is not properly broken up, the entire efficiency of the outfit is curtailed.

The men in charge of the drilling and blasting hold the key to the production of the plant. They vary the profits to such a degree that, this being the most important factor in connection with the plant, it should be under the care of competent men to not only operate the drills successfully but to be able to space the holes and use the right amount of explosive to do the work properly without waste of material.

The saving of drilling by proper spacing and springing of holes, the material broken up properly for economical handling, the delays of the entire shovel crew incident to the improper production of the material have no comparison to the trifling saving as between a cheap man and a competent man in charge of the drills.

Contractors who have tried out the experiment of placing drill men in charge of their outfits find that it is the most economical by big odds; the writer refers to drills of the well driller type.

When they are being used for deep holes and light charges it is no small problem to handle the drilling and blasting end of a big contract, as there are no set rules that can be strictly adhered to on account of the varying conditions of materials to be handled.

A plan carried out successfully on one job does not mean that it can be done in exactly the same manner on the next job even if the material seems to be about the same, so that each proposition must be worked out according to its own peculiarities.

A man who can adapt himself to the varying conditions can save the contractor more money than any other man on the job, and a cheap drill foreman can break up more machinery, cause more delays, and, through inexperience, waste more explosive, therefore causing more loss, than any one else on the job.

Very truly,
B. G. COPE,
President, Cyclone Drill Co.
Orrville, O., Oct. 15, 1910.

Comment on the Proposed Colorado License Law for Engineers.

Sirs: Referring to your issue of Oct. 12 and the proposed engineering license legislation in Colorado:

(1) The definition of civil engineering seems to include among other branches mining, electrical and mechanical, yet the examiners are to be chosen from the American Society of Civil Engineers, wholly ignoring the other societies. I question the ability of a civil engineer to pass upon the qualifications of say a mining engineer. One has only to read current literature to see where knowledge of mining, of geology, etc., would have played some civil engineer in good stead. Generally speaking a civil engineer is not so broadly trained or experienced as a mining engineer.

(2) Supposing a New York engineer is retained to make a valuation of a public utility in Colorado for New York bankers. Can he do the work under the proposed legislation? An engineer's work takes him to all parts of the country. Is this legislation proposed in order to confine an engineer's activities to his own state? If so, this is certainly a question for federal and not state legislation. The act as I read it would certainly prevent expert work outside of an engineer's own state unless he were licensed in each state in the Union. How can he obtain this license if ten years' residence is required?

It seems to me as if these two points were of vital importance and worthy of broader treatment than that accorded under the Colorado act as I read it.

Very truly yours,
FRANCIS W. COLLINS,
Civil and Mining Engineer.
New York city, Oct. 14, 1910.

Sirs: In your issue of October 12 you appear to express a desire for remarks by engineers on the subject of license laws for engineers and on the proposed bill for licensing civil engineers in Colorado. As an engineer, not a resident of Colorado, but interested in the subject, permit me therefore to submit the following for your consideration:

(1) The writer believes some protection is needed by the profession against the use of the title of "civil engineer" by unqualified parties, but he does not pretend to decide at this moment that a license law is or is not the best solution of the problem.

(2) From the viewpoint of the writer, one defect of the Colorado bill is that it apparently makes no provision for allowing qualified engineers to be called into Colorado for consultation purposes from other states where a license law may not exist, and the writer believes that such provision should be clearly made.

Very respectfully,
W. W. CROSBY,
Chief Engineer,
Maryland State Roads Commission.
Baltimore, Md., Oct. 17, 1910.

Sirs: Referring to the draft of a proposed act to license civil engineers in the state of Colorado, and your editorial relative thereto appearing in your issue of Oct. 12, 1910, it appears to me that if the half hundred states of the Union should pass a half hundred legislative acts licensing engineers there would likely result wide diversity and much inconsistency in the requirements and in the significance which would attach to the licenses of the various states. It also appears that legislation by states on this matter is likely to present many sectional features designed to favor the engineers already established in the various states; for example, section 8 of the proposed Colorado license says:

> The board of engineering examiners may examine and license candidates, or may, in their discretion, during the first year of the operation of this act, accept as proof of a candidate's capacity to perform any of the duties of a civil engineer the record, training and experience of any candidate who has practiced civil engineering within the state of Colorado for a continuous period preceding of not less than 10 years.

Obviously this section, proposed by Colorado engineers, is intended to issue a license to Colorado engineers without the necessity of passing an examination as to actual qualifications. It will doubtless be found that Colorado engineers are not peculiar in this respect and that this section 8 would be a popular section in any state if the name of the latter should be substituted for that of Colorado. If membership in the American Society of Civil Engineers or any of the other engineering societies of the country should entitle one to receive a license, it is probable that there would be no objection from the members of such societies to any legislative act embodying such provision. It appears to the writer absurd and ridiculous that discrimination as to technical qualifications should be made on the lines of political subdivisions; also that where an examination is required it should be applied indiscriminately to all candidates asking for a license.

The writer would favor the new nationalism in the way of a practical application of it through an act of congress comprehensively covering the whole subject of licensing engineers, rather than the distinctions and diversities that would be sure to be present in state legislation.

Yours truly,
J. L. CAMPBELL.
El Paso, Tex., Oct. 14, 1910.

Sirs: Recently considerable of interest seems to be centering about the subject of licensing civil engineers in the states. Because of the close relationship this step may bear to development within the commonwealth no hasty action of an effective nature should be undertaken. This thought lends favor to the plan now proposed for Colorado, that is, that the profession generally is invited to criticize and offer suggestions for amendment to the proposed bill some time in advance. The licensing of any profession or trade indicates a necessary regulation for the protection of some one. Many times, however, the regulation sought becomes ineffectual by lack of clearness and definiteness as to that which is sought to be regulated. Civil engineering in its various phases covers a wide field, and it is somewhat doubtful, if it is the intention of the bill as drawn to cover the whole field, that such is fully embraced in its reading. To criticize this without the offer of amendment seems without force, but it is done for the purpose of expressing the doubtful advisability of endeavoring to cover the entire practice of civil engineering as now understood. Some reasons are apparent for the regulation and licensing of engineering practice along certain lines, as for instance that of land surveying for particular purposes, and perhaps that of kindred performance.

Further in the bill as drawn not only does engineering seem to be included, but also construction and inception, which seems to give an exceptionally wide latitude to the subject. By the inclusion of these items without some special limitation there would seem to be opportunity for endless complications to arise, and again this but returns the argument to the prior statement.

It is noted that the proposed act provides that the examining board shall be corporate members of the American Society of Civil Engineers. With no other thought than that of esteem for this society and its membership as a whole, there are other societies and associations of engineers of prominence that would immediately seek recognition in the same manner, and this would without doubt cause many jealousies and embarrassments to arise. It would seem proper therefore to eliminate this feature of the bill and leave out all reference to any engineering society or association in the selection of a Board of Examiners. This could hardly be construed either as operating to discriminate against any member of the board to be, but would give latitude sufficient for all.

Another thought with reference to the licensing of the general practice of civil engineers is the possible practical effect covering certain lines. Civil engineering can hardly be compared or made parallel to that of professions now largely regulated, as that for instance of physicians and surgeons. It is a business not only requiring in some of its phases technical knowledge, but a majority of the time experience and judgment, and many times intervention. Large enterprises like one of our great railways are handled by a large engineering organization, over which there is a chief or directing engineer. A considerable number of his force are engaged individually in designing certain construction. The entire organization by reason of its peculiar duties is shifted from one state to another and are only laboring for the one employer. One state may require licensing and another not. As a practical question of licensing what can be the purpose and who is protected in treating with this organization?

In conclusion the writer is very much inclined to the belief that a state law regulating the practice of civil engineering in all its phases is not advisable, but more inclines to the belief that some good and protection may follow where a more limited field is embraced. This thought, too, is advanced with the knowledge that there is a growing belief amongst the profession in favor of the enactment of license laws for the states.

Respectfully yours,
E. C. HURD,
Engineer Valuation Railways, Nebraska State Railway Commission.
Lincoln, Neb., Oct. 24, 1910.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York, N Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H Warder, Monadnock Block Chicago, Ill.

PERSONALS.

Edward Flad & Co. have opened offices in the Fullerton building, St. Louis, Mo., and will engage in a general engineering practice.

Capt. Robert M. Clay, City Engineer of Atlanta, Ga., has been elected to the newly created position of Chief of Construction of that city.

Mr. Ernest McCullough, M. Am. Soc. C. E., has opened offices at 2114 Fisher building, Chicago, Ill., where he will engage in a general engineering practice.

Mr. E. H. Hendricks of Fort Plain, N. Y., and Mr. A. E. Steere, Fort Hunter, N. Y., have been appointed Resident Engineers of the New York State Department of Engineers.

Mr. Edwin Dwight Smith, Superintendent of Power Stations for the United Railways of St. Louis, has been appointed Manager of the municipal water and light plant of Columbia, Mo.

H. P. Bell, a pioneer civil engineer in British Columbia died Oct. 19 at Victoria, B. C., aged 69 years. Mr. Bell had done much work in British Columbia for the Canadian Pacific Ry.

Mr. Dabney H. Maury, Consulting Engineer, Peoria, Ill., has been engaged by the Municipal Research Commission of St. Paul, Minn., to make an investigation of the water system of that city.

Mr. John A. McGrew, for the past year inspector of maintenance of the Delaware & Hudson R. R. Co., has been appointed superintendent of the Saratoga and Champlain divisions, succeeding Mr. Abram T. Benjamin, resigned. For several years Mr. McGrew was engineer of maintenance of ways of the Pennsylvania, Fort Wayne and Chicago railroad, with headquarters in Allegheny. Previous to engaging in railroading he was in the contracting business and at one time was president of the National Engineering Co., of Columbus, Ohio.

Mr. James V. Howe, formerly an instructor in civil engineering at Cornell University and at the Missouri School of Mines, has been appointed to a similar position at Union College, Schenectady, N. Y.

Mr. A. Bement, Consulting Engineer, Chicago, Ill., addressed the students and faculty of the College of Engineering of the University of Illinois on Oct. 22, his topic being "The Practical Uses of Coal Analysis."

Mr. E. T. Thurston, Jr., Assoc., M. Am. Soc. C. E., formerly of the late firm of Couchot & Thurston, Designing and Constructing Engineers, has opened offices in San Francisco as a Consulting Civil Engineer.

Mr. John P. Brooks, of Elgin, O., has accepted a position as engineer with the Cleveland, Orville, Barberton & Coshocton Electric Ry. Co., which is now constructing a new traction line out of the city of Cleveland, O.

Mr. Henry Stroup, of Paris, Ark., has been elected President of the Fort Smith, Subiaco & Eastern R. R., now operating 14 miles of road from Paris, Ark., to Scranton, Ark. Mr. Stroup was formerly Chief Engineer of the road.

Mr. C. Eugene Bentley and Mr. S. D. Newton, Assoc. M. Am. Soc. C. E., have entered into a copartnership with offices at 422 Chadakoin Bldg., Jamestown, N. Y., and will engage in a general engineering and surveying business.

Prof. A. N. Talbot of the College of Engineering of the University of Illinois is serving as a member of an expert commission which is engaged in inspecting and reviewing the work of construction of the new city hall of Chicago.

Mr. L. C. O. Andrews, for the past four years Chief Draughtsman for the Southern Pacific at Houston, Tex., under Chief Engineer and Maintenance of Way A. V. Kellogg, has entered the employ of the San Antonio & Aransas Pass at Yoakum as office engineer.

The New York State Civil Service Commission, Albany, N. Y., will hold an examination on Nov. 26 to fill the position of mechanical engineer, Transportation Department, Public Service Commission, First District. The salary of this position ranges from $2,400 to $3,000.

Mr. Charles K. Mohler has opened offices at 1839 McCormick building, Chicago, Ill., where he will engage in a consulting engineering practice, making a specialty of reports on traffic and transportation, valuations of steam and electric railways, and in the design of abutments and retaining walls.

Mr. Thomas J. Morrison, M. Am. Soc. C. E., and Mr. James F. Leary of New York City have entered into a partnership under the firm name of Leary & Morrison Co., and will engage in a general contracting business. Mr. Morrison recently resigned his position as Resident Engineer of the New York State Engineers' Department at Rochester, N. Y.

Mr. Alfred Craven, heretofore acting Chief Engineer of the Public Service Commission of New York City, has been promoted to the position of Engineer in charge of subway construction at a salary of $10,000 per year. Mr. Craven entered the city's rapid transit service in 1900, when he became a division engineer. He was a graduate of the U. S. Naval Academy.

Mr. E. A. Kimmel, of Kirkwood, Ga., formerly with the Atlanta & Carolina Electric R. R., has gone to Brazil where he will be Assistant Engineer of a new railroad to be built in that country. Mr. Kimmel was formerly engaged in railroad construction work in Cuba, where he was resident engineer on a line being constructed by the same company which is to do the work in Brazil.

A scholarship valued at $1,000 per year for advanced work in Architecture has been made available to the Trustees of the University of Illinois by Mr. Francis John Plym of Niles, Mich. The conditions under which this scholarship is to be bestowed will be determined by the Trustees. For the present it is understood that it will be given each year to a graduate of the Department of Architecture for the purpose of foreign study and travel.

The Edmund T. Perkins Engineering Co. has been organized with offices in the First National Bank Bldg., Chicago, Ill., and will engage in the business of examining, constructing and reporting upon engineering works. Especially for irrigation and other agricultural purposes. The active and managing head of the company is Mr. Edmund T. Perkins, M. Am. Soc. C. E.; who has been in the government service for a number of years in the development of the West.

The U. S. Civil Service Commission will hold an examination on Oct. 19, at various cities throughout the country, to secure eligibles from which to make certifications to fill six vacancies in the position of engineer in forest products in the Forest Products Laboratory at Madison, Wis., at salaries ranging from $1.600 to $2.500, and vacancies requiring similar qualifications, as they may occur. An examination will also be held at the same date to secure eligibles from which to make certifications to fill four vacancies in the position of chemist in forest products in the Forest Products Laboratory at Madison, Wis., at salaries ranging from $1,600 to $2.500 per annum, and to secure eligibles from which to make certifications to fill two vacancies in the position of chemical engineer in forest products in the Forest Products Laboratory at Madison, Wis., at salaries ranging from $1,600 to $2.500 per annum, and vacancies requiring similar qualifications as they may occur.

Sam Calloway, a well-known contractor, died Sept. 26, at Snowdown, Ala., of cancer of the stomach. Mr. Calloway was Assistant Engineer on the Birmingham Mineral Division of the Louisville & Nashville in 1887. He was next appointed Assistant Roadmaster of the same division, and in 1890 was made Roadmaster of the Birmingham Mineral Division, which position he held until 1899, when he was promoted to Assistant Superintendent of that division. In 1905 he was made superintendent of the Owensboro & Nashville Division of the Louisville & Nashville, where he remained until 1907, resigning to go into the contracting business.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Concrete Equipment.—Paper. 6x9 ins.; 4 pp. The Lilley & Thurston Co., 82 Second St., San Francisco, Cal.

This bulletin describes concrete and lumber hoists made by the Wallace Machinery Co.

Zelnicker Equipment.—Circular. Walter A. Zelnicker Supply Co.

A long list of stock on hand for immediate shipment including all kinds of contractors' supplies, new and second hand.

Structural Steel Specifications.—Paper 5x7½ ins. 68 pp. Carnegie Steel Co., Pittsburg Pa.

This booklet contains the Standard Specification for steel products by the Association of American Steel Manufacturers, the Carnegie Steel Company, the American Society for Testing Materials. Also figures of test specimens.

Marion Dredges.—Paper 9x11½ ins., 4 pp. The Marion Steam Shovel Co., Marion, O.

An illustrated description of Marion construction in connection with their 2 and 2½ yard dipper dredges.

Continuous Blueprint Machine.—Paper 3½x6½ ins., 4 pp. Shaw Blueprint Co., 13 Campbell St., Newark, N. J.

Illustrating and describing the Shaw Continuous Blueprint machine. With prices.

Supplies.—Paper 3½x5½ ins., 48 pp. Mussen's Ltd., Montreal.

A reference list of Railway, Mining, Municipal and contractors' supplies, listed alphabetically.

Street Flushing.—Paper 3x6 ins., 12 pp. The D. Connelly Boiler Co., Cleveland, O.

A very complete illustrated description with tables of data collected on street flushing in New York city.

Crushers.—Paper 6x9 ins., 4 pp. Eureka Stone & Ore Crusher Co., Cedar Rapids Ia. Barron & Cole, Agts. Barron Bldg., New York city.

A bulletin describing and illustrating the Mitchell Improved crusher.

Carbolinium Wood Preserver.—Paper 6x9 ins., 16 pp. Carbolinium Wood Preserving Co., 182½ Franklin street, New York.

Bulletin No. 30 on open tank and brush treatment containing a reprint of an article describing the treatment of ties, cross arms of telegraph poles, mine timbers and trestles.

Wood Water Pipe.—Paper 6x9 ins., 64 pp. A. Wyckoff & Son Co., Alexandra, La. A useful catalog describing the uses of wood pipe, places where it is in use, with useful tables of capacity, loss of head due to friction and formulae.

Old Dominion Portland Cement.—Paper 6x9 ins., 108 pp. Virginia Portland Cement Co., Fordwick, Va.

A catalog of illustrations and various descriptions of work done with Old Dominion cement.

Sidewalk Lights.—Paper, 3½x6 ins.; 40 pp. Richards & Kelly Mfg. Co., 309 West 23d St., Chicago, Ill.

This catalog gives price lists and cuts of sidewalk, floor, and skylights, coal hole covers, and sidewalk doors.

Baldwin Locomotive Works.—Paper, 9x6 ins.; 32 pp. Baldwin Locomotive Works, Philadelphia, Pa.

This is record No. 67, showing photographs of thirteen types of passenger locomotives, and giving a concise description, and a table of general dimensions for each.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

New York City has been the chief center of attraction for contractors during the past week. As noted elsewhere in this issue the Rapid Transit Commission of that city is now considering the bids for some $60,000,000 worth of subway work. In addition to this big job the city, through its Water Supply Commision will soon take up the expenditure of $25,000,000 for the construction of a water tunnel under the city. Official approval for this work was recently granted by the State Water Supply Commission. The plans include the construction of a reservoir to hold between 400,000,000 and 500,000,000 gallons for city distribution. The plan proposes to run the high pressure tunnel into Manhattan, The Bronx and Brooklyn. From these boroughs pipes are to run to the other two boroughs.—New York state is also planning some large canal contracts. One of these is contract No. 37, for which revised specifications and estimates have been prepared. This contract includes the construction of a new "high dam" near Oswego and a new dam at Minetto. The contract was originally advertised in September, but no bids were tendered. Bids are now being asked for the work which will cost about $1,500,000. Another large piece of work for which it is hoped to award contracts by the first of next year is for rebuilding the Cayuga and Seneca Canal. The route selected follows the line of the old Cayuga and Seneca canal through the Seneca River valley and will make Waterloo and Seneca Falls barge canal ports. The work will be done under the constitutional amendment appropriating $7,000,000. The cost of the work by the route selected is placed at $5,600,000.—The Nevada & California Ry., running 150 miles from Mojave, Cal., on the Southern Pacific, to Lone Pine, Cal., in Invo county, was formally opened on Oct. 18.—Among the levee contracts let recently are the following: Evergreen Levee, 106,000 cu. yds., O. A. Gibson, Natchez, Miss., at 19 cts.; Harpers Levee, 36,500 cu. yds., E. H. Jackson, Natchez, Miss., at 12.9 cts.; Kempe Levee, 96,500 cu. yds., Grassmere Levee, 102,500 cu. yds., Pittsfield, Levee, 103,500 cu. yds., Hearin & Ryan, Baton Rouge, at 12.39 cts. All of the above work is in the Lower Tensas (La.) Levee District.—Quite a number of fair sized railroad construction contracts have been let recently. Among them may be noted the following: John McMenamim, Arcade Bldg., Philadelphia, Pa., for fill and masonry to carry elevated tracks of the Philadelphia & Reading Ry. over Kensington and Frankford Aves., Philadelphia, the contract amounting to $117,425; the American Bridge Co., at $125,428 for the steel bridges for the above work; The McDowell Construction Co., for building 17½ miles of new road for the Harriman, Knoxville & Eastern R. R., from Harriman, Tenn., in a northeasterly direction toward Knoxville, the contract including 477,930 cu. yds. of excavation and 3,920 cu. yds. of concrete; The Utah Construction Co. of Ogden, Utah, for building an additional 30 miles of the extension of the Northwestern Pacific R. R. to Eureka; Nels Larson, Rice Lake, Wis., for grading five miles of railroad for the Willow River Lumber Co., near Ashland, Wis.; The Eastern Railway Construction Co., for constructing the 16-mile line of the Westchester & Wilmington Electric Ry. Co., which is to extend from Wilmington along the Concord Pike to West Chester, Pa.; The Calbach Construction Co., Portland, Ore., for constructing about 100 miles of railroad for the Rock Island, Texico-Farwell & Southern Ry., from Texico, New Mexico, construction work now being underway.—Frederick D. Cloud, formerly American Consul at Antung, has notified the Chinese government that Americans represented by him are willing to take up the loan of $30,000,000 for the Hankow-Sze-Chuen R. R., satisfactory terms for which have not been agreed upon as yet by the original American group of financiers.—On account of the big deficit in the budget of 1911-1912, of the Panama Government, it is now believed that a majority of the proposed public works will be indefinitely postponed. This includes the construction of the Panama David railway, the survey of which has been made.—At the annual meeting of the stockholders of the New York, New Haven & Hartford R. R. on Oct. 26, the number of directors was increased from 25 to 27. A resolution was approved concerning the purchase by the company of the Berkshire R. R. Co. at a cost of $1,887,725. The purchase of the New Haven & Northampton for $984,000 and the purchase of the Rhode Island & Massachusetts Railroad for $191,700 was also approved.

New York Subway Work.

Most of the large construction contracts of the past few weeks have been located in the South and the West; but now the East comes forward with by far the largest piece of work of the year. This work is the construction of the three most important divisions of the Triborough Subway System in New York City, and bids for doing it were opened last Thursday at New York. The total length of the system is to be about 44 miles, but as the city had only the small sum of $60,000,000 available at this time for subway work, the bids received on Thursday were for only about 18 miles of the system. The part on which bids were received, however, will be by far the most expensive and difficult part of the system, as it includes the subways under the business section of the city. The portions of the route for which bids were received are: 1. The Broadway-Lexington Ave. line, from Battery to two points in The Bronx, one at 157th St. and River Ave. on the Jerome Ave. branch, and the other at 158th St. and Third Ave. on the Pelham Bay Park branch. There are about nine miles in this portion and it was divided into 16 sections. 2. The Canal St. crosstown subway, from West St. through Watts St. and Canal St., below the Interborough Subway in Lafayette St., to a point 40 ft. east of the Bowery, where it will join the Brooklyn loop subway, and so connect with the Manhattan Bridge. This road is eight-tenths of a mile and was divided into two sections. 3. The Broadway-Lafayette Ave. Subway, Brooklyn, from the Williamsburg Bridge, under Broadway, to a point in the vicinity of the junction with Lafayette Ave., and returning under Lafayette Ave. to Fulton St., then under Fulton St. a couple of blocks to Ashland Pl., where it will join the Fourth Ave. subway and so reach Manhattan Bridge. The length of this portion, including the tracks over Williamsburg Bridge, is about eight miles, and there was three sections. In all 23 different contractors bid on the work, submitting 77 estimates on the 21 sections of the three routes. The only bid for all of the sections was submitted by the Bradley Contracting Co., of New York City. Most of the other bidders submitted estimates on only one or two sections, so it is likely that quite a number of contractors will get in on the work. The bids were on the unit price basis and at this writing we are unable to state as to who were the lowest bidders. The bids are said to be well inside the estimates of the engineers, so it is probable that there will be no delay in letting the contracts for the work.

Getting His Money.

Our very interesting contemporary, the Bulletin of the General Contractors' Association of New York, tells in its last issue how a contractor gets his money from the American Metropolis. We have not space for the whole story and will begin at the point where the engineer has "passed" the bill. Up to this time it may be remarked anywhere from a week to several months may have elapsed since the work was finished and the bill presented. But starting with the "passing" of the bill by the engineer the following is what happens: After being docketed and entered in the book as passed, a messenger takes it with the contract to the examiner, who notes its return in the book and transmits it to the warrant clerk, who draws a warrant for the amount; a messenger carries it and the contract to an auditor, who goes over every detail of both the certificate and the contract to see that everything is correct, that the warrant is drawn on the proper fund, etc.; from the auditor it goes to another set of bookkeepers, who enter it in two or three ledgers, and it is given a schedule number and sent to the schedule room, there to be entered in triplicate on a sheet about 36 inches square with not less than thirty other payments, as no schedule is permitted to go ahead without a sufficient number of payments on it; the schedule with the vouchers and warrants goes back to the bookkeepers, entered; to the examiners, entered, and is given to a messenger who carries it to the Mayor's office, where it is entered in another ledger and signed by the Mayor's Chief Clerk; returned to the examiner and bookkeepers in the finance department, checked off in the books and sent to the chamberlain. As soon as he has signed the warrant, it is as good as legal tender, but not before. Again it goes to the bookkeepers, and to the lien clerk who looks up the lien record to see if any liens have been filed against this particular work; if so the payment is held until the liens are either paid, bonded, or outlawed. If any accident, thirty days have not elapsed since the certificate was first received in the finance department, it must be held until that time has expired, in accordance with the lien law, but if there be no liens, and the thirty days have passed, the lien clerk releases it, it is entered once more in the bookkeepers' room and charged to the disbursing room, where the contractor is waiting to receive it. The remaining movements, it may be stated, are so rapid that the contractor sometimes wonders if the thing was worth bothering about at all.

Securing the Western Pacific Right of Way.

One of the most difficult propositions with which the promoters of a new railroad have to contend is the securing of the right of way at a fair price. In most cases the bare rumor that a railroad is to be built will cause the value of land along the probable route to jump into its aeroplane for a record breaking ascension. As a result, when a new line is projected the promoters are very secretative as to their plans and if they can make their surveys under cover so much the better. As an instance of this the manner in which the Western Pacific Ry. secured its right of way through the Sierras may be mentioned. When the Goulds decided to extend the Gould system to the Pacific Coast they realized that diplomacy was necessary in the securing of a right of way through the Sierras. They knew that the Southern Pacific would not relinquish its hold on the territory that it had long possessed as its own. They knew also that it would be a comparatively easy matter for the Southern Pacific to extend its line from Oroville at the mouth of the Feather River Canyon up the canyon and thus forstall the proposed new line. On the recommendation of the late E. L. Yard, at that time Chief Engineer of the Denver & Rio Grande R. R., the Gould people secured a man to pioneer a route through the Sierras for the new road without arousing the suspicions of the old road in California. This man went to Oroville in 1902 and immediately made some large purchases of real estate. He then organized a mining company and it was generally believed that he was a promoter—a belief that he took every means to foster. An office in Oroville was fiitted up and he continued buying land and making many mining locations. The extent of his operations attracted some attention and he was a target for interviews for several newspapers in California. The reporters were always cordially received but never succeeded in obtaining even a hint as to the true purpose of the land purchases and mining claims. The filing of locations continued by the wholesale and the State Mineralogist protested against the "land grabbing." In all it is said that 260,000 acres of mineral land in Butte and Plumas Counties, mostly along the Feather River Canyon, were filed on. The object of this was primarily for the purpose of securing a right of way for the Western Pacific, but it was also intended to obtain patents and develop such claims as showed mineral in paying quantities. The Butte & Plumas Ry. Co. and the Indiana Valley Ry. Co. was next organized for the purpose, it was given out, of carrying the products of the mines and mills that it was proposed to operate on the claims. Surveys for the roads were started at once, and about the same time the Stockton & Beckwith R. R., which was afterwards incorporated as the Western Pacific began surveying a route through the Feather River Canyon. The two corps of engineers came into contact and had many squabbles over their work, but the representative of the Goulds, who was paying both corps, said nothing and the war between the surveyors went on. Presently the Western Pacific and the Butte & Plumas Ry. were merged, and the whole scheme became clear.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

A company composed of Birmingham men is to be incorporated shortly for the purpose of building an electric line from a point on the south side of Birmingham, connecting with the lines of the Birmingham Railway, Light & Power Co., to Grandview, a suburb on the crest of Shades mountain. The length of the line will be approximately 3½ miles. No grade above 6 per cent will be allowed, necessitating an expensive construction of roadbed. The right of way has been secured. Entrance to the city will be over the tracks and via the cars of the Birmingham Railway, Light & Power Co.

A project is under consideration for building a dam across Pea River for the development of electric power. The plan includes the construction of an electric car line from Elba to Troy, Ala. Prof. Edgar B. Kay, Tuscaloosa, Ala., is to report on the project.

Surveys for the Decatur & Falls City R. R. were completed from Falls City to Moulton, in Lawrence county, 20 miles west of Decatur, on Oct. 22. The survey is being continued on to Decatur. It is expected that work will commence on the construction of this road within the next few months.

Construction work on the extension of the Union Springs & Northern Ry. from Fort Davis to Milstead is nearly finished, according to contractors who have been at work on the line for the past three months. The extension covers 20 miles, and by means of it connection is made with the Western Railroad of Alabama and the Tallassee Railroad at Milstead, opening up an important territory.

Arizona.

The Santa Fe System has arranged to install two new 100 H. P. oil burning boilers to be used in Seligman, Arizona.

Arkansas.

The Hot Springs, Ouachita & Mena Ry. Co. has been incorporated with a capital stock of $770,000 of which $154,000 has been subscribed. The incorporators are J. F. Read, J. B. McDonough, G. B. Wood, J. R. Davis, Wright Pickett, Scott Wood, George B. Dennis, Harry B. Ravenscraft and Gibson Witt.

California.

Good progress is being made with construction work on the Butte & Plumas R. R., nearly 500 men being on the grade between Bidwell's bar and Berry creek. The work is being carried on both toward Oroville and in the opposite direction.

The Western Pacific Ry. is to build ten additional industrial and switching tracks at Oroville.

Grading work for the electric road from Stockton to Modesto via Escalon will begin early this month with 40 teams. It is expected to run a branch road from Manteca to Escalon, via Oakdale.

The Northwestern Pacific R. R. Co. is reported to have awarded a contract to the Utah Construction Co., Ogden, Utah, for building an additional 30 miles of the extension of that line to Eureka. Fifteen miles will be built north from Sherwood, and 15 miles south from Elinor, leaving about 60 miles to be constructed. About 4,400 ft. of tunnel work is included in the contract.

J. H. Wallace, formerly chief engineer of the coast division of the Southern Pacific, has been engaged to superintend the construction of the recently organized Tidewater & Southern R. R. The company is planning to start grading work early this month and expects to have the road in operation between Stockton and French Camp in a few weeks. T. J. Wisecarver, Modesto, Cal., is a director.

The White Pine Lumber Co. of Loyalton, which has been operating near Cromberg, has made a survey from a point on the Western Pacific near the center of Spring Garden Valley to a point near the ranch of J. E. Gill, with a view to constructing a spur railroad into a timber tract of about 2,500 acres. It is expected the spur will be completed next year.

A plan has been submitted to the Visalia Electric R. R. Co., Ben M. Maddox, President, Visalia, Cal., looking to the extension of the line to the Bravo Lake country. The plan proposes the development of land in that section and it is said that the extension will be built if the promoters of the land project can show that they have the money with which to carry on the development.

English capitalists are reported to be considering financing the Holley Interurban project. This road, for which surveys have already been made, will be about 60 miles in length, and will connect with Porterville with the foothills, Lindsay, Frazier valley and the dairy country to the west. Waterpower sites have already been located on the upper Tule river, and it is stated that 5,000 electrical horse power can be developed in each of two plants. This power will be ample for the purposes of the road for the first two years at least. Rights of way have been secured west from Porterville through the Woodville section and it is probable that this will be the first leg of the line to be constructed.

Work has been completed, according to advices from Lone Pine, Cal., on the Nevada & California Railroad running to Lone Pine in Inyo county, California, from Mojave, on the Southern Pacific. The new line is subsidiary to the Southern Pacific Co. and has been under way for the past three years. It will handle the freight of the Los Angeles aqueduct which runs parallel to it through Inyo county, but it is of first-class standard construction and evidently intended for a part of a trans-continental line. It will connect with the old narrow gage Carson and Colorado line running from Nina to Keeler, now owned by the Southern Pacific. This latter road will be standardized, it is said, and will form another link in the new road to Salt Lake.

The Santa Fe System has appropriated $11,000 to purchase new tools and machinery to be distributed as follows: Bakersfield, Cal., $1,400; Needles, $3,400 and Richmond, Cal., $3,200.

The Quincy & Western R. R. is planning building operations in the immediate future, to improve the freight and depot terminal facilities at Quincy, Cal.

Engineers of the Humboldt & Eastern R. R. under J. N. Lentell have established a permanent route for the railroad from Goods Pass near the source of Cottonwood Creek on the western slope of the Sacramento Valley, as far westward as Hymapom, an approximate distance of 50 miles. The cost of the work already completed is estimated at about $25,000. During the rainy season the surveyors will run preliminary lines westward into Humboldt county, California, from Hyampom and locate a number of long tunnels which will be necessary on Kinsey ridge, a few miles west of Hyampom valley. Some of the most difficult tunnel work on the entire route will be encountered at Kinsey ridge, where one tunnel over ¾ of a mile in length will be required.

According to advices from Los Angeles, Cal., the Los Angeles Ry. Co. has increased its capital stock from $5,000,000 to $20,000,000 and also changed the name to the Los Angeles Ry. Corporation. Howard E. Huntington is General Manager and the principal subscriber, his shares representing all but $6,000. Extensions and improvements are to be made with the additional capital. The corporation already operates 240 miles of trackage and this is to be increased by 100 miles within two years. Immense shops are to be built. Electricity is also to be manufactured and sold for light, heat and motive power. H. E. Huntington, president and heretofore virtual owner of the corporation, whose forthcoming retirement had been announced, is said to have reconsidered, and will engage in the trolley business more actively than ever on his return from New York in a few months.

The Los Angeles-Western Ry. Co. has filed articles of incorporation and proposes the construction of a standard gage line from Culler Station to the tidewater at Hermosa Beach, Cal., to be operated together with three miles of branch lines. The capital stock of the company is placed at $500,000, $250,000 of which has been subscribed. The directors board is composed of the following men of Los Angeles, Cal.: W. C. Wallace, A. W. Taylor, J. W. Castillo, L. Metzger and M. Conway. E. A. Stowell is credited with subscribing $249,975 of the total subscribed stock.

The contract and specifications for the construction of the Western Pacific Shops on the outskirts of Sacramento, Cal., have been filed with the County Recorder and show the concrete work must be done within 50 days, signifying that no time is to be lost in getting the shops established. The headquarters of the Mechanical Department are to be located at this place.

Articles of incorporation have been filed with the Secretary of State, Sacramento, Cal., by a company proposing to connect by a monorail railway Bellingham, Mount Vernon, Port Townsend, Irondale and Port Angels. The capital stock of the company is placed at $7,000,000 and the incorporators are Charles C. Gentry, Walter Strange and Arpad Tokay. It is proposed to use Boyes Mono rails in connecting with the Northwestern Washington, which runs on the opposite side of Puget Sound.

Colorado.

In the double tracking of the Colorado & Southern and Denver & Rio Grande and in the construction of the Pueblo-Rocky Ford Irrigation Co. system, fully 4,000 men are now employed and the number will be increased as soon as the contract for the rock filled dam on the Cucharas is let.

It has been officially announced, according to information received from Salt Lake City, Utah, that surveys for the extension of the Denver & Rio Grande R. R. have been completed and the work is under serious contemplation. H. W. Clarke, Denver, Colo., is Second Vice President and General Manager of the company.

Surveys are now being made for the projected 13-mile line of the Hecla Junction & Box Canon R. R. The capital for construction has been secured but construction contracts will not be let before next April on account of weather conditions. The road is to extend from Hecla Junction at the Denver & Rio Grande R. R. to Granite City. David Heaton, Salida, Colo., is Chief Engineer and President.

Georgia.

The Fairburn & Atlanta Ry. & Electric Co., Fairburn, Ga., has completed its grade and is about ready to lay track. The road extends from College Park to Fairburn, Ga., and is about 10½ miles in length. The company is now considering the question of motive power and is in the market for gas-electric cars. S. W. Hobert is Chief Engineer.

The property of the Augusta-Aiken Railway & Electric Co., which recently came under the control of new owners is to be improved and several important extensions to the electric railway system built. The J. G. White Co., Inc., New York, is in charge of the operation and construction work of the company.

Idaho.

Surveys are in progress, according to information received from Salt Lake City, Utah, for the double tracking of the main line of the Idaho Division of the Oregon Short Line from Pocatello, Idaho, to Minidoka. This stretch is 58 miles in length and as it gets the burden of the Idaho Division, the Utah Division and the Montana Division at Pocatello, the second track will enable the force at the later city yards to handle the freight movements with better results by far, doing away with congestions such as are bound to occur at seasons like the present when the harvest rush is on in the Fall. J. P. Congdon, Pocatello, Idaho, is Supervising Engineer of the company.

Illinois.

Tracklaying on the Evansville, Mt. Carmel & Olney Electric Ry. has been started at Mt. Carmel. The J. J. Burns Construction Co., Isabella Bldg., Chicago, Ill., is building this road.

Under a special contract with the Chicago Transfer & Clearing Co., of Chicago, Ill., the Chicago City Railway Co. is extending its tracks from its present terminus at the corner of 63rd St. and 56th Ave., at Clearing, to the corner of 63rd St. and Archer Ave., at Argo, Ill. The grading for this extension is well under way and it is expected that the line will be in operation in December.

The Chicago & Alton R. R. on Oct. 26 placed in service the new double track between Bloomington and Atlanta, 25 miles. With recent completion of double track between Iles and Nilwood, 30 miles, the road is now double track all the way from Chicago to Nilwood, a distance of 225 miles. This improvement between Bloomington and Atlanta will cost $200,000.

The Fox & Illinois Union Ry. Co., of Aurora, Ill., has been incorporated with a capital stock of $25,000 and proposes a line to be constructed from Yorkville, Ill., to Morris, Ill., with connecting lines to Dwight and Sandwich, Ill. The incorporators and first board of directors are: John Meredith, Joshua Rhodes, Frank M. Zimmerman, Henry H. Evans, Ralph C. Putnam, all of Aurora, Ill.

The Marion Electric Light & Street Ry. Co., of Marion, has changed its name to the Marion Light, Power & Water Co. and has increased its capital stock from $20,000 to $100,000.

Work is well along on the new tracks being constructed at the Wallace yards of the Illinois Central at Freeport. James Ryan, Janesville, Wis., who has the contract for grading and track laying, has already completed over 2,500 ft. track and is working on the other two tracks which will be 4,000 ft. long. This work will be finished this month.

Indiana.

Citizens of Clay City, Ind., are considering a project for an interurban line from Brazil to Jasonville. The line would be about 35 miles long and would run through a productive territory.

At the annual meeting of the directors of the Chicago-New York Electric Air Line Ry. Co., held recently at LaPorte, it was stated that with the opening of the LaPorte-Gary-Hammond line next year construction work will be begun on the road east of LaPorte, building to South Bend and Goshen. A. C. Miller, 77 Monroe St., Chicago, Ill., is President.

Iowa.

The project for the construction of an interurban line from Monticello to Davenport is to be revived. Fred J. Cross, Monticello, Ia., is interested.

The Iowa Traction Co. has been incorporated under the laws of New Jersey and proposes to build a line of railroad from Oskaloosa, Ia., to Tama, Ia., a distance of 65 miles. The authorized capital is $2,000,000, and Geo. E. Wodehouse, of Oskaloosa, Ia., is the principal stockholder.

According to a bulletin issued by the Commercial Club of Des Moines, Ia., surveyors are soon to start on a preliminary survey for the extension of the St. Paul & Des Moines R. R. from Garden Grove, a station on the Short Line in Hardin County about 60 miles north of Des Moines, to Waterloo and Cedar Falls.

The Waterloo, Cedar Falls & Northern Ry. is projecting a 20-mile extension from Waterloo to Dike. Surveys for the line were made this year and construction contracts are to be let next year. T. E. Rust, Waterloo, Ia., is Chief Engineer, and L. S. Cass, Waterloo, is President.

Advices from Villisca, Ia., state that grading on the Atlantic Northern & Southern Railroad line from Atlantic, Ia., to Villisca is being pushed rapidly.

Kansas.

The Garden City, Gulf & Northern R. R. Co. now has 40 miles of line constructed and work is under way on the remainder of its projected 120-mile line. The company also proposes a line from Liberal to St. Francis, Kan., 200 miles. Ten local contractors are now at work on the road. L. L. Graham, Garden City, Kan., is Chief Engineer and B. M McCue, Garden City, is President. E. A. Tennis, Garden City, is Manager.

The grading for the railroad from Westmoreland to Wamego has been started and the promoters expect to complete this part of the work this fall.

Meetings have been held at Ashland, Kan., and Englewood to consider granting aid to the State Line Railroad building west from Hardtner in Barber County. The promoters ask for $3,000 for a preliminary survey, and in case the line is run into Ashland, and across the country they want $75,000 in bonds.

A new autogenous welding plant will be constructed at the shops of the Santa Fe System at Topeka, Kan., at a cost of $6,500. An appropriation has been made to cover the cost of the work.

Good progress is being made by Wheeler & Kelher, Garden City, Kan., on their contract for grading for the railroad from Westmoreland, Kan. The following sub-contractors are working on the grade: Jim Reilly of Emmett, who has contracted to grade, counting from Westmoreland, miles five, ten and eleven; J. E. Sracy, miles thirteen and fourteen; C. W. Humburd, miles fifteen and sixteen; P. H. Smith, mile twelve; William Burns, mile six, and E. Woodworth, mile nine.

The Santa Fe System has arranged to spend $2,500 in connection with the alteration of the water tank and extension of the crane line at Great Bend, Kan.

At a recent meeting of business men at Salina, Kan., it was agreed to subscribe $150,000 of the necessary $350,000 to begin the construction of a railroad line from Newton, Kan., to Chester, Neb. A total of $250,000 already has been pledged. The business men in the cities along the route selected will build the road and own it.

The Kansas & Missouri R. R. Co., is projecting a 37-mile line to run in a southerly direction from Fort Scott to Pittsburg, Kan. Preliminary surveys only have been made as yet. Capital to the amount of $200,000 has been secured for construction purposes. No construction contracts have been let nor has the Chief Engineer been named. H. L. Phillips, 610 Broadway, Kansas City, Mo., is President, and C. E. Cory, Fort Scott, Kan., is Secretary.

Kentucky.

The contract awarded Jones Bros., Columbus, O., for work on the Lexington & Eastern Ry. extension, noted in our last issue, includes 550,000 cu. yds. earth and rock excavation, 2,800 lin. ft. of tunnels, 600 lin. ft. of wood trestles, 8,500 cu. yds. stone masonry and 15,000 lin. ft. of piling. Part of the work is to be sublet and the contractors want teams, car and cart outfits, and also small masonry outfits for setting up stone boxes. Good prices can be offered sub-contractors and they can obtain supplies from the warehouse of the general contractors in the work. This contract extends from Shay to Whitesburg, Ky.

The Covington, Big Bone & Carrollton Traction Co. has applied in the city of Covington for another franchise for the operation of its cars through the streets of Covington. This is the third franchise for which the company has applied. It is for the use of Second St., from Johnson to the western corporation line.

The Chesapeake & Ohio Ry., H. Pierce, Engineer of Construction, Richmond, Va., has completed plans for constructing shops and terminal facilities at Lexington and contractors have already been looking over the work. About $200,000 is to be expended.

The Louisville, Lincoln Farm & Mammoth Cave Traction Co., of Glasgow, Ky., is reported to have opened bids Nov. 1 for the construction of the first section of its proposed 47-mile line. J. M. Richardson, Glasgow, Ky., is President.

Louisiana.

At a recent mass meeting at Haynesville, La., a committee was appointed to investigate the project of securing the Clingman-Kinnsbrew R. R. It is claimed the road can be built through Haynesville $90,000 cheaper than the route via Homer, La., to Memphis, Tenn.

Advices from Homer, La., state that engineers are now at work on the route of the proposed railway which is planned to connect Minden, Homer and El Dorado, ,Ark. Taxpayers of Wards 7 and 4 in that parish are to be asked for a bonus of $50,000 to aid the work. The new road will be part of the Rock Island System and will eventually be extended to Memphis, Tenn., giving this place the outlet which has been needed. A. R. Johnson and C. O. Ferguson are promoting the project.

Construction work has been started on the Oberlin, Hampton & Eastern R. R. from Oberlin to a point on Bayou Mezpique, near Wilburton, about 14 miles southeast. It is expected that the road will be completed about Jan. 1, 1911.

Maine.

The U. S. Circuit Court has issued a decree ordering the sale of the Atlantic Shore Line Ry. to satisfy the claims of the bondholders. The sale will be held in Alfred, Me., on Dec.

1. A bill was brought recently by the Knickerbocker Trust Co. of New York, as trustee under the mortgage, for $1,191,500 of 4 per cent bonds. The railroad extends from Biddeford to York, Me.

Maryland.

The Baltimore & Ohio R. R. has completed plans for terminal improvements at Frederick, Md., which will cost about $60,000. The plans consist of a rearrangement of tracks in the freight yard and the construction of extra trackage. A new freight depot and warehouse will be erected and shipping facilities provided. Extra storage space for cars will also be furnished.

The State Public Service Commission has approved the application for the purchase of the Washington, Berwyn & Laurel Ry. Co. by the City & Suburban Electric Ry. Co. The former operates an electric line from Laurel to the District line, after which its cars run over the City & Suburban Co.'s tracks into Washington.

The Pennsylvania R. R. is said to be planning to build a 4-track tunnel between Union and Fulton St. stations in Baltimore, Md. Some ground for this rumor is found in the refusal of the company to explain why its own plan for the elimination of the grade crossings is preferred to the one proposed by the topographical survey, which the company admits is less expensive than its own.

Michigan.

The Grand Trunk Ry., F. T. Irving, Resident Engineer, Detroit, Mich., has notified the Board of Trade of Saginaw, Mich., that the railway will do its share in the filling in of the bayou and lowlands on the west side of the river and adjacent to the river banks, for a considerable distance within the Saginaw city limits. This decision of the company concerned removes the last obstacle to the proposed filling in.

At a meeting recently held by the officials of the Detroit, Toledo & Ironton R. R., it was decided to reorganize and take the company from the hands of the receiver. A careful inspection of the system has been made and prospects are reported to be very bright. G. K. Lowell, Detroit, Mich., is Receiver, and J. A. Strubel is Assistant General Manager.

Work has been commenced by the Grand Trunk Ry. for the extensive additions planned to its shops at Port Huron, Mich. The cost of the work is $100,000.

Minnesota.

The construction of an interurban line between Algona and Fairmont is proposed. It is proposed that the citizens along the proposed route unite in having a reliable preliminary survey made of a line from Algona through Lotts Creek, Fenton, Seneca, Armstrong and then north into Minnesota near the northwest corner of Kossuth county, straight into Fairmont. It is estimated that this survey could be thoroughly done for somewhere around $3,000. Tom Doughty, Armstrong, Ia., and William Stewart, Armstrong, are interested.

Duluth and the Ranges.

BY PETER E. MEAGHER.

C. E. Jamieson, contractor on the Canadian Northern extension into Duluth, was a caller a few days ago, and reported that he was rapidly finishing up his work.

J. Newville, railroad contractor, was a visitor with us last week. He has been working the past season for Morris & Shepard on the Great Northern R. R. in North Dakota, and has completed his contract.

C. B. Bean of the C. C. Sagnell Construction Co., of Denver, Colo., was a visitor with us recently. They have been doing some bridge work for MacArthur Brothers in Wyoming, and at the present time are looking for some new work.

Charles Rees, of the American Locomotive Co., was a caller here this week. He was on his way up to the Iron Range, where his company has some steam shovels working. He said that business was pretty fair.

Thomas Walsh, of the Johnson-Carey Co., was a caller. They have the rock work on the Canadian Northern extension into Duluth, and are progressing very nicely on the same. They have just sent three standard gage locomotives up to their large rock contract on the Canadian Northern in Canada.

Thomas Higgins, of Higgins & McDonald, Railroad Contractors, was a visitor. The only work they are doing at the present time is some rock work on the Canadian Northern near Duluth.

L. A. Bumgardner and Frank Peabody, of the firm of Dale & Bumgardner, Railroad Contractors, are sick at the present time with typhoid fever. Mr. Peabody has been laid up for about five weeks, and is on the road to recovery. Mr. Bumgardner is getting along very nicely. They both have our well wishes for a rapid recovery.

Bids were opened at Duluth recently for dredging of the Duluth harbor, and the Duluth-Superior Dredging Co. of Duluth was the lowest bidder at 9 cts. per cu. yd. The Great Lakes Dredging Co. were the next at 9.9 cts. The Zenith Dredge Co. of Duluth bid 10 3/9 cts. The Northern Dredge & Dock Co., 14 cts., and the Empire Engineering Co. of New York 15 cts. The Duluth-Superior Dredging Co. was awarded the contract, and have already started on the same.

John Dunlavey, General Superintendent for the Duluth & Northeastern Ry. Co., was a caller at this office a few days ago. They are very busy at the present time constructing about 30 miles of railroad. They are doing this work themselves.

W. F. Lawrence of Pastoret-Lawrence Co., General Contractors, was a caller this week. They have a great many sewer and water contracts under way at the present time, and he reported that all of them were going along in very nice shape.

The labor situation at Duluth is, if anything, worse than it was two weeks ago. The wages being offered for common labor run from $2.25 to $2.50 per day, and there are about three jobs for every man. There is a great deal of construction work, municipal and lumbering operations going on in this vicinity, and there is really at the present time a very serious shortage of men.

Mississippi.

According to a letter received by the Board of Trade of Natchez, Miss., a company has been organized by financiers of Western cities, to construct and operate a trunk line from a deepwater point near Houston, into that city, and thence northeast through the timber district of East Texas and Western Louisiana to some point on the Mississippi River as its eastern terminus. It is the desire of the company to make Natchez the eastern terminus, if conditions are favorable. The distance from Houston to Natchez is 294 miles. Edward Kennedy, Houston, Tex., is interested.

Surveys have been made for a railway to be built from Tishomingo to the stone quarries three miles distant from that city. Work on the road will be started at an early date.

Missouri.

The first report of the Kansas City Terminal Ry. Co. of Kansas City, organized March 10, 1910, to take over the franchises of the Kansas City Belt Ry. Co., shows that the company has a total par value of capital stock authorized of $50,000,000, of which $1,200,000 is issued and outstanding, and $17,500,000 of outstanding mortgage bonds. The company reports its operating revenues from March 10 to June 30 to have been $113,171, and its operating expenses, $117,525, making an operating deficit of $4,364. Of its operating expenses during the period of that time, $20,356 was for maintenance of way and structure, $2,931 for maintenance of equipment, $64,399 for transportation expenses, $3,497 for general expenses. The report shows the total cost of railroad and equipment to be $12,800,639.40, of this amount $4,702,258.75 was for real estate purchased for a site for new union passenger station and its tracks and for prospective widening of present right of way, which was acquired from the Kansas City Belt Ry. Co.

City Council of Savannah, Mo., has granted a franchise to the Chicago Great Western R. R. permitting them to construct two additional tracks through the city. One will begin at the switch of the old stove factory warehouse and will run south to the power house, and the other will commence at a point east of the stock yards and run south on the east side of the passing switch to the old harrow factory site.

Mr. D. C. Blue and Mr. J. J. O'Connell have opened an office at 90½ Union Ave., Kansas City, Mo., where they will act as contractors' agents and will also conduct a railroad labor agency.

The Santa Fe System has authorized the construction of one of its new style steel tanks and cranes to be built at Marceline, Mo., at a cost of $5,800.

The St. Louis, Webster & Valley Park Ry., which has 24 miles of line completed but not yet in operation, is reported to have been sold to J. D. Houseman, St. Louis, Mo. It is said that this road will now be extended from the present terminus at Webster, through the center of St. Louis county, to a point opposite Weldon Springs on the Missouri River. Mr. Houseman is also interested in the St. Louis County Belt R. R., which proposes a 30-mile belt line to extend from O'Neill, just north of the city limits of St. Louis, to Spanish Lake, Ferguson, Ramona, Vinita Park, Clayton, Webster, Maplewood, Grant Farm and Jefferson Barracks. At the western limits, near the southwestern corner of Forest Park, it will connect with the St. Louis, Webster & Valley Park. The line will be thirty miles long.

St. Louis Items.

BY A. B. KOENIG.

The J. A. Ware Construction Co. has started on its Missouri Pacific work near Herman, Mo.

Jerry Lyman left here the other day to open up work for the J. A. Ware Construction Co. between Herman and Gasconade, Mo., on the Missouri Pacific R. R.

A passenger station to cost $1,000,000 will be erected by the Illinois Central, Yazoo and Mississippi Valley, Frisco and Rock Island Railroads at Calhoun Ave. and Main St., Memphis. The Rock Island, it is said, has been holding out of any agreement toward a new station until its controversy with the city over the West Memphis freight rates was settled. This matter has not been settled, but it is said that the Rock Island has decided not to wait on this account, the officials feeling that the rate matter will be amicably adjusted. The Rock Island signed the agreement last week. The Frisco entered the agreement with the Illinois Central, the head of the movement, and its subsidiary, the Y. & M. V., some time ago. Vice President Parke of the Illinois Central is expected in Memphis this week, at which time he is expected to make official announcement of the agreement. The L. & N., Southern Cotton Belt, Iron Mountain and other roads entering Memphis made combined efforts some time ago to settle on plans for a real union station, but the Illinois Central Railroad and others refused.

L. G. Hamblet has been apopinted General Manager for the Petersen & Fell Boarding & Supply Co. W. J. Rowland resigned last week as Superintendent of the above company.

W. L. Mosby came in from Slough Landing, Tenn., for a bunch of skinners and left here happy. Mosby has a lot of levee, also railroad work to let in Tennessee in quantities to suit outfits. Write him at Hickman, Ky.

The Board of Local Improvements of East St. Louis has adopted plans for the improvement of five East St. Louis streets at a cost of approximately $100,000. No objectors appeared when the public hearing was called in Mayor Cook's office. According to the plans adopted, brick will be used in the improvement of 18th St., Alexander St. and 27th St., while concrete and gravel will be used on 19th St., or Gray Boulevard and Wimmer Place. The work on these streets, all of which are in what is known as "Lincoln Place," will cost $84,524. Because the board did not feel justified in deciding immediately whether to use brick or creosote blocks in the improvement of Ridge Ave., the hearing on this street went over. The Ridge Ave. improvement will cost approximately $16,000 if brick is used. Mayor

Cook said that he would try to get the City Council to reconsider its action in killing the ordinance for the improvement of State St. This improvement means a boulevard 14 miles long. It will cost $277,000.

Pat Hickey of Hannon & Hickey has extended an invitation to come to New York and ride in his new touring car. We have accepted Pat's invitation and we will call on him the first time we are in New York and take this ride.

The first meeting of the directors of an interurban railway which has just been chartered by the Secretary of State of Illinois has been held at Springfield, Ill. Isaac A. Smith, 5169 Morgan St., Civil Engineer, is president of the company. The survey of the proposed road, it is said, passes through the county seats of Montgomery, Bond, Clinton, Washington, Fayette, Wabash and Madison Counties, Illinois and Centralia, Springfield and East St. Louis, Ill., and St. Louis. The management says the road will be financed in Amsterdam, Holland, and when completed will cost $18,500 a mile. Either electric or gasoline motor cars will be used. The incorporators and first Board of Directors are: Isaac A. Smith, St. Louis; Geo. W. White, Creve Coeur, salesman, Mississippi Valley Trust Company; Noble E. McMillan, 3504A Vista Ave., stenographer, Mississippi Valley Trust Company; Alfred L. Lynch, 2122A Waverly Place, salesman, Mississippi Valley Trust Company, and Jas. W. Gullett, H. B. Williams, John B. Conant, Oscar Ansell and Wm. J. Barrett, of Springfield, Ill.

The C. & A. R. R. Co. has finished double tracking their road between Bloomington and Atlanta, Ill.

Wm. Wilson writes us from Effington, Ill., that he wants work for a 6 to 10 team outfit.

Pat Hannon returned from San Francisco last week, looking better than ever.

Swift & Rust secured a nice paving contract from the Burlington R. R. Co. at Hannibal, Mo.

Chas. Nagel was in and out of town last Tuesday. Nagel reports everything lovely.

Labor is scarcer now than ever before. The Steamer Rees Lee leaving here last week for Memphis had to pay its colored roustabouts $100 per month and board and even at these prices was only able to secure half crew. The prices they are paying for picking cotton in the south range from $1.00 to $1.20 per 100 lbs., which has attracted all of the colored labor and as no white labor to amount to anything is coming in from the north, the situation is beginning to look serious in the south.

Montana.

The Northern Pacific R. R. is understood to have completed its surveys for its Glendive-Helena cutoff, and maps and detailed data are said to have been prepared so that contracts can be let and construction work started in the early spring.

Indications are that work will probably be started early in the spring on the Mondak-Helena line of the Great Northern R. R. The company has secured nearly all its right of way from Mondak through Lewiston to Hobson, where connection will be made with the Billings & Northern. From Hobson to Meagher into Helena the line will be owned jointly by the Great Northern and the Northern Pacific. The Great Northern has secured all of its right of ways through Lewiston and has removed the buildings, preparatory to grading. For a distance of 30 miles between Grass Range and Forest Grove the Great Northern and the Milwaukee will control jointly a 30-ft. roadbed, but will own and use separate tracks.

New Mexico.

The Rock Island, Texico-Farwell & Southern Ry. has closed a contract with the Calbach Construction Co., Portland, Ore., for the construction of 100 miles of railroad from Texico, N. Mex., to Farwell south. Work is now in progress and a full force will be put on as soon as the grading machines arrive. This road will traverse a fine agricultural country which is susceptible of great development. From Texico to the Texas-Pacific is an undeveloped country 150 miles wide, without a railroad, and this line will traverse the center of it. The company is in the market for ties, rails and other construction materials and expects to push the work with all possible expediency. M. J. Healy, Texico, N. Mex., is President.

New York.

Preliminary steps have been taken at Jamestown, N. Y., for securing the right of way for the construction of an electric railway between Jamestown and Dunkirk, running through the villages of Gerry, South Stockton, Centralia, Cassadaga, Lily Dale and Laona. Among those interested are V. E. Peckham, Orsell C. Price and Robert M. Garfield.

Construction work has been started on the Sanfords Corners cutoff for the New York Central Lines. The work is being done by the Walsh Construction Co., of Davenport, Ia.

The Utica & Mohawk Valley Ry. Co., Utica, has applied to the Common Council of Utica for a franchise for operating its cars from the end of its tracks in Genesee St. to its North Genesee St. line, including the right to cross the new Genesee St. overcrossing.

The Fonda, Johnstown & Gloversville R. R. Co. has petitioned the Common Council of Amsterdam, N. Y., for permission to change its route through that city on the line to Rockton.

Bids were opened Oct. 27 by the Public Service Commission of New York City for constructing the Tri-borough subway system in that city. In all 23 contractors bid on the work. As a rule the bids received were lower than the estimates made by the Engineers of the Commission. For the 17 sections of the Broadway-Lexington Ave. line the Bradley Contracting Co., 1 Madison Ave., New York City, offered bids a rough estimate of the total being $94,000,000. As the city has set aside only $60,000,000 for subway work this year, it will be seen that according to these figures only a portion can be attempted at this time. S. Pearson & Sons, Ltd., 29 Broadway, New York, who built the East River tubes for the Pennsylvania Railroad, put in a bid for that section of the Broadway-Lexington Ave. route from 129th St., beneath the Harlem River, to Mott Ave., in The Bronx. Its bid is $8,500,000, with a suggestion that the tube beneath the river be of cast iron rings in concrete. The Bradley Contracting Co. put in a bid for the same work, with either riveted steel or cast iron tubes. Its bid is $6,400,000, or $2,100,000 less than the bid of S. Pearson & Sons. The Broadway-Lexington Ave. line is to be about nine miles long, and the work was divided into 17 sections. The bidders on the sections were as follows: Section 1, Battery Park to Cortlandt St.—Bradley Contracting Co., MacArthur Bros. Co., O'Rourke Engineering Construction Co., and the Degnon Contracting Co. Section 2, Vesey St. to Canal St.—Bradley Contracting Co., MacArthur Bros., O'Rourke Contracting Co.; F. L. Cranford, section 2A, bids by the same contractors. Section 3, Canal St. to Prince St.—Bradley Contracting Co., MacArthur Bros., and F. L. Cranford. Section 4, Prince St. to East 14th St.—Bradley Contracting Co. and MacArthur Bros. Section 5, East 14th St. to East 26th St.—Metropolitan Contracting Co., Bradley Contracting Co. and MacArthur Bros. Section 6, East 26th St. to Grand Central Station—Degnon Contracting Co., Bradley Contracting Co. and MacArthur Bros. Section 7, Grand Central to East 53rd St.—Degnon Contracting Co., Bradley Contracting Co., MacArthur Bros. and Charles H. Beckworth. Section 8, E. 53rd St. to E. 67th St.—Degnon Contracting Co. and Bradley Contracting Co. Section 9, E. 67th St. to E. 78th St.—Bradley Contracting Co. Section 10, E. 78th St. to E. 93rd St.—Henry Steers and Bradley Contracting Co. Section 11, E. 93rd St. to E. 105th St.—Henry Steers and Bradley Contracting Co. Section 12, E. 105th St. to E. 117th St.—Behrman & Rodgers, Bradley Contracting Co. and the Oscar Daniels Co. Section 13, East 117th St. to E. 128th St.—Brody & Adler, Bradley Contracting Co., MacArthur Bros. and the Hugh Nawn Contracting Co. Section 14H, 128th to E. 138th St., under the Harlem River—S. Pearson & Sons, Ltd., Bradley Contracting Co., MacArthur Bros. and the O'Rourke Contracting Co. Section 14K, covering the same territory—Arthur McMullin, the Bradley Contracting Co., MacArthur Bros. and the O'Rourke Engineering Construction Co. The Public Service Commisison's engineers supplied two separate specifications for building the tube under the Harlem River, one being a steel-riveted tube and the other a cast-iron tube, leaving it optional with the contractors to bid on either of the two forms. Section 15, E. 137th St. to E. 157th St.—The Goodwin Construction Co., the Bradley Contracting Co., the Hugh Nawn Contracting Co., Boston, Mass., and the Haggerty-Drummond Co. For the Canal St. subway, .8 mile long, the following were bidders: Section 1, Washington St. to W. Broadway—The Metropolitan Contracting Co. and the Bradley Contracting Co. Section 2, W. Broadway to Manhattan Bridge—Bradley Contracting Co. For the Broadway-Lafayette loop in Brooklyn, 8 miles long, the bidders were as follows: Section 1, Williamsburg Bridge to Flushing Ave.—The Bradley Contracting Co., F. L. Cranford, Patrick McGovern, Newman & Carey and the Degnon Contracting Co. Section 2, Flushing Ave. to Broadway, thence to Tompkins Ave.—The Degnon Contracting Co., the Bradley Contracting Co., Patrick McGovern, Newman & Carey and the Hugh Nawn Contracting Co. Section 3, Tompkins Ave. to Ashland Pl.—The Degnon Contracting Co., the Bradley Contracting Co., S. Pearson & Sons, Ltd.; Smith, Scott, Harmon & Hickey, the Oscar Daniels Co., the Hugh Nawn Contracting Co., Newman & Carey, the Smith-Pennock Contracting Co., J. H. Holmes, Creamer, Cranford & Donovan, and Walter H. Cahagan. Rough estimates show that the bids of the Bradley Contracting Co. for the sections of the Broadway-Lexington Ave. subway in numerical order are: $6,987,000, $9,065,000, $2,323,000, $3,620,000, $3,716,000, $2,473,000, $3,634,000, $3,870,000, $3,360,000, $2,447,000, $3,253,000, $3,132,000, $3,474,000, $4,701,000, $6,396,000, $6,362,000 and $5,336,000. The Bradley Contracting Co. also bid $5,979,000 on that part of the Canal St. subway from Washington St. to West Broadway, and $9,163,000 for the second section of that subway, from West Broadway to Manhattan Bridge. Its bids for the three sections of the Broadway-Lafayette Ave. route in Brooklyn were numerically $4,318,000, $4,725,000 and $3,451,000.

North Carolina.

The Statesville Air Line R. R. Co., of Statesville, N. C., is to at once build a new line of road from Statesville to Yadkinville, the county seat of Yadkin County, a distance of 25 miles. The road will be built by convict labor, arrangements having been made to transfer 50 convicts from the state prison to Statesville to begin the work of grading for the new line at once.

Surveys have been started, according to advices from Scotland Neck, N. C., for the construction of a railroad to Roanoke River for the Bowers-White Lumber Co. The work is in charge of L. R. Mills, Lake Forest, N. C.

Ohio.

The stockholders of the Cleveland, Barberton, Coshocton & Zanesville Ry. Co. have voted to increase its capital stock to $2,000,000. This company was organized three years ago, and has acquired some 190 miles of private right of way for its proposed electric lines. It is said that grading work is to be started this month on the first section between Cleveland and Orrville. A. De Mayo & Co., Montreal, Que., are the contractors.

The Norfolk & Western Ry. has ordered 100-lb. rails for all its Ohio double-tracking sections to the amount of 15,000 tons for 1911 delivery.

The Chesapeake & Ohio Ry. Co. of Indiana, H. C. Starr, General Manager, 355 Dearborn St., Chicago, Ill., is stated to have prepared plans for new yards on a large scale near Ferguson Road and Lick Run Road. Options on ten acres of land for this purpose have been secured. The new yards will be about five miles from the business section of Cincinnati and on the division that was formerly the C., C. & L. Road.

A project is under consideration for the construction of an electric railway from Newark, O., to Coshocton and Uhrichsville. The route will parallel the Panhandle R. R. between the points named. E. A. Nesbit of Pittsburg and A. E. Townsend of Doyleston are the promoters of the project.

The Massillon Brewster Air Line Co. has completed surveys and is now negotiating for capital for the construction of its proposed eight-mile line from Massillon to Brewster over private right of way. Howard Yost is Chief Engineer and Jacob J. Wise, Massillon, O., is President.

The Columbus, New Albany & Johnstown Traction Co. has been purchased by Anderson T. Herd of New York City. It is now said that steps will be taken at once for building the road to Mansfield.

Oklahoma.

Citizens of Taft, a city about nine miles west of Muskogee, have asked the Muskogee Electric Traction Co., R. D. Long, General Manager, Muskogee, to build a line to that place. The plan proposes the extension of the Alta Vista line through the brick yards and Crekola to Taft. It is possible to cross Pecan Creek over a county bridge.

The Wichita Falls & Northwestern Ry. has now under construction an extension of its main line from Elk City, Okla., north to the town of Hammon, Okla., 18 miles. The work is being done by the Texas & Oklahoma Construction Co., of Wichita Falls, Texas. About 90 per cent of the grading has been completed, and tracklaying will begin early in November. The grading was let to small sub-contractors, and averaged about 30,000 cu. yds. per mile. The tracklaying, bridging and buildings will be done by the construction company with its own forces. The line will be laid with 65-lb. rail with 2,760 oak ties per mile, and will have only trestle bridges of a total length of about 1,500 lin. ft. All material has been ordered. R. A. Thompson, Wichita Falls, Texas, is Chief Engineer of the Wichita Falls & Northwestern Ry.

The Texas, Oklahoma & Eastern Ry. has been incorporated at Guthrie, Okla., with a capital stock of $200,000, and proposes the construction of a 30-mile line from Valiant through Bismarck to Mountain Fork River in McCurtain County, tapping some of the best pine timber in Oklahoma. The incorporators are J. E. Hansdricks, A. E. Hart, Harry L. Drieks, J. S. Kirkpatrick, Kansas City, Mo.; S. B. McCargey, Bismarck; C. E. Baxter and J. H. Crook, Idabel, Okla.

Oregon.

The Santiam Development Co. has applied for a franchise over the principal streets of Salem to be used in connection with an electric railway from that city to Slayton. The company proposes to have the line in operation within two years.

The Rogue River Valley Ry., W. S. Barnum, President, Jacksonville, Ore., has work under way for an extension west from Jacksonville for a distance of two miles up Jackson Creek.

Work will be completed some time in December on the Oregon Railroad & Navigation Co.'s cutoff from Pendleton to Yoakum. This has been an expensive piece of work and covers but 12½ miles and will cost nearly $1,200,000, or about $100,000 a mile. Heavy grades have been eliminated and curves straightened, shortening the distance 1.7 miles.

Four steam shovels are now at work between Gresham and Portland, grading for the projected line of the Mount Hood Ry. Co., Commercial Bldg., Portland. It is expected that the grade will be completed to Sandy River by March 1.

The Portland Railway Light & Power Co., Portland, Ore., is to at once extend its Cazadero lines for a distance of 3½ miles.

Tracklaying on the Oregon Trunk Line from the Columbia River south began about Oct. 14 and it is expected that the work will be completed as far as the Crooked River within the next 70 days. There is sufficient material on the ground at present to complete tracklaying to Crooked River, in Crook County, a distance of 131 miles from Malmood, Ore., the station on the Columbia River. At Crooked River work will be delayed on account of the deep canyon and it will be necessary to build a bridge at that point before laying of tracks can be begun between there and Bend, a distance of 25 miles. The grade for the entire distance between the Columbia River and Bend is practically completed, covering a distance of 156 miles. The bridge across Crooked River will be 340 ft. in length and 350 ft. above the bottom of the canyon. Although it is necessary to cross the Deschutes River at three different places with high bridges, the largest and most costly structure will be over the Crooked River Canyon.

Pennsylvania.

A company which proposes an electric railway between Montandon, Lewisburg and Mifflinburg is reported to have been granted the right to electrify that portion of the Lewisburg & Tyrone R. R. between Montandon and Mifflinburg. It is said that connection will be made with the trolley system at East Lewisburg, where, by means of an extensive over-the-river road, a line can easily be built that will permit the trolley cars to reach the railroad and, using the bridge, come into Lewisburg, thence to Mifflinburg. J. T. Whittaker, Harrisburg, Pa., is interested.

The Westchester & Wilmington Electric Ry. Co. has completed surveys and has secured the capital for the construction of its projected 16-mile line from the Pennsylvania R. R. station at Wilmington along Concord Pike to West Chester. The contract for constructing the road has been let to the Eastern Railway Construction Co. Louis Dalmos, Morris Bldg., Philadelphia, Pa., is President of the West Chester & Wilmington R. R., and H. G. H. Cooke, Real Estate Trust Bldg., Philadelphia, Pa., is Chief Engineer.

The Philadelphia & Reading Ry. has awarded the following contracts in connection with the elevation of its tracks on the Richmond Branch in Philadelphia. For the construction of steel bridges over Kensington and Frankford avenues and abutments, the American Bridge Co., $125,428. For fill and masonry to carry the elevated tracks between those points, John McMenamin, Arcade Bldg., Philadelphia, $117,425.

The Monongahela & Western R. R. has made surveys and has secured the right of way for an extension from its present terminus at Mariana to Ten Mile Creek, within four miles of the Monongahela River. The extension would be made to gain admittance into new coal fields about to be opened up in the Marianna and Zollarsville region.

The Clarion & East Brady Electric Ry. Co. is projecting a line to connect Clarion, Reidsburg, Curilsville, Sligo, Reinersburg and East Brady. Construction contracts for the first section from Clarion to Reidsburg, six miles, will be let at once. G. E. Arnold, Clarion, Pa., is President.

The Chambersburg, Greencastle & Waynesboro Street Ry. Co. has decided to defer the extension of the trolley line to Blue Ridge Summit and to Shippensburg until all the rights of way have been secured. For this reason the contract for the building of the line between Pen-Mar and the Summit was not let as had been expected.

It is reported that the Lehigh Valley R. R. has advertised for bids for the construction of double track between Lofty and Delano, a distance of about 5 miles. G. L. Moore, South Bethlehem, Pa., is Engineer Maintenance of Way.

South Dakota.

The Chicago, Milwaukee & Puget Sound Ry. is reported to be planning to have work started next spring on the extension of its line from Platte, S. Dak., to Orient. For several years Platte has been the northern terminus of the Charles Mix County line of the company. It is believed that when the Platte line is extended it will run in a northwesterly direction from Platte to Bijou Hills and from that point to Chamberlain, connecting with the Black Hills line as well as extending through to Orient.

Commercial Club of Lennon, S. D., has taken up with the Board of State Railroad Commissioners, the matter of having the Great Northern and Milwaukee Roads construct a connecting link at that place. It is said the Great Northern has expressed its willingness to do its share of the work.

Tennesee.

The Pittsburg Lumber Co., in which Senator Flynn, of Booth & Flynn, Contractors, 1942 Forbes St., Pittsburg, Pa., is largely interested, is considering building a railroad from its large tract of timber above Hampton to Elizabethton.

Work may be started before the end of the year on the proposed new passenger station at Memphis, Tenn., which with necessary track changes will cost $1,000,000. The Illinois Central, Yazoo and Mississippi Valley, Frisco and Rock Island Railroads will use the station.

The McDowell Construction Co. has been awarded the Harriman, Knoxville & Eastern R. R. work noted in our Oct. 19 issue. The work calls for the construction of a roadbed masonry drains and other work necessary for building approximately 17½ miles of new road from Harriman, Tenn., in a northeasterly direction toward Knoxville. The approximate quantities are as follows: Excavation, 477,930 cu. yds.; clearing, 88 acres; grubbing, 29 acres; concrete, 3,920 cu. yds.; cast iron pipe (laying), 1,272 lin. ft.; lin. ft. piles, 12,530 lin. ft.; B. M. in timber structures, 146,930 ft. B. M. The road will be of single track and the cuts for same will be 22 ft. at sub-grade, while the embankment will be 16 ft. The road runs along Emory River for part of the way and the cliffs overhanging this section will not be allowed to be blasted with excessive amounts of heavy explosives, inasmuch as this is a navigable stream and the debris must be taken care of and not allowed to go into the river. W. J. Clarke, of Harriman, Tenn., is Chief Engineer of the railroad.

The Knox Construction Co. has been incorporated with a capital stock of $20,000, the incorporators being George W. Callahan of Knoxville, Thos. A. King, W. K. Anderson, H. C. Harvey and B. A. McCallie.

Texas.

Frank D. Fuller and Oscar L. Allen, eastern promoters, are reported to be making arrangements for the construction of an electric railway to connect Houston and La Porte. According to a statement of the promoters, who have been stopping at the Bristol Hotel, Houston, construction work will be started next month and the grading will be done by force account.

A special meeting of the stockholders of the Chicago, Rock Island & Pacific Ry., and of the Chicago, Rock Island & El Paso Ry. has been called to be held at the La Salle street station offices in Chicago on Dec. 15, for the purpose of approving the purchase of the El Paso line by the parent company. The El Paso road constitutes the Rock Island line in New Mexico, running from Texas State line to Santa Rosa and has therefore been maintained as a separate corporation.

L. E. Walker, President of the Quanah, Seamour, Dublin & Rockport R. R., has submitted to the Board of Trade of Taylor a proposition for the running of his railroad through Taylor.

The Chicago, Weatherford & Brazos Valley R. R. has filed an amendment to its charter providing for construction of a 60-mile extension from Bridgeport to Gainesville, through Wise, Denton, Montague and Cooke Counties, Texas. The main line of the road will now extend from Weatherford to Gainesville.

The State Railroad Commission on Oct. 31 gave formal consideration to the application to sanction the operation of the Texas Central R. R. by the Missouri, Kansas & Texas R. R. The Missouri, Kansas & Texas agrees to follow the policy of the former owners of the Texas Central, of extending that line west through the lower Panhandle to Roswell, N. Mex., a distance of about 350 miles, and completing the branch line that is now being constructed from Deleon, to a point 40 miles west of there.

At a meeting of the Business Men's League, Gonzales, Texas, Oct. 18, L. E. Walker, President of the Quanah, Seymour, Dublin & Rockport Ry. Co., submitted a proposition for the construction of a section of his railroad from Bloomington via Gonzales, utilizing the grade of the O'Connor Ry. that is already constructed as far as Yoakum. It was decided to leave the matter open for the present.

The St. Louis, Brownsville & Mexico Ry., E. C. Burgess, Engineer, Kingsville, Tex., has selected the route of the belt line which will provide transportation from the sugar cane plantations below Brownsville to the Ohio-Texas mill, and active construction work will be instituted as soon as some details regarding the right of way has been adjusted. The road is to be completed in time to handle the present crop.

A report has been submitted to the State Railroad Commission, Austin, Texas, of the progress in the construction of the Altus, Lubbock & Roswell R. R. across the Panhandle. It is stated that the grade of 60 miles of the line from Memphis southwest to Lockney, Tex., will be finished by Dec. 10. Arrangements have been made for the construction of the bridges between Memphis and Cap Rock. From Lubbock, Tex., the proposed road will run almost due west to Roswell, N. Mex., a distance of about 150 miles.

It is reported in Houston, Tex., that the Santa Fe is about to begin the expenditure of a considerable sum on the straightening and improving of its grades and track between Coleman and Temple in preparation for the inauguration of heavy service as soon as the long stretch between Coleman and Slaton is finished.

W. T. Andrews, Stamford, Tex., President of the Stamford & Eastern Ry. Co., is quoted as having stated that engineers of the Stamford & Eastern Road will complete the work of permanent location in the vicinity of Ellisville soon and will begin preliminary surveys in an easterly direction with Fort Worth or Dallas as objective point. The line between Stamford and Ellisville is unusual in the fact that nothing greater than a 2-degree curvature has been developed with a predominance of long tangents, one of them eighteen miles in length. The road bed is eighteen feet wide with six-tenths grade in all the work done to date, and the same specifications will be followed in the extension.

A franchise granting the Texas & Pacific Ry. the right to run a track down North St. to the east line of Cherry St. is being prepared for presentation to the City Commission of Fort Worth, Tex. It is said that property owners favor the grant.

The Arkansas, Oklahoma & Texas Ry. Co. has been chartered to construct a line 5½ miles long from Arkoal, southwest to a connection with the Choctaw division of the Rock Island R. R., the entire line to be within the Greenwood district of Sebastian County. It will be a lumber and coal road. The capital stock is placed at $48,000, of which $12,000 has already been subscribed. The incorporators are H. Denman, W. T. Quinley, Ransom Gulley, Jr., C. H. Finley, J. F. Read, John Trigg, Will Hall, S. T. Moore, R. A. McEachin and Amos Johnson.

Articles of incorporation have been filed by the Orange & Western Construction Co. of Orange, which proposes to build the railroad from Louisiana into Orange, Tex. A meeting of the directors will be held soon and definite plans for the work will be made.

According to advices from Beeville, Tex., under date of Oct. 23, the Southern Pacific Ry. Co. has under consideration the construction of an extension of its line from that city west to a connection with the overland line of the system at Spofford, a distance of 225 miles. The line would also form a cutoff by which a new and shorter route will be obtained through Texas, connecting with the existing overland line again at Rosenber, a short distance west of Houston. The proposed new short line will run to the south of San Antonio about one hundred miles, and it is said it will be used chiefly for freight traffic. It will penetrate a ranch territory that is rapidly settling up with farmers. There are several propositions now on foot looking to the construction of independent lines of road through this same territory, and the probability of the field being occupied by one or more of these lines is said to be one of the things hastening the Southern Pacific with its plans. Spofford is the junction point of the branch line of the Southern Pacific that runs down to Eagle Pass, where it connects with the National Railways of Mexico. The proposed cutoff line will give a shorter route to the East for the Mexico traffic than by the existing route through San Antonio.

It is reported in Gail, Tex., that the Commercial Club has taken up with Morgan Jones, the promoter of the railway from Abilene, Tex., into King County, the matter of constructing an extension of his road into that place. It is expected that a proposition will be submitted the club soon.

The management of the Pecos Valley Southern Ry. has announced that rails and ties have been purchased for the extension of the line at once to Balmorhea and the Davis Mountains. The company is the same for which the citizens of Pecos, Tex., raised a $100,000 bonus last December and which is opening up a new irrigated agricultural section for settlement and development.

Announcement has been made that the Texarkana Electric Street Ry., W. L. Wood, Manager, Texarkana, is to double track its line through the business part of the city, and also build a 2-mile extension.

The Santa Fe System has arranged to purchase two new 125-hp. boilers, to be installed at Silsbee, Tex. A steel tank and crane is to be erected by the Santa Fe System at Alven, Tex. The estimated cost is $5,500.

The Santa Fe System will build additional tracks at Fort Worth, Tex., at a cost of $12,500. This work will be principally an enlargement of the stockyard tracks.

The Santa Fe will soon construct a track scale and 600 ft. of scale track at Lakeside, Tex., at an estimated cost of $4,500.

The Santa Fe System has appropriated $52,500 for the purchase of new tools and machinery to be distributed as follows: Temple, Tex., $42,900; Silsbee, Tex., $3,100; Cleburne, Tex., $4,000, and Amarillo, Tex., $2,500.

Utah.

The Denver & Rio Grande Ry. has made surveys for an extension of its line to St. George, and seriously contemplates constructing the extension.

It is rumored in railroad circles that the Denver & Rio Grande R. R. will build a new line from Lehi, Utah, south passing through Saratoga Springs, Mosida and into Goshen Valley, shortening the route to Eureka by several miles.

Vermont.

Preliminary surveys have been completed for the proposed railroad of the Rutland & Montpelier R. R. Co. from Montpelier, Vt., across the state to Rutland, Vt. The route as surveyed measures 86 to 87 miles and the maximum grade secured is said to be 80 ft. to the mile. A rough estimate places the cost of constructing the road at $40,000 to $50,000 per mile. The route as surveyed runs from Montpelier through the towns of Middlesex, Moretown, Warren, Waitesfield, Granville, Rochester, Stockbridge, Pittsfield, Mendon gap, Chittenden, Mendon to Rutland. The surveys were made by R. P. McCormick, Chief Engineer of the Harrison Engineering Co., New York City.

Virginia.

The Chesapeake & Ohio Ry., is reported to be planning to extend its Big Sandy Branch from its present terminus near the Buchanan County line in Virginia along Lavisa fork of the Big Sandy to the properties of the New River and Pocahontas Consolidated Collieries Co. and the Mason Coal & Coke Co. in Buchanan County, and on to the Mouth of Garden, 19 miles by county road from Richlands. No information is available as to when the work is to be started, but inasmuch as surveys were recently made of the Big Sandy it is generally believed that construction will be started in the spring.

The Carolina, Clinchfield & Ohio Ry. is making surveys between Elkhorn City and Keiser, Va., on the Norfolk & Western Ry. No definite decision, however, has been reached as to whether construction will be undertaken at this time.

Washington.

The City Council of Bellingham has given its approval to the franchise of the Skagit-Bellingham Interurban Ry. This assures the construction of the road, which will be 30 miles long, and will extend between Bellingham, Burlington, Mount Vernon and La Conner. It will cost $1,500,000. The road will be constructed for the Stone & Webster Engineering Corporation, whose Washington offices are in the White Bldg., Seattle.

Application is to be made to the County Commisisoners at Seattle for a franchise for a suburban railroad to tap the valley between Kirkland, on the east shore of Lake Washington, and Cherry Valley, at the border line of Snohomish and King Counties. A private right of way is said to be practically assured and a franchise has already been obtained from Kirkland for terminals and use of city streets. The length of the line is 40 miles. Gasoline engines will be used. James Campbell, Seattle and Burke & Farrer, Seattle, are interested.

Articles of incorporation have been filed by the Spokane, Portland & Northern Ry., Spokane, Wash., which proposes the construction of an electric or steam road from Spokane to Bridgeport, thence to Deffin's Ferry and on to the international boundary near Nighthawk in Okanogan County. The incorporators are A. M. Dewey, E. P. Spauling, S. A. Skinner, George D. Needy, A. M. Spauling and Arthur B. Lee, all of Spokane, Wash.

At a meeting recently held at Twisp, Wash., citizens of Methow Valley took up the matter of organizing a company to construct a railroad in that section. The promoters state that such a road as would meet all present requirements would cost $9,000 per mile. Farmers in the valley will take stock in the line and pay for it by grading a portion of the road.

The Northern Pacific Ry. Co. has completed surveys for the construction of a line to Glacier, Wash., to serve the same territory as that of the Bellingham, Bay & British Columbia Ry.

An official of the Chicago, Milwaukee & Puget Sound Ry. is quoted as stating that the branch into Olympia, Wash., will be completed within the next 18 months. Two routes have been surveyed into that city, one follows the west shore line from Tumwater, crossing the Northern Pacific tracks near the bridge, thence along Water St. to First, swinging off towards the east side where the old Union Pacific right of way is followed through the city park.

West Virginia.

The Buckhannon & Tygarts River R. R. Co., of Buckhannon, W. Va., has been incorporated with a capital stock of $25,000, and proposes to build a line from near the town of Parsons in Randolph County to Huttonsville, in the same county. The incorporators are U. G. Young, Henry Spies, J. W. F. Stone, G. M. Fleming and C. E. Hiner, all of Buckhannon.

The Braxton Splint Coal Co., of Gassaway, W. Va., recently incorporated with a capital stock of $300,000, according to its articles of incorporation can mine coal, manufacture coke, build railroads and tramroads, and drill for oil and gas near Frametown, in Braxton County. The incorporators are Allen H. Fitzer, Galion, O.; Neal Meiser, Don M. Osborne, H. C. Bradley and George G. Meier, all of Cleveland, O.

It is now given out that the route of the proposed extension of the Coal & Coke Ry. will connect with the M. & K. at or near Rowlesburg, and run over the lines of the M. & K. to Albrights, Kingwood, Reedsville, Masontown, Morgantown, and thence to Pittsburg. In addition to this a line will be extended down on the east side of Cheat River from Trowbridge's Ferry through Pleasant Grant Districts to Point Marion.

Wisconsin.

The Chicago, Milwaukee & St. Paul Ry. is reported to have plans under way for a new passenger station to be built in Milwaukee some time within the next year. The yards of the company will also be enlarged. The railroad company is reported to be figuring on spending at least $2,000,000 in new depot and yards.

Wisconsin.

The Badger Railway & Light Co. has been incorporated and proposes to build an electric line on the old "air line grade" from Lake Geneva through Elkhorn to Whitewater and possibly on to Fort Atkinson. The road bed was graded practically all the way through about 50 years ago. John I. Beggs, Milwaukee, Wis., is reported to be back of the company.

Nels Larson, Rice Lake, Wis., has been awarded a contract for grading five miles of railroad for the Willow River Lumber Co. The work is located near Ashland, Wis.

Canada.

The Canadian Northern Ry. has completed its land purchases for its right of way between Ottawa and Toronto, via Smith's Falls. The railway will start building its new line this fall from the Ottawa end.

Engineers in the employ of Mackenzie & Mann, Toronto, are said to be going over the proposed route of the Alberta & Great Waterways Ry. with a view to estimating the probable cost of constructing the line and the securing of the best and most direct route to Fort McMurray. This leads to the belief that the Canadian Northern interests will take over the Alberta & Great Waterways Ry. project and will build the line for the Provincial Government, and in all probability either buy it outright from the Government or else operate it on a long-term lease.

David McBeth, according to advices from Nelson, B. C., has taken a sub-contract on the Kettle Valley Lines for the clearing of the right of way between Rock Creek and Beaverdale, a distance of about 25 miles. He expects to have the work completed by March 1 next.

The Canadian Northern Ry. has announced built at Courtenay Bay. Extensive construcits route to Vancouver Island. By a coincidence the announcement was made simultaneously with the announcement by the Canadian Pacific of the immediate beginning of construction to Cowichan Lake. It will be a race between these rival roads to that great timber area. The Canadian Northern plan is to extend from end to end of Vancouver Island.

The City Council of Toronto, Ont., by a vote of 12 to 9 decided against the purchase of the Toronto Ry. Co. by the city.

It now looks as though the construction of the Canadian Northern line from Winnipeg, by way of the Brokenhead River, to Fort Alexander, is to be comemnced shortly. Representatives of the railway are now purchasing the property necessary for a right of way from Bird's Hill through Selkirk.

Bids are asked until Nov. 10, by H. B. Walkem, Acting Division Engineer, Canadian Pacific Ry., Calgary, Alberta, for the erection of timber trestle at Mileage 53.7, Crows Nest Sub-division. Maximum height, 115 ft., length, 750 ft. Plans and forms of tender on file at following offices: Assistant Chief Engineer, Winnipeg; Division Engineers, Moose Jaw and Calgary; Resident Engineer, Cranbrook.

Andrew McGinnis, contractor for five miles of the Canadian Northern through and to the west of Belleville is now working 80 men and 24 teams and if the weather is favorable expects to complete grading early in December.

The Canadian Northern Ry. has been granted permission to construct a subway at Coburg, Ont. The Grand Trunk Ry. is also to construct a subway. The subways will be where the railways cross Division St. and about 600 ft. apart.

Borings have been started at St. John, N. B., on the site of the first two docks to be tion work is expected to begin in the early spring to provide terminal facilities for the Grand Trunk Pacific. It is now certain that part of that line through New Brunswick will be operated next spring.

Mexico.

Plans and specifications have been completed by engineers for the construction of the proposed new railroad from Tepehuanes to Guanacevi, both in the state of Durango, Mex. Providing the canvass for freight is favorable, work will be commenced at once. The line will be approximately 75 miles long.

Advices from Guanajuato, Mex., state that the San Gregorio R. R., twenty-five miles long, owned by Dwight Furness and associates, is to be abandoned, after playing an important part for many years in the development of mines in this district. It was planned a few years ago to extend the road to Irapuato and make it a part of the old National Railroad, but the purchase of the Mexican Central Railroad by the government and its merging into the National Railways of Mexico, put an end to the extension project. Its traffic has fallen off to such an extent that its abandonment has been decided upon. The track will be taken up and sold with the rolling stock.

A banking association of Sonora, Mexico, has been granted a concession for a line from Kino Bay on the Gulf of California through Hermosillo, to Ures. The concession is for 99 years, and calls for the completion of 25 miles of the railway within 18 months, and the remainder within four years. The same concessionaires have asked for a supplementary concession to extend this line north from Ures, Sonora, through Arizpe, to Agua Prieta on the international line.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

Surveys have been made by J. W. Kaerth, Colusa, for levee improvements in District No. 108 of Colusa. About $125,000 is to be expended in this district.

The city of Sacramento will hold an election Nov. 17 to vote on issuing bonds for river improvement work. An election will also be held Nov. 18 to vote on raising $50,000, to be used to raise the north levee from Front to 16th St. to a point 5 ft. above high water mark, to correspond with the rest of the city's levee protection.

Colorado.

George B. McFadden, Denver, Colo., has filed statements and maps with the County Recorder at Greeley, for the projected Jersey canal. The statement calls for the expenditure of $1,073,000 in taking the canal through Washington, Morgan and Weld Counties, to take the water from the South Platte River to the Roosevelt and other reservoirs that will be constructed along the Cache la Poudre.

Illinois.

The following list of drainage and levee districts in Illinois was compiled by the Harman Engineering Co., Peoria, for the Peoria Herald-Transcript: Hennepin drainage and levee district, Putnam County, Ill., 2,500 acres, now under construction; Partridge drainage and levee district, Woodford County, Ill., 3,000 acres, cost $100,000, nearly completed; East Peoria drainage and levee district, Tazewell County, Ill., 750 acres, cost $55,000, organized but work not started; Pekin and LeMarsh drainage and levee district, Peoria County, Ill., 2,600 acres, cost $100,000, levee completed 1889—first pump installed 1904—levee rebuilt and new pump installed 1907; Spring Lake drainage and levee district, Tazewell County, Ill., 14,000 acres, cost $300,000, nearing completion; Banner Special drainage and levee district, Peoria and Fulton Counties, Ill., 5,000 acres, cost $150,000, organized but construction not begun; Lacey drainage and levee district, Fulton County, Ill., 5,700 acres, about 1893 and first pumping plant installed 1900, second pumping plant installed about 1906; Coal Creek drainage and levee district, Schuyler County, Ill., 7,000 acres, original work completed 1898, ditches rebuilt 1909; Crane Creek drainage and levee district, Schuyler County, Ill., 5,000 acres, cost $135,000, nearing completion; Meredocia drainage and levee district, Morgan County, Ill., 5,000 acres, cost $101,000, about 1904, pumping plant capacity now being doubled; Magee Creek drainage and levee district, Brown County, Ill., 12,000 acres, 1908; Scott County drainage and levee district, Scott County, Ill., 12,000 acres, cost $168,000, organized about 1½ years ago but work not started; Big Swan drainage and levee district, Scott County, Ill., 12,000 acres, cost $200,000, 1908; Hillview drainage and levee district, Scott and Greene Counties, Ill., 11,000 acres, cost $275,000, 1909; Hartwell drainage and levee district, Green County, Ill., 12,000 acres, 1907, levees were rebuilt after being broken by high waters of 1902 and 1903; Keach drainage and levee district, Greene County, Ill., 10,000 acres, levees were completed 1908 and pumping plant recently installed; Eldred drainage and levee district, Greene County, Ill., 9,000 acres, cost $250,000, now under construction; Nutwood drainage and levee district, Jersey and Greene Counties, Ill., 11,000 acres, cost $279,000, 1910.

H. S. Walter, Cisco, Ill., has been awarded the contract at $8,600 for furnishing the labor and materials for constructing ditches and five retaining walls for the Nixon Special Drainage District of Dewitt and Macon Counties, Ill.

Indiana.

The citizens of English, Crawford County, have started a movement to straighten a branch of Blue River and remove the obstruction in the river below the town in order to avoid the recurring freshets and overflows. English is the county seat of Crawford County.

Kansas.

Bids were opened Oct. 24 by the Kaw Valley Drainage District of Kansas City, Kan., on the $1,250,000 project of erecting dikes and revetments along both sides of the Kaw River from the mouth to Turner, Kan., a distance of 10½ miles. The following contractors bid on the work: Callahan Bros., of Omaha, McGuire, Stanton & Jones, Leavenworth, Kas.; George Forrester, Kansas City; Edward Crebo, Kansas City; W. B. Carmichael, St. Louis; De Witt & Shobe, Glasgow, Mo.; Burke & Joseph, Cape Girardeau, Mo.; Joyce Bros. & Bagwell, Keokuk, Ia.; Midland Bridge Company, Kansas City.

Louisiana.

Contracts for levee work in the Lower Tensas Levee District, bids for which were opened Oct. 13, at New Orleans, La., have been let as follows: Evergreen Levee, 106,000 cu. yds., O. A. Gibson, ,Natchez, Miss., at 19 cts.; Harpers Levee, 36,500 cu. yds., E. H. Jackson, Natchez, Miss., at 12.9 cts.; Kempe Levee, 96,500 cu. yds., Grassmere Levee, 102,500 cu. yds., Pittsfield Levee, 103,500 cu. yds., Hearin & Ryan, Baton Rouge, at 12.39 cts.

The St. Charles Land Co. is planning the construction of a reservoir system in connection with the reclamation of 7,500 acres near Keener, La. The reservoir system will consist of a series of canals and ditches which take care of the surplus or run-off from the rainfall and store a portion of the same, as well as conduct such run-off to the pumping plant. It will be two or three months before any contracts will be let, then the contracts will be for dredging and leveeing, while some time later the contracts will be let for the pumping plant. John A. Kruse, 706 Gaff Bldg., Chicago, Ill., is the Consulting Engineer.

Missouri.

The County Court at Palmyra has created the Fabius River Levee and Drainage District, and steps will be taken to construct a levee. The territory to be protected by the levee will embrace all of that south of the north line of Marion County which is several miles north of Quincy and as far south as the Fabius River. The levee on the north end will end as far back as Taylor, Mo., or nearly to the bluffs. It is thought that a total of about 11,120 acres of land will be reclaimed.

Nevada.

P. Anker, Lovelock, Nev., has purchased a clam shell dredge, which will be used for the construction of irrigation canals by the Lake Shore and Irish-American ditch companies. Through a compromise, the above companies will divert water from the dam of the Old Channel Ditch Co. This makes necessary the construction of several miles more of ditch, and the dredge is for this purpose. It will also be used for the construction of ditches for a number of the farmers of the lower valley.

New Mexico.

Farmers in Estancia Valley east of Albuquerque, N. Mex., are advocating the establishment of a system of pumping for irrigation, and negotiations are now in progress with the Albuquerque electric light company to furnish power over a 40-mile transmission line.

New York.

✣Bids are asked until noon, Nov. 7 (instead of Nov. 17 as noted in our Oct. 19 issue) by Col. W. M. Black, U. S. Engineer, Army Bldg., 39 Whitehall St., New York, for dredging and rock removal in Port Chester Harbor, N. Y., and in harbor at Echo Bay, N. Y. The work at Port Chester Harbor is situated between the southerly end of Fox Island and Studwell's dock, and embraces eleven areas of rock excavation of varying lengths and breaths, requiring the removal of approximately 10,000 cu. yds. of ledge rock, place measurement, to secure a depth of 10 ft. at mean low water. It is intended to remove about 4,500 cu. yds. of ledge rock, place measurement; about 7,000 cu. yds., scow measurement, of material other than ledge rock, bowlders and broken rock; and probably bowlders and broken rock to the amount of about 50 cu. yds. The proposed work at Echo Bay Harbor is situated off Duck Point and Hudson Park and extends from 10 ft. mean low water contour a distance of about 1,300 ft. to immediately above Hudson Park, and consists in making a channel 100 ft. bottom width somewhat increased at the bend and at the inner extremity of the channel, by the removal of about 1,000 cu. yds. of ledge rock, place measurement, and about 22,000 cu. yds., scow measurement, of other material than ledge rock.

The State Canal Board has adopted a route for the rebuilding of the Cayuga and Seneca Canal and has directed Frank Williams, State Engineer, Albany, N. Y., to prepare plans and specifications for contracts. It is believed that this can be done so that the contracts for the work may be awarded before Jan. 1, 1911. The route selected follows the line of the old Cayuga and Seneca canal through the Seneca River valley and will make Waterloo and Seneca Falls barge canal ports. The work will be done under the constitutional amendment appropriating $7,000,000. The cost of the work by the route selected was placed at $5,600,000.

The State Canal Board has approved the revised specifications and estimates for contract No. 37 for the improvement of the Oswego River from Fulton to Oswego. This contract includes the construction of a new "high dam" near Oswego and a new dam at Minetto. The contract was originally advertised in September, but no bids were tendered. The plans for the work have not been changed, the locations and crest elevations of the dams remaining as originally planned. Bids are now being asked for the work which will cost about $1,500,000.

With the exception of a 20-mile section between Clyde and Palmyra, and the Medina arch, the entire work on the Erie canal improvement is either under way or completed. The Medina arch is to be one of the largest concrete arches extant, and tests of material and construction have been made by State Engineer Frank Williams for more than a year. The plans for the Wayne County stretch in the Erie canal are now under preparation, and will be ready for the action of the canal board and submission to contractors in a short time. It is also expected that the Medina arch contract will be ready for the contractors' estimates by the end of the year.

Pennsylvania.

The committee of seven appointed to represent the Atlantic Deeper Waterways Association and the Citizens' Committee of New York, New Jersey, Pennsylvania and Delaware, organized to obtain data as to the proposed canal connecting New York and Delaware Bays, has decided to ask Colonel Black, of the United States Engineers at New York, to hold open his inquiry until Jan. 1. The committee has elected Prof. Emory R. Johnson, of the University of Pennsylvania, chairman, and Wilfred H. Schoff, of the Philadelphia Museums, secretary. A sub-committee, consisting of Wilfred H. Schoff, Philadelphia, Prof. Johnson and George F. Sproule, was appointed to formulate plans and draft a report. The work of the sub-committee will consist of obtaining comparative figures on railroad tonnage and documented and undocumented freight rates by water carriers.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

Carey Brothers state that they will remove their team forces from the Shelby County road work, which they recently sub-let from Bob Cheshire, and will place a drag line machine on the contract instead of the mules. It has been found by the boys that the scraper bucket equipment will prove a much better paying proposition on this particular piece of work.

C. C. Aderholdt will soon be in the market for some grader work. He is rolling up many yards of earth on his Sunflower levee contract and will have same finished by Dec. 15th. Charlie uses a traction engine to pull his grader.

Russell Martin has asked bids on approximately 7,000 cu. yds. of gravel to be spread on various streets through his new sub-division. He has also requested bids on a concrete surface for Bellevue Ave. between Lamar and Walker.

Quinn Corey is still at work with his outfit in Birmingham, Ala., and reports operations going on very nicely. Quinn's hustling qualities has brought him much success within the past few years and he bids fair to keep up the good work for many years to come.

It now seems an assured fact that the Illinois Central, in conjunction with the Rock Island and Frisco lines, will erect a $1,000,000 station in Memphis within the near future. It is stated that work will begin before the end of the present year. It is understood that the old Union Station walls will be used for partitions where possible, or in other words, the new depot will be built around the present one. There will be about 40,000 cu. yds. of grading to be done before work of erecting the building can begin.

Sam Bush has begun his Missouri levee contract, his outfit having arrived several days ago from Gatesville, Texas, where it had been at work on a railroad contract. Sam's present address is Crosno, Mo.

T. A. Garvin has been awarded a sewer contract in this city near the intersection of McLemore Ave. and the Belt Line. Tom has been very lucky in securing some good contracts of a like nature this season, all of which he has finished in good time.

Jesse Nickols of levee building fame has taken contract from the city of Memphis to dig a one-mile ditch just north of Poplar Ave. to take care of the storm drainage of that street. Jesse states he will begin work at once and will place practically all of his forces on the new contract.

J. W. Williams has been given contract by the Snowden estate to improve certain pieces of property in southeast Memphis. Mr. Williams has just finished a subway proposition for Jimmie Omberg, who has contract for the Union Station culvert and subways.

The various contractors in this section were given quite a scare last week when the federal court enjoined 144 saloons in Memphis from selling liquor and for a time it looked as if the injunction might be made permanent when it would reach out and finally include all saloons in the city. However, last Friday Judge McCall decided that the matter was one for the city itself to cope with and dissolved his temporary injunction. All the saloons which had been closed for six days immediately opened their doors again. There is no doubting the fact that had the saloons been forced to close their doors permanently in this city it would be a big blow to the contractors, because it seems impossible to get labor to come to a town where they can't get their drink. It is hard enough now to get sufficient labor to carry on all the work in and contingent to this section and certainly should the liquor laws be enforced, it would work a serious hardship on those who look to Memphis for their common laborers.

Jim McClavey is preparing to move his outfit from Rosedale, Miss., to a piece of levee work near Cottonwood Point, Ark., he having about completed his large job for the Mississippi Levee Board near Rosedale.

Tim Shea, superintendent for J. T. Walsh & Bro., at Cape Girardeau, Mo., reports excellent progress of his forces at the latter place and expects to finish his contract on good time. When it comes to moving dirt, Tim is there with the goods.

Glenn Donelson has accepted a position with Roach & Stansell at Clay, Tex., and writes to some of his Memphis friends of the good work all the outfits are doing on Brazos River.

Jim Lewis is hard at work on the Sunflower levee below Memphis and so far has been very successful with his contract. It's hard to beat Jim at levee building.

The Jennings boys, with their entire outfit, are still on the Riverton loop, but will soon be ready to move on some of their other contracts. Their address is Rosedale, Miss.

Mike Roach has moved one of his outfits to Hard Bargin, Miss., where he is building a levee for the Mississippi Levee Board. Chris Collins is in charge of operations.

Helgason Brothers, of Vicksburg, Miss., were awarded the 200,000 cu. yds. of levee work let by Capt. Clarke S. Smith at Vicksburg on Oct. 26. Their price was 14½ cts. The work is in the Lower Yazoo U. S. Government district just below Rosedale, Miss., and is all riverside enlargement. The upper section is through timber, while the lower end is through an open field with but a few standing trees in the way. It is a long time contract, the time limit being January 1st, 1912. Helgason Bros., in conjunction with Clarke & Co., also of Vicksburg, are building a new loop for the Government just above Tyler, Mo.

Texas.

Arthur A. Stiles, State Levee and Drainage Commissioner, Austin, Tex., is now finishing the last of the hydraulic field measurements of the levee work in the following counties: Dallas, Collin, Kaufman, Rockwall, Waller, Grimes, Washington, Brazoria, Burleson and Milam. Final computation will be made sometime this month, and the entire work will be finished by Jan. 1, when all reports of the levee and drainage department will be delivered to the governor.

Wyoming.

The Wyoming Development Co., J. C. Hadsall, Engineer, Wheatland, Wyo., received bids last week for the blasting and removing of approximately 2,500 cu. yds. of rock from the company's tunnel, located in Section 36, Tp. 23, N., R. 72 W.

Utah.

The Weber-Davis County Canal Co. has work well along on the concreting of its irrigation canal. In connection with the work in the Weber Canyon it will be necessary to do considerable blasting, and plans are under consideration for removing some 10,000 tons of rock in this way. W. M. Bostaph, Ogden, Utah, is Chief Engineer.

Items marked thus ✣ indicate work now open for bids.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

The Peoples Oil & Gas Co., according to advices from Birmingham, Ala., has been receiving bids on the laying of about 140 miles of main from the company's fields at Fayette to Birmingham and to Columbus, Miss., and other points that are to be supplied with natural gas by the company. The construction of the mains will involve the installation of reduction plants at all points of distribution. It is stated that the gas will reach Birmingham and Columbus under pressure that will be too high for practical purposes until reduced. It is estimated that the mains can be completed to both cities within 90 days after ground is broken. Dr. G. B. Crowe is President of the Peoples Oil & Gas Co.

Following bids were received and opened by 1st Lieut. Frederic H. Smith, Coast Artillery Corps, Constructing Quartermaster, U. S. Army, at Fort Hancock, N. J., on Oct. 25, for construction, plumbing, electric wiring and fixtures of one set quarters for civilian employees at Fort Hancock: Construction proper—The M. McManus Contracting Co., Philadelphia, Pa., $7,102 per plans and specifications, $7,392 with brick foundation, $7,392 with tile roof; Robert J. Walsh, Highlands, N. J., $5,785 per plan and specifications, $5,710 with brick foundation, $5,885 with tile roof; Geo. W. Wines, East Quogue, New York, $5,888 per plans and specifications, $5,888 with brick foundation, $6,038 with tile roof. Plumbing—The McManus Contracting Co., $650; Hines & Hammer, Long Branch, N. J., $604 using Federal-Huber fixtures, $583 using J. L. Mott fixtures, $575 using Haines, Jones & Cadbury fixtures; Robert J. Walsh, Highlands, N. J., $715 using Mott fixtures, $700 using H. J. & C. fixtures; Geo. W. Wines, East Quogue, N. Y., $590 using John Douglas Co. fixtures. Electric wiring and fixtures—Elmer E. Lowell, Portland, Me., $187 wiring, $127 fixtures; Robert J. Walsh, Highlands, N. J., $265 wiring and fixtures complete; Geo. W. Wines, East Quogue, N. Y., $265 wiring, $150 fixtures. Construction, plumbing, electric wiring and fixtures—Robert J. Walsh, Highlands, N. J., $6,725.

Arizona.

✣Bids will be received until 11 a. m., Nov. 2, by Capt. W. C. Babcock, Quartermaster Fort Huachuca, Ariz., for constructing coal shed at Fort Huachuca, Ariz.

Arkansas.

The Arkansas Pipe Lines Co., of Little Rock, Ark., has been incorporated. The object of the company is the development and production and marketing of mineral oil, petroleum and natural gas in Arkansas. The capitalization is $25,000. The officials and incorporators are: George J. Wolf, President; A. B. Dally, Jr., Vice-President; W. B. Smith, Secretary and Treasurer; F. H. Garrott and Mr. Trieber.

California.

✣Bids will be received until 11 a. m., Dec. 1, by Capt. W. P. Stokey, U. S. Engineer, 723 Central Bldg., Los Angeles, Cal., for extending shoreward the breakwater at Los Angeles harbor, Cal.

✣Bids will be received until 3 p. m. Dec. 5, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus and electric conduits and wiring of the United States Post Office at Santa Cruz, Cal.

The Mount Shasta Power Co., San Francisco, has work well along on a 6½-mile tunnel which is being driven through the mountains from Montgomery Creek, where a big power plant is to be located, to the Big Bend of Pitt River, where the tunnel will have its intake. Jean Worley and T. J. Worley are the contractors.

The Board of Public Works, of Los Angeles, has awarded a $5,000 contract for furnishing creosoted piling for the municipal wharf to be constructed at Wilmington to the Pacific Creosoting Co. Bids will be received next month for the actual construction of the proposed wharf which is to be constructed at the foot of Fries St. in front of Wilmington proper.

Delaware.

✣Bids are asked until noon, Nov. 15, as previously noted, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Mispillion River, Delaware. The amount of money available for the work is about $13,500. It is proposed to dredge, as far as available funds will permit, in the river a channel 6 ft. deep and 60 ft. wide, widening at sharp turns, between the head of navigation at Milford and the mouth of the river, a distance of about 13 miles, and to redredge the channel across the flats at the mouth 4 ft. deep and 100 ft. wide to the 4 ft. contour of Delaware Bay, a further distance of about one mile. The depth of cutting will be from 0 to 5 ft. The material is believed to be mud, sand and gravel.

District of Columbia.

✣ Bids will be received until 2 p. m., Nov. 8, by Commissioners of the District of Columbia, Washington, D. C., for the construction of a chemical engine house at Pennsylvania Ave. and 28th Place southeast, Washington, D. C.

✣Bids will be received until 2 p. m., Nov. 15, by Commissioners of the District of Columbia, Washington, D. C., for furnishing and delivering during the remaining portion of the fiscal year ending June 30, 1911, 15,000 ft. more or less of 2½ in. cotton covered rubber lined hose for use in the fire and other departments of the government of the District of Columbia.

✣Bids will be received until Nov. 4, by Capt. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Zone Requisition, 4802-A, two hoisting engines, three drum with boiler and swinging gear.

Florida.

The following bids were received Oct. 20 by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for dredging in the Caloosahatchee River, the work including 355,000 cu. yds.: Southern Dredging Co., of Galveston, Tex., for Sections A and B, 18 cts.; Sections D, E and F, 11 cts.; total, $49,900. The Home Dredging Co., of Mobile, 17 cts. for the first and 14½ cts. for the second, making a total of $55,350. Hillsborough Dredging Co., of Tampa, 16½ cts. for the first division and 14 3-10 cts. for the second; total $54,175. The Southern Dredging Co., of Mobile, 17 95-100 cts. for the first and 15 7-10 cts. for the second, making a total of $59,222.

Georgia.

✣Bids will be received until noon, Nov. 12, by Board of Trustees of Grady Hospital, Atlanta, Ga., for the construction of the Grady Hospital Building, as per plans and specifications prepared by King & Walker, architects, 90 N. Forsyth St., Atlanta, Ga.

✣Bids will be received until 11 a. m., Nov. 21, by Major G. G. Bailwy, Chief Quartermaster, Department of Gulf, Chandler Bldg., Atlanta, Ga., for the construction of superintendent's lodge, outbuildings, roadway, sidewalk, inclosing wall, entrance gate, rostrum sewer and water supply, at Shiloh National Cemetery, Pittsburg Landing, Tenn

Hawaii.

The following bids were received Oct. 14 by Major Winslow, U. S. Engineer, Honolulu, for placing rock in the Hilo Breakwater: Substructure—Lord & Young, $1.84 per ton; Morgan Engineering Co., $2.35; D. E. Metzger, $2.85. On the superstructure D. E. Metzger bid $2.85. For placing stone in the Kahului breakwater the Kahului R. R. Co. bid $1.85 per ton.

Illinois.

Work has been started laying a 6-in. pipe line from the Sandoval oil field to a connection with the main line north of Vandalia. W. D. Loftus, Post Office Bldg., Vandalia, is in charge of the work.

Indiana.

✣Bids will be received until 2 p. m., Nov. 7, by Commissioners of Grant County, at Marion, Ind., for metal equipment for Auditor's office. A. Y. Stout is Auditor of the county.

✣Bids will be received until 10 a. m., Nov. 30, by Board of Public Works, Indianapolis, Ind., for the interior decorations of new City Hall building.

✣Bids will be received until 10 a. m., Nov. 3, for Depot Quartermaster, Jeffersonville, Ind., for furnishing miscellaneous supplies under Schedule No. 568.

The Commercial Club of Richmond, Ind., is back of a project for the construction of a lake and park at Richmond. It is proposed to sell $50,000 of stock. It is planned to construct a lake about a mile in length and to establish a summer resort.

Iowa.

Utt Brothers, 108 La Salle St., Chicago, Ill., are to have the dam in the Skunk River at Oakland Mills, about six miles southwest of Mt. Pleasant, Ia., rebuilt. The old dam at Lowell is also to be rebuilt and power plants established at both places. L. J. Hyland, who has been at Mt. Pleasant, Ia., for some months, will superintend the work.

Kentucky.

The Board of Public Works of Louisville, Ky., is to at once call for bids for furnishing street signs. The estimated cost of the contract is $15,000. Specifications were prepared by Roy W. Burks, First Assistant Engineer of the Boad of Public Works of Louisville.

The Ayer & Lord Tie Co., Chicago, Ill., is to build docks at the foot of Jefferson St., Paducah, Ky. Work is to be started shortly.

Louisiana.

✣Bids will be received until 11 a. m., Dec. 3, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for furnishing two 300 h. p. boilers, piping, economizer, flue, boiler feed pumps, motor generator set, wiring, etc., at the United States Naval Station, New Orleans, La.

Maine.

Bids as follows were received Oct. 18 by Lt.-Col. W. E. Craighill, U. S. Engineer, Portland, Me., for dredging in Pepperells Cove, Me: (1) dredging, per cu. yd.; (2) boulders, per cu. yd.; Eastern Dredging Co., Boston, Mass., (1) 16.2 cts., (2) $8; Bay State Dredging Co., Boston, Mass. (1) 18.3 cts, (2) $10; Charles M. Cole, Fall River, Mass., (1) 20 cts, (2) $10; Daly & Hannan Dredging Co., Ogdensburg, N. Y. (1) 22 cts., (2) $12.

Maryland.

The American Telephone & Telegraph Co., New York City, has a large gang of men at work in Cecil County, Maryland, laying creosoted timber casing for a conduit system between New York and Washington.

The Maryland Dredging Co., of Baltimore, Md., has been awarded the contract to remove 400,000 cu. yds. of material from the cutoff channel leading to Baltimore. The bid for the work was $75,000.

The Furst-Clark Construction Co., of Baltimore, Md., a subsidiary company of the Maryland Dredging & Contracting Co., has purchased the entire equipment and good will of the International Contracting Co., of New York. The latter corporation has been in business about 18 years and owns five dredges and

Items marked thus ✣ indicate work now open for bids.

18 scows, as well as a shipyard and machine shop at Bayonne, N. J. The new equipment thus acquired by the Furst-Clark Co. will enable it to give employment to about 300 additional men. After completing a number of contracts which the International Co. had on Long Island, amounting to about $150,000 worth of work, most of the dredges and scows will be used by the new owners on the extensive Cape Cod Ship Canal contract, which they have well under way. The Cape Cod canal work necessitates eight miles of land excavation and an equal distance of dredging. There are now 500 men engaged on the work, while six dredges and two land excavating machines are in daily use, with three additional dredges to be placed in operation shortly.

Massachusetts.

✣Bids will be received until noon, Nov. 23, by Col. F. V. Abbot, U. S. Engineer, Boston, Mass., for the dredging in Merrimac River, Mass.

Bids as follows were received Oct. 17 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing a pier between piers 4 and 5 at the navy yard, Boston: Riverside Construction Co., 39 Cortlandt St., New York City, $27,918; Luke B. Mullen, 161 Devonshire St., Boston, Mass., $32,900; Lawler Bros., 16 Clay Sq., Charlestown, Mass., $31,126; W. S. Rendle & Son, 135 Prescott St., East Boston, Mass., $31,122.61; W. L. Miller, 19 Mill St., Boston, Mass., $36,900 and $32,873; Rendle & Stoddard, 33 Border St., East Boston, Mass., $39,776; W. H. Keyes & Co., 95 Mill St., Boston, Mass., $36,801 and $43,801; W. H. Ellis, 18 Tremont St., Boston, Mass., $38,365.

Michigan.

✣Bids will be received until noon, Nov. 3. by the Board of Trustees, A. N. Lawrason secretary, 401 Glass Block, Lansing. Mich., for the construction of the Michigan Ave. M. E. Church at Lansing.

✣Bids will be received until 8 p. m., Nov. 3, by Board of Public Works, Grand Rapids, Mich., for chain grate stokers for combination pumping and lighting station for the city of Grand Rapids, Mich.

New Jersey.

✣Bids will be received until 3:30 p. m., Nov. 3, by Board of Street and Water Commissioners of the city of Newark, City Hall, Newark, N. J., for dredging along the docks of the Passaic River. Morris R. Sherrerd is chief engineer.

✣Bids will be received until Nov. 2 by E. Steeleman Royal, city clerk, Ventnor City, N. J., for furnishing and placing of concrete monuments. Plans and specifications are on file and can be obtained at the office of W. I. Risley, city engineer, 30 Real Estate and Law Bldg., Atlantic City, N. J.

✣Bids will be received until 8 p. m., Nov. 28, by Charles Anderson, borough clerk, South River, N. J., for the water tight and enduring construction of that one or those of the following sections into which the electric light, pumping and power plant and transmission line are divided as follows: Section I. Furnishing and setting 3 125 h. p. boilers and the piping in and about the power house, or, alternately, furnishing and setting 2 200 h. p. gas producers. Section II. Furnishing and installing 2 190 h. p. steam engines, or, alternately, 2 190 h. p. gas engines, together with the piping in and about the gas engine plant. Section III. The furnishing and installing 2 800,000 gal. steam pumps, or, alternately, 2 800,000 gal. power pumps, including all piping, valves and fittings to well. Section IV. Furnishing and installing 2 125 kw. electrical generators and equipment. Section V. Contracting radial brick chimney 100 ft. by 5 ft., or, alternately, a steel stack 25 ft. by 4 ft. and induced draft apparatus. Section VI. Constructing a covered suction well, complete except piping. diam. 32 ft., depth 33 ft., or, alternately, diam. 25 ft., depth 33 ft. Section VII. Furnishing and erecting a stand pipe 20 ft. by 100 ft. with ladders, automatic altitude valve and connection to main. Section VIII. Constructing the concrete foundation for the stand pipe. Section IX. Furnishing the material and erecting the building for the power plant, together with all wall and machinery foundations, sewers and conduits. Section X. Building electrical transmission line from the power house into the borough, a distance of about 9,000 ft.

Bids were opened Oct. 19 by Lt.-Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich. About $75,000 is to be expended. The bids received per 2,000-lb. ton for rock in place in the embankment were as follows: Thomas L. Burocher, Sault Ste. Marie, Mich., $0.99¾; Powell & Mitchell, Marquette, Mich., $1.3440; Francis L. McDonald, Duluth, Minn., $0.84 (recommended for acceptance); Alexander Sang, Duluth, Minn., $1.45; Great Lakes Dredge & Dock Co., Chicago, Ill., $1.75; Northern Dredge & Dock Co., Duluth, Minn., $1.67, and $1.56 for quartzite.

Mississippi.

Bids were received Oct. 20 by Capt. Clarke S. Smith, U. S. Engineers, Vicksburg, Miss., for constructing steel hull, self-propelling, hydraulic dredge, steel pontoons and pipe line, and also for the component parts. For the dredge plant, complete, including four pontoons and pipe line complete, Thomas M. Rees, P. O. Box 709, Pittsburg, Pa., bid $119,500 for delivery at Vicksburg and $117,000 for delivery at Pittsburg, Pa.; time in both cases was 300 days. For the dredge, without pontoons and pipe lines, and without pumping machinery, Mr. Rees bid $70,000 for Pittsburg delivery and $71,000 for delivery at Cairo, Ill. Bids as follows were received for furnishing parts of the dredge: The Norborn Engineering Co., 312 Deuckla Bldg., Philadelphia, Pa., main sand pump complete, $3,000; suction pipe and ladder, cutter head, gear and engine, winches, $16,500; American Bridge Co., Candler Bldg., Atlanta, Ga., dredge hull complete, $28,000 and $27,000; four pontoons and pipe line complete, $11,000 and $10,500. Mississippi Electric Co., Vicksburg, Miss., electric plant complete, $1,750.

Minnesota.

L. A. Ogaard, county surveyor, International Falls, Minn., is in Big Falls, Minn., making a survey of the route of the proposed Judicial Ditches No. 1 and 2, near this place. Ditch No. 1 will start from Section 19-66-26 and extend west through Dentaylow, a distance of about 15 miles to Nett River, with one branch running north to Cross River. No. 2 will start from Section 25, in Grand Falls township, and run south about 12 miles and empty into the Big Fork River in 155-26.

New Jersey.

✣As noted in our last issue bids are asked unitl noon, Nov. 22, by Col. Wm. T. Rossell, U. S. Engineer, 39 Whitehall St., New York, for dredging in Keyport Harbor, Matawan Creek, Raritan and South Rivers, Shoal Harbor and Compton Creek, and Cheesequake Creek, N. J. The Keyport harbor work requires the removal of mud, sand and clay, the sum of $16,000 being available for the work. For the Matawan Creek work the sum of $5,000 is available; the material is mud, sand and clay. The amount available for the Raritan River work is $18,000, and the material is mud, sand, clay and gravel. For the Smith River work the sum of $16,000 is available; the material is mud, sand, clay and gravel. The sum of $8,000 is available for dredging in Shoal Harbor and Compton Creek; the material is mud, sand and clay. For the Cheesequake Creek work the sum of $4,000 is available; the material to be removed is mud, sand and gravel.

✣Bids are asked until noon, Nov. 17, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., as noted in our last issue, for dredging Raccoon Creek, N. J. The approximate yardage of the contract is 75,700 cu. yds. of mud, sand and gravel.

New York.

The State Water Supply Commission has granted the Board of Water Supply of New York City the right to build a high pressure tunnel under The Bronx and Manhattan to Brooklyn. The Boroughs of Queens and Richmond are to be reached by pipes. The commission calls the plan a wise and economical one that is justified by public necessity. An issue of revenue bonds for $25,000,000 for the project was authorized several years ago by the Board of Estimate. The plans include the construction of a reservoir to hold between 400,000,000 and 500,000,000 gallons for city distribution. The plan which was presented to the State board proposes to run the high pressure tunnel into Manhattan, The Bronx and Brooklyn. From these boroughs pipes are to run to the other two boroughs.

The State Lunacy Commission, Albany, N. Y., has awarded to the R. T. Ford Co., of Rochester, a contract to build the kitchen and dining room buildings at the Central Islip State Hospital. The cost will be $132,000.

Progress reports on several of the contracts on the New York Aqueduct are given as follows in the Oct. 22 issue of Democracy: Contract 54. The heading at the portal is in 100 feet. At Shaft 1 head framing is nearly completed and cages are being assembled. Cages are in full operation at Shaft 2. The new offices of the Section Engineer on Palmer Ave. are now being occupied by himself and his assistants. Contract 23. Glyndon Contracting Co., contractor. The best record in grade tunnel excavation on this contract was made during the week ending Oct. 19, 1910, 42 ft. having been excavated from the north portal of Hunter's Brook tunnel. Contract 24. Bradley Contracting Co., contractor. Preparations were made to install cages in the uptake shaft of Croton Lake pressure tunnel. The concrete lining of Turkey Mountain grade tunnel was commenced and the laying of invert and arch masonry for the cut-and-cover section of the aqueduct begun. Contract 2. Charles W. Blakeslee & Sons, contractors. Croton grade tunnel has been practically holed through by top heading; all that is left is to break through the sod at the north portal. Concreting was continued on the cut-and-cover section of the aqueduct. Contract 55. Rinehart & Dennis Co., contractors. Concreting of the western cut-and-cover work was continued. Excavating was continued on Millwood, Sarles & Harlem R. R. grade tunnels and on the Reynolds' Hill grade tunnel. Excavating was begun at the south portal. Contract 53. Eumire & Hamilton Contracting Co., contractors. The first concrete arch for the cut-and-cover section of the aqueduct has been built. On Eastview grade tunnel excavating was in progress. Contract 54. George W. Jackson, Inc., contractor. At the Yonkers pressure tunnel good progress was made in the transition section which connects with the smaller diameter of the steel pipe siphon. In the west branch 35 ft. and in the center branch 140 ft. of excavation from the north portal was made during the week ending Oct. 19, 1910. Contract 68. T. A. Gillespie Co., contractor. At Hunters' Brook siphon the concrete covering is being placed. The delivery of pipe was begun at Fort Hill siphon and preparations are being made to test the steel pipe at Turkey Mountain siphon. Contract 9. John C. Rodgers. James M. Rodgers and John J. Haggerty, contractors. A record has been established in steam shovel excavation at Kensico reservoir. In an eight-hour day a 70-ton Bucyrus steam shovel located in Rye swamp has removed from a borrow pit 704 carloads, averaging about 4¼ yards per car, or a total of 2,988 cu. yds. The material was hauled an average distance of 600 ft. in three trains of eleven cars each and was then spread to an average depth of 12 ins. The work on the temporary reservoir and on the new State highway was continued.

North Carolina.

✣As previously noted bids are being asked by Capt. Earl I. Brown, U. S. Engineer, Wilmington, N. C., until noon, Nov. 12, for dredging in Smith's Creek, Harbor at Morehead City and Harbor at Beaufort, N. C. The work at Smith's Creek [illegible]

Items marked thus ✣ indicate work now open for bids.

10 ft. deep at mean low water and about 1,560 ft. long, varying in width from 800 to 150 ft.; also of some dredging in the existing 10 ft. channel from the wharves in Oriental to the Neuse River, a distance of about four-fifths of a mile. Little dredging is required in this channel. The work consists of straightening the channel at several places and removing a few shoals. The present depth in the bay in the town gradually decreases from 10 ft. at the channel end to about 2.2 ft. at the head of the proposed improvement. The amount of material to be removed is estimated at 130,000 cu. yds. of mud and sand. The work to be done at Morehead City consists of deepening the existing channel to a depth of 10 ft. at mean low water, with a width of 100 ft. for 2,800 ft. of its length, and a width of 200 ft. for 1,000 ft. of its length. The existing depth in the area to be dredged varies from 2.2 ft. to 7.6 ft. The quantity of material to be removed is estimated at 152,000 cu. yds. of mud and sand. The work to be done at Beaufort harbor consists of deepening the present channel to a depth of 10 ft. at mean low water, with a width of 60 ft. The minimum depth of the existing channel is about 3.5 ft. In the length of the area to be dredged (about 3.6 miles) a depth of over 10 ft. exists for a distance of about four-fifths of a mile, where no dredging will be required. The width of the existing channel varies from 100 to 300 ft. The amount of material to be removed is estimated at 221,408 cu. yds. of sand and mud mixed with shells.

Contracts for dredging in Shallowbag Bay, etc., bids for which were opened Oct. 10 at the U. S. Engineer's Office, Wilmington, N. C., have been awarded to the Miner Engineering Co., 530 Bond Bldg., Washington, D. C., as follows: Dredging 40,000 cu. yds. from Shallowbag Bay at 25 cts. per cu. yd.; 75,000 cu. yds. from South River at 14 cts.; 140,000 cu. yds. from Bay River at 12¾ cts., and 53,000 cu. yds. at 19½ cts. The material is mostly mud and sand.

Ohio.

✣Bids will be received until noon, Nov. 14, by Director of Public Safety, City Hall, Cleveland, O., for furnishing 100,000 ft. b. m. beech lumber.

✣Bids will be received until noon, Nov. 15, by Secy., Director of Public Safety, Cleveland, O., for furnishing the city of Cleveland, Department of Fire, with 5,000 ft., more or less, of two and one-half (2½) inch, internal measurement, of cotton, rubber lined fire hose, coupled, to weigh not less than 60 pounds to the section, without couplings; two and one-half (2½) inch couplings to be made of hard brass and to weigh not less than five and fourteen-sixteenths (5 14-16) pounds, Cleveland Fire Department standard, with Higbee thread. Plans and specifications may be seen and blank proposals can be obtained at the office of the Director of Public Safety.

✣Bids will be received until noon, Nov. 15, by Secretary of Director of Public Safety, Cleveland, O., for furnishing for the Department of Fire 2,000 ft. 2 conductor cable, made up of No. 16 B. & S. soft tinned copper wire, insulated with 1/16 inch wall of rubber, seamlessly applied; 5,000 ft. 4 conductor cable, made up of No. 16 B. & S. soft tinned copper wire, insulated with 1/16 inch wall of rubber, seamlessly applied; 1,000 ft. 6 conductor cable made up of No. 16 B. & S. soft tinned copper wire, insulated with 1/16 inch wall of rubber, seamlessly applied.

The Erie R. R. is to make dock improvements along the west bank of the river between Columbus Road and Center St., at Cleveland, O. The work will cost about $75,000.

Pennsylvania.

✣Bids will be received until 11:30 a. m., Nov. 5, by Board of Public Education, Philadelphia, Pa., for the construction of a 12 division building annex to B. B. Comegys school house, 51st St. and Greenway Ave., 40th section. Plumbing, carpentry, cement paving, iron gates and grilles, gas and steam fitting, etc. William Dick is secretary of the committee on property.

✣Bids will be received until noon, Nov. 7, by Philip Jones, Chairman of the Street Committee of Councils, Turtle Creek, Pa., for the construciton of retaining walls on Monroeville road, Stewart St. and Brown Ave.

✣Bids will be received until 11 a. m., Nov. 15, Chauncey H. Baker, Depot Quartermaster, Philadelphia, Pa., for furnishing and delivering at that depot 1,000 axes, 70,000 mosquito bars, single; 14,000 bedstead casters, 200 spade handles, 2,500 hatchet helves, 50 guidon staffs.

✣Bids wil' be received until 3 p. m., Dec. 9, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Carbondale, Pa.

Rhode Island.

✣Bids are asked until 2 p. m., Nov. 19, by Lt.-Col. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging in Newport Harbor, R. I. The work is located in Newport Harbor, R. I., and embraces that portion of the harbor lying east of the easterly line and south of the southerly line of the 18-ft. channel through the harbor. The approximate amount of material to be removed is 769,930 cu. yds. measured in place. It is intended to award the work as a whole to one bidder. The material to be removed is believed to be compact sand, gravel and clay overlaid by a small amount of mud, and containing some bowlders of varying sizes.

South Carolina.

✣Bids will be received until noon, Nov. 24, by Capt. E. M. Adams, U. S. Engineer, Charleston, S. C., for furnishing steel forgings, castings, etc., for Granby Dam, Congaree River, S. C.

Texas.

David M. Picton, Galveston, Tex., who was recently awarded the contract for the Aransas Pass improvement, has begun work. This contract is jetty work intended to make Aransas Pass a deep water port, and there will be used in construction of jetties about 12,700 tons of stone for new work on the south jetty and about 22,000 tons of repairs to the north jetty. The contract amounts to about $110,000.

W. C. McLelland, 513 Commercial Bank, Houston, has been advertising for a contractor to clear 200 acres of Brazos bottom land, 50 miles from Houston.

The Atlantic, Gulf & Pacific Co. has started work on its contract for redredging the Texas City channel for the U. S. government. The contract calls for the removal of 1,000,000 yds. of earth. When completed the channel will have a depth of 27 ft. throughout and will be approximately 300 ft. in width. L. T. Gaylord of Port Arthur, Tex., is District Manager for the dredging company.

Utah.

The City Council of Ogden, Utah, has awarded a contract to Clark & Stowe for the running of a prospect tunnel in Cold Water Canyon, 400 ft. back from the intake of the new conduit.

Virginia.

✣Bids will be received until 1:30 p. m., Nov. 15, by John T. Hume, Treasurer Southern Branch N. H. D. V. S. National Soldiers' Home, Va., for furnishing labor and material for the installation of an electrical elevator in the Quartermaster's Storehouse.

✣Bids will be received until 1:30 p. m., Nov. 16, by John T. Hume, Treasurer Southern Branch N. H. D. V. S., National Soldiers' Home, Va., for furnishing and delivering miscellaneous supplies.

The Coastwise Dredging Co., Norfolk, Va., at $145,710, was the low bidder, Oct. 20, for dredging 2,330,000 cu. yds. of material in James River for the U. S. Government.

The following bids were received Oct. 20 by Col. Mason M. Patrick, U. S. Engineers, Norfolk, Va., for dredging Pagan River, Va.: W. H. French, Norfolk, Va., 21 cts. per cu. yd.; Norfolk Dredging Co., Norfolk, Va., 17 9-10 cts. per cu. yd.

Washington.

✣Bids will be received until 11 a. m., Nov. 10, by E. C. Long, Quartermaster, 322 Arcade Annex, Seattle, Wash., for furnishing and delivering at Seattle or Tacoma, Wash., or other Puget Sound ports, Portland or other Pacific coast ports, accessible to vessels of deep draft or f. o. b. railroad wharf, Honolulu, I. H., 229,082 ft. b. m. lumber; 132,650 ft. do.; 100,000 ft. do. and 223,500 shingles.

The following bids were received Oct. 14 by Capt. Arthur Williams, U. S. Engineers, Seattle, Wash., for dredging Olympia Harbor, Wash.: Standard American Dredging Co., San Francisco, Cal., 14.9 cts. per cu. yd.; International Dredging Co., Seattle, Wash., 17.3 cts. per cu. yd.; Puget Sound Bridge & Dredging Co., Seattle, Wash., 10.86 cts. per cu. yd., accepted; Tacoma Dredging Co., Tacoma, Wash., 13.75 cts. per cu. yd.

The City Council of Bremerton, Wash., is considering a proposition for holding a special election to vote on the question of building a municipal wharf, and purchasing a local electric plant.

West Virginia.

✣Bids will be received until noon, Nov. 23, by J. C. Oakes, Maj. U. S. Engineers, Cincinnati, O., for removing Sand Creek Dike and dredging in Ohio River about 1¼ miles below Ravenswood, W. Va.

The following bids were received Oct. 18 by Capt. F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for constructing and delivering the steel hull, stern wheel towboat "General Craighill": Thomas M. Rees, Pittsburg, Pa., $31,600 and $31,450; M. A. Sweeney Shipyard & Foundry Co., Jeffersonville, Ind., $34,000 and $33,600; Ed. J. Howard, Jeffersonville, Ind., $27,550 and $27,100; J. M. Harmitt, Marietta, O., $39,800.

The following bids were received Oct. 12 by Capt. F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and delivering steel Poirée-dam trestles for Dams Nos. 11, 13 and 18, Ohio River, (1) standing for 120,000 lbs. structural steel at Dam No. 11, (2) for 120,000 lbs. structural steel at Dam No. 13, and (3) for 120,000 lbs. structural steel at Dam No. 18:

	(1)	(2)	(3)
Pittsburgh Bridge & Iron Works, Rochester, Pa..	$0.0385	$0.039	$0.0395
New Jersey Foundry & Machine Co., New York, N. Y.	.0341	.0341	.0341
W. N. Kratzer & Co., Pittsburg, Pa.	.033	.0335	.034
Independent Bridge Co., Pittsburg, Pa.	.0367	.0368	.0374
American Bridge Co. of New York, Pittsburg, Pa.	.03	.03	.03
J. & J. B. Milholland Co., Pittsburg, Pa.	.0355	.035	.036
Sterrit-Thomas Foundry Co., Pittsburg, Pa......	.035	.0355	.036

Wyoming.

✣Bids will be received until 9:30 a. m. (Mountain Time), Nov. 14, by Constructing Quartermaster, Cheyenne, Wyo., for the completion of certain items of construction in Administration Building, Rear Annex and Ward Wings 3 and 4 new post hospital, Fort D. A. Russell, Wyo.

Canada.

✣Bids will be received until 11 a. m., Nov. 7, by M. Peterson, Secretary Board of Control, Winnipeg, Man., for overhead wire and cables for electrical distribution system.

✣Bids will be received until 11 a. m., Dec. 1, by M. Peterson, Secretary Board of Control, Winnipeg, Man., for poles and line supplies for the electrical distribution system.

✣Bids will be received until 4 p. m., Nov. 9, by R. C. DesRochers, Secy., Department of Public Works, Ottawa, Ont., for the construction of a post office building at Dresden, Ont.

✣Bids will be received until 11 a. m., Nov. 16, by M. Peterson, Secy., Board of Control, Winnipeg, Man., for the supply of labor and materials required in the erection of a public bath house to be located in the Selkirk Park. William Bruce, 222 McWermot Ave., Winnipeg, Man., is architect.

BRIDGES—STEEL AND CONCRETE

California.

Charles W. Coberley, Los Angeles, Cal., has been awarded contracts for the construction of two steel bridges for the San Diego & Arizona R. R. One is a 510-ft. span over the Second Crossing of the Tia Juaha River and the other a 180-ft. span over Matanuco Creek. The superstructures are to be deck girders on steel towers. By the terms of the contract the work is to be completed by December 1.

At a meeting of the Board of Public Works, Oakland, Cal., the Secretary was directed to advertise for bids for the construction of a concrete bridge over Sausal Creek.

California.

✣Bids will be received until 11 a. m., Nov. 14, by Board of County Supervisors, El Centro, Cal., for grading approaches to bridge across New River at Rock Wood Station. D. S. Elder is clerk.

✣Bids will be received by Board of Supervisors until 11 a. m., Nov. 14, for grading south approach to bridge across New River south of Slisbee bridge, according to plans on file at the office of the county engineer; also for grading approaches to a bridge over New River at Seeley. D. S. Elder, El Centro, Cal., is clerk of the board.

✣Bids will be received until 10 a. m., Nov. 10, by H. H. Carpenter, clerk, San Luis Obispo, Cal., for the construction of a reinforced concrete girder bridge across San Simeon creek, about 5 miles from town of Cambria.

✣Bids will be received until 10 a. m., Nov. 9, by P. J. Thornton, county clerk, Merced, Cal., for the construction of five concrete bridges, three to be built in Road District No. 1 and two in Road District No. 3.

Illinois.

✣Bids will be received until November 17, by Commissioners of Highways of the Town of Rockvale, Ill., for the construction of 17 tubes and culverts, two bridges in the town. A. W. Blanchard is Chairman of the Board of Commissioners,

The Council Committee on Harbors, Chicago, Ill., is to file a memorial with the War Department, asking that the city be given until June, 1912, to remove the Lake St. bridge.

It has been announced by George F. Simmons, Commissioner of Public Works, Peoria, Ill., that plans for the proposed new bridge across the Illinois River at Bridge St. will be completed in about two weeks. Bids for the work will be advertised soon after the approval of the plans.

Plans and specifications have been prepared according to advices from Peoria, Ill., for the construction of seven bridges to be erected in that county and Joint Committees of the Commissioners and supervisors of the county and township will let contracts for the work about November 14.

The Santa Fe System has arranged to construct a large concrete box culvert on the Illinois Division at what is known as bridges No. 223-A. The estimated cost is $4,000.

Indiana.

✣Bids will be received by the Board of Public Works, Indianapolis, Ind., until 10 a. m., November 7, for the construction of a concrete slab bridge over Pogues Run at Dorman St.

✣Bids will be received until 10 a. m., Nov. 7, by the Board of Public Works, Indianapolis, Ind. for the construction of a concrete girder bridge over Pogue's Run at East Tenth St.

✣Bids will be received until noon, Nov. 7 by Board of County Commissioners of Crown Point, Ind., for the construction or repair of four bridges. Charles A. Johnson is Auditor of Lake County.

✣Bids will be received until 2 p. m., Nov. 9, by Board of County Commissioners at Petersburg, Ind., for the construction of three steel bridges in Washington, Madison and Jefferson townships. Franklin R. Bilderback is Auditor of Pike County.

Iowa.

The County Commissioners, Davenport, Ia. have awarded a contract for the construction of five steel bridges and bridge piers in various parts of the county to Braly & Whitlock, Portland, at $20,995. According to the terms of the contract the work must be completed by June, 1911.

It is reported that Engineers of the Chicago, Great Western R. R. are contemplating the construction of a bridge across the Mississippi River at Bellevue, Ia.

Board of Supervisors have contracted with the Clinton Bridge Co., Clinton, Ia., for the construction of a cement reinforced bridge across the Little Fox south of the H. C. Taylor Farm near Pulaski in Davis County.

Plans and specifications of the proposed Rock River bridges in Davenport, Ia., have been prepared, but owing to the absence of the City Engineer at the last meeting nothing definite was done.

Kentucky.

Plans have been completed for the Underhill St. bridge, to be built of steel and concrete across Beargrass Creek and Kentucky St. in Louisville, Ky. The work, according to the estimate, will require an expenditure of about $20,000.

Maine.

A special town meeting has been held at Rumford Falls, Me., to take up the matter of constructing a new steel foot bridge to replace the present structure.

Massachusetts.

Advices from Pittsfield, Mass., state that the Berkshire Street Railway company will, at its own expense, replace the present bridge over the Housantonic River at Elm St., with a new and stronger bridge.

Maryland.

✣Bids will be received until 2 p. m., Nov. 19, by Commissioners of Westernport, Md., for the construction of a bridge over Georges Creek within the town of Westernport, Alleghany County. O. H. Bruce is Clerk.

Michigan.

A proposition is to be submitted to the citizens of Delta County, Mich., to issue bonds for the construction of a concrete bridge over the Escanaba River at Wells, Mich. The structure will be part of the Bay Shore Road, connecting cities of Escanaba and Gladstone, and is estimated to cost about $40,000.

Included in the items for which $137,350 of bonds will be issued by the City of Kalamazoo, Mich., is that of $25,000 for the construction of a new bridge to replace the present structure at Gull St., and $16,000 for the new bridge on Mill St.

Advices from Marshall, Mich., state that the Michigan United Railways will construct an overhead bridge at Guin crossing, east of Battle Creek.

Minnesota.

It was proposed at a recent meeting of the City Council, Duluth, Minn., to construct a timber bridge on East Fourth St., connecting the East End and Allouez instead of the steel structure proposed. The cost of such a structure would be between $40,000 and $50,000, while a steel bridge would cost $100,000.

Plans have been prepared by City Engineer Rundlett, St. Paul, Minn., for the construction of the proposed bridge over East Seventh and Earl Sts., where they are crossed by the Omaha & Northern Pacific tracks. The estimated cost of the improvement, which will be done with cement, is $35,000.

Mississippi.

✣Bids will be received until Nov. 7 by Board of Supervisors, Tupelo, Miss., for the construction of a bridge in Town Creek bottom, north of Belden, on Leighton and Union road. Norbin Jones is clerk of the board.

✣Bids will be received until 2 p. m., Nov. 7, by W. R. Pistole, County Clerk, Meridian, Miss., for the construction of a wooden bridge across Richardson's Creek on Pine Springs Road near W. P. Love's place

Missouri.

Advices from Harrisonville, Mo., state that all bids received for the construction of seven steel bridges were rejected as too high and new proposals will be called for. F. W. Baker is County Highway Engineer.

The contract has been awarded James O'Connor & Son, Kansas City, Mo., for the completion of the Melan Bridge extension. The contract price was $33,397, of which the contractor agreed to deduct $6,000 in favor of the material left by the former contractor. Other bidders for the work were Topeka Bridge & Iron Co., $32,100; Midland Bridge Co., Kansas City, Mo., $34,974; Missouri Valley Bridge & Iron Co., Leavenworth, $34,500; Jones Bros., Leavenworth, $48,000.

Plans and specifications have been completed by Engineers of the Board of Public Works, Kansas City, Mo., for the construction of the proposed concrete bridge over Brush Creek at Wornall Road. As the straightening of the creek at this point is contemplated, the structure will be on Park land and it is proposed that the Park Board bear part of the expense.

As the result of a conference recently held by the City, County and Missouri Pacific officials at the office of C. E. Baker, City Clerk, Sedalia, Mo., it is believed that the company will build a viaduct over its tracks and those of the Missouri, Kansas and Texas Ry., on Washington Ave.

Boone County, Mo., according to advices from Columbia, Mo., is planning the construction of a number of new bridges and with that purpose in view has voted $5,000 for the commencement of the work. All the structures will be of steel and the largest one will be 100 ft. long over a creek a few miles southwest of Columbia.

Nebraska.

The Commissioners of Polk and Merrick Counties, Polk, Neb., have decided to construct a $12,000 bridge across the Platte River, north of Polk at what is known as Little's Island. Farmers of the surrounding country have already subscribed $5,000 toward the required amount.

New Mexico.

The contract for the construction of the proposed bridge across the Verde River at Albuquerque, N. Mex., has been let to the Missouri Valley Bridge & Iron Co., Leavenworth, Kan., for $18,390. The structure will have three 100-ft. spans.

New York.

State Engineer and Surveyor Williams has approved the plans for the construction of the concrete bridge on Burdick Road, leading northerly from Higginsville, near what is known as the Burdick bridge over the Barge canal on Contract 4. It is planned to have the structure completed this winter.

Authorities of the Village of Voorheesville, N. Y., have asked the town for a new bridge on Foundry St. The present structure is small and is near the Law Hotel.

Board of Public Works, Fulton, N. Y., has been conferring with the officials of the Syracuse, Lake Shore & Northern R. R., in regard to the company's crossing the river at that place. It is proposed by the railroad to build

Items marked thus ✣ indicate work now open for bids.

a new bridge just north of the present structure if a site can be obtained of the Fulton Light, Heat and Power Co. and the Granby Paper Co.

North Carolina.

✣Bids will be received until Nov. 7 by F. M. Burgess, clerk of the Board of County Commissioners, Columbus, N. C., for the construction of a bridge over the Green River.

Officials of the Southbound have announced that work will soon begin on the construction of the proposed steel bridge which is to cross the Southbound south of the new station on Fifth Ave., in Lexington, N. C.

Ohio.

✣Bids will be received until noon, Nov. 11, by Board of County Commissioners, Cincinnati, O., for the construction, under specifications No. 121, of concrete bridge on Fallis Road, second bridge north of Loveland in Symmes township. Stanley Struble is President.

The contract for the construction of the Bixby Bridge over the Arkansas River, according to advices from Tulsa, Okla., was awarded to the Canton Bridge Co., Canton, O., at $68,970.

Citizens of Cayahoga County, O., will vote on Nov 8. on the proposition of constructing a county bridge over the Cuyahoga River on the Cleveland-Milan State Road between Detroit and Superior Aves., in the city of Cleveland, O.

The contract for the construction of the foot bridge over the River at Canal Fulton has been awarded E. J. Lander, Canton, O., for $814.

The County Commissioners, Dayton, O., have awarded the contract for the construction of a concrete bridge on Schuster Road in Miami township to William H. Proctor & Co.

Bridge Committee of the Chamber of Commerce, Cleveland, O., recently took up with the officials of the Street Railway and County officials the matter of constructing a new high level bridge.

A large delegation of residents of Ironville recently appeared before the Council Committee at Cleveland, O., asking for the relocation of the old Cherry St. bridge at Galena St. and Paine Ave.

Advices from Ashland, O., state that the Shippensburg Town Council resolved at a recent meeting to authorize the Secretary to advertise for bids for the construction of a bridge over Main's Run at King St.

Elimination of the center arch in Lake Ave., N. W., Cleveland, O., grade crossing of the Lake Shore & Michigan Southern R. R. has been started. The structure will ultimately have one concrete and steel ornamental arch 80 ft. long.

The Board of Control, Springfield, O., has awarded the contract for the construction of a concrete bridge over Indian Run in West High St., to M. J. Cooney at $1,080.

Oregon.

A joint meeting of the Improvement Clubs of the southern portion of the city of Portland, Ore., was recently held, at which resolutions were adopted urging the City Council to grant a franchise to the Oregon Electric on Salmon and Tenth Sts., and to construct a bridge across the river at or near Meade St. on the West Side.

Information volunteered from Wheeling, W. Va., states that the Ohio County Board of Commissioners decided at a recent meeting to reject all bids on the proposed bridge to span Woods Run on the Bethany Pike. A. S. Bell, County Road Engineer, has been authorized to draw plans in accordance with the proposition of J. D. Merriman and associates in so far as a reinforced concrete arch bridge is concerned.

Pennsylvania.

At a recent meeting of the Business Men's Association of Lock Haven, Pa., the location of the proposed new county bridge east of the city was thoroughly discussed. It was the unanimous opinion of all present that the facilities for reaching Lock Haven from the eastern end of the county would be better served by locating the structure at McElhattan.

The proposition submitted by the committee of citizens of West Philadelphia has been passed by the council and approved by the Mayor. The work will include the widening of Chestnut St. bridge over the Schuylkill River and will require an expenditure of $90,000.

The following bids were recently received by the Board of County Commissioners, Wilkesbarre, Pa., for the construction of the proposed new river bridge between Plymouth and Breslau. The plans and specifications were drawn by Engineer Scofield, there being two separate sets of plans. One, known as 6-A, being for a structure with wooden floor and without facilities for a railroad track. The other set of plans, known as 6-B, provided for a concrete driveway and a heavier structure, capable of carrying a railroad. Penn Bridge Co., 6-A, $266,969; 6-B, $276,973; W. H. Stebbins, 6-A, $268,500, 6-B, $279,000; Northeastern Construction Co., 6-A, $271,879, 6-B, $287,776.

The following contracts have been awarded by the County Commissioners, York, Pa., for the construction of concrete and stone arch bridges: The contract for the repair of the Dover bridge to make it a 34 instead of a 15-ft. span was awarded to Hartley, Ziegler Company at a bid of $976.60. The contract to build the stone arch bridge near Yocumtown was awarded to Charles Witmer at a bid of $763. The contract to build a concrete bridge over Muddy Creek Forks near Brogueville was awarded to George A. Wagman & Company, Dallastown, at a bid of $1,280.

At a recent meeting of the Northside Chamber of Commerce, Pittsburg, Pa., a resolution was introduced providing for the construction of a bridge to connect Woods Run with McKees Rocks. One end of the bridge will be at the foot of Wilkins St., near Penitentiary in Woods Run, and the other at a point near the old Indian Mound in McKees Rocks.

Texas.

Corrigan, Lee & Helpin, the Kansas City firm recently awarded the contract for the construction of the Dallas-Oak Cliff viaduct of Dallas, Texas, has sublet the concrete piling to the Gulf Concrete Construction Co., Houston, Texas.

Plans have been drawn and construction will soon be started on the new Main St. viaduct over the Santa Fe system at Belton, Texas. The improvement is estimated to require an expenditure of $16,000.

Commissioners Court, Richmond, Texas, has called an election Nov. 4, to vote on the issuance of bonds for $30,000 for the erection of a bridge across the Brazos at Orchard.

Utah.

City Council of Salt Lake City, Utah, has referred to the Committee on Improvements the petition for the construction of two foot bridges across the canal at Seventh South and Tenth East Sts.

Virginia.

Work of making temporary repairs to the Gosport Causeway Bridge, Norfolk, Va., which was authorized in October by the Common Council will be delayed somewhat owing to the fact that the Council did not have a sufficient number present to pass upon financial items. It is rumored that in a short time the bridge will be replaced together.

Washington.

It has been decided by the Commissioners of Brown County, according to advices from Aberdeen, Wash., to construct six new bridges the coming year over streams in the different parts of the state.

Wisconsin.

Citizens of Grand Rapids, Wis., are in favor of selling the present structure across the river and replacing it with a new concrete affair large enough to accommodate local traffic and street cars.

Town of Mayville, Wis., recently voted bonds for the construction of a new bridge at that place to replace the old structure.

Canada.

✣Bids will be received until Nov. 28, by the Minister of Public Works, Victoria, B. C., for the erection and completion of the substructure of a 2-span steel bridge over the Thompson River near Walhachin, a station on the line of the Canadian Pacific Ry., about 218 miles east of Vancouver, B. C.

✣Bids will be received until Nov. 28, by the Department of Public Works, Vancouver, B. C., for the construction and completion of the superstructure of a 2-span steel bridge over the Thompson River near Walhachin, a station on the line of the Canadian Pacific Ry., 218 miles east of Vancouver. F. C. Gamble is Engineer of the Department of Public Works.

ROADS, STREETS AND PAVEMENTS

Alabama.

The board of revenue of Montgomery, Ala., has accepted the report of the viewers appointed to mark out the new Central Ave. road in Shades valley and has announced that construction work will begin immediately.

Ordinances will soon be introduced in the city council of Birmingham, Ala., providing for the paving of 104,000 sq. yds. of streets of the Southside, 85 per cent of which will be composed of bitulithic and brick pavement. These improvements will represent an expenditure of $169,800.

Advices from Birmingham, Ala., state that the Mullarky Construction Co. has been awarded a contract for extensive sidewalk paving on Ensley Highlands.

Arizona.

Bids were received on Oct. 18 by the territorial board of control at Phoenix, Ariz., from the following, for the section of the territorial road proposed to be built into Douglas: R. Toohey & Sons, of Phoenix; Scott Co., of Douglas, and Johnson Shea Co., of Riverside, Cal. It is understood that the three bidders are below the engineer's estimate.

California.

✣Bids will be received until 2 p. m., Nov. 7, by Board of Supervisors, Los Angeles County, Los Angeles, Cal., for the improvement of certain portions of Central Ave., Tropico Ave. and Sixth St., Glendale, in Los Angeles County. C. C. Keyes is County Clerk.

H. H. Beard has been awarded the contract at Ukiah, Cal., for the improvement of the Little Lake and Potter Valley road for $6,480, and C. A. Lawson has been awarded the contract for the improvement of the Little Lake and Long Valley Road for $7,448.

The supervisors of San Francisco, Cal., have set aside $50,000 to continue the resurfacing of Mission St., between 11th and 14th Sts.

A proposition is to be submitted to the voters of the state of California at the November election providing for the $18,000,000 bond issue to be used in building highways in the state. W. Ellery, Sacramento, is State Engineer.

A contract for the paving of about seven miles of streets in Colonial Heights, Sacramento, Cal., was let to the Clark & Henery Co., by the Colonial Investment Co.

Colorado.

El Paso County, Colorado Springs, Colo., will vote at the coming election on a proposed $110,000 bond issue for road improvement.

A good roads convention will be held in Denver, Colo., in December to outline plans for increasing the funds for road building from $1,300,000, and to devise means whereby these funds may be more judiciously expended.

Connecticut.

The State Highway Commissioners at Hartford, Conn., have awarded the contract for the construction of about 5,847 lin. ft. of macadam-telford road to the Lane Construction Co., of Meriden, Conn., for $1.71 per lin. ft. for macadam and $2.15 for telford.

Delaware.

The survey for the rebuilding of the Philadelphia and Wilmington turnpike from the Practical Farmer to the Pennsylvania State line, in Brandywine hundred, is finished, according to advices from Wilmington, Del.

Florida.

According to advices from Sanford, Fla., that end of Orange County will vote as a unit for the bond issue of $1,000,000 for the construction of 140 miles of hard road with brick surface.

The Edwards Construction Co., of Tampa, Fla., has been awarded the contract at Fort Dade, Edgmont, Fla., for furnishing 33,200 sq. ft. of concrete road and 2,650 sq. ft. of concrete walk at Fort Dade for $7,913.

The city of Miami, Fla., contemplates issuing bonds to the amount of $100,000 for additional street improvements. F. H. Wharton is mayor.

Illinois.

✣Bids will be received until 10 a. m., Nov. 7, by Board of Commissioners of Hendricks County, Danville, Ill., for the construction of the following named highways: The Henry Rutledge Road, in Center Township, of a length of 13,336 lin. ft.; the Oliver Harris Road, in Center Township, of a length of 14,986 lin. ft.; the Jonathan Lowe Road, in Union Township, of a length of 8,802 lin. ft. W. H. Nichols is County Auditor.

✣Bids are asked by the Commissioner of Public Works, City of Chicago, Room 705 City Hall, for furnishing and delivering 1,000 sq. yds. of No. 2 granite block to the Bureau of Streets. The blocks shall be 4 to 5 ins. wide, 8 to 12 ins. in length and 5 ins. in depth, and shall be dressed to rectangular plane surface. The blocks shall be of syenite or granite and free from an excess of mica or feldspar, and shall be of uniform grain and texture without lamination or stratification. Specifications and bidding sheets are on file at the Commissioner's office, where the bids will be opened 11 a. m. Saturday, Nov. 5th, 1910.

The contract for the paving of West Bridge St., in Streator, Ill., has been awarded to John Baer for $1.25 per yd., and for paving South Vermillion St. to George Swartz for $1.39 per sq. yd.

The board of local improvements of Chicago, Ill., has taken up the proposition of paving 5th Ave., between South Water and Van Buren St., and of Wabash Ave., between Washington and Congress Sts., with creosote block pavement.

Engineer Paddock of Moline, Ill., has been instructed by the village board of Silvis to prepare plans and estimates for pavement in First Ave., from 1st to 16th Sts. The plan is to have all details completed this winter in order that the improvement may be taken up early in the spring.

The citizens of Moline, Ill., have petitioned for the completion of the 7th St., improvement with macadam from 18th Ave., south to Rock River bottom road.

Following are the low bidders and bids as opened by the board of local improvements, city of Chicago, Chas. A. V. Standish, Sec'y, Room 302 City Hall, Oct. 25, for the construction of sidewalks as follows: Both sides of Ave. L from 96th St. to 104th St., H. P. Larsen, 140 La Salle St., contract price $.21½ per sq. ft.; Elm St., Milton St. to Crosby St., both sides, Albert Graff, 70 La Salle St., contract price $.14 per sq. ft.; Ewing St., Halsted St. to Blue Island Ave., south side, H. P. Larsen, 140 La Salle St., contract price $.15 per sq. ft.; Grace St., Elston Ave. to Central Park Ave., north side, H. P. Larsen, 140 La Salle St., contract price $.19 per sq. ft.; Harbor Ave., northeasterly, The Strand to 92d St., H. P. Larsen, 140 La Salle St., and General Cement Construction Co., 160 Washington St. (tied), contract price $.21 per sq. ft.; Halsted St., 43d St. to 47th St., A. Graff, 70 La Salle St., $.14 per sq. ft.; Hammond St., Tell St. to Eugenie St., General Cement Construction Co., 160 Washington St., $.13½ per sq. ft.; Lawrence Ave., Drainage Canal to Albany Ave., north side, Bairstow Supply Co., 6084 Ridge Ave., $.16 2/10 per sq. ft.; Murphy Ave., Birchwood Ave. to Rogers Ave., both sides, Bairstow Supply Co., 6084 Ridge Ave., $.11 35/100 per sq. ft.; Maxwell St., both sides, Halsted St. to Blue Island Ave., General Cement Construction Co., 160 Washington St., $.12 9/10 per sq. ft.; Ontario St., both sides, Lake Shore Drive to St. Clair St., A. Graff, 70 La Salle St., $.14 per sq. ft.; Stony Island Ave., west side, 60th St. to 63d St., H. P. Larsen, 140 La Salle St., $.13 84/100 per sq. ft.; 35th St., south side, Halsted to Morgan St., A. Graff, 70 La Salle St., $.13 per sq. ft.; Wellington St., south side, Sacramento Av. to Whipple St., H. P. Larsen, 140 La Salle St., $.17 per sq. ft.; 17th St., north side, Dearborn St. to 1st alley east, A. Graff, 70 La Salle St., $.19 per sq. ft.; Lawrence Ave., north and northwesterly, C. & N. W. Ry. to 56th Ave., Demling & Wendt, 84 La Salle St., $.16 7/10 per sq. ft.; Grand Ave., 44th Ave. and C. & N. W. Ry., G. Kehl & Son Co., 1224 N. Campbell Ave., $.11 96/100 per sq. ft.; Harrison St., 42d Ct. to 45th Ct., south side, H. P. Larsen, 140 La Salle St., $.13 84/100 per sq. ft.; 33d St., Wood St. to 1st alley w. of Archer Ave., south side, A. Graff, 70 La Salle St., $.14½ per sq. ft.; 72d St., Vernon Ave. to South Park Ave, south side, P. F. Biesen, 145 La Salle St., $.13 per sq. ft.; 39th St., Lowe Ave. to Halsted St., south side, A. Graff, 70 La Salle St., $.13½ per sq. ft.; 71st St., South Park Ave. to State St., P. F. Biersen, 145 La Salle St., $.15½ per sq. ft.; Hirsch St., Grand Ave. to 42d Ave., south side, Skafgard Concrete Construction Co., 4024 W. North Ave., $.12 12/100 per sq. ft.; Hirsch St., 42d Ave. to 44th Ave., south side, $.11 94/100 per sq. ft., Skafgard Concrete Construction Co., 4024 W. North Ave.; North Ave., 42d Ave. to 44th Ave., south side, $.11 99/100 per sq. ft., Skafgard Concrete Construction Co., 4024 W. North Ave. All walks 6 feet in width except as follows: Elm St., 14 ft.; Harbor Ave., 12 ft.; Halsted St., 13½ ft.; Maxwell St., 14 ft.; Ontario St., 8 ft.; Stony Island Ave., 10 ft.; 17th St., 14 ft.

Indiana.

✣Bids will be received until 2 p. m., Nov. 8, by Board of County Commissioners at Bloomfield, Ind., for the construction of a macadam road in Jefferson Township. Peter M. Cook is Auditor of Greene County, Ind.

✣Bids will be received until noon, Nov. 9, by Board of County Commissioners at Sullivan, Ind., for the construction of a stone road in Hamilton Township. Ben C. Crowder is Auditor of Sullivan County.

✣Bids will be received until 10 a. m., Nov. 15, by Commissioners of Cass County at Logansport, Ind., for the construction of a road on line dividing Jefferson and Jackson townships. George W. Cann is Auditor.

The County Commissioners at Indianapolis, Ind., contemplate improving the John H. Hoss road, which runs on the line between Washington Township, Marion County, and Delaware Township, Hamilton County.

Sam Grauel has secured the contract for building the Cline road out of Royal Center, Ind., for $6,800.

Iowa.

✣Bids will be received until 5 p. m., Nov 7, by A. W. Casady, City Clerk, Council Bluffs, Ia., for furnishing the material and constructing the artificial stone sidewalks in divisions as follows: Division 1, 19,313 sq. ft.; Division 2, 19,337 sq. ft.; Division 3, 14,535 sq. ft.

Business men and property owners along Fourth St., in Waterloo, Ia., are agitating the construction of pavement on that street.

Advices from Decorah, Ia., state that a new road between the farms of Eugene and William Smith, Section 24, Bluffton Township, is to be built by subscription.

Property owners on Mulberry Ave., Muscatine, Ia., have asked for the permanent improvement of that thoroughfare next year. The petitioners have asked that brick pavement be used.

The City Council of Waterloo, Ia., has passed a resolution providing for the paving of East and West 4th Sts., from the Great Western tracks on the west side to the Illinois Central tracks on Dane St.

Cary & Son have received a contract in Clinton, Ia., for the paving of 3d Ave., be-

Kentucky.

The Cemetery Committee at Paducah, Ky., are considering plans for grading and graveling the roads in Oak Grove. It is expected that work will begin as soon as the Board of Works lets the contract.

Louisiana.

✣Bids will be received until 11 a. m., Nov. 18, by George B. Davis, D. C. G., Acting Quartermaster, 416 Hibernia Bank Bldg., New Orleans, La., for the construction of roads and walks at Jackson Barracks, La.

The citizens of Hammond, La., have decided to help construct the proposed good road between that city and Springfield. The police jury has also decided to aid the promoters, and it is believed that the plans will mature shortly and active work begin.

Judge Blackman, of Alexandria, La., recommended that the grand jury urge the police jury of this parish to vote bonds, $300,000 or $400,000, if necessary, for the purpose of establishing good roads throughout the parish.

The city of Crowley, La., has decided to construct 33,000 sq. ft. of concrete crossings. J. D. White is City Engineer.

Maryland.

The merchants of Baltimore, Md., have petitioned the Board of Estimates for the repaving of Lombard St., from Liberty St. to Light St. William B. Hurst is interested.

William M. Elder has been awarded a contract in Baltimore, Md., for the paving of Cokesbury Ave., east of York road, with vitrified brick for $8,816.

The Cecil County Commissioners, Elkton, Md., have decided to issue bonds to the amount of $10,000 to make permanent improvements to the public roads.

William M. Elder, Baltimore, Md., has been awarded the contract in that city for $8,816 worth of paving, including curb and gutter on Cokesbury Ave. Vitrified blocks will be used.

Massachusetts.

The Central Construction Co., of Boston, Mass., has been awarded the contract for the construction of vitrified brick pavement at the Navy Yard, Boston. Bids were opened Oct. 1.

Michigan.

The Board of County Supervisors at Marshall, Mich., has voted upon a resolution to submit the county roads system proposition to the voters at the November election.

Kent County Supervisors, Grand Rapids, Mich., have appropriated $45,000 to be available for the construction of good roads next year.

The Board of Supervisors at Port Huron, Mich., has passed up the proposition to submit the county road system at the November election. The proposition will probably be submitted at the April election.

The Supervisors at Traverse City, Mich., have appropriated [illegible] to be used in im

Items marked thus ✣ indicate work now open for bids.

proving the Grand Traverse County roads the coming year.

The Board of Supervisors at Detroit, Mich., has asked for an appropriation of $500,000 for the improvement of the following roads during 1911: Michigan road, $60,000; Gratiot, $30,000; Mt. Elliott, $10,000; Grand River, $20,000; Fort, $7,000; Eureka, $10,000; Northville, $8,000; Plymouth, $3,500; River, $20,000; Van Dyke, $11,000; Wayne, $5,000.

Minnesota.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for the construction of curb, filling and leveling and improving Geranium St. from Greenbrier Ave. to Walsh Ave., in St. Paul.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for curbing the east and west sides of Horton Park in St. Paul. R. L. Gorman is Clerk of the Board of Public Works.

✣Bids will be received until 2 p. m., Nov. 3, by Board of Public Works, St. Paul, Minn., for grading Temple Court from Cretin Ave. to Rondo St. in St. Paul. R. L. Gorman is Clerk of the Board.

According to advices from Minneapolis, Minn., an automobile speedway connecting Lake Harriet, Lake Calhoun and Cedar Lake is to be built next spring. The road will be 200 ft. wide, made of dirt, and will be kept free from dust by oil.

E. R. Dutton, Paving Engineer for Minneapolis, Minn., has made plans for next summer's paving work in that city. Following are the streets to be paved: Franklin, from 11th to Hennepin; Mary Pl., from 8th to 13th Sts.; 10th St., from Hennepin to Harmon Pl.; 11th St., from Hawthorn to Holden; Laurel, from Hennepin to Aldrich; 13th St., from Nicollet to Grant; Bloomington, from Franklin to Lake; Grant, from 4th Ave. to 11th St.; 27th Ave. S., from Riverside to Lake; Hennepin, from 31st to 34th; Nicollet, from Lake to 32nd; Park Ave., from 28th to 34th; 5th Ave. S., from 7th to 11th; 3rd Ave. S., from 24th to Lake; 15th St., from Vine to Hennepin; 5th Ave. S., from 3rd to Washington; 6th Ave. N., from 3rd to Washington; 3rd St. N., from 3rd to 6th Aves.; 11th St., from Hennepin to Hawthorn.

Mississippi.

✣Bids will be received until 1:30 p. m., Nov. 9, by Board of County Supervisors, Winona, Miss., for working public roads in Montgomery County, Miss. Joseph T. Parks is Clerk.

The Hinds County Road Commission, Jackson, Miss., has retained Mayes Cooper, of Jackson, as engineer to prepare plans and specifications for the good road construction work in the first and fifth districts, on which the sum of $200,000 will be expended.

Nebraska.

The Commercial Club Committee, of Omaha, Neb., having in charge the movement to construct a road from Omaha to Yankton, is making good progress.

New Jersey.

✣Bids will be received until 10 a. m., Nov. 10, by Committee on Roads and Assessments of the Board of Chosen Freeholders of the County of Essex, Newark, N. J., for grading and paving with telford pavement Gregory Ave. in West Orange, including 8,846 ft.; Union Ave., in Belleville, a distance of 6,133 ft.; Green Brook Road, in Caldwell, a distance of 1,333 ft. Wallace Ougeltree is Director

New Mexico.

The property owners on San Francisco St., west of Fischer's drug store, as far west as Don Gaspar Ave., in Santa Fe, N. Mex., have petitioned the City Council for the paving of that street with vitrified brick.

North Dakota.

Advices from Steele, N. D., state that approximately $1,000 will be expended on the construction of a road from Steele to Dawson, a distance of 14 miles.

Advices from Bottineau, N. Dak., state that a meeting will be held Nov. 22 by the association organized to promote the proposition of constructing a state road from Bottineau to St. John. The proposed road will lead through the Turtle Mountains.

Ohio.

✣Bids will be received until noon, Nov. 8, by Commissioners of Hamilton County, at Cincinnati, O., for the improvement of change in River Road through lands of William Knollman and Fred Kinsler in Crosby Township.

✣Bids will be received by the County Commissioners at Urbana, O., until Nov. 12, for the construction of a gravel road on the Cable Road in Wayne Township, extending about 1 mile toward Cable Farm from the farm of B. F. Miller.

✣Bids will be received until noon, Nov. 25, by Board of County Commissioners, Cincinnati, O., for the improvement of Comer Road from Sharon Ave. to Van Zandt Road (Oak Ave. or County Road), between Pennsylvania R. R. and Canal, Sycamore Township. Fred Dreihs is Clerk.

✣Bids will be received until noon, Nov. 9, by Board of County Commissioners, Caldwell, O., for the grading and paving with brick a road 1.09 miles in length in Noble Township, which is estimated to cost $16,487. The work is to be done under the supervision of the Ohio Highway Commission.

✣Bids will be received until noon, Nov. 9, by County Commissioners, Chardon, O., for grading and paving with brick a road one mile in length in Hambden Township, estimated to cost $11,897. J. C. Wonders, Columbus, O., is State Highway Commissioner.

City Engineer Shipley, of Cincinnati, O., has transmitted approximate estimates of the cost of improving Summer St. with granite, and the estimates of the cost of constructing sewers in Epworth Ave., Wardall Ave., and Feltz Ave., to Public Service Director Sundmaker. The Summer St. improvement is estimated at $15,426, while the sewer improvements are estimated at $14,043.

The City Council of Painesville, O., has voted in favor of the proposed paving of Main St. The City Engineer has estimated the cost of the pavement at $1.12 per sq. yd.

The City Council of Canton, O., has passed a resolution declaring it necessary to improve Meyer Ave., from Shorb St. to Oxford St.

The Grape Isle Stone Co. has been awarded the contract at Toledo, O., for the improvement of the River Road from Maumee to Turkey-foot Rock for approximately $13,500.

G. M. Montgomery, City Engineer of Youngstown, O., has received the following bids for paving in the city: McKinnie St., paving, S. H. De Groot, $10,514; Rayen Ave., with Westrumite material, Kennedy Bros., $16,211; asphalt, Cleveland Trinidad Co., $17,272; Hine St., M. P. Conelley, $12,891, and Woodbine and Bryson St., S. H. De Groot, $10,285

Oklahoma.

The City of Tulsa, Okla., has decided to construct 110,000 sq. yds. of paving, of which 20,000 sq. yds. will be of brick. The estimated cost is $15,000. T. C. Hughes is City Engineer.

The City Commission of Tulsa, Okla., will shortly ask for bids for paving about 85 blocks of streets with asphalt at an estimated cost of $317,175. The contract for this work will be let as a whole. T. C. Hughes, City Engineer.

Oregon.

Mayor Simon, of Portland, Ore., has vetoed an ordinance to improve Lucretia Pl., between Washington and Everett Sts.

Pennsylvania.

Contracts for the subgrading, curbing and bitumen macadamizing of Monitor Ave., from the Brighton Road, Pittsburg, Pa., to the right of way of the Pittsburg, Ft. Wayne & Chicago Ry., and for walks, steps and stone fence in the park at Ben Avon station, have been awarded by the Ben Avon Borough Council to Thomas Sweeney and J. K. Wymard respectively. The Monitor Ave. work will require about 958 cu. yds. of grading, 1,743 ft. of curb, 2,022 sq. yds. of bitumen macadam and 396 sq. yds. of block brick gutter. The latter improvements will require about 270 cu. yds. of grading above the walks and steps, 2,110 sq. ft. of concrete walk, 520 lin. ft. of concrete steps, 579 ft. of stone fence and other material.

The Barber Asphalt Co. was the lowest bidder in Philadelphia, Pa., for the work of repaving Arch St., from Front to 21st St., with wood block, and from Delaware Ave. to Front St. with granite blocks; also 12th St., between Chestnut and Market Sts., with wood blocks.

The Pennsylvania State Highway Department is advertising for bids for the paving of 1,386 ft. of road in Mount Carbon, Schuylkill County. Bids for this work were asked for in September of this year, but no bids were submitted.

The City Council of Punxsutawney, Pa., has rejected all bids for the paving of Union, South Jefferson, Penn Sts. and Cranberry Ave. The work will be re-advertised.

Twenty-five of the 28 contracts for street paving in Chester, Pa., under the first half of the $600,000 loan bill, were awarded to the Filbert Paving & Construction Co., of Philadelphia, on Oct. 24, by the joint session of Select and Common Councils. Edwin H. Vare, of Philadelphia, was awarded the contract for paving West 3d St., from Concord Ave. to Thurflow St., with wood block. The cost of the Filbertine paving will be about $190,000. Contractor Vare will receive about $101,928. The pavement will probably not be laid before next spring.

The City Council of Mechanicsburg, Pa., has decided by unanimous vote to continue the paving of Main St. with brick to Filbert St., on the east, and within 160 ft. of the borough limits on the west.

Rhode Island.

✣Bids will be received until noon, Nov. 9, by State Board of Public Roads, State House, Providence, R. I., for the construction of a section of state highway in the town of West Greenwich, about 5,280 ft. long; a section of state highway in the town of Exeter, 5,280 ft. long; a section of state highway in the town of East Providence about 5,280 ft. long.

Tennessee.

The City of Memphis, Tenn., has awarded the contract for paving Peabody Ave. to the Memphis Asphalt Paving Co., at $35,260, and H. P. Streicher & Co. for the extension of Madison Ave., from Cooper St. to the parkway for $19,130. Asphalt will be used in both instances.

The Knox County Road Commissioner, Knoxville, Tenn., will present a proposition to the County Court at its January session to purchase a portable road construction outfit at a cost of $6,000.

According to information from Rogersville, Tenn., Albert Lyons of that city has been awarded the contract by the Hawkins County Commissioners for the construction of 10,000 cu. yds. of macadam roadway. J. L. Cresap is County Engineer.

Virginia.

Scott County, Gate City, Va., will vote the issuance of bonds in the sum of $300,000 for road improvements.

An election will be held in Amherst County, Amherst, Va., on Jan. 14 to vote on the issuance of $135,000 of bonds for improvement of 45 miles of road.

The Commissioners of Bedford County, Bedford City, Va., are considering issuing bonds to the amount of $55,000 for road improvements. P. St. J. Wilson, State Highway Commissioner, Richmond, Va.

The Augusta County Commissioners, Staunton, Va., have decided to macadamize Spring Hill Road from the city limits to the bridge over Middle River, a distance of about eight miles.

Texas.

According to advices from Houston, Tex., two more gravel roads are to be built within

Items marked thus ✣ indicate work now open for bids.

the grounds of the William M. Rice Institute. The work of clearing the right of way and grading has already commenced and arrangements made for the delivery of some 1,600 cu. yds. of gravel. Altogether about 2,500 ft. of roadway will be paved. Engineer W. Waldo will have charge of the work.

The contract for laying approximately 792 ft. of concrete walk on Cedar Spring St., in Dallas, Tex., was awarded by the City Commission to W. G. Stubbs for $.11 per sq. ft.

The City Engineer of Dallas, Tex., has plans prepared for what is considered one of the most comprehensive campaigns for the permanent paving of streets ever inaugurated by the city. The plans call for approximately 236,092 sq. yds. of pavement at an estimated cost of $590,000.

Advices from Brownwood, Tex., state that another election will be held in Road District No. 1 of Brown County, to vote on the issuance of $50,000 additional bonds with which to carry the roads out to the district lines.

W. D. Haden, of Galveston, Tex., has been awarded the contract for the complete construction of the new shell road to be completed at once from Richmond, Tex., to meet the Harris County shell road below Missouri City.

Virginia.

Superintendent L. B. Manville, of the Old Dominion Land Co., and Commissioner of Roads Oliver Curtis, both of Newport News, Va., are agitating the construction of a highway between Newport News and the state capital, through Williamsburg. The estimated cost of the highway is $90,000.

Washington.

Tangible results that will soon lead to the construction of the part of the Pacific highway through the state of Washington have already been secured, according to the officials of the Pacific Highway Association. The Washington State Highway Commissioner, Henry L. Bowlby, has already secured permission from all the county commissioners of the counties of Washington through which the road will pass to survey the route and prepare estimates for cost to be submitted to the State Legislature when that body convenes this winter.

J. C. Scott, president of the Commercial Club of Walla Walla, Wash., has asked the County Commisisoners to hold a special meeting to sign a resolution asking that the survey of the road running from Wallula through Walla Walla to Waitsburg, a distance of 58 miles, be made.

According to information received from Wenatchee, Wash., the first rural improvement district to be formed in Douglas County, under provisions of the law, has been created in South Wenatchee. The improvement takes in territory from the Columbia River to the town of Rock Island, a distance of 13 miles. The road will be macadam, 16 ft. in width and it will cost between $22,000 and $25,000.

The Board of Public Works of Seattle, Wash., has rejected bids for three jobs of paving, as follows: 16th Ave., northeast and neighboring streets, a $12,000 job; concrete walks for East 50th St., $9,900; and paving the alley in Block 17, Boren, Denny & Yesler's Addition, $3,450. The bids were above City Engineer R. H. Thompson's estimated cost.

The Commissioners of Tacoma, Wash., have awarded Besel & Rahn the contract to grade South 56th St., from McKinney Ave. to East A St., for $3,250, and the contract for grading and laying cement sidewalks on South 50th St., from Sheridan Ave. to I St., to P. E. McHugh for $6,600. The Coast Contracting Co. will grade Oakes St. for $4,155.

Headquarters for the Vancouver, Wash., section on the Washington state highway, to be built around the borders of the state, have been located in the Ranck Bldg., 9th and Washington Sts., Vancouver, by M. D. Miller, engineer in charge. The headquarters office here will make preliminary surveys and estimates of the cost of the proposed road. D. Allerton has a party of about eight engineers near Camas making a preliminary survey.

WATER-WORKS AND SEWERAGE

California.

The proposed plan of laying pipes of the high pressure water system for fire protection in the center of Dolores St., between 18th and 22nd Sts., has been adopted by the city council of San Francisco, Cal.

The city board of health of Fresno, Cal., officially passed up to the trustees the proposition to sewer Russiantown as an urgent sanitary measure.

The following detailed estimate on the cost of constructing the Belmont annexed district main sewer with concrete pipe, prepared by City Engineer, Chris. P. Jensen, will probably be accepted by the city council of Fresno, Cal.: 27,000 cu. yds. earthwork, including excavation and backfilling at 60c, $16,200; 9,473.5 lin. ft. of 16-in. cement pipe laid at 60c, $5,684.10; 5,682.2 of 12-in. at 33c, $1,875.13; 3,589 of 10-in. at 27c, $969.03; 7,601.8 of 8-in. at 21c, $1,596.38; 60 manholes at 50 cents, $30; 382 Y's at $1 each, $382; surveying 26,456.5 lin. ft., $526.93; incidentals, $600; profit to contractor at 20 per cent on $29,706.64, 5,941.32. Total, $36,774.89.

The U. S. war department has notified Capt. W. P. Stokey, U. S. Engineer in charge of the proposed sewer extending into Newport bay, Los Angeles, Cal., to notify Santa Ana, Cal., officials that it will make no objections to the construction of the sewer.

Colorado.

The Westcott-Doan Investment Co. has been awarded a contract in Denver, Colo., for the Seventh Ave., special sanitary sewer, which is to be held between Clayton and Adams St., on Sixth, Seventh and Eighth Aves., and for a short distance on Ninth Ave., for $7,894. The company has also been awarded the contract for the improvements in sub-district No. 2 of South Capitol hill storm sewer district No. 2 for $4,752.

The city council of Colorado Springs, Colo., has voted not to construct the proposed south side sewer.

Illinois.

✣Bids will be received until 1 p. m., Nov. 3, by John R. Cross, mayor, McLeansboro, Ill., for the construction of a reservoir and filter and extensions of water mains in said city. The estimate of the work is $14,542.

✣Bids will be received until 1 p. m., November 3, by John R. Cross, Mayor, McLeansboro, Ill., for furnishing all necessary labor and material for the construction of a reservoir for water supply by the erection of dam and spillway, extensions and additions to water mains, water pipes, water system and filter for said city of McLeansboro. The work will include the following approximate quantities: 8,210 cu. yds. earth fill in dam; 115 cu. yds. concrete in spillway, protective walls, etc.; sluice gate and pipe; 14 hydrants, 1,634 ft. of 8-in. cast iron pipe; 12,300 ft. of 4-in. cast iron pipe; filter installed and complete.

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, in connection with sewer construction: N. Avers Ave., Greenwood Terrace to first alley S. of Wrightwood Ave., 490 lin. ft. of 12-in. tile pipe, 4 man holes and 6 catch basins, $681.10, Stephen A. Healy, 4323 Dearborn St.; N. Avers Ave., Dickens Ave. to Humboldt Ave., 670 lin. ft. of 12-in. tile pipe sewer, 4 manholes and 8 catch basins, $905, Stephen A. Healy, 4323 Dearborn St.; N. 52nd Ct., Grand Ave. to Humboldt Ave., 550 lin. ft. of 15-in. tile pipe sewer and 670 lin. ft. of 12-in. tile pipe sewer, 9 man holes and 12 catch basins, $1,744, Stephen A. Healy, 4323 Dearborn St.; W. 39th Pl., S. Kedzie Ave. to S. Sacramento Ave., 675 lin. ft. of 15-in. tile pipe sewer and 675 lin. ft. of 12-in. tile pipe sewer, 10 man holes and 14 catch basins, $1,971, Stephen A. Healy, 4323 Dearborn St.; N. Central Ave., Division St. to Hirsch St., 670 lin. ft. of 15-in. tile pipe sewer and 670 lin. ft. of 12-in. tile pipe sewer, 12 manholes and 16 catch basins, $1,909, Stephen A. Healy, 4323 Dearborn St.; and the system of brick and tile pipe sewers in the following streets: W. 49th Pl., Oakley to Leavitt St., 50th St., Western Ave. Boulevard to Leavitt St., 50th Pl., Western Ave. Boulevard to Leavitt St., 51st St., Western Ave. Boulevard to Leavitt St.; 51st Pl., 1st alley east of Western Ave. Boulevard to 430 feet of Oakley Ave., 1st alley east of Western Ave. Boulevard, W. 49th Pl. to W. 51st Pl., with a total lin. ft. of sewer as follows: 760 lin. ft. of 2-ft. single ring brick sewer, 2,650 lin. ft. of 15-in. tile pipe sewer, 3,385 lin. ft. of 12-in. tile pipe sewer, 56 man holes and 53 catch basins, $10,160, Stephen A. Healy, 423 Dearborn St.; Ave. H, E. 107th St. to E. 108th St., 640 lin. ft. of 12-in. tile pipe sewer, 5 man holes and 4 catch basins, $1,056, Fred Seip, 3057 E. 92nd. St.; Humboldt Ave., N. 41st Ave. to N. 41st Ct., 340 lin. ft. of 12-in. tile pipe, 2 man holes and 2 catch basins, $408, Nicholas and Angelo Mancini, 900 W. Taylor St.; W. 34th Pl., Western Ave. to a point 470 ft. west, 510 lin. ft. of 12-in. tile pipe, 4 man holes and 6 catch basins, $734, Michael Pontorelli, 4817 W. Dakin St.; W. 34th St., Western Ave Boulevard to a point 120 ft. west of S. Artesian Ave. and S. Artesian Ave., 34th St. to Bross Ave., 520 lin. ft. of 15-in. tile pipe and 590 lin. ft. of 12-in. tile pipe, 10 man holes and 9 catch basins. Nicholas and Angelo Mancini, 900 W. Taylor St., $1,597; Exchange Ave., E. 85th St. to E. 87th St., 670 lin. ft. of 15-in. tile pipe and 670 lin. ft. of 12-in. tile pipe, 10 manholes and 16 catch basins, $2,613; Jno. W. Brunt, 2447 E. 74th St.; W. 43rd St., Western Ave. to P. C. C. & St. L. Ry., 695 lin. ft. of double invert brick sewer 2½ ft. in diameter, 35 lin. ft. of 18-in. double strength tile pipe wing sewers, 180 lin. ft. of 18-in. double strength tile pipe, 300 lin. ft. of 15-in. tile pipe, 11 man holes and 11 catch basins, $3,454, Federal Improvement Co., 953, The Rookery; Muskegon Ave., 85th St. to 87th St., 670 lin. ft. of 15-in. tile pipe and 670 lin. ft. of 12-in. tile pipe, 10 man holes and 16 catch basins, $1,943, Tortelli & Scully, 518 W. Taylor St.

Following are the low bids and bidders as opened October 28th, 1910, by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, for furnishing and installing steam and water piping in connection with the remodeling of the 68th St. pumping station: Wm. A. Pope, 80 LaSalle St., $11,300; Thomas & Smith, 118 N. Carpenter St., $11,479.

Following are the low bidders and low bids as opened October 27, 1910, by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, for the furnishing and erection of two chain grate stokers to be used in connection with the new boilers in the 68th St. pumping station: Manistee Iron Works, $3,230; Illinois Stoker Co., 204 Dearborn St., $3,510. No awards have yet been made.

Contracts have been awarded as follows by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, for the laying of house drains: Hollywood Ave., N. Clark St., to Southport Ave., $.22 per lin. ft., Malachy Murphy, 5315 Wabash Ave.; S. Kedzie Ave., W. 36th St. to W. 39th St., $ .45 per lin. ft., M. Doran, 4612 Emerald Ave.; Medill Ave., Kimball Ave. to

Items marked thus ✣ indicate work now open for bids.

N. Central Park Ave., $ .27 per lin. ft., Simon Ryan, 2927 W. Congress St.; E. 75th St., Stony Island Ave. to Paxton Ave., $.53¾ per lin. ft., Carmin Roberts; Dauphin Ave., 87th St. to 92nd St.. $ .26 per lin. ft., E. 87th St., St. Lawrence Ave. to Dauphin Ave., $ .28 per lin. ft., E. 87th Pl., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 88th St., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 88th Pl., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., 89th St., St. Lawrence Ave. to Dauphin Ave., $ .38 per lin. ft., E. 89th Pl., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 90th St., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 90th Pl.. St. Lawrence Ave. to Dauphin Ave., $ .28 per lin. ft., E. 91st St., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 91st Pl., St. Lawrence Ave. to Dauphin, $ .25 per lin. ft., E. 92nd St., St. Lawrence Ave. to Dauphin Ave., $ .26 per lin. ft., E. 92nd Pl., St. Lawrence Ave. to Dauphin Ave., $ .27 per lin. ft., E. 93rd St., St. Lawrence Ave., to Cottage Grove Ave., $ .30 per lin. ft., Lyons Ave., E. 93rd St. to Cottage Grove Ave., $ .32 per lin. ft., Evans Ave., E. 93rd St. to Lyons Ave., $ .30 per lin. ft., Simon Ryan, 2927 W. Congress St.

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, for furnishing and laying water supply pipes in the following streets: North Arens Ave., Greenwood Terrace to a point 90 ft. north of the north line of Wrightwood Ave., 850 lin. ft. of 6-in. cast iron pipe, $ .90 per ft., valve basins, $30 each, total $795, Malachy Murphy, 5315 Wabash Ave.; 42nd Ct. W. 14th St. to W. 15th St., 737 lin. ft. of 6-in. cast iron pipe, $ .91 per lin. ft., total $700, Angelo Mancini, Chicago, Ill.; S. 43rd Ave., W. 14th St. to W. 15th St., 737 lin. ft. of 6-in. cast iron pipe $ .91 per lin. ft., valve basins $30, total $700, Angelo Mancini, Chicago, Ill.; S. 43rd Ct., S. 14th St. to 16th St., 1317 lin. ft. of 8-in. cast iron pipe, $1.18½ per lin. ft., valve basins $30 each, total $1,620, Tirtelli & Scully, 518 W. Taylor St.; W. 105th St., Wentworth Ave. to C. & W. I. R. R., 1,238 lin. ft. of 8-in. cast iron pipe, $1.21 per lin. ft., valve basins $30 each, total $1,527, Malachy Murphy, 5315 Wabash Ave.; W. 69th Ave., Wrightwood Ave. to Fullerton Ave., 1,294 lin. ft. of 8-in. cast iron pipe, $1.24 per lin. ft., valve basins $30 each, total $1,634, Angelo Mancini, Chicago, Ill.

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, for furnishing and laying water service pipes in the following streets: Hollywood Ave., N. Clark St. to Southport Ave., David Walsh, 6628 South Chicago Ave.; Balmoral Ave., N. Robey St. to West Ravenswood Park, 408 lin. ft. of lead pipe, $2.87, Jas. J. Renn, 367 W. Chicago Ave.; Burnside Ave., Cottage Grove Ave to St. Lawrence Ave., 240 lin. ft. of lead pipe, $189, David Walsh, 6628 South Chicago Ave.; Bernard St., Elston Ave. to Irving Park Boulevard, $492, Jas. J. Renn, 367 W. Chicago Ave.; Byron St., N. Hamlin Ave. to N. 40th Ave., 108 lin. ft. of lead pipe, $97, Jas. J. Renn, 367 W. Chicago Ave.; Costello Ave., Kimball Ave. to N. Lawndale Ave., 1,273 lin. ft. of lead pipe, $1,056, Jas. J. Renn 367 W. Chicago Ave.; Champlain Ave., Burnside Ave. to E. 95th St., 243 lin. ft. of lead water service pipe, $185, Jas. J. Renn 367 W. Chicago Ave.; Christiana Ave., Elston Ave. to Irving Park Boulevard, 1092 lin. ft. of lead pipe, $813, Daniel J. Hardin, 3139 Indiana Ave.; Gladys Ave., S. 48th Ave. to S. 50th Ave., 503 lin. ft. of lead pipe, $349, Jas J. Renn, 367 W. Chicago Ave.; S. Michigan Ave., E. 68th St. to E. 71st St., 1,400 lin. ft. of lead pipe, $826, David Walsh, 6628 South Chicago Ave.; 90th St., St. Lawrence Ave. to Dauphin Ave., 1,617 lin. ft. of lead pipe, $954, Peoria St., 119th St. to 122nd St., 192 lin. ft. of lead pipe, $158, Jas. J. Renn, 367 W. Chicago Ave. All pipe to be best quality of lead water service pipe 1 inch internal diameter and is to be fitted with brass stop cocks and shut off boxes.

The Improvement Board of Waukegan, Ill., received the following low bids on October 20 for the construction of two sewers and two water mains, as follows: Johnson & Thompson, $16,637, Washburn Springs Sewer; Banyon & Clifford, $623, Phillippa Ave., sewer; H. C. Patterson, $829; Maple Ave., water main; H. C. Patterson, $349, First St., water main.

Specifications and profiles of the new proposed city lake for Rushville, Ill., were submitted to the City Council and the waterworks committee instructed to secure estimates of cost without delay. Under the present plans it is proposed to purchase 20 acres of ground located between the upper and lower Crane creek bridges and to construct a dam at the lower end.

The Board of Local Improvements of Lewistown, Ill., on October 20 received the following bids for the construction of a sewer in District No. 1, being the North Side sewer district: Henry J. Rees. Quincy, Ill., $17,755; John F. Albright, Blanco, Minn., $16,636; E. R. Harding & Co., Racine, Wis., $16,003; James E. Daily, Hammond, Ind., $15,295.

The City Council of East Moline, Ill., has passed an improvement ordinance calling for the laying of a sewer system south of the railroad tracks. Plans and specifications were prepared by City Engineer Paddock of Moline and approximately 7 miles of sewer will be laid. The estimated cost is $55,000.

Indiana.

✣Bids will be received until 10 a. m., November 19, by Commissioner of Shelby county at Shelbyville, Ind., for the furnishing of 575 18-in. common tile. G. B. Huntington is Auditor.

The following bids were received October 18 by the Board of Public Works of Marion, Ind., for furnishing and installing a new boiler at the water works: McMaul Boiler Manufacturing Co., Toledo, O., $2,525; Superior Boiler Works, Marion, $3,300; Babcock & Wilcox, Chicago, Ill., $3,728.

Plans, looking to the installation of a trunk sewer in the southern section of South Bend, Ind., to cost approximately $100,000, have been announced by the City Council. City Engineer William S. Moore is making a survey for the improvement, with the expectation of having specifications ready for bids by January 1. The sewer will drain an expanse of land about 6 miles square.

Iowa.

✣Bids will be received until 9 a. m., Nov. 5, by city clerk, Sioux City, Ia., for furnishing the necessary labor and material for the construction of a sanitary sewer of hard burned salt glazed vitrified sewer pipe on portions of about 15 streets. E. O. Wesley is superintendent of streets and public improvements.

The citizens of Sigourney, Ia., have voted in favor of the proposition of constructing a complete sewage system for the town. The town council has had the town surveyed and estimates made by competent engineers and it is believed that the $35,000 bond issue will pay for the system.

Following bids were received at West Liberty, Ia., October 25, for 6 miles of sanitary sewer and a disposal plant, for which Chas. P. Chase of Clinton, Ia., was the engineer: C. R. Nichols, Caney, Kans., $21,874; C. R. McKav, Omaha, Neb., $22,682; Ottawa Construction Co., Ottawa, Ill., $22,861; Guy E. Smith, Indianola, Iowa, $23,263; J. W. Turner Improvement Co., Des Moines, Iowa, $23,370; Independent Construction Co., Davenport, Iowa, $24,885; Dearborn & Jackson, Cedar Rapids, Iowa, $25,362; M. Conroy & Co., Des Moines, Iowa, $25,718; R. C. Dela Hunt, Cedar Rapids, Iowa, $25,933; E. L. Dimick, Laurel, Neb., $26,246; W. D. Yeager, Cedar Rapids, Iowa, $26,977; Thos. Carey & Son, Clinton, Iowa, $28,737; Lytle Construction Co., Sioux City, Iowa, $28,951; Pastoret & Lawrence, Duluth, Minn., $29,885; O'Farrell Contracting Co., Dubuque, Iowa, $30,109. Disposal plant, C. R. Nichols, Caney, Kans., $6,780; Independent Construction Co., Davenport, Iowa, $7,129; A. Romaine, West Liberty, Iowa, $7,478; John A. Dahlsad, Waukon, Iowa, $7,728; J. W. Turner Improvement Co., Des Moines, Iowa, $7,913; W. D. Yeager, Cedar Rapids, Iowa, $8,031; O'Farrell Contracting Co., Dubuque, Iowa, $8,300; R. C. De la Hunt, Cedar Rapids, Iowa, $8,640; Guy H. Smith, Indianola, Iowa, $8,707; Cook Construction Co., Des Moines, Iowa, $8,857; Dearborn & Jackson, Cedar Rapids, Iowa, $9,571; Pastoret & Lawrence, Duluth, Minn., $10,769; E. L. Dimick, Laurel, Neb., $11,489.

City Engineer John Budd of Des Moines, Ia., has prepared sewage plans for the digging of a ditch to join the Fraley ditch near East 20th and Delaware Sts. The city engineer also recommends that the ditch be broadened and deepened to prevent overflow.

Kentucky.

The contract for the construction of Section B of the Frankfort Ave. sewer, in Louisville, Ky., has been awarded to James Ferry & Sons of Pittsburg, Pa., by the sewerage commissioners of that city. The new sewer will extend from Galt to Kennedy Ave., a distance of about 2,168 ft. The contract price was approximately $25,000. Charles P. Weaver, secretary and treasurer of the commission, has stated that work on the sewer will begin within 10 days.

Kansas.

✣Bids will be received until 11 a. m., November 16, by Capt. J. E. Normoyle, Constructing Quartermaster, Fort Leavenworth, Kan., for the construction of a 24-in. outfall sewer, approximately 8,500 ft. long of which about 2,600 ft. is to be cast iron pipe.

Following contracts were awarded at Mulvane, Kans., for the construction of a municipal water plant, for which bids were opened October 17; The J. S. Worley Co., Kansas City, Mo., Engineers: U. S. Cast Iron Pipe Co., Chicago, Section 1—215 tons of 4-in. cast iron pipe at $29.90 per ton; 58 tons of 6-in. cast iron pipe, at $28.15 per ton; 24 tons of 8-in. cast iron pipe at $28.15 per ton; 15,000 lbs. of special castings, at $ .03 per lb. Section 2—The Iowa Mfg. Co., Oskaloosa, Ia., fifteen 4-in. valves and boxes at $10 each; six 6-in. valves and boxes at $14 each; one 8-in. valve and box at $23; 35 two-way hydrants at $25 each. Section 3—Lund, Keenan & McCarty, Ponca, Ia., 19,620 lin. ft. of 4-in. cast iron pipe, 3½-in. trench, at $ .14 per ft.; 3,275 lin. ft. of 6-in. cast iron pipe, 3½-in. trench, at $ .17 per lin. ft.; 900 lin. ft. of 8-in. cast iron pipe, 3½-in. trench, at $ .20 per ft.; 100 lin. ft. of 6-in. cast iron pipe, 16-in. trench, at $1.75 per ft.; 125 lin. ft. of 8-in. cast iron pipe, 16-in. trench, $2 per lin. ft.; 35 hydrants, setting, at $2.50 each; one pump house, $1,600; 5 wells, at $210 each; 50 machinery foundations, at $8 each; placing one pump, at $50; extra concrete, at $12 per cu. yd. Section 4—Dean Stearns Pump Co., Kansas City, Mo., one 350-gal. per min. pump and motor, $1,678. Section 5—John Deere Plow Co., Chicago, Ill., one 25 h. p. gasoline engine, $1,050. Section 6—Des Moines Bridge & Iron Co., Des Moines, Ia., one 50,000-gal. tank on 90-ft. tower, at $3,250.

The city officials of Coffeyville, Kan., contemplate constructing a sewer in the western part of the city.

The City Council of Nicholasville, Kan., has passed an ordinance calling for an election in November on the question of issuing bonds to the amount of $20,000 for the purpose of installing a sewerage system. At the same time a vote will be taken as to whether the city will enter into a contract with a company for the extension of the water mains.

Louisiana.

The city Board of Health of Opelousas, La., has recommended the establishment of a sewerage system for this city and the formation of a sewerage district.

Maryland.

✣Bids will be received until 1:30 p. m., November 7, by Capt. R. H. C. Kelton, Constructing Quartermaster, Fort Washington, Md., for the construction of a new sewer outfall at Fort Washington, Md.

✣Bids will be received until noon, Nov. 3, by Board of Highway Commissioners, Towson, Md., for the construction of storm water sewer on Baltimore St. and Highland Ave. and Fairmount Ave., a distance of 1,800 ft.

The Baltimore Suburban Sewerage Co. of Mount Washington, Baltimore, Md., has been incorporated to construct the proposed sewerage system and a boulevard from Mount Washington along Western run to Pikesville for the suburb of Mount Washington. The plans call for an outlay of $600,000, part of which is represented by a bond issue of $300,000. The survey and maps for the system have been done under the direction of the McLean Contracting Co. of Baltimore.

Michigan.

Contracts for the construction of sewers on Avenue A and Wood St., and on Stevens St., Flint, Mich., were awarded to Thomas Bergin for $1,685 and $393 respectively.

City Engineer Tabor of Muskegon, Mich., has practically completed plans for the new proposed Lake St. sewer in the Seventh ward.

According to advices from Kalamazoo, Mich., $43,200 was recommended for the extension of water mains in the city.

The officials of Holland, Mich., are confronted with a water famine problem. The present waterworks plant is said to be inadequate and it is probable that a new system will be installed.

The City Council of Kalamazoo, Mich., has passed a bond issue of $13,350, for the construction of a sewer in Patterson St., and has decided to put the proposition up to the voters at the coming election.

The City Council of Allegan, Mich., has adopted the plans for the construction of the proposed South Side sewer.

The City Council of Muskegon, Mich., has decided to complete the three blocks of the Amity St. branch of the Spring St. sewer from the Pere Marquette intersection to Wood Ave.

Mississippi.

✣Bids will be received until Nov. 7 by the Board of Supervisors of Yazoo county, S. S. Griffin clerk, for boring an artesian well at Benton, Miss.

✣Bids will be received until 2 p. m., Nov. 8, by Clinton Thompson, mayor, Osyka, Miss., for furnishing the necessary labor and material for the construction of a water works and electric light plant. Xavier A. Kramer, Magnolia, Miss., is engineer.

Minnesota.

The Municipal research commission of St. Paul, Minn., has engaged D. H. Maury of Peoria, Ill., to make an investigation of St. Paul's water system.

According to information received from St. Paul, Minn., the Canadian Pacific Ry. will build a 1,000,000-gal. reservoir near Red Deer, Sask.

The City Council of Virginia, Minn., has decided to construct a storm sewer and sanitary sewer on the North Side of the city. The proposed sewer will drain the North Side addition and run into Virginia. The sanitary sewer will be constructed from the corner of First St., and First Ave., and connect with the main sewer on Virginia Ave.

W. B. Bosworth has received the contract at Long Prairie, Minn., for the construction of seven blocks of sewer. The work is to be completed this fall.

The City Council of Bemidji, Minn., has accepted the bid of Thomas Johnson of that city for the construction of a new septic tank for $2,250.

The Board of Public Works of Red Wing, Minn., has recommended that a sanitary sewer of 36-in. sewer pipe be constructed on West Ave. between Third and Fourth Sts. The work will be done this fall.

Missouri.

✣Bids will be received until 5 p. m., Nov. 7, by the city council, Sedalia, Mo., for the construction of a district sewer in Sewer District No. 43.

An engineer's report has been received at Kansas City, Mo., estimating that it will cost $4,000,000 to improve the sewer system of the city. As the city is close up to its debt making power the improvement cannot be made with a bond issue and consequently there is some talk of pulling away from the county so as to avoid the assessment roll as prepared by the county assessor.

Montana.

City Attorney J. A. Coleman of Lewistown, Mont., is arranging the details for a special election to be held in that city the latter part of November when the proposition to bond the city for $80,000 in order to replace the wooden water mains with iron and rebuild the water system will be submitted to the voters.

Nebraska.

✣Bids will be received until noon, Nov. 4, by Roscoe Ozman, city clerk, Lincoln, Neb., for the construction of sewers in Sewer District No. 106, located in 30th St., between Potter and Fair Sts.

The City Council of Grand Island, Neb., has awarded to H. J. Cathroe of Omaha, Neb., the contract for the construction of the sewer to the Soldiers' Home, connecting that institution with the city's sanitary sewer system, for $12,100.

New Jersey.

✣Bids will be received until 8 p. m., Nov. 28, by Charles Anderson, borough clerk, South River, N. J., for the water tight and enduring construction of either one or both of the following sections into which the sewerage system is divided: Section I. The collecting system, comprising about seven (7) miles of terra cotta pipe sewer fifteen (15 ins.) inches and less in diameter and all appurtenances. Section II. The disposal works, including C. I. pipe, river crossing, pump house, disposal works, and piping to and through these. Plans and specifications, instructions to bidders, bidding sheets, and form of contract may be seen at borough hall, South River, New Jersey, or at these offices of the engineer, viz.: New York, 220 Broadway; New Jersey, 46 Park St., Bordentown; Pennsylvania, Drexel Building, Philadlephia.

✣Bids will be received until 8 p. m., Nov. 28, by Charles Anderson, borough clerk, South River, N. J., for the water tight and enduring construction of one or both of the following sections into which the water works system is divided: Section I. Furnishing f. o. b. South River about fifteen (15) miles of cast iron pipe and fittings ten (10 ins.) inches and less in diameter. Section II. Furnishing f. o. b. South River approximately 43 valves and valve boxes and 60 fire hydrants. Section III. Hauling, laying, constructing complete a system of water mains, using the materials mentioned under sections one and two as furnished by the borough. Section IV. Furnishing and constructing a system of collecting drains near the proposed pumping station, including about 1,180 feet of stone covered terra cotta pipe of eight and fifteen inch sizes.

✣Bids will be received until 8 p. m., Nov. 7, by borough council, Keyport, N. J., for furnishing the necessary labor and material for the complete construction of about 10.5 miles of vitrified pipe sewers from 8 to 15 ins. in size with Y branches, manholes, flushing manholes and other necessary appurtenances, and of a sewage disposal works and pumping station, including the necessary piping, grading, etc. Marcus B. Taylor is borough clerk.

The Bloomfield, N. J., town council has rejected all bids received for the proposed storm sewer in the Watsessing section. It is estimated that the work will cost $13,000. Ernest Baechlin is Town Engineer.

Steps have been taken in East Orange, N. J., which may eventuate in the construction of a separate sewage disposal system for the city. The city has refused to combine with Orange, Montclair, Bloomfield and Glen Ridge in the building of a trunk sewer.

New York.

The board of contract and supply of Utica, N. Y., has awarded a contract to Peters & Co., for the construction of a sewer in Tilden Ave., from the end of the existing sewer south to South St., and in South St., from Tilden Ave., to Ontario St.

The Board of Water Commissioners of Amsterdam, N. Y., has entered into contract with Joseph Lyon to construct 1,981 ft. of 6-in. water mains in Brookside Ave., at $ .70 per lin. ft.

The Board of Water Commissioners of Amsterdam, N. Y., has awarded contracts for the construction of 1,682 lin. ft. of water mains in Van Derveer St., and Fourth Ave., to Phillip Bellen for $ .38 per ft., and for water mains 165 ft. long in Slona Ave., to Umberto De Rosa, for $ .94 per ft.

The proposition to appropriate $57,000 for the construction of a new 20-in. water main in Geneva, N. Y., from the pumping station to the city reservoir was recently voted upon and carried. The proposition to appropriate $35,000 for the purchase of a new pump was also carried at the same time.

Clyde Potts, Civil and Sanitary Engineer, 30 Church St., New York City, has been retained by the Village of Millerton, N. Y., to design for that village a system of sewerage and sewage disposal works.

The report of Emil Kuichling, engineer employed by Schenectady, N. Y., which has been received by the aldermanic committee, recommends the establishment of a reservoir on Bevis hill, near the grounds of the Mohawk Golf club, at an estimated cost of $175,000. This reservoir would require about 20 acres of land for the construction of it, making a total of $266,000 to be appropriated by the city.

The sewage and disposal plans prepared by City Engineer of Oswego, N. Y., for that city, have been approved by Civil Engineers Hering & Fuller of New York City.

The citizens of Yorkville, N. Y., have voted in favor of the proposition of installing a sewer system at an estimated cost of $22,000. The plans for the system were prepared by W. G. Stone, Civil Engineer of Utica, N. Y.

Advices from Brooklyn, N. Y., state that the Maspeth taxpayers association will join with the Winfield taxpayers association for the purpose of getting sewers for those two villages.

The business men's association of Port Jefferson, L. I., recently held a meeting to consider the proposition of installing a public drainage system in the village. Dayton Hedges, president of the town board of health, is interested.

North Dakota.

The city of Minot, N. Dak., contemplates constructing a dam in the Mouse River for the purpose of preserving the water supply and making certain a supply for the winter months.

The city of Bowbells, N. Dak., has awarded a contract to George W. Kemper, at $11,850, for the construction of a complete new system of waterworks. The contract calls for the completion of the work before January 1.

Ohio.

✣Bids will be received until noon, Nov. 10, by Board of Commissioners for the erection of the Lima State Hospital, at the office of Frank L. Packard, 1214 New Hayden Bldg., Columbus, O.; for performing the labor and furnishing material for the foundations of the infirmary "A" and infirmary "B," women's pavilion and isolation pavilion; also for the construction of a storm sewer at the Lima State Hospital. George E. Whitney is secretary of the Board of Commissioners.

The proposition to issue $750,000 of bonds to build a new waterworks plant to take the place of the one now operated by the Akron Water Works Co., Akron, O., was defeated October 25.

The city of Marysville, O., contemplates employing an engineer to prepare plans and superintend the construction of the proposed sewer system for the city. C. C. Armstrong is chairman of the sewer and drainage committee.

City Engineer Phil H. Weber of Canton, O., has begun the making of plans to complete the sewage system of the south and west ends of the city and will have them ready so that the construction will not be delayed longer than next spring.

The City Auditor of Cincinnati, Ohio, has sold bonds to the amount of $150,000, the proceeds of which will be used in extending the present waterworks system.

The West Lafayette, O., City Council has decided to put the construction of a water works and storm sewer system for the village up to the voters by submitting the proposition to them by separate ballots at the regular fall election.

The village of New Concord, O., is planning the establishment of a sewage and water distribution system for the central part of the village. Prof. L. J. Graham has presented the village council with a plan which is considered feasible and workable.

The citizens of Silverton, O., contemplate laying water mains in the village so as to get Cincinnati filtered water. The improvement will cost about $18,000 and a vote will be taken on the issuing of bonds in this amount at the fall election, November 8.

The city of New Philadelphia, O., has sold bonds to the amount of $130,000 for the purchase of the local waterworks, now owned by the American Water Co., of Pittsburg, Pa. The plant will become the property of the city November 1.

The City Council of Lorain, O., has purchased land from Geo. Hollstein containing three and nine tenths acres, for the construction of a disposal plant thereon.

Oklahoma.

✣Bids will be received until 5 p. m., Nov. 7, by Bob Parman, city clerk, Oklahoma City, Okla., for the construction of a lateral sewer. Plans and specifications are on file at the office of the city clerk.

City Engineer Hughes of Tulsa, Okla., has asked that the sewer in block No. 103 lying south of the Central Fire Station, be reconstructed.

Consulting Engineer Alexander Potter of New York City, employed by the city of Muskogee, Okla., as consulting engineer for the proposed intercepting sewer to the Arkansas river for the city's sanitary sewage, has been looking over the data collected by City Engineer T. P. Clonts, together with the line surveys, contour maps, etc.

Oregon.

The contract for laying the sewer pipe in Salem, Ore., has been awarded to Andrew Burns of Spokane, Wash., for $89,439.

Property owners in the Holgate-Kenilworth sewer district, Portland, Ore., have signed a petition asking the city council to have the city engineer prepare estimates for glazed cement sewer pipes for that district.

Pennsylvania.

✣Bids will be received until 8 p. m., Nov. 4, by P. S. Davis, burgess, borough of Saegertown, Pa., for furnishing the necessary labor and material for the construction of a system of water works for the said borough. There will be required approximately 205 tons cast iron pipe, 10,000 lbs. special castings, 28 fire hydrants, gate valves, valve boxes, etc., a concrete reservoir, approximately 3 miles pipe laying, 4, 6, 8 in. Witmer & Brown, Buffalo, N. Y., are engineers.

South Dakota.

The citizens of Morristown, S. Dak., have authorized the bonding of the town in the sum of $10,000 for the construction of a municipal system of waterworks.

Tennessee.

A petition is being circulated among the residents of Lincoln Park, Knoxville, Tenn., to be presented to the Knoxville Water Commission, asking to have the mains of the Knoxville water plant extended to that suburb.

Texas.

The city commission of Dallas, Tex., has awarded a contract to Smith & Whitney for the furnishing of an air compressor, capable of 1,029 cu. lbs. of free air per minute under 100 lbs. pressure for $2,000. The compressor will probably be put on one of the wells to be sunk to the Woodbine sands.

The city commission of Fort Worth, Tex., has under consideration the establishment of auxiliary pumping stations on the South Side and also a plan to compel the railways to connect with the dual system.

Utah.

Contracts for the building of a sewer in district 108, comprising Goddard and Wall Aves., and the laying of intersections in Orchard Ave., and a pipe line in Orchard Ave., between 20th St., and the Ogden river, were awarded by the city council of Ogden, Utah, as follows: The Wheelwright Construction Co., sewer contract, $4,500; J. P. O'Neil Construction Co., intersections on Orchard Ave., $467; McKay & Reed, drain pipes on Madison Ave., $1,513.

Virginia.

✣Bids will be received until 12:30 p. m., Nov. 19, by the Board of Control, Norfolk, Va., for the design, furnishing and installation of three electrically driven centrifugal pumps at Colley Ave. sewer pumping station; 1 2,000 gals. per minute, 1 3,000 gals. per min., 1 4,000 gals. per minute. W. T. Brooke is city engineer.

West Virginia.

The citizens of Moundsville, W. Va., have voted in favor of bonding the city in the sum of $166,900 for the construction and installation of a complete system of public sewers, consisting of a complete system of sanitary sewers and a separate system of surface drainage sewers.

Wisconsin.

✣Bids will be received until 10:30 a. m., Nov. 5, by Department of Public Works, Milwaukee, Wis., for the construction in the West Sewerage District pipe sewer in 22d St. from Hopkins St. to a point 12½ ft. south of Concordia Ave. H. E. Briggs is Commissioner of Public Works.

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The Evolution of "Representative Government" Into Commission Government.

All forms of government in America, whether the unit is the nation, the state, or the city, possess the common principle of district "representation." Each taxpayer is "represented" in the legislative body by a man from his district. Such representation is necessarily factional, hence legislation is usually a compromise between factions.

In a country whose industrial interests are not widely diversified, or in a city whose size is not great enough to make it an object of attack by predatory politicians, this "representative" form of government may serve well enough; but growth inevitably results in a differentiation of interests, as well as in a complexity that demands a different form of legislative control.

The recently appointed tariff commission serves to show most strikingly the charge that is soon to come in the federal government, just as the commission form of government in cities shows the evolution going on in the smaller units of public administration. The tariff commission is to investigate costs of manufacture at home and abroad, with a view to establishing a scientifically correct protective tariff—one based not upon "dickering" between representative factions in Congress but based upon data fairly and scientifically applied. In brief, a few men of special training—a commission of tariff experts—will ultimately direct the gathering of exact information and formulate the specific tariffs that will be imposed.

Another step in the same direction was taken when President Taft signed the river and harbor bill only upon the understanding that, in the future, a board of army engineers shall prepare the budget for all such expenditures. Incidentally this serves to indicate the growing importance of engineers in the affairs of government.

The public service commissions appointed in different states—all modeled after New York state and all of recent creation—are further evidence of the growth of the commission form of government. Few states are now without railway commissions and these commissions are taking on greater power, often, as in New Jersey, becoming a full-fledged public service commission in charge of municipal lighting, water works, telephone and telegraph, express and railway companies.

The commission form of government is not unlike the government of an industrial organization through its board of directors. While there are occasionally factions in such boards, they can be neither numerous nor large. Where a comparatively few men are engaged in directing an enterprise, there is a tendency to act with harmony that is rarely manifest when the number is great. Moreover, if they are selected regardless of "district," there is a strong tendency to act as seems best for the interest of all, rather than in the interest of sections.

In al likelihood political parties will not entirely disappear, even though legislatures and boards of aldermen shall become extinct; but it seems equally probable that party lines will ultimately not exist in city government, and will be rather tenuous even in national politics, except at times when radical differences of opinion arise as to important principles of government.

In Milwaukee the socialists are now in power. Among the planks in their platform is the municipal ownership and operation of all public utilities, and another plank provides for the abrogation of the contract system of doing public work. Both of these important tenets of socialistic faith stand exactly counter to the fundamental law of economic production, namely, that the individual reward for performance shall be proportionate to the individual productive output. There can be no compromise where men differ as to a fundamental principle of economics. Hence, political parties will exist so long as such wide differences of opinion exist. But, little by little, our nearby Milwaukeeans will furnish object lessons as instructive as those already to be seen at greater range in England and Europe, and it will be manifest to the vast majority of voters that the removal of individual incentive is infinitely worse in its economic results than the incidental ills concommitant with strife to excell. With the gradual dissipation of fallacious ideas about political economy there will come greater unanimity of belief in fundamental principles, loss of party strife and a more insistent demand for brains and integrity in public office. Political government will approach more closely to the present administration of industrial organizations.

To the civil engineer, as well as to the contractor, this evolution is a matter of extreme importance. The engineer will find in it his opportunity to act upon important commissions or to serve as an important employee of such commissions. The contractor will find a widened field of action, unlimited by political pull; and the complete elimination of political graft will result inevitably in far greater expenditures for public works.

Contract Work and Day Labor Work in Canadian Cities.

The practice in Canadian cities of having the City Engineer bid on public work in competition with contractors was mentioned briefly in our issue of Oct. 26. In several recent issues of our Canadian contemporary, the *Contract Record*, a number of Canadian contractors and city engineers have been debating by letter the merits of this practice. We have followed the arguments on both sides with some attention for, as stated in our previous issue, Canadian cities appear to get results more favorable to day labor than have American cities and we are interested to learn why. The letters published in *Contract Record* do not help much in this search, but they do bring out some few facts which deserve notice. If our Canadian contractor friends are correct in their contention that contract work is preferable to the day labor system as practiced in Canadian cities, they are directing their attack with poor effect.

The charge made against city bidding, as we gather, is three-fold: (1) The competition is not on a fair basis; (2) the quality of work secured is not superior, and, (3) the employment of public money to destroy private enterprise is wrong. None of these charges is very strong and two of them are in addition in our opinion wholly misdirected.

The contractors claim that competition is not on a fair basis because the city engineer bids on work which he will control and, consequently, he is in a position to deal leniently with himself in obeying specifications. Again they argue that the basis of competition is unfair because the engineer takes no financial risk and has to make no charges for this risk as a contractor must do. These claims have an appearance of importance which is misleading. The measure which we must use here is not bidding price but quality and cost. If the engineer is lenient with himself the quality of his work will in the long run be inferior. Risk is an item which cannot be escaped. The engineer personally may not bear the charges and he may not include it in his bidding price but it exists and is paid by some one and is a part of the cost of the work. Appraised by the measure of cost and quality of work and not by the measure of bidding price these "advantages" against which the contractors complain do not amount to much.

The charge that the quality of day labor work is not superior is doubtless sound. We do not speak with full knowledge of Canadian conditions but we do speak with extended knowledge of the facts in the United States. At comparable prices day labor construction in America is seldom superior and is quite often inferior in quality to well supervised contract construction. There is no plain reason why conditions should be different in Canada and we doubt if they are.

The final plea of the contractors against the employment of public money to destroy private enterprise is an admission of weakness. There is no greater reason why a city should give its work to contract so as to support the contracting business than why it should do its work by day labor so as to afford employment to indigent or inefficient laborers to prevent them from becoming burdens on the city's charitable institutions. If charity is to be distributed in either case it is cheaper and better to give pensions to the inefficient and disabled and have done with the matter.

We have been ruthless in criticizing the arguments of our Canadian contractor friends because we believe that they are losing by them a sure chance of victory. There is but one criterion for comparing the merits of contract work and day labor work and that is cost and quality. If a city can by day labor do its public work as well at less cost or better at the same cost than by contracting for it, it should most certainly do it by day labor. We do not believe that in the long run it

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can, much less do we believe that as a general policy day labor work can equal in cost and quality work done by contract. The facts wherever they have been demonstrated fully and fairly are against such belief and the burden of reason supports the facts. If Canadian contractors wish to convince the public that the day labor system of work of Canadian cities is wrong they should apply the measure of cost and quality by actual comparative figures and not forget that the city engineer's bidding prices are not costs.

In all the letters of the city engineers who have taken part in the debate in the columus of the *Contract Record* there is not a figure showing that day labor work costs less than contract work in Canadian cities. Nor do we find in their letters a definite assertion that the quality of day labor work is better than contract work. The most definite statement that we find anywhere is the following:

> The assertion that poor workmanship and material are put into the work by the city engineer if he underbids the contractor, does not bear the appearance of fact. The engineer, of all men, is the one most interested in having his design properly executed in every way, for upon the results he is adjudged competent or incompetent.
>
> As far as the ratepayer is concerned, he reaps the advantage, as he is saved both the contractor's profit and the salary of the inspectors.

That the engineer is interested in having his work good no one will dispute. He is no less interested when the work is being done by contract than when it is being done by day labor and he supports his interest by putting inspectors on the contract work. The engineer is also interested in having his day labor work cost no more than his bidding prices, by this also will he be "adjudged competent or incompetent." Suppose the engineer makes a low estimate, as contractors sometimes do, and as he is quite as likely to do as are contractors, he must take care of it either by doing the work well and charging up the loss or by skimping the work so that it will come within the estimate. The contractor in a similar position will and must do one or the other of these things, but he has to accomplish the "skimping" should he choose that resort in spite of the engineer's inspectors. Now we will say frankly that our belief in the rectitude of engineers is such that we think that between the two ways open to him he will choose to make the work good and charge up the increase over his cost estimate, but if he chooses the other way it must be admitted that it will be easier for him to succeed them for a contractor. We bring out these points not to curb suspicion on the honesty of engineers' day labor work but merely to show that the second sentence of our city engineer's statement is not so completely final a disposition of the matter as it sounds to be.

In his last sentence our city engineer harks back to the silly old bugaboos of the "contractor's profit" and "cost of inspection." What is the contractor's profit but pay for services? Some one must manage the work and get paid for it, if there is no contractor the city must hire a manager. There are no two ways about this. As for inspection it cannot be omitted safely on any construction work whether done by day labor or by contract. This is a fact so well recognized that day labor construction of any importance is seldom carried on without inspection.

The bids for the Tri-Borough subway of New York City are given in our Contract News section this issue. As the lowest bids for the Broadway-Lexington Ave., the Broadway-Lafayette Ave. and the Canal St. subways aggregate $85,437,570.11, or more than $25,000,000 in excess of the money supposed to be available, the Commission may not be able to begin work on all the sections at once, but it will go just as far as the funds appropriated will permit it to go and finish up on later appropriations.

CONCRETE AND REINFORCED CONCRETE SECTION

An Unusual Column Head Supporting a Girderless Concrete Floor.

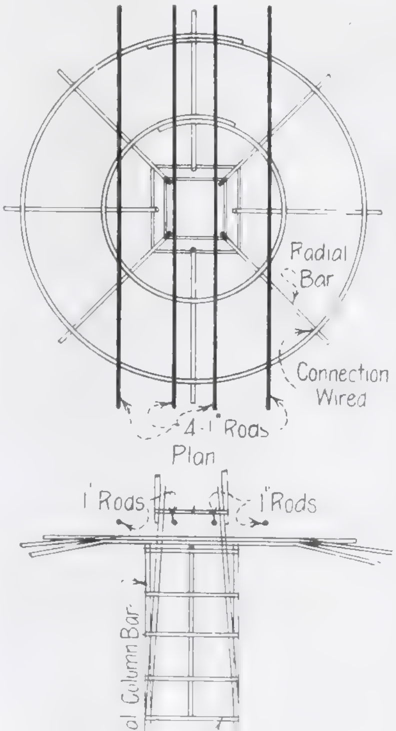
An interesting problem arose in connection with the location of some shafting and piping in the new reinforced concrete Truck Assembly Building of the Pierce Arrow Motor Car Co., at Buffalo, N. Y. This building is designed with the girderless or mushroom type of reinforced concrete; the column heads begin to flare at a distance of 2 ft., 3 ins., below the bottom of the floor slab, the width at the floor slab being 4 ft., 10 ins. The floor is designed to carry 150 lbs. per sq. ft. live load, the slab is 8 ins. thick and the columns 20 ft., 6 ins. on centers. Figuring the weight of the floor slab at 103 lbs. per sq. ft., this means 106,323 lbs. to be supported on the floor in one panel or 26,580 lbs. on each column for each story.

In laying out the shafting it was found necessary to run a line close to the head of one row of columns and it was also desirable to run a line of pipe on the other side of this same line of columns close to the floor slab of the floor above. It was consequently necessary so to design this line of columns that the flare of the head to support the floor slab should not interfere with the shafting or piping. This was accomplished by running the columns on two opposite sides, plum up to the under side of the square portion of the column head. The flare of the columns in the other directions acted in a measure as a cantilever beam supporting the square column cap on which the floor slab of the story above would rest. There would consequently be developed a reverse bending moment over the column and at right angles to the flare which would tend to crack the floor slab at near its upper surface. The shear at the column was taken care of by increasing the depth of the square top of the cap from 3 ins. which was the depth in the ordinary columns, to 5 ins. giving in all a total depth of 13 ins. at this point. To take care of the reverse bending, in addition to the regular slab steel consisting of ½ in. round rods 6 ins. c. to c. in each band of reinforcement, four 1 in. rods were placed across each column near the top of the floor slab running at right angles with the flare of the column. These rods were 9 ft. in length and extended out into the floor slab equal distances on either side of the column, as shown by the accompanying sketch.

This arrangement was designed by Messrs. Lockwood, Greene & Co., of Boston, engineers and architects, for all of the new buildings at the Buffalo plant of the Pierce Arrow Motor Car Co., and was constructed by the Aberthaw Construction Co., also of Boston.

Bond—Friction—Resistance in Reinforced Concrete.*

Early in 1907 the writer began a systematic study of bond in reinforced concrete in flexure. This study was particularly directed to the published reports of experiments by eminent American investigators on reinforced concrete. The reports on hand at the time the study began were by Professors Hatt, Lanza, Talbot, Howe, Turneaure, and Marburg, and Messrs. Humphrey, Harding, and others. Later, further reports were obtained from the Universities of Illinois and Wisconsin. The files of *Engineering News, Engineering Record,* and *Concrete Engineering* were carefully scrutinized, and other publications were examined for data on this subject.



Special Column Head Reinforcement.

As a result of this investigation the writer has proven that the usual assumption that reinforced concrete is "practically a homogeneous material" is not true, and it follows from this that sectional planes before bending do not remain plane surfaces after bending.

The method of analysis pursued by the writer, though not along strictly conventional lines, as laid down in the current literature on the mechanics of a reinforced concrete beam, was nevertheless mathematically correct. A reinforced concrete beam is not like a timber girder or a steel beam. It is a really wonderful combination of two unlike materials, each having properties when alone that are not at all in evidence when the two materials are combined. Further, there are no precedents in the history of mechanics of materials for such a combination.

The following is a brief synopsis of the mechanics of the beam as adapted to this study:

The bending moment produced on a beam by external forces is resisted by an equal and opposing moment which is developed in the beam—this is the section moment. If a transverse section is made through a beam, the action of the portion to the right on the portion to the left may be reduced to two equal forces, one positive and the other negative, which two form a couple the arm of which is the distance between their respective points of application. The point of application for the former will be the centroid of the compressive stresses; and of the latter, the center of the steel. Manifestly, the force acting on the steel in one direction, say, to the right, is equal to the friction force operating to the left between the steel and the surrounding concrete. This latter force is usually called "bond," but, as the real bond is broken at a very low stress compared with the final resistance at failure, and, as a kind of friction-resistance ensues after the bond is broken, it has been considered better to call it bond-friction-resistance. This bond-friction-resistance, therefore, may be defined as a friction force which operates after incipient movement has taken place. The intensity of the tensile stress that can be developed in the steel at a cross-section is mainly dependent on this bond-friction-resistance.

---

*A paper by William Fry Scott in Proceedings American Society of Civil Engineers, Vol. XXXVI, p. 1245.

The following formulas have been used

$$M_b = M_s = f_s\ A_s\ d' = f_b\ \Sigma O\ l'\ d',$$

in which M_b is the bending moment,
M_s is the section moment,
f_s is the unit stress in the steel,
A_s is the total area of the cross-section in the steel,
d' is the distance from the center of the reinforcement to the centroid of compressive stresses,
f_b is the average value for bond-friction-resistance per unit area of the surface of rods to, say, the left of the cross-section;
ΣO is the sum of the perimeters of either round or square rods, and
l' is the entire length of the encased portion of the rod to the left of the cross-section.

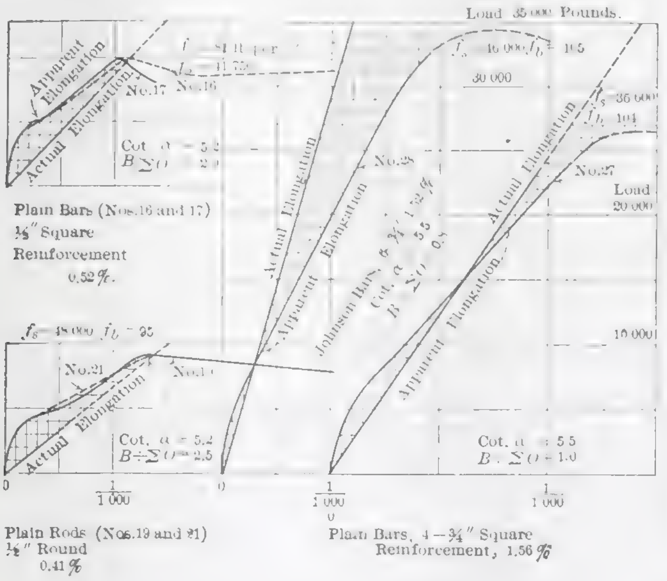


Fig. 1—Slipping of Rods in Reinforced Concrete.

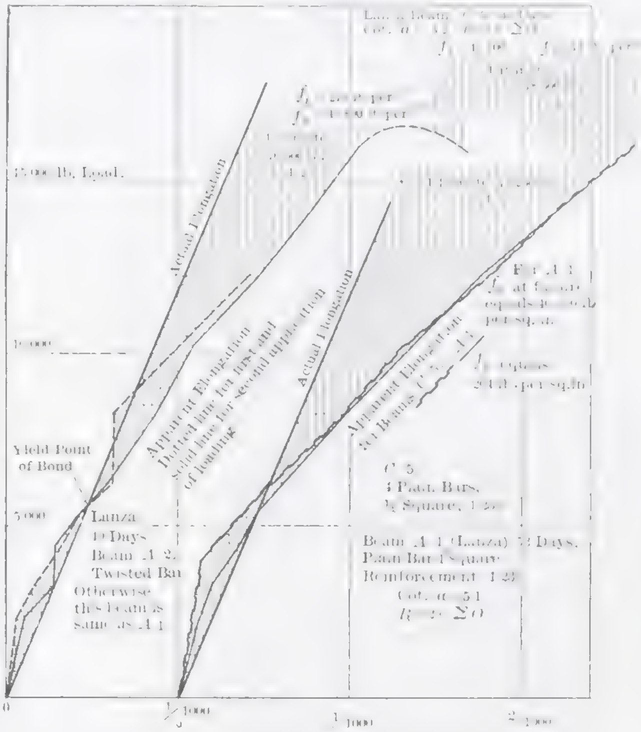


Fig. 2—Slipping of Rods in Reinforced Concrete.

The following is a short history of the various steps leading to the final results that have been developed from this investigation:

The first phenomena noted were: that perfect bond between the concrete and the surface of the steel did not seem to be very lasting; that, after the real bond was broken, there was a creeping of the rods accompanied by a frictional resistance between the particles adhering to them and the rough surface of the concrete encasing them; and, that, in cases of repeated loading, after the load had been taken off, the rods would not always return to their original position—evidently having been stopped in their return because loosened particles of the concrete turned sufficiently to wedge in and prevent it.

The slipping of rods is shown in Figs. 1 and 2. The group of beams in Fig. 1 is from Talbot's series of 1904. The group in Fig. 2 is from Lanza's series.[1] The apparent elongation was observed by extensometers in the Talbot series, and by direct readings in the Lanza series. The actual elongation was computed from the known value of the modulus of elasticity of the steel and from the value of the tension produced therein, as calculated from the known forces acting on the specimen.

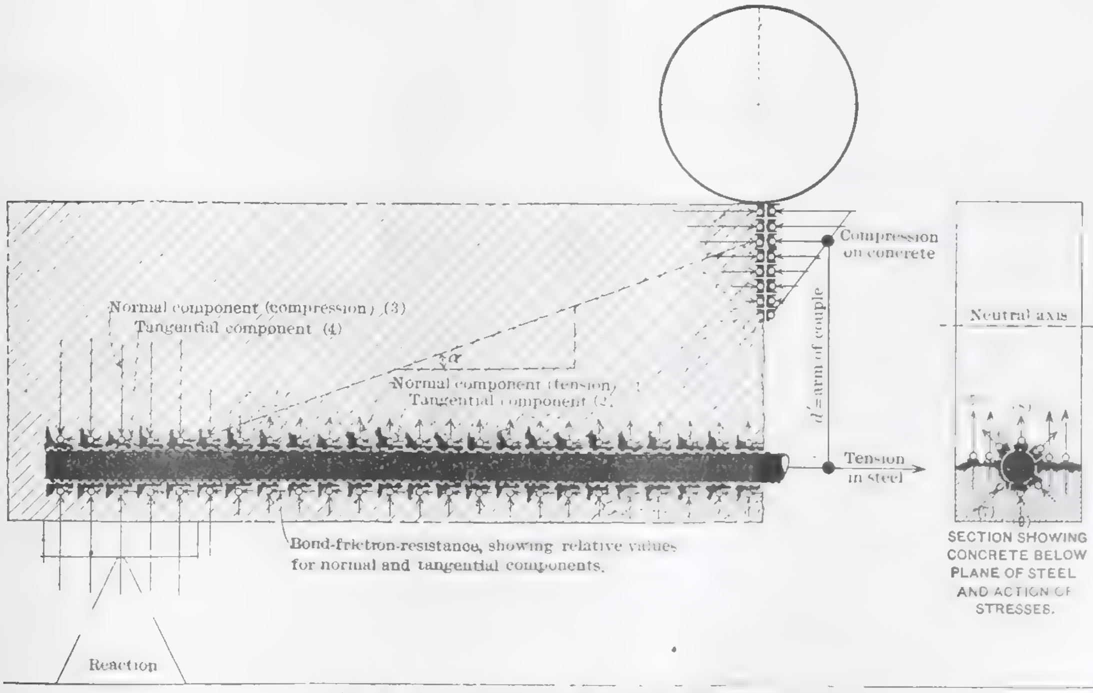

Compression on concrete
Neutral axis
Normal component (compression) (3)
Tangential component (4)
α
Normal component (tension)
Tangential component (2)
d' = arm of couple
Tension in steel
Bond-friction-resistance, showing relative values for normal and tangential components.
Reaction
SECTION SHOWING CONCRETE BELOW PLANE OF STEEL AND ACTION OF STRESSES.

Fig. 3—Bond Stresses on Beam Reinforcement.

The Talbot beams, Nos. 27 and 28, were practically alike, with the exception that one was reinforced with plain bars and the other with deformed bars. The creeping seems to have begun on No. 28 (deformed-bar reinforcement) at about one-fourth of the ultimate load, and to have increased to nineteen-elevenths (1.72) of the actual elongation of the steel at the reading taken immediately before failure. This implies an apparent slip of 72 per cent of the actual elongation. This point, where the creeping seems to have begun, may be called the yield point of the bond, and, for all practical purposes, may be taken as the point of intersection of the curves for actual and apparent elongation of the steel. On No. 27 (plain-bar reinforcement) the creeping seems to have begun at about two-thirds of the ultimate load, and the apparent elongation at the reading taken before failure was about 12 ÷ 10½ (1.14) of the actual. This implies an apparent slip of only 14 per cent of the actual elongation.

The Lanza beams, A-1, A-2, and C-5, in Fig. 2, are very much like the Talbot beams, Nos.

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[1] Reports on both these series may be found in Proceedings, Am. Soc. for Testing Materials, Vol. VI.

27 and 28, as to make-up and quality, with a very slight variation as to age. On *A*-2 (deformed-bar reinforcement) the creeping seems to have begun at about one-third of the ultimate load, and the apparent elongation at the reading taken before failure was 22 ÷ 13½ (1.63) of the actual. This implies an apparent slip of 63 per cent of the actual elongation. On *A*-1 (plain-bar reinforcement) the creeping seems to have begun at one-third of the ultimate load, and the apparent elongation at the reading taken before failure was 22½ ÷ 12 (1.88) of the actual. This implies an apparent slip equal to 88 per cent of the actual elongation. On *C*-5 (plain-bar reinforcement) the creeping seems to have begun at about one-third of the ultimate load, and the apparent elongation at the reading taken before failure was 26½ ÷ 13¼ (2.0) of the actual. This implies an apparent slip equivalent to the actual elongation of the rod.

Before considering the Talbot beams, Nos. 16, 17, 19, and 21, it is desirable to define the exact meaning of "apparent elongation." The apparent elongation, which is observed on the side of the beam, is transmitted from the rod to the face of the concrete by the intervening concrete. It is fair to assume:

First.—That the strain transmitted to the intervening concrete by the rod must (when the bond is not broken) be a maximum on the fibers next to the surface of the rod, and zero at some points remote therefrom in the horizontal plane of the steel.

Second.—That that point may fall (*a*) on the surface of the beam, (*b*) between the surface of the beam and the surface of the rod, or (*c*) entirely outside of the surface of the beam. If the zero point falls within, then none of the strain (unless possibly of a negative nature) will reach the surface of the beam; on the other hand, if it falls without, then a certain proportion of the strain will reach the surface. In the above statements it will be recognized that the writer does not accept without question the historic assumption regarding plane sections in reinforced concrete beams.

Third.—Another circumstance that will also be apparent is the fact that, after the ultimate tensile strength of the concrete has been exceeded, the horizontal fibers of this material begin to tear apart and form irregular divisions along the tensile side of the beam.

It is conceivable that the bond may be preserved in some of these divisions, and more or less transformed to bond-friction-resistance in others. Some of the slip may be taken up in visible tension cracks and some by a number of microscopic cracks distributed in each of these divisions, but, as the load increases, these will tend to close and localize the elongation in a few definite fractures, more particularly those under the load or loads. The closing of the microscopic cracks will tend to hide most of the real elongation on that division if it should happen that readings are confined to that region. This is particularly true for the middle third of a beam with third-point load. That there is a true elongation in the steel, other than the apparent, may be inferred from the indications in the elongations for the Talbot beams, Nos. 16, 17, 19, and 21, and from the indications resulting (before creeping begins) from repeated loadings on the same beam, or from the first loadings on like beams. The apparent elongation was not even equal to the actual elongation when the maximum load was on beams Nos. 16, 17, 19, and 21. It was ten-elevenths for No. 17, and about the same for the others.

This is what occurred: The true elongation did not happen to appear on the surface within the region measured. It was in evidence, in an irregular way, outside of that region. The apparent elongation also for the second application of load for *A*-2 suggests that there is an elongation other than the apparent. This is evident when the apparent elongations for the first and second applications of load are compared, and is suggested by their relatively erratic behavior below the yield point.

The fact that, in cases of repeated loading, the rods would not always return to their original positions when the load was removed is made evident in the diagrams for deflection of beams tested with repeated loads by Professor Hatt.[2] This slipping and creeping of the reinforcement, although interesting and not without importance in itself, had only a secondary bearing on the analysis of the tests which follow. The same is the case with the question of plane sections before and after loading.

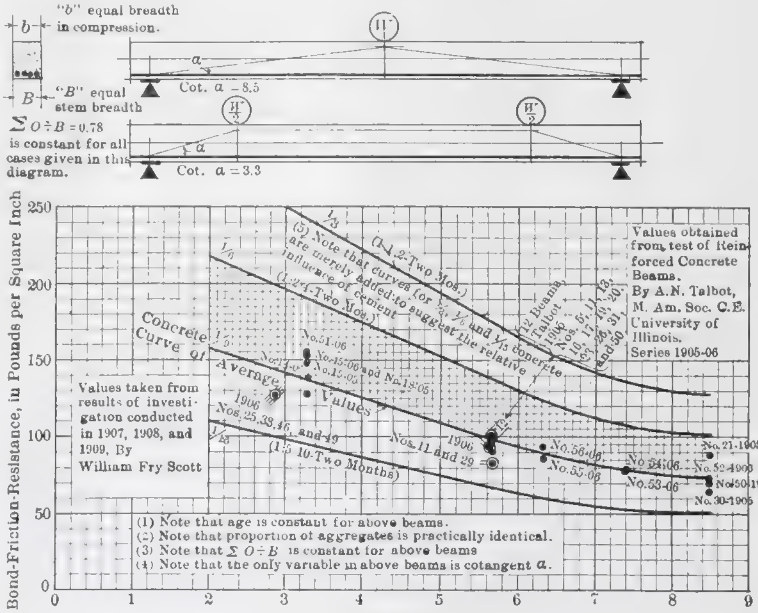
After several hundred beams had been analyzed, an attempt was made to divide them into groups, as to age and quality of concrete, but—other things being equal—it was observed:

I.—That, as the load on like beams approached the supports, the bond-friction-resistance increased;

II.—That, under no circumstance was there any indication of the high bond values that had been obtained from early experiments on bond by pulling rods from cubes of concrete;

III.—That those beams having a maximum of concrete between the rods gave very high results; and,

IV.—That those beams with a minimum of concrete between the rods gave very low results.



Description of Beams: Net dimensions; Breadth 8," Depth 10,"
1905 Series 1:3:6 Concrete, 2 months old,
1906 Series 1:3.5½ Concrete, 2 months old.
Reinforcement: 4 Straight Rods, ½" ϕ.

Fig. 4—Bond-Friction-Resistance When Cotangent a is the Only Variable.

The first and second observations led to the belief that there must be two components in the bond-friction-resistance, a tangential and a normal component, and to the further beliefs that the normal component in the cases of pulling rods from cubes or cylinders of concrete was a compressive stress; that the normal component in beam tests was mostly tension, with more or less compression at and near the supports; and that this compression at and near the supports varied with the variations of the angle, *a*, shown in the diagram, Fig. 3. In the section of this diagram showing concrete below plane of steel, the values of the forces (7) and (9), are dependent on the values of (5). This section will also suggest the reason for the sense of the forces acting on the lower side of the rod. In this diagram will also be found further illustration of the distribution of the stresses just mentioned.

The reports, therefore, were all examined again and analyzed with reference to these four elements. Groups were carefully sought which would have not more than one variable the influence of which it was desired to study. Although choosing from more than a thousand experiments, it is surprising how few of them it was possible to place in each group and keep free from foreign influences. However, the material was gradually gathered until sufficient information was obtained as to the influence of each element.

The first hint that the bond-friction-resistance increased as the loads approached the end supports of a beam was gained from a small group of experiments[3] in which the beams were identical in every way; dimensions of cross-section, length, span, reinforcement, depth of reinforcement, quality of concrete, and age at testing, were as nearly alike for all specimens as could be obtained in laboratory work. The only variable was the position of the load. The group was peculiarly fascinating to the writer, as it held some confusing contradictions. When the load was nearest the supports, the highest values for bond-friction-resistance were developed, yet when it was farthest from the supports, the highest values were developed for the tensile strength of the steel. This group did not seem to be sufficiently representative, but when Bulletin No. 14, from the same Experiment Station, came out with another group, identical in every way and giving results that agreed in every particular with it, the evidence seemed to be conclusive. However, further search was made, and quite an elaborate group was found in Bulletin No. 148 of the University of Wisconsin. The beams in this group were identical as to shape, size, span, and age; they were not as large as those tested in the University of Illinois, nor was the span as great. At the latter station the cement was measured by loose volume, but it was weighed at the University of Wisconsin, 100 lbs. being rated as a cubic foot. The other materials were measured by loose volume at each station. The reinforcement in the first two groups was straight round rods without hooks, crooks, deformations, or web members. In the latter group the rods were also round, but they were bent up at various points. The influence of this bending, however, does not affect the comparative values resulting from the influence of position of load. The results from this group confirmed those from the first two groups. That is, there was high bond-friction-resistance when the load was near the supports and lower values as it moved toward the center of the beam. Evidently, the high values that result when the load is near the support are due to an increase in the value of the normal component of the bond-friction-resistance. For each group the length of the arm of the couple which forms the section moment on the cross-section under the load point is constant for every position of the load, therefore the only variable is the distance of the load from the support.

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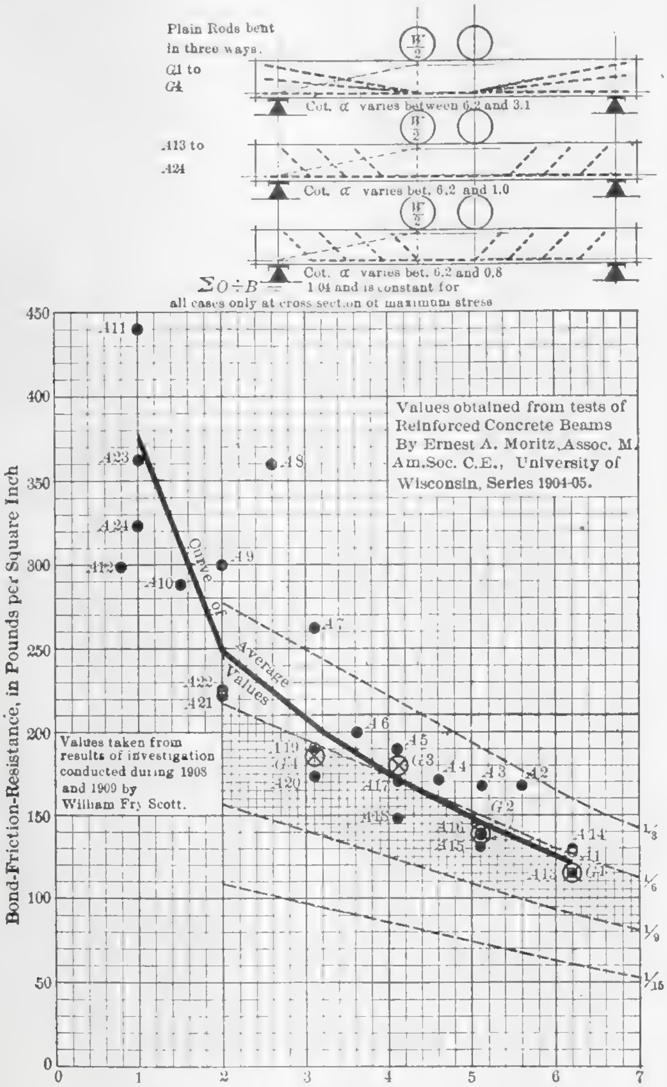
[2] Proceedings, Am. Soc. for Testing Materials; also published in Engineering News, October 24th, 1907.

[3] Bulletin No. 4, University of Illinois, Engineering Experiment Station.



Description of Beams: Breadth 3," Net depth 4½"
Gross depth 5," length 4'6," Span 4'0"
Mortar 1:2½ (Note Cement was weighed, 100 lb. to the cubic foot which would make a mortar equivalent to 1:2 when measured by loose volume, the latter being the method used by Professor Talbot, Univ. of Illinois.)
Reinforcement: 4 Rods, ¼" ϕ.

Fig. 5—Bond-Friction-Resistance When Cotangent a is the Principal Variable.

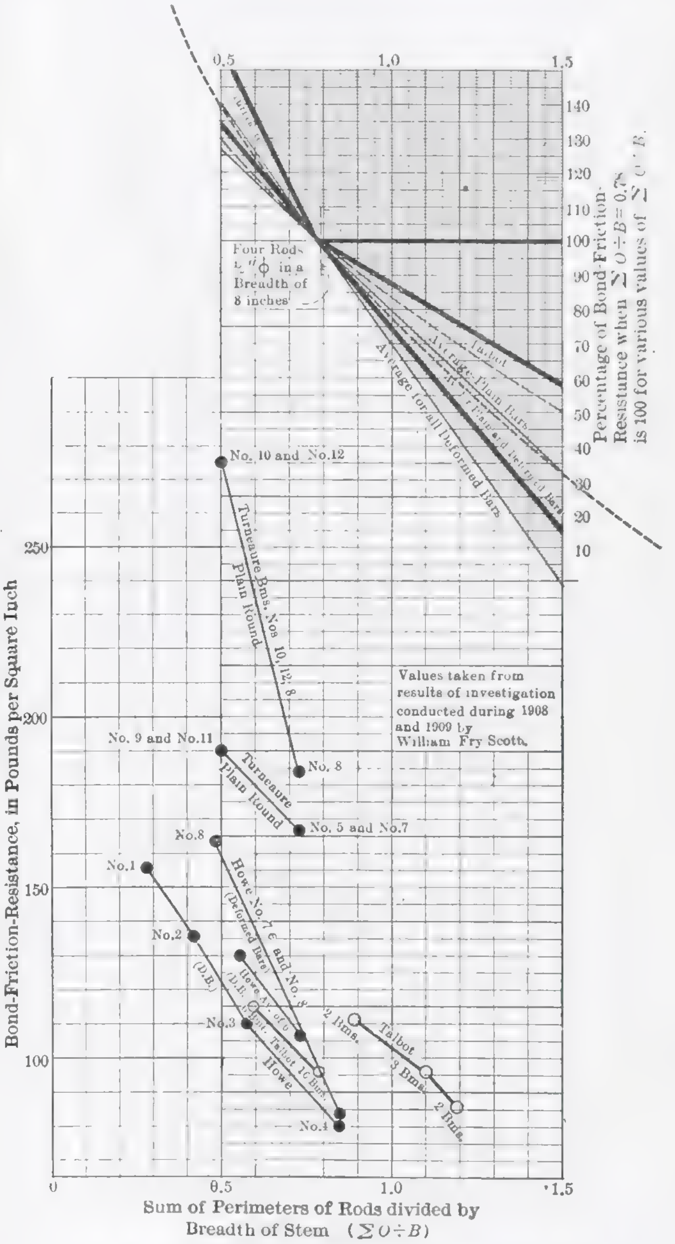


Fig. 6—Bond-Friction-Resistance When $\Sigma O : B$ is the Principal Variable.

The ratio of these two lengths, therefore, will give an accurate value as a basis for determining the influence of this normal component as affected by the position of the load with reference to various dimensions of beams and various percentages of reinforcement. The variations of this ratio are represented by the cotangent of the angle, *a*, as abscissas on the diagrams, and the bond-friction-resistance as ordinates. The individual values for each beam and the mean values for like beams are both given for all three groups. The results are plotted on Figs. 4 and 5. It is believed by the writer that this bond-friction-resistance as given on these diagrams is only an average value, and that the true value varies at several points along the rod. At and near the supports it will be almost as great as is obtained from pulling a rod from a cube or cylinder of concrete, in which case the normal component is a compressive force. Outside the influence of the compressive forces acting on the beam, that is, within the influence of the tensile forces, it will be less than the average value given in these diagrams.

Bond-friction-resistance on steel with a high elastic limit, but stressed very much below it, will be higher, probably 3 or 4 per cent, than on steel with a low elastic limit, but stressed a little beyond that limit—other things being equal.

As to the second observation, "that under no circumstance was there any indication of the high bond values that had been obtained from early experiments on bond by pulling rods from cubes or cylinders of concrete," the results of the most important tests on adhesion, as given by Turneaure and Maurer,[4] indicate that plain bars develop from 237 to 756 lbs. per sq. in. for 1:2:4 concrete under such methods, while Fig. 13 indicates that plain bars develop from 50 to 110 lbs. for 1:2:4 concrete when embedded in a reinforced concrete beam with a breadth of stem equal to two-thirds of the sum of their perimeters, as explained later.

Since this investigation was completed, there have been published[5] the results of two sets of experiments which are interesting as further confirmation of this second observation. The first is entitled "Tests on Bond in Reinforced Concrete Beams," by Mr. Morton O. Withey, made in the Materials Testing Laboratory at the University of Wisconsin. The second is entitled "Some Tests of Bond of Steel Bars Embedded in Concrete by Three Methods," by Mr. H. C. Berry, made in the laboratory of the Civil Engineering Department of the University of Pennsylvania. The conclusions of Messrs. Withey and Berry are similar, and therefore it will be sufficient to quote the latter who found that "push-out" tests gave two and one-tenth times, and "pull-out" tests two and six-tenths times, the bond stress that had been obtained on their beam tests. He says, of these experiments:

"It is evident * * * that the maximum value of the bond between concrete and plain steel in reinforced concrete beams is between 200 and 250 lbs. per sq. in., and that this value instead of the higher values usually quoted should be taken for guidance in reinforced concrete design."

It will be noted that these results are the same as the minimum value obtained from "pull-out" tests quoted from Turneaure and Maurer. This is easily explained. The specimens in the Withey tests had a value of 5 for cot. a, and those in the Berry test a value of 2; and in both cases the breadth of the concrete was two and one-half times the sum of the perimeters of the reinforcing rods. Therefore, according to Fig. 13, the Withey tests should have given more than 200 lbs. per sq. in., and the Berry tests nearly 400 lbs. per sq. in., in the rods in these specimens had extended into the supports.

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[4] "Principles of Reinforced Concrete Construction."

[5] Proceedings, Am. Soc. for Testing Materials.

That they did not extend into the supports, and that one-half of the average bond-friction-resistance was all that was developed on the rods, is convincing proof that the writer's theory — that the bond-friction-resistance varies at different points along the rod—is true. The Berry rods extended 8 ins. only, in each direction from the center of the beam, that is, one-third of the distance to the support, thus they were entirely within the field of the tensile stresses in the concrete, instead of reaching into the field of the compressive stresses at the supports.

With regard to the confusing contradictions previously mentioned as existing in the two groups illustrated in Figs. 4 and 5—that is, when the load was nearest the supports the highest values for bond-friction-resistance were obtained, yet when the load was farthest from the supports the highest values were obtained for the tensile strength of the steel—the writer has only recently arrived at a positive explanation of this anomaly. The theory underlying the explanation had been developed some time ago, having been held in abeyance until an opportunity should arise to prove it. The secret may be found from two facts:

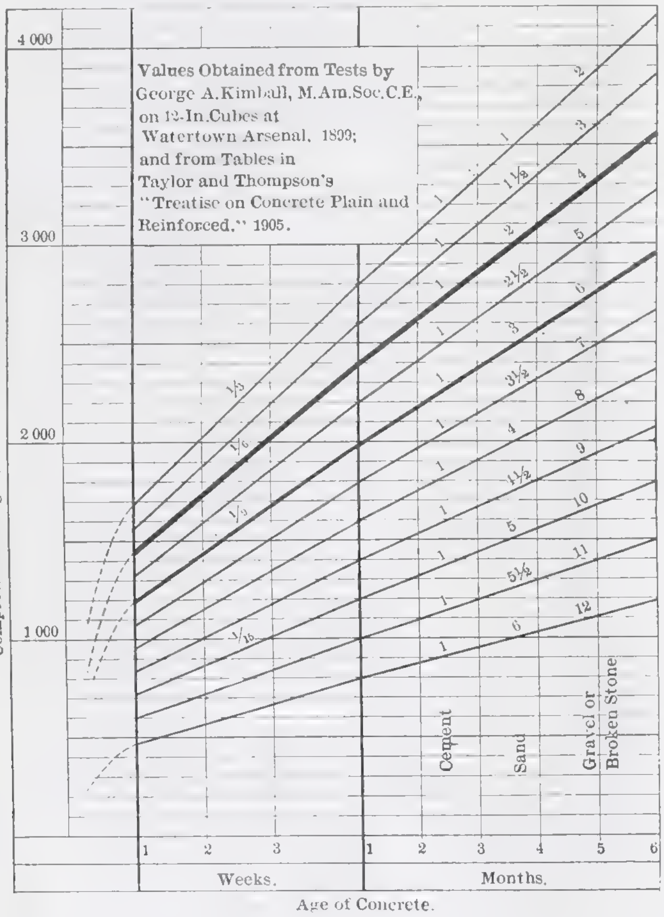

Values Obtained from Tests by George A. Kimball, M.Am.Soc.C.E., on 12-In.Cubes at Watertown Arsenal, 1899; and from Tables in Taylor and Thompson's "Treatise on Concrete Plain and Reinforced." 1905.

Fig. 7—Average Compressive Strength of Concrete.

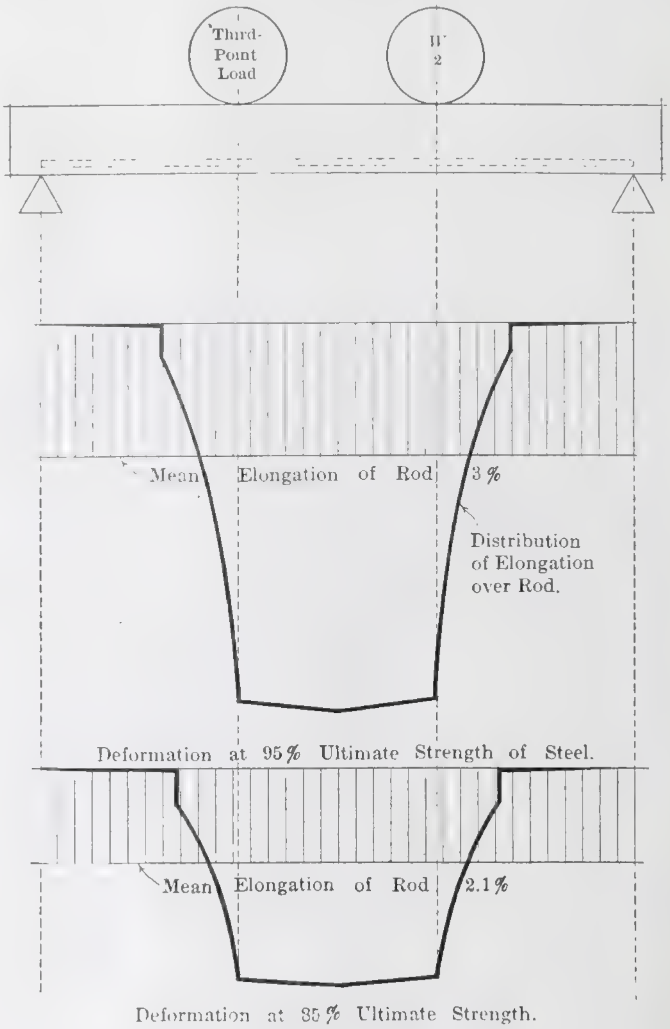

Third-Point Load
W/2
Mean Elongation of Rod 3%
Distribution of Elongation over Rod.
Deformation at 95% Ultimate Strength of Steel.
Mean Elongation of Rod 2.1%
Deformation at 85% Ultimate Strength.

Fig. 8—Steel Strains in Reinforced Concrete.

1.—The maximum tensile stress is a rod embedded in a beam that is centrally loaded is localized, rather than disturbed over the entire length of the rod; thus a local increment of elongation reaching 7 or 8 per cent will not appreciably affect the total elongation over the whole length of the rod. The exact distribution of the elongation is represented graphically in Figs. 8 and 9 for center point and one-third point load.

2.—At 90 per cent of the ultimate strength of the steel the elongation does not exceed 6 or 7 per cent when the rod is uniformly stressed from end to end; at 80 per cent, from 3 to 4 per cent, and at 70 per cent, say, 2 per cent elongation. (See Figs. 10, 11, and 12.)

From this evidence it will be seen that the region of plasticity of steel and iron, between the yield point and from 85 to 95 per cent of the ultimate strength, has an important influence in reinforced concrete. The writer is of the opinion that rods thus tested will give a higher average of values than is obtained from ordinary tension tests, the reason for which is the fact that market steel is not absolutely uniform, and that the point where the maximum stress is forced to become localized is not likely to coincide with the weakest point in the material, but will more probably occur where the material has an average value.

This will be understood from a study of Figs. 10 and 11. These give the results of tests on ⅞-in. rods, 6 ft. long, with a measured length of 48 ins., or six standard measured units. Measurements were taken from period to period as the load progressed. The readings were taken for each inch over the entire measured length. The tests, made in the Engineering Laboratory of the University of Toronto on a 100-ton Riehlé machine, were undertaken for the express purpose of obtaining information for the construction of the two diagrams, Figs. 8 and 9. The writer was assisted in these tests by Mr. Peter Gillespie, Lecturer in Applied Mechanics in the University of Toronto, Mr. Kenneth Alexander MacKenzie, and Mr. Herman Hyman, all of whom he wishes to thank for the able manner in which the work was conducted. Special gratitude is due to Mr. Gillespie for the interest shown by him in this problem. The results of these tests are further supplemented by the diagram, Fig. 12, which gives a carefully prepared curve for the elongation of steel and iron within the region of plasticity. The abscissas represents the percentages of elongation and the ordinates the percentages of the ultimate load. This diagram is presented for the purpose of indicating the wide variation in the location of the yield point. The variations in the elongation were less variable, and seemed to fall indifferently on either side of the curve for both common iron and hard steel.

Regarding the third and fourth observations—as to the influence of the concrete between the rods in the plane of the reinforcement—it is commonly assumed that a breadth of one diameter of clear concrete between the rods is ample to develop the bond strength of the lower half surface of round rods, or of square rods when their diagonals are in the plane of the rods. The following, which is quoted from Turneaure and Maurer, fairly represents the generally accepted theory with regard to the spacing of rods or bars:

"In rectangular or T-beams the spacing of bars is important; in T-beams this consideration will largely control the width of the beam. The requirement in general as to spacing is that the amount of concrete left between the bars must be sufficient to transmit to the upper part of the beam the stress which the bars give over to the concrete below them. If the bars are circular it may be assumed that one-half of the stress in them is given over to the concrete below, hence the strength of the concrete on a longitudinal section through the center plane of the bars must equal one-half of the stress in the bars. If the shearing stress be taken as equal only to the bond stress then the clear space between bars must be one-half the circumference of a bar, or 1.57 diameters. In the sense here employed the shearing strength is at least twice the bond strength for smooth rods, so a clear spacing of less than one diameter is sufficient from this standpoint. In the case of square bars, on the same basis, the clear spacing would need to be 1½ diameters if the bars are placed with sides vertical, or one diameter if placed with sides diagonal. But in addition to the shearing stresses there is likely to be developed more or less tension in the concrete surrounding the rods, so that there should be left ample areas of concrete between them, especially towards the end where the bond stresses are large. * * * A minimum clear spacing of at least 1½ diameters should be provided, with an equal distance between the outside rod and the surface of the beam. Where some of the rods are bent up the spacing can readily be made more liberal towards the end of the beam."

In conformity with this theory, the proposed specifications of the Special Committee on Concrete and Reinforced Concrete require that, "The lateral spacing of parallel bars should not be less than two and one-half diameters, center to center." The extra half diameter is provided for the purpose of allowing for the possibility of the placing of square bars with the sides diagonal. Owing to the great variety of forms of cross-sections of bars, it is believed by the writer that the relation between perimeter and breadth will establish a better basis for determining the correct values for bond-friction-resistance than the relation between diameter and breadth; because a bar with a major and minor axis has no fixed diameter.

According to the theory outlined by Turneaure and Maurer, the breadth of the concrete should never be less than two-thirds of the sum of the perimeters of the bars, but that is assumed to be ample.

The question was investigated carefully by the writer, and, though the data were rather meager, sufficient were gathered to prove conclusively that, say, three times the above-mentioned allowance for breadth of concrete will develop more than two and one-half times as much bond-friction-resistance.

The first hint that the writer received that the breadth of concrete between the rods was of more vital importance than was commonly supposed was obtained from a series of tests of beams by Malverd A. Howe, M. Am. Soc. C. E., of Rose Polytechnic Institute, in 1903.[6] The Howe series consisted of 18 beams, the reinforcement was old-style corrugated bars, and the ages were from 10 to 11 weeks. The concrete was composed of 1 of cement to 7 of aggregates. The percentage of reinforcement was practically 0.7 of 1 per cent of the net cross-section of the concrete for all the beams. No two beams had like dimensions. Beams Nos. 1, 2, 3, and 4, were almost identical, with regard to the possible modifying influences, except that of the ratio of the perimeter of the rods to the breadth of the concrete in the plane of the reinforcement. A very decided rate of increase was noted in the resulting bond-friction-resistance developed on these four beams due to the increase in breadth of concrete between rods. Besides this series just mentioned, several other groups were found for both plain rods and deformed bars. These groups have been plotted on Fig. 6, the ordinates giving the bond-friction-resistance in pounds per square inch of the surface of the bar, and the abscissas giving the ratio of the perimeter of the rods to the breadth of the beam. In each individual group of beams every beam had a common value for cot. *a*, thus making the normal component of bond stress constant for that group.

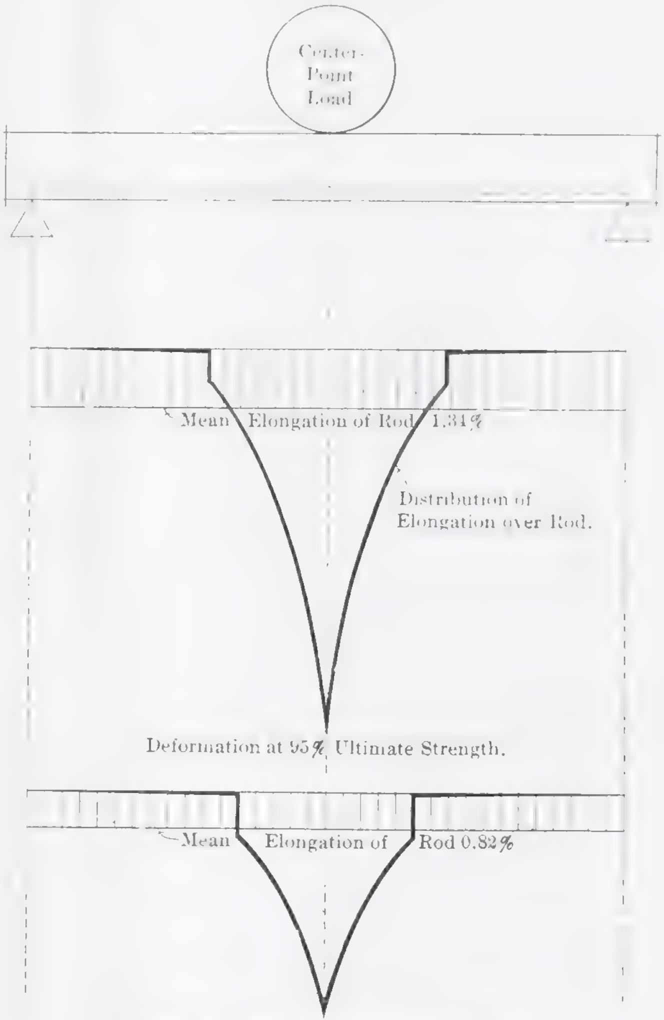

Center-Point Load
Mean Elongation of Rod 1.31%
Distribution of Elongation over Rod.
Deformation at 95% Ultimate Strength.
Mean Elongation of Rod 0.82%
Deformation at 85% Ultimate Strength of Steel

Fig. 9—Steel Strains in Reinforced Concrete.

The following method was devised for establishing a relation between the values on this diagram and the values previously determined in Fig. 4: In the beams represented in Fig. 4 the sum of the perimeters of the rods was equal to 78/100 of the breadth of the concrete, therefore this value for the spacing of the rods was adopted as the unit value for comparison of the results in Fig. 6. A point was chosen on the ordinate passing through the abscissa (78/100), but near the

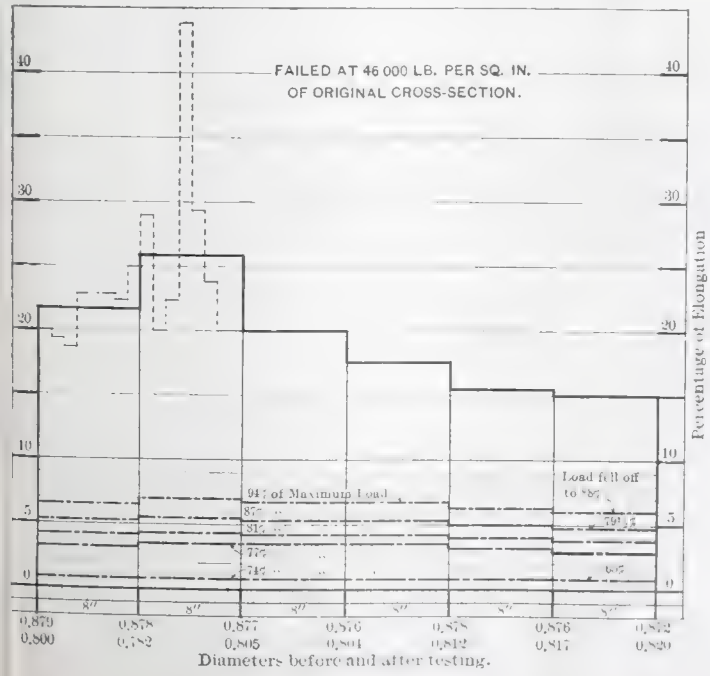


Fig. 10—Development of Elongation-Iron Rod Failed at 46,000 Lbs. Per Sq. In. Original Section.

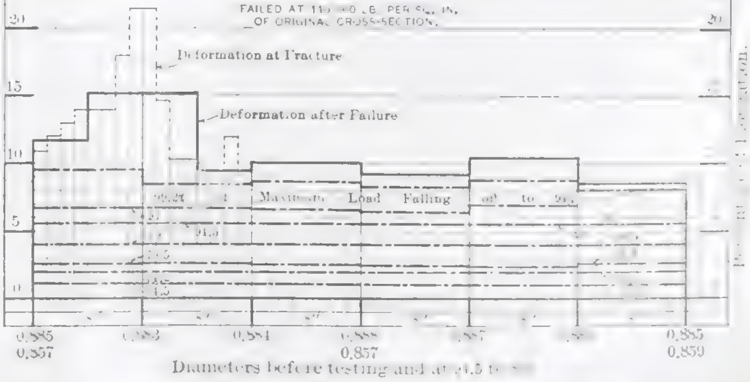


Fig. 11—Development of Elongation Hard Steel Rod Failed at 110,000 Lbs. Per Sq. In. Original Section.

top of the diagram. This point then became the nucleus of a new set of diagrammatic values with the abscissas as before and the ordinates to be established in the following manner:

Through this nucleus, lines parallel to those in the lower figure were drawn. Where an average direction for two or more groups was desired, the protractor was used to obtain the mean inclination of the series with respect to the horizontal axis. Thus a line representing the entire series of plain bars was constructed; similarly, curves for the entire series of deformed bars, and for all the bars, deformed and plain, were obtained. These are the values to be found on the upper diagram in Fig. 6. It will be noticed that there is practically no difference in the results obtained for plain or for deformed bars—both seem to be equally influenced by the increase or decrease of the concrete between the bars.

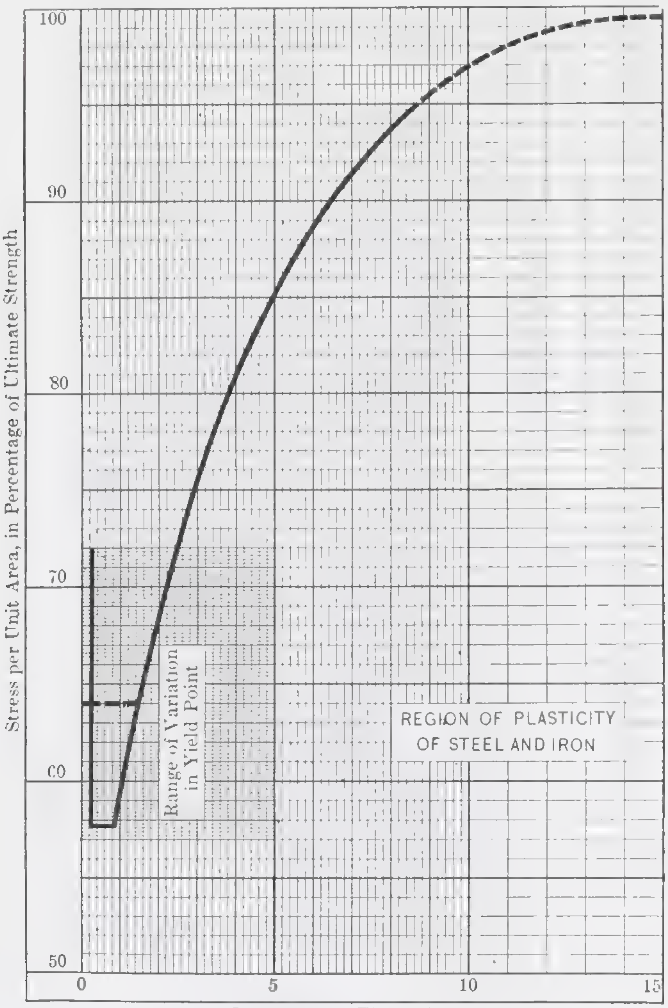
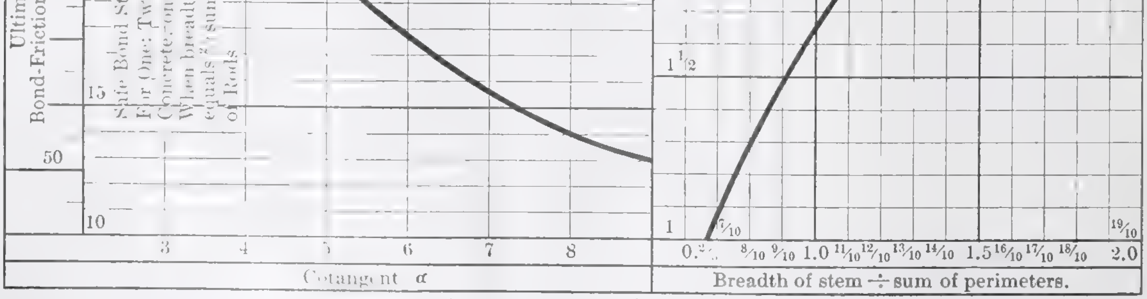


Fig. 12—Region of Plasticity of Steel and Iron.



Add 10% per month up to six months

Fig. 13—Safe Bond Strength.

The specimens in the preceding investigation were practically two months old, therefore the values are only true for that age. The writer found no sufficiently elaborate reports of tests on beams to enable him to establish a basis for judging of the influence of age of concrete on bond-friction-resistance. Therefore, a careful study was made of the investigations of Kimball, as conducted at the Watertown Arsenal, and of the theories of Taylor and Thompson, as given in "Concrete, Plain and Reinforced," on the effect of age on the compressive strength of concrete. The results of this study are given on Fig. 7. It is fair to assume that the influence of age on concrete is relatively the same, whether it be stressed in compression, in tension, or in bond. This assumption was made for the values as plotted on Plate CLXIX, and odd experiments on age influence seem to bear out the probable truth of the assumption.

Further explanation as to the method of construction of the additional curves on Fig. 4 is necessary here. It will be recalled that the curve for the 1:9 mixture was plotted from a very large number of experiments, the individual values being shown adjacent to the curve. Talbot's experiments, Series 1907-08, provided the information which enabled the writer to construct the curves for the 1:15, the 1:6, and the 1:3 mixtures, as shown. These experiments show that for a given value of cot. *a* (2.8 in this specific instance), the values of the bond-friction-resistance—other things being equal—were as follows:

For a 1:9 mixture	100 (assumed)
" " 1:6 "	138
" " 1:3 "	176
" " 1:15 "	68

It was then assumed that for values of cot. *a*, the same relations would obtain. Hence the 1:6 curve was drawn so that each of its ordinates is 38 per cent greater than the ordinate on the 1:9 curve; for like values of cot. *a*, similarly, all values of the ordinates to the 1:15 curve are 68 per cent of the values of the ordinates to the 1:9 curve. A glance at Fig. 7 indicates the relative compressive strength of various grades of concrete at one month to be:

For a 1:9 mixture	100 (assumed)
" " 1:6 "	120
" " 1:3 "	140
" " 1:15 "	60

The writer believes that the bond-friction-resistance is affected to some extent by richness of mixture, in a manner similar to that in which compressive strength is modified by the same influence. He has the additional conviction that the curves shown on Fig. 4 are probably somewhat high, and that values of the ordinates somewhere in the neighborhood of the mean of those just quoted for compressive strength, and those from which the curves were plotted, would more nearly represent the facts. He recognizes also that

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[6] A report of these tests may be found in the Proceedings, Am. Soc. for Testing Materials, in Mr. Condron's discussion of Professor Talbot's tests, Series of 1904.

variation in material, manipulation, and method are quite unavoidable, under all circumstances; that in any kind of experimental investigation a close degree of refinement is absolutely impossible, and that the unbiased investigator must never lose sight of the personal equation in individual experiments.

Plate CLXIX is a composite diagram, constructed from the results in Figs. 4, 6, and 7. Therefore it gives a comprehensive picture of the whole investigation, and will serve for laboratory and investigation purposes as a means for checking the accuracy of these new laws. It is rather too complicated for daily office use in reinforced concrete design, for which purpose Fig. 13 has been prepared. The latter is a double diagram, for concrete 1 month old and mixed in the proportion of 1 of cement to 2 of sand and 4 of coarse aggregates. The abscissas in the left-hand diagram give values for cot. *a*, and the ordinates the bond-friction-resistance. The abscissas in the right-hand diagram give values for the breadth of concrete divided by the sum of the perimeters of the rods, and the ordinates are multiples of the ordinates which must first be obtained from the left-hand diagram. It will be noted that the values in this diagram are made for the standard concrete for use in reinforced concrete as laid down by the Special Committee on Concrete and Reinforced Concrete.

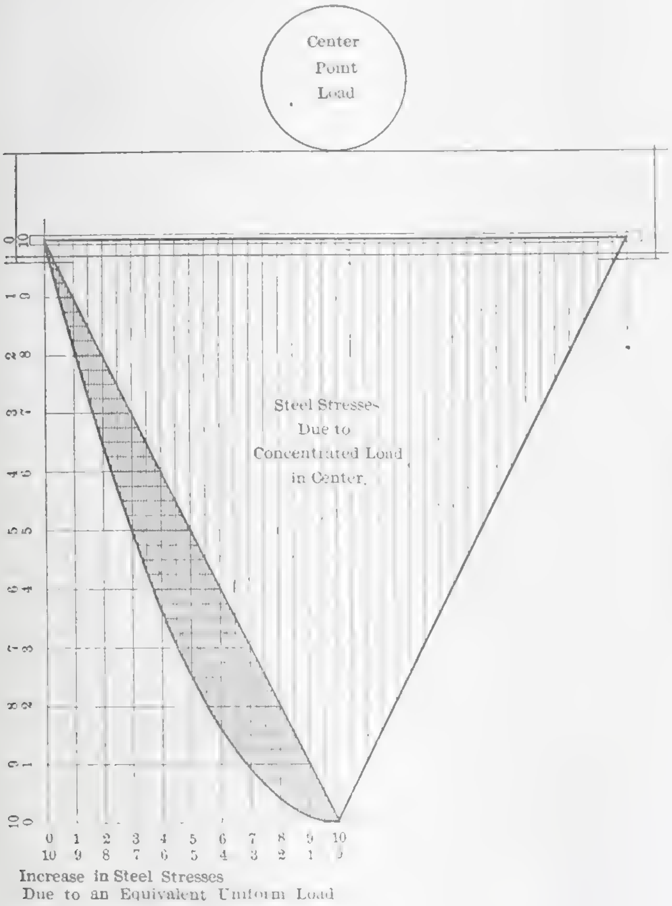


Fig. 14—Unit Stresses in Steel in Reinforced Concrete.

What has gone on before refers to reinforcement with plain bars, embedded in the bottom of the concrete beam, with their axes parallel to its top. This was adopted as a type, for comparison with alternative or modified methods as alleged improvements. Improvement as here considered is any change made in this type. For instance, the following are some of the changes which have been considered in this class:

a. Deformations on rods,
b. Hooks on the ends of rods,
c. Bending rods upward to near the top of beam,
d. Stirrups for the web of the beam,
e. Combinations of two or more of the preceding.

Special care was taken to investigate thoroughly the standard type of reinforcement, so as to establish values with which to compare other alleged improvements. As a matter of fact, there were more data for the standard than for the others; however, sufficient were gathered to warrant the following statements:

a.—Deformations as media for increasing bond strength are of doubtful value. Any increase in strength resulting from the use of deformed bars is found to show itself only after the yield point of the bond has been passed. It will be noted in the studies for steel elongation in reinforced concrete beams that deformed bars sometimes exhibit a slower development in the slipping than is indicated by plain bars. A good illustration of this will be found by comparing Lanza beam *A*-2 with the Lanza beams *A*-1 and *C*-5, in Fig. 2. It will also be noted that deformed bars sometimes begin to creep earlier than plain bars. This is indicated by comparing the Talbot beams Nos. 27 and 28 in Fig. 1, and it will be found that this is by no means an uncommon occurrence; it may be due to a difficulty in getting the concrete to reach into the corners of the deformations.

The writer is of the opinion that, with proper tamping of concrete, the deformed bars of the twisted and corrugated type would probably give about 15 or 20 per cent increase over plain bars.

The re-rolling necessitated in the manufacture of deformed bars usually has the effect of raising the elastic limit of the steel, and it is to the increase thus produced that a great deal of the merit of deformed over plain-bar reinforcement may be attributed. In the majority of cases it will be found that the bond-friction-resistance developed on deformed bars seldom exceeds, in fact seldom seems even to reach, that developed on plain bars under similar conditions. Now and again a group of beams will be found to indicate 30 or 40 per cent increase due to the deformed bars. This seems to be particularly the case when the beams have been cured in water. This would cause a tightening of the grip of the concrete on the deformations of the rods resulting from expansion. Such results, however, have not been general, and, further, they have not been found to vary greatly from those given for the standard reinforcement on Plate CLXIX; or, in other words, it has usually been the case that the plain bars with which they were compared behaved very badly. In every case average values for any of those groups varied less from the diagrammatic values than the variations in like beams in any group. This was true when the groups were from different laboratories, in which case the averages would also vary according to the practices of each laboratory. Thus the variations in the values in such groups may be considered as due mainly to the erratic nature of the concrete rather than to the influence of the deformations on the bars. Witness the series of groups in Table N-1, Bulletin No. 148, of the University of Wisconsin, by Ernest A. Moritz, Assoc. M. Am. Soc. C. E. In no case are there developed as high values for bond-friction-resistance for deformed bars as for plain bars.

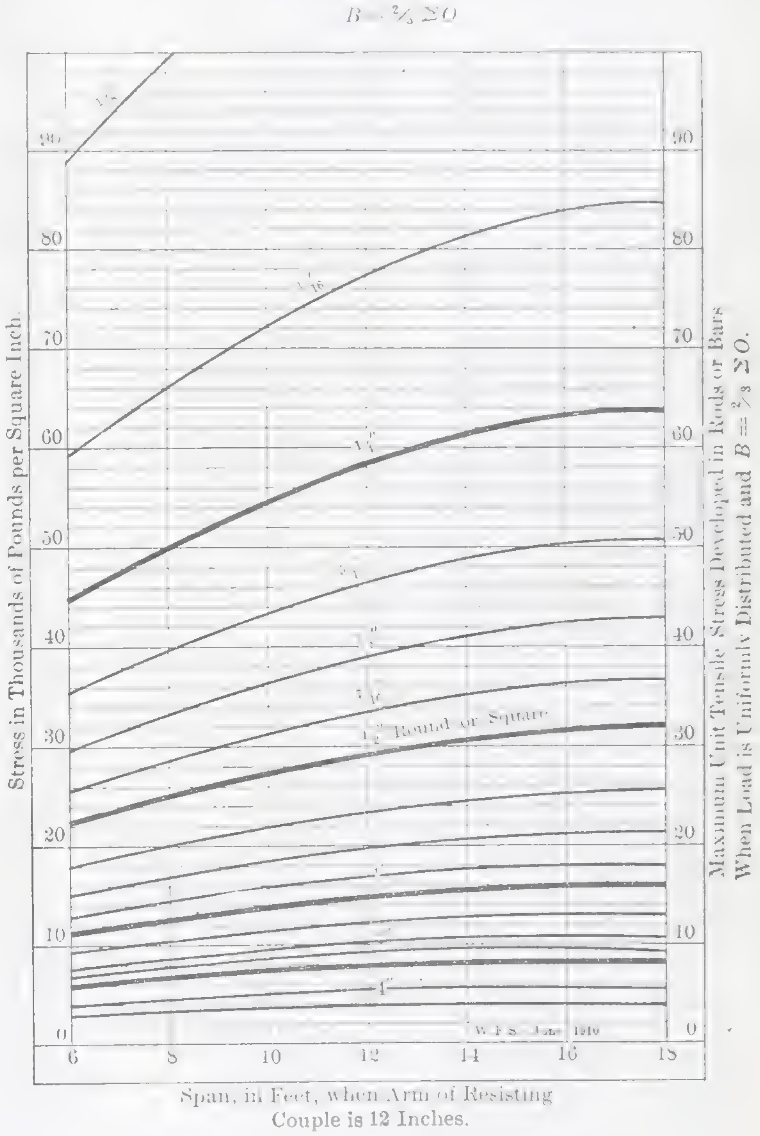


Fig. 15—Maximum Steel Stresses Developed by Bond-Friction-Resistance When B $^2/_3\Sigma O$.

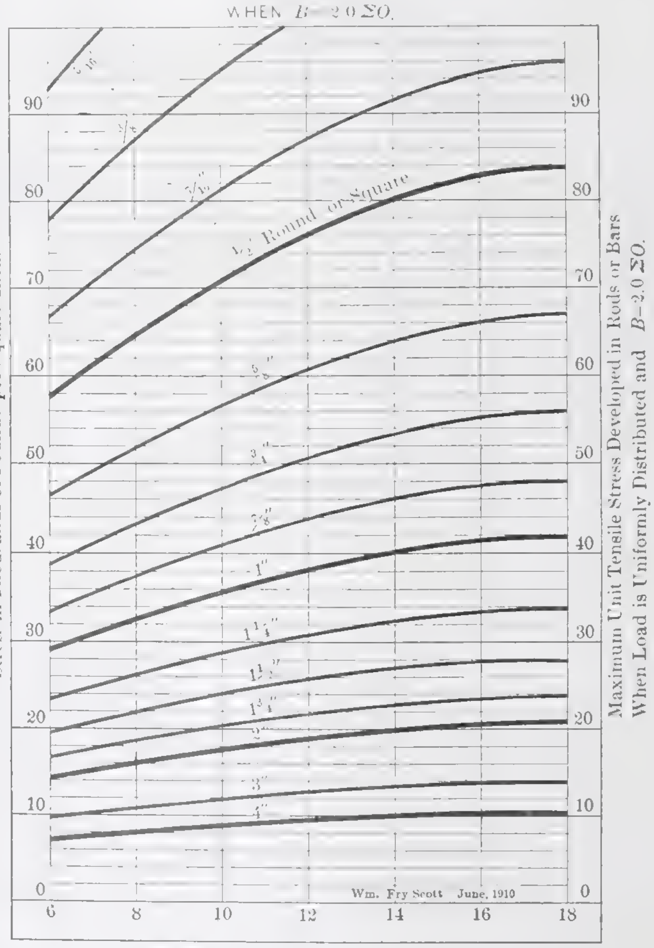
This series may be assumed to be a representative one because of the fact that there

TABLE I.—DEFORMED VERSUS PLAIN BARS. MORITZ TESTS ON REINFORCED CONCRETE BEAMS. ALL BEAMS OF 1 : 3 MORTAR. EACH BEAM CONTAINS 1 STEEL ROD.

Age, in mos.	Plain Bars.		Deformed Bars.	
	1½-in. round As = 0.197 sq ft B / Σ O = 1.93 Cot a = 4.5	⅜-in. round. As = 0.110 sq. in B / Σ O = 2.55 Cot. a = 4.35	Twisted, ½-in. square. As = 0.25 sq. in. B / Σ O = 1.5 Cot. a = 4.55	Corrugated, ½-in. As = 0.18 sq. in. B / Σ O = 1.77 Cot. a = 4.5
	Loads at Failure			
One	4 000 5 250 4 100 4 500 4 400 4 500 Av. = 4 460 fb = 292	2 600 3 000 2 700 2 000 Av. = [illegible] fb = 215		
Three	2 800 4 200 6 000 5 600 6 500 Av. = 5 020 fb = 328		5 500 5 000 4 600 4 600 5 800 Av. = 5 100 fb = 263	4 400 4 600 4 650 5 500 5 500 Av. = 4 930 fb = 296
Six	5 300 4 900 5 600 4 600 Av. = 5 100 fb = 333		6 000 2 200 2 640 5 660 Av. = [illegible] fb = 211	6 200 5 000 6 000 5 400 4 200 Av. = 5 360 fb = 322

are never less than four beams (usually five) for each kind of reinforcement, and nearly the same for each age, 1, 3, and 6 months, as shown on Table 1. In every case there is a much greater variation between the average values and the maximum and minimum values for each group than between the average values of the several groups and the values to be obtained from Plate CLXIX. The minimum variation from the averages for each group was in one case 54 per cent and the maximum variation 147 per cent. The minimum variation of the averages for each group is in one case 62 per cent of the values in the diagram, and, strange to say, that was for a group of deformed bars. Considering only the plain-bar reinforcement in this series, the minimum variation of these experimental values from those on the diagram is 81 per cent and the maximum 130 per cent of the diagrammatic values. Also, in the Lanza and Talbot beams, there cannot be said to be any appreciable increase in the ultimate bond-friction-resistance due to the deformations on bars. In the case of Talbot beam No. 9, which was reinforced with three twisted bars, ½ in. square, the ultimate bond-friction-resistance was 168 lbs. per sq. in., while in Nos. 16 and 17, which were each reinforced with three plain bars, ½ in. square, the ultimate bond-friction-resistance was 81 and 82 lbs. per sq. in. In both cases $B = 2\ \Sigma\ O$ and cot. $a = 5.2$. Now, according to Plate CLXIX, the average value for bond-friction-resistance for plain-bar reinforcement, as in Nos. 16 and 17, is 145 lbs. per sq. in. Thus it is evident that these two beams must have been of very poor concrete; on the other hand, beam No. 9, with deformed-bar reinforcement, developed only 16 per cent more than the average value obtained where plain bars were used. Beam No. 13 developed 104 lbs. per sq. in., or 16 per cent more than the average; No. 28 developed 105 lbs. per sq. in., or 40 per cent more than the average; while Nos. 3 and 7 developed only 67 per cent of the average value for the bond-friction-resistance given on the diagram. The foregoing are the deformed bars. The plain bars behaved in a similar manner. Beam No. 21 developed 60 per cent; No. 19, 60 per cent; and No. 27, 110 per cent of the average values on Plate CLXIX. In other words, it is apparent that variations in bond-friction-resistance are attributable to such influences as age, the position of the load, the ratio of steel perimeter to width of stem, etc., rather than to special deformations in the reinforcement, except as indicated above. Yet, if the writer's suspicions regarding the values for the 1:6 concrete in Plate CLXIX and Fig. 13 are correct, that is, that the ordinates may be, say, 7 per cent too high, the foregoing deductions or comparisons are subject to a slight modification in favor of the deformed-bar reinforcement.

b.—Hooks on the ends of rods do not produce any increase in the strength of the reinforcement. They even tend to cause failure to occur sooner than when they are omitted.



Span, in Feet, When Arm of Resisting Couple is 12 Inches.

Fig. 16—Maximum Steel Stresses Developed by Bond-Friction-Resistance When $B = 2\ \Sigma O$.

With regard to the combination of hooks, bends, and stirrups in the reinforcement of a concrete beam, a rather curious anomaly is apparent in the results of any experiments on such a combination of which the writer has been able to obtain reports. In no case does such a combination show a materially higher development of bond-friction-resistance than the plain straight-rod reinforcement without hooks, bends, or stirrups, yet the effect of bending some rods without the use of stirrups or hooks, materially increases the bond-friction-resistance, and, also, when stirrups alone are added to the plain straight-rod reinforcement, a marked increase occurs. The separate influence of these will now be considered.

c.—Beams with reinforcing bars bent up have been investigated by Talbot. The following is from the results of his investigation.[7]

Comparing the results of beams with all the bars bent up and the results of beams with all straight bars, there was no material difference in the bond-friction-resistance when the stresses on the cross-section under the load were considered for both cases. The writer believes that, on one hand, there is a gain due to the rods reaching into and being acted on by the compressive stresses in the beam, and, on the other hand, a loss due to the reduction of the length of the arm of the couple—the loss and gain are apparently about equal. Beams with part of the rods bent up and part left straight develop from 25 to 50 per cent higher values than beams with the rods all straight. It is reasonable that this should be so. The concrete between the rods is increased from the beginning of the bend to the end of the beam, and such an increase has already been found to be a material factor in increasing the bond-friction-resistance. (See Fig. 6.)

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[7] Bulletin No. 29, University of Illinois Experiment Station.

"As may be expected, in the beams with all the bars bent up, as soon as the concrete at the bottom was sufficiently stretched, a vertical tension crack formed at some point between the beam support and the bend of the bar, extending from the bottom of the beam to the level of the reinforcing bars. * * * After the formation of this vertical crack, the tension in this part of the beam is taken mainly by the reinforcing bar; and as its depth below the top of the beam * * * is considerably less than in beams having the bars horizontal throughout, the tensile stress developed in the bar at this section is greater than in beams having the reinforcement horizontal throughout. * * * As the tensile stress in the steel at this section is greater than when the bars are horizontal, the amount of bond brought into action toward the end of the bar must be greatly increased. There is evidently, then, a greater chance for slip of bar in such beams than in beams where straight reinforcement is used."

Much depends on the manner of bending, but the most important point is to guard against sharp bends in the rods.

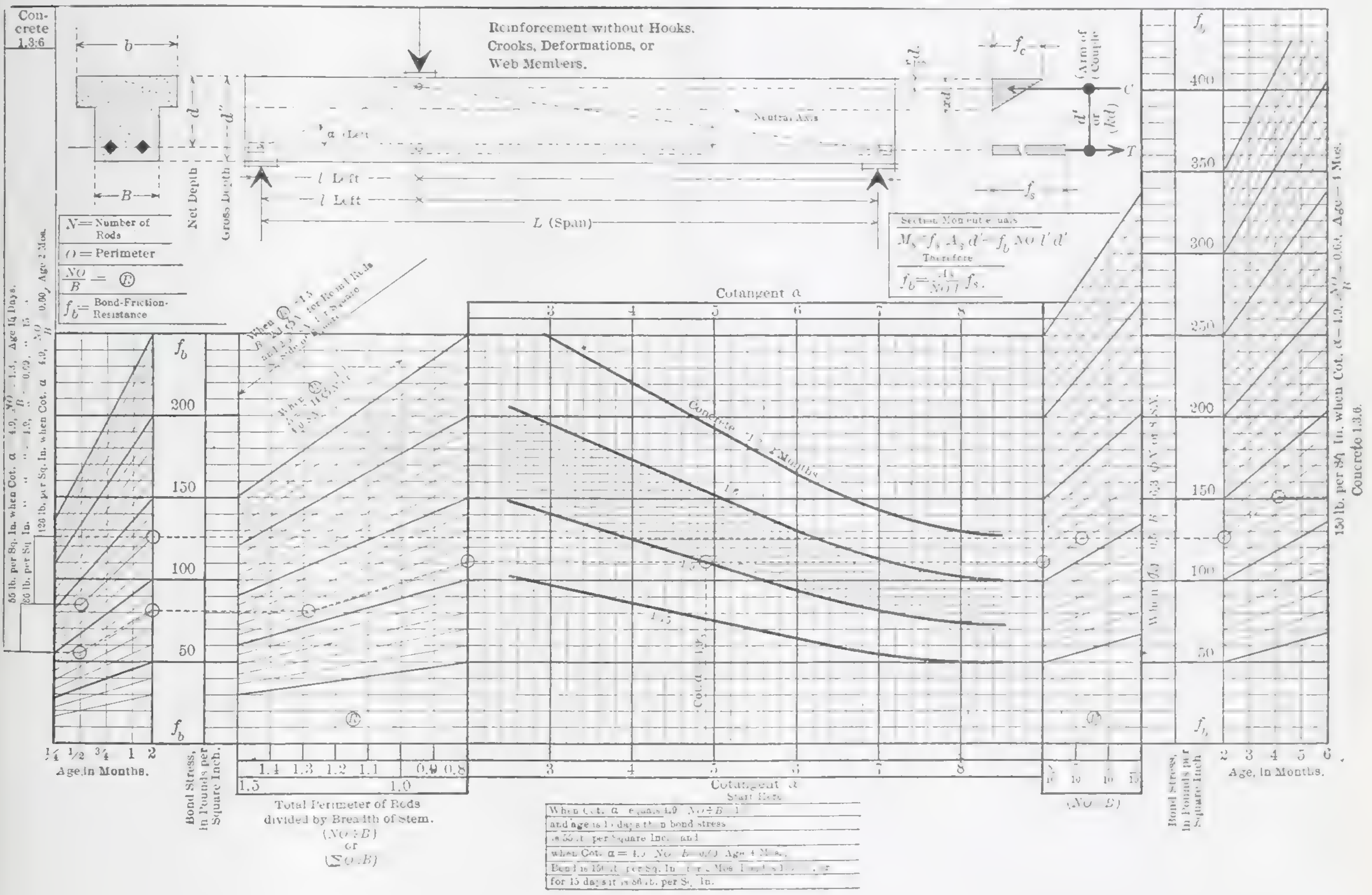

Fig. 17—Ultimate Bond-Friction-Resistance of Plain Rods and Bars.

d.—Stirrups.—A series of tests on beams by the Boston Transit Commission,[8] is interesting because it shows that, as the proportion of concrete between the rods decreases, the value of the stirrups increases. Thus, of beams with 81/100 of 1 per cent reinforcement, those with stirrups were 25 per cent better than those without stirrups; when 50 per cent more reinforcement was put in similar beams, there was 50 per cent increase in the value of the stirrups, that is, those with stirrups were 37 per cent better than those without stirrups; and, when double the reinforcement was put in the beams, there was a twofold increase in the value of the stirrups, that is, those with stirrups were 56 per cent better than those without stirrups.

In the Talbot series of 1907-08 the use of stirrups has been studied. The beams were 1:2:4 concrete, two months old, with cot. $\alpha = 2.8$. In plain-rod reinforcement, with $B = 1.28\,\Sigma O$, the average value for the beams with stirrups was 20 per cent better than for those without stirrups. When $B = 1.03\,\Sigma O$, beams with stirrups were 18 per cent better than those without. Beams with this value of B and having deformed-bar reinforcement were 26 per cent better with than without stirrups. This illustrates in an entirely new manner the effect of the suspension of the concrete below the plane of the steel by the concrete between the rods. In this way, the stirrups are seen to perform the function which would otherwise be performed by a proportionate quantity of concrete.

e.—Combinations of Two or More of the Preceding.—One case, only, will be considered: the combination of stirrups with part of the rods bent up and part left straight. As previously mentioned, there does not seem to be any evidence of improvement over plain straight rods without stirrups. The only way the writer can account for the absence of improvement is in the possibility that the stirrups disturb the concrete around the region of the bent rod, thus destroying some of the advantage due to the influence of the compressive stresses on that bent rod. It is also probable that the absence of improvement is partly attributable to the fact that the reinforcement usually consisted of rods bent at sharp turns, instead of having continuous easy curves throughout.[9] Further investigation may throw new light on the question.

As to the practical aspect of the results of this investigation, with particular reference to the question of reinforced concrete design, a few points should be mentioned.

The problem of reinforced concrete design must be decided on purely scientific lines. In the writer's opinion, tests in reinforced concrete buildings are utterly impracticable and useless. Such tests are deceptive and misleading, because of many influences, more or less transitory, which aid the tested panel or series of tested panels so materially that, though incalculable and uncertain, they are nevertheless the dominating factors in carrying the loads. The loads themselves are seldom what they seem. It is necessary to understand the value of each element in a design, from a special study of that element. Its relation to the general problem must always be based on the judgment of the designer.

With regard to the question of loads in building work, it is the custom to specify a uniform distribution of loading. Buildings have been classed on the basis of the use to which they are to be put. The method of fixing the standard of classification has been by the determination of the uniform live load each class will safely carry. The precedents existing today as to what each class should be designed to sustain are based on a history of accidents. The lessons learned from these accidents have been so dearly bought that a designer must be bold indeed to presume to set up his judgment against the standard specified loadings for various classes of buildings. As previously mentioned, these standards are given in terms of the relative values for a uniform distribution of loading. Now, it can be shown that the comparative effect of a uniformly distributed load and a center concentrated load on a reinforced concrete beam is not the same as their comparative effect on a steel, a timber, or a plain concrete beam. It is commonly known that in the latter cases the effect of a concentrated load is double that of a uniform load on like beams; but in the case of a reinforced concrete beam, of the standard type, previously referred to, the bond-friction-resistance under a uniform load is not the same as under a concentrated load in the center of the beam. It is not unreasonable that this should be the case. For instance, consider the stresses produced on the cross-section midway between the center of the beam and the center of its supports. For uniform load, the strain on the cross-section is 75 per cent of the strain at the center; and for center concentration of load, the strain is only 50 per cent of the strain at the center (this is illustrated for any cross-section between the center and the support by Fig. 14), that is, uniform load will develop 50 per cent more strain on the bond at the quarter-point than will be developed by center load. This is based on the assumption that the steel in each beam is strained alike at the center cross-section. Owing to the variable nature of the bond-friction-resistance, it would be an endless task to determine theoretically the location of the cross-section where failure would occur on a reinforced concrete beam under a uniform distribution of load. However, experiments seem to indicate that failure will occur coincidently when like beams are loaded uniformly or are loaded at the center with 70 per cent of the uniform load. This value, therefore, may be used as a basis for uniform loads when the values for the bond-friction-resistance given in Fig. 13 are under consideration.

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[8] Reported by Turneaure and Maurer.

[9] See "Some Mooted Questions in Reinforced Concrete Design," by Edward Godfrey, M. Am. Soc. C. E., Proceedings, Am. Soc. C. E., for February, 1910.

The formulas for such a case would be developed as follows, when W = the total uniform load on the beam or girder:

$$M_s = \frac{70\ W\ l}{100\quad 4} = 0.175\ Wl$$

$$M_s = t_s A_s d' = n\ \Sigma\ O\ l'\ d'$$

$$\text{or}\quad Wl = 5.7\ n\ \Sigma\ O\ l'\ d'$$

In this case l' will be half the length of the rod.

The size of the rod is an important factor in such reinforced concrete as depends on bond-friction-resistance to develop the tensile strength of the steel. This is plainly evident from the fact that, for equal areas of cross-section, the perimeter of rods or bars increases inversely as the diameter or side. This is true for round or for square sections. For instance, the perimeter of a 1-in. square bar is 4 in., the perimeter of a ¼-in. square bar is 1 in., and it requires sixteen bars per square inch of area, thus sixteen ¼-in. bars expose four times as much area of surface as a 1-in. bar. This is illustrated, for beams which have the real working dimensions most commonly used in buildings, in Figs. 15 and 16. In Fig. 15, it will be seen that, for the standard type of reinforcement, ¼-in. rods develop 64,000 lbs. per sq. in. on an 18-ft. span uniformly loaded, when $B = ⅔\ \Sigma\ O$; ½-in. rods, 32,000 lbs., and 1-in. rods only 16,000 lbs. per sq. in. When $B = 2\ \Sigma\ O$ (Fig. 16), ⅝-in. rods develop 67,000 lbs.; 1-in., 42,000 lbs., and 2-in. rods only 21,000 lbs. per sq. in., on an 18-ft. span uniformly loaded.

With regard to the determination of the neutral axis and the centroid of compressive stress, the ordinary methods, as laid down by the Special Committee on Concrete and Reinforced Concrete, may be used for the working stresses on reinforced concrete. On the other hand, from the yield point of the bond, which occurs at about three-eighths of the ultimate bond-friction-resistance, to the point of failure of the beam, the slipping of the rods has the effect of gradually raising the centroid of the compressive stresses, or, in other words, of increasing the length of the arm of the couple formed by the tensile and compressive forces. This increase at very near failure probably seldom exceeds 5 or 6 per cent of the computed length of the arm.

In conclusion, the writer desires to say that at first glance the evidence presented herewith points to the fact that the stresses, in such reinforced concrete as depends on bond-friction-resistance to develop the tensile strength of the reinforcement, are much more complicated than has hitherto been supposed. This is true from a purely technical point of view only, and, notwithstanding the very valuable investigations of Messrs. Hatt, Talbot, Turneaure, Howe, Humphrey, Lanza, Marburg, Harding, and others, without whose work it would have been impossible to prepare this paper, and to whom the writer before closing wishes to express his indebtedness, there is a tremendous amount of work still to be done in engineering laboratories in the way of further investigation before the last word has been said on this subject. The Profession is especially indebted to those eminent investigators who have unselfishly reported full and comprehensive data on their experiments, thereby enabling any practicing engineer to draw his own conclusions from the material presented.

Method of Estimating Costs of Piping and Wiring for Buildings.

Data on the cost of wiring for power and lighting, and on the cost of erecting steam piping for heating and power are extremely scarce. A "rule of thumb" method employed by various Chicago consulting engineers averages about as follows:

Labor cost of electric wiring (mill buildings): For lighting, $1 per light; for power, $2 per horse power per motor. When figuring the above to include material (except motors) use $4 per light and $10 per horsepower, respectively. In figuring the cost of erection of piping for mill heating for buildings, the rule is to use $1.25 per sq. ft. of radiation required. For the cost of installing steam pressure pipe and similar pipe, the rule is to multiply the estimated cost of the material by 2¼, that is 1¼ more than the cost of the material. When figuring the general cost of material and labor for installation of power, piping and machinery, $250 per horsepower is used. These rules are all worked out for union labor rates of wages.

The Board of Public Improvements of St. Louis, in a partial report of its investigation of the grade crossings on Poplar St. from the Levee to Seventh St., recommends five ways to eliminate the crossings and gives an estimate of the expense of each way. The cost of carrying out the plans runs from $83,000 to $591,000. The first plan, known as scheme No. 2, suggests the building of elevated tracks from the tracks on the wharf to the elevated tracks of the Terminal at a cost of $83,000. Scheme No. 4 provides for the construction of a viaduct from the wharf to Seventh St. at a cost of $400,000, while schemes 5, 6 and 7 provide for the erection of elevated tracks.

EARTH AND ROCK SECTION

Excavation of the Wallkill Pressure Tunnel—Catskill Water Supply to New York City—American Record for Hard Rock Tunnel Driving.

The Wallkill pressure tunnel forms an inverted siphon 4.4 miles in length under the valley of the Wallkill River. This concrete lined tunnel is a part of the Catskill Aqueduct, 92 miles long, which will supply New York city with water from the Catskill Mountains. The inside diameter of the concrete lining will be 14 ft. 6 ins., the tunnel and permanent shafts being circular and of the same size. Fig. 1 is a section of the tunnel showing the dotted lines marked *A*, *B* and *C*. The *A* line marks the line inside of which no unexcavated rock or material of any kind is allowed. This line defines the minimum thickness of the masonry lining to be built. The *B* line is arbitrarily fixed 13 ins. outside the *A* line. This line limits the excavation, masonry and dry packing to be paid for. The *C* line is the line of effective average thickness of masonry lining. Rock or other foreign materials are allowed to remain within the *C* line only under circumstances such that the effective strength is not reduced. This line is placed 5 ins. outside the *A* line.

The tunnel under the valley is reached by six shafts, three of which are permanent shafts and three are for construction purposes only. Shafts 1 and 6 are to be a part of the aqueduct line and are known as permanent waterway shafts. Shaft 3 is located in the low part of the valley and will be used as a drainage shaft. Shafts 2, 4 and 5 are temporary construction shafts and are rectangular, being about 22x10 ft. in plan.

Plant.—The main power plant is in a structural steel building located near shaft 4 and also near Forest Glen, a station on the Wallkill Valley R. R. The building covers an area of 80x160 ft. The plant is operated entirely by electric power, alternating current at 33,000 volts being purchased of the Newburgh Light & Power Co. from its plant at Honk Falls. The voltage is transformed to 2,200 volts at the power house, which is the voltage used by the motors to drive the air compressors. There are five cross-compound compressors driven by belt, two of which are of 2,520 cu. ft. capacity each, furnished by the Laidlaw-Dunn Gordon Co.; two are of 2,600 cu. ft. and one of 1,660 cu. ft. capacity of free air per minute. The last three are Ingersoll-Rand machines. The four large compressors are each driven by a 500 hp. General Electric motor and the small one is driven by a 300 hp. General Electric motor. At the shafts the hoisting is done by a Lambert machine operated by a 150 hp. motor. The hoist drum is 5½ ft. in diameter by 4 ft. long, with a 1⅛ in. Hazzard steel cable carrying two balanced cages. The hoist is operated at about 400 ft. per minute. The cages are equipped with automatic safety brakes.

For ventilation, motor driven Sturtevant blowers are used. The blowers are located near each shaft and are connected to within 200 or 300 ft. of the heading by a 12 in. galvanized pipe. The blowers are capable of supplying 7,500 cu. ft. of air per minute at 6½ ozs. pressure. A by-pass in the pipe at the blower allows air to be drawn out of the heading by reversing the blower.

Pumps.—Water troubles have not been serious in the Wallkill tunnel. Most of the pumping has been done by air driven pumps. Electrically driven pumps are installed for emergency pumping. Natural steam pumps of 200 and 100 gals. capacity are installed and operated by air, and a 200-gal. Worthington turbine pump is installed and operated by motor.

Circular Shaft Excavation.—The material excavated in the shafts and tunnel consists for the most part of hard shale, locally known as Hudson River shale. It occurs in layers alternating with sandstone, from very thin layers to layers 1 ft. thick. The general dip of the strata is about 45° S. E. and the strike is about 30° to the center line of the tunnel. The permanent shafts were lined with concrete, which was done as the sinking progressed. Usually about 40 ft. of lining was built at a time, this work proceeding alternately with the sinking. These shafts are about 18 ft. in diameter, to the payment line. The holes were drilled on three circles, the outer one being 16 ft. 6 ins. in diameter contained 9 relieving holes, and the inner circle 5 ft. diameter containing 5 sump holes. Five Ingersoll-Rand tripod drills were used. The drilling amounting to about 190 ft. for the 31 holes was done in one shaft. The line holes were loaded with four to five sticks of dynamite, the relievers with from three to six sticks and the sumpholes with about two sticks. When "guns" were left in the bottom of the holes after firing they were sometimes re-shot, but only when necessary to keep the mucking gang busy. "Forcite" was used of 40 per cent and 60 per cent strength, furnished by the Dupont Powder Co. Two mucking shifts were used for cleaning out after firing. The muck was hoisted in buckets of about 20 cu. ft. capacity. These buckets were in use during the shaft sinking, but were replaced by the balanced cages when tunneling was begun.

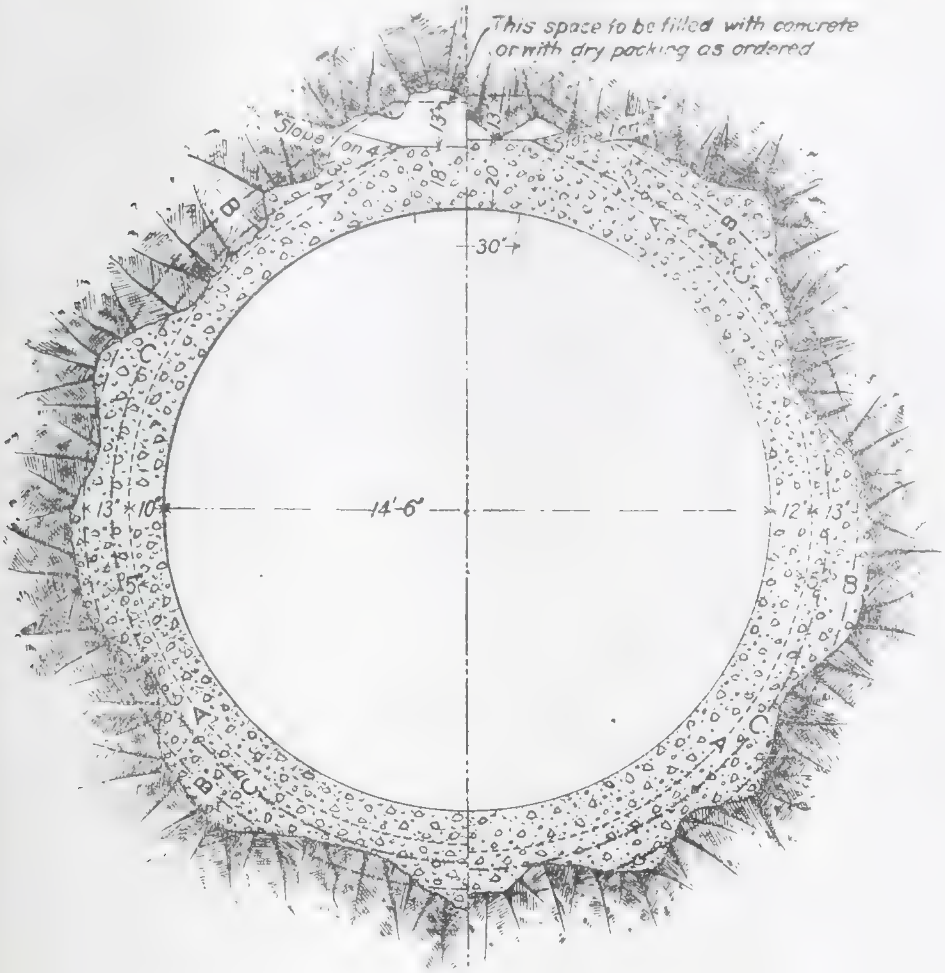
This space to be filled with concrete or with dry packing as ordered
Slope 1 on 4
13"
30"
14'-6"
13"
10"
12"
13"
5"
A
B
C

Fig. 1—Section of Pressure Tunnel with Concrete During Catskill Aqueduct.

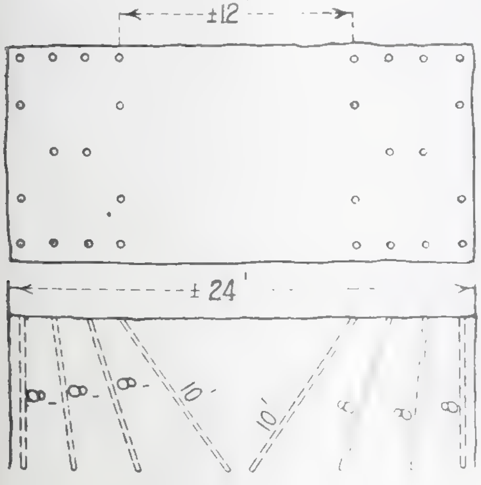

Fig. 2—Location of Holes for Drilling Rectangular Shafts.

In concreting the shafts steel forms in sections 5 ft. high were used. Each section of form is ¼ of the circle, and is made of 3/16-in. steel braced with circular 6 in. channels. The flanges of the channels are drilled to receive bolts for fastening the sections of forms together. Two sections of the steel forms are placed first, resting on a timber platform. The platform consists of timbers notched into the rock sides of the shaft. The bottom of the lining is beveled off so as to make a space for pouring in grout when making a joint between two 40-ft. sections of lining. The concrete is lowered into the shaft in buckets and dumped into chutes which discharge into the forms. Two men work in the bottom spading the concrete in the forms. When one section is filled with concrete, the next section of forms is put on, which requires about 6 hours' time, and concreting is again resumed.

Rectangular Shaft Excavation.—The method of excavation of the rectangular shafts differed considerably from that of the circular shafts. The rectangular shafts were built for construction purposes only. The contractor was paid by the lineal foot for them, instead of by the cubic yard, as in the circular shafts, and was required only to have space enough for two cage ways and a pipe and ladder way. Instead of using tripod drills as in the circular shaft, columns were used with two drills on each column, and the drilling and mucking gangs worked simultaneously. The rectangle is drilled with 28 holes, aggregating about 240 lin. ft. The holes, as shown in Fig. 9, consist of 8 sump holes in two rows 12 ft. apart, beyond which are two rows of 3 bench holes and a row of 4 line holes. The bench and end line holes were 8 ft. deep and the sump holes 10 ft. deep. The columns were set up over each row of sump holes, but one set-up is sufficient for the remaining bench holes, thus requiring four set ups for one round. For blasting 60 per cent Forcite was used. Five or six sticks were placed in the bench holes and 9 or 10 in the sump holes.

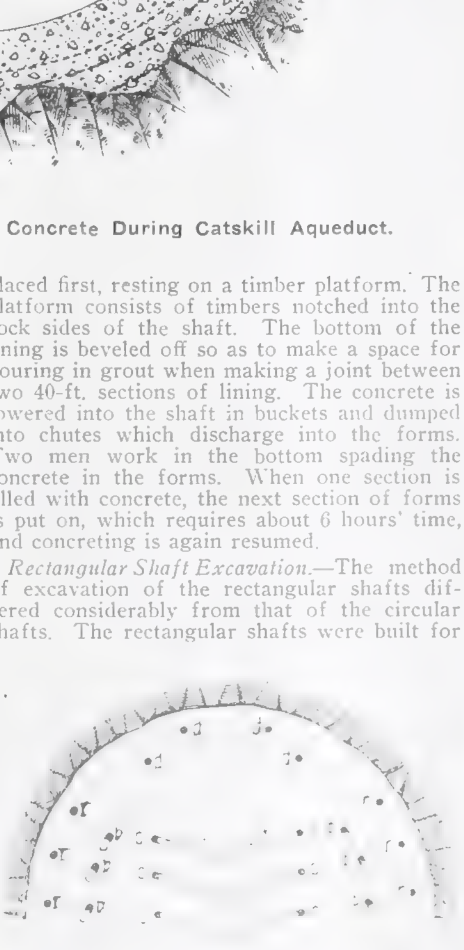

Fig. 3—Locations of Holes in Heading.

The sump holes were first drilled and fired and the bench cleared to start the drills on the bench holes. The column was set up after the 10 bench holes on one side, which were drilled while the rock was being mucked out of the sump and hoisted out in buckets. The bench was then fired and the column was then set up on the opposite bench for putting down the remaining 10 holes. Sometimes guns were left in the bottom of the sump holes and these were reshot in case there was not enough muck to keep the gang working. An advance of 6 to 7 ft. was usually made each round. The circular shaft was generally more rapidly sunk than the rectangular shaft, probably on account of the less amount of drilling necessary, as the yardage per lineal foot was about the same in either case.

The timber sets for the construction shafts were spaced 5 ft. on centers vertically with 8x10-in. wall and end plates and two 8x8-in. buntons, thus making three wells, of which one was for ladders and pipes, and the others for cage-ways. The lagging was placed back of the timbering regardless of the kind of material through which the shaft passed. At various depths the water leakage was collected in troughs and pumped to the surface by means of pumps hung on the timbering.

The force worked and the progress made on the shaft work are indicated by the following tables.

The force worked on circular shafts was as follows:

Each circular shaft one shift.		No. shifts worked.	No. men.
Superintendent	1	1	1
Shift boss	1	3	3
Drillers	2	3	6
Drillers' helpers	2	3	6
Signalmen	1	3	3
Muckers	5⅓	3	16
Dumpmen	2	3	6
Carpenters	½	2	1
Mechanic	1	½	½
Hoist runner	1	3	3
Blacksmith	1	1	1
Blacksmith helper	1	1	1
Totals	19		47½

The corresponding figures for rectangular shaft gangs were as follows:

Rectangular shaft. One shift.		No. shifts	No. men.
Superintendent	1	1	1
Shift boss	1	3	3
Drillers	[illegible]	[illegible]	[illegible]
Drillers' helpers	[illegible]	[illegible]	[illegible]
Signalmen	[illegible]	[illegible]	[illegible]
Muckers	[illegible]	[illegible]	[illegible]
Dumpmen	[illegible]	[illegible]	[illegible]
Carpenters	[illegible]	[illegible]	½
Mechanic	[illegible]	1	½
Hoist runner	1	3	[illegible]
Blacksmith	[illegible]	1	[illegible]
Blacksmith helper	1	1	1
Totals	[illegible]		42

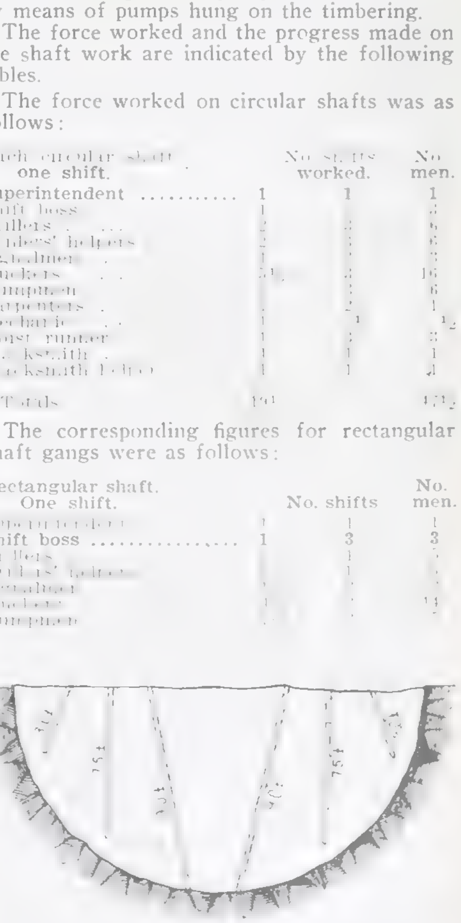

Fig. 4—Location of Bench Holes.

The records of progress in excavating all shafts were as follows:

		Av. per month. Lin. ft.	Max. month. Lin. ft.	Min. month. Lin. ft.
Circular Permanent Shafts	1	72	95	27
	3	51	93	34
	6	52	77	18
Rectangular Construction Shafts	2	49	97	15
	4	55	76	35
	5	46	91	10

The above record covers 988 ft. of rectangular shafts and 1,243 ft. of waterway and drainage shafts. In shafts Nos. 2 and 3, 78 ft. and 58 ft. respectively were in soft material. Monthly records for concreting and timbering shafts were as follows:

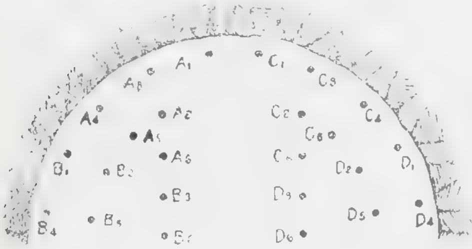

Fig. 5—Method of Drilling with Four Machines and Two Columns.

(Letters represent machines, numbers show order of drilling holes.)

No. of shaft.	Av. lin. ft. per mo.	Max.	Min.
CONCRETING.			
1	84	115	52
3	65	107	24
6	49	91	10
TIMBERING.			
2	39	87	15
4	51	100	12
5	42	111	10

Tunnel Excavation.—In all cases the top heading and bench method was used, slightly more than half of the area being taken out in the heading and the bench taken out to within about 18 ins. of the bottom, leaving about ½ yd. per lineal foot in the bottom to make ballast for the track. The methods of drilling in the different headings are shown by Figs. 4, 5 and 6. Four and five machines were used, the four machine method being standard. Four machines are mounted on two columns and five machines on three columns. On the bench two tripod drills are used. Twenty-four holes are in the heading, of which 6 are cut holes, which are called 10 ft. holes, but measure about 9 ft. The rest are 8 ft. holes, measuring about 7½ ft. They include four dry holes, 8 relief holes and 6 line or rib holes.

The steel used is 1¾ and 1⅜ octagonal in 2 ft. and multiple lengths to 10 ft. After each driller has completed the holes necessary for him to finish, the drill is taken back, so that the least amount of time is lost in the preparations for loading the holes. The holes are blown out with compressed air and loaded with 60 per cent Forcite at .8 lbs. per stick. About 10 sticks are used in the cut holes, 4 sticks in the dry holes, 5 to 7 sticks in the high water holes (B and D, Fig. 6), 6 to 7 in the relief holes (B_3, B_5, D_3, D_5) and in the rib holes (D_2, E_1, B_2, C_1), 7 or 8 in the relief holes (E_3, C_3) and in the rib holes E_4, C_4. In the bench 10 sticks are placed in the 9 ft. holes, 8 or 9 in the 7½ ft. holes and 3 or 4 in the 3 ft. holes. The drill holes are filled with sand tamping. About two-thirds of the depth of the hole consists of tamping. One exploder is placed in each hole, being located in the last or next to the last cartridge. Where the rock is soft, as it is here in most cases, all holes are loaded before the shooting starts. The holes are shot in three rounds, the cut and bench holes being shot first, the relief holes second and the rib holes third. The holes are wired in series, and the cut holes in the heading are fired in series with the bench holes. The firing battery is located about 400 or 500 ft. back from the heading. The firing switch is placed on the oposite side of the tunnel from the feed wire, making it necessary to break the connection across the track at all times when no firing is being done.

Mucking.—The mucking gang averages about one foreman and 40 muckers at each shaft (2 headings). The material is wheeled in wheelbarrows from the heading out over a plank platform usually one plank wide and 30 ft. long, and dumped into Koppel cars. The platform is supported by telescoping iron columns about 10 ft. apart and is kept as near to the bench as possible. About 70 cars (2 headings) are hauled out per shaft, the record being 104 cars. These cars are 1¼ cu. yd. capacity.

During the month of September only one heading was in operation at Shaft 3 and special effort for a record was made. This is the drainage shaft for the tunnel. It is 340 ft. deep and is located 75 ft. off the center line of the tunnel, being connected with it by a 10x10-ft. cross drift. The rock here strikes N. E. about 60° with the center line, and has a dip of about 30° to the S. E. The work was done in 3 shifts of 8 hours, making two advances each day averaging 8.7 ft. per shift. The length of the drill steel was increased to 12 ft. for drilling the cut holes and 10-ft. steel was used in the side round holes. Four Ingersoll 3¼-in. air machines were used, being mounted on two columns and on the bench two tripod drills were used. Part of the time 3 tripod machines were used.

The first drilling shifts went on at 7 a. m. till 3 p. m., and the second shift went on at 7 p. m. and worked till 3 a. m., each shift drilling and shooting the completed 24 holes. Between the regular drilling shifts two extra drillers and helpers came on and mucked out the heading and set up the columns and machines ready for the regular drilling shift and drilled one hole. These men then helped the drillers on the bench for the balance of the shift.

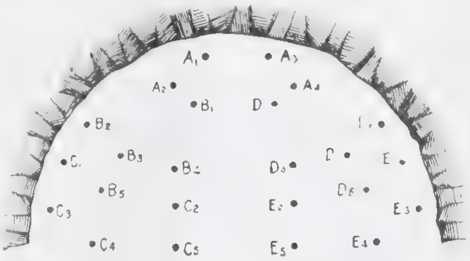

Fig. 6—Method of Drilling with Five Machines and Three Columns.

(Letters represent machines and numbers show order of drilling holes.)

The mucking shifts came on at 3 p. m., 11 p. m. and 7 a. m. Each consisted of 25 muckers, a foreman and 4 drivers and brakemen. Four mules were used to haul the cars to the shaft, the distance averaging 2,400 ft. for the month.

Koppel steel side dump cars of 1¼ cu. yds. capacity were used on track of 30-in. gauge and built of 25-lb. rail. The track has turnouts for passing at about 900 and 1,800 ft. from the shaft and has a spur at the bench so that two cars can be brought up close to it. The muck from the heading is carried in wheelbarrows out over the end of the bench and dumped in cars, as previously described. The total length of tunnel made consisted of 523 ft., the progress on the bench being 522 ft. and that in the heading 524 ft. About 9½ cu. yds. was taken out per lin. ft. About 300 lbs. of 60 per cent Forcite was used for each round.

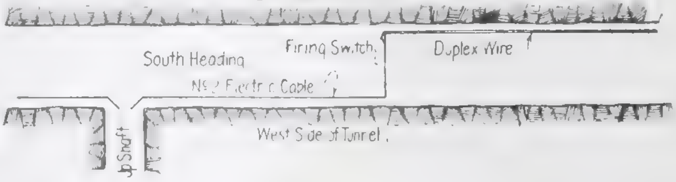

Fig. 7—Showing System Used in Carrying Firing Wires to Heading.

The records of progress for the whole tunnel have been as follows:

Shaft No.	Av. lineal ft. per mo.
1—South	312.3
2—North	257.5
2—South	247.0
3—North	343.4
3—South	325.4
4—North	343.8
4—South	270.6
5—North	351.1
5—South	340.5
6—North	326.9

This tunnel will probably be completed in December, making 4.4 miles of tunnel in about 11 months.

The Degnan Contracting Co., of New York, is constructing the Wallkill tunnel, and the credit for the record made is due to the experience and organization of the men on the work. Mr. E. A. Herrick is the general superintendent in charge, and the superintendent in charge of Shaft 3 is Mr. Chas. Marion. The Board of Water Supply is represented on the work by Mr. J. S. Sanborn, division engineer, and Messrs. C. R. Hulsart and D. W. Howes, section engineers. The Dravo Contracting Co., of New York, superintended the sinking of the shafts. We are indebted to the various persons and firms named for information furnished during a visit to the work by the editor.

Some Records and Costs of Well Drilling Machines in Prospecting.

The following progress and cost data were obtained in prospecting with well drilling machines for copper ore in Arizona, but they may be used equally well in estimating for blast hole drilling. A No. 23 traction drill made by the Star Drilling Machine Co., Akron, O., was used. The data are given by Mr. M. B. Gentry, of Silverbell, Arizona, in the *Engineering and Mining Journal* for October 29, 1910. A useful hint is given as to roads for moving drills. The wheel gauge of the drill named is 8½ ft., and it is found advisable to make the roads at least 9 ft. wide on top. The drills have been found capable of negotiating on good roads grades as steep as 28 per cent for distances of over 200 ft. On level roads it saves time in making moves to have the derrick up.

The crews used consist of a driller, a helper and a sampler. This last man would not be needed for blast hole work. For the records given here, two 12-hour shifts per day were worked, and the wages per shift were driller $6, helper $4.50 and sampler $3.

Starting the Drill Hole.—In starting the hole a slotted wooden extension, fixed permanently to the beam, is used to guide the stem. Generally the rock for the first few feet drilled is soft and falls into the hole, so that a short piece of 8-in. casing, belled over at the top is placed in the hole. However, at several places where the silicification has been intense and several joint planes intersect at sharp dips, it has been necessary to drill holes by hand and shoot them before any progress could be made. Spudding is continued to a depth of 100 to 130 ft., depending on the character of the rock. Old cable is always used in spudding, as the wear is much more severe then than during drilling. Contrary to usual custom, splices are run into the hole during spudding. As the ground stands up fairly well for the first hundred feet, but little difficulty has been experienced from this practice.

Crooked Holes.—In the matter of crooked holes it is often difficult to place the blame under the conditions prevailing, namely, greatly fractured and silicified rock with occasional soft and hard streaks, talcy slips and comparatively shallow holes. Generally speaking, however, the driller who spuds with a fairly tight rope will not have much difficulty with crooked holes. Shooting a crooked hole with dynamite has not met with much success. Filling the hole for a few feet with hard boulders and scrap cast iron is sometimes successful. In the work at Silverbell, drilling only shallow holes, it has been found best not to waste too much time trying to straighten a crooked hole, but to put on the next smaller size bit and continue drilling.

The sizes of bits used are the 7⅝, 6¼ and 4¼ in. The former are used with stems, 4 ins.x20 ft., and the latter with stems, 3¼ ins.x20 ft. It has not been found necessary to start any hole with the 10-in. bits, although if it should be desired to drill deeper holes the 10-in. or larger starter would be advisable. The Columbia and the Tubbs cable have been used, the latter so far giving the best results.

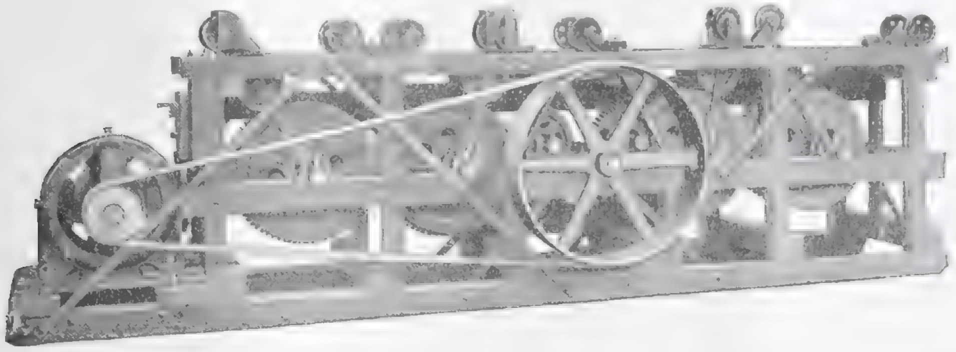

Fig. 1—Special Hoist for Sinking Foundation Caissons.

TABLE II.—AVERAGE COST PER FOOT FOR CHURN DRILLING AT SILVERBELL, ARIZ.

Labor on drills	$1.25
Supplies	0.17
Pipe line	0.09
Repairs	0.07
Fuel	0.35
Renewals	0.12
Roads	0.47
Total	$2.52
Average cost of cable per foot of hole	$0.132
Average cost of coal per foot of hole	0.366

As may be seen from table I, fishing has not been a serious factor in the drilling here. Generally speaking, fishing jobs are due to carelessness and lack of judgment on the part of the driller. The fishing equipment consists of horn socket, slip socket, jars, sinker bar, rope knives, rope spear and spuds. Two strings of tools have been abandoned in their holes during the year's work. When drilling in ore the holes are cased as soon as it is apparent that caving is not likely to cease. The casing is delivered at the hole by the teamster, and one crew strings up the casing.

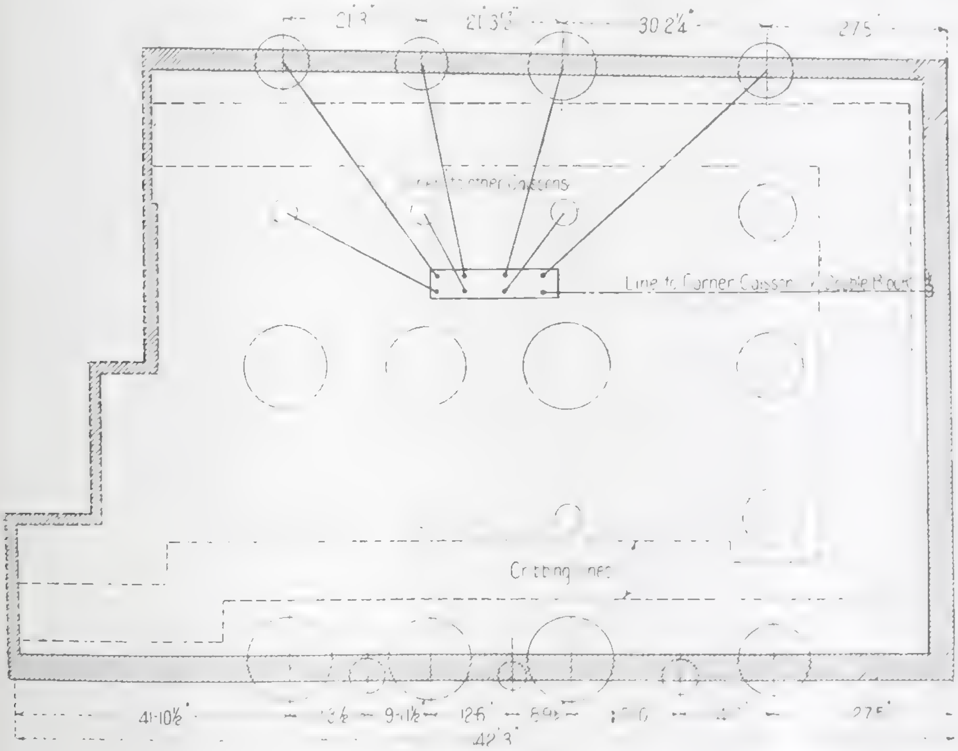

Fig. 2—Foundation for Boston Store, Showing Hoist Operating Several Caissons.

Annual Repairs on Drilling Machines.—Table I shows that repairs take up 8.2 per cent of the time. This rather large per cent includes time for washing boilers, replacing flues, splicing cable, and all time on repairs of any description. The actual amount of repairs or replacement on the drill itself has not been great. Besides small items such as bolts, packing, washers, piping, etc., the following list of repair parts placed on one drill during a year's operation will give a fair idea of the amount of replacing done: Valve rods, 2; wrist pins for crank arm, 2; wrist pins for slide arm, 2; wrist pin for upright arm, 1; brasses for spudding arm, 5; spokes for front wheel, 4; reinforcing plate for sill 1; Sampson post brace, 1; set of piston rings, 1; sets of flues, 2. For work of this nature, traveling such rough roads, it would seem that all of the draw bolts, tie rods and braces could to advantage be made heavier. Additional repairs on the other rigs include: pinion for friction shaft, engine-bed frame, and hub for rear wheel.

The figures shown in tables are reduced to operations per drill. Delays of all kinds except for repairs and including time idle for lack of drillers have been included in "Hours Idle." Approximately one-half of the water used as given in Table I is used in the boiler, the rest being used in the hole and for washing the sampler. The road cost per foot of hole as given in Table II, may be considered high for general work, due to rough ground and numerous long roads between holes.

TABLE I.—SUMMARY OF DRILLING RECORDS.

Number of holes drilled	62
Total feet drilled	14,256
Total drill days	579
Average depth of holes, feet	229.9
Average footage per drill per day	24.61
Number of drill months	19.3
Average footage per drill per month	738
Average footage per foot of cable	1.82
Average footage per ton of coal	22.97
Average tonnage of coal per day	1.07
Gallons of water used per day	2,200
Hours consumed in moving (7.6 per cent)	1,058
Hours consumed in drilling (65.2 per cent)	9,071
Hours consumed in repairs (8.2 per cent)	1,147
Hours consumed in fishing (2.9 per cent)	393
Hours consumed in casing (1.4 per cent)	186
Hours idle (14.7 per cent)	2,041
Total hours	13,896

Method of Sinking Curbed Well Foundations Using a Special Hoisting Machine.

The accompanying illustrations show a new hoist devised for use when space is limited in sinking open caisson or curbed well foundations of the so-called Chicago type. These foundations consist, as many of our readers know, of separate pieces made by fitting with concrete circular wells sunk through the overlying clay to rock or hardpan. The wells are sunk by excavating and curbing with wood lagging successive 4 or 5 ft. sections. The hoisting from these wells is done by tripod windlasses and generally a row of several wells is made at once, the windlasses being operated simultaneously by a rope drive from an engine off one end of the row. The method is simple and efficient, but it requires considerable room and freedom from obstruction for the rope drives. These conditions are not available in some cases, as for instance when a new foundation is being put under an existing building and it is to meet conditions of work in cramped places that the first illustrated has been designed. The work can best be shown by taking an actual job of foundation work which was recently completed for the new Boston Store building in Chicago.

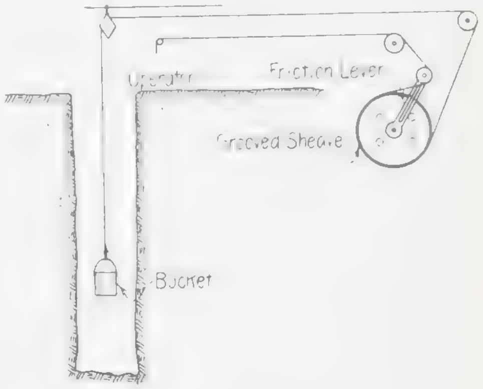

Fig. 3—Diagram Showing Arrangement of Hoist Lines.

In this building it was desired to construct all the foundations for the new structure before the old building was vacated, thus saving time and rental. Heavy timber cribbing was set up in the basement and on the outside of the building all along the walls. Holes, at various intervals, were then made in the walls and heavy I-beams were slipped through and rested on screw-jacks supported on the cribbing. The jacks were screwed up until they were under a strain. Then other holes were cut and other beams placed in the same way, until the entire weight of the building was on the cribbing. With all this cribbing in the way and the small amount of headroom it was impossible to use the ordinary method of hoisting from several wells in a single line, but the hoist shown by Fig. 1 was found to fit the conditions and was successfully used.

This machine is built to operate eight wells at one time. At the Boston Store the practice was to excavate alternate wells so as to lessen danger of settlement of the cribbing by having two open wells close together. The lead lines to the wells are carried by pulley blocks around any obstacle that may be in line between the hoist and the caisson. The hoist was set at about the center of the area and lines are run from it to caissons in all directions as shown by Fig. 2. The machine is built to handle eight caissons at one time. A 1⅛-in. manila rope is used for each hole and passes from the bucket (Fig. 3) through a pulley overhead to a swivel pulley on the top of the hoist, then down around the V-grooved sheave, over a pulley on the end of the friction lever and back to the caisson. The man at the well, by taking a strain on the rope, causes the friction lever to throw the sheave laterally into friction with the revolving drum and the bucket is then hoisted. For lowering the load or bucket, the line is allowed to slip loosely through the hand. The hoist was used about 45 days in excavating all but seven of the caisson foundations of the Boston Store. These caissons were excavated to rock about 108 ft. below street grade. About 70 ft. was in soft clay and the balance in hardpan. In sinking the well, the sides in clay were lined with 3x6-in. tongued and grooved wood lagging, 3 ft. long. In hardpan 2x6-in. lagging, 5 ft. 4 ins. long was used. The steel rings used to hold the lagging to the true circle were 1x4 ins. in section and were bolted together in two halves. The buckets used were about 18 ins. in diameter and 30 ins. in depth.

For handling eight caissons at one time the following men were required:

Foreman	1
Engineer	1
Hoistmen, 1 at each caisson	8
Dumpmen, 2 at each caisson	16
Wheeling,* 1 at each caisson	8
Bottom men, 3 at each caisson	24
	56

The material was hauled up and dumped on the ground beside the hole and wheeled from there to a chute which led to cars stationed below in the Illinois Tunnel. The material was taken by the tunnel cars to the Geo. W. Jackson Disposal Station, where it was loaded into scows, taken 8 miles out in Lake Michigan and dumped.

The average progress in excavating the caissons was about 10 ft. in 8 hours in clay *and* about 3 ft. in 8 hours in hardpan. Most of the caissons were 8½ ft. in diameter. Seven of the caissons, however, were 13 ft. in diameter and are the largest ever put down in Chicago. Another notable fact about this work is that here are the first metal columns which have been put down to bed rock in Chicago. Three such cast iron columns were used under the wall of the adjacent building because of lack of space for concrete foundations at these points.

The architects of this building are Holabird and Roche, of Chicago. Purdy and Henderson are the supervising engineers and John Griffiths & Son are the general contractors. The special hoist used is made by the Thomas Elevator Co., Chicago, Ill.

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*When excavating in hardpan one man took care of wheelbarrow work at 3 wells.

ROADS AND STREETS SECTION

Correlation of Sidewalk and Curb Grades.*

Upon unimproved streets the sidewalk grade problem would appear as a very simple proposition of grades and their intersections. As soon as the roadway curb makes its appearance, or upon streets where the curbs are in place, the question of sidewalk grade comes forth with an astonishing variety of combinations, and especially so at street intersections.

As an illustration I might ask, "What should be the elevation of grade for the intersection of two walks at a corner from which one curb ascends at the rate of 4 per cent with the walk 10 ft. distant, and the other curb descends at the rate of 8 per cent, with the walk 4 ft. distant from the curb?" In this particular case we will have one of two possible conditions: either the walk on one of the streets must be depressed below the curb on that street, thus draining the parking on to the walk, or, if the walk be raised so as to drain the parking to the curb, it will necessitate either steps or a very sharp incline to meet the conditions at the cross street.

The elements to consider in the establishing of sidewalk grades should be:

1. Service to the public.
2. Hazard to the municipality from the standpoint of personal injury damage suits.
3. Benefit and damage to the abutting property.
4. Beauty of the street.

In considering service to the public it is not sufficient to take account only of what the ordinary able-bodied person is capable of doing, or what the public is willing to tolerate; but honest effort should be given toward bringing the walks provided for pedestrians to such condition that the blind, lame, aged and women with children may travel along the same with reasonable assurance of safety and with the least effort.

Volume of traffic may enter into the question of service to the public, as excessive slopes, steps and other necessary devices that may be permitted on residential streets of limited extent and traffic, might prove hazardous, objectionable and intolerable on business streets. Uniformity in general plans is also worthy of consideration, as man is more or less of an automaton in his actions. Provide one or two of the eight gutters at a street intersection with crossing plates, and you will find many people stumbling there, especially if the street light happens to be out of commission; or let a crosswalk drop on an excessive grade at such a place, and people will be continually slipping there, on the same principle that your foot will always discover the faulty riser in a flight of stairs.

The public at large is disposed to ignore the principle of law as applied to reasonable care to "stop, look and listen," and expect their servants to provide means of travel of such character that this principle need not be invoked by them. We say it is impossible, but many a costly judgment in personal injury suits could have been spared municipalities if a little more attention had been given these insignificant details.

In cities of rugged character, topographically, the question of damage or injury to the abutting property, due to determining sidewalk grades, and location of the walk as well, often becomes very troublesome. This is especially true on streets where retaining walls have been carelessly built to support terraces, or where buildings may exist close to the street line. Having found a happy reconciliation of utility, safety, damage, and beauty of the street, under such conditions the engineer may well grin defiance at the most intricate problem in the higher mathematics. No one may say, in these days of aesthetic endeavor, that the beauty of the street should be neglected for the sake of utility. But the engineer, having determined upon a reasonable compromise in the establishing of a difficult sidewalk grade, is rather disposed to say, with the fellow in prison for smiling at his neighbor's wife, "To perdition with beauty! See where it lands me!"

When other modifying conditions may be ignored, there are three combinations of circumstances under which hard and fast rules may be laid down for the relationship between sidewalk grade and curb grade, namely; where intersecting curbs approach a block corner on a level; where intersecting curbs approach a block corner on equal, or substantially equal, descending gradients, and where intersecting curbs approach a block corner on substantially equal ascending gradients. It is readily seen that there are three other combinations, namely: where a level curb intersects a curb on descending gradient; where a level curb intersects a curb on ascending gradient, and where a curb on ascending gradient intersects a curb on descending gradient, any or all of which conditions upset any fixed rule for this relationship. The three last named combinations are more frequently met with than are the three first named.

The first determinations to be made are, satisfactory transverse slope for the walk and desirable incline of the parking or that portion of the walk space between the walk and the curb. There is some difference of opinion among engineers as to what these slopes should be. As the writer is using ¼ in. per foot, or the equivalent of 2.08 per cent., for transverse slope in the walk, and a minimum of ½ in. to the foot, or the equivalent of 4.17 per cent., for the slope of the parking on streets used for residential purposes, these figures will serve as well as any others for the purpose of illustration.

The only useful function of the transverse slope is to drain surface water to the street gutter. This will not be accomplished in the case of walks on level or low grades, using the figure given for minimum in the parking, unless the earth surface is left somewhat lower than the top of the walk, in case the parking is seeded, as the sod will form a mat higher than the edge of the walk, that effectually dams the water and prevents its flow to the gutter.

In dealing with transverse slopes we find that the maximum incline in a walk on level grade is the transverse slope perpendicular to the direction of the walk, and that as the grade increases, the maximum incline shifts with the width and slope of the walk, so that on excessive grades we find the surface water flowing nearly parallel with the center of the walk.

The direction of this maximum incline may be defined as the hypothenuse of a triangle of which the width of the walk is the altitude and the base is the width of the walk multiplied by the ratio of the percentages of the walk gradient and the transverse slope. For example, given a walk 6 ft. wide on a 10 per cent grade, with a transverse slope of ¼ in. per foot, we find that the ratio of percentages of gradient and slope, multiplied by the width of the walk, equals 28.8 ft., and that the surface water will flow diagonally from one corner to the other of a stretch of walk 28.8 ft. long. Pursuing this a little farther, we find that this diagonal is on an incline of 10.21 per cent, as against the prescribed 10 per cent longitudinal gradient. The combined effect of transverse slope and longitudinal gradient is to increase the prescribed incline of the walk, and to lead the surface water on and along the walk instead of across it, both of which results add to the hazard and discomfort of the public using the walk.

It would therefore seem reasonable to require that surface drainage should be confined to the shortest path across the walk, wherever possible, and that a limiting angle should be fixed, beyond which it should not be permitted to go. Assuming that the path of drainage be confined between the limits of 90 degrees and 45 degrees with the direction of the walk, substituting the value of any required transverse slope, making the base equal to the altitude, and solving for per cent of grade in the formula given, we find that in each case the limiting grade is equal to the transverse slope. This relationship may be best shown by the following table:

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*Paper by Clark G. Anderson, City Engineer, Moline, Ill., read before the 17th Annual Convention of the American Society of Municipal Improvement.

Transverse slope, inches per foot.	% of transverse slope, also limiting grade.	Inclination of 45 degree diagonal per cent.
1/8	1.042	1.47
1/6	1.389	1.96
1/5	1.667	2.36
1/4	2.083	2.94
1/3	2.778	3.93

It will be observed that the inclination of the 45 degrees diagonal is in all cases approximately 40 per cent greater than the corresponding transverse slope.

This table gives us working limits for any assumed slope. Thus, assuming that ¼ in. per foot is the minimum permissible slope for satisfactory drainage, and ½ in. per foot is the maximum permissible slope, we find that ¼ in. per foot may be used on grades from 0.00 up to 2.08 per cent; that ⅕ in. per foot may be used on grades from 1.48 per cent (interpolated) to 1.67 per cent; that ⅓ in. per foot may be used on all grades less than 2.78 per cent; that ½ in. per foot may be used on level grade only, and so on for any of the other slopes, if the cross-drainage is to be confined to the shortest reasonable paths across the walk.

If the surface drainage could be confined to the amount of water falling on the area of the walk alone, if it was uniformly distributed, or if the walk is of short length, the issues here raised would be without point, but this is rarely the case. Property owners will spend considerable sums of money in leveling their premises so as to drain away from the dwellings and toward the street. Private walks and driveways are often water collectors, discharging upon the public walks, with no regularity of interval and in such manner as to often make the walks unduly hazardous during the cold and wet season. This drainage also has a tendency to wear fixed water courses along and in the walk. For these reasons all effort should be made to rid the walks of water as quickly as possible, and the method here offered will apply to grades up to 4 per cent.

Again, the principles enunciated are sufficiently obvious to most of us to be axiomatic, but it is not unusual in formal sidewalk specifications, to find requirements for transverse slope, without regard to grade. The average contractor engaged in this class of work will blindly follow a "rule of thumb," with acquiescence on the part of the average inspector allotted to the engineer, unless explicit instructions to the contrary are issued.

How should walks laid on grades in excess of 4 per cent be treated? At first glance it might appear desirable to give the walk a crown similar to that prescribed for pavements, in order that the middle of the walk, which is also the path of the greatest number of pedestrians, may rapidly shed snow, ice and water. It might also appear less objectionable to have a gradually increasing and curved incline on either side of the center, than to have all of the incline in one direction across the walk. As the principles already stated for transverse slope apply with the same force to a crowned surface, and for the further reason that this form of construction would have to be built with greater care than is usually accorded this class of work, and at a greater expense, this idea may be dismissed without further comment.

The answer to this question appears to lie in restricting the amount of surface drainage to the area of the walk by either providing suitable depressions in the earth surface on either side of the walk, or laying artificial drains to serve the same purpose. The walk should then be laid without tranverse slope, as the longitudinal incline is sufficient for purposes of drainage.

In connection with the subject of slope in the parking, brief mention may be made of the admissibility of steps in sidewalk construction. As a general proposition the writer is of the opinion that they should be avoided wherever it is possible to do so. They are from 400 to 500 per cent more costly than walks of the same area, exclusive of proper guard rails; they add to the expense of maintaining the parking by creating excessive slopes; they subject the public to needless hazard in sleeting weather; they are dangerous to persons afflicted with bodily infirmities; they add to the lighting bill of the city. The objections apply to all ordinary conditions. Situations undoubtedly exist where steps afford the only possible convenient means of ingress or egress for the public from one street to another, or from one section of a city to another. On residential streets of short extent, where the lot lines may lie parallel with terraces, and where the street walk may be placed at a considerable distance from the curb, steps may be used with good effect. Cement walks with a float finish, brick walks laid of unglazed brick, and cinder walks, on grades as high as 12 per cent and possibly higher, may be used by the public with no apparent discomfort at all times, except when the walks are covered with ice, and the insertion of steps for the purpose of reducing the grades would appear to be of doubtful economy. Limestone flags and walks constructed of glazed tile, in vogue in some sections of this country, are slippery in wet weather on relatively low grades. There is one feature of the prescribed slope for parking that deserves consideration in communities of rapid growth, where certain streets in the residential districts are so located as to invite invasion by business houses. In such localities the slope in the parking should be held down to the minimum commensurate with satisfactory drainage, in order that the walk may be extended out to the curb without creating an excessive inclination or needlessly require building up over the top of the curb.

Given two walks, *A* and *B*, located parallel with corresponding curbs, *a* and *b*.

Let *Aa* equal distance between curb and walk *A*.

Let *Bb* equal distance between curb and walk *B*.

Let *Wa* equal width of walk *A*.

Let *Wb* equal width of walk *B*.

Let *Sa* equal per cent of slope in parking for *A*.

Let *Sb* equal per cent of slope in parking for *B*.

Let *IA* equal transverse incline in *A* in percentage.

Let *IB* equal transverse incline in *B* in percentage.

Let *%a* equal per cent of grade of curb *a*.

Let *%b* equal per cent of grade of curb *b*.

Let *ab* equal elevation of grade at intersection of curbs.

Let *AB* equal elevation of grade at intersection of walks.

Then, for walks of equal width and equidistant from the curbs, when the curbs leave the intersection on equal ascending grades, and with uniform slope in the walks and uniform slope in the parking, for both cases, *AB* equals *ab* plus (*Bb* plus *Wb*) *%a* plus (*Aa*) *Sa* plus (*Wa*) *IA*.

The symbols here used are applicable to requirements for walk *A*.

While this formula, and others that will be referred to, may seem long and involved, a mere glance will show that they require but the simplest of arithmetical operations in their solution and that the symbols are used simply for brevity.

For walks on level grades the second term, (*Bb* plus *Wb*) *%a*, is equal to zero, and therefore drops out. For curbs on equal descending grades the second term, (*Bb* plus *Wb*) *%a*, is prefixed by a minus sign. In other respects the formula is the same and may be used for the three conditions.

If one walk is wider than the other, and (*Bb* plus *Wb*) is equal to (*Aa* plus *Wa*), satisfactory results may be had by taking the mean of *AB*, as obtained by the formula as written and when *B* and *b* is substituted for *A* and *a*. It must be borne in mind, however, that where the curb grades exceed 4 per cent the slope in the parking should be reduced on ascending grades in order to avoid excessive inclination at the approach to the curb.

If the walks are of the same width, but walk *A* is remote from the curb and walk *B* is near the curb, where the curb is on level grade, then *AB* is obtained by inserting in the formula the nomenclature applicable to the walk *B* (nearest to the curb). In case this determination leaves little or no slope in the parking along walk *A*, the grade equal to

$$\frac{(Bb)\ Sb \text{ plus } (Wb)\ IB}{Bb \text{ plus } Wb}$$

should be extended through point *AB*, to an intersection with the regular gradient of walk *A*. Solving the formula for *AB* for both walks and subtracting the result obtained for the near walk from that obtained for the remote walk, we find a certain difference in elevation, which, divided by

$$\frac{(Bb)\ Sb \text{ plus } (Wb)\ IB}{Bb \text{ plus } Wb,}$$

gives the distance from the point *AB* to the grade intersection. We thus find that walk *B* has one controlling grade point located at the walk intersection, while walk *A* has two, one of which is located at the intersection of *A* and *B* and the other at some distance therefrom, at the intersection of the two gradients. If the curbs in this case depart from the intersection on substantially equal ascending grades, the formula should be applied for walk *B*, the same as for level curbs, and the *AB* so found should be used for controlling grade for both walks *A* and *B*. If the curbs in this case depart from the intersection on substantially equal descending grades, the formula may be applied in the same manner as for ascending grades, except where this result causes a reverse slope in the parking along the remote walk, when two controlling grade points in the remote walk *A* should be determined as described in a previous case.

It is not the intention of the writer to go into wearisome detail of this whole subject. The variations in the relationship between sidewalk and curb are almost infinite, but the general principles to be borne in mind in the solution of any given problem are not many, and can be applied to almost all combinations. His purpose is to lay stress upon matters often disregarded because of their seeming insignificance, and to aid in securing proper recognition and rational treatment of the sidewalk question.

The sidewalk is in reality the most important surface structure on a street, for the vast majority of the public travel on foot. Many a family has lived through generations without owning a vehicle of any kind. The householder may carry his drink, food, raiment, and even his furniture, fuel and building materials without the use of a road, but he cannot be deprived of a foot path leading to his home or to his means of livelihood.

Serving so many of us, it does not seem unreasonable to ask that the sidewalk be given a place of equality with and that it receive the same application of professional skill in design that is accorded to that part of the street devoted to the use of brutes and vehicles.

One does not have to travel far and wide, nor to observe sidewalks in many cities, to find horrible examples in sidewalk grades and be impressed with the inequality that exists in this matter, and which is generally occasioned by indifference and neglect of some one.

The location of walks with reference to curb lines and property lines is often considered an executive duty, in which case the engineer may not be consulted, and the location is fixed by some arbitrary rule. By applying the methods previously discussed for the determination of sidewalk grades at street intersections it will be readily seen that the location of the walks with reference to the curb lines may be rationally determined by the gradients of the intersecting and adjacent curbs.

Reversing the operation heretofore described, the required elevation of grade for curb intersections may be determined from given conditions for sidewalks. We thus come to the question of establishing curb grades, and it may be pertinent to inquire if it is sufficient to prescribe elevation of grade for curb intersection only, and use uniform grade for curb throughout a block in all cases, or, if it would not be well under certain aggravated conditions to break grade at intersection of walks with curbs, in order to modify steep walk approaches.

It is quite customary in small towns and in certain rapidly growing sections of the larger cities, where there is not immediate call for paved or curbed streets, to establish walk grades without regard to how a future curb grade may fit. Again, such places may have established grades for curbs, with no regard as to the possibility of placing a future walk at a desirable grade. Either of these conditions, upon the ultimate completion of the street improvements, gives rise to situations that have all the earmarks of unsightly, inconvenient and objectionable patchwork, against which the public may with justice protest.

Road Construction Plant of the Board of Road Commissioners of Wayne County, Michigan.

Some years ago Wayne County, Michigan, adopted a plan for the construction of good roads throughout the county. In accordance with this plan a board of county road commissioners, reporting to the County Supervisors, was appointed to handle and disburse all money appropriated for county road purposes. A definite systematic plan of road construction covering a period of years was adopted, and work under this plan has now been under way for four years. The work of the Commissioners is extensive, covering, as it does, the main highways leading into the city of Detroit and the main highways radiating from the smaller communities in the county. One feature of especial interest in the work of the Commissioners is the comparatively large mileage of concrete paved roads that have been constructed. Of this type of road about 15 miles have been completed or are under way at the present time. Most of the road work has been done by day labor, at times as many as 250 men being in the employ of the Commission.

In its road work the Board has eliminated all hand and horse labor wherever the same or better results could be achieved by machinery. Stone, cement and sand are hauled in trains of from two to six cars holding seven ton loads by road engines. Water is piped and pumped by gasoline engines wherever possible. Plowing and grading are done behind an engine. Concrete is mixed in a mechanical batch mixer which travels under its own power and from which a long crane projects over the work on which a clam shell bucket travels with the mixed material. The accompanying figures taken from the 4th annual report of the Road Commissioners for the year ending Sept. 30, 1910, show the original cost of the plant used by the Commissioners in its road work:

Hauling and Grading Machinery and Equipment:

Steam engines	2	$ 4,870.00
Road rollers	4	9,607.00
Seven ton stone dump wagons	24	6,780.00
Top boxes for same	24	432.00
Tongues for same	1	16.00
Sprinkling wagons	12	2,224.00
Team dump wagon	4	440.00
Graders	2	430.00
Scarifier	1	424.79
Plows	2	61.75
Tool wagons	4	190.00
Tool boxes	2	8.50
Scrapers, Doan	3	15.00
Scrapers, steel	2	9.50
Scrapers, hand	1	1.00
Scrapers, wheeled	4	100.00
		$25,609.54

Concrete Equipment:

Concrete mixers	2	$ 3,475.00
Platform for same	1	23.15
Concrete carts	6	114.00
Wheelbarrows	37	130.27
Road forms	7	45.90
Road irons, 25 feet long	3	17.50
Trowels	2	1.50
Galvanized cylinder	1	2.50
Floats steel	1	.95
Wire screens	1	1.50
Name plates	2	27.50
2-in. black lead pipe, feet, 5,367	..	302.17
Canvases for protecting concrete	24	433.93
Tarpaulins, 20x30	2	78.00
Tarpaulins, 12x15	2	23.40
Water tanks, stationary	2	15.00
Hydrant reducer	1	4.75
Special goose-neck reducer	1	1.20
Hose	..	15.00
Tampers, various sizes	9	6.75
Iron pins	48	12.00
T-squares (grading bars)	9	9.00
		$ 4,741.06

Maintenance Equipment:

Street sweeper (and extra broom)	1	$ 238.00
Road drag	1	15.63
Scythe and snath	3	5.25
Tar kettles, 100 gallons	2	220.00
Wire and splint brooms	14	8.40
Sprinkling cans	14	14.00
Barrel spouts	15	.90
		$ 502.18

Blacksmithing Outfit and Tools:

Post drill	1	$ 10.50
Ratchet drill	1	6.75
Breast drill	1	3.75
Drill bits	set	4.15
Anvil	1	16.80
Forge	1	10.80
Tongs, pairs	2	4.60
Reamer	1	.50
Hacksaw	1	1.00
		$ 58.85

Shovels and Handled Tools:

Shovels, L. H.	87	$ 63.53
Shovels, D. H.	67	48.40
Shovels, scoop	7	5.25
Spades, garden	7	4.88
Spades, tiling	20	18.90
Stone forks	17	30.69
Picks	47	30.75
Grub hoes	2	1.00
Mattocks	14	11.20
Stone rakes	5	3.75
Post hole digger	1	1.50
Hoes	3	2.75
Crowbars	4	2.40
		$ 225.00

Concrete Tile Making Equipment:

Molds, 8-in.	5	$ 87.50
Molds, 12-in.	7	153.50
Top rings, 8-in.	5	4.00
Top rings, 12-in.	3	2.85
Bottom rings, 8-in.	36	18.00
Bottom rings, 12-in.	72	46.90
Irons for bending reinforcement	1	2.00
Pallets	200	27.12
		$ 341.87

Camp Equipment:

Mess and bunk tents	2	$ 104.86
Outhouse tents	2	3.92
Tent cover, 20x30, with poles	1	42.14
Canvas fences	2	7.35
Cots	18	16.02
Pads for cots	15	18.75
Comforters	18	17.64
Pillows	18	8.82
Pillow-cases	18	2.25
B blankets	18	28.62
G blankets	18	10.62
Towels	12	1.25
Dishes, cutlery, pots, kettles, cooking utensils and other camp equipment		98.93
		$ 361.17

In addition to the above the Commissioners own the following:

	Cost.
Carpenters' tools	$ 32.73
Miscellaneous	131.96
Engineering and office equipment	1,025.97
Cement testing apparatus	55.05

The total original cost of the plant and property was $33,185.38. The depreciation for 1909 was placed at $3,850.88 and the depreciation for 1910 at 15 per cent was placed at $4,400.18. This makes the present value of the plant and property $25,934.92.

* * *

Annual Convention of the American Road Builders' Association.—The seventh annual convention of the American Road Builders' Association will be held Dec. 6, 7, 8 and 9 at German House, East Michigan and New Jersey Sts., Indianapolis, Ind. The sessions will be devoted to the presentation of a large number of technical papers on road and pavement construction and maintenance, and discussions of the papers and of matters pertaining to the work of highway improvement. In accordance with the custom inaugurated at the sixth annual convention held a year ago at Columbus, O., an exhibit of road making materials and machinery will be held in connection with the convention. Ample exhibition spaces have been obtained in German House, and in the summer garden connected with it, thus bringing the sessions of the convention and the exhibits together. The meetings and exhibits will be open to the public and a general invitation to attend is extended to all interested in highway work. The headquarters of the association are at 150 Nassau St., New York City.

Notes on Road and Street Work.

Scarifying An Old Gravel Road.—The officials in charge of the County Road System of Frotenac County, Ontario, use a scarifier in breaking up old roads. Mr. Geo. W. Smith, County Engineer, informs us that the scarifier has been used with good success in breaking up some of the hardest roads in the county. In one instance on old gravel and limestone road was broken up to a depth of 10 in. for a width of 18 ft. and a length of one mile in two days. A traction engine was used to haul the scarifier. The engine was hired at the rate of $10 per day, the owner of the engine running it and furnishing his own coal and oil. In this particular case it took two more days with the grader to put the road up in shape.

Cost of Pavement Maintenance at Birmingham, England.—The city of Birmingham, England, according to the report of the City Engineer for the year ending March 31st last, had 170,694 sq. yds. of wood pavement maintained directly by the corporation. The cost of this maintenance during the past year was $4,424, or about 2.56 cts. per square yard. This cost was for repairs only and not for renewals. The city also had an area of 111,585 sq. yds. of wood pavement under maintenance contract with the Improved Wood Pavement Co. The amount paid during the past year for this maintenance was $19,736, or about 17.48 cts. per square yard, this payment covering according to contract the cost of entire renewals where necessary. The following table shows the expenditure per year, the mileage and the cost per mile for repairing various classes of pavements and for cleaning, watering and gritting streets for the year ending March 31, 1910:

	Expenditure.	Mileage.	Cost per mile.		
	£		£	s	d
Repairing macadamized streets	23,242	220.92	105	4	2
Repairing granite pavements	3,528	39.18	90	1	2
Repairing wood pavements and part renewing	4,972	20.22	245	18	0
Cleansing paved streets	20,811	59.40	350	7	3
Cleansing macadamized streets	17,111	220.92	77	9	1
Watering paved streets.	766	59.40	12	18	1
Watering macadamized streets	1,631	220.92	7	7	8
Gritting paved streets	2,148	59.40	36	3	4
Gritting macadamized streets	16	220.92	0	1	6

Oiling Shell Roads.—In many coast cities, particularly in the south, there is a considerable mileage of streets which have been surfaced with shell. In some of the states these roads are constructed of oyster shells, but in Texas most of the roads are surfaced with clam shells. In Houston, Tex., there are a number of streets of this type, and that city has recently undertaken the oiling of these streets. An asphaltic oil furnished by the Texas Co. was used for this work, which proved so successful that it is hoped to treat all of the city's shelled streets in a like manner. The oil was shipped in tank cars fitted with steam coils by means of which it was heated by a portable boiler and allowed to run into distributing wagons. The streets were first cleaned of all dust and the oil applied at a temperature of over 200° F. at the rate of 1 gal. per square yard. Time was allowed for the street to absorb as much oil as possible. The surplus was then absorbed by sand or dust spread over the street and then swept off, exposing the original surface.

Low Cost Roads for Small Towns.—The following method of constructing roads particularly suitable to towns where appropriations are small and the mileage great was given by Mr. Charles W. Ross in a paper on the "Modern Surface Treatment of Roads," read before the recent National Good Roads Convention at St. Louis, Mo.: In the first place, a road should be prepared and rolled so that it is perfectly smooth before any finishing coat is applied. In riding over some roads it is found that the surface resembles the waves of the ocean. This is caused by loads of material being dumped at different points, top leveled off, leaving the center of the load undisturbed and more compact by being dumped. As the surface material is so much softer, when the road is first leveled and raked, these depressions do not appear, but the hard core in the center of each load will remain there and grow more and more exaggerated by the action of the traffic. The wheels going over the hard place and striking the soft will leave the road very uneven. Every load of gravel or stone placed upon the surface of the street should be dumped upon a platform or every shovelful should be so handled that it will be evenly spread. In this way it is possible to get a smooth, even surface. A good quality of gravel spread upon the surface of the road and thoroughly rolled and wet and covered with a preparation of some of the heavy asphaltic oils or the lighter tar preparations will make a road almost free from dust and cheap to maintain. This method will appeal particularly to the towns where the appropriations are small and the mileage great.

"Prepared Filler" in Macadam Construction.—During 1909 Cornell University and the U. S. Office of Public Roads co-operated in the construction of an experimental road at Ithaca, N. Y., for the purpose of testing, by actual service, different bituminous binding materials. One of the most interesting experiments at Ithaca and one by the way which was not originally planned in this curb was the use of a "prepared filler." This experiment was made at the suggestion of Mr. Charles H. Hoyt, U. S. Superintendent of Road Construction. The basis of the experiment is the incorporation of a prepared filler with the coarser stones of the macadam, the idea being that this would make it difficult for motor traffic to loosen the stones. Two stretches of roads, one 59 ft. in length and the other 75 ft. in length, were built according to this method. The bottom course of the road was constructed the same as the ordinary macadam road. The top course stone was then laid, but before rolling was covered with a layer of prepared filler made of stone chips sand and bituminous material, all of which was heated and mixed together in a concrete mixer. A layer about 1½ ins. in depth of prepared filler was spread over the top course stone and was then harrowed in with a spike tooth harrow until the top course stone appeared through the filler course. The road was then rolled until it was firm and on one of the sections a light paint coat was applied which was covered with chips and then rerolled. On the other section, a thin surface coat about ½ in. in depth of the prepared filler was spread and the road then re-rolled. The experiment demonstrated that the physical difficulties in using the above method were no greater than those of either the penetration or the mixing method.

Tarvia Matrix for Road Construction.—The road word of the Urban District of Alton, England, included the laying of 100 tons of crushed granite upon a tarvia matrix. The method of preparing and using this matrix was described in a recent issue of the Engineering Record. For the matrix specially prepared ⅜ in. Clee Hill chippings from the roller mills were used. These chippings were heated upon hot plates ¼ in. thick over a furnace consisting of an excavation 9 in. deep and slightly less in width and length than the plates. The tarvia was heated in an ordinary tar boiler, and upon reaching a temperature of 125° F. was measured out and mixed with the chippings in the proportion of 12 imperial gallons per cubic yard.

The cost of the matrix was as follows:

30 tons roller chippings at $3.36	$100.98
280 imp. gals. of Tarvia	21.81
Manual labor (including construction of furnace	20.35
Team labor (hauling fuel)	.40
Cost of fuel	1.21
Total	$144.75

This makes the cost per ton slightly less than $5. No charge is made above for haulage of granite and tarvia from station, nor for the use of boiler and plates.

It is stated that on a sunny day it is not necessary to warm the whole of the chippings; those on the surface of heaps being sun dried are raked off and mixed with those furnace warmed before the latter are covered with tarvia. It is said to be very important that the furnace heated chippings are not too hot; 70° F. should be sufficient, as excessive heating tends to make the resultant mixture hard and brittle. After heating, the matrix is heaped until required for use; if of the right consistency it appears to be a mass of shiny black particles, similar in appearance to anthracite coal, and for weeks after, it should be possible to push a stick into any part of the mass without effort. In using the material the surface of the road being scarified, raked and rolled to the required contour, using plenty of water during the rolling of the foundation, the matrix was spread to a depth of ½ in. and covered with a coating of 2 in. basalt. The roller was then moved very slowly on to the granite; it appears to be very important with tarred matrixes that the roller be moved uniformly and slowly; quick motion was found to give the wavy appearance to the surface so common with water bound roads. After the roller had passed over some three or four times the matrix appeared through the crevices of the stone: the macadam was next sprayed with liquid tarvia and covered with top binder, using the same material as for the sub binder, and the whole sprinkled with Shepton Mallett Chippings and rolled in. After some dozen turns up and down rolling was stopped for the day, and on the following day a few more turns of the roller completedly finished the material. Before commencing the second day's rolling the few interstices that appeared were filled with top binder and consolidated, and the same material used for a neat finish to channel stones and manhole covers. Immediately on completion the material was subjected to very heavy tests. Twenty army transport engines, each hauling three heavy trucks, passed over, leaving no depressions whatever on the material that had been perliminary rolled on the previous day, but of course leaving slight tracks upon the work in hand; these tracks were eliminated by passing the roller over three or four times.

STEAM AND ELECTRIC RAILWAY SECTION

Methods of Handling Tool and Material Supply Trains for Railway Maintenance Work.*

BY MR. A. S. KELLOGG †

This paper is a review of the supply car system as in operation on the Tuscon division of the Southern Pacific Co. It is our purpose to deliver on a regular day every month of the year to section foremen and others what material they require for the ensuing thirty days, to pick up all tools in need of repairs, and all scrap on the entire division. We operate as follows:

Two regular supply cars are fitted up, one being the oil car, the other a living car for the supply car storekeeper and his helper, in which is also stored supplies for station men, pumpers, etc. To this equipment are added three common standard freight cars, in which are stored all spikes, track bolts, track tools, etc., for section men, and supplies for signal maintainers on the block signal system, and on leaving El Paso three empty flat cars with side boards and one empty box car, the latter being used to load all second hand track tools for repairs, such as picks, tamping bars, shovels to be rehandled, etc., as well as all other material of that nature. On the three flat cars is loaded all scrap, the different classes of scrap being separated as much as possible. In one car all the car scrap and second hand material, such as brake beams and couplers, found along the right of way, is placed. It is always understood that this scrap is assembled at section tool houses and piled conveniently near the tool house close to the track, where it can be loaded in the least possible time. For this purpose an air derrick with a capacity of three tons is used, which with the superintendent's business car and a caboose for the crew makes up the supply train.

This train is run as a special on the 18th of each month and is also used as a pay train, pay checks being delivered to the section foremen, extra gangs, etc., by a regularly authorized division paymaster. On this trip are the superintendent, storekeeper and the several roadmasters, who go over their respective districts. At times the division engineer accompanies the train. It takes four days to make the main line trip from El Paso to Yuma, a distance of 560 miles. Every tool house is entered, personally gone over by the superintendent, storekeeper and roadmaster; pump houses, pumpers' quarters and station quarters are inspected. Wherever the section foreman has a surplus of tools they are turned over to the supply cars and due credit allowed. Where he may have an insufficient supply, he is fitted out with what is necessary to do good work. Every tool delivered is inspected. The superintendent knows when he leaves each section that its section foreman is equipped with tools and material to do good work for the following thirty days. Requisitions are always made out by the section foreman, approved by the superintendent, and are in the hands of the supply car storekeeper four or five days previous to the date the supply cars are scheduled to leave Tucson. On the ground oftentimes these requisitions are reduced or increased in quantity, as the case may be, as conditions may have changed between the time the section foreman placed his order and the arrival of the supply cars, so that this trip is not only to deliver material but is one of a monthly inspection by the officer in charge of the division with his assistants. The turning in of old tools and material for the new is carried out and followed rigidly, even in the case of material which is not further usable. Every third month the branch line, about eighty miles in extent, is gone over. Every pound of scrap is picked up and when the supply cars arrive at Yuma, the western terminus, the superintendent is satisfied that the division has been thoroughly cleaned of scrap and is in absolutely first class working order as to tools and material necessary to do first class work, and also that every man has been correctly paid.

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*Paper read at the annual convention of the Railway Store Keepers' Association.

†Division storekeeper, Southern Pacific Co., Tuscon, Ariz.

When these supply cars were first instituted so many track tools were collected that scarcely a new track tool was ordered for nearly two years. Hand cars are also picked up on this trip and left at Tucson, the division headquarters on the trip west, unloaded and repaired. The car with the second hand tools is also set out, all tools being immediately repaired and all shovels rehandled in the shops, so that with but very little addition of new tools the same tools picked up one month are repaired and given out the following month. Thus the only charge made against operating accounts for this class of material is that of labor and what material is required to repair such tools. With the derrick car all frogs in need of repair, as well as hand cars, are loaded, and almost every trip during the past four or five months there have been picked up wrecked cars, etc., which in each case means the saving of sending the 100 ton derrick and crew to the scene of the wrecked car. The trucks are previously separated by a couple of car men sent out for this purpose on passenger trains in advance. The saving in the operation of the supply cars cannot be correctly estimated, they being so diversified and so many. Following are some of the things they eliminate:

They have reduced O. S. and D. reports on damaged and company freight 95 per cent. They save local freight crews handling this class of supplies, which almost invariably means overtime to them. They save revenue trains handling this class of freight. They save local freight trains from being burdened with a lot of material sent in haphazard from sections and stations from month to month for repairs. They save the loss and leakage of oils on shipments made by local freight and consequent damage to commercial freight, which is often loaded along with company supplies. They pick up all the scrap and get it to the mills, instead of leaving it for the roadmaster to drift a car, which is handled by local trains, set out at station after station, and then the scrap is only half picked up. They reduce complaints from section men and others as to non-receipt of material, as their receipts for material delivered on their requisitions are secured.

Before the advent of the supply cars the Southern Pacific Co. ran a scrap train with an extra crew over this division. Upon arrival at Yuma, the western terminus, there had been picked up forty-four carloads of scrap. This was the result of not running a supply and scrap train, but leaving it to drift cars. One may think this a rather bad condition of affairs, but it is safe to say that a great many railroad companies not operating supply cars can do this very thing right now. The Tucson division now averages about ten to twelve car loads of scrap per month, representing all kinds of scrap and second hand material, and it is surprising where it all comes from, as it often looks as though section men were digging up scrap buried years ago by their predecessors. The Los Angeles division, several years ago, ran a strictly scrap train once only. It took about three months to complete the division, including all branches, and the value of this train figured over $40,000, the operating accounts being credited with that amount.

The tanks in the oil car in this supply car equipment are piped with air pressure drawn from the train line, so it is not necessary to have oil pumps. Oil for the next station deliveries is drawn into oil cans and receptacles between stations.

The division superintendent feels that only by accompanying the monthly supply cars and noting conditions, can an approving officer be qualified to correctly sign these monthly requisitions for material. There was considerable antagonism against the supply cars when they were first inaugurated, but section foremen and roadmasters would now be a unit in opposition against their discontinuance, and they were the ones who looked upon it with suspicion and distrust when first inaugurated. The inspection given by the superintendent and his assistants has had a wonderful effect on the general appearance and tidiness of tool houses, as there was a time when each section man had so much miscellaneous material in these tool houses that they had hardly room enough to get their hand cars inside, and they were still ordering material, which they had buried under sacks of spike hole plugs, etc. The inspection of section men's tool houses and their equipment, as one feature only, is a commendation to the supply cars.

In the interim between the monthly trips, a semi-monthly trip is made to the roundhouses and car shops, where the sub-stores are located. The supply car storekeeper takes their supplies with him on this trip. He goes over their stock where necessary, by checking up their stock books, helping them where necessary to get their stock in order, tag and properly mark it, take away surplus material and give them what they need. The supply car storekeeper is responsible for the general appearance of these outside stores. He sees that all bad order wheels are promptly shipped in to the division store, where they can be worked over; takes a check of baggage trucks and warehouse trucks at each station, and he also makes a trip over the branch every thirty days, though not at the time when the regular monthly main line trip is made.

All scrap is loaded at district terminals before the arrival of the supply cars by section yardmen, and it is only necessary at such points to switch the cars into the supply train. At Tucson all these cars of scrap are gone over carefully, good second hand material picked out, the scrap being shipped on to the mills. This sorting over and shipping are also done at Yuma.

BY MR. C. H. ROST[‡]

On the road with which I am connected there are operated four cars, consisting of: 1. A car with necessary shelves for miscellaneous material and supplies for all departments. The car is arranged with ample space to provide sleeping accommodation for attendants. 2. A car with necessary racks and shelves in one end for roadway tools, in the other end floor space for spikes and track bolts. 3. A car with necessary tanks with self-measuring pumps for oil supply; also contains waste bin and necessary racks for oil cans. 4. An ordinary box car for stationery. This car is loaded by the stationery department, supplies being loaded in station order, and the car is released as soon as empty. The first three cars mentioned are provided with end doors, to enable attendants to pass from one to the other while the train is in motion. They travel on local freight trains when making deliveries, and cover the entire line of 1,000 miles in ten days, averaging 100 miles per day, two attendants being required to handle the work.

Requisitions are due from all departments on the 25th of each month. These on receipt are registered and any bulky items not carried by the cars are drawn off to be shipped otherwise. They are then stamped "To be filled by supply cars," and turned over to attendants, who draw off a summary of material needed, and check with the various sections in the storehouse, to ascertain if the material is on hand with which to stock the cars. Items short are immediately reported, and efforts made to get them before date of departure. Two days before cars are due to leave, they are stocked for the trip, and by closely checking the orders received and stocking cars accordingly, it has been found that very few complaints are registered on account of running out of any items en route.

No supplies are delivered by cars, with exception of oil or tools for extra gangs, unless the attendants hold approved requisitions for same. When deliveries are made, items are circled on the original requisitions, which are sent in at the close of each day's business. In addition to this, receipts are prepared in duplicate, bearing the requisition numbers and the date of delivery; one copy receipted is retained by the attendant, and turned in with requisitions, while the other copy is given the party receiving the material, who signs it and sends it to his approving officers. On receipt of the requisitions, items circled as delivered are invoiced against the department ordering same, and invoices are checked in the division offices against the receipts sent in covering the delivery. In case any items are not delivered they are back ordered and taken care of the following month, unless items are duplicated, in which case the back order is canceled, with permission of the maker.

One of the greatest advantages gained by operating the car is the picking up of old material, a large percentage of which can be repaired at a small cost and reissued. We insist on old material being turned in when new is drawn. On the return of the cars this is closely inspected, and any that is worth repairs is immediately put in shape to be reissued, the worthless being scrapped, credit as to its worth being allowed the department to which it properly belongs. If this material were not picked up and taken care of by the cars, it would reach the scrap dock in scrap cars, and would nearly all be worthless and unfit for repairs when received in this manner. The value of the material picked up for repairs by the supply cars will more than pay the expense of operating them. During the season when track work is extensive, sufficient tools are carried to take care of extra gangs.

Once each year, usually in October or November, in connection with the supply cars, there is run what is known as an "Economy Special." Accompanying the special are all division officers, a representative of the stationery department, and last, but not least, the storekeeper. Every building on the right of way—stations, towers, shops, roundhouses, car repairers' shanties and hand car houses—in fact everything resembling a building, is inspected, and all surplus serviceable material and tools, including those needing repairs, is picked up by the special and returned to the general store. The first trip of this kind was inaugurated three years ago, and the result was amazing to all, the material picked up representing a greater value than was anticipated. The result of this trip cannot be based alone on the value of the material reclaimed, its influence being worth much more to the company, as the trip one year later demonstrated. Less than 10 per cent of the material picked up on the initial trip was gathered in on the second. Some of the older men on the line are talking about it yet, as we gave them all a thorough house cleaning.

Branch lines of from ten to forty miles are not covered by the cars, as the small amount of material to be taken care of would not justify the time consumed. Oil cans and tools needing repairs are sent to junction points, and orders are taken care of by the cars at these points and are shipped from there. Branch lines, however, are covered by supply cars once each year when run in connection with the "Economy Special." The cars run about the same time each month, varying only a day or two, and this allows agents, section men and lamp men to order closely, as they know what is required to last them between trips, when they are regular. A schedule is prepared sufficiently in advance, showing divisions, date and trains on which cars will travel, and this is mailed direct to each party interested. The transportation department follows this schedule closely and moves the cars promptly according to same.

The supply car is not alone a benefit to the store department, but all departments gain through its operation. Its field should not be limited, but broadened, and every item of material that can be handled by this means of delivery should be added to its work. Small items ordered, which usually are handled by baggage or on local freight trains, as far as consistent should reach the consignee through the supply car, thereby saving handling and expense to the transportation department and preventing loss or damage. Since we have used the cars for such deliveries, our claims have been materially decreased, thus saving correspondence and labor in all departments. By giving the cars close attention and following up the details in connection with them very satisfactory results are being obtained.

[‡] District storekeeper, Chicago, Rock Island & Pacific Ry., Shawnee, Okla.

Cost of Washing Gravel for Ballast.

The following costs of washing gravel for ballast are given in the *Railway and Engineering Review* for Oct. 1, 1910, by S. B. Rice, Roadmaster, Richmond, Fredericksburg & Potomac R. R. The washing plant is located near Fredericksburg, Va.

The gravel is loaded from a pit by steam shovel, in the ordinary manner, the loaded cars being dropped down on a gravity track to position over a large concrete hopper, into which the material is dumped, and from which it is taken by a conveyor up an incline to the top of the plant, about 45 ft. high, where it is discharged into a steel lined box 3x6 ft. in size and 1 ft. deep. This box opens into the top of a chute, 6 ft. wide and lined with steel plate. As the gravel is delivered into the box water is discharged upon it from a flat nozzle 1 in. wide and 24 ins. long. On the smooth surface of the bottom of the chute 1-in. iron bars are laid transversely, to obstruct the flow of material and cause it to be more thoroughly washed. The nozzle delivers water at the rate of about 800 gal. per minute. From this chute, which is 8 ft. in length, the gravel is carried against a double screen standing at an angle of about 45°. The first of these screens has meshes 1 in. square, and the second, which is 9 in. in rear of the first, ½ in. square. Material which does not pass the screens drops into a bin, and that which does pass falls upon another chute and then passes through another series of screens until, finally, all the material is sorted into the various sizes of washed gravel, pebbles and building sand, the last-named material falling into a settling rank of water, the sand collecting in the bottom and being withdrawn through conical steel hoppers.

The material which is used for ballast is all over ⅛-in. in size. To convey an idea of the character of the work, a run of 22,100 cu. yds. of rough gravel was dumped into the plant, from which 18,050 cu. yds. of washed gravel, and 3,102 cu. yds. of sand were obtained. The muddy material washed from this quantity of gravel amounted to 618 cu. yds.

The average cost per cubic yard for the washed gravel, loaded on cars at the plant, was 17.61 cts.; the cost for hauling 10.13 cts.; and the cost for placing in the track, 17.86 cts., making a total of 45.6 cts. as the cost for the washed gravel in place in the track.

The percentage of various products of the plant are as follows: Washed gravel for shipment, 81.67 per cent; sand for shipment, 14.04 per cent; sand wasted, 1.49 per cent; muddy material wasted, 2.80 per cent.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Design for a Granite Masonry Sea Wall at Boston, Mass.

Concrete has replaced masonry to a large extent in recent years for the construction of permanent sea walls or quay walls. While, therefore, many descriptions of old masonry sea wall construction are available a very thorough search of engineering literature will give but few examples of recent and modern practice. For this reason the work described here is worth attention. This work is being done by the Land and Harbor Commission of Massachusetts, Mr. Frank W. Hodgdon, chief engineer, and its description is extracted from the engineer's specifications.

The work to be done is the building of a solid pier or wharf 1,200 ft. long and 300 ft. wide, enclosed by heavy stone masonry sea-walls, and the filling of about 900 ft. in length of Northern Ave. with its enclosing light sea-wall and bulkhead, the whole located at South Boston, Mass.

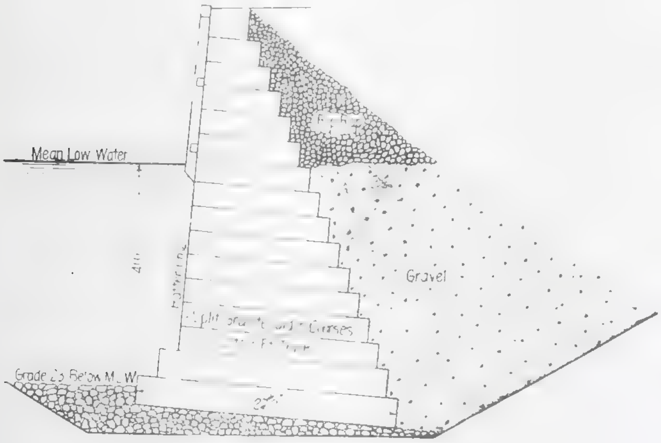


Fig. 1—Section of Granite Sea Wall.

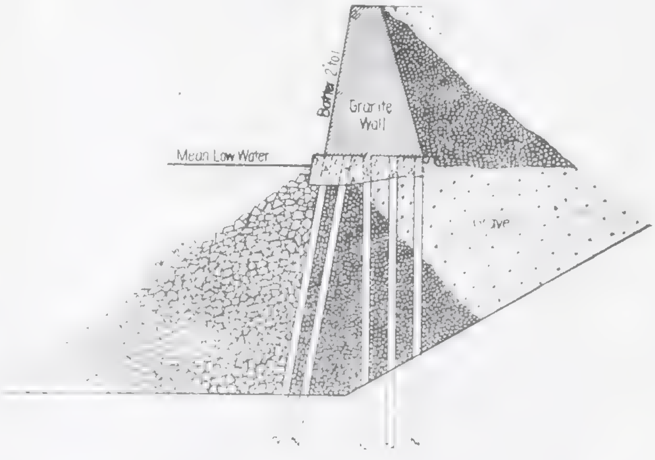


Fig. 2—Section of Granite Sea Wall on Files.

The sea-wall (Fig. 1) enclosing the pier or wharf, called the heavy sea-wall, shall be built of granite blocks resting on a bed of granite quarry chips with a ballast-backing as follows: below mean low water the backing shall consist of coarse, clean gravel or small stone, having a width of 14.5 ft. at the level of mean low water with a back slope of not less than 1 on 1½, and above mean low water it shall consist of quarry chips or broken stone of such sizes as will pack closely and prevent the filling from working out through the joints of the wall, with a back slope not less than 1 on 1¼ extending from the back top line of the cap stone. The joints between the stones on the back of the wall from the cap stone down to the level of mean high water shall be pointed with Portland cement mortar of the same proportion as is to be used in laying the cap stones.

The light sea-wall (Fig. 2) along the northeasterly side of Northern Ave. shall be built of granite quarry stone on a foundation of spruce piles cut off 1 ft. above mean low water.

The trench for the heavy sea-wall shall be excavated to a depth of about 28 ft. below mean low water; the excavation shall be 36 ft. wide on the bottom with such side slopes as may be necessary to maintain the bottom width until the foundation of the wall is in place. The excavation for the light sea-wall shall be to a depth of not less than 23 ft. below mean low water and shall extend from a vertical line through the top front line of the wall to a line 35 ft. in front of the same, with such side slopes as may be necessary to maintain the bottom width until the foundation of the wall is in place.

The foundation for the heavy sea-wall shall be constructed in the trench excavated therefor and shall consist of granite quarry chips of such assorted sizes as will pack together and make a solid foundation under the wall. The chips shall be compacted by divers using steel crowbars and the top surface shall be carefully trimmed to line and grade. They shall extend at least 5 ft. in front of the front foundation stones of the wall and at least 4 ft. back of the rear foundation stones.

Soon after the foundation course of the wall has been laid, any space in the trench below a depth of 23 ft. below mean low water and in front of the foundation course shall be filled solid with granite chips compacted in the same manner as the chips under the wall.

The portion of the heavy sea-wall below the level of mean low water shall be built of good quality granite quarry stone, sound and split straight, the stones in the face of the wall and those forming the main ties across and along the wall, back of the face, to be in large blocks weighing not less than 5 tons each and of the following dimensions: height 2 to 3 ft., length not less than 6 ft. and generally not over 12 ft., and width at least 1¼ times the thickness; the beds and builds to be parallel and out of wind and the sides and ends substantially at right angles to the beds. The spaces between the above-described stones shall be filled with similar stones the full height of the course and of as large a size as the spaces will permit. The stones shall be laid compactly with good bond and full to line and grade; the bond in the face and at rear end of face headers to be not less than 15 ins. All the front face stones in the two off-set courses at the bottom of the wall shall be headers; above this at least one-fifth the area of the face of the wall shall be headers uniformly distributed and all headers in the face of the wall shall be at least 9 ft. long. The work shall be done by divers skilled in this class of work, who have had experience and given satisfaction in similar work. Each stone shall be laid on the bed which will make the most compact work and must have direct bearing on each and every stone directly under it; such bearing to be sufficient to prevent its being broken by the weight of the stones which are to be placed above it. Extra care must be taken with the stones at the face of the wall where each stone must have a full bearing on the stones on which it rests. The space in the vertical joints between the stones shall average not more than 4 ins. in width and each stone when set shall be laid with its sides in close contact with the adjacent stones previously laid. No spalls or pinners shall be used in laying the stone below low water

The stones shall be laid in courses with their beds at right angles to the face of the wall; so far as is practicable the thickness of each course shall be the same throughout the length of the wall but no change shall be made in the thickness of any course within 100 ft. of a similar change in the same course and no vertical joint shall be continuous across more than one course except where a change in thickness of course is made and then said joint shall not be continuous across more than two courses. If laid during spring tides and when the water surface is below mean low water, the upper course of the masonry below low water may be laid by the masons who are to do the work on the upper portion of the wall. At the two outer corners of the pier the outer corners of the corner stones shall be broken back about 1 ft. before the stones are laid.

The portion of the heavy sea-wall above mean low water, to the under side of the cap stone, shall be of the same general character as the wall below low water except that the stones may be smaller in proportion as the width of the wall decreases and the portion back of the face stones need not be built in courses. The wall shall be laid by skilled masons and not by divers, and all spaces between the large stones shall be filled with spalls or chips and the wall made as compact as possible.

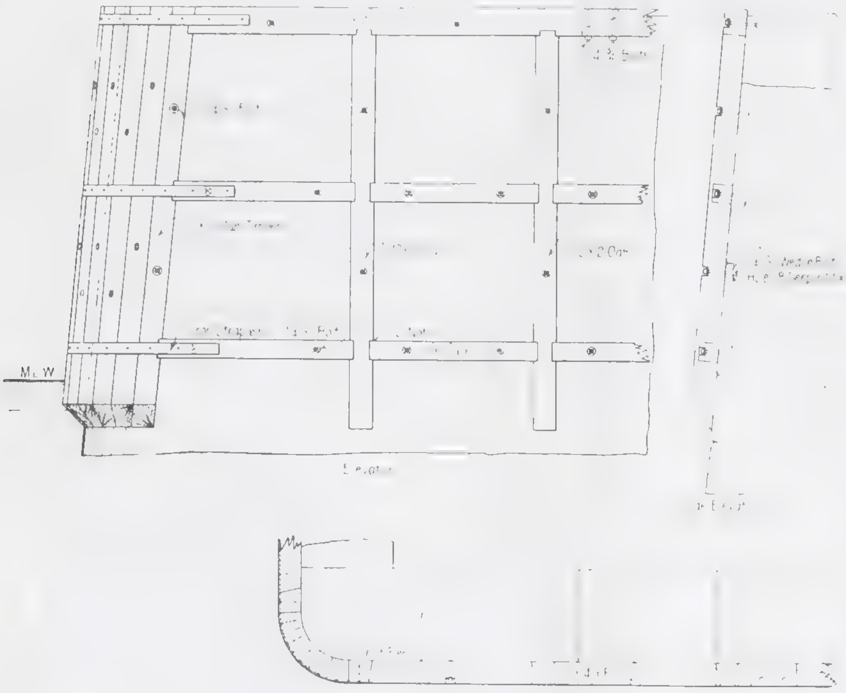


Fig. 3—Wooden Fenders for Granite Sea Walls.

At the two outer corners of the pier the outer corners of the corner stones from the top of the cap stones to 2 ft. below mean low water shall be rounded to a curve having a radius of 2 ft. and shall be pointed smooth.

The cap stones for both the heavy and light sea-walls shall be selected stone having sufficient height, not less than 3 ft., to bring the top of the walls to the required grades, the width to be the full thickness of the wall and each stone to be not less than 4 ft. in length. Joints between coping stones shall not exceed ½ in. The cap stones shall be laid in Portland cement mortar mixed in the proportion of 1 part of cement to 3 parts of sand and all joints shall be thoroughly filled. The joints on the face and top shall be raked out and pointed full and flat. Either before or after the cap stones are laid they shall be dressed on top with 6-cut work, the front and back lines of the top cut straight and the front and back faces pointed smooth, the front 12 ins. and the back 6 ins. down from the top. The arrisses shall be well defined.

New, sound and straight spruce piles, not less than 10 ins. in diameter at the butt when cut off and not less than 6 ins. in diameter at the point, shall be furnished and driven for the foundation of the light sea-wall. The piles shall be spaced as shown on the plans, shall penetrate not less than 15 ft. into the hard clay bottom, and be driven so that the piles shall be in straight rows when cut off. The two front rows of piles shall be driven at an inclination of 1 horizontal to 6 vertical. All piles shall be cut off level at a grade 1 ft. above mean low water.

After the foundation piles have been driven, pulled into place where necessary, secured and cut off, the space between the piles and in front and rear of the same to the lines shown on the plans shall be filled with broken stone riprap and gravel up to the under side of the concrete cap.

The stone and gravel filling shall be deposited carefully, so as not to displace any of the foundation piles. The upper surface under the concrete cap shall be carefully levelled, trimmed and compacted with bars or otherwise to the grade shown, with small stone and gravel, to form a bed for receiving the concrete cap. The riprap shall consist of sound and clean broken quarry stone. The stones in front of the piles shall weigh 50 to 300 lbs., and shall have the interstices between them filled with smaller stones. The riprap between the piles shall be smaller stones, of such a size as will pack together closely in the spaces between the piles. The gravel in the rear shall be clean and coarse, from 10 to 20 per cent of the bulk to consist of stones at least 2 ins. in diameter.

After placing the riprap and gravel filling in the foundation, curbing or forms shall be built and securely braced in place along the front and rear of the foundation where shown on the plans, with such cross curbs as in the opinion of the Engineer may be required in order to properly place the concrete. The curbs shall be built of plank not less than 2 ins. thick and shall be removed as the work proceeds, but no curb or form shall be disturbed or removed until in the opinion of the Engineer the concrete against it will not be endangered by such action.

The space around the piles enclosed by the curbs or forms shall be filled with Portland cement concrete, to the grade of the top of the piles; dumping of concrete so that it will fall through the water will not be allowed.

No concrete shall be laid during freezing or inclement weather. The concrete shall consist of 1 part of Portland cement, 2 parts of sand and 4 parts of broken stone or pebbles; measurement to be by volume. If required by the Engineer, the surface of the concrete shall be protected from the wash of the waves while it is being placed and until it has set by such barriers or coverings as he may deem necessary.

The wall above the concrete pile cap shall be built of good quality granite quarry stone, laid without mortar, in the location and of the dimensions shown on the plans; the stones shall be of large size, from 1 to 3 ft. thick, laid compactly with good bond and full to line and grade; any interstices between the stones shall be filled solid with pinners; all the work shall be done in the best manner by skilled workmen.

The stones in the face of the wall shall be laid so as to have sufficient bearing on the stones below within 3 ins. of the face of the wall, to make good work without the use of pinners. The width of horizontal joints, within 6 ins. of the face of the wall, shall not exceed 2 ins. at any point, and no pinners will be allowed in the face of the wall.

In the front portion of the wall, stretchers shall be not less than 18 ins. in width, and the height shall not exceed the width. Below the top course under the cap, headers shall form not less than one-fifth the area of the face of the wall, they shall be long enough to make good bond with the stones in the rear portion of the wall, and shall be uniformly distributed so as to make good bond and strong work. The top course under the cap stone shall consist entirely of headers.

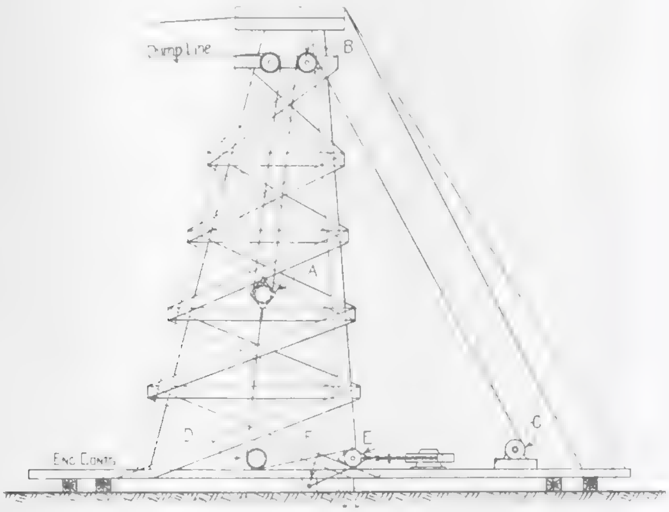
After the back-ballast of the walls is in place, the filling next to the ballast below sub-grade shall be placed carefully and in such a manner as will exert the least pressure against the wall and for this reason it shall be placed generally in layers, allowing as much time as is practicable for each layer to settle before placing the next layer. The filling must be so placed that if it has any tendency to flow, the direction of flow shall be away from the wall, and at no time shall any filling be placed within 50 ft. of any wall at a higher elevation than 2 ft. above the elevation of the top of the coping of said wall.

In placing the dredged material upon the area enclosed by the walls, any method which requires that it be mixed with a large volume of water, as is done by the so-called hydraulic or suction dredges, must not be used.

Timber fenders (Fig. 3) shall be built on the face of the heavy sea-wall, consisting of vertical oak timbers 12x12 ins., extending from the top of the wall to about 2 ft. below mean low water and spaced 8 ft. on centers except at the two outer corners where they shall be fitted close together as shown on the plans. The heads of the vertical sticks shall be capped by hard pine caps, 12x14 ins., on edge, extending the whole length of each side and across the end of the pier. The caps shall be notched down on the verticals as shown on the plans. Between the vertical sticks two horizontal rows of chocks, of 10x10-in. hard pine, shall be placed and fitted; the lower row to be 1 ft. above mean low water and the other midway between the lower row and the cap. All the timbers, both vertical and horizontal, shall be secured to the wall by 1¼-in. galvanized-iron screw bolts secured to the wall in holes at least 8 ins. deep in which the bolts shall be secured by split ends and wedges. The holes shall be filled with molten lead well calked. The washers and nuts shall be counter-sunk and the bolts shall be of such a length that the outer end shall not come within 1¼ ins. of the face of the timber. The vertical fender timbers at the outer corners of the pier shall also be fastened to the fenders on the sides and end of the pier by three wrought-iron straps, each 6 ins. wide and ½ in. thick, the straps being made fast to the fenders as shown on the plans. The butt joints of the caps shall come between the verticals and shall be ship-spliced 2 ft. long and bolted with four, ¾-in., screw bolts in each splice.

A New Skip Dumping Device for Cableways.

A new device for dumping cableway skips has been developed in connection with the Ashokan Reservoir work of the Catskill Acqueduct. As described in our issue of Oct. 12 a group of four cableways are used in constructing the Olive Bridge Dam portion of this reservoir. These cableways are of the Lidgerwood type and were equipped with Locher skip dumping mechanism. The new device is a substitution in part for the regulation Locher mechanism.



Sketch Showing Skip Dumping Device for Cableways.

As shown by the accompanying drawing, the dump line and the hoisting rope are wound on the same drum *C* in the cableway tower and all their motions coincide. The dump rope, at the tower, runs down through a fall block *A*, then up over the shieve *B*, and thence to the main drum *C*. By pulling down the fall block *A*, which is suspended in the loop of the dump line, this line is shortened, lifts the rear of the skip and thus dumps it It is the method of pulling down this fall block with which is novel. The old method was by a cable which wound upon a small drum. This method worked well, but was slow. The new method consists in pulling down the fall block by means of a cable which is fastened to the block and passes from there through a stationary shieve *D* directly below, thence through a shieve *E* fastened to the end of a piston rod, operated by a compressed air cylinder about 12x72 ins. in size and thence back to a stationary anchorage *F* on one of the heavy timbers of the tower. By passing the cable through the shieve *E* on the end of the piston it will be noted that the distance through which the piston acts is only one-half the distance through which the fall block is moved. The piston is operated by compressed air which is used for operating all the machines in the work.

The device described was worked out by Mr. C. H. Peters, Master Mechanic for McArthur Brothers & Winston, the general contractors for the Ashakan Reservoir.

Sloper Used on the New York State Barge Canal Work.

A special floating derrick handling a scoop bucket designed to slope the banks of canal excavated by dredge, is shown by the accompanying cuts. The machine was built specifically for work on the Champlain Canal, in New York State, the section of which had been widened and deepened by a 20-in. hydraulic dredge. The banks above the water surface are left untouched by the dredge, owing to the impossibility of operating the cutter above the water, and are quite irregular. The "sloper" was designed by Mr. George E. Field, superintendent for the contractors, the Atlantic, Gulf & Pacific Co., New York city.

As shown by the drawings the derrick is set on one of the two barges which are each 17½x75 ft. and fastened parallel to each other with a 10 ft. space between. The engine for operating the derrick and bucket is set on the second barge opposite to the location of the derrick. The derrick is equipped with Terry & Tench fittings. The dimensions are indicated on the drawing, which shows clearly the method of operating the bucket The bucket digs with an upward motion, being pulled by the line attached to the cutting end. Two lines are fastened to the rear of the bucket, one of which runs ever a sheave in the end of the boom and is used to dump the bucket,—the other runs directly from the back of the bucket through a sheave at the base of the mast and is used to haul the bucket back.

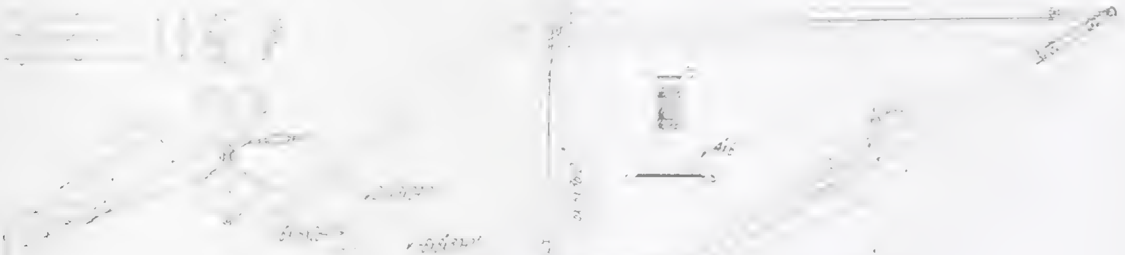


Fig. 1—Details of Bank Sloping Dredge.

The lines are operated by an 10x12-in., double drum, Lidgerwood engine. Two other engines, each 6x10 ins., located near the bow are used respectively to operate the lines connected to deadmen up and down stream, and to operate the spuds. One operator, a fireman and five men constitute the usual crew on this machine. The work done varies according to the amount of material to be trimmed off. The machine has trimmed from 50 lin. ft. of bank per day of 8 hrs. to 400 lin. ft.

Templets are set at various intervals (about 25 ft.) along the banks, indicating the correct slope and the grade to which the operator works. The slope is produced by holding the boom at a certain angle with the horizontal, which once having been found by the "cut and try" method, generally need not be changed while digging the one class of material.

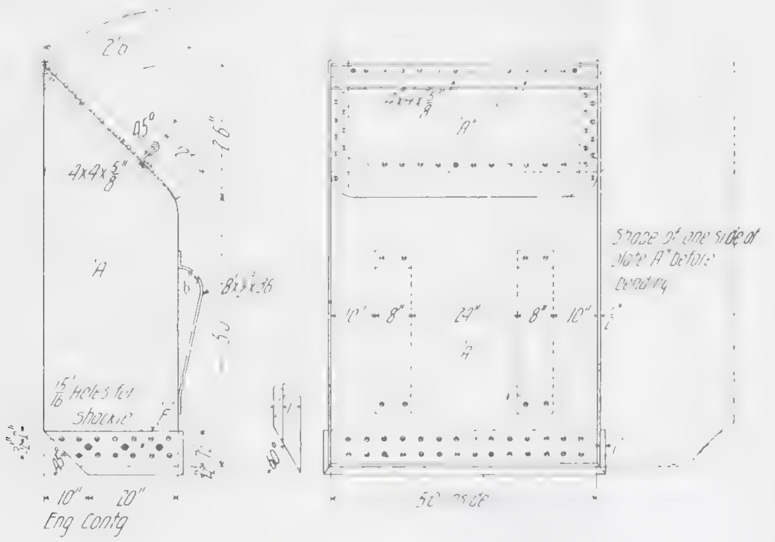


Fig. 2—Bucket for Bank Sloping Dredge.

BILL OF MATERIAL FOR CANAL BANK SLOPER.

Derrick:		For sloper.	Ft. B.M.
Boom	2	14"x14"x40'	1,306
Boom splice	2	6"x14"x20'	280
Mast	1	16"x16"x36'	768
Stiff legs	2	12"x12"x30'	720
Stiff legs	2	12"x12"x34'	816
Stiff legs	2	12"x12"x28'	672
Stiff legs fish plates	6	6"x12"x16'	576
Stiff legs braces	2	8"x 8"x28'	298
Stiff legs braces	1	8"x 8"x30'	160
Bull wheel	4	8"x 8"x12'	256
Bull wheel	2	8"x 8"x 8'	[illegible]
Bull wheel	2	6"x 6"x12'	72
Foot block	2	14"x14"x 5'	161
			6,273
Blocking under derrick—	3	12"x12"x12'	432
	4	12"x12"x17'	816
	2	4"x12"x18'	174
			1,422
Spreader between barges	4	12"x12"x16'	768
	4	6"x12"x20'	480
	4	6"x12"x10'	240
			1,488
Trusses—			
Top chord	2	8"x12"x20'	320
End posts	4	8"x12"x14'	448
Intermediate posts	4	6"x12"x12'	288
Verticals	4	6"x12"x 6'	144
Kick blocks	4	3"x12"x10'	120
Lower chord	4	4"x12"x16'	256
Lower chord	2	4"x12"x15'	120
Lower chord	6	4"x12"x[illegible]	[illegible]
Lower chord	4	4"x12"x12'	192
Lower chord splices	12	2½"x12"x 5'	180
Lower chord packers	16	2½"x 2"x 1'	[illegible]
Lower chord top blocks	4	12"x14"x[illegible]	[illegible]
Lower chord end clamps	8	6"x12"x[illegible]	[illegible]
Bracing between barges	4	6"x12"x14'	336
Bracing between barges	1	6"x12"x16'	[illegible]
			4,028
Housing			
Main boiler and engine, operating cabin, 2"x4"			[illegible]
Spud and pulling engines, 1" boards			2,000
Spud and pulling engines, 2" boards			1,000
Spuds	2	16"x16"x28'	[illegible]
Spuds frame	2	6"x12"x16'	192
Spuds frame	8	8"x10"x18'	[illegible]
			12,352
Blocking under trusses—	2	12"x12"x17'	408
	2	9"x12"x17'	306
			714
Grand total			20,277

Book Reviews.

Standard Specifications. — Structural Steel, Timber, Concrete and Reinforced Concrete. By John C. Ostrup, M. Am. Soc. C. E., Professor of Structural Engineering, Stevens Institute of Technology. McGraw-Hill Book Co., New York. Cloth, 6x9 ins.; pp. 99. $1.

In his preface the author says: "A serious attempt has been made to incorporate into one volume a set of ten specifications, which not only cover the most important materials used in construction work of any magnitude, but which are condensed so as to avoid unnecessary repetitions, are consistent throughout, and which, at the same time, conform in every essential to the latest experiments and investigations, to the best authorities, to modern practice and to the author's own considerable experience." It is safe to say that no specification or number of specifications will ever be devised which will meet all mental conditions of engineers and all constructional and manufacturing conditions of actual work, and Prof. Ostrup's specifications do not perform the impossible. Certain distinctive merits can be accorded them, however. One of these is that they are models of concise and consistent craftsmanship in specification writing. Another is that any structure built in strict accordance with them will be a creditable one in workmanship and economy. These two qualifications alone commend the book to general practitioners and particularly to students in our engineering schools who have their habits and methods in specification writing to develop. Of the several specifications given those for reinforced concrete are the most completely original and the most worthy of study.

Practical Shaft Sinking.—By Francis Donaldson, Chief Engineer, Dravo Contracting Co. McGraw-Hill Book Co., New York. Cloth, 6x9 ins.; pp. 143; illustrated. $2.

As chief engineer of a firm of contractors who have become known as experts in shaft sinking, the author of this little volume speaks from practical knowledge of his subject. There are ten chapters or sections to his book and of these eight are thoroughly practical and generally useful. The two chapters excepted describe certain boring methods used in Europe, chiefly in mining work, and describe them in too general a way to convey much practical information. To the general contractor the chapters on plant and on sinking methods are of most interest. In the chapter on plant the author lists the various structures and machines required for ordinary shaft work and gives a multitude of really important practical hints as to arrangement, capacities, types, etc. An itemized cost estimate of plant for a 500-ft. shaft closes the chapter. Following the chapter on plant are two chapters on soft ground shaft sinking. These chapters are chiefly descriptive, but they contain some fairly good costs and some useful hints on sealing shaft lining when passing from soft ground to rock. Chapter V is devoted to sinking in rock. This, like the chapter on plant, is thoroughly useful, containing records of progress, efficiency and costs which are directly usable. The final chapters on pumping and shaft lining are likewise based on first hand knowledge and experience. Altogether the book is good; if the author by eliminating general descriptive matter had made it half as big it would have been twice as good.

Power Gas and the Gas Producer.—By J. C. Miller. Popular Mechanics Co., Chicago. Cloth, 5x8 ins.; pp. 184; illustrated.

This is a book written for the novice or nontechnical reader, and it has all the limitations of such writings. In a word, the engineer will not find the book much to his purpose. As a book for the general power user, it will serve a good purpose in making him generally familiar with gas producer construction, operation and use and in giving him the arguments which producer gas power presents for consideration in comparison with other forms of power.

Applied Thermodynamics.—By H. W. Spangler. John Jos. McVey, Philadelphia, Pa. Cloth, 6x9 ins.; pp. 160; illustrated. $2.50.

This book is a reprint of the series of lectures given to the students of mechanical, electrical and chemical engineering at the University of Pennsylvania, on the applications of thermodynamics to engineering problems. Its contents comprise: Flow of gases and vapors; flow of steam; efficiency; air engines; steam engines; steam engine tests; refrigeration, air machines; refrigeration, volatile liquids; absorption machines; internal combustion engines; evaporators.

General Specifications for Structural Work for Buildings.—By C. C. Schneider, M. Am. Soc. C. E. Engineering News Publishing Co., New York. Paper, 6x9 ins.; pp. 68; illustrated. 75 cents.

This pamphlet contains two specifications, one for steel construction and one for reinforced concrete construction, and an appendix of such data as weights of building materials and merchandise, permissible stresses in iron, steel and wood, extracts from building laws and standard framing details. The specifications are very complete.

Factory Organization and Administration.—By Hugo Driner. McGraw-Hill Book Co., New York. Cloth, 6x9 ins.; pp. 317; illustrated. $3.

This book is worth reading by contractors for the information it contains on management of labor and on wage systems. The author writes specifically for the manufacturer or works manager, but the arguments and examples which he presents on organization, cost keeping, and wage systems are of general application. The following are the chapter headings: I. Industrial Engineering. II. The Economic Theory of Factory Location. III. The Planning of Factory Buildings and the Influence of Design on Their Productive Capacity. IV. Staff and Departmental Organization. V. Executive Control in the Factory. VI. Departmental Reports. VII. The General Office. VIII. The Order Department. IX. Bills of Material. X. The Drafting Department. XI. The Pattern Department. XII. The Purchasing Department. XIII. Stores and Stock Departments. XIV. The Production Department. XV. Foundry Systems. XVI. The Machine Shop and Tool Department. XVII. Shipping and Receiving Departments. XVIII. Time Taking. XIX. Cost Department. XX. Aids in Taking Inventory. XXI. Inspection Methods in Modern Machine Shops. XXII. Employment of Labor and Labor Problems. XXIII. Wage Systems. XXIV. The Fixing of Piecework Rates. XXV. Principles Underlying Good Management. XXVI. A Bibliography of Works Management.

The American Ditcher.—6½x9½; 24 pp. American Ditching Machine Co., West Minneapolis, Minn.

A catalog which gives a good description of a ditching machinery with illustrations of work showing its adaptabilities and tables showing the daily cost of operation and the rates at which various sized ditches have been exca-

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

Very little appears to have been doing during the past week in the way of awarding new railroad construction contracts. Several fair sized contracts, however, have been let and among these may be noted the following: Bunn & Co., Big Stone Gap, Va., for the construction of a 5-mile extension of the Roaring Fork R. R. in Wise County, Va.; Williams-McQuary Contracting Co., Fort Smith, Ark., for a considerable amount of concrete work for the St. Louis & San Francisco R. R.; J. N. Gillis & Son, Brewton, Ala., for grading and laying track on 10 miles of the Florida & Alabama R. R. from its present terminus to Natural Bridge, Fla.; C. F. Betz, Sioux City, Ia., for filling in a large trestle on the narrow gage railroad running into Washington Mills, Ia.; Peppard & Co., for the construction of a 3,000-ft. side track extension near the Crystal Falls, Minn., depot for the Chicago & Northwestern Ry.—The various railroads seem to be somewhat slow in placing their orders for rails for 1911 delivery. Several good orders, however, are in sight. Principal among the near probabilities are 33,000 tons for the Erie, which is looked to to develop into a contract at almost any moment. Another good sized tonnage near being closed is for the Norfolk & Western, involving some 30,000 tons, and the Pennsylvania may close up on 100,000 tons for 1911 almost any day. New York Central's requirements are under consideration and something also is looked for soon in this direction.—Callahan Bros., Omaha, Neb., have been awarded the large contract for flood protection work for the Kaw Valley Drainage Board of Kansas City, Kan. The contract calls for the construction of solid dikes along both banks of the Kaw River, from Turner, the west end of the district to the mouth of the river and the removal of the solid obstructions in the river. The drainage board recently disposed of a $1,225,000 bond issue for drainage work.—Bids were opened on Oct. 27 for a large dredging contract in Oakland Harbor, the San Francisco Bridge Co., San Francisco, being the lowest bidder at 11.4 cts. per cu. yd. The contract involves the dredging of 1,289,200 cu. yds. of material.—The U. S. Reclamation Service has been authorized to proceed with the construction of the Elephant Butte Dam in New Mexico by force account, and orders have been issued for the commencement of work on living quarters and on the installation of a power plant. About $750,000 is available for preliminary work. The total cost of the project will be about $7,000,000.—Prospects seem good for the letting of contracts by the Illinois Central R. R. for continuing its line on the Alabama Division from Haleyville to Birmingham, Ala., a distance of about 80 miles. This work will probably be a heavy steam shovel proposition with about 200,000 cu. yds. of team work near the Birmingham end. In all the yardage to be moved will be nearly 3,000,000 cu. yds.—Several new railroads are planning to let construction contracts for portions of their lines this month. Among these are the Gulf & Magnolia Northern R. R., which projects a 200-mile line from Monroe, La., to Horatio in Servier County, Ark., and the Fairview & Intermountain Ry. Co., which projects a 25-mile line from Delta, Colo. The contract of the latter road, of which Chas. G. Mantz, 1154 Clarkson St., Denver, Colo., is Secretary, will be for track laying.—The Nueces River Valley R. R., a new Texas proposition of which W. A. Frisby, Beeville, Tex., is President, is reported to have placed contracts for the first 60 miles of its road, with the intention of having work started at Beeville on Dec. 1.—The Memphis Union Depot Co., of Memphis, Tenn., has asked bids on a considerable amount of concrete work in connection with the new depot at Memphis. The contract will amount to about 60,000 cu. yds. of concrete.

The Official Life of the City Engineer.

In glancing through the able address of Mr. A. Ernest Prescott upon his assuming the presidency of the Institution of Municipal Engineers of Great Britain at its recent annual meeting we find a passage which will attract the attention of American city engineers. Referring to the tenure of office of municipal engineers, Mr. Prescott remarks:

> I need only refer to the recent case of a municipal engineer who, after 14 years of public service, was called upon to resign his office. On the merits of the case it is not my business to discuss, but it undoubtedly provides us with an object-lesson and makes us realize more fully than before that Government protection is absolutely necessary for the municipal engineer if he would discharge his duties conscientiously and honorably and without fear or favour.

In this country the City Engineer who has held his office continuously for 14 years is the rare exception. Two of these exceptions occur to mind as we write this. One is the late Thomas Murray, who served continuously for 42 years as City Engineer of Davenport, Ia., and the other is Mr. David A. Hartwell, who has just resigned as City Engineer of Fitchburg, Mass., after 20 years' service, to accept the position of Chief Engineer for the Sewage Disposal Commission of that city. These are notable exceptions for in many cities each change of municipal administration means a new city engineer. Just why an engineer, who has performed his duties ably and conscientiously, should be removed from office simply because he is of a different political faith from the administration, is a question which only a politician can answer. Too often, we fear, the politician's answer will be, "To the victors belong the spoils."

Michael J. Heney.

Michael J. Heney, who died last month, ranked among the foremost railroad contractors of this country. As a builder of railroads under difficult conditions many consider him to have been without an equal. He built the White Pass & Yukon R. R., and at the time of his death was engaged on the construction of the Copper River & Northwestern R. R., in Alaska. When this latter work was let to Heney in December, 1907, it was said to be the biggest contract ever made in connection with the development of Alaska. The greater part of this railroad is now in operation and had Mr. Heney lived a few months longer he would have seen its entire completion. In Alaska Heney was considered to have done more for the actual developmen of that country than any other one man. In Cordova, on the day of his funeral all business was suspended and memorial services were held in all the churches; and on the Copper River & Northwestern R. R. all trains were at a standstill for ten minutes on the day of his burial. Heney was a poor boy, and all that he became was due to his own efforts. He was successful in his work and his pecuniary rewards were large.

The New York Subway Work.

The recent opening of bids for work on the Triborough subway in New York City showed quite clearly the great increase in number in the past few years of contractors willing to bid on large pieces of work. A few years ago you could have counted on your fingers the number of contractors who would have bid on a $2,000,000 public works contract; on the New York work last month 23 contractors or contracting firms submitted bids. The total cost of this work, based on the aggregate of the totals of the lowest bids will be $80,836,014. The smallest single contract on the work amounts to $2,323,542; while the largest contract amounts to $9,164,999. Of the 23 bidders but one submitted bids on all of the 21 contracts into which the work was divided. This contractor, it may be noted in passing, was the lowest bidder on 10 of the contracts. Of the other bidders one submitted bids on 11 contracts, one bid on 7 contracts, three bid on 4 contracts, one bid on 3 contracts, six bid on two contracts and ten bid on one contract. Of the latter three were the lowest bidders on their respective contracts. Another contractor who submitted bids on only two contracts was the lowest bidder on both of them, the total amount of his bids being $7,020,771. If the work is awarded to the lowest bidders it will be divided up among ten contractors. With the exception of two contractors from Boston, Mass., one from Philadelphia and two or three from other places, all of the bidders have their headquarters in New York City.

Sanitary Note.

Citizens of some of the new Western cities sometimes adopt rather crude methods for settling sanitary questions. Quite recently some of the residents of one of the smaller cities in Oklahoma became dissatisfied with the septic tank used in connection with the city sewer system. They claimed that the tank was worthless and a menace to the public health, and they expressed their dissapproval in an emphatic manner by means of a charge of dynamite. The tank was completely destroyed and the sewer system, which cost some $40,000, was also put out of commission. It seems to an outsider that a safer, although perhaps not sanitary, way of showing disapproval of the septic tank, would have been to refuse to use the sewer system for a period of say three days.

Good progress is being made by C. J. Erickson, Seattle, Wash., on his contract for constructing the $2,000,000 dry dock at the Puget Sound Navy yard. The force is at present engaged in laying the concrete foundation for the granite bottom of the dock. The degree of completion of the entire contract is estimated at 32 per cent and the concrete work is about 18 per cent completed. A total of 103,000 cu. yds. of concrete will be used in the work. The work of putting in the granite bottom and sides of the structure will begin early next year. The dock is to be completed in about two years.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

It is rumored that the Illinois Central R. R. is preparing to continue its line on the Alabama Division from Haleyville to Birmingham, a distance of about 80 miles. The work will be for the most part, according to the report, a heavy steam shovel proposition with about 200,000 cu. yds. of team work near the Birmingham end. In all the yardage to be moved will approximate nearly 3,000,000 cu. yds. There is now about 50 miles of steel rail near Haleyville, which our informant advises is to be used in construction of the new line, surveys for which have been completed for two years. At present the Illinois Central enters Birmingham over the lines of the Frisco R. R. Two tunnels, it is said, are going to be built between Haleyville and Birmingham. A. S. Baldwin, Chicago, is engineer in charge of construction.

The County Board of Revenue at Birmingham has extended the franchise of the Tidewater Railroad Co. for rights through Jefferson county for one year from Nov. 1, 1910. This action was taken at the request of the promoters of the line, which is to extend from Gadsden through Birmingham to a point in Tuskaloosa county, from which the transportation arrangement will be continued by barge to the gulf. It will be recalled that J. M. Dewberry, Birmingham, Ala., recently purchased Dauphin island for $76,000, and announced the expenditure of $3,000,000 in constructing terminals for the Tidewater railway. He is acting for Eastern capitalists, and it is believed in Birmingham that he has about perfected arrangements and that the work will begin in a short time.

Arkansas.

The Gulf & Magnolia Northern R. R. is planning to let construction contracts this month for a portion of its proposed line. The company projects a 200 mile line from Monroe, La., to Horatio, Servier county, Ark., via Waldo, Hope, Mineral Springs, and Lockesburg. Surveys have been made and arrangements are now under way for financing the project. Henry Nunan, Hope, Ark., is chief engineer, and S. Q. Servier, Hope, Ark., is president.

Williams-McQuary Contracting Co., Fort Smith, Ark., has been awarded a contract for a considerable amount of concrete work for the Frisco.

The Business Men's League and other commercial organizations of Helena, Ark., are making an effort to have the St. Louis, Iron Mountain & Southern Ry. Co. erect a logging incline at some favorable point near the river front for the purpose of transporting logs brought there by barges to the bank.

The St. Louis & San Francisco R. R. is planning considerable track work on its central division during the next three months. About 10 miles of heavy steel is to be laid south from Winslow. H. H. Brown, Fort Smith, Ark., is superintendent.

Contracts for grading for the Hot Springs-Glenwood R. R. are said to have been let. When completed this road will reach a point within five miles of Hot Springs.

The Citizens Light & Transit Co., W. Y. Ellis, chief engineer, Pine Bluff, Ark., is to extend and improve its street railway service at Pine Bluff. It is said that the company will raise $300,000 for the work.

Citizens of Columbus, Ark., have raised a large bonus for the purpose of securing the construction of the Magnolia & Northern Ry. through that place. The line will open up one of the richest blackland sections in Hempstead County, Ark., which at present has no railroad connections.

George D. Locke, General Manager of the Arkansas, Oklahoma & Western R. R., who has been arranging the financing of the railroad, has stated that the line from Rogers to Huntsville would soon be completed and that the line would be then extended toward Little Rock, Ark., in order to obtain an eastern outlet.

California.

As previously noted in these columns, the city and county of San Francisco are preparing to begin work on the reconstruction of the Geary St. electric railway. Bids are now being asked until Nov. 16 for furnishing and delivering the steel rails. On Oct. 22 the status of the plans for other supplies for this work were as follows: Contract No. 2, for furnishing and delivering joints, plates and rail fastenings. Plans and specifications prepared. Contract No. 3, for furnishing and delivering rail bonds. Plans and specifications 98 per cent completed. Contract No. 4, for furnishing trolley and feed wires. Plans and specifications 60 per cent completed. Contract No. 5, for furnishing and delivering special track work. Plans and specifications 70 per cent completed. Marsden Manson is city engineer of San Francisco.

The Northern Electric Co., Chico, has applied to the city trustees of Sacramento for a franchise to permit it to lay tracks on I St. from 2d to 7th, on 2d from I to M, and on M St. to the alley between 2d and Front.

The Salt Lake Ry. Co. is reported to have determined to abandon Ocean Ave., at Long Beach as a right of way and will, it is said, build a shorter line to the city by way of the Bixby ranch and Cerritos slough. The railway holds a franchise for a right of way along the ocean front, but so much complaint has been made of noise and danger that the company has chosen a more convenient route into Long Beach.

Good progress is being made with the grading work for the San Diego, El Cajon & Escondido Ry. All the gangs are now working eastward toward La Mesa. The franchise provides that the road be completed to El Cajon by June 17 next. G. W. Pursell, San Diego, Cal., is Engineer and promoter of the road.

A plan is under consideration for the building of a steam railroad from San Bernardino to San Diego by way of Escondido. Seth Hartley, formerly owner of the electric light and gas plant as Escondido, is interested.

Automatic signals will be installed by the Santa Fe system between Barstow, Cal., and Cottonwood, Cal., at an estimated cost of $31,000 and also between Barstow and Daggett, Cal., at an estimated cost of $27,000.

The Santa Fe system will install a mechanical interlocking plant at Cottonwood, Cal., at an estimated cost of $6,700.

The Santa Fe system has appropriated $6,695 to cover the cost of drilling wells and lowering pumps at Bakersfield, Cal.

Plans have been drawn up for a concrete storm ditch to be constructed by the Santa Fe system at East Highlands, Cal. The work is estimated to cost $27,000.

The Santa Fe system has arranged to construct a mechanical interlocking plant at Dennison, Ariz., at a cost of $6,000.

The Santa Fe system will construct a wooden dam at Lyle Creek, Wash., near San Bernardino, Cal., at an estimated cost of $3,900.

The Los Angeles Ry. Co., Los Angeles, has begun construction work on the extension of its suburban system from Hollywood, through Cahuenga Pass to Lankershim, and through the Van Nuys ranch. The work will cost about $500,000.

The Stockton Terminal & Eastern Ry. Co., now in operation between Stockton and a point about three miles the other side of Linden, is to carry on through the winter the building of its road to Jenny Lind. M. J. Gardner is President.

It is believed in Porterville, Cal., that the officials of the Western Pacific Ry. Co. are contemplating the construction of a branch line into the citrus district of the valley.

Colorado.

The Fairview & Intermountain Ry. Co. projects a 25-mile line from Delta to Fairview coal mines and to Cedar Ridge. Surveys for 18 miles of line have been made, but not all of the capital for construction purposes has been secured. Construction contracts will be let in the near future for the track laying. The road is being constructed by the owners of the Fairview coal mines. W. Ziegler, Fort Collins, Colo., is president and Chas. G. Mantz, 1154 Clarkson St., Denver, Colo., is secretary.

Both the Chicago, Burlington & Quincy Ry. and the Union Pacific Ry. have completed surveys for branch lines through the Box Elder in the Denver-Greeley valley irrigation district.

The last piece of land for the right of way for the Hudson-Greeley Link by the Chicago, Burlington & Quincy R. R., has been purchased, and it is believed that construction work will be started in the early spring.

The Santa Fe System will construct a new water tank and steel crane at Granada, Colo., at an estimated cost of $4,500.

A new 100-ton track scale will be installed by the Santa Fe System at Colorado Springs, Colo., at an estimated cost of $3,400.

It is now reported that the Southern Pacific is not to build its proposed extension from Farmington north through Durango this winter or next spring. Durango subscribed $100,000 for this extension, the final surveys having been completed many months ago. It is stated that the project has not been definitely abandoned. But nevertheless it is rumored that the Rock Island has made a deal with the Southern Pacific for the right to build into this territory, and this may be the reason the latter company has decided not to proceed with its extension.

Bonds have been floated, it is said, by J. J. Yeckel, promoter of the proposed railroad through Plateau Canon into the Plateau Valley and construction work will be resumed. Grading will be commenced this Fall and roadbed completed as far as Atwell bridge, near Mesa, Colo., this Fall and Winter.

P. J. Cain, Chief Contractor for the grading of the Walden extension of the Laramie, Hahns Peak & Pacific Ry., has moved his camp from Fox park, the present terminus of the line, to a point near Walden, and has greatly enlarged his working force. The line has been located to Walden and Hebron, Colo., and is being surveyed to Steamboat Springs, Colo.

Florida.

The Stearns & Culver Lumber Co. of Bagdad, Fla., has awarded to J. N. Gillis & Son of Brewton, Ala., the contract for grading and laying track on 10 miles of the Florida & Alabama R. R. from its present terminus to Natural Bridge, Fla. The grading is fine station work.

The following statement of the damage done by the recent gulf hurricane on the Florida East Coast Ry. extension was given out by W. J. Krome, chief constructing engineer: The extension work north of Knights Key was not severely damaged and the equipment was practically uninjured. Several of the temporary trestles were partly destroyed by floating debris and the repairs to these prevented the operation of regular trains for about a week. At Marathon the warehouses, offices and shops were unhurt. At Boot Key harbor the floating equipment was somewhat damaged, but there was no very serious loss. The force at Pigeon Key weathered the storm in the cement warehouse and came through safely. The concrete and bridge plant was sunk, before the storm, in the hurricane harbor which had been prepared for it by dredging a canal in Molasses Key bank, and nearly all of it came through, although it required considerable work to float it and get it into shape to resume work. The concrete and steel bridges were entirely intact. The camps on Bahia

Honda Key and at Pine Channel were not seriously damaged. At Boca Chica the mixers, dredges and other floating property were scuttled and came through in remarkably good condition. Nearly all of it can be raised and repaired. One pump barge was destroyed and the steamer Virginia drifted into the bridge and was a total wreck. The concrete arch work suffered no damage whatever. From Key West to Boca Chica the loss was very heavy. The extreme height of the water and the fact that the wind came from what was considered the least exposed side of the road bed caused the washing out of a long section of track and embankment. The opposite side of the fill had been to a great extent protected, but this work had not advanced sufficiently to be of any benefit to the south slopes of the embankments. The loss at the Key West end of the line was much heavier than in 1909 and was the greatest damage that has been incurred. With full protection such as would have seen completed within a few months it is probable that trains could have been operated from the terminal to Trumbo Island without delay. No lives were lost at any point along the extension work and for this and the opportunity which was afforded for saving plant a great deal of credit is due the local weather bureau at Jacksonville, who kept the office at Marathon fully advised of the progress of the storm until the wire went down.

The Charlotte Harbor & Northern Ry. is said to be considering extending its line through Mulberry to Lakeland. G. S. Bruce, Arcadia, Fla., is Chief Engineer.

Georgia.

The Carnesville Ry. Co. is projecting a 20-mile line from Toccoa, Ga., via Red Hill and Mize to Carnesville, Ga. Surveys have been made but the capital for construction has not been secured as yet. A. W. Wilson, Cornelia, Ga., is Chief Engineer.

Surveys are being made by Chief Engineer Cothan of Atlanta, Ga., for the proposed route of the Atlanta & Northeastern R. R., from Atlanta to Cumming in Forsyth County. The line will be about 40 miles long and will probably be operated by electric power. According to the survey the road will leave Atlanta in a northwesterly direction, crossing the Chattahoochee river at Bolton, then follow the river up to Roswell and from here to Cumming via Alpharetta, in Milton County. It is said that construction work will be started as soon as the surveys are completed.

The Waycross & Southern R. R. has commenced regular train service between Waycross, Ga., and Fredel, 10 miles southwest of the former place. An extension south from Waycross may be built. J. M. Hopkins, Waycross, Ga., is General Superintendent.

Idaho.

Work is progressing on the Montpelier-Paris R. R., two miles of the grading being completed. The people of the valley are slow to respond to the call for men and teams, and the Utah Construction Co. has been under the necessity of shipping in teams from the outside. Fifteen teams arrived from Shoshone. There are more teams on the way from Twin Falls and Idaho Falls. Twelve teams are at work at Montpelier, 12 at Ovid and 11 at Paris. Chief Engineer Cumberland and A. C. Bybee, representing the Utah Construction Co., Ogden, state that the work on the road will be completed by Jan. 1. The railroad company intends to build and equip this branch just the same as the main line.

The Milner & Northside R. R. Co., D. C MacWalters, General Manager, Milner, Idaho now operating 21 miles of line, has increased its capital stock from $250,000 to $500,000.

A contract is reported to have been let by the Gilmore & Pittsburg R. R. Co., for the delivery of 1,000,000 ties along the line of the proposed extension from Salmon City to Challis before the end of this year.

Advices from Boise, Idaho, state that two railroads are already headed for Long Valley. The Pacific & Idaho Northern, now being extended to Meadows, is having surveys made for the further construction of the line to Payette Lakes and on to Roseberry. The Idaho Northern (Dewey Road) is expected to be extended from Emmett to Horseshoe Bend and on to Long Valley.

Illinois.

The directors of the Peoria & Pekin Union Ry., W. E. Emery, chief engineer, Peoria, Ill., have voted to expend $300,000 for betterments. This road connects the cities of Pekin and Peoria and handles the bulk of the freight and passenger traffic into Peoria from the east. The yards at East Peoria will be increased in size so as to hold 3,000 additional cars.

The Chicago Southern R. R., a coal road belonging to a company headed by John R. Walsh, former banker, has been sold, in compliance with a decree entered by Judge Kohlsaat in the United States Circuit Court at Chicago. The purchasers were Raymond D. Martin, of New York, and W. D. Lawler, of Chicago, tenants in common. The price was $1,000,000 and only one bid was made.

The matter of constructing a street railway system for Pekin and an interurban system between that city and Springfield is under consideration. John E. Mellich, C. E., Springfield, Ill., president of the Mississippi Valley Interurban Co., is interested.

The Sterling-Moline Traction Co., which has construction work under way on its line between Moline and Sterling, has started surveys from the latter place to Princeton. The Sterling-Moline section will run from Sterling through Prophetstown, Erie, Lyndon, Morrison, Denrock and Hillsdale and into Moline. The other end of the line will run from Princeton to Kasbeer, Ohio, Walnut, Van Petten and into Sterling. This makes Princeton and Moline the terminals of the road. W. U. Tuller, Sterling, Ill., is president and A. G. Van Petten, Sterling, is general manager.

The Indiana Harbor Belt R. R. Co., R. B. Seymour, chief engineer, Gibson, Ind., has purchased several acres of land in the township of Thornton for yardage purposes, it is thought.

The Phee Construction & Engineering Co. of Chicago, Ill., has been incorporated with capital stock of $10,000 and will engage in a general contracting business. The incorporators are Thomas Phee, George H. Boyd and F. R. Coates.

The Illinois Traction System is reported to be negotiating with the Fisher syndicate of Joliet for the purchase of franchises in the latter city, which will enable the Illinois Traction system to secure an entrance to Joliet.

The Chicago, Burlington & Quincy R. R. has formally placed in operation the double track between Galesburg and Bushnell. The work has been under construction for about five months and is said to have cost about $1,000,000.

Advices from Aurora, Ill., under date of Oct. 27, state that the stockholders of the Illinois Fox Valley R. R., mentioned in our last issue, have elected the following officers: H. H. Evans, President; John Meredith, Vice President; R. C. Putnam, Secy.; Frank M Zimmerman, Treasurer.

Indiana.

The Pennsylvania R. R. has work under way at Hartford City on improvements which involve the expenditure of about $100,000. These include a coaling station two miles east of the city. The National Concrete Co., Indianapolis, and G. B. & T. R. Fulton of Hartford City had contracts for the concrete foundation work.

Construction work has been started on the south end of the line of the Fort Wayne & Toledo Electric Ry. Co. T. Tierno and P. Volke, Philadelphia, Pa., have charge of the construction work between Harlan and Fort Wayne. The company projects a line from Fort Wayne north and east to Bryan, O. R. T. Bastress, Maysville, is president.

All of the stock of the Southern Indiana R. R. Co., organized by John R. Walsh, has been purchased at a receiver's sale by Michael B. Loeller and Raymond D. Martin, acting as trustees. The purchase price was announced as $1,263,333.33. It is stated that the election of directors of the road would take place in Chicago at an early date, and that Receiver Myron J. Carpenter, Chicago, Ill., would be made president of the new corporation, which will be known as the Chicago and Southwestern R. R. Co. The new owners will immediately set about the rehabilitation of the road, it is said.

The New York, Chicago & St. Louis R. R. is planning to eventually double track its line from Fort Wayne, Ind., to Chicago, and all of its new bridges, four of which were recently completed at Valparaiso, are being built for double track.

Iowa.

The Iowa & Omaha Short Line R. R. now under construction, has purchased land between 6th and 7th Sts. on 21st Ave. at Council Bluffs, Ia., for its terminal yards and offices in that city. It is said that work will be started this month.

Plans are under contemplation at Davenport, for river front improvements, relocating of tracks and a new union depot. The estimated cost of the improvements is $442,998, apportioned as follows: City of Davenport, $124,578; Milwaukee and "Q" roads, $273,820; I. & I Interurban, $42,800; Tri-City Railway Co., $1,800.

The route for the entrance of the proposed new branch of the Rock Island R. R. into Corydon, Ia., has been changed somewhat. The first line was surveyed to come into Corydon from the northwest and cross the Burlington tracks quite a distance west of the depot, but by the new route, which was surveyed recently, the line runs to the east from the Zimmerman farm, on Chariton creek, and comes into Corydon from the McMurry pasture and approaches our depot from the east, crossing the tracks east of the elevator and runs across the street in front of the light plant.

A contract has been awarded C. F. Betz, Railroad Contractor, Sioux City, Ia., to fill in a large trestle on the narrow gage railroad running into Washington Mills. It is rumored that the whole line will be reconstructed in the near future.

It is stated that beginning at Carlisle, Ia., on the Winterset branch of the Rock Island Ry., the company will construct a line southwest to Dallas in Marion County to the coal fields in that vicinity.

Kansas.

Final surveys have been started for the extension of the Midland Valley R. R. from its present terminus at Arkansas City, Kas., to McPherson. The route is northwest from Arkansas City to Geuda Springs, near Oxford, through Wichita, and then direct to McPherson. C. Kaighn, Muskogee, Okla., is engineer Midland Valley R. R.

The Santa Fe System will have constructed at Peterton, Kan., a spur track to serve the coal shaft of the Jackson Walker Coal & Material Co.

The Committee of Business Men's Club, Osborne, Kan., appointed recently to confer with the promoters of the Salina, Tipton & Northwestern Ry., have reached an agreement whereby the town will contribute $7,500, of which 40 per cent will be paid when the township of Penn will vote $12,500 in bonds for the purpose. The balance of the amount will be paid when the line is completed to Osborne. The new road from Osborne to Salina, Kan., will be 85 miles long and will be standard gage laid with 75-lb. steel, costing $20,000 per mile. The officers are as follows: J. A. Haseltine, Cawker City, President; James W. Higgins, Cawker City, Treasurer; D. Monte Gants, Cawker City, Secretary. Louis S. Tucker, Los Angeles, Cal., is one of the directors.

At a meeting of business men held at Salina, Kan., Oct. 27, with several representatives from Canton, Kan., it was agreed by the Salina men to subscribe $150,000 of the necessary $350,000 to begin the construction of the proposed railroad line from Newton, Kan., to Chester, Neb.

The Santa Fe System is now working two gangs of about 100 men each relaying its track with 90-lb. rails between Newton and Wellington.

Kentucky.

The Louisville & Nashville R. R. is to extend the yardage at its northern terminal by building a new yard, containing 27 new tracks, new roundhouses and other terminal buildings at DeCoursey. When these yards are completed the congestion in Covington will be relieved and many of the yards in that city may be abandoned.

Louisiana.

The Athens & Southeastern R. R. Co., capitalized at $100,000, has been organized at Athens, La., to build a short line. Harry R. Swartz of St. Louis is president, J. E. Kennedy of Athens, vice president; J. T. Fleishel of St. Louis, secretary, and Marcus L. Fleishel of Fullerton, La., treasurer. All are interested in the Chicago Lumber & Coal Co. of St. Louis. M. L. Fleishel is general manager of the Gulf Lumber Co. at Fullerton.

Massachusetts.

The Grand Trunk Ry. is reported to have tentative plans under consideration for building a branch from the Massachusetts Central in Belchertown through South Hadley Falls and into Holyoke.

Michigan.

The Grand Rapids-Northwestern R. R. Co. has applied to the State Railroad Commission, Lansing, Mich., for authority to issue $5,000,000 of bonds to construct the proposed road from Grand Rapids to Ludington, Mich.

Minnesota.

The Mesaba Electric Ry. Co., of Duluth, Minn., has filed its articles of incorporation and proposes to build electric railways in St. Louis, Itasca and adjoining counties. The capital stock is $50,000 with a limit of $2,000,000 to the indebtedness. The officers are Oscar Mitchell, president; W. D. Bailey, vice president; F. M. Emanuelson, secretary and treasurer.

Wick, O'Connell & Co., Houghton, Mich., have had work under way since August on the construction of the tunnel on the Canadian Northern Ry. line from Virginia, Minn., to Duluth, at Shortline Park, 12 miles from Duluth. The tunnel is to be about 538 ft. in length, with an 18 ft. bore. At each end there will be an open cut of about 200 ft. Work is under way at both ends of the tunnel and good progress is being made. It is expected that the tunnel will be completed about May 1.

The Duluth & Northern Minnesota Ry., John Millen, general manager, Duluth, Minn., is said to be planning to extend its line to Grand Marais, the capital of Cook county, on Lake Superior, 104 miles east of Duluth. The ultimate northerly end of the road will probably be the international boundary, for the lumber company controlling the road owns timber clear to the line.

Higgins & McDonnell have begun work on the tunnel and rock cut at Ironton on the new line of the Canadian Northern, from Virginia to Duluth.

The Dan Patch Air Line has filed an application with the City Council of Minneapolis, Minn., for permission to construct its lines into the city to some point near Lake St. and Nicollet Ave.

The Chicago & Northwestern has awarded a contract for the construction of a 3,000 ft. side track extension near the depot of Crystal Falls, Minn., to Peppard & Co

Missouri.

Grading work has been resumed on the projected electric line of the Mexico, Perry & Sante R. R. north from Mexico, Mo.

The St. Joseph Railway, Light, Heat & Power Co., I. H. Van Brunt, general manager, St. Joseph, Mo., is to apply to the city council of St. Joseph for a franchise on 3d St. from Francis to Edmond. In the meantime construction work is well along on the Savannah-St. Joseph interurban line, of which Mr. Van Brunt is the manager. Track laying on this line will be started about Nov. 15 and will take about three weeks for completion. A. Baird of Hiawatha, who has been employed on an Illinois contract of the J. L. Flick Construction Co., will have charge of the track laying.

Surveys have been made and much right of way secured for the proposed interurban line from Springfield to Nixa in Christian county. Representatives of Chicago capitalists have recently been over the route. W. H. Schreiber, Springfield, Mo., is interested.

The Charleston & Hickman R. R. Co. has been incorporated with a capital stock of $600,000 and proposes to construct a railroad from Ancil, in Scott County, to a point opposite Hickman, Ky., in Mississippi County. The proposed road will connect with the Cape Girardeau and Thebes Bridge Terminal R. R., and will run by way of Charleston. It will be approximately 40 miles in length. The incorporators are: Gibony Houck, Cape Girardeau, Mo., attorney for the Chester, Perryville & Ste. Genevieve Ry.; Charles C. Juden, Ralph Schultz, William H. Bohnsack, and Charles T. Lewis.

St. Louis Items.

BY A. B. KOENIG.

The East St. Louis City Council has served formal notice that it is ready to pass an ordinance for the improvement of State St., which is best known as the Boulevard, provided the street is paved all the way across and there is no inside curbing. When a resolution providing for the making of an ordinance embodying these features, which are regarded as essential, was adopted the matter was referred to the Board of Local Improvements. The Council's plan means that if the street is paved all the way across and the inside curbing is eliminated, the street car tracks will have to go in the middle of the street. Mayor Silas Cook said, after the Council adjourned, that the East St. Louis & Suburban Railway Co. has a franchise to lay its tracks on the side of the street and that its officials already have told him that they will not move the tracks to the center of the street. The resolution by the Council followed the receipt at the last meeting of a resolution adopted by the Real Estate Exchange expressing approval of the original plan and asking the Council to pass the ordinance originally offered by the Board of Local Improvements, which provided for inside curbing and for the paving of the street only outside the car tracks. The Boulevard, as contemplated by the Board of Local Improvements in its first ordinance, which the Council rejected by a vote of 12 to 4, means a boulevard from Collinsville Ave. and State St. in East St. Louis to the public square in Belleville, a distance of 14 miles. There are to be 12-ft. sidewalks and 24-ft. driveways on each side of the street car tracks. With the tracks taking up 12 ft. each, or 24 ft. in all, the street would be 96 ft. wide. City Engineer William J. Crocken's estimated cost for the improvement is $277,000.

J. E. Lyman, who is in charge of the J. A. Ware Construction Co.'s work on the Missouri Pacific R. R. west of here informs us that he has made a good start and expects to finish this work in record time.

We are under many obligations to T. J. Dolan for an elegant photograph of himself with Teddy Roosevelt by his side, and hope some day that Dolan will hold the job that Teddy vacated a couple of years ago.

Wm. Jucksh spent several days with us here last week. Jucksh has just finished putting in the sewer and water system at Vandalia, Mo., and at present working his outfits at Gatesville, Texas, Lubbock, Texas, and Stuttgart, Ark.

W. H. Gridley, one of the best known track layers in the country, died in Little Rock, Ark., on Oct. 29th.

Geo. C. Smith & Sons got quite a large job and are putting in a drag line at Prairie Du Rocher, Ill. They also secured a nice bridging job at Hoisington, Kan., and another putting in the foundation piling at Jefferson City for the Missouri Pacific R. R. also secured the bridging and pile driving on the new Alton, Jacksonville & Peoria Electric Railway. Geo. C. Smith, Jr., is going to have charge of the work in Jefferson City and Hoistington, Kan., and J. E. Smith, the youngest son, is going to be in charge at Prairie Du Rocher, taking care of the drag line and steam shovel work at that point. Papa Smith is tickled the way the boys are taking hold of contracting and managing the jobs they have been on.

J. W. (Doc) Skinner passed through St. Louis the other day on his way from Arkansas to Mt. Carmel, Ill., where he is doing some bridge work for the Big Four R. R. Co.

Residents of Washington Heights who want the river Des Peres sewered where it passes through that section waited on Mayor Kreismann here to press their claims. President Reber of the Board of Public Improvements also attended the meeting. Another conference will be held Thursday. Conditions in that section might be benefited by the re-establishment of pump wells, which were in operation during the World's Fair, whereby the sewage was forced into the Pine St. sewer. President Reber says the difficulty is not due to any sewage from that particular section, but what comes into the city from the county. He says that pumping a station would solve the problem at much less expense than sewering the entire line of the river.

Geo. Arnold spent a day in St. Louis and returned to Memphis.

T. J. Dolan, the hustling Secretary of International Brotherhood of Steam Shovel and Dredgemen, took a flying trip into St. Louis the other day. As usual he was a very busy man. Sorry we missed you this time, Dolan, but come again soon and if possible give us a little notice.

A charter was issued on Nov. 3rd by the Secretary of State to the Missouri-Osage R. R. Co. The object is the construction of a railroad 25 miles in length, from Linn, Osage County, to Wardsville, Cole County. The capital stock is $250,000. H. C. Avis, Alfred K. Prince, Page Nelson and Alphonse Dur, all of St. Louis, and M. A. Greding, of Alton, Ill., are the stockholders, each owning 100 shares. According to the route outlined in the articles of agreement, the line is to cross the Osage River at Osage City, about eight miles east of Jefferson City. Wardsville is a little hamlet some nine miles southeast there.

John Kuert Co. have started on their concrete work on the new reservoir on the Big Four R. R. at Livingston, Ill.

Work began on Nov. 1st on the completion of the sewerage system in Stuttgart, Ark., which was commenced in May. The original contract was thrown up and last week another contract was let for the completion of the system, this time to Pettit & Galloway, of Little Rock. The new contractors promise to have the sewerage system ready for use by Christmas and are putting a large force at work to make good their promises.

The Universal Construction Co. are making rapid progress with its big sewer contract in South St. Louis.

Ryan Bros. report that they have enough work at Godfrey, Ill., on the new Alton & Jerseyville Electric Line to hold them there all winter.

S. H. R. Robinson is piling up big estimates on his drag line work at Blinkey, Ill.

Capt. J. A. Ware, of the J. A. Ware Construction Co., has gone east and we expect to report something new about him in next issue.

Jack Hickey has been in town several days. Left here the other day to look over their work near Mt. Carmel, Ill.

Isaac H. Smith, President and General Manager of the proposed Springfield & Central Illinois Traction Co., is expected to visit the Tri-Cities across the river here next week in an effort to get a franchise for the new electric line. The proposed route is arranged as follows: Main line, from Springfield south through Pawnee, Morrisonville, Hillsboro, Coffeen, Greenville, Carlisle and southeast through Hoffman to Centralia. One branch will run from Greenville to St. Louis through Old Ripley, Alhambra, Edwardsville, Granite City and over the McKinley bridge. The other branch will run southwest from Coffeen, to Mount Carmel, through Vandalia, Kimmundy, Louisville, Saylor Springs and Olney. This will make 110 miles in the main line. Mr.

Smith is reported as being greatly encouraged at the prospects of the new road.

McCann Bros. have moved their outfit to Odin, Ill.

The new McKinley power plant at Venice, Ill., is nearly completed. Thursday night fires were put in the furnaces to temper the boilers. The source of the power at present is located at Riverton, Ill. The new plant is said to be the largest electric railway power plant outside of New York. There will be a surplus supply of power, and this will be used to light towns along the road.

W. L. Mosby has 50,000 yds. of work on the Illinois Central R. R. at Buckner, Ill., to let at once. This work is suitable for a 15 or 20 team outfit; all field work; short haul; prices 16 cts.; free transportation over Illinois Central R. R. Write or wire Mosby to Buckner, Ill., or Hickman, Ky.

Councilman Schneiderhahn last Friday introduced a bill, authorizing the appointment of a Board of Arbitration for the adjustment of the damages to the property of the Southern Ry. Co. on the East Side, which the city is condemning for the approaches to the municipal bridge. The bill proposes that three men shall serve, one to be appointed by the city, a second by the Southern Ry. Co., and the third by the other two. Should they fail to agree, the third is to be selected by the Judge of the Federal Court for the Eastern District of Illinois, in which court the condemnation proceedings are pending. A fee of $750 each is allowed to the three commissioners. The Southern Ry. Co. has agreed to accept the verdict of the board in lieu of any findings that may be made by the commissioners, appointed by the court. The Board of Public Improvements last week submitted to the House of Delegates drafts of ordinances for the abolition of the grade crossings at Chouteau Ave. and the Missouri Pacific tracks. Two bills were given so that the members of the Assembly would have their choice of placing the consequential damages on the city or on the railroad. The viaduct will begin at a point 290 ft. west of Tiffany St. and clear the tracks by at least 18 ft., and terminate at a point on Chouteau Ave. 42 ft. east of Vandeventer Ave. A roadway 12 ft. wide is provided on each side of the viaduct. The estimated cost of the bridge is $400,000. At the last conference held by the property owners of the district and the members of the Assembly, the United Rys. Co. was asked if it would not pay a portion of the costs. President McCulloch promised to present the matter to the Board of Directors of the company, but since that time no answer has been heard from that source. Chairman Russell of the House of Delegates Railroad Committee on Friday announced a public hearing on the bill granting the Southern Traction Co. of Illinois the right to use the municipal bridge from 3 o'clock next Friday afternoon.

The Hollerback & Moy Contract Co. have started constructing the concrete piers for a bridge across the Wabash River near Mt. Carmel, Ill., on the line of Evansville, Mt. Carmel & Northern Ry.

Henry Schweitzer expects to finish his work on the Big Four R. R. at Harrisburg, Ill., within the next eight or ten days.

The city council of Fulton, Mo., at special session on Nov. 5th granted to the Mexico, Santa Fe & Perry Traction Co. an extension of franchise for one year. The original franchise expires shortly. The company now is building a line out of Mexico and is at work on the 6th mile. It is proposed to extend the line to Fulton and from there build to Mokane, where direct connections will be made with the Missouri, Kansas & Texas R. R. The Fruin-Bambrick Construction Co. of St. Louis has charge of the work, and the extension to Fulton is to be carried out under the same arrangements as now exist for the construction of the line out of Mexico, bonds to the amount of about $6,000 being issued for each mile and being purchased by the people along the route through which the line passes. As outlined at present, the company will traverse different sections of Audrain, Boone and Callaway counties, taking in the following towns: Mexico, Santa Fe, Perry, Columbia, Fulton, Mokane and Hereford. Officials of the road deny that the Chicago & Alton contemplates taking up the new road.

Montana.

The Billings Traction Co. has completed its organization and is reported to have secured the necessary capital for the construction of its street railway in Billings, Mont. It is said that preliminary arrangements are being made to begin track laying in the spring. A. C. Trumbo and R. D. Long, Muskogee, Okla., are interested in this proposition. Mr. Long is superintendent of the Muskogee Electric Traction Co. of Muskogee, Okla.

The Butte Electric Ry. Co., J. R. Wharton, general manager, Butte, Mont., is to build a short extension to its line at Meadville, and will also double track a portion of its line in that city.

North Dakota.

Grading on the Midland Continental Ry., has been completed from Jamestown, N. Dak., south to Edgely by the contractors, and it is expected by J. T. Adams, Columbus, O., who has the general contract for the road, to have the same ready for operation early next Spring.

New Jersey.

The Central Railroad of New Jersey, J. O. Osgood, chief engineer, New York city, has purchased three tracts of land adjoining the right of way of the Newark & New York railroad branch. Two of the pieces are located in the township of Kearny and the other one in Jersey City. The tracts are 50 ft. wide and have a total length of about 3,000 ft. They will be used for additional tracks.

The City Council of Burlington, N. J., has granted to the Burlington Electric Light & Power Co. a 50-year franchise. The company proposes to erect a plant at Burlington as the central station for operating trolley lines and supplying light and power to adjacent towns.

New Mexico.

The Santa Fe System has arranged to construct a mechanical interlocking plant at Suwanee, N. Mex., at a cost of $4,000.

An electrical interlocking plant will be installed by the Santa Fe System at Rio Puerco, N. Mex., at an estimated cost of $15,000. The money has already been appropriated.

Steps are to be taken immediately by A. O. Bailey, President of the Colorado, Columbus & Mexican R. R. Co. toward financing the construction of a line tapping the coal fields of Northern New Mexico and Colorado and extending through Deming and Columbus into the interior of Mexico. The system, it is said, will involve the construction of about 450 miles of line.

New York.

A public hearing was recently held by a committee of the Buffalo, N. Y., City Council to learn the sentiment of Black Rock citizens relative to the application of the Frontier & Western R. R. Co. to construct a road through that section of the city. The State Public Service Commission has the matter under consideration.

The state public service commission will hold a hearing at New York on Nov. 17 on the application of the Jay Street Connecting Railroad Co. of Brooklyn for a certificate of public convenience and necessity. The company now is building a freight station on the block bounded by Jay, John, Plymouth and Pearl streets in Brooklyn borough. It desires to build a steam freight railroad from the pier at Jay St. to the new freight station and to lay tracks in all the streets surrounding the terminal block. The road will be only one-third of a mile long.

The Public Service Commission of New York City on Nov. 2 made public the totals of the bids received Oct. 27 for constructing the Tri-Borough subway system in that city. The Commission will award the contracts and these contracts will then be referred to the Board of Estimate for its approval. The Board of Estimate will also decide on the amount of money to be appropriated for subway building purposes. As the lowest bids for the Broadway-Lexington Ave. the Broadway-Lafayette Ave. and the Canal St. subways aggregate $85,437,570.11, or more than $25,000,000 in excess of the money supposed to be available, the Commission may not be able to begin work on all the sections at once, but it will go just as far as the funds appropriated will permit it to go and finish up on later appropriations. The following is a list of the bidders and their totals:

BROADWAY-LEXINGTON AVE. SUBWAY

Sec.	Bidder.	Bids.
1.	O'Rourke Eng. Const. Co., [illegible] Fifth Ave., New York	$[illegible]
	MacArthur Brothers Co.	[illegible]
	Bradley Contracting Co.	[illegible]
	Degnon Contracting Co.	[illegible]
[illegible]	MacArthur Brothers Co., [illegible] St., New York	[illegible]
	O'Rourke Eng. Const. Co.	[illegible]
	Bradley Contracting Co.	9,065,007.50
	Frederick L. Cranford	[illegible]
2A.	Bradley Contracting Co., 1 Madison Ave., New York	[illegible]542.75
	Frederick L. Cranford	3,086,908.75
	MacArthur Brothers Co.	[illegible]
3.	Bradley Contracting Co.	3,619,315.00
	MacArthur Brothers Co.	3,802,444.50
	Frederick L. Cranford	[illegible]
4.	Bradley Contracting Co.	3,716,304.50
	MacArthur Brothers Co.	4,305,933.20
5.	Metropolitan Contracting Co., 95 Milk St., Boston	2,419,127.20
	Bradley Contracting Co.	2,473,159.00
	MacArthur Brothers Co.	[illegible]
6.	Bradley Contracting Co.	3,634,213.50
	MacArthur Brothers Co.	4,300,023.50
	Degnon Contracting Co.	4,443,561.50
7.	Charles H. Peckworth, 415 Hudson St., New York	[illegible]
	Bradley Contracting Co.	3,870,333.50
	MacArthur Brothers Co.	4,953,157.90
	Degnon Contracting Co.	4,955,764.60
8.	Bradley Contracting Co.	[illegible]
	Degnon Contracting Co.	[illegible]
9.	Bradley Contracting Co.	2,447,479.70
10.	Bradley Contracting Co.	3,253,072.80
	Henry Steers	4,476,855.96
11.	Bradley Contracting Co.	3,132,195.05
	Henry Steers	4,159,085.08
12.	Oscar Daniels Co., 38 Park Row, New York	2,825,740.74
	Behrman & Rodgers	3,397,802.70
	Bradley Contracting Co.	3,474,080.80
13.	Bradley Contracting Co.	4,071,416.50
	Hugh Nawn Contracting Co.	4,209,594.05
	[illegible]	[illegible]
	MacArthur Brothers Co.	4,892,484.50
14K.	[illegible] New York	[illegible]
	MacArthur Brothers Co.	5,534,965.30
	O'Rourke Eng. Const. Co.	6,109,858.30
	Bradley Contracting Co.	6,362,166.00
15.	Haggerty-Drummond Co., 41 Park Row, New York	[illegible]
	Godwin Construction Co.	4,154,360.40
	Bradley Contracting Co.	4,336,925.50
	Hugh Nawn Contracting Co.	4,414,642.40
14H.	MacArthur Brothers Co.	5,748,608.40
	O'Rourke Eng. Const. Co.	6,119,934.40
	Bradley Contracting Co.	6,396,054.00
	S. Pearson & Son, Inc.	8,500,000.00

CANAL STREET SUBWAY

1.	Metropolitan Contracting Co.	$4,601,644.75
	Bradley Contracting Co.	5,979,657.25
2.	Bradley Contracting Co.	9,164,909.65

BROADWAY-LAFAYETTE AVENUE SUBWAY BROOKLYN

1.	Newman & Carey, 215 Montague St., Brooklyn	$4,265,424.67
	Bradley Contracting Co.	4,318,700.50
	Degnon Contracting Co.	4,764,782.10
	Frederick L. Cranford	4,926,512.25
2.	Patrick McGovern, Hotel Belmont, New York	4,676,941.65
	Bradley Contracting Co.	4,726,259.50
	Degnon Contracting Co.	4,802,919.65
	Newman & Carey	[illegible]
	Hugh Nawn Contracting Co.	5,022,709.30
3.	Walter H. Gahagan, 198 Montague St., Brooklyn	2,981,992.80
	James H. Holmes	3,240,437.00
	Patrick McGovern	3,311,827.00
	Degnon Contracting Co.	3,411,697.05
	Bradley Contracting Co.	3,455,583.75
	Smith, Scott, Hannan & Hickey	3,471,897.15
	Creamer, Cranford & Donovan	3,575,278.15
	Oscar Daniels Co.	3,575,485.00
	Smith & Pennock Cont. Co.	3,668,568.85
	Hugh Nawn Contracting Co.	3,813,727.50
	Newman & Carey	3,822,764.84
	S. Pearson & Son, Inc.	5,066,937.48

The City Council of Jamestown will probably grant franchises to the Jamestown Street Ry., permitting the completion of the Second St. double track, the double tracking of Main St., the construction of a line on West Second St., and the construction of a Willard St. line.

Ohio.

It is expected that the Columbus Railway & Light Co., Columbus, will soon ask for a franchise to extend its lines west on Mound St. to Glenwood Ave.

The Western Ohio Ry. Co., Lima, O., is reported to have about completed negotiations for the purchase of the Toledo, Bowling Green

& Southern Electric Ry. It is stated that if the deal goes through $200,000 will be expended in improvements. The Western Ohio Ry. Co. is also said to be planning to build a new line from Findlay to Fostoria.

The Norfolk & Western Ry. has about completed its double track work between Dugan's Grove and Piketon and it is expected that this section will be ready for use by the middle of December. This is the last strip between Kenova and Columbus.

The Hocking-Sunday Creek Traction Co., A. B. Young, president, Nelsonville, O., has placed a $200,000 bond issue on the market. The proceeds of the bond sale will be used in building and equipping the traction line from its present terminus at Green Lawn cemetery out of Nelsonville to Athens. Right of way is now being taken up and the company expects to begin construction soon.

It is now said that the Columbus, Mt. Vernon & Mansfield Traction Co., incorporated last July to build an electric interurban railway conecting Columbus with Mansfield by way of Mt. Vernon, is the new owner of the Columbus, New Albany & Johnstown Traction Co., the sale of which to Anderson T. Herd of New York City was noted in our last issue. Surveys for an extension of the latter line to Mansfield have been made and it is said that the work may be started soon. L. P. Stephens, Columbus, O., is General Manager.

Oklahoma.

The city of Tulsa and the M., K. & T. and St. Louis & San Francisco railroads have reached an agreement regarding the building of subways under both roads on North Denver Ave. The subways will cost $25,000 and the railroads will pay for the work.

The Missouri, Oklahoma & Gulf Ry., J. J. Harrison, chief engineer, Durant, Okla., is reported to have placed $5,500,000 of its bonds in France. The railway is seeking an entrance into the oil fields, with an extension of its Coalton branch to Okmulgee, and in addition the survey is being made for the main line extension north to Joplin and later to Kansas City, Mo. The company has made a trackage agreement with the Rock Island to use the latter's track for hauling coal from Lehigh to Wapanucka, a distance of about 25 miles. This will give the Missouri, Oklahoma & Gulf a direct line to the Oklahoma coal fields.

The Nelson Construction Co. of Vinita, Okla., has been incorporated with a capital stock of $25,000, the directors being August Nelson of Mound Valley, Kan., Fred Nelson and S. H. Atwood of Parsons, Kan., C. C. Roberts of Vinita, and H. H. Hellen of Wagoner, Okla.

The Midland Valley R. R., E. M. Alvord, general manager, Muskogee, Okla., is reported to have been awarding contracts for a part of the constrlction work on its new extension to Wichita, Kan.

The Choctaw Railway & Lighting Co., of McAlester, Okla., is contemplating making a number of improvements and a possible extension of the line east to Wilburton and south to Denison, Tex.

Surveyors of the Buffalo & Northern Oklahoma R. R., under direction of Eugene Tilleux, Hutchinson, Kan., are at present seeking a connection for their proposed line to the eastward to make it a feeder to some trunk line. E. M. Best, Buffalo, Okla., is President of the company.

It has been announced by R. A. C. Steele, Sterling, Okla., that Sterling had raised $20,000 for the construction of a new railroad line contemplated from Sulphur through that city

The Missouri, Oklahoma & Gulf R. R. is planning to construct a line into Coalgate and Lehigh, Okla., though no definite route has yet been decided upon.

Oregon.

An outfit of the C. J. Cook Co. of Portland, which has been working on the Mount Tabor reservoir for that city, has been placed at work on the construction of the new line of the Mt. Hood Ry. The outfit consisted of two steam shovels, six locomotives and 40 dump cars. One steam shovel was sent to the Base Line road, where it intersects with the Troutdale branch of the O. W. P. company, and the remainder of the outfit was sent over the O. W. P. to Anderson, to be used in grading.

Some of the Portland papers are carrying an advertisement asking for contractors to build 10 to 50 miles of railroad. The advertisement states that particulars as to the work can be obtained at 411 Henry Bldg., Portland, Ore.

At a recent meeting of the City Council of Portland a recommendation was made to vacate East Twenty-third, East Twenty-fourth and East Twenty-fifth Sts., between Powell and Frankfort Sts., and a portion of Frankfort St., through a 10-acre tract of land desired by the Portland Ry. Light & Power Co., as a site for its proposed new car shops, providing right of way for a sewer be given through this and adjacent tracts. The committee has no objection to the vacation of the streets, but insists that a right of way for a sewer drain, to drain a large territory in that vicinity should be granted through the property.

Surveys have been completed by engineers of the Southern Pacific for the revision of the Natron cutoff to bring it into Crescent, Ore. The line about the lake Odell has been raised 10 ft. above the former survey and several curves have been eliminated.

Pennsylvania.

Right of way is being secured for an electric railway from Hagerstown, Md., to Mercersburg, via Clearspring, 27 miles. Preliminary surveys have been made and it is estimated that the road can be built for about $20,000 per mile, this cost including power house and equipment. New York capitalists are reported to be behind the project. Major L. F. Downs, New York city, and James B. Kreps, Hagerstown, Md., are interested.

The Pittsburg, Summerville & Clarion R. R., C. F. Heidrick, president, Clarion, Pa., now operating 22 miles of line, is planning to extend its road next year.

The proposition to lease the Northern Central Ry. to the Pennsylvania R. R. Co. for 999 years has been ratified by nearly 90 per cent of the stockholders of the former road.

The Stony Creek Lumber Co., Sullivan County, Pa., has secured control of a timber tract of 2,250 acres in that county and will build a railroad through the tract connecting with the Lehigh Valley R. R. at Lopez. The capital stock of the company is $200,000 and its officers are John H. Blackman, West Pittston, President; Frank E. Carter, West Auburn, General Manager; J. C. Hughes, West Pittston, Pa., Secretary and Treasurer.

The Delaware, Lackawanna & Western Ry. is planning to eliminate the crossing at McHale court, which connects Railroad Ave. and Meridian St., at Scranton, Pa., by means of a subway.

William Riche, Tamaqua, Pa., has been awarded a $35,000 contract for building a connection between the Mauch Chunk-Nesquehoning R. R. and the new Broad Mountain road.

South Carolina.

The city of Orangeburg, S. C., has voted to issue $20,000 of bonds to aid in the construction of the proposed Orangeburg R. R. W. C. Wolfe is the promoter. The railway is to be about 18 miles in length and will connect with the Seaboard Air Line railway at North. It is to be owned and operated by a private corporation, but will have traffic arrangements with the Standard Air Line railway, thereby giving Orangeburg freight competition between the Southern, Atlantic Coast Line and Seaboard systems and the steamboat line to be placed on the Edisto river. The road is to be built through North into Springfield as soon as possible. The charter of this railroad allows it to build from Charleston to Augusta, which will be the ultimate terminus.

South Dakota.

Surveys have been completed for the proposed new railroad from Huron, S. Dak., to Chamberlain. The survey work was done under the direction of the Missouri Valley Engineering Co., of Mitchell, S. Dak., with R. G. Culbertson in charge; R. W. Fulweller as locating engineer, and C. G. McHugh, draughtsman. The original survey of the proposed enterprise was to run along American creek, but later was changed in order to avoid heavy grades in the Wessington hills. The line passes through a well improved country. The heaviest grade is in the hills and is 45 ft to the mile.

Information received recently from Platte, S. Dak., is to the effect that an announcement has been made by officials of the Chicago, Milwaukee & St. Paul Ry., that in the Spring the company will extend the line from Platte to Orient, closing the gap which has existed for many years. It is believed that the line will run northwesterly from the present terminus through Bijou Hills to Chamberlain, connecting with the Black Hills line as well as extending to Orient.

Tennessee.

The McDowell Construction Co., which has been awarded the contract for constructing the first 17½ miles of the Harriman, Knoxville & Eastern R. R., from Harriman, Tenn., as noted in our last issue, has its headquarters at Knoxville, Tenn.

An ordinance has been approved at Memphis for the elevation of the tracks of the Frisco, Louisville & Nashville and other railroads. The plan includes a construction of subways to eliminate various grade crossings

Texas.

The Union Terminal Ry. Co. is projecting a 20-mile line from Rockport to Harbor Island to deep water and from Rockport to the town of Aransas Pass. No contracts have been let. Chas. F. Hoff, Rockport, Tex., is president. Dr. Alexander Bailey, Rockport, is also interested.

It is believed that the St. Louis & San Francisco R. R. shortly will announce plans for the building of a short line from the international bridge at Brownsville to the city of Mexico.

The State Railroad Commission has fixed a valuation of $444,067.63 upon the Houston & Brazos Valley R. R. This follows the inspection of the road made last June by Engineer R. D. Parker of the commission. The road is 23 miles in length and extends from Anchor, on the International & Great Northern, to Velasco, which point is greatly interested in the deep water project. The railroad company will soon issue stocks and bonds in the sum above mentioned.

The officials of the Palacios, San Antonio & Pecos Valley R. R. of Palacios, have placed an engineering corps of 15 men under the supervision of Engineer Mondine in the field to locate the best route to the other end of the line, which will be San Antonio. At a recent meeting of the city council of Palacios the new road was given a franchise to enter the city.

It is stated that contracts for the construction of the first 60 miles of the Nueces River Valley R. R. have been let and work will begin from Beeville by Dec. 1. Surveys are under way to determine which of the two proposed routes will get the road, Clareville on the South or Cadiz, and on through Oakville to the north. W. A. Frisby, Beeville, Tex., is president and G. A. Hubb is constructing engineer.

Steps are being taken to extend the Aransas Harbor Terminal Ry. from Aransas Pass to Harbor Island. D. B. Scott, San Antonio, is interested.

Grading work for the foundations for the machine shops and roundhouses to be erected at Sweetwater for the Santa Fe System is well under way. At the machine shop site alone, the plans call for 250,000 cu. yds. of excavation. All of the buildings to be erected, such as paint, repair, engine houses, etc., will be built of concrete. The round house will contain 50 stalls for engines and several of the main buildings will be over 400 ft. long. A large reservoir of a square mile will be built and a large watering station erected.

The Bay Shore Land Co., O. L. Allen, President, Houston, Tex., is planning to start work shortly on its Bay Shore rapid transit line. The company is reported to have already purchased 100,000 ties for the line. The line is to be operated by steam and will cost about $14,000 per mile.

The Enid, Ochiltree & Western R. R. has placed in operation the first ten miles of its line extending from Dalhart, Tex., to Victory, Tex. The total proposed length of this road is 300 miles, and Enid, Okla., will be one of its terminals.

It is reported here in San Antonio that the San Antonio & Aransas Pass R. R. has passed from the control of the Southern Pacific to that of the Frisco, the purchase being effected by B. F. Yoakum, the promoter and builder of the road. If the report proves true it is expected that the extension of the Frisco from Brady to a connection with the San Antonio road at Comfort will be pushed.

The Chicago, Weatherford & Brazos Valley R. R. Co. has filed an amendment to its charter providing for the construction of a 60-mile extension from Bridgeport to Gainesville, through Wise, Denton, Montague and Cooke Counties, Texas.

Press reports quote James Frazier, Assistant Auditor of the Roscoe, Snyder & Pacific R. R., as stating that the company has under consideration the extension of its line several miles northwest to Fort Worth, Texas, to develop coal fields in that direction. Financial arrangements are to be made at once.

It is reported in Taylor, Texas, that H. H. Fielder, President of the Houston, Somerville & Western Ry. Co., has announced that engineers will start work on the proposed line from Taylor toward the gulf and that an approximate estimate of the cost will be made. George H. Harris, Secretary of the Taylor Board of Trade, is interested.

James W. Orr, General Counsel of the Beaumont & Great Northern, is reported as stating that the railroad which is now building northward will ultimately extend to Waco, Texas, and will have as a southern terminus Beaumont, Texas.

Roach & Stansell, Memphis, Tenn., have completed the new line of the Kansas City, Mexico & Orient R. R. from San Angelo to Mertzon, a distance of about 75 miles. The work was finished three weeks in advance of the expiration of the contract time limit. This contract was awarded to the above firm last spring.

The Pecos Valley Southern R. R. will on Nov. 15 formally open for traffic 36 miles of its line. An extension to a connection with the Southern Pacific is now under consideration, W. L. Carwile, Dallas, Tex., is President

Utah.

Articles of incorporation have been filed with the Secretary of State, Salt Lake, Utah, by the Alta & Jordan Valley R. R. Co. The capital stock of the organization is set at $200,000 and they propose the construction of a line between Sandy and Alta, a distance of 16 miles. The incorporators are D. J. and M. A. Williams, 40 J St.; William F. Williams, 678 Fifth Ave., and B. F. and E. W. Cummings, 295 Center St., Salt Lake City, Utah.

It is rumored in Lehi, Utah, that the Denver & Rio Grande Ry. will soon build a spur from Lehi to Eureka, going around the west side of Utah Lake by way of Saratoga Springs and Pelican Point and up through one of the canyons southwest of that point into Eureka. The distance is about 35 miles and an easy grade could be established without any heavy pulls, whereas the present line, a distance of 64 miles to Eureka, is a very heavy pull over dangerous trestle work. C. A. Blake, Salt Lake City, Utah, is Division Engineer.

Virgina.

Bunn & Co., Big Grove Spring, Va., have been awarded a contract for the construction of a 5-mile extension of the Roaring Fork R. R. in Wise county, Va. E. L. Gobble, Blackwood, Va., is chief engineer of the Roaring Fork R. R.

The State Corporation Commission has granted a two years' extension of time in which to begin actual construction of the Richmond, Urbanna & Peninsular Ry. This line is proposed between West Point and Urbanna.

The Rivermont tunnel, near Lynchburg, Va., for the Southern Ry., has been completed and will be ready to receive traffic as soon as the track is put in condition. The general contractor for this work was W. J. Oliver of Knoxville, Tenn. Work has been under way for about two years.

Washington.

The city council of Colfax, Wash., has accepted the plans of the Spokane & Inland Empire R. R., A. M. Lupfer, chief engineer, Spokane, Wash., for widening the channel of a stream in Colfax.

The Yakima Valley Transportation Co., North Yakima, Wash., has been asked to construct a street car line from Young's corner. on Nob Hill Blvd., south to the cemetery west gate, along Cemetery road, at North Yakima.

A joint meeting of the South Bend and Raymond City Councils has been held to consider two applications for a franchise to operate an electric railway line in the two towns and connecting them. The terms upon which the towns will grant the franchise were agreed upon and the matter now awaits action of the companies.

Articles of incorporation have been filed by the Methow Valley & Washington Northern Ry. Co., Twisp, Wash., mentioned in our last issue. The capital stock is placed at $1,000,000 and the incorporators are S. P. Vallentine, E. W. Rollins, J. C. Platter, Charles G. Andrews and H. W. Henry. The company proposes to build a line through the Methow Valley from Spokane to the Sound and operate same by steam, electricity or other power.

Another section of the double track joint line of the Northern Pacific between Tacoma and Portland was recently placed in operation from Napavine to Winlock. Work on this contract has been under way since last Spring and a great deal of heavy work was encountered. It is believed that the entire distance will not be completed before March or April of 1911. At the present time trains are run on double tracks over 61 of the 143 miles between Tacoma and Portland as follows: Between Tenino and Chehalis 15 miles, Winlock and Napavine 8 miles and Kalama and Portland 36 miles. There still remain 82 miles to be built to complete the double tracking. Of this 44 miles is to be built via the Point Defiance line from Tacoma to Tenino, this route being two miles longer than the one now in use. As yet only preliminary work has been started on this portion of the line. Over the 40 miles from Napavine to Kalama the work is now being prosecuted.

Information given out by J. H. Young, President Alaska Steamship Co., and Vice President of the Copper River & Northwestern Ry. Co., is to the effect that the line will be completed from Cordova to Kinicott, Alaska, a distance of 195 miles, this year if unusual weather conditions do not interfere with the plans of the constructors.

It has been announced that the Chicago, Milwaukee & Puget Sound and the North Coast Railway Companies, which received franchises from the city of Spokane, Wash., recently, will commence work on yards and grading and tracklaying into Spokane early in December. These projects involve a joint expenditure of more than $6,000,000, and include temporary yard tracks pending the completion of a $1,000,000 union station and terminal grounds in the heart of the business district. It is also given out that the North Coast will be completed into North Yakima, Wash., early in November, thus connecting that city with Donald, Zillah, Prosser, Granger, Sunnyside, Grandview, Benton City and Kennewick. The line in south central Washington involved heavy bridge building. One bridge near Parker is 500 feet in length, while the bridge across the Columbia River below Kennewick has 11 spans. It is one of the largest in the State. Construction work on the Milwaukee road east of Spokane is progressing, the contractors devoting their attention to the Coeur d'Alene branch. Graders are building the road bed between Dishman, Wash., and Coeur d'Alene, Idaho. 26 miles, and tracklaying will begin early in November, to be completed before Dec. 1.

West Virginia.

Grading work is to be started shortly for an electric railway to run from Sisterville through Middlebourne to Salem and eventually to Clarksburg. Col. T. Moore Jackson, Clarksburg, W. Va., is the promoter.

Bennett & Talbott have grading work under way for four additional tracks for the Baltimore & Ohio R. R. at Clarksburg, W. Va

Wisconsin.

A five-mile branch road from the Wisconsin & Northern R. R. through a portion of Menominee Indian Reservation is to be constructed. Owing to the lateness of the season, however, the road will probably not be constructed until next spring. C. H. Hartley, Oshkosh, Wis., is General Manager of the Wisconsin & Northern R. R.

The Janesville Traction Co. of Janesville has filed its articles of incorporation. The capital stock is $125,000. The incorporators include T. S. Nolan, who recently purchased the property of the Janesville Street Ry. Co. at public auction. William Murphy of Janesville is also interested. In its articles of incorporation the company declares its intention to build new interurban lines into the territory surrounding Janesville.

Under the employ of the Canadian Construction Co., F. E. Halladay has made preliminary surveys for the construction of the proposed railroad between Stevens Point, Wis., and Rosholt in Marathon County, a distance of 20 miles. The estimate of the cost of construction is as follows: Removing 125,000 cu. yds. of earth at 35 cents per yard, $33,750; 50,000 ties as 40c, $20,000; 160 tons of steel rails at $26 a ton, $41,600; laying 20 miles of track at $300 a mile, $6,000; spikes and fish plates at $300 a mile, $6,000; ballasting at $200 a mile, $4,000. A total of $111,350, or at the rate of $5,567 a mile.

Wyoming.

The Union Pacific R. R. has made plans for enlarging its shops and yards at Laramie, Wyo. About $400,000 is to be expended for the improvement.

Officials of the Chicago, Burlington & Quincy R. R. have been making an inspection trip from Casper, Wyo., to the Salt Creek oil fields. This company proposes to build a branch from Casper to the oil fields to secure the increasing business there, and ultimately this line will be extended to Kaycee, Buffalo and on to Sheridan, or Clearmount, to a connection with the Burlington main line. The Burlington is pushing work on its Kirby-Orin Junction line, which will follow the Platte River, passing through Casper, Douglas and other large towns. With the completion of this line the Burlington and Colorado & Southern roads will have a direct route from the Gulf of Mexico to the Pacific Northwest, save for a short stretch of country between Casper and Wellington, Colo. Surveys have been made for this connecting link, and the Burlington system is under agreement with the city of Cheyenne to build it inside of a year.

Canada.

The Toronto & Eastern Ry. Co., recently chartered, has been financed and has completed its survey for its projected lines and is arranging preliminary matters so that construction work can be started in the spring. The road is to run from Toronto to Cobourg, with extensions of the system from Port Hope to Peterborough, from Oshawa to Lindsay, and from a point in the township of Scarborough to Uxbridge. R. H. Rothray of Toronto, Ont., has recently been appointed superintendent of the line.

The Alberta Electric Ry. Co. is to apply for incorporation. The chief proposed lines of the new company are from Calgary to Banff, from Calgary to Medicine Hat via Grand Forks, from Long Coulee to Lethbridge, from Expanse Coulee to Tabier, thence westerly to Lethbridge and Long Coulee, from Thigh Hills to Macleod, from Calgary to Cariboo, thence to Knee Hill Creek, from Lethbridge to the boundary line at Milk River, and from Medicine Hat to Wood Mountain, Saskatchewan. Stuart & Lathwell of Calgary, Alberta, are solicitors for the applicants.

It is understood that the Canadian Pacific Ry. will, at the earliest practicable date, build through the lake shore towns of Port Hope, Cobourg, Bowmanville, Oshawa and Whitby. The charter for this road has been obtained. The line will run between the present C. P. R. R. route and the G. T. R., actually touching the towns, thus giving more convenient service than they have at present.

It now looks as though the Toronto-Ottawa branch of the Canadian Northern Ry. would not be ready for operation before next summer. Good progress has been made on the grading work and this will be completed nearly on contract time. The principal delay, however, has been in connection with the bridge work, and this is said to have been due to slow delivery of steel. The bridge work began at the junction point in the Don Valley, where this line branches off the Sudbury branch for the east, for the Don River had to be spanned. This was only a small problem and was soon completed. In the meantime the grading east had been completed to allow of the rails being laid on to the next gully, which was at the Rouge River. There are two forks to this stream. The western, 19 miles from the union station at Toronto, made necessary a steel viaduct with concrete abutments, 500 ft. in length. The eastern fork called for a span only 180 ft. long. There was only one cutting that could be called big in the ground work along this mileage, where the road crossed under the Grand Trunk Ry. at Scarborough. The steam shovel work there was extremely heavy. But the completion of this and the throwing over of the steel made it possible to lay the rails down east almost to Bowman's Creek, which is situated north of Bowmanville. Here was another viaduct, though a small one. But a little farther on came the Dixie Creek gully, which entails a viaduct of 850 ft. in length. This one is not yet built. Beyond it again there is another at Stephen's Mill Pond, which is a span of 650 ft., also not constructed as yet. It is about 56 miles from the Union Station. From there the line continues on and down to Port Hope, where there is a span to be thrown of 2,000 ft. in length. The grading from Cobourg to Trenton is practically all finished, and the steel laid, except a small piece near Brighton, where there is still some work to be completed. The engineers hope the grading will be finished by the new year, and that by the end of January all the steel viaducts to Trenton will be in place. Ballasting has been done on a good portion of the line, and it is expected this work can be proceeded with in the winter and be finished in the early spring.

The Canadian Pacific Ry. will meet with some opposition when it applies to the Canadian parliament for an extension of time on the charter for a line between Yorkton, Sask., and Prince Albert, Sask. The Yorkton board of trade will act in conjunction with the Prince Albert board in opposing the extension. The company secured the charter 20 years ago.

It is stated here in Toronto that as a result of a western trip just concluded by C. J. Merry and Joseph Mackenzie, brother-in-law and son respectively of Wm. Mackenzie, president of the Canadian Northern Ry., a new construction company may be formed to engage in construction on the main line of the Canadian Northern west from Edmonton.

Hearings have been held at Ottawa by the Minister of Railways on the application of the Canadian Northern Ry. for approval of its route map for the Toronto entrance of the new Toronto-Ottawa branch. The Minister strongly advised the city, the Canadian Northern and the Canadian Pacific to confer with a view to reaching some mutually satisfactory agreement as to the location of the C. N. R. tracks, from Don Junction to the Union Station. Failing such an agreement, he intimated that the whole question would probably be left to the Railway Commissioners for decision. The plans submitted show that the Canadian Northern proposes to parallel its existing line from Don Junction to below the Canadian Pacific viaduct, then branching out, crossing the Don and running along the east bank. The line would go under the C. P. R. near the Smallpox Hospital, and continue along the space reserved by the city for railways to the Eastern Ave. yards.

The Laurent, Jacques Cartier & Maisonneuve Ry. Co. has submitted a plan to the Railway Commission to construct a railway line in and near Montreal. The company proposes to build its line from the junction of St. Laurent Ave. and Cartierville Ave. in St Laurent parish, through the north end of the city, ending at St. Catherine St., between Frontenac and Harbor Sts. Part of the line will follow Iberville St. This line is really a branch of the Grand Trunk Ry. System, and is intended ultimately to connect the eastern and western terminals of the system in the city. The G. T. R. proposes to build an east end station with docks and wharves. At present only a freight shed has been erected in the east end, but the company is now laying this line, which will connect the two stations.

A. C. Mackenzie has started grading operations on the Morinville east branch line of the Canadian Northern R. R. The line will run east from Morinville, but as yet it has not been decided just where it will connect with the main line. In all probability a town on the line in the North Battleford district will be made the junction.

Advices from Rock Creek, 7 miles north of Chesaw, Wash., state that a crew of construction men have started work on the extension of the new railroad westward from Midway, B. C. to the coast and several miles have already been graded. It is believed that the Canadian Pacific is interested in the project.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

✣Bids will be received at the office of Crawford & Hoboken, Attorneys, Pine Bluff, Ark., on Dec. 1, for the construction of the Grassy Lake Drainage District No. 1 in Lincoln County. The work consists of about 100,000 cu. yds. of excavation, the estimated cost being $12,000. Plans and specifications can be obtained from Wm. J. Parkes, Engineer, Room 101 Senyard Bldg., Pine Bluff, Ark.

Colorado.

The Camfield Development Co. of Greeley, Colo., will soon close contracts with the grant board of the Las Vegas land grant for the irrigation of 20,000 acres owned by the City of Las Vegas, New Mexico. The project will be pushed to completion and will open a large area suitable for cultivation adjoining Las Vegas. The water of the Gallinas River will be used and the land to be irrigated lies in the valley of that river. A part of the project is already completed. The diversion dam will be 1,480 feet long, 63 ft. high, 268 ft. wide at the bottom and 116 ft. at the top.

Kansas.

✣Bids will be received until noon November 14, by Board of County Commissioners, Topeka, Kan., for the construction of a levee along the south bank of the Kansas River through the city of Topeka. Approximate estimate of quantities are as follows: 8327.0 cu. yds. of earth embankment; 8816.0 cu. yds. of earth embankment. Facing: 1706.0 cu. yds. of puddle ditches; 125.0 cu. yds. of concrete A; 37600.0 lin. ft. of 25 ft. 10 in. piling; 439000.0 sq. ft. of clearing and grubbing; 530.0 lin. ft. of 12 ft. gravity wall; 2000.0 lin. ft. of 14 ft. cantilever wall; 1860.0 lin. ft. of 17 ft. cantilever wall; 3853.0 sq. yds. of 6 in. reinforced revetment; 9 storm water drains and head gates. Blank proposals will be furnished bidders on application to the County Clerk. Plans and specifications can be seen at the office of the County Clerk. Additional sets of plans and specifications will be furnished contractors by the engineer, V. R. Parkhurst, Topeka, Kansas, at $5.00 per set to cover cost of printing.

The Kaw Valley Drainage Board of Kansas City, Kan., has awarded the contract for flood protection work to Callahan Brothers, Omaha, Neb. The contract calls for the construction of solid dikes along both banks of the Kaw River, from Turner, the west end of the district to the mouth of the river and the removal of the solid obstructions in the river. The drainage board recently disposed of a $1,225,000 bond issue for drainage work.

Louisiana.

Israel R. Bobbitt, Point Pleasant, La., has been awarded the contract for 36,000 cu. yds. of levee work in the Lafourche Levee District. The contract price was 15⅞ cts. per cu. yd.

Montana.

The McKellar Creek Reservoir Co. of Stevensville, Mont., proposes to drain two small lakes at the foot of St. Mary's Peak to secure a supply for irrigation purposes.

New Mexico.

The Engineers of the U. S. Reclamation Service in charge of the Elephant Butte Dam at Engle, N. Mex., have been authorized to proceed with the work on force account. About $750,000 is available for preliminary work, and orders have been issued for the commencement of work on living quarters and the installation of a power plant. The total cost of the project is about $7,000,000. W. M. Reed, El Paso, Tex., is District Engineer.

Oklahoma.

The Alfalfa Irrigation Co., Harley J. Hooker, President, Altus, Okla., is putting about 2,000 acres of land under irrigation. This will be done by means of eight or ten pumps and gasoline engines. Pumps, engines, piping and flumes will be about the only things the company will be in the market for, as the work will be handled under its own supervision.

Pennsylvania.

The City Council of Wilkesbarre, Pa., has been asked to appoint a committee to confer with similar committees from the Dorranceton and Kingston councils relative to the plan to construct a dike along the west bank of the river in order to protect the west side from floods.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

The Memphis Union Station Co. has asked bids for the covering with concrete filling and waterproofing of the underpass for the new depot now under construction at Carolina Ave. and Secons St., Memphis. The bidders invited to submit propositions on this work are requested to have their bids in the office of Chief Engineer J. Werness, Louisville, Ky., as soon as the figures can be assembled. The concrete work will run to about 60,000 cu. yds. and must be reinforced with a special billet rolled corrugated bar, while the waterproofing material must be what is known as "Acquabar" manufactured by Girvan, Nachod & Co., of Philadelphia.

The high moguls of the Metropolitan Construction Co., of Kansas City, Mo., met in Memphis last week to consider various business propositions connected with the concern. Those who were present at the meeting were Ed White, of New Orleans, Stanton Palmer

Items marked thus ✣ indicate work now open for bids.

and F. R. Hedrick, of Kansas City, C. D. Smith, M. J. Roach, Louis Kavanaugh and Ed Manigan, of Memphis, [illegible] to largely increase the business of the company, so the report goes, and to [illegible] some of the big municipal contracts coming up in Southern cities this next [illegible].

A new construction firm has been organized in Memphis, which will be known as the Morgan Engineering Co. and which will conduct a general construction and engineering business. The members of the new firm are, Arthur E. Morgan, S. B. Hutton, L. L. Hidinger, C. C. Chambers, and Wm. H. Fitzhugh.

Charlie Lowrance, one of the largest and best known levee contractors along the Mississippi River, has just purchased a big plantation near Wilson, Ark., on which he will grow cotton and corn and in time gradually retire from the construction line. Charlie has about 2,000 acres and it is most beautifully situated and said to be very valuable land. It is the intention of Charlie to sort of "ease" out of levee building, for as he states, prices for this class of work have become so low that there is but very little profit in this line now. He points out the fact that Helgason Brothers, of Vicksburg, recently took a contract from Capt. Clarke S. Smith for the construction of approximately 200,000 cu. yds. of levee work near Rosedale, which is all enlargement, and which Lowrance Brothers constructed as a new levee four years ago for 4½ cts. more than Helgason now gets for the work. With the increased cost of living, supplies and labor, Charlie thinks the work worth about 4½ cts. more now than when he first built the levee four years ago, yet it went at a much cheaper price on Oct. 26 than it cost the government to do a cheaper proposition as a new levee in 1896.

Apropos of high cost of living and low prices which contractors are now getting for work, it is the general impression of those in this section that something must be done towards an organization of the various construction firms doing work along the Mississippi River, whereby some agreement may be reached to stop the cut-throat methods now in vogue. Certain it is that with the contractors fighting one another on the getting of new work, prices will be greatly demoralized and no one will receive any benefit, as has been proven to be the case in recent years. The peculiar fact in the whole thing is that a small subcontractor will attend a large levee letting bid on the amount of work which his outfit can do on contract time and then lose same because the larger contractor can bid on all the work let at a cheap general bid. The small man will turn around then and sub-let the same piece of work on which he bid from the successful large contractor at about 5 cts under the bid which he (the small contractor) made the government. This sort of thing must stop, say the contractors, or all must turn their attention to other lines of business.

Martin Jennings & Brother have taken a contract for the construction of about 50,000 cu. yds. of levee work in the White River District, near Helena, Ark., and have already moved their outfit on same. The work is considered exceptionally good and the boys expect to make some nice returns for their labor.

McClavey Brothers will move up on the next trip of the Kate Adams to Cotton Wood Point, Ark., where they have the contract to build about 60,000 cu. yds. of levee for the United States. Mr. Gowan will be engineer in charge.

Tom Shields has finished his contract for the Cotton Belt Levee District and has moved his outfit from Helena.

Lowrance Brothers are the boys left on Riverton Loop, but hope to have their work done by January 1st. The other three outfits which were on this same loop have finished their contracts and are now en route to other jobs.

W. W. Hayden, formerly chief engineer of the Lake View Traction Co., has resigned his position with the new interurban in order to open an office for himself and engage in a general engineering business in this city. Bill is one of the niftiest men who ever ran a level and much of the wonderful success of the Lake View Traction Co. has been due to his ability and untiring efforts. Success will always attend Bill in whatever he undertakes and in his new venture he has the good wishes of a host of contractors and friends of other lines.

Capt. Clarke S. Smith left Saturday for the scene of his large dam works on the Ouachita River in Arkansas. Capt. Smith is kept pretty much on the "go" these days when he has the first, second and third Mississippi River districts to look after, to say nothing of the White, Arkansas and Ouachita Rivers to supervise in addition.

H. P. Johnson, Vice President of the Union Sand & Material Co., of St. Louis, Mo., has awarded contract to Roach & Manigan, of this city, for the construction of half a mile of concrete street work. The contract calls for City of Memphis specifications on concrete streets, or in other words, provides for a pavement that is known as Moran's Patent, a mixture of lime stone and cement. Work must be started at once and rushed through to an early completion. Alle Bartee will be the superintendent in charge.

Jake Baxter reports good progress on all his many I. C. contracts and states that he will complete same in good time. Jake is now looking around for more work.

Wyoming.

The State Engineer at Cheyenne has approved the water rights and the state land board has approved the segregation of lands for the project of the Riverside Irrigation Co., which will the coming year reclaim 150,000 acres of land in the vicinity of Shoshoni, Wyo. The company will install a pumping plant in the Big Horn River 18 miles above Boysen, from which place it will obtain its electric power. The main canal will be 20 miles long, while the land to be reclaimed lies in a strip from one to four miles wide and extending down the river nearly 18 miles. The main ditch passes close to Shoshoni.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be received until 11 a. m., Nov. 18, by Maj. George McK. Williamson, Constructing Quartermaster, Fort Mason, Cal., for constructing complete five single barracks, including plumbing, heating, electric wiring and fixtures, at Fort Winfield Scott, Cal.

✣As noted in our last issue bids are being asked by Capt. W. P. Stokey, U. S. Engineer, 723 Central Bldg., Los Angeles, Cal., for extending shoreward the breakwater at Los Angeles Harbor, Cal. The work will consist in furnishing, delivering and placing in position stone in a rubble mound to extend westerly to the shore, from the shore end of the breakwater at Los Angeles Harbor, Cal. It is the intention to build the rubble mound to a height of about 14 feet above low water, with top width of about 15 ft. and with such side slopes as the stone will naturally assume under the action of the sea. The bulk of the stone may be simply dumped or dropped into place at random, but in finishing the mound about 10,000 tons of this stone will be more carefully lowered into place with the derrick. It is estimated that about 40 per cent of the stone required may be in sizes under 2 tons and that about 25 per cent must be in sizes of not less than 6 tons. Stone of the various sizes must be delivered as may be from time to time required, and placed in the work where directed. About $230,000 will be available for payments under this contract. If the quantity of stone procurable under the contract be insufficient to build the mound throughout to the size contemplated, a lesser height will be adopted along the westerly three-fourths of the length. The depth of water along the line diminishes from about 25 ft. at the inner end of the present breakwater to nothing at the low water line. The construction will continue shoreward of the low water mark to the base of the bluff, making the length about 1,900 ft.

Bids as follows were received Oct. 27 by Brig. Gen. Chas. E. L. B. Davis, U. S. Engineer, San Francisco, for dredging 1,289,200 cu. yds. of material from Oakland Harbor: San Francisco Bridge Co., Monadnock Bldg., San Francisco, Cal., 11 4-10 cts. per cu. yd. Mr. N. R. Harris, 95 Market street, San Francisco, Cal., 11 94-100 cts. Standard American Dredging Co., Merchant's Exchange Bldg., San Francisco, Cal., 12 9-10 cts.

District of Columbia.

✣Bids will be received until 11 a. m., Dec. 22, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing three steel caissons for dry docks at the navy yard, New York, N. Y., and Bremerton, Wash., and naval station, Pearl Harbor, Hawaii.

✣Bids will be received until 2:30, Nov. 11, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for the furnishing of 2 75-K. W. motor generator sets and necessary appurtenances, one lathe, one milling machine, manganese steel castings, onion skin and bond paper and wooden tie plugs.

✣Bids will be received until Nov. 11 by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing one crank shaft, forged steel, of soft or low carbon steel.

✣Bids will be received until 2 p. m., Nov. 14, by Capt. F. C. Boggs, General Purchasing Officer,, Isthmian Canal Commission, Washington, D. C., for furnishing 18 girders, steel, marked G. I.; 8 do, marked G2; 8 do, marked G3, and 2 do, marked G4.

Florida.

✣Bids will be received until 11 a. m., Dec. 10, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a quay wall at the naval station, Key West, Fla.

✣Bids will be received until noon, Nov. 21, by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for removing the wreck of the "Chatham" at the entrance to St. Johns river, Fla.

Illinois.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, city of Chicago Room 705, City Hall, until 11 a. m., November 16, 1910, for furnishing, erecting and delivering to the 68th St. crib well room structural steel and iron work as shown on plans on file at the Commissioner's office. The work includes the erection of all beams, brackets, gratings, the curved "I" beams for trolley runs, fog bell supports, ladder, platforms, hand rails and all other work necessary to the completion of the contract as shown in the specifications.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, city of Chicago, Room 705, City Hall, until 11 a. m., November 15, 1910, for furnishing boilers for the Roseland pumping station, 104th St. and Stewart Ave. The boilers are to be 4 horizontal water tube boilers, each to develop 300 horsepower normally, but shall be capable of being forced at least 40 per cent in excess. Each boiler is required to have 3,000 sq. ft. of heating surface, measured on the surface with a free flow of hot gases and shall be designed for a working pressure of 175 pounds of steam, gauge pressure, using a factor of safety of six. Full plans and specifications may be had upon application to the Commissioner of Public Works.

✣Bids will be received until 11 a. m., November 16, 1910 by B. J. Mullaney, Commissioner of Public Works, Room 705, City Hall, for furnishing regular tug service and service to the two mile crib. The accepted tug must pass the inspection of a representative of the city, after having complied with the requirements of the United States government. The hull of the tug if of wooden construction must be armored with iron plates, securely and properly fastened in place. The engine boiler and appurtenances must be of sufficient size to drive the tug (accepted for regular service) through 8 inches of solid ice. Full specifications may be had upon application to the Commissioner of Public Works.

Indiana.

✣Bids will be received until 10 a. m., Nov. 15, by Depot Quartermaster, Jeffersonville, Ind., for furnishing under schedule No. 571, miscellaneous quartermaster's supplies.

A company headed by former Mayor E. J. Fogarty, of South Bend, Ind., has purchased 78 acres betwen South Bend and Mishawka and will build a one-mile racing track, aviation field, clubhouse and grand stand with a seating capacity of 10,000. The company will have a capitalization of $50,000.

✣Bids will be received until 3 p. m., Dec. 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatue, and electric conduits and wiring of the U. S. Post Office at Granite City, Ill.

Iowa.

✣Bids will be received until noon, Nov. 28, by O. L. Ingledue, Mayor, Marshalltown, Ia., for the installation of machinery and water wheels for development of water power.

Kansas.

As soon as the question of the debt making powers of Kansas City, Kan., now before the State Supreme Court, is decided an election will be called to vote on issuing $435,000 of bonds. Of this amount about $350,000 will be used in buying a municipal lighting plant, $50,000 for the building of a new fire headquarters and $35,000 for the installation of two garbage incinerating plants.

Louisiana.

✣Bids will be received until 7:30 p. m., Nov. 15, by Board of Commissioners, Port of New Orleans, La., for furnishing and delivering such lumber and piling as may be ordered for repairs, etc., for a period of one year. Specifications are on file at the office of A. C. Bell, Engineer, 200 New Orleans Court Bldg., New Orleans, La.

Maine.

✣Bids will be received until 3 p. m., Dec. 7, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the extension, etc., including plumbing, gas piping, heating apparatus, and electric conduits and wiring of the U. S. Post Office and Custom House at Ellsworth, Me.

Maryland.

✣Bids will be received until 11 a. m., Nov. 16, by Board of Awards, Baltimore, Md., for furnishing a locomotive crane of standard type as manufactured by the Browning Engineering Co., of Cleveland; the Industrial Iron Works of Bay City; Brown Hoisting Machinery Co., Cleveland, O. J. Barry Mahool is President of the Board.

Massachusetts.

✣Bids will be received until 2 p. m., Dec. 3, by Lieut. Col. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging Nantucket Harbor, Mass.

Michigan.

✣Bids will be received until 3 p. m., Nov. 15, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for repairs to canal walls at Sault Ste. Marie, Mich.

✣Bids are asked until 3 p. m., Nov. 15, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for repairs to canal wall at Sault Ste. Marie, Mich. The work to be done is to remove the timber work and all soft and broken rock along about 660 ft. of canal wall, to face the rock with concrete, and to build on top of the rock a concrete wall and furnish all the labor, plant and supplies necessary to perform the required work. The sum of $36,000 is available for the work. The approximate quantities are as follows: Excavation, class A—Timber crib work, filling and backfilling 3,200 cu. yds.; excavation, class B—rock, either solid, broken or soft, 550 cu. yds.; concrete (exclusive of cement), 4,040 cu. yds.; backfilling, 1,500 cu. yds.; cement, furnishing and delivering, 5,000 bbls.

Missouri.

✣Bids will be received until 10 a. m., Nov. 14, by Maj. W. M. Coulling, Quartermaster, St. Louis Depot, St. Louis, Mo., for furnishing miscellaneous quartermasters' supplies under schedule No. 21.

Montana.

✣Bids will be received until 2 p. m., Dec. 15, by Board of County Commissioners, Butte, Mont., for furnishing and installing of a heating and ventilating system in the County Court House at Butte, Mont.

New Jersey.

✣Bids will be received until 9 p. m., Nov. 22, by the Board of Education of Jersey City, N. J., for the necessary labor and material for the construction of a technical and industrial high school adjoining the present high school building, Newark and Palisade Aves., Jersey City.

✣Bids will be received until 3 p. m., Nov. 17, by Board of Chosen Freeholders of the County of Hudson at Jersey City, N. J., for the erection of a steel truss roof for the new boiler house at the Alms House County Farm, Secaucus, N. J.

The general contract for a cold storage warehouse building, which will be erected on the northwest corner of Henderson and 9th Sts., at Jersey City, N. J., for the Swift Co., has been awarded to the MacDonald Engineering Co. of 98 Jackson Blvd., Chicago. The new building will be of concrete, four stories in height and measure 300x100 ft. All modern improvements will be installed. The cost of the structure will be $150,000.

New York.

✣Bids will be received until 2:30 p. m., Nov. 10, by William Williams, Commissioner of Immigration, Ellis Island, N. Y. H., for all necessary labor and material for the reconstruction of the ferry rack at the U. S. Immigration Station, Ellis Island, N. Y. H.

✣Bids will be received until 5 p. m., Dec. 1, by R. H. Palmer, Clerk Board of Commissioners, 519 Frear Bldg., Troy, N. Y., for the erection of a new jail, workhouse and quarters for the Sheriff in Rensselaer County, at Troy, N. Y.

Ohio.

✣Bids will be received until noon, Nov. 18, by F. G. Hogen, Director of Public Safety, Cleveland, O., for furnishing and installing a steam and electric generating unit switchboard and appliances for the Service Quadrangle, Colony Farm, Warrensville, O.

✣Bids will be received until noon, Nov. 17, by Director of Public Service, Cleveland, O., for furnishing and delivering top soil for the grounds of the Kirtland Pumping Station in the City of Cleveland, O. A. B. Lea is Director of Public Service. Ira O. Hoffman is Secretary.

✣Bids will be received until noon, Dec. 5, by Clerk, Board of Education, Toledo, O., for furnishing necessary labor and material for the construction of two high school buildings at Toledo.

The following bids were received Oct. 27 by Maj. John C. Oakes, U. S. Engineer, Cincinnati, O., for constructing loose stone dam and shore protection in Ohio River, near the foot of Sister Island: (1) standing for Ohio River Contract Co., Evansville, Ind., and (2) for Oscar F. Barrett, Cincinnati, O.:

	(1)	(2)
Excavation, 3,700 cu. yds.	$ 0.60	$ 0.25
Stone, 300 cu. yds., 6 to 10 cu. ft. each	3.00	3.00
Stone, 4,700 cu. yds., ¾ to 1½ cu. ft. each	2.00	1.95
Total	$12,520	$10,990

Oklahoma.

The Muskogee Industrial Development Co. of Muskogee, which was organized to secure the building of a dam across the Grand River, has filed a certificate with the secretary of state showing an increase in its capital stock from $250,000 to $300,000.

Pennsylvania.

✣Bids will be received until noon, Nov 14, by Joseph F. Hasskarl, Acting Director, Department of Wharves, Docks and Ferries, 555 Bourse Bldg., Philadelphia, Pa., for the following work: Under Contract No. 38, for repairs to Arch St. pier; Contract No. 39, for painting Race, Arch and Chestnut St. piers.

✣Bids will be received until 2 p. m., Nov. 11, by Chairman of the Building Committee, Pennsylvania Reform School, Morganza, Washington County, Pa., for the light fixtures for the kitchen and bakery buildings and for cottages Nos. 3 and 4. T. E. Billquist, 341 Sixth Ave., Pitsburg, Pa., is Architect.

Texas.

No bids were received Nov. 1 by the Beaumont Navigation District, for the sale of the bond $498,000, from the proceeds of which Jefferson county will meet the United States government half way in completing a 25-toot ship channel to connect the mouths of the Neches and the Sabine Rivers with deep water at Port Arthur. The bonds will be readvertised for sale at a later date. There is no especial hurry about the sale of the bonds as, if the expected appropriations are obtained at the forthcoming session of Congress, there will be no necessity for the bond issue money being turned over to the Federal government until some time next spring.

Virginia.

✣The James River Improvement Committee of Richmond, Va., has extended the time for submitting bids for the construction of the new city wharf to Dec. 2. Charles E. Bolling is City Engineer of Richmond.

Council Committee on Finance of the City of Richmond, Va., is considering providing an appropriation of $25,000 to begin the work of building walls and an invert for Shockoe Creek and Bacon's Quarter Branch in the city. It is planned to construct a curved concrete bottom and reinforced concrete walls. Charles E. Bolling is City Engineer of Richmond, Va.

Washington.

✣Bids will be received until 10 a. m., Nov. 11, by Board of Public Works, Seattle, Wash., for the construction of a steel picket fence around the Green Lake Low Service Reservoir. C. B. Bagley is Secretary.

The Tacoma Dredging Co., Tacoma, Wash., at 48 cts. per cu. yd., was the only bidder Oct. 22 for dredging 16,200 yds. of earth, composing three bars at Cape Horn, near Shelton, for the U. S. Government. The estimate of Maj. C. W. Kutz, engineer in charge, was 50 cts. per yd. It will be necessary for the contractors to use the bucket system on the entire job, as the earth is chiefly gravel and hardpan.

West Virginia.

The contract for the building of Dam No. 12, on the Ohio river has been let by the United States engineers to the Pneumatic Caison Co.

Items marked thus ✣ indicate work now open for bids.

of New York. The dam will cost in the neighborhood of $900,000. Bids for this work were received some weeks ago.

Wisconsin.

✣Bids will be received until 2 p. m., Nov. 22, by the Wausau Telephone Co., Wausau, Wis., for the necessary labor and material for the construction complete of a three-story and basement office and telephone exchange building for the company. Van Ryan & DeGelleke, 726 Caswell Block, Milwaukee, Wis., are the Architects.

✣Bids will be received until 10:30 a. m., Nov. 18, by Department of Public Works, Milwaukee, Wis., for the necessary labor and material for the construction and erection of a fire engine house at the southeast corner of Broadway and Martin St., in the Seventh Ward of Milwaukee. H. E. Briggs is Commissioner of Public Works.

✣Bids will be received until 3 p. m., Nov. 9, by Board of Supervisors, Milwaukee County, Milwaukee, Wis., for furnishing the county of Milwaukee with lamps for lighting the Grand Ave. viaduct. F. O. Phelps is County Clerk.

✣Bids will be received until 3 p. m., Nov. 9, by Board of County Commissioners, for furnishing the County of Milwaukee with lamps for lighting the Grand Ave. viaduct. F. O. Phelps is County Clerk.

✣As previously noted bids are being asked until noon, Nov. 23, by Lt. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for building rubble mound break water at Superior Entry, Wis. The work will consist in furnishing, delivering and placing in position rubble stone to build a part of the proposed north rubble mound breakwater at Superior Entry, Wis. There is about $142,000 available, for payment under contract, and the quantity of stone to be delivered in place will depend upon the price bid. The object is: (a) To complete the rubble mound breakwater between its present easterly end as completed and the cribs of the breakwater head. (b) To complete the breakwater shoreward from its present westerly end as far as the available funds will permit. The total estimated quantity of stone to be placed to complete the north breakwater is 131,252 tons of 2,000 lbs. each. As much will be built under this contract as can be accomplished with the funds available at the unit price of the accepted bid. The stone used in this work must be of igneous origin, hard durable rock, and must weigh not less than 170 lbs. per cubic foot, generally angular in shape. The maximum weight of any one piece will not be required to exceed 10 tons. The least dimension of the 10-ton facing stones shall be not less than one-fourth the greatest. Samples of the stone weighing about 20 lbs. must be submitted ten days before the bids are opened, cost of transportation prepaid.

The Berwind Fuel Co. is to spend about $200,000 for improvements to its dock on St. Louis Bay at Superior. The dock is to be extended to the dock line, a distance of 600 ft., giving it an additional storage capacity of 150,000 tons of coal and bringing the total capacity up to 600,000. Barnett & Record Co., Minneapolis, Minn., have the contract for the extension. The contract for a new unloading rig has been let to the J. M. Dodge Co. of Philadelphia. The rig will have a four-ton unloading clam instead of the three-ton buckets now used.

The Northern Hydro-Electric Power Co., Oshkosh, Wis., is planning to develop Johnstone Falls next year. Work on the dam is to be started in the spring. The machinery, cement and other material to be used in the construction of the power plant will be hauled to the site by teams from Crivitz as soon as the sleighing is good.

Canada.

✣Bids will be received until noon, Nov. 15, by P. E. Ryan, Secretary Commissioners of Transcontinental Ry., Ottawa, Can., for the construction, etc., of ice houses at Springfield, Man., and Graham, Ont.

✣Bids will be received until 11 a. m., Nov. 16, by M. Peterson, Secretary Board of Control, Winnipeg, Man., for supply of labor and materials for the erection of a public bath house to be located in Selkirk Park. Plans and specifications are on file at the office of William Bruce, Architect, 222 McDermot Ave., Winnipeg.

✣Bids will be received until Nov. 10, at noon, by D. Paterson, Secy. Treas., Maple Creek, Sask., for the erection and installation of an electric light and power plant and flour mill.

✣Bids will be received until noon, Nov. 15, by G. R. Geary, Chairman, Board of Control, Toronto, Ont., for furnishing tungsten lamps.

Mexico.

The Wm. P. Carmichael Co., Fullerton Bldg., St. Louis, Mo., has been awarded the contract for the design and construction in reinforced concrete, of the proposed Braniff hotel to be built at the intersection of Avenida Morelos and the Paseo de la Reforma in the City of Mexico. The "raft foundation," exterior walls, interior partitions, as well as all columns, girders, and floor slabs will be of monolithic reinforced concrete.

BRIDGES—STEEL AND CONCRETE

Arkansas.

Advices from Clinton, Ark., state that the Van Buren County Levying Court has authorized the construction of a steel bridge across the north fork of Red river at a cost of $6,000, and the contract for the work will be let at once.

Engineers have filed plans with County Judge Joe Asher, Little Rock, Ark., for the construction of the viaduct over the tracks of the Iron Mountain and Rock Island on West Fourteenth St. The length of the viaduct, which is to be constructed of concrete footings and creosoted timbers, will be 192 ft. long, 36 ft. wide, allowing a 6-ft. passage on either side of the driveway, of 3 per cent grade, and when completed will cost about $1,000. The work on the viaduct will be commenced within 30 days and will be completed by the middle of January.

Information received from Camden, Ark., states that the county court has provided $40,000 for the construction of a steel bridge over the Ouachita river at that place.

California.

✣Bids will be received until noon, November 28, by Brig. Gen. Charles E. L. B. Davis, U. S. Engineer, 726 Chronicle bldg., San Francisco, Cal., for furnishing and installing electrical machinery on drawbridges across tidal canal, Oakland Harbor, Cal.

Plans have been prepared by the firm of Haviland & Tibbetts, for the construction of the proposed bridge of the San Joaquin Valley Electric R. R. over the Stanislaus river, at Modesto, Cal. The structure consists of two 80-ft. spans and is to be of reinforced concrete. The contract for the work which it is estimated will cost $33,000, will be let at once.

Board of supervisors, Oakland, Cal., are soon to call for bids for the improvement of the Webster St. bridge. The work is estimated to cost approximately $28,000. New concrete abutments will be constructed on each side, the floor is to be torn up and renewed and the iron work is to be scraped and painted.

A hearing will be held by the Board of Supervisors, Los Angeles, Cal., on the proposition to construct a concrete bridge for the Arroyo Seco on Pasadena Ave., instead of the proposed dirt fill. The cost of the bridge would range between $120,000 and $175,000.

Board of Public Works, Oakland, Cal., has awarded the contract for the construction of a culvert over Sausal Creek to the Esterly Construction Co. Bids were also received for the construction of the Bridge Ave. culvert and were referred to the City Engineer and Attorney.

Colorado.

The Santa Fe System has decided to replace its old bridge No. 119 on the Colorado division with a new 118-ft. heavy loading span with ballasted deck.

District of Columbia.

✣Bids will be received until noon, December 1, by W. J. Barden, U. S. Engineer, Washington Barracks, D. C., for furnishing white pine lumber for pontoon bridge equipage.

Illinois.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, until 11 a. m., Nov. 10, 1910, for repaving the Clark St. bridge over the Chicago River. The contractor shall furnish all tools, labor, material, etc., for making the repairs, which consist of furnishing and fabricating new floor beams, new stringers, subplanking, sidewalk brackets, guard rails, chord covers and such other materials as are shown on plans. When this work is completed and the street car rails laid (by the Chicago Railways Co.), the contractors shall furnish and lay 130 sq. yds. of creosoted block pavement, all blocks to pass a test as shown in specification. Following is the approximate amount of material necessary to complete the work. 3,000 ft. B. M. oak, 2,000 ft. B. M. white pine, 9,000 ft. B. M. yellow pine, 130 sq. yds. creosoted block pavement, and 30,000 lbs. structural steel. Plans and specifications are to be had at the above office.

An ordinance has been introduced into the City Council of Joliet, Ill., authorizing the Joliet & Southern Traction Co. to replace at its own expense, the McDonough St. structure. The roadway will be 22 ft. wide.

City Council of Danville, Ill., has adopted a resolution instructing the Committee on Bridges and the City Engineer to advertise for bids for the laying the stringers and new floor on the Gilbert St. bridge.

Highway Commissioners of Dixon and Grand Detour townships, Illinois, recently awarded the contract for the erection of a bridge on the county line road near the Prindaville farm to J. W. Kelly, Dixon, Ill., at $1,542. Other bidders were J. P. Harvey, Amboy, $1,532; Huggins & Stitzel, $1,757.

The River and Harbor Committee of the Chicago Association of Commerce has sent a request to Maj. Charles S. Bromwell, U. S. Engineer, Chicago and Milwaukee, asking him to recommend that the bridge over the Chicago river at 12th St. be declared an unreasonable obstruction to navigation, and its removal be ordered. Also that no plans for a bridge at that point be approved unless they provide for a clear channel of at least 200 ft. with 16 ft. head room across the channel.

The Santa Fe System has drawn up plans and has made arrangements for replacing bridge No. 72 with a new structure at an estimated cost of $33,000.

Commissioners of Ford County, according to advices from Bloomington, Ill., have decided upon the construction of five new steel bridges in Sullivan township this year.

Indiana.

The contract for the St. Paul bridge over Flat Rock River has been awarded the Lafayette Bridge [illegible]

Items marked thus ✣ indicate work now open for bids.

Iowa.

The Board of Supervisors, Harlan, Ia., has awarded the contract for the construction of 5 new bridges over the new Botna ditch to the Lana Construction Co., Harlan, Ia., at $10,750. There were ten other bidders for the work.

Commercial Club Civic Committee, Des Moines, Ia., has approved the plan of Wesley Ash providing that the Walnut St. bridge be moved to First St. over the Racoon River and that the river be straightened at that point. The cost of the work as estimated by the City Engineer is $40,000.

Kansas.

✣Bids will be received until Nov. 15, by Board of County Commissioners, Larned, Kan., for the construction of two new cement bridges in Pawnee County, one at Rozel, 80 ft. single arch with 18-ft. roadway, estimated to cost $5,400; the other 30-ft. single arch with 18-ft. roadway over Coon Creek west of Garfield and on the new Santa Fe trail, estimated to cost $1,400.

City Commissioners of Kansas City, Kan., have passed an ordinance providing for the construction of a viaduct across the Rock Island and Union Pacific tracks on Mill St.

Kentucky.

Advices from Paducah, Ky., state that work on the Burlington bridge at Metropolis has been delayed until Spring owing to changes made in the plans by the Board of River Engineers at Cincinnati and St. Louis. The revised drawings will call for a bridge of steel costing between $3,000,000 and $5,000,000, which will eventually carry two tracks.

Maryland.

✣Bids will be received until 2 p. m., Nov. 19, by Mayor and Commissioners of Westernport, Md., for constructing a bridge over George's Creek within the town of Westernport, Alleghany County, Md. O. H. Bruce is City Clerk. Plans and specifications can be obtained at the office of William Harvey, City Engineer.

Michigan.

The Joint Committee on County Roads and Bridges have reported favorably to the Board of Supervisors at Saginaw, Mich., regarding the additional appropriation of $2,500 for the filling in of that section of State St. bridge approach which recently caved in. The committee also recommends the construction of two bridges over the Bad River in Brant Road.

Advices from Escanaba, Mich., state that Board of County Supervisors of Delta County have voted to submit to the voters of that county at the next election the proposition of issuing bonds amounting to $40,000 for the construction of a modern concrete bridge over the Escanaba River at Wells.

The Michigan United Ry. Co., according to advices from Marshall, Mich., will construct an overhead bridge at Guin Crossing, east of Battle Creek.

Minnesota.

✣Bids will be received until 2 p. m., Nov. 29, by Department of the Interior, Office of Indian Affairs, Washington, D. C., for the construction of a steel bridge over the Clearwater River, Red Lake Indian Reservation, Minn. Materials must be furnished by the contractor. F. H. Abbott is Assistant Commissioner.

Plans prepared by City Engineer L. W. Rundlett, St. Paul, Minn., for the construction of the proposed bridge over the railroad tracks at E. 7th and Earl Sts., calling for a concrete structure with a 30-ft. driveway, were recently under discussion and Alderman W. Baumeister suggested that plans be prepared for a steel structure.

City Council of St. Paul, Minn., has under consideration the construction of a 60-ft. concrete bridge over the Omaha & Northern Pacific R. R. tracks at E. 7th St. and Earl St. The bridge proper is to be built by the railroads, but the approaches costing probably $50,000, half of which is already available, are to be built by the city.

Missouri.

Board of Public Works, St. Joseph, Mo., has received from Henry Auerbach, New York, a set of plans for the construction of the proposed viaduct in South Sixth St. near the present Union Depot; cost is estimated at $252,350. A conference will be held with the City Council in the near future for the purpose of considering the matter.

City Council of St. Louis, Mo., has passed a bill authorizing the appropriation of $50,950 for land to be used for the approaches of the municipal free bridge.

New Jersey.

Joint Bridge Committee of the Essex and Hudson Board of Freeholders, have decided to recommend that instead of spending money on repairs to the Bridge St. bridge over the Passaic, Newark, N. J., an entirely new structure be built.

New York.

✣Bids will be received until 3 p. m., Nov. 17, by Department of Parks, New York City, for the repairing of three bridges in Forrest Park, Borough of Queens. Charles B. Stover is President.

✣Bids will be received until noon, Nov. 10, by Superintendent F. C. Stevens, Public Works, Albany, N. Y., for the construction of a lift bridge over the Erie Canal at Franklin St., Syracuse, N. Y. Plans may be seen and blank forms for proposals and specifications may be obtained at the office of the superintendent of Public Works, at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division, at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the western division at Rochester, N. Y., and at the canal office, Spauldings Exchange, Buffalo, N. Y.

The taxpayers of the town of Niagara Falls, N. Y., at the next election will vote on the question of building a new bridge over Cayuga Creek near LaSalle, work which has been recommended by the State Highway Commission in connection with the Buffalo Falls Blvd.

Plans have again been filed by the Engineering Department of the New York Central R. R. for the elimination of the Van Woert St. crossing, Albany, N. Y., and as soon as the Mayor approves same, they will be turned over to the Public Service Commission for approval and work started immediately.

Town Clerk of Carlton, N. Y., has called a special meeting to be held soon to vote on the propositions to borrow $6,800 for the construction of two bridges.

North Dakota.

The Park Commissioners at Bismarck, N. Dak., have awarded the contract for the construction of the new concrete bridge and pergola for Oak Glen Park to J. R. Sorenson, at $1,900. The other bidders were The Easterly Construction Co., $3,883; F. E. Nelson, $2,481.

Ohio.

✣Bids will be received until 11 a. m., Nov. 16, by Board of County Commissioners, Cleveland, O., for furnishing the necessary labor and material for the elimination of the grade crossing of the Pennsylvania and W. & L. E. Railroads, Dunham Road, in Bedford township, by the construction of an overhead bridge across the said railroads on Dunham Road, between Granger Road and Bedford Road. John F. Goldenbogen is Clerk.

✣Bids will be received until noon, Nov. 11, by Board of County Commissioners, Cincinnati, O., for the construction, under Specifications No. 121, of a concrete bridge on Fallis Road, second bridge north of Loveland, in Symmes township. Fred Dreihs is Clerk of the Board.

The County Commissioners, according to advices from Greenville, O., have granted John Ludy the contract for the construction of two bridges, one in Harrison township, and the other, known as the Sentman bridge. The combined cost is $1,126.

Charles Patterson, 7606 Shaw Ave., Cleveland, O., was awarded the contract by the County Commissioners at Cleveland, for the construction of a concrete bridge on Clegue Road, in Dover township, under Report No. 2478; concrete floor and extension to bridge on Dover Center Road, Report No. 2701. Bids were opened Oct. 5.

Commissioners of Cuyahoga County, at Cleveland, O., have directed County Engineer Lander to prepare plans and specifications for the construction of a new 40-ft. concrete bride on the boulevard over Eddy brook, in Bratenahl township.

Citizens in the South End of Cleveland, O., are signing a petition asking for the construction of a high level bridge across the Clark Ave. route to connect the East and West sides of the city. The cost of such a structure is estimated at $1,000,000.

As a result of conferences held by Councilman Cliff Martin of the Third Ward, with City Solicitor Ballard regarding the proposed bond issue for the Gilbert Ave. viaduct, plans have been prepared by Bridge Engineer Frank Morris, which will effect a saving of $60,000 for the city of Cincinnati, O.

It has been decided by the County Commissioners, Defiance, O., to place the remaining span of the old Frances St. river bridge over the Tiffin River, in Tiffin township.

Oregon.

Committee of the City Council, Portland, Ore., recently instructed City Engineer Morris to prepare plans and estimates of the cost of building a steel bridge across the Willamette River with approaches located at Ellsworth St. on the East Side, and Meade St. on the West Side.

Pennsylvania.

The Penn Bridge Co., Beaver Falls, Pa., mentioned as low bidder for the construction of new river bridge connecting Plymouth with Breslau, in our last issue, has been awarded the contract. The contract price was $276,973. This bid provides for a substantial structure of steel and concrete, heavy enough to carry railroad tracks for trolley lines. The roadway will also be of concrete.

Town Council of Shippensburg, Pa., has adopted a resolution authorizing the Secretary to call for bids for the construction of a bridge over Main's Run at King St. during the year of 1911. Plans and specifications will be prepared by the Borough Engineer for a structure capable of supporting a 15-ton road roller.

A project is under consideration involving the construction of a viaduct over the railroad tracks from the foot of Mulberry St. to Providence Road, Scranton, Pa. The cost of the structure is estimated at $200,000. One-half the amount will be borne by the American Rys. Co., one-eighth by the Delaware and Hudson Company, and three-eighths by the city. An ordinance was passed two years ago by the City Council authorizing a $75,000 bond issue, which was reserved for this purpose.

South Carolina.

✣Bids will be received until noon, Nov. 10, by J. P. Goodwin, County Supervisor, Greenville, S. C., for the construction of steel bridge over Mush Creek, near Tigerville, and one over Brushy Creek, on Augusta Rd., 5 miles from Greenville.

Texas.

✣Bids will be received until 10 a. m., Nov. 14, by C. J. McKenna, County Auditor, Fort Worth, Texas, for the construction of a concrete bridge over Sycamore Creek; also for the construction of a steel bridge over Little Bear Creek on Smithfield and Pleasant Run Rd.; the latter structure will be 40 ft. long.

The Commissioners' Court, Dallas, Tex., has awarded the contract for furnishing 55,000 barrels of cement for the construction of the Dallas-Oak Cliff viaduct, to the Southwestern States Portland Cement Co., Dallas, Tex., at $1.48 per barrel, with a refund of

10 cents for each sack returned in good condition. Other bidders were Southwestern Portland Cement Co., El Paso, $1.70 per barrel; Texas Portland Cement Co., Dallas, Tex., $1.48 per barrel.

County Commissioners, Fort Worth, Tex., have ordered that the petition of Fred Scharf and others be granted for the construction of a bridge over Sycamore Creek, and that bids be asked for a bridge over Little Bear Creek on the Smithfield and Pleasant Run Road in Precinct 3.

Advices from Cameron, Tex., state that bids were received Nov. 2 for the construction of two steel bridges and one steel approach. One structure to be built on Brushy Creek near Thorndale, and the other on Big Pond Creek, about 12 miles northeast of Cameron.

Washington.

✣Bids will be received until 10 a. m., Nov. 11, by Board of Public Works, Seattle, Wash., for an improvement, including the construction of a 200-ft. timber swing bridge, complete with piers, protection, etc., and suitable approaches thereto. C. B. Bagley is Secy. Board of Public Works.

West Virginia.

All bids received recently by the Board of County Commissioners, Wheeling, W. Va., for the construction of the proposed bridge over Woods Run on Bethany Pike, were rejected as the lowest bid, that of Faris Co., Pittsburg, Pa., $3,450, was too high. The work will soon be readvertised.

A company has been chartered to construct a bridge over the Ohio River between Bellaire and Benwood and as U. S. Engineers seem to deal with the proposition favorably, it is believed that the project will go through. Members of the company are: R. M. Gilleland, Bellaire; E. B. Bowie, Wheeling, W. Va., and George A. Blackford, Martins Ferry.

Wisconsin.

Alderman Henry Smith will ask the City Council of Milwaukee, Wis., to provide a $150,000 bond issue in the next budget for the construction of a bridge across the upper Milwaukee River at Wright St.

Canada.

Among the number of by-laws proposed by the Works Committee to submit to the ratepayers of Toronto, Ont., are the following: One for $500,000 to carry out improvements at Ashbridges Bay; another for $75,000 for the construction of a subway on Coxwell Ave.; last for $175,000 for the construction of a viaduct to connect Parliament St. with the proposed Bloor St. viaduct.

ROADS, STREETS AND PAVEMENTS

Alabama.

The city of Cullman, Ala., contemplates constructing several miles of cement sidewalks. M. L. Robertson is Mayor.

Arizona.

The Board of Supervisors at Phoenix, Ariz., on Oct. 24, opened bids for the construction of the road between Wickenburg and Morristown, by the way of Tub Springs, a distance of a little more than 20 miles. The contract was awarded to F. B. Jacobs for $2,750. Six miles of new road is to be constructed and extensive repairs will be made on sections of the old road.

Arkansas.

M. D. L. Cook of Little Rock, Ark., has been awarded a contract in that city for the paving of Rock and Scott Sts., from 4th to 15th Sts., a distance of 11 blocks on each street, with asphalt concrete, for $40,000.

Bids were opened Oct. 25 in the office of D. A. McRae, engineer for the Main street district, Little Rock, Ark., for the paving of Main street, from Markham to Eighth street. The following bid on the work: Memphis Asphalt & Paving Co., M. D. L. Cook Asphalt Co., of Little Rock; Ayer & Lord Tie Co., of Chicago, Ill.; Stewart & McGehee Construction Co., of Little Rock; Conway & Co., of Texarkana, and Joseph McCoppin, of Little Rock.

California.

The city council of Bakersfield, Cal., has instructed the city engineer to advertise for bids for a 10 and 12-ton steam traction road roller.

B. R. Davison Contracting Co., of Monrovia, Cal., has been awarded the contract by the city of Huntington Beach., Cal., for paving, with petrolithic, Walnut and Olive Aves. J. C. Fountain, City Engineer.

According to advices from San Pedro, Cal., a survey has been completed for the proposed boulevard from the west basin to the outer harbor and bids for the work will be asked for soon. John Melville, Deputy City Engineer, had charge of the survey.

The board of trustees of Visalia, Cal., has awarded the contract for paving Acequia St., from the westerly line of Court St. to the easterly property line of Gardon St., with asphalt concrete pavement, to the Worswick Street Paving Co.

County Surveyor Reading, George O'Grady and Charles Basler, viewers appointed by the supervisors of Shasta County, Cal., have made a survey for improvements on the wagon road between Kennett and Keswick. They recommend the building of two miles of new road from Squaw Creek towards Coram, and a completely new road from Coram to Copley.

Secretary Burke, of the Board of Trade, of Bakersfield, Cal., has applied for a government engineer to survey a highway through the government reserve from that county to the coast by way of Nordhoff and the Sespe Springs.

Colorado.

The County Commissioners of El Paso County, Colorado Springs, Colo., have issued a comprehensive statement showing in detail road improvements that will be made if the bond issue of $110,000 at the November election is approved. Eleven roads will be made or greatly improved, and the work will be done under the supervision of an experienced road engineer. All roads are to be properly surfaced, graded and drained, bridges are to be of concrete, masonry or some other permanent material, and all culverts are to be of concrete or iron.. The estimated cost of these improvements is in the neighborhood of $200,000.

Connecticut.

✣Bids will be received until 2 p. m., Nov. 14, by State Highway Commission, Hartford. Conn., for the following road work: 3,300 lin. ft. macadam road and 6,598 lin. ft. gravel in Naugatuck; 11,900 lin. ft. grading on Torrington Rd., and 10,100 lin. ft. grading on Winsted Rd. in Norfolk; 2,000 lin. ft. grading on River Rd. in Huntington; 7,277 lin. ft. grading on Falls Village Rd. in Canaan; 4,165 lin. ft. grading in New Fairfield; 5,055 lin. ft. gravel road in Southbury; 11,230 lin. ft. gravel road in Plainfield; 11,997 lin. ft. of gravel in Danbury on the Danbury and Norwalk turnpike.

Charles F. A. Biltz has been awarded a contract in Bridgeport, Conn., for paving State St., from Main to Broad Sts., with wood blocks, for $1.20 per sq. yd.

The Lane Construction Corporation has been awarded a contract in Wethersfield, Conn., for the construction of about 4,500 lin. ft. of macadam road, bids for which were received on Oct. 28, by the board of selectmen. The company's bid was as follows: $1.14 a lin. ft., for a 12-ft. roadway and $1.49 a lin. ft. for a 16-ft. roadway.

Florida.

✣Bids will be received until Nov. [illegible] by G. L. Baltzell, City Clerk, Fernandina, Fla., for paving Center St., from 5th to 11th St., with vitrified brick.

The city of West Palm Beach, Fla., voted on Nov. 6 on the issuance of $4,000 in bonds for street paving.

The city of Fernandina, Fla., has decided to pave Center St., from 5th to 11th St., with vitrified brick. G. L. Baltzell is City Clerk.

Georgia.

✣Bids will be received until November 22, by City Council, Dalton, Ga., for the construction of pavement on Hamilton, Crawford and King streets.

✣Bids will be received until 3 p. m., Nov. 22, by City Council, Dalton, Ga., for furnishing the necessary labor and material for the construction of the following street improvement, including: Approximately 28,000 sq. yds. of street paving (vitrified brick, wood block, bitulithic, granitoid and asphalt will be considered), with all necessary drainage and granite curb as specified. W. M. Carroll is City Clerk and H. S. Jaudon Engineering Co., Savannah, Ga., and Atlanta, Ga., engineers.

The citizens of DeKalb county, Decatur, Ga., recently held a meeting at Decatur to discuss the advisability of issuing $300,000 worth of bonds for improving the roads in that county.

H. S. Jaudon Engineering Co., of Savannah, Ga., has prepared plans and specifications for the construction of approximately 28,000 sq. yds. of street paving in Dalton, Ga. Paul B. Tremmell, Mayor.

Illinois.

The Board of Local Improvements of Chicago, Ill., has ordered Wabash avenue paved with creosote blocks between Washington and Congress streets.

The village officials of McHenry, Ill., have decided to macadamize a number of streets of the town.

Engineer Wilson, of Batavia, Ill., has begun a survey of Main street, for the paving of five blocks of that street with bitulithic macadam from Water street, westward to the Burlington tracks. The estimated cost of the improvement is $8,000. Barton E. Sperry is mayor.

South of the Vady stone quarry in the east end of Moline, Ill., the John Cady third addition will be opened this spring. The district lies between 38th and 34th streets, and between 11th avenue and a line 1,250 feet from the south line. Mr. Cady has let the contract for grading and general landscape work to Henry Klehm, who will construct the macadam roads, etc.

The Board of Local Improvements of Chicago, Ill., contemplates paving Cottage Grove avenue, along the east side of Washington park, between East 51st and East 59th Sts.

The following contracts have been awarded by the Board of Local Improvements, city of Chicago, Chas. A. V. Standish, secy., room 302, City Hall; Avenue "L" 96th St. to 104th St., H. P. Larsen, 140 LaSalle St.; Elm St., Milton St. to Crosby St., Albert Groff, 70 LaSalle St.; Ewing St., Halsted St. to Blue Island Ave., H. P. Larsen; Grace St., Elston Ave. to Central Park Ave., H. P. Larsen, Harbor Ave., The Strand to 92d St., General Cement Construction Co., 160 Washington St.; Halsted St., 43d St. to 47th St., A. Groff; Hammond St., Tell St., to Eugenie St., General Cement Construction Co.; Lawrence Ave., Drainage Canal to Albany Ave., Bairstow Supply Co., 6084 Ridge Ave.; Murphy Ave., Birchwood Ave. to Rogers Park Ave., Bairstow Supply Co.; Maxwell St., Halsted St. to Blue Island Ave., General Cement Construction Co.; Ontario St., Lake Shore Drive to

St. Clair St., A. Groff; Stony Island Ave., 60th St. to 63d St., H. P. Larsen; 35th St., Halsted St. to Morgan St., A. Groff; Wellington St., Sacramento Ave. to Whipple St., H. P. Larsen; 17th St. system, including 17th St., Dearborn St., etc., A. Groff; Lawrence Ave. system, including Lawrence Ave., 56th Ave., etc., Demling & Wendt, 84 LaSalle St.; Grand Ave. system, including Grand Ave., 44th Ave., etc., G. Kehl & Son Co., 1224 N. Campbell Ave.; Harrison St. system, including Harrison St., 45th Court, etc., H. P. Larsen; 33d St. system, including 33d St., Wood St., etc., A. Groff; 72d St. system, including 72d St., South Park Ave., etc., P. F. Biesen, 145 LaSalle St.; 39th St. system, including 39th St., Halsted St., etc., A. Groff; 71st St. system, including 71st St., State St., etc., P. F. Biesen, 145 LaSalle St.; Hirsch St. system, including Hirsch St., 42d Ave., etc., Skafgard Concrete Construction Co., 4024 W. North Ave.; Hirsch St. system, including Hirsch St., 44th Ave., etc., Skafgard Concrete Construction Co.; North St. system, including North Rd., 44th Ave., etc., Skafgard Concrete Construction Co. Prices for this work were published in ENGINEERING-CONTRACTING of November 3.

E. J. Wetterstrom of Chicago, Ill., has been awarded a contract in Little Rock, Ark., for paving Main St., from Markham to 10th St., with wooden blocks for $50,000.

Indiana.

✣Bids will be received until 7:30 p. m., Nov. 14, by common council, Wabash, Ind., for the completion of improvement of Thorne street by resurfacing with broken stone. William L. Ogan is clerk of the city.

✣Bids will be received until 10 a. m., Nov. 22, by Board of County Commissioners, Anderson, Ind., for the improvement by grading, graveling or macadamizing the Charles L. Webb et al. road in Anderson and Lafayette townships. W. T. Richards is county auditor.

A petition is being circulated by Henry Smith of Jonesboro, Ind., for the improvement of a road in Mill township under the provision of the three-mile road law. The improvement is to be made with crushed stone on the road beginning at the intersection of the Marion and Jonesboro and the Deer Creek and Kokomo gravel roads.

Edward Pennington has been awarded a contract by the board of public works of Vincennes, Ind., for the improvement of Broadway, from 14th St. to the city ditch, with concrete walks, the contract price being $.08 a sq. ft., and $.36 a lin. ft. for stone curb.

Iowa.

The Department of Streets and Public Improvements of Des Moines, Ia., contemplates purchasing an asphalt plant for the manufacture of asphalt. John MacVicar is superintendent of the department.

A county association will probably be formed in Wapello county, Ia., for the purpose of improving the roads in that section around Ottumwa.

According to a statement reported to have been made by City Engineer Keyes C. Gaynor of Sioux City, Ia., an asphalt repair plant will hereafter be maintained by that city.

Maryland.

✣Bids will be received until noon, Nov. 15, by county commissioners, Annapolis, Md., for improving the public highway from Shipley Station, 1½ miles south, known as the Annapolis Rd., Sec. 2. S. O. Tilghman is Clerk.

It is stated that the United States Fidelity & Guaranty Co., of Baltimore, Md., the contractor's bondsman for the completion of the section of state road embraced by the Baltimore turnpike between Cumberland and the Six-Mile House, has secured J. E. Francis to complete the six-mile stretch.

Michigan.

Gogebic county, Mich., which has adopted the county road system, will spend $33,000 in good roads construction the coming year. The board of road commissioners recently asked that that amount be appropriated, the same to be expended on the trunk road between Ironwood and Bessemer and between Wakefield and Dunham. Bessemer is the county seat of Gogebic county.

The Board of Supervisors of Wayne County, Detroit, Mich., has approved of the submission of the $2,000,000 bonding proposition for good roads in Wayne county to the vote of the people Nov. 8.

Minnesota.

✣Bids will be received until 2 p. m., Nov. 10, by board of public works, St. Paul, Minn., for curbing with cement curb Van Buren St., from Snelling Ave. to Wheeler Ave. P. Van Horn is President of the board.

✣Bids will be received until 2 p. m., Nov. 10, by board of public works, St. Paul, Minn., for the grading of Kilburn St., from Union St. to the right of way of the Northern Pacific Ry. R. L. Gorman is Clerk of the board of public works.

The City Council of Crookston, Minn., which recently rejected all bids received for the paving in that city with creosote block, Donnelite, asphalt and other materials, will probably decide on the use of asphalt for the entire district.

Missouri.

A petition has been filed with the county court at Springfield, Mo., by residents of the Walnut Grove neighborhood of that city, asking the court to award $500 to that section to be expended on the roads of that district.

Plans and specifications for the construction of stone block pavement were adopted by the board of public works of Kansas City, Mo., as follows: St. Louis Ave., from Wyoming St., north of St. Louis Ave., to Turner & Co.'s Addition; St. Louis Ave., from Turner Co.'s Addition to Santa Fe St.; St. Louis Ave., from Santa Fe St., to the westerly line produced northerly, of Union Ave.; Hickory St., from alley next west of Ninth St. to St. Louis Ave.; Santa Fe St., from St. Louis Ave. to Union Ave.

Nebraska.

The city of Omaha, Neb., has awarded the contract for the repaving of Broadway, from 1st to 6th Sts., with Galesburg blocks, to E. A. Wickham of that city for $27,030.

The City Council of Omaha, Neb., has awarded the National Construction Co., paving contracts amounting to about $70,000. The work includes the paving of the alley between 24th and 25th Sts., from C to D Sts.; G St., from 25th to 26th St.; I St., from 18th to 25th St.; 23d St., from the city limits to I St.; 23d St., from I to J Sts.; 27th St., from C to F Sts.; J St., from 22d St. to 24th St. In most cases the material designated was asphaltic concrete, class A.

The Park Board of Omaha, Neb., has decided to eliminate the trouble experienced this year in getting material for paving and macadamizing roads by purchasing a stone quarry, from which they can supply their own material.

The City Council of Lincoln, Neb., has passed an ordinance providing for the repaving of 10th St. between Q and R Sts., on the east side of the street.

A petition has been filed in the city clerk's office, Hastings, Neb., for paving Burlington Ave., between Second and Third Sts.

New Jersey.

✣Bids will be received until 3:30 p. m., Nov. 10, by board of water commissioners of the city of Newark, N. J., for the construction of the following street improvement work: Warwick St. sewer, between Tyler St. and Lang St.; Avenue A, storm water sewer; paving Hackett St. from Plane St. 245 ft. westerly; paving of Watson Ave. from Elizabeth Ave. to Jelliff Ave.; paving Rose St. from Bergen St. to Kipp St.; paving of Berkeley Ave. from Mt. Prospect Ave. to Lake St.; repaving of East Kinney Pl. from East Kinney St. northerly about 338 ft.; repaving of Pierson's Alley from Market St. to Bank St.; grading, curbing and flagging of 3d Ave. from 5th St. to Roseville; flagging Bryant St. from Lincoln Ave. to Summer Ave.

✣Bids will be received until 3:30 p. m., Nov. 10, by board of street and water commissioner, Newark, N. J., for grading, curbing and flagging Hillside Ave. from Watson Ave. northerly about 112 ft.; New York Ave. from Garrison St. to Jabez St.; Parkhurst St., from Goble St. to Ave. C; also for paving of Hedden Pl. from Orange St. to the East Orange line and 13th Ave. from South 10th St. to South 12th St.

The contract for the construction of 8,450 sq. yds. of creosoted wood paving blocks on Cookman Ave., from Grand Ave. to Kingsley St., in Ashbury Park, N. J., has been awarded to the U. S. Wood Preserving Co., of New York City, for 2.42½ a sq. yd. Bids were received Oct. 31.

New York.

✣Bids will be received until 11 a. m., Nov. 16, by President of the Borough of Manhattan, New York City, for four street improvement contracts, the largest being No. 3, as follows: For regulating and repaving with asphalt pavement on a concrete foundation, the roadway of 17th St., from Prospect Park west to Terrace Pl., together with all work incidental thereto. The engineer's estimate of the quantities is as follows: 5,800 sq. yds. asphalt pavement, 5 years' maintenance; 805 cu. yds. concrete for pavement foundation; 2,675 lin. ft. new curbstone set in concrete; 670 lin. ft. old curbstone reset in concrete; 17 noiseless covers and heads for sewer manholes. The time allowed for the completion of the work and the full performance of the contract is 30 working days. The amount of security required is $4,200.

The Dunkirk Construction Co., of Dunkirk, N. Y., has received the contract for laying 17,000 sq. yds. of brick pavement in Olean, N. Y. The aggregate cost is $30,000.

The work of making a preliminary survey of the Trenton road, running from Deerfield Corners to Trenton, in Oneida County, N. Y., has been begun at the Deerfield end. The board of supervisors at Utica, N. Y., voted last spring to improve the road as a county highway.

North Dakota.

City Engineer Frank L. Anders, of Fargo, N. Dak., has under preparation a general scheme for the paving of Fargo residence streets. Brick and asphalt will probably be used.

Ohio.

✣Bids will be received until noon, November 15, by Director of Public Service, Columbus, Ohio, for furnishing the necessary labor and material for the improvement of High St. from Fifth Ave. to Dodridge St., by grading, draining, curbing and repaving the roadway with sheet asphalt, brick wood or stone block, and laying water service pipe. David A. Jones is clerk.

✣Bids will be received until 10 a. m., Nov. 12, by James Swisher, County Surveyor, Urbana, O., for the work of constructing 692.5 cu. yds. of gravel pike, beginning at the southeast corner of B. F. Miller's land, in Wayne township on the center line of the Urbana and Cable pike, thence northerly with the center line of said pike for distance.

✣Bids will be received until noon, Nov. 19 (instead of Nov. 8, as noted in our last issue) by Board of County Commissioners, Cincinnati, O., for the construction of improvements, under Specifications No. 87, of change in River Road through lands of William Knollman and Fred Kinsler, in Crosby township.

✣Bids will be received until 11 a. m., November 26, by board of commissioners, Cleveland, O., for grading Granger Road at Station 45 in South Newburg township. Frank R. Lander is County Engineer.

The County Commissioners at Portsmouth, O., have awarded contracts for building and repairing three county roads, as follows: For the grading, grubbing and building 2,400 ft. on the Fallen Timber and Miller's Run Road, Andrew Haggerty, $930; for graveling three sections of the Rocky Fork Road in Brush Creek township, section 1, W. H. Ewing, $.23

per yd.; section 2, Will Koening, $.30 per yd.; section 3, S. C. Robinson, $.27 per yd.; for graveling the Otway and Wamsleyville road, from Otway to the residence of George Hazelbaker, Thomas Riley, $.30 per yd.

The city council of Greenville, O., has adopted resolutions declaring it necessary to improve West 3d St., from Race St. to Chestnut St. and the south end of Race St., with macadam and storm sewers. L. N. Jackson, City Engineer.

Bids will be received in Springfield, O., for the improvement of Sigler St. extension in West Springfield, according to plans and specifications on file at office of Winters-Coleman Scale Co., or Duplex Mill & Manufacturing Co. Contracts will be let as soon as possible and work to be completed promptly.

Plans for the paving of Virgin alley, from Riverside Ave., to Broadway, have been approved by the city council of Wellsville, O.

The City Council of Portsmouth, O., contemplates paving all of the principal alleys in the city for next spring.

It was decided by the township trustees in a joint meeting of Goshen township and Union township to cut and grade the hill on the Mechanicsburg pike in front of George Willet's. The trustees of Union township will continue the improvement one mile from the township line west toward Mutual.

Plans are being worked out by Engineer Swisher for the commissioners of Champaign County, Urbana, O., to improve the pike extending north from St. Paris, one mile into Johnson township with stone. The improvement will begin at the township line of Springfield St., within the town limits.

Oklahoma.

The city of Oklahoma City, Okla., will grade 15th, 14th, 13th, 12th and 11th Sts., Indiana, Kentucky and Louisa Aves. Henry M. Scales is Mayor.

The City Commissioners of Tulsa, Oklo., have passed an ordinance providing for the paving of District No. 30, Guthrie, from Ninth southward to the city limits, which will cost $13,396.

A. S. Hawkins, state highway engineer of Oklahoma, has started out with a surveying party to make a permanent survey for the state highway from McAlester directly north to Claremore.

Headquarters for the Oklahoma State Good Roads Association has been established on the 12th floor of the Colcord bldg., Oklahoma, Okla., by Clark Hudson, secretary of the organization. The association will co-operate with the state highway engineer and highway inspector in the interest of building roads throughout the state. Mr. Hudson is now devoting his efforts toward the building of two surfaced highways across the county and lateral roads leading thereto. An election is to be held Nov. 8 to vote on the proposition of county aid.

Oregon.

The following bids have been received by the city executive board of Portland, Ore., for street work: East Burnside St., from E. 74th to E. 82d, grading and concrete curbs and walks, G. K. Howlett Co., $5,437; E. 26th St., from Holgate to Powell, grading and concrete curbs and walks, M. Hansen, $6,573; Albina Ave., from W. Piedmont to Portland Blvd., grading Bechill Bros., $1,173; E. 32d St., from E. Harrison to E. Sherman, grading and concrete curbs and walks, Stevens Bros., $2,494; Lane St. Dist., concrete pavement, Giebisch & Joplin, $25,228; E. 46th St., from Broadway to Halsey, grading and concrete curbs and walks, Carter Bros., $1,204; E. Harrison St., from E. 30th to Sunnyside, grading and concrete curbs and walks, Giebisch & Joplin, $2,066.

Plans to extend Grand Ave., to a connection with Milwaukee St., in Portland, Ore., have about matured. The avenue will be extended south along the brink of the bluff above the Willamette river next year. The avenue will also be paved next year to Ellsworth St., and perhaps to the end of the extension.

A meeting is under consideration, and will doubtless be called at an early date in West Salem, Ore., to discuss road improvement and the matter of voting a special tax for the district.

Pennsylvania.

✣Bids will be received until 3 p. m., Nov. 11 by the Board of Public Works, Altoona, Pa., W. M. C. Craine, president, for grading and paving with vitrified brick on concrete foundation and maintenance under several ordinances duly passed and approved, together with the setting and resetting of curbing, where required of portions of about thirty streets. Plans and specifications are on file at the office of the city engineer.

The Borough Council of Punxsutawney, Pa., on Oct. 26 awarded the contract for the paving and curbing of South Penn St., South Jefferson St., Union St., and Cranberry alley to P. E. and P. J. McGovern, for a sum aggregating $12,342. There are 7,350 sq. yds. of paving in the contract and the specifications call for wire-cut brick.

A resolution has been introduced in the City Council of Scranton, Pa., asking for plans and an estimate of the cost of paving Olive St., between Wyoming and Adams Aves.

The City Council of Harrisburg, Pa., on Oct. 31, awarded contracts for the paving of 67 streets in the city as follows: Barber Asphalt Co., 102,908 sq. yds. of paving and 102,639 ft. of curbing, for 47 streets; The Central Construction & Supply Co., 71,935 sq. yds. of paving and 57,997 ft. of curbing, for 19 streets; Stucker Bros., for paving State St., from Canal to 10th St., with brick, $4,908.

The Cement Products Co., has been awarded the contract in Erie, Pa., for the paving of German St., from Front St. south to Fourth St., for $1.20 per sq. yd.

The commissioners of Luzerne county, Wilkes-Barre, Pa., are having a survey made of a proposed route for a road from Fairview to White Haven, and for a short road from Fairview to Hazleton, to connect with the system of macadam roads to Sugarloaf. The proposed connecting link from the stone bridge on the Ashley Blvd., to Laurel Run, is also considered, a petition having been submitted asking for the road.

Tennessee.

The special road committee of the Bristol, Tenn., board of trade held a meeting recently to further consider plans for having the Bristol-Blountsville pike extended to Kingsport. About eight miles of construction work will be provided for.

Texas.

✣Bids will be received until noon, Nov. 14, by John M. Murch, county Auditor, Galveston, Texas, for the improvement of Seawall Blvd. from Ave. H to 16th St., including approximately 9,300 sq. yds. of concrete sidewalk; 5,400 ft. of concrete curbing; 5,500 ft. of 10 in. retaining curb.

The city engineer of Temple, Tex., will prepare plans and specifications for about three-quarters of a mile of paving on North Main St. and French Ave.

A petition has been received by the City Council of Dallas, Tex., for the paving of Fort Worth Ave., formerly Davis St., Oak Cliff, to the city limits.

Innes Gano has been awarded a contract by the City Commissioners of Dallas, Tex., for grading Rawlins St., from Throckmorton to Coke St., for 30c. per cu. yd.

The Municipal Commission of Dallas, Tex., has ordered the paving with Jacksboro rock of Rawlins St., from Oak Lawn Ave. to Coke St., and Coke St., from Rawlins to Hall St. The work is to be done by the city.

A movement is now on foot to have a petition submitted to the board of city commissioners of Galveston, Tex., asking that Avenue P from Tremont St. to 19th St., be paved with vitrified brick pavement, with a concrete curb and gutter. The petition will also request that 21st St., from the seawall boulevard to Avenue P shall also be paved with vitrified brick.

The City Commissioners of Dallas, Tex., instructed Secretary Winslett to advertise for bids for the paving of Holmes St., from Grand Ave. to Pennsylvania Ave., and Grand Ave., from Ervay St. to Holmes St. Bids are to be asked on bitulithic, wooden blocks, vitrified brick and asphaltic concrete.

The city secretary of Dallas, Tex., was instructed by the city commissioners to advertise for bids for the construction of combination curb and gutter on both sides of Rawlins St., from Oak Lawn Ave. to Coke St., and on Coke St., from Rawlins St. to Hall St.

The city engineer of Temple, Tex., has been instructed to prepare specifications for the paving of North Main St., from Adams Ave. to French Ave., and French Ave., from Main St. to Ninth St. The amount of paving required in the district aggregates 10 city blocks or about three-fourths of a mile. Bids will be asked for vitrified brick, hassam and wood block paving.

The citizens of Groesbeeck, Tex., have just voted in favor of the proposition of building sidewalks in the town.

Fay McClure, government road engineer, recently left San Antonio, Tex., in company with a delegation from the San Antonio Automobile Club to inspect the proposed route of the auto road from that city to Corpus Christi.

Preparations for the paving of the business streets of Abilene, Tex., are being made. Several blocks are to be paved at an estimated cost of $150,000.

Utah.

Allen & Austin have received the contract for the construction of about 2,000 sq. ft. of cement paving around the grounds of the Waterloo school, in Salt Lake City, Utah, for 17c. per sq. ft.

Virginia.

The finance committee of Norfolk, Va., has recommended to the city council an ordinance providing for the paving of Bank St., from Freemason to Queen St., with smooth material, and an appropriation of $14,500.

The Central Improvement Association of Norfolk, Va., together with the local board of improvement and city council, are considering the paving of streets in the Sixth and Seventh wards.

Washington.

✣Bids will be received until 10 a. m., Nov. 11, by C. B. Bagley, secy. board of public works, Seattle, Wash., for the improvement of Washington St., from 30th Ave. south to 31st Ave. south, and 31st Ave. south, from Yesler Way to Washington St., all in the city of Seattle, by grading and curbing the same, constructing concrete sidewalks, together with all necessary cross-walks, and providing for the necessary surface drainage.

✣Bids will be received until 10 a. m., Nov. 11, by board of public works, Seattle, Wash., for the improvement of 32d Ave. south, from Yesler Way to Washington St., and Washington Ave., from 32d Ave. south, to the east line of H. E. Holmes Addition to the city, by grading the same, constructing wood curb and gutters and concrete walks with necessary cross-walks, and providing necessary surface drainage. C. B. Bagley is secretary of public works.

✣Bids will be received until 10 a. m., Nov. 11, by board of public works, Seattle, Wash., for the improvement of East 47th St., from 7th Ave. northeast to Tenth Ave. northeast; 8th Ave. northeast, from E. 47th St. to E. 50th St.; Ninth Ave. northeast, from E. 45th St. to E. 50th St., and 10th Ave. northeast, from E. 45th St. to E. 47th St., all in the city of Seattle, by grading and curbing the same, and providing for the necessary surface and subdrainage.

City Engineer C. W. Ewart, of Aberdeen, Wash., has presented profiles and an estimate of the probable cost of the construction of the proposed road around Dabney hill.

The first rural improvement district in Wenatchee, Wash., section has been formed by the residents of East Wenatchee, across the Columbia river from Wenatchee. The district includes the territory between the Columbia river bridge and Rock Island. A 16-ft. macadam road will be constructed to cost approximately $25,000.

Charles Lindberry, county engineer, Bellingham, Wash., will soon prepare plans and specifications for a highway, macadamized and 24 ft. in width, from the northern to the southern boundary of Whatcom county. A. W. Troutman, City Engineer.

Wisconsin.

Ashland county citizens, Ashland, Wis., have started a movement to build a county road from Ashland south the entire length of the county.

WATER-WORKS AND SEWERAGE

California.

City Surveyor Polk of Chico, Cal., has prepared the plans for the storm sewer system provided for in the recent bond issue. The plans have been presented to the board of city trustees for approval.

The board of trustees of East San Jose, Cal., has awarded to A. L. Chambers of Oakland, Cal., the contract for constructing a brick storm sewer on Chase Ave., for $3,650. The sewer is to be 3,250 ft. in length.

The citizens of Monrovia, Cal., have voted a bond issue in the sum of $170,000 for new sewer and water systems for the city. The sewer system and sewage farm are estimated to cost $120,000 and the remaining $50,000 will be used to install a water plant and distributing system.

Colorado.

The following bids were received by the board of public works of Denver, Colo., on Oct. 25 for subdistrict No. 9 of East Side sanitary sewer district No. 1: Denver-Pueblo Construction Co., $25,121; Dillon Stone Co., $25,893; Municipal Construction Co., $22,167; John B. Hughes, $23,524; Wescott-Doan Improvement Co., $24,559.

District of Columbia.

✣Bids will be received until 2 p. m., Nov. 9, by Commissioners of the District of Columbia, Washington, D. C., for furnishing cast iron water pipe and water pipe specials.

✣Bids will be received until 2 p. m., Dec. 6, by Department of Interior, Office of Indian Affairs, Washington, D. C., for the necessary labor and material for the construction of a tank and tower at the Pima Indian School, Arizona.

Georgia.

An election will be held in Dublin, Ga., on Dec. 6, for the purpose of voting on the issuance of bonds in the sum of $30,000 to make improvements at the municipal light and water plant and for improving the streets of Dublin.

The city council of Douglasville, Ga., on Oct. 25 passed a resolution authorizing an election for voting bonds to build a waterworks system. The date of the election was set for Nov. 28.

Bids have been received by the sewer committee of the city council of Atlanta, Ga., for the Proctor creek disposal plant, as follows: Interstate Construction Co. of Atlanta, $121,276; Municipal Engineering Co. of Chattanooga, Tenn., $121,684; Nichols Contracting Co., Atlanta, $139,214; Piedmont Construction Co., Atlanta, $144,575; C. W. Lane & Co., Atlanta, $150,503, and Gude & Co., $193,180.

Idaho.

The Athol Water & Light Co., of Athol, Ida., has been incorporated with a capital stock of $10,000. The incorporators are D. D. Drennan, Harry Kaye, H. H. Rawlings.

Illinois.

William Moran & Co., of Joliet, Ill., have been awarded a contract in Waukegan, Ill., for the construction of the Washburn Spring sewer for $17,725.

A delegation from Cicero, Ill., appeared before the engineering committee of the Drainage Board, Chicago, Ill., recently and asked assistance in the construction of a two-and-a-half-mile sewer from Madison Ave. to 52d Ave., to cost around $340,000.

No bids were received on Oct. 26 by the board of public works of Quincy, Ill., for the construction of a sewer in 10th St., from Oak to Vine, with four catch basins. The sewer would be made of 411 ft. of 24-in. pipe, 51 ft. of 18-in. pipe, and 41 ft. of 12-in. pipe, all laid at an average depth of 6 ft., and connected with the 42-in. brick sanitary sewer at Vine St.

A new election will probably be held in Galesburg, Ill., for the submission of the water works bond issue of $75,000 to the people.

Plans for a thorough overhauling and reorganization of the waterworks system of Chicago, Ill., are being outlined by City Engineer John Ericson and Henry A. Allen, consulting engineer.

Following are the low bids received by the Board of Local Improvements, city of Chicago, Chas. A. V. Standish, Sec'y, Room 302 City Hall, for constructing sewers in the following streets: S. 48th Ave., W. Jackson St. to W. Van Buren St., 710 lin. ft. 12 in. tile pipe, average cut 10.5, 4 manholes and 6 catch basins, Michael Pontorelle, 4817 W. Dakin St., $1.52 per cu. ft., total $1,079; S. 48th Ave., W. Monroe St. to W. Jackson St., 990 lin. ft., 12 in. tile pipe, average cut 10.5, 7 manholes and 9 catch basins, $1.54 per lin. ft., total $1,524, Nicholas and Angelo Mancini, 900 W. Taylor St.; Humboldt Ave., N. 44th Ave. to N. 43d Ave., 680 lin. ft., 12 in. tile pipe, average cut 8.0, .95½ per lin. ft., total $649, Nicholas and Angelo Marcini, 900 W. Taylor St.; N. Maplewood Ave., Irving Park Blvd. to Belle Plaine Ave., 670 lin. ft. 15 in. tile pipe, average cut 95; N. Maplewood Ave., Belle Plaine Ave. to Berteau Ave, 670 lin. ft. 12 in. tile pipe, average cut 8.0, $1.42 per ft. for 15 in. pipe, $1.28 for 12 in. tile pipe, total $1,809, including 10 manholes and 15 catch basins, Wm. F. Healy, 101 Washington St.; W. 113th St., Stewart Ave. to Eggleston Ave., 335 lin. ft., 2½ ft. brick sewer, double ring, average cut 13.0, $3.77 per lin, ft.; W. 113th St., Eggleston Ave. to Parnell Ave., 660 lin. ft. 2 ft. brick sewer, double invert, average cut 14.5, $3.20 per lin. ft.; Eggleston Ave., W. 112th St. to W. 113th St., 670 lin. ft. 12 in. tile pipe sewer, average cut 10.5, $1.30 per lin. ft.; Eggleston Ave., 113th St. to 114th St., 660 lin. ft. 15 in. tile pipe sewer, average cut 9.0, $1.40 per lin ft.; Egglestion Ave., 114th St., to alley n. of W. 115th St., 495 lin. ft. 12 in. tile pipe sewer, average cut 9.0, $1.40 per lin. ft.; Butler St., W. 111th St. to W. 113th St., 1,330 lin. ft. 12 in. tile pipe sewer, average cut 9.5 ft., $1.30 per lin. ft.; Butler St., 113th to 114th St., 660 lin. ft. 15 in. tile pipe sewer, average cut 9.0, $1.40 per lin. ft.; Butler St., 114th St. to alley n. of W. 115th St., 495 lin. ft. of 12 in. tile pipe sewer, average cut 8.0, $1.30 per lin. ft.; Parnell Ave., W. 111th St. to W. 113th St., 1,325 lin. ft. 12 in. tile pipe sewer, average cut 9.0, $1.30 per lin. ft.; Parnell Ave., W. 113th St. to W. 114th St., Stony Island Ave., E. 75th St. to E. 76th St., 610 lin. ft. 12 in. tile pipe, average cut 12 ft., $1.50 per ft.; E. 75th Pl., Stony Island Ave. to alley e. of Washington Ave., 420 lin. ft. of 12 in. tile pipe, average cut 9.0, $1.55 per lin. ft., including 9 manholes and 4 catch basins, total $1,596, Tortelli & Scully, 518 W. Taylor St.; S. Spalding Ave., W. 38th St. to W. 37th Pl., 340 lin. ft. 12 in. tile pipe, average cut 11.0 ft., $1.45 per lin. ft.; W. 37th Pl., S. Spalding Ave. to 290 ft. west, 330 lin. ft. 12 in. tile pipe, average cut 10.0, $1.38 per lin. ft., including 6 manholes and 5 catch basins, total $948, Michael Pontorelli, 4817 W. Dakin St.; Oglesby Ave., E. 79th St. to E. 78th St., 670 lin. ft. 20 in. tile pipe (double strength), average cut 12.0 ft, $2.75 per lin. ft., including 5 manholes and 6 catch basins, total $1,842, Tortelli & Scully, 518 W. Taylor St., and the W. 111th St. system, comprising the following streets with itemized bid of low bidder; W. 111th St., Eggleston Ave. to S. Halsted St., 2,320 lin. ft. 2 ft. brick sewer, average cut 13.0 ft., $3.20 per lin. ft.; 660 lin. ft. 15 in. tile pipe sewer, average cut 10.0 ft., $1.40 per lin. ft.; Parnell Ave., W. 114th St. to alley n. of West 115th St.; 495 lin. ft. 12 in. tile pipe sewer, average cut 8.0 ft., $1.30 per lin. ft., 69 manholes and 100 catch basins, total bid, $19,823, Nicholas and Angelo Mancini, 900 W. Taylor St.

Indiana.

The Board of Public Works of South Bend, Ind., contemplates building a trunk sewer one and one-half miles long at an estimated cost of $100,000. The new sewer will drain an area covering six square miles in the south end of the city and will follow as closely as possible the bed of Bowman creek. It will be built of concrete according to the plans and will have a diameter of about 12 ft. City Engineer Wm. S. Moore is preparing a survey of the work.

According to advices from South Bend, Ind., the citizens of Niles will vote on the proposition of bonding the city for the sum of $22,000 for the purpose of constructing a trunk sewer west on Broadway from Ninth to Seventh Sts., thence north Sycamore, thence west to the St. Joseph river, on Nov. 8.

The Board of Public Works of Indianapolis, Ind., has ordered the Indianapolis Water Co. to lay mains as follows: Twenty-fifth St. from Dearborn to Oxford St., La Salle St. from Twenty-third to Twenty-fourth St., Gale St. from Sixteenth St. to a point 500 ft. south, and Thirty-second St. from Broadway to College Ave.

Iowa.

✣Bids will be received until 9 a. m., Nov. 12, by City Clerk, Sioux City, Ia., for the installation of a deep well and turbine and centrifugal pumping outfit. G. B. Healy is Superintendent of Parks and Public Property.

The City Council of Battle Creek, Ia., has decided to have a new sewer system at an estimated cost of $6,000.

J. J. Dunnegan was recently awarded the contract in Essex, Ia., for sewer work to cost $3,500.

The City Council of West Liberty, Ia., let the contract for the construction of four miles of sewers and for a modern septic tank to Clifford Nichols of Caney, Kan., for $21,874 for the sewer work and $6,783 for the septic tank and outlet.

The City of Harlan, Ia., has taken steps to increase and improve its water supply.

Kansas.

A resolution has been passed by the City Council of Coffeyville, Kan., creating a new sewer district to be known as sanitary sewer district No. 5.

The City Council of Lyons, Kan., has taken action to provide a complete survey of the city with plans and specifications for a sewer system. Engineer McDonnell of the firm of Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., has been employed to prepare the plans.

City Engineer Gillam of Coffeyville, Kan., has been setting the stakes for the extension of sanitary sewer No. 2 to the Kansas Glass plant. The sewer will extend from a point

Items marked thus ✣ indicate work now open for bids.

on Hickory St., between 12th and 13th Sts., 600 ft. west to the plant. The city will do the work.

Kentucky.

✣Board of Public W[illegible] Ky., will receive bids until Nov. 15, for the construction of a 7 ft. concrete sewer to be located on Preston St. between Water and Fulton Sts. The cost of the work is estimated at $25,000.

Louisiana.

The Sewerage Board of Lake Charles, La., has arranged for the sale of bonds for the purpose of constructing a sewer system.

The Mayor and President of the Board of Health of Opelousas, La., have been appointed a sewerage committee, with the Mayor as chairman. The duties of the committee include practically everything necessary toward the perfection of a plan to secure a sewerage system.

The City of Patterson, La., has sold bonds to the amount of $30,000 for the installation of a modern municipal waterworks system. The Fred A. Jones Co. of Houston, Tex., has prepared the plans and specifications and made surveys for the laying of the mains. It is thought that active work will be under way by Jan. 1. B. J. Morey is Mayor.

Maryland.

✣Bids will be received until 11 a. m., Nov. 15, by Board of Awards, Baltimore, Md., for the construction of the McMechen St. interceptor, Sanitary Contract No. 58. The work will include the following approximate quantities: 4,350 lin. ft. vitrified pipe sewer, 20-in. to 24-in. diameter; 600 ft. double line 16-in. C. I. pipe sewer including 140 ft. of inverted siphon, 260 lin. ft. brick and concrete sewer, 50 in. diameter, 4 special manholes. J. Barry Mahool is President of the board.

Massachusetts.

The Council of Shelburne Falls, Mass., has received estimates from A. H. Beers of Whately for a sewer system to accommodate all the residents of Buckland side. There are two different plans, one that would cost $23,500, and the other $19,375.

Michigan.

✣Bids will be received until 8 p. m., Nov. 11, by the Board of Public Works, Allegan, Mich., for the construction of a sewer in Marshall, Herkimer, Bond and Division Sts., on the south side in Allegan City, and known as South Side sewer. John W. Peet is City Clerk.

The City of Durand, Mich., will hold an election Nov. 14 to vote on the proposition to bond the town for $12,000 to secure an adequate water supply and make improvements to the electric light and waterworks plant. The money will be used for the purchase of grounds, erecting a pumping station, drilling wells, purchasing water pipe and machinery.

Minnesota.

✣Bids will be received until 2 p. m., Nov. 14, by Board of Public Works, R. L. Gorman, Clerk, St. Paul, Minn., for the construction of a sewer on State St. from Congress St. to Isabel St.

✣Bids will be received until 2 p. m., Nov. 14, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Manomin Ave. from Baker St. to a point 135 ft. north of the north line of Baker St. R. L. Gorman is Clerk of the Board.

The City Engineering Department of Duluth, Minn., has completed its estimate for the sewer system which has been petitioned for at Oneota, near West Duluth. The cost is estimated at $5,474.

The City Council of Virginia, Minn., has passed an ordinance providing for the establishment of a sewer district No. 4. This district takes in the Northside, Pillsbury and Rooney additions.

The City Council of Virginia, Minn., proposes to build a storm sewer in the Northside addition which will drain into Virginia lake and the sanitary sewer will be constructed from the corner of First St. and First Ave., and connect with the main sewer on Virginia Ave.

The City Council of Moorhead, Minn., has decided to advertise for bids for the drilling of 6, 8 and 10 in. artesian wells to be dug for the city in connection with the proposed water system.

Missouri.

The property owners of Washington Heights, St. Louis, Mo., as a sanitary measuré desire the immediate construction of a permanent sewer at least of that portion of the River Des Peres extending from 6000 Delmar Ave. south into Forest Park, a distance of about eight blocks.

The City of Granby, Mo., has voted and has for sale bonds in the sum of $18,000 for improvements. J. Hutsell is City Clerk.

The citizens of Marionville, Mo., have voted in favor of the proposition of installing a water and light system.

Montana.

The citizens of Conrad, Mont., recently voted to bond the town for $25,000 for the purpose of installing a sewer system. The sewer will be 10,340 ft. in length. The contract for the system will be let at once.

The Helena Water Co., Helena, Mont., has been notified by the City Council that the city will take over the water plant on Aug. 11, 1911. Judge R. M. Foster of St. Louis, Mo., is the present owner of the plant.

New Jersey.

The City Council of Plainfield, N. J., has sold bonds to the amount of $30,000 for sewer extension. The larger part of the sewer system will be worked on the gravity system.

It has been definitely decided by the City Council of Madison, N. J., to lay the sewers on Madison Ave. up to Loantaka way, instead of Morris Pl., as was first planned.

Carroll P. Bassett, civil engineer of Summit, N. J., who has been engaged by the city of Williamsport, Pa., to untangle the East End sewer problem, has submitted his report to the City Council.

Dr. Edward A. Ayers, Sr., Jacob C. Price and others of Branchville, N. J., have an option on 30 acres of land which they propose to purchase and construct a reservoir and furnish water to the borough in addition to its present supply. They also propose to construct a dam which will be 350 ft. wide by about 3,000 ft. long, and which will flood from 15 to 18 acres. Harvey Snook will survey out the boundary lines.

New York.

The Common Council of Syracuse, N. Y., has adopted a resolution to advance the proceedings for extending the Colvin St. sewer, a part of the Midland Ave. sewer system, to the 17th ward.

The North Corona Taxpayers' Association of Brooklyn, N. Y., are making arrangements for a mass meeting which will be held early in November for the purpose of getting sewers for Corona.

City Engineer Lamb of Watervliet, N. Y., has submitted to the Common Council an estimate for the construction of a storm sewer to cross the canal at Schuyler's bridge and to continue up Third Ave. to Fifth St. The estimated cost is $4,000.

The necessary rights of way and a site for the disposal plant for a complete sewer system for Yorkville, N. Y., will be secured as soon as possible and an effort will be made to put in the system before winter sets in. The Board of Village Trustees has passed a resolution authorizing advertisements for bids.

E. S. Carr, representing the Farmers' Loan & Trust Co. of New York City, has purchased at public auction the waterworks plant of the city of Gainesville, Tex.

The South Bay Water Co., of Patchoque, N. Y., has bought land on Rolstone Ave., in West Sayville, on which a pumping station is to be built.

Ohio.

✣Bids will be received until noon, Nov. 15, by Director of Public Service, Youngstown, O., for furnishing the necessary labor and material for the construction of a sewer in Stafford St. from Penn Ave. to Himrod Ave. W. H. McMillin is Clerk.

✣Bids will be received until noon, Nov. 15, by Director of Public Service, Youngstown, O., for the necessary labor and material for the construction of sewers in Jackson St. from Shelby to Himrod Ave. W. H. McMillin is Clerk.

✣Bids will be received by Director of Public Service, Youngstown, O., until noon, Nov. 15, for the construction and material necessary for sewering Truesdale Ave. from Himrod Ave. to Charlotte. W. H. McMillin is Clerk.

✣Bids will be received until noon, Nov. 15, by Director of Public Service, Youngstown, O., for the necessary labor and material for the construction of sewers in Caledonia St. between Iram St. and the City Limits. W. H. McMillin is Clerk.

✣Bids will be received until noon, Nov. 10, by Director of Public Service, Lorain, O., for the construction of sewers as follows: West 25th St., sanitary sewer from Lexington Ave., westerly to the west line of Lorain Stone Co.'s addition in Granger St.; E. 34th St., sanitary sewer from Milton Ave. to Elyria Ave.; Livingston Ave., sanitary sewer from W. 32d St. southerly to W. 35th St.; W. 32d St., sub-main sewer from Broadway to Lexington Ave., in W. 32d St. L. B. Johnston is Clerk.

✣Bids will be received until noon, Nov. 18, by Joseph H. Laufersweiler, Village Clerk, Minster, O., for the necessary labor and material for the improvement by sewering of Fifth St. from alley between Main St. and Zweibrucken St. to Frankfort St., and Zweibrucken St. by sewering from Lot No. 43 to Fifth St.

The City Council of Lancaster, O., has been petitioned for the construction of a sewer in the alley back of King St., along Fifth Ave.

W. H. Louthan has been awarded a contract by the city of Hamilton, O., for the construction of a sanitary sewer on Hanover St. Frank Weaver is City Engineer.

Electors of Springfield, O., will vote on the project of issuing bonds to the amount of $130,000 for the construction of the low level sewer. This sewer is to be laid along the creek from Lagonda Ave. to the western section of the city, where a pumping station is to be placed. Included in this $130,000 bond issue is considered the cost of erecting the pumping station.

The Board of Control of Eylria, O., has rejected both bids for the work in connection with the construction of a sewer on Louisiana St., because it considered the figures too high.

The sewer committee of the City Council of Ironton, O., reported favorably on the extension of drainage sewers in Eighth and Ninth Sts., plans and estimated cost of which were presented by the engineer. The work will cost about $2,300.

The Service Department of Portsmouth, O., will open bids early next month, the date to be decided on later, for a new sewer to run in the alley between Third and Fourth from Waller St. to Maddox alley. It will be an extension to a sewer.

The City Council of Defiance, O., has decided that the city shall erect and maintain a municipal water plant.

C. F. Layman, civil engineer, Cincinnati, O., has submitted to the Board of Public Affairs of West Carrollton, O., plans and specifications for the new water system. The plans call for a city building and pump-house building to be one story, of hard brick, 50 ft. long, 28 ft. wide. A concrete reservoir will be placed on the Eby hill, which will hold 100,000 gals. of water.

The Village Council of New Lexington, O., has passed an ordinance granting to James Westwater & Co. of Columbus, O., a franchise to build a system of waterworks in that village.

The City Council of Wilmington, O., will probably engage E. G. Bradbury, civil and sanitary engineer, of Columbus, O., to make a survey and prepare plans for the construction of a sewer system.

The City Council of Hubbard, O., has passed two resolutions for the establishment of a sewer system, the first to designate the portion of sewer work required for immediate use and the district to be improved. The second decided it necessary to construct all sewers provided for in plans and profiles for a general sanitary sewer system.

The board of control of Youngstown, O., has awarded the following contracts for street improvements, including sewering and paving: Rayen Ave. sewer to W. E. Gartland for $3,942; Lansing Ave. sewer to Anthony O'Horo, for $484; Starr St. sewer to Hannon Bros., for $912; Logan Ave. sewer to W. E. Gartland, for $15,529; Hine St. paving to M. P. Connelly, for $12,891; Woodbine and Bryson paving to S. H. DeGroot for $10,285; Ardale and Wirt St. sewer to Hannon Bros., for $12,214; N. Minnie St. paving to M. Fleming, for $10,593. All the contracts were awarded to the lowest bidders.

The board of health of East Liverpool, O., has asked the city council to take necessary steps for the immediate sewering from Supplee St., on the east to Maryland St., on the west. Alex McBane is director of public service.

Oklahoma.

✤Bids will be received until Nov. 17 by John Middleton, Collinsville, Okla., for furnishing the following material required in the construction of a system of waterworks, including cast iron pipe, hydrants and valves, triplex pump and paving brick; also 2,000 ft. of 12-in. and 2,400 ft. of 10-in. salt glazed sewer tiles. O'Neil Engineer Co., 1218 First State Bank Bldg., Oklahoma City, Okla., engineers.

Although the City Council of Oklahoma City, Okla., at a recent meeting turned down the proposition for an electrolytic plant for the disposal of sewage at the Deep Fork terminal of the northwest district sewer, the question will again be brought up and an effort made to have the city adopt the plan.

Mayor A. J. Titus of Cherokee, Okla., recently visited the offices of the State Health Commissioner at Guthrie for the purpose of considering plans on file in the Commissioner's office for sewers which are to be installed in Cherokee.

Oregon.

Mayor George F. Rodgers of Salem, Ore., has signed a contract with Behee & Stevenson of Portland, Ore., for the construction of the South Salem sewer system, which involves an expenditure of over $175,000.

The citizens of Vale, Ore., have voted to bond the city in an additional sum of $35,000 to build a gravity water supply from Willow Springs, 12 miles south.

The Newport Engineering Co. of Portland, Ore., has been awarded the contract for installing a modern sewerage system by the town of Pasco, Wash., which will cost between $75,000 and $80,000. According to the plans for the district, as prepared by the Northwestern Engineering Corporation, there will be about 40,000 ft. of pipe used in the system, including the main trunk and the laterals. Vitrified clay pipe will be used exclusively and the contract calls for the laying of 24,410 ft. of 8-in. pipe, 2,590 ft. of 10-in pipe, 8,720 ft. of 18-in. pipe and 3,320 ft. of 24-in. pipe.

The following bids were received in Portland, Ore., for the construction of the Riverside district sewer: George Gordon, terra cotta pipe, $129,783; William Lind, cement pipe, $132,533; K. C. Lundstrum, cement pipe, $155,739; Paquet, Geibisch & Joplin, cement pipe, $140,522, and Jeffrey & Bufton, cement pipe, $132,734.

The city council of Pasco, Ore., on Oct. 21 awarded the contract for building 38,000 ft. of sewers to the Newport Engineering Co. of Portland, Ore., for $66,226.

Pennsylvania.

✤Bids will be received until 7:30 p. m., Nov. 14, by Common Council of Lebanon, Pa., for the construction of a sanitary sewer 1,563 ft. long in alley between Meridian and East Sts. Edmund Connor is City Clerk.

✤Bids will be received until 6 p. m., Nov. 19, by Brookville Water Co., Brookville, Pa., for the necessary labor and material for the construction of reinforced concrete settling basins and a dam. The work includes the following approximate quantities: 2,150 yds. earth excavation, 30 yds. rock excavation, 1,510 yds. embankment, 490 yds. rubble concrete, 526 yds. reinforced concrete, 208 yds. plain concrete, 340 sq. yds. slope paving, 230 ft. of 12-in. cast iron pipe. George W. Huber is Secretary.

The Common Council of New Castle, Pa., has passed the ordinance providing for the construction of a sanitary sewer on Mercer St., from Edison Ave. to the old city line.

The contract for the sewer on Center St., in the Third ward of Oil City, Pa., has been awarded to F. T. Sutley.

The City Engineer of McKeesport, Pa., has been instructed to prepare plans for a comprehensive sewer system, as required by the State Board of Health.

Important action for a sanitary sewerage system and disposal plant in Beaver Falls, Pa., was taken by the Borough Council recently. Bids have been received from a number of engineers for the drawing of plans and making preliminary surveys for the system and plant.

The City Council of Chambersburg, Pa., has awarded the contract of building the gravity water conduit in that city to H. C. Brooks Co., Clarkesburg, W. Va., for $39,053.

The village of Saegertown, Pa., is to have a municipal water plant.

The State Water Supply Commission of Pennsylvania has approved applications for the incorporation of the Reliance Water Co., West Telford Borough, Montgomery County; Green Hill Water Co., Logan Township, Blair County, and the Kulpmont Water Ct., Mount Carmel Township, Northumberland County.

W. C. Hatton, hydraulic engineer, Wilmington, Del., has been engaged by the special water committee of Schulykill Haven, Pa., to make a survey and draw up plans and specifications for a pipe line from Tumbling Run and distributing mains throughout the town.

The Pottstown, Pa., city council has decided to postpone the vote by the people on constructing a sewer system until next year.

Bennett, Huggett & Co., were the lowest bidders at Scranton, Pa., on the contract for the Poplar St. sewer to be built on that street from Monroe Ave., as far down as the Erie tracks. The company bid as follows: Brick sewer complete, $3.98; under Erie tracks, $4.50; concrete cradle complete, $4.24; concrete invert, $4.35; man holes $35.

Rhode Island.

✤Bids will be received until 10 a. m., Nov. 16, by Lieut. Rodney H. Smith, Constructing Quartermaster, Fort Adams, R. I., for the construction of reinforced concrete 1,000,000-gal. reservoir at Fort Greble, R. I.

South Dakota.

✤Bids will be received until 3 p. m., Nov. 14, by Mayor and City Council of Belle Fourche, S. Dak., for the construction of a waterworks system. Plans are on file at the office of Rush O. Fellows, City Clerk, and at the office of S. H. Lea, State Engineer, Pierre, S. Dak. A certified check, payable to D. R. Evans, Mayor Belle Fourche, must be filed with each bid.

Tennessee.

The City Council of Johnson City, Tenn., has purchased Tannery Knob for a reservoir site. As soon as $500,000 in bonds are disposed of the city will construct and extend the water system of which it recently became the owner at a cost of $150,000.

The Municipal Engineering & Construction Co., of Chattanooga, Tenn., was the lowest bidder at $54,436, in Jacksonville, Fla., for the construction of the 3,000,000-gal. reinforced concrete reservoir.

The board of public works of Chattanooga, Tenn., awarded the contract for the construction of the storm sewer on McCallie Ave., between Highland Park Ave. and Hawthorne St., to I. H. Mishler for $4,013.

Texas.

✤Bids will be received until Nov. 11 by Board of Public Works, Texas, for the completion of the Lincoln Heights reservoir. George W. Armstrong is Commissioner.

A special city election was held in Terrell, Tex., on Oct. 28 to determine whether $3,000 school, sewerage and improvement bonds should be issued.

The City Council of Dallas, Tex., received bids Oct. 28 for the construction of the pumping station at the White Rock reservoir, as follows: Hughes-O'Rourke Co., $38,535; Alex. Watson, $40,640; H. J. Emmins, $41,208; Fred A. Jones Co., $42,990; Southern Construction Co., $41,183.

Bids were received, Dallas Tex., from the following for the laying of a 24-in. water main on Sycamore St., from Grigsby St. to Peak St.; on Peak to Swiss Ave., and on Swiss Ave. to Haskell Ave.: Dallas Home Improvement Co., Dallas Lime & Cement Co., C. W. Olcott, D. J. Grigsby and J. B. Winslett, Jr.

C. W. Olcott has been awarded the contract by the city of Dallas, Tex., to lay a 6-in. sanitary sewer in the alley between Holmes and Spence Sts., south of Lenway St., for $649.

The erection of a sugar mill in Victoria, Tex., at a point on the river, a short distance below the city'e sewer outlet, has made it necessary to move the outlet 1,400 ft. down the stream.

President L. W. Chase of the Taylor Water Co. has announced that J. H. Finley, principal owner of the Taylor Water Co., has authorized him to immediately proceed with the improvements in the local service which were demanded by the City Council, entailing the expenditure of upwards of $40,000. Among the improvements will be the construction of an 18-acre reservoir.

The City Council of Bryan, Tex., has decided to begin at once the work of constructing a municipal sewer system, and in time to extend the present water system or put in a new plant. The estimated cost of both systems is $45,000.

The City Council of Hearne, Tex., has ordered an election for Nov. 23 for the purpose of voting on the proposition of installing a waterworks.

Virginia.

✤Bids will be received until noon, Nov. 23, by W. L. Craft, City Clerk, Roanoke, Va., for the construction of the sewer so as to accommodate the properties abutting on south side of Madison Ave., N. E., between Fourth St. and Lick Run. Plans and specifications may be obtained of F. L. Gibboney, City Engineer.

Washington.

✤Bids will be received until 10 a. m., Nov. 11, by C. B. Bagley, Secretary Board of Public Works, Seattle, Wash., for the improvement of 15th Ave. northwest from West 65th St. to West 75th St., by constructing sewers therein of proper dimensions and materials, together with all necessary Ys, openings, manholes, flush tanks, catch basins and other appurtenances necessary for the proper sewerage and drainage of said district.

Wisconsin.

✤Bids will be received until 10:30 a. m., Nov. 12, by Department of Public Works, Milwaukee, Wis., for furnishing to the city water department 200 fire hydrants of the Single Valve Mathews or Improved Stowell pattern. H. E. Briggs is Commissioner.

Items marked thus ✤ indicate work now open for bids.

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CHAS. S. HILL . . . . . . Editors
C. T. MURRAY . . . . . . Editors
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An Example of High Cost of Company Work as Compared With Contract Work in Railway Tunneling.

Although most railway managers have demonstrated again and again that contract work is cheaper than work done with company forces, every once in a while the decision is made that some important or difficult piece of railway construction had better be carried out by forces employed directly by the railway company. An instance of this kind was the building of the Cascade Tunnel by the Great Northern Railway in 1897 to 1900. It so happens that in 1886 to 1888 the Northern Pacific Railroad built the Stampede Tunnel through the same range of mountains by contract, and at a time when wages were higher. Since these two tunnels are so nearly comparable, in the character of excavation and in length, the N. P. tunnel being 9,844 ft. long, and the G. N. tunnel being 13,813 ft. long, a tabulation of cost becomes very instructive. The following costs are brief abstracts of much more detailed statements given in the 1910 edition of the "Handbook of Cost Data" by Halbert P. Gillette.

COST OF NORTHERN PACIFIC TUNNEL.

	Per lin. ft.
Excavation, station to station, [illegible]	[illegible]
Extra excavation [illegible]	[illegible]
Traffic charges	[illegible]
Total	[illegible]
Timber lining, 305 ft. B. M. at $35.00....	10.68
Brick and concrete lining (by company forces)	[illegible]
Track and ballast (by company forces)	[illegible]
Engineering	[illegible]
Grand total	$16[illegible].40

COST OF GREAT NORTHERN TUNNEL.

Labor excavating tunnel	$60.60
Explosives	7.40
Power	22.50
Tools	10.00
Machinery	16.20
Buildings	3.50
Personal injuries	2.10
Hospital expenses	1.10
Total	$123.40
Timber lining	9.40
Concrete lining	43.50
Track and ballast	2.80
Engineering	4.30
Grand total	$183.40

We see that the Great Northern tunnel cost 11 per cent more than the Northern Pacific tunnel; but if we compare only the work done by contract on the Northern Pacific tunnel with the corresponding work done by company force on the Great Northern tunnel, we have $93.17 as compared with $123.40. This shows that the company force work cost 33 per cent more than the contract work.

It remains only to determine whether or not the contractor for the Northern Pacific tunnel made a profit. Fortunately, careful costs were kept, and, as recorded in Gillette's "Handbook of Cost Data," it is clear that the contractor made a handsome profit, in spite of the fact that the lowest priced workman received $2.50 per day. Moreover, the contractor made more rapid progress on the Northern Pacific tunnel than was made on the Great Northern Company work.

Doubtless the knowledge that this contractor had made a splendid profit was the chief actuating motive that led the Great Northern to attempt to "save the contractor's profit." When will all engineers come to a realization of the fact that a contractor's profits are merely his salary for expert supervision and management? When will all engineers see clearly that a successful contractor is a manager who has been appointed to the position by the most astute selecting agent in the world—competitive strife? When will all of us invariably apply the fundamental law of business management? Namely: "*All payments for work should be proportionate to work done.*"

Incidentally, we may add, the contractor for the Northern Pacific tunnel through the Cascade Mountains, was himself far ahead of his time in that he used a bonus system in paying his employes. Mr. Nelson Bennett, the contractor, was one of the great railway builders of the West. We believe he is still active in the railway construction world. The history of his work on the Stampede Tunnel through the Cascades is a real romance of achievement. It serves to the ear a story as keenly interesting as the best of fiction.

Conservation of Labor.

Under this title an interesting editorial article appears in a recent issue of *Engineering News*. The unsatisfactory condition of English workingmen and women is contrasted with the condition in Germany.

"England has been wearing out its greatest of all assets, its working people, while Germany is conserving hers. This is a feature of the Conservation doctrine that should be preached more strongly in the United States," says a correspondent of *Engineering News*, and the News adds: "Without doubt, the most marvelous achievement of Germany for the benefit of its working people is its compulsory insurance against the calamities of sickness, accident and infirmity. The statistics have recently been published showing the results of government insurance in Germany for the year 1908. There was paid out during that year, in indemnity to wage earners, the enormous sum of over $167,000,000. About half of this sum went for the maintenance of wage earners during illness, and of the remainder, about $40,000,000 was paid to those suffering from accident, or their survivors, and about $45,000,000 for the support of the infirm."

While we are duly impressed by the nonagesimal figure above quoted, and while it may be one of the coming functions of every government to insure its citizens, still we fail to see wherein this is true "conservation of labor." Indeed we find in this editorial of our contemporary nothing that justifies the caption, conservation. Were we asked to indicate what Germany has done to conserve labor, we should not point to its insurance of workmen, for that is merely the taking of money from the many to aid the few who are in distress. And, however praiseworthy the scheme it really conserves nothing for the state at large. True conservation of labor exists only where machines or methods are so used as to increase the daily output—the making of two blades of grass to grow where one grew before.

Germany has unquestionably experienced great industrial progress during the last twenty years, and English thinkers have attributed the progress mainly to Germany's splendid system of technical education. For the most part, this is undoubtedly so. Yet there is another feature that distinguishes the average German from the average English worker, and that is his freedom from trade union tyranny. American manufacturers and contractors who have undertaken to establish branches in England have been astounded at the maze of restrictions that confine both workmen and employes. Not many years ago the salesman for an American firm that makes rock channelers told us that he had found it impossible to introduce these labor saving devices into English quarries, because the workmen had threatened to strike if channelers were installed. Here was positive opposition to an engine for labor conservation of the most effective kind, and it is typical.

Lack of technical education and hereditary resistance to labor saving machines and methods appear to us to explain why English workmen are in bad financial straits.

The greatest conserver of labor in the world is the American, for, with all his seeming wastefulness, he produces abundantly. The average American farm produces only half as much grain to the acre as the average English or German farm, and this is frequently cited as an evidence of lack of conservation of farm resources in America. But those who use this argument fail entirely to consider that in America we still have so much land that its productiveness per acre is a matter of minor economic consideration. The unit to be considered is the labor cost per bushel of grain, or its equivalent, and measured in that unit the American farmer leads the world, for he produces twice as much grain per year as his best European competitor The modern American farmer may be called one-third farmer and two-thirds engineer. What, indeed, would he be were he deprived of his score and one "engines" for the conservation of labor?

No, we must not look to the three or four dollars per capita spent in German insurance of workmen if we aim to find the "most marvelous achievement for the benefit of its working people." We must look, rather, to the technical schools and to a deeper general knowledge of the science of economics.

Finally, here in America as well as abroad, the one great theme for labor conservationists to preach is the payment of all workmen in proportion to individual output. That is the golden rule of industrial righteousness and of industrial progress. The crude wage systems of the past must give place to bonus payment piece rate, and profit sharing systems of one sort or another. On this great method of conserving labor we shall dwell at length in following issues of ENGINEERING-CONTRACTING.

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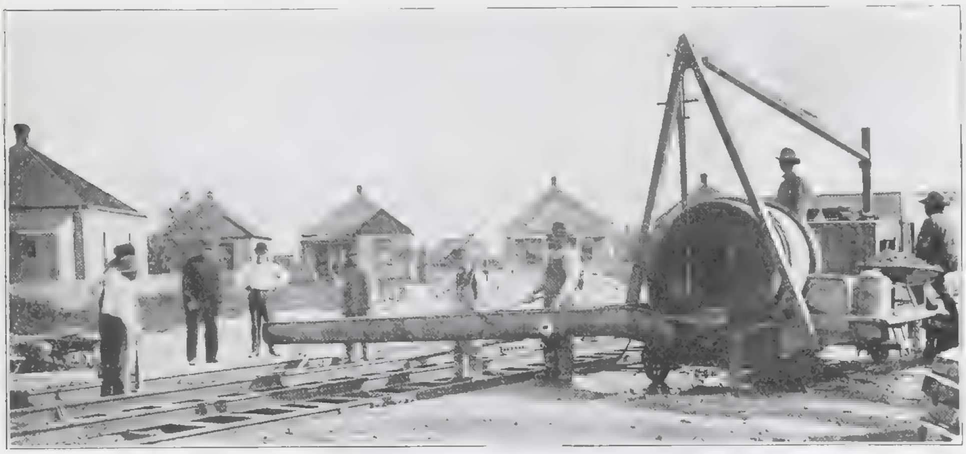
CONCRETE AND REINFORCED CONCRETE SECTION

Arrangement of Mixer with Chutes for Concreting Street Railway Tracks.

A mixer arrangement for concreting street railway tracks which leaves the tracks entirely free for traffic is shown by the accompanying engraving. This plant was used by the Land Construction Co., of St. Joseph, Mo., on street railway work in that city and we are indebted to Mr. M. O. Land of that company for the information given here.



Portable Mixer With Chute for Concreting Within Street Railway Tracks in Service.

The mixer was a No. 14 Eclipse traction mixer, with a 10-HP. gasoline engine, made by the Standard Scale & Supply Co., Chicago, Ill. As shown by this illustration, a wooden A-frame was bolted to the mixer frame at the discharge end and was braced rigidly in place. From the apex of the A-frame straight down is a ¾-in. rod, which passes through a metal chute and constitutes a pivot in which the chute can be swung horizontally. The outer end of the chute is guyed to the top of the A-frame by a wire rope connecting with a bail which is fastened to the sides of the chute about 4 ft. from its end. In the center of this cable is a turnbuckle, by which the end of the chute can be raised to clear the ground when in use and lowered to rest on the ground when not in use.

The chute is 18 ft. long, 12 ins. deep and 12 ins. wide with an open top, and with the end next to the mixer flared to receive the concrete. As will be seen from the illustration the chute, with the mixer at one side of the tracks, can be swung so as to deliver concrete at any point within the track space or so as to clear the tracks entirely for passing cars. The flat slope of the chute makes necessary a man with a hoe to keep the concrete flowing, but otherwise the concrete is delivered without handling.

In operation the mixer with 10 men has deposited 90 to 100 cu. yds. in 10 hours. This was not the capacity of the mixer, but was the amount made possible by the progress of the track work. The mixer was moved by hand from one station of work to the next and without interrupting the mixing. One engineer wets down this batch, dumps it and closes the mixer ready for another batch from one position on the platform.

Cost of Mixing and Placing Concrete by Hand in Riverside, Cal.

Concrete mixed and placed by hand in a 6-in. wall, with experienced labor, in Riverside, Cal., during 1909 cost $1.19 per cu. yd. An itemized account of the cost of the work is given by C. W. Gaylord in "Cement and Engineering News." The crew was as follows:

1 foreman at $3 per day	$ 3.00
2 men at $2.25 per day	4.50
8 men at $2 per day	16.00
Total	$23.50

This crew averaged 12 batches per 9-hour day, each batch containing 1.7 cu. yds., or 20.4 cu. yds. per day. This amount included 84 sacks of cement, 9.8 cu. yds. of sand and 19.6 cu. yds. of 1½-in. stone. This is over 2 cu. yds. per man per day and is above the average. The work was divided as follows:

Loading on Wheelbarrows:	Per cu. yd.
Sand, 0.46 cu. yds. at 10 cts	$0.05
Stone, 0.92 cu. yds. at 15 cts	0.14
Total	$0.19
Wheeling to Mixing Board and Dumping in Measuring Box:	
Cement (all handling)	$0.04
Sand, average haul 30 ft	0.02
Stone, average haul 50 ft	0.05
Total	$0.11
Mixing:	
Sand and cement (2 turnings)	$0.12
Mortar and stone (3 turnings)	.27
Total	$0.39
Loading into wheelbarrows	$0.17
Wheeling to place (av. haul 55 ft.)	0.06
Dumping, spreading and ramming	0.11
Supervision (⅓ foreman's time)	0.10
Care for water	0.02
Total	$0.46
Grand total	1.15

Adding cost of mixing boards and divided by number of yards mixed with each board gives: 16x16 ft. boards 500 ft. B. M. at $40 per M. divided by 500 equals $0.04. Adding this we get a total cost of $1.19.

Some Unit Costs of Constructing a Brick and Concrete Building.

The Sanitarium at Battle Creek, Mich., was built in 1902 at a cost of about $1,000,000. It is a fireproof building with brick walls and reinforced concrete floors. The building is 600 ft. long and 400 ft. deep. It is seven stories high at one end, but the slope of the ground makes it only six stories at the other end. The accompanying tables of costs were furnished by Mr. John McMichael, 175 Dearborn St., Chicago, who did the work on a percentage basis.

The material for construction was hauled in wagons from switch tracks about four blocks distant. Teams for this purpose were hired at $4 per day.

The following table gives the cost per cubic yard of concrete footings. The concrete was mixed by hand on a board which was shifted along to save wheeling of the mixed concrete. The sand and gravel was bought by the load, mixed, and was dumped at various points convenient to the board.

Materials:	Per cu. yd.
Cement, 1.1 bbls	$1.40
Gravel and sand	0.07½
Gravel and sand hauling	0.50
Total materials	$1.975
Labor:	
Carpenters	$0.18
Common labor	0.68
Total cost of labor	$0.86
Total cost of labor and material	$2.83½

This does not include superintendence. Carpenters received 35 cts. per hour and laborers 20 cts.

Rubble Stone Masonry.—The foundation walls were laid up with boulder stones taken from the old buildings. These are much harder to lay in foundation walls than any other class of stone masonry. The item $6.42 is the cost of wrecking the foundations of the old buildings to get the stone from them. The costs are given per cord of masonry in place. One cord is equal to 100 cu. ft. as here considered.

Materials:	Per cord.
Stone	$ 6.42
Sand	0.57½
Cement, 1 5/16 bbls	2.25
Total material	$ 9.245
Labor:	
Masons	$ 1.82½
Common	3.04
Total labor	$ 4.865
Total labor and material	$14.11

Masons received 40 cts. per hour and laborers 20 cts. The amount of stone laid per mason per 8 hours was 1¾ cords.

Brick Work.—The total amount of brick in the building is about 5,250,000, of which about 1,250,000 are pressed brick used for the exterior and for trimmings. About 60 bricklayers were employed during the main part of the work. Three of the Thomas Elevator Co.'s double brick hoists were used for elevating brick and mortar. The costs given are per thousand of brick laid. The number of common brick laid per 8-hour day per man was 2,400.

Materials:	Per M brick.
Common brick f.o.b. Chicago	$ 4.00
Freight	2.68
Hauling	0.78
Sand	0.57½
Lime (4 bu.)	1.06
Hauling lime	0.16
Total materials	$ 9.25½
Labor:	
Masons	$ 1.65
Common labor	1.82
Total labor	$ 3.47
Total labor and material	$12.72½

Masons received 50 cts. per hour and common labor 20 cts.

Shawnee Buff Pressed Brick were used for the exterior. The number of pressed brick laid by each mason per 8-hour day was 480. The cost of pressed brick work was as follows:

Materials:	Per M brick.
Pressed brick per M f.o.b	$11.00
Freight	5.50
Hauling	0.95
Sand	0.57½
Lime (3 bu.)	0.91½
Mortar color (buff)	1.82
Cement	0.45
Bonds (wire cloth)	0.57
Total material per M	$21.78
Labor:	
Masons	$ 9.43
Common	6.40
Total labor	$15.83
Total labor and material	$37.61

Masons for pressed brick work received 55 cts. per hour and common laborers 20 cts.

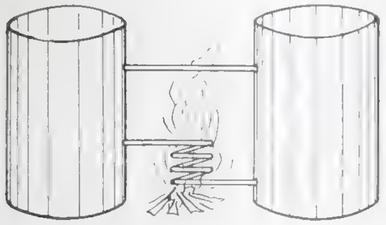
For trimmings, Gray pressed brick were used. The cost of this work was as follows:

Material:	Per M brick.
Cost of gray pressed brick f. o. b.	$14.00
Freight	6.50
Hauling	0.95
Sand	0.57½
Lime (3 bu.)	0.91½
Cement	0.45
Mortar color (lampblack)	0.18
Bonds (wire cloth)	0.85
Total material	$24.42
Labor:	
Masons	$ 9.45
Common	6.41
Total labor	$15.86
Total labor and material per M	$40.28

The time required for executing the entire work was about six months.

A Simple Arrangement for Heating Mixing Water for Concrete.

The accompanying sketch illustrates a simple arrangement for heating mixing water on small jobs of concrete work in cold weather. It is adapted from a scheme originally used by Mr. E. L. Jones of Nelson, Ill., and described by him in a recent number of *Popular Mechanics.* Mr. Jones set two barrels about 6 ft. apart, one elevated about 3 ft. above the other, and then bent three coils in a 16 ft. piece of 3-in. pipe, putting one end in each barrel. This left the pipe on a slant between the barrels. A fire was built under the coil and water poured into the elevated barrel. As the water ran through the coil it was heated and passed into the other barrel hot and ready for use. The illustration shows the above principle somewhat improved upon, and by this method a greater supply of warm water should be secured.



New Rules of Measurement for Excavation and Concrete Work in Chicago.

A joint committee composed of five members each of the Western Society of Engineers, the Chicago Architects Business Association and the Masons and Contractors' Association of Chicago has recently formulated a standard code of rules for the measurement of excavation and of concrete work. As this code touches many subjects of general interest to contractors, we have reprinted it nearly in full from the 1910 Guide of the Masons and Contractors' Association:

Excavations of Cellars and Basements.—Excavation to be measured and computed by the actual amount of material displaced. If unit price is based upon loose measurement and 40 per cent to actual bank measurement, except if consisting of sand and gravel, when only 20 per cent will be added. If rehandling becomes necessary, this to be done at a special price agreed upon in addition to the above.

Excavation of Trenches and Pits.—Excavation of trenches, pier holes or pits when more than 3 ft. wide to be computed on actual contents when less than 5 ft. deep. When less than 3 ft. wide, to be computed on actual contents if less than 2 ft. deep.

If more than 2 ft. deep compute contents of trench on base of 3 ft. width, even though same is narrower. If less than 2 ft. in depth, estimate actual width.

For pits or pier holes more than 2 ft. deep and less than 12 sq. ft. in area, estimate area of same on base of 12 sq. ft. multiplied by depth of same down to 5 ft. If more than 5 ft. deep, estimate on same basis as given below for additional depth of trenches, with the same percentage of increase added.

Depth, ft.	Add to actual contents, pct.
5 to 10	75
10 to 15	150
15 to 20	225

and so on, adding 75 per cent accumulative for every 5 ft. additional depth.

Backfilling and Grading.—Soil required for backfilling or grading to be measured by computing from cross-sectioning cubic contents of area to be filled or graded.

Sheet Piling.—Sheet piling and lagging to be estimated per 1,000 ft. of lumber required. Kind of lumber to be specified.

Shoring.—Shoring of earth banks to be done at unit price per sq. ft. of shored surface of bank.

Draining.—Pumping or bailing to be done at special price, in addition to excavation unit price, as the excavation rules are based on dry work. This, however, does not apply to rain or storm water.

Concrete Foundations.—Foundations for walls to be measured by actual contents when made with square and level offsets. For footings with sloping or beveled offsets less than 30 per cent from the horizontal, multiply area of base by greatest height of footing. This applies to piers, also, except when courses in pier foundations are less than 12 ft. in area, when 1 cu. ft. will be added for each corner for every foot in height of such course.

Foundations for all projections such as chimney breasts, pilasters, buttresses or flues connected with walls, to be measured actual contents contained therein; and 1 cu. ft. added thereto for each corner for every foot in height.

Recesses and slots in foundations to be measured solid, and in addition thereto allow 2 cu. ft. for every foot in height of length.

Arches in foundations. Multiply length of chord at spring of arch by height from chord to extrados by thickness of arch, and add to the wall measurement. Height of arch ring equal to thickness of wall.

Circular or polygon foundations to be figured at double actual contents.

External, Division and Interior Concrete Walls.—For walls 14 ft. or less in height, 24 ins. or more in thickness, use the actual thickness as basis in computing the volume. For walls less than 24 ins. thick, add half the difference between the actual thickness and 24 ins. in computing the volume. If walls are more than 14 ft. in height between floors, add to cubic contents 15 per cent for every additional 4 ft. in height on accumulative scale, as given for trench excavations.

Circular Walls.—For circular walls of radius sufficiently large to obviate for forms, of using specially prepared lumber for forms, add 20 per cent of length to girt of wall, and figure cubic contents on the same basis as prescribed for "External and Division Walls."

Battered Walls.—For battered or sloping walls, estimate contents on same basis as for external and division walls, and add 50 per cent of contents of wedge, or batter to same when narrower on top than 24 ins. (See also Corners.)

Intersection of Walls.—Intersection of division walls 24 ins. thick or less (bonded together in any manner not abutting) to be measured as slot or recess. When thicker, add 1 ft. to length of wall for every intersection when measuring.

Retaining Walls.—In retaining walls reinforced with beams, columns or girders, figure concrete casing a minimum thickness of 12 ins. from outside edge of steel on side next to earth bank and 6 ins. from outside edge of steel on opposite side; that is, compute wall 18 ins. thicker than width of steel.

For all other retaining walls compute on same basis as for external or internal walls. (See also Cornices.) No deduction in cubic contents to be made for metal imbedded in wall.

Hollow Tiles.—To be at special rates.

Corners.—For each corner of wall more or less than 90° add 18 ins. to girt length of walls in measuring. The term corner is used for salient angles of walls, and angle for reentering angles.

Piers.—Independent plain square piers to be measured by the same rule; i. e., add 1 cu. ft. for each corner for every foot in height. For plain polygon or round piers, add 4 cu. ft. for each foot in height.

Recesses.—Recesses and clots to be measured solid, and in addition thereto allow 2 cu. ft. for every foot in height or length.

Arches.—In Vaults: Multiply length of chord at spring of arch by height from chord to extrados by thickness of arch.

In Walls: Find contents of arch by same rule and add same to wall measurement, as called for under foundations.

In Sewers and Tunnels: Multiply length of extrados by thickness of arch.

Openings With Frames Built In.—Deduct contents of windows, doors and other openings, measuring from jamb to jamb and from top of sill to spring of arch, and add 2 ft. of wall for each jamb for every foot in height of opening when plank frames are used. If box frames are used, add 4 ft. of wall for each jamb for every foot in height.

Openings Without Frames.—Deduct contents of openings, same to be measured from top of sill to spring of arch and shortest distance between concrete jambs for width. Add for each jamb 2 ft. of wall for every foot in height of opening. Circular, oval or other special shaped openings to be figured at special price.

Chimney Breasts, Flues and Pilasters.—All flues and hollows in chimneys or walls less than 2 ft. in area, figure solid and add 2 cu. ft. for every foot in height. All flues and hollows in chimneys or walls from 2 ft. to 4 ft. in area to be measured solid. When larger, deduct half of contents of flue.

Detached portions of chimneys in buildings and plain chimney tops above roof to be measured solid, and 1 cu. ft. to be added for each corner for every foot in height.

Detached chimney stacks to be figured at special rates.

Trimmings.—No deductions allowed for omissions of concrete for cut-stone, terra cotta or other trimmings, bond blocks, timber, joists or lintels. All ornamental or molded work in cornices, gutters, belt or sill courses, etc., to be figured at special rates.

Cutting and Patching.—Cutting and patching of joists, girder or other holes, slots, panels, recesses, etc., to be paid for on basis of time and material required.

Toothing.—When ordered to rack or block, in consequence of delay of delivery of iron, steel, stone, terra cotta or other material, concrete work that may connect with such racking or blocking shall be measured as extra work, as follows: Increase girt length of such line by half, and multiply by thickness of wall.

Concrete Floors on Soil and Tile Arches.—Floors to be measured by the superficial surface between outside walls of building. No deductions to be made for floor sleepers, conduits, pipes, drains, division or partition walls. No deduction to be made for any piers, columns, chimney breasts, pilasters or other projections of walls of 10 ft. or less in area.

Caissons.—Owing to grillage in caissons being left at different heights in same building, unit price for caissons will be computed on excavated contents, including necessary wood lagging and rings for same. Cubic contents of excavation of caissons to be computed from top of first set of lagging to bottom of caissons and from outside to outside of lagging. If steel or other special casing is required, same to be paid for additional at special unit price per pound.

Area of bottom of bell to be multiplied by height of bell to neck for cubic contents.

For caissons 7 ft. or more in diameter, estimate actual contents from outside to outside of lagging. For smaller caissons add percentage to actual contents, as follows:

Diam., ft.	Add pct.
7 to 6½	5
6½ to 6	15
6 to 5½	25
5½ to 5	35
under 5	50

If compressed air is equipped, to be paid for in addition to the above.

If rings are ordered left in caissons, to be paid for additional at unit prices per pound.

Pumping and bulkheading to be paid for at additional price.

No deductions to be made for cubic contents of metal imbedded in concrete.

Concrete for filling caissons to be computed on actual contents per cubic foot of concrete, but no deduction to be made for any metal imbedded in same.

Reinforced Concrete Work.—Reinforced Walls: Compute concrete on same basis as specified for external and division walls, and add to same cost of reinforcing metal put in place. If (through changes or revisions) cutting of reinforcing metal delivered or ordered becomes necessary, estimate the full length of such bars or metal fabric and add to same the cost of cutting and fitting required. Reinforcing metal to be computed on unit price per pound or square foot. No deductions to be made in estimating cubic contents of concrete for any metal imbedded in same such as wire netting, expanded metal, bars, beams, columns, etc.

Columns: Measuring of plain uniform size columns to be covered by paragraph relating to piers.

Capitals, caps, brackets, panels, moldings or other ornamental or molded work to be figured at special rate.

Girders, Floor Beams or Other Drop Projections Below Floor Slab.—For projections named in this paragraph add for each corner and angle to cubic contents 1 cu. ft. for each foot in length. For each chamfered or rounded corner or angle add ½-cu. ft. for each foot in length in addition to the above.

Floor Slabs.—Floor and roof slabs to be estimated on same basis as floors or soil and at a minimum thickness of 6 ins.

Openings.—No deductions to be made in floor area for openings of less than 20 sq. ft. For larger openings, after deducting full area of opening, add 1 sup. ft. to floor area for each foot in length of girt of opening, and 1 cu. ft. extra for each corner or angle.

Depressions.—For pits, baskets or other depressions in floor, add 1 sup. ft. to the area of walls and floors of same for each foot in length of each corner and angle.

Setting.—Setting of facias, frames, pipes, sleeves, bolts, rods, clamps, etc., imbedded in concrete to be paid for additional at special price.

Floor Base and Coves.—To be estimated at special price per lin. ft. with 1 ft. added to length of same for each corner and angle. For base or cove around round columns estimate three times girt of column, and for square or polygon columns add 1 ft. for each corner to girt of same.

Concrete stairs to be estimated at sq. ft. area of face of treads and risers. Stair-landings and platforms between floors to be same unit price per foot as stairs.

EARTH AND ROCK SECTION

Methods of Making Test Borings in Ohio River.

Test borings to determine the depth to bed rock for the location of the lock and dam sites, in the Ohio River, have been under way for over a year. The river is being explored from New Cumberland, W. Va., to Ashland, Ky. The drilling consists in making test holes across the river and also on the bank.

Fig. 1—View Showing Test Boring Barges and A-Frame for Borings on Shore Using Power from Barges.

A number of Cyclone well drills are used and also four Ingersoll-Rand drills. For drilling in the river the Cyclone drills are mounted on scows and wash borings are put down to rock using the ordinary pipe casing. These machines at first operated the drill through a 20-in. hole in the barge, but this scheme was altered by cutting a slot from the 20-in. hole to the end of the boat, thus making it possible to leave the casing standing and remove the drill boat.

The most interesting development of the work was the drilling of the land holes from the river equipment. The method used is clearly indicated by the accompanying photographs. An A frame was built about 25 ft. high and was braced and guyed to the bank. The Cyclone drill boat was anchored near the bank and a line run from it over sheaves on the A frame to the drill. This scheme worked very satisfactorily and avoided the necessity of providing extra machines for the land work. The work is being done by the U. S. Government and is in charge of Capt. Lytle Brown of Louisville, Ky.

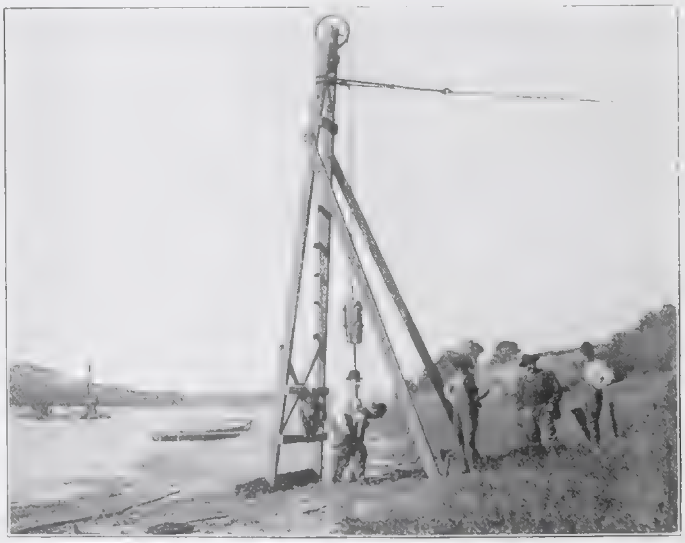


Fig. 2—View Showing Arrangement for Making Borings on Land Using Power from Barges.

The Necessity for Strong Detonators.*

In detonating high explosives, the stronger or sharper the initial shock the quicker and more thorough is the detonation of the charge. It is a well known fact that certain detonating substances will exert this effect more powerfully than others do. To obtain the full value of the explosive charge it should be detonated as quickly and completely as possible. If the detonation is slow and incomplete a greater quantity of explosive is required to do the same work, and large volumes of poisonous gases are evolved—a matter of serious consequence when the work is underground, instances being known where workmen have been killed by gases given off from partially detonated or burning explosives. Quick and complete detonation results in a minimum of flame—a point of first importance with those explosives intended for use in the presence of inflammable gas or coal dust. Electric Fuzes or Blasting Caps too weak to detonate a charge of high explosives frequently generate sufficient heat to ignite it, while slightly stronger ones may partially detonate it. Still stronger ones may cause complete detonation but with insufficient rapidity to give best results.

The effect of a detonator on a charge of high explosives in a bore hole is by no means infinite, but decreases with distance. It is, therefore, easy to understand the necessity for using detonators sufficiently strong for the effect of the detonator itself to extend as far as possible through the charge. It might be understood from this that the detonator should be located in the centre of the charge, and this would be correct, had not numerous tests shown that the greatest effect of the detonator is straight away from its loaded end, and in a line with its long axis. That is a detonator will explode a cartridge of dynamite farther away from it, if it is lying with the loaded end pointed toward the cartridge, than it will if it is lying parallel to the cartridge. We do not attempt to explain this, but we know it is a fact.

In deep bore holes loaded with long charges, whether they be fired with fuse and blasting caps or with electric fuses, it is well to place blasting caps in cartridges of explosives at intervals of at least five feet throughout the charge, so that the effect of the explosive material which they contain will extend the entire length of the charge. It is also advisable to use two electric fuses in deep boreholes so that if one should be defective the other may be depended on for the initial detonation.

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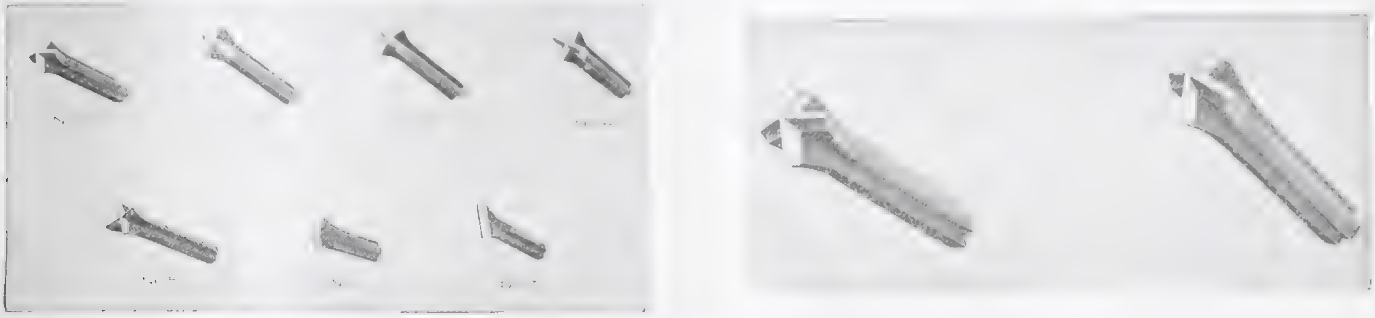
*From the catalog of the E. I. Du Pont de Nemours powder Co., Wilmington, Del.



Figs. 1 and 2—Views of Various Shapes of Drill Bits for Stoping.

A point to be remembered in buying detonators is, that the charge which they contain is readily affected by moisture, and consequently, unless storage conditions are of the best, a fair margin of safety in strength should be allowed. Blasting caps, being open at one end, are more quickly weakened by dampness than are electric fuses.

Another strong argument for allowing a fair margin of safety when buying detonators is the very small cost of the detonator in comparison with that of the charge of explosives with which it is used. It is difficult to understand why anyone, in order to save a few cents on the price of a hundred detonators, would risk the misfire, partial detonation or imperfect work of the charge of explosives in a bore hole which results at best in the loss of several dollars and may cost thousands if it burns in a gaseous coal mine or unexploded dynamite happens to cause a fatal accident afterward.

The following from a contractor who was driving a railroad tunnel shows how thoroughly those who have used strong detonators recognize their value. The 5X blasting cap referred to is now known as the Du Pont No. 5 and the No. 30 Special is the present Du Pont No. 8:

Sir: In reply to your request for information as to the efficiency of your No. 30 Special Blasting Caps I submit the following comparison:

	Du Pont 5X Caps.	No. 30 Special Du Pont Caps.
No. of holes—Ave....	34	25
No. sticks powder per hole	12	9
Minutes before force was able to return to work............	15	7

We have had great success with every hole since using your No. 30 Special and the shift-bosses, etc., are very enthusiastic about them.

The rock to be blasted was very hard granite in a tunnel. Great difficulty was experienced in breaking the rock, especially in the heading. This was drilled about 6 ft., but all holes were shot twice. The section was only 8x16 ft., but a large number of holes was necessary on account of the hard and tough rock. By the use of the No. 30 Special we saved outright the work of one machine for one shift and in that same shift 20 lbs. of powder and at least 20 minutes' time, for the entire force of about 20 men. This is quite a saving and demonstrates beyond a doubt that the No. 30 Special is the best cap for hard rock. The above report shows the results of a test on which close account was kept for a period of 10 days.

The extended study and tests of explosives conducted by the Technologic Branch of the United States Geological Survey have clearly demonstrated the economy of using only strong detonators, and we find on page 52 of Bulletin 423—A Primer on Explosives for Coal Miners, issued by the Department of the Interior—the following:

In the appendix setting forth the test requirements for permissible explosives it is stated that electric or other detonators containing not less than 1 gram of the fulminating composition should be used in firing the charges. For use with high explosives in rock blasting, detonators of that strength are also best. Under no circumstances should an electric or other detonator be used of less strength than No. 5, containing 0.8 gram of the fulminating composition. The greater efficiency and certainty of the stronger detonator more than make up for the slightly greater cost.

The clause in the appendix of Bulletin 423, referred to above, states "That No. 6 detonators, preferably No. 6 electric detonators (double strength), are used of not less strength than 1 gram charge, consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate (or its equivalent)," etc. The Du Pont No. 6 Blasting Cap and Victor No. 6 Electric Fuse, recommended throughout this catalogue for detonating high explosives, comply with the above specifications.

Strong electric fuses and blasting caps should be used with all high explosives; because they insure complete detonation; because they increase the execution of the explosive; because they tend to counterbalance careless and improper usage; because they offset to some extent deterioration due to improper storage; because they reduce to a minimum fumes from the explosive; because they decrease the size and duration of flame; because they prevent the loss of the charge by burning; because their effect carries farther in long charges; because they reduce the chances of misfire.

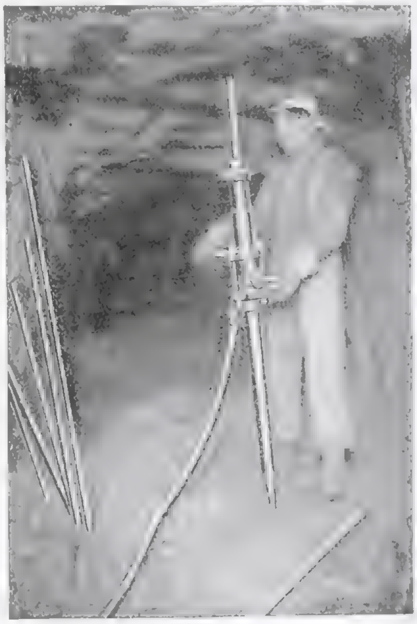


Fig. 3—View of Stoping Drill in Operation.

The largest piece of process welding ever done on the Isthmus was turned out this week from Gorgona shops. It is one of the 18¾-in. shafts of the rock breaker "Vulcan(" which is on subaqueous rock excavation in the Pacific entrance. This shaft forms a part of the ram by the weight of which the rock is crushed. It is made of compressed cast steel, is 56 ft. long and weighs 19 tons.

Refuse Incineration Data, Seattle, Wash.

In our issue of Nov. 2, 1910, costs were given of operating the Meldrum refuse incinerator at Seattle, Wash., for each of the calendar years of 1908 and 1909. Recently figures have been compiled of operation for 24 months from July 31, 1908, to Aug. 1, 1910. The main items are as follows:

Total tons burned	42.581
Composition:	
Ashes, per cent	43.5
Moisture, per cent	4.0
Garbage, per cent........................	32.1
Rubbish, per cent........................	20.4
Average cost per ton burned..............	$0.7365
Receipts from sale of clinkers per ton burned	0.0546
Receipts from sale of power per ton burned	0.0159
Credit for property filled in per ton burned	0.2000
Total receipts	$0.2705
Net cost per ton refuse burned	0.4660

Notes on the Shaping and Tempering of Stoping Drill Bits.

The shape of the bit which will give the best results in any particular kind of ground must be determined by actual test, for the bit which proves its efficiency under certain conditions may be found inadequate in other conditions, and a very slight change in the shape may bring about surprising results.

For this reason it is impractical to make any rigid rule to follow in shaping stoping drill bits. As a general rule, however, the cross bit shown by Fig. 1, sometimes modified to the X-shaped bit, Fig. 2, gives the best results. Modifications of these shapes are determined by experience. The length of the wings is dependent to a great extent upon the hardness of the ground. If extremely hard, long wings are preferable, as they are capable of withstanding the blow much better than short flaring ones; while on the other hand short wings give the bit more chance and enable the drill to be rotated easier for a given amount of reduction in size of the gage.

In drilling holes where several bits are used, a proper gage for each length of bit should be established and adhered to, so that the successive bits will work easily and freely in the hole.

Under all conditions, outside edges of the wings should be made with square corners, and never rounded. This is necessary to maintain the gage of the hole and greatly facilitate the removal of stub, especially when the hole is drilled at a flat angle. In the accompanying table which was prepared by the Sullivan Machinery Co. of Chicago, the tests were made under similar conditions with a stoping drill such as is illustrated by Fig. 3. The drills were carefully selected and each of the shapes illustrated in the cut, Fig. 4, were used. The diameter of all holes drilled was 1⅝ ins., and the duration of each run was 2 minutes. It should be determined just how much work each drill bit will do before the gage begins to wear, and a bit should not be used a second time if the gage is worn, even if the cutting edge is still sharp. Furthermore, a drill bit should never be used if the cutting edge is dull, for not only is the drilling

SHAPES OF DRILL BITS AND RELATIVE DRILLING SPEEDS.

Description of bit.	Average depth drilled per run 70 lbs. Pressure ins.	Average depth drilled per run 85 lbs. Pressure ins.	Remarks.
No. 1—25 degree diamond point +......	6⅝	8½	Spots easily. Hole rifles slightly. Rotation easy. Gage does not wear rapidly.
No. 2—25 degree diamond point X......	6	7¾	Spots easily. Drills round hole. Rotation easy. Gage fairly durable.
No. 3—Convex + ...	6⅛	8¼	Spots easily. Hole rifles slightly Rotation easy. Gage does not wear rapidly.
No. 4 Flat + ...	6	7½	Difficult to spot hole. Hole rifles badly. Rotation hard. Gage fairly durable.
No. 5 4 degree concave +.............	5¾	8¼	Difficut to spot hole. Hole rifles badly. Rotation hard. Gage fairly durable.
No. 6—25 degree pointed bull—.........	5¾	7	Spots easily. Drills round hole. Rotation easy. Gage wears rapidly.
No. 7—Flat bull—......................	5 15/16	7¼	Difficult to spot hole. Hole rifles badly (3 flutes). Rotation hard. Gage wears rapidly.

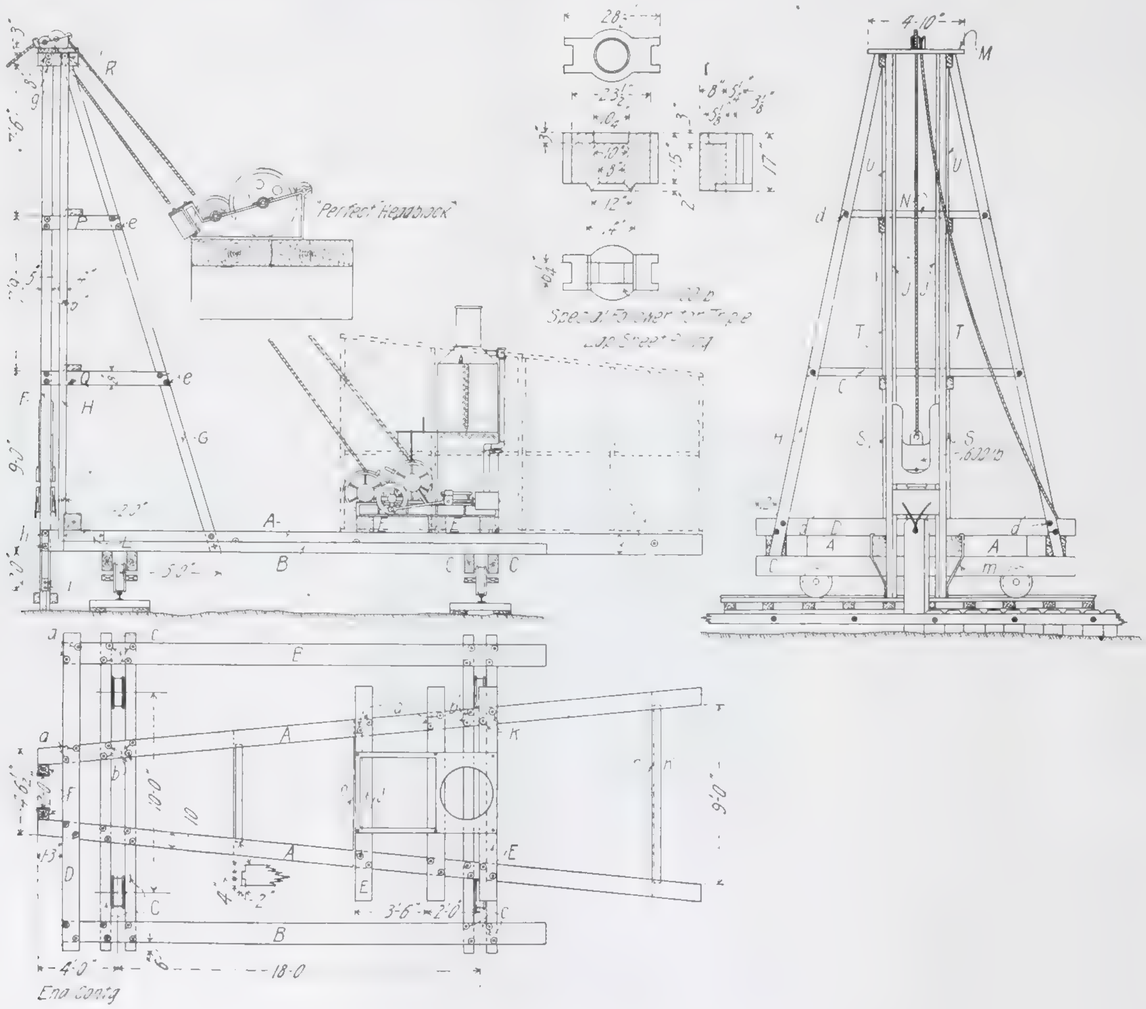
speed of the machine reduced, but the cushioning effect, due to the penetration into the rock at each blow, is lost, with consequent greater rebound and jar on the moving parts.

Bits should be tempered to a hardness suitable to the particular kind of ground in which they are used. The rear end of the bit should also be slightly tempered and ground off flat, with the edges slightly beveled or rounded. Under no circumstances should a bit be inserted in a machine if the shank end is rounded or otherwise out of shape, for it will have a tendency to hollow out the striking plug, with the consequent breakage of this part.

A Special Sheet Pile Driver and Follower for Work on the New York Barge Canal.

The accompanying drawings show a traveling pile driver, with a special follower for triple lap sheet piling, which was used successfully on the Champlain Canal last season. A section of the canal required the building of an embankment along the side of the canal for a distance of several miles. Along the center of the embankment a line of triple lap sheet piling was driven. The pile driver was rigged on wheels, running on two rails, as shown, and was equipped with a Lidgerwood 7x10 in. double-drum engine. A 1,600-lbs. drop hammer was used, and a special follower was made which played a very important part in keeping the sheeting in true alignment, and by so doing, considerably lightened the work. A detail of the follower is shown on the plans.

The accompanying table is a bill of material covering the lumber and iron used in the construction of the pile driver frame. The driver was used by the Atlantic-Gulf and Pacific Co. and was designed by the constructing engineer for the company, Mr. C. R. Neher.



Plans of Sheet Pile Driver With Details of Follower.

BILL OF MATERIAL—SHEET PILE DRIVER.

Mark.	No.	Size, ins.	Length Ft.	Length Ins.	Ft. B. M.
A.	2	10x12	30	0	600.
B.	2	6x12	24	0	288.
C.	4	6x12	16	0	384.
D.	1	10x10	16	0	134.
E.	3	10x10	12	0	300.
F.	2	6x 6	27	3	168.
G.	2	4x 6	26	3	112.
H.	2	4x 6	25	9	104.
I.	1	4x12	4	10	20.
J.	1	4x12	6	1	24.
K.	1	4x12	8	11	36.
L.	2	6x12	2	0	24.
M.	2	3x12	4	10	30.
N.	1	4x10	7	7	25.
O.	1	4x10	11	0	36.
P.	2	4x 8	4	0	20.5
Q.	2	4x 8	6	5	35.
R.	2	4x 8	2	0	10.5
S.	2	2x 6	6	6	13.
T.	2	2x 6	7	2	14.
U.	2	2x 6	7	7	16.
					2,394.
House and floor					1,800.
					4,194.

Mark	No.	Size of bolts. Ins.	
a′	16	1x22 (Wood)	
b′	14	1x24 (Wood)	
c′	16	1x18 (Wood)	
d′	12	1x13 (Wood)	
e′	8	1x 8 (Wood)	
			C'nt'rsink heads
g′	12	1x10 (Wood)	
h′	4	1x15¾ (Wood)	"
i′	4	1x 6½ (Wood)	"
j′	6	1x 8 (Wood)	"
k′	2	1x34 (Wood)	
l′	2	1x13 (Wood)	"
m′	2	½x 3x41	Plate.
n′	1	1x10 ft. 3 ins.	Wood Rod.
o′	1	1x 7 ft. 5 ins.	Wood Rod.
p′	1	1x 6 ft. 3 ins.	Rod.
	2	26 ft.x6 ins.	Channel.
	170	1 in. O-G	Washers.

Some Costs of Gold Dredging and Records of Dredge Operation of Interest to Dredging Contractors.

The following notes on dredging are abstracted from an article by Mr. John Tyssowski in the *Engineering and Mining Journal*. The dredges considered are all ladder dredges used for excavating in gold bearing gravel and are equipped with washing and screening machinery, but the costs given and tables worked out are of great value to the dredging industry at large.

The buckets on the largest dredges now operating in California fields are of 13½ cu. ft. capacity. Through the use of the improved and larger dredges costs have been reduced, in some cases, close to 2½ cts. per cu. yd. of material handled.

Experience seems to have proved the superiority of the spud method of anchoring dredges to that of using headlines to keep them to their work and the latter type is fast disappearing from the field, except where only loose material must be dug. The close-connected bucket chain is also almost universally desired in preference to the open link chain, although the latter type is doubtless better adapted to digging ground containing quantities of large rocks.

The period of usefulness of the dredge has been determined in some cases by the life of the hull. This indicates that the hull is the critical point to be considered in dredge design. The difficulty of designing a hull strong enough to stand up under the hard service has been a serious obstacle in dredge building. On one California boat, after 1½ years of excavation, the distortion of the hull measured 6 ins. According to the latest and most improved California design, two trusses, one along each side of the well hole and about 20 ft. above the deck, extend from bow to stern gauntree. This has been found to give stiffness and add materially to the wearing qualities of the hull. Athwartship distortion is taken care of by trusses under the main drive and forward of the main housing. Partitions of heavy timber forming a continuation of the sides of the well hole run the full length of the hull dividing it into three longitudinal compartments. Partitions of lighter timber extend from bow to stern subdividing the outer compartments. An overhang of 4 to 6 ft. is usually provided on either side of the deck. Heavy timbers are laid crosswise to form the bottom of the hull, and upon these, between compartments horizontal angle braces, butting at their ends, are placed to form a lacing across the hull. This gives rigidity to the hull and takes care of the excessive strains that come to it from the spuds.

On the boats of the Yuba Consolidated Gold Fields, buffer plates and nuts of heavy steel car springs are used to assist in taking the shock from the spuds. On each of the boats being built by the Yuba Construction Co. a steel casting will distribute the load over the stern. This casting will weigh 8 tons. Each boat will be provided with 38x50 in. x 70 ft. steel spuds with 10-ft. steel points and weighing 84,000 lbs. each. The main cord of each spud will be lined on the edges with 1x8x8 in. angle irons. There will be a guide at the top but no spud casing will be required.

These dredges are all electrically equipped, and take power from local companies in California. In a large number of cases the power is furnished from hydro-electric plants. The later improvements in the mechanical equipment of dredges differ only in a few details from the old machines. In the original 5 cu. ft. boats the upper tumbler shafts were 9½ ins. in diameter, but on the new 13 cu. ft. boats this shaft is to be 25 ins. in diameter and built of forged nickel steel. For the swinging winch, gearing for speed reduction and speed change will be set on an auxiliary frame, to one side of the main winch. Speed change clutches will be of the friction type instead of the jaw type commonly used. It will be possible to change from low to high speed without stopping the motor.

The close connected, in preference to the open link bucket chain, is in general favor. The buckets consist of three parts, bottom, hood and lip. The bottoms are made of chrome-nickel steel and for the 8 cu. ft. buckets are 1 in. thick and about 9 ins. long. The hoods are made of ⅜ in. pressed flange steel and 1-in. rivets are used.

The disposal of waste is expensive. Practically all of the present boats use rubber conveyor belts. On the Folsom No. 6 (Table III) the belt is 32 ins. wide and 317 ft. long, being run at 360 ft. per min. This conveyor is suspended from the bow over the bank at an angle of 22° from the horizontal which is about the maximum inclination possible. On the new boats 42-in. belts 136 ft. long will be used and will be supplied with silent chain drives.

A 32-in. belt of 7-ply rubber costs from $7 to $8 per lineal foot and lasts only from 90

TABLE I.—COST OF DREDGE EXCAVATION.

Bucket capacity	Period of observation, months.	Actual operating time, per cent	Gravel dug, per mo.	Depth of gravel	Character of ground	Cost per cu. yd., cents.
3	12	82.3	38,200	27	Favorable	70.0
3½	12	83.7	38,400	35	Compact	7.32
5	12	....	67,600	36	Medium	6.65
7	12	77.0	84,700	28	Compact	4.51
7½	12	73.2	113,900		Medium	4.16
8	6	72.2	97,000	42	Light	3.92
13½	8	77.2	225,000	19	Fine & light	2.30

TABLE II.—PERCENTAGE SEGREGATION OF COSTS OF DREDGING IN CALIFORNIA.

Capacity of buckets, cu. ft.	Labor and material.	Repairs.	Water.	Electric power	General.	Taxes and insurance
3	28.7	47.0	...	9.9	9.0	5.4
3½	38.9	23.3	1.6	21.6	14.6	...
5	34.5	44.2	...	16.2	....	5.1
7	24.4	48.5	3.3	14.4	6.3	3.1
7½	23.8	47.0	..	18.5	10.7	...
8	43.1	29.1	.	15.1	7.1	5.6
13½	44.4	26.0		20.4	5.3	3.9

TABLE III.—DIMENSIONS OF MAIN FEATURES.

Dredge.	Hull Dimensions: Depth	Width	Length.	Digging: Length ladders C of drums	Dig below water line.	Carry bank.	Buckets: Capacity, cu. ft.	Number in chain.	Travel: Feet per minute.	No. per minute.
Natoma No. 1...	11′-6″	50′	112′	104′	35′-6″	20′	[illegible]	61	64	20
Natoma No. 2....	9′	42′-8″	105′	92′	31′	25′	[illegible]	66	50	20
Natoma No. 3...........	9′	42′-8″	105′	92′	37′	25′	[illegible]	[illegible]	50	20
Folsom No. 3..................	10′	42′-7″	120′	100′	37′-6″	20′	[illegible]	[illegible]	50	18
Folsom No. 4..................	10′-3″	44′-7″	102′	90′	24′	20′	[illegible]	[illegible]	50	18
Folsom No. 5..................	10′-3″	44′-7″	110′	142′	49′-6″	26′	8½	[illegible]	50	18
Folsom No. 6........	10′-3″	46′-6″	120′	145′	54′	30′	[illegible]	[illegible]	50	18
Yuba 9-10-11-12.... ..	9′-4″	44′	133′		60′	...	[illegible]	94	.	..

TABLE IV.—ELECTRICAL EQUIPMENT AND POWER CONSUMPTION ON CALIFORNIA DREDGES.

Dredge.	Main Drive Motors: H. P.	Make	V. or C.¹	Volts	R. P. M.	Type	Conveyor Motors: H. P.	Make	V. or C.	Volts	R. P. M.	Type	Side-line Winch Motors: H. P.	Make	V. or C.	Volts	R. P. M.	Type	Monitor: H. P.	Make	V. or C.	Volts	R. P. M.	Type	Transformers⁵: Number	KW	Volts	Horsepower Totals: Capacity	[illegible]
Natoma No. [illegible]	300	G.E.	v	550	514	.	35	G.E.	c	550	600	.	35	G.E.	v	550	514	..	....	......	..	...	.	.....	3 1⁴	175 5	4000-575	570	219
Natoma No. [illegible]	200	G.E	v.	2000	600	...	35	G.E.	c	440	600		25	G.E.	v	440	600	.	....	......	.	...	.	.....	3 1⁴	125 5	4000-460	560	182
Natoma No. [illegible]	200	G.E.	v.	2000	600	...	25	G.E.	c	440	600	..	25	G.E.	v	440	600	..	....	......	..	...	..	.....	3 1⁴	125 5	4000-460	270	229
Folsom No. [illegible]	150	West.	v	2000	315	F	40	West.	c	400	850	C	30	West.	v	400	850	F	150²	West.	c	...	850	CCL	3	37.5	2300-460	520	364
Folsom No. [illegible]	200	West.	v.	2000	580	HF	40	West.	v.	400	850	F	30	West.	v.	400	850	F	....	......	..	..	..	.....	3	37.5	[illegible]-460	270	167
Folsom No. [illegible]	200	West.	v.	2000	580	HF	30	West.	c.	400	850	C	30	West.	v.	400	850	F	50²	West	c.	....	850	CCL	.	37.5	2300-460	360	353
Folsom No. 6	200	West.	v	2000	600	HF	50	West.	v.	400	850	C	30	West.	v	400	850	F	150²	West.	v.	2000	580	F	.	37.5	2300-460	500	229
Yuba Nos. [illegible]	200	......	..	....	...	....	25	......	..	...	...	..	25	......	..	...	...	..	....	......	..	....	...	.....	.	....	4000-440	250	...

¹Variable or constant speed. ²Two motors. ⁴Light circuit. ⁵Natoma division carries 4400 volts on boats and transforms to 440 volts; Folsom carries 2000 volts on boats and transforms to 440 volts for small motors.

to 140 days, so it is evident that there is still room for improvement on this feature of the operation.

Nearly one-third of the gold dredges operating in California have been built by the Yuba Construction Co., all being operated by companies under the control of W. P. Hammon, who organized the dredge building company. Most of the other dredges have been built by the Bucyrus Co. and the Risdon Engineering & Construction Co. A considerable part of the machinery used in the Yuba and Western engineering boats is built by the Bucyrus Co.

The accompanying Table I shows the data on the operation of seven dredges of various sizes. Table II gives a percentage distribution of the costs. The item Water is for water bought from the irrigation companies. The costs of electric power given in both tables includes the power for the pumping machinery. The horsepower required for this pumping and screening machinery averages 64 per cent of the total horsepower on all the dredges considered. The cost of power for the actual excavation may, therefore, be assumed as 64 per cent of the cost of power given by the tables.

Other available data on the costs of dredging at Oroville show costs per cubic yard ranging from 5 to 9 cts. Wages do not vary greatly in the different fields. The winchmen receive $3.50 and $4.00 per 8-hour day. Oilers receive from $2.50 to $3. Chinamen employed cleaning off ground before dredges, receive $2 per day. The repair men receive $2.50. A regular dredge crew consists of 1 winchman and three oilers besides extra men employed on extraordinary repair work. One clean-up crew usually attends several dredges. Three 8-hour shifts are worked. Power costs range up to about 1½ cts. per K. W.-hr., 1¼ cts. being a fair average, and 0.65 being minimum.

In Table IV, which shows the electrical equipment and power consumption—the equipment for the screens and gravel washing machinery has been neglected. The figures for horsepower output were originally figured for the entire capacity of the dredge motors, but in this case the output has been proportioned to show that for the digging machinery only.

ROADS AND STREETS SECTION

Comparative Costs of Macadam, Rocmac and Tarviated Roads.

The Urban District of Alton, England, in 1909, began the tar painting of its granite-coated main roads with a view to reducing the dust. Experiments were also conducted in the construction of special types of roads, such as Rocmac and tarviated macadam. This dust preventive work was described by Mr. G. Bertram Hartfree, Surveyor to the Council, in a paper read at the recent Guildford, England, meeting of the Institution of Municipal and County Engineers. In his paper Mr. Hartfree gave the following comparative costs of the construction of several types of roads.

The construction of a Rocmac road is on somewhat similar lines to the various tar subbinders, the tar being replaced by the Rocmac solution, which contains caustic soda, sugar, molasses and several other ingredients the names of which the makers do not divulge. The mineral portion of the matrix is carboniferous limestone; magnesium limestones are unsuitable. It is imperative that the road have a sound foundation.

In the construction of the Rocmac type of road in the Alton Urban District the road surface was first lightly scarified to within 12 in. of the channel stones, raked over and rolled to the required camber, the surplus material being carted away. Upon this foundation a layer of matrix ⅞ in. thick was spread, the matrix consisting of Shepton Mallet limestone dust two parts to one of ⅜-in. chippings from the same locality. To every cubic yard of the limestone 15 gallons of solution were added, and the whole well mixed and turned over seven times. Thorough mixing and turning over are essential for good results, and half-yard mixings should be the maximum. The mixture was immediately spread and raked over to the required thickness and covered with 2-in. Clee Hill basalt to a depth of 4 in.; as soon as sufficient granite was spread to render rolling possible it was rolled by a 10-ton roller. At the end of an hour the matrix commenced showing through the interstices of the macadam, first the ooze containing the smaller particles and eventually the chippings until the whole of the voids were filled and a slurry that could be swept appeared on the surface. No water whatever was required on wet days, but during sunshine it was necessary to water the roller and wheels to prevent the matrix sticking to them. This being of a nature somewhat similar to a quick-setting cement, spreading must immediately be followed by rolling, and the whole of the material spread during any day must be rolled before the expiration of that day's work.

In the tarviated road work a Tarvia matrix was used. This Tarvia matrix was made by heating ⅜ in. Clee Hill chippings and mixing with Tarvia heated in an ordinary tar boiler to a temperature of 125° F. The Tarvia was mixed in the proportion of 12 gals. to 1 cu. yd. of chippings. In using the matrix the surface of the road was first scarified, raked and rolled to the required contour, plenty of water being used during the rolling of formation. The matrix was then spread to a depth of ½ in. and covered with a coating of 2 in. basalt. The roller was then very slowly moved onto the granite. After the roller had passed over some three or four times the matrix appeared through the crevices of the stone. The macadam was next sprayed with liquid Tarvia and covered with top binder, using the same material as for sub-binder. The whole was then sprinkled with chippings and rolled in.

Owing to the great variation in cost per square yard which the difference in thickness of a road surface even ¼ in. will make Mr. Hartfree has adopted the following standard for purposes of comparison: Two tons of broken granite, consolidated, will fill 1 cu. yd. of new surface equal to 12 sq. yds. 3 in. thick; 5 tons of limestone chippings or dust will make 3 cu. yds. consolidated; 1 cu. yd. of imported grouting (small gravel and sand) equals 1 cu. yd. consolidated; earth binding being calculated the same; and 5 cu. yds. of flint will consolidate to 3 cu. yds.

Mr. Hartfree gives the following comparative costs of road work at Alton, England, for plainer macadam roads, based on an estimated compacted thickness of 3 ins.:

FLINT ROAD (2,208 SQ. YDS.).

	Total cost.	Per sq. yd.
273 cu. yds. flints, including breaking	$367.40	$0.1664
Hauling flints	56.20	.0254
Spreading	16.02	.0072
Rolling	30.86	.0137
Sweeping	5.66	.0025
Hauling water	10.08	.0045
Hauling binder	9.06	.0041
Total (2,208 sq. yds.)	$494.78	$0.2238

ROAD LAID WITH ROWLEY REGIS GRANITE (2,508 SQ. YDS.).

212 tons 2¼ in. Rowley rag.*	$682.50	$0.2730
84½ tons 2-in. Rowley rag	277.20	.1108
42 tons 1-in. Rowley rag	112.26	.0448
Hauling granite	89.28	.0356
Spreading, etc.	33.46	.0133
Rolling	48.60	.0194
Scarifying	23.20	.0092
Sweeping	17.14	.0068
Hauling water and cost of water	14.58	.0058
Hauling binding	19.76	.0079
Grouting 40 yds.	23.36	.0091
Earth binding	.....	.....
Total (2,508 sq. yds.)	$1,341.34	$0.5357

*Some of the above was spread on flint surface, which did not require scarifying.

CLEE HILL GRANITE SPREAD IN 1908 (3,370 SQ. YDS.).

227 tons 18 cwt. 2¼-in. Clee Hill stone	$803.00	$0.2382
219 tons 14 cwt. 2-in. Clee Hill stone	782.46	.2321
18 tons 1-in. clean stone	55.02	.0163
16 tons 3 cwt. 1-in. to dust	45.44	.0135
40 yds. grouting	30.76	.0091
Haulage	101.38	.0300
Spreading, etc.	36.42	.0108
Rolling	78.10	.0235
Scarifying	30.36	.0090
Water and binding	46.56	.0138
Sweeping	21.14	.0062
Totals (3,370 sq. yds.)	$2,030.64	$0.6025

CLEE HILL GRANITE SPREAD ON FLINT SURFACE PARTLY SCARIFIED (1,074 SQ. YDS.).

153 tons 2 cwt. Clee Hill granite	$513.99	$0.4778
10 yds. grouting	7.66	.0070
16 yds. earth binding	.....	.....
8,000 gals. water	.96	.0001
Rolling	20.94	.0195
Scarifying	4.24	.0040
Hauling granite	37.14	.0345
Spreading	15.78	.0146
Sweeping	5.82	.0054
Hauling water and binding	24.54	.0228
Total (1.074 sq. yds.)	$631.07	$0.5857

The following was the cost of constructing a Rocmac road. The area covered was 1,266 sq. yds., with an average thickness of nearly 2½ ins. On the 3 in. basis the cost would have been 75 cts. per sq. yd. A portion of the gravel was hauled from station to depot and thence to the road. Otherwise the cost on the 3-in. basis would have been 74 cts. per sq. yd.

ROCMAC ROAD (1,266 SQ. YDS.).

93 tons 10 cwt. 2-in. Clee Hill stone	$316.19	$0.2497
15 tons 18 cwt. ⅜-in. limestone chippings	38.58	.0304
30 tons 5 cwt. limestone dust	73.50	.0580
568 gals. Rocmac fluid	114.98	.0908
Team labor	41.61	.0328
Manual labor, including night watchman	47.38	.0374
Steam rolling (44 hours)	26.76	.0211
Scarifying	13.18	.0120
Total (1,266 sq. yds.)	$674.18	$0.5322

The cost of the Tarviated road was as shown below. The total yardage was 1,208 sq. yds. On the basis of being 3 ins. thick the yardage would have been 666 sq. yds. and the cost would have been 75.4 cts. per sq. yd.

TARVIATED ROAD (1,208 SQ. YDS.).

69¼ tons 2-in. Clee Hill basalt	$234.18	$0.1938
32¾ tons ¼-in. Clee Hill chippings	110.05	.0911
7½ tons ⅜-in. limestone	18.18	.0150
Rolling (21 hours)	12.72	.0105
Scarifying (1,208 sq. yds.)	15.28	.0126
Hauling chippings and limestone to depot	4.94	.0041
Other team labor	14.10	.0116
524 gals. Tarvia	46.39	.0389
Haulage and return carriage on Tarvia barrels	3.00	.0024
Fuel for tar boiler	1.40	.0011
Manual labor	47.90	.0396
Total (1,208 sq. yds.)	$508.14	$0.4202

On a basis of the tonnage of granite and limestone used, the total cost of the various types of roads was as follows:

	Per ton.
Water-bound roads without imported grouting	$3.92
Water-bound roads with imported grouting	4.11
Rocmac road	4.79
Tarviated roads	4.61

The tonnage rolled per day of 9 hours was as follows:

	Tons.
Water-bound macadam	36
Rocmac	28
Tarviated	46

The following table shows the allocated percentage of cost of the various types of road:

	Water-bound.	Rocmac.	Tarviated.
Granite and limestone	84⅜	65⅜	71¼
Water and binding	1⅛	....	....
Rocmac fluid	....	17¼	....
Tarvia	....	....	10⅛
(1) Materials	85½	82⅝	81⅜
(2) Scarifying	1½	2½	3
(3) Rolling	3⅝	4	2⅝
(4) Team	6⅞	3½	3½
(5) Manual	2½	7⅜	9½
Totals, per cent	100	100	100

Repairing and Renewing Sheet Asphalt Pavements.

At the recent convention of the American Society of Municipal Improvements at Erie, Pa., in a discussion of a paper on repairing asphalt pavements, the question was raised as to what should be the limit of repairs to an asphalt pavement before deciding to lay a new surface. In the discussion at Erie it was stated that the engineers of the street department of New York City figured that when the costs of repairs amounted to 30 cts. or more per sq. yd. it was time to renew the surface. The specifications for sheet asphalt pavements, prepared by Mr. F. P. Smith, as a member of the sub-committee on that subject, for submission to the general committee on specifications at the Erie convention contain the following provision regarding repairing asphalt pavements:

> Whenever the repairs made at any one time shall amount to more than 50 per cent of the surface of any one block, the entire pavement on that block shall be taken up and relaid. These repairs, except as provided for below, shall in all cases be made by cutting out the defective binder and wearing surface down to the concrete and replacing them by new and freshly prepared binder and wearing surface made and laid in strict accordance with these specifications.
>
> Whenever any defects are caused by the failure of the foundation, the pavement, including such foundation, shall be taken up and relaid with freshly prepared material made and laid in strict accordance with these specifications.

As this question as to the limit of repairs to street asphalt pavements is one of no little interest, and as there seems to be no set rule in use regarding it, we give below some notes on the practice followed in several cities:

Washington, D. C.—In this city the decision regarding the renewal of an asphalt pavement instead of further repairing it is not determined by any formulated rules. There are, however, certain general conditions which can be stated as applying to the determination of the question. The cost of repairing the asphalt streets for some years past, including all pavements that were out of guarantee, has approximated 3 cts. per sq. yd. per year. The average age of pavements resurfaced in recent years has approximated 21 years. The annual cost of repairing streets that have been recently resurfaced, in the year preceding their resurfacing, can probably be stated as ranging from 8 to 15 cts. per sq. yd. The annual cost of repairing a street is influenced to a considerable extent by its importance as a thoroughfare, the less important ones not being maintained on as liberal basis as the more important ones. Certain streets, moreover, which do not cost large sums for repairing on account of the toughness of the pavement become proper cases for resurfacing on account of their uneven surfaces and what might be described as their bumpy condition. The selection of the time for resurfacing any particular street is a matter of judgment on the part of the district engineers and inspectors who have had many years of experience in the patching and resurfacing operations.

Buffalo, N. Y.—This city has a direct provision in its charter covering the repairing and repaving of its streets. This charter provision is as follows:

> Sec. 279. All streets or parts of streets paved at the time this act takes effect, or which shall subsequently be paved, shall be deemed accepted streets within the meaning of this title, and shall be repaired when necessary, if the Commissioner of Public Works certified that less than one-third of the carriageway is in condition requiring repairs, but whenever the Commissioner of Public Works shall certify that it is not expedient to make further repairs upon the pavement in an accepted street, or in the portion thereof between two streets that intersect or meet the same, the Common Council may order said street, or the portion thereof mentioned in such certificate, repaved, and two-thirds of the expense thereof shall be paid by local assessment, and the remaining one-third thereof shall be a charge on and paid out of the General Fund of the city, as in this act provided.

The custom has been to certify as "inexpedient" when $1 per yd. has been expended upon repairs.

The Department of Public Works has under maintenance about 2,900,000 sq. yds. of asphalt after expiration of the 10-year guarantee. For a number of years the department's appropriation was insufficient to keep the streets in proper condition and a few went so far as to have more than one-third the surface in need of repairs and these were certified and repaved. For the past two years the appropriation has been larger, the deficiency in repairs nearly eliminated and the streets put in good condition. When funds were short, the repairs, of necessity, were limited in extent to little more than filling holes. The result was that the surrounding poor material soon pounded out and the patch of good material went with it. This led to the erroneous public opinion that the patch material was at fault. For the past two years the policy has been to cut back until sound material was found upon which to join the patch and to remove thin and noduled spots which would probably become holes before the next repair, or to prevent holes rather than fill them. It is believed that this policy of preventing holes will reduce the cost of repairs as well as prevent a nuisance.

The above policy, however, has raised a serious question. For example, four streets having about 25,000 sq. yds. have been certified as inexpedient to repair. They range from 17 to 28 years old and have had about $1 per. yd. in repairs. They could be put in serviceable condition for another year at a cost of 4 or 5 cts. per yard. This is less than the interest charge for a new surface and its annual deterioration. Of course, such repaired pavement is not as smooth and easy for traffic as a new one, but it is serviceable. An old pavement with some waves, depressions and uneven gutters may be reasonably serviceable on a street of light traffic and low property values where such conditions would not be satisfactory on a street of heavy travel or fine residences.

As to the theoretical side of the question Mr. George H. Norton, Deputy Engineer Commissioner of Buffalo, gives the following opinions:

First—Theoretically an asphalt surface should be renewed when the annual cost of repairs equals the interest and depreciation charges on a new pavement, or is less to the extent that a new surface is worth more than the old for traffic accommodation.

Second—No asphalt surface should be so maintained as to be in need of one-half, one-third or one-fourth repairs at any time, and such rule is not applicable.

Third—Theoretically the expediency of further repairs should be determined by the judgment of the engineer, having in mind the first point above and a knowledge of the physical condition of the old material as to its probable subsequent serviceability. This, however, may place upon him an unjust burden of local influence and charges of favoritism, making it undesirable.

Fourth—A limit of the total amount of repairs to be made before laying a new surface now seems the most just and practical solution. Some reasonably fair but definite limit will be best appreciated by those who are to be assessed for a new surface. Where such renewal is not a local charge upon abutting property, then the whole matter should be left to the judgment of the engineer having before him the detailed cost of all repairs made and the physical and traffic conditions of each individual street without rule.

Asphalt repairs are made by contract in Buffalo, using all new material, material and labor furnished at unit prices, at a cost of about $1.02 per sq. yd. with one year guarantee. For all repairs since asphalt was laid about 43,000,000 yd.-years have cost 3.8 cts. per yd.-year. The Department of Public Works now estimates that asphalt can be kept in good condition for 4½ cts. per yd.-year after expiration of a 10-year maintenance period to reach an average age of at least 20 years.

Detroit, Mich.—This city has no set rule for resurfacing its sheet asphalt pavements and has no clause in its specifications specifying at what time such work shall be done. Every fall the city asphalt expert goes over the old asphalt pavements carefully and if in his opinion they should be resurfaced he makes his recommendations accordingly to the Commissioner of Public Works, who lists the streets in his estimates and these are acted upon by the Common Council and the Board of Estimate.

Kansas City, Mo.—In Kansas City the Board of Public Works has no fixed rule for determining when to repair or when to repave the streets; thus far it has been found true in a large per cent of the streets that when the surface has failed the base has also shown decided weaknesses and in such cases repaving has been done, where if the base had been of good quality only the surface would have been repaired. In deciding whether or not a street should be repaved or repaired, the Board of Public Works is guided in its decision by first making an estimate of the cost of repairing to see if such repairing will produce a less or a greater annual expense than to repave.

The city owns its own asphalt repair plant and on that account may in some cases have repaired, where if the work had been done by contract and paid for by tax bills, repaving would have been resorted to.

Harrisbury, Pa.—This city has about 40 miles of sheet asphalt streets, all of which are under guarantee in one way or another—either a 5-year guarantee contract or the repairing contract. In either case the specifications state that "Should it be found necessary to replace 50 per cent or more of any section of the street with new material, the entire section shall be resurfaced with 1 in. of binder and 2 ins. of asphalt wearing surface." So far it has not been found necessary to resurface an entire section of a street.

Pittsburg, Pa.—The Department of Public Works of this city has no general rule governing the question as to when asphalt repairs should be abandoned and the pavement renewed. The streets selected for repaving are determined by the City Councils and frequently the appropriations are so limited in their amount that asphalt repairs have to be made by the department upon streets where the pavement has been laid from 15 to 20 years and scarcely any of the original material remains. Under these conditions where the authority for the repaving of streets is vested in the legislative branches of the city government, the question can not always be treated from the standpoint of economy and therefore asphalt repairs must be made to meet these conditions. If the question is treated from a purely economical standpoint, Mr. H. S. Sprague, Superintendent of Construction, is of the opinion, assuming the concrete foundation, curbing, etc., are in a good condition, that it will be economical to make asphalt repairs considerably in excess of 50 per cent of the surface area of the street, especially in cities having their own asphalt repair plants.

Close Jointed Heavily Grouted Granite Block Pavement.

Within the past few years a great advance has been made in this country in the construction of granite block pavements. The two main features of this advance have been the use of close jointed blocks and the special attention which has been paid to the grouting of the pavement. The city of Newark, N. J., during the past two or three years has been giving much attention to the construction of close jointed heavily grouted granite block pavement, and now has perhaps a greater yardage of this kind of pavement than any other American city. The work in Newark has been done under the direction of Mr. W. A. Howell, Engineer of Streets. At the recent convention of the American Society of

Municipal Improvements, Mr. Howell presented a paper describing the work at Newark, and from the paper we have taken the notes that follow.

The idea of grouting granite block pavements is said to have originated in New England. The city of Worcester, Mass., has been familiar with this style of pavement for 10 or 12 years. The cities of Lawrence, Mass., and Troy, N. Y., have laid a considerable yardage of close jointed, heavily grouted granite pavements, during the past 3 years. In Newark, the city officials became interested in this form of pavement in the autumn of 1908. The city of Newark had adopted cement grout as a filler in 1906, when some 833 sq. yds. of pavement were laid, but no especial change in the specifications, as to the dimensions of the granite blocks, and the width of the joints was made until 1909. The Newark granite specifications from about 1900 to 1908, inclusive, practically called for a 7 in. block. The 1909 specifications provided for a 6 in. block, and they further provided that the joints should not exceed ⅜ in., and that there should be no deviation from a true plane surface, on each face of the block, greater than 3/16 in. In order to get good results from grouting the specifications were worded as follows:

> The grout must be mixed with a suitable apparatus in which the mixture of sand, cement and water are continually agitated, immediately preceding and during the process of pouring. To obtain satisfactory results with the grout, it would seem essential that some form of mechanical agitator should be used, and if found necessary to obtain satisfactory results, such a method of handling the operation of grouting must be employed.

The first granite blocks laid in Newark in conformity with the above specifications, as to size of blocks and width of joints, were laid by the Public Service Corporation, owner of the local street railway, in a stretch of its Broad St. tracks, from Market St. to Clinton Ave. The material used was mostly from the Long Cove quarries in Maine. Although these blocks were not grouted with cement, tar and gravel filler being used, the general public at once realized that a great advance had been made in this form of granite paving. The smoothness of the surface of the pavement, in the tracks, contrasted with the old style of granite block pavement, laid between the tracks and curb, on the same street, was very noticeable. This stretch of smooth track pavement at once became a favorite automobile course, and remains so to the present day. This Broad St. track paving was laid under city supervision, and the good results obtained were secured only by the most rigid inspection, and untiring efforts on the part of the City Engineering Department. The first six contracts awarded during 1909, for close-jointed, heavily grouted granite pavements, were awarded to the same contractor, who laid the block pavement in the Broad St. tracks of the Public Service Corporation. The six streets referred to carried a yardage of 21,280 sq. yds. Three of the streets were selected to be paved with granite from Rockport, Mass., and the other three streets were paved with Long Cove granite from Maine. The first two streets paved were Arlington St. and Augusta St., the material used, Long Cove granite, being a fine grained granite. Although there was much culling of blocks, frequent delays caused by striking pavers and slow shipments, the trouble experienced in paving these streets did not compare with the difficulties encountered in paving Christie St., and getting a ¾ in. joint from the coarse grained Rockport granite. The result of the first year's work at Newark on the new style of granite paving was not particularly encouraging as the city awarded contracts for 55,830 sq. yds., of which amount it actually laid only 17,835 sq. yds. Acting under the suggestion of Mr. William Booth of the Booth Brothers & Hurricane Island Granite Co., Mr. Morris R. Sherrard, Chief Engineer of Public Works of Newark, called a conference of municipal engineers, paving block producers and granite paving contractors, for the purpose of discussing uniform specifications, which would secure an improved quality of granite block. This conference was held on Feb. 18, 1910, at New York City and after considerable discussion it was recommended that the following be adopted as part of the specifications for granite paving blocks: That the depth of the block run from 4¾ to 5¼ ins., practically a 5-in. block. That blocks be required which can be laid with a ½-in. joint. Also that the head of the block shall not have more than ⅜ in. depression from a straight edge, laid in any direction across the head, and held parallel to the general surface of the block. These requirements were the result of a compromise between what the engineers wanted and what the quarrymen said it would be possible to accomplish at the quarries. At the Chicago convention for Standardizing Paving Specifications, held Feb. 21 to Feb. 26, 1910, granite block specifications were adopted almost identical with the above. These specifications have also been adopted by the City of Newark. The Chicago specifications, subsequently adopted at Newark, contained the following reference to grouting:

> After the pavement has been brought to a uniform surface, Portland cement grout shall be poured into the joints until it appears on the surface, and the operation must be continued as the grout settles until the joints are thoroughly filled flush with the surface of the blocks, immediately after which the entire pavement shall be broomed to a smooth surface, sufficient grout being applied to bring said surface even with the highest part of any of the blocks. The blocks shall be wet by sprinkling immediately before applying the grout, if the condition of the atmosphere requires this precaution to be taken.
>
> The cement grout shall be composed of one or more measures of the best quality of freshly burned Portland cement not to exceed one measure of clean, sharp sand. The mixture to be employed for any piece of work shall depend upon the hardness of the granite used, and this mixture shall be ascertained by sufficient experiments to give a grade which will be of such a strength as to wear down uniformly with the granite used. In the mixing of the cement and sand, clear water shall be used to give the proper consistency. The grout must be mixed for this purpose in a box about 4 ft. 8 ins. long, 30 ins. wide, and 14 ins. deep, resting on logs of different lengths, so that the mixture will readily flow to one corner of the box, the bottom of which shall be 6 ins. above the pavement. The mixture must be removed from this box to the street surface with scoop shovels, all the while being stirred in the box, as the same is being emptied. One such box to be provided for each 10 ft. of width of roadway. The work of filling should thus be carried forward in line until an advance of 15 to 20 yds. has been made, when the same force and appliance shall be used to regrout the same in a like manner, excepting that the proportion of the mixture shall be two parts Portland cement to one part sand. To avoid the possibility of causing the grout to become too thick at any point there should be a man with a sprinkling can, the head perforated with small holes, slightly sprinkling the surface ahead of the sweepers. To insure the penetration of the grout into the joints of the pavement there shall be used in addition to the brooms, a squeegee scraper, 15 to 18 ins. in length, on the last application of the grout. Within one-half to three-quarters of an hour after the last coat has been applied and the grout between the joints has fully subsided, and the initial set is taking place, the whole surface must be slightly sprinkled and all surplus mixture left on the top swept into the joints, bringing them up flush and full. After the grouting is done and a sufficient time for handling has elapsed, so that the coating of sand will not disturb any moisture from the cement, ½ in. of sand shall be spread over the whole surface, and in case the work is subjected to a hot summer's sun, an occasional sprinkling sufficient to dampen the sand should be followed for two or three days. After the grouting is completed the street shall be kept closed, and no carting or traffic allowed until at least seven days have elapsed on any portion of the street grouted, and the face of the pavement shall be kept moist if the condition of the weather requires this precaution.

The Cement Tests in the Newark specifications for 1910 are much more rigid than in the specifications of any previous year. The minimum requirements for tensile strength of briquettes, 1 in. square in section, shall be the following:

24 hours in moist air (neat)	200 lbs
7 days (1 day in moist air, 6 days water) (neat)	550 lbs
7 days, 1 part cement, 3 parts sand	150 lbs

The sand used in this test must be taken from the sand to be used on the work. It was found during the present year that the 1 to 3 test was of great value in determining the strength of the grout. In the City of Newark, there has been more trouble getting good sand than in securing good cement. A recent inspection of the close jointed, cement grouted streets in Newark, of which 15 have been completed, several having been finished more than one year ago, shows that good results were obtained by the grouting on most of the streets. On Bloomfield Ave., between Mt. Prospect Ave. and the Belleville Township Line, a County road, containing two street railway tracks and carrying an unusually large volume of traffic, both light and heavy, it was found that the grout was holding decidedly well. This street was paved by Van Keuren & Son, contractors; New Hampshire granite was used, which, it is stated, forms a more perfect union with the grout, than the harder Long Cove and Rockport granites. This street has a roadway of 39 ft and the space between the curb and the outer rail of the street railway tracks is only about 12 ft., on which the traffic in each direction is concentrated, as the frequent trips of the cars of the street railway company prevent much use of the track pavement by teams. The length of the pavement is about 6640 ft., and the yardage above 18,000 sq. yds. The bidding price per square yard of pavement was $3.09. Another street showing very gratifying results, under very heavy traffic, is the Newark Approach, of the Jackson St. County Bridge over the Passaic River, between Newark and Harrison. The Newark Approach had been paved about 1897-1898 with Catskill brick on a 6-in. concrete foundation. At the request of the Board of Chosen Freeholders of Essex County the Newark Board of Public Works undertook to pave this approach with 5-in. granite blocks, laid according to the Newark standard specifications. The contractor used blocks from Booth Brothers, Long Cove, Maine, Quarries. The traffic was so heavy that the bridge approach could not be temporarily closed, consequently one-half of the width of the roadway had to be paved at one time before the other half could be torn up. As the roadway was 40 ft. in width this meant that the entire volume of traffic was thrown on the newly paved portion within a space of about 16 to 18 ft. Mr. Howell states that the grouting shows hardly any signs of wear after two months of traffic. A short street, known as Orange Place, located between Orange and High Sts., very near the coal pockets of the Lackawanna Railroad Co., is noted by Mr. Howell as another good example of what can be accomplished in the way of grouting, if care be taken throughout the operation. This is a very narrow street, the roadway being only 21½ ft. in width, the traffic is of necessity concentrated within very narrow limits. On this street there is only one bare spot, about 2 ft. square, and that spot is close to the curb and not in the line of traffic. This spot was undoubtedly caused by the grouting gang dumping the box at that point instead of using the scoop. The grouting on the entire street, except at this one spot, shows no deterioration whatever, after 6 months of very heavy traffic. South Canal St., carrying the heavy traffic of Lyons Brewery and other large concerns, with a width of roadway of 18½ ft., also shows an unbroken surface after several months of traffic. The granite used on this pavement came from a number of small quarries in Vermont. Mr. Howell states that Thomas St., paved with Rockport granite, and Watson Ave., paved with New Hampshire granite, are mistaken every day for brick streets by hundreds of people. The only instances where the grouting failed entirely to hold were on portions of two streets, Main St. and Fifteenth Ave. Main St. paving included three blocks, each about 550 ft. long. The work of paving the street was not started until late in the Fall of 1909 and the last grouting was done during freezing weather late in December at the urgent request of the property owners who had waited a long time for the blocks to arrive from the quarry. The portion of the street paved and grouted before December is still in an excellent condition. On the portion grouted during December a part having a length of 150 ft. the grouting has entirely disappeared. On the rest of the street, the paving of which was started during the Spring of 1910, the grouting is in fine condition, showing up nicely. The same is true of 15th Ave. Blocks did not arrive from the quarry in sufficient quantities to pave more than two blocks of this street late in 1909. As the property owners were insistent on proceeding with the pavement, work was carried on almost up to Jan. 1, 1910. The grouting on the two blocks was done during very cold weather, with the usual result—it has disappeared. On the remaining eight blocks of this street completed in the Spring and early Summer of this year, the grouting remains unbroken to the present time, although carrying exactly the same traffic as the two blocks at the beginning of the work. The City of Newark had completed and in use on Oct. 1, 1910, 3.78 miles of close jointed, heavily grouted granite pavement, comprising a yardage of 62,773 sq. yds., laid at an average cost per square yard of $3.11 and at a total cost of $226,581.21. Work is now progressing on 2.77 miles of this form of pavement, having a yardage of 57,218 sq. yds. at an average cost per square yard of $3.17 and amounting to $214,657.96. All told it is expected to have completed by Jan. 1, 1911, 6.55 miles of close jointed, heavily grouted granite pavement at a total cost of $141,239.17. Of the 3.78 miles actually laid, Mr. Howell states that not more than ¼ of a mile shows much signs of wear. The advantages of this form of pavement, according to Mr. Howell, are: Its durability; it is comparatively a noiseless pavement; it is a sanitary pavement; it is a non-slippery pavement especially in Winter, horses get an easy foothold even on pavements laid on a grade, the gritty nature of the grout seeming to help the horses get a foothold; it is not an expensive pavement when the small cost of maintenance is considered; loads can pass over this style of pavement almost as rapidly as over brick or bitulithic. The greatest objection to its use is the difficulty of taking it up to make repairs to sewer or water pipes or public service conduits, consequently great care should be exercised by officials in getting down all pipes and connections before laying the pavement.

The Chicago specifications for close jointed, cement grouted granite have been adopted by the following cities, and work has already been laid during the present year under these new specifications as follows: New Orleans, La., 10,000 lin. ft., 35,000 sq. yds., average price per square yard, $3.75; granite from Lithonia, Georgia. Philadelphia, Pa., one street, Vine St., yardage not given. Troy, N. Y., 4,000 lin ft., 16,600 sq. yds.; average price about $2.80 to $3.18 per sq. yd.; Hildreth Granite Quarry, New Hampshire. Lowell, Mass., 15,627 sq. yds.; average price about $3.25 per sq. yd. Lawrence, Mass., 30,000 sq. yds.; average price about $2.85 per sq. yd. Chelmsford, Mass. Chicago, Ill., 35,000 lin. ft., 100,000 sq. yds.; average price $3.68 per sq. yd.; Wisconsin granite; grouting not satisfactory.

The cities, Memphis, Tenn., Reading, Pa., Bridgeport, Conn., Dayton, O., and Paterson, N. J., have also adopted the Chicago Specifications, but have not yet laid any blocks under those specifications.

WATER-WORKS AND SEWERS SECTION

Cost of Laying 10,693 Lin. Ft. of 8-In. Water Main at Tuscaloosa, Ala.

BY C. E. ABBOTT*

On July 22, 1910, work was started at Tuscaloosa, Ala., at laying an 8-in. main on 10th Ave., from University Ave. to 10th St., thence on 10th St. from 10th Ave. to 18th Ave., thence on 18th Ave. from 7th St. to the A. G. S. depot, a distance of 10,693 ft., inserting 10 valves and locating thereon 23 fire hydrants and 7 specials for future extensions, using 60 ft. of 6-in. pipe and 312 ft. of 4-in. pipe. Prior to starting this work all pipe, fittings, valves and hydrants had been distributed along the route. This main was laid to replace a 4-in. and 3-in. main along our main thoroughfare to the cemetery and the A. G. S. depot.

The streets had been graveled and rolled with a 5-ton roller, making the first 6 ins. of very hard picking. The trench was 3 ft. deep from the surface of the ground the entire distance, except 420 ft., which was 5 ft.

The main was tested to 125 lbs. hydrostatic pressure without a single leak.

The work was done by day labor under the personal supervision of the writer at the following cost.

Labor	$ 986.43
11,275 lbs. lead at $4.85......	546.84
760 lbs. oakum at 3½ cts.	26.60
1,000 lbs. coal at $2 per ton.	1.00
Nails, etc..................	.60
Oil	2.55
8-in. plug wood....	1.50
Total	$1,565.52

This gives a cost of 14.2 cts. per lin. ft.

In laying this pipe, 120 ft. were laid at a time, using the same method employed in laying the 12-in. main, towit: derricks, equalizers, tongs, etc., made by the H. Mueller Mfg. Co., of Decatur, Ill., of which methods and costs were published in ENGINEERING-CONTRACTING of June 6, 1910.

The time required to complete this extension was 15 days, of 10 hours each; average number of men each day, 44 4-5; greatest number of feet of pipe laid in one day, 994; average number feet per day, 737 2-3; price paid labor, 12½ cts. per hour, yarners and calkers 15 and 20 cts. per hour.

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*Manager Water Works Department, Tuscaloosa, Ala.

Concretet work in Gatun Locks is about 40 per cent completed, 865,524½ cu. yds. out of a total of 2,085,000 having been placed at the close of work on Oct. 29.

Examples of Practice in Using Check Valves to Prevent Contamination from Secondary Water Supplies.

In past years the installation of private fire protection systems in manufacturing and business premises has been largely increasing and in many instances these private systems have as auxiliary to the local water works supply, fire pumps taking their water from rivers, canals, ponds or storage basins adjacent to the premises, which water is very frequently polluted. To prevent the water from these secondary supplies from entering the city water mains check valves are used. It is evident that this separation of the polluted and wholesome supplies is safe only if the check valve operates perfectly. Recently this question of the sufficiency of check valves has had the attention of water works officials and in many discussions the fact has been brought out that only exceptionally good design and careful construction can check valves be made satisfactory. In the accompanying drawings are shown two check valve arrangements which have been employed with satisfaction.

Nashua, N. H.—The drawings of Fig. 1 show the double check valve arrangement employed by Mr. Wm. F. Sullivan, Superintendent, Pennichuck Water-Works, of Nashua, N. H. This arrangement was worked out by Mr. Sullivan in conjunction with the engineers of the insurance interests. It is used where it is impracticable to separate the supplies; Mr. Sullivan believes in separating the supplies and wherever practicable this has been done. Mr. Sullivan describes the check valve arrangement as follows:

> In addition to double checking, we also want a check on the water passing through the fire pipes. Our method is to put on a straight commercial check, not the kind that sticks. Back of that, towards the inlet, we put on a Hersey detector meter. On the side and around the checks we have a testing apparatus so arranged that we can increase the pressure on either check and tell from the gauges if any water is going back. The telltale meter on the detector informs us if the flapper is off its seat. If the water is going forward, it is up to the mill officials to look into the matter. If it is going backwards, it is time for the water works people to stop it. There is also an electrical connection to a bell which will ring in case of the failure of a check-valve. This was worked out in conjunction with the insurance people for these particular places, and no doubt could be employed under similar conditions elsewhere.

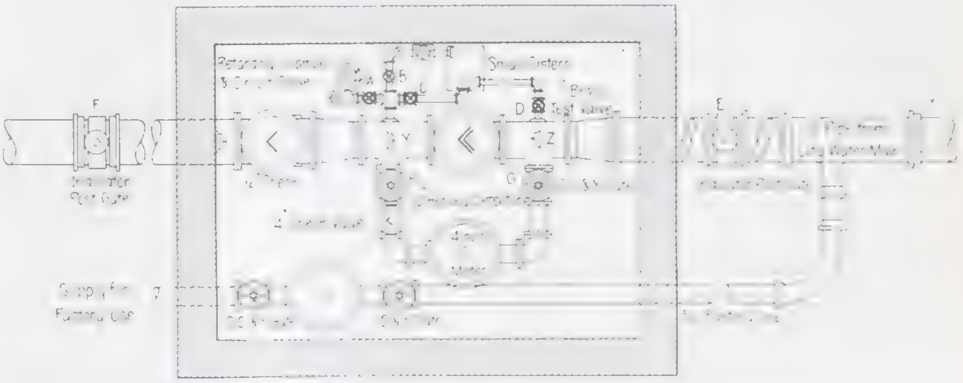

Fig. 1—Check Valve Installation at Nashua, N. H.

Referring to the illustration, Fig. 1, the normal condition of the valves is as follows:

A open
B shut
C shut
D shut
E [illegible]
F [illegible]
G open
H open

If the 12-in. check should leak the increased pressure would cause the relief valve to open and make electric connection to a bell in the water-works office. The following are the directions for testing the valves for leaks:

> 12-in. Check: Close E and A, increase pump

pressure to 100 lbs in gage X Increase of pressure at gage Y indicates leak.

4-in. Check: Condition as above. Open B and raise pressure on gage Y to 80 lbs. Increase of pressure at gage Z indicates leak.

Detector Check: Any leak will show through small meter.

To Set Relief Valve: Conditions as above. Open C until pressure is normal, then close C and open A. Increase pressure on gage Y by force pump and set valve to open at desired pressure.

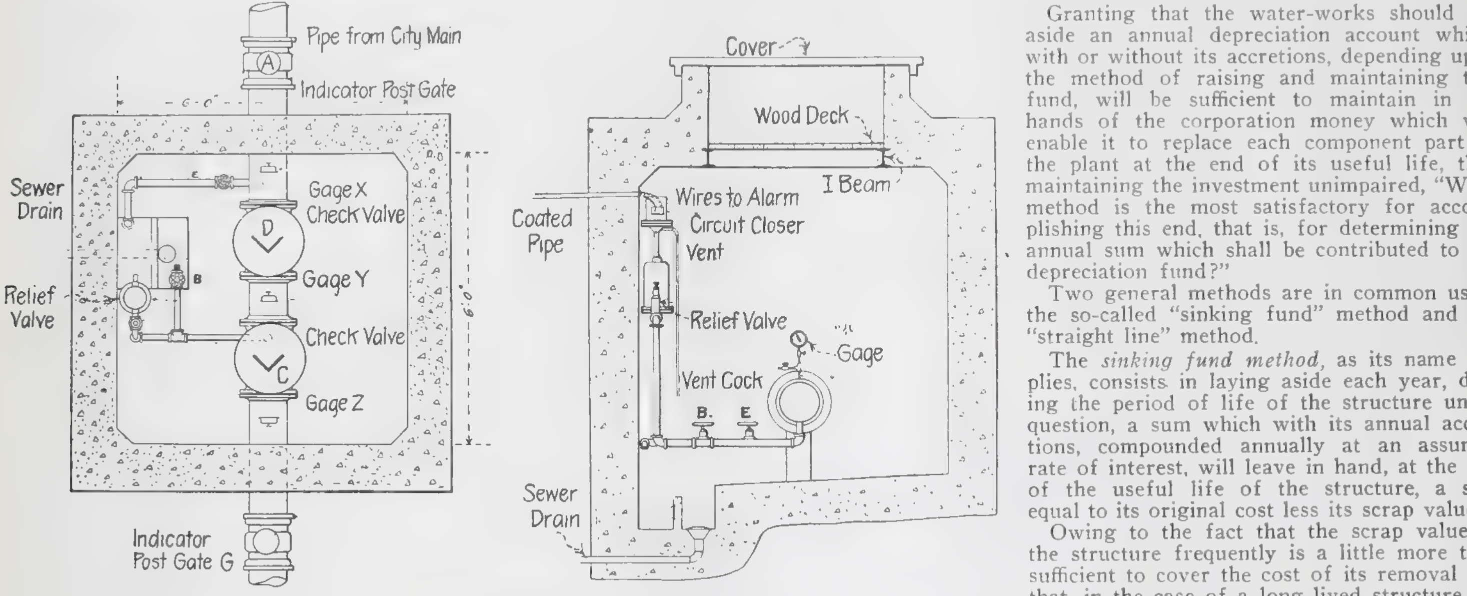

Fig. 2—Check Valve Installation at Hartford, Conn.

Hartford, Conn.—Figure 2 shows the standard check valve arrangement employed at Hartford, Conn. Altogether, according to Mr. Ermon M. Peck, Distribution Engineer, Hartford Water-Works, there are 13 of these valve sets in use in the city, and they are tested each month to insure their perfect operation. Mr. Peck states that the costs of these installations vary between wide limits. The work is done by the companies under the direction of the water-works engineers. In one or two instances the installation has cost as much as $1,000, but in these cases a considerable changing of pipe line was necessary. It is thought that from $300 to $500 is a fair estimate of cost.

Methods of Computing Depreciation of and Reasonable Assumptions as to Period of Useful Life of Water Works.

That the author may not hereafter be charged with plagiarism he calls attention to the fact that a portion of this paper was written by him early in the year 1910, for insertion in a report (made by Mr. John W. Alvord, of Chicago, and the writer) upon the reproduction cost of the water-works supplying one of the larger cities of the United States. It was subsequently used, in part, by Mr. Alvord (as stated by him at the New Orleans Convention of the American Water Works Association, held in April, 1910), as a basis for the progress report to that association of the "Committee on Depreciation," of which Mr. Alvord was the chairman and the writer was a member. The water company officials have courteously consented to the use of the material submitted to them, and it was thought that the fact that some of the opinions expressed had been reported to an operating company, as suggestions bearing upon its future government, might give it an added interest.

The Decision of the Supreme Court of the United States upon the Knoxville Water Works Case, delivered by Mr. Justice Moody, and handed down in January, 1909, gives emphasis to the need of practical recognition of depreciation by managers of public service corporations, and will effectually estop hereafter any corporation from making claim for the effect of depreciation of its property that has failed to earn, through the agency of its rate, a sufficient fund to meet this depreciation.

Exception might be made in the plants which have not yet passed through the formative period, or which, by reason of heavy reconstruction expenses, have not been able to lay aside a suitable depreciation fund without increasing the rates. Such plants may have preferred to temporarily suspend the laying aside of a depreciation allowance, in the hope of making good the deficit a few years later, rather than to bear the public odium of temporary increase in rates. It seems reasonable to assume that a public service commission would take the same view.

Granting that the water-works should lay aside an annual depreciation account which, with or without its accretions, depending upon the method of raising and maintaining this fund, will be sufficient to maintain in the hands of the corporation money which will enable it to replace each component part of the plant at the end of its useful life, thus maintaining the investment unimpaired, "What method is the most satisfactory for accomplishing this end, that is, for determining the annual sum which shall be contributed to the depreciation fund?"

Two general methods are in common use—the so-called "sinking fund" method and the "straight line" method.

The *sinking fund method*, as its name implies, consists in laying aside each year, during the period of life of the structure under question, a sum which with its annual accretions, compounded annually at an assumed rate of interest, will leave in hand, at the end of the useful life of the structure, a sum equal to its original cost less its scrap value.

Owing to the fact that the scrap value of the structure frequently is a little more than sufficient to cover the cost of its removal and that, in the case of a long lived structure the present worth of the scrap value would be exceedingly small, engineers have generally omitted the correction for the scrap value of the structure and have assumed, unless the life of the structure was comparatively short, that the scrap value is negligible. In the case of very short lived structures it is better that

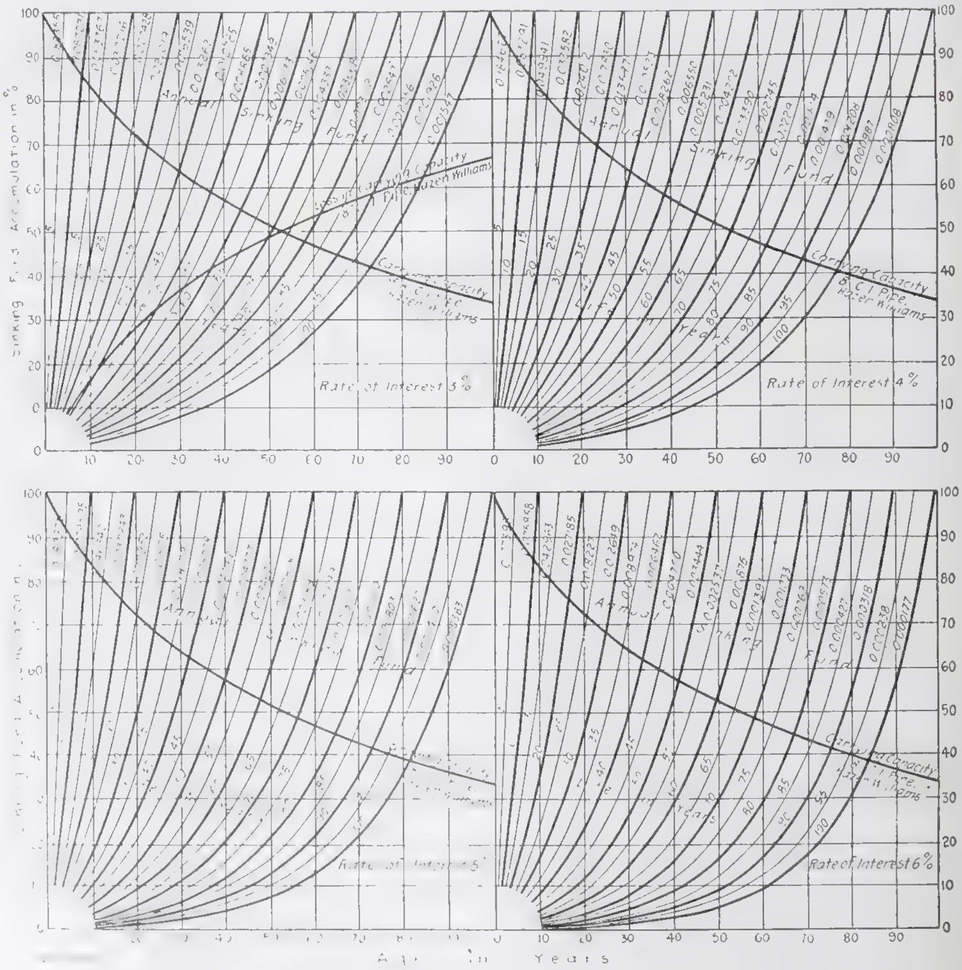

Fig. 1—Depreciation Diagrams Based on the Sinking Fund Method, With Rates of Interest of 3, 4, 5 and 6 Per Cent.

(Interest compounded annually, with contributions at end of year.)

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*From a paper by Leonard Metcalf, 14 Beacon St., Boston, Mass., before the New England Water-Works Association. Cuts reproduced from "Engineering News."

TABLE I.—APPROXIMATE LIFE AND CORRESPONDING ANNUAL PERCENTAGE CONTRIBUTIONS TO SINKING FUND.

Water-works structures.	General limits of useful life years.	Corresponding annual contribution to depreciation account at end of year in % of cost of structure,* based upon Sinking fund method, using interest rate compounded annually at 5%	4%.	3%.	2½% to 4%, depending upon length of life.	Straight-line method.
Reservoirs	50 to 100	½ to 0†	⅝ to ⅛	⅞ to ⅛	0.89 to 0.23	2 to 1
Steel stand-pipes	25 to 40	2⅛ to ¾	2⅜ to 1	2¾ to 1⅜	2.57 to 1.33	4 to 2½
Masonry buildings	30 to 50	1½ to ½	1¾ to ⅝	2⅛ to ⅞	2.02 to 0.89	3⅓ to 2
Wooden buildings	20 to 40	3 to ¾	3⅜ to 1	3¾ to 1⅜	3.54 to 1.33	5 to 2½
Filter plants, perm. const'n.	25 to 50	2 to ½	2⅜ to ⅝	2¾ to ⅞	2.57 to 0.89	4 to 2
Pumping machinery, high-duty in large units	30 to 50	1½ to ½	1¾ to ⅝	2⅛ to ⅞	2.02 to 0.89	3⅓ to 2
Ordinary pumping machinery	20 to 30	3 to 1½	3⅜ to 1¾	3¾ to 2⅛	3.54 to 2.02	5 to 3⅓
Steam engines	15 to 25	4⅝ to 2⅛	5 to 2⅜	5⅜ to 2¾	5.09 to 2.57	6⅔ to 4
Boilers	12 to 20	6¼ to 3	6⅝ to 3⅜	7 to 3¾	6.66 to 3.54	8⅓ to 5
Elec. generators and motors.	20 to 30	3 to 1½	3⅜ to 1¾	3¾ to 2⅛	3.54 to 2.02	5 to 3⅓
Masonry conduits	50 to 100	½ to 0†	⅝ to ⅛	⅞ to ⅛	0.89 to 0.23	2 to 1
Cast-iron pipe, large dia.:						
In non-tuberculat'g waters	60 to 100	¼ to 0†	⅜ to ⅛	⅝ to ⅛	0.67 to 0.23	1⅔ to 1
In tuberculating waters	50 to 75	½ to ⅛	⅝ to ¼	⅞ to ⅜	0.89 to 0.41	2 to 1⅓
Cast-iron pipe, small dia.	30 to 50	1½ to ½	1¾ to ⅝	2⅛ to ⅞	2.02 to 0.89	3⅓ to 2
Steel pipe	25 to 40	2⅛ to ¾	2⅜ to 1	2¾ to 1⅜	2.57 to 1.33	4 to 2½
Wood stave pipe	20 to 30	3 to 1½	3⅜ to 1¾	3¾ to 2⅛	3.54 to 2.02	5 to 3⅓
Wrought-iron service pipes	15 to 30	4⅝ to 1½	5 to 1¾	5⅜ to 2⅛	5.09 to 2.02	6⅔ to 3⅓
Hydrants	35 to 50	1⅛ to ½	1⅜ to ⅝	1⅝ to ⅞	1.58 to 0.89	3 to 2
Valves	40 to 50	¾ to ½	1 to ⅝	1⅜ to ⅞	1.33 to 3.89	2½ to 2
Meters	15 to 25	4⅝ to 2⅛	5 to 2⅜	5⅜ to 2¾	5.09 to 2.57	6⅔ to 4

*By cost of structure is meant first cost of the physical structure, including allowance for "interest during construction" and "engineering and contingencies" items, but excluding "going value" and "franchise value."

†Less than ⅛%.

the cost of the structure be charged off to operating expense, rather than to capital account with large annual allowances for depreciation.

The *straight-line method* consists in laying aside an annual sum proportioned to the length of useful life of the structure.

The essential differences between these two methods of meeting the needs of the depreciation account are:

(1) The fact that the *sinking-fund method* requires not only an annual contribution to the principal sum of the depreciation account, but that care be observed in the method of accounting for this fund, to the end that it may receive annual accretions of interest, which accretions with the principal sum and contributions will receive annual interest, so that the fund may, in fact, be a true sinking fund and enjoy the compounding affect of the interest allowances.

In the case of the *straight-line method*, no accretions or interest allowances are credited to the fund—the principal sum of the annual deposits being sufficient alone to make up the necessary depreciation fund at the end of the useful life of the structure. Such earnings, therefore, as may be enjoyed upon the straight line depreciation account should be credited to the general operation of the works and not to the depreciation account itself—whereas the reverse is the case in the sinking fund method of application.

(2) Of perhaps greater importance to the operator of water-works—particularly of new works—the sinking fund method requires much smaller annual contributions to the depreciation accounts, and the accretions thereon amount to a much smaller sum, during the early years of the life of the plant, whereas in the later years, the accretions become a very important element, rapidly swelling the amount of the fund. It will thus be seen that the works are relieved by this method, in the early years of the formative period, from a burden which might prove heavy for the corporation and the water takers to bear under the straight-line method.

These methods are but aids to judgment. They must be applied with care and discretion, and with a clear conception of the extent and effect of the local influences or considerations. No subject in the engineering field requires larger experience or riper judgment.

While general limits for depreciation in water-works property, found under what might be considered normal conditions, may be indicated and are submitted herein, the fact that local conditions and limitations are likely to have substantial influence upon current depreciation in any specific plant must never be lost sight of.

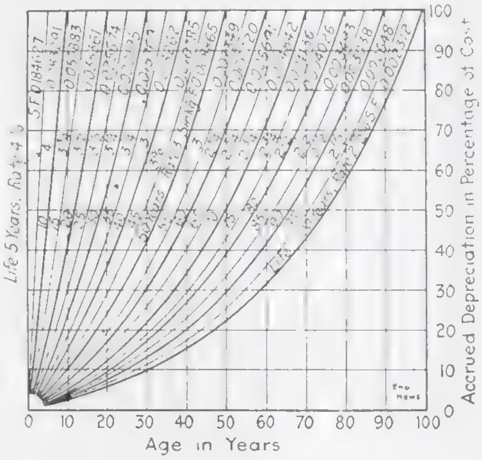

Fig. 2—Depreciation Diagram Based on Sinking Fund Method, With Interest Ranging from 2½ to 4 Per Cent, According to Assumed Life of Structure.

(Interest compounded annually, with contributions at end of year.)

Final analysis of the necessary amount of or contributions to depreciation fund ultimately resolves itself into a question of expediency and standards of the day. It is well to be conservative in forecasting the annual needs for depreciation, alike in the interest of the public and of the corporation whose funds are invested in the plant; for it is easy to charge off, or make future abatement, for an excessive amount earned by the rates and credited to depreciation account, while it may be difficult later to recover, by increased depreciation allowances, earlier deficits caused by failure to make adequate allowance therefor. In the long run, failure to make ample provision for depreciation, either through failure to earn it by the rates or to retain it in the treasury for legitimate corporate use (not for disbursement in dividends), must inevitably, upon the one hand make capital apprehensive of the soundness of the management, if not of the project itself, and thus lead to demands for higher returns commensurate with the added risk, or to flat refusal to go into the project, and upon the other, force the public to meet this demand by the payment of higher rates than would otherwise be necessary for the service rendered.

Subject to the words of caution referred to above, the accompanying approximate figures (Table I.) bearing upon the life of different structures entering into a water-works plant, are given, as representing the general range ascribed to them by competent engineers testifying in water-works valuation suits. Knowing the period of useful life of a structure the annual depreciation may be found by whatever method best fits the case. It will be well, however, to bear in mind the method to be used in figuring the depreciation, when estimating the probable life of the structure, if safe or conservative results are desired—particularly if the sinking fund method of computation is to be adopted and a high rate of interest is to be used in figuring the accretions upon the fund.

The accompanying diagrams, Fig. 1, based upon the sinking fund method and rates of interest of 3 per cent, 4 per cent, 5 per cent and 6 per cent, and Fig. 2, based upon the sinking fund method and rates of interest varying from 2½ per cent to 4 per cent (dependent upon the assumed length of life) will be found of service for rapid approximate computation or estimating purposes. Tables II. and III. also give similar data with greater precision. More complete information can be had from the "Robinsonian Bond and Investment Tables," published by J. Watts Robinson.

Data concerning formulas for the computation of sinking funds, etc., are to be found in a paper presented by the writer before the American Society of Civil Engineers upon "Water Works Valuation and Fair Rates," published in the "Transactions" of the Am. Soc. C. E., Vol. LXIV., p. 1, 1909, pp. 20 to 24.

The average length of life of water-works plants depends upon many factors. Broadly speaking from 40 to 60 years probably represents the usual range of life of the struc-

TABLE II.—SINKING FUND DATA.*

Annual contributions to sinking fund in percentage of first cost, with different assumed interest rates upon sinking fund accumulations.

Life of structure, years	3%	4%.	5%.	6%	Variable† (4% to 2½%).	Straight-line method.
5	18.8355%	18.4627%	18.0975%	17.7396%	18.46%	20.00%
10	8.7231	8.3291	7.9505	7.5868	8.33	10.00
15	5.3767	4.9941	4.6342	4.2963	5.09	6.67
20	3.7216	3.3582	3.0243	2.7185	3.54	5.00
25	2.7428	2.4012	2.0952	1.8227	2.57	4.00
30	2.1019	1.7830	1.5051	1.2649	2.02	3.33
35	1.6539	1.3577	1.1072	0.8974	1.58	2.86
40	1.3262	1.0523	0.8278	0.6462	1.33	2.50
45	1.0785	0.8262	0.6262	0.4700	1.08	2.23
50	0.8865	0.6450	0.4777	0.3444	0.89	2.00
55	0.7349	0.5231	0.3667	0.2537	0.73	1.82
60	0.6133	0.4202	0.2828	0.1876	0.67	1.67
65	0.5146	0.3390	0.2189	0.1391	0.57	1.54
70	0.4337	0.2745	0.1699	0.1033	0.48	1.43
75	0.3668	0.2229	0.1322	0.0769	0.41	1.33
80	0.3112	0.1814	0.1030	0.0573	0.40	1.25
85	0.2647	0.1479	0.0803	0.0427	0.35	1.18
90	0.2256	0.1208	0.0627	0.0318	0.30	1.11
95	0.1926	0.0987	0.0490	0.0238	0.26	1.05
100	0.1647	0.0808	0.0383	0.0177	0.23	1.00

*NOTE.—Deposits at end of year, compounded annually.
†4% Sinking fund rate for 0 to 14 years life inclusive.
3¾% Sinking fund rate for 15 to 19 years life inclusive.
3½% Sinking fund rate for 20 to 25 years life inclusive.
3¼% Sinking fund rate for 26 to 35 years life inclusive.
3 % Sinking fund rate for 36 to 55 years life inclusive.
2¾% Sinking fund rate for 56 to 75 years life inclusive.
2½% Sinking fund rate for 76 up.

TABLE III.—SINKING FUND DATA CONTINUED.

Sinking fund in per cent	Approximate age in years at maturity or end of life of structure, with different assumed interest rates upon sinking-fund accumulations. 3%. Years.	4%. Years.	5%. Years.	6%. Years.	Variable (2½% to 4%). Years.	Straight-line method. Years.
¼	87	72	62	55	97	400
⅜	74	63	55	49	83	267
½	66	56	49	44	69	200
⅝	59	51	45	41	62	160
¾	54	47	42	38	54	133
⅞	50	44	39	35	50	114
1	47	41	37	33	47	100
1¼	41	37	33	30	41	80
1½	37	33	30	28	37	67
1¾	34	30	28	26	34	57
2	31	28	26	24	30	50
2½	27	24	23	21	25	40
3	23	22	20	19	22	33
3½	21	19	18	17	20	28
4	19	17	17	16	18	25
5	16	15	14	14	15	20
6	14	13	12	12	13	17
7	12	12	11	11	12	14
8	11	10	10	10	11	12
9	10	9	9	9	10	11
10	9	9	8	8	9	10
15	6	6	6	6	6	7
20	5	5	5	5	5	5

tures, except in the case of very rapidly growing towns or cities.

The total allowance to be made for depreciation, including contingent depreciation, will probably vary between limits of 1 per cent and 2 per cent per annum, though in many cases it may lie even beyond these limits. Data are scarcely sufficient at the present time to fix the proper allowance for contingent depreciation with a reasonable degree of accuracy. It seems reasonable to anticipate, however, that an allowance of not less than ¼ of 1 per cent per annum, upon the sinking fund basis, should be provided, and in many cases, perhaps in the majority of cases, this allowance will prove inadequate. In this connection it may be of interest to cite the experience of the Knoxville Water Co., the plant of which, in a period of 17 years, showed an average annual rate of depreciation, exclusive of proper allowances for repairs and renewals, of 2.12 per cent.

Owing to the variation in the amount of the gross income of water-works, as compared with their cost or value, the depreciation thereon, expressed in percentage of the gross income, is correspondingly variable. Broadly speaking, however, it may be said that the depreciation is likely to amount to 10 per cent more or less, of the gross annual income of the works.

Thus, if we assume a plant having a value of $5,000,000, a gross annual income of 10 per cent thereof, or $500,000 per year, and a depreciation of 1 per cent thereof, or $50,000 per year, the depreciation will amount to 10 per cent of the gross annual income. Assuming value $500,000, gross annual income 12 per cent = $60,000, depreciation 1¼ per cent = $6,250, the depreciation would amount to 10.4 per cent of the gross annual income. Assuming value $50,000, gross annual income 16 per cent = $8,000, depreciation 1½ per cent = $750, the depreciation would amount to 9.4 per cent of the gross annual income.

How many of you gentlemen, as waterworks superintendents, are charging off 10 per cent of your gross annual income to depreciation account, unless you are doing it through the agency of a sinking fund to retire the outstanding bonds upon your works?

STEAM AND ELECTRIC RAILWAY SECTION

Economic Considerations Governing the Selection of Electric Railroad Apparatus.*

There is often great variance of opinion or serious doubt among engineers and railroad men as to the relative merits of the three electric railroad systems that are more or less in common use. It is the purpose of this paper to discuss the matter briefly from the standpoint of economy of construction and operation. It is not intended to discuss the economical value of electric motive power compared with steam power, except to point out at the outset that the high cost of electric equipment is the chief thing that prevents the rapid extension of railroad operation by electric power.

There is no general rule by which the cost of electrical equipment for railroads can be determined because this cost is affected by such a great variety of conditions; for some parts of the equipment it depends on the weight and frequency of trains and the power used per train and for other parts it depends on the length of track to be electrified and on local conditions.

There are three distinct parts in the equipment required for every electric railroad system:

(1) The electric power generating plant.

(2) The electric power transmission and distribution system, including substations or transformer stations.

(3) The motive power apparatus, viz., the electric locomotives and electric cars.

Of these three parts the cost of the power plant and of the motive power apparatus, which is the locomotives or motor cars, varies with the total amount of power required for train propulsion at times of heavy traffic movements. On the other hand, the cost of the power transmission and distribution system varies with the length of the track equipped, with the maximum total power required and with the maximum power that may be concentrated at any place on the line.

Train Weights.—Railroad service varies according to the requirements of traffic and the motive power of railroads must operate trains of different weights from light single car trains of 25 to 60 tons each, as on interurban electric roads, to heavy freight trains sometimes of 1,000 or 2,000 or more tons each. Increase of train weight tends to reduce operating expenses, and consequently railroad practice is steadily making trains heavier and heavier.

Train Speeds.—Trains must be operated at varying speeds since some kinds of traffic demand higher speeds than other kinds, and on every railroad there are some places where it is safe and economical to run faster than at other places. To meet the needs for quick time and to utilize railroads to the best advantage, it is necessary that speeds be adjusted to passing conditions of tracks, or for grade, or for regard to cautionary signals, or for standing on sidings, or a thousand different and ever varying matters. Since the business of railroads is to move traffic in the greatest quantity and in the shortest time practicable at reasonable cost, train speeds must be kept always at the maximum that safety and economy will permit, and since conditions of safety and economy vary with every run and with nearly every mile of every run, the required speed varies from the lowest speed or standing still to the highest speed and therefore railroad motive power should be economical at all speeds.

Density of Traffic.—The density of railroad traffic may be anything, from the train each way per day on some roads, to as many trains as can be crowded over the tracks on some other roads. On some roads the traffic may be best served with single cars, as on interurban trolley roads or where gasoline motor cars are used, while on other roads it may be best served with maximum weight trains, either passenger or freight, as is common on many main lines.

Power per Train.—This depends, of course, on the weight and speed of trains, on the grades to be climbed, on the stops and starts required, etc.

Since the total power and the tractive effort required vary according as the train is standing still, or is being accelerated, or is running at maximum speed, or is climbing a grade, or is coasting down grade, the power and tractive effort are constantly varying from zero to maximum. A locomotive of 1,000 h. p. will handle a 1,000-ton train under certain conditions of speed grade, etc., but under other conditions 1,000 h. p. or more may be required for a 250-ton train, or a 50-ton electric car may in certain kinds of service require 400 to 500 h. p per car to make its schedule.

Amount of Localized Power Required on Railroads.—Modern steam railroad trains on main lines use locomotives capable of delivering 700 to 1,400 h. p. or more each, and trains are often passing or following or double headed so that even on single track roads 2,000 to 4,000 or more horsepower may be required by trains within comparatively short distances of each other.

Wide variations in all of the above factors—that is, in train weights, train speeds, density of traffic, power per train, and power concentrated at local points on a railroad—may occur at different times and places on a single railroad or section of track. All of these conditions must be met by railroad motive power.

Choice of Systems.—Which of the three well known electric systems, each of which has its ardent and often partisan advocates, is best adapted to meet all of the variable conditions?

The systems are:

(1) The direct current system.

(2) The single phase system.

(3) The three phase system.

Each System Differs Radically from the Others.—The electric motors used in each system are fundamentally different from the motors used in the other two systems, and require a different kind of electric current for their operation, and this necessitates for each system different apparatus for the distribution of the electric power. I propose to discuss the relative merits of the three systems briefly from the standpoints of reliability and of economy of construction and operation.

Power Plants for the Three Electrical Systems Compared.—The electric power generating stations are usually steam turbine or hydroelectric plants. Gas engines have not come into extensive use for furnishing power to electric railroads. The cost and efficiency of the power plants for the three systems do not differ greatly, for although single-phase generators are more costly than the three-phase generators used for the other two systems, the total engine and boiler power usually has to be somewhat greater for direct-current and three-phase than for single-phase operation. This is because the losses are greater in direct-current trolleys or third rails, and in direct-current substations than in single-phase trolleys and transformer stations, and because three-phase motors under ordinary railroad conditions make greater fluctuations in the load on the power plant than single-phase and direct-current motors do. In spite of the greater capacity in engines and boilers for direct-current operation of railroads than for single phase, it may often occur that the K. V. A. or apparent electrical output will be greater for single-phase than for direct-current service, due to the difference in the power factor of the current supplied.

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*A paper by F. Darlington, before the Western Society of Engineers, June 7, 1910.

For three-phase main-line railroad electrical operation the power plant will generally be somewhat larger and more costly than for either direct current or single phase. This is especially the case where variable heavy grades are encountered or where heavy trains are frequently accelerated, and is caused by the characteristics of three-phase motors which tend to make high peak loads on the power plant when worked at the widely varying tractive efforts and speeds usual in railroad work. This will be discussed later.

Under most conditions the total of the variations described does not cause a large difference in the cost of the power plants required for the three electric railroad systems.

Ordinarily the cost of steam-turbine plants for railroad electrical operation is somewhere in the neighborhood of 25 per cent to 40 per cent of the total cost of electrical equipment. It more closely approaches the larger proportion of the whole cost when the traffic is dense, requiring a large supply of power per mile of track, or where high-tension single-phase trolleys are used, which by their relatively low cost reduce the total cost of electrical equipment, thereby making the cost of the power plant a larger proportional part of the whole electrification cost.

Power Transmission and Distribution Lines and Equipment, Including Substations or Transformer Stations, Compared for the Three Electric Railroad Systems.—The power transmission and distribution system forms the link between the power plant and the electric locomotives or cars. It consists of trolley lines or third rails, of feeder cables, of track bonding, of substations, and of high-tension transmission lines. The aggregate cost of these items is the largest or at least a very large part of the total cost of electrification for heavy railroad operation. Where direct currents are used the power transmission and distribution apparatus generally costs more than either the power plant or the electric locomotives and motor cars, and is liable to be between 40 per cent and 60 per cent of the total electrification cost, and is especially high where heavy trains are to be operated requiring large units of power distributed over long sections of track. Under these conditions, even where advantage is taken of the most modern improvements, using 1,200 volts direct current on trolleys or third rails, the cost of direct-current distribution apparatus is still the largest cost item for electrical equipment.

Where single-phase apparatus is used the electric power transmission and distribution system is greatly simplified and cheapened. A single high-tension trolley wire is substituted for the trolley wire or third rail and feeder cables of the direct-current system, and static transformer stations are substituted for direct-current substations in which there are both static transformers and rotary converters or motor generators. The single-phase trolley system is equally suitable for light infrequent service and for heavy dense service or for large units of power infrequently operated. The substations are widely separated, and their cost, as well as the cost of the distribution conductors, is much less for single phase than for direct current, so that the combined cost of the substations and transmission and distribution conductors may be fairly stated under average railroad conditions to be about one-quarter to two-thirds as costly for single phase as for direct currents.

Where three-phase apparatus is used, high-tension alternating-current trolleys are employed and three conductors are necessary to carry the current for three-phase motors, so that two separately insulated trolley wires are necessary in conjunction with the track rails.

Three-phase motors, as will be hereafter explained, can be built for working on higher potentials than can either direct-current motors or single-phase motors as ordinarily used. For this reason the potential employed on three-phase trolley lines is usually applied directly to the motors without intermediate reducing transformers carried on the locomotives or cars. The desirability of working the motors without transformers, combined with the difficulty of separately insulating two trolley conductors for very high potentials, has generally prevented the use of as high potentials on three-phase trolleys as are common on single-phase trolleys. The latter are often built for 11,000 volts potential on the trolley, while according to present practice 3,300 volts is usual and 6,600 volts is high for three-phase trolleys, though in the latter case reducing transformers are generally used on the trains.

Three-phase motors for their successful operation under the varying loads encountered in railroad work require more uniform potential supplied to them than is required by either single-phase motors or direct-current motors, and in order to maintain better potential regulation on the trolley at the relatively low voltages at which three-phase trolleys are generally operated as compared with single-phase trolleys, it is necessary to locate transformer stations closer together on three-phase lines than on single-phase lines. For heavy trains the number of transformer stations will generally be more than double as many, and under certain conditions three or four times as many for three-phase as for single-phase installations.

There is another thing about three-phase transformer stations for railroads that is becoming more important than it was a few years ago when it was not practical to use as high a potential on transmission lines as can be advantageously used today. Three-phase transformer stations require either one three-phase transformer or three single-phase transformers. It is much more costly to build one very high voltage three-phase transformer or three single-phase transformers than one single-phase transformer of the same aggregate output. In other words, the cost of transformers per kilowatt of capacity is very much greater for three small units than for one large unit, especially when they are for very high primary potentials such as 100,000 or 110,000 volts. It is now well established that 110,000 volts or thereabouts will be widely used in large long-distance power-transmission schemes, the increase in potential over the practice of a few years ago having been brought about largely by improvements in line insulators, especially of the suspended type.

I cannot state just what the relative cost of three-phase and single-phase power transmission and distribution systems will average for the ordinary requirements of railroads, but it is clear that with two trolley wires for the three-phase system instead of one wire as for single phase, and with transformer stations two or three times as frequent for the three-phase as for the single-phase system, the cost for the three-phase system will be considerably increased, and will probably average somewhere from 30 to 80 per cent more for three phase than for single phase.

Relative Weight and Operating Characteristics of Direct Current and of Single Phase and of Three Phase Electric Railroad Motors.—The three distinct types of motors used in railroad work determine the three standard systems—that is, the direct-current system, the single-phase system and the three-phase system—and the motors all differ in cost and weight and method of operation.

Direct-Current Motors.—The different types of motors may be conveniently compared by taking the direct current motor as the basis of comparison, since it is the oldest and best known in railroad work. It should, however, be noted in this connection that only within the last few years have direct-current railroad motors been commonly built with so called commutating poles, and they are now known as interpole motors, and the new construction has greatly improved them. Formerly the capacity of direct-current motors for heavy sudden overloads was limited chiefly by commutation, and the maximum voltage for which they were practically built was somewhere between 600 and 700 volts. The use of interpoles has considerably increased this limit, especially for large motors, and has largely done away with sparking on the commutator and flashing over, so that now overheating is the principal thing that limits the capacity of direct-current motors of the latest design.

Single-Phase Motors.—Single-phase motors for railroad work are very similar in construction and in operating characteristics to direct-current railroad motors. They are series wound, variable-speed motors, and have compensating windings. Their compensating winding is differently arranged from the interpole windings of direct-current motors, but performs a similar function, which is to improve commutation, and at the same time it improves the power factor by reducing the self induction of the motors.

Single-phase motors are generally designed to work with variable voltages up to about 350 volts maximum applied to the motor, and experience has pretty well demonstrtaed that when everything is considered, 15 cycles or thereabouts is the best current frequency to employ.

High potentials are used on single-phase trolleys and whatever the potential may be, whether 11,000 volts or more or less, the potential is reduced for the motor by transformers carried on the locomotives or motor cars. There is one type of single-phase motor called a "repulsion" motor that is used in Europe to a limited extent. It is practically a motor and transformer combined and is heavier than ordinary single-phase motors, but 11,000 volts, which is a common and economical single-phase trolley voltage, is too high for economy and safety on repulsion motors without separate transformers.

An important difference in operation results from the difference in the motor control apparatus used for direct-current and for single-phase motors. Direct-current railway motors are governed to vary the speed and tractive effort by connecting them in series and in parallel, by varying the field strength and by inserting resistance in the circuits to regulate the flow of the direct current. Single-phase motors are governed in speed, etc., by applying varying potentials to them from different potential taps on the transformer from which they get their current supply. Thus the transformers serve the double purpose of reducing the potential for the motors and varying it to govern the speed.

Single-phase railroad motors are heavier and more costly than direct-current railroad motors of the same capacity. Designers state that the difference is somewhere between 10 and 25 per cent in weight and 25 to 50 per cent in cost in favor of direct-current motors as compared with single-phase motors. The transformers required for single-phase electric locomotives will generally constitute about 5 to 10 per cent of the total locomotive weight, and the motors themselves will generally constitute about one-quarter to one-third of the locomotive weight. Additional weight seldom has to be put into the locomotive frame and running gear to carry the extra weight of the transformers and single-phase motors when compared with direct-current motors, because when the locomotive frame is designed with sufficient strength to withstand the shocks encountered in operation it is strong enough to carry all the load put upon it with single-phase apparatus. There are so many conditions entering into the design of electric locomotives that it is very difficult to determine an average difference in weight between direct-current and single-phase designs with any reasonable approximation. For one thing, the need for series parallel control with direct-current makes it necessary to always use either two or four motors to get an even number for connecting in series, when one or three motors might otherwise be lighter and more convenient, and of course there is no need for series parallel control with single phase motors. Then again the entire weight of any electric locomotive is sometimes necessary to get sufficient adhesion to the track to prevent slipping the driving wheels. This occurs in many designs of single-phase freight locomotives, so that if the weight were not in the mechanism, cast iron or other weights would have to be added to get adhesion.

In locomotive design we might perhaps reasonably say that if single-phase motors are 25 per cent heavier than direct-current or three-phase motors, the additional weight would be 8 per cent of the weight of the locomotive and that this weight and 7 per cent additional for transformers would make single-phase locomotives 15 per cent (more or less) heavier than direct-current locomotives.

As already explained this extra weight will often not be objectionable from an operating point of view for freight locomotives, as it may be necessary to secure adhesion, but extra weight of machinery of course always makes extra construction cost, and it will almost always be objectionable in operation, as well as in first cost, with high-speed passenger locomotives. I want to caution you that 15 per cent is not a uniform factor for difference in weight between direct-current and single-phase locomotives, for under some circumstances single-phase locomotives may actually be lighter than equivalent direct-current locomotives, or, on the other hand, under certain circumstances they may be more than 15 per cent heavier than direct-current locomotives.

Proportion of the Cost of Electric Locomotives and Electric Equipment of Cars to the whole Cost of Railroad Electrification.—It is difficult to give an approximate ratio between the cost of electric locomotives and electric apparatus on motor cars and the whole cost of equipping railroads for electrical operation.

For complete divisions of 100 miles or more on a single-track main-line railroad, where the trains are heavy and frequent, the cost of electric locomotives may be 25 per cent to 40 per cent of the total cost of electrification, but where the trains are lighter and less frequent this will be reduced to say 15 per cent to 25 per cent of the total cost. On this basis, if single-phase locomotives cost more than direct current in proportion to twice the difference of their weights, or say they cost about 30 per cent, more, this difference in cost between single-phase and direct-current locomotives will amount to about 4.5 per cent to 12 per cent of the total cost of railroad electrification, but under ordinary conditions this is many times offset by the higher cost of power transmission and distribution by direct currents than by single-phase currents.

On interurban electric roads, operating cars at one hour to one-half hour headway, the cost of the motors and electric equipment on the cars for direct-current apparatus may be about 5 per cent to 8 per cent of the total electrification cost, and it is about one-quarter to three-quarters greater for single-phase apparatus, including transformers, etc. On interurban lines except where they are very short the difference in cost between direct-current and single-phase motors is generally more than offset by the saving in cost of single-phase power transmission and distribution apparatus, and on long interurban lines the difference is a good many times offset even where 1,200 volts is used for direct-current distribution.

Three-Phase Motors and the Effect on Railroad Operation of Their Constant-Speed Characteristics.—Three-phase motors, unlike direct-current and single-phase motors, tend to maintain constant speed at all loads. They are light and durable and cheap to build. Their advocates claim that on their continuous rating they are lighter and cheaper than direct-current railroad motors of the same capacity. I am not certain on this point as regards weight, especially since direct-current motors have been so greatly improved by commutating poles and improved design. Large size three-phase motors have somewhat greater continuous horse-power capacity than direct-current railroad motors of the same outside dimensions, but they are usually heavier than direct-current motors of the same dimensions. In any event, it is entirely immaterial for railroad work how the two types of motors compare at their continuous rating, because there is very little railroad work in which the motive power is operated at a constant rating or at uniform speed and tractive effort. The important consideration is, which motor is the best, the lightest, and the cheapest for the varying speeds and tractive efforts required in propelling railroad trains. Simple three-phase motors are very inefficient at all speeds but normal constant speed, except where a certain device is employed by which it is possible to operate three-phase motors at good efficiency at exactly half normal speed, or by another device at exactly double normal speed. Each of these devices, which are known as cascade connections and pole-changing devices, require special appliances, and the use of both on one locomotive or motor car in order to get good efficiency at both half speed and double speed as well as at normal speed would be very troublesome, except possibly for low-voltage motors for which transformers would have to be carried on the locomotives. Neither of the devices gives good efficiency at intermediate speeds or at starting, and as a consequence three-phase motors are not so well adapted as other railroad motors for work requiring frequent starting or frequent variations in tractive effort and speed. Other speed combinations than the above are possible, but add still further to the complication.

One of the results of constant-speed operation, as I mentioned before, is to cause very heavy demands on the power plant when heavy traction is needed. This may be best made clear by referring to a specific condition. Suppose a 2,000-ton train is running at 30 miles an hour on a level track, it will require 14,000 lbs. tractive effort to propel it. The horse power exerted will be 1,120. If the same train encounters a 1 per cent up grade the tractive effort required will be 54,000 lbs., and at the same speed—namely: 30 miles an hour—the horse power exerted will be 4,330, which would make a heavy peak demand on the power plant, and this could be reduced only by using a half-speed device. There is another important thing to be considered where constant speed is maintained, whether it be 15 miles per hour or 30 miles per hour or any other constant speed, and that is that no advantage can be derived from velocity head, or what engineers call a "running start." If the speed is constant, the extra work on grades must be supplied just as it occurs without assistance due to momentum, and corresponding power must be supplied by the power house, resulting as in the previous case in heavy peak loads. But even aside from the motors and power plant there are very few instances where the best economy and safety can be had by running trains at a constant speed. There are places where it is desirable to run fast and other places and occasions where it is best to slow down and in practical railroading these conditions are encountered continually.

The variable speed characteristics of direct-current and single-phase motors readily permit a reduction in train speed when the tractive effort is increased; in fact, unless controlled by the motorman, these motors will automatically reduce in speed with increased tractive effort, thus helping to keep down the total power demanded at the time that tractive effort is greatest. On the opposite side of the case, where the track is level and straight and high speed is desirable, a three-phase motor cannot exceed a certain fixed speed, whereas a variable-speed motor, especially a single-phase variable-speed motor that can be supplied with extra high potential from over-voltage taps from the transformer, can take advantage of this opportunity to make extra good time; also trains equipped with variable-speed motors can take advantage of velocity head or a running start in climbing short grades.

Reliability of Electric Railway Apparatus.—Reliability of motive power is of prime importance in railroading and any acceptable railroad motor must be reliable. Fortunately experience has established a pretty good degree of reliability for electric motive power.

Reliability of Single-Phase Motors.—Much speculation and some doubt has been current regarding the reliability of single-phase railroad motors. This should be set at rest by the results accomplished with them.

The largest single-phase installation is on the New York city terminal of the New York, New Haven & Hartford railroad, where there are 40 or 50 1,000-h. p. single-phase locomotives in interchangeable operation between 11,000 volts, 25 cycles, single-phase current and 650 volts direct current.

This installation is demonstrating a high degree of reliability, not only for the motors, but for the entire electrical plant and equipment. On some days every electric locomotive has been in service, none being in the repair shops. Such a thing would not occur with forty or more steam locomotives. The number of electric locomotive miles made per motive-power delay on the New Haven road has averaged, for several months at a time, one failure or delay in 15,000 to 17,000 locomotive miles. This is two or three times as many miles as is averaged per motive power delay with steam locomotives in the same kind of service.

The heavy single-phase freight locomotives in service on the Grand Trunk railway in the Detroit River tunnel between Port Huron and Sarnia likewise give very reliable service.

Including interurban electric roads there are over 20 single-phase electric systems in operation in America, and over 25 in Europe, and while minor difficulties have been encountered in some places an excellent operating reliability has been demonstrated for single-phase apparatus.

Reliability of Three-Phase Motors.—There is not so much practical railroad experience upon which to base judgment regarding the reliability of three-phase motors as there is for direct-current and single-phase motors, but such railroad experience as there is, together with the extensive use of three-phase motors for industrial work, points to an excellent degree of reliability that is unexcelled in any type of motor.

Reliability of Direct-Current Motors.—The wide use of series-wound direct-current motors by railroads has thoroughly established their reliability.

Cost of Maintenance of Electric Motors and Locomotives.—Time will not permit much discussion of locomotive maintenance costs, but experience has demonstrated that it will average less for well constructed electric locomotives of all types than for steam locomotives.

In America the maintenance cost of the heavy direct-current and single-phase electric locomotives for use on various railroad systems is low in all cases. The roads using heavy electric locomotives are:

(1) The Baltimore & Ohio R. R.—Direct-current locomotives used in tunnel in Baltimore.

(2) The New York Central R. R.—Direct-current locomotives used on New York city terminal.

(3) The New Haven R. R. interchangeable single-phase and direct-current locomotives used between New York city and Stamford, as already mentioned.

(4) The Grand Trunk Railroad.—Single-phase locomotives, previously mentioned, used in the Detroit River tunnel.

An interesting tabulation of the comparative cost of repairs for steam and electric locomotives has recently been published by Mr. L. R. Pomeroy in a paper presented before the Engineering Society of Columbia University. He segregates the items of repair cost for both steam and electric locomotives and gives the total cost of the repairs of electric locomotives at about 40 per cent of the cost of repairs of steam locomotives. He gives a little over one-third of the total cost of electric locomotive repairs as belonging to the motors, the remainder being for repairs of running gear, for painting, etc.

It is reasonable to suppose that single-phase motors being more costly and somewhat heavier than direct-current motors, will cost more for repairs; but even if the cost of repairs on single-phase motors should be 25 per cent more than on direct-current motors, this increase will add less than 10 per cent to the total cost of locomotive repairs, provided Mr. Pomeroy is correct in his estimate, which gives the repairs of electrical machinery as three-eighths of the total cost of electric locomotive repairs. Likewise for three-phase locomotive, since the repairs on the motors are only a small part of the cost of repairs on the whole locomotive, the possible saving by the use of three-phase instead of direct-current or single-phase motors can never be a relatively large item. As regards motor cars the cost of repairs of the electric equipment has long been known to be very low.

Efficiency of Distribution Systems Compared.—Brief mention has already been made of the difference in efficiency between the direct-current and alternating-current electric power distribution systems, but without giving relative figures.

All moderate and large size direct-current railway systems employ rotary converter or motor generator substations located at frequent intervals along their tracks to change the alternating current from the high-tension lines to direct current for the trolley or third rail. The apparatus in direct-current substations includes moving machines that are necessarily operated much of the time under light loads; also the drop in the direct-current trolleys or third rail at time of heavy loads is large, and the average result is that on direct-current systems much electric power is lost between the power house and the trolley wheels or other collecting devices on the trains. On many large direct-current railroads this average loss in power amounts to 40 per cent or 50 per cent, more or less, but is seldom as low as 35 per cent. These are average losses and indicate the all-day efficiency of the power transmission and distribution systems, and should not be confused with the loss at times of heavy load, or so called peak load, on the power house, which latter loss is the amount by which the maximum power-house output exceeds the sum total of the electric power taken simultaneously by the trains.

With the single-phase and the three-phase railroad systems the loss in electric-power transmission and distribution is very much less than with direct current. On the large single-phase installation of the New Haven road no transformer stations are used, as the current from the generators is conducted directly to the locomotives. The same thing is true in the single phase plant of the Grand Trunk railroad at the Detroit River. The transmission and distribution losses at these places probably average less than 5 per cent, and even where transformer stations are used with single-phase apparatus the losses are small, but are somewhat greater than 5 per cent. The above statements about the efficiency of single-phase distribution apply also to three-phase distribution, but in a lesser degree, because while both systems employ transformer stations without moving parts, three-phase stations have to be closer together than single-phase stations and consequently the transformer losses are greater in the aggregate.

Efficiency of the Three Types of Motors Compared.—A comparison of the full-load efficiency of the three kinds of motors shows several per cent, probably 3 per cent to 4 per cent, in favor of direct-current and three-phase motors compared with the single phase, and this difference is increased 2 per cent or 3 per cent by the losses in the transformers used with single-phase motors; but this difference is partly or wholly offset by the superior efficiency of the control of single-phase motors, which makes no use of resistances to cut down the current when starting and when running slow, as is done with direct-current and three-phase motors. In any event whether or not the lower full-load efficiency of single-phase motors and transformers as compared with other motors is entirely offset by difference in the efficiency of control, this difference in efficiency is very small compared with the difference in efficiency of the power transmission and distribution systems which is in favor of the single-phase system, as already described.

Direct-Current Substations, Operating and Maintenance Costs.—There is one large item of operating labor and maintenance cost that must not be overlooked and which is necessary where heavy direct currents are used, but that has no counterpart in single-phase and three-phase operation. It is the attendance and repairs of the moving machinery in direct-current substations. This is a heavy expense and for ordinary conditions will run between $2,000 and $3,000 per substation per year.

Uniform Electric Railway System.—Transportation constantly requires interchange of traffic between railroads, and this makes interchange of appliances and uniformity of systems highly desirable even if not absolutely essential. The use of special appliances to gain a slight advantage in some particular limited case will not be justified in railroad work. If a standard and uniform system can be found that will economically and satisfactorily meet all of the many demands on railroad motive power. A choice between the three existing systems should not be based upon consideration of those parts of the system in which there is no great difference in cost or efficiency or in their practical operation. It has been pointed out that (except in the matter of operating three-phase motors) the difference in these regards between the three systems is not nearly so great in the power houses or in the electric motors on the trains as it is in the apparatus for the transmission and distribution of electric power from the power house to the trains. For ordinary railroad conditions the transmission and distribution apparatus is the most costly part of railroad electrification and is the part in which there is a vast difference between the different systems. If we could entirely eliminate the cost of this part, together with the losses sustained in delivering electric power from the power house to moving trains, train propulsion with electric power would be so much more economical than with steam that steam locomotives would be supplanted by electric locomotives just as steam engines in industrial plants are being supplanted by electric motors receiving power from large central stations.

There is no present prospect of such a perfect wireless method of distributing electric power from power houses to railroad trains, but highly efficient and reasonably economical apparatus is available for the work.

There Should Be as Little Dead Weight as Possible on the Wheels and Axles.—I will next mention a few important points to be considered in connection with electric-locomotive designs.

You all know, in a general way, how the motors are mounted on the earlier designs of street cars and interurban trolley cars. Referring to the single reduction geared motors, the motor is suspended horizontally with one end carried on a bearing that rests on a car axle and the other end is mounted with some form of spring support resting on the truck frame. This results practically in dividing the weight of the motor between two supports; one of the supports is the motor bearing on the axle and the weight of the motor at this point is not spring supported, so that any shock or blow, due to irregularities in the track or other causes, is transmitted directly to the heavy motor, and, conversely, whatever blow is transmitted to the motor is returned with equal force to the track, since for every action there is an equal reaction. It is obvious that the force of the blow struck will depend on the amount of the irregularity in the track, on the velocity with which the wheel strikes it, on the weight of the wheel and axle, and the weight that is attached inflexibly to the axle. Therefore, adding half of the weight of the motor to the axle in the manner just described increases the force of the blow of the wheels upon the rails. The other half of the motor, being carried on springs, rides easily on the track.

Consider for a moment the condition regarding weight on axles of steam-railroad rolling stock. On steam locomotives the weight that bears upon the track without spring supports intervening is only the weight of the wheels, axles, and journals, since the weight of the locomotive frame is carried by springs resting on the journals. Also there is some weight due to connecting rods, which I will mention later, but the entire dead weight, or the weight that is not spring supported in a steam locomotive, is a relatively small part of the total weight. The same is true of steam-railroad cars. All of the weight of the cars excepting the wheels, axles, and journal boxes is supported on springs.

Some people have had the impression that the most serious single cause for wear on steam-railroad tracks is the unbalancing due to the reciprocating motion of the locomotive cross heads, connecting rods, etc. This has always been balanced as far as possible, but it is not possible to completely balance it, and for this reason many people confidently expected that electric locomotives and motors which had no reciprocating parts would be far easier on the track than steam locomotives. The unbalanced effect of steam-locomotive reciprocating parts is undoubtedly an important source of track wear, but when the balancing is properly done this source of trouble can be very fairly well taken care of.

Experience with electric motor cars and locomotives did not at first wholly fulfill the early hopes of electric motor advocates for railroad work. When heavy cars were operated at high speeds, it was found that the track wear was much higher than anticipated, and it is evident that the dead weight of half of the motor on the axle is a very serious cause of increased track wear, especially with high-speed trains. Some of the most skilled designers of electric locomotives and motor cars are strenuously discouraging the use of any construction for high speeds that adds dead weight (by which I mean weight that is not spring supported) to the weight of the wheels and axles. There are two practical ways of avoiding this; one method is called the quill suspension, the other is the side-rod construction, to be described later on in connection with the electric locomotives of the Pennsylvania R. R. New York terminal.

For the quill suspension, a tube or sleeve is placed around the axle between the wheels. The hole in the tube is considerably larger than the diameter of the axle. Flanged heads or arms are shrunk on to the ends of the tubes and springs are inserted between the flanges or arms and the wheels so that the tube, or quill as it is called, is supported by springs with the shaft central through the hole in the tube. The springs permit a certain latitude of motion up and down and in a circular direction up to the limit of spring compression or extension. In some recent designs of motors, the total clearance between the axle and the inner side of the tube is 1½ ins. For gearless motors, the armature is built up on the tube or quill and the tube is the armature axle and runs in the motor bearings. The weight of the motor is balanced on springs, or on a frame that is supported on springs, the whole weight of the quill, the armature, and motor thus being spring supported. With geared motors the gear is carried on the quill, as is also one end of the motor itself, thus securing a spring support instead of making a dead weight on the axle.

This construction has been found very effective for relieving the force of the blow of the wheels when striking irregularities in the track, and effectively reduces the track wear. The importance of having no dead weight carried on the axles increases as the operating-speed increases, and it is very essential at high speed. I believe that few people realize how essential it is until they learn from experience and observation. The pounding due to a reasonable amount of extra dead weight on the axle may not be serious to the track or the motors up to 35 miles per hour, more or less, but becomes very hard and must cause serious wear at speeds of 60 miles per hour or over, and where the dead weight is great it will be a serious factor at 50 miles per hour or over.

It does not require a very lengthy description to show how the dead weight is relieved in the case of side-rod locomotives. In these locomotives the motor is mounted on the locomotive-frame, which is carried on springs which transmit the weight to the journal boxes. The power is transmitted through connecting-rods to a jack-shaft that has its bearings in the locomotive-frame, and from the jack-shaft it is transmitted again by connecting-rods to the driving-wheels. The connecting-rods, of course, require counter-balancing, and this is done for electric-locomotive connecting-rods more effectively than it can be done for the cross-heads and connecting-rods of steam-locomotives, since in the case of the electric-locomotives the motion of all the connecting-rods and journals, etc., is circular in direction, and a circular movement is possible of complete balancing. In steam locomotives the motion of certain parts, like the cross-heads, is reciprocating and cannot be perfectly balanced. For this reason the balance of the connecting-rods on electric locomotives can be made more perfect than the balance of the connecting-rods and reciprocating-parts of steam locomotives.

The Center of Gravity of Locomotives Should be Fairly High.—Regarding high and low centers of gravity in locomotives, experience has shown that locomotives, especially for high speed, should have the center of gravity high up. One of the reasons for this is apparent if we consider the effect of high speed on curved tracks. Consider what would happen if a locomotive could be built with a center of gravity so low that it was directly between the rails and therefore on a level with them. Such a locomotive could be run at high speeds without danger of turning over on curves even on a flat track. Whatever other results might occur, the locomotive would not tend to tip over, but would press against the outside rail on the curve in a horizontal direction, and this would tend to push the rail over, and if the rail would not turn over, it would tend to push the whole track over—ties and all—and the whole track has actually been moved on curves by locomotives of very low center of gravity running at high speeds. Now consider the case of a locomotive with a high center of gravity. Such locomotives when run at high speeds on curves tend to turn over. This is countered by elevating the outer rail, but still the tendency to turn over occurs on curves if the center of gravity is high, but with a high center of gravity the tendency to turn over throws the weight of the locomotive on top of the rail, pressing it down instead of pushing it out in a horizontal direction, as is the case where the center of gravity is low. It is manifest that a pressure on top of the rails will not spread the track or do the damage that a horizontal lateral pressure will cause.

The tendency of modern electric-locomotive design—especially for high speed operation—is toward a construction in which the dead or un-spring-supported weight of the wheels and axles is minimum and in which the center of gravity of the locomotive is high.

Geared Versus Side-Rod Locomotives.—There has been considerable speculation and controversy regarding the relative merits of geared locomotives and side-rod locomotives for powerful machines. The New York, New Haven & Hartford Railroad Co. is going to determine this matter in a practical way. It has contracted for two very powerful moderate speed locomotives to perform equivalent work. One of these locomotives is already built and is in operation with gears. The other one is being built with side rods. The motors of the geared locomotive drive through quills, so that they add no dead weight to the axles and they are carried vertically above the axles instead of in the customary horizontal position, and therefore the motors are easily accessible and the center of gravity is higher than it would be if they were horizontal.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Cost of Stopping Trains—When it is Cheaper to Install Interlocking Signals.

Under the laws of Canada, all trains are required to come to a full stop before crossing another railway at grade. Mr. C. L. Hackett, in an article on railway signaling in the *Canadian Engineer,* shows that the installation of interlocking signals is an actual saving in operating expenses when trains reach a certain number. The following figures are based on the results secured by Mr. Peabody, signal engineer of the C. & N. W. Ry., who having experimented with different trains, concluded that the cost of stopping and again accelerating a train to its original speed averaged 45 cts. per tain. The interlocking plant considered is for a single track crossing, where 16 levers would be required. A day and night towerman would be required, and the following is the estimated annual cost:

NAME LIST Blank No 1

Date.............................. Contract

NAME	Number	Rate Per Hour	Remarks
	0		
	1		
	8		
	9		

Foreman.

Notation—Foreman will fill out this blank and send to main office with first pay-roll of each job. All men added afterward to be entered on back of weekly statement sheet in spaces provided.
Make sheets in duplicate. Retain one copy.

Cost of interlocking, complete	$4,800.00
Interest at 4%	192.00
Depreciation at 7%	336.00
Maintenance, per year	240.00
Operation, per year	1,200.00
Total cost per year	$1,968.00

The following table shows the saving brought about by such a plant as compared with stopping trains for 14, 20 and 25 trains per day:

Trains per day	Cost of stopping per year.	Cost of interlocking, per year.	Net saving, per year.	Years required to pay for installation from savings.
14	$1,971	$1,968	$ 3.00	...
20	2,817	1,968	849.00	5½
25	3,521	1,968	1,553.00	3

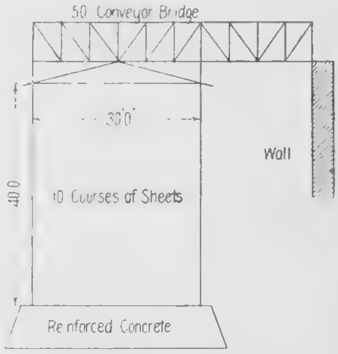
It is apparent, from this table, that 14 trains a day in this case would justify the installation of the plant, aside from the savings due to increased safety.

A Method for Keeping Cost Records for Steel Erection Work.

BY FRED H. MARSH.*

The blanks shown herewith illustrate a system of cost keeping for small jobs of steel erection work. This system has been successfully used by two different companies engaged exclusively in steel erection work.

The method employed in this system is as follows: At the commencement of a new piece of work, the foreman in charge makes duplicate copies of blank No. 1 entitled Name List, entering thereon every man's name, rate and duties, sends one copy to the cost clerk in the main office and retains the other himself. Should any other men be employed during the course of the work, the data, including the number given them, is entered in the place provided therefore on the foreman's copy of the Name List. Blanks No. 2, entitled Weekly Distribution Statement, are forwarded to the cost clerk each week and the data referring to new men is entered by him on his copy of the Name List. Only the men's numbers are used by the cost clerk in handling the distribution from there on. Blank No. 2, entitled Weekly Distribution Statement, is provided with a column for the men's numbers; one for the rates per hour at which they are employed; nine major divisions, each subdivided into eight columns, one for each day of the week and one for totals, and seven wider columns, one for each day of the week. Several of the nine major divisions are given headings corresponding to some operation of steel erection work common to practically every steel job, the balance is left with blank headings for the insertion of any piece of work peculiar to the erection job in hand. The foreman or time keeper in the field enters each man's rate in the proper column, from his name sheet, and enters each day, under the proper headings and after each man's number, the number of hours worked; and also enters in the proper one of the seven wider columns at the end of the sheet any information relative to the work in hand, such as shop numbers of pieces being worked with, location in building of day's work, etc., needed by the cost clerk in intelligently distributing the time. When these blanks reach the cost clerk he extends the totals into the columns headed Sum, foots up these columns, and checks the total against his pay rolls. He then enters these footings on the Blank No. 3 entitled Summarized Cost Statement.



WEIGHT ESTIMATE.

	Lbs.
Reinforcing L + rods (set by purchaser)	1,225
Bottom L	1,035
10 courses of sheets 3/16"-¼"-5/16"	43,020
Top L	445
Roof, ⅛" galv x 2½" L rafters	7,800
Two trusses (conveyor bridge)	4,400
	56,700

Rivets to drive.

2,490	⅜" in roof.
1,705	½" in shell
2,100	⅝" in shell
2,720	¾" in shell
9,015	

Contract includes erecting, riveting and painting outside only.

The Summarized Cost Statement is intended to give a complete synopsis of each contract in a manner such that unit costs for each operation are shown accurately and can be used in estimating other work of a similar character. The pay roll items are entered

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*612 So. Penn Ave., Denver, Colo.

WEEKLY DISTRIBUTION SHEET

Date .... Contract ....

Number	Rate per hour	Unloading								Transporting								Erection								Riveting								Calking								Painting								Corrugating																									Portion of Contract Being Executed						
		Mon	Tues	Wed.	Thurs	Fri.	Sat.	Sun	Sum.	Mon.	Tues.	Wed.	Thurs	Fri	Sat	Sun	Sum.	Mon.	Tues	Wed.	Thurs	Fri	Sat.	Sun.	Sum	Mon.	Tues	Wed.	Thurs.	Fri	Sat.	Sun.	Sum.	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Sum.	Mon	Tues	Wed	Thurs	Fri.	Sat	Sun	Sum.	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Sum	Mon.	Tues	Wed	Thurs.	Fri	Sat	Sun	Sum	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Sum	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
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Foreman ....

Time Clerk ....

NOTATION.—The foreman, or time clerk, will fill out each day under proper heading, the hours of labor performed by each man after his number. He will also insert under proper day and after proper number the exact portion of the structure being handled. Send blank properly filled out to the Main Office each week.

each week as outlined above and bills for coal, coke, oil, small tools, repairs, etc., are audited and entered once a month. At the end of the contract the liability insurance, depreciation of tools, etc., are reckoned up and properly charged on this sheet, the total cost is footed up and the profit or loss ascertained and entered for reference. Then each individual part of the work is divided by the number of units, be it tons, pieces, or rivets, and the unit cost entered in the places provided therefore at the foot of the sheet. All other columns in the analysis of cost at the foot of the sheet are entered and a concise record of the work is at hand for future reference. On the reverse of this sheet is provided a place for entering the original estimate, for comparison, a place for a sketch showing the outlines of the building or other salient features, below which a short description of the work or of difficulties met with is sometimes written. Table I shows the face of a master card and Table II the reverse of the master card prepared from an actual contract and made of a size to be carried in a pocket loose leaf binder. Table III shows the face and Table IV the reverse of the master card prepared from a piece of reinforced concrete floor work where a system patterned after the above was used.

Blank No. 4 shows the pay roll sheets used with both of the above cost systems. There is one feature worthy of mention used on these sheets and that is the arrangement of the numbering on the sheets. It will be readily seen that one set of blanks only has to be printed, as the figure in the tens place is inserted in pen or pencil after No. 9 is passed.

In passing it may be well to say that two men are never given the same number during the course of any one job. However, if the contract is of considerable time duration, it would be well to turn in new name sheets and readjust the numbering of the men each month instead of only at the beginning of a new contract.

Method and Cost of Constructing a Concrete Flume.—On account of the large percentage of boulders encountered in the excavation for a flume—a part of the project of the Arizona Power Company—the original plan was changed and a reinforced concrete flume, built on a bench, was substituted. The flume carries from 4 to 4½ cu. ft. of water per second and has a slope of 1 to 1,000.

Concrete was mixed in a proportion of 1—3—6 and was tamped thoroughly. The cement cost from $8 to $10 per bbl. delivered at the work.

The average labor cost of installing the flume in a continuous stretch, with sand, cement and rock delivered on the site in piles from 300 ft. to 400 ft. apart, without concrete mixing machinery, and with a water supply pipe following the bench, was about as follows. The average day's work was 100 lineal feet.

Day Labor Cost of Installing Concrete Flume

Setting and moving forms (11 men at $2), sub-foreman (1 man at $5)	$ 31.00
Placing reinforcing metal (3 men at $2)	6.00
Mixing concrete, hand (5 men at $2)	10.00
Wheeling concrete material (2 men at $2)	4.00
Wheeling concrete mixed (5 men at $2)	10.00
Shoveling into forms (3 men at $2)	6.00
Tamping (7 men at $2)	14.00
Finishing (1 man at $2)	2.00
Wetting for seasoning (1 man at $[illegible])	[illegible]
Foreman	[illegible]
Timekeeper	[illegible]
Total	$[illegible]

A construction crew organized as above constructed from 120 ft. to 150 ft. of flume on good days in 10 working hours when no unforeseen interruption occurred, but the average amount of flume during the entire job was 100 ft. per working day for the said crew. All of the men employed were Apache and Mojave Indians, excepting the foreman, sub-foreman and time keeper.

The above is taken from an article by F. S. Masson in the Engineering Record.

A party of about 120 persons, members of the American Institute of Mining Engineers and their friends, arrived at Colon on Nov. 1

SUMMARIZED COST STATEMENT—Blank No. 3

Contract

Date	Item	Transportation Tools	Transportation Men	Unloading	Trasporting Iron (Bulling)	Erection	Riveting	Calking	Painting	Corrugating	Plant Expense	General Expense	Total Cost	Amount Received	Net Profit
	Totals														

Analysis of Cost

Scale of Wages	Foreman's Rate	Foreman's Total	Superintendent's Rate	Superintendent's Total	Time Clerk's Rate	Time Clerk's Total	Tonnage	Sqs Corrugating		Cost Per Ton	Cost Per Sq		Cost Unloading Per Ton	Cost Transporting Per Ton	Cost Erection Per Ton	Cost Riveting Per Ton	Cost Calking Per Ton	Cost Painting Per Ton

Steel Furnished By

RUTH-FLYNN CONSTRUCTION CO., Steel Erectors

SUMMARIZED COST STATEMENT

Erection of Steel Grain Tank for Gem State Roller Mills, Elva, Idaho

Weather cold with snow flurries

Date	Item	(1) Transportation Tools	(2) Transportation Men	(3) Unloading	(4) Hauling	(5) Erecting	(6) Riveting	(7) Calking	(8) Painting	(9) Force account	(10) Plant Expense	(11) General Expense	(12)	Total Cost	Amounts Received contract	Net Profit
1908 Sept. and Oct.	To and from	42.45													765 45 $27.00 per ton	
	R. R. Fares		56 21						brushes			nails etc.				
	Supplies								1 40			2.50				
	Coal						18.05									
	Lumber					14 37										
	Rope, tool rental, etc.										22.50					
	Liability Ins											23.75 office				
	Payroll			6.04		162.67	272.75		14.75	23.30		10.26			Force Acc't 25.63	
		42 45	56.21	6.04		177 04	290 80		16.15	23.30	22 50	36 51		671 00	791.08	120 08

Scale of Wages	Foreman Rate	Foreman Total	Tonage	Total Cost per Ton	Cost per Ton Omitting Columns 1-2-9-10-11	Number of Rivets	Cost of Riveting Per Rivet	Cost of Unloading Per Ton	Cost Hauling Per Ton	Cost Erecting Per Ton	Cost Riveting Per Ton	Cost Calking Per Ton	Cost Calking Per Foot	Cost Painting Per Ton
40c per hour	$125.00 per Month		28.35	$28.66	$17.28	9015.	3¼c	$0 213		$6.25	$10.25			$0.57

Steel Furnished by American Bridge Co

W. M. PORTER ENGINEER & CONTRACTOR

SUMMARIZED COST STATEMENT

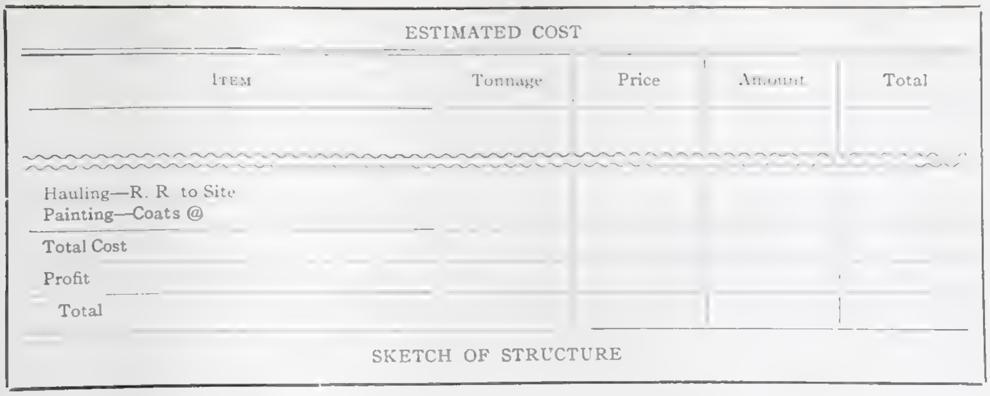
Reinforced Concrete Charging Floors, Retort House for Denver G. & E. Co.

November, 1909

Weather cold, with 2 snow storms

ITEM	Transportation Tools	Loading and Hauling materials	Forms		Reinforcement		Concrete				Superintendence	General and Tool Expense	Total Cost	Amounts Received	Net Profit
			Material	Labor	Material	Placing	Material	Charging	Mixing	Placing					
Steel 40 ½"x 2' 0" @ 3.60 cwt.					165 00										
" 260 ⅜"x11' 2" @ 2 30 "															
" 34 ⅝"x11' 2" @ 2 65 "															
Bending 3.14 @ 15c ea.	Mixer 5 60	Cement 7.28													
Payroll		Gravel 45 41		138.29		37.75		50.21	22 34	67 07	94.60 Distrib'ted in Costs	Office 12.64			
"															
Gravel 74 yd. @ 50c							37 00					Repair Mixer 17.33			
Cement 423 sacks @ 31½c							133 25								
Salvage on Lumber														30 49	
Contract Price														787.88	
Extra Concrete at Ends														30.00	
Lumber			60 98												
	5 60	52 69	60.98	138 29	165 00	37 75	170 25	50 21	22 34	67 07		29.97	800.15	848.37	48.22

Scale of Wages	Total Yards Concrete	Total Tons Steel	Forms Reinforcement						Cost Concrete Per Cubic Yard							Forms Per Sq Ft	Proportion
			Material Per Yd	[illegible]	Material Per Yd	Placing		Bending Per Cwt	Total With Steel	Total Without Steel	Gravel and Cement	Charging	Mixing	Placing			
						[illegible]	Per Yard										
Foreman 40c hr Carpenters 27½c hr Labor 25c hr.	73.33	2 44	83c.	1.89	[illegible]	75½c.	[illegible]	99c	10 91	8.15	2.32½	68½c	Labor 20½c Mixer rent 10c	93c		11c	1 part Cement 59c Bank Gravel



ESTIMATED COST

ITEM	Tonnage	Price	Amount	Total
Hauling—R. R to Site				
Painting—Coats @				
Total Cost				
Profit				
Total				

SKETCH OF STRUCTURE

The Tri-Borough Rapid Transit Subway of New York City.

As noted in our last issue bids have been received for building in New York city some 18 miles of new subway rapid transit railway to cost about $60,000,000. The lime to be constructed is a portion of the Tri-Borough System, which will aggregate 44.2 miles, and it will interest many of our engineering contracting readers outside of New York to have a concise account of the whole system which will probably cost close to $100,000,000.

Beginning at the Battery, the road runs up Church and Vesey streets to Broadway as a two-track subway. It runs north under Broadway as a four-track subway to a point about Ninth St., where it continues under private property and Irving Place to Lexington Ave. and thence up Lexington Ave. to and under the Harlem River. Throughout the greater part of its length in Lexington Ave., the subway will be a double-deck structure, with local tracks on the top level and express tracks on the level below. North of the Harlem, the line divides into two branches of three tracks each, one running northwesterly through Mott, Gerard, River and Jerome avenues to Woodlawn, and the other easterly and then northeasterly through Southern Boulevard, Whitlock and Westchester avenues to Pelham Bay Park.

The point of division is at 135th St. and Park Ave. The Jerome Ave. branch will continue as a subway to River Ave. and 157 St. and from that point to Woodlawn will be an elevated road. The southern Boulevard and Westchester Ave. branch will be a subway through 138th St. and Southern Boulevard and Whitlock Ave. to a point south of Westchester Ave., beyond which it will continue as an elevated road to Pelham Bay Park.

The above route covers the trunk line of the tri-borough system in Manhattan and The Bronx branches. In the lower part of Manhattan, the trunk line will connect with the Manhattan Bridge by a subway through Canal St., the tracks from which will run across the Manhattan Bridge and into another subway on the Brooklyn side through Flatbush Ave. Extension. This subway (under Flatbush Ave. Extension) is a part of the Fourth Ave. Subway in Brooklyn, now under construction. Two tracks connecting with the Broadway-Lexington Subway at Canal St. will pass through this subway to Fulton St., turning from Fulton St. into Lafayette Ave. and running in a subway under Lafayette Ave. to Broadway, and back through Broadway to and over the Williamsburg Bridge, and then into the Manhattan portion of the Brooklyn Loop, running through Delancey and Centre streets to Canal St. and Park Row. The Brooklyn portion of this loop subway is known as the Broadway-Lafayette Avenue route.

The Fourth Ave. Subway begins at the Brooklyn end of the new Manhattan Bridge and runs as a subway under Flatbush Ave. Extension to Fulton St., through Ashland Place, and under Fourth Ave. as far as 43rd St., Brooklyn. This is the part for which contracts were executed in November, 1909, and the construction of which is well advanced.

Branches of this subway, which have not yet been contracted for, but will be a part of the tri-borough system, extend from the terminus of the Fourth Avenue Subway to Fort Hamilton and Coney Island. The branch to Fort Hamilton will be a two-track subway continuing down Fourth Avenue.

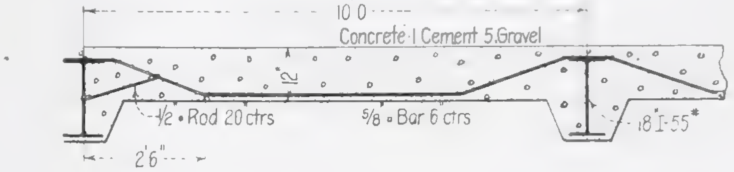
The Coney Island branch will leave the main line at 40th St. and continue as a three-track subway through New Utrecht Ave. and other streets to a point beyond 24th Ave., where it will become an elevated railroad and continue as such to Coney Island. Provision is made in the plans so that another track may be added in the future to the Coney Island branch and two more tracks to the Fort Hamilton branch.

The whole system, as has been said, will embrace 44.2 miles of road divided as follows:

	Miles.
Total four track construction	13.9
Total three-track construction	17.4
Total two-track construction	12.9
Total	44.2

The commission advertised for bids in two different ways—namely: for construction, equipment, maintenance and operation by private capital, and for construction alone by municipal funds. The method of construction, equipment and operation by private capital is made possible by a recent amendment to the rapid transit law. This permits the use of private capital on the indeterminate franchise plan. That is, an individual or company willing to furnish money for the construction of a rapid transit line can be granted a franchise to operate the same for a length of time sufficient to amortize the cost of the work and allow a reasonable return on the capital invested. The ownership of the road, however, vests in the city from the beginning and the city retains the right to retake road and equipment at any time after ten years from the beginning of operation by reimbursing the contractor for his outlay, the payment not to exceed actual cost plus 15 per cent. Upon this basis the commission drafted a form of contract for the construction, equipment, maintenance and operation of the entire tri-borough system. If an acceptable bid is received, the successful contractor will build with his own money all that portion of the system not already under construction, will acquire the right to operate such portions as are constructed or under construction, and will equip the whole road at his own expense. He must agree to pay interest on the cost of construction, all expenses for administration, maintenance and operation, all taxes, rates and assessments except special assessments, to set aside a contingent fund and a quarterly contribution to the amortization fund before taking any profits from the operation of the road, and when the profits are to be divided share and share alike with the city after payment of a dividend of a given percentage. The contractor will bid upon the percentage of the revenue he is willing to set aside as an amortization fund and the length of his lease will be governed by the amount thus bid and the rate of dividend before division of profits.

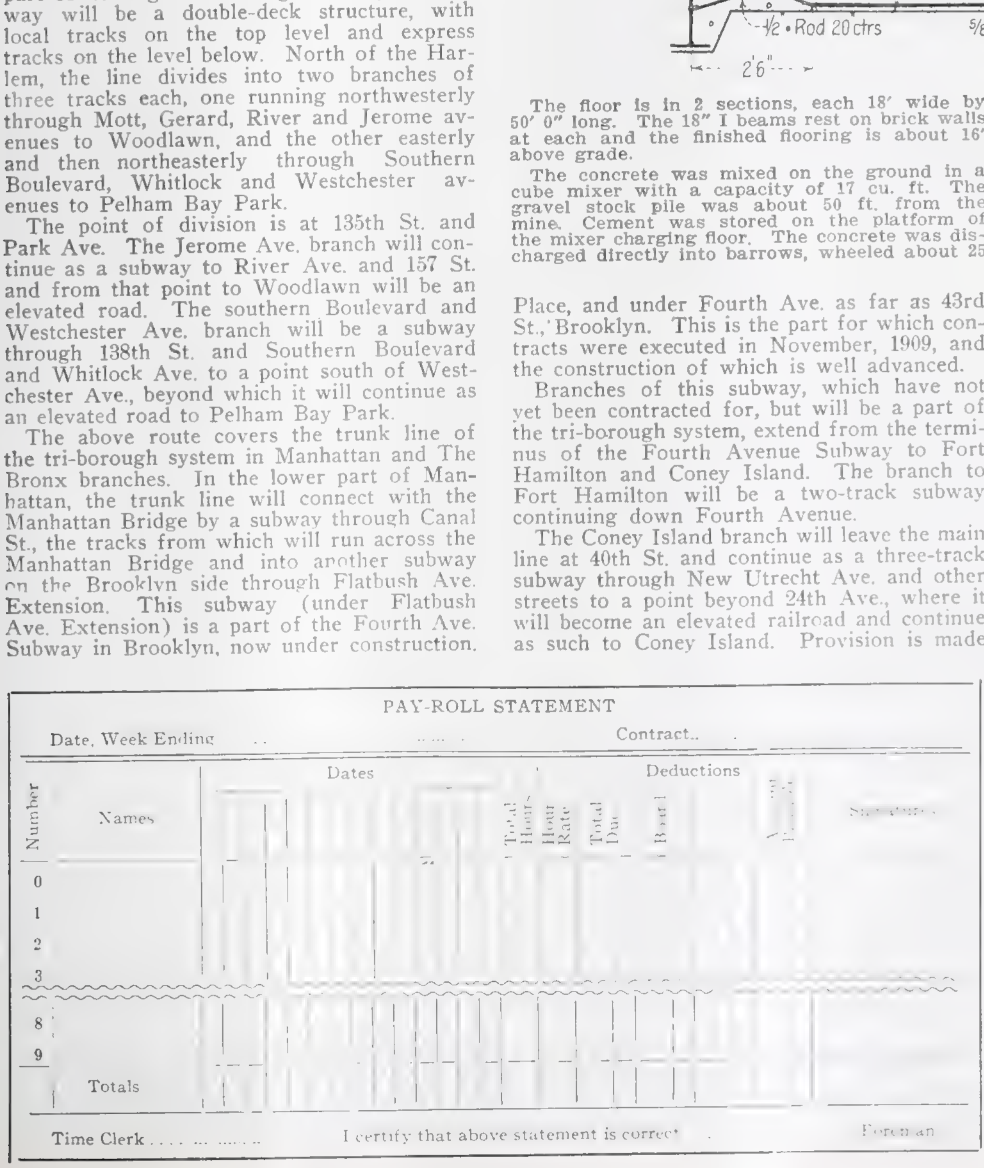
Municipal construction was provided for in another form of contract drafted according to the terms of the rapid transit act governing construction by city money. Under this form of contract, no provision is made for operation, that being deferred to a later day. The contractor is asked to bid only on the cost of construction. Unit price bidding is provided for; that is, the form of contract contains a schedule of all the work and material entering into the construction of the road and the contractor must set a price at which he will furnish each unit. Not all of the tri-borough system can be contracted for this year under this form of contract for the reason that the city authorities can appropriate only $60,000,000 for rapid transit purposes. The



The floor is in 2 sections, each 18′ wide by 50′ 0″ long. The 18″ I beams rest on brick walls at each and the finished flooring is about 16′ above grade.

The concrete was mixed on the ground in a cube mixer with a capacity of 17 cu. ft. The gravel stock pile was about 50 ft. from the mine. Cement was stored on the platform of the mixer charging floor. The concrete was discharged directly into barrows, wheeled about 25 ft. and elevated to the floor level and wheeled an average of about 40 ft. to place. A freight elevator used for elevating coal, barrows or cars was utilized for this raising of concrete.

The cost of the work is higher than it should be owing to the fact that another contractor delayed the starting of our work into cold weather. Using the old freight elevator also was a mistake, as it moved so slowly as to greatly delay the work.

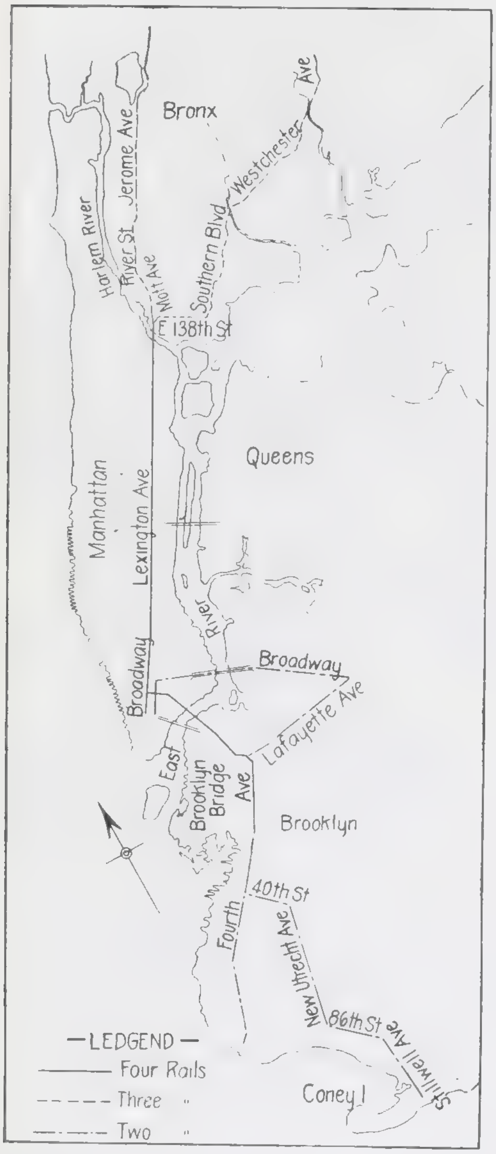


PAY-ROLL STATEMENT

Date, Week Ending .... Contract..

Number	Names	Dates	Total Hours	Hour Rate	Total Due	Deductions Board	
0							
1							
2							
3							
8							
9							
	Totals						

Time Clerk .... I certify that above statement is correct Foreman advertising for bids, therefore, was limited to such portions of the tri-borough system as could be constructed within that figure. The parts selected naturally were those which will take the longest time to build, so that a start could be made on these and the balance of the work let in following years according to the amount of money which the city could appropriate each year. The parts advertised include the Broadway-Lexington line from the Battery to 149th St. and River Ave. on the Jerome Ave. branch and to a point just beyond 3d Ave. on the Southern Blvd. and Westchester Ave. branch; all of the Canal St. crosstown subway in Manhattan and all of the Broadway-Lafayette Ave. subway in Brooklyn. It is estimated that it will take from three to four years to complete the construction of these portions. The remaining sections, consisting largely of elevated roads, can be completed within two years after construction begins. The bids received, as noted in our last issue, were all on this last form of contract.



Map Showing Route of Tri-Borough Rapid Transit Railway, New York City.

Costs of Hand Driven Steel Sheet Piling.—The foundation pits for the new buildings of the Bush Terminal Co., on the South Brooklyn water front, have this year been sheeted with U. S. steel sheet piling. This is found to be a saving of about 20 per cent on 2x10-in. wood piling, which was previously used, and works much more satisfactorily than with wood. The wood piling is used on an average of 2½ times, whereas the steel sheet piling is used 14 times and is still in good condition.

The costs, as given in an article describing the work by F. T. Llewellyn in the Engineering Record are as follows:

Steel material	$222.00
Driving 14 times at $14.65	205.00
Pulling 14 times at $4.84	68.00
Total for 14 pits	$495.00
Average cost per pit	35.30

The pits were 10x12x12 ft. The steel piling was 6 ins. wide and the corners were made without attempting to joint the sheeting, merely driving them flush. The bracing consisted of 6x8-in. horizontal square sets with one cross brace of the same dimensions at the center.

A study is being made of the land and water near the Atlantic entrance to the Panama Canal on which to base plans for a terminal harbor and docks, such as have already been arranged for at the Pacific entrance. A survey has just been completed of the territory between Cristobal Point on the north, Gatun Locks on the south, the French canal on the east and the American canal on the west, an area approximately four miles long and one mile wide. About 100 wash drill borings have been made to determine the nature of the bottom, and dry samples were taken from the holes at regular intervals.

LETTERS TO THE EDITOR.

Information Requested of the Extent of the Use of Waterproofing Compounds for Concrete.

Sirs: I am testing some waterproofing compounds in concrete in thesis work in the civil engineering course at the University of Illinois. Can you give me some information as to the extent of use of waterproofing materials used in the so-called integral method where the compound is incorporated in the concrete when placed? Could you send me a list of the compounds most generally used and arranged in order of the extent of their use? This is to include proprietary compounds and any others.

Very truly yours,
CHAS. W. LAURENCE.

806 So. Fifth St., Champaign, Ill.

(No statistics of the character requested by our correspondent are available. We shall be glad if any of our readers can answer our correspondent's questions.—Editors.)

The Design of Retaining Walls.

Sirs: I beg to acknowledge receipt of a copy of Engineering-Contracting containing my article on retaining walls. Can you conveniently insert the enclosed sheet in a subsequent copy with the following remark:

Tables to be used in connection with the article by Geo. M. Purver, C. E., on Retaining Wall Design published in the Engineering-Contracting, Nov. 2, 1910.

I do not think that the original compiler of the tables could object to their use. My intention is that the article published should enable one to design retaining walls without referring to any other book except for extensive treatment of the subject.

Hoping to hear from you, I remain yours truly,
GEORGE M. PURVER.

Brooklyn, N. Y., Nov. 9, 1910.

(The tables sent by our correspondent are printed below.—Editors.)

BAKER'S TABLE FOR COEFFICIENT OF FRICTION FOR DRY MASONRY.

Soft limestone on soft limestone, well dressed	.75
Brick-work on brick-work, with slightly damp mortar	.75
Hard brick-work on hard brick-work, with slightly damp mortar	.70
Point-dressed granite on like granite	.70
Point-dressed granite on well dressed granite	.65
Common brick on common brick	.65
Common brick on hard limestone	.65
Hard limestone on hard limestone, with moist mortar	.65
Fine cut granite on pressed beton blocks	.60
Well dressed granite on well dressed granite	.60
Polished limestone on polished limestone	.60
Well-dressed granite on well-dressed granite, with fresh mortar	.50
Common brick on common brick, with wet mortar	.50
Point-dressed granite on gravel	.60
Point-dressed granite on dry clay	.50
Point-dressed granite on sand	.40
Point-dressed granite on moist clay	.33

CAIN'S TABLE FOR WEIGHTS OF MATERIALS AND ANGLE OF REPOSE.

Material.	Weight per cu. ft. in lbs.	Angle. of repose
Water	62.4	0
Mud	102.	0-?
Shingle, gravel	90-109-120	35°-48°
Clay	120	14°-45°
Gravel and earth	126	
Settled earth	120-137	21°-37°
Dry sand	90	34°
Damp sand	120-128	35°-45°
Marl	100	
Brick	90-135	
Mortar	86-100	
Brickwork	110	
Masonry	110-144	
Sandstone	130-157	
Granite	164-172	

NOTE.—We may assume generally, as safe values for brickwork, 110 pounds per cubic foot: and for walls, one-half ashlar and one-half rubble backing, of granite 142 pounds, and of sandstone 120 pounds per cubic foot, though the last two values are generally exceeded. For ordinary earth or sand filling the angle of repose can be taken at one and one-half base to one rise, or a slope of 33° 42′ with weights per cubic foot varying from 100 to 130.

Screened and Run-of-Crusher Stone for Concrete.

Sirs: Could you in the near future give your full opinion in Engineering-Contracting as to the practice or advisability of screening crushed rock that is to be used in making concrete?

If I were asked to give an opinion on the matter, based on the statement of different authors of works on concrete, I would be unable to do so. They do not seem to get anywhere. One and all say that the densest mass is one obtained by graduating the sizes of the materials and thoroughly ramming same. The same result can be accomplished by mixing wet, putting in a little more cement, and, no more tamping necessary than to settle the materials and work out the air. One would suppose, then, that it is detrimental to the strength and density of the concrete to screen out the small pieces of rock and the pounded rock, since these go to fill voids in all concrete leaner than a 1:2:3 mixture, approximately.

I understand that crushed rock is screened to get out the "dirt." Some authors say that 10 per cent of the volume of the sand may be loamy material, or, if the "dirt" is clay, this amount can be as high as 20 per cent. After the stumps, vines and grass, etc., are stripped off the rock, I can't imagine anything else coming out of a quarry that would be anything like in quantity the 10 per cent or 20 per cent above mentioned, and a great deal better in quality.

Whenever I put in porous concrete, so full of holes that all the water of a 2½-in. fire hose sinks out of sight right through it, and see others doing the same thing, I know there is a mistaken idea most engineers are working under. What I have said about porous concrete you will find to be true of nearly every pavement foundation put in and every side wall I have seen put in or put in myself before the top is put on.

I have done a good deal of finishing surfaces myself and I believe that if the screening and dust were left in there would be enough mortar to finish easily and quickly without an extra coat of topping. Such a sidewalk would last a person's lifetime. I never saw a sidewalk worn down smooth until the rocks in the concrete base were exposed, and although I have talked to a great many engineers and contractors about it, I never had one admit to me that he had seen or heard of it.

Would not an extra amount of mortar facilitate spading in finishing wall surfaces?

I have mixed and put in concrete, using 2 bbls. to the yard, and think even here unless more cement were used some powdered rock would have made the concrete denser. This was for a reinforced concrete standpipe.

Hoping you will give the subject your attention I am, Respectfully yours,

Assoc. M. Am. Soc. C. E.

Spokane, Wash., Nov. 1, 1910.

(Formerly engineers almost universally demanded that broken stone for concrete should have all the fine particles screened out. This practice has been modified to some extent in recent years by using all the crusher products both coarse and fine, or, as it is commonly expressed, by using run-of-crusher stone. The comparative merits of screened and crusher-run stone for concrete work are questions of comparative economy and convenience. The fine stone dust and chips produced in crushing stone are not, as was once thought, deleterious; they simply take the place of so much of the sand which would, were the stone screened, be required to balance the sand and stone mixture. It is seldom that the proportion of chips and dust produced in crushing stone is large enough to replace the sand constituent entirely; some sand has nearly always to be added to run-of-crusher stone and it is in determining the amount of this addition that uncertainty lies. The proportions of chips and dust in crushed stone vary with the kind of stone and with the kind of crusher used. This variation in the crushed product makes the task of adding sand and producing a balanced sand and stone mixture one of extreme uncertainty and some difficulty unless considerable expenditure is made in testing and reproportioning. When the product of the crusher is screened the task of proportioning the sand to the stone is a straightforward operation, and the screened out dust and chips can be used as a portion of the sand if desired. The only saving then in using crusher-run stone direct is the very small one of not having to screen out the fine material. Strength and density of concrete are determined by the granulometric composition of the fine and course aggregates; by the proportion of cement used, and by the character and quality of the mixing and placing; these conditions being constant no more nor less dense a concrete can be secured by letting the crusher dust and chips form a part of the fine aggregate than by removing them and using all sand. There need be no hesitation in using run-of-crusher stone under ordinary conditions except for the reasons indicated above. —Editors.)

Examinations for Positions on the Efficiency Division of the Chicago Civil Service Commission.

Sirs: The Civil Service Commission of the City of Chicago will hold examinations on Nov. 21 and 22, 1910, for a number of positions in connection with its Efficiency Division. I believe that information regarding at least two of these examinations would be of interest and value to the engineering profession, and I am giving you a few facts:

During the current year the Civil Service Commission has accomplished a large amount of preliminary work and laid plans for future activities in connection with the efficiency of city employes and the organization and systematizing of departmental work. The organization proposed for the continuation of this work includes the following positions:

Examiners of efficiency (engineering).
Examiners of efficiency (general).

The examination for "Examiner of Efficiency (Engineering)" to be held Nov. 21, will include the following subjects:

Mathematics ....weight of 3
Experience ....weight of 3
Report ....weight of 2
Technical ....weight of 4

Total ....weight of 12

The papers on "Report" and "Technical" will include questions on Civics, Organization of Engineering Works, Cost Measuring, etc. Local residence will be waived in the case of this examination.

The examination for Examiner of Efficiency (General), to be held Nov. 22, will include the following subjects:

Educational ....weight of 3
Experience ....weight of 4
Special subject.....................weight of 8

Total ....weight of 15

The "Special Subject" will include questions on Civics, Efficiency, Organization, Systematizing, etc. Local residence will be required in the case of this examination.

The compensation for these positions has not been fixed, but will range from $1,800 per year upward.

I feel assured that this is a field of work for which engineers are peculiarly fitted by both training and experience, and they should not neglect the opportunity offered to broaden their professional field.

Yours truly,
E. O. GREIFENHAGEN
Engineer, Efficiency Division.
Chicago, Ill., Nov. 4, 1910.

Letters to the Editors.

Progress Records of Hard Rock Tunnels.

Sirs: I would be pleased to know the best progress made in hard rock tunnel from one heading, with three shifts, in twelve months. Any information you can give me regarding tunnel progress will be appreciated.

Yours respectfully,
J. L. LYTEL.
Project Engineer, U. S. Reclamation Service
Provo, Utah, Oct. 17, 1910.

(We find, on making considerable investigation, that records giving progress in tunneling for 12 months are very scarce. We take pleasure, however, in presenting the following table of records, which may be of general use. The table is prepared from the information taken from the files of several technical journals and from Gillette's "Rock Excavation, Methods and Cost."—Editors)

Record Ft	Time Work'd	Size	Class of Rock	Location	Date	Purpose	Executed by
488½	30 da.	17 ft. d.	Hudson River shale	N. Y.	Nov. '09	Catskill Aqueduct	T. A. Gillespie Co
523	30 da.	17 ft. d.	"	"	Sept. '10	" "	Degnan Co.
3264	1 yr	19x24	Laminated quartz		1909	C., M. & St. P. Ry	
385	1 mo	7½x7½			Jan '09		
359	1 mo.	7½x7½	Hard rock	Colo.	1908		2 8 hr. shifts
1710	5 mo	7½x7½	"	"	1908		
464	1 mo	9x10	Medium hard granite	Cal.	Apr. '09	Los Angeles Aqueduct	Day Labor
1392	4 mo	9x10	" " "			"	"
354	1 mo.	9x11	Quartzite	Idaho	Oct. '98	Mine	
499	1 mo.	11x12	Granitic gneiss	Colo	Jan. '08	Acqueduct	
300	av. mo.	11x12					
468	1 mo	16 ft. d.	Fine grained limestone	Ill.	Apr. '09	Chicago Water Works	Geo. W. Jackson
4059	11 mo.	16 ft. d.	" " "	"	1909	" " "	
390	1 mo.	12x15	Flint limestone	N. Y.	Mar. '10	Buffalo Water Works	Buffalo Dredg. Co
2349	6 mo.	12x15	"	"	"	" " "	
579	1 mo.	10x11	Soft limestone & bould.	Cal.	May '09	Los Angeles Aqueduct	Day Labor
466	1 mo	9x10	Gneissoid granite	"	Oct. '08	" "	"
476	1 mo.	9x10	"	"	Mar. '09	" "	
370	1 mo.	9x10	Granite	"	"	" " "	
370	1 mo.	9x10	"	"	"	"	"
2082½	4 mo		Hard rock	Mont.	June 08	C., M. & St. P. Ry	Winton Bros. & Co
583½	1 mo		" "	"	"	" " " "	"
1061	1 mo.	10x12	Soft rock	Cal.	Aug. '09	Los Angeles Aqueduct	Day Labor
449	1 mo.	8½x12	Granite	Colo.		Aqueduct	
417	1 mo.			Nev			
297	1 mo.		Rock	"	1870	Railway	
184	1 mo.		"	Mass	1870		
165	1 mo.		"	Pa.	1871		
144	1 mo.		"	N. J.	1874		
436	1 mo.		"	Swiss Alps	1872-81		
4116	12 mo			" "	1872-81		
556	1 mo.			Alps	Mar. '82		
594	1 mo.			"	Apr. '83		
610	1 mo.				May '83		
613	1 mo.				July '83		
637	1 mo.				Aug. '83		
509	1 mo.		"	"	June '82		
527	1 mo.		"	"	Aug. '82		
625	1 mo			"	May '83		
641	1 mo.			"	July '83		
274	1 mo.			Wash.	1888	Northern Pacific Ry.	
127	1 week	140sq.ft	"	N. Y.	1887	Aqueduct	Denton Breuchard
175	Av.mo.	140sq.ft	"	"	1887	" "	" Co.
202½	1 mo.			Colo.	1890-3	Midland Railway	
301	1 mo			Wash	1897-00	Great No. Railway	
306	1 mo.			Wyo	1901	Union Pac. Railway	
558	1 mo.		Antigorio gneiss	Alps	Sept. '01	Railway	
607	1 mo			"	Dec. '01	"	
552	1 mo.		Rock	Aust'a Alps	Aug. '03	"	
544	1 mo.		"	" "	June '04	"	
553	1 mo.		"	" "	July '04	"	
546	1 mo.		"	" "	Feb. '05		
526	1 mo.		"	" "	Mar. '05		
685.5	1 mo.		"	Alps	Dec. '02		
682.2	1 mo.		"	"	July '04		
548	1 mo.		Metamorphosed granite	Austria	Oct. '04		
540	1 mo.			"	Nov. '05		
545	1 mo			"	July '05		
546	1 mo.			"	June '06		
6300 +	1 yr.			"	1905		
452	1 mo.			Switzerland	Jan. '05		
461	1 mo.			"	June '05		
413	1 mo			"	June '06		
358	1 mo				Nov. '07		
555	1 mo.			"	Aug. '07		
574	1 mo.				Sept. '07		
538	1 mo.			"	Oct. '07		
558	1 mo.				Nov. '07		
551	1 mo.				Jan. '08		
1013	1 mo.				July '09		
191	Av.mo.				May '05	Alaska Central Ry.	
735	2 mo.	37x22	Porphyry	Mexico		Railway	C. Gordon Paterson.
435	1 mo.	10x 6	Granite	Colo.	Jan. '09	Aqueduct	
3504	1 yr.			"	1909		
540	1 mo	16½x22	Shale	Wash.	Apr. '88	Railway	Nelson Bennett
9050	22 mo.	16½x22		"	1886-88	"	
1560	Av. yr	283sq ft	Mica-schist	N. Y.	1885-93	Croton Aqueduct	
5575	1 yr.	16½x22	Shale	Wash.	June '99	Railway	Day Labor
301	1 mo	16½x22	"	"	June '00	"	
1201½	1 yr	14x 8	Iron Ore	Belle Island	1907	Mining	[illegible]
2048	1 yr	14x 8	"	" "	1908	"	
270.1	1 mo.	14x 8	"	" "		"	
222	1 mo.			Colo.		"	
244	1 mo			"			
260	1 mo.			"			
307	1 mo.			Cal.		"	
333	1 mo			Mont.		R. R.	
338	1 mo.			N. Y.		Aqueduct	
359	1 mo.			Colo.		Mining	
412	1 mo.			"		R. R.	
4550 ±	1 yr	9x 9	Granite	"		Mine Drainage	

PERSONALS.

Lewis Pittman, a road contractor of Chehalis, was instantly killed on Oct. 24 by the premature explosion of a blast.

Mr. J. S. Worley, of the J. S. Worley Company, Engineers, Kansas City, Mo., has been called to Michigan this week to appraise water power plants for the state.

Mr. W. F. Daerr, assistant city engineer in charge of the department of sewer maintenance of Cleveland, Ohio, has resigned that position. Mr. A. L. Stevens succeeds Mr. Daerr.

Mr. William Gladdes, employed by the Union Pacific Railroad's engineering department, was recently accidentally shot and killed by his hunting companion near Cheyenne, Wyo.

Mr. J. Walter Bennett, formerly secretary of the department of water supply, gas and electricity of New York City, has been made deputy commissioner of the department, succeeding Mr. Edward W. Bemis.

Sir Clifton Robinson, managing director and engineer of the London United Electric tramways and director of the underground railways of London, died suddenly Nov. 6 while on a Lexington Ave. street car in New York City.

Mr. G. E. P. Smith, Assoc. M. Am. Soc. C. E., Irrigation Engineer at the Agricultural Experiment Station of the University of Arizona, has been granted a year's leave of absence, which time he will devote to making investigations in irrigation and hydraulic engineering at the University of Wisconsin.

Mr. W. L. Upson, formerly Assistant Professor of Electrical Engineering at Ohio State University, is now Professor of Electrical Engineering at the University of Vermont. He succeeds Prof. W. H. Freedman, who has become a member of the faculty of Pratt Institute, Brooklyn, N. Y.

Mr. Albert Gray Norton, M. Am. Soc. C. E., has established an office at Middleton, N. Y., where he will engage in a general architectural and engineering practice. For the past 20 years Mr. Norton has been engaged in the different lines of construction work, including buildings, bridges, water supply, tunneling and railroad maintenance and construction.

Mr. F. H. Clark, general superintendent of motive power of the Chicago, Burlington & Quincy R. R., delivered an address before the students and faculty of the College of Engineering of the University of Illinois on Thursday, November 3. His subject was "Problems of the Motive Power Department." Mr. Clark is a graduate of the University of Illinois with the class of 1890.

The U. S. Civil Service Commission, Washington, D. C., has postponed to Jan. 4, 1911, the examination scheduled for Oct. 19, 1910, to secure eligibles from which to make certification to fill six vacancies in the position of engineer in forest products in the Forest Products Laboratory at Madison, Wis., at salaries ranging from $1,600 to $2,500, and vacancies requiring similar qualifications, as they may occur, unless it shall be decided in the interest of the service to fill vacancies by reinstatement, transfer or promotion.

The U. S. Civil Service Commission, Washington, D. C., will hold an examination on Dec. 7-8, 1910, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of fortification draftsman. The usual entrance salary for the position is $1,500 per annum. An examination will also be held on the same date to secure eligibles from which to make certification to fill a vacancy in the position of cartographic draftsman at $3.84 per diem, Naval War College, Newport, R. I., and vacancies requiring similar qualifications as they may occur in any branch of the service.

The U. S. Civil Service Commission, Washington, D. C., has announced a change of title of the Assistant Superintendent of Construction announcement to that of Superintendent of Construction, also the postponement to Dec. 7, 1910, of the examination scheduled for Nov. 9, 1910, to secure eligibles from which to make certifications to fill a vacancy in the position of Superintendent of Construction, United States Penitentiary, McNeil Island, Wash., at $6 a day, and vacancies requiring similar qualifications as they may occur, unless it shall be decided in the interest of the service to fill the vacancy by reinstatement, transfer, or promotion.

Professor A. H. Blanchard, M. Am. Soc. C. E., of Brown University, Providence, R. I., is to establish a consulting practice in highway engineering. Special attention will be given to consultations, examinations, reports, designs, estimates and specifications relative to roads and pavements, systems of maintenance, highway bridges and the use of bituminous materials in the preservation of roads and the prevention of dust. Mr. Blanchard has been associated with the highway engineering department of the city of Providence, and the American Bridge Co. and was for seven years with the state board of public roads of Rhode Island, first as assistant engineer and later as deputy engineer in charge of the construction and maintenance of bituminous roads. During 1909-1910 Mr. Blanchard made a personal investigation of the methods employed in the construction and maintenance of roads and pavements in Great Britain and on the continent.

Mr. Brent S. Drane, Assoc. M. Am. Soc. C. E., formerly Assistant Engineer on construction of the Carlsbad, New Mexico, project of the Reclamation Service, and for the past two years Division Engineer in the Porto Rico Irrigation Service, has opened an office at 1118 Realty building, Charlotte, N. C., for general civil and hydraulic engineering practice in the Southern states. He will also be available for consultation in the Spanish-American countries.

Maj. E. Richard Esmond, a civil engineer and veteran of the Civil War, died Nov. 9 at New York City from the infirmities incident to age. He was 65 years old and was born in Fulton, N. Y. When the Civil War started Mr. Esmond enlisted in the One Hundred and Forty-seventh New York Volunteers, of which regiment he was promoted to be major for conspicuous services. He was engaged in civil engineering for many years, and at the outbreak of the Spanish-American war received a commission as a captain of Company L of the United States Volunteer Engineer Corps.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us i. you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Air Compressor Accessories.—Paper, 6x9 ins.; 32 pp. Sullivan Machinery Co., 150 Michigan Ave., Chicago.

Bulletin No. 58I, published in October, contains illustrations and descriptions of air receivers, reheaters and unloading devices. Also a number of useful tables and a collection of miscellaneous data on the subject of compressed air and its applications.

Small Air Compressors.—Paper, 6x9 ins.; 12 pp. Sullivan Machinery Co., 150 Michigan Ave., Chicago.

Bulletin No. 58H gives illustrations and descriptions of "Classes WA.-4" and "WA.-3" air compressors. Drawings and tables of dimensions and weights are given.

Wood Block Pavement.—Paper, 9x6 ins.; 16 pp. The Wyckoff Pipe and Creosoting Co., Stamford, Conn.

A catalog setting forth the merits of creosoted wood blocks for paving with examples of work done by the above company.

Creosoted Materials.—Paper, 9x6 ins.; 32 pp. The Wyckoff Pipe and Creosoting Co., 50 Church St., New York.

Notes on the history of wood preservation and a description of the creosoting process. A description of methods of laying Wyckoff wood conduits, illustrated with photos of conduits in service after 21 years. Also creosoted crossarms, poles, cross-ties, wharf timbers and sheet piling.

Superior Graphite Paint.—Paper, 4x9 ins.; 44 pp. Detroit Graphite Co., Detroit, Mich.

An attractive little book giving ten descriptions of the preparation of Superior Graphite Paint, facts regarding its use, advice in painting steel structures and illustrations of various structures which have been painted with this material.

Lehigh Portland Cement.—Paper, 9x6 ins.; 16 pp. Lehigh Portland Cement Co., Indianapolis, Ind.

An illustrated description of the construction of the Bedford Power Company's hydro-electric development, where Lehigh cement was used.

Kahn System Standards.—Paper, 5¼x7⅝ ins.; 128 pp. Trussed Concrete Steel Co., Detroit, Mich.

This is an attractive handbook of "Practical Calculation and Application of Reinforced Concrete." This is the fourth edition of the book, which has been edited and published by the engineering department of the company, and is revised and enlarged. The subject of "Waterproofing" has been entirely rewritten, and entire new sets of tables for hooped columns and footings are added. The book also contains data on the various Kahn system products for reinforced concrete, steel lath fireproofing, steel windows, etc. Free to practicing architects, engineers and contractors. Others 50 cents.

Gas Traction Engines.—Paper, 10½x9 ins.; 12 pp. Buffalo Pitts Co., Buffalo, N. Y.

This catalog gives a complete description with several full-page illustrations of the Buffalo Pitts Triplex Gas Tractor and its various parts.

Sash Center.—Paper, 4x18 ins.; 1 p. C. H Drives, Racine, Wis.

A card illustrating and describing a new one-piece weather tight sash center.

Vanadium Steel.—Paper, 7⅝x5 ins.; 24 pp. Carnegie Steel Company, Pittsburg, Pa.

A description, including tables, of the physical properties and the applications of vanadium steel in practice.

Clutch Pulleys and Couplings.—Paper, 3¼x6¼ ins.; 8 pp. Allis-Chalmers Co., Milwaukee, Wis.

A little pamphlet entitled "Clutch Economy" which points out the advantages of using these clutch pulleys and couplings in transmission work. Illustrated.

Compressed Foundations.—Paper, 6¾x9½ ins.; 12 pp. Hennebique Construction Co., 1172 Broadway, New York City.

An illustrated description of a new method of excavation for pile foundations. Illustrated with photographs showing work in progress.

Aerial Tramways.—Paper, 8½x10½ ins.; 8 pp. The Trenton Iron Co., Hamilton Ave., Trenton, N. J.

An illustrated description of the Bleichert system. Shows various arrangements for transporting bales, logs and dump buckets. Automatic loading and dumping devices.

Grinding and Pulverizing Machinery.—Paper, 7¾x10¾ ins.; 80 pp. Raymond Brothers Impact Pulverizer Co., 520 Laflin St., Chicago.

Catalog No. 10, 1911, is a complete description of the Raymond grinding, pulverizing and separating machinery and specially designed machinery. Plans and photographs are given.

Hauling Machinery.—Paper, 12x9 ins.; 36 pp. Buffalo Pitts Co., Buffalo, N. Y.

Loose leaf catalog F of special hauling machinery. Describes and illustrates contractors' special double cylinder road engines, reversible road cars for hauling heavy machinery, stone or merchandise. Some costs of operation on various classes of work are given.

Electrical Machinery. — Paper, 8x10½ ins. Fort Wayne Electric Works.

These are bulletins issued by the manufacturers of the "Wood" systems. Each bulletin is punched for filing: Bulletin No. 1125, 8 pp.—A complete illustrated description of single-phase induction watt-hour meters. Bulletin No. 1121, 4 pp.—"Northern" type B direct current generators. Bulletin No. 1124, 4 pp.—Portable watt-hour meter calibrators, for alternating current. Instruction Book, No. 3043, 4⅜x6⅝ ins., 28 pp.—General instructions for locating, installing and adjusting type K, single-phase watt-hour meters, with diagrams.

Contractors' Supplies.—Paper, 6x9 ins.; 8 pp. Al. H. Hoffman, Hutton Bldg., Spokane, Wash.

A pamphlet showing various classes of equipment on hand at the company's various warehouses in the northwest.

Universal Cement.—Paper, 6x9 ins.; 20 pp. Universal Portland Cement Co., Chicago-Pittsburg.

This is the October Bulletin, No. 77, illustrating and describing various structures where Universal cement has been used.

Chloride of Calcium.—Paper, 6x9 ins.; 8 pp. The Carbondale Calcium Co., Carbondale, Pa.

Two bulletins are issued, which contain reprints of articles on the "Prevention in freezing in concrete by calcium chloride" (Bulletin No. 128, 8 pp), and "Materials which retard the setting of Portland cement" (Bulletin No. 116, 8 pp.).

Sirocco Fans and Blowers.—Paper, 7x8¾ ins.; 48 pp. American Blower Co., Detroit, Mich.

Bulletin No. 284 is a complete illustrated catalog of ventilating and mechanical draft machinery. Gives diagrams, plans showing the features of design, comparisons with steel plate fan, and applications. This bulletin replaces Nos. 251 and 283. Tables of speeds, capacities and horsepower required for different pressures.

Electrical Machinery. — Paper, 10x8½ ins. Crocker-Wheeler Co., Ampere, N. J.

These bulletins are prepared for filing: Bulletin No. 120, 16 pp.—Form I motors, belt D. C. 3¾ to 50 h.p.; generators, 3 to 45 K.W. Bulletin No. 122, 8 pp.—Form D machines, belt type D. C. motors, 25 to 300 h. p., generators, 45 to 250 K. W. Bulletin No. 123, 16 pp.—Adjustable speed motors, ½ to 32 h.p.; speed ranges, 2:1-2.5:1-3:1; eleven frame sizes. Bulletin 125, 8 pp.—Reinck type transformers for light and power.

Star Drilling Machinery.—Paper, 6x9¼ ins.; 24 pp. Star Drilling Machine Co., Akron, O.

A series of articles describing work done with Star machines, in some cases giving the records of work accomplished. Also detailed descriptions of various sizes of machines.

Iron Pipe.—Paper 6x9 ins.; 32 pp. Reading Iron Co., Reading, Pa.

Extracts from papers and discussions on "The Relative Corrosion of Steel and Wrought Iron Water Pipes."

Wood Rock Drills.—Paper, 5½x8½ ins.; 4 pp. Wood Drill Works, Paterson, N. J.

Circular illustrating the use of Wood Rock Drills at Panama, with brief statements of general dimensions of the canal, etc.

Koppel Cars and Track.—Paper, 6⅓x9⅜ ins.; 16 pp. Orenstein-Arthur Koppel Co., Chronicle Building, San Francisco, Cal.

A collection of photographs showing Koppel cars and track equipment in contract and quarry operations in the United States.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

The Illinois Traction System's new bridge over the Mississippi River at St Louis, Mo., was formally opened on Nov. 10.—It has been given out that manufacturers are looking for a distribution of orders for steel rails between now and the first of the year to the amount of 500,000 tons. They believe the Pennsylvania, the Harriman lines and the New York Central will go into the market for this amount of product. It is believed likely that the Pennsylvania alone will take 120,000 tons.—It is expected that definite announcement will be made shortly by the Quebec Bridge Commission as to the successful bidder for constructing the superstructure of the Quebec bridge. Press reports state that the commission has about reached a definite decision, the contest having narrowed down to companies supported by the United States Steel Corporation and the new Canadian company which has recently been incorporated by British builders.—Just as a symptom of the coming prosperity of the country it may be noted that the recently issued crop reports show that the corn crop for this year will amount to 3,122,000,000 bu., that 11,500,000 bales of cotton will be harvested this fall, that the money value of the hay crop will amount to probably $600,000,000 and that wheat, oats and other grains have done as well. Estimates place the money value of this year's crops at $9,000,000,000.—Bids are now being asked by the New York state superintendent of public works for two large barge canal contracts. These are Contract No. 27 for completing the construction of the Champlain Canal, Sec. 2, from Dunham's Basin Road and the Hudson River at Fort Edward, a distance of 3.76 miles, and Contract No. 37 for improving the Oswego Canal between Fulton and Oswego, a distance of 9.73 miles. Bids are to be opened at Albany, N. Y., on Nov. 22.—Among the railroad construction contracts let recently are the following: Watson, Flagg & Strandifer, Portland, Ore., for constructing a 3½-mile extension of the Cazadero line of the Portland Railway, Light & Power Co., the contract amounting to about $35,000 per mile; Walter H. Gahagan, 189 Montague St., Brooklyn, N. Y., for double track work on the Mahanoy & Hazleton division of the Lehigh Valley R. R. from Silver Broad Junction to Laurel Junction; Louis Houck, Cape Girardeau, Mo., for the construction of the Cape Girardeau, Charleston & Hickman R. R., a new line, proposing 50 miles of road from Ancil or Kelso to Dorena opposite Hickman, Ky.; B. J. Luther & Co., Asheville, N. C., for grading ¾ mile of road for the extension of the Asheville Electric Co.; F. W. Hunt Contracting Co., Cross Construction Co., A. G. Fretwell, M. M. Schultz, Geo. L. Davidson and Eddington & Pack, subcontracts from the McDowell Construction Co., Knoxville, Tenn., for work on the construction of the 17½ miles of line of the Harriman, Knoxville & Eastern Ry., from Harriman, Tenn.; Hurley-Mason Co., Tacoma, Wash., a $100,000 contract from the Oregon & Washington Ry. Co. for constructing the Jackson St. viaduct at Seattle, Wash.; Grant Smith & Co., a $100,000 contract from the same railroad for a bridge at the Boulevard, Seattle; and Hans Pedersen for constructing a new 11-stall reinforced concrete round house at Argo for the Oregon & Washington Ry.—Grading work has been started on a new 125-kilometer line in Mexico for the National Railways of Mexico. The line is to be built between Penjamo, Guanajuato, on the Guadalajara division of the Central and Ajuno on the National Railways. The contract was awarded a short time ago to Engineer Armando Santacruz, city of Mexico, of the presidential staff, and he in turn has subcontracted it to the Compania Constructora Ferrocarrilera, city of Mexico.

Mississippi Valley Drainage Work.

A convention of much importance to land owners in the Mississippi Valley will be that of the Mississippi Valley Drainage Association, which is to be held Nov. 17 and 18 at Memphis, Tenn. The primary object of the convention is to secure aid from the federal government to complete a survey of the swamp lands of the Mississippi Valley, aggregating between 20,000,000 and 25,000,000 acres. This survey has already been started, an area covering about 1,000,000 acres, in the St. Francis Valley of Arkansas, having been surveyed recently under the auspices of the U. S. Department of Agriculture. The preliminary survey has brought out the fact that in drainage lies a quick and inexpensive solution, and probably the only solution, of a problem which has been facing the people the Mississippi Valley for many years. It has been demonstrated that the soil to be reclaimed is very rich and that it needs only a system of proper drainage to convert what is now unproductive lands into one of the best producing sections in the country. In view of the extensive work that the Reclamation Service has done in making dry lands wet in the west, it does not seem that the government can well refuse its aid in making wet lands dry in the south.

Something for Nothing.

The gentle art of getting something for nothing dates from the time Esau sold his birthright for a mess of pottage; and even then Esau got the lentiles and a side order of bread. Since that time the art has been much improved, as many a specification and contract condition will bear witness. American contractors who have chafed under the onerous conditions sometimes attached to their contracts are not alone in their misery. Their Canadian brethren also are sometimes confronted by contract conditions, which to say the least places the "burden of proof" on the contractor. A case in point is cited in a recent issue of our Canadian contemporary, the Contract Record. It seems that one of the reservoirs of the city of Victoria, B. C., was in need of repairs. The engineer under whose supervision the reservoir was first constructed gave it as his opinion subsequently that the necessary repairs could be made for $30,000. Later the acting city engineer made a survey of the reservoir and reported that in his opinion the reservoir could be made water tight for $15,000. Later again the city engineer gave the council an estimate that the work could be done for $6,000. Still later a construction company offered to do the work for $3,000. The civic authorities, with a shrewd eye doubtless on the way the estimates of cost had scaled down, decided to call for bids for doing the work. Accordingly bids were invited on the following basis:

(a) The tenderer shall submit his own specifications.

(b) The successful tenderer shall give a guarantee bond, covering a period of five years from date of completion of the contract; that the work done by him under the contract shall effectually prevent any further leakage, even when the reservoir is filled with water to its full capacity; and that if any leakage shall occur during the guarantee period he will repair the breach forthwith and make the reservoir watertight at his own expense.

(c) A sum equal to 25 per cent of the contract will be paid to the contractor at the end of the guarantee period, providing the reservoir will then hold water at its full capacity without leaking.

(d) If, at the expiry of the guarantee period, the reservoir should not hold water when filled to its utmost capacity, without leaking, the said sum of 25 per cent shall be forfeited to the corporation. The lowest or any tender not necessarily accepted.

It is quite easily seen from the above conditions that the city of Victoria does not want a contractor; it wants a philanthropist.

Canada's Inland Waterways.

Canada, despite the vast amount of railroad construction work it now has under way, has not forgotten the importance of developing its inland water ways. The Canadian government now has surveys under way for the establishment of a navigable channel via the North Saskatchewan River from Edmonton to Winnipeg. With this development of the Saskatchewan Canada will have a 30-ft. navigation (soon to be 35 ft.) from the sea to Montreal, a distance of nearly 1,000 miles; a 14-ft. channel from Montreal to Fort William, something over 1,200 miles; 9-ft. navigation from Winnipeg to Cedar Lake, and from there to the Rocky Mountains 4 to 5 ft. navigation, over a distance of 1,500 miles, a total of approximately 3,700 miles of actual inland waterway traversing the greater part of the northern half of the continent, the only break in the chain being the 400-mile section from Fort William to Winnipeg.

The Recent Election and Public Work.

Public work contractors, irrespective of political belief, will find much satisfaction in the results of the elections held a week ago last Tuesday. While the main purpose of the elections was the choosing of state and national officials, many cities, counties and states took the opportunity to vote on the authorization of bond issues for public works. In the great majority of these cases the bond issues were carried. It would be safe to say that the total amount authorized at the recent election for public works purposes will amount to more than $75,000,000. In California the citizens of that state voted on state bond issues amounting to $28,500,000 for public works. Of this sum $9,000,000 was to go for the improvement of the harbor at San Francisco, $1,500,000 for the improvements of the harbor of San Diego, and $18,000,000 for a system of state highways. In the city of Portland, Ore., the voters by a majority of over 6,000 authorized a proposition providing for a $25,000,000 bond issue for a system of public docks. In Baltimore, Md., bond issues amounting to $4,500,000 were authorized, $1,000,000 being for the construction of a boulevard, $2,000,000 for constructing public docks and $1,500,000 for new school buildings. In Pittsburg, Pa., bond propositions for the expenditure of $10,305,000 for public improvements were carried by large majorities. Among the sums authorized are $100,000 for a refuse disposal plant, $1,500,000 for a new city hall, $1,000,000 for public play grounds and parks, $1,400,000 for raising the flood district and widening and improving thoroughfares, $250,000 for a municipal tuberculosis hospital and $100,000 for parking the wharf, $570,000 for improving the Try St., Soho run and Negley run sewer systems and $3,100,000 for giving filtered water to the north side and otherwise improving the water service. These are only a few of the larger cities which have voted bond issues. Many smaller cities also voted to issue bonds for public work, and many counties in Oklahoma, Texas and the south Atlantic states voted bonds for constructing county roads. With this work already in sight and much more to come, the coming year should be a prosperous one for public work contractors.

Liability of Paving Contractor.

A decision of some little interest to paving contractors was recently rendered by the supreme court of Arkansas. In its decision the court holds that after a paving company has concluded its work and has turned the district over to the commissioners, the company cannot be held responsible for accidents due to bad conditions in such improvements. The paving company did some street paving and sidewalk construction work in the city of Little Rock, Ark., and shortly after the company had turned the district over to the board of commissioners as finished and it had been accepted, a woman sustained bodily injuries in falling from an unprotected culvert. She sued the paving company on the ground of negligence in not constructing a protecting railing over the culvert and was awarded damages. The supreme court in reversing the judgment held that she was not so entitled, as the company had relinquished the district to the commissioners at the time.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Advices from Demopolis, Ala., state that it is expected there that active work of construction of the Birmingham, Demopolis & Pascagoula R. R. will begin within the next few weeks. The directors of the railroad have decided to increase the capital stock from $300,000 to $400,000. A. R. Smith, Demopolis, is President. .

Reports from upper Baldwin County, Alabama, are to the effect that there is quite a large gang of men at work on the new railroad that is being built from Pensacola to Mobile via Daphne, and that at present they are grading the roadbed five miles back of Daphne at a place called Belforest. It is said that the road will come out at a place known as Dolive Creek, and from there will be built to Mobile, Ala.

The Alabama Railway & Electric Co. is to be formed at Birmingham, Ala., for the purpose of building a 3½ mile street railway from the end of the Wylam line of the Birmingham Street Ry. Application is now before the City Council of Birmingham for a franchise. R. W. Snyder, W. W. Crawford and W. J. Stacy, all of Birmingham, are interested.

The Alabama Traction Co. has filed its articles of incorporation and proposes to build a new street railway system in Montgomery. The capital stock is $1,000,000, of which $250,000 is said to be paid in. Charles G. Abercrombie, Montgomery, Ala., is President.

The Tidewater R. R. Co., mentioned in our last issue, is reported to have awarded contracts for constructing 46 miles of its proposed electric line between Eastlake and Bessemer. J. M. Dewberry, Birmingham, Ala., is President.

Arizona.

Reports from Winslow, Ariz., state that the status of work on the double tracking of the coast lines of the Santa Fe from Albuquerque to Los Angeles at the end of October was as follows: The first 20 miles out of Winslow was graded, track laid and ballasted. From Flagstaff to Williams the work was about 60 per cent completed by the L. J. Smith Construction Co. direct, and from Agassiz to Riordan, about 40 days more work was necessary. From Riordan to Bellemont the L. J. Smith Construction Co. had, with B. B. Crosby, the work in about the same condition. From Bellemont to Arey and about a mile westward, the work was graded, track laid and ballasted. With the exception of two rock cuts between Davern and Williams, the grade was about finished. The two rock cuts are big ones and will hold the forces there for at least 90 good working days. Twenty bridges have been completed by T. Maddox, who was working on four of the six remaining ones.

Good progress is being made by H. Dalhoff, general contractor, on the building of the Stuttgart and Rice Belt railroad into Stuttgart, and he probably will be able to turn over the road to Stuttgart by Dec. 3, the date first announced for its completion. Work has been hampered some early in November by lack of ties, but tie cutters were at work in the La Grue timber, the laying of steel having reached that point, and sufficient ties can now be secured to extend the road into Stuttgart.

The Fort Smith & Van Buren R. R., which proposes a line from Fort Smith to Van Buren, is reported to have started grading work. W. D. Pratt, Fort Smith, Ark., is interested.

The State Board of Railway Incorporators has granted the Fort Smith, St. Louis & Chicago Ry. Co. an extension of time to begin work on its proposed line.

California.

In connection with the development work in the Palo Verde Valley it is proposed to construct a new railroad line, leaving the Parker division at Calzona, serving the Blythe estate, and crossing both Palo Verde and Chuckawalla valleys. A right of way has already been secured for this road, and is controlled by R. M. Teague, San Dimas, Cal., and his associates.

The San Joaquin Valley Electric Ry. Co., which has completed the grading for its road bed as far as Ripon, opened bids early this month for the construction of a reinforced concrete bridge over the Stanislaus river south of Ripon. The bridge will span the river alongside the county's concrete bridge. The two main spans will be 80 ft. each. These, with the approaches, will make the structure 200 ft. in length. The company was recently reorganized and the following officers and directors elected: President, Harold S. Renwick, New York City; vice-president and general manager, Morris L. Brackett, Stockton; treasurer, Robert F. Covert, Salida; secretary, Daniel G. Gary, Stockton; E. T. Zook and John G. Weir of San Francisco. J. C. Campbell of San Francisco is counsel for the company and H. U. Wallace is consulting engineer.

The Southern Pacific R. R. Co. is reported to have acquired the property of the Pacific Electric Ry. Co., owner of some 600 miles of electric railway in California.

Promoters of the Stockton-Jenny Lind R. R. are canvassing Calaveras County, Cal., for the purpose of ascertaining what inducements the mining interests, merchants, shippers and people in general will offer for an extension of the line into Angels and Copperopolis

Colorado.

The Denver, Northwestern & Pacific Ry., L. D. Blauvelt, Chief Engineer, Denver, Colo., has been placing tie contracts. Perhaps this indicates that work will be started soon on the extension from Steamboat Springs.

The Grand River, Meeker & Salt Lake Ry. Co., recently incorporated to build 300 miles of line from Chapman towards Salt Lake City, is reported to have awarded the construction contract to the Meeker-Rangely Construction Co., of Denver, Colo.

Connecticut.

Good progress is being made with the construction of the new trolley line between Hartford and Norwich. About four miles has been graded down Hillstown way, but the laying of rails will not be started until about March when, it is expected, about ten miles of grading will have been completed.

Contract will soon be let for the double tracking of the Air Line division of the New Haven road between Middletown and Willimantic, a distance of 30 miles. The Air Line for years has been the weakest spot on the New Haven system, but the proposed bridge and roadbed changes will put it up to the high standard of the main lines. The heavier types of engines used by the New Haven have been barred from the Air Line because of weak bridges, but when the proposed work is completed this line will be used to a much greater extent for transportation of freight and some of the proposed new passenger trains will probably be moved over that line The new steel bridge being built over the Connecticut river between Middletown and Portland is progressing rapidly. Two of the six spans have been set. The total length of this bridge is 1,200 ft. It will have a swinging draw. The new bridge takes the place of one built in 1872 and will cost about $180,000 The entire work on the Air Line will cost the road upwards of a half a million dollars

Georgia.

Grading work has been started on the new Wrightsville, Adrian & Lyons R. R.

The State Railroad Commission has authorized the City Suburban Ry. Co., of Brunswick, Ga., to issue bonds and stock for improvements, outstanding obligations and extensions.

The Sparks & Western R. R., a new line from Sparks to Moultrie, is reported to have been purchased by the Georgia & Florida Ry It is understood that the road, which now lacks a few miles of being completed to Moultrie, will be finished at once.

Idaho.

The Oregon Short Line R. R. has made surveys for second track from Pocatello to Minidoka. No actual construction work, however, has yet been authorized, and it is impossible to say just when active work will be started.

The Oregon Railway & Navigation Co. is reported to have purchased the Idaho Northern R. R.. The Idaho Northern was built in 1908 and connects Enaville and Murray. It is 50 miles in length.

Illinois.

The city council of Mount Carmel has granted the Evansville, Mt. Carmel & Olney Traction Co., a franchise for use of the desired streets of the city upon which to operate an electric car line. Construction work on this road is now underway.

Practically all right-of-way has been obtained from Walworth to Delavan for the Harvard and Marengo electric line. Allendorf and Thornton, Harvard, Ill., have been setting the poles for the line between Harvard and Marengo.

The Commercial Club of Elgin of which Joseph Newman is President, has adopted resolutions instructing the committee on finance to proceed with the incorporation of a company and the construction of a belt line railway for Elgin.

The Chicago & Alton R. R. has started construction work on the Western Avenue subway in Chicago, and plan on completing it this year. The work is estimated at $20,000 and will, when finished, complete the track elevation of the Alton in Chicago. W. D. Taylor, Chicago, Ill., is Chief Engineer of the C. & A. R. R.

An ordinance is now before the city council of Joliet to grant the present owners of a franchise to enter Joliet the right to transfer it to the Chicago, Ottawa & Peoria Ry. (Illinois Traction System). The latter company is completing plans for extending its line from Morris to Joliet. Should the transfer of the franchise be granted by the Joliet city council the road connecting Morris and Joliet will be completed within one year. H. E. Chubbuch, Peoria, Ill., is General Manager of the Illinois Traction System.

The Chicago, Burlington & Quincy R. R. has completed the double tracking of the road between Bushnell and Galesburg, a distance of 35 miles. The second main track will relieve a serious congestion of traffic over the section of the road.

The Denverside Connecting Ry. Co., of East St. Louis, Ill., has filed its articles of incorporation at Belleville. The company has a capital stock of $10,000. The incorporators are: Harry S. Kramer, Robert P. Munger Arthur W. Baltz, Robert E. Gillespie and George H. Heller. The company proposes to construct a railway from the southeastern limits of East St. Louis, running between the right of way of the Southern Railway and State street and to the right of way of the Southern Railway and the Illinois Central line to the banks of the Mississippi.

Indiana.

Surveys have been started for an electric interurban from Chesterton to Whiting. As proposed, the line will be built from Chesterton to Whiting passing through Dune Park, Miller, Aetna, Gary, Buffington, Indiana Harbor and from there to Whiting, connecting in that city with the Hammond, Whiting and East Chicago line. It is said that the promoters have already started work on the erection of a powerhouse at Chesterton. C. H. Geist, Philadelphia, Pa., is interested.

The Chesapeake & Ohio R. R. of Indiana is to take steps for double tracking its line between Chicago and Cincinnati.

Iowa.

The Iowa Traction Co. has completed surveys, and has secured the capital for the construction of its proposed line. Construction contracts are to be let in 30 to 60 days. This company projects a 65-mile line from Oskaloosa through Barnes City. Montezuma, Malcom and Tama. Geo. E. Woodhouse, Oskaloosa, Ia., is President.

Surveys for the projected interurban line of the Sioux City. Bijou Hills Ry. Co. have been about completed and it is planned to have construction work started in the spring on the first 50-mile section out of Sioux City.

According to a statement reported to have been made by C. A. Ross, President of the Engineering, Construction & Securities Co. at Clarinda, Iowa, all right of way has been secured for the construction of the proposed line and about 5 miles of the 18 miles of necessary grading has been completed.

Advices from Atlantic, Ia., state that rails have been delivered for the construction of the line of the Atlantic North & South Ry. and 100 men are to be put to work at once.

Kansas.

It now looks as though the McKinley syndicate, of which W. B. McKinley of Champaign, Ill., is the head, will next spring, take definite steps for building two Atchison-St. Joseph lines, one on each side of the Missouri River line from Atchison to Leavenworth to connect with the Leavenworth-Kansas City road, and electric roads to Topeka, and to Horton and Hiawatha.

Business men of Salina, Kan., have agreed to raise $150,000 for the proposed line of the Motor Grand Interurban Co., provided the line is constructed from Canton to Minneapolis. The company is said to have practically all of the right-of-way from Goessal to Canton and from Canton to Roxbury. Goessal is about 16 miles southeast of Canton and Roxbury is about 15 miles north of Canton.

The Southwest Kansas & Colorado Ry. Co., which proposes a road west from Hardtner into the state of Colorado, has elected R. W. Scott, of Coldwater, Kan., President, and A. A. White, of Coldwater, Vice President and General Manager. The surveyors have completed a line west from Hardtner into Meade County, and the company is said to be now completing arrangements to build the first 85 miles of the line.

A meeting is to be held this month by the stockholders and directors of the Wichita, McPherson & Gulf Ry. to take up the matter of securing the necessary right of way for the proposed line, selecting the route of the road south of Wichita, Kan.

Louisiana.

A three mile railroad is to be built to connect the Taft and Balch properties in Concordia Parish, La., with the Natchez & Western R. R. S. A. Coon, Natchez, Miss., is said to be interested.

The preliminary survey of the Vidalia & Southeastern Ry., a company recently chartered, was commenced at Vidalia, Nov. 1. The line will run from that city to Fleming, in Liberty County, and possibly to Darien or Brunswick. When the preliminary survey is completed a permanent line will be run, and the work of securing options and other concessions from people living along the line will be commenced.

The police jury of St. Bernard Parish have been petitioned to grant a franchise for the establishment and operation of a street car line between the Barracks and the plant of the American Sugar Refinery, near New Orleans.

Maine.

A favorable report will be made to the officers of the Maine Central R. R. regarding the proposed route for a line from Boothbay Harbor to New Castle.

The new Grand Isle-Fort Kent extension of the Bangor & Aroostook R. R. has been formally opened for traffic. This extension to the Bangor & Aroostook system is 28½ miles in length and parallels the St. John river for its entire length.

Maryland.

It is reported that the Baltimore & Ohio R R., will establish extensive yards at Meyersdale, to consist of from 10 to 20 tracks, each two miles long.

The New York, Philadelphia & Norfolk R. R., Elisha Lee, Superintendent, Cape Charles, Va., is said to be planning to have surveys started shortly from Stockton to Sinnickson, Md., with a view of building a branch road to open up the timber interests of that section of Maryland lying between these two points.

The Industrial Engineering Co., Drexel bldg., Philadelphia, Pa., engineers for the proposed electric line from Salisbury to Nanticoke Point, is now securing the right-of-way. The line is to be constructed for the recently organized Wicomico Electric & Power Co

Massachusetts.

The Boston & Maine R. R., a subsidiary company of the New York, New Haven & Hartford R. R., is reported to be considering four-tracking its line between the Sagus River bridge and Swampscott, Mass. Some color is given to this report by the fact that the railroad has temporarily abandoned eliminating the grade crossings in Lynn, which would be effected by four-track construction.

Michigan.

Advices from Millersburg, Mich., state that it has been announ[illegible] the D. & M Ry. that a line will be built into Rogers, the present delay being caused by an inability to secure steel. Grading will probably be started this fall.

A proposition has been made to the city council of Detroit, Mich., by B. S. Ross, Consulting Engineer, 407 Hodges bldg., Detroit, outlining a proposition for building a subway railway system in that city. Mr. Ross is reported to be backed by Philadelphia capitalists.

The construction of an electric railway from Lansing to Battle Creek by way of Charlotte, is reported under consideration. It is reported that the line will go through Olivet, Charlotte, Potterville and Millett and will come into Lansing on the M. U. R. line from Waverly park. It is said that it is the intention of the company to begin work on the project not later than next fall. Mr. W. A. Foote, Lansing, Mich., President of the Commonwealth Power Co., is said to be back of the project.

Proposition has been made to residents of Inlay City to subscribe for stock to a proposed corporation to operate an interurban line between Detroit and Bay City, running through the city. A committee was appointed and will investigate the merit of the proposition. The plan is being backed by the Illinois Valley Traction Co.

Minnesota.

The Mesaba Electric Ry. Co., of Duluth recently incorporated as noted in our last issue, has applied to the County Commissioners at Duluth, for a franchise to cross the county roads on the proposed line of the railway. A survey has been made for a line 36 miles long, extending from Hibbing to Gilbert and passing through Chisholm, Buhl, Virginia and Eveleth. It is estimated that the cost of the road will be $1,000,000. The company is reported to be backed by Boston and Duluth parties, who are interested in the Great Northern Power Co. of Duluth, which has a plant at Thomson. Oscar Mitchell, Duluth, secretary of the Great Northern Power Co., is President of the Mesaba Electric Ry. Co.

The Minneapolis, St. Paul & Sault Ste Marie Ry. Co. will inaugurate shortly service on the spur recently built connecting Superior, Wis., with the Winnipeg line at Thief River Falls. J. R. Michaels will be superintendent of the new division.

Duluth and the Ranges.

BY PETER F. MEAGHER.

Mr. A. J. Perrin of Carl Hall & Co., contractors, returned from a trip to New York City. He stated that their railroad work was all finished up, and that they were in the market for a new contract.

Arthur Mitchell was a caller. He stated that he had just returned from Canada. He is not doing anything at the present time.

Duluth was quite a gathering place a week ago for railroad presidents. We had here in one day President Shaughnessey of the Canadian Pacific Railway, President Fitch of the Duluth, South Shore & Atlantic Railway, and President Pennington, president of the Soo Railroad. They spent a couple of days here, and went away looking as wise if not wiser, than when they came.

Dennis Madden, General Superintendent for the MacArthur Brothers Co., of New York and Chicago, was a caller here on the writer last week. He was upon a trip of inspection to their stripping contracts on the Iron Range He stated that they had already started on their Government contracts at the Soo Canal, and were figuring on quite a bit of new work.

Robert Railey, representing the Sullivan Machinery Co., came in to see us this week. He said that business was not rushing very strongly in his line at the present time.

Pastoret-Lawrence Co., general contractors of Duluth, were awarded last week a new water works contract by the City of Superior, Wis., and have already started on the same.

C. J. A. Morris of the firm of Morris & Shepard, General Contractors, St. Paul, Minn., was a caller last week. Mr. Morris, while making a trip of inspection of dock work in Duluth Harbor, met with an accident that was [illegible] In stepping from his boat to the dock, he slipped and bruised both of his legs badly, and as a consequence, is now going around on crutches. Mr. Morris is to be congratulated that this accident was not more serious than it was.

Barnett & Record Company of Duluth, Minn., were awarded a contract last week for some cribbing and piling for one of the large coal companies in this city, and have already started on the same.

Mr. E. P. Kimball, of Kimball Brothers, railroad contractors, was a caller last week. They have finished up their railroad work in Dakota on the Great Northern Ry, and he was up here placing his horses in the woods for the winter season.

Timothy Foley, head of the construction firm of Foley, Welch & Stewart, was a caller in Duluth last week. He was up here on a trip of inspection of their work of building the Canadian Northern Extension from Virginia to Duluth, Minn., a distance of 85 miles.

C. A. Baker, Secretary of the Sterling Wheelbarrow Co. of Milwaukee, Wis., was a visitor with us this week. Baker was just as optimistic as he always is, and had just returned from a trip to Old Mexico. He said that business prospects for the coming season looked very bright.

P. Damon of Boone Construction Co., was a caller last week. They have finished their contract that they had on the Great Northern Ry. in North Dakota for Morris & Shepard, and was up here for the purpose of finding some place to put in his horses for the winter.

F. A. Adams, employment man from Minneapolis, came in to see us this week. He reported business in his line very quiet, and that he is going up into the North Woods to try and get a moose or two. He expected to be gone about three weeks.

There has been no new contracts let in this section for some time, and prospects for any new work in the near future are not very encouraging. The supply of laborers at the present time is better than it was two weeks ago, but, still, there is not any more than enough to go around. The demand for men in some lines of work has decreased, and in others, especially the lumbering operations, have increased. There will be plenty of work for all the men in this neighborhood for some time to come.

Contractors and others interested in the employment and equipment business are cordially invited to make the offices of Peter E. Meagher, 409 West Michigan St., Duluth, Minn., their headquarters while in Duluth.

Missouri.

The St. Louis, St. Charles & Northern Traction Co., has secured nearly all of its right-of-way from Troy north, for its projected interurban line, and is now seeking right-of-way through Old Monroe. This company was recently chartered with a capital stock of $900,000. It proposes to build a road 77 miles long from St. Charles to Laddonia, Audrain county. It is proposed to construct the line through the counties of St. Charles, Lincoln, Montgomery, Audrain and Pike. R. E. Race of Mexico, Mo., is the principal stockholder, owning 3,204 shares. R. M. Hendershot, C. Pearson, A. Hazelton, Dr. C. H. Rigg, C. B. Duncan, R. F. Gooch, C. M. Vermillion, A. L. Miller, H. A. Stone, Charles L. Everett, C. F. Butler and J. A. Farmer, all of Middleton, Audrain county; W. J. Dunn of Silex, C. R. Wells of Marling, John Hickerson of Wellsville, F. C. Stroker of Onley, Hugh E. Tige of Laddonia and D. S. Stokes of Mexico, are also stockholders.

The Missouri-Osage R. R. Co. has been chartered by the Secretary of State of Missouri with a capital stock of $250,000 to construct a line of railroad from Linn, Osage County, to Wardsville, Cole County, intersecting the Missouri Pacific at Osage City and covering a distance of 25 miles. The directors of the company are H. C. Hlvis, Alfred K. Prince, Page Nelson, Alphonse Dur, St. Louis and M. A. Greding, Alton, Mo.

It has been announced by John M. Eagan, President of the Metropolitan St. Ry. Co., Kansas City, Mo., that it is impossible at present for the company to take up the matter of constructing the Chestnut St. line owing to the inability of the company to obtain money for improvements outside those it has already obligated itself to make.

The Cape Girardeau, Charleston & Hickman R. R. Co. has completed surveys and has secured the capital for the construction of its projected 50-mile line from Ancil or Kelso to Dorena, a point opposite Hickman, Ky. The contract for constructing the road has been let to Louis Houck, Cape Girardeau, Mo. James F. Brooks, Cape Girardeau, Mo., is chief engineer. Mr. Houck is president of the Chester, Perryville & Ste. Genevieve Ry., now operating 85 miles of line.

St. Louis Items.

BY A. B. KOENIG

The Chicago, Memphis & Gulf Ry. began track laying on its new extension last Monday.

After the meeting of the board of park commissioners of East St. Louis, Ill., last week it was announced that arrangements have been made to dispose of the entire authorized bond issue of $100,000 to N. W. Halsey & Co. of Chicago. The bonds will be delivered to Halsey & Co. and the money paid to officers of the park board next week. The money is to be used in building and improving parks and boulevards in East St. Louis.

The Engineers' Club of St. Louis, at the invitation of the board of public improvements, inspected the piers of the municipal bridge Saturday afternoon. The trip to the piers was made in the harbor boat Erastus Wells, the boat leaving Market street at 2 o'clock.

Bondurant & Mosby came in for a couple of car loads of station men for their new work in Kentucky and Tennessee.

An enabling section authorizing the city to build, own and operate railroad terminals in connection with the free bridge will be a part of the new city charter being drawn by the board of freeholders. Pending the completion of the charter the board is urging civic organizations to withhold indorsement of the granting of railroad franchises over the free bridge. If the section is adopted it will give the city power to construct and operate the terminals, a vote being necessary before bonds to build the terminals could be issued. The terminals provision in the new charter became publicly known through a letter written by Julius Pitzman to the East End Property Owners' Association requesting that association to act slowly in endorsing the bill granting the Southern Traction Co. a franchise over the bridge.

Dan J. Sullivan, who is now with Hannon & Hickey at Mt. Carmel, Ill., spent a couple of days in town and returned to the work at that point.

The pneumatic mail tube commission, composed of postal officials, met in St. Louis Nov. 14 to consider the question of increasing tube facilities between the post office at Eighth and Olive Sts. and the union station, to carry all the mail, instead of a portion of the letter mail, as at present. The commission consists of J. M. Masten of Washington, D. C., assistant superintendent of the railway mail service; Walter R. Hinman, assistant superintendent of the division of salaries and allowances; W. R. Keyes, post office inspector at Chattanooga; T. J. Akins, postmaster at St. Louis, and Stil P. Taft, superintendent of the railway mail service in this district. It is proposed to put in a new service, the cost of which will be $17,500 a mile.

John Higgins is going to winter his outfit near Godfrey, Ill.

The board of local improvements of East St. Louis at a meeting last Friday authorized City Comptroller Frank B. Hanna to issue vouchers for the payment of $42,429.48 on account of work on the Illinois avenue improvements and the outlet sewer. A voucher for $28,636.98 was given the O. T. Dunlap Construction Co. for work on the sewer. The estimated cost of the sewer is $650,000. John and Pat Keeley, contractors for the improvements on Illinois Ave., were given a voucher for $13,792.50 for work up to date. This makes a total of $55,727.10 paid the Keeleys thus far. The contract price is $147,000.

The labor situation is getting worse in place of better. The cotton growers are coming as far north as St. Louis for cotton pickers and offering them the highest prices for picking. The Rees Lee leaving here last Saturday morning had to pay its colored rousters at the rate of $150 per month before being able to get a crew.

Marshall Rust of Swift & Rust was elected a member of the Missouri state legislature by Cooper county last Tuesday. Congratulations, Rust.

Mike Conroy has a nice little piece of wheeler work or short machine work about 10,000 yards, at Godfrey, Ill.

All the railroad laborers and teamsters in town attended the funeral on last Friday of Mrs. Katherine Duppler. Her death will be missed by many a hobo this winter who had been in the habit of making a touch, also warming up and eating her free lunches during the cold wintry days and nights in the past. The day of her funeral it was impossible to get any hoboes to leave St. Louis, as they all were at the cemetery mourning.

P. J. Murphy, 310 N. Williams St., Moberly, Mo., has about 2,500 yds. of bridge filling to let on the Wabash R. R. at the south end of the Luther yards in North St. Louis. This is good wheeler work and will suit a 6 or 8 team outfit. He has also 95,000 yds. of levee work on the Missouri River near Hardin, Mo., that he will let to any size outfit. This work runs from 1 to 7 ft. and is mostly sand.

Montana.

Rumors in Miles City, Mont., are to the effect that prospects are now bright for the financing of the proposed line from Miles City to Sheridan, which is being promoted by R. H. Walsh.

Advices from Rapid City, Mont., state that grading outfits of McIntosh Bros., Pabst Bldg., Milwaukee, Wis., and Wickham Co., Council Bluffs, Ia., which have been in use on the Pacific coast extension and branch lines of the Milwaukee in various states principally in northern South Dakota, have been shipped to that city, and it is believed that work will be started grading the long rumored Chicago, Milwaukee & St. Paul line from Rapid City north and west to make connections with the transcontinental line at Miles City, Mont., or some point near Miles City, thus giving a shorter route from Chicago through Iowa to Manila, Sioux City, Platte, Chamberlain, Rapid City, Miles City and then west.

Nevada.

The Nevada Salt & Borax Co., Fallon, Nev., recently organized to develop the salt marshes in Carson Sink, will start surveys in about 30 days for the construction of a railroad from the sink to the city of Fallon, a distance of 30 miles. C. W. Kinney, Fallon, is interested.

New Jersey.

The Morris County Traction Co., Morristown, N. J., has work under way on its connecting link between Morristown and Summit, N. J. This link will be seven or eight miles long and when completed will allow a through service to Lake Hopatcong.

It was recently voted in the Watsessing Section of Bloomfield, N. J., to adopt the proposed changes for the Lackawanna R. R. improvements and to request the City Council to vacate Willow St. at the railroad in order that the proposed bridge over the thoroughfare need not be built. It is proposed to widen the small thoroughfare leading from Willow St. to Orange St., provided the cost will not increase the general expense.

New Mexico.

A construction outfit has arrived at Texico, N. Mex., billed to J. P. Calback, who has the contract for the construction of the Rock Island Texico-Farwell & Southern Ry., as mentioned recently in Engineering-Contracting.

Advices from Cimarron, N. Mex., are to the effect that work has been started running preliminary surveys for the construction of an extension of the Cimarron & Northern into the Rock Castle Country. It is believed that the line will be connected with the Denver & Rio Grande at some point. H. G. Frankenburger, Cimarron, N. Mex., is Manager of the company.

New York.

The South Shore Traction Co., A. C. Hume, Secretary, Times bldg., New York City, has completed franchise arrangements for building its line across Long Island from Sayville to Port Jefferson.

Engineers of the Pennsylvania and Long Island Railroads, have been investigating the site at Fort Pond Bay, where it is proposed to build docks for the New York terminal for ocean steamship traffic. This plan for docks, it may be noted, was proposed 20 years ago by Austin Corbin, at that time president of the Long Island R. R. As a necessary part of the plan to bring travelers from Europe into the heart of New York by the Long Island R. R. and the Pennsylvania's tunnel, engineers are preparing plans for a large transfer station at Jamaica, L. I.

The Second District Public Service Commission of New York, will resume the consideration, on Nov. 30 and Dec. 1 and 2, of the application of the Buffalo, Rochester & Eastern Ry. Co., for the proposed road from Buffalo to Troy. At the hearings the commission will grant counsel on both sides one month in which to file briefs, etc., so that no determination of the application can be looked for until along in January at the earliest.

The Union Traction Co., Albany, has work underway at Albany on a new extension across Arbor Hill, and the work will probably be completed in four to six weeks.

The Long Island R. R., according to recent reports, is pushing rapidly the construction of its line over the new route between Syosset and Cold Spring Harbor on the Wading River branch, involving the removal of 2,000,000 cu. yds. of earth from that section to Jamaica and straightening of the line between Syosset and Cold Spring Harbor Station.

The Public Service Commission will hold a hearing at Rochester, N. Y., on the application of the Rochester Belt Line Co., incorporated last June to construct a railway, for permission to build a line not to exceed 15 miles in length connecting various railroad lines entering the city, affording easy means of transferring freight. The company is capitalized at $2,500,000, of which $1,000,000 is preferred. The road is to be a standard gage railroad, to be operated by steam power or by electricity. It will lie entirely within the county of Monroe and the terminals will be near or within the city. The plans of the company contemplate the establishment of sufficient yards, storage tracks and warehouses to take care of the needs of manufacturers and shippers. The directors of the company are Henry C. Brewster, John F. Alden, Thomas H. McInnerney, Edgar N. Curtice, Benjamin E. Chase, George F. Roth, Martin E. Wolff, V. Moreau Smith, of Rochester; Frank A. Dudley, of Niagara Falls; Clifford D. Beebe, W. A. Holden, J. Stanley Moore, Syracuse, and Harold C. Beatty, Skeneateles.

North Carolina.

The Asheville Electric Co., J. E. Rankin, President, Asheville, N. C., has awarded a contract to B. J. Luther & Co., Asheville, for grading ¾ mile of road for the new car line in West Asheville. The line will be extended later.

The North Carolina & Virginia R. R. Co. has been chartered and proposes to build a 22 mile line from Spray, N. C., to Ridgeway, Va. The incorporators include J. D. Huffine and P. W. Glidewell of Rockingham County, N. C.

Ohio.

The construction of an electric railway from Poland to Boardman to a connection with the Youngstown & Southern Ry., is proposed. Tentative plans propose that residents of Poland raise the necessary construction capital. John McClure, Poland, is interested.

The Baltimore & Ohio R. R., it is reported will have expended $2,000,000 by the end of the next fiscal year for improvements to include larger yards at Chilicothe, O., Washington, Ind., and Flora, Ill.

Ordinances for grade separation work of the Pennsylvania R. R., at Cleveland, O., are now before the city council of that city.

The Defiance Interurban Ry. Co., of Defiance, Ohio, has been incorporated with a capital stock of $50,000 and proposes to build an interurban railroad from Defiance to Ft. Wayne, reaching Ashwood, Emmett, Cecil, Paulding, Antwerp and New Haven.

Citizens of Middletown have asked the Ohio Electric Ry. Co., Cincinnati, Ohio, to extend its lines over several streets in Middletown. The company at present operates a line over Main st. through the city.

At the recent election at Cleveland, Ohio, the franchise ordinances for the construction of subways in that city were accepted. According to W. R. Hopkins, Cleveland, the chief promotor of the company proposing the underground transit projects, Euclid Ave. and Superior Ave., northeast from the Public square to the city limits, will be the first thoroughfares in which subways will be constructed. Under the provisions of the high level subway ordinance construction must be started within 18 months and subway cars must be in operation within four years. Work on the low level system must be started within two years and one of the tubes from the Cuyahoga valley through to the lake front in operation in four years.

Waugh & Waugh, Station L, Route 8, Cincinnati, Ohio, are making good progress with their contract at the yards of the Chesapeake & Ohio R. R. of Indiana at Summit Siding, just west of Cincinnati. They recently put a new Model 60 Marion shovel on to work and also have a 40 mule scraper outfit on the job.

Advices from Cincinnati state that arrangements have been made between the Consolidated Coal Co., the Chesapeake & Ohio, the Baltimore & Ohio and the Cincinnati, Hamilton & Dayton railroads whereby the Consolidated Co. will build a line of 23 miles into the heart of the richest Kentucky coal district and bring the coal north to Chicago and Cleveland over the railroads mentioned. This line will cost approximately $3,000,000 and will have a terminal in the heart of the coal district near Potter Gap, eastern Kentucky. The Chesapeake & Ohio now has a line within 30 miles of the section, and the Consolidated will make an extension from Shelby Gap to the proposed mines. It will be finished before next fall.

Oklahoma.

A meeting of the stockholders of the Missouri, Oklahoma & Gulf Ry., is to held at Denison, Tex., on Jan. 3, to take action on authorizing the issuance of $1,000,000 of first mortgage bonds.

The Mountain Valley & Plains Ry., which projects a line from Guthrie west to Cimarron, N. Mex., has issued bonds to the amount of $20,000 per mile; Guthrie citizens have put up a $75,000 bonus.

The Denver, Kingfisher & Gulf Ry., which proposes to build from Oklahoma City northwest to Denver, has recently filed a $2,000,000 mortgage on its right-of-way for construction money. The Chamber of Commerce of Oklahoma City, has offered a $100,000 bonus to the company.

The Oklahoma Ry. Co., Anton H. Classen, President, Oklahoma City, is to at once expend $500,000 for building additional terminal buildings, train sheds, trainmen's quarters, waiting rooms and other improvements at the site of the railway terminal, Grand and Harvey Aves., Oklahoma City.

The Buffalo & Northern R. R. chartered a few weeks ago, to build eastward from Buffalo, in Northwestern Oklahoma, to a connection with the Santa Fe and Frisco lines, has opened headquarters at Buffalo, where subscriptions have been taken amounting to $20,000. A permanent survey has been made to Avard, on the Frisco and Santa Fe, and a tentative survey to Fair Valley, in Woods county. No railroad as yet traverses Harper county, and the nearest stations to Buffalo are Sitka and Ashland, Kan., 35 miles distant.

Oregon.

Advices from the office of Division Superintendent J. P. Rogers, of the North Bank Road, Portland, Ore., are to the effect that work on the Oregon Trunk line is moving right along, 22 miles having been graded, over which steel is being laid as rapidly as possible. The new road starts opposite Clark, about 275 miles below Spokane, and is heading for Central Oregon, ostensibly, though it is popularly supposed that J. J. Hill has California for his objective point. Porter Brothers, Spokane, have the contract for the first 130 miles, and H. C. Henry, the Seattle railroad contractor, who built a large share of the Great Northern Railway, has the next 125 miles south of the contract held by Porter Brothers. The latter firm also has the piers for the bridge, of which there are nine, and 400 yards of concrete are now being daily placed in these. The abutments on both sides of the river rest on solid rock, making them doubly secure.

Information from Klamath Falls, Ore., states that Erickson & Peterson, contractors of the Southern Pacific Ry. Co., have torn down and moved their headquarters and camps 25 miles north of that place to a point known as Williamson River Canyon. The roadbed is practically completed to the point where the new headquarters are to be located and the work from there through what is known as the Williamson River Canyon is to be prosecuted with vigor as long as the weather will permit this winter. This canyon roadbed will be about nine miles in length and is considered the roughest territory through which the road is to be built until the head of the Deschutes River is reached.

Watson, Flagg & Standifer, Portland, Ore., have been awarded the contract to construct the extension of the Cazadero line of the Portland Railway, Light & Power Co., from the present terminus to the new power site on the Clackamas River. The distance to be covered will be 3½ miles. The contract was let on a basis of $35,000 a mile. The extension will follow the Clackamas River the entire distance. On account of the rocky formation it will be necessary to resort to blasting for about half of the distance. The extension is to be completed by April 1, 1911.

Pennsylvania.

The Lehigh Valley R. R., E. B. Ashby, Chief Engineer, New York City, will in the near future, double track its line from Lofty to Delano.

The Borough Council of Williamsport, has amended the franchise of the Sylvan Dell Park Passenger Ry. Co., and it is now said that that company will proceed with the construction of its proposed trolley line.

Attorney J. Clarence Lane, of Hagerstown, one of the incorporators of the Blue Ridge Railway Co., which contemplates building an electric railway from Pen-Mar to Blue Ridge Summit, has asked the County Commissioners for permission to cross two county roads between the two places. The commissioners will grant the permission, and it is believed work on the new road will be started soon and that a good portion of the work will be finished during the winter.

The Woodlawn-Southern Ry. Co. has been organized to build a street car line for the purpose of furnishing better transportation facilities for the employes of the Jones & Laughlin Co., at Woodlawn. A charter has been applied for and at the last regular meeting of the Woodlawn borough council, a franchise ordinance passed first reading. The ordinance provides for the right of way through Franklin Ave. and to the borough line in the direction of New Sheffield, over the Woodlawn-Aliquippa road to Woodlawn and above the Pittsburg and Lake Erie R. R.

from the present station to the south end of the borough.

The Lehigh Valley R. R. has awarded the contract for the double track work on its Mahanoy & Hazleton division from Silver Brook Junction to Laurel Junction to Walter H. Gahagan, 189 Montague St., Brooklyn, N. Y.

It is now believed that construction work will be started in the spring on a new trolley line which will afford communication between York and Glen Rock, via Paradise and Loganville. The plans contemplate using the tracks of the York Railways Company from Center Square to a point near the Old Dew Drop Inn property, about two and one-half miles south of York, then diverging to the west and going through Paradise or Jacobus and thence through Loganville and on to Glen Rock, a distance of a little over twelve miles. Several surveys for such a line have been made. The latest survey was made by the Tennis Bros. Co., Magee Bldg., Pittsburg, Pa., which is backing the proposition.

Advices from Sharon state that bids have been asked for the construction of a part of the line of the Allegheny & Northwestern R. R., which has been completely surveyed between Evans City, Butler county, and Harmarsville, Allegheny county, on the Allegheny River. Work will be started on the Evans City end. The bonds are said to have been taken by a Philadelphia syndicate. The road is 21 miles long and will cost $400,000. At Evans City the road will connect with the Pittsburg, Harmony & New Castle Line and at Mars with the Pittsburg and Butler and the proposed Mars & Rochester Ry. J. G. McPherson, of Philadelphia, is president of the company.

Contractors for the construction of the Pittsburg & Shawmut R. R. have ordered the timber to be cleared off the right of way at once for the grading of same. Engineers are now busy setting stakes and two steam shovels will be placed on the work at once. From present indications the large bridge at Mahoning, Pa., will be built before summer comes.

A citizens' committee has been appointed and is now taking up the matter of securing the necessary right of way through Grove City, Pa., for the proposed new railroad from Franklin into Grove City. W. A. Redmond, Grove City, is a member of the committee.

The Simplex Surface Contract Co., Williamsport, Pa., has been awarded a contract for installing its system on the extension of the line of the Lewisburg, Milton & Watsontown Passenger Ry. Co., from Montandon, through Lewisburg, to Mifflinburg, over the Lewisburg-Tyrone branch of the Pennsylvania R. R.

South Dakota.

The plat for the new line of road to be constructed by the Missouri River & Northern Ry. Co., running from Chamberlain to Huron, has been filed with the board of railway commissioners at Pierre. The new line will be about 75 miles in length and will pass through the counties of Brule, Buffalo, Hand, Jerauld and Beadle. The engineering work for this road is in charge of the Missouri Valley Engineering Co., Mitchell, S. Dak., as was noted in our last issue.

Tennessee.

The Tennessee Traction Co., of Memphis, has plans under consideration for beginning active construction work early next year. This company proposes a line between Memphis and Nashville, Tenn., via Jackson, Tenn. W. K. Burton, Memphis, Tenn., is President and George E. Bushneer, Memphis, Tenn., is General Manager and Chief Engineer.

The grading contract recently awarded to the McDowell Construction Co., Knoxville, Tenn., for constructing 17½ miles of line for the Harriman, Knoxville & Eastern Ry. from Harriman, Tenn., will amount to about $300,000, it is said. Part of the work has already been covered by sub-contractors, but the McDowell Construction Co. will bear the heaviest share of the labor, and will place a steam shovel outfit, as well as teams, concrete outfit, carts and cars on the scene of the site of the railroad. The sub-contractors on the line, so far, are: F. W. Hunt Contracting Co.; Cross Construction Co.; A. G. Fretwell, M. M. Schultz, Geo. L. Davidson and Eddington & Pack. Camps are now being erected and the construction work has already begun.

Texas.

With the exception of two short stretches all the grading work along the line of the Galveston-Houston Interurban line has been completed. Of the two short stretches for which contracts have not yet been let one is between Houston and Brays Bayou and the other between Virginia Point and the Texas City Junction. It is very likely that neither of these contracts will be let until after the first of next January, although there is a possibility of the Brays Bayou-Houston contract being let during December. J. C. Kelso, Galveston, and Harty & Ford, Bay City, had the grading contracts which have now been completed. The interurban is being built for the Stone & Webster Engineering Corporation, which has a construction office in the First National Bank Bldg., Houston.

The Trinity Valley Traction Co., J. V. Watkins, President, Scollard Bldg., Dallas, Tex., has engineers in the field making the second preliminary survey for the projected interurban line for Dallas. The first survey began at the city limits of Oak Cliff and passed through Lancaster, and from there followed the Missouri, Kansas & Texas right of way to Waxahachie, thence to Corsicana and Palestine. The route now being surveyed begins at the city limits of Oak Cliff and passes Wheatland and DeSoto, leaving Lancaster to the east, going on an almost direct line to Waxahachie. The officials of the company will meet soon after the second survey is completed and determine which route is to be selected. It is said that the details of the construction are well under way and all financial arrangements will soon be closed so that the actual construction work may begin early in the new year.

The Crystal City & Uvalde R. R. has been completed to Gardendale. This road is being built by a syndicate of St. Louis and Texas men. The new line will connect with the International and Great Northern at Gardendale, 85 miles south of San Antonio. The particular object in constructing the Crystal City & Uvalda was to enable the opening up for settlement of a large scope of ranch territory.

Work on the extension of the Pecos Valley Southern Ry. to Balmorhea and Phantom Lake, at the foot of the Davis Mountain, is now in progress, a crew being at work laying the rails between Saragosa, Old Saragosa and Balmorhea.

Track laying is to be started this month on the extension of the Beaumont & Great Northern R. R., of which C. J. Rogan, Onalaska, Tex., is General Superintendent. Grading work is well along and at last reports the graders were working about 15 miles northwest of Liberty.

The city of Belton, Tex., has raised a $70,000 bonous for the Quanah, Seymour, Dublin & Rockport R. R.

The Southern Pacific R. R. is reported to have agreed to co-operate with the U. S. Government in making improvements to the Colorado River to prevent the overflow of that stream during the spring freshets. The matter has also been taken up with the Mexican Government, as parts of the improvement will have to be made on Mexican soil.

Good progress is being made with the surveys for the line of the Palacios, San Antonio & Pecos Valley R. R., from Palacios to San Antonio. On Nov. 6 the crew had reached Edna, from which point the work of locating the new line to San Antonio will continue.

The Bay Shore Rapid Transit Co., of Houston, mentioned in our last issue, has made surveys for a line 17.3 miles long, to extend from Harrisburg to La Porte. It is planned to build it right along the edge of the Houston ship channel, or as near to the government stream as possible. At the San Jacinto battlegrounds it is proposed to build a loop, and also one in La Porte. The main idea is the development of La Porte and connecting it with Houston in such a manner as to afford the Houston people easy access to the beach. The company is reported to be backed by Kansas City and Pittsburg capitalists. H. N. Tinker, Houston, is the local representative.

As the result of a meeting at which L. P. Featherstone and F. P. James, Chief Engineer of the Ore Line Ry., were present, it is believed in Hughes Springs, Texas, that a satisfactory line has been located to the ore beds near that place and that the line will be located on through that section.

Work is being carried on to completion of the Bartlett-Florence Ry. by Contractor S. F. Hamilton, under direction of the receiver, Samuel Brown, Bartlett, Tex.

The St. Louis, Brownsville & Mexico R. R. Co. will soon ask the state railroad commission for authority to issue and register bonds in the sum of $4,000,000, one-half of which will be used for improvements and equipments for the old line and one-half for 57 miles of new line, including spurs and short lines.

J. W. Burton of Crosbyton, representing the Crosbyton South Plains Ry. Co., has filed an application with the State Railroad Commission for authority to issue $150,000 of stock of this company. This company has already graded the new road from Crosbyton to Lubbock, a distance of 40 miles, and proposes to build from Crosbyton to Tucumcari, N. M.

Vermont.

The Boston & Maine R. R., which is controlled by the New York, New Haven & Hartford R. R., is to petition the Vermont Legislature for permission to build a line between South Vernon and Brattleboro, Vt., where the connecting line is now owned by the Vermont Central, which is controlled by the Grand Trunk. The distance of the new parallel line will be about ten miles, and if built it will give the Boston & Maine a line entirely of its own from Springfield, Mass., to Windsor, Vt.

Washington.

The Oregon & Washington Ry. Co. has awarded a contract to the Hurley-Mason Co., of Tacoma, for the construction of the Jackson St. viaduct at Seattle, which will cost about $100,000. Hurley-Mason Co. have the contract for concrete work on the joint line of the Northern Pacific, Great Northern and Harriman road to Portland.

It has been stated in Riverside, Wash., by officials of the Great Northern Ry. that the grade for the line from Oroville to Pateros has been completed and it is expected to have steel laid this winter. Steel, it is said, is already in Oroville for the completion of the track as far as Riverside.

Railroad contractors on the construction work of the Oroville to Wenatchee Branch of the Great Northern Ry. announce that they have practically completed their work for the 60-mile stretch between Oroville and Ophir and the camps on this stretch were to be broken before the middle of this month. Between Ophir and Brewster, however, there is considerable heavy work to be done and this section will not be completed until after the new year.

The Bellingham-Skagit Ry. Co. has completed surveys and has secured the capital for the construction of its 37-mile electric railway south from Bellingham to Mt. Vernon. The road is being constructed by the Stone & Webster Engineering Corporation, Bellingham, Wash., and sections of the work will be sublet at any time.

The Oregon & Washington Ry. has awarded a $100,000 contract to Grant Smith & Co., for constructing the Seattle Boulevard bridge at Seattle. Hans Pedersen was awarded the contract for the construction of the new reinforced concrete roundhouse at Argo for the Oregon & Washington. The roundhouse will have eleven stalls for locomotives, and the contract also provides for the construction of a yard master's office.

Wisconsin.

It is probable that the Sparta-Melrose R. R. Co. will ask the towns of Melrose and Irving to extend the time for the expiration of the bonds to Nov. 1, 1911. It is likely that if this is done definite steps will be taken next spring for building this line. Howard Teasdale, Melrose, Wis., is interested.

The next piece of construction undertaken by the Minneapolis, St. Paul & Sault Ste. Marie Ry. will probably be a line from Mellen, on the Ashland branch of the Chicago division, to Reserve on the Court Orielles Indian reservation, south of Hayward.

The Kenosha Electric Ry. Co., of Kenosha, has plans under way for building a spur from Middle st., Kenosha, to Washington Island. The work would require the rebuilding of a bridge at a cost of about $10,000.

The Flagg River Ry. Co. has acquired property in Superior for crossing the right of way of the Interstate Transfer Ry. The Flagg River Ry. proposes a line to run along the south shore of Lake Superior to Bayfield and Ashland. The line was surveyed and laid out about three years ago, but it is said that there is no intention of going ahead with its construction immediately, the property being acquired simply to clear up titles and get a crossing over the Interstate line. C. E. Wales, Superior, Wis., is interested.

The Northern Pacific Ry. has applied to the City Council of Olympia for a franchise giving the company a perpetual franchise over streets and alleys in the city now in use by the company and granting it the right to extend a spur track along the Water St. fill to deep water, this right to a spur being also perpetual. In return for which the company agrees to within three years construct a tunnel with concrete retaining walls and a concrete roof of sufficient strength to carry any character of pavement that the city cares to pave 7th St. with in the future. The company also agrees to fill in behind the retaining walls and level up the holes left along the property outside of the walls.

Work has been started by the contractors, Balch & Co., Minneapolis and Rice Lake, Wis., on the construction of the Superior & Southeastern R. R. Co.'s 10-mile extension from Grandview, Wis., where operations are carried on by the Willow River Lumber Co.

Wyoming.

It is reported in Cheyenne, Wyo., that the Union Pacific Ry. Co. has under consideration the extension of its Utah division eastward to Laramie. This would mean the curtailment of the Wyoming division by transfer of trackage between Laramie and Rawlins, and would leave the Wyoming Division, consisting of the trackage between North Platte, Neb., and Laramie.

Canada.

The Manitoba & Keewatin Ry. Co. will apply to parliament at the next session for an extension of time in which to complete its road.

The Grand Trunk Pacific Branch Lines Co. has given notice of application to parliament for authority to construct a number of additional branch lines in Alberta and Saskatchewan, including the following: From Moose Jaw westerly to Calgary; from a point on the western division between ranges 21 and 28 west of the second meridian, westerly to a junction with the authorized line between townships 29 and 37; from a point on the authorized branch line between ranges 12 and 16, west of the second meridian, southerly to the international boundary.

C. H. Rust, city engineer of Toronto, has reported to the board of control his estimate of the cost of equipping and operating a civic street railway service in the districts recently annexed to the city. The equipment he places at $507,600. In addition there would be 10 per cent for engineering and miscellaneous charges, making $558,360. The track work would cost $250,000, and permanent pavements $320,000. The grand total cost would therefore be $1,128,360.

The Canadian Northern Ry. is understood to have surveys underway for a railway line in the Peace River and Grand Prairie country, striking off the main line just east of Lac Ste. Anne. This new survey will connect with the old survey made to Fort Assiniboine several years ago. The construction of a line into the Peace River country has been contemplated by the Canadian Northern Ry. for some time. The Provincial Government has guaranteed the bonds of the company for the first 50 miles of the line.

The blizzard of Nov. 7, which has ushered in the winter in Alberta at least two weeks earlier than usual, has called a halt to practically all railway construction in the Province. About all grading outfits have closed work and have sought winter quarters. This brings to a close a very active year in railway building in the Province. A total of 400 miles has been built, as follows: C. N. R. main line, 40 miles; G. T. P. main line, 80 miles; C. N. R. Calgary branch, 110 miles; Brazeau branch, 35 miles; Goose Lake branch, 25 miles; Landing branch, 39 miles; G. T. P., Calgary branch, 125 miles. Of the 400 miles, 265 were constructed under Provincial Government guarantees.

The Alberta Central Ry. Co., Red Deer, Sask., is to apply to Parliament for an act to enable it to construct a line of railway from Saskatoon easterly to Hudson Bay, with terminals at both Fort Churchill and Fort Nelson. The Alberta Central Ry. Co. has now under construction a line of railway 70 miles westerly from Red Deer, and 40 miles easterly towards Moose Jaw. Smith & Johnston, Ottawa, Ont., are the solicitors for the company.

Official announcement has been made that the Canadian Pacific Ry. is to expend $3,000,000 improvements at the East End of Montreal in connection with Place Viger station, new passenger and freight terminals, and new freight sheds and warehouses. The first section of the work—the eastern construction of the passenger terminal, has been so far completed that trains have been run on the new tracks. When the completed tracks are all laid and in working order, they will number 13. Only about half that number are completed now. The work done this summer has been all on the north side of Notre Dame, only excavating operations having been carried on south of that street. The street itself will be carried across the yard on a continuous bridge supported by pillars.

Mexico.

Grading work has been started on the new railroad, 125 kilometers in length, which is to be built between Penjamo, Guanajuato, on the Guadalajara division of the Central and Ajuno on the National Railways. The contract was awarded to Engineer Armando Santacruz, City of Mexico, of the presidential staff, and he in turn has sub-contracted it to the Compania Constructora Ferrocarrilera, City of Mexico.

Construction work on the cut-off of the Interoceanic Ry., which was begun several months ago and which involved the building of some 42 kilometers of new road between the points of Metepec and San Lorenzo, is so far along that it is believed that the work will be completed, and traffic will be in operation by the end of January, or the middle of February, at latest. This work was necessitated on account of a very steep grade over which the old route lies and which, upon the accomplishing of the present design, will be done away with.

W. A. Bird, Chihuahua, who has the contract for the masonry work on the extension of the Mexico Northwestern R. R. from Madera to Terrazas station, has about 180 men employed at present in arching tunnels and bridges and will put on more as soon as they can be obtained. Work on the entire line is progressing rapidly under the direction of Contractor R. M. Dudley and the sub-contractors. Grading camps are established on an average of one every four kilometers. Practically every foot of the line that is not already graded is being worked. Sixty-four kilometers are now graded out of Madera on which 17 kilometers of track have been laid From Terrazas station track is now down on 70 kilometers and the road open for traffic to the town of Pearson.

The Department of Communications and Public Works of Mexico has formally passed the grant to the Southern Pacific Railroad Co. in Mexico of a concession to build a railroad from Guadalajara to the City of Mexico. The petition for this concession was filed in the department some time ago, but it was only recently that action was taken. It is stated that the line will be built as rapidly as possible after the completion of the present Southern Pacific extension to Guadalajara. The Southern Pacific started to build south from Guaymas a number of years ago and the work went quietly on, with little comment, until after Mazatlan in the state of Sinaloa was reached. Since that time the line has been extended to the South until now it has reached Tepic, the capital of the territory of that name, and is being pushed rapidly toward Guadalajara.

The narrow gage Acambaro-Uruapan R. R. is now being shortened and widened. The work is being done by Bell & Semmes of the City of Mexico, under a contract with the National Railways. This week will be completed by next March

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

✣Lund & Hill, Consulting Engineers, Little Rock, Ark., will let contracts at the Court House, Batesville, Ark., for drainage ditches of the District No. 4, Independence County, on Nov. 22. These ditches are about 7 miles long and estimated to cost $18,000. A certified check made payable to the county clerk for $300 must accompany each bid.

California.

The City of Sacramento is considering raising its north levee 5 ft. above the high water mark from 16th St. to the Sacramento River. City Engineer Randle estimates that it will take 75,000 cu. yds. of material at 65 cts. per cu. yd. to raise the levee. In addition 7,000 cu. yds. will be necessary to raise the Southern Pacific tracks, but this must be furnished by the railroad.

The Redlands & Yucaipa Land Co., of Redlands, has awarded a contract at $10,000 to W. S. Hewitt & Co., Los Angeles, for constructing a dam in Yucaipa Valley. The contract calls for a dam 40 ft. high which will retain water to a depth of 25 ft. and covering eight acres when full. This dam will be built of rocks with a clay puddle wall of 6 ft. in thickness. The reservoir will be surfaced with rock and have a cement floor. The contract calls for the removal of 32,000 yds. of dirt in the construction of the dam and in making the excavation.

Colorado.

The County Commissioners at Greeley are to be petitioned to allow the formation of an irrigation district in northern Weld County. W. Rolla Wilson, a capitalist of Denver and president of the North Poudre & Weld County Reservoir Ditch Co., and E. S. Smith, of Denver, secretary and treasurer of the same

Items marked thus ✣ indicate work now open for bids.

company, are interested. The company proposes to secure its water supply from the North Poudre river and several small creeks, build five reservoirs and water 50,000 acres.

Illinois.

✣Bids will be received until 8 a. m., Nov. 25, at the office of Dan Bower, County Clerk, Murphysboro, Ill., by the Commissioners of the Big Lake Special Drainage District, Jackson County, Ill., for the purchase of an issue (authorized) of $54,500 of bonds of said district. For particulars address R. J. Stephens, attorney for Com'rs, Murphysboro, Ill. Official advertisement appeared in our last issue.

Louisiana.

Contracts for levee work in the Caddo Parish Levee District, bids for which were opened Nov. 1, have been let as follows: Upper Rush Point Levee, 35,000 cu. yds., W. G. Burt, Benton, La., at 11.6 cts.; Beaird Levee, 12,000 cu. yds.; V. V. Hunt, Shreveport, La., at 11.8 cts.; Robson Levee, 30,000 cu. yds.; George Epples, Shreveport, La., at 11.88 cts. The other bidders on the work were: J. M. Montgomery, Benton, La.; J. H. Stinson, Benton, La.; W. R. Cavett, Shreveport, La.; Hall Nattin, Belcher, La.; F. T. Constant, Alexandria, La.

Minnesota.

✣Bids will be received by County Auditor, A. G. Lundgren, Roseau, Minn., until Dec. 8 for the construction of judicial ditch No. 19.

Contracts for ditch work in Faribault County, Minn., bids for which were opened Nov. 1 at Blue Earth, have been let as follows: Ditch No. 9, C. W. Rood Construction Co., Grand Rapids, Wis., excavation, $4,275; tile work, Carl Knudson, Mason City, Ia., at $5,565; Ditch No. 8, Interstate Drainage Co., Britt, Ia., at 9.2 cts. per yd. for excavation; L. P. Anderson, Clear Lake, Ia., for tile work.

Mississippi.

✣Bids are asked until 11 a. m., Dec. 9, by the Black Creek Drainage Commissioners for digging a drainage canal from Howard, Miss., to Tchula Lake. James F. Fontaine, Lyons, Miss., is Chief Engineer. Official advertisement appeared in our last issue.

Missouri.

O. A. Gibson, Natchez, Miss., has placed a force at work on the Texasbend levee above Tyler, Mo. This contract was secured by Mr. Gibson and J. Parker and amounts to about 255,000 cu. yds. Mr. Gibson has also placed a force at work on 100,000 cu. yds. of levee work located about six miles above the first named work. The contract for the latter work was let on Nov. 2 by the Mississippi County Levee Board at Charleston, Mo., to Gibson & Lee.

Nebraska.

The Pollard-Campbell Dredging Co., Omaha, Neb., has been awarded the contract for constructing drainage ditches for Pawnee County Drainage District No. 1, the work involving 800,000 cu. yds. of excavation.

New York.

✣Bids will be received until Noon, Nov. 22, by F. C. Stevens, Supt. of Public Works, Albany, N. Y., for the following contracts: (1) Contract No. 27-A. Champlain Canal. Section 2. For completing the construction of the canal, together with all incidental work, between Station 1046+16, the south end of Contract No. 25 at Dunham's Basin road, and the Hudson River at Fort Edward, Station 1245. Length, 3.76 miles. Sheets, 99 as follows: From original Contract No. 27 as modified by Alterations Nos. 1, 2, 3, 4, 5 and 7; sheets 4 to 8 inclusive; 34 to 38 inclusive; 40; 53 to 60 inclusive; 62 to 64 inclusive; 71; 73; 75 to 77 inclusive; 83 to 92 inclusive; 94 to 108 inclusive. New sheets, 1A, 2A, 109 to 153 inclusive. (2). Contract No. 37. Oswego Canal, Section 1. For improving the Oswego canal between Fulton and Oswego. Length, 9.73 miles. Sheets 1 to 64 inclusive. (3) Contract No. 82. Erie Canal, Section 9. For constructing new highway bridge superstructures over the Erie canal between the Genesee River and the east end of Contract No. 6 within the limits of Contract No. 21. Sheets 1 to 8 inclusive. Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y

North Carolina.

The Brett Engineering & Construction Co., Wilson, N. C., has been awarded the contracts for constructing several drainage canals for the Chadbourn Drainage District, Chadbourn, N. C. The contract amounts to about $30,000.

Pennsylvania.

✣Bids will be received by the H. C. Brooks Co., Chambersburg, Pa., for 5 miles water trench 4 to 5 ft. deep in open country through farms.

Washington.

✣Bids will be received until 2 p. m., Dec. 3, by Charles H. Swigart, Supervising Engineer, Department of Interior, North Yakima, Wash., for the excavation of about 73 miles of sub-laterals, Tieton Unite of Yakima project. For particulars address the United States Reclamation Service, Fourth Ave. and B. St., North Yakima, Wash.

Canada.

Preliminary surveys for the new Welland Ship Canal are now so far advanced that it is possible to give an outline of the proposed work. The new canal will have a length of 27 miles as compared with 32 miles in length of both of the two old canals. The course of the canal as at first surveyed began midway between Jordan Harbor and Port Dalhousie, on Lake Ontario, about three miles east of the first named port. It ran due south for about four miles and then turned a little to the east. It was to have continued in a generally southeasterly direction until it struck the Welland Canal about three miles north of the city of Welland. The existing canal was to have been enlarged the rest of the way, a project which seemed thoroughly practicable. After almost $25,000 had been spent in preliminary survey and when only six miles remained to be staked out, the engineers ran into a stretch of quicksand, and so the entire route was abandoned, at a point one mile northwest of St. John's West, at the place where Twelve Mile Creek crossed the line of survey. The new course starts from Jordan Harbor on Lake Ontario, and follows Twenty-Mile Creek past Jordan Station and the village of Jordan, due south, touching Pelham Union and passing into the neighborhood of Rosedene and then south again, past Boyle, to the Welland River. The utilization of almost three miles of the Welland River will shorten the work and lighten the expense of the new channel. The stream will be followed about as far as Forks Creek, when the course of the canal will veer again to the south past the great Cranberry Marsh and thence on to Reeb's Bay or Morgan's Point. At Reeb's Bay there is a deep semi-circular indention in the shore-line, forming a natural harbor. The bottom here is rocky and the water deep almost to its edge. Morgan's Point juts out into Lake Erie forming a natural breakwater and harbor wall. The last big problem that the experts will be forced to face is that of lockage. Lake Erie is 572 ft. above sea level; Lake Ontario is only 346. The drop of 226 ft. must be negotiated by means of a series of locks. The New Welland canal will be widened and deepened from Port Colbourne to Allanburg. That much is almost certain. The canals along the St. Lawrence River, between Prescott and Montreal, will have to be deepened to correspond with the improved condition of this commercial avenue to the Atlantic. The probable cost of the Welland Ship Canal is placed at $30,000,000.

Survey work to decide on the feasibility of a water route from Lake Winnipeg to Edmonton has been concluded for the year. A preliminary report to the Department of Public Works states that the projected waterway is feasible. From the head of Lake Winnipeg to Rocky Lake beyond La Pas the waterway would be 9 ft. in depth at the minimum. It covers a distance of 146 miles, and the estimated cost is $3,000,000. The bigger stretch is from La Pas to Edmonton, 252 miles. In that part a 5-ft. waterway is proposed and is shown to be accompanied by no particular obstacles. The estimates of cost are not completed, but roughly stated it is about $15,000,000 for the whole work, Winnipeg to the Rockies.

Mexico.

The Compania Irrigadora de Santa Maria, S. A., has been organized and the following have been elected officers: Emilio Pardo, ex-minister from Mexico to the Belgian capital, president; Lieut.-Col. Armando I. Santacruz, of the presidential staff, vice-president and treasurer, and Indalecio Sanchez Gavito, Jr., secretary. This company has purchased a large tract of land on the Higueron and Apatlaco rivers in the district of Jojutla, state of Morelos, where it is the intention of the company to establish, on an extensive scale irrigation works and a light and power plant. It is proposed to develop the power from a large waterfall accessible on the River Apatlaco. Already a large system of canals has been constructed in preparation for the irrigation. Work has been begun on a railroad which is to traverse not only the whole rice and sugar district, but is to connect with the National Railways, giving thus an outlet to the markets.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

The Atlantic, Gulf & Pacific Co., 13 Park Row Bldg., New York, will begin work early next month on its $250,000 contract for dredging at Mobile for the U. S. Government.

The Pea River Power Co. has had preliminary surveys made and has secured the capital for the construction of a 35-mile power transmission line. The time for awarding contracts has not been determined. Chas. Henderson, Troy, Ala., is president and Edgar B. Kay, Tuscaloosa, Ala., is engineer.

California.

An ordinance has been before the City Council of Los Angeles to construct a tunnel under Hill St., between 1st and Temple. The work is to be done under the bond provision of the Vrooman act, paid for by property owners within an assessment district considered to be benefited by the tunnel. This tunnel is to parallel the tunnel recently constructed by the Los Angeles-Pacific as an outlet for its cars to Hollywood. It is estimated that the proposed tunnel will cost $135,000. It is to be, approximately, 546 ft. in length, with a roadway 24 ft. wide. A feature will be the white tiling, which is to line both sides of the tunnel to a height of nine and one-half feet. The ceiling will be covered with pressed brick of enameled face. Homer Hamlin is City Engineer of Los Angeles.

The Alta Planing Mill Co., 8th and Alameda Sts., Los Angeles, has signed a contract to erect all of the buildings and the scenic railway to be constructed on the large concrete pier being erected at Ocean Park for A. R. Fraser. The work will be done on a percentage basis and will cost approximately $350,000. Chas. W. Corbaley, Wilcox Bldg., Los Angeles, as previously noted, is now constructing the pier and his contract calls for the completion of the pier by March 15, 1911, at which time work will be started on the superstructures. The structural steel and all construction material will be prepared in advance in order to complete the buildings for the next summer's season. Work on the scenic railway will be started Feb. 1, 1911. It will cost about $50,000.

District of Columbia.

✣Bids will be received until 11 a. m., Dec. 3, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for furnishing and installing at the United States Naval coal depot, Tiburon, Cal., two steel boilers, one boiler feed pump, one steel stack, one motor generator set, one transformer, switchboard, wiring, piping, etc., and installing a generating set to be furnished by the government.

✣Bids will be received until 2 p. m., Nov. 21, by Commissioners of District of Columbia, Washington, D. C., for constructing an addition to the McKinley Manual Training School building at Rhode Island Ave. and 7th St. northwest, Washington, D. C.

✣Bids will be received until Nov. 25, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under circular No. 511-B one Scotch marine boiler and 100 20-in. car wheels.

✣Bids will be received until 2 p. m., December 13, by U. S. Grant, 3d, First Lieutenant, Corps, Engineers, Superintendent, for installing an electric wiring system for the State War and Navy Department Building, Washington, D. C.

Bids will be received until 2 p. m., Nov. 17, by Department of Interior, Washington, D. C., for the installation of steam engines, electric generators and switchboard for the central power plant at Freedmen's Hospital and Howard University, Washington, D. C.

Indiana.

✣Bids will be received until 10 a. m., Nov. 26, by Depot Quartermaster, Jeffersonville, Ind., for furnishing under schedule No. 572, 15,000 ft. B. M. lumber, including 3,000 ft. of white ash and 12,000 ft. poplar, yellow.

✣Bids will be received until 10 a. m., Nov. 25, by Depot Quartermaster, Jeffersonville, Ind., for furnishing miscellaneous depot supplies.

✣Bids will be received until 10 a. m., by Board of Public Works, Indianapolis, Ind., for the construction of fire escapes and porches for the City Hospital.

The Great Lake Dredge & Dock Co., of Chicago, Ill., has about completed its work for the year on the new $1,000,000 breakwater being built at Gary for the U. S. Steel Corporation. In the spring the concrete covering, over a mile long, will be put on and the breakwater will then be complete in its last detail. The lighthouse foundations have been sunk at the end of the pier 3,200 ft. from the mouth of the slip and by spring the work will have commenced on this essential part of the breakwater. It consists of a half mile of rip rap, stone and concrete.

Iowa.

✣Bids will be received until Noon, Nov. 28, by O. L. Ingledue, Mayor, Marshalltown, Ia., for the installation of machinery and water wheels for development of water power.

The State Board of Education has let the contract for the new veterinary building at the State college to Benson & Marxer of Des Moines, Ia., for $135,000. The new building will be located at the north side of the college ground and will be a large structure with interior court. Work will be begun at once.

Kansas.

✣Bids will be received until 11 a. m., Dec. 5, by Capt. J. E. Normoyle, Constructing Quartermaster, Fort Leavenworth, Kan., for furnishing and delivering F. C. B. terminal railroad, Fort Leavenworth, freight prepaid, one 40 to 45 ton, Standard Guage Locomotive, two standard gage air brake and air dump cars, also two standard gage flat cars.

Kentucky.

✣Bids will be received until Noon, December 9, by Maj. J. C. Oakes, U. S. Engineer, 415 Custom House, Cincinnati, O., for removing rock ledge at dam No. 11, Kentucky River, Ky., near College Hill, Ky.

Maryland.

✣Bids will be received until 11 a. m., Nov. 30, by Board of Awards, Baltimore, Md., for the construction of an office and laboratory building and transformer house at the Black River Disposal works.

The city of Baltimore, Md., has voted a $2,000,000 loan for a proposed municipal pier system. Included in the plan is a new recreation and commercial pier to be built of reinforced concrete. The estimated cost of this pier, including the cost of superstructure and bulkhead work on Thames St. will be $300,000. This will probably be the first work done under the loan. Oscar F. Lackey, Baltimore, Md., is the engineer in charge of harbor improvements for the city.

Massachusetts.

The Harbor Commissioners of Lynn, Mass., which city is contemplating extensive harbor development work, will probably not make their recommendations before the first of next year. Work on part of the improvements in Lynn harbor has already been commenced. The channel is to be widened, deepened and straightened and the mud flats are to be dredged. The government has allowed $75,000 for the job.

Minnesota.

The Zenith Dredge Co., Duluth, Minn., is having plans made for a large new hydraulic dredge.

Missouri.

✣Bids will be received until 3 p. m., December 19, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Lexington, Mo.

A committee has been appointed at Kansas City, Mo., to consider turning Turkey Creek into the Kaw River above the West Bottoms by the construction of a tunnel and a new channel through the bluff. L. R. Ash is City Engineer of Kansas City.

The Dubuque Boat & Boiler Works, Dubuque, Ia., has been awarded the contract by the U. S. Government for the construction of three towboats to be used in the vicinity of Kansas City, Mo. The three boats are to be known as the Gurney, Augustin and Lewis and will be built at a total cost of $105,000.

Mississippi.

✣Bids will be received until Nov. 22 by the City of Brookhaven, Miss., for one compound condensing high speed 200 R. P. M. Corliss Valve type engine for direct connection to 200 K. V. A. Alternator, steam consumption stated for operating ½, ¾, 1, 1½ loads at 90 per cent P. F., 24-in. vacuum, 140 pounds steam.

Nebraska.

✣Bids will be received until 5 p. m., Nov. 26, by Warren & Johnson, Axtell, Neb. for the erection of a church at Axtell, Neb. Dimensions, 70x34, one story and basement.

New Jersey.

✣Bids will be received until December 1, at noon, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging the Salem River in New Jersey.

✣Bids will be received until Noon, December 5, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Maurice River, New Jersey.

The contract for the Ocean City Title & Trust Co.'s new building, corner of 8th St. and Asbury Ave., Ocean City, N. J., to cost $35,000, has been awarded to Hiram Godfrey, of Cape May Court House, N. J.

The Kipp Construction Co., of Camden, N. J., has been incorporated with a capital stock of $125,000, the incorporators being V. A. Murray, J. R. Bradley and D. Bellinger of Camden.

New Mexico.

The Territorial Engineer of New Mexico has approved the application of Boulware & Johnson, Silver City, N. Mex., for a large power development on the Upper Gila River. They asked for 100 second ft. of the flow to develop 4,000 H. P. to be used in the Mogollon mining district. The project has been financed in Philadelphia and will require the expenditure of $1,200,000. A pipe line 24 miles long was to have been constructed, but it was later decided to tunnel a hill, which will reduce the distance just one-half. The dam is to be 80 ft. long and 30 ft. high and will be of reinforced concrete.

New York.

✣Bids will be received until 3 p. m., December 9, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for installing a heating apparatus in the U. S. Assay Office, New York, N. Y.

✣Bids will be received until 11 a. m., Nov. 30, by Capt. F. T. Arnold, Constructing Quartermaster, New London, Conn., for the dredging of the harbor at Fort H. G. Wright, N. Y.

✣Bids will be received until noon, December 12, by Col. W. M. Black, U. S. Engineer, Room 710, Army Bldg., New York, N. Y., for dredging and rock removal in Hudson River, New York.

✣Bids will be received until December 12, by Col. W. M. Black, U. S. Engineer, 710 Army Bldg., New York City, for dredging and rock removal in the Hudson River, N. Y.

✣Bids will be received until 11 a. m., Nov. 30, by F. T. Arnold, Constructing Quartermaster, New London, Conn., for the construction of an addition to stable at Fort H. G. Wright, N. Y.

The Turner Construction Co., 11 Broadway, New York, has been awarded the contract for the construction of a reinforced concrete bakery building for Thomas & H. K. S. Williams Co., Stapleton, S. I., N. Y.; to be two stories, 66x100 ft., reinforced concrete construction, brick wall.

North Carolina.

Bids as follows were secured Nov. 12 by Capt. Earl I. Brown, U. S. Engineers, Wilmington, N. C., for (1) dredging in Smith's Creek, (2) Morehead City Harbor and (3) Beaufort Harbor: P. Sanford Ross, Inc., Jersey City, N. J., (1) 20.5 cts, (2) 20.5 cts., (3) 20.5 cts.; Mitchell & Co. (recommended for award), New York city, (1) 10.5 cts., (2) 10.5 cts., (3) 10.5 cts.; N. Risley & Sons, Ventnor, N. J., (1) 11.8 cts , (2) 11.8 cts., (3) 11.8 cts.; Miner Engineering Co., Washington, D. C., (1) 12 cts., (2) 13.2 cts., (3) 15.8 cts.; W. H. French, Berkeley, Va., (1) 12.3 cts., (2) 12.3 cts., (3) 12.3 cts.; Hillsboro Dredging Co., Tampa, Fla., (1) 10 cts., (2) 16.75 cts., (3) 13.5 cts.; Maryland Dredging & Contract Co., Baltimore, Md., (1) 10.5 cts., (2) 11.5 cts., (3) 10.5 cts.

Ohio.

✣Bids will be received until 3 p. m., December 5, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a vacuum cleaning system in the United States Post Office and Court House at Columbus, O.

✣Bids will be received until noon, Nov. 18, by Secretary C. A. Marvin, Director of Public Safety, Cleveland, O., for the furnishing and installing of a steam and electric generating unit switchboard and appliances for the

Items marked thus ✣ indicate work now open for bids.

Service Quadrangel, Colony Farm, Warrensville, O.

✣Bids will be received by the City Hall Commission, Nov. 22, for the excavation and foundation contract of the proposed new city hall in Cleveland, O.

Oscar F. Barrett, Cincinnati, Ohio, has been awarded the contract at $10,990 for constructing a loose stone dam and shore protection in the Ohio River near the foot of Sisters Island for the U. S. Government. Bids for this work were opened Oct. 27 by Maj. John C. Oakes, U. S. Engineer, Cincinnati, Ohio.

The following bids were received Nov. 5 by Maj. John C. Oakes, U. S. Engineer, for constructing a dam of concrete, etc., at the head of Buffington Island, Ohio River, (1) standing for New Jersey Foundry & Machinery Co., New York, recommended for award, and (2) for the Pennsylvania Contracting Co., Pittsburg, Pa.:

	(1) Rate.	(2) Rate.
Excavation, 5,300 cu. yds......	$ 0.625	$ 2.00
Piles, No. 86..................	11.50	15.00
Iron tie rods, etc., 6,000 lbs....	.047	.06
Gravel filling, 450 cu. yds......	.63	1.25
Stone, ¾-3 cu. ft. each, 820 cu. yds.	6.30	4.00
Stone, ½-3 cu. ft. each, 820 cu. ft.	6.00	4.00
Concrete, 1,720 cu. yds........	7.17	10.50
Extra cement, 25 bbls.	2.80	2.50
Totals	$31,639	$40,215

Oregon.

✣Bids will be received until 2 p. m., December 5, by Constructing Quartermaster, Fort Stevens, Ore., for constructing an addition to quartermaster's stable at Fort Stevens, Ore.

At the recent election at Portland, Ore., the citizens voted in favor of the proposition for establishing a public dock system. An ultimate expenditure of $25,000,000 is proposed.

Pennsylvania.

✣Bids will be received until Nov. 18, by Commanding Officer, Frankford Arsenal, Philadelphia, Pa., for furnishing and erecting trolley system in machine shop building No. 73.

At the election on Nov. 8, the City of Pittsburg, Pa., voted to approve a bond issue of $10,305,000 for public improvements. Among the sums authorized, are the following: $100,000 for a refuse disposal plant; $1,500,000 for a new City Hall; $1,000,000 for public playgrounds and parks; $1,400,000 for raising the flood district and widening and improving thoroughfares; $250,000 for a municipal tuberculosis hospital and $100,000 for packing the wharfs. N. S. Sprague is superintendent Bureau of Construction, Department of Public Works, Pittsburg.

South Dakota.

✣Bids will be received until 3 p. m., December 14, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office at Lead, S. Dak.

Tennessee.

✣Bids will be received until Noon, Nov. 25, (extension of time from Nov. 15) by Board of Education, Nashville, Tenn., for the construction of a new high school building.

✣Bids will be received until 10 a. m., December 3, by Depot Quartermaster, Jeffersonville, Ind., for the construction of a new station complete at Fort Donelson National Cemetery, Dover, Tenn.

The Southern Ferro Concrete Co. of Atlanta, Ga., has been awarded the contract for designing and erecting all of the reinforced concrete skeleton work in connection with the Falls Building, Memphis, Tenn. The Chickasaw Building Co. is the owners and the Valley Construction Co. of Memphis is the general contractor. The building is of the general dimensions of 100x150 ft., and is to be ten stories and basement, reinforced concrete skeleton with brick curtain walls. The general contract is for the sum of $200,000, and the reinforced concrete skeleton contract amounts to about $80,000. The work is to be started immediately and is to be completed by Sept. 1st, 1911.

Texas.

✣Bids will be received until 6 p. m., Nov. 19, by S. E. Woods, Secretary of School Board, Marshall, Texas, for the erection of a brick and wood school building at Marshall, Tex. A certified check for $500 must be filled with each bid.

✣Bids will be received until 4 p. m., Nov. 17, by Waller & Field, Architects, Fort Worth, Texas, for the construction of three reinforced concrete and brick buildings for the Texas Christian University. Certified check for $4,000 required.

✣Bids will be received until Nov. 24, by Cooke & Co., Theater Bldg., Houston, Texas, or Vivier Bldg., Brownsville, Tex., for the construction of 3-story brick building and three residences at Brownsville, Texas.

✣Bids will be received until December 2, by Capt. Fred H. Gallup, Quartermaster, Fort Sam Houston, Texas, for the erection at Fort Sam Houston, Texas, of a 100-ft. iron flagstaff, consisting of supplying materials, necessarv foundation, erecting, painting, etc.

The stockholders of the proposed pleasure pier at Port Arthur have decided to ask for bids for the work. Definite plans for the structure are reported to have been decided on. G. N. Bliss, Port Arthur, Tex., is a member of the committee in charge.

Virginia.

✣Bids will be received until 4 p. m., Dec. 2, by Charles E. Bolling, City Engineer, Richmond, Va., for building a reinforced concrete bulkhead wharf on James River at Richmond, Va.

Bids were received Nov. 1 by Lieut. Col. Mason M. Patrick, U. S. Engineer, Norfolk, Va., for furnishing cast iron brackets, gear wheels, steel shafting, etc., for devices for transmission of range data at various batteries. It has been recommended that the contract be awarded the Steacy-Schmidt Mfg. Co., of York, Pa., for $4,350.

Washington.

✣Bids will be received until 10 a. m., December 2, by Secretary of Board of Public Works, C. B. Bagley, Seattle, Wash., for three automobile hose wagons.

✣Bids will be received until 11 a. m., December 10, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for reinforced concrete pier at the navy yard Puget Sound, Wash.

The City of Tacoma, Wash., has voted to issue $405,000 of bonds for proposed municipal docks.

West Virginia.

The Pneumatic Caisson Co., 5th Avenue Bldg., 5th Ave. and 23rd St., Now York City, which was recently awarded the contract for constructing Lock and Dam No. 12 in the Ohio River near Wheeling, W. Va., and Lock and Dam No. 19 near Little Hocking, O., for the U. S. Government, is in the market for plant for general river work. The contract price for Lock and Dam No. 12, bids for which were opened late in September, was $908,492 The work includes 4,000 cu. ft. coffer dam, 124,200 cu yds. common excavation, 26,200 cu. yds. riprap, 112,850 lin. ft. round piles, 1.043 M. ft. sheet pile, 930,000 lbs structural steel and 52,500 cu. yds. of concrete.

Wisconsin.

B. F. Palmer, Sturgeon Bay, Wis., who recently completed a concrete contract on the new power dam at High Falls on the Peshtigo River, has been awarded another contract at that same place. Louis Fabry, Green Bay. Wis., is associated with him in this later contract which consists of covering an embankment for a distance of about two miles and calls for driving 500,000 ft. of sheet piling on top of which will be laid 7 in. of concrete for which 5,000 bbls. of cement will be used. The work will be carried on throughout the winter by use of steam pipes and other arrangements to overcome the interference of the cold. The contract will require from four to five months to complete.

Canada.

✣Bids will be received until Noon, Nov. 22. by G. R. Geary, Chairman of the Board of Control, Toronto, Ont., for one 10-ton hand operated traveling crane at the high level pumping station and one 15-ton handed traveling crane at the main pumping station.

✣Bids will be received by C. T. Armstrong, Clerk of the Village of Manitou, Man., until Dec. 15 for the purchase of $3,500 debentures.

The town council of Magog, Que., has decided to increase the capacity of the present electric light dam. The proposed scheme is extensive, involving an outlay of $100,000 and increasing the capacity of the dam from less than 300 hp. to about 1,200.

An excellent record in dry dock construction work was recently made at Port Arthur. Ont. Work on the excavation of hard pan and boulders for the site of the dock was started in May, about 80,000 cu. yds. of excavation being required. Concrete work was started Sept. 13 and was finished Nov. 1, 15 days ahead of the time limit. A total of 25,000 cu. yds of concrete was placed. The dock is 700 ft. long, 100 ft. wide, with 16 ft. of water on sill. It is owned by the Western Dry Dock & Shipbuilding Co. The contractor for the work was the Canadian Stewart Co. A breakwater will be constructed next year by the Dominion Government, giving protection to ships approaching the dock and seawall. It is rumoured that a second dock will be built at an early date. James Whalen of Port Arthur is interested.

Advices from Vancouver, B. C., state that John W. Moore and George H. Pethick have been awarded the contract for clearing 1,000 acres of land for the townsite of Fort Mann, the new terminal on the Fraser River, opposite New Westminster. Work on the undertaking has already been started.

BRIDGES—STEEL AND CONCRETE

California.

Advices from Stockton, Cal., under date of Oct. 31, state that the San Joaquin Valley Electric Ry. Co., has called for bids for the construction of the proposed concrete bridge over the Stanislaus River, near Ripon, Cal. The total length of the structure including the approaches and two 80-ft. spans will be over 200. Morris L. Brackett, Stockton, Cal., is treasurer of the company.

Colorado.

The contract has been awarded M. F. Levy Construction Co., for building the bridge across the Conejos River near Antonito, Colo The structure will be of concrete with 80-ft arch and will cost $4,200.

The following bids were received by the City Council of Pueblo, Colo., Nov. 7, for the construction of the proposed new steel bridge over the Arkansas River on Union

Items marked thus ✣ indicate work now open for bids.

Ave: Midland Bridge Co., Kansas City, Mo., $50,600; Missouri Valley Bridge Co., Wichita, Kan., $50,800; J. J. Burke & Co., $52,000; Pueblo Bridge Co., Pueblo, Colo., $49,000; M. J. Patterson Construction Co., Denver, Colo., $59,090; A. M. Blodgett Construction Co., Kansas City, Mo., $49,950. The Pueblo Bridge Co., was awarded the contract. D. P. Gaymon is City Engineer.

✣Bids will be received until Noon, December 20, by Bridge Construction Committee, Norwalk, Conn., for the construction of a reinforced concrete bridge from the Foot of Washington St. in South Norwalk easterly to the proposed fill 100 ft. at the east end of East Norwalk. The structure will have a steel lift draw, spanning 70 ft., 60 ft. wide all over, with two sidewalks 10 ft. wide and paneled sides. A. F. Beard is Chairman of the Committee.

Connecticut.

The General Assembly of 1909, Hartford, Conn., has authorized the construction of a half million dollar bridge across the Connecticut River about one-half mile above the ferry. Preliminary work has already begun and the structure is likely to be completed in a year or two. It will accommodate general traffic including trolley cars and when finished, will mark the passing of the ferry which has been in operation 248 years.

Delaware.

Advices from Dover, Del., states that the contract for the construction of two bridges one near Slaughter Station and the other near Bethesda Church in the fourth district, West Dover has been let at $1,700.

District of Columbia.

Committee on Bridges of the Board of Trade, Washington, D. C., has completed its report and urges the construction of a bridge at Q. St., northwest over Rock Creek.

Georgia.

✣Bids will be received until Noon, December 5, by Special Committee of the City Council, Savannah, Ga., for the Henry St. Subway under the Atlantic Coast Line R. R.; work will consist mainly of following quantities: 5,600 cu. yds. earth excavation, 6,150 lin. ft. piles in place, 800 cu. yds. concrete in place, 700 sq. yds. sidewalks, 280 lin. ft. sidewalk hand railing; each bid to be accompanied by certified check for $500; plans and specifications can be seen at City Engineer's office, and further information desired will be furnished upon application.

Illinois.

At a meeting of the highway commissioners of Centralia township, Centralia, Ill., and the Bridge Committee of the Board of Supervisors, it was decided in regard to the construction of the bridge over a stream of the Swartz land, east of Central City, to advertise for bids at a later date.

The Chicago & Northwestern Railroad Bridge between DeKalb and Spring Valley, Ill., was recently destroyed by fire. The structure which was 250 ft. long has been temporarily repaired and steps for its reconstruction will be taken by the company at once.

A contract has been awarded Bert Abbott, Oregon, Ill., at $6,500 for the rebuilding of the floor of the Oregon Bridge, over Rock River. The contract calls for 2-in. pine floor, coated with pitch, upon which is to be laid creosoted white oak blocks, they to be thoroughly saturated with pitch and sanded.

Residents of Fox Lake, Ills., and property owners of McHenry County, have under consideration the matter of constructing a concrete bridge across the north end of Pistakee Lake, just south of the St. Paul bridge, for the use of teams and pedestrians. The cost of the improvement is estimated at $60,000.

Indiana.

✣Bids will be received until 2 p. m., Nov. 21, by Commissioners of Boone County at Lebanon, Ind., for the repair of Prairie Creek bridge at Thorntowns, estimated cost $1,289. B. F. Hendrich is Auditor.

✣Bids will be received until 11 a. m., Nov. 21, by Commissioners of Orange County at Paoli, Ind., for the construction of a concrete bridge in French Lick township. A. B. Ham, Auditor.

The commissioners of Hancock County, Greenfield, Ind., have awarded the contract for the construction of three bridges to the Greenfield Bridge & Sewer Co., for $3,550. Bids were opened Nov. 7.

Town officials of Indiana Harbor, Ind., are to make an effort to induce the railroad companies whose tracks cross Michigan Ave., to construct a viaduct.

Iowa.

City Council of Cedar Rapids, Ia., has received plans from the Hedrick Bridge Co., for the construction of the Third Ave. bridge. The matter of financing the project was also discussed at the last meeting of the council.

The Iowa Bridge Co., Des Moines, Ia., has been awarded the contract for the construction of a steel bridge over the Iowa River, near Lone Tree. Supervisors of Johnson and Louisa Counties will pay the cost which is $8,900.

Kansas.

✣Bids will be received until 5 p. m., Nov. 16, by F. A. Marcell, City Clerk, Ottawa, Kan., for cleaning, painting, adjusting and repairing the steel highway bridge on Main St. for placing a 6-in. reinforced concrete floor up on the same and also for cleaning, painting, adjusting and repairing the steel highway bridge on Locust St.

✣Bids will be received until 5 p. m., Nov. 16, by F. A. Marcell, City Clerk, Ottawa, Kan., for cleaning, painting, adjusting and repairing the steel highway bridge on Main St., for placing a 6-in. reinforced concrete floor upon same; also for cleaning, painting, adjusting and repairing the steel highway bridge and approaches thereto on Locust St., both in the city of Ottawa. A. H. Slater is Mayor.

City Council of Ottawa, Kan., at a recent meeting decided upon the construction of a concrete floor on the Main St. Bridge and a new plank floor on the Locust St. structure.

City Commissioners of Topeka, Kan., on Nov. 2, awarded the contract for the extension of the Kansas Ave. bridge over the Kansas River to William P. Carmichael Co. The extension consists of two Melan type reinforced concrete arches, each of 75-ft. clear span. The work will be handled through Kansas City office of the Carmichael Co., 516 Midland Bldg. The contract price was $28,860.

Massachusetts.

The County Commissioners have granted the petition of the City Council of Worcester, Mass., to construct a bridge over the Boston & Albany tracks at Crystal St. The site has been viewed by the County Officials.

Minnesota.

City Council of St. Paul, Minn., has instructed the City Engineer to prepare plans for the construction of a street-wide concrete bridge over the Northern Pacific and Omaha R. R. tracks and East 7th St., at Earl St. The condemnation of a strip of land was also recommended.

Missouri.

Plans in detail have been received by the Board of Public Improvements, St. Louis, Mo., for the Compton Ave. viaduct. A meeting is soon to be held by the Executive Committee of the Terminal R. R. Association, which is to build the viaduct and at that time the contract for the work will probably be awarded. The viaduct is to be entirely of reinforced concrete, excepting only the roadway.

The City Council of Springfield, Mo., at the last meeting awarded the contract for the construction of a 30-ft. concrete arch bridge across Wilson Creek on Boonville St., to the Canton Bridge Co., Canton, O., the price being, $6,848.

City Council of St. Louis, Mo., has introduced a bill in the council, authorizing a contract with the Southern Ry., settling the price of the land which the city wants through the company's property for the municipal bridge right of way.

City Council of Louisiana, Mo., has appointed a committee to secure plans for the construction of the proposed bridge across Fifth St.

At a meeting of the city council of Marysville, Mo., the matter of requesting the Wabash R. R. Co. to make a number of improvements will be taken up. It is intimated that the construction of concrete crossings at North Mulberry St. and Storm Ave., will be taken up.

A contract has been awarded the Midland Bridge Co., Kansas City, Mo., for the construction of a viaduct over the railroad tracks at Washington Ave., in Sedalia, Mo., at $12,000. Pettis County, Sedalia, the Missouri Pacific and Missouri, Kansas & Texas Rys. will each pay $3,000 of the total cost of the work

Montana.

Board of County Commissioners, Hamilton, Mont. has awarded the contract for the construction of the proposed bridge across the Bitter Root at Stevensville, to O. E. Peppard, Missoula, Mont., the bidders being as follows: Security Bridge company of Minneapolis, $10,400; O. E. Peppard, $9,995; A. Y. Bayne & Co., $9,900; Roberts, Ibblings & Lee, $9,997; William Oliver Bridge company, $10,500; Minneapolis Steel & Manufacturing company, $10,186; J. F. Harrington, $9,993.

Nebraska.

City Council has taken up the matter of constructing a new viaduct to replace the present structure at 11th St., Omaha, Nebr. City Engineer has prepared a report and the bridge has been judged too weak to stand heavy traffic such as steam rollers, trucks and traction engines.

New York.

✣Bids will be received until 2 p. m., Nov. 25, by Kingsley L. Martin, Commissioner of Bridges, 13-21 Park Row, Borough of Manhattan, New York, N. Y., for constructing the elevators, stairs, drainage, ornamental and electrical work for the anchor piers of the Queensboro Bridge over the East River, between the Boroughs of Manhattan and Queens.

The electors of the town of Denmark, N. Y., voted at the recent election on the proposition of bonding in the sum of $6,000 for the purpose of constructing a concrete bridge over the Deer River in the Village of Deer River.

City Council of Auburn, N. Y., is contemplating the construction of a new bridge over the Owasco outlet in Lizette St. It was proposed to purchase a second hand bridge of Bethlehem, Pa., but nothing definite was decided.

Advices from Ogdensburg, N. Y., state that the New York Central Ry. is preparing to replace the old wooden culvert a mile west of the city on the Morristown division with new steel girder bridge.

A proposition has been voted upon, according to information received from Falconer, N. Y., to appropriate the sum of $15,000 for the construction of a new bridge at Levant over the Cassadaga Creek and two on South Work St., Falconer. The former is estimated to cost $6,000 and the latter $9,000.

City Council of Buffalo, N. Y., has approved plans of the Lake Shore R. R. for a bascule bridge across Buffalo River. The committee on Wharves and Harbors adopted the report recommending that the plans be approved. The structure provides for a 90-ft. clear and 115-ft. between the bearings.

The following bids were received by F. C. Stevens, Superintendent of Public Works, Albany, N. Y., for the construction of the lift bridge over the canal at Franklin St., Syracuse, N. Y.: Raymond Kelton, Albany, $46,963; W. J. Burns, Syracuse, $45,576; Lupfer & Rennick, Buffalo, $44,608, and the Steel Storage and Elevator Co., of Buffalo, $38,245. The proposed structure is to carry a highway as well as the tracks of the New York Central

Items marked thus ✣ indicate work now open for bids.

and the expense of its construction is to be borne one-third each by the state, the city of Syracuse and the railroad company. The announcement of the award was not made.

North Dakota.

City Council of Grand Forks, N. Dak., has under consideration plans for the reconstruction of the Minnesota approach to the DeMers Ave. bridge. The work will be done in such a manner as to prevent future slipping and sliding of the banks.

Ohio.

At the recent election at Cleveland, O., it was voted by the citizens to authorize the County Commissioners to construct the proposed high level bridge over the Cuyahoga River on the Super-Detroit site. A resolution has been passed by the Commissioners, instructing County Engineer, Frank Lander to prepare plans and estimates of the cost of making borings in the Cuyahoga Valley to determine best locations for the footings of the structure.

Board of County Commissioners, Zanesville, O., have received bids for the construction of the proposed Duncan Run bridge and it is believed that either E. J. Landor or J. Mercer will be awarded the contract.

The County Commissioners, Youngstown, O., have awarded the contract for the construction of the proposed bridge on Powers Road to J. Blim & Son, at 75 cts. per cu. yd. for excavation and $6.35 per cu. yd. for masonry; also a bridge over Dry Run to J. K. Mauser at 30 cts. per cu. yd., for excavation and $5.50 per cu. yd. for masonry.

The Concrete Steel Construction Co., has been awarded a contract by the county commissioners at Cleveland, O., for the construction of bridge work per Report No. 2732, Steel ties, Denison-Harvard viaduct, Newburgh township, for $4,083. Bids were opened Nov. 2.

Oklahoma.

Advices from Nowata, Okla, state that the Canton Bridge Co., Canton, O., has been awarded the contract for the construction of 25 small bridges in Nowata County. The contract price was $44,090.

Pennsylvania.

County Commissioners, Reading Pa., are considering the matter of presenting to the Court a petition asking that the December Grand jury be called at an early date to pass upon the necessity of a new Penn St. Bridge.

At a recent city election, it was voted to issue bonds amounting to $1,975,000 for the construction of the Point bridge and for other bridges across ravines in the city of Pittsburg, Pa.

The County Commissioners of York and Cumberland, met in New Cumberland, Pa., recently for the purpose of looking over the site for the proposed new bridge to be placed over the Yellow Breeches Creek at Lieb's Park to join the Springer Road.

The County Commissioners have under consideration the construction of a free bridge between West Brownsville and South Brownsville, Pa., to replace the old wooden structure recently raised.

The Reading Ry. Co. has, it is said, offered to contribute $2,000 toward the expense of erecting a bridge at Tulpehocken and Green Streets over its tracks in Reading, Pa. The structure which will be 500 ft. long will cost $35,000.

The County Commissioners at Harrisburg, Pa., have awarded the contract for the extension of the county bridge across the Swatara Creek near Hummelstown, to R. A. Simmons, Pottsville, Pa., at $2,050. The only other bidder on the work was Ferro Concrete Co., Harrisburg, Pa., at $2,145.

Texas.

As a result of the recent inspection by Engineer R. D. Parker of the Railroad Commission, Austin, Texas, it is believed that the St. Louis, Brownsville & Mexico R. R. will be instructed to replace the present bridge across the Colorado River between Bay City and Buckeye, Matagorda County. The present structure which is 4,000 ft. long has one steel span.

The contract for the bridge over Brushy, near Thorndale, Texas, and over the slough on Big Elm Creek, mentioned in our last issue, has been awarded C. Q. Horton, Austin, Texas, for $4,675.

T. H. Alsbury & Co., of Houston, Tex., and New Orleans, La., have been awarded the contract by the police jury of Madison Parish, at Tallulah, La., for the construction of a bridge over Joes Bayou at Bozeman, for $2,750. The bridge will be 168 ft. in length. Bids were opened Nov. 2.

Virginia.

✣Bids will be received until Noon, Nov. 22, by Clerk's Office, Madison, Va., for the construction of three steel bridges, two 50 ft. long and one 40 ft. long, in Madison County, Va. P. St. J. Wilson, State Highway Commissioner, Richmond, Va.

Board of Supervisors of Henrico County, Richmond, Va., have under consideration the matter of securing the necessary land of the Virginia Methodist Conference Orphanage in Henrico County for the construction of a viaduct on Broad St. road over the belt line tracks of the Richmond, Fredericksburg & Potomac railroad.

Washington.

City of Tacoma, Wash., has voted in favor of bonds for the construction of two new bridges and a municipal dock. One structure will be built across Eleventh St., and is estimated to cost $475,000; the other across the Puyallup River, and will cost $68,000.

Advices from Bellingham, Wash., state that a location for a permanent bridge across Glacier Creek on the Glacier-Twinn Lakes Road has been secured about a mile south of the old bridge recently washed out.

The Board of Public Works, Seattle, Wash., has awarded the contract for the construction of the Stoneway bridge to Grant, Smith Co., North Yakima, Wash., for $60,000. By the terms of the contract the structure must be completed within six months.

West Virginia.

Advices from Wheeling, W. Va., state that the county commissioners have awarded the contract for the construction of the superstructure of the Glen's Run bridge, north of the city to the Faris Bridge Co., Pittsburg, Pa., at $1,700. The contract for the fill was also awarded them at 60 cents per cu. yd. The masonry contract went to J. P. Gilligan, Wheeling, W. Va., at $6 per cu. yd.

Wisconsin.

A special meeting of the Bridge Committee of the City Council of Superior, Wis., will be held soon to take up the matter of constructing the proposed bridge at East Fourth St. The advisability of an all steel structure will be taken up. Representatives of various bridge companies will be present.

At the election held Nov. 8, Janesville, Wis., the matter of constructing two bridges across the Rock River, one at Fourth Ave., and one at Racine St., was voted upon.

Canada.

It has been announced in Vancouver, B. C., that work on the construction of the bridge connecting the north and south shores of Burrard Inlet at the second narrows would commence next Spring. Towards the expense involved, the city of North Vancouver will contribute $100,000 and the district municipality of North Vancouver will contribute $200,000, while the adjoining municipalities of Point Grey, Burnaby and South Vancouver are expected to give about $100,000. These various amounts added to the one promised by the provincial government of $250,000 and the borrowing power, the company will give a total amount available of $1,400,000.

It is reported that the Quebec Bridge Commission, Quebec, Que., on Nov. 5, reached a definite decision regarding the awarding of the contract for the new bridge, and that the placing of the contract is now only a matter of a few days, the contest narrowing down to companies supported by the United States Steel Corporation and the new Canadian Co., which has recently been incorporated by the British builders.

Advices received from the Board of Railway Commissioners, state that the commission will recommend the construction of the Canadian Northern bridge over the Moir, a river at Belleville, Ont., with only five piers instead of seven, as proposed by the railway company.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received by the City Council, Montgomery, Ala., for the construction of pavement on Clitheral St. between Hull and Decatur Sts., a distance of about two blocks.

Contracts for street paving in Birmingham, Ala., have been let by the city council as follows: Dunn & Lallande Co., $13,673, and the E. W. Jordan Co., $3,350.

The O. T. Newall Co., of Birmingham, Ala., has been given permission by the Board of Revenue of that county to build at its own expense a mile of improved road between the villages of Powderly and Bessemer.

Arkansas.

✣Bids will be received until December 5, by Directors of Road Improvement District No. 3, Pine Bluff, Ark., for the construction and repairing of approximately 10 miles of gravel road together with culverts and cross drains. The work contemplated is a pike from Pine Bluff to Sulphur Springs and when completed the road is expected to be one of the finest in Arkansas. The estimated cost of the work is $20,000.

Arizona.

The board of control of Phoenix, Ariz., has declared Grand Ave. a territorial road and has instructed Engineer J. B. Girand to make it a good one by fair time. The road will be graded, watered, rolled and dragged.

Special road district No. 1, Phoenix, Ariz., has bonded itself for $30,000 to improve Central Ave., and make it a boulevard from the city line to the canal. The trustees of the district are: Fred G. Woolsey, E. M. Lamson and Dwight B. Heard.

Colorado.

It is proposed to construct a new road in the vicinity of Penrose, Colo., at an estimated cost of $3,000. T. E. Spencer of Penrose is interested.

District of Columbia.

A committee on streets and avenues of the board of trade, Washington, D. C., has recommended that the district shall maintain a plant for street paving and street repairing, instead of letting this work out by contract.

Florida.

Eighteen different contractors bid on the work Nov. 2, to be awarded by the County Commissioners at Jacksonville, Fla., for the grading, curbing and laying of 19.09 miles of roads, as follows: Hassem Concrete Co., Worcester, Mass.; J. A. Gregory Co., San

Items marked thus ✣ indicate work now open for bids.

Antonio, Tex.; Gilbert Paving Co., Philadelphia, Pa.; Charles Van Antwerp, Cincinnati, O.; The Graves Matthews Co., and the Alabama Paving Co., of Birmingham, Ala.; Atlantic Bitulithic Co., and Irving J. Smith, Richmond, Va.; Georgia Engineering Co., Augusta, Ga.; Rudolph S. Blaine and S. S. Saxton & Co., of Chicago, Ill.; J. Collier Brown, Bryan & Co., Engineering & Paving Co., of Jacksonville; Foster & Long, Logan Concrete Engineering Co., H. Lowe and Wright & Peterson, all of Jacksonville. The roads to be graded, curbed and paved are: Atlantic Boulevard, 1.60 miles; St. Augustine Road, 3.18 miles; New York Ave., 3.00 miles; Black Creek Road, 2.25 miles; Pensacola Road, 3.00 miles; Kings Road, 3.00 miles; Moncrief Road, 1.06 miles; Lem Turner Road, 2.00 miles.

Georgia.

✣Bids will be received until 3 p. m., Nov. 22, by City Council, Dalton, Ga., for the necessary labor and material equipment material, etc., for the construction of approximately 28,000 sq. yds. of street paving with all necessary drainage and granite curb as specified. H. S. Jaudon, Savannah and Atlanta, Ga., Engineers.

The citizens of Troup County have voted a bond issue amounting to $250,000 for the construction of good roads. LaGrange is the county seat of Troup County.

The city of Macon, Ga., contemplates paving First, Cherry and Mulberry Sts. and Georgia and Hardeman Aves. These improvements will be made out of the recently voted $100,000 bond issue.

A mass meeting was recently held in the DeKalb County Court House at Decatur, Ga., to discuss the issuance of $300,000 in bonds for improving the roads of DeKalb County. Recently this county voted bonds in the sum of $50,000 for the opening up of a macadam road connecting Decatur with Atlanta. C. D. McKinney of Decatur is interested.

Illinois.

According to advices from Mahomet, Ill., L. N. Sizer has surveyed the Primmer Rd., cutting it down to 40 ft., as petitioned by the Highway Commissioners.

The improvement of two and one-half miles of highway south of the city of Pekin is planned by the business men of Pekin, Ill., and farmers who are land owners along that road.

J. B. McAuley of Galesburg, Ill., has been awarded the contract in that city for laying the South Seminary St. pavement for $26,859. The new pavement will extend south from the Burlington tracks on South Seminary St., to Fifth St., a distance of about eight blocks. The paving will be of brick block laid on a concrete base, having concrete curbings and concrete gutter.

The Wisconsin Granite Co., 520 Chamber of Commerce Bldg., Chicago, was the low bidder for furnishing to the City of Chicago (35th St. yard) 1,000 cu. yds. No. 2 granite blocks. The bid, as submitted to B. J. Mullaney, Commissioner of Public Works, was $1.79 per cu. yd.

At a recent meeting of the farmers residing south of Pekin, Ill., the preliminary steps toward the improvement of the Alfs Road, leading south on Fifth St., were taken. The plan is to make a roadbed 8 ft. wide of stone, 10 ins. in depth, or of stone and gravel, to be decided upon later. The proposed roadway will extend a distance of about 2¼ miles, from Derby St., at the south side limits of the city, to a point near the Bernshausen school building.

Indiana.

✣Bids will be received until 1 p. m., December 5, by Board of County Commissioners, Williamsport, Ind., for the construction of a gravel road in Jordan township. R. L. Winks is Auditor of Warren County.

✣Bids will be received until 10 a. m., Nov. 23, by Indianapolis, Ind., for the improvement of Morris St. from White River bridge to east curb line of Bismark Ave., by curbing the outer edges of the roadway.

✣Bids will be received until 10 a. m., Nov. 23, by Board of Public Works, Indianapolis, Ind., for the improvement of first alley north of Lowell Ave., from east property line of Ritter Ave. to a point 123 ft. west of east property line of Ritter Ave., by grading, graveling and rolling the roadway.

✣Bids will be received until noon, December 6, by Board of County Commissioners at Rensselaer, Ind., for the construction of 5 stone road improvements in Keener township. James N. Leatherman is Jasper County Auditor.

✣Bids will be received until 11 a. m., Dec. 5, by Board of Commissioners, Greencastle, Ind., for the construction of a gravel road in Jackson and Franklin townships. D. V. Moffet is Auditor of Putnam County.

✣Bids will be received until 2 p. m., Dec. 5, by Commissioners of Union County at Liberty, Ind., for the construction of a gravel road in Center township. Clinton Gardner is Auditor.

✣Bids will be received until 10 a. m., Dec. 5, by Commissioners of Clark County at Jeffersonville, Ind., for the construction of a gravel road in Bethlehem township. Peter Machand is Auditor.

The County Commissioners at Huntington, Ind., propose to improve the county line road between Union township, Huntington County, and the same township in Wells County at an estimated cost of $20,000.

The viewers appointed by the Board of County Commissioners at Huntington, Ind., for the Foust Road, a little more than a mile, along Little River, from the Union township line to the city limits, have reported favorable to the construction and estimated the cost at $3,000.

The Board of Commissioners of Hendricks County, at Danville, Ind., have awarded a contract to Shahan & McCarthy of Lebanon, for the construction of the Lowe and Harris Roads, and a contract to McMahon & Co., of Fortville, Ind., for constructing the Rutledge Road. Bids were opened Nov. 7.

A petition headed by William Rudig and William Bitzer, signed by residents of Dallas township, Huntington County, Ind., and Lagro township in Wabash County, has been presented to the County Commissioners. It asks for a road on the county line, the south end of which will be at the point where the Wabash River and the Wabash railroad intersect. to a point over in Wabash County. The petition asks for a highway 36 ft. wide and an 8-ft. track of gravel 10 ins. deep, and for a complete draining and grading of the road.

Iowa.

The towns along the Chicago, Burlington & Quincy railroad, between Council Bluffs and Burlington, Ia., have taken up the matter of constructing another river-to-river road. The road will pass through Glenwood, Red Oak, Corning, Creston, Osceola, Chariton, Albia, Ottumwa, Fairfield and Batavia.

Sewer and pavement schedules were accepted by the City Council of Des Moines, Ia., as follows: For paving West Thirty-fifth St. from Grand Ave. to Woodland Ave., for extending the sewer on West Twenty-third St. The schedule for paving West Thirtieth St. from College Ave. to Hickman Ave. was referred to Commissioner MacVicar pending the action to be taken upon a number of protests.

Residents of the towns and counties along the route of the proposed Hawkeye Highway will probably form an organization for the purpose of doing their part in the movement for the construction of the road. The road is to extend from Dubuque to Sioux City.

Louisiana.

✣Bids will be received until 11 a. m., December 7, by George B. Davis, D. C. G., U. S. Army, Acting Constructing Quartermaster, 416 Hibernia Bank Bldg., New Orleans, La., for the construction of roads and walks at Fort St. Philip, La.

Several petitions have been filed with the Council by property owners in New Orleans, La., asking that the material for paving their streets be changed from granitoid to bitulithic. The streets concerned are: Napoleon Ave. from St. Charles to Claiborne; Valence from St. Charles to Clara; Valence from St. Charles to Magazine; Cleveland Ave. from Hagan Ave. to Murat, and Napoleon Ave. from South Claiborne to Camp.

Commissioners have been appointed at Lake Charles, La., to lay out and procure a right of way for a public road running from Frusha bridge on Barn's creek to Longville, thence to the intersection of the Kinder and DeQuincy road.

Maryland.

A plan is on foot in Anne Arundel County for hastening the county and state roads' improvement. George T. Melvin of Annapolis recently addressed the County Commissioners and urged the county to take over the contracts from the State Road Commission for building the roads within its borders. He roughly estimates that the initial cost for necessary equipment, including mule teams, harness, rollers, dump wagons, sprinkling wagons and spreaders will be $17,200.

Michigan.

At a recent meeting of the Ontonagon County Board of Supervisors, Ontonagon, Mich., the sum of $4,000 was appropriated for the improvement of the old Military Road, the work to be done next year under the direction of the County Road Commission. The section to be improved commences at the county line between Gogebic and Ontonagon Counties, running thence north to Paulding in the township of Haight.

The Oliver Iron Co., of Ishpeming, Mich., is preparing to build a new road along the line of the main highway that will shorten the distance between the city and the National Mine location about a mile.

The County Road Commissioners, Gladwin, Mich., have adopted the proposed route for the new county road in Butman and Clement.

Minnesota.

✣Bids will be received until 8 p. m., Dec. 13, by A. M. Childs, City Clerk, Crookston, Minn., for the paving of the following Sts.: Ash St., from its intersection by the southerly end of Houston Ave to its intersection by 3d St., including 7,148 sq. yds.; East Third St., from Broadway to Elm St., 2,381 sq. yds.

The Joint Council Committee on Good Roads, St. Paul, Minn., has decided to ask for an appropriation of $25,000 for road improvements and maintenance during the coming year. The improvement fund for the coming year is apportioned as follows: Lexington Ave., $500; River Road, West side, $3,000; Smith Ave., West side, $2,000; Snelling Ave., North end, $1,000; Snelling Ave., South end, $1,000; St. Clair, $2,500; Jackson St., from University Ave. North, $5,000; Point Douglas, $500.

The County Commissioners at Glencoe, Minn., have been petitioned for three county roads, one in Glencoe and Sumter towns, one in Hassan Valley and one in Rich Valley.

George R. King has been awarded the contract in Duluth, Minn., by the Board of Public Works for a cement paving on Third alley between 20th and 21st Aves., East, for $1,415.

Mississippi.

The City Council of Vicksburg, Miss., has authorized the purchase of equipment for the sweeping of the streets at a cost of $4,000. Two sweepers, two sprinklers, eight mules, harness, cans and brushes are included in the equipment.

The Southern Bitulithic Co. has been awarded the contract in Jackson, Miss., by the City Council for the paving of State St., with bitulithic for $2.15 per sq. yd. The work includes 25,800 sq. yds. of pavement.

Missouri.

The Boone County Court, Columbia, Mo., has condemned the roadway along the creek bank, north of Hartsburg, on the farm of Henry Strattman. P. S. Quinn, County Engineer, will re-locate the road.

Curtis Hill, State Highway Engineer of Missouri, has completed the survey of the

Items marked thus ✣ indicate work now open for bids.

proposed pike road to be built from Hollister to Kirbyville.

Nebraska.

✣Bids will be received until noon, November 18, by Roscoe C. Ozman, City Clerk, Lincoln, Nebr., for paving and curbing the roadway in Paving District No. 113, consisting of B St. from 8th to 11th Sts.; and Paving District No. 183, being C St. from 19th to 27th Sts., B St. from 19th to 20th Sts., and 19th St. from A to D Sts., according to plans and specifications on file in the office of the City Clerk. Blank proposals may be obtained at the office of the City Engineer. The Engineer's estimate of the cost of this work is as follows: Sheet Asphaltum, Class A, 5 years' guarantee, District 113, $2.15; District 183, $2.15 per sq. yd. Vitrified Brick Paving, Class B, 5-year guarantee, District 113, $2.15; District 183, $2.15 per sq. yd. Artificial Stone Curbing, District 113, $0.55; District 183, $0.55 per lin. ft. Artificial stone curb and gutter, District 113, $0.95; District 183, $0.95 per lin. ft. Extra grading, District 113, $0.50; District 183, $0.50 per cu. yd. Extra concrete, District 113, $7.00; District 183, $7.00 per cu. yd. Extra broken stone, District 113, $2.25; District 183, $2.25 per cu. yd. Extra binder in place, District 113, $7.50; District 183, $7.50 per cu. yd. Extra sand in place, District 113, $1.15; District 183, $1.15 per cu. yd. Resetting old curb and gutter, District 183, $0.50 per lin. ft. Cement grouting for brick paving, District 113, $0.13; District 183, $0.13 per sq. yd. Asphalt filler for brick paving, District 113, $0.25; District 183, $0.25 per sq. yd. Paving pitch for brick paving, District 113, $0.20; District 183, $0.20 per sq. yd.

New Jersey.

Within the next two weeks the freeholders of Essex and Hudson Counties, N. J., expect to be able to award contracts for the grading of the Plank Road at the Newark and Jersey City ends. The right of way will probably be secured by that time. James Owen, Newark, N. J., is County Engineer.

Following bids were received by Wm. C. Burroughs, City Clerk, Asbury Park, N. J., for paving work in that city: Empire City Contracting Co., $2.97 per sq. yd.; J. C. Fowler, $3.28 per sq. yd.; J. F. Shanley Co., $3.04 per sq. yd.; O'Reilly Bros., $2.79 per sq. yd.; United States Wood Preserving Co., $2.52½ per sq. yd.

New York.

✣Bids will be received until 11 a. m., Nov. 22, by the President of the Borough of the Bronx, New York city, for eight sewer construction contracts, the largest being No. 5, for repaving with redressed granite blocks on a concrete foundation the roadway of the Southern boulevard from Willis Ave. to E. 138th St. and setting curb where necessary. The Engineer's estimate of the work is as follows: 18,250 sq. yds. of granite blocks, to be taken up, redressed and relaid on a concrete foundation, with cement grout joints, and keeping the same in repair for one year from date of acceptance: 3,880 cu. yds. of concrete; 6,450 lin. ft. of new granite curbstone, 6 in. by 18 in., furnished and set; 6,400 sq. ft. of new granite bridgestone for crosswalks, furnished and laid; 8,200 sq. yds. of granite blocks to be taken up, redressed and relaid on a concrete foundation with cement grout joints; not to be kept in repair. The time allowed for the completion of the work will be 150 consecutive working days. The amount of security required will be $30,000.

✣Bids will be received until noon, Nov. 22, by the President of the Borough of Richmond, George Cromwell, New York city, for three contracts for the improvement of streets, the largest being No. 1, for furnishing all the labor and materials required for constructing a temporary combined sewer and appurtenances in Monroe Ave., from Cedar St. to the Staten Island Rapid Transit Railroad crossing, and through an easement as laid out on the map or plan of the city of New York to the northerly end of Winant St., and in Winant St., from the easement to a point about one hundred and fifty-six (156) feet south of Crocheron St., together with all work incidental thereto. The Engineer's estimate of the quantity and quality of the material and the nature and extent, as near as possible, of the work required is as follows: 363 lin. ft. of reinforced concrete sewer of 2 ft. by 3 ft. interior diameter, all complete, as per section on plan of the work; 61 lin. ft. of reinforced concrete sewer of 2 ft. interior diameter, all complete, as per section on plan of the work; 820 lin. ft. of salt-glazed vitrified pipe sewer of 20 in. interior diameter, all complete, as per section on plan of the work; 48 lin. ft. of cast-iron pipe of 24 in. interior diameter, not less than 250 lbs. per foot, furnished, laid and calked; 2 receiving basins of the circular pattern, with 1¼ in. galvanized wrought-iron bars and iron traps, all complete, as shown on plan on file in the office of the Commissioner of Public Works, and connected with the sewer; 6 manholes, complete, as per section on plan of the work; 1 drop manhole, complete, as per section on plan of the work; 5,000 ft. B. M. of foundation timber and planking in place and secured; 4,000 ft. B. M. of sheeting, retained; 10 cu. yds. of concrete, in place; 1 cu. yd. of brick masonry; 10 cu. yds. of additional excavation; 10 cu. yds. of additional filling; 1,000 sq. ft. of additional reinforcing metal, equal and similar to Nos. 4 and 10 expanded metal, furnished and placed; 300 lbs. of additional reinforcing metal, equal and similar to corrugated or deformed steel rods, furnished and placed; 16 lin. ft. of new 5-in. by 16-in. bluestone curbstone, furnished and set in sand foundation; 25 lin. ft. of additional 12-in. vitrified culvert pipe, furnished and placed; 460 sq. yds. of existing pavement, to be replaced to present depth. The time for the completion of the work and the full performance of the contract is 65 days. The amount of security required is $3,400.

The Pittsburg Railways Co. has decided to improve the Chartiers Road between Bucyrus St. and the grain elevator in Chartiers township, Sheridan, N. Y. This section of the road is one mile in length and it will be improved with macadam.

Bids were received by the Board of Contract and Supply of Syracuse, N. Y., Nov. 1, for the paving of Catherine St. from James to Butternut St. The lowest bid is about $20,000.

North Carolina.

E. T. Belote of Asheville, N. C., has been awarded the contract in that city for the construction of 5,000 sq. yds. of concrete sidewalks for $1.08 per sq. yd.

Autoists in the western portion of North Carolina contemplate the construction of an automobile highway from Salisbury to Asheville. Committees have been appointed from Salisbury's Board of Trade and Merchants' Association to attend a conference to be held at Hickory with a view to selecting a route.

Ohio.

✣Bids are reported as being asked Dec. 5, by F. O. Howell, Clerk of the Council of the Village of Linden Heights, O., for furnishing the necessary labor and materials for the construction of approximately 190,000 sq. ft. flagstone sidewalks, and also the construction of gutters sufficient to drain the walks in the village.

✣Bids will be received until noon, December 9, by Board of County Commissioners, Cincinnati, O., for the improvement under Specifications No. 35, of the Hill Road near the residence of Jacob Stephan in Colerain township. Fred Dreihs is Clerk.

✣Bids will be received until noon, Nov. 18, by Board of County Commissioners, Cincinnati, O., for the improvement under Specifications No. 39, of the Hamilton Pike through the village of Mt. Healthy in Springfield township.

The City Council of Hamilton, O., has passed an ordinance providing for the paving of F St., from Park to Ross Ave.

The City Council of Steubenville, O., has passed an ordinance providing for the paving of Fifth St., from Market to Washington.

The City Council of Galion, O., contemplates paving about eight streets next spring, and has passed an ordinance providing for the issuing of bonds in the sum of $27,000 for that purpose. The streets to be improved are East Main St., east of the Big Four tracks; North Market, Atwood, Railroad, Jefferson, South Union, Boston and Cherry Sts.

Louis Deckard, Canton township; William Casler, Jackson township, and John Bennett, Canton township, were appointed viewers for the new road in Plain township petitioned for by Daniel Paulus. The proposed road is to be one mile in length and is to connect with the Canton-Harrisburg road.

Geo. W. Bish, Auditor of Dayton, O., will sell bonds Nov. 28 to the amount of $12,500 for the paving of Springfield St., from Irwin St. to the corporation line.

The City Council of Bryan, O., plans to improve the Main St. road north of Bryan. The proposed improvement is to be made with the co-operation of the State Highway Department, which propose to expend $1,000 on the section of road just north of the corporation line on North Main St. It is planned to build this road of slag.

Property owners on South B St., in Hamilton, O., met with the Board of Control to discuss the kind of pavement to be used for the paving of that street. Petitions were filed for asphalt and brick, and it is probable that either of the materials will be used.

It is reported that the Andrews Asphalt Paving Co. has been awarded the contract in Hamilton, O., for the paving of East Ave with sheet asphalt.

Oregon.

The Street Committee of the Executive Board of Portland, Ore., has awarded the following contracts for street work: East 32nd St., from East Harrison to East Sherman, grading and concrete curbs and walks, Stevens Bros., $2,494; East Madison St., from East 16th to East 24th St., Warren Construction Co., $19,622; East 26th St., from Holgate to Powell, grading and concrete curbs and walks, M. Hansen, $6,573.

Pennsylvania.

The Barber Asphalt Co. was the lowest bidder in Philadelphia, Pa., for asphalt paving contracts its bids ranging from $1.40 to $1.60 per sq. yd. Sections of 46 streets in various parts of the city, not heretofore improved, are to be paved with asphalt under these specifications.

The following bids were received by the City Council of East McKeesport, Pa., on Nov. 1 for the contract for paving the east side of Greensburg Ave.: Collins Gordon Co., $4,901; S. James Topley Co., $4,460. The contract was awarded to the latter.

The citizens of Reading, Pa., have voted to borrow $1,275,000 for public improvements, including storm water sewers and paved streets.

An ordinance has been introduced in the City Council of Philadelphia, Pa., providing for the paving of Fourth and Fifth Sts., between Market and Chestnut St., with wood blocks.

The Cement Products Co. has been awarded a contract in Erie, Pa., for the paving of German St. from Front St. south to Fourth St., with asphalt. The contract price was $1.20 per sq. yd. for paving, $0.33 per ft. for artificial curbing, $35 each for catchbasins, $5 each for spills, $.60 per ft. for 9-in. pipe, $.40 per ft. for 6-in. pipe.

The contract for the paving of Centre St., in Mt. Carbon, from Pottsville borough line to the bridge spanning the Schuylkill river just beyond the arch, has been awarded to the Juniata Paving Co. for $6,660.

Texas.

✣Bids will be received until 3 p. m., Nov. 21, by Sam. J. Brown, Secretary, Dallas, Texas, for the construction of approximately 80,000 sq. yds. of pavement. Each bid shall be read separately on (a) bitulithic pavement, (b) vitrified brick paving, (c) sheet asphalt paving, (d) rock asphalt pavement, (e) creosoted pine block pavement; E. L. Dalton, Dallas, Tex., is Engineer.

Items marked thus ✣ indicate work now open for bids.

The city of Greenville, Tex., has sold bonds to Spitzer & Co., of Cleveland, O., to the amount of $100,000 for the paving of 10 miles of the city's streets.

The City Council of Abilene, Tex., on Nov. 1 awarded the contract for the paving of Chestnut St. to the Texas Bitulithic Co. It is reported that R. H. Locke of Abilene has received the contract for doing all the curb work.

The City Council of Sherman, Tex., has passed several ordinances providing for the paving of North and South Travis St. with brick. At the same time the city awarded a contract to C. H. Foley for the construction of sidewalks, a concrete curbing and gutter around Court Plaza.

W. D. Haden of Galveston, Tex., was recently awarded the contract for the construction of a shell road from Missouri City to Richmond, Tex., for $81,745.

Utah.

A special committee has been designated by the County Commissioners of Sevier County, Richfield, Utah, to investigate the matter of a right of way for a new section of a road along the east bank of the Richfield canal.

Advices from Theodore, Utah, state that M. B. Pope and a crew of engineers are surveying the proposed state road between Theodore and Castle Gate.

Virginia.

The street committee of the City Council of Norfolk, Va., on Nov. 1 opened bids for the contract to carry into effect the Council's paving program as arranged several months ago. The contracts will probably be let this month.

Bids were received Nov. 1 at Portsmouth, Va., for 71,350 ft. of street paving. Bids were received on asphalt, bituminous blocks, bitulithic and filbertine. The contract has not as yet been awarded.

Washington.

✤Bids will be received until 10 a. m., Nov. 18, by the Board of Public Works, Seattle, Wash., for the grading and curbing of Walnut Ave.

✤Bids will be received until 10 a. m., Nov. 18, by the Board of Public Works, Seattle, Wash., for the grading and regrading of Harrison St.

Frank M. Fretwell, Secretary of the Pacific Highway Association, Seattle, Wash., has urged every commercial club in the state to urge the county courts in the various counties through which the international road will pass to locate and improve their part of the highway at the earliest possible moment.

Long & Thornton of Pomeroy, Wash., have received the contract for the construction of 30 miles of state road from the Grouse country, south of Pomeroy, to that city. The contract calls for the completing of the first eight miles of the road by July 1, 1911.

The survey of the state aid road extending from the city limits of Walla Walla, Wash., from South Ninth St., two miles south on the upper Milton road, has been completed and the construction work is now open for the bids of contractors. The estimated cost of the work is $7,000.

The County Commissioners at Bellingham, Wash., have passed a resolution for the improvement of a highway from Bellingham to Blaine by way of Ferndale.

The State Highway Commission of Washington, at Olympia, is working on plans for the construction of a north and south highway extending across the state from British Columbia on the north to Vancouver, Wash., on the south. The road will run from the British Columbia line, through Bellingham, Mount Vernon, Everett, Seattle, Tacoma, Olympia, Centralia, Chehalis, Kelso and Kalama, to Vancouver, a distance of 275 miles. The commission will this year build three of the seven miles of proposed road from Ravena Park to Bothell, complete the four miles of road between Kirkland and Redmond and the 24 miles of road from Orilla to Tacoma. The latter is an extension of the 12-mile road from Seattle.

West Virginia.

The Woodsdale City Council has awarded the contract for furnishing 1,000 tons of broken stone which will be placed on the streets of the town to the Thomas B. Prosser Co., for approximately $1,500.

Advices from Williamson, W. Va., state that Lee District, Mirgo County, voted Nov. 8 on the issuance of $60,000 of bonds for road improvements.

Wisconsin.

A petition is being circulated in Brule, Wis., for a road between that town and Winneboujon to run from C. J. Skoglund's corner on the south line of 14 through section 23, along the old right of way, to H. S. Hughson's land in 26, thence to the west line of 26.

WATER-WORKS AND SEWERAGE

Arkansas.

Engineers of Fort Smith, Ark., have been in Malvern, Ark., looking over the ground and talking with citizens interested in putting in a waterworks system. Definite action is expected soon.

California.

Bonds in the sum of $35,000 have been voted by the city of Calexico, Cal., for a municipal sewer system. Plans will at once be completed by the city engineer for the work, and bids will be advertised for.

The Spring Valley Water Co. has refused the offer of the city of San Francisco, Cal., for the purchase of the plant of the company for $33,000,000 or $35,000,000.

Colorado.

The Park Center Land & Water Co. has begun the construction of a diversion dam across Four Mile creek, about six miles northeast of Canon City, Colo.

The citizens of Aurora, Colo., have asked the Denver Union Water Co. to erect a pumping station near the town so that it will furnish adequate assistance to the present pumping facilities.

Connecticut.

✤Bids will be received until 8 p. m., Nov. 17, by Board of Sewer Commissioners, City Hall, Ansonia, Conn., for the construction of Section "D" of the Ansonia Sewer System. Bids may be filed for commencing the work immediately or as soon as the 1911 season opens. The work includes: 893 ft. of 27-in. vitrified pipe, 1,420 ft. of 24-in. vit. pipe, 1,331 ft. of 18-in. vit. pipe, 2,900 ft. of 15-in. vit. pipe, 35 manholes. V. B. Clarke is Engineer.

Georgia.

✤Bids will be received until 10 a. m., Nov. 21, by the Secretary of the Mayor, Atlanta, Ga., for furnishing 6,000 barrels of Portland cement to be delivered on the line of the Proctor Creek Intercepting sewer in car load lots at such points as may be designated by the engineer in charge of the work as needed. R. M. Clayton is City Engineer.

✤Bids will be received until 10 a. m., Nov. 21, by the Mayor's Secretary, Atlanta, Ga., for the construction of the Proctor Creek Disposal Plant. Bids are to be received on original plans and on those eliminating the one-half acre section of the sprinkling filter.

The sewer committee and the bond commission of the City Council of Atlanta, Ga., on Nov. 1 received bids for the Proctor Creek disposal plant as follows: Interstate Construction Co., of Atlanta, $121,277; Municipal Engineering Co., of Chattanooga, Tenn., $121,684; Nichols Contracting Co., Atlanta, $139,214; Piedmont Construction Co., Atlanta, $144,575; C. W. Lane & Co., Atlanta, $150,503, and Gude & Co., $193,180.

At an election held in Americus, Ga., Nov. 8, the proposition to bond the city to the amount of $65,000 for public improvements, including sewerage extension and municipal lighting plant, was defeated. Another election will be held shortly to vote on the same proposition.

The following bids were received at Eastman, Ga., for the construction of sewer system in that city, for which F. M. Binner, of Marion, Ind., was awarded the contract: Geo. H. Palmer, Opelika, Ala., $15,912; F. M. Binner, Marion, Ind., $17,022; Dysard Construction Co., Atlanta, Ga., $17,998; Abu Bros. & Hart, Hickory, N. C., $18,102; Edwards Construction Co., Hickory, N. C., $18,608; Bryant & Co., Jacksonville, Fla., $18,652; J. Whitt Guley & Co., Mobile, Ala., $19,553; Carolina Construction Co., Florence, S. C., $19,990; J. D. Cranford & Co., Macon, Ga., $20,397; M. P. Flynn & Co., Chattanooga, Tenn., $20,870; Municipal Engineering & Construction Co., Chattanooga, Tenn., $21,202; Sirlavin & Ding, Bessemer, Ala., $21,698; Isaac Mishler, Chattanooga, Tenn., $22,026; P. J. Curran, Knoxville, Tenn., $22,068; Mann & Garvey, Knoxville, Tenn., $22,116; Geo. H. Craft & Co., Dublin, Ga., $22,184; Charleston Engineering & Construction Co., Charleston, S. C., $22,377; Noll Construction Co., Chattanooga, Tenn., $22,937; Newman Sewer Construction Co., Evansville, Ind., $24,925; John R. Jeffery, Elberon, N. J., $25,323; J. H. Hargrove & Sons, Eastman, Ga., $25,929.

Illinois.

✤Bids will be received until 5 p. m., Nov. 16, by City Council, Bloomington, Ill., for the construction of a new sewer in Virginia avenue, from Main street, east 1,521 ft.

The village council of East Alton, Ill., has adopted an ordinance authorizing the building of a waterworks system.

The city of Bloomington, Ill., has sold bonds to the amount of $50,000 for waterworks.

The petition for the construction of a sanitary sewer in West Dundee, Dundee, Ill., is now being prepared and will be filed in the County Court at Geneva immediately. The estimated cost of the work is $15,850.

The contract for the digging and building of the Meadows Manufacturing Co.'s sewer, Pontiac, Ill., has been let to Grassall Bros.

The City Council of Lewistown, Ill., recently awarded J. E. Daily, of Hammond, Ill., the contract for installing the North Side sewer, septic tank, etc., for $15,295.

The Peoria Water Works Co., Peoria, Ill., is making plans for the expenditure of a large sum of money on its plant the coming year.

Following are the low bids and bidders as opened by the Board of Local Improvements, City of Chicago: Chas. A. V. Standish, secretary, Room 302, City Hall, for furnishing and laying lead water service pipe in the following streets: Western Ave., Montrose Ave., to Lawrence Ave., 2,788 lin. ft., $.69 per lin. ft., Jas. H. Roche, 222 E. 31st St.; Ave. J., Indianapolis Ave. to 106th St., 488 lin. ft., $.73, Jas. J. Renn, 367 W. Chicago Ave.; Rice St., Western Ave. to Campbell Ave., 528 lin. ft., $1.15, Jas. J. Renn; Whipple St., Addison Ave. to Elston Ave., 181 lin. ft., $.79, Jas. H. Roche; Lunt Ave., Clark St. to Sheridan Road, 604 lin. ft., $.65, Jas. J. Renn; Dauphin Ave., E. 90th St. to E. 92nd St., 342 lin. ft., $.68, Jas. J. Renn; and the system comprising the following streets: 87th St., St. Lawrence Ave. to Dauphin Ave., 87th Pl., St. Lawrence Ave. to Dauphin Ave., 88th St., St. Lawrence Ave.

Items marked thus ✤ indicate work now open for bids.

to Dauphin Ave., 88th Pl., St Lawrence Ave. to Dauphin Ave., 89th St., St. Lawrence Ave. to Dauphin Ave., 89th Pl., St. Lawrence Ave. to Dauphin Ave., Dauphin Ave., 87th St. to 90th St., 8,964 lin. ft., $.59, David Walsh, 6628 South Chicago Ave

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, secretary, for constructing sewers in the following streets: S. 48th Ave., W. Jackson St. to W. Van Buren St., 710 lin. ft., 12-in. tile pipe, average depth 10.5 ft., 4 manholes, 4 catch basins, M. Pontorelle, 4817 W. Dakin St., $1,079; S. 48th Ave., W. Monroe St. to W. Jackson St., 990 lin. ft., 12-in. tile pipe, average depth 10.5 ft., 7 manholes and 9 catch basins, Nicholas & Angelo Mancini, 900 W. Taylor St., $1,524; Humboldt Ave., N. 44th Ave. to N. 43rd Ave., 680 lin. ft., 12-in. tile pipe, average depth 8.0 ft., 4 manholes, 1 catch basin, Nicholas & Angelo Mancini, $649; N. Maplewood Ave., Irving Park Blvd. to Belle Plaine Ave., 670 lin. ft., 15-in. tile pipe, average depth 9.5 ft., N: Maplewood Ave., Belle Plaine Ave. to Berteau Ave., 670 lin ft., 12-in. tile pipe, average depth 8.0 ft., 10 manholes, 15 catch basins, Wm. Healy, 101 Washington St., $1,809; S. Stony Island Ave., E. 75th St. to E. 76th St., 610 lin. ft., 12-in. tile pipe, average depth 12.0 ft., E. 75th St., Stony Island Ave. to Alley east of Washington Ave., 420 lin. ft., 12-in. tile pipe, average depth 9.0 ft., 9 manholes and 4 catch basins, Tirtilli & Scully, 518 W. Taylor St., $1.596; S. Spaulding Ave., W. 38th St. to W. 37th Pl., 340 lin. ft., 12-in. tile pipe, average depth 11.0 ft., W. 37th Pl., S. Spaulding Ave., 290 ft. west, 330 lin. ft., 12-in. tile pipe, average depth 10.0 ft., 6 manholes, 5 catch basins, M. Pontorelle, 4817 W. Dakin St., $948; Oglesby Ave., E. 79th St. to E. 78th St., 610 lin. ft., 20-in. tile pipe, double strength, average depth 12.0 ft., 5 manholes and 6 catch basins, Tirtilli & Scully, 518 W. Taylor St., $1,842; W. 111th St., Eggleston Ave. to Halsted St., 320 lin. ft., double invert. brick sewer, 2 ft. internal diameter, average depth, 13.0 ft. W. 113th St. Stewart Ave. to Eggleston Ave., 335 lin. ft., double ring brick sewer, 2½ ft. internal diameter, average depth 13.0; W. 113th St., Eggleston Ave. to Parnell Ave., 660 lin. ft., double invert. brick sewer, 2 ft. internal diameter, average depth 14.5; Eggleston Ave., W. 112th St. to W. 113th St., 670 lin. ft., 12-in. tile pipe, average depth 10.5 ft., Eggleston Ave. 113th St. to 114th St., 660 lin. ft., 15-in. tile pipe, average depth 9.0 ft., Eggleston Ave., 114th St. to Alley, north of W. 115th St., 495 lin. ft., 12-in. tile pipe, average depth 8.0 ft., Butler St., W. 111th St. to W. 113th St., 1,330 lin. ft., 12-in. tile pipe, average depth 9.5 ft.. Butler St., W. 113th St. to W. 114th St., 660 lin. ft., 15-in. tile pipe, average depth 9.5 ft., Butler St., W. 114th St., to Alley, north of W. 115th St., 495 lin. ft. of 12-in. tile pipe, average depth 8.0 ft., Parnell Ave., W. 111th St. to W. 113th St., 1,325 lin. ft., 12-in. average depth 9.0 ft., Parnell Ave. W. 113th St. to W. 114th St., 660 lin. ft., 15-in. tile pipe, average depth 10.0 ft., Parnell Ave., 114th St. to Alley, north of W. 115th St., 495 lin. ft., 12-in. tile pipe, average depth 8.0 ft., 69 manholes and 100 catch basins, Nicholas & Angelo Mancini, 900 W. Taylor St., $19,823.

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Room 302, City Hall, for furnishing and laying water service pipe in the following streets: Westtern Ave., Montrose Ave. to Lawrence Ave., 2,788 lin. ft., $.69 per ft.; Jas. H. Roche, 222 E. 31st St.; Ave J., Indianapolis Ave. to 106th St., 488 lin. ft., $.73 per ft., Jas. J. Renn, 367 W. Chicago Ave.; Whipple St., Addison Ave. to Elston Ave., Jas. H. Roche, $.79 per lin. ft.; Lunt Ave, N. Clark St. to point 520 ft. east of Sheridan Rd., 604 lin. ft., $.65 per ft., Jas J. Renn; Dauphin Ave., E. 90th St. to E 92nd St., 342 lin. ft., $.68 per ft., Jas. J Renn; 87th St., 87th Pl., 88th St., 88th Pl., 89th St., 89th Pl., St. Lawrence Ave. to Dauphin Ave. and Dauphin Ave. to 87th St. to 90th St., 8.964 lin. ft., $.59 per ft., David Walsh, 6628 S. Chicago Ave.

Plans for diverting the Evanston sewer system have been outlined by Commissioner of Public Works Moore, before the Evanston Commercial Association. Of two possible plans he named, one contemplated a 10 ft. trunk sewer along Lake St., from the lake to the drainage canal, and the other contemplated a trunk line along Howard Ave., from the lake to the canal. The first plan would cost about $1,000,000, the second $1,400,000.

Indiana.

The C. L. Olds Construction Co., of Fort Wayne, Ind., has been awarded a contract for the installation of a waterworks system in Bronson, Mich.

Bids received by City Clerk L. E. Webb, of Shelbyville, Ind., on Nov. 1, for the construction of a sanitary trunk sewer system in that city, were rejected, and the work will be readvertised.

Iowa.

C. H. Hubbel has been awarded the contract for the construction of the Pleasant St. sewer, by the Board of Public Works of Davenport, Ia.

Kansas.

C. R. Nichols, of Caney, Kan., has been awarded the contract in West Liberty, Ia., for the construction of a sewer system in that town, for $28,684.

Civil engineers are preparing plans and specifications in Lyons, Kan., for a sewer system for that town. It will require three months to complete the plans.

Plans are being prepared by J. S. Worley Co., 206-7 Reliance Bldg., Kansas City, Mo., for the construction of a waterworks for Altoona, Kan.

The J. S. Worley Co., 206-7 Reliance Bldg., Kansas City, Mo., is preparing plans for the construction of a waterworks for Coldwater, Kan.

J. S. Worley Co., of 206-7 Reliance Bldg., Kansas City, Mo., has completed plans for the waterworks and light plant improvements for Stafford, Kan.

Kentucky.

✣Bids will be received until Dec. 2, by Commissioners of Sewerage, of Louisville, Ky., for the construction of a sewer known as "8th and St. Catherine Sts. Sewers" Contract No. 75. The work will consist of the construction of about 3.250 ft. of 26-in., 42-in. and 48-in. concrete sewer, including about 1,150 cu. yds. of concrete and the excavation will be from 12 to 18 ft. deep. J. B. F. Breed is Chief Engineer

Bids for the erection of the water softening plant for Owensboro, Ky., were opened Nov. 1 by the City Council of that city, as follows: National, $22.475; Fetter, $20 414; Booth Co., $22,125; Kennicott, $25 900; Pittsburg Manufacturing Co., $37.300; Northern Co., $22 000. In the bids the excavation runs from $600 to $5.000, the machinery from $8,500 to $18 500, and the concrete work averages about $10,000.

Maryland.

City Engineer B. T. Fendall, of Baltimore, Md., has included in his departmental estimate for next year an additional $15,000, with which it is proposed to construct a sewer in the bed of Old Liberty Rd., east of Garrison Ave., and connecting with a sewer constructed for diverting drainage from the new high service reservoir.

Following bids were opened by the board of awards of Baltimore, Md., Nov. 2 for sanitary contract No. 57, lateral sewers in district 34-A: The Whiting-Middleton Constr. Co., Sexton Bldg., Baltimore, Md., $85,461; B. F. Sweeten & Son, 820 Sharp St., Baltimore, Md., $104,578; Irwin Brothers, 330 N. Gay St., Baltimore, Md., $108,913; D. V. Ault & Co., Knickerbocker Bldg., Baltimore, Md., $110,064; Wm. McCarthy & Co., American Bldg., Baltimore, Md., $114,063; Ryan & Reilly, Amer[illegible] Bldg., Baltimore, Md., [illegible]

Massachusetts

✣[illegible] will be received [illegible] p. m., Dec. 12, by Board of Public Works, Pittston, Mass., A. B. Farnham, Engineer, for the construction of a dam and reservoir. The dam will consist of cyclopean stone concrete masonry, faced with concrete blocks or ashlar on the upper side, and there will be concrete core-walls at the ends. The site of the reservoir above the dam is to be cleared and grubbed and soil is to be removed. A road about 8,500 ft. in length and about 16,000 ft. of diversion conduits are to to be constructed for the purpose of diverting water into the proposed reservoir. Some of the diversion conduits will be open channels, some vitrified pipes and some concrete. The construction work will be about 47,000 cu. yds. of masonry, about 85,000 cu. yds. of earth excavation, about 9,600 cu. yds. of rock excavation, about 45 acres clearing and grubbing, about 4,000 lin. ft. of 12, 20 and 24-in. vitrified pipe, and about 1,300 cu. yds. of paving.

The Board of Public Works of Battle Creek, Mich., has recommended new water mains on the following streets: Echo St., south from High, 250 ft.; Lulu Ave., west from Meachem, 580 ft.; Margaret St., from Spencer to Stile St.; Oakland Ave., west to Howland, 130 ft.; Emmett from Central to Chestnut and on Chestnut south 100 ft.; on Hall St., east of Mott, 50 ft.; on Mott St., 140 ft.; extensions of present mains; Burnham St., east 400 ft.; extensions of present mains; Burnham St., east 400 ft.; East Ave., south 150 ft.; Tennyson Ave., east 100 ft.

Charles B. Hayes, of Kalamazoo, Mich., has offered that city $15,000 to build the Fulford St. sewer. The route of the proposed sewer is from the main sewer on Lake St. southerly on Fulford St., to the right of way of the G. R. & I. Railroad, thence across the right of way, thence south on Fulford St., to the alley between the Lane and Lay Blvds., thence to the end of Cameron St.

The City of Caro, Mich., has received the following bids for the installation of a sewer system, for which Riggs & Sherman, of Toledo, O., are the engineers; the contract being awarded to the lowest bidder: Jas. W. Collins, Flint, $7.392; Louis Jagnaw, Jackson, $8,894; W. N. Sager, Sarginaw, $9.046; Geo. C. Penney, Toledo, $9,075; Vanderweele Bros., Grand Rapids, $9 252; E. M. Sheflow, $10,081; J. T. Lynch, Flint, $10,731; Peter Peterson, 2 Nick Maker, Bay City, $10,826.

Minnesota.

✣Bids will be received until 7:30 p. m., Nov. 25, by City Council of Minneapolis, Minn., for furnishing for use in the Waterworks Department, one or two electric-driven centrifugal pumps.

✣Bids will be received until 2 p. m., Nov. 21, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Pusey St., from the center of Tallula Ave. to a point 240 ft. north. R. L. Gorman is Clerk of the Board.

The City Council of Virginia, Minn., has decided to establish sewer district No. 4. This district takes in the Northside, Pillsbury and Rooney additions.

The City of Albert Lea, Minn., has awarded the contract for the construction of a new lateral sewer to Illstrup & Olson.

Mississippi.

Plans are being prepared by Walter G. Kirkpatrick of Jackson, Miss., for the construction of a $160,000 sewer system in Lake Charles, La. T. H. Mandell is city engineer.

Missouri.

J. B. Hodgdon & Co. has been awarded a contract in Galena, Mo., for the construction of sidewalks, curb and gutters on Joplin St., between First and Third Sts.

Plans have been made by Michel & Cook, of Joplin, Mo., for the construction of a new sewer system in Granby, Mo., at an estimated cost of $18,000. J. W. Dale is Mayor.

Nebraska.

✣Bids will be received until noon, Nov. 18, by Roscoe C. Ozman, City Clerk, Lincoln, Neb., for the construction of plumbing and sewer connections at the F. St. pumping station and in the F. St. Park.

✣Bids will be received until noon, Nov. 18, by Roscoe Ozman, City Clerk, Lincoln Neb., for the construction of sewers in sewer district No. 113, being the alley between T. and U. Sts., from 22d to 23d Sts

New Jersey.

✣Bids will be received [illegible] by W. C. Van Duyne, C. E., 267 North 18th St., East Orange, N. J., for the construction and for furnishing all labor, tools, appliances, etc., and materials necessary for the construction of a certain section of storm sewer at Bloomfield Ave. and North 13th St. in the City of Newark, N. J.

The South Amboy, N. J. City Council, on Nov. 1, opened bids for the laying of 10,000 ft. of house connections to city sewers, and awarded the contract to Collins & Gundrum for $.50 per ft. Bids were also opened for the building of Section 2 of the city sanitary sewers, as follows: J. B. La Rorke, $49,350; Fusco Construction Co., $43,720; Liddle & Pfeiffer Co., $40.575; Cantrell Construction Co., $33,440; Johan Jensen, $29,050; P. J. Monaghan, $26,750. This contract was given to P. J. Monaghan, of South Amboy.

The Bloomfield Town Council has awarded the contract for the proposed Watsessing storm sewer to James J. Boylan, of Belleville for $10,781.

New York.

Bids totaling 64 were received Nov. 1 at Long Island City for the construction of the Richmond Hill sewers. The section on which bids were received and the lowest bid on each were as follows: Lefferts Ave., from Liberty Ave. to Ulster Ave., Thomas G. Garlin, $59,130; Lefferts Ave., from Ulster Ave. to Rockaway Rd., and in Rockaway Rd., from Rockaway Rd. to Panama St., Thomas G. Garlin, $77,758; Panama St., from Blake Ave. to Rockaway Rd., William Kelly, $60,058; Panama St., from Vienna Ave. to Blake Ave., William Kelly, $55,156; Panama Ave., from Cozine Ave. to Vienna Ave., William Kelly, $90,225; Panama St., from Jamaica Bay to Cozine Ave., William Kelly, $53,590. The Hicks-Johnson Construction Co. was the lowest bidder on the construction of a sewer in Seneca Ave., from De Kalb Ave. to Putnam Ave., and from Cornelia Ave. to Myrtle Ave., and in Himrod St., from Seneca Ave. to the Brooklyn Borough line, and in Putnam Ave., from Seneca St. to Myrtle Ave. The price was $58,956.

The citizens of Lawrence, L. I., contemplate constructing a sewer system and recently held a meeting to discuss plans of various disposal plants. The committee on sewers intends to invite the taxpayers of Cedarhurst and Woodmere to co-operate with it in order that a system of sewers for the three villages may be built.

The supervisors at Mineola, L. I., have approved a plan allowing the town of North Hempstead to issue bonds to the amount of $108 000 for the installation of a water system in the village of Roslyn.

The New York State Water Commission has approved the City of New York's application for permission to construct the proposed system of distribution for the new Catskill water supply. Within a few years New York will have 5 000,000 gals. a day added to its supply. It is expected that the system will cost about $25,000,000. The water will be brought into the city through a pressure tunnel.

Ohio.

✣Bids will be received until noon, Nov. 16, by John S. Heeter, Clerk of the Board of Public Affairs of the Village of West Carrolton, O., for the necessary labor and material for the proposed extension and improvement of the water works.

✣Bids will be received until noon, Nov. 28, by Director of Public Service, E. C. Yochem, Clerk, Galion, O., for the construction of sanitary sewer in the 5th District of the city. The work includes 2,080 ft. of 15-in. sewer; 247 ft. 12-in. sewer; 1,218 ft. of 10-in. sewer; 8,205 ft. of 8-in. sewer; 1,131 ft. of 6-in. sewer; 4,123 ft. of 4-in. sewer. Henry Hocker is Director.

✣Bids will be received until Noon, Nov. 28, by Director of Public Service, W. B. Mitchell, Secy., Piqua, O., for the necessary labor and material for the construction of a sewer on parts of Vine St., Madison Ave. and Lincoln St.

Waterworks Superintendent Laidlaw of Cincinnati, O., has completed an estimate of the cost of installing city water into the six suburban places which voted for annexation at the last election. The total cost will amount to $205,000, for which water bonds have to be issued. College Hill, Mount Airy, Sayler Park, Carthage, Madisonville and Mount Washington are the annexed districts.

C. A. Childers has been awarded the contract in Alliance, O., for the building of what is known as the old fair grounds storm sewer and the building of North Union sanitary sewer from Vine St. to Selby St.

Joseph Degnan, of Toledo, O., was the lowest among 16 bidders for sewer improvements in Bellefontaine, O., at $46,010.

The engineer's estimate on the proposed sewer in North Defiance, O., has been accepted by the City Council. The estimate is $4,206.

Noah Myers has been awarded the contract in Circleville, O., for the new sanitary sewer extending from Mill St. on west boundary alley, to Main, east on Main to Schumm's flats, and from the intersection of Court and Main to the north line of Seyfert's Park, and from Mill north on Scioto to High, for $12,736.

The Board of Control of Bucyrus, O., has authorized the public service to enter into a contract with Riggs & Sherman, Sanitary Engineers of Toledo, O., to prepare plans and specifications for the intercepting sewer, and sewerage disposal plant for that city. The board will be ready to let the contract by March 1, 1911.

An ordinance has been passed by the City Council of Cincinnati, O., authorizing the director of Public Service to enter into contracts for furnishing, delivering and laying of cast-iron pipe and special castings in Sixth St., Hillside Ave., Anderson's Ferry Rd., and lower River Rd., for the supply of water to the annexed village of Delhi, the cost not to exceed $91 000.

John Snyder, of 4436 Forest Ave., Norwood, O., has been awarded the contract for the installation of a sanitary sewerage system in the city of Carthage, O., for $45,321. Bids were opened Nov. 8. Lewis Hall is Clerk of the village.

The City Hall Commission of Cleveland, O., has awarded the contract for drainage work on the new City Hall site to Hoag & Zullo for $25,800.

Oklahoma.

Plans have been made by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the construction of a sewer extension outlet in Cherokee, Okla., for $16,000, estimated cost. Contract for the work will be let in January.

The citizens of Fairfax, Okla., on Nov. 1, voted in favor of the proposition of installing a waterworks and sewerage system.

The United Construction Co., of Vinita, Okla., has been awarded a contract in Neosho, Mo., for the construction of a sewer system in that city, for $34,950. Bids were opened Nov. 1. Wm. Warden is city clerk.

Oregon.

The contract for the construction of the main sewer has been let by the City Council of Brownsville, Ore., to John R. Penland, of Albany, for $1,500.

The most important improvement projected for the East Side of Portland, Ore., next year, is the Sullivan's Gulch main sewer, which will embrace the territory north and south of Sullivan's Gulch as far east as the city limits not now provided with sewerage. It will include 3,771 acres and about 24,000 lots. The cost of the system is estimated at $274,899. The cost of extensions, laterals and connections will increase the cost to more than $1,000,000.

The Executive Board of Portland, Ore., has awarded the contract for the construction of the Riverside District sewer, Lower Albina, to William Lind, for $132,200. The main trunk sewer will be more than one and one-half miles long, with laterals extending over a wide area, and will be constructed of cement pipe.

Plans are being prepared by City Engineer J. W. Morris, of Portland, Ore., for the construction of the Moreland sewer, which will be installed during the coming year. According to the present plans 1,350 acres will be included in the new drainage system. The districts that will be benefited are Berkeley, portions of Woodstock, Westmoreland and Eastmoreland, and the districts of City View Park, Sellwood and Midway. The main trunk sewer will be more than two miles long and will cost nearly $250,000. The entire system will exceed a cost of $500,000.

The Northwestern Engineering Corporation of Portland, Ore., is the engineer for the proposed gravity water supply for the City of Pasco, Wash. An irrigation system will be installed and it is the intention to tap the main pipes of the Pasco Reclamation Co., adjacent to the city, and supply water to property owners by means of wooden pipes layed in the streets. L. D. Conrad is City Clerk.

Pennsylvania.

✣Bids will be received until 8 p. m., Nov. 16, by Meadville, Pa., for the construction of sanitary sewers in Alden St., extension from the terminus of the present sewer extending eastwardly to city limits; in Alfred St., from a point 200 ft. south of Arch St., south to connect with the Pine St. sewer. Fred Kiebort is City Clerk.

The American Steel Foundries Co., has awarded to William McIntyre & Sons, the contract for the construction of a 12-in. sewer, 3,500 ft. in length, to connect with its dwelling houses on McClure Ave., Sharon, Pa.

The City of Pittsburg, Pa., on Nov. 8, voted bond issues for public improvements as follows: $570 000 for improving the Try St., Soho run and Negley run sewer systems; $3,100 000 for giving filtered water to the North Side and otherwise improving the water service.

The citizens of Lebanon, Pa., voted on Nov. 8 on the proposition of installing a sewer system.

W. S. Hanna, engineer, with J. B. Hogg, at Pittsburg, Pa., is working on the plans and specifications for a swerage disposal plant for Union town, Pa.

The City of Connellsville, Pa., has engaged W. S. Hanna, who at present is with Engineer J. B. Hogg, of Pittsburg, Pa., to prepare plans and specifications for a sewerage disposal plant.

The citizens of Norwood, Pa., on Nov. 8, voted on the proposition of issuing bonds to the amount of $50 000, the proceeds to be used for new pavements and the completion of the sewerage system. The Norwood Borough Improvement League is back of the movement.

Rhode Island.

The right-of-way for the extension of the Kinsley Ave. sewer, above Eagle St., has been secured by the City of Providence, R. I., and the work on the construction of the last link of the sewer system to the west will begin soon. The plans for this addition include the erection of a concrete retaining wall along the Woonasquatucket River, from a point about 100 ft. west of the Eagle St. bridge, to Ericson Pl., a distance of about 300 ft. The wall [illegible] ft. thick at the top, and 12 ft. high.

Contracts for the construction of several sewers in Providence, R. I., have been awarded to F. E. Shaw, by the Board of Contract and Supply [illegible] and Union Ave., Shaw, $10 773; Allen's Ave and Public St., Shaw, $4 251; Rodman St., $1,131; Everett Ave., $1,476. The award for the Atwell's Ave. and Fricsson Pl. sewer was made to Charles Crankshaw for $13,717.50. The contract for cast-iron water pipe was awarded to the Standard Cast Iron Water Pipe and Foundry Company, Bristol, Pa., the bids on [illegible] $21.40, $21.60 and $22.10 per ton.

South Carolina.

✣Bids will be received until Noon, December 7, by City of Timmonsville, S. C., for the construction of storm water drainage system; to include 6,000 ft. of lateral drains, consisting of brick and concrete and terra cotta pipe from 12 to 36-in. diameter, catch basins, manholes, storm water inlets, etc. J. N. Johnston, Florence, S. C., is Engineer.

✣Bids will be received until Noon, December 7, by Commissioners of Public works, Timmonsville, S. C., for the materials and constructing a system of water works for the city. The work will require the following: 429 tons of cast iron pipe, 10 tons of special castings, 52 fire hydrants, gate valves, valve boxes, etc.; a brick reservoir and pumping station, 100 H. P. boiler, a fire service pump and air compressor, a deep well, a steel tank and tower, approximately 5 miles of pipe laying 4-in., 6-in. and 8-in. The estimated cost of the work is $40,000. J. N. Johnston, Florence, S. C., is Engineer.

South Dakota.

The town of Leola, S. D., has voted $4,500 bonds for the installation of a waterworks.

Arrangements have been completed in Ardmore, S. D., for the installation of a municipal water works system, for which the necessary bonds will be issued.

Texas.

✣Bids will be received until 8 p. m., Dec. 3, by J. D. Yocom, City Secretary, Denison, Texas, for furnishing f. o. b. Denison, Texas, necessary pumping machinery to equip proposed pumping station at Shawnee reservoir.

Plans have been prepared by J. M. Preston, City Engineer, Dallas, Tex., for the construction of a new reservoir dam, pumping plant, etc., in connection with the city waterworks, at an estimated cost of $500,000. A new pipe line is also to be constructed on Sycamore St. The contracts for this work are now being let.

The question of constructing a sewerage system in Yoakum, Tex., is again being agitated, and a joint committee appointed by the Mayor and the Commercial Club has formulated a plan to be presented to the Council.

Two propositions have been presented to the City of Cuero, Tex., to put in a sewer system, one by a private corporation and one for city ownership.

The Bartlett-Williamson Co., Bartlett, Tex., is being organized in that city to put in a $12,000 sewerage plant for the city. Plans for the system have been prepared.

The City of Dallas, Tex., has rejected all bids for the $650,000 issue of bonds, which include $350,000 for street improvement; $100,000 for sanitary sewer, public school and waterworks.

The contract for the erection of the pumping station at White Rock reservoir, Dallas, Tex., has been awarded to the Hughes-O'Rourke Construction Co., for $30,050.

Theodre Stegner, of Kansas City, Mo., has made a proposition to take over the city water and light plant of Brownsville, Tex., and operate the same.

The city waterworks department of Galveston, Tex., is preparing to renew the old pipe line connecting the city water system with pipes running to Fort Jacinto, having a diameter of 6 in.

Bids will soon be asked by the City Secretary of Dallas, Tex., for the installation of a 6-in. sanitary sewer in Convent St., from the 12-in. sewer at Mill Creek to St. Josephs St., and south in St. Josephs St.

The city commission of Dallas, Tex., has been petitioned for the extension of the water mains on Madison Ave., between Sixth and Canty St., Oak Cliff.

The Dimmick Pipe Co. has been awarded the contract, by the city commission of Dallas, Tex., for furnishing water pipe, to be used in connection with the work at White Rock reservoir, as follows: 700 tons in sizes of 6, 8, 10 and 16 ins. for $25.89 per ton and $49.75 per ton for specials, f. o. b. Dallas.

As a result of a recent election held in Denison, Tex., the city commissioners have adopted an ordinance for the issuing of $50,000 bonds for the local waterworks system.

The city of Ballinger, Tex., has voted unanimously for the issuance of $16,000 worth of bonds to be used in extending the waterworks system and otherwise improving the plant.

Citizens of Betterton Addition, Oak Cliff, Dallas, Tex., have petitioned the city commissioners to extend the water mains along Polk Ave., from Ewing Ave. to Sutton St.

The city of Georgetown, Tex., will sell bonds in about 30 days to the amount of $15,000 for the purchase of the waterworks plant. The plant will be purchased for $13,500 and immediately will be enlarged and improved. At present the plant is owned by W. N. Coler & Co., of New York City.

The citizens of Maxwell, Tex., recently met and perfected arrangements to establish a waterworks system in that town.

The contract for laying the city main across the channel in the Galveston causeway, Galveston, Tex., has been awarded by the city commissioners to the A. M. Blodgett Construction Co., for $8,000.

At a recent election held in Ballinger, Tex., it was voted to issue bonds to the amount of $16,000 for improving the waterworks system.

The citizens of San Augustine, Tex., have voted the issuance of bonds for the purpose of installing a waterworks system.

The city council of Pecos, Tex., has voted to call a special election December 3 to vote on an issue of $25,000 in bonds for the construction of a sewerage system. Engineers from Dallas, Kansas City, and local engineers have submitted tentative plans for the system.

The Assistant Attorney General, Caldwell, Austin, Tex., has approved the following bond issues for the city of Snyder, Tex.: $27,000 for water works, and $17,000 for sewers.

Capt. A. B. Wolvin of the Texas City Land Co., has announced that his company will expend $1,500,000 for improvements at Texas City, Tex., including a sewer system to cost approximately $500,000.

The attorney general's department at Austin, Tex., has approved bond issues as follows for the city of Dallas, Tex.: $100,000 sewer bonds; $100,000 water works bonds, and $350,000 street bonds.

The City Council of Terrell, Tex., has ordered a special election for Nov. 10 to determine whether $3,000 in bonds should be issued for the construction of sewerage and other improvements at the Central High School building.

Virginia.

Contracts have been awarded by the town Council of Highland Park, Richmond, Va., for a complete system of water works to cost in the neighborhood of $45,000, as follows: I. J. Smith & Co., Richmond, for wells, trenches, pumps and pumphouses, $4,885; The Glamorgan Pipe & Iron Co., of Lynchburg, for hydrants, pipes and valves, $25,000; Contracts for engines and tanks, to cost about $10,000 were not awarded.

The council committee on water, Richmond, Va., has authorized the construction of a 12-in. water main in Shepherd St., to the property of the Southern Benedictine College.

Washington.

The City Council of Snohomish, Wash., has awarded the contract for the laying of the Maple St. sewer, from Fifth to First and on First one block west to the trunk sewer to Philips & Son for $3,035.

The Chehalis, Wash., City Council passed the ordinance for installing a $55,000 sewer district in the southern and eastern part of the city. The contract will not be let until next spring.

Commissioner N. Lawson and Owen Woods of Tacoma, Wash., have awarded a contract to P. E. McHugh at $49,190 for laying a new tideflat water system.

The city council of Spokane, Wash., has ordered steel mains laid in Cable addition at an approximate cost of $16,000. The new mains are to replace old wooden mains put in four years ago.

The Chamber of Commerce of Seattle, Wash., has adopted a report submitted by its committee, on taxation, in favor of the bond issue of $46,000, for the construction of a masonry dam to enlarge the city's water supply reservoir.

City Engineer G. N. Miller of Ellensburg, Wash., has started his preliminary survey of a water system from Lake Cle Elum to Ellensburg.

The City Council of Pasco, Wash., on Oct. 26 passed a resolution declaring the intention of calling a special election for the purpose of voting upon the matter of the city purchasing its own water system. The estimated cost of an adequate system is $39,500.

West Virginia.

Plans have been made in Moundsville, W. Va., for the construction of a new sewer system at an estimated cost of $166,900. J. M. Williamson is at present in charge of the work.

The city council of Wheeling, W. Va., has accepted the bid of Trimble & Lutz for installing the proposed water system to supply residents of Wheeling Heights. The system will include two pumps with a capacity of 18,000 gals. each and two tanks with a capacity of 20,000 gals. each. The entire system will cost $3,272.

Wisconsin.

The Milwaukee, Wis., Sewerage Commission composed of Harrison P. Eddy, of Boston; George C. Whipple, of New York, and John W. Alvord, of Chicago, is completing its report to the City Council of that city. The problem is to avert contamination of water.

Plans for the proposed sewer system for Stoughton, Wis., have been approved by the City Council. Four acres of land have been purchased for septic sewage disposal tanks.

The Pastoret-Lawrence Co. has secured the contract in Rice Lake, Wis., to lay about 4,548 ft. of water main on the west side for $0.23 per lin. ft. The contract calls for a ditch 7 ft. deep.

Plans for the proposed city sewerage system have been approved by the city council of Stoughton, Wis. The city has purchased four acres of land in the eastern portion of the city for septic sewage disposal tanks.

Canada.

✣Bids will be received until 6 p. m., Nov. 18, by Frank Ness, Secy.-Treas., St. James, P. O. Manitoba, for sinking a well at the corner of Ness Ave. and Brooklyn St. in D. G. S. 35, St. James.

A by-law to provide for the construction of seven miles of sewers in Calgary, Alta., which will cost $72,000, has been submitted to the City Council. The sewers will be laid in Hillhurst and Sunnyside, and strips on First and Second Aves., east; and in East Calgary, on Fifth Ave., east of Fourth St., will be completed.

The citizens of Chippewa, Ont., on Oct. 26 defeated the proposition to bond the corporation to the extent of $30,000 for the installation of a new waterworks system.

Civil Engineer Howard, for Montreal, Que., has recommended the following sewers to be laid in the city: Demontigny, from the City Hall to St. Elizabeth St., cost $1,000; Iberville St., to drain that street and Poupart St., cost $7,000; St. Ferdinand St., cost $600. It is also recommended that a sewer be constructed at this point between St. James and Notre Dame St., as the present one is too small. The cost of this is estimated at $4,010.

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CHAS. S. HILL . . . . }
C. T. MURRAY . . . . }
H. P. KIRKLAND . . . . }
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The Law of Compensation Proportionate to Performance.

Among the ten fundamental laws of business management, as formulated by Gillette and Dana in their work on "Cost Keeping and Management Engineering," the most important is the seventh: "All payments for work should be proportionate to work done." There are five ways in which business managers have attempted to follow this law, where they have attempted it at all, namely:

1. By the payment of higher wages or salaries to the most skillful and most intelligent individuals.
2. By payment of a wage with a sharing of profits.
3. By payment per unit of work done.
4. By giving a bonus, commission, or the like, in addition to a regular wage or salary.
5. By a combination of two or more of the foregoing methods.

The first method is a crude attempt to follow the fundamental law of economic management. The degree of its crudity depends upon the conditions of supply and demand in the labor market, the [illegible] of labor unions, and the [illegible] employers [illegible] individual employes. [illegible] by the payment of managers, superintendents and foremen. In a rough way, the employer measures the productive efficiency of each man, and attempts to reward them by higher salaries for increased profits due to their skill or energy. When, however, we come to the compensation that men in the ranks receive under the wage system, we find far less intelligence displayed by employers. Here are large bodies of men, classed almost alike as to wages, regardless of individual ability. Can we wonder at the restlessness of the wage earner under such a system? Can we find fault with him for listlessness? Is he to be blamed for listening seriously to socialistic doctrines? The wage system in its present form [illegible]. Those managers who abandon it first are the ones most likely to win greater profits for themselves while giving greater income to their employes.

The second system of payment has been widely advocated in years past, but, in spite of frequent trial, has never become strikingly effective. Its drawbacks are many. To be perfectly fair, a profit sharing plan involves its converse—a loss sharing plan. If employes are to receive extra compensation in the fat years, they should suffer a deduction from their wages in the lean years, which none as yet has been found willing to do. Even a more serious objection, however, is that a profit sharing plan violates the law of prompt reward. The average workman lacks enough imagination to work hard today that he may receive a profit a year hence. Finally, the profit sharing plan fails miserably, when applied by itself, because it fails to appeal sufficiently to the instinct for individual supremacy. It fails for the same reason that socialism must fail, because it asks the energetic to share with the lazy, the wise with the foolish.

The third method of payment is amazingly effective wherever it can be applied. Unfortunately it is difficult of application except in the payment of managers and employers. The manufacturer, the farm owner, the contractor and the railway owner, are paid per unit of product. The fundamental law of social economics—payment in proportion to performance—is applied in their cases, and with results that can leave no doubt whatever about the superiority of creating individual incentive. Yet the very men who are themselves thus driven to work with the greatest energy, the employers—have usually failed to apply to their employes this system of payment per unit of product.

In seeking a reason for this anomaly we need not look far. A contractor, for example, receives 20 cts. per cu. yd. for excavation, involving the use of a steam shovel and car plant. His employes are engaged in many different duties—some running the shovel, some on the dirt trains, some on the dump, some laying track, some repairing cars and track, and so on. It is practically impossible to pay each of these classes of men on the basis of the cubic yard of excavation, and do so with any measure of justice. The yardage output secured by the steam shovel gang is dependent not only upon their own efforts, but upon the size and condition of the shovel, the depth of the cut, etc. Yet they might be fairly satisfactorily recompensed on a yardage basis. On the other hand, the crews on the dirt trains perform work that is not closely measurable in terms of the cubic yard at all. Still less so is the work of the track layers, and of the repair men thus measureable. Difficulty of apportioning payment on the yardage basis is so great that it is rarely attempted. Even to a greater degree would it be impracticable to pay the employes of a street railway system on the basis of the passengers carried—for that is the unit in which the street railway company itself is paid.

Piece rate payment is a unit price system for the employe in which the unit usually differs from that in which the employer is paid. Avariciousness of employers has doubtless led to the disrepute under which the piece rate plan now labors. Added to this we have the socialistic influence so strongly manifest in most labor unions. Between the employers who constantly seek excuses to cut piece rates as productiveness increases, and the organized employes who aim to secure pay for the poorest workman equal to that of the best, the piece rate system has been prevented from attaining the popularity that it really deserves.

[illegible] has been slowly growing in popularity, and seems destined to find a wider application than any other method of compensation, unless we except the fifth plan, which, as yet, has been tried too infrequently to admit of satisfactory comparison with the others. The bonus system was probably first applied extensively in the payment of traveling salesmen, who received a salary plus a commission on sales effected. Perhaps a claim to priority might be raised for the "tipping system" of paying waiters, which is essentially a bonus system wherein the patron pays the bonus. In passing, we may add that the persistence of the tipping system is due to the fact that it secures better service through the stimulus that the tip—the bonus—creates. So long, therefore, as no better application of the bonus system in restaurants and hotels is devised, the tipping system will retain popularity.

A few farsighted merchants have adopted a bonus system for paying their clerks. Each clerk receives a small commission on the sales that he effects, in addition to his salary. The result is unquestionably more intelligent and more obliging service, which, in turn, draws more custom.

The greatest difficulty that usually arises in attempting to apply the bonus system is the difficulty of finding satisfactory units in which to measure the output of employes of each class, and particularly of individuals. How, for example, shall the work of train conductors be measured? In train-mile units? The train-mileage, however, is only to a degree within the control of the train crew. Yet we believe that any well conceived plan of paying train crews a bonus on train-mileage would aid remarkably in increasing the present average mileage performance, just as certainly as bonus for small coal consumption has effected marked reduction in fuel used on locomotives.

To contractors who adopt the bonus system and apply it justly, even liberally, there will come not only greater profits than they now receive, but the satisfaction of having aided in bettering the condition of their employes.

To engineers who introduce the bonus system in the management of public utilities, will come positions of large emolument and the respect of the world. Such engineers will raise the status of their entire profession, to a managerial science.

Some Analyses of the Cost of the Tri-Borough Subway New York City Based on Bidding Prices.

The unit bidding prices of the lowest bidder for each of the 21 contract sections of the New York Rapid Transit subway known as the Tri-Borough Subway, are given in our Contract News Section this week. These tables of prices are original in arrangement, having been compiled from the scattered data contained in the specifications and blue print bid sheets of the Public Service Commission, and they are the first tables printed which permit immediate and direct comparison of unit prices for each item of work for every contract section as those prices were set by the low bidder on each section. Such comparison is obviously only of general interest and value without a close knowledge of the differences in conditions and details between sections which can be had only from the detailed plans, but for such value as it may have the comparison is given in our tables. A more useful study, in many respects, is a comparison of mileage costs as represented by the low bidder's prices.

The portions of the Tri-Borough Subway for which bids were received on Oct. 27, 1910, aggregate 16.37 miles of two, three and four-track line. This mileage of line was divided into 21 contract sections and bids were re-

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ceived for each section. The following statement shows the general subdivision:

Route.	No. Sections.	Miles.	Price Bid.
5	16	10.17	$58,746,650
20	2	1.00	13,766,553
9	3	5.20	11,924,357
Total	21	16.37	$84,437,560

Route 5 runs lengthwise of Manhattan Island from the Battery to beyond the Harlem River; Route 20 is a short approach line to the Manhattan end of the Manhattan Bridge across the East River, and Route 9 is a portion of a half-circle line connecting the Brooklyn ends of the Williamsburg and Manhattan bridges over the East River. The subsurface conditions and the number of tracks differ for each of these routes and also for the different portions of each route considered individually. A mileage cost based on the above figures is, therefore, of general significance only. It is, however, $5,158,067 per mile of line.

Taking the sections individually, we have the following lengths and bidding prices and trackage from which the rate per mile can be computed as shown:

Sec.	Miles.	No. tracks.	Low bed.	Rate per mile.
Route 5:				
1	0.73	2	$5,863,194	$8,031,772
2	0.71	4	7,677,464	10,813,329
2A	0.09	4	2,323,542	25,817,133
3	0.50	4	3,619,315	7,238,630
4	0.68	4	3,716,304	5,465,153
5	0.62	4	2,419,127	3,901,818
6	0.66	4	3.634,213	5,506,383
7	0.66	4	2,750,463	4,167,368
8	0.70	4	3,369,484	4,813,548
9	0.59	4	2,447,479	4,148.269
10	0.71	4	2,253,072	3.173,341
11	0.65	4	3,132,195	4,818,761
12	0.60	4	2,825,740	4,709,566
13	0.53	4	4,071,416	7,681,917
14	0.48	4	4,823,513	10,048,985
15	1.26	3	3,820,129	3,031,848
Total	10.17		$58,746,650	
Route 20:				
1	0.58	2	$4,601,644	$7,933,869
2	0.42	2	9,164,909	21,821,212
Total	1.00		$13,766,553	
Route 9:				
1	1.3	2	$4,265,424	$3,281,095
2	2.0	2	4,676,941	2,338,470
3	1.9	2	2,981,992	1.574.377
Total	5.2		$11,924,357	
Grand total	16.37		84,437,560	

From the enormous differences in the rate per mile bid for the various sections, it is obvious how greatly local conditions influence the figures. Some of this difference is, of course, due to the natural variation between contractors' estimates, but it results mostly from varying conditions. For example, the high cost of Section 2A, comes from the fact that it is almost wholly station construction and in addition includes the construction underneath of a structure for a crossing subway. Similarly Sections 1 and 2, include four stations in 1.43 miles of line, terminal yard tracks at Battery Park, and are down town sections in streets with congested surface and underground utilities. Again Section 14 is largely subaqueous tunnel under the Harlem River, and Section 2 of Route 20 is approach to a bridge terminal and in addition involves two crossings under existing subways.

The average cost per mile of line for all three routes is given above as $5,158,067. This figure takes no account of the number of tracks of different routes. The tabulation gives the nominal number of tracks for each route but these numbers are not invariable. There is, for example, in Section 2 of Route 20, some four track line and in Section 1 of Route 5 several extra terminal tracks. There is also in each route a certain mileage of siding, turnouts, loops, etc., which is not definitely known from the figures available. Neglecting this extra trackage there are 41 miles of track in the three routes which gives a cost per mile of track of $2,059,452.

In Route 5 there are 11 sections, Sections 3 to 13 inclusive, of nearly straightforward 4-track subway construction. The mileage of these 11 sections is 6.9 miles and the aggregate of the low bids is $34,238,808, which gives a cost of $4,962,146 per mile. Route 9 is straightforward 2-track subway and the 5.2 miles is bid at $11,924,357, or $2,293,145, which, it may be noted, is not far from just one-half the figures for 4-track line. The cost of the 1.26 miles of 3-track line of Section 15, Route 5, is $3,031,848, or approximately half-way between the cost of the 4-track and the 2-track lines named.

Summarizing we have the following figures:

Cost per mile line (average of all lines)	$5,158,067
Cost per mile track (average of all lines)	2,059,452
Cost per mile 4-track line (Sections 3 to 13, inclusive)	4,962,146
Cost per mile of track (4-track line, Sections 3 to 13, inclusive)	1,240,536
Cost per mile line (2-track line, Route 20)	2,293,145
Cost per mile track (2-track line, Route 20)	1,146,572

The construction work covered by these amounts does not include the station finish work nor the provision for laying of rails, ties and ballast. It does include "the construction of all necessary sewers and connections, along the route of the railroad; also the necessary support, maintenance, readjustment and reconstruction of vaults adjacent to buildings, pipes, tubes, conduits, subways or other subsurface structures; the support and care including underpinning where necessary of all buildings, monuments, surface, subsurface and elevated railroads and other structures, etc., affected by or interfered with during the construction of the work; also the restoration of the sidewalks and the temporary paving and maintenance of roadways."

The above figures are not presented as a conclusive analysis, but simply for general comparison with the costs of the original, City Subway as published in our issue of April 13, 1910, and with the unit costs as given in Gillette's "Handbook of Cost Data."

In presenting these figures the question naturally arises as to how they compare with the costs of the subway lines already built. The average cost per mile of single track of the present subways ran about $785,000. This is some 40 per cent less than the smallest figure per mile of single track which is given above. The figures which we present are, it must be observed, for only a portion and the most expensive portion of the Tri-Borough Subway. Combining these bids with the estimated costs of the remaining sections of line we have a cost, according to the engineers of the Public Service Commission of $1,017,000 per mile of single track line. This is about 30 per cent more than the present subways cost. The Tri-Borough Subway will, however, line for line, have a greater capacity. Besides the conditions of construction are more expensive than they were for the original subway.

CONCRETE AND REINFORCED CONCRETE SECTION

Tests to Determine the Effects of Frost on Concrete and Methods of Concrete Work in Freezing Weather.*

The general practice a few years ago was to bring all concrete work to an abrupt close at the approach of cold weather, and concrete structures that could have been completed and in use long before work was again resumed were permitted to remain in their incompleted condition throughout the winter. Of late years, however, conditions have changed somewhat, and a large amount of concrete work has been successfully carried on at the season, during which a few years ago contractors were idle, and would have experienced considerable difficulty in obtaining permission to proceed with the work had they cared to do so.

The satisfactory results obtained where the work has been properly handled have served as an incentive for increased activity during the winter months, but we wish to caution against the growing disregard of the importance of properly placing and protecting concrete work in freezing weather. Serious accidents and examples of unsatisfactory work done by freezing are far too numerous, and the practice of mixing, placing and protecting concrete in cold weather in the same manner as in warm weather is most certainly to be condemned.

Just what should be considered good practice in handling concrete during freezing weather is a question upon which there is considerable difference of opinion amongst engineers and contractors. That low temperatures materially retard the hardening of concrete is admitted by all, and while there is some difference of opinion as to the ultimate effect of freezing upon Portland cement concrete, the general opinion is that freezing will not damage concrete that has had a chance to harden under favorable conditions for from 24 to 48 hours. The freezing simply retards the process of hardening, which again proceeds under favorable conditions, and the concrete eventually obtains its full strength.

On the other hand, concrete that is frozen before the action of hardening has started is not apt to be permanently injured, if upon thawing it is not again frozen until it has had a chance to harden sufficiently to withstand the action of subsequent freezing. But alternate freezing and thawing at comparatively short intervals, which allows the intermittent action of hardening, is very apt to damage concrete. It is this latter condition that almost always occurs in actual practice, and which makes it imperative to mix and place concrete in such a manner as to insure proper hardening during the first few days.

Interesting and valuable experiments were conducted at the Watertown Arsenal some years ago, the results of which demonstrate very clearly the effect of low temperatures upon the strength of cements and cement mortars. Cubes of different mixtures were placed in a cold storage warehouse where some of them were subjected to a temperature of 39° F. and some to a temperature of 0° F. Those subjected to the lower temperature were mixed and molded at a temperature below freezing. All cubes were subjected to the temperature noted as soon after mixing as was practicable, and before being tested were kept at a temperature of 70° for the number of days indicated. The results obtained on cubes composed of a 1:1 Portland cement mortar are tabulated below. Each strength shown is the average compressive strength in pounds per square inch of five 2-in. cubes:

The results show quite plainly that during exceptionally low temperatures the action of hardening is practically suspended and that a marked increase in age is accompanied by a comparatively slight increase in strength; also that frozen concrete when subjected to favorable conditions will show a marked gain in strength. It will be noted that all cubes subjected to a temperature of 70° for 7 days show practically the same strength, irrespective of the length of time they have been frozen, and that the 12-day strength, 7 days at 70° and 5 days at 0°, is over 70 per cent greater than the 91-day strength, 90 days at 0° and 1 day at 70°.

The Universal Portland Cement Co. during the past year conducted an extensive investigation of the effect of low temperatures on the strength of Portland cement concrete. Eight-inch cubes of a 1:2:4 concrete with ten different brands of American Portland cement were subjected to various temperature conditions at a cold storage warehouse and broken at different periods up to and including three months. The results obtained upon cubes of every brand stored at a temperature of about 70° F., what might be termed normal or summer conditions, are graphically shown in the upper diagram of Fig. 1, and the results on cubes stored at a temperature of 10° F., winter conditions, in the lower diagram. The figures at the bottom of the diagram indicate the age in days of the cubes when broken, and those along the left hand edge their compressive strength in pounds per square inch at each period. Each line in a diagram represents a different brand of cement, similar lines in each diagram showing the behavior of the particular brand under the two different temperature conditions. The solid black line in each diagram represents the results obtained on the cubes made with Universal Portland cement and shows, for example, that those stored at a temperature of 70° for 90 days developed a strength of approximately 1,925 lbs. per sq. in., while those stored at 10° F. for 90 days had a strength of but about 710 lbs. per sq. in.

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*A paper by J. H. Chubb, Assistant Inspecting Engineer Universal Portland Cement Co., Chicago, Ill.

The cubes placed in cold storage were all left in the molds and subjected to the temperature indicated as soon after making as practicable. These cubes were all stored at a temperature of between 50° and 60° F. for 7 days before being tested, to give them sufficient strength to be readily handled and to make sure that they had been completely thawed out, so the results plotted in the lower diagram really represent the 7-day strength of specimens stored at 10° F. for the period indicated.

Days at 39° F.	Days at 70° F.	Strength, lbs.
15	0	1710
31	0	1960
60	0	2460
15	7	2710
31	7	2720
60	7	3270

Days at 0° F.	Days at 70° F.	Strength, lbs.
5	7	846
14	7	1000
21	7	1010
31	7	981
60	7	981
90	7	1010

Days at 0° F.	Days at 70° F.	Strength, lbs.
5	1	287
14	1	321
21	1	337
31	1	383
60	1	416
90	1	497

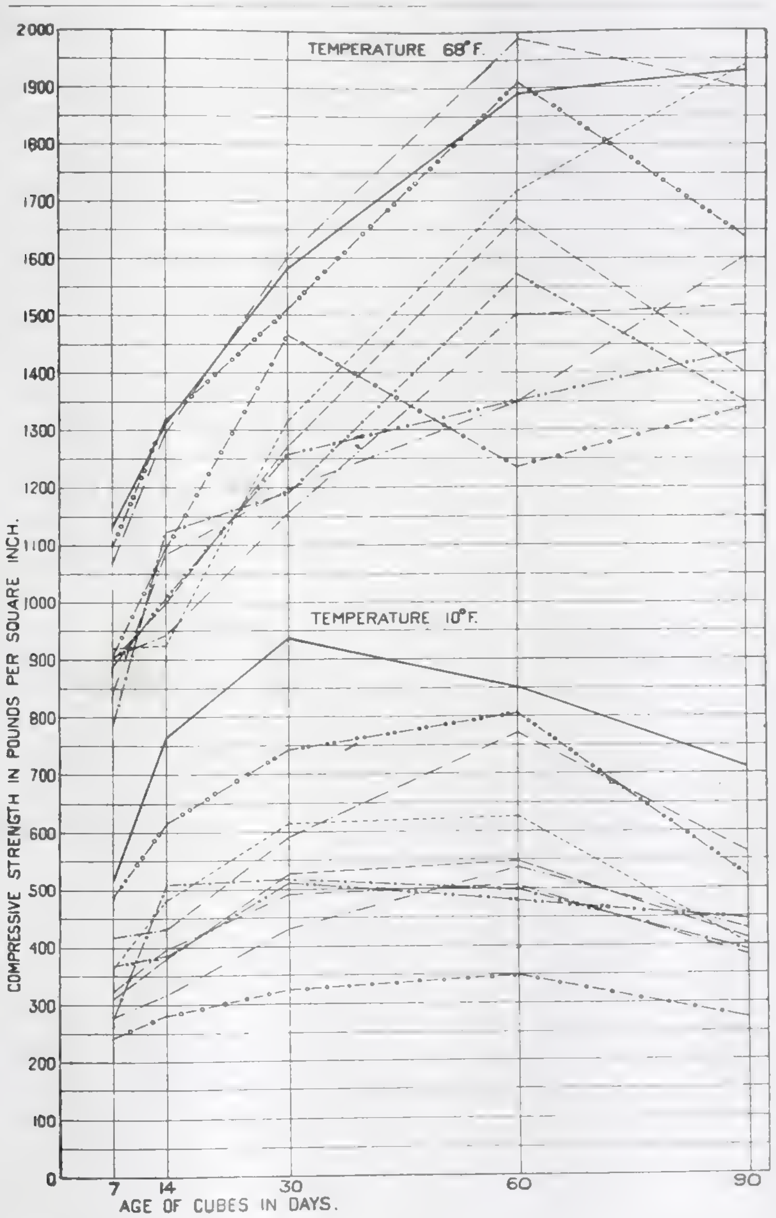

Diagram Showing Effect of Temperature on Strength of Concrete.

A comparison of the two diagrams clearly indicates what a marked effect different temperature conditions have on the strength of Portland cement concretes. While under normal conditions an increase in age is accompanied by an increase in strength, especially at the short time periods, no such gain is to be expected during the time that the concrete is frozen. Similarity in the behavior of all brands of cement when subjected to low temperatures is also to be noted.

These and numerous other laboratory results, together with those obtained in every day practice, show the folly of attempting to carry on concrete construction during the winter months without taking proper precautions to counteract the action of freezing. A given amount of heat expended in heating materials and protecting the work from freezing immediately after placing will be infinitely more effective than an equivalent amount of heat expended in attempting to hasten the hardening of concrete that has been mixed with cold materials and subjected during the next few days to unfavorable conditions.

A case is reported where it was possible to remove the forms from an upper floor concreted during favorable weather conditions late in April before those of the floor directly beneath, which was constructed during cold weather in February, yet the lower floor was subjected to the same favorable weather conditions which influenced the hardening of the upper one, and was, in addition, nearly two months older. During the construction of an 8-story reinforced concrete building, where the work progressed at the rate of about two stories in three weeks, it was found necessary to use eight sets of floor forms. While they were concreting the lower three or four stories, the temperature was close to but rarely went below freezing, and the contractors did not consider it necessary to heat materials or protect the work. During the concreting of the fourth story the weather turned exceptionally cold. The work was housed in with canvas, heated with salamanders and the water used for mixing concrete heated. An examination of the work showed that the concrete in the upper floors when but a week or ten days old was stronger and better than that in the lower floors, which were many weeks older. Had the contractor taken the precautions at the beginning that were taken later on, only about half as much lumber would have been required for forms, and the extra cost of handling the work would have been but a fraction of that for these additional forms.

As an example of the benefit to be derived from the proper handling of winter work the experience of a contractor during the construction of a reinforced concrete bridge will answer. The bridge consisted of three three-centered arches having a clear span of 110 ft. each. While the arches proper were being concreted the weather turned quite cold, from 12 to 15 ins. of ice forming on the river. Nineteen days after the center span was concreted a warm rain set in, resulting in a flood which carried away the false work and centering for this span, but did not result in any damage to the bridge. The materials for the concrete were thoroughly heated, being delivered to the mixer at an average temperature somewhat above blood heat, and as soon as the concrete was deposited it was protected with a covering of tar paper and boards. The proper handling of the work in this case probably prevented the total destruction of the middle span when the forms were accidentally removed long before the intended time.

These and numerous other examples in every day practice clearly illustrate that winter work can not and should not be handled in the same manner as summer work.

The proper precautions necessary to insure satisfactory results with concrete during freezing weather depend very much upon the class of construction, large plain mass work such as retaining walls and abutments not requiring the same care and protection as thin walls, columns, beams and floor slabs. Elaborate and expensive plants for heating the

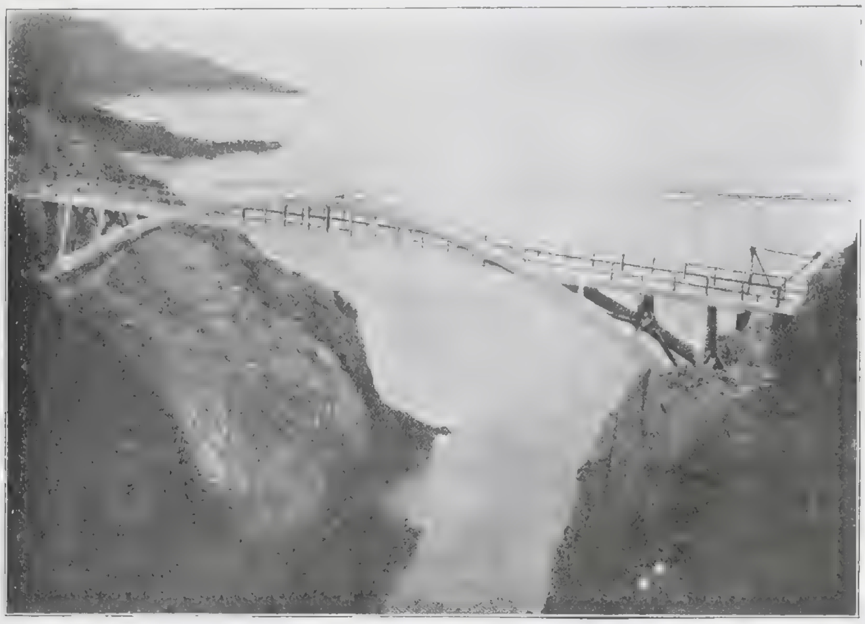

Fig. 1—Reinforced Concrete Foot-bridge at Mizen Head, Ireland.

materials and protecting the work have been constructed and successfully used on important work, but the additional equipment considered necessary for winter work is really comparatively limited, consisting simply of a sufficient amount of canvas for housing in or covering the work, salamanders or some other form of heaters for maintaining a temperature above the freezing point and some provision for heating materials.

Half cylinders of sheet steel set directly upon the ground in the form of an arch make a simple form of sand heater, as also do lengths of metal culvert pipe closed at one end and provided wtih a short piece of smaller pipe for a flue. Sand and stone may be heated by piling directly upon pipe coils supplied with steam or by covering with tarpaulins and applying the steam directly to the material to be heated. Where the materials are delivered in cars excellent results can be obtained by this latter method. For heating water the common practice of relying upon a steam pipe placed in an ordinary barrel is not to be recommended; the water is generally used too fast to permit of its being properly heated by this method. A suitable tank should be provided, the water being heated by means of a coil supplied with steam from the boiler supplying the mixer engine or from one erected for this purpose. The size of the tank will of course depend upon the amount of water needed and the time required for heating it.

Work can be successfully carried on during freezing weather by either one or both of two methods; heating the concrete materials and then protecting the work until it has had a chance to harden, or for temperatures but little below freezing by lowering the freezing point of the concrete. This latter method is probably the simplest and cheapest but not the best, and consists of adding some substances to the concrete that will reduce its freezing point. Only those substances that have no effect on the strength and durability of the concrete can be used. Ordinary salt is most commonly used for this purpose and experiments indicate that while the addition of a limited amount of salt retards the hardening somewhat and lowers the initial strength, the ultimate strength of the concrete is not affected by its use. Even when salt is used it is important that the aggregate be free from frost as it is impossible to properly mix such materials. Approximately one per cent by weight of salt to the weight of the water is required for each degree F. below freezing, but more than 10 per cent of salt should not be considered safe and this amount is not effective for temperatures lower than 22° F. Caluim chloride has been used in place of salt for the same purpose and apparently gives very good results. In one case where commercial muriatic acid was used to prevent freezing, a small amount of acid being added to the mixing water, the results obtained were not entirely satisfactory, and the present unsatisfactory condition of the concrete both as to color and strength, is undoubtedly due to the use of the acid. At any rate the use of acid in this connection is not to be encouraged.

The present day practice in handling reinforced concrete building construction during the winter months is practically as follows: Take for example the construction of a building having a reinforced concrete skeleton and floors, and with wooden floors on top of those of concrete. After completing the forms for the first story columns and second story floor slabs, beams and girders, but before depositing any concrete, the entire area is housed in with canvas and heated with salamanders to a temperature of about 60° or 70° F. Where it is possible to obtain sand and broken stone or gravel that is dry and free from frost these materials are usually not heated, but if not they should be heated. All water used for mixing concrete is heated to a temperature of about 100° F. and some engineers and contractors, in addition to using hot water, add about a pint of salt per bag of cement to the mixture. For heating water, provide a tank, about the size of that on an ordinary street sprinkler, equipped with a special heating coil supplied with steam from the boilers used for the mixer and hoist. The concrete when deposited should be quite warm, this initial heat, that supplied from the salamanders on the floor below, and the protection offered by the forms keeping it from freezing.

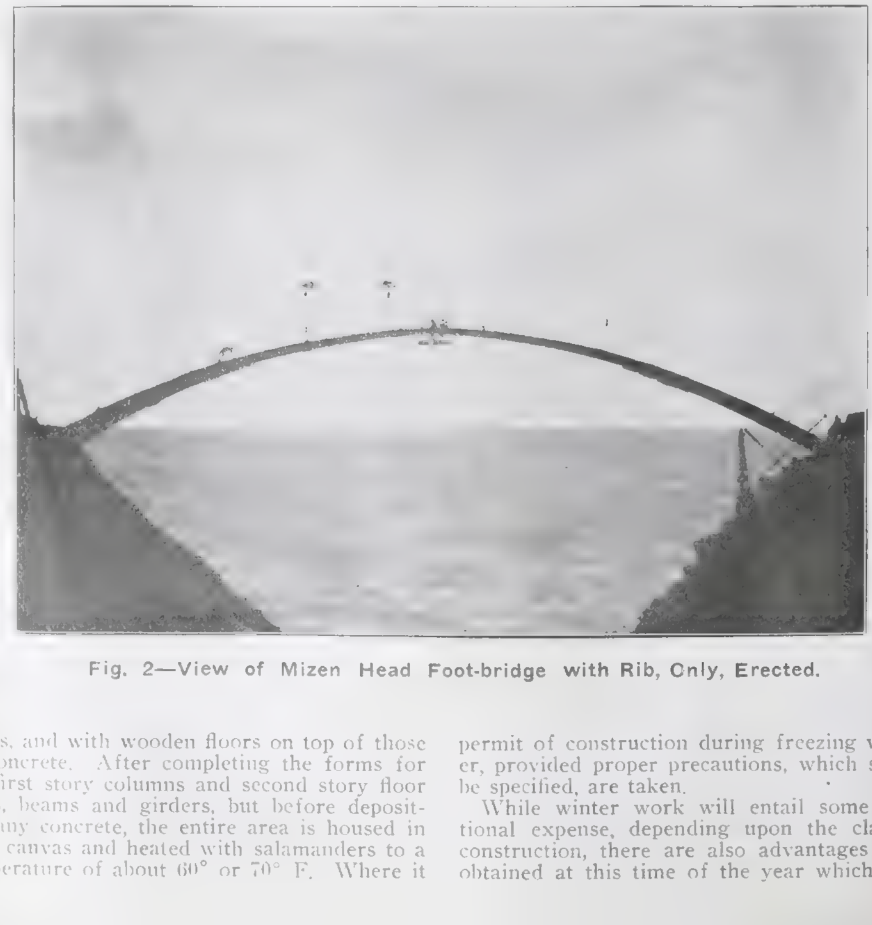

Fig. 2—View of Mizen Head Foot-bridge with Rib, Only, Erected.

The forms for the wall columns of the next story above are placed first and this story housed in with canvas as soon as possible. Enough canvas to house in at least two stories at a time is necessary, salamanders being kept burning on each floor during the time the housing is in place. Work handled in this manner progresses but little slower than similar work concreted under favorable weather conditions, and while it is not possible to remove forms as soon as is customary with summer work, but one additional set of forms is as a rule required. Where a cement wearing surface is placed with the floor slab it is necessary to have the housing in place and the salamanders burning on each story before depositing concrete, otherwise it would be impossible to properly finish the surface of the floor.

Careful inspection of winter work is necessary before removing the forms and it must be remembered in this connection that frozen concrete, which upon thawing has but little strength, closely resembles thoroughly hardened concrete in appearance, and when broken frequently shows a fracture through the aggregate.

To prohibit placing of concrete when the temperature is near or below freezing, as is frequently done in specifications, causes unnecessary delays and imposes an unjust hardship upon the contractor. If concrete work is properly handled it may be successfully carried on irrespective of weather conditions. The cold weather clause in specifications, instead of prohibiting should be so written as to permit of construction during freezing weather, provided proper precautions, which should be specified, are taken.

While winter work will entail some additional expense, depending upon the class of construction, there are also advantages to be obtained at this time of the year which compensate for this addition [illegible] apt to be cheaper and more plentiful and the same is true to some extent of the materials of construction, deliveries of which are more prompt. This is a consideration of much importance, as those will affirm who have had work held up for weeks and [illegible] due to the delays in obtaining materials during the busy building season.

Where conditions and importance of the work will warrant this slight extra expense, concrete construction may be carried on during the severest winter weather with the assurance that it will be entirely satisfactory, providing proper precautions are taken in placing and protecting the work.

A Boldly Designed Reinforced Concrete Bridge.

For light and bold design and construction in reinforced concrete European engineers far outrank engineers on this side of the ocean. As an example of European practice and by no means an exceptional example we illustrate a reinforced concrete arch [illegible] constructed in Ireland. We are indebted to [illegible]

This bridge was erected to provide access to Cloghan Island at Mizen Head, the extreme southwest point of Ireland, on which the Commissioners of Irish Lights have built a fog-signal station. The island is saparated from the mainland by an inlet of the sea, and the site chosen for the bridge necessitated a [illegible] sea. Designs were called for, and Mr. C. W. Scott, Engineer to the Commissioners, chose the design sent in by Mr. M. Noel Ridley, of Westminster, for a bridge in reinforced concrete under Ridley & Cammel Patents. A concrete bridge was preferred to a steel bridge, for which several cheaper designs were sent in, as the maintenance of the latter would be so costly and the life so short in such an exposed position where the bridge is often smothered in spray and wet fogs are prevalent. The contract was placed in the hands of Messrs. Alfred Thorne & Sons, of Westminster.

The bridge is 172 ft. long in one span and [illegible] parabolic curves with a versed sine of 30 ft., [illegible] the crown. The ribs are parallel in the center portion, 5 ft. 6 in. centers, but where the footway cuts through at the quarter spans they splay out, being 15 ft. centers at the abutments, and are connected by wind-bracing; this is to give stability under wind pressure as the bridge is so narrow. The footway is 4 ft. 6 ins. wide between the horizontal beams, and is 5 ins. thick at the center, including the granolithic surface; the beams are 15x9 ins. and the reinforcement is made continuous from end to end by rigid connections, and is anchored to the rock on either side to stiffen the bridge under unequal loading. The trestles and wind-bracing are of 9x9-in. section, and the hangers 9x6 ins. The handrail is of reinforced concrete with 4-in. octagonal rails, and posts 9x6 ins. to 6x6 ins.

The Paris-Versailles Road in France has an automobile traffic of from 5,000 to 10,000 cars per day. It is made dustless by applying [illegible]

EARTH AND ROCK SECTION

Methods of Excavating Canal Prism Using a Bridge Conveyor Excavator with Costs of Work for Twenty-four Consecutive Months.

The bridge conveyor excavator illustrated in the accompanying engraving at work on Contract 6 of the New York State Barge Canal is perhaps the most costly excavating machine ever used in canal work if we except possibly certain large dredges. It cost erected and completely equipped about $105,000. The machine is an adaptation to earth and rock excavation of a type of conveyor excavator long employed at Great Lake ports for unloading ore vessels. In its new field it has proved to be a fairly economical excavator but not more economical probably than several other devices used on the canal and whose first cost was far smaller.

No section of the Barge Canal work is perhaps better adapted to the use of a machine of the type and magnitude shown than the section known as Contract 6. This contract section is 3½ miles long through very level country. Some 2½ miles of the section are in rock cuts from 12 to 36 ft. deep with an over burden of from 2 to 12 ft. of earth. The amount of rock to be excavated was some 1,500,000 cu. yds. The canal section in rock called for by the plans had a bottom width of 94 ft., with vertical channeled sides to 14½ ft. above grade, then 10 on 1 rock slopes and 1 on 1½ earth slopes. After work was begun it was proved that this cross-section could not be secured throughout. For about 1 mile near the west end of the section the rock proved to be too soft for channeling and also to disintegrate rapidly on exposure. Here the cross-section was changed to a trapezoid with a bottom 94 ft. wide and side slopes of 2 on 1. Obviously these conditions, the level ground, the depth and width of excavation and the amount of material to be handled, argued the suitability of such a device as the bridge conveyor. The level ground made possible the moving of the conveyor bodily along the canal while the depth of cut and consequent height of spoil banks necessitated a machine able to make a vertical lift of 70 to 80 ft., succeeded by a rapid lateral movement over the spoil banks. At any rate the bridge conveyor excavator was decided upon by the contractor and was designed for him by Hoover & Mason, engineers, of Chicago, and constructed and erected in 1907 by the Pittsburg Steel Construction Co.

The view Fig. 1 indicates the construction of the conveyor excavator. It consists of a two-truss "bridge" supported by two steel towers and having a contilever arm extending beyond the towers over the spoil banks on each side. The bottom chords of the "bridge" carry the truck on which the bucket trolley moves. The towers are 90 ft. high and each rests on a "car" consisting of a framework of steel girders riding on 32 car wheels. The wheel base of these cars is 36 ft., and the cars run on structural gage tracks, one on each side of the canal. One tower, that adjacent to the shorter cantilever arm, is rigidly attached to the car frame. The opposite tower rests on its car frame on two sets of roller bearings. One set of roller bearings permits the tower to move across the car in the line of the axis of the "bridge"; the other set permits the tower to swing on an arc lengthwise of the car or at right angle to the axis of the bridge. As will be seen, the first set of roller bearings permits a certain variation in distance between the cars, and the second set permits one end of the bridge to be "swung" ahead of the other when occasion demands. The total amount of this swing is an arc of 17°.

The cantilever arms differ in length, that adjacent to the fixed tower being 96 ft. span and the opposite one being 128 ft. span. The reason for this design was that the original plans called for the earth to be wasted on one bank and the rock on the opposite bank. The ratio between the lengths of the cantilevers is the ratio between the widths of spoil banks as figured on the engineers' estimates of the amounts of earth and of rock excavation. The longer arm was to provide for the larger rock spoil bank. It may be noted here that this original plan for the separation of the earth and the rock spoil has not proved to be completely practicable and has been only partially accomplished.

The operating mechanism consist first of the mechanism for operating and controlling the [illegible] mechanism for moving the conveyor along the work. All this mechanism is operated by electric power. A service transmission line along the canal brings current at 4,100 volts a. c. from the plant of the Rochester Railway & Light Co., to a transformer car attached to one of the towers and traveling with the conveyor. At this point the 4,100-volt alternating current is transformed to 260-volt direct current and led to the various operating motors. [illegible] to [illegible] tact rails suspended from the lower

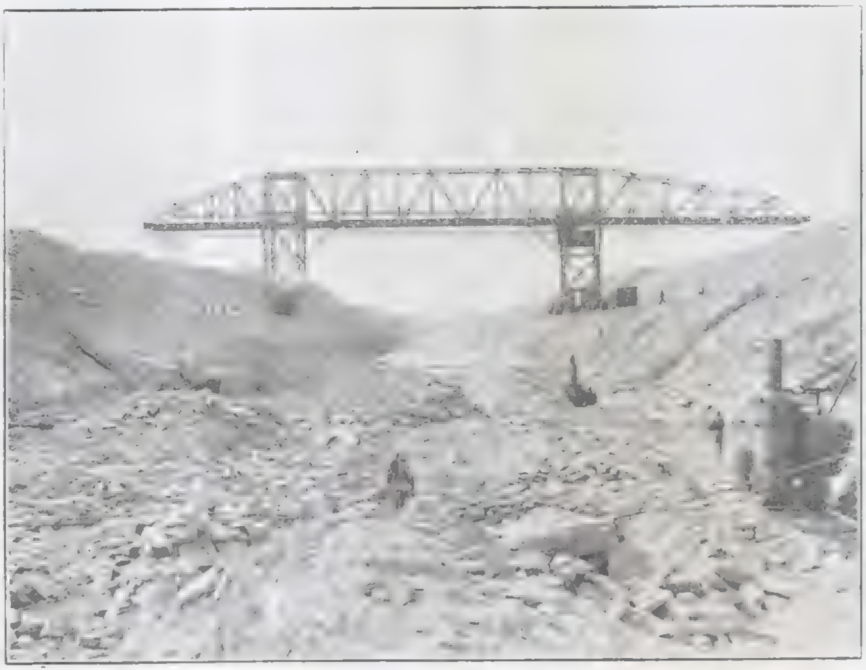

Fig. 1—Bridge Conveyor Excavator on Section 6, New York State Barge Canal.

TABLE I.—SCHEDULE OF OPERATION OF BRIDGE CONVEYOR EXCAVATOR FOR 24 MONTHS.

Month.	Cu. yds. rock excavation.	Cu. yds. earth excavation.	Av. excavation per 8-hour shift.	Character of rock removed	Repairs to Br. conveyor.	Cost of electric power.	Cost of drilling rock, per cu. yd.	Cost of blasting rock, per cu. yd.	Cost of removal, earth and rock, per cu. yd.	Total cost per cu. yd. excavation.
1908.					$	$	$	$	$	$
January	11,579	.	.	Hard shale.	375.00	580.00	.0244	.0523	.3919	.4686
February	10,550	.....	...	Hard shale.	5,150.00	400.00	.0181	.0662	.8343	.9186
March	27,882	.....	...	Hard shale.	250.00	945.00	.0155	.0643	.1851	.2649
April	7,209	4,062	469	Hard shale.	*8,500.00	480.00	.0578	.0672	.1137	.2387
May	31,699	812	706	Hard shale.	155.00	1,265.00	.0161	.0653	.1670	.2484
June	31,905	4,465	674	Limestone.	†3,600.00	1,485.00	.0146	.0647	.253	.3323
July	31,648	3,194	670	Hard shale.	165.00	1,430.00	.0156	.0837	.153	.2523
August	28,187	4,165	622	Hard shale.	75.64	1,430.00	.0181	.0851	.177	.2802
September	23,608	474	573	Limestone.	149.55	1,155.00	.0191	.0566	.228	.3037
October	21,475	.....	438	Limestone.	139.80	1,347.00	.0251	.0802	.263	.3683
November	21,922	.....	...	Limestone	13.98	1,265.00	.0214	.0900	.258	.3694
December	10,944	12,317	...	Limestone	23.30	1,045.00	.0152	.0463	.225	.2865
1909.										
January	21,421	6,617	572	Limestone.	....	1,347.00	.0178	.0543	.205	.2771
February	17,624	.....	493	Limestone.	......	990.00	.0185	.0885	.284	.3910
March	19,142	.....	456	Limestone.	3,715.50	1,155.00	.0288	.1019	.449	.5787
April	21,254	....	462	Limestone.	20.00	1,265.00	.0232	.0995	.281	.4037
May	27,007	.....	530	Limestone.	......	1,402.00	.0205	.0784	.218	.3169
June	19,387	3,615	451	Limestone.	......	1,402.00	.0264	.0472	.283	.3566
July	33,850	.....	627	Limestone.	......	1,485.00	.0148	.0421	.191	.2479
August	24,398	....	542	Limestone.	......	1,237.00	.0155	.0624	.265	.3429
September	27,778	....	591	Limestone.	......	1,292.50	.0121	.0508	.226	.2939
October	17,035	....	516	Limestone.	......	907.50	.0279	.0928	.327	.4477
November	19,350	.....	510	Limestone.	......	1,045.00	.0235	.0737	.280	.3772
December	3,552	.....	355	Limestone.	......	275.00	.0170	.1025	1.1603	1.3798
Totals	510,406	39,721			$22,332.77	$26,630.00				

*High cost of repairs due to fire.
†High cost of repairs due to replacing bucket.

chords of the bridge. From these rails it is taken by contact shoes on the trolley and conveyed to a switchboard and controllers in the trolley cab. Another set of feeders runs to four 30-hp. motors which move the conveyor along the work. These motors are geared to drums carrying cables the ends of which are led ahead to deadmen on opposite banks of the canal. To control the travel of the conveyor there is an electric brake on each car; these brakes are applied automatically when the current is shut off from the motors.

The trolley is propelled back and forth along the "bridge" by two 60-hp. motors, and a round trip from the middle of the bridge to either end and return requires about 1½ minutes including the time for dumping the bucket. An air brake is arranged to stop the trolley at any desired point and there is also an electric emergency brake to prevent overrunning in case of failure of the air brake. Air for this brake and also for the brakes on the hoist, which are mentioned later, is supplied by a small electrically driven compressor located on the trolley.

The bucket is of the clam-shell type and is operated by two pairs of cables, one for opening and one for closing the jaws. Each pair of cables is wound on a separate drum and each drum is operated by two 80-hp. motors. To lower the bucket the closing cables are run slack and the opening cables sustain the bucket until it touches the ground when the opening cables are also slacked off to permit the jaws to bury themselves in the spoil. As soon as the bucket is buried, the closing cables are hauled in to close the jaws and then both pairs of cables, opening and closing, are operated to hoist the bucket and its load. The combined power of all four motors or 320-hp. is thus available for hoisting. The controllers for the bucket operating drums are inter-connected with air brakes so that as soon as power is thrown off the drums are locked fast and the bucket can be lowered only at will. Figure 2 shows the construction of the bucket quite clearly. It weighs 9 tons and has a nominal capacity of 8 cu. yds. The actual load grasped, however, averages more nearly 3 cu. yds. A single operator in the trolley cab controls all movements except that of pulling the conveyor ahead which is directed from a cab in one of the towers by the oiler.

The method of operation is to break up the rock by blasting, station the bridge over the pit and excavate and convey the spoil to the spoil bank by the grab bucket. The work of the bridge conveyor, therefore, involves as separate operations both channeling and blasting. These items will be considered separately. The conveyor requires nominally three men, an operator, an oiler and an electrician. The full crew working is larger and the total wage charge per 8-hour day includes the following items:

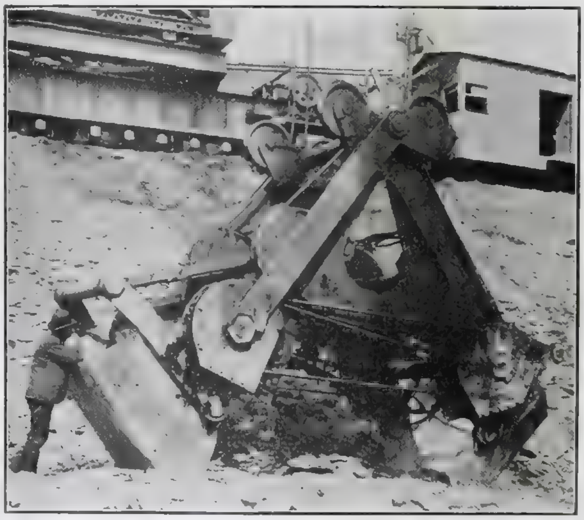

Fig. 2—Grab Bucket for Bridge Conveyor Excavator.

1 operator at $6	$6.00
1 electrician at $4	4.00
1 oiler at $3.25	3.25
2 to 5 laborers at $1.50 and $1.60	$3.00 to 8.00
1 team at $4	4.00
1 watchman at $2	2.00
Bookkeeper, part time at	$125 per mo.
Timekeeper, part time at	80 per mo.
Superintendent, part time at	250 per mo.

The records of operation of the conveyor, which have been secured, cover the work of the calendar years 1908 and 1909. During this period the machine was laid up an aggregate of about two months because of repairs due to a fire and to the breaking of the bucket. The schedule of output and operating costs for the 24 months is given by Table I. Summarizing the figures of this table we find the total output of the machine to have been 510,406 cu. yds. of rock and 39,721 cu. yds. of earth or a total of 550,127 cu. yds. This is an average of 22,922 cu. yds. per month. The cost per cubic yard figures out as follows:

Item.	Per cu. yd
Repairs	$0.0400
Electric power	0.0484
Drilling	0.0212
Blasting	0.0715
Removal of spoil	0.3091
Total	$0.4902

This cost does not include interest or depreciation.

The method of blasting is to drill parallel rows of holes across the prism and break down a working face. The rows of holes are spaced from 20 to 22 ft. apart and the holes in each row are spaced from 17 to 18 ft. apart.

DuPont 40 per cent powder is used. The following statement gives the cost of drilling for four months, April to July, inclusive, of 1908:

Date, 1908.	Spacing drill holes feet	Spacing Rows of drill holes	Av. depth of holes.	Lineal feet drilled.	Av. time required to drill 1 ft., minutes.	Total hours required to drill.	Lbs. explosive per hole.	Total explosive used.	Cost per lin. ft. of hole.
April	..	20-21	10-13	1197	9.6	192	42	4150	.348
May	..	20-22	8-12	2492	9.4	392	75	18000	.205
June		..	11	2245	8.8	328	87	18000	.2084
July	..	..	13	2510	9.2	384	120	23250	.198

The original contractor for the work was F. A. Maselli, who died; since his death the work has been under supervision of Mr. E. J. Govern, Consulting and Constructing Engineer, of Rochester, N. Y. The work is on the Western Division of the canal of which Mr. T. W. Barrally is Division Engineer Mr. T. J. Morrison is Resident Engineer in charge of Residency No. 9-B., and Mr. B. L. G. Rees is Engineer in charge of Contract No. 6.

Concrete Bridge Floors.—In his report for 1909 Mr. R. E. Chadwick, Bridge Engineer, Toronto, Ont., recommends that concrete be used for flooring on all new bridges that are built. Taking the figures for the past ten years, the top wearing course on the wooden bridge floors (2-in. red pine) has a life of 2.58 years, and in all cases fails by wearing through.

Progress of Work on the Panama Canal During the Year Ending June 30, 1910.*

ATLANTIC DIVISION.

The work in this division embraces the construction of the locks and dam at Gatun, the quarry at Porto Bello, the sand supply at Nombre de Dios, the excavation between the locks and deep water in the Carribean, the breakwaters for the shelter of shipping and protection of the channel in Limon Bay, municipal improvements in Colon and various settlements embraced within the territorial limits of the division, and such sanitary engineering construction as is prescribed by the sanitary department. The work is in charge of Lieut Col. William L. Sibert, Corps of Engineers, U. S. Army, as division engineer.

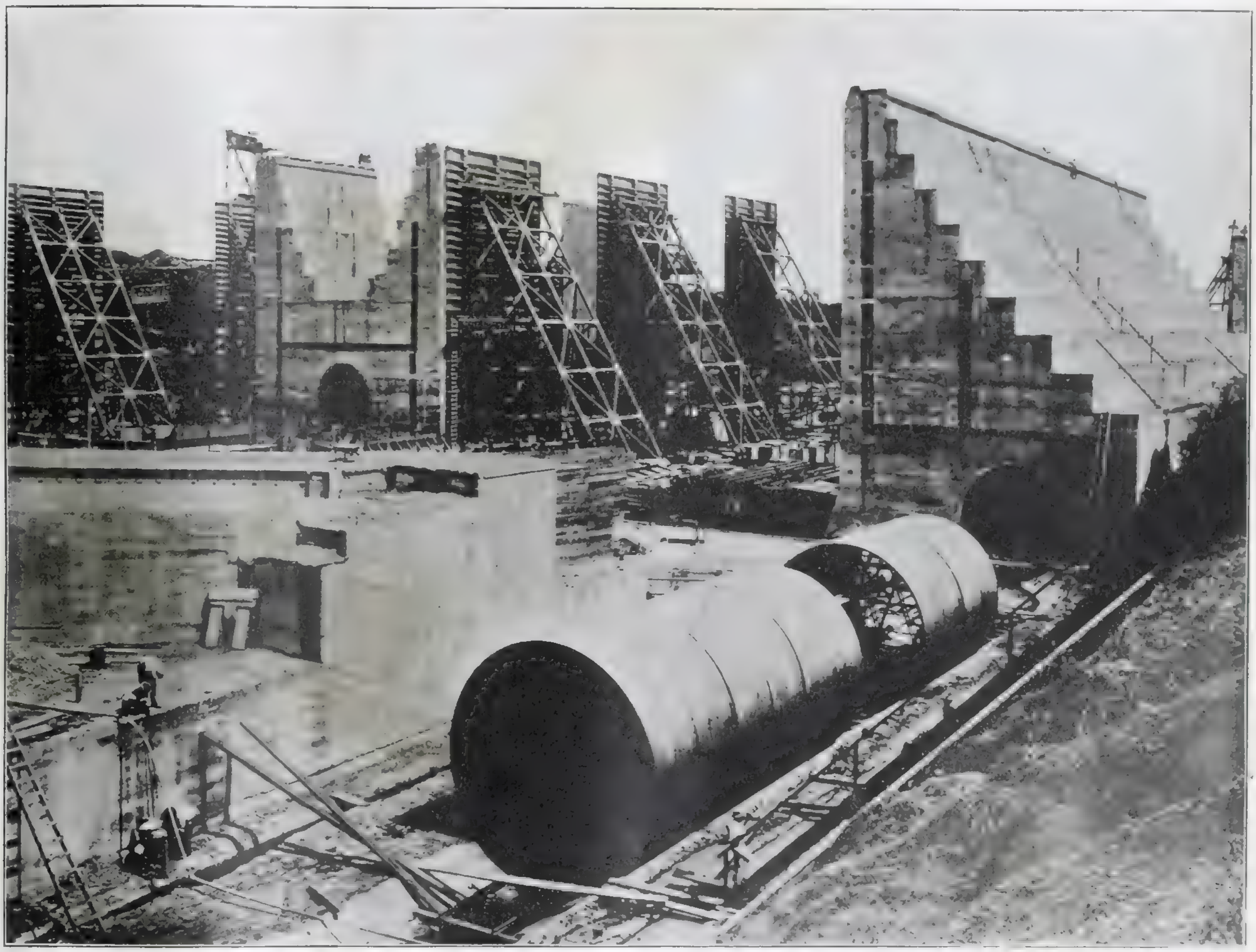

Fig. 1—View of Concrete Walls of Gatun Locks, Showing Steel Forms.

Gatun Locks.—The work of excavating the locks was continued during the year by steam shovels, and to some extent by dredges, resulting in the removal in lock chambers of 3,965,699 cu. yds. in the dry and 435,178 cu. yds. in the wet. In addition to this work of excavation, there were removed 646,520 cu. yds. of material in auxiliary work, including dredging in the French canal. The average cost of the excavation for the past six months, including plant charges and division expenses, was $0.6751 per cu. yd. In preparing the foundations for the concrete, including the excavation for the trenches for the lateral culverts, 33,843 cu. yds. were removed during the past six months at an average cost of $2.515 per cu. yd., including plant charges and division expenses.

At the close of the fiscal year 1909 the unloading cableways were in partial operation, and the erection in progress of the balance of the plant. During the year the entire plant was completed in time to permit laying of concrete on Aug. 24. The unloading cableways were unable to stand the strain required by operating them continuously at the speed necessary to secure the capacity called for in the specifications, and slight modifications were made to reduce the speed. Certain structural weaknesses in these and the lock cableways also developed, which were subsequently remedied.

The unsatisfactory operation developed during the early stages of their use resulted in the construction of an additional unloading plant just north of the cement shed, consisting of a sand bin having a capacity of 200 cu. yds., which was so arranged as to feed into the automatic cars, and two rock bins having capacities of 300 and 200 cu. yds., respectively; derricks were also erected, one at each of the bins, for unloading sand and rock from barges. The material is fed by gravity into cars, and the stone transported to the stock pile or to an auxiliary concrete plant placed at the south end of the locks. These were subsequently supplemented, in order to secure a proper supply of material, by a stiff leg derrick erected at Mindi, with proper docking facilities, for unloading sand and stone from barges to cars, and when the floods in November prevented the use of the French canal by tugs and barges arrangements were made for unloading barges at Dock 13, using a locomotive crane to pass the material from barges to dump cars. The Mindi plant was in service from November to June, and the plant at Dock 13 from December to April. To deliver material unloaded by these plant additions to the stock pile, and to unload in the stock pile sand secured from the Pacific division, a trestle 179 ft. in length was constructed over the east sand tunnel.

The unloading plant has been operated 24 hours per day since April, when the searchlights were installed. The quantity of material handled was 2,458 cu. yds. of large rock, 358,665 cu. yds. of crushed stone, and 155,458 cu. yds. of sand, of which the unloading cableways handled 314,854 cu. yds. of crushed stone and 138,813 cu. yds. of sand. The greatest output was in June; during this month the unloading cableways, five strands, handled 64,797 cu. yds. of material, of which 22,521 cu. yds. were sand. Operating on the basis of 24 hours per day, 48.65 per cent of the time was consumed in actual unloading operations, the balance lost waiting for barges (29.50 per cent) and in other delays (21.85 per cent); in other words, these cableways averaged 21.6 cu. yds. per hour while in the service, or 44.33 cu. yds. per hour of actual time in unloading. During the same month two derricks operating on the basis of 24 hours per day unloaded 25,400 cu. yds. of crushed stone from the barges to the bins, or an average of 20.5 cu. yds. per hour per derrick.

Difficulties were encountered with the automatic cars, due to lack of stability of the motor mounting, which set up a vibration and caused such excessive strains on the driving chains as would result in early destruction. This was remedied by extending the motor support and raising it by means of bearings on the axle. Due to the narrow gage and lack of clearance, the king pin of the truck is high, resulting in occasional derailments when the car was started, and an extra guard rail was placed where the most frequent derailments occurred, thereby eliminating the trouble.

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*Extracts from the report of Geo. W. Goethals, Chairman and Chief Engineer, Isthmian Canal Commission.

Cement deliveries under the contract with the Atlas Portland Cement Company commenced in July, 1909, and with the cement shed full, the difficulties met with in the operation of the plant caused the supply to accumulate faster than it could be used. Rather than stop the deliveries, instructions were issued to lay as much concrete as possible, even at increased cost, and for the erection of an auxiliary plant, not only to increase the output of concrete sufficiently to care for the deliveries of the cement, but as an auxiliary to the plant in case of similar or other breakdowns. Work was prosecuted daily, including Sundays, until November, when Sunday work was discontinued. On Sept. 6 a 12-hour day for the permanent plant was instituted and continued throughout the year.

The auxiliary plant consists of two 2-yd. mixers similar to those used in the permanent plant, but steam-driven. Material is handled from the cement shed and stock piles to the bins above the mixers by standard railroad equipment. The product of the mixers is handled by narrow gage locomotives with cars, the later being small side dumps when concrete is placed in the floors, and platform cars holding from two to four 2-cu. yd. buckets when concrete is placed in the walls. In the latter case derricks are used in connection with this plant. It was installed, began operations in December, and has continued since on the basis of an 8-hour day.

The permanent plant laid, to the close of the fiscal year, 409,381 cu. yds., including large rock placed in the concrete, and the auxiliary plant, 104,422 cu. yds., or a total of 513,803 cu. yds. The total amount of concrete to be placed in the Gatun locks, including the approach and wing walls, is estimated at 2,046,100 cu. yds., so that the total amount remaining to be placed is 1,532,297 cu. yds.

The largest amount of concrete laid in any one month was in June, when a total of 89,869 cu. yds., bucket measurement, was reached. The permanent mixing plant had six of its mixers in use operating, theoretically, 12 hours per day, excluding Sundays, and in actual operation for an average of 11.82 hours per day. The number of cubic yards mixed was 62,202, or an average of 32.4 cu. yds. per mixer per hour. The auxiliary-plant mixers operated 8 hours per day, excluding Sundays, and mixed 23,390 cu. yds., or an average of 56.73 cu. yds. per mixer per hour. The lock cableways, consisting of 8 strands, averaged 12.59 hours per day, excluding Sundays. Of this time, 79.8 per cent was in laying concrete, 7.1 per cent setting steel and forms, 0.24 per cent removing excavation, 2.62 per cent in moving, 1.3 per cent in repairs, and 8.94 per cent in delays. The actual number of cubic yards of concrete and large stone laid by the cableways was 66,479, or an average of 31.42 cu. yds. of masonry per strand per hour at work. The average cost of the concrete per yard in place for the year was $7.355, including plant charges and division expenses.

With a view to reducing the cost of concrete, instructions were issued in November to make arrangements to embed large stone, not less than one-man size, in the masses of concrete, and to an amount of about 20 per cent of the mass. This was begun in March, and up to the close of the year aggregated a total of [illegible] cu. yds. The stone was selected from material shipped from the central division for use in constructing the toes of the dam, and 2,458 cu. yds. of large stone were procured from the Porto Bello quarry in May and June. On account of the excessive cost of the latter, $6.284 per cu. yd. delivered at the locks, this source of supply was abandoned.

Collapsible steel forms are used throughout for the main and lateral culverts, and steel tower forms, which were purchased and erected under contract and are in place, are used for constructing the side and center walls.

Stone and Sand.—Crushed stone for the concrete of the locks and spillway was obtained from the Porto Bello quarry, which was developed during the year with a single face having a length of 2,500 ft. and a maximum height of 140 ft. Considerable delay is occasioned by the fact that a large amount of "dobying" is required to handle the blasted material to and from the cars and to feed the No. 9 crusher—the largest installed as yet. To overcome this, and to increase the output, a No. 21 crusher was ordered in November, and is under erection. It is so placed that its entire product will be raised to the two No. 9 crushers, through which it will pass. Additional delay has been caused by the fact that the underpinning of the bins settled so as to render their use unsafe, necessitating the handling of the product from the crushers directly to the barges. The foundations have been made secure, so this source of delay is practically eliminated. The 12-hour working day was increased to 16 hours on Dec. 27 by operating two 8-hour shifts, and this was continued during the remainder of the year.

The total amount of stone quarried and crushed was 549,678 cu. yds., at an average cost for the last six months of $2.6283 per cu. yd. delivered in the stock pile at Gatun, this

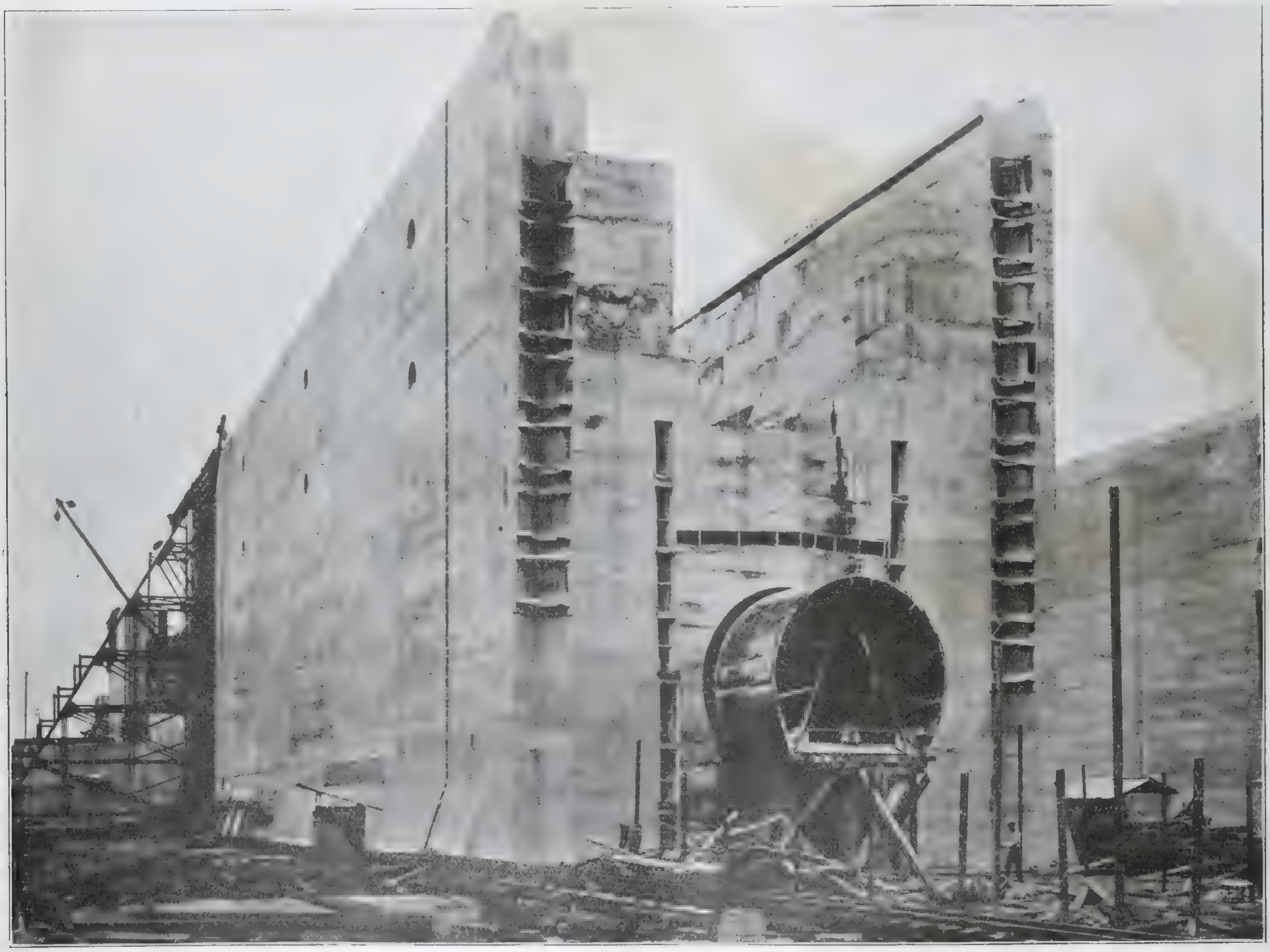

Fig. 2—View Showing Culvert and Culvert Form, Center Wall, Gatun Locks.

cost including plant charges and division expenses. The greatest month's output was in June a total of 74,181 cu. yds., when the plant for 70.15 per cent of the time, excluding Sundays, was engaged in crushing, 19.72 per cent undergoing repairs, and 10.13 per cent not working, waiting for barges and on account of other delays. The output of the crushers averaged 176.3 cu. yds. per hour in service, and 251.3 cu. yds. per hour crushing.

Sand was obtained from Nombre de Dios and from the Pacific division. The dredge "*Nombre*" was converted into a 12-in. pipeline dredge, and began pumping March 1. In addition to this, sand was obtained by a clam shell dredge temporairly mounted on a barge, by a locomotive crane, and by the dipper dredge "*Chagres*" operating until removed to Limon Bay in December. The total amount of sand obtained from Nombre de Dios amounted to 187,183 cu. yds., [illegible] for the last six months delivered in stock pile at Gatun of $1.9153 per cu. yd., including plant charges and division expenses. During the year, 101,748 cu. yds. were transported from Balboa docks in the Pacific division and delivered in the stock pile at Gatun, at a total cost for the last six months of $1.2488 per cu. yd.

Gatun Dam.—The total amount of material placed in the dam during the fiscal year was, dry fill 2,577,234 cu. yds., estimated on car, or place measurement plus 25 per cent swell, and hydraulic fill 2,933,175 cu. yds., estimated on borrow pit measurements, less losses ascertained by cross section when practicable. The average cost for the last six months of the year for the dry fill, including plant charges and division expenses, was 28.19 cts. per cu. yd.; for the wet fill on the same basis, 32.54 cts. per cu. yd. Excavation for the spillway was continued during the year, resulting in the removal of 127,210 cu. yds. Work on the floor and the side walls was continued, 53,632 cu. yds. of concrete being placed, at an average cost for the last six months of the year, including plant charges and division expenses, of $8.602 per cu. yd. The waters of the Chagres river passing through the west diversion had access to the French canal, and as silting resulted, the necessity for closing the passage was apparent. The plan contemplates the construction of a levee connecting Spillway Hill with Mindi Hills, having an elevation of plus 25 at the spillway, and sloping to plus 21 in a mile; its length is to be 1½ miles; 126,000 cu. yds. of material were placed at an average cost of 41.10 cts. per cu. yd.

Channel between Gatun Locks and the Atlantic Ocean.—Excavation in the dry in the Mindi section was continued until Nov. 20, when work was suspended due to the cut being filled by the high water in the Chagres river, which had access to the French canal. There were excavated in the dry 91,572 cu. yds. of earth, and 233,144 cu. yds. of rock at an average cost of 62.18 cts. per cu. yd., including plant and division expenses. The deepest part of the cut had reached a depth of 42 ft. below sea level at the time work was suspended.

The dredges in operation between the Mindi Hills and the Caribbean consisted of the 20-in. suction seagoing dredge "*Caribbean;*" 5-yd. dipper dredge "*Mindi;*" three French ladder dredges, and the dipper dredge "*Chagres.*" These dredges removed a total of 1,556,375 cu. yds. of earth, and 399,285 cu. yds. of rock from the canal prism, at an average cost of 23.60 cts. per cu. yd., including plant and division expenses.

An old French hull was overhauled and fitted with 8 Star well drills, and was worked successfully on subaqueous drilling. Four drills are placed on each side of the barge in quincunx order, separated 22 ft. apart, the drills in each set of four being 15 ft. apart. The barge drills, loads, and fires approximately 8 holes per day.

CENTRAL DIVISION.

The work of this division embraces all the excavation between the Gatun dam and Pedro Miguel locks, including diversion channels; construction of the Naos Island breakwater; clearing of timber from the channel and anchorage basin; municipal improvements in the various settlements included within the division limits, and such sanitary engineering work in the same area as is prescribed by the sanitary department. The work is in charge of Lieut. Col. D. D. Gaillard, Corps of Engineers, U. S. Army, as division engineer.

Due to the resignation of Mr. L. K. Rourke, assistant division engineer, a reorganization of the division was made, effective May 1, 1910, by which the position of assistant division engineer was abolished on the date that Mr. Rourke's resignation became effective, and the position of a general superintendent of construction created. The five construction districts were consolidated into four, as follows: The Chagres River district, extending from Gatun to the Chagres river at Gamboa; the Empire district, extending from Gamboa to the Empire suspension bridge; the Culebra district, extending from the Empire suspension bridge to the railroad crossing north of Pedro Miguel locks; and the Pedro Miguel district, embracing the excavation between the railroad crossing and the locks, the dumps south of Pedro Miguel, and the construction of the Naos Island breakwater. The division includes the Culebra cut proper, extending from Gamboa to Pedro Miguel.

Chagres District.—The Chagres river by

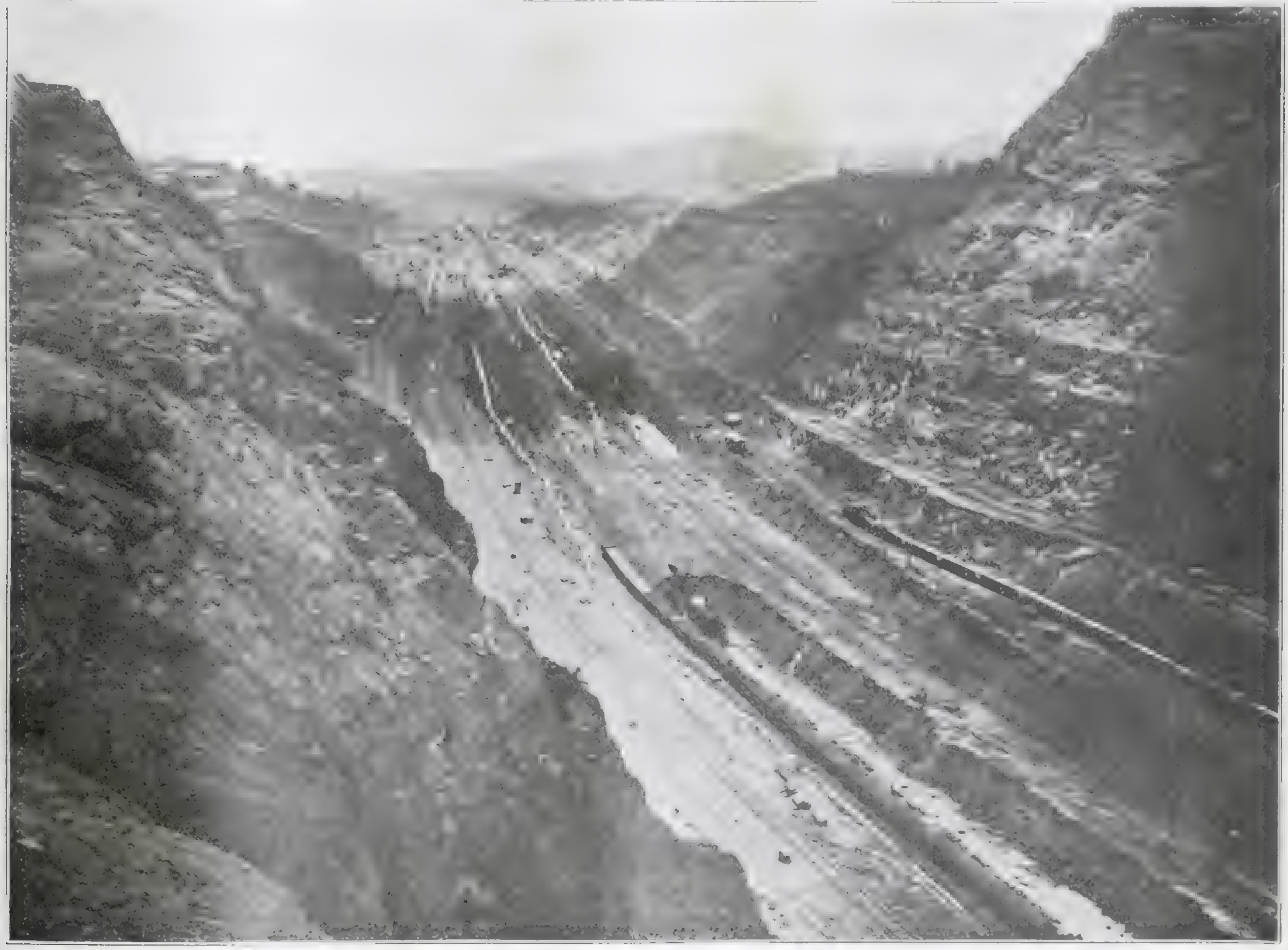

Fig. 3—View of Culebra Cut, Panama Canal.

rossing the axis of the canal 23 times before it reaches Gatun forms a series of peninsulas, which, commencing at Gamboa, are known as Point 1, Point 2, Point 3, etc. The total amount removed from the Chagres section from the beginning of operations in 1907 to the close of the last fiscal year was 9,497,673 cu. yds., leaving still to be excavated an estimated amount of 3,415,944 cu. yds. This estimated amount has been increased over the estimate of September, 1908, by 251,965 cu. yds., thus providing for excavating to elevation 39 above sea level instead of 40, made necessary on account of silting by floods, and by allowing 670,000 cu. yds. for silting, due to the fact that during the rainy season of 1909, 152,000 cu. yds. of sand and gravel were deposited by the river at Santa Cruz and Matachin.

At the beginning of the dry season the clearing, grubbing and burning of trees in the channel of Lake Gatun were commenced, and resulted in clearing 950.4 acres. There still remained 162 acres to clear to complete the entire width of channel throughout the central division.

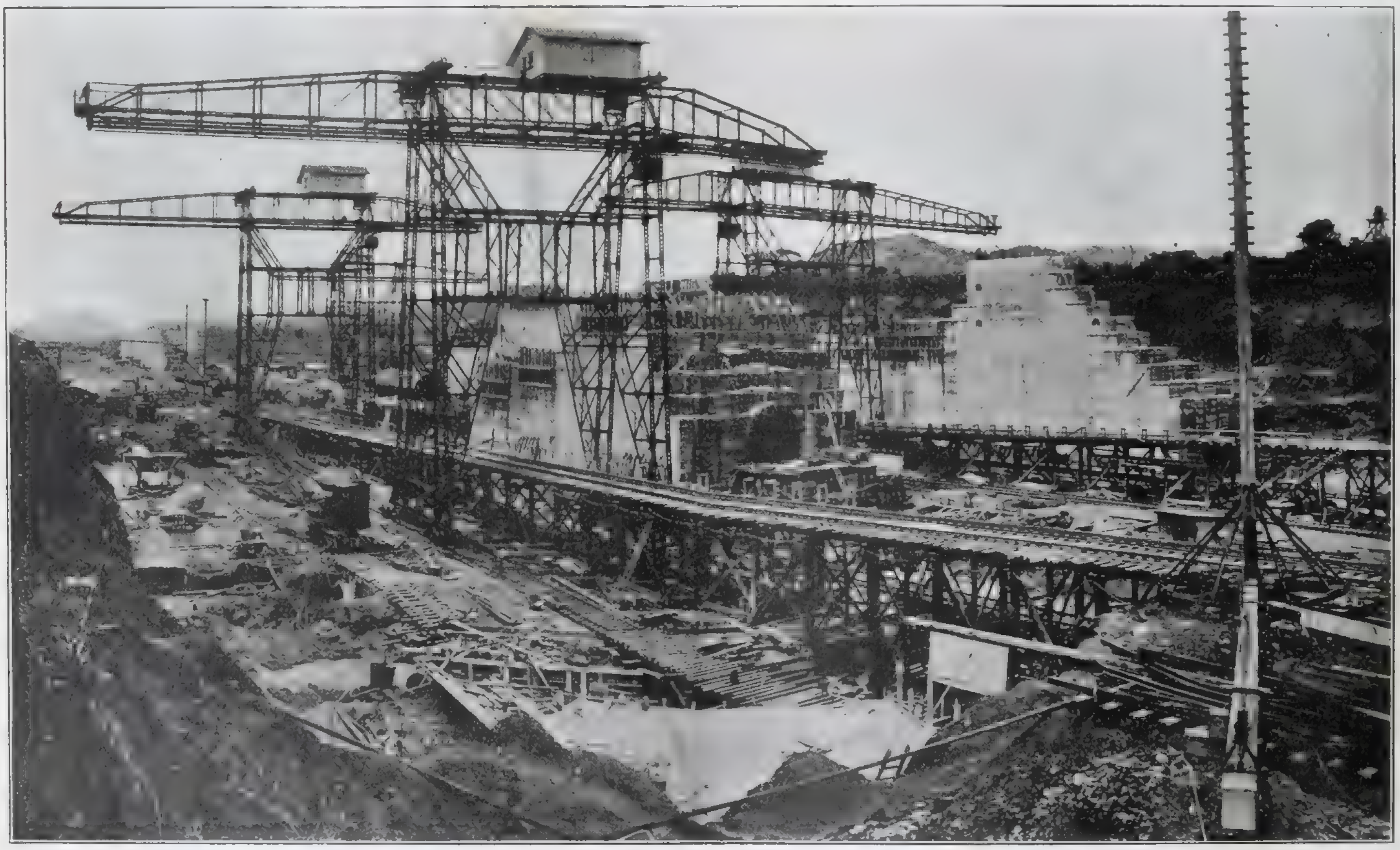

Fig. 4—View of Concrete Handling Plant, Miraflores Locks, Panama Canal.

Culebra Cut.—During the fiscal year 14,921,750 cu. yds. of material were excavated from the Culebra cut, leaving 34,893,531 cu. yds. to be removed in order to complete this section of the canal. The remaining amount includes an increase of 6,408,560 cu. yds. over the estimate made in September, 1908. This increase is due to widening the canal north of Pedro Miguel lock so as to form a basin, adding thereby 932,572 cu. yds., and to allowing 5,475,988 cu. yds. for slides and breaks, as a number of new ones developed during the year and could not be foreseen when the estimate of September, 1908, was made.

Previous to the fiscal year the movement of material into the prism was due almost entirely to slides caused by the movement of the top layer of clay upon smooth sloping surfaces of rock or other material harder than the clay. In addition to the slides, however, several breaks have occurred in the banks of the canal. At the points where these breaks exist the underlying rock is of poor quality, intersected by vertical seams, or seams sloping toward the canal. Generally, the upper surface of the broken portion of the bank remained approximately horizontal, settling nearly vertically. The weight of the broken portion forces up and displaces laterally the material lying directly below it in the bottom or on the berms of the canal. As the material thus forced up is taken away the upper part gradually settles and moves toward the axis of the canal until the entire broken portion is removed.

In widening the canal so as to secure the requisite 300 ft. bottom width the benches or berms that existed were removed, and while this method reduced to a minimum the amount of additional excavation it exposed fresh surfaces to the action of tropical downpours and at the same time increased the pressure at the bottom. It was expected that slides would occur, and in the estimates provision was made for them, but it now appears, from cracks that show in the upper surface adjacent to the faces of the cut, that sufficient allowance had not been made, and the estimates were corrected to meet the new conditions.

Of the slides proper, the most important is the one at Cucaracha, referred to in previous reports. The total area embraced since the commencement of operations is 47.1 acres. Prior to July 1, 1909, 1,125,017 cu. yds. of material had been removed from this slide, and 639,239 cu. yds. were removed during the fiscal year.

The next largest slide is on the west bank of the canal where the village of New Culebra was located. It has been caused by the movement of a large French dump into the canal. The area involved amounts to 7.3 acres. Prior to July 1, 1909, 118,024 cu. yds. had been removed, and 327,540 cu. yds. were removed during the year.

The third slide covers an area of 4.6 acres, and is located on the east bank of the canal directly opposite Whitehouse yard. Prior to July 1, 1909, 50,800 cu. yds. of material had been removed, and 110,000 cu. yds. were removed during the present fiscal year.

The fourth slide covers an area of 1.7 acres on the east bank of the Obispo diversion at La Pita Point, where the west slope of a hill broke away and commenced to slide toward the Obispo diversion. Steps were taken to remove this material before it could cut off the diversion, and 15,608 cu. yds. were taken away.

Three bad breaks occurred during the year. On the west bank of the canal at the town of Culebra the break covers an area of 10½ acres, and during the fiscal year 1,500,388 cu. yds. were removed, making a grand total of 1,680,000 cu. yds. since the break began.

The second largest break, directly opposite that just described, covers an area of 11½ acres on the east side of the canal; during the year 314,184 cu. yds. were removed, making a total from this locality of 480,202 cu. yds.

The third break was at La Pita Point, and permitted the waters of the Obispo diversion to flow into the canal for a period of three days, drowning out some of the shovels at the north end. This break aggregates about 40,000 cu. yds., but will not be disturbed until the dry season. A flume has been constructed of timber and concrete to carry the flow of the diversion past the break.

The total amount of material removed from all slides and breaks in the central division during the fiscal year amounted to 2,649,563 cu. yds., or about 15 per cent of the amount removed from the Culebra cut.

The average cost of excavation for the year was 66.99 cts. per cu. yd., including plant charges and division expenses.

PACIFIC DIVISION.

The work in this division consists of the construction of the locks and dam at Pedro Miguel, the locks and dams at Miraflores, the Ancon quarry, dredging for sand at Chamé, excavating a channel between the locks and below Miraflores locks to deep water in the Pacific, such municipal work as may be required within the territorial limits of the division, and such sanitary enginering work as may be prescribed by the sanitary department within the same area. The work is in charge of Mr. S. B. Williamson, as division engineer.

Pedro Miguel.—Work was continued in excavating the lock site and the approaches thereto from the south. The total amount of excavation during the year was 277,935 cu. yds. by steam shovels, and 65,513 cu. yds. by hand, of which 44,948 cu. yds. were classed as preparing foundations. Excavation proper was done at an average cost of $1.188 per cu. yd., including plant charges and division expenses.

Subsequent to the completion of steam shovel work the preparation of the foundations for the reception of concrete was undertaken by removing the loose rock which remained, and by excavating 42 trenches, 13 ft. wide, 11 ft. deep, and 137 ft. long for the lateral culverts, and an area of 2,500 sq. ft. to a depth of 5 ft. below the floor level at the miter sills. The greater portion of the material was handled by pick and shovel into buckets or skips, which were unloaded into cars by the use of locomotive cranes or derricks. A small portion was handled directly into cars by a Thew shovel. In the preparation of the foundations a total of 64,084 cu. yds. were removed, at an average cost for the last six months of $2.8193 per cu. yd., including plant charges and division expenses.

Bids were invited for the lock construction plant under date of October 8, 1908. The largest amount of concrete in the division is to be laid at Miraflores, and while in the selection of the plant the economical handling of this material was the guiding consideration, another important factor was that the plant should be capable of being adapted to the work at Pedro Miguel. Cantilever cranes were adopted.

The total amount of concrete laid was 166,869 cu. yds., of which 1,656 cu. yds. were large stone placed in the mass. Of this total, the permanent plant laid 73,083 cu. yds. on the basis of an 8-hour day. The average cost per cubic yard for concrete placed in the Pedro Miguel locks was $6.089, including plant charges and division expenses. The estimated amount of concrete in the locks, including approach and wing walls, is 858,600 cu. yds., so there remain 691,732 cu. yds. to complete.

Steel collapsible forms are used for the main and lateral culverts, and wooden forms in built-up panels, 15 ft. long and 8 ft. high, are used for the construction of the walls. The panels are a series of uprights, 14 ft. long, held together by walling strips and lagging. The latter is placed on the upper 6 ft., the lower 8 ft. acting as cantilevers on the concrete previously placed. The anchor bolts extend into the masonry for 2 ft., and are removed as the work progresses, leaving the anchor nut embedded. Each panel is used at least 12 times.

Filling back of the west wall was begun about the 1st of June. Material was obtained from the Ancon quarry site, and 9,616 yards were placed at a cost of 28.47 cts. per cu. yd., including plant and division expenses.

The west dam at Pedro Miguel consists of two mounds or toes of all classes of waste material, a large percentage being rock, with the intervening space filled with selected material, forming an impervious core. The selected material is clay, excavated from the canal prism south of the locks, and is deposited from dump cars in layers about 6 ft. deep, each layer being thoroughly wetted down and compacted. Within the year 51,827 cu. yds. have been added to the impervious portion and 41,964 cu. yds. to the toes at a cost of 38.60 cts. per cu. yd.

A total of 99,703 cu. yds. were removed below the locks at Pedro Miguel at a cost of $0.6345 per cu. yd. The bulk of this material was placed in the dam.

Miraflores.—The excavation for the upper locks of the flight at Miraflores was practically completed during the year, and the work of preparing the foundations, erecting concrete plant, and placing concrete begun. The total amount excavated was 234,731 cu. yds. by steam shovels, and 59,098 cu. yds. by hand, scrapers, and cranes; the actual excavation work being done at a cost for the last six months of $1,369.

A 20-in. suction dredge worked in the lower lock site until Dec. 20, 1909. Because of the large number of bowlders encountered and the character of the material, the output was small and the performance of the dredge unsatisfactory. As this dredge could be utilized to advantage in the Atlantic division, it was transferred, and arrangements are being made for excavating the remainder of the material by hydraulic means. The dredge removed 141,759 cu. yds. at an average cost of 50.63 cts. per cu. yd.

The work of repairing the foundation of the upper locks was begun as soon as the excavation was completed sufficiently, and consisted of cleaning up loose material and excavating for the lateral culverts and the areas above the miter sills. This work was done by a Thew steam shovel and by hand, the total amount excavated being 39,381 cu. yds. Excavation by steam shovels, classed as preparing foundations, was 25,655 cu. yds. The average cost was $1.947 per cu. yd.

The handling plant in these locks will consist of four berm cranes, two of which are in operation in the forebay at Pedro Miguel and four chamber cranes, all of which are in use at Pedro Miguel. On June 1 concreting in the upper lock was begun on the floor and lateral culverts, the mixture being furnished by two ½-yd. mixers, as it is desired to complete the floors before the permanent plant is transferred from Pedro Miguel. The total amount of concrete laid was 1,630 cu. yds., at a cost of $7.393 per cu. yd. The estimated amount of concrete in the locks, including approach and wing walls, is 1,327,300 cu. yds.

The west dam, extending from the head of the locks to Cocoli Hill, consisting of two mounds or toes made up of waste material obtained from lock excavation, mostly rock, and of hydraulic fill between them, was continued during part of the year; 157.483 cu. yds. were placed in the toes, at an average cost of $0.6774 per cu. yd., and 120,910 cu. yds. of impervious material were added by the dredge. As this material was taken from the lock chamber, the expense was charged to excavation, Miraflores locks. Operations on the impervious part of the dam ceased when the dredge was taken out of commission.

Stone and sand.—Broken stone for concrete is furnished by the quarry which was opened on the west side of Ancon Hill. In opening up the quarry, 2,384 cu. yds. were removed in preparing the necessary grade, and 194,112 cu. yds. of stripping. The plant was finally installed and operations begun on Feb. 19, 1910, and a total of 175,174 cu. yds. of crushed stone was secured. The quarry is worked 8 hours per day, and during June furnished 32,232 cu. yds., or 155 cu. yds. per hour in service and 265 cu. yds. per actual working time. As a large amount of screening was required for road surfacing in connection with municipal improvements, a small jaw crusher was installed, fed directly from one of the storage-bin pockets, which reduces the size to one-half inch or less. It has produced from 30 to 40 cu. yds. of finishing material per day. The average cost of crushed stone delivered in the bins was $1.2682 per cu. yd., and delivered in the stock piles at Pedro Miguel $1.5023 per cu. yd., including in each case plant charges and division expenses.

Prior to the operation of the Ancon quarry stone for concrete was obtained from the Rio Grande quarry, which furnished broken stone for ballast and highway construction. This quarry was operated until Feb. 10 and supplied 58,928 cu. yds., at an average cost of $1.28 per cu. yd. In addition 3,750 cu. yds. were obtained from the Atlantic division, at a cost of $2.39 per cu. yd.

Sand for concrete is obtained from a bay formed by Point Chamé, about 20 miles up the coast from Balboa. Sand is secured by a French self-propelling ladder dredge and loaded into barges of 500 cu. yds. capacity, which are towed to Balboa, where it is removed from the barges to storage bins by means of rapid unloading cranes. Dump cars are loaded from the bins by gravity and the sand transferred to the storage trestles at the lock sites. A total of 229,250 cu. yds. of sand was secured during the year, of which 101,748 cu. yds. were sent to the Atlantic division for use in concreting there. The average cost per cubic yard for the last six months is $0.7293 delivered in the bins and $0.9764 per cu. yd. delivered in the stock piles, plant charges and division expenses included.

Hydraulic machinery.—The material to be removed in the 2-mile stretch of channel below Miraflores locks amounts to about 9,650,000 cu. yds., of which over 1,500,000 cu. yds. are rock. As time is one of the important elements and it was impossible to assemble a sufficiently large dredging plant to complete this section within the limit fixed, an hydraulic excavating plant was selected as being not only the most expeditious method of handling loam overlying the rock, but the cheapest. It has an additional advantage in that the material removed can be utilized in reclaiming swamp lands adjacent to the line of the canal and belonging to the commission.

The plant as designed contemplates the washing of the material overlying the rock to sumps by means of a date jet under high pressure, and of dredging pumps elevating and conveying the material from the sumps through flumes. It consists of a central pumping station, pipe lines, hydraulic monitors, and dredging pumps. The central station is located on the west bank of the canal, and in the center of the area to be excavated. There are mounted four Worthington horizontal direct acting, triple expansion pumping engines, with 24-in. stroke, 24½-in. water cylinders, and 19, 30 and 50-in. steam cylinders. Each pump is provided with a surface condenser and a direct acting single cylinder 12x20x24 in. vacuum pump. The pumps discharge into a common delivery pipe equipped with the necessary checking gate valves. Steam is supplied by four Babcock & Wilcox standard water tube boilers arranged in batteries of two each. Oil will be used for fuel, for which purpose two steel tanks of 2,000-bbl. capacity each were erected on a hill at the rear of the station so as to feed the oil burners by gravity. The supply pipe from the pumping station is 3,600 ft. long, made up of 2,000 ft. of 40-in. and 800 ft. of 32-in. lock-bar pipe, and 800 ft. of 24-in. spiral riveted pipe. The main is provided with valves and tees suitably located for connecting branch lines leading to the monitors. The branch lines are 16-in. spiral riveted pipe laid in groups of three so that two giants may be continued at work while the third is being changed. The monitors are fitted with special deflecting nozzles. The dredging pumps, three in number, are 18-in. single suction centrifugal pumps, direct connected to a 655-h.p. induction motor. These pumps, with motors, switchboard, and priming pump, are all mounted on reinforced concrete barges especially designed by the division engineer and constructed for the purpose.

The Rio Grande River which originally occupied a portion of the area to be excavated has been diverted and a dike constructed across the south end to prevent the access of tide water to the area. After the removal of loam overlying the rock by hydraulic process, the rock will be excavated by means of steam shovel in the dry, that method being the most economical.

South of the area to be excavated by hydraulic means, the necessary depth and width of channel will be secured by ordinary dredging operations. During the year, there were employed at this work the 20-in. seagoing suction dredge "*Culebra*," one 5-yd. dipper dredge "*Cardenas*," and four French ladder dredges. The total output of these dredges aggregated 6,914,384 cu. yds., of which 57,161 cu. yds. were classified as plant, at an average cost of $0.2408 per cu. yd., including plant charges and division expenses.

Three methods are employed in breaking up the rock in this section so that it may be handled by the dredges; the rock lies in separate shoals of comparatively small area and volume. The first method is by drilling and mining, in which case well drills operate through the overlying earth to a depth below the required grade; the holes are sprung, charged, and fired. By this means 274,339 cu. yds. of rock were broken up, of which 19,392 cu. yds. were removed by the dredges.

The second method is by subaqueous blasting, for which purpose a drill barge was constructed consisting of a steel hull 112 ft. long by 36 ft. 8 ins. wide, provided with timber spuds—one at each corner of the barge. Three drill frames 38 ft. high are located along one of the gunnels, arranged to move lengthwise of the barge on rails. Each frame carries a slide to which is attached a 5½-in. rock drill, and each slide is operated by a hydraulic ram and may be moved vertically through 10 ft. The drills are operated over a distance of 85 ft. from one position of the barge, and the holes thus far have been spaced 5 ft. apart on 6-ft. centers located by means of ranges on shore. The barge began operations in March, 1910, and blasted over an area of 49,600 sq. ft. No dredging was done.

The third method is by rock breaking, and a Lobnitz rock breaker was placed in commission in August, 1909. It consists of a ram or cutter of steel fitted with a hardened steel conical point which is alternately hoisted and dropped. The device is mounted on a steel hull 100x28x8 ft. The tidal range requires the use of three sizes of rams, 30, 40, and 56 ft., weighing approximately 15, 16, and 19½ tons. The general practice has been to attack the surface of a rock shoal which has been exposed by dredging with the rock breaker at intervals of 4 ft. each way, the points of attack being located by ranges on shore and permanent marks on the bay. The average limit of penetration thus far has been 3.12 ft. After the entire area of a shoal is gone over, the rock breaker is removed and the broken rock dredged out. The area covered during the year was 266,230 sq. ft., from which 25,515 cu. yds. were dredged.

Notes on Dredging and Its Cost in French Guiana.

In French Guiana, dredges handle river gravel at from 36 to 42 cts. per cu. meter. Mr. Albert F. J. Bordeaux, in the November Bulletin of the American Institute of Mining Engineers deals in considerable detail with the conditions in the Guiana gold fields, from which we have abstracted the following notes: Dredging is the cheapest method of excavation. On a plant costing $60,000 including its transport and erection on the spot, the depreciation is considered to be about 16 per cent per year, on account of the excessive wear and tear in tropical climates. This assumes the life of the plant to be about 6 years. On the supposition that, by reason of numerous obstacles in the creeks and in hauling the gravel, the real efficiency of a 1,000 cu. m. capacity plant is reduced to 600 cu. m. a day, with 300 days' work in a year, then the amount of gravel will require 5.5 cts. per meter to repay the plant cost in 6 years.

The following table is a complete estimate of costs, after experiments lasting about 6 months with a dredge of English design (Renfrew, Scotland). While this dredge should have worked at 1,000 cu. m. daily capacity, so many difficulties were experienced during the first season, that it was impossible to excavate more than 300 to 400 cu. m. per 24 hours:

Fuel, 23 cords at $1.30	$ 30.00
Labor, 10 men per 8 hour shift at $1.12 including food	34.00
Engineer and fireman	5.50
Clearing the wood, and sundries	16.00
Repairs, water, and tools	5.00
Freight, general exp., management, etc.	40.00
Total cost per day	$130.50

In each shift are 10 men, 1 winchman, 1 engineer, 1 foreman, 1 man and helper for washing, 3 men with shovels for cleaning the gravel from clay which sticks to the buckets, 3 men for transporting the wood, tying the ropes, etc. The wages average $0.80 per day and $0.32 for food according to contract. In 1907-1908, two dredges on the Lezard Creek, operating with many interruptions, gave the following results with the above costs: No. 1, 126,000 cu. m. gravel; No. 2, 40,000 cu. m gravel.

Cost of Repairing Leaks in Water Mains.—In Toronto, Ont., during 1909, 234 leaks of all sizes in water mains were repaired, or an average of 0.686 leak per mile of main. The cost of repairs was $6.84 per mile, or $9.97 per leak, including materials and labor.

Some Costs of Channeling Rock on the New York State Barge Canal.

No single item of work in the construction of the New York State Barge has, perhaps, been the subject of more criticism than the item of channeling. It is required that the sides of prism in rock shall be channel cut. Percentage bidding is also required and the law requires that no bid can be accepted which for any one item exceeds the engineer's estimate by 20 per cent and that the excess over the engineer's estimate for all items must not exceed 10 per cent. At the beginning of the work the engineers in calling for bids made their estimate for channeling 20 cts. per sq. ft. Complaints were general that this estimate was far too low and later the estimate was increased, we believe, to 30 cts. per sq. ft. These prices, it should be understood, applied to the general run of work, in special cases they were widely varied from by the engineers. In one case which comes to mind the estimate was 75 cts. per sq. ft. and the bid accepted was 90 cts. per sq. ft. Normally, however, the price set has been 20 cts. and 30 cts. per sq. ft.

While complaint has been general that these prices and particularly the earlier price of 20 cts. are too low to give any profit, a quite general inquiry among the contractors on the Barge Canal has given very few actual cost data. It is with particular interest, therefore, that we present the following cost figures from an authoritative source, covering 16 consecutive months of channeling work on one section.

The data covers work on Contract 6. The work here was limestone. The channelers used were Sullivan Y-8, costing $2,800 each. The operating crew comprised:

½ to 1/6 foreman at	$4.00	per day
1 channeler at	3.50	" "
1 fireman at	2.00	" "
1 helper at	1.75	" "
1 laborer at	1.50	" "

The work was done between Sept. 1, 1908 and Dec. 31, 1909, covering a period of 16 months, and using from 2 to 6 channeling machines.

In presenting the costs we consider each month separately and finally summarize to secure averages.

(1) In September, 1908, 2 channelers worked 9 8-hour shifts and channeled 454 sq. ft., or an average of 50½ sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$199.47	$0.4393
Coal	12.87	0.0283
Water	0.90	0.0020
Interest and depreciation	98.10	0.2160
Total	$311.34	$0.6856

(2) In October, 1908, 2 channelers worked 44 8-hour shifts and channeled 2,582 sq. ft., or an average of 59 sq. ft. per shift, at the following costs:

Item.	Total.	Per sq. ft.
Labor	$494.81	$0.1916
Coal	62.92	0.0244
Water	4.40	0.0017
Interest and depreciation	98.10	0.0379
Total	$660.23	$0.2556

(3) In November, 1908, 2 channelers worked 48 8-hour shifts and channeled 2,282 sq. ft., or an average of 48 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$621.25	$0.2722
Coal	68.64	0.0301
Water	4.80	0.0021
Interest and depreciation	98.10	0.0429
Total	$792.79	$0.3473

(4) In December, 1908, 3 channelers worked 75 8-hour shifts and channeled 3,942 sq. ft. or 53 ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$1,079.75	$0.2739
Coal	107.25	0.0272
Water	7.50	0.0019
Interest and depreciation	163.77	0.0413
Total	$1,358.27	$0.3443

(5) In January, 1909, 3 channelers worked 82 8-hour shifts and channeled 4,522 sq. ft., or an average of 55 ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$1,161.75	$0.2570
Coal	117.26	0.0259
Water	8.20	0.0018
Interest and depreciation	201.00	0.0444
Total	$1,488.21	$0.3291

(6) In February, 1909, 3 channelers worked 82 8-hour shifts and channeled 5,795 sq. ft., or an average of 71 sq. ft. per shift at the following costs:

Item.	Total.	Per sq. ft.
Labor	$1,270.22	$0.2191
Coal	117.26	0.0202
Water	8.20	0.0014
Interest and depreciation	187.60	0.0324
Total	$1,583.28	$0.2731

(7) In March, 1909, 3 channelers worked 95 8-hour shifts and channeled 9,962 sq. ft., or an average of 105 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$1,496.64	$0.1502
Coal	135.85	0.0136
Water	9.50	0.0009
Interest and depreciation	201.00	0.0202
Total	$1,842.99	$0.1849

(8) In April, 1909, 4 channelers worked 180 shifts and channeled 16,541 sq. ft., or an average of 91 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,148.32	$0.1299
Coal	257.40	0.0156
Water	18.00	0.0011
Interest and depreciation	195.00	0.0118
Total	$2,618.72	$0.1584

(9) In May, 1909, 4 channelers worked 175 8-hour shifts and channeled 15,149 sq. ft., or an average of 86 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,284.26	$0.1507
Coal	250.25	0.0165
Water	17.50	0.0011
Interest and depreciation	130.00	0.0085
Total	$2,682.01	$0.1768

(10) In June, 1909, 4 channelers worked 168 8-hour shifts and channeled 13,402 sq. ft., or an average per shift of 80 sq. ft. at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,179.33	$0.1626
Coal	240.24	0.0179
Water	16.80	0.0012
Interest and depreciation	195.00	0.0145
Total	$2,631.37	$0.1962

(11) In July, 1909, 4 channelers worked 183 shifts and channeled 10,525 sq. ft., or an average of 57 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,299.00	$0.2184
Coal	261.69	0.0249
Water	18.30	0.0017
Interest and depreciation	195.00	0.0185
Total	$2,773.99	$0.2635

(12) In August, 1909, 4 channelers worked 197 8-hour shifts and channeled 6,673 sq. ft., or an average of 34 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,273.00	$0.3407
Coal	281.71	0.0422
Water	19.70	0.0029
Repairs	116.00	0.0174
Interest and depreciation	210.00	0.0314
Total	$2,900.41	$0.4346

(13) In September, 1909, 4 channelers worked 202 8-hour shifts and channeled 8,162 sq. ft., or an average of 40 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,520.00	$0.3087
Coal	288.86	0.0353
Water	20.20	0.0024
Interest and depreciation	132.00	0.0161
Total	$2,961.06	$0.3625

(14) In October, 1909, 6 channelers worked 236 8-hour shifts and channeled 10,816 sq. ft., or an average of 46 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,724.25	$0.2518
Coal	337.48	0.0312
Water	23.60	0.0021
Interest and depreciation	300.00	0.0277
Total	$3,385.33	$0.3128

(15) In November, 1909, 6 channelers worked 261 8-hour shifts and channeled 8,802 sq. ft., or an average of 34 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	$2,933.00	$0.3332
Coal	373.23	0.0424
Water	26.10	0.0029
Interest and depreciation	300.00	0.0341
Total	$3,632.33	$0.4126

(16) In December, 1909, 6 channelers worked 145 8-hour shifts and channeled 6,935 sq. ft., or an average of 49 sq. ft. per shift at the following cost:

Item.	Total.	Per sq. ft.
Labor	[illegible]	$0.2576
Coal	207.35	0.0298
Water	[illegible]	0.0021
Interest and depreciation	300.00	0.0432
Total	$2,308.10	$0.3327

Summarizing and averaging these figures we get the following costs:

Item.	Per sq. ft.
Labor	$0.2171
Coal	0.0246
Water	0.0017
Repairs	0.0009
Interest and depreciation	0.0237
Total	$0.2680

These figures cover 126,544 sq. ft. of channeling.

ROADS AND STREETS SECTION

Some Costs on Concrete Road Construction in Wayne County, Mich.

The Board of County Road Commissioners of Wayne County, Michigan, has devoted much of its attention to the construction of concrete roads, and at the present time has completed or underway about 15 miles of this type of road. The standard specifications under which these roads were constructed were printed in our issue of [illegible]. Most of the work has been done by day labor, the board at times having as many as 250 men in its employ. Labor saving devices are used as much as possible. Stone, cement and sand are handled by traction engines, and plowing and grading are done behind an engine. The concrete is mixed in mechanical batch mixer which travels under its own power. The wages paid for labor per 9-hour day are about as follows: Subforeman, $3; watchman, $2; laborers, $2. Teams are hired at the rate of $4 per day. The following notes have been taken from the last annual report of the Board of Road Commissioners for the yearing ending Sept. 30, 1910:

Woodward Avenue Road.—The work on this road is a continuation of the mile of concrete built last year, extending to the county line, and is the first complete stretch of road through Wayne County. The road is laid in two courses, 24 ft. wide at its narrowest point, ranging from thence up to 34 ft., with 18 ft. of concrete, 6½ ins. deep. It is 1.21 miles long. The first course is made of a 1-2 ½-5 mix of Portland cement, sand and limestone, 4 ins. deep; and the second course is made of a 1-2-3 mix of Portland cement, sand and crushed cobblestone, 2½ ins. deep. It is laid in 25-ft. sections, using a specially prepared tar paper for the expansion joints. The Board last year having experimented on several forms of joint, came to the conclusion after a year's wear that the tar paper had given the most satisfactory service. Weather conditions during the early spring were very unfavorable for any road work, owing to the excessive rainfall, and it was not until June 2d that the actual work of concreting was started. The road was finished July 13th and opened to traffic its entire length July 20th. Despite all unfavorable conditions, more rapid progress was made in the construction than was anticipated.

Following is a summary of the cost of the roadway proper:

Roadway proper:	Total.	Per sq. ft. Concrete.
Teams	$951.75	$0.074
Other labor	6,042.62	.472
Limestone, 1,702.15 tons	1,709.32	.133
Crushed cobblestone, 1,119.73 tons	2,154.13	.168
Sand, 1,046.76 cu. yds	822.30	.064
Cement, 3,214 bbls	3,486.94	.272
Tar paper for joints	40.75	.003
Coal, 52½ tons	154.89	.012
Lumber	31.45	.003
Totals	$15,394.15	$1.201

The other items in the cost of this road were as follows:

Drainage:	
Open ditching, labor	$ 238.64
Tile drains, labor	442.44
Tile drains, material	201.79
Culvert, 7-mile road	498.65
Culvert, 8-mile road	129.30
Extra drainage, not included in bids	73.59
Total drainage	$1,584.41

Blue prints and photographs	$ 9.90
Advertising	9.00
Liability insurance	90.41
Water supply	36.62
Lubrication, waste, kerosene, etc.	105.35
Miscellaneous	36.99
Extras, not included in bids (approaches, etc.)	246.35
Total	$ 534.62

This makes the total cost of the road $17,513 or about $14,475 per mile.

Michigan Avenue Road.—This road was one of the longest pieces of road constructed by the Board during the past year, it being 2.412 miles long. It was the original intention to build the road 6½ ins. deep, but owing to the nature of the sub-grade and the heavy traffic, it was finally decided that 7½ ins. would more satisfactorily fulfil the requirements and make a better and more durable highway. This road is built of concrete, in one course, 18 ft. wide, 24 ft. over all, using a 1-2-4 mix of Portland cement, washed sand and washed gravel. The original roadbed of Michigan Avenue Road was found to be about 20 ft. at its widest point, ranging from this down to 16 ft., necessitating a large amount of fill to bring it up to the required width of 24 ft., which added very materially to its cost.

Two reinforced concrete culverts were also constructed and a 45 ft. span, steel bridge was reinforced. The work of laying concrete was started on June 22. The road was finished Aug. 25 and thrown open to traffic throughout its entire length on Sept. 2d.

Owing to the Grand Trunk strike and other causes the proposed commissions were subjected to many annoying delays in securing material, which necessarily added to the cost of the road, and delayed the time of completion. However, with all attendant delays, an average of 236 ft. of completed roadway per working day, rain or shine, was made.

Following is a summary of the cost of the roadway proper:

Roadway proper.	Total.	Per sq. yd. Concrete.
Teams	$3,099.75	$0.121
Other labor	10,778.51	.423
Pebbles	5,061.66	.199
Sand	2,110.78	.083
Bank run gravel	115.70	.004
Cement	10,234.86	.402
Coal	339.85	.013
Tar paper	76.82	.003
Yard rental, lumber, etc.	673.18	.026
Total	$32,491.11	$1.274

In addition there were the following items:

Drainage.	
Open ditch, labor	$ 645.26
Tile drains, labor	1,358.25
Tile drains, material	644.87
Culverts, labor	197.76
Culverts, material	168.98
Total	$3,015.12
Bridge.	
Labor	$ 250.45
Material	404.64
Repairs to, before road was built	125.00
Total	$ 780.09

The grand total cost of the 2.412 miles of road was $36,286 or about $15,044 per mile.

Van Dyke Road.—This road is one mile long and its construction was started from where work was left off last year. It is built of concrete, 15 ft. of metal, 24 ft. over all, 6 ins. deep in two courses, the bottom course being composed of Portland cement, washed sand and concrete limestone in the proportions of 1-2½-5; the top course of Portland cement, washed sand and crushed cobblestone in the proportions of 1-2-3. Work was started Aug. 19 and finished September 15. Following is a summary of the cost:

Roadway proper.	Total.	Per sq. yd. Concrete.
Teams	$468.50	$0.053
Other labor	3,250.79	.369
Limestone	1,116.00	.127
Crushed cobblestone	1,562.09	.177
Sand	873.38	.099
Cement	3,498.35	.397
Coal	62.70	.007
Tar paper	27.54	.003
Board of men	221.06	.025
Engineer's stakes, lumber, etc.	121.37	.014
Total	$11,201.78	$1.271
Drainage		
Open ditching		$76.46
Grand Total		$11,278.24

Wayne Road South—This is a leading road out of the village of Wayne, connecting up with Romulus and other small centers of population in Wayne County. It is built of concrete, 10 ft. wide, with 3 ft. of gravel on one side and 3 ft. of limestone macadam on the other side and dirt shoulders bringing the width up to 24 ft. over all. The gravel and limestone macadam were in the nature of an experiment to determine the feasibility of such a construction under actual travel conditions, on roads where the traffic is not great, with a view of reducing the initial cost and still making provision for the passage of teams and other vehicles, without subjecting the dirt shoulders to wear in wet weather. At the time the report was issued the limestone had bonded together, owing to its inherent properties, and vehicle traffic had used it to the exclusion of the gravel side which had not bonded thoroughly as yet. The report states that it will take a longer period to determine the points on which the Board was experimenting. This road is built in one course, 6 ins. deep, of Portland cement, washed sand and washed pebbles in the proportions of 1-2-4, and makes a very satisfactory road. The construction work was undertaken late in the fall and owing to frost and other bad weather conditions, the cost was somewhat increased over what it would have been had the work been done under normal conditions.

The following is a summary of the cost:

Roadway proper.		
Labor	[illegible]	
Pebbles, 1,014.35 cu. yds	818.64	
Sand, 597.65 cu. yds	402.23	
Limestone, 190.12 cu. yds	193.76	
Cement, 665 bbls	790.82	
Protection to concrete	28.00	
		[illegible]
Drainage.		
Labor	[illegible]	
Material	[illegible]	
		$ 112.30
Proportion of general expense		204.07
Rental of Machinery and repairs		146.60
Coal and wood		32.20
Miscellaneous		[illegible]
Total		[illegible]

This makes the cost per mile about $9,259

Notes on Road and Street Work.

Rough Surface Concrete Pavement.—During 1909 the city of Toronto constructed a total of 2,883 sq. yds. of concrete pavement. This pavement was laid on lanes upon which the traffic of wheeled vehicles was not excessive. The pavement consisted of a 4-in. rough concrete foundation upon which was placed a 2-in. surface of richer mixture, which was finally blocked off into rectangles 8 in. by 10 in. According to the annual report of the

City Engineer of Toronto for 1909 it has been found that this mixture is very brittle and abrades rapidly under the action of traffic and becoming smooth does not afford sufficient foothold for horses. Accordingly it is proposed in the future to construct a monolithic type of concrete pavement, leaving the surface rough.

Cost Data on Surface Tarring at Alton, England.—In 1909 the Urban District of Alton, England, undertook the tar painting of some of its granite coated main roads. This surface tarring proved so successful in reducing the dust and lengthening the life of the roads, that at the commencement of the present season it was decided to also tar portions of the district roads in addition to the main roads. The work was described in a paper by G. Bertram Hartfree, Surveyor to the Council of the Alton Urban District, presented at a recent meeting of the Institution of Municipal and County Engineers, and the notes that follow have been taken from Mr. Hartfree's paper. The area to be tar painted was intended to be one-third by hand treatment and the remainder by contract, subject to a small machine being used. The following prices were quoted for contract work: Hand treatment crude tar, including labor in sweeping and dusting, 3 cts. per sq. yd.; machine treatment, including labor as before, 2½ cts. per sq. yd.; using distilled tar, 3¾ cts. per. sq. yd. For machine tarring, the council to provide for sweeping and gritting with distilled tar, the prices ranged from 1⅘ cts. to 2⅜ cts. per sq. yd., and with condition from 1¾ cts. to 2 cts. per sq. yd. In every case about 6 yds. per gallon was quoted. The offer of a firm to supply a horse drawn machine using distilled tar was accepted, but this offer was canceled later and the whole of the work was carried out by direct labor. At first there was only a 40-gal. boiler available and the tar was dipped out and spread from watering cans provided with horizontal spreaders. This type, Mr. Hartfree states, is preferable to the hose spreader as a more uniform covering is obtained. The tar was well brushed in with special tar brushes and left to dry in by the sun. Towards evening dust was sprinkled on by hand, and not direct from the shovel, sufficient to cover only being used. The best results were obtained on scorching hot days, commencing tarring about 11 a. m. and finishing at 3 p. m.; this allowed a perfectly dry and hot surface before treatment, and good sun drying after. When the tar had reached a rusty brown color it was taken as sufficiently dried. With the small boiler about 1,000 sq. yds. per day could be covered, working from six to six, but tarring during suitable hours only half this quantity could be covered. To further advance the work a "Weeks" 80-gal. boiler and sprayer was purchased at a cost of $143.34. This gave satisfactory results, and 2,000 yds. were treated, working a full day; but, as before, the best effects were obtained by treating about 1,000 yds. during the hottest part of the day. At first trouble was found with the spray, arising through insufficient knowledge on the part of the men using it, the tar from previous spraying having caked the nozzle. Afterwards, by cleaning it immediately after use and warming the end before the next operation, no further choking occurred. With the advent of the "Weeks" machine it was possible to make comparisons between crude and distilled tar and Tarvia by hand treatment and machine-sprayed. The crude tar was obtained from local gas works, and was subjected to no other treatment than well boiling to expel water and free ammonia, and the admission of a ltitle lime to neutralize the fixed ammonia. This gave rise to a noticeable smell, but, the work being carried on in an isolated part of the district, no serious complaint was received.

The cost of various treatments was as follows:

HAND PAINTING

	Cts. per sq. yd.
Crude tar, 1 gal. to 7 yds.	1½
Distilled tar, 1 gal. to 5 yds.	2¾
Tarvia, 1 gal. to 6 yds.	2¼

SPRAYING

Crude tar, 1 gal. to 7 yds.	1
Crude tar, 1 gal. to 7 yds. and covering with limestone dust	1¼
Distilled tar, 1 gal. to 6½ yd.	2
Distilled tar on flint surface, 1 gal to 5 yds. and coating with sand	2¾
Tarvia, 1 gal. to 5½ yds.	2½
Tarvia, 1 gal. to 5½ yds. and covering with limestone chippings	3¼

Crude tar costs 3 cts. per gal., distilled tar 7½ cts., and Tarvia, 8¾ cts.

Asphalt Pavement Work at Toronto, Ont.—Previous to last year the city of Toronto, Ont., had been laying two clases of asphalt pavement—a light type and a heavy type. In 1909, however, a third class, known as the medium type, was introduced. The total yardage of asphalt pavement laid for the city last year was 230,657 sq. yds., of which 49,139 sq. yds. was of the heavy type (2-in. asphalt surface, 1 in. binder course and 6 in. concrete foundation), 69,179 sq. yds. was of the light type (2 in. asphalt surface and 4 in. concrete base) and 110,743 sq. yds. of the medium type (2 in. asphalt surface, 1 in. binder and 5 in. concrete base). The following table taken from the report of C. H. Rust, City Engineer, for the year 1909, shows a comparison between the maximum, minimum and average prices for asphalt pavements, from 1901 to 1909:

	Maximum.	Minimum.	Average.
1901 Heavy	$2.70	$2.30	$2.46 6/10
" Light	2.23	1.88	2.04 1/2
1902 Heavy	2.60	2.45	2.51
" Light	2.15	1.66	2.01 1/4
1903 Heavy	2.50	2.14	2.21 3/5
" Light	1.88	1.60	1.70
1904 Heavy	2.30	2.15	2.22 6/10
" Light	1.83	1.53	1.65
1905 Heavy	2.19	1.99	2.05
" Light	1.66	1.36	1.51
1906 Heavy	2.01	1.79	1.91 4/5
" Light	1.64	1.38	1.42 2/5
1907 Heavy	2.27	2.14	2.19
" Light	1.83	1.50	1.62
1908 Heavy	2.33	1.92	2.15 2/3
" Light	1.96	1.33	1.51 2/5
1909 Heavy	1.95	1.59	1.72 2/3
" Medium	1.80	1.40	1.60
" Light	1.44	1.12	1.28

The extremely low prices for 1909, states the report, were brought about rather by the keen competition existing among the contractors, than by a reduction in the actual cost of the pavement. The report adds that as it is impossible for contractors to lay asphalt pavements at these prices and make a reasonable profit, it is not probable that the city will obtain so durable a pavement at such a small cost. Of the total of 230,657 sq. yds. of asphalt pavement constructed last year, 33,841 sq. yds. was laid by the day labor forces of the Roadways Branch of the City Engineer Department. In addition to the new work the Roadways Branch made such repairs as were necessary to all asphalt pavements upon which the contractor's guarantee had expired. The amount of repairs required totaled 50,884 sq. yds., the average cost per sq. yd. being 54.2 cts. During the season the municipal asphalt plant turned out 13,414 batches of asphalt surface and 2,303 batches of binder, or approximately 3,200 loads of fiye batches each. It is figured that each batch of asphalt surface will lay approximately 6 sq. yds. of surface 2 in. thick and that each batch of binder will lay 12 sq. yds. 1 in. thick. Binder was not used in making the ordinary repairs except in cases of excessive thickness. The average cost per batch of binder and surface was as follows:

	Binder. Per batch.	Surface. Per batch.
Pay roll	$0.10	$0.21
Aggregate	1.05	1.95
Fuel	.04	.07
Burden	.58	.51
Total, per batch	$1.77	$2.74

On the basis that one batch of binder makes 12 sq. yds., 1 in. thick, the cost per square yard was 14¾ cts. The cost of asphalt surface on the basis of one batch making 6 sq. yds. 2 in. thick, the cost per sq. yd. of the surface was about 45.7 cts. per sq. yd.

Road Surface Tarring in Switzerland. The surface treatment of roads with tar as a means for preventing dust has been used in Switzerland for a number of years. In fact as early as 1906 in the town of Basle the work had progressed beyond the experimental stage. At the present time a large number of the towns in Switzerland are using tar surface treatment both for carriage ways and foot-ways as a means for counteracting dust. In the town of Basle the tarring of roadways has proved particularly successful and at the end of 1909 the town had about 230,000 sq. metres of tarred roadways. On roads with heavy traffic the tar coating did not prove efficacious and was not again applied. On roads with light traffic, however, the success attained even in the first year was great. The tarring was also successful on medium traffic roads and was renewed after a lapse of three or four and was renewed after a lapse of three or four years. In a report of roadway conditions in Switzerland, presented at the Second International Road Congress at Brussels, Mr. Victor Wenner and Mr. Arthur Schlaepfer of Zurich discuss in some little detail the use of tar as a means for preventing dust. The matter in this note has been taken from this report. Of 16 towns of Switzerland reporting on the surface tarring of carriage ways, seven towns praised the process for roads with light and average traffic; four towns had either not yet made any experiments or considered such to be inadequate for light traffic and had quite abandoned them for the time being; five towns including Zurich, had made more or less thorough experiments, the results of which, however, could not up to the present be described as satisfactory. Messrs. Wenner and Schlaepfer state that in order to assure success in the surface tarring of carriageways the following points should receive careful consideration: (1) The roads to be tarred should be in a good state of preservation; and if an entire pebble coating is not to be laid at the outset, the bad places should be broken up and fresh pebbles rolled in as firmly as possible before the tar is applied, a wornout road should not be tarred; (2) Roads which are not firm or are constructed of inferior material, should not be tarred; (3) The tar coating should be applied from four to six weeks after the rolling of the surface. In any case the metal surface must be perfectly dry and free from dirt or dust, but the binder should not be scraped out; (4) The tar used should be as free as possible from water and ammonia. A coal tar is to be recommended, which, at 300° gives the following: Hard pitch, 66 to 68 parts, oil 31½ to 29½ parts, water about 2½ parts. (5) The first coating of tar should only take place during dry weather, and if possible, after several warm, summer days. Continuous warm weather is less essential for the second coating. (6) Before the tar coating has become quite hard, it must be strewn with sifted granular sand. This thin layer of sand is then to be suitably rolled with a not too heavy hand roller. The above points are considered essential to assure the success of the surface territory. As the result of special comparative studies of the tar surfaces of Basle and Zurich, Messrs. Wenner and Schlaepfer recommend the following points for especial consideration: (1) A very hard metal is less suitable for this tarring process than a somewhat softer metal, which, however, may be able to support light or moderate traffic; for instance, river and quarry rubble. This combination, however, should be fairly homogeneous. (2) A principal cause of failure appears to be that in many places the rolling of the roads without the addition of sand is not continued until the surfacing has become completely cemented. (3) Another cause of failure is due to the fact that during the first year the surface becomes hacked in the middle principally by the calks on the horses' shoes. In order to prevent the penetration of water, it is of advantage to strew the moist tar covering lightly with sand, by which the separate holes will be more or less filled and during good weather closed up again by traffic.

The Interborough Rapid Transit Subway of New York City has 74.18 miles of single track.

WATER-WORKS AND SEWERS SECTION

Types of Wells; Their Comparative Cost and Merits and Methods of Protection from Pollution.*

Because of their cheapness, convenience, and fancied safety, wells are [illegible] popular source of domestic supplies in all regions in which water is found at reasonable depth. If properly located and constructed they afford an ideal source of supply fully justifying their popularity. But if they are carelessly finished or improperly located they are much more liable to pollution than is commonly supposed, and it is with the view of pointing out some of the precautions that should be taken for their protection, as well as of presenting information concerning desirable types, location, and construction, that the following discussion is presented.

TYPES OF WELLS

Although no two wells are exactly alike in all particulars, there are, in reality, only a few distinct forms, the others being simply modifications or combinations of these. The kind of well to be sunk at a particular locality depends mainly on the nature of the material to be encountered, one form being particularly adapted to a certain material, such as sand, while an entirely different form is demanded if rock is to be penetrated. The following tables show clearly and concisely the characteristics and methods of sinking the more common types and point out the conditions to which they are best adapted:

TYPES OF WELLS AND CONDITIONS TO WHICH THEY ARE ADAPTED.

Dug.—Generally circular excavations, 3 to 6 ft. in diameter, dug or blasted by hand and curbed with wood or with stones or bricks laid without cement. Adapted to localities where the water is near the surface, especially where it occurs as small seeps in clayey materials and requires extensive storage space for its conservation. Should not be near sources of pollution.

Bored.—Bored with various types of augers from 2 ins. to 3 ft. in diameter, rotated and lifted (together with the earth) by hand or horsepower. Curbed with wood, cement, or tile sections, with open or cemented joints, and more rarely with iron tubing. Adapted to localities where the water is at slight or medium depths and to materials similar to those in which open wells are sunk.

Punched.—Small holes, usually under 6 ins. in diameter, sunk by hand or horsepower, by dropping a steel cylinder slit at the side so as to hold and lift material by its spring. Clay is added to incoherent materials like sand to bind them together so that they can be lifted. Adapted to clayey materials in which water occurs as seeps within 50 ft. of surface, but not at much greater depths.

Driven.—Small iron tubes, usually 1¼ to 4 ins. in diameter and provided with point and screen, driven downward by hand or by simple hand or horsepower apparatus. Adapted to soft and fine materials, especially to sands and similar porous materials carrying considerable water at relatively slight depths. Particularly desirable where upper soil carries polluting matter.

California or Stovepipe.—Overlapping sheet-steel casings, 4 ins. or more in diameter, forced downwards by hydraulic jacks and finally perforated by a special apparatus at water strata. Drillings are removed by a long sand-bucket with valve. Adapted to soft materials extending to considerable depths and having several water strata capable of utilization.

Standard Drilled.—Sunk by percussion of heavy drill, 1½ to 12 ins. or more in diameter, lifted and dropped from portable rig or derrick by horse or steam power. Cased with iron pipe in soft materials; usually not cased in rock. Drillings removed by long bucket with valve in bottom. Can be used to advantage in all but the softest materials, but is particularly adapted to rock work, especially at great depths, being cheaper and quicker than other methods of drilling in rock.

Diamond-drill Hole.—Sunk by rotating hollow bit, usually 1¼ to 4 ins. in diameter, with rim fitted with black diamonds. Penetrates by abrasion due to rotation. Drillings removed by water forced down drill and up along outside of rods. Not adapted to water wells because of great cost. Used where cores of materials penetrated are required, or where hole is sunk at an angle with the vertical.

Wood.—Square wooden boxes in wells over 3 ft. in diameter; cylindrical curbs of narrow staves in wells under 3 ft. in diameter. Can be placed in any shallow well, but are never safe and should never be used.

Tiles.—Glazed sewer tile, cement tiles, and porous terra cotta tiles, laid without cement. Adapted to conditions similar to those of rock and brick curb.

Tiles.—Glazed sewer tile and cement tile with cemented joints. Same as cement-lined stone or brick curbs, except that it is more applicable to wells of small diameter.

Heavy Iron Casings.—Iron pipes, 1 to 4 ins. in diameter, with tight joints. Adapted to wells of all depths in which water is obtained from a stratum below the casing, or from strata between cased sections. Not adapted to strongly corrosive waters.

Sheet-iron Casings.—Iron pipes 4 to 16 ins. in diameter, with snug joints. Adapted to wells of all depths, in loose material, in which it is desired to procure water from a number of strata.

SUMMARY OF ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPES OF WELL CURBS AND CASINGS.

Rock.—Allows all water to enter, thus utilizing all seeps. Material often costs little or nothing. As a rule requires little money outlay for labor. Polluting matter enters readily and well is never safe if near sources of contamination. Affords no filtration and permits dirt and soil to enter. Permits entrance of mice and other small animals at top.

Brick.—Where uncemented it allows all water to enter, utilizing all seeps. Filters out most of sediment. Does not allow small animals to enter. Involves little money outlay for labor. Polluting matter enters readily, and well is never safe when near sources of contamination. Material costs considerable.

Cement-lined Rock or Brick.—Safe from pollution (except that entering at bottom) as long as walls are not cracked. Prevents entrance of sediments. Prevents entrance of animals. Does not impart taste to water. Utilizes water from bottom only. Is unsafe if so shallow that polluting matter can reach its bottom. Costs considerably more than uncemented wells. May require skilled labor.

Wood.—Cheap in many localities. Can be used in wells of very small diameter. Does not taste of iron. Swells tight in wet ground, the water either entering at bottom or (after sudden rises) through shrunken portion at top. Pollution enters readily. Animals gnaw through. Wood rots, giving taste to water and favoring development of bacteria. Expensive in some localities.

Glazed and Cemented Tiles with Uncemented Joints.—Allows all water to enter, utilizing all seeps. Does not give taste to water. Does not require skilled labor. Polluting matter enters readily and well is never safe if near source of contamination. Soil may wash in through joints. Requires some outlay for material.

Glazed and Cement Tiles with Cemented Joints.—Safe from pollution (except that entering at bottom) as long as joints are tight. Does not require expensive labor. Can be used only in soft materials containing considerable water.

Iron Casings.—Adapted both to rock and to unconsolidated materials. Safe from pollution except that entering at bottom. The cost in large, deep wells is considerable. Practically limited to wells under 14 ins. in diameter. Is subject to deterioration by corrosion and incrustation in some places. Utilizes but one water stratum (except where perforated).

YIELD OF WELLS OF VARIOUS TYPES.

If an adequate supply of ground water is available, the yield of a well will depend on the character of the water-bearing material, the facility of entrance of water, the size or storage capacity of the well, and the nature of the pumps.

Character of the Material.—The character of the water-bearing material is of the greatest importance in determining the yield of a well, as it is on the structure and texture of the water-bearing beds, that the amount of water which they will give up depends. A close-textured clay, for instance, may hold as high as 45 per cent and a chalk as high as 53 per cent of its volume, while an open-textured sand may hold as little as 26 per cent of its volume. Notwithstanding this a sand will ordinarily yield large supplies, whereas a chalk and especially a clay will yield little or no water. In quicksands water is usually present in large amounts, but owing to the absence of good foundations for the curbing and the ready flow of the fine sand through the minutest crevices, ordinary dug wells in such material are generally out of the question and even driven wells equipped with the ordinary strainers usually soon become clogged. Driven or drilled wells equipped with special screens and sunk by experts familiar with the various methods of handling quicksand are usually the only types entirely successful in such material.

Structures, such as solution passages, bedding planes, or joints, play an important part in determining the yield of a well. A solution passage in limestone may afford inexhaustible supplies where the mass of the rock is practically destitute of water. In other rocks the bedding planes and joints may afford excellent supplies where no water is found in the rock itself. The amount of water present in the pores of different rocks is indicated by the following average porosities: Sandstones 15 per cent, shales 4 per cent, limestones 5 per cent, crystalline rocks 2 per cent. The water present in the larger openings mentioned, though small in amount in comparison to that held in the pores, is yielded much more rapidly and, except in sandstones and similar porous rocks, usually affords the principal source of supply.

Facility of Entrance.—The facility with which water enters the well depends in part on the rock features enumerated and in part on the nature of the well. In loose materials water accumulates most easily in stone-curbed and similar types of dug wells and only less so in tightly curbed dug wells with open bottoms. Where the water bed is a strong one and the materials are sufficiently consolidated to prevent them from entering the well the water will freely enter an iron casing open at the bottom. In weak water beds in soft materials, and in quicksands, either perforated casings or casings equipped with long screens are necessary to permit the entrance of the required amount of water. In many of the harder rocks the walls will stand without caving and casings are therefore unnecessary, the water entering at any point without hindrance

Storage Capacity of Wells.—Where strong water beds exist storage is unnecessary, the water entering from the rock as fast as the pumps demand. Where the supply is derived from weaker beds, especially those having only small seeps, storage is a significant factor and the type and size of the well are of great importance. The volume of tubular wells of equal depth varies with the square of their diameters, hence a 6-inch well will hold nine times as much water as a 2-inch well of the same depth, and a 3-foot well thirty-six times as much as a 6-inch well. Dug wells are therefore of advantage in clays and similar materials where the water enters more slowly than it can be lifted by the pumps, for they permit accumulations that may tide over periods in which the amount used is greater than the supply. For the deeper rock waters dug wells are impracticable and small-bore drilled wells must be used even where the supplies are slight. To get the best results the wells are generally made as large as can be afforded and sunk considerably below the point of entrance of the water, to afford the necessary storage.

DEPTH OF THE WATER

The depth of the water is a factor of importance in the determination of the type of well to be sunk. A dug well, for instance, is suitable only when the water is within 30 or 40 ft. of the surface, although many deeper dug wells exist. A punched well is commonly limited to depths of 50 ft., and a bored well is with difficulty carried to depths greater than 100 ft. Driven wells are most suitable at depths of less than 150 ft., although they are sometimes successfully extended to depths of 250 to 300 ft., or even to 400 or 500 ft. or more, where the conditions are favorable. Jet wells are usually sunk only where it is not necessary to go much more than 100 ft. from the surface. Wells of the California type are frequently extended to depths of 1,000, and occasionally to depths of 2,000 ft. Hydraulic rotary wells are successful to depths of 1,000 or 2,000 ft. in the proper rocks. The percussion or churn drill may be used for all depths down to 5,000 ft., or deeper if special outfits are provided. Diamond drills have been successfully used to depths of 6,000 ft.

[illegible] TYPES

So many items, such as accessibility to fuel, cost of labor, trade combinations, knowledge of water conditions, relative availability of different outfits, and local practice, enter into the cost of a well that few definite statements can be made. Instances are not uncommon where wells of certain types have been put down for one-tenth the price demanded for wells of the same type in other regions where conditions are essentially similar. In general, however, if only actual outlay of money is considered the dug well is the cheapest, for it may be constructed by the owner himself at times when he has nothing else to do. Bored and driven wells do not require expensive rigs and are often cheaper than dug wells when paid labor is employed in their construction. California wells for deep bores in soft materials are moderately cheap where the proper outfits are available, but unfortunately their use is as yet confined mainly to a single region. The jet process is adapted to the sinking of a large number of adjacent wells in soft materials, especially sand, and is occasionally successful for single wells, although in most places driven wells can be put down at less cost. The hydraulic and rotary processes may be cheaper than straight drilling where there are numerous alternations of hard and soft material. Of the processes in use for drilling in rock the standard rig (percussion drill) is the cheapest, the calyx and diamond systems being generally used only when cores of the rocks penetrated are desired. A more detailed comparison of the methods is given in the subjoined table. Although the relative costs indicated are fairly constant over the country as a whole, the cost of any method in a particular locality may be entirely abnormal, owing to the lack of drilling outfits capable of doing the work or to the existence of peculiar conditions rendering its operation difficult.

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*Extract from Water Supply Paper No. 255, U. S. Geological Survey, by Myron L. Fuller.

SAFETY OF WELLS.

The safety of a well depends on the purity of the water at its source and on its protection against the entrance of contaminated waters and polluting solids. The type of well does not affect the purity of the original source; but if the water supply is primarily pure, its maintenance in that condition depends largely on construction that prevents contamination.

Polluting matter finds entrance to wells in a variety of ways. In dug wells it enters through the crevices in the stone, brick, or wood curbing, or possibly through the brick itself; in bored wells it enters through the uncemented joints of the tiling or through cracks between the staves of tubular wooden curbing; and in drilled and driven wells through leaky joints or holes eaten in the iron casing by corrosive waters. By cementing the interior surfaces of stone or brick curbed wells, by replacing wood by cement or other impervious curbs, and by substituting new pipes for leaky iron casings the entrance of polluting matter through the walls can be prevented. Little or nothing enters the small tubular wells from the top and they may, therefore, be regarded as free from danger of pollution from this point. The larger open wells should be protected by a water-tight iron or cement cover standing somewhat above the level of the surrounding ground and tightly joined to the curb proper. The sloping of the earth away from the well serves to turn rainwater or pump drippings away from it, so that little will penetrate, even if the curb becomes cracked by frost.

A particularly dangerous type of well—the more so because of the fancied security of the owners—is the combination dug and drilled type. Because of a slight saving of expense, drilled wells are frequently sunk in old dug wells, the casing commonly beginning at the bottom of the old well. Although the water encountered by the deep well may be perfectly pure, it is liable to be contaminated, especially after rains, by the entrance of seepage waters into the open well and thence into the drilled well. The remedies are obvious; either the casing should be carried to the surface of the outside ground, or at least above the highest level ever reached by the water, or the open well should be converted into a water-tight cistern by the application of a thick coat of cement over both sides and bottom.

OPEN OR DUG WELLS.

Location.—The chief considerations in the location of open wells and wells in which pervious casings are used, in the order of importance usually ascribed to them by the owners, are: Cost, accessibility, convenience, and safety. The requirements, unfortunately, often conflict. Most houses and barns are located on elevations for the sake of good drainage, sightliness, or other considerations, but wells in such situations are rarely as cheap as the less convenient wells in the hollows. Again, convenience often demands that the well be located near the house, where slops are thrown upon the ground, in the vicinity of a cesspool or privy, or near the barnyard or hogpen, while safety demands its location on high ground at a considerable distance from these and other sources of pollution.

In cases of conflicting requirements it is usually the cost which eventually determines the location, or rather it is the initial cost, for in many instances the final cost of a proper installation—if the cost of the resultant loss of health is considered—is much less than that of an improper installation, although the latter may not produce actual disease.

A safe well is nearly always, in the long run, the cheapest, such a well being decidedly cheaper than the cost of medical attendance. Safety should invariably be made the first consideration instead of the last. A well should never be put down in a doubtful situtaion, even as a temporary makeshift, for the owner almost always waits until too late before replacing it.

Sources of Pollution.—Open or dug wells may be polluted by material seeping through the ground and curbing or entering from the top of the well. Of the seepage materials cesspools and privies are the most important source. In most localities the large amount of liquid reaching such receptacles is rapidly absorbed by the earth and becomes a part of the water body feeding the wells. Slops thrown on the surface likewise soak into the ground, and even if the liquid at first evaporates the residue is later taken up by the rain which sinks into the ground, and is carried downward to the ground-water body. The matter leached from hen yards, from hogpens, and from the manure piles near barns, eventually enters the ground and finds its way in one form or another to the ground water below. Drainage from manured fields and from pastures occupied by stock may also be a prominent source of pollution. Much of the polluted water from such sources is purified by passage through the ground and the danger of pollution of well waters by seepage is commonly exaggerated, yet gross carelessness in locations of wells near privies, cesspools, drain pipes and other filth receptacles is prevalent in many farm districts.

One of the greatest sources of pollution for farm wells is the entrance of material at the top, and dug wells are especially liable to contamination of this sort, though other well types are not entirely exempt.

Of the material entering a well from the open top dust is an important source of contamination. It is always present in the air and the amount actually settling is very many times more than the conspicuous dust coatings collecting in buildings. In fact, in open wells, especially in regions where brisk winds are common, the accumulations sometimes amount to several inches in a year. Many wells which are cleaned only once in two years are found to contain as much as 6 inches of foul-smelling black muck, representing the dust and other refuse entering the well in that length of time.

Small animals, such as toads, mice, moles, and snakes, fall into the well in times of drought when the sources of water they usually depend on have failed.

Except that it keeps the larger animals out and is a convenience in using the well, the ordinary plank covering affords but little improvement over the open well. Crevices almost invariably exist through which the smaller animals may find access, and the dirt washed through the cracks by the pump drippings may be almost equal to that entering through an open top. Moreover, it is a very dangerous type of dirt, as in many places it includes filth from domestic fowls and from the shoes of farm hands and others coming from manured fields, hogpens, or barnyards.

Movement of Ground Water.—When a well is carried downward in porous or semiporous materials, such as those in which most open wells are located, a level is soon reached, below which the ground is saturated with water (at least down to the first impervious stratum). This water body, or ground water, as it is called, has a definite upper surface, known as the water table, which conforms in general with the broader surface irregularities as shown in figure 17, but with the difference that the section of the water table is flatter than that of the surface, being far below the ground on hilltops and cutting the surface in valleys. The motion of the ground water is in the direction of steepest slope of the water table, as illustrated in figure 18, and as this roughly coincides with the surface slope it follows that the direction of motion of the ground water generally approximates that of the surface drainage.

From the laws of occurrence thus outlined it appears that low points are the most favorable for obtaining water by open wells, as the water movements converge in that direction and the water table is nearer the surface there than elsewhere. Sewage, being to a large ex-

TABLE I.—COST OF WELLS.
(By O. E. Meinzer.)

Formation.	Diameter in inches.	Locality.	Explanations.	Cost per foot.
Limestone	6	Illinois, Iowa, Minnesota, Wisconsin.	No casing required	50 cts. to $1.
Glacial drift and Cretaceous shale.	2	Iowa and Minnesota.	Heavy iron casing furnished; water guaranteed.	55 cts. to $0.75+.
Do	4	...do	....do	$1, more or less.
Glacial drift	4 to 6	Illinois	Light casing furnished	50 cts. or more.
Do	Bored, 6 to 36	Minnesota and Iowa.	Casing not furnished; planks or tiles are used. These are expensive per foot, but the wells are not as deep as the drilled wells.	50 cts. to $1+, increasing with depth.
Glacial drift and Cretaceous shale (mostly soft shale).	$1\frac{1}{4}$ at bottom	South Dakota artesian basin.	Casing furnished; flow of clear water guaranteed.	$350 to $500 for a well 900 to 1,000 feet deep.
Clay, free from bowlders.	$1\frac{1}{4}$	Utah	Casing not furnished	20 cts.
Clay, sand, and gravel.	Dug, 3 to 4 ft	.do	Not cased	$1.50 to $2, increasing with depth.
Quartzite	6	Minnesota	No casing required; yield of 3 barrels an hour guaranteed.	$3 to $4.
Alluvium	4 to 12	California	Casing not furnished. Stove pipe casing costs from 32 cts. a foot for 4-in. 16-gage pipe to $1.40 a foot for [illegible] 10-gage pipe.	30 to 65 cts. a foot for 4 to 10-in. wells, for first 100 feet, with additional charge of 25 to 35 cts. a foot for each additional 50 feet in depth.

tent simply water to which a certain amount of foreign polluting matter has been added, follows the same laws of motion as the ground water, converging in an identical manner toward the low spots, which are therefore points of danger where sources of contamination occur on the adjacent slopes.

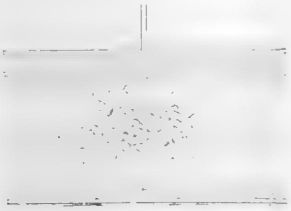

Fig. 1—Diagram Showing Loosening Effect of Shooting Wells.

Safety Distance.—By "safety distance" is meant the distance from a source of pollution at which a well may be sunk with a fair degree of safety. Some writers have spoken of a "cone of safety," by which is meant an inverted conical section of earth with its apex at the bottom of the well and its base a circle of some fixed radius on the surface. The radius taken by some is the depth of the well, by others twice the depth of the well, but such limits are usually fixed without taking into consideration the nature of ground-water movements or the character of the passages in which it moves. The distance of safety also depends to a considerable degree on the quantity and concentration of the pollution entering the ground water. Where coming from the surface the amount is commonly not large, but where entering at a considerable depth, as from cesspools sunk in limestone or in porous sands which also supply water to wells, it may reach the water stratum almost undiluted. It follows that no absolute radius can be laid down, each case demanding individual consideration. Certain generalizations, however, may be made as to conditions in materials of different types and under different topographic conditions, some of which are indicated below.

Clay and Till.—In ordinary clay and in the pebbly or bowlder clay known as "till" the water circulates in part by general seepage through the mass, in part through relatively thin sandy layers, and in part along more or less open but irregular tubular passages. Seepage through the body of the clay or till is very slow and polluting matter is rarely carried for any great lateral distance; 100 ft. from the nearest source of pollution may perhaps be regarded as a safe limit. The clay offers even more resistance to the passage of water directly downward, a 5-ft. bed as a rule effectively shutting off polluting matter from the underlying water beds, unless such matter obtains access along the break made in sinking a well or other excavation. When the water follows sandy layers the movement, though much faster than in uniform clay, is nevertheless not very rapid, rarely exceeding a few feet per day, and pollution does not often extend much over 150 ft., 200 ft. usually being a safe distance. In open passages movement is much more rapid, and may amount to several hundred feet a day in extreme cases. Under such conditions there is no purification and relatively little dilution, and if the passage discharges into a well dangerous contamination may result. In a thickly inhabited region a well depending for its supply on passages of this nature is never safe.

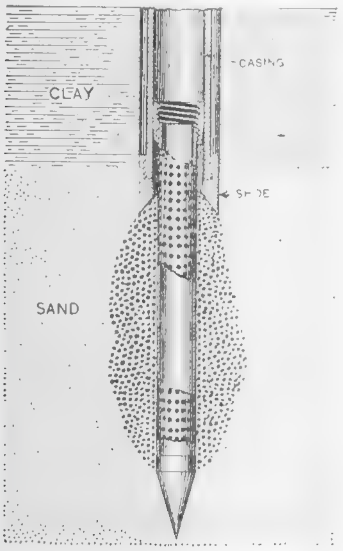

Fig. 2—Diagram Showing Formation of Sand Packing Through Pumping.

Sand.—A bed of sand is among the safer water beds. Being of an incoherent nature, the material rarely contains open passages, the water circulating in general by a slow movement among the grains. The rate, though sometimes amounting to 50 ft. or more a day, is usually under 5 ft. and may be under 1 ft. A well 200 ft. from the nearest point of pollution is probably safe in fine and medium sands, but in coarse sands and gravel a much greater distance may be essential.

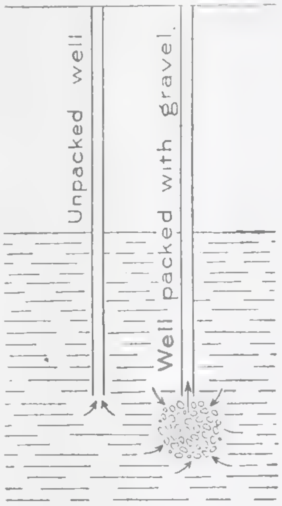

Fig. 3—Diagram Showing Advantages of Packing with Sand and Gravel.

Sandstone.—The movement of water in sandstone is in part through the body of the rock and in part through small open passages along the joint or bedding planes. Owing to the greater density of the rock resulting from the cementation of the grains the distance to which pollution may extend through the pores of the rock is less than in sand, 100 ft. usually being a safe distance. Probably even with the water moving along the joints and bedding planes 125 to 150 ft. from the source of pollution is a safe distance for a well.

Slate and Shale.—In slate and shale the water follows in part the planes of stratification or bedding and in part the more or less vertical joints by which these rocks are usually cut. Unless certain of the layers are sandy the movement along the bedding planes is generally slow and pollution is carried for only short distances. The joints, however, are in many places fairly open and may conduct the water within a short time to considerable distances, possibly many hundred feet, like the granite joints described on page 15. However, unless the examination of the rock or the behavior of the drill in the well shows the presence of such open joints, a well in slate or shale may usually be considered safe if not less than 100 ft. from a source of pollution.

Limestone.—The movement of water through limestone is almost entirely by means of open passages. Some of these are only a minute fraction of an inch in width, being no wider than joint and bedding planes. In such passages the movement of water is very slow and pollution is rarely carried far, 150 ft. from a possible source usually being a safe distance. Other passages, however, are of considerable size, perhaps many feet in diameter, and may extend for miles. One chamber in Mammoth Cave is nearly 10 miles long, and there is evidence that similar though perhaps smaller channels exist at numerous other points. These openings are not uncommonly occupied by flowing streams which, if polluting matter is introduced, may carry it for many miles. Such streams may have connection with surface sink holes. Cornstalks and other refuse from the surface not infrequently appear in wells drawing water from limestone, and the waters are often muddy after storms. Such occurrences are indications of surface contamination and the waters should be avoided if possible.

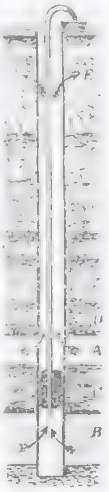

Fig. 4—Section of Well Showing Loss by Leakage Into the Superficial Deposits.

Granite. — Practically no water passes through the body of granite, the movement being mainly along joint or fault planes or through pore spaces in the disintegrated upper portions of weathered granite masses. Polluting matter may reach to considerable distances through joint or fault planes, as is indicated by the fact that the salt water of the ocean finds entrance to some wells located 500 ft., and in places even a quarter of a mile or more, from the shore. It is said that in the deep public well sunk in granite at Atlanta, Ga., sufficient polluting matter entered through a joint struck at 1,160 ft. from the surface to render the water unfit for drinking.

Protection from Surface Wash.—Many open wells are exposed to the same danger of pollution from surface wash as springs, and the same methods of protection should be used. A water-tight curb should be raised a few inches or a foot above the level of the surrounding surface and the earth banked around it, with a slope away from the well. This curb quickly deflects the water and prevents it from collecting and soaking through the ground into the well.

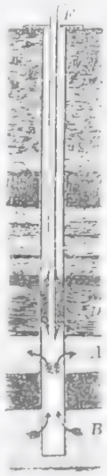

Fig. 5—Section of Well Showing Loss by Leakage from One Deep Bed Into Another.

Protection from Stock.—The chief means in which wells become polluted by stock is through seepage from the surface. Watering troughs are commonly placed close to wells, and usually in such places the hoofs of the animals soon wear holes in which the rain water and more or less of the animal excrement collect and soak into the ground, finally reaching the well. To prevent this contamination the watering trough should be placed as far away from the well as possible, the water being conducted to it by pipes. A well in an open pasture, if it is to be used at all by human beings for drinking water, should be surrounded by a fence at least 20 ft. away.

Protection from Pump Drippings.—The drip from pumps is a very common and dangerous source of pollution. In the greater proportion of dug wells provided with pumps the well is covered with boards or planks laid or nailed over the top. No matter how carefully these platforms are constructed cracks through which water can enter almost invariably exist, and it is a common occurrence to have the water dropping or trickling back into the well whenever any is spilled in pumping. The danger of this will be understood when it is recalled that those stepping upon the platform to pump may have just come from the barnyard or from manured fields, bringing with them on their shoes more or less filth, part of which is left on the planking and washed into the well by dripping water from the pump or by the next rain. The wooden platform should be replaced by a water-tight cover made of iron, cement, or other impervious material. Cement covers are coming into use in many localities and afford ideal protection.

Protection from Small Animals.—An ever-present cause of pollution in open wells and wells insufficiently protected by coverings is the entrance of small animals. It is a common thing for snakes, toads, mice, and even rabbits to penetrate through crevices and to fall into the well, especially in dry seasons when the animals are compelled to make desperate attempts to reach water. The remedy is an impervious well cover fitted tightly to the curb.

Protection from Dust.—Dust is usually less dangerous than other sources of pollution, but in dry seasons, when dirt from the street or barnyard is being blown about, it may become of considerable amount and danger. It is not uncommon to find several inches of black, foul-smelling silt in the bottom of a well on cleaning, even though it may have been cleaned only a year or two before. The dust may be kept out by water-tight coverings such as are used to keep out pump drippings.

Increasing the Yield.—The methods of increasing the yield of wells vary according to whether the well is of the dug or drilled type and whether the existing supply has or has not materially decreased from the original supply. An originally inadequate yield commonly results from insufficient supplies in the water-bearing rock or from the slowness with which the supplies are given up. A decreased yield may be due to some defect in the well itself.

Remedy for Insufficient Supplies.—Ordinary clay and the denser varieties of pebbly and bowlder clay or till usually contain but little water, and this little is often largely in the form of interstitial water held in the body of the material and given up slowly to a well by general seepage. Under such conditions the amount entering the well is often more or less proportional to the area of surface exposed in the wall. This area varies with the diameter of the well; thus, three times as much surface will be exposed in a given height of wall in a 6-in. well as in a 2-in. well and six times as much in a 3-ft. as in a 6-in. well. To give a large yield a large-diameter well is very desirable in materials of the character mentioned.

Large wells are also desirable in rocks in which the water occurs in a similar manner—that is, in pores rather than in open passages. In general, however, if water is yielded at all by the rocks, it is given up more readily than by clays, hence a large bore is less necessary. This is fortunate, for the range of size in rock wells is usually rather scant, owing to the fact that most rock wells are of the drilled type. Where the water occurs in bedding or joint planes the diameter is of still less importance, as the entrance of the water is localized and is relatively free. Large diameters, nevertheless, increase materially the likelihood of striking an opening. In the oil regions the increase of the diameter of a bore 2 ins. by reaming has been known to open pools not encountered in the original hole, and a similar result is possible in water wells.

The depth of dug wells in material in which the amount of water is relatively small is also important, for increase in depth increases the storage space in which the water can collect during periods when the well is not in use, thereby greatly adding to its total capacity.

In many regions, owing to the removal of the forests and the construction of drainage ditches, the water from rainfall and snowfall runs off more rapidly than formerly and much less sinks into the ground. As a result the ground-water level has been lowered over large areas and wells which once afforded good supplies are now dry. In many places there is still plenty of water in the ground, the only difference being that its level has sunk below the bottom of the well. In such places the deepening of the well brings complete relief.

In the course of time an accumulation of material entering the well as dust at the top, or washed in through the ground, forms considerable amounts of silt in the bottom and on the sides. In some wells this deposit is sufficient to hinder, to a certain extent, the entrance of water into the well and to lessen its storage capacity. Some relief is usually afforded by cleaning out the well.

DEEP WELLS.

Depth is one of the most important factors to be considered in sinking a well. On it both the type and the location often depend. The benefits which the owner expects to realize from a deep well as compared to a shallow well are (1) larger supply, (2) higher head, and (3) purer water.

Location.—In the location of deep wells the chief consideration is the obtaining of a supply, slight differences in location seldom seriously affecting the cost, while the prevailing use of casing in soft deposits insures safety from ordinary sources of pollution. The occurrence of deep waters depends on the character and structure of the rocks far below the surface. No indications of these features are usually found at the surface, and the well may as a rule be located independently of surface relief, though where artesian flows are expected the well should be located on as low ground as possible. Information as to the best location for a deep well may often be obtained from a careful study of the records of wells in adjacent regions, which can be made by the more experienced and intelligent drillers, or from a study of the rocks and their structure, which often requires the services of a trained geologist.

Relation of Supply to Depth.—It is a widespread, in fact an almost universal belief that the amount of water increases with depth and that water may be had anywhere if one only "goes deep enough." This is, however, far from the truth. Rainfall appears to be the source of at least 99 per cent of the fresh water found in the ground, the remainder being water included in the rocks at the time of their accumulation beneath the sea, together with a small amount derived from volcanic sources. As would be expected from its atmospheric source, water actually decreases rather than increases in amount with depth, a great many rocks encountered by the deeper wells and mines, especially at depths below 1,000 ft., being entirely destitute of water.*

However, if only the more superficial portion of the crust is considered, there is in general an increase of water with depth. Except in valley bottoms and other depressions the surface soil and rocks, although carrying much moisture, are rarely saturated; but at depths which vary, according to climate, soils, and topography, from a few to several hundred feet, a saturated zone constituting the ground-water body is encountered. Wells starting anywhere above drainage level will in general encounter water in increasing amounts at least down to the drainage level. Again, the surface beds may be of non-porous nature and may therefore be destitute of water, while the underlying beds, if porous and below drainage level, are likely to be saturated.

Of course there is a constant tendency for the surface waters to penetrate downward and fill the porous rocks below. That these are at present destitute of water may be due, at least in certain rugged regions, to the draining of the deeper and in places relatively porous beds by deep valleys. Elsewhere, and this is doubtless the most common cause, the water is kept from percolating downward by impervious beds near the surface. The deeper rocks are largely of the granitic type and hold but little water. Except where they constitute the surface rock and are somewhat broken by joints it is of little use to penetrate them in search of water.

To speak broadly, it may be said that there is no general increase of water with depth and that the finding of deep supplies is entirely dependent on local geologic conditions. Unless there is some proof that deep water-bearing beds exist, the sinking of a deep well should be regarded wholly in the light of an experiment, although in sedimentary rocks it has the decided advantage that it may penetrate a number of water strata, which may afford in the aggregate a fair supply where a single stratum might not suffice.

Relation of Head to Depth.—As with regard to volume, there is a general belief that the head of water increases progressively with depth. This belief has a better basis than the other, for in some places such a relation of head to depth exists, as in the artesian system shown in figure 19, in which the deeper beds outcrop at successively higher levels.

The reverse condition is shown in figure 20 Such conditions are not the result of universally prevalent structures, although it is perhaps more common than otherwise that the strata are higher at the rims than they are at the centers of the great structural troughs. In many structural basins, the outcropping beds of the rims in fact lie high up on the flanks of mountains, while the beds of the center constitute low plains.

Relation of Quality to Depth.—Another prevailing idea is that the deeper waters are purer. Within limitations this is generally true as regards the shallower waters, which, being close to the surface and without the protection afforded by overlying clays or other impervious beds, are susceptible to pollution. Deeper waters, on the other hand, are almost always overlain by relatively impervious beds that serve to keep out polluting materials, and as a rule they are entirely safe. In many places, however, the amount of mineral matter dissolved in the water shows a general increase with depth, the amount in deep waters averaging several times that in surface waters, which are largely made up of recent rainfall. There are some exceptions to this law, due mainly to variations in the character of the materials in which the waters are found, the waters in a calcareous glacial drift or in an alkaline flat, for instance, often being very much harder than those in underlying beds. Limestone waters, too, are generally harder than sandstone waters. The maxim of certain drillers, "The harder the rock the harder the water," is based on the prevailing softness of the sandstones in many districts as compared to the hardness of the limestones.

In addition to the impervious beds mentioned, the casing plays an important part in preventing the access of pollution to deep waters. When the casing has been corroded, pollution from sources near the surface is often admitted through the minute holes eaten in the iron, spoiling the deep waters. Where the casing does not entirely fill the hole, contamination may pass down outside of it, while in uncased rock wells pollution may enter through any of the numerous fissures that usually exist in the upper part of the rocks. Even in such wells, however, the danger of contamination decreases rapidly with depth.

Protection of Nonflowing Wells.—Many of the conditions favorable to pollution of the shallow wells likewise favor the contamination of deep wells, but as the causes and remedies have already been discussed, especially in connection with the section on "Safety distance," they do not require further consideration at this point.

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*Fuller, M. L., Total amount of free water in the earth's crust: Water-Supply Paper U. S. Geol. Survey No. 160, 1906, pp. 64-70.

The water of deep wells when first encountered is usually safe and rightfully has a good reputation, so that people often go to great expense in drilling for deep rock waters. Unfortunately, however, many fail to realize that unless care is taken, it is possible for deep wells to become polluted by the entrance of surface waters. In regions where the rock is within a few feet of the surface, for instance, the casing may be carried only to the rock, the fact that pollution can enter the well through the rock crevices being entirely overlooked. The chief precaution necessary against this danger is to carry the casing to a sufficient depth to shut off all surface waters entering through fissures. It is hard to say how deep it must be carried to remove all danger of contamination, but the crevices are usually limited to the upper part of the rock and every additional foot of casing gives additional safety. Ten feet of casing in the rock would materially reduce the danger, while 25 ft. would in most wells probably insure safety. The best plan, however, is to carry the casing from the surface down to the water-bearing seam. The casing should always be set with a tight joint at the bottom to prevent the entrance into the well of surface waters that find their way downward along the outside of the pipe.

Again, it is not unusual to drill new wells in the bottom of old dug wells and to allow the polluted surface waters to mingle with the pure rock waters.

Many towns situated on rock surfaces and using unprotected wells of the type mentioned have been visited by epidemics of typhoid fever, cholera, and other diseases, leading to the loss of many lives.

Another source of pollution, less common and possibly less dangerous than the preceding, arises from the fact that many casings are left open at the top, even when care has been taken to carry them to proper depths.

A fourth and very common means of contamination of deep wells is by leaks in the casing due to imperfect joints or to corrosion. The process of corrosion may be very rapid, the pipe in some wells with acid chalybeate waters lasting only a few years. No one expects a pipe laid in the ground near the surface to last many years, yet many seem to think that a well casing will last indefinitely. Unfortunately, this is far from true.

The detection of leaks is somewhat difficult. In some wells, however, water may be heard trickling in or may be seen by a light ray projected down the well by a mirror when the pump is withdrawn. The admixture of water from outside sources may sometimes be detected by a difference of the hardness of the well water, by an earthy taste or taste of decayed vegetation, or by a cloudiness due to silt brought in by superficial waters.

The remedy is usually to pull the old casing and replace it by a new one, the length of time the pipe is allowed to remain before replacement being determined by an estimate of its life based on the action of the water on the pump tube or other pipes. An alternative treatment sometimes employed when the leak is near the surface is to set a packer designed for the purpose in the space between the bottom of the pump tube and the casing and fill the space above with cement.

Flowing Wells.—In order that water may have sufficient head to flow out upon the surface it must be confined under some impervious or relatively impervious clay or other bed. This effectually shuts out pollution from the overlying materials, and any contamination that reaches the well must be transmitted laterally for relatively long distances. As pollution rarely extends through the ground to any great lateral distance from its source, it follows that artesian waters are almost never polluted.

In artesian wells the water, being under greater head than that in the surrounding materials, will pass outward through any leak that may develop rather than admit the water of lower head to the well. Suction, such as is developed in the Richards apparatus in laboratories, which might be conceived as drawing in outside water through openings in the casings, can not take place with the relatively low velocities of the water in the ordinary artesian wells. Even in a well in which the water has a very high velocity, the suction is so slight in proportion to the immense volume discharged that it may usually be neglected.

Methods of Increasing Original Yield.—Shooting.—The practice of "shooting"—exploding a charge of nitroglycerine or other explosive in a well—has long been successfully employed in the oil regions and has in late years been used to increase the flow of water wells, in which dynamite is more commonly used. The action of the dynamite is to shatter the surrounding rock, with the result that connection is frequently established with other crevices, in some wells largely increasing the water supply. (See Fig. 1.) The dynamite is most effective in hard, brittle rocks, such as limestone, which are as a rule completely shattered by the explosion, and is least effective in soft tough shales, which are bent and compressed rather than broken.

Steam Jet.—Shooting, owing to the character of the materials, is not usually practiced in unconsolidated deposits, in which the steam jet is sometimes used instead of dynamite. The steam is forced down a small pipe inside of a larger one and coming into contact with the water at the bottom turns it quickly into steam, the resulting explosion loosening the material or making a pocket about the bottom of the pipe. Where the materials are dense and clayey, the action of the steam jet may considerably increase the influx of water; in the more porous deposits it has less effect.

Packing with Gravel or Sand.—It frequently happens that where the material is very fine it packs around the well so as to hinder the entrance of water. In such cases it is a common practice to drop a supply of pebbles into the well and with the aid of a drill force them out into the surrounding clay, etc., until a pocket of pebbles is produced through which the water flows freely to the well.

In quicksands, the space between the outer casing and the pump tube and striner is often filled with sand through the heavy suction induced by pumping. The sand in many wells keeps back the quicksand while allowing the water to pass through it freely and to enter the well. (See Fig. 1.)

Production of Sand or Other Pockets by Pumping.—Many of the materials yielding water to wells consist of mixtures of sand or gravel and clay. By heavily pumping a new well it is often possible to remove the fine clayey material, leaving the sand grains and pebbles in a sort of pocket about the well (Fig. 2), the result being much like that produced by the artificial gravel pocket described in the preceding section. A similar method is employed in certain stiff clays, in which small open pockets at the bottom of the well are apparently produced by the heavy pumping.

Methods of Restoring Lost Supplies.—When a deep well is first sunk, it usually gives good supplies, but as time elapses the yield is found to decrease gradually until finally it is but a small fraction of the original amount. This decrease is commonly attributed to a decrease in the general supply of the region or to the drawing off of the water by newer and better wells. In many wells this is a real cause, but in others the failure is due rather to the deterioration of the old well than to the losses caused by new wells, which in reality have a large yield simply because they are new and in good condition. The chief cause of decrease or failure are clogging of the screen, entrance of sand, and leakage.

Rescreening the Well.—Of the causes of failure enumerated the clogging of the screen or strainer is probably the most common. This may result from the filling of the perforations by sand and silt sucked in with the water, but other very common causes are the closing of the pores by the deposition of iron or lime. Where the waters carry acids in solution, the screen is often attacked and corroded, the iron set free being redeposited in the sand about the screen, forming thick, impervious coatings of a sort of sandstone which sooner or later effectually shuts off the water.

When the matter collected about the well point is soft and loose, it can often be removed by back pressure produced by pumping heavily into the well, the outward current forcing back the accumulated silts. When this fails, the usual remedy is to pull the casing and screen, or the pump and well point, and replace it by a new one. (See Pl. XVII.)

Prevention of the Entrance of Sand.—If a well is not properly constructed and screened, sand or quicksand may enter the well in large quantities and greatly hinder the entrance of water. In some wells this is remedied by substituting a finer screen, and in others by packing gravel about the bottom of the well, or around the screen or strainer, as already described. The packing of sand about the strainer has enabled many wells to draw on quicksands that ordinarily would have choked and ruined the wells.

Prevention of Leakage.—Leakage in wells affording acid waters is very prevalent, the pipes becoming rapidly corroded until holes appear in their walls through which the water from the well may escape. The only way to prevent leakage of this type is to recase the well.

In uncased wells there is much leakage into other nonsaturated beds, as is clearly shown by the accompaying diagrams (Figs. 3 and 4). Figure 3 shows the water from two deep-lying beds being lost into one near the surface, and Fig. 4 shows a loss from one deep bed into another. The remedy for either condition is to carry the casing down to the principal water bed and not try to draw on two beds of different heads.

Waterproofing Concrete Tanks.—The following method is given by Mr. Albert Moyer for making impervious concrete tanks or vats for buttermilk, wine, oil, pickles, sauerkraut, etc.: After the forms are removed, grind off with a carborundum stone any projections due to the concrete seeping through the joints between the boards. Keep the surface damp for two weeks from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of 1 part water glass (sodium silicate) 40° Baume, with 4 to 6 parts water, total 5 to 7 parts, according to the density of the concrete surface treated. The denser the surface the weaker should be the solution. Apply the water glass solution with a brush. After four hours and within 24 hours, wash off the surface with clear water. Again allow the surface to dry. When dry apply another coat of the water glass solution. After 4 hours and within 24 hours, again wash off the surface with a clear water and allow to dry. Repeat this process for 3 or 4 coats, which should be sufficient to close up all the pores. The water glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of ⅛ to ½ in. according to the density of the concrete. The excess sodium silicate which has remained on the surface not having come in contact with the alkalies is soluble, therefore is easily washed off with water. The reason for washing off the surface between each coat and allowing the surface to dry, is to obtain a more thorough penetration of the sodium silicate.

Indiana Engineering Society.—At the annual meeting of the Indiana Engineering Society to be held Jan. 12 to 14, 1911, a feature will be made of an exhibit by manufacturers of instruments, tools, and devices of all kinds of interest to engineers. Space for exhibition purposes may be secured from Secretary Charles Brossman, Union Trust Building, Indianapolis, Ind. The meeting is to be held at Indianapolis.

STEAM AND ELECTRIC RAILWAY SECTION

Some Notes on Methods and Costs of Chemically Treating Cross Ties.

The chemical treatment of ties to prolong their life was carefully studied by the Board of Supervising Engineers Chicago Traction, in connection with the work of track reconstruction of the Chicago street railways. In the second annual report of the Board the results of these studies are given in the form of reports by Bion J. Arnold, Chief Engineer; Mr. J. Z. Murphy, Chief Engineer Chicago Union Traction Co., and Mr. Octave Chanute. These reports are printed below, that of Mr. Arnold first:

The preservation of timber against the ravages of decay has occupied the attention of railway engineers in connection with the subject of the renewal of ties and of timber structures upon their roads and has also occupied the attention of the Division of Forestry in the Department of Agriculture of the United States government by reason of the rapid depletion of the timber supply of the country, so that much valuable literature upon the subject is at hand explanatory of the various treatments that have been used and the results in increased life of timber so treated; also the opinions and advice of engineers well informed upon the subject are available, and the existence of timber treating plants within reasonable distances of Chicago where the treatment of ties by the latest accepted methods is being conducted, made it possible to thoroughly and quickly investigate the subject and compile reliable and comparative information in a concrete form.

In the preparation of this report we have had the benefit particularly of the following sources of information: The publications of the Division of Forestry of the United States government relative to the preservation of timber, a publication upon the subject by Samuel M. Rowe, C. E., literature furnished by the Carbolineum Wood Preserving Co. and the personal inspection of the Chanute timber treating plants of Terre Haute, Ind., and Paris, Ill.

As a result of this study we have learned that the treatments that have met with the greatest success and the ones that are in most general use are the following: (1) Creosoting; (2) chloride of zinc (Burnettizing); (3) zinc tannin (Wellhouse); (4) creosote, zinc emulsion (Rutger); (5) carbolineum.

The developments of the different combination treatments, zinc tannin, creosote, zinc emulsion, etc., are the results of information derived from the use of the plain creosote treatment and the plain chloride of zinc treatment of ties and timbers exposed to air and to variable conditions of moisture.

The chloride of zinc treatment has been most commonly used in the preservation of ties in this country. It is the cheapest method and if retained in the wood in proper quantities is an effective preservative.

The use of creosote has in most cases shown high results, but the cost of this treatment as compared to the straight chloride of zinc is very high. The cost of creosote treatment with about 10 lbs. or more to the cubic foot is from 30 cts. to 40 cts. per tie, while the zinc chloride treatment ranges from 8 cts. to 15 cts. per tie.

Chloride of zinc being soluble in water, it is believed that the salt is washed out of railroad ties and timbers by the action of rains and floods and the value of the preservative destroyed, thereby proportionately reducing the resistance of the timber to decay. In order to render the tie impervious to water and prevent the leaching out of the salt, the zinc tannin, or Wellhouse process (chloride of zinc, glue and tannin) has been adopted, the glue and tannin combining to form an insoluble substance that plugs up the cells of the wood. The cost of the zinc tannin treatment is from 10 cts. to 17 cts. per tie.

The complete impregnation of the timber to its center with preservative being essential to insure the best results—and in the case of creosote this required large quantities of oil, heavy pressure and long treatment, making the cost very high, 60 cts. to 70 cts. per tie, while chloride of zinc is easily and quickly carried to all parts of the timber with proper treatment—a combination of the two preservatives is now being used in the treatment of ties, known as the "Rutger" or "emulsion" treatment, which results in an impregnation of chloride of zinc to the center of the tie and a partial impregnation with creosote, the result being that the interior of the stick is preserved by the chloride of zinc and the exterior has the benefit of the creosote as a preservative and to make it water proof.

The Chanute timber preserving plant at Paris, Ill., is at present engaged upon a contract for the Big Four railroad, treating ties with the zinc chloride creosote or "Rutger" treatment at a cost of 23 cts. each.

The carbolineum treatment of timber is being pushed by the Carbolineum Wood Preserving Co. The antiseptic material is a patented compound made in Germany and known as Avenarius Carbolineum.

The treatment advocated is "dipping" and costs about 25 cts. per tie, this cost information being given by the Wood Preserving Co.'s Chicago representative, Mr. A. H. Sauerbier. He quotes a price of 60 cts. per gallon for the compound and says that in the dipping treatment each tie takes up about ⅓ gal., equaling 20 cts. for material, and he adds 5 cts. for labor, making a total of 25 cts. per tie. The dipping treatment cannot possibly permit a complete penetration of the tie and the small amount of compound taken up would indicate that this treatment is a surface treatment only and that the interior of the stick would not be protected against dry rot.

It is conceded that the life of timber is greatly increased where there is no variation in the amount of moisture it contains and is protected from evaporation and alternating wet and dry conditions.

In our substructure the ties will be protected when entirely encased in concrete, as in type 2 construction, and partially encased in concrete, as in type 3 construction, which will act as a great factor in extending the life of our tie timber beyond the life ordinarily experienced in open track construction, where the ties are subjected to alternate varying conditions of wet and dry. We can expect, therefore, a much longer life to our ties so protected than would be the case were our ties not encased in concrete. It is predicted that the concrete will act as a preservative against decay, and the information we have at hand in the pine tie taken from the tracks of the Twin City Lines in St. Paul, Minn., after a service of 15 years, 3 years of which the tie was imbedded in a sandy soil and 12 years on a sandy foundation with the sides and top encased in concrete (similar to our type 3 construction), and which tie seems to be in a perfectly sound condition, would seem to indicate that the original position taken by the board upon this subject, that a wooden tie encased in concrete would be preserved against decay, was, in the light of existing information, a tenable position, and in the case of timber absolutely free from fungus or fermentation at the time it is placed into the concrete would probably be preserved against decay. It is not so probable, however, that ties in which fungus has started or a state of fermentation exists at the time of placing them into the work will be preserved against decay, and as it is a physical impossibility to inspect each tie to the extent of determining whether or not it is perfectly free from infection, it would seem that an antiseptic treatment of the ties would be a desirable precaution.

It has been the object of this board to produce as nearly as possible a permanent substructure, and in the concrete foundation and screw spike fastenings it would seem that with an indestructible tie we might reasonably expect to have accomplished our aim.

Inasmuch as our ties are encased in concrete and thereby protected from the action of water there would be no tendency for the soluble salts to leach out and it would seem that the straight zinc chloride treatment would be all sufficient for our requirements.

If the antiseptic treatment of ties is determined upon, changes in our tie timber specifications should be discussed. It would seem, however, that the timber should be restricted to such as can be sawed, which means proximity to commercial saw mills.

Our present specifications call for long leaf yellow pine 90 per cent heart. By using treated ties sap timber can be accepted, greatly increasing the scope of our market and reducing the cost of our timber.

Oregon fir would make good ties for treating, but the transportation cost may place it beyond our reach.

In considering suitable timber for treating, the permeability of the wood or its ease of accepting treatment must be considered.

The financial part of the question may be summed up as follows:

The present price of our ties is on the masis of $27 per 1,000 feet B. M., or 75.6c each.	Cts. each.
New price of timber $24 per 1,000 feet (M. & B. Co.) or	67.2c
Add for zinc chloride treatment	15.
Total	82.2c
Cost per mile of tie, type 2 construction, present	$ 997.92
Cost per mile of tie, type 2 construction, treated	$1,085.04
Additional cost per mile for treated ties	$ 87.12
Total cost of track at present $36,500, per mile, which makes added cost for treated ties ¼ of 1 per cent.	
Total cost of substructure, type 2 track	$11,500

Inasmuch as we are not in possession of exact information as to length of life, we will assume twenty years' life for the substructure. Upon this basis annual depreciation would equal $575; depreciation per month $48. Based on the theory that the renewal of the ties would mean the renewal of the entire substructure, an increased life of two months would pay for the extra cost due to treatment. Based upon the theory that the renewal of ties would mean a 50 per cent renewal of the entire substructure, then four months' added life would pay for the treatment. This depreciation and consequent saving does not include $25,000 represented by the cost of the superstructure, but the assumption is made that the substructure renewal would be made at a time when a renewal of rails would be necessary. In case rebuilding of the track was made necessary by the condition of the substructure only, then an increased depreciation must be figured and a corresponding advantage given to the increased life.

It would seem from the above that it would be advisable to adopt the zinc chloride treatment for our ties.

John Z. Murphy representing the Chicago Railways Company submitted the following report:

After consulting several authorities and reading what literature I could obtain upon the subject I learn that by treating timber you can nearly treble its life. The facts obtainable are all in regard to ties, and were copied from carefully compiled records furnished by the engineers of the various railways, who have been treating ties for the past 25 years. Previous to that time ties were treated in Europe, but not in this country.

Of the various processes in use today, what is called the "zinc creosote" is the one that appeals to me as being the best and the most economical. The cost of installation is about the same as for the "zinc tannin" "rueping" or "creosote" process. A "one retort" plant with a normal capacity of over 2,000 ties per day would cost about $20,000. The cost of treating a tie would be about 18 cts.

The reason for selecting the "zinc creosote" in preference to the "creosote" process is that many timbers cannot be impregnated with creosote by any practical means, the excessive cost of ties that can be impregnated, and the cost of "creosote."

The cost of a "zinc creosoted" tie is about one-half the cost of a "creosoted" tie, while the result is the same, both ties failing from mechanical wear when used for railway track in from 15 to 20 years.

In 1885 the Santa Fe Railway laid several thousand treated ties. In 1905, 20 years afterwards, more than 4 per cent were still in good condition. On the Chicago and Eastern Illinois the average life of an oak tie is about 12 years.

If the life of a tie can be prolonged 25 per cent it will pay to treat it, as the following facts will show:

The Santa Fe Railway laid about 1,000 untreated ties of various kinds in the spring of 1902 as an experiment. These untreated ties were placed by the side of treated ones. The treated ties were all in good condition 4 years and 10 months after treatment. The untreated ones were in the following condition:

Of 196 white oak ties, 41 showed decay, while the balance were in good condition.

Of 24 black oak ties, 22 were removed 4 years after laying, the two remaining showing decay.

Of 20 willow oak ties, 15 removed in 3 years.

Of 20 Spanish oak ties, 4 removed in 3 years after laying; 7 showed decay and the balance were in fair condition.

Of 20 yellow butt oak ties, 18 removed 4½ years after laying.

Of 91 red oak ties, 82 removed 3 years after laying; 7 showed decay and 2 in good condition.

Of 49 tamarack ties, all removed 2 years and 9 months after laying.

Of 100 loblolly pine ties, all removed 2 years after laying.

Of 93 long leaf pine ties, 85 removed 2¾ years after laying, balance except 1 showing decay.

Of 100 short leaf pine ties, 95 removed 4½ years after laying.

Of 101 hemlock ties, all removed 2½ years after laying.

Of 100 beech ties, all removed.

All of the ties removed were on account of being rotten.

From the above data it is evident that the average life of an untreated tie is about 4½ years, and that of the treated tie at least 12 years, or you would have to place an untreated tie 2 2-3 times alongside of a treated one.

In conclusion allow me to state that the cost of installing a plant and of treating ties given in this report is based on a separate plant. It is my opinion that a plant could be erected at a lower figure than $25,000 if placed adjacent to the California avenue power house.

In my report of September 2 on the "Preservation of Timber" four processes for treating timber were mentioned. Since that date I have obtained data on several other processes, as you will note by the following table:

	Method	Cost per Tie	Est. Yrs. of Life for Tie	Est. Inc. of Life for Tie
Burnettyzing	Zinc chloride	11c	10-12	6-8
Wellhouse	Zinc chloride, tannin and glue	11c	10-12	6-8
Rueping	Creosote	15-18c	12-15	8-11
Lowry	Creosote	20-25c	12-15	8-11
Rutger	Zinc chloride and creosote	15-18c	12-15	8-11
Allardyce	Zinc chloride and creosote	15-18c	12-15	8-11
Card	Zinc chloride and creosote	15-18c	12-15	8-11
Haskin	None	3-6c	12-15	8-11

In the Haskin process only green timber can be used. The method is to heat the timbers to about 600 degrees under a pressure of 250 lbs.

Concrete ties have been tried by the Pennsylvania Co. They did not prove a success. The same company tried steel ties, and still have them in track as an experiment. They figure the average life of a steel tie should be about 40 years. The tie cost about $2.50, and the scrap iron would be worth about 50 per cent of the original cost.

One other point in favor of treated ties is that they seem to last several years longer when laid in rock ballast.

On the comparative value of cross ties of different materials, the following discussion was submitted by Octave Chanute, an engineer of note and past president of the American Society of Civil Engineers:

I believe that, in his thoughtful and valuable paper published in Bulletin No. 75, for May, 1906, W. C. Cushing is over conservative in assuming a life of but 10 years for inferior woods well treated with zinc-tannin and laid in the tracks without the use of tie-plates. It was demonstrated that over [illegible] and tamarack ties treated by the writer for the Chicago, Rock Island & Pacific Ry., averaged a life of 10⅔ years in the tracks east of the Missouri River, and 11⅔ years west of that river, the latter in consequence of the lesser rainfall.

These ties were mostly treated by the original two-injection zinc-tannin process, which was changed in 1895 to the three injection process. By this latter a good many ties were treated by the writer from 1896 to 1903 for the Southwest System of the Pennsylvania Lines, west of Pittsburgh, and 86,346 of them have been located in the track, all being beech, red and black oak, which accept the treatment better than hemlock or tamarack ties.

It is confidently believed by the writer that these 86,346 ties will exhibit an average life of 12 to 14 years if laid without tie-plates or wood screws. Doubtless they would do still better if fastened to the rail with wood screws. He also believes that creosoted wooden tie-plates, cut from the gnarly butts of the poplar, such as are used in France, will give satisfaction in this country. They cost about 4 cts. a tie, instead of 32 cts. for iron tie-plates, estimated by Mr. Cushing, and are said to last ten years.

As an indication of what is being accomplished with zinc-tannin injection and ordinary fastenings, a table is hereto appended showing a record of the treatment of red, black and water oak ties at Mt. Vernon, Illinois, for the Chicago & Eastern Illinois R. R., together with the record of those removed up to April 1, 1906, which has been kindly furnished by R. H. Howard, Engineer of Maintenance of Way.

Until the system of tie fastening is thoroughly reformed in this country and the barbaric spikes abandoned, it seems probable that the life of ties will be limited by mechanical wear, and that from this point of view the zinc-creosote process will be a good one to use. This has been introduced at the Paris (Illinois) plant, with which the writer is connected, and after a year's experimenting, success has been achieved in thoroughly overcoming the only defect found in that process, i. e., the possible separation of the oil from the watery solution of chloride of zinc during the period of pressure required to inject the desired quantity.

The results to be expected in tie preservation depend, of course, upon the thoroughness and skill with which the work is done. For this reason, some of the important railways are now doing the work themselves, and this is doubtless the best way, provided they place it in the hands of a special department, as has been done by the Atchison, Topeka & Santa Fe Ry., for the doing of good work requires expert experience as well as faithfulness. Some of the unfavorable results produced have been the result of ignorance of not knowing when ties are best fitted for treatment and the idiosyncrasies of various woods, but the weakest point hitherto evolved has been the fact that the railroads do not maintain long enough the keeping of records of the removals of treated ties in the track to determine the true value of various modes of treatment.

Other railroads contemplate building plants, and incline to go into the straight creosoting. It is believed that some of them are figuring on sufficient doses of this costly antiseptic, and as an instance of what may be the result the writer hereto appends the relation of the experience of the Western Railway of France, which has been just received.

On the Western Railway (France) the creosoting of the railway ties has been carried on over 40 years. The first contract for creosoted ties was dated Sept. 10, 1865. From that date until 1878 the beech ties were injected with 18 to 22 kilos. (39.6 to 48.4 lbs.) and the results obtained were perfect; in 1899 the Western Railway Co. exhibited some creosoted beech ties taken up from the tracks after 25 years' service. At the present time ties of the same kind dating back to 1870 and 1871 are in our tracks and are in perfect condition (25 to 26 years).

In 1878 it was thought best, from motives of economy, to diminish the quantity of creosote injected, and until 1885 treatment was carried on with the injection of 12 to 15 kilos. per tie (26.4 to 33 lbs.).

The results of this decision were bad; at the end of three years decay began in ties insufficiently injected, and after five years' service, a considerable number had to be renewed. In consequence, injection of feeble doses was given up, and although the contract called for 15 kilos (33 lbs.) the injection was increased to 18 or 20 kilos (37.4 to 39.6 lbs.), the surplus creosote being paid for extra.

To insure more perfect treatment, we concluded in 1897 to further increase the injection and in 1902 formal instructions were issued to inject 22 kilos. (48.4 lbs.) as a minimum.

We may now say that all the ties insufficiently injected from 1878 to 1885 have been replaced because of premature decay after 10 or 12 years. Since 1885, on the other hand, results have again been good, and we are certain that the ties delivered since 1897 will resist the action of decay.

RECORD OF OAK TIES (RED, BLACK AND WATER OAK) TREATED AT MT. VERNON BY ZINC-TANNIN PROCESS FOR C. & E. I. R. R. CO.

Year	No. Ties Treated	Cubic Feet Treated	Gals. Sap Extracted	Lbs. Solution Injected	Lbs. Solution Absorbed Per Cu. Feet	Strength of Solution (Average)
1899	111,816	296,954	40,148	4,391,870	14.79	3.72%
1900	221,568	576,250	57,804	7,894,590	13.70	3.70%
1901	[illegible]	[illegible]	40,878	6,888,213	15.45	3.40%
1902	191,150	[illegible]	44,644	7,175,125	14.20	3.73%
1903	92,317	246,753	26,366	3,480,300	14.10	4.00%
1904	181,426	461,992	42,722	5,832,190	12.62	4.20%
1905	[illegible]	[illegible]	....	[illegible]	[illegible]	4.10%

DRY ZINC CHLORIDE ABSORBED PER CUBIC FOOT.

1899	0.55 lbs.	1903	0.56 lbs.
1900	0.51 "	1904	0.53 "
1901	0.53 "	1905	0.53 "
1902	0.53 "		

STATEMENT OF TREATED TIES RENEWED ON C. & E. I. R. R. PREPARED BY R. H. HOWARD, ENG. M. W.

Year	Rotten	Broken	Burnt	Wrecks	Changing Track	Tracks Taken Up	Cause Not Known
1900	...	2	17	11	.	..	..
1901	3	..	160	17	1710	....	..
1902	...	11	25	39	....	409	.
1903	15	2	43	94	393	240	.
1904	66	27	39	324	262	....	..
1905	108	17	19	236	178	1406	55
1906 to April 1	2	..		149	...	....	8
Total	194	59	303	870	2543	2055	63

TOTAL.

1900	30
1901	1890
1902	464
1903	787
1904	718
1905	2019
1906 to April 1	159
Total	6067

To sum up: when the injection of beech ties is performed by the "vacuum and pressure" process, experience has taught us that to obtain good treatment we must inject an average of 22 kilos, (48.4 lbs.) of creosote per tie. The average corresponuds to the dose of liquid required to impregnate the wood to a depth sufficient to preserve the whole of the tie against decay.

It is possible, however, that this last result may be attained by other processes which permit the retention in the wood of a smaller quantity of creosote after pushing the injection to refusal, or, say, 35 to 40 kilos. (77 to 88 lbs.) per tie.

Later Mr. Chanute joined in a discussion of this question before the Board. Following a statement made by the Chairman that one question this Board was particularly anxious to know about was the relative permeability of a heart pine tie as compared with other timber when treated with a preservative compound without steaming, Mr. Chanute declared that if it was not thoroughly air seasoned and had been grown on upland, a tie would take the treatment with difficulty, but if grown on lowland it would be much more easily impregnated; the difference being in the coarseness of the fibre cells of the wood, and the short leaf, or loblolly pine, being the most easily treated. He stated that treated loblolly pine would give greater service than untreated long leaf pine. Being asked as to the preservative qualities of concrete in which timber is encased, Mr. Chanute stated that it was his opinion that the effect would be wholly mechanical, by the exclusion of air and moisture, decay being caused by three factors; viz., air, moisture, and a reasonable degree of heat. Very cold weather stops the decay for the time being and if moisture is kept out of wood it will last almost indefinitely, as was evidenced by the covered bridges in Pennsylvania which were built of wood and stood for 150 years, or if air be thoroughly kept out no decay takes place, or when submerged in water untreated green ties, even though placed in concrete, would have a tendency to rot or ferment, he said. He stated that when a stick of wood is thoroughly seasoned in the ordinary way, that is, by drying in the open air for a year, it still has 20 per cent of moisture. In France such ties are passed through drying ovens and in the course of a week they drive out an additional 8 per cent of moisture, leaving only about 12 per cent. Under the latter condition, which is essential for impregnation with creosote, 60 lbs. of fluid to the tie were injected, thereby obtaining a life of 27 years.

On the character of treatment, it was Mr. Chanute's opinion that zinc chloride is not the best preservative. The best treatment, in his judgment, is creosote, providing enough of it is used, but after being shown the Board's plans for incasing the ties in concrete he recommended that the chloride of zinc treatment be used, inasmuch as the ties were not to be exposed to the weather. When zinc chloride treated ties are encased in concrete, practically all possibility of decay from fungus will have been eliminated, if the tie is given an opportunity to dry for some weeks in the air so that the water of the solution is evaporated, leaving nothing but the antiseptic, which is chloride of zinc. In five or six weeks, under ordinary conditions, ties would lose seven-eighths of the water. The practice in France is to inject 60 lbs. of creosote to the tie. In America the usual practice is to use about 20 lbs., the cost of the treating substances being considered almost prohibitive to be used in large quantities.

On the steam treatment of green ties, it depends entirely upon the condition the tie is in when received. If it is thoroughly air seasoned, that is, containing 20 per cent of its weight in water, it need not be steamed, but if only partially seasoned the steam process should be used. An absolutely fresh cut tie should not be steamed because when a tie is fresh cut it is full of sap and there is no way of driving the sap out short of bringing the interior of the wood to a boiling point, when steam is generated and the sap driven out through the ends. The steaming requires sometimes for piles 18 to 20 hours. When black oak has been seasoned and reduced to 50 lbs. to the cubic foot, it is the practice to cease steaming altogether. More solution can be injected into an unsteamed tie. In bringing out the importance of the exclusion of air in the preservation of timber, Trojan's Bridge across the Danube River, where piles have been found in good condition after 1400 years, was cited, the good condition after many centuries being due largely to the exclusion of air.

Some Notes on Repair Costs of Electric and Steam Locomotives.

The following notes on repair costs of electric and steam locomotives are extracted from a paper and discussion on Electrification of Railways before the Western Society of Engineers:

H. H. Evans.—There are also large savings to be expected by the electrical working from a lessened repair bill. A good many of the derangements which come to electrical motor vehicles may be repaired where they occur out on the road, instead of requiring a trip to the roundhouse, when there is not only the repairs to be paid for, but the lost time from service of the locomotive in making the trip as well. The tendency of electric motor vehicles in towards relative freedom from the aggregation of small troubles which are responsible for a good deal of the repair bills of the steam locomotive, and these small derangements will keep small, whereas in a steam locomotive they magnify themselves; they cannot be attended to on the run and the result is that at the end of the run they have grown to a derangement requiring a trip to the repair shop. Take the case, for instance, of a badly packed stuffing box; in an attempt to stop it from blowing the engineer jumps down from the cab at the station, twists up a couple of turns with a wrench, gets the packing jammed or too tight and comes in with a cut rod. Repairs would also be cheapened because of the greater standardization of electrical parts, and because a good many of such repair parts permit of easy installation without fitting. As to standardization, everybody believes it to be extremely desirable and everyone may be counted upon to work towards standardization and to secure it in a measure. At the same time there has been an effort to secure standardization of steam locomotive types which has not been altogether successful. There is tendency now to standardize electrical types which may be about equally successful. The variations, though, may be expected to be merely ones of detail. However, the developments are such, that the fitting which will be required will be small. A great many electrical parts can be transferred directly from one machine to another, whereas with any steam engine an attempt to transfer a part from one machine to another leads to tedious and expensive fitting, and in the fitting of new parts there is usually a good deal of dismanteling to be done in addition to the fitting, all of which runs up repair bills. There are fewer danger points for derangements on the individual electric locomotive than on the steam locomotive, that is, there are fewer points the derangement of which disables the machine. The uniform load and the even torque on the motors tends to reduce strains and failure. The result is, we may predict, a maintenance charge of about 3 cts. a mile for electrical locomotives against 8 to 11 cts. for steam ones and of about 1¼ cts. per car mile for multiple unit suburban cars.

W. E. Symons.—The question of repair costs is maintained, was also referred to by the previous speaker. I have some data to offer in that connection: 3 cents per mile for electrical locomotives, as against 8 to 11 cents per mile for steam locomotives, are, I believe, the author's figures.

I have before me the figures on the item of repairs of three prominent railway companies running out of Chicago; (two of them are of the largest trunk lines) the costs for repairs last year were as follows: I will designate them as A, B and C, A 4.42c, B 3.53c, C 5.64c, or an average of 4.53c per mile. These companies own and operate the heaviest locomotives running out of this city. Going a little further into the matter of expense, I have actual figures covering tests between electric and steam locomotives, and I shall quote from a statement made by Mr. J. E. Muhlfield, General Superintendent of Motive Power and Machinery, Baltimore & Ohio Railroad, who has had both steam and electric locomotives in his charge for several years. About a year and a half ago a paper was read before the New York Central Railroad Club by a well informed engineer, upon the use of electric *versus* steam locomotives, and in the analysis of that paper Mr. Muhlfeld submitted a written discussion from which I quote:

> Where considerable expenditures are involved, it is the general rule in electrical and mechanical work, to prepare estimates showing the cost for the construction of the proposed equipment, and to specify the saving and benefits to be derived from the inauguration of its use, previous to the authority for the work being given. From several years experience it has been found that the anticipated operating results from new construction does not always materialize, and it will be interesting to learn whether this may not be the outcome, in event of some of the estimated figures that have been given to use, indicating the improved efficiency and economy to be derived by the substitution of electric for steam locomotives, are taken as the basis for making such an investment.
>
> From present performances, electricity, as applied to locomotives for the handling of traffic on steam lines, implies luxury, and it will no doubt have to be put through the same process of liquidation that labor and material must undergo, before results comparable with past and present steam locomotive performance will be obtainable.
>
> Electricity undoubtedly has its place on railroads for use as power and lighting at shops, stations and terminals; for signaling and similar operations; for city, suburban and inter-urban motor car operation, and for tunnel and underground locomotive service where the use of steam locomotives may be impracticable, but for the handling of passengers or tonnage, at terminals, of for any considerable distance, the electric locomotive, with the present state of art when compared with the steam locomotive, is an expensive proposition.
>
> The following comparison of shop charges for locomotive classified and running repairs, made during recent periods covering from one and one-half to two and one-half years' performance, may be of interest.
>
> Three passenger electric locomotives, each consisting of two sections, with two pairs of independent driver-wheels per section, total weight of locomotive 320,000 pounds, tractive power 28,000 pounds, cost for mechanical and electrical repairs per hundred miles actually run, approximately $19.20.
>
> Two freight electric locomotives, each consisting of two sections, with four pairs of independent driver-wheels per section, total weight of locomotive 320,000 pounds, tractive power 70,000 pounds, cost for mechanical and electrical repairs per hundred miles actually run, approximately $12.70.
>
> One Mallet articulated type of compound steam locomotive, composed of two sections, each having three pairs of coupled driver-wheels, total weight of locomotive 350,000 pounds, tractive power in compound gear 74,000 pounds, cost for mechanical repairs per hundred miles actually run, approximately $5.75.
>
> Thirty-five passenger steam locomotives, Pacific type, total weight of locomotive, excluding tender, 230,000 pounds, tractive power 35,000 pounds, cost for mechanical repairs per hundred miles actually run, approximately $4.35.
>
> One hundred and seventy-five freight steam locomotives, Consolidation type, total weight of locomotive, excluding tender, 290,000 pounds, tractive power 42,000 pounds, cost for mechanical repairs per hundred miles actually run, approximately $3.15.
>
> The above would make the average cost for all repairs to these locomotives, per 1,000 pounds

of rated tractive power at ten miles per hour, about as follows:

	Per 100 miles run.
Passenger electric locomotives..........	68 cts
Freight electric locomotives	18 cts.
Passenger, steam, "Pacific	12½ cts.
Freight, steam, "Mallet Compound"..	8 cts.
Freight, steam, Consolidation........	7½ cts.

Furthermore, by comparing the entire working expense of locomotives of similar tractive power, which have been operated in similar service, during a two and one-half years' period, we have the cost per 100 miles actually run of approximately $84.00 for the electric, and of approximately $41.00 for the steam locomotives. These figures are comparative for electric and steam locomotives of corresponding ages, but do not take into consideration the interest, depreciation, taxes or insurance, nor do they include the expense incident to the maintenance of such equipment as feeders, third-rail, bonding wires, insulation, safety cut-out switches and auxiliaries, which are required only in connection with electric locomotive operation.

The original cost for the comparative locomotives may be made on the basis of the total working weight, excluding the tenders of steam locomotives, and the cost for each when new built, would be about as follows:

	Per lb.
Passenger electric locomotives...........	20 cts.
Freight electric locomotives..............	12 cts.
Freight, steam, Mallet locomotives......	9 cts.
Passenger, steam, Pacific locomotives....	8 cts.
Freight, steam, Consolidation locomotives	8 cts.

The author refers to the fact that some lessening in the track maintenance may be expected, although he does not make any strong claim. It occurs to me that it might not be out of place to mention a fact sometimes overlooked, that the total expense of track maintenance is not entirely governed by the kind of locomotives, but that perhaps 80 per cent is due to deterioration, through the action of the elements, and about 20 per cent to its wear in service. The reduction in cost of track maintenance by the use of electricity in place of steam, would be rather questionable if the number of trains were not materially reduced, and, as I take it, they contemplate increasing the number of units, which would shorten the life of permanent structures rather than increase them.

Mr. H. H. Evans.—Criticism has been made that data is not afforded as to the cost of maintenance of electrical rolling stock. While the working of electrical locomotives on a large scale is somewhat recent and comparatively infrequent, those in charge have been glad to publish such figures as there are and to let them stand for comparison against similar figures for steam locomotives. When we come to multiple unit coach equipments, more complete data is afforded from the performances of the elevated railroads and of the suburban and interurban equipments of the character required for the electrical operation of the present steam suburban services. This is extremely pertinent because the logical electrical operation of the suburban service of a steam railroad is by multiple unit equipment of the same general character as that in use by the elevated railroads and with the service operated in the same general way. I may point out that, on two of our terminals the suburban train mileage exceeds all other mileage over the terminal combined.

Taking the 1907 report of the Illinois Railroad and Warehouse Commission, and calculating from the total operating expenses, the operating expenses per car mile, and the amount of operating expenses charged to maintenance of equipment, we find the following values for maintenance per car mile on electric third-rail roads:

	Per car mile.
Aurora, Elgin & Chicago...........	1.[illegible] cts.
Chicago & Oak Park Elevated..........	1.02 cts.
Metropolitan Elevated	1.55 cts
Northwestern Elevated	1.90 cts.
South Side Elevated......................	1.41 cts.

From the Massachusetts Railroad Commission Report, we calculate for the same, Boston Elevated 1.84 cts. per car mile.

Mr. Potter ("Developments of Electric Traction," before New York Railroad Club, January 20, 1905—quoted in Street Railway Journal), gives the maintenance of electrical equipment on the Manhattan Elevated cars as ¼ ct. per car mile.

Cserhati states that on the Valtellina, from July 1, 1903, to June 30, 1904, the maintenance and repair of rolling stock, including electrical equipment and mechanical parts, was 1.38 cts. per *locomotive* mile.

On the Paris-Orleans line, the maintenance and repairs per *train* mile, according to M. Dubois, are 2.5 cts. per *train* mile; and on the Paris-Versailles (largely multiple-unit trains) 2.4 cts. per *train mile.*

On the Mersey road, according to Dawson, the repairs and renewals of "wagons and carriages" per *train* mile were reduced from 3.498 cts. to 2.150 cts. by changing from steam to electrical working.

Dawson, gives the cost of maintenance of electrical motor cars at 0.961 ct. per car mile. This is for a two motor equipment (125 H. P. motors), and represents the maintenance on the car bodies, trucks, airbrakes, air compressor and governor, motors, and multiple unit controlling apparatus.

Based on tests, the repairs on the New Haven electric locomotives is estimated by Mr. W. S. Murray at 2.5 cts. per train mile.

The expenses for a New York Central electric locomotive, for inspection and repairs, on a 100,000-mile test run, were 1.26 cts. per *train* mile.

The St. Louis & Belleville Electric Railway, in a letter to the General Electric Company stated, regarding their electric locomotives, that for an average working of 312 days per year hauling coal and miscellaneous freight averaging about ten hours per day, the electric-locomotive repairs (for the locomotive performing this work), were a little over $88.

The International Railway Co., in a letter to the General Electric Company, stated that records covering the cost of maintenance of two electric locomotives for three years and eight months, showed a total of $1,257.56, or an average of $342.96 per annum. This is $171.48 per annum per locomotive. The letter states that the locomotives make an average of 100 miles per day for seven days in the week and are out of commission for repairs about five days a year. This figures less than ½ ct. per *locomotive* mile.

The unfavorable comparison between the electric and the steam locomotives of the Baltimore & Ohio R. R. made by Mr. Muhlfeld, has been brought up. The comparison is hardly a fair one. The Baltimore & Ohio installation was the first heavy electric locomotive installation in the world. The machines could not be other than experimental. At the time they were built, electrical design did not run to its present day simplicity nor did it keep always in sight the building of machines in which the maintenance would be kept to a minimum. To compare the earliest type of electric locomotive with the latest type of economical freight engine is hardly fair upon its face. Further, these electrical locomotives are operated within tunnels, on a run only 3.5 miles long, up-grade, with seven curves in the distance, and with two intermediate stops. The tunnels are foul with the gases from the locomotives at the heads of the trains, the corrosive action of which gases was so severe that they rapidly deteriorated the overhead conductor at first provided and compelled the substitution of a third rail therefor. What must their effect be upon the repair bills of the electric locomotive? The service is really switching service under severe conditions and is not at all comparable to the service of a carefully groomed engine over an entire division with hardly a stop. Furthermore there are only half a dozen electric locomotives at Baltimore for which a separate maintenance plant was provided. These locomotives are not all of the same type. The cost per locomotive to maintain such a plan in operation, is necessarily much beyond the cost per locomotive to maintain the large plants for steam locomotives at the end of divisions. This is independent, in a degree, of whatever class of rolling stock is cared for. It comes nearer to a showing of the relative economy of maintenance in small and in large plants than the relative economy in maintenance of the two classes of locomotive.

Causes of and Methods of Preventing Efflorescence on Brickwork.*

Wherever brick are used for building purposes, brick walls will be noted which are covered or partially covered with a film of scum. This scum is generally white but may be yellow or green. It appears at its worst on red brick walls, but may be seen more or less plainly on brick of any color. When the walls are new it appears as white blotches at various places. Later it may come out all over the buidling, giving the brick work a faded or dirty appearance. In a few years a red brick building so affected will take on a faded pink appearance which will stay with it forever.

The scum is simply a film of soluble salts carried from the interior of the brick to the surface by the water which they absorb, and left there after it evaporates. The scumming is always worst near the eaves and downspouts, and under the window-sills and water table. This is caused by leakage of rainwater between the roof and trough and from the downspouts, and through the catching of the water by the sills and water table which consequently soaks into the brick beneath.

The scum is generally composed of sulphates, although it may be composed of any other soluble salt. Chlorides are found in seacoast clays and alkalies in clays of the Western arid region. In the clays of this country, the scum causing salts, in order of their abundance are:

(1) $CaSO_4$, calcium sulphate; (2) $MgSO_4$, magnesium sulphate; (3) K_2SO_4, potassium sulphate; (4) Na_2SO_4, sodium sulphate; (5) $FeSO_4$, ferrous sulphate; (6) $Al_2(SO_4)_3$, aluminum sulphate.

Often all of these occur in a single clay, espcially if it has been weathered and subjected to the attack of decomposing pyritiferous minerals.

Causes.—All of the above salts are very soluble except calcium sulphate, which is soluble 1 : 400. But this is great enough to completely ruin face brick in which it occurs, as the surface is small in comparison with the weight. This particular salt, in fact, is probably responsible for half the ruined walls in this country. The sulphates of soda, potash, and magnesia will often cause scum when present in the most minute quantities. As little as 0.01 per cent of any one of these salts has been known to ruin face brick.

There are four ways in which salts are incorporated into the brick: (1) soluble salts in the clays or other materials used; (2) soluble salts in the water used for tempering the clay; (3) soluble salts formed in kilns by oxidation of minerals in clay, or by reaction of sulphurous kiln gases on clay; (4) soluble salts introduced into brick after burning, principally from mortar.

A great majority of clays contain soluable salts, some large quantities, others but a trace. Surface clays are more likely to have a high content than the older deposits. Trouble is encountered in all parts of the world from this source, and probably 75 per cent of the scumming comes from this cause.

Often materials are mixed with clays that carry soluble salts into them. Examples of this are the brick made around London, England, in which ashes are used to reduce shrinkage, and brick made along the Hudson in which coal slack is used to aid in burning. In both of these cases the soluble salts in coal add to, if they do not entirely produce, the scum.

In the clays that vitrify, scumming can be overcome by burning them to a vitrified body, in which case the salts form silicates and become harmless.

The water used for mixing and tempering mud brick often contains soluble salts. This, of course, produces the same effect as if the clays contained them. Many good clays are injured in this way.

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*From a paper by A. F. Graves-Walker, Salt Lake City, Utah, in the "Journal of Industrial and Engineering Chemistry" of the American Chemical Society, Sept., 1910.

The formation of soluble sulphates in the kiln is a very common trouble. It is often encountered with clays that contain practically no troublesome ingredients before being fired. In many cases there is really no excuse for trouble at this stage. It is simply a case of ignorance on the part of the brickmaker or poorly designed kilns and stacks. When a kiln is set and the heating-up process is started, the ware contains considerable moisture. If good judgment is used and the fires are kept at such a stage that only so much of the moisture is being driven off as the sluggish draft of a cool stack will carry off, trouble is not likely to occur; but if the moisture is driven off more rapidly than the stack can handle it, it is precipitated on the ware again, when it absorbs sulphur from the gases and forms sulphuric acid. This acid attacks the carbonates and other soluble salts and forms soluble sulphates.

There is no doubt that considerable trouble is caused by the mortar in which the brick are laid. Poorly mixed mortar is dissolved by the rain water and the salts carried into the brick, only to be brought to the surface later. It is therefore always important to take great care with the mortar.

Methods of Overcoming Scum.—Many methods are employed to overcome or prevent scum. It is possible to do this in nearly every case, but is often impracticable on account of the low selling price of the ware. Where facing brick or other wares are made by the wet process or where the ware is vitrified there is practically no excuse for trouble.

The preliminary treatment is the principal method of overcoming or preventing scum. This is done by treating the clay or treating the water used.

Treating the Clay.—Clays that contain soluble salts can be washed before using and the salts leached out. This may be done by treating piles of clay, after mining, with water and then allowing them to dry. This method is only possible where high-priced ware is made. Clays are often allowed to stand in piles for from six months to a year, in which case the rain and snow do the same thing.

In many clays the above methods will only cause the trouble. This would be the case where a clay did not contain soluble salts originally, but upon exposure to the weather insoluble salts were converted into soluble salts. This would be the case with pyritiferous clays.

Chemical treatment is very often resorted to. This is accomplished in clays made up by the wet process, by adding, to the water used, such chemicals as will precipitate the soluble salts and form harmless byproducts, such as barium sulphate. Barium salts are the favorites with which to accomplish this reaction, but others can be used; barium chloride and carbonate are most commonly used.

In case soluble sodium compounds are present, the addition of the above-mentioned barium salts would form either sodium carbonate or chloride, both of which are soluble. However, they are so soluble that they would be readily washed from the surface of the ware by the rain, as soon as they formed.

According to Gerlach, a clay containing 0.1 per cent calcium sulphate, which is 0.4 gram per lb., would require 0.6 gram of barium carbonate to perform the reaction. However, 6 or 7 grams should be added to every pound of clay, for safety. This would mean practically 100 lbs. per 1,000 brick. If barium chloride is used, but 26 lbs. are required per 1,000 brick. However, when this is used, close to the theoretical amount must be added, for if added in excess it will form a scum itself.

This method cannot, of course, be used in the dry press process, where no water, or at least very little, is added, as the barium or other salts must be used in solution to do the required work.

Treating the Water.—When it is necessary to use a water that contains injurious soluble salts, it is simply necessary to precipitate them before adding the water to the clay. Many good clays are being ruined by bad water, when it needs but a few hours of a chemist's time to rectify the trouble.

Correct Drying.—If ware containing soluble salts is placed in a drier and allowed to sweat slowly, the chances are all in favor of scummed ware, whereas, if the water is carried away from the surface of the ware as fast as it appears this will not often be the case.

It is a remarkable physical fact, not yet fully explained, that where a clay contains soluble salts, they are not deposited on the surface at all, or at least to a less degree, where the drying is steady and rapid, than where it is slow and discontinuous. It seems that rapid drying causes the water to come through the pore channels of the clay as through a filter and a sort of osmosis is set up, by which the saline matters are retained inside the mass of clay, while the water escapes as vapor from the outside. But where the drying is slow the salts get through this barrier and arrive on the surface plentifully.

It is therefore only necessary that brickmakers, in order to avoid trouble from this source, build good driers and install in them hygrometers by which their operation can be controlled.

Many other methods are used to prevent this trouble; some of them, however, have but temporary effects. One of these is to paint the surface of the scummed ware with oil, which for the time being covers up the scum. This is really practicing a fraud, for while the ware does not show scum when put into the building it shows up as soon as the oil evaporates.

Another method is to paint one surface of the unburned brick with a heavy oil or tar. This prevents evaporation from that surface, the salts being carried to the other surfaces. The oil or tar is burned off in the kiln, leaving a clean face. This, too, is only temporary unless the brick is vitrified, as otherwise the salts will be drawn to the clean surface after a few soakings.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Contractors' Supplies.—Paper, 6x9 ins.; 4 pp. Al. H. Hoffman, Hutton Bldg., Spokane, Wash.

A monthly calendar folder containing illustrations of various supplies, acetylene lights, wrecking cranes, car replacers, etc.

Wood Rock Drills.—Paper, 5¼x11 ins.; 3 pp. Wood Drill Works, 30-36 Dale Ave., Paterson, N. J.

A folder illustrating and describing the tripod drills.

Murphy Varnishes and Coach Colors.—Paper, 5¼x8 ins.; 32 pp. Murphy Varnish Co., Chestnut and McWhorter Sts., Newark, N. J.

This is a descriptive list with prices per gallon can of varnishes and colors.

Solvay.—Paper, 6x9 ins.; 36 pp. Carbondale Calcium Co., Carbondale, Pa.

A catalog explaining in detail the various uses of chloride of calcium, manufactured as a byproduct, for ice machines, canning vegetables, air drying, tempering steel, road improvement, dust prevention and other purposes.

"All Proof" Building Material.—Paper, 11x8½ ins.; 1 p. International "All Proof" Building Material Co., 5 Beekman St., New York.

Circular describing a fireproof material for use as stucco for facing and plastering walls.

Reinforced Concrete Specifications.—Paper, 14x8½ ins.; 6 pp. Pittsburg Steel Products Co., Frick Bldg., Pittsburg, Pa.

A set of specifications covering reinforced concrete construction for reference purposes.

Warehouse Design.—Paper, 12x8½ ins.; 4 pp. Pittsburg Steel Products Co., Frick Bldg., Pittsburg, Pa.

Bulletin No. 1, indicating computations necessary for a three-story concrete warehouse by use of [illegible] book, furnished by the company.

Rail Welding.—Paper, 6x9¼ ins.; 16 pp. Goldschmidt Thermit Company, 90 Wells St., New York; 432 Folsom St., San Francisco.

This catalog describes and illustrates the process of rail welding by pouring superheated thermit steel around rail ends. Illustrations show the various applications.

Asphalt.—Paper, 9x6 ins.; 32 pp. Barber Asphalt Co., New York.

Illustrations of various pavements, and a history of the growth, advantages, durability, maintenance costs, etc.

Moran Flexible Joints.—Paper, 4⅝x10½ ins., 32 pp. Moran Flexible Steam Joint Co., Louisville, Ky.

A catalog showing photographs of the various applications of the flexible joints, with complete description and price list.

Compressed Air.—3¼x6⅜ ins.; 12 pp. Allis-Chalmers Co., Milwaukee, Wis.

A booklet illustrating and describing motor driven air compressors and brakes.

Power Control.—Paper, 6x9 ins.; 16 pp. Woodward Governor Co., 201 Mill St., Rockford, Ill.

The first issue of a quarterly number of this booklet published in the interest of users of water power and water wheel governors. A history of the plant.

Woodward Water Wheel Governors.—Paper, 6x9 ins.; 48 pp. Woodward Governor Co., 658 Race St., Rockford, Ill.

A complete catalog illustrating and describing the above water wheel governors and controlling mechanism used on various types of water power machinery. Also plans, diagrams and other information.

Lehigh Cement.—Paper, 6x9 ins.; 16 pp. Lehigh Portland Cement Co., Indianapolis, Ind.

Illustrations of buildings and plants constructed with Lehigh cement.

Hayward Skid Excavators.—Paper, 7¼x9 ins.; 4 pp. The Hayward Co., 50 Church St.

A pamphlet which illustrates a steel A frame derrick on skids. With complete description of the various main features.

G. K. Sewer Joint.—Paper, 3½x6 ins.; 8 pp. Union Clay Products Co., 51 Church St., New York.

A pamphlet containing reprints from technical journals on water tight sewers with flexible joints.

Gas and Gasoline Engines. — Paper, 3¼x6⅜ ins.; 16 pp. Rockford Engine Works, Rockford, Ill.

A folder which illustrates stationary, portable, sawing rigs, semi-portable machines and various engine supplies.

Electrical Fittings. — Paper, 6x9 ins.; 4 pp. Steel City Electric Co., 1207-19 Washington Ave., Pittsburg, Pa.

Bulletins A and B, for July, 1910, punched for filing, contain illustrations, descriptions and prices of floor outlets and Star bushings.

Finishing Tools.—Paper, 3½x5½ ins.; 10 pp. Arrowsmith Concrete Tool Co., Arrowsmith, Ill.

A folder containing illustrations and directions for using Arrowsmith tools.

Steam Power Stations.—Cloth, 7½x6 ins.; 24 pp. Stone & Webster Engineering Corporation.

This book contains excellent photographs and plans of some of the steam power plant installations made by the Stone & Webster Engineering Corporation throughout the United States.

Mack Gasoline Trucks.—Paper, 3½x6 ins.; 48 pp. Mack Bros. Motor Car Co., 30 Church St., New York, N. Y.

Photographs of motor trucks, sight seeing cars, busses, stages and special cars with information for prospective buyers.

Lifting Magnets.—Paper, 9x6 ins.; 125 pp. The Electric Controller & Mfg. Co., Cleveland.

Descriptions and diagrams of magnets made by this company, and bringing out the vital points of consideration.

Sullivan Hammer Drills.—Paper, 6x9 ins.; 16 pp. Sullivan Machinery Co., 150 Michigan Ave., Chicago, Ill.

The monthly bulletin of the company, calling especial attention to the new Sullivan stoping drill recently placed on the market.

Lehigh Portland Cement.—Paper, 6x9 ins.; 16 pp. Indianapolis, Ind.

A series of illustrations showing recent work done with Lehigh Portland cement.

Barrett Specification Roof.—Paper; 4½x7 ins.; 12 pp. The Barrett Manufacturing Company, Chicago and New York.

A booklet describing the construction for standard slag or gravel roofing, over boards, over concrete, and over tile or brick roofing.

Gas Traction Engine.—Paper, 9¼x4 ins.; 24 pp. Gas Traction Co., 2723 University Ave., Minneapolis, Minn.

A folder illustrating the working of gas traction engines.

Lehigh Portland Cement.—6x9 ins.; 16 pp. Lehigh Portland Cement Co., Indianapolis, Ind.

A catalog of illustrations of various structures of concrete built with Lehigh cement.

Eureka Mixers.—Paper; 9x12 ins.; 16 pp. Eureka Machine Company, Lansing, Mich.

Catalog 10, illustrating and describing the various Eureka continuous mixers for mixing concrete and mortar.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

Announcement was made on Nov. 16 that in October New York State Barge Canal work amounting to $1,337,270 was completed. This is 12 per cent greater than the work performed in September, which was the largest amount done up to last month. ¶Bids are now being asked by the Commission on New Prisons of New York state for a large building contract. This contract calls for construction of a prison plant to take the place of the old Sing Sing prison. The new prison is to be located near Wingdale in the town of Dover, N. Y. The bids close Dec. 15. ¶A large contract for constructing an irrigation system has been let to the Southwest Construction Co., Lamar, Colo. This contract calls for the construction of the Bent-Prowers irrigation system which will water about 100,000 acres of land in the southern part of Bent County, Colo. The main canal will be about 120 miles long and the work also includes a 132,000 acre foot capacity reservoir. A bond issue of $4,000,000 has been voted by the district. ¶The largest piece of dike work of the past week appears to have been the contract awarded to Haskins & Ramsey, Topeka, Kan., for constructing the South Side dike at Topeka for the county. The contract price for this work was $103,469, and it includes the construction of a dike nearly two miles long, mostly of concrete backed by an earth wall. ¶A considerable number of good sized railroad construction contracts appear to have been let recently. Among these are the following: Ridge Bros. Co., Pittsburg, Pa., for constructing the first section of the line of the Clarion & East Brady Electric Ry., six miles, extending from Clarion to Reedsburg, Pa.; Interurban Construction Co., Indianapolis, Ind., for constructing an interurban line from Tulsa to Sapulpa, Okla., for the Oklahoma Union Traction Co. of Tulsa, Okla., the contract amounting to about $300,000; M. Casey, Birmingham, Ala., for constructing nine miles of line for the Lexington & Eastern Ry., from Whitesburg, Ky., to Potters Fork, Ky., this contract including 270,000 cu. yds. of excavation, mostly steam shovel work; Luck Construction Co., Roanoke, Va., for constructing a 22-mile line from Spray, N. C., to Ridgeway, Va., for the recently chartered North Carolina & Virginia Ry.; Foley, Welch & Stewart, St. Paul, Minn., for the grade work for the entire line of the Alberta & Great Waterways Ry., in the Province of Alberta, Canada; Burke & Joseph, Fort Smith, Ark., a $50,000 concrete job on the Frisco R. R., in Oklahoma and Arkansas; Chas. Nagel, for a grading contract on the Alton & Jerseyville Electric line near Godfrey, Ill.; the Heinz-Young Construction Co., St. Louis, Mo., for constructing the line of the Mexico, Santa Fe & Perry Traction Co., from Mexico, Mo., to Hereford, a distance of about 20 miles. ¶The Board of Water Supply of New York City has its plans so well along for the new $25,000,000 pressure tunnel under New York City for the Catskill water supply, that bids will be received in December on four contracts for the work. This pressure tunnel is to be constructed from the Hill View reservoir, beneath the Boroughs of The Bronx and Manhattan, to a point near the Atlantic Avenue subway station, in Brooklyn. This tunnel will be driven at from 250 to 700 ft. below the surface and will be lined with concrete. It will range from 11 to 15 ft. in finished diameter and will be constructed from 24 shafts, spaced from 3,000 to 5,000 ft. apart. Its total length will be about 17½ miles. Chambers at the heads of the various shafts are also to be constructed so that through them and the shafts connections for the delivery of the water into the distribution systems can be made. ¶A considerable amount of new railroad construction work is about ready for letting, and in some cases bids have probably already been received. This work includes a 25-mile line from Hudson to Greeley, Colo., for the Chicago, Burlington & Quincy Ry., and a line between the two above towns for the Colorado & Southern Ry. The Vandalia R. R. is also reported as being about ready to award contracts for a considerable amount of revision work between Terre Haute, Ind., and St. Louis, Mo. This work is said to include 25 miles of double tracking.

Construction Camps.

In the last few years there has been a great improvement in the conditions under which laborers are cared for in construction camps. The old time camp, with its unsanitary conditions and general lack of all conveniences, is now practically a thing of the past. Nowhere perhaps is this change better shown than in the construction camps which have been set by the contractors engaged in building the Catskill Aqueduct for the city of New York. Some 16,000 men are employed in this work. On this work there are 20 contracts, each amounting to more than $1,000,000 and each requiring from three to four years for completion. The size of these contracts and length of time required for their completion, combined with the remoteness of the work from towns has made construction camps a necessity. The regulation of these camps is made a part of the contract with the Board of Water Supply which has charge of the construction of the aqueduct. Under the articles of the contract the conditions are set forth under which the contractor's men shall be employed, paid, safeguarded while at work, and treated when ill. Many of the camps in the aqueduct work resemble those of the state militia. Most of them are located on high ground to which the water supply is piped from a distant and safe source. The water, milk, and food supplies are inspected periodically. Many of the camps are laid out in streets, and have water pipes, sewers and electric lights. The men are quartered usually four in each sleeping room. These rooms are large, well ventilated and lighted by windows screened against flies. The old time bunk has been replaced by bedsteads of the enameled iron type. Separate quarters are provided for eating and recreation, and married men are assigned to separate cottages for one or two families. Washing and bathing facilities are provided and all wastes not removed by the sewers and disposal plants are destroyed in special incinerators similar in pattern to those used in the army. The contractors are required to retain medical and surgical practitioners, to furnish, equip and maintain a hospital for the sick and injured, and an isolation hospital for contagious cases. A physician's signed report as to the health conditions of the camp is required from the contractors each week. It is required that "first aid to the injured" boxes be placed at points conveniently available to the work, and that the work, particularly the shafts and tunnels be connected by telephone with the doctors' quarters. At Browns Station, where the largest camp along the aqueduct is located, the contractor has erected a large band stand, and every Saturday night during the summer open air concerts are given. The band is made up of employes, and they are paid for this work. In this camp the men have gardens which they care for in their spare time. The contractors have instituted prizes for the gardens most neatly and attractively kept. A night school, maintained by private subscription, is also conducted at this camp, and is well patronized both winter and summer.

Bugs.

One of the minor inconveniences to which employes on construction work in tropical countries are subjected, is the prevalence of insect and reptile life. When the Americans began work on the Panama Canal the first thing they did was to improve the sanitary conditions. Marshes were drained or filled up and practically all mosquitoes driven from the Canal Zone. There are, however, other forms of insect life still left in the Canal Zone, as the following extract from a letter from an employe of the Isthmian Canal Commission goes to show:

> As to bugs, we have all the original species, besides several crosses. The dhobie is the most interesting little cuss of the bunch. You can't see him, but when he gets busy you know he is there all right. He gets to you by way of your laundry or your shower bath, and when he arrives he proceeds to crawl under your skin in the protected parts and then crosses his little hands and dies. After that you have the dhobie itch, which keeps you from thinking of your other troubles. The dhobie is no respecter of persons; he'd just as soon bite the chief as a West Indian negro. Then, too, there is the red bug, who is also a pretty busy little cup of tea. This bug bores his way under the skin, and the farther he can get the happier he is. He has to be dug out with the point of a knife, or he will cause a bad sore. The mosquitoes are not so bad, as they have been driven into the jungle. Once in a while, however, a big one will come along and look you over. If you look too tough the mosquito will fly away, whet his bill on a stone and come back again ready for business. A stout, able-bodied mosquito after sharpening his beak on a stone pile can bite right through the sole of your shoe. We also have sand fleas, large flying roaches, beetles, scorpions, tarantulas and red and white ants. The two last mentioned are the hardest workers on the Isthmus. They are always busy doing something they hadn't ought to do. The white ant has a highly developed appetite for all kinds of wood. He breakfasts on a soap box, lunches on a dry goods box and dines on a house. When he gets after a house he sometimes cuts the supporting timbers away, thus causing a general inconvenience to the human tenant. The red ant spends most of his time chewing up plants and trees. On his account it is practically impossible to grow vegetables such as are raised in the states. Attempts have been made to do this in a few places, but in most cases the red ants beat the farmer to the vegetables.

Mayor by Appointment.

American cities, as is shown by the large number which have adopted some form of commission government, are beginning to appreciate the fact that it is desirable to have less politics and more business principles in the public administration. In Germany this fact has been recognized for many years. In that country the administration of a city is regarded from a strictly business standpoint, the same as any other big enterprise, and the municipality selects its mayor with the same thorough care that an industrial, commercial or financial concern employs in selecting a manager. When it becomes known that the office of mayor is to become vacant applications for the position are made to the Town Council. These applications are considered by a committee of the Council; if municipal officers have made especially good records in other cities, they may be invited to apply for the vacant position. To become mayor of a city like Berlin, the applicant must have established his reputation for efficiency by governing other German cities. In selecting a new mayor, the record of the applicant is carefully considered by the members of the Town Council, for not only must he be competent and be able to perform successfully the duties of his high position, but he must also be young enough to remain competent for many years. The reason for this last requirement is that in Prussia a mayor is appointed for a term of 12 years, and if not re-elected after that period, he is entitled to a life pension of half the amount of his salary. If he serves 20 years his pension is two-thirds of his salary; if he serves six years his pension is one-fourth of his salary. After a thorough consideration of the merits of the applicants the Town Council makes its selection, subject to confirmation by the King of Prussia.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Advices from Centreville, Ala., state that the corps of engineers, who are running lines for the construction of the proposed Selma & Cahaba Valley R. R., had completed the survey to that town. The new line will tap a rich coal and ore section between Centreville and Birmingham.

Arizona.

It is believed that the El Paso & Southwestern R. R., Walter Douglas, Vice President, Bisbee, Ariz., will within the next two months, begin construction work toward Yuma and Phoenix from Benson, Ariz. The road from Phoenix to Yuma will follow the Gila River to a point this side of Dome where it will cross the Gila and come into Yuma. The plans as far as Yuma is concerned are said to have been all mapped out and the right of way quietly secured for most of the distance.

Arkansas.

At the request of the company's attorneys the State Board of Railway Incorporation, Little Rock, Ark., has extended the charter of the Fort Smith, St. Louis & Chicago three years on account of a necessary delay in the financial plans. The company was organized about a year ago for the purpose of constructing a line from a point near Bergman, through Boone, Newton, Johnson and Franklin counties to Mulberry in the latter county, a distance of about 100 miles, connecting the Missouri and North Arkansas road with the Iron Mountain.

The St. Louis & Southwestern Ry. (Cotton Belt) has awarded a large contract for furnishing cross ties to the National Lumber & Creosoting Co., Texarkana. The ties which are mostly of oak, will be used for new improvements.

California.

W. H. Erwin, of Fort Worth, Tex., a foreman for the L. J. Smith Construction Co., on the Santa Fe double track work was killed a couple of weeks ago near Williams, Ariz. Mr. Erwin had sought refuge under a dirt car from an exploding dynamite blast. The falling rocks and debris tilted the car over sidewise on to him, fracturing his skull. He never regained consciousness.

Construction work is under way on the San Diego, El Cajon & Escondido Ry. This company projects a 55-mile line from San Diego to Escondido, via City Heights, Lemon Villa, Lemon Grove, South La Mesa, Le Mesa Springs, Grass Mount, El Cajon, Bostonia, Laluride and Kernardi. Surveys have been completed and all arrangements made for securing construction capital. F. M. Fairchild, Broadway and Clifton St., Oakland, Cal., is Construction Engineer; E. W. Case, San Diego, Cal., is Field Engineer; A. C. Riordan, San Diego, is President and G. R. Pursell, San Diego, is General Manager. Hobart Bros., San Diego, Cal., are the contractors.

Good progress is being made with the Butte & Plumas R. R., which is being built for the Truckee Lumber Co. from Oroville to timber lands in the mountains. The right of way has been graded from Whitewashed Trees, four miles from Oroville, to the crossing of the middle fork of the Feather river. As soon as the grading from Whitewashed Trees to Oroville is completed tracklaying will be commenced from Oroville. There are over 700 men employed on the Butte & Plumas R. R. The present contract calls for the construction of 35 miles of railroad, and, as the timber is cut the road will be extended into Plumas County.

The greater part of the survey for the proposed Humboldt & Eastern R. R. has now been completed and the field work has been discontinued until spring. During the summer some 40 miles of the route through the Trinity National Forest Reserve were surveyed. It is said that good grades and stream crossings were secured. A. D. Nash, Eureka, Cal., is Chief Engineer.

S. N. Griffith, of Fresno, has applied to the City Council of that city for a franchise for the railroad which he proposes building from Fresno to Clovis. The Western Electric Co., San Francisco, is reported to be working on plans for the electrical installation for the road. It is said that actual construction work will be started as soon as the franchise at Fresno is secured.

The Southern Pacific Co. has applied to the City Council of Oakland for a renewal of its Seventh St. franchise, which expires November 11, 1911. The proposed line will be operated as an electric street railway and will be part of the gridiron system of electric suburban lines now being constructed by the company throughout the county.

G. D. Armstead is reported to have applied to the County Supervisors at Riverside for a franchise for a steam road through Riverside county, starting presumably at the county line in the pass country, running through Moreno and Riverside, thence through Elsinore and Temecula. The ultimate destination of the line would be San Diego. It is believed in Riverside that Mr. Armstead is representing the Western Pacific Ry. It is pointed out, however, that Seth Hartley of Colton has announced that plans had been considered for a road from San Bernardino to San Diego by way of Escondido. He is credited with the statement that if the different communities along this stretch of country would stand with the promoters that he was confident the road would be in operation between Escondido and San Diego within one year from date.

Two new tracks will be constructed at Junction, Cal., by the Santa Fe System to give service to the Keller ice plant.

The Santa Fe System has appropriated $12,000 to cover the cost of installing a new interlocking plant at Daggett, Cal.

A new spur track is to be built by the Santa Fe System at Stockton, Cal., to serve the National Ice Co.

The Santa Fe System has prepared plans and appropriated $288,828 for the construction of a new and up-to-date hotel, station, recreation building and electric power plant to be located at Barstow, Cal.

The Santa Fe System has appropriated $53,000 to be used to cover the cost of raising the grade between Colejo, Cal., and Elmo, Cal., a distance of 61 miles

Colorado.

The Santa Fe System has planned to reballast its tracks with gravel at an estimated cost of $17,000 from mile post No. 610 to 616 on the Colorado division.

The Santa Fe System has planned to have constructed at La Junta, Cal., an autogenous welding plant at an estimated cost of $3,800.

The Union Pacific is to start track laying in the spring on its Dent to Fort Collins branch line. The La Salle to Denver line has been completed.

Rails for a three-mile railroad to be built at once connecting mines three miles from Oak Creek with the Denver, Northwestern & Pacific Ry. have been shipped from Denver. The terminus of the new feeder line is at mines which are rapidly being developed by two Walsenburg operators.

Reports from Denver state that the Colorado & Southern Ry., H. W. Cowan, Chief Engineer,. Denver, has, or is about to let contracts for its proposed line from Hudson to Greeley. The same report states that it is probable that the contract for the construction of the Hudson-Greeley line of the Burlington, 25 miles long, and also an integral part of the Gulf-to-the-Sound line, also will be let at once.

The Union Pacific is to erect a new freight house on 19th St., at Denver, and will rearrange its freight terminal tracks.

Connecticut.

The Shore Line Electric Ry. Co., New Haven, Conn., is perfecting details for extending its line into New Haven. In connection with the plan it is probable that the line between New Haven and East Lyme and Niantic will be extended to cross the new Connecticut river bridge. At present the Shore Line Electric Railway operates between Guilford and Saybrook, and from the latter town to Essex and Ivoryton. The spur of the road between Guilford and Stony Creek will soon be in operation and by connecting with the Connecticut Railways' line at Stony Creek will complete continuous trolley service between New Haven and Saybrook.

Georgia.

The Georgia & Carolina Ry. Co. has been chartered and proposes to build a line from Augusta, Ga., to Spartanburg, S. C., via Hamburg, Saluda, Edgefield, Newberry, Glenn Springs and Pacolet, 120 miles. The stockholders are Wm. E. Jackson of Augusta, Allen W. Jones of Midville, Ga., President; A. E. Padgett of Edgefield, Secretary; J. W. Thurmond, also of Edgefield.

The Georgia, Southern & Florida Ry., W. C. Shaw, Jr., Chief Engineer, Macon, Ga., has applied to the City Council of Valdosta, for permission to double track a portion of its steam road running through the city along Trouple St.

A deal was made Nov. 10, according to advices from Valdosta, Ga., whereby the Sparks & Western R. R., the new line from Sparks to Moultrie, passed into the ownership of the Georgia and Florida R. R. It is now understood that the road which now lacks a few miles of being completed to Moultrie will be finished at once. J. M. Wilkinson, Valdosta, Ga., is President of the company, and Rutherford Fleet is Secretary and Treasurer.

Grading work on the Wrightsville, Adrian & Lyons R. R., mentioned in our last issue, is in charge of McKenzie & Snyder, Augusta, Ga. At the point where the road will cross the Choopee River, the piling has been driven and the lumber placed on the ground and it is the purpose of those in charge to have the bridge erected by the time the grading of the right of way is completed to that point. The railroad commission of Georgia recently authorized the company to issue a $1,000,000 in stock and a $1,000,000 in bonds for financing the project.

Idaho.

Engineers of the Oregon Short Line R. R. have been rushing surveys at Pocatello with a view to the rearrangement of the yards at that city.

Illinois.

The City Council of Springfield has approved the ordinance for the construction of a subway under the Chicago, Peoria & St. Louis Ry. at Amos Ave. and Jefferson St., Springfield. W. A. O'Brien, Springfield, is Chief Engineer Maintenance of Way.

The Cleveland, Cincinnati, Chicago & St. Louis Ry. has purchased seven lots near Eighth St. and Shelby Ave. at Mattoon for use in constructing additional trackage facilities at the new round house.

The Santa Fe System will install at Corwith, Ill., a new horizontal tubular boiler at a cost of $2,500.

The Santa Fe System has planned to purchase a new ditching machine for work on the Eastern lines at a cost of $6,100.

The Santa Fe System has arranged to have a dynamo meter car built and equipped and when completed it will be used over the lines.

The sum of $60,000 has been appropriated by the Santa Fe System to equip its class 900 and class 1600 engines with the Walschaert valve gear.

The Lake Shore & Michigan Southern Ry. has purchased 2,037x130 ft. of land, on the south side of South Chicago Ave., extending from 87th to 89th St., Chicago, to be used in connection with the construction of another track and the elevation of its roadway at that place.

The Sterling-Moline Traction Co., which is projecting a 100-mile line from Moline via Sterling to Princeton, Ill., has completed surveys for that portion of the line from Moline to Sterling. The capital for the construction of the line has not all been secured as yet and construction work will probably not be started until early next year. The Northwestern Engineering & Construction Co., Milwaukee, Wis., has the contract. W. E. Tuller, Morrison, Ill., is President of the traction company and C. G. Schneider, Sterling, Ill., is Chief Engineer.

The Pekin & Petersburg Interurban Ry. Co. has been chartered with a capital stock of $50,000 and proposes to construct an electric railroad from Pekin, Tazewell County, to Petersburg, Menard County. The principal office of the corporation is Pekin. The incorporators are: W. A. Elliott of New York City, J. A. Shallito of Chicago, William Ressler of St. Paul, Minn.; A. C. Sprague of Dubois, Ill., and E. C. Todd of Roodhouse, Ill.

W. E. Emery, Peoria, Ill., Chief Engineer of the Peoria & Pekin Union Ry., has plans under way for a new yard at East Peoria to have a capacity of at least 7,000 cars. The intake of the new yard will be near Wesley City and will be the delivery yard for seven main lines, one main feeder being used to take the cars from the different roads. This feeder will be connected with 42 sidetracks, which, when completed, will have a capacity of 7,000 cars. The cost of the new arrangement will be $300,000.

It has been announced in railway circles, that the Chicago & Northwestern R. R. will build a cutoff from Nelson, a mile or so south of Rock Falls, joining the main line at Rock Island Junction. The improvement is necessitated, it is said, by the congestion of traffic.

The Decatur & Southern Traction Co. of Decatur, Ill., is reported to have raised $1,500,000 for construction purposes, and it is said that work will be started as soon as weather will permit.

Another section of the double tracking upon the Chicago, Burlington & Quincy has been completed between Savanna, Ill., and La Crosse, Wis., a distance of 75 miles. Next year it is planned to extend the double track west as far as Quincy and to enlarge the yards in that city.

Indiana.

The Vandalia R. R., F. T. Hatch, Chief Engineer, St. Louis, Mo., is reported to be about to award contracts for a considerable amount of revision work between Terre Haute, Ind., and St. Louis, Mo. It is said that the work will include 25 miles of double tracking.

Practically all work at Jackson Hill between Cambridge City and Knightstown has been completed for the Pennsylvania R. R. This was the heaviest grading in the division. The company expects to have a double track line from Indianapolis to Richmond in the early spring.

Advices from Fort Wayne state that Cooperative Construction Co. will push the work of extending the Valparaiso & Northern Ry. north from Flint lake during the winter months.

Iowa.

The Des Moines Street Ry. Co. has asked for a new franchise from the city of Des Moines. In return from the franchise the company promises improvement of physical property by rebuilding of ten miles of track within two years, and providing 25 new cars.

Kansas.

The Santa Fe System has appropriated $5,400 to cover the cost of installing an autogenous welding apparatus and piping at Topeka, Kan.

The Santa Fe System has prepared plans and will soon construct a steel treating plant to be located at Syracuse, Kan.

The Santa Fe System will install a large engine lathe at its shops at Topeka, Kan., to do the necessary work on Mallet pistons and bushings.

The Santa Fe System plans to install an autogenous welding plant at Shopton, Kan., at an estimated cost of $7,100.

The stockyards at Moline, Kan., are to be relocated by the Santa Fe System at an estimated cost of $4,300.

The Santa Fe System has appropriated $4,500 to cover the cost of constructing a reservoir at Attica, Kan.

The Santa Fe System has planned to enlarge its Kansas City yards and has appropriated $40,000 for the work.

The Santa Fe System has planned to erect a new steel water tank at Cambridge, Kan., at a cost of $2,800.

The Salina Street Ry. Co. of Salina, Kan., is reported to be considering building an extension to its car line in Salina. H. C. Smithers, Salina, is the owner.

Surveys have been completed from Hardtner into Meade County, Kan., for the construction of a line from that city through Liberal and along the Southern Kansas border to Colorado. The line is being promoted by a number of farmers in Comanche, Barber and Clark counties of whom A. A. White is one.

It is reported that bonds amounting to over a millior dollars have been floated by the Kansas & Southeastern, which proposes to build a line through Pratt and Stafford Counties in Kansas. S. V. Wardell, Pratt, Kan., is President.

Kentucky.

The Consolidated Coal Co. of St. Louis, Mo., is reported to have entered into a deal with the Louisville & Nashville and Chesapeake & Ohio railroads, whereby the coal company will build a railroad from Shelby, Ky., to Shelby Gap, Ky., at a cost of $3,000,000. From Shelby Gap it will be extended to Potter Gap. The new line will connect with the Chesapeake & Ohio and Louisville & Nashville and will be in service before next Fall, it is said.

The Paducah Traction Co., Paducah, Ky., has surveys under way for an extension to Lone Oak. Three routes are under consideration. The company also proposes to build a new park on the line.

A meeting was recently called by the citizens of Corbin to discuss plans for securing the construction of a railroad connecting Corbin, Somerset and Hodgenville, Ky. It is suggested that the proposed route would be from Corbin to Somerset, thence to Columbia and via Campbellsville and Buffalo into Hodgenville, and Buffalo into Hodgenville, connecting at Hodgenville with the branch of the Illinois Central. Such a line would open up a direct route for the I. C. to the coal fields of Southeastern Kentucky.

In order to accommodate the increased business due to the connection at Peducah with the Burlington system, the Nashville, Chattanooga & St. Louis R. R. has acquired a wide strip of land on the south side, extending back 12 blocks from the Tennessee River to build new spur tracks.

The Ohio, Kentucky & Virginia Ry. Co. has been incorporated with a capital stock of $1,000,000 and proposes the construction of a railroad from Manchester on the north side of the Ohio River through Eastern Kentucky toward the southeast, intersecting the counties of Lewis, Fleming, Rowan, Bath, Menefee, Morgan, Wolfe, Breathit, Perry, Leslie, Knox, and Letcher and through Greenup, Carter, Elliott and Morgan, a distance of 300 miles. The incorporators are William H. Howe, and Philip S. Clarke, Brooklyn, N. Y.; Thomas Atkinson and Macauley Arthur, Middlesboro, Ky.; J. Wood Browning, B. R. Huthehoft and W. F. Downing of Lexington, Ky.

M. Casey of Birmingham, Ala., has just signed a contract to build nine miles of road on the Louisville & Eastern extension from Jackson to Whitesburg, Ky. The work consists of rock and earth and two tunnels. There is 270,000 cu. yds. excavation, including the tunnels. There is also about 3,000 cu. yds. box culvert masonry and approximately 900 cu. yds. bridge masonry.. This contract will require 14 months to complete. The box culvert and bridge masonry will be sub-let to suitable parties and competent tunnel foremen, and rock foremen for outside work, may be able to find steady work with the above mentioned contractor at Jackson, Ky. Teamsters and laborers will be needed also for this contract.

Louisiana.

Citizens of the 9th Ward and Parish of St. Bernard have asked the New Orleans Railway & Light Co., New Orleans, to extend its Claiborne trolley line from Poland St. into St. Bernard Parish.

Engineers representing the Port Commission of New Orleans, the Orleans Levee Board and the various railroads have filed a report agreeing on the rearrangement of the tracks on the levee front between Nichols and Mandeville Sts., at New Orleans. The tracks will be arranged systematically so as to keep the streets open to the levee and also to build approaches from North Peters street.

The St. Louis & San Francisco R. R. is reported to be planning to secure an entrance into Lake Charles, La., in the near future. The report has it that the Frisco system will build into the Lake City from a point on its main line—Kinder, Reeves, Fulton or De Quincey.

Massachusetts.

The Boston & Maine R. R. and the New York, New Haven & Hartford R. R. have petitioned the State Legislature for authority to acquire the Boston, Revere Beach & Lynn R. R. upon such terms as may be approved by the Massachusetts Board of Railroad Commissioners. The company whose control is sought runs a narrow gage line between East Boston and Lynn, with a branch line in Winthrop, the connection with Boston proper being made by ferryboats. The petition further asks that authority be given to widen the gage of the road, to extend it on the north to connect with the Portland division of the Boston & Maine, and to make a connection by tunnel between East Boston and the South station in Boston, trains in this tunnel to be run by electricity.

The Boston & Maine Railroad Company, subsidiary to the New York, New Haven & Hartford Ry., has under way a scheme by which it plans to obtain a through line from White River Junction to Springfield, Mass., discontinuing the use of the Central Vermont trackage altogether. A bill introduced into the Vermont House of Representatives authorizes the Vermont Valley (B. & M.) to extend its line southerly from Brattleboro to the Connecticut River R. R. (B. & M.) paralleling the Central Vermont a distance of 10 miles. In order to be entirely independent of the Central of Vermont Ry. in operating its Connecticut and Passumpsic division, the Boston & Maine will take up the matter of building another stretch of line paralleling the Central of Vermont between Windsor and White River Junction, a distance of 14 miles. It will then probably be necessary for the Central of Vermont which is a Grand Trunk line, to build about 50 miles of line paralleling the Baltimore & Maine holdings in order to compete with the latter company.

It is stated that although the Grand Trunk Ry. Co. has been taking no noticeable action toward constructing the Palmer Providence extension, for which a charter was granted some time ago, a large corps of engineers are in the field making surveys and preparing estimates. It is thought that the location plat will be filed about next July.

Construction work on the Moshassuck Valley R. R. extension is, according to advices from Providence, R. I., practically at a standstill. The only work being done this summer, was that on the fill in the swamp between Lorraine and Woodlawn, where the new line was to leave the old and cross under the main tracks and yard of the New York, New Haven & Hartford R. R.

Michigan.

A Chicago syndicate has purchased the property and rights of the Interurban Light & Power Co. in Mason County, and proposes to construct a concrete dam on the site of the old one on Hamlin lake, another at the Manistee bridge on the Sauble River, and another on the Pere Marquette River in Mason county. Light and power will be furnished the Hamlin resort region next summer. The ultimate purpose of the company is to develop the waterpower along the lake shore streams for an electric line between Muskegon and Manistee, tapping the fruit belt in that district. F. R. McMullen, Chicago, Ill., is President of the new company.

Work has been started, according to information received from Detroit, Mich., on the construction of the Essex Terminal Ry. Company's spur line into the Windsor Mfg. Company's district. Already a considerable portion of the track has been laid from the main line of the road in Walkerville towards Windsor. The work is being done under the direct supervision of J. J. Dewhurst, the engineer who had charge of the Michigan Central tunnel tracks.

Minnesota.

McDougall & Yale, Contractors on the double tracking of the Chicago, Milwaukee & St. Paul R. R., have started filling in the ditch at the bridge over Rollingstone Creek, a quarter of a mile west of Winona.

Mississippi.

Now that the election is over it is probable that the Chicago, Burlington & Quincy R. R. through a subsidiary company, will make some move for a line up the Pearl river valley, connecting the present main line of the New Orleans, Mobile & Chicago with Jackson, and giving almost a direct line to the coal fields of Alabama. This line had been under advisement some time, and the only thing that held up proceedings is said to have been the approaching election in New York. A survey of the line from Memphis to the city limits of Jackson has been made, by way of Yazoo City, and the preliminaries are said to have been all arranged.

Missouri.

The North Missouri Central Electric Ry. Co. has asked the Commercial Club of Columbia, Mo., for a bonus of $30,000, to be payable only on condition that the line is built and in operation from Columbia to Jefferson City and from Columbia to Mexico by Sept., 1912.

Grading work is under way near Bethel, Mo., for the proposed Hannibal & North Missouri Electric railway. J. L. Simons is working about one mile east of Bethel. He has the contract for three miles of the line. Others at work along the line are as follows: W. R. Stetters, W. D. Webb, Jesse Ziggler, Thomas Ballard, M. Alroy, and Patrick McGraw. Most of these are farmers who are grading the line across their farms. However, each one has been working gangs of 25 to 30 men.

Officials of the Mexico, Santa Fe & Perry Traction Co., now under construction, have been in conference with citizens of Fulton, regarding extension of the line from Hereford to Fulton. The proposition of the company to the Fulton people is the same as made to people living along the Hereford line, namely, that they subscribe for $6,000 worth of bonds for every mile that is to be constructed. A surety company in St. Louis is said to have agreed to secure a construction company that will do the work and one that will furnish a bond of $100,000, and more if necessary, for fulfillment of the contract. Mathias Crum, Mexico, Mo., is President of the Mexico, Santa Fe & Perry Traction Co.

The Heinz-Young Construction Co. of St. Louis, Mo., A. B. Corwin, President, has been awarded the contract for constructing the line of the Mexico, Santa Fe & Perry Traction Co. from Mexico, Mo., to Hereford, a distance of 20 miles. Work is to be completed about April 1.

St. Louis Items.

BY A. B. KOENIG.

L. J. Smith of the L. J. Smith Construction Co. of Kansas City, has bought out a large locomotive and machine shop on 4th and Central Sts., Kansas City, and organized the L. J. Smith Locomotive & Equipment Co. R. L. Langtim will be superintendent of the new company. They will make a specialty of general and heavy repairs to locomotives, cars, steam shovel, railway and contracting equipment, machinery, etc. They will also buy and sell locomotives, cars and contractors' equipment.

No more strikes can take place in the various branches of the building industries in this city if the plans formulated last week by an organization of the largest general contractors in the city carry. The general plan is to settle all controversies by forcing the unions to arbitrate instead of allowing them to go out on strike. This is to be done by putting each contractor under bond to obey a labor committee of the organization, to whom all controversies are to be referred. If union men in one branch refuse to arbitrate, every contractor in the city is under bond to stop work on the job and discharge all men pending the settlement of the controversy. The plan carries with it the sanction of the bonding companies, who agree to refuse to give bond to any contractor who forfeits on the association's bond. The new organization is to be called the Master Builders' Association. It is an offspring of the Building Industries Association, but at present only contemplates taking in members of the building trades. The organization has been forming for several months secretly under the supervision of F. G. Boyd, secretary of the Building Industries Association. The contractors practically completed their organization at a meeting in the headquarters of the association at 3 p. m. Thursday. They approved the preliminary work and immediately signed the charter member roster. The bond to stand by the agreement will be $5,000. All labor troubles are to be referred to a board of governors composed of 15 men. When trouble arises the work on a particular job is to be declared closed. It remains closed until the questions at issue are finally settled. To prevent contractors from losing money by having to stop work, the members agree to refuse to take any contract without the strike or lock-out clause being in the agreement. In this way, when a contractor is under agreement to complete a piece of work by a certain time, the clause will save him. The building trades had three strikes in the last year and lost all of them. They now have a strike on among the glass workers. The glass workers have been out for three months, and all of the fifteen firms involved have declared open shop and raised a fund of $10,000 to break the strike. All are running with non-union labor. The full membership of the association will not be made public until all details of organization are perfected.

Dan Hannefin has finished his work at Marble City, Okla., and is in the market for some new work.

Grant Bros. have moved their outfit to Ridge Farm, Ill., on the Big Four R. R.

Charles Nagel got in on a nice piece of the Alton & Jerseyville electric line near Godfrey, Ill.

Burke & Joseph, Fort Smith, Ark., secured a $50,000 concrete job from the Frisco R. R. in Oklahoma and Arkansas the other day.

Henry Schweitzer has moved a part of his outfit from Harrisburg to Evansville, Ind.

T. J. Dolan, the hustling secretary of the Steam Shovel and Dredgemen's Union has been here the past week as a delegate to the American Federation of Labor meeting being held here.

Costello Bros. have finished their work at Oaklandon, Ind., on the Big Four R. R. and moved a part of this outfit to Evansville, Ind., where they are putting in the new yards for the Big Four R. R. They are still on the work at Ingalls, Ind., and expect to finish this shortly.

When the Lakes-to-the-Gulf Deep Waterway Association holds its fifth annual convention in this city Nov. 25-26, strong resolutions will be presented opposing any attempt to doing the work with a 9-ft. channel. The resolution will declare that the delegates are in favor of a 14-ft. channel first and ultimately 21 or 24. Friends of the deep channel in this city have received word that several of the delegations will come prepared to boost the 9-ft. project. These men assert this will never do, as it would make the river no better than it is now. Peter B. Gibson, secretary of the Mississippi Society of St. Louis, with office in the Third National Bank Building, requests all Mississippians who live in St. Louis, who wish to attend the dinner to be given to Governor E. F. Noel at the Mercantile Club, to send in their names and formal invitations will be sent to them. The dinner will take place Saturday afternoon, Nov. 26, at 12:30 o'clock. Governor Noel will be in St. Louis on Nov. 25 and 26, as a delegate from Mississippi to the waterways convention and will take a leading part during the sessions. It is the purpose of the Mississippi Society to give him royal welcome while he is here. Governor Noel will make an address at the dinner to be given in his honor.

Mike Conroy has a small piece of team work to let on the Alton & Jerseyville Electric line at Godfrey, Ill.

Bondurant & Mosby, Hickman, Ky., have a nice piece of work on the Illinois Central R. R. in Southern Illinois that they want to sublet.

There has been no change in the labor market since last issue. The planters in the south are still begging for cotton pickers and the railroad and river improvement jobs for laborers. No trouble for all the labor in the country to get employment if they will come to St. Louis, Memphis or Little Rock and apply at any of the Koenig Labor Agency offices.

H. W. Burcher started work last week on his ditch contract at Poag, also started another outfit at Glinky, Ill.

New Mexico.

Owing to the use of the new Mallet Compound engines the Santa Fe System has found it necessary to spend $42,000 to remodel their roundhouse at Wellington, Kan. The work will be started in the near future.

New York.

The Beebe electric railway interests of Syracuse are considering plans for constructing a short spur connecting with the main line of the Rochester, Syracuse & Eastern Electric R. R. at Port Gibson. Maps of the proposed route have been prepared. C. D. Beebe, 500 O. C. S. Bank Bldg., Syracuse, N. Y., is President.

The Syracuse Rapid Transit Co., Syracuse, is considering double tracking its line through the village of Liverpool, N. Y.

In his testimony before the Interstate Commerce Commission at its rate investigation hearing at New York William C. Brown, President of the New York Central & Hudson River R. R., gave out the following information regarding improvement work on the subsidiary lines of the New York Central. Answering questions by one of the attorneys, Mr. Brown said: "The Michigan Central has in progress expenditures of approximately $14,200,000, of which $9,700,000 was expended prior to Jan. 1, 1910, approximately $3,500,000 is to be expended in 1910, leaving the expenditures to complete the improvements amounting to about $1,000,000. The Pittsburg & Lake Erie has in progress expenditures amounting to approximately $9,170,000, of which $400,000 was expended prior to Jan. 1, 1910, approximately $3,400,000 is to be expended in 1910, leaving to complete the arrangements about $1,250,000. The Big Four has in progress expenditures amounting to approximately $7,300,000, of which $660,000 was expended prior to Jan. 1, 1910, approximately $6,300,000 will be expended during 1910, leaving for completion of the improvements about $340,000."

North Carolina.

The North Carolina & Virginia Ry. Co., the incorporation of which was mentioned in our last issue, is reported to have awarded the contract for the construction of its line from Spray, N. C., to Ridgeway, Va., to the Luck Construction Co., Roanoke, Va.

The Madison County R. R. Co., of Stackhouse, N. C., has been chartered and proposes to construct a railroad from Stackhouse to Allenstand, Madison county, a distance of ten miles. The capital stock is $50,000, and the principal incorporators are W. N. Garrett, Hot Springs, N. C., and Anson C. Betts, Troy, N. Y.

Construction work is well along on the Rockingham R. R. and over eight miles of the line have been graded. Eight camps are located along the line from Roberdel to Gibson. It is reported that tracklaying will be started about Jan. 1.

Reports from Winston-Salem, N. C., are to the effect that good progress is being made on the route of the Winston-Salem Southbound R. R. The track has been connected up with the Southern and Norfolk and Western track in that city and work trains are running as far as Lexington. The steel work on the bridge over the Yadkin River has been started and the masonry is in readiness for the steel work at the crossings at Lexington and Wadesboro.

North Dakota.

Advices from Mott, N. Dak., state that the extension of the St. Paul, Milwaukee & Chicago R. R. will be completed in the near future. Steel has already been laid through that city and are within a short distance of New England, the proposed terminus.

Ohio.

Financial arrangements are reported to have been completed which will mean the resumption of work on the Lorain & Ashland Ry., which some years ago was partially completed from Lorain to Ashland. The Lorain, Ashland & Southern Ry. Co. recently incorporated, has been merged with the Industrial Ry. and the Lorain & Ashland Ry., Joseph Ramsey, Jr., 42 Broadway, New York City, is interested.

While nothing definite has been given out it is reported that at the recent meeting of the directors of the Hocking Valley Ry. at Columbus, the matter of extensive improvements for that road were considered. It has been known for some time that plans were under way for extensive double track for the Hocking Valley in order to meet the increase of business which will ensue from the road's relations with the C. & O. It is planned to construct a new line from the present southern terminus of the Hocking Valley to the Ohio river, thus connecting with the C. & O. on the other side, necessitating a new bridge across the Ohio. The present capital of the Hocking Valley will be doubled in order to meet the financial requirements of these immense improvements. This means that $11,000,000 will be spent in the state of Ohio.

R. B. White, Indianapolis Superintendent of the Cincinnati, Hamilton & Dayton R. R., was recently over the Springfield Division with a view to deciding on laying additional side tracks on that division.

The County Commissioners at Columbus have been given the right to construct a grade crossing over the Cleveland, Akron & Columbus Ry. near Linden.

The Hocking-Sunday Creek Traction Co., which projects a 16 mile line from Nelsonville to Athens by way of Doanville, Floodwood and Chaunsey, is now selling bonds locally for construction purposes. Surveys for this line were made last April and it is proposed to let construction contracts on or about Jan. 1 next. The line is already completed and in operation for a distance of 3.3 miles from Nelsonville. E. B. Young, Nelsonville, O., is President and Warren J. Badger, Nelsonville, O., is Chief Engineer.

The Defiance Interurban Electric Ry. Co. incorporated with a preliminary capital stock of $50,000, for the purposes of building an electric line from Defiance to Fort Wayne, has secured most of its right of way, and is said to have arrangements well along for financing the project. The company is said to have negotiations pending with an engineering firm for surveying and constructing the line. The officers of the Defiance Interurban Co. are as follows: K. V. Haymaker, of Defiance, president; Charles E. Bennett, of Wauseon, Vice President; T. C. Jacks, Defiance, Secretary and General Manager; Robert C. Holgate, Defiance, Treasurer, and George F. Knight, of Canton.

The Columbus, Mt. Vernon & Mansfield Traction Co., mentioned in our Nov. 9 issue, is now working on details for building an interurban line connecting Columbus with Mansfield by way of Mt. Vernon. Plans will probably be matured by Jan. 1. L. P. Stephens, Columbus, O., is General Manager.

Oklahoma.

It is now practically assured that the Missouri, Oklahoma & Gulf Ry. will enter Coalgate and Lehigh, Okla., although the exact route by which it will reach these places has not been determined fully. The railway is contemplating an extension to Okmulgee, Okla., which town has already donated terminal facilities.

The Chickasha, Ardmore & Lawton Ry. Co. is reported to have made financial arrangements to guarantee the building of the entire 180-mile road westward from Ardmore. Oscar Ayres, Chickasha, Okla., is President.

The Cherryvale, Oklahoma & Texas R. R. Co., now under construction, has started condemnation proceedings in the District Court at Bartlesville for right of way through Washington County, and has filed a mortgage for $20,000,000 in favor of the Carnegie Trust Co. Two Oklahoma branches of the road are provided in the charter, one southeast through the state to Siloam Springs, Ark., the other southwest to Geary in Blaine County.

Stockholders of the proposed Osage & Western R. R. have bought in the property of that company, which was to have been sold at Billings to satisfy judgments against it for debts. The understanding is that the work of construction will now be resumed, the line to be built as a "Katy" extension through the Osage Indian country to Billings and Enid.

J. J. Harrison, Durant, Okla., Chief Engineer of the Missouri, Oklahoma & Gulf Ry., has made a preliminary survey for a branch line from Wapanucka to Bromide. It is said that the deal has been closed between Bromide and the railroad company and that the branch is to be built at once. It is understood that Bromide is to grade the road, a distance of about 3½ miles from the town to a point on the main line two miles north of Wapanucka, in consideration of the company's carrying its tracks and operating its trains to the town.

The Santa Fe System has planned to spend $112,000 in making track changes between Waynoka, Okla., and Mooreland, Okla., a distance of 26 miles.

The Oklahoma Union Traction Co., Tulsa, Okla., has awarded the contract to the Interurban Construction Co., Indianapolis, Ind., for an interurban line from Tulsa to Sapulpa, touching West Tulsa and Redfork and skirting through the Redfork oil district. The road will cost $300,000, which includes a bridge over the Arkansas River at Tulsa.

The Santa Fe System has appropriated $24,000 to cover the cost of the remodeling of the [illegible] made necessary to accommodate the new Mallet compound engines.

The Santa Fe System has appropriated $4,100 to cover the cost of installing an interlocking plant at Oklahoma City, Okla., at the crossing of the A. T. & S. F. and the O. J. C.

According to a holding of the State Election Board Article 9, section 9 of the constitution which prohibits the consolidation of railroad lines either by lease, contracts or purchase, still stands. The state board holds that inasmuch as the question involves the amending of the constitution it must receive a majority of all the votes cast at the election; that a mere flat majority of the votes cast in the proposition itself is not sufficient.

A. E. Weist, promoter of the Enid, Ochiltree & Western R. R., has succeeded in interesting a large amount of Chicago capital in the project.

Oregon.

The Oregon Electric Ry. Co., and the United Rys. Co., John F. Stevens, President, Portland, Ore., will probably award additional contracts this winter in order to complete the lines to Eugene and Tillamook within the next year. The two railway companies have definitely planned more than 200 miles of extensions, involving an expenditure of $7,000,000 to $10,000,000. The Eugene line will be an extension of the road now in operation between Portland and Salem and will also serve Albany. McMinnville is to be reached by a road branching from the main line near Tualatin or Wilsonville and running via Newberg. The extension to Eugene will require the construction of 71 miles of railroad and the length of the McMinnville line will be approximately 30 miles. In addition to these two trunk lines about 100 miles of short lines or feeders are to be constructed, reaching numerous points in the Willamette Valley between Portland and Eugene. Routes for these lighter lines have been practically settled upon by the company, but construction will necessarily be deferred pending the completion of the main roads to the principal cities of the valley.

The Oregon Short Line R. R. is considering building in the spring a 27-mile extension from Vale on to the west. The Short Line is also to commence work soon on improvements to the yards at Vale. The work will be in the shape of a large main line water tank near the proposed passenger depot, 2½ miles of new tracks for switching, and the filling of the yards with 2½ ft of gravel and dirt. A steam shovel will be used to fill in the several blocks within the yards. D. H. Ashton, Vale, Ore., is Construction Engineer.

Francis H. Clarke, President of the Coos Bay & Boise R. R., the proposed route of which was recently surveyed from Marshfield, Ore., to Roseburg, has announced, it is said, that the road will positively be built and that money additional to the $60,000 which has already been spent has been secured. When the work is under way plans for extending the line further to Boise, Idaho, will be made.

Pennsylvania.

Charters have been granted to the Glassport & Elizabeth R. R. Co. to build a line three miles long in Allengheny county, capitol $18,000, and the Pennsylvania Southern to construct a one-mile line in Clarion county, capital $20,000.

A charter has been granted for the proposed electric railway from Hagerstown, Md., to Mercersburg, Pa., a distance of 2[illegible] miles. As mentioned in our Nov. 9 issue right of way is being secured. Preliminary surveys have been made and it is estimated that the road can be built for about $20,000 per mile, this cost including power house and equipment. [illegible] behind the project. Major L. F. Downs, New York City, and James B. Kreps, Hagerstown, Md., are interested.

UNIT BIDS OF LOWEST BIDDER ON EACH SECTION OF THE TRI-BOROUGH SUBWAY, NEW YORK CITY, AND ESTIMATED QUANTITIES

UNIT PRICES OF LOW BIDDERS ON THE TRI-BOROUGH SUBWAY WORK IN NEW YORK CITY.

The accompanying tabulations show the unit bids of the lowest bidder for each section of the three routes of the Tri-Borough Subway of New York City, bids for which were opened Oct. 27 by the Public Service Commission. The estimated quantities for each item on which bids were received are given in separate tables. The low bidders on each section of this work were as follows:

ROUTE 5.

Sec. 1—O'Rourke Engineering Construction Co., New York $5,863,194
Sec. 2—MacArthur Bros. Co., New York 7,761,173
Sec. 2A—Bradley Contracting Co., New York 2,323,542
Sec. 3—Bradley Contracting Co., New York 3,619,315
Sec. 4—Bradley Contracting Co., New York 3,716,304
Sec. 5—Metropolitan Contracting Co., Boston, Mass. 2,419,127
Sec. 6—Bradley Contracting Co., New York 3,624,213
Sec. 7—Chas. H. Peckworth, Brooklyn, N. Y. 2,750,463
Sec. 8—Bradley Contracting Co., New York 3,716,304
Sec. 9—Bradley Contracting Co., New York 2,447,479
Sec. 10—Bradley Contracting Co., New York 3,253,072
Sec. 11—Bradley Contracting Co., New York 3,132,195
Sec. 12—Oscar Daniels Co., New York. 2,825,740
Sec. 13—Bradley Contracting Co., New York 4,071,416
Sec. 14 Type H—Bradley Contracting Co., New York 3,619,315
Sec. 14 Type K—Arthur McMullen New York .... 4,8[illegible]
Sec. 15—Haggerty-Drummond Co., New York .... 3,820,[illegible]

ROUTE 9.

Sec. 1—Newman & Carey, Brooklyn, N. Y. $4,265,424
Sec. 2—Patrick McGovern, New York. 4,676,941
Sec. 3—Walter H. Gahagan, Brooklyn. 2,981,992

ROUTE 20.

Sec. 1—Metropolitan Contracting Co., Boston, Mass. $4,601,644
Sec. 2—Bradley Contracting Co., New York 9,134,904

UNIT BIDS OF THE LOWEST BIDDER OCT. 27 ON EACH SECTION OF ROUTE 5—BROADWAY-LEXINGTON AVE. PORTION OF THE TRIBOROUGH SUBWAY SYSTEM OF NEW YORK CITY

Item.	Classification.	Sec. 1	Sec. 2	Sec. 2A	Sec. 3	Sec. 4	Sec. 5	Sec. 6	Sec. 7	Sec. 8	Sec. 9	Sec. 10	Sec. 11	Sec. 12	Sec. 13	Sec. 14H	Sec. 14K	Sec. 15
1.	Earth exc. above m. h. w. except for sewers and pipes, incl. disp., per cu. yd.	$4.50	$5.75	$7.50	$4.00	$3.50	$4.75	$3.50	$3.10	$3.50	$3.50	$3.50	$3.50	$3.80	$3.50	$7.00	$3.75	$2.50
2.	Earth exc., below m. h. w., except for sewers and pipes, incl. disp., per cu. yd.	7.50	7.50	20.00	7.50	7.50	....	7.50	....	....	....	....	9.00	6.00	7.00	7.50	7.50	3.75
2a.	Earth exc. above and below m. h. w. for sewers and pipes, incl. disp., per cu. yd.	5.00	4.00	....	5.00	5.00	1.75	5.00	3.10	5.00	5.00	5.00	5.00	4.00	5.00	4.50	6.00	2.50
3.	Rock exc. (except exc. for sewers and pipes), incl. disp., per cu. yd.	6.00	10.00	5.75	....	6.00	5.50	7.00	4.25	5.60	5.00	5.00	[illegible]	6.70	5.00	7.70	8.00	4.00
3a.	Rock exc. for sewers and pipes, incl. disp., per cu. yd.	....	....	....	....	....	6.00	6.00	1.10	6.00	6.00	6.00	6.00		6.00	....		5.00
4a.	Underpinning Bldgs. less than 7 stories, per front ft.	150.00	165.00	350.00	200.00	200.00	175.00	150.00	17.00	150.00	150.00	150.00	175.00	82.70	150.00	135.00	40.00	100.00
4b.	Underpinning Bldgs., 7 to 12 stories, per front ft.	200.00	310.00	400.00	300.00	300.00	550.00	200.00	30.00	....	....	200.00		....	200.00	300.00	70.00	....
4c.	Underpinning Bldgs. over 12 stories, per front ft.	600.00	800.00	....	....	400.00	500.00	....	....	....	....	....		....	....	700.00	100.00	....
5.	Tunnel exca., incl. disp. timbering, etc., per cu. yd.	....	20.00	....	....	15.00	9.50	9.00	7.50	9.00	9.00	9.00	9.00		....	....	....	9.00
5a.	Tunnel exc., for sewers and pipes, incl. disp., timber, etc., per cu. yd.	....	....	....	....	....	....	20.00	10.00	....	....	....	....	....	....	....	....	....
6.	Concrete masonry, in pl., per cu. yd.	12.00	11.00	10.00	10.00	10.00	10.60	10.00	7.75	10.00	10.00	10.00	10.00	9.50	10.00	10.00	13.00	8.50
7.	Protective conc. maso. in pl. outside w. proofing, per cu. yd.	12.00	8.50	8.00	8.00	8.00	10.00	8.00	7.75	8.00	8.00	8.00	8.00	9.50	8.00	8.50	12.00	8.15
8.	Rubble stone masonry in place, per cu. yd.	10.00	8.50	8.00	8.00	8.00	6.00	8.00	3.00	8.00	8.00	8.00	8.00	6.50	8.00	8.70	8.00	5.00
9.	Brick masonry, in place, per cu. yd.	16.00	15.00	15.00	15.00	15.00	20.00	15.00	10.00	15.00	15.00	15.00	15.00	10.00	15.00	15.00	18.00	12.50
10.	Hollow t. c. brick masonry, in pl., per cu. yd.	16.00	15.00	15.00	15.00	15.00	14.25	15.00	9.00	15.00	15.00	15.00	15.00	10.00	15.00	15.00	18.00	11.00
11.	Grout of Portland cement, per bbl.	....	1.00	....	....	4.50	7.00	4.50	3.00	4.50	4.50	4.50	4.50	....	....	....	....	6.25
12.	Timber piles in pl., and [illegible], per lin. ft.	1.50	1.25	1.25	1.25	....	....	....	....	....	....	....	1.25	.70	1.25	1.70	1.25	.50
13.	Timber foundations in place and [illegible], per M. ft. B. M.	100.00	65.00	75.00	75.00	75.00	75.00	75.00	....	....	....	....	75.00	70.00	75.00	65.00	100.00	62.50
14.	Broken stone or gravel, in pl., per cu. yd.	3.00	3.00	2.50	2.50	2.50	2.17	2.70	1.60	2.50	2.50	2.50	2.50	2.00	2.50	....	....	1.90
15a.	Waterproofing, 1-ply, per sq. yd.	.80	.80	.75	.75	.75	.40	.75	.28	.75	.75	.75	.75	.35	.75	.80	.75	.35
15b.	Waterproofing, 2-ply, per sq. yd.	1.00	1.10	1.25	1.00	1.00	.60	1.00	.50	1.00	1.00	1.00	1.00	.60	1.00	1.10	.75	.60
15c.	Waterproofing, 3-ply, per sq. yd.	1.25	1.15	1.75	1.50	1.50	.85	1.50	.65	1.50	1.50	1.50	1.50	.80	1.50	1.45	1.00	.70
15d.	Waterproofing, 4-ply, per sq. yd.	1.75	1.75	2.00	1.75	1.75	1.16	1.75	1.00	1.75	1.75	1.75	1.75	1.00	1.75	1.75	1.25	1.15
15e.	Waterproofing, 5-ply, per sq. yd.	2.00	2.10	2.50	2.00	2.00	1.36	2.00	1.20	2.00	2.00	2.00	2.00	1.20	2.00	2.10	1.50	1.40
15f.	Waterproofing, 6-ply, per sq. yd.	2.50	2.35	3.00	2.50	2.50	1.60	2.50	1.50	2.50	2.50	2.50	2.50	1.40	2.50	2.35	1.75	1.75
16.	W. proofing brick laid in asp. mastic, in pl., per cu. yd.	32.00	30.00	25.00	30.00	30.00	28.75	30.00	18.00	30.00	30.00	30.00	30.00	27.00	30.00	30.00	16.00	25.00
17a.	12-in. vit. pipe, in pl., per lin. ft.	1.75	1.50	1.75	1.75	1.75	.75	1.75	.60	1.75	1.75	1.75	1.75	.90	1.75	1.50	1.00	.75
17b.	10-in. vit. pipe, in pl., per lin. ft.	1.50	1.30	1.50	1.50	1.50	.65	1.50	.50	1.50	1.50	1.50	1.50	.90	1.50	1.30	.80	.65
17c.	8-in. vit. pipe, in pl., per lin. ft.	1.00	.80	1.25	1.25	1.25	.50	1.25	.40	1.25	1.25	1.25	1.25	.80	1.25	.80	.65	.50
17d.	6-in. vit. pipe, in pl., per lin. ft.	.60	.50	1.00	1.00	1.00	.40	1.00	.35	1.00	1.00	1.00	1.00	.70	1.00	.50	.50	.45
17e.	4-in. vit. pipe, in pl., per lin. ft.	.50	.40	.75	.75	.75	.35	.75	.30	.75	.75	.75	.75	.60	.75	.40	.40	.40
17f.	8-in. c. i. pipe, in pl., per lin. ft.	....	2.00	....	....	....	1.25	....	....	....	....	....	....	....	....	2.00	1.50	....
17g.	6-in. c. i. pipe, in pl., per lin. ft.	1.50	1.50	1.50	1.50	1.50	1.00	1.50	.90	1.50	1.50	1.50	1.50	1.00	1.50	1.50	1.10	1.15
17h.	4-in. c. i. pipe, in pl., per lin. ft.	1.00	.85	1.00	1.00	1.00	.75	1.00	.55	1.00	1.00	1.00	1.00	.60	1.00	.85	.90	.65
18.	Tunnel ducts, in place, per duct ft.	.15	.15	.15	.15	.15	.10	.15	.09	.15	.15	.15	.15	.09	.15	.15	.15	.10½
19.	Riveted steel, paint. and erect., per ton	95.00	110.00	90.00	90.00	90.00	71.50	90.00	72.00	90.00	90.00	90.00	90.00	74.00	90.00	110.00	80.00	85.00
20.	Steel beams and shapes with connections, paint. and erect., per ton	85.00	100.00	80.00	80.00	80.00	65.00	80.00	57.00	80.00	80.00	80.00	80.00	70.00	80.00	100.00	70.00	65.00
21.	Steel rods and bars in conc., per ton	80.00	80.00	65.00	65.00	65.00	50.00	65.00	64.00	65.00	65.00	65.00	65.00	50.00	65.00	80.00	80.00	67.50
22.	C. i. tun. lining, in pl. in work, per ton	....	60.00	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
23.	Steel bolts and washers for tun. lin., per ton	....	85.00	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
24.	C. i. column erect. and paint., per ton	....	....	....	75.00	75.00	75.00	75.00	56.00	....	75.00	....	....	....	....	....	....	....
25.	Miscellaneous iron castings, in place, per ton	65.00	70.00	75.00	75.00	75.00	60.00	75.00	75.00	75.00	75.00	75.00	75.00	40.00	75.00	70.00	75.00	87.50
26.	Wire mesh, in place, per lb.	.06	.06	.10	.10	.10	.05	.10	.10	.10	.10	.10	.10	.05	.10	.06	.06	.10
27.	1½-in. galv. i. pipe, h. rail, in pl., incl. expan. bolts, etc., per lin. ft.	1.00	1.00	....	1.25	1.25	.15	1.25	.75	1.25	1.25	1.25	1.25	.80	1.25	1.00	.50	.45
28.	Steel grates for ventil., in pl., incl. frames, etc., per sq. ft.	2.25	2.00	2.50	2.50	2.50	1.00	2.50	1.40	2.50	2.50	2.50	2.50	1.50	2.50	2.00	1.75	3.15
29.	Vault lights, in place, per sq. ft.	2.25	2.15	2.00	2.00	2.00	1.60	2.00	1.20	2.00	2.00	2.00	2.00	1.75	2.00	2.15	3.00	2.25
30a.	St. surface, except rdways., restored, per sq. yd.	3.00	2.50	3.00	3.00	3.00	2.00	3.00	1.20	3.00	3.00	3.00	3.00	2.50	3.00	2.50	1.50	1.15
30b.	Temporary repave. and maintena. rdways, per sq. yd.	2.50	1.50	3.00	3.00	3.00	2.00	3.00	.60	3.00	3.00	3.00	3.00	1.25	3.00	1.50	1.00	.90
31.	Park sur. resto. (all classes), per sq. yd.	2.00	2.50	....	....	2.00	1.50	....	....	....	....	....	....	....	....	....	....	.50
32a.	¾-in. wr. i. elec. conduits, per lin. ft.	.15	.12	.30	.30	.30	.10	.30	.08	.30	.30	.30	.20	.10	.30	....	....	.10
32b.	1½-in. wr. i. elec. conduits, per lin. ft.	.25	.22	.45	.45	.45	.15	.45	.15	.45	.45	.45	.45	.18	.47	....	....	.20
32c.	2-in. wr. i. elec. conduits, per lin. ft.	.15	.30	.60	.60	.60	.20	.60	.25	.60	.60	.60	.60	.20	.60	....	....	.25
32d.	2-in. fiber elec. conduits, per lin. ft.	.30	.15	.15	....	.15	.15	.15	.15	.15	.15	.15	.15	.10	.15	....	....	.20
33.	c. i. outlet boxes in pl. in sta., each	1.75	1.00	1.00	1.00	1.00	.25	1.00	1.00	1.00	1.00	1.00	1.00	1.50	1.00	....	....	1.25
34.	6-in. c. i. pipe and fitts., incl. spec., in pl. in sta., per lin. ft.	1.50	1.40	2.50	2.50	2.50	1.50	2.50	.80	2.50	2.50	2.50	2.50	1.50	2.50	....	....	1.60
							....	....	....	....	....				....	2200.00		....

35.	Tube tun. un. Harlem River, per lin. ft. of 1-tr. tube																1925.00	
36.	Tube tun. un. Harlem River, per lin. ft. of 4-tr. tube																	2.40
37.	12-in. vit. pipe sewer, per lin. ft.						4.00	6.00	2.30	6.00	6.00	6.00	6.00	2.75	6.00			2.75
38.	15-in. vit. pipe sewer, per lin. ft.	6.00	3.50		6.00	6.00	5.15	7.00	2.80	7.00	7.00			3.00	7.00	4.00	4.70	
39.	18-in. vit. pipe sewer, per lin. ft.	7.00			7.00	7.00												
40.	20-in. vit. pipe sewer, per lin. ft.																	5.00
41.	24-in. vit. pipe sewer, per lin. ft.						30.00	50.00			50.00	50.00	50.00	45.00	50.00			40.00
42.	C. i. sewer pipe (st. pipe), in pl. in work, per ton		50.00		50.00													
43.	C. i. sewer pipe (special casting), in pl. in work, per ton													55.00				
44.	3 ft. x 2 ft. sewer, per lin. ft.						8.00	15.00	6.00	15.00	15.00	15.00	15.00	6.00	15.00	7.50	20.00	6.25
45.	3 ft. 6 in. x 2 ft. 4 in. sewer, per lin. ft.	10.00	7.50		15.00	15.00							15.00					
46.	3 ft. 9 in. x 2 ft. 6 in. sewer, per lin. ft.						10.00		7.00	16.00								
47.	4 ft. x 2 ft. 8 in. sewer, per lin. ft.	11.00					11.00											
48.	4 ft. 3 in. x 2 ft. 10 in. sewer, per lin. ft.				16.00	16.00	11.60											
49.	4 ft. 6 in. x 3 ft. sewer, per lin. ft.						12.60											
50.	4 ft. 9 in. x 3 ft. 2 in. sewer, per lin. ft.																	
51.	5 ft. 7 in. x 3 ft. 5 in. sewer, per lin. ft.						9.60											
[illegible]	[illegible] sewer, per lin. ft.								[illegible]									
[illegible]	4 ft. sewer, per lin. ft.				18.00													
[illegible]	[illegible] sewer, per lin. ft.				19.00													
[illegible]	[illegible] sewer, per lin. ft.																	
[illegible]	[illegible] sewer, per lin. ft.							72.00										
[illegible]	[illegible] 6 ft. sewer, per lin. ft.							40.00	15.00									
[illegible]	[illegible] sewer, tunnel, per lin. ft.									24.00								
[illegible]	[illegible] sewer, per lin. ft.						[illegible]	[illegible]		[illegible]	[illegible]							
60.	6 ft. sewer, per lin. ft.																	
61.	[illegible] sewer, per lin. ft.										[illegible]							
62.	6 ft. 6 in. sewer, per lin. ft.									[illegible]								
63.	7 ft. sewer, per lin. ft.							[illegible]										
64.	8 ft. sewer, per lin. ft.									[illegible]								
65.	8 ft. 9 in. sewer, per lin. ft.							40.00										
66.	9 ft. 6 in. sewer, per lin. ft.																	
70.	7 ft. x 12 ft. sewer, per lin. ft.							[illegible]										
71.	Triple sector sewer, per lin. ft.							[illegible]										
72.	4 ft. wooden barrel sewer, per lin. ft.																	
73.	6-in. centrif. pump and motor and appur. in pl. comp. [illegible] volts D. C.													[illegible]				
74.	8-in. centrif. pump and motor and appur. in pl. comp. each													[illegible]				
75a.	Electric railroads, per lin. ft. of single track	24.00	12.00	20.00	18.00	18.00	17.00	18.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.00	[illegible]	[illegible]	[illegible]	
75b.	Horse railroads, per lin. ft. of single track	7.50	5.00	5.00	5.00	5.00	10.00	5.00					[illegible]	6.00		[illegible]	[illegible]	
76.	Support and mainten. of v. rr. struct., per column	1000.00	800.00						1000.00									
77.	3-in. water pipe, per lin. ft.																	
78.	4-in. water pipe, per lin. ft.	.75	.55	1.25	1.25	1.25	.75	1.25	.35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
79.	6-in. water pipe, per lin. ft.	1.00				1.50	1.00	1.50	.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
80.	8-in. water pipe, per lin. ft.																	
81.	10-in. water pipe, per lin. ft.	[illegible]	1.10	[illegible]	[illegible]	2.00			[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		
82.	12-in. water pipe, per lin. ft.										[illegible]							
83.	16-in. water pipe, per lin. ft.								[illegible]	[illegible]								
84.	20-in. water pipe, per lin. ft.	[illegible]																
85.	24-in. water pipe, per lin. ft.		[illegible]						[illegible]									
86.	30-in. water pipe, per lin. ft.			[illegible]	[illegible]										[illegible]			
87.	36-in. water pipe, per lin. ft.					[illegible]							[illegible]					
88.	48-in. water pipe, per lin. ft.																	
89.	3-in. gas pipe, per lin. ft.																	
90.	4-in. gas pipe, per lin. ft.	.70				1.00	.75	1.00	.30	1.00	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]
91.	6-in. gas pipe, per lin. ft.	.80		1.25		1.25	1.00	1.25	.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
92.	8-in. gas pipe, per lin. ft.					1.50	1.00	1.50	.60	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			
93.	10-in. gas pipe, per lin. ft.					2.00	1.50	2.00	.70		[illegible]	[illegible]			[illegible]			[illegible]
94.	12-in. gas pipe, per lin. ft.		1.65					2.25	.80	1.25				1.75				
95.	16-in. gas pipe, per lin. ft.		1.75					2.50	.90	[illegible]	2.50	2.50						[illegible]
96.	20-in. gas pipe, per lin. ft.	5.00	2.00											[illegible]				
97.	24-in. gas pipe, per lin. ft.									3.50								
98.	30-in. gas pipe, per lin. ft.													[illegible]				
99.	36-in. gas pipe, per lin. ft.													[illegible]				
100.	New c. i. hub and spig. st. pipe, deliv. on wk., per ton	40.00	37.50	40.00	40.00	40.00	30.00	40.00	26.00	40.00	40.00	40.00	40.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
101.	New c. i. hub and spig. pipe spec. cast., deliv. on work, per ton	75.00	77.00	70.00	70.00	70.00	70.00	70.00	65.00	70.00	70.00	70.00	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	[illegible] w. pipe, per lin. ft.		2.00	2.50	2.50	2.50												
[illegible]	[illegible] w. pipe, per lin. ft.		2.40	3.00	3.00	3.50												
[illegible]	[illegible] water pipe, per lin. ft.		3.50	4.00		4.00												
[illegible]	[illegible] w. pipe, per lin. ft.				4.50													
[illegible]	[illegible] w. pipe, per lin. ft.		5.00															
[illegible]	New [illegible] pipe, deliv. on work, per ton		37.50	35.00	35.00	35.00												
[illegible]	New [illegible] and groove pipe spec. cast., deliv. on work, per ton		77.50	70.00	70.00	70.00												
110.	[illegible]	1.25	1.25															
113.	[illegible]	7.50																
116.	[illegible]	1.35	1.25															
119.	[illegible] per lin. ft.	8.00																
[illegible]	[illegible] per lin. ft.								.40			[illegible]						
[illegible]	[illegible] per lin. ft.							[illegible]	.60	2.00	2.00				[illegible]			
[illegible]	[illegible] on work, per lin. ft.								1.00									
[illegible]	[illegible] on work, per lin. ft.								1.70	2.50	2.50							
[illegible]	[illegible] per lin. ft.								.60						[illegible]			
[illegible]	[illegible] on work, per ton								[illegible]						[illegible]			
[illegible]	[illegible] in place, per lin. ft.	[illegible]	[illegible]				[illegible]		[illegible]							[illegible]	[illegible]	[illegible]

ESTIMATED APPROXIMATE QUANTITIES FOR EACH SECTION OF ROUTE 5, TRI-BOROUGH SUBWAY SYSTEM OF NEW YORK CITY.

Item.	Unit.	Sec. 1.	Sec. 2.	Sec. 2a.	Sec. 3.	Sec. 4.	Sec. 5.	Sec. 6.	Sec. 7.	Sec. 8.	Sec. 9.	Sec. 10.	Sec. 11.	Sec. 12.	Sec. 13.	Sec. 14H.	Sec. 14K.	Sec. 15.
1.	Cu. yds.	160,000	256,100	28,070	172,000	181,400	10,600	73,000	125,600	172,700	101,100	44,700	52,100	126,000	79,320	47,970	49,510	106,630
2.	Cu. yds.	143,000	142,300	59,370	40,500	14,100	....	500	....	....	....	....	22,700	93,000	51,360	156,650	156,100	71,900
2a.	Cu. yds.	9,000	3,500	....	10,400	9,000	17,500	37,000	6,300	24,000	18,000	2,500	3,600	11,300	2,400	1,565	1,565	16,900
3.	Cu. yds.	61,000	100	100	....	25,700	21,800	116,200	221,000	54,000	48,400	150,100	81,300	12,820	207,460	24,480	27,620	265,000
3a.	Cu. yds.	....	....	....	....	....	3,800	27,000	5,800	2,200	500	700	1,900	....	260	....	....	900
4a.	Front ft.	3,000	3,000	318	3,700	2,100	400	340	1,284	1,743	350	910	2,300	4,680	3,300	850	850	1,200
4b.	Front ft.	400	1,300	70	1,700	1,600	0	30	145	0	0	100	0	0	95	0	0	0
4c.	Front ft.	300	750	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0
5.	Cu. yds.	....	23,300	....	....	33,000	75,300	85,000	17,700	78,900	60,900	91,800	82,900	....	....	....	....	10,460
5a.	Cu. yds.	....	....	....	....	....	....	2,810	565	....	....	....	....	....	....	....	....	....
6.	Cu. yds.	70,500	84,800	18,180	42,300	46,400	37,800	42,300	54,200	45,100	36,360	49,540	39,170	42,535	50,215	38,600	39,000	78,000
7.	Cu. yds.	10,300	6,220	2,625	2,200	1,300	620	370	1,240	430	900	260	2,060	5,480	3,570	5,140	5,130	5,060
8.	Cu. yds.	2,300	3,250	500	2,300	900	350	1,700	3,200	3,750	4,650	2,300	2,270	874	1,200	1,370	1,370	360
9.	Cu. yds.	100	50	230	50	1,300	3,100	1,610	800	3,480	2,740	1,910	1,880	100	100	100	100	100
10.	Cu. yds.	770	2,360	105	1,230	1,700	1,400	880	230	470	525	65	1,340	1,212	450	100	100	3,200
11.	(BM)	....	4,000	....	....	1,000	2,000	2,500	500	2,000	2,000	2,500	2,500	....	....	....	....	500
12.	Lin. ft.	5,000	1,000	1,000	1,000	....	....	....	....	....	....	....	1,000	1,000	1,000	10,000	10,000	1,000
13.	M. ft. B. M.	2	2	2	2	2	2	2	....	....	....	....	2	2	2	2	2	2
14.	Cu. yds.	[illegible]	3,300	1,070	2,800	3,700	3,500	3,100	2,250	2,400	1,300	1,000	1,760	3,450	2,800	....	....	5,400
[illegible]	Sq. yds.	[illegible]	45,500	20,625	16,900	9,900	5,900	4,810	5,535	3,050	4,860	5,820	17,850	37,870	27,360	44,820	45,000	37,400
[illegible]	Sq. yds.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	Sq. yds.	4,000	5,300	1,255	3,700	1,320	5,600	6,300	10,840	7,600	7,950	4,820	8,800	5,300	3,199	310	300	8,150
[illegible]	Sq. yds.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	Sq. yds.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	Sq. yds.	100	100	120	100	100	100	100	100	100	100	100	100	100	590	100	100	100
16.	Cu. [illegible]	12,200	7,300	3,255	3,060	1,550	770	650	1,030	430	824	595	2,500	6,053	4,660	7,380	7,450	6,100
17a.	[illegible]	100	100	100	100	100	100	100	100	100	100	100	2,340	2,634	1,102	100	100	210
[illegible]	[illegible]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	[illegible]	2,430	210	800	1,460	3,330	6,600	5,100	6,500	7,100	6,490	4,100	2,200	685	3,610	100	100	7,060
[illegible]	[illegible] ft.	200	100	200	200	200	200	200	200	200	200	200	100	200	200	100	100	100
[illegible]	[illegible] ft.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	Lin. ft.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100	0
[illegible]	Lin. ft.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
[illegible]	Lin. ft.	1,800	1,600	625	1,170	4,420	9,000	8,200	8,570	11,170	8,540	10,300	8,730	2,225	6,790	100	100	12,400
18.	Duct ft.	238,000	365,400	45,025	207,400	437,000	525,000	555,000	609,000	569,000	491,400	576,300	409,480	319,190	291,770	179,000	180,420	508,000
19.	Ton	5,500	6,700	2,275	2,560	1,940	270	1,770	4,390	1,417	994	2,655	1,480	754	5,585	62	6,620	5,060
20.	Ton	4,400	3,850	1,945	780	1,750	650	2,710	3,650	760	695	2,574	2,480	4,163	3,905	690	580	3,133
21.	Ton	660	1,240	23	1,530	1,250	1,150	610	380	1,305	1,017	588	300	95	90	550	550	2,050
22.	Ton	....	5,300	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
23.	Ton	....	75	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
24.	Ton	....	....	....	10	90	130	60	52	....	52	....	....	....	....	....	....	....
25.	Ton	10	20	10	12	16	15	15	18	5	5	5	7	12	12	12	12	32
26.	Lbs.	10,600	13,620	4,100	6,400	6,030	1,400	8,200	5,900	1,270	1,300	6,970	6,640	12,760	21,320	16,340	17,380	25,660
27.	Lin. ft.	100	9,130	....	3,520	10,140	11,100	12,900	9,783	12,758	10,520	14,968	6,960	6,320	6,260	5,330	5,460	11,440
28.	Sq. ft.	9,000	10,310	900	8,200	6,200	8,300	10,100	10,100	8,560	5,780	6,070	5,535	8,440	5,220	1,560	1,560	8,130
29.	Sq. ft.	4,500	2,900	2,025	5,000	900	5,500	6,400	8,150	5,600	2,620	234	4,120	8,900	3,960	100	100	8,700
30a.	Sq. yds.	7,120	8,065	2,442	9,390	6,950	5,970	3,170	9,970	8,710	4,790	4,130	5,570	8,230	8,940	3,500	3,500	11,800
30b.	Sq. yds.	14,520	18,695	2,798	14,240	15,470	14,070	19,630	15,430	17,190	15,760	8,340	9,170	17,330	14,730	7,095	7,355	28,800
31.	Sq. yds.	20,800	1,300	....	....	1,350	1,000	....	....	....	....	....	....	....	....	....	....	3,180
32a.	Lin. ft.	18,900	31,300	9,640	7,600	4,500	15,550	12,000	23,100	7,865	14,045	9,065	15,260	12,455	4,770	....	....	25,000
32b.	Lin. ft.	3,230	1,550	520	1,000	570	450	900	1,070	706	478	908	373	373	820	....	....	650
32c.	Lin. ft.	1,730	830	260	520	310	230	460	575	380	256	477	187	187	410	....	....	325
32d.	Lin. ft.	6,600	4,400	2,160	0	2,200	4,000	4,400	6,610	2,200	4,400	4,400	2,160	2,160	4,320	....	....	4,320
33.	Boxes	1,030	1,160	578	440	242	640	640	994	494	612	466	587	720	480	....	....	820
34.	Lin. ft.	140	380	770	160	25	40	60	440	90	300	75	250	275	245	....	....	200
35.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,110	....	....
36.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,080	....
37.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2,900
38.	Lin. ft.	1,250	1,760	....	1,272	2,134	1,738	720	2,887	1,596	2,800	1,985	1,405	2,418	514	....	....	2,564
39.	Lin. ft.	720	....	....	543	170	280	1,055	830	1,758	530	....	....	830	270	290	290	1,132
40.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	400
41.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	102
42.	Ton	....	9	....	283	....	4	9	....	....	12	25	51	568	10	....	....	30
43.	Ton	....	....	....	....	....	....	....	....	....	....	....	....	130	....	....	....	....
44.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	80	....	....	....	....	....	....
45.	Lin. ft.	2,168	185	190	554	1,978	1,465	390	1,044	1,863	1,250	95	975	1,296	677	50	50	960
46.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	308	....	....	....	....	....
47.	Lin. ft.	452	95	230	....	....	248	60	806	342	....	210	....	....	....	60	60	....
48.	Lin. ft.	....	....	....	484	228	210	....	....	....	....	....	....	....	....	....	....	....
49.	Lin. ft.	....	....	....	....	....	242	....	....	....	....	....	....	....	....	....	....	....
50.	Lin. ft.	....	....	....	....	....	246	....	....	....	....	....	....	....	....	....	....	....
51.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	70	....	....	....	....	....	....
52.	Lin. ft.	....	....	....	....	....	264	....	....	....	....	....	....	....	....	....	....	....
53.	Lin. ft.	....	....	....	1,145	....	....	....	300	....	....	....	....	....	....	....	....	....
54.	Lin. ft.	....	....	42	284	....	....	....	....	....	....	....	....	....	....	....	....	....
55.	Lin. ft.	....	....	208	....	....	....	....	....	....	....	....	....	....	....	....	....	....
56.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	430
57.	Lin. ft.	....	....	68	....	....	....	1,080	....	....	....	....	....	....	....	....	....	....
58.	Lin. ft.	....	....	....	....	....	....	1,280	257	....	....	....	....	....	....	....	....	....
59.	Lin. ft.	....	....	....	....	....	....	....	....	268	....	....	....	....	....	....	....	....
60.	Lin. ft.	....	....	....	....	....	1,250	1,160	....	260	1,200	....	....	....	....	....	....	....
61.	Lin. ft.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
62.	Lin. ft.	....	....	....	....	....	....	....	....	....	240	....	....	....	....	....	....	....
63.	Lin. ft.	....	....	....	....	....	....	....	....	870	....	....	....	....	....	....	....	....
64.	———	....	....	....	....	....	....	420	....	....	....	....	....	....	....	....	....	....
65.	Lin. ft.	....	....	....	....	....	....	....	....	520	....	....	....	....	....	....	....	....

66.	Lin. ft.							1,935										
67.	——																	
68.	——																	
69.	——																	
70.	Lin. ft.															985	985	329
71.	Lin. ft.							102										
72.	Lin. ft.							336										
73.	Each													1				
74.	Each													1				
75a.	Lin. ft.	5,500	6,750	1,280	5,470	4,800	2,300	5,800	7,192	7,624	6,196	3,900	3,560	6,585	5,980	1,550	1,550	4,730
75b.	Lin. ft.	240	770	100	720	150	200	270	0	0	0	0	40	310	0	0	0	0
76.	Columns	120	6						4									8
77.	——																	
78.	Lin. ft.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
79.	Lin. ft.	760				530	1,800	1,230	800	680	330	120	580	440	1,670	100	[illegible]	[illegible]
80.	Lin. ft.																	
81.	Lin. ft.																	
[illegible]	Lin. ft.	730	500	500	600	1,560			340		1,050	160	[illegible]	1,180	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Lin. ft.										100							
[illegible]	Lin. ft.	680							700	60				[illegible]	[illegible]			
[illegible]	Lin. ft.		1,200															
[illegible]	Lin. ft.			400	800				140									
[illegible]	Lin. ft.					2,300									[illegible]			
[illegible]	Lin. ft.												[illegible]					
[illegible]	Lin. ft.																	
90.	Lin. ft.	280				130	560	160	360	400	350	[illegible]	100	[illegible]	[illegible]			
91.	Lin. ft.	610		960		1,800	1,190	830	200	800	1,200	540	1,260	[illegible]	[illegible]			210
92.	Lin. ft.					1,070	720	880	540	900	280	350	930	[illegible]	[illegible]			[illegible]
93.	Lin. ft.														230			
94.	Lin. ft.		500			270	580	1,000	270		290	100			129			[illegible]
95.	Lin. ft.		500					110	470	60				[illegible]				540
96.	Lin. ft.	90	500					230	180	1,000	530	120		190				[illegible]
97.	Lin. ft.													100				760
98.	Lin. ft.									250								
99.	Lin. ft.													[illegible]				
100.	Ton	25	50	21	32	130	20	27	40	36	30	12	29	40	33	1	1	60
101.	Ton	6	13	6	8	40	5	7	10	9	8	3	7	10	13			15
102.	Lin. ft.		100	100	100	100												
103.	Lin. ft.		200	490	410	90												
104.	Lin. ft.		180	150		120												
105.	Lin. ft.				120													
[illegible]	Lin. ft.		120															
[illegible]	Ton		15	12	10	12												
[illegible]	Ton		5	4	3	4												
[illegible]	Lin. ft.	30	500															
[illegible]	Lin. ft.																	
[illegible]	Lin. ft.																	
[illegible]	Lin. ft.	830																
[illegible]	Lin. ft.	30	100															
[illegible]	Lin. ft.	200																
[illegible]	Lin. ft.								130			150						
[illegible]	Lin. ft.							250	500	550	410				[illegible]			
[illegible]	Lin. ft.								30									
[illegible]	Lin. ft.								100	100	100							
[illegible]	Lin. ft.								1,900						[illegible]			
[illegible]	Ton								10						6			
127.	Duct ft.	45,900	31,000	11,000	42,000	49,600	86,000	103,000	106,000	121,000	170,000	19,000	38,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Estimated approximate quantities for Routes 9 and 20, The Borough Subway System, New York City.

Item.	Unit.	Route 9 Sec. 1.	Route 9 Sec. 2.	Route 9 Sec. 3.	Route 20 Sec. 1.	Route 20 Sec. 2.
1	cu. yds.	233,600	478,700	425,600	30,600	82,700
2	cu. yds.	86,900	[illegible]	100	150,700	182,500
2a	cu. yds.	29,000	46,500	44,500	1,330	8,110
3a	ft.	4,050	3,690	465	3,685	7,746
3b	ft.	0	0		75	376
3c	ft.	[illegible]	0		0	0
4	cu. yds.	74,630	76,800	76,100	25,600	42,850
5	cu. yds.	6,050	1,350	1,575	3,150	4,520
6	cu. yds.			100	....	....
7	cu. yds.	530	170	190	100	75
8	cu. yds.	2,420	5,930	6,700	1,780	2,190
9	lin. ft.	1,000	1,000	1,000	1,000	1,000
10	lin. ft.	2	2	2	2	2
11	cu. yds.	2,830	5,330	4,650	...	573
12a	sq. yds.	44,800	22,330	19,200	41,800	52,200
12b	sq. yds.	100	100	100	100	100
12c	sq. yds.	9,850	8,820	19,175	100	1,285
12d	sq. yds.	100	100	100	100	100
12e	sq. yds.	100	100	100	100	100
12f	sq. yds.	100	100	100	100	100
13	cu. yds.	6,840	2,010	2,580	6,700	8,230
14c	lin. ft.	100	100	100	100	100
14b	lin. ft.	100	100	100	100	100
14c	lin. ft.	2,760	2,580	100	0	0
14d	lin. ft.	200	200	100	0	0
14e	lin. ft.	100	100	100	200	200
14f	lin. ft.	0	0	0	0	0
14g	lin. ft.	100	100	100	0	0
14h	lin. ft.	100	100	100	0	0
15	duct. ft.	323,520	592,000	771,800	58,900	131,560
16	tons	3,130	6,050	2,140	4,980	7,493
17	tons	5,290	4,770	3,585	1,560	1,740
18	tons	390	1,060	1,415	160	160
19	tons	....	13	....	....	....
20	tons	9	97	10	5	5
21	lbs.	10,600	12,160	6,380	6,600	12,000
22	lin. ft.	6,320	11,670	14,100	1,100	2,675
23	sq. ft.	6,390	8,310	13,300	1,800	188
24	sq. ft.	8,730	4,870	14,300	930	242
25a	sq. yds.	11,020	17,900	15,800	1,700	3,705
25b	sq. yds.	30,000	35,710	42,500	11,680	13,960
27a	lin. ft.	14,930	15,900	32,250	10,000	13,817
27b	lin. ft.	540	910	1,765	475	690
27c	lin. ft.	290	490	920	260	373
27d	lin. ft.	2,200	6,610	25,000	4,400	4,320
28		690	1,050	1,750	315	540
29	lin. ft.	290	165	500	375	15
30	lin. ft.	3,168	2,390	9,503	30	.
31	lin. ft.	1,004	831	2,915	485	410
32	lin. ft.	849	900	1,160	....	60
33	lin. ft.	190	1,035	715	....	. .
34	lin. ft.	....	2,790	....	....	. .
35	tons	...	66	28	....	73
36	tons	....	10	4	....	12
37	lin. ft.	4,306	1,608	1,655	15	250
38	lin. ft.	1,100	780	1,030	....	..
39	lin. ft.	1,100	3,355	1,215	40	177
40	lin. ft.	. .	. .	. .	40	36
41	lin. ft.	946	960	655	....	.
42	lin. ft.	....	...	10	....	90
43	lin. ft.	...	. .	25	....	
44	lin. ft.	...	180	614	....	...
45	lin. ft.	..	....	15	....	.
46	lin. ft.	900	15	490	75	.
47	lin. ft.	....	375	....	....	.
48	lin. ft.	35	. .	...	...	.
49	lin. ft.	...	540	...	25	.
50	lin. ft.	....	...	450	....	260
51	lin. ft.	....	. .	....	....	275
52	lin. ft.	....	....	. .	....	250
53	lin. ft.	...	. .	....	325	...
54	lin. ft.	...	. .	....	....	36
55	lin. ft.	...	. .	...	100	138
56	lin. ft.	...	.	.	40	
57	lin. ft.	. .	.	.	397	
58	lin. ft.	...	.	.	172	
59	lin. ft.	...	.	.	610	.
60	lin. ft.	424	.		....	
61	lin. ft.			128	....	.
62a	lin. ft.	15,740	12,320	2,900	3,920	3,375
62b	lin. ft.	0	0	0	2,300	2,820
63		163	110	19	8	4
64	lin. ft.	100	100	100	100	100
65	lin. ft.	100	100	100	100	100
66	lin. ft.	360	3,600	3,400	200	140
67	lin. ft.	830	120	50	. .	
68	lin. ft.	435	890	2,370	[illegible]	230
69	lin. ft.		....	...	[illegible]	72
70	lin. ft.	1,365	1,500	150	.	350
71	lin. ft.	800	[illegible]	. .	.	
72	lin. ft.	250	100	.	.	
73	lin. ft.	.	880	. .		..
74	lin. ft.		....	150		
75	lin. ft.	250	750	1,550	[illegible]	240
76	lin. ft.	100	820	1,570	360	100
77	lin. ft.	[illegible]	410	2,180	120	280
78	lin. ft.	100	200	880		350
79	lin. ft.	1,330	[illegible]	1,785	240	260
80	lin. ft.	.	120	1,400	120	270
81	lin. ft.		..	70		420
82	lin. ft.	100			.	..
83	tons	76	[illegible]	.	3	[illegible]
84	tons	19	.	24	9	7
85	lin. ft.	.			100	100
86	lin. ft.				240	170
87	lin. ft.					350
88	lin. ft.			.	..	70
89	tons	.	.	.	5	16
90	tons	.			3	4
91	duct ft.	9,000	25,000	15,000	2,000	5,000

UNIT BIDS OF LOWEST BIDDER OCT. 27 ON EACH SECTION OF ROUTES 9 AND 20, TRIBOROUGH SUBWAY SYSTEM OF NEW YORK CITY.

	Route 9			Route 20	
	Sec. 2	Sec. 1	Sec. 3	Sec. 1	Sec. 2
1. Exc., above m. h. w. (except exc. for sewers and pipes), incl. disp., per cu. yd	$ 3.95	$ 4.20	$ 2.40	$ 8.50	$ 4.50
2. Exc., below m. h. w. (except exc. for sewers and pipes), incl. disp., per cu. yd	10.00	6.70	4.00	8.50	20.00
2a. Excavation, both above and below m. h. w., for sewers and pipes, incl. disp., per cu. yd	3.95	2.00	2.40	3.00	5.00
3a. Underpinning Bldgs. less than 7 stories, per front ft	110.00	80.00	100.00	500.00	400.00
3b. Underpinning Bldgs. from 7 to 12 stories, per front ft	200.00	.....	.....	500.00	500.00
3c. Underpinning Bldgs. over 12 stories, per front ft	250.00	.....	.....	750.00	.....
4. Concrete masonry, in place, per cu. yd	9.65	10.00	9.50	11.25	10.00
5. Protective conc. mas. in pl., outside w. proofing, per cu. yd.	10.00	10.00	16.00	10.00	9.00
6. Rubble stone masonry, per cu. yd	.....	.....	6.00	.....	.....
7. Brick masonry, in place, per cu. yd	20.00	11.00	13.50	20.00	15.00
8. Hollow t. c. brick mas., in pl., per cu. yd	14.25	12.00	13.50	14.25	15.00
9. Timber piles, in pl. and prepared, per lin. ft	.50	.70	1.00	1.50	1.25
10. Timber, foundations pl. and fasten., per M. ft., B. M	75.00	100.00	60.00	75.00	75.00
11. Broken stone or gravel, in pl., per cu. yd	2.15	2.50	1.75	.....	2.50
12a. Waterproofing, 1-ply, per sq. yd	.10	.65	.12	.40	.75
12b. Waterproofing, 2-ply, per sq. yd.	.60	1.05	.16	.60	1.00
12c. Waterproofing, 3-ply, per sq. yd.	.85	1.46	.20	.85	1.50
12d. Waterproofing, 4-ply, per sq. yd	1.10	1.86	.28	1.10	1.75
12e. Waterproofing, 5-ply, per sq. yd	1.36	2.28	.34	1.36	2.00
12f. Waterproofing, 6-ply, per sq. yd	1.60	2.69	.40	1.60	2.50
13. Waterproofing, brick laid is asp. mastic, in pl., per cu. yd.	28.75	12.00	40.00	28.75	30.00
14a. 12-in. vit. pipe, in pl., per lin. ft	.75	.56	.60	.75	1.75
14b. 10-in. vit. pipe, in pl , per lin ft	.65	.39	.50	.65	1.50
14c. 8-in vit. pipe, in pl., per lin. ft	.50	.28	.40	.50	..
14d. 6-in. vit. pipe, in pl., per lin. ft	.40	.20	.30	.40	.....
14e. 4-in. vit. pipe, in pl., per lin. ft	.35	.16	.20	.35	...
14f. 8-in. c. i. pipe, in pl., per lin. ft	1.25	....	....	1.25	.
14g. 6-in. c. i. pipe, in pl., per lin. ft	1.10	1.00	1.20	1.00	.
14h. 4-in. c. i. pipe, in pl., per lin. ft	1.00	.80	1.00	.75	..
15. Tunnel ducts, in place, per duct ft	.11	.10	.12	.10	.15
16. Riveted steel, painted and erected, per ton	75.00	98.00	80.00	75.00	90.00
17. Steel beams and shapes with connections, paint. and erect., per ton	60.00	85.40	65.00	65.00	80.00
18. Steel rods and bars built in concrete, per ton of 2,000 lbs	45.00	55.00	80.00	50.00	65.00
19. Cast iron columns erected and painted, per ton of 2,000 lbs.	60.00	.	.....	.	.....
20. Miscellaneous iron castings, in pl., per ton	65.00	45.00	70.00	60.00	75.00
21. Wire mesh, in place, per lb	.05	.07	.06	.05	.10
22. 1½-in. galv. iron pipe hand rail, in pl., per lin. ft	.12	1.20	1.00	.15	1.25
23. Steel gratings for ventil., in pl., per sq. ft	.75	.70	1.00	1.00	2.50
24. Vault lights, in place, per sq. ft	1.65	2.00	1.25	1.60	2.00
25a. Sidewalks restored, per sq. yd	1.50	3.50	3.00	2.50	5.00
25b. Temporary repave. and mainten. of r'dways, per sq. yd	1.40	3.00	.75	2.00	3.00
37a. ¾-in. wrought iron, per lin. ft	.10	.08	.10	.10	.30
27b. 1½-in. w. i. elec. cond., per lin. ft	.20	.18	.12	.15	.45
27c. 2-in. w. i. elec. cond., per lin. ft	.25	.24	.12	.20	.60
27d 2-in. fiber elec. cond., per lin. ft	.20	.14	.12	.15	.15
28. C. i. outlet boxes in pl. in sta., each	.30	1.00	1.00	.25	1.00
29. 6-in. c. i. pipe and fittings, in pl. in sta., per lin. ft.	1.75	1.50	1.25	1.50	2.50
30. 12-in. vitrified pipe sewer, per lin. ft	4.00	3.00	.60		.....
31. 15-in. vitrified pipe sewer, per lin. ft	4.50	2.87	.80	...	6.00
32. 18-in. vit. pipe sewer, per lin. ft	5.00	3.73	1.00	.....	.....
33. 20-in. vitrified pipe sewer, per lin. ft	5.50	2.80	1.40	...	.....
34. 24-in. vitrified pipe sewer, per lin. ft	5.90	.....	.....	.....	.....
35. C. i. sewer pipe, per ton	35.00	.....	50.00	....	50.00
36. C. i. sewer pipe (spec. cast.), in pl., per ton	60.00	.....	55.00	....	100.00
37. 3 ft. 6 in. x 2 ft. 4 in. sewer, per lin. ft	8.00	4.39	5.60	.	....
38. 3 ft. 9 in. x 2 ft. 6 in. sewer, per lin. ft	9.00	3.93	5.90	.	...
39. 4 ft. x 2 ft. 8 in. sewer, per lin. ft	10.00	4.81	6.20	.	..
40. 4 ft. 3 in. x 2 ft. 10 in. sewer, per lin. ft	.....	.....	.....	.	16.00
41. 4 ft. 6 in. x 3 ft. sewer, per lin. ft	11.50	5.33	6.80	.	.....
42. 4 ft. 9 in. x 3 ft. 2 in. sewer, per lin. ft	.....	.....	7.10	.	...
43. 5 ft. x 3 ft. 4 in. sewer, per lin. ft	.....	.	7.40	..	...
44. 5 ft. 3 in. x 3 ft. 6 in. sewer, per lin. ft	14.00	...	7.70	...	...
45. 3 ft. circular sewer, per lin. ft	.....	.....	4.86	..	....
46. 4 ft. circular sewer, per lin. ft	10.50	4.56	5.60	..	....
47. 4 ft. 6 in. circular sewer, per lin. ft	12.00	.....	.....	.....	.....
48. 4 ft. 9 in. circular sewer, per lin. ft	.....	.....	.....	....	....
49. 5 ft. circular sewer, per lin. ft	14.00	.....	.....	.....	.....
50. 5 ft. 6 in. circular sewer, per lin. ft	.....	.....	7.20	.....	.....
53. 6 ft. 6 in. circular sewer, per lin. ft	.....	..	.....	21.85	.....
54. [illegible] ft. circular sewer, per lin. ft	...	....	.....	.....	32.00
62a. Electric railroads, per lin. ft. of single track	10.00	9.00	4.00	15.00	18.00
62b. Horse railroads, per lin. ft. of single track	10.00	.....	.....	10.00	5.00
63. Support and mainte. elev. r. r. struct., per column	250.00	900.00	600.00	250.00	2000.00
64. 3-in. water pipe, per lin. ft.	.50	.25	.32	.75	1.00
65. 4-in. water pipe, per lin. ft	.75	.30	.50	.75	1.25
66. 6-in. water pipe, per lin. ft	1.00	.35	.80	1.00	1.50
67. 8-in. water pipe, per lin. ft	1.50	.45	.98	.....	.....
68. 12-in. water pipe, per lin. ft	2.00	.60	1.94	1.50	2.00
69. 16-in. water pipe, per lin. ft	.....	.....	.....	2.00	2.50
70. 20-in. water pipe, per lin. ft	2.50	1.00	3.74	.....	3.00
71. 30-in. water pipe, per lin. ft	3.50	2.00	.....	....	.....
72. 36-in. water pipe, per lin. ft	4.90	.	.....	....	.....
73. 48-in. water pipe, per lin. ft	5.00	.	.....	....	.....
74. 3-in. gas pipe, per lin. ft	.....	.	.35	....	.....
75. 4-in. gas pipe, per lin. ft	.75	.25	.50	.75	1.00
76. 6-in. gas pipe, per lin. ft	1.00	.30	.88	1.00	1.25
77. 8-in. gas pipe, per lin. ft	1.25	.35	1.10	1.00	1.50
78. 10-in. gas pipe, per lin. ft	1.25	.40	1.60	.....	1.75
79. 12-in. gas pipe, per lin. ft	1.50	.45	2.40	1.50	2.00
80. 16-in. gas pipe, per lin. ft	2.00	.	3.00	2.00	2.25
81. 20-in. gas pipe, per lin. ft	.....	.....	4.10	.....	2.50
82. 24-in. gas pipe, per lin. ft	.....	1.50	.....		.....
83. New c. i. hub and spig. st. pipe deliv. on work, per ton	30.00	40.60	30.00	35.00	40.00
84. New c. i. hub and spig. pipe, spec. cast., deliv., per ton	60.00	81.20	32.00	70.00	70.00
85. 8-in. high pressure water pipe, per lin. ft	.....	.....	.....	1.25	2.50
86. 12-in. high pressure water pipe, per lin. ft	...	....	.....	2.50	3.00
87. 16-in. high pressure water pipe, per lin. ft	.....	...	.....	.....	4.00
88. 24-in. high pressure water pipe, per lin. ft	.....	..	.....	..	5.00
89. New c. i. spig. and groove st. pipe deliv. on wk., per ton	.....	.	..	35.00	35.00
90. New c. i. spig. and groove pipe, spec. deliv., per ton	.....		...	100.00	70.00
91. Electric ducts and conduits in place, per duct ft	.16	.14	.15	.15	.25

Pennsylvania.

The State Railroad Commission has been petitioned to revocate the charter of the South Penn R. R. on the ground of abandonment. The plan is to organize a new company to take over the charter and to complete the road. The South Penn R. R. was projected in the early 80's to run across the Maryland state line just above the Southern Pennsylvania. Part of the road was completed.

Construction work is to be started shortly, it is said, on the Pen-Mar extension of the Chambersburg - Greencastle & Waynesboro Street Ry. Co., of Waynesboro, Pa. The line is to be run from Pen-Mar along the west side of the Western Maryland railroad to the Cascades, then north and almost in a straight line to Monterey.

The Central Pennsylvania Traction Co. is to extend its street car line at Harrisburg to Lewis St., Riverside, and through the grounds of the Harrisburg Academy. The work will be started as soon as the Central Construction Co. completes its grading to Division street from Reel's lane. There is little grading to be done north of Division St. and the traction company already has its poles and rails on the ground for the work to be done there.

The Pennsylvania R. R. is to continue work during the winter on the construction of its new classification yards being built between Mahoningtown and Moravia. It is said that over 1,000 men will be employed on the work, which has now been going on for more than a year and will continue for a like or longer period. So far, the work has consisted chiefly in getting the ground in shape. By spring work will be begun, it is thought, on laying track.

The Stony Brook Lumber Co., John Hughes Blackman, President, Scranton, Pa., has awarded a contract for building a railroad to connect a timber tract of 2,250 acres in Sullivan County with the Lehigh Valley R. R. at Lopez, Pa.

The Clarion & East Brady Electric Ry. Co., on Nov. 15 awarded the contract for constructing the first section of its proposed line, six miles, to Ridge Bros. Co., Pittsburg, Pa. This section extends from Clarion to Reidsburg In addition to these towns the company also projects the line through Curllsville, Sligo, Rimersburg and East Brady. F. W. Patterson, Clarion, Pa., is Chief Engineer, and F. M Arnold, Clarion, Pa., is President.

The cutoff on the line of the Delaware, Lackawanna & Western between Slateford, Pa., and Port Morris, N. J., has advanced to such a stage that the railway has placed orders for rails to cover approximately 11 miles of track.

All preliminary arrangements for financing the proposed new electric railway from Reisterstown, Md., to Hanover, are reported to have been completed. The road will pass through Baltimore and Carroll counties, Maryland, and a portion of Pennsylvania. It will connect the railroad systems of York, Hanover and Philadelphia with Baltimore, Md. The line passes through a rolling country of about 20 miles, and it is not expected that much grading will be necessary. For the most part the road will be built along the Reisterstown and Hanover pike. It will pass through Arcadia, Hampstead, Manchester, Fowblesburg, Woodensburg and Boring. It is estimated that about $600,000 will be required to construct the roadbed, and to secure the right of way and equipment. It is stated that the Maryland Construction Co., Howard Tebbs, President, Baltimore, Md., has the contract for constructing the road.

Texas.

The Santa Fe System has planned to enlarge its roundhouse at Canadian, Tex., at a cost of $13,000; the work consists principally of new engine stall construction.

The Santa Fe System plans to renew its scale track at El Paso, Tex., at an estimated cost of $2,800.

The Santa Fe System is to enlarge its telegraph facilities between Gainsville, Tex., and Cleburne, Tex., by stringing two additional copper wires between these points at a cost of $8,000.

The Santa Fe System has appropriated $41,000 to be used in repairing and enlarging its roundhouse at Amarillo, Tex.

The Santa Fe System has appropriated $4,400 to cover the cost of the installation of an autogenous plant at Cleburne, Tex.

Col. I. D. Polk, of Beaumont, has accepted the franchise recently granted by that city for the Beaumont-Port Arthur interurban electric line. The franchise requires that work of construction shall begin within twelve months from acceptance of the franchise and be completed within 18 months.

Surveying crew of the Houston, Somerville & Taylor R. R., according to advices from Taylor, Tex., is within three miles of Lexington coming from Somerville via Lexington and Beaukiss toward Taylor. The preliminary work is being done under the supervision of H. H. Fielder of Houston, Texas.

M. R. Hoxie, Lexington, Texas, is promoting the project.

The Gulf, Texas & Western Ry. now has 75 miles of line in operation, and 63 more miles graded. Work, however, has been suspended for the present. This company plans a 400-mile line from Southeastern to Northwestern Texas.

The San Antonio, Rio Grande & Tampico R. R. has agreed to construct a 2-mile branch from San Antonio to the new town of San Jose at Terrell Wells. The line will also connect the wells with San Antonio & Aransas Pass R. R.

The Chicago, Weatherford & Brazos Valley Ry. Co., of Weatherford, Tex., is to file a preliminary application with the State Railroad Commissioners for the issuance of bonds. The bonds are to be issued on the road from Weatherford to Gainesville, a distance of 95 miles. Actual work of construction is now well under way for the road between the two points. F. B. Trueax, is Chief Engineer, and L. M. Kirkus, is President of the road.

It is believed that the next work undertaken by the Santa Fe will be the extension from Paint Rock to Eden, thus furnishing an outlet for the line now constructing between Lometa and Brady. The railway company, under its contract has twelve months in which to make this extension.

Utah.

Engineers of the San Pedro, Los Angeles & Salt Lake R. R., are reported to have been making changes in the former surveys which were made last spring from a number of points below Modena. These surveys were for a cutoff which is designed to cross the Pioche branch line at a point nine miles or so from Caliente and extend to a connection with the high line, at present under construction from Caliente, Nev., south.

The Eureka Hill Ry. Co. has filed articles of incorporation providing that the main place of business shall be at Provo.

All improvements and extensions started this spring by the Utah Light & Railway Co. have been completed and the company has cut down materially the construction forces, keeping only those necessary for maintaining the track and roadbed.

A crew of surveyors under direction of I. T. Burgess, Salt Lake City, Utah, have started work on surveys for the construction of the proposed new railroad from Beaver west to Milford and south to Cedar. Grading will be started as soon as the preliminary work is completed. The line will eventually extend from Cedar south to the Grand Canyon and from Beaver north to Nephi. The company will attempt to raise $150,000 in southern Utah by selling stock.

Virginia.

Meetings have been held at the office of the Board of Trade of Bristol, Va., looking to the construction of an electric road between Bristol and Kingsport, Tenn., with a view to later having a road that would in all probability traverse the county of Hawkins from border to border.

Robert E. Ellis, a foreman of the Norfolk & Western Ry. camp on the Cox road in Dinwiddie county, was attacked on Nov. 15 with a shovel by one of the negro construction hands and probably fatally injured. The blow was struck on the head, fracturing the skull. Ellis was brought to the hospital at Petersburg.

Right of way is being secured for the projected steam railroad through the Northern Neck of Virginia. This project is being promoted by Channing M. Ward, of New York City, who for the past few days has had his headquarters at Warsaw, Richmond County.

West Virginia.

Bennett & Talbott have work well under way for the B. & O. tunnel at Tunnelton, W. Va. They are working two steam shovels, one at each portal. Bennett & Talbott are also working on a big cut at Anderson, W. Va. They have one steam shovel in this cut and have another new shovel coming. Ed Clark is the powder foreman on this job. T. A. Bennett also has the contract for some concrete work between Anderson and Tunnelton, W. Va.

The Norfolk & Western Ry., in connection with the double tracking and relocation of its line, is said to be planing to build a long tunnel near Coopers, W. Va., at the summit of the Alleghenies. The proposed tunnel, it is said, will not be less than 2½ miles, and will take place of the Coaldale tunnel, which has been in use for years. The grade leading to it is the heaviest on the Pocahontas division.

Wisconsin.

The company which is preparing to build an electric railway from Kenosha to the lake regions from the western part of Kenosha County is said to have declared that it will be in a position to build the line next year if the people along the proposed route show a willingness to aid by stock subscriptions. Representatives of the company are now canvassing the situation with farm owners. This is the propect promoted by Justin K. Orvis of Waukegan, Ill.

The Minneapolis, St. Paul & Sault Ste Marie Ry. has completed surveys for its proposed new short line between Ashland and the Gogebic range and St. Paul and Minneapolis, mentioned in our last issue. The new construction will be between Mellen, on the Ashland branch of the Chicago division, and the terminus of another Soo branch, Reserve, in the Lac Court Oreilles Indian reservation in Sawyer county. Then at least a portion of the distance will be covered by using the Barron-Ridgeland branch.

The Superior & Southeastern Ry., J. E. Glover, President, New Richmond, Wis., is reported to have completed plans for a 5-mile extension.

Canada.

Applications have been made to the Canadian Government for the incorporation of the following companies: Saskatoon & Hudson Bay Ry., from Saskatoon, via Melfort to The Pas Mission; Pacific & Peace Ry., from Bella Coola, B. C., via Teta Chuck, Cheslatta, and Fraser lakes to Dunvegan, Alta.; Skettle River Valley Ry., from Penticon, B. C., to Osoyoos Lake, to Allison or Princeton and from Coldwater River to Fraser River and to the Steamboat mining camp; Southern Central Pacific Ry., from North Saskatchewan to Dunvegan, Peace River, Parsnip River, and Necliaco River, and from Elk River; via Waterton River to Coutts.

Foley, Welch & Stewart, St. Paul, Minn., have been awarded the contract for constructing the Alberta & Great Waterways R. R.

John Armstrong, chief engineer of the Hudson Bay railway surveys, was in Ottawa recently, conferring with the minister of railways. He stated that the construction of the bridge at La Pas is well under way, while the general survey of the line has been completed. The outlet of the railway is still an unsettled point. Much will likely depend on the hydopraphic survey of the harbor at Fort Churchill and Port Nelson. We can go ahead with 200 miles of it anyway, leaving the terminus to be determined later, Mr. Armstrong stated.

Six municipalities will vote next January on the money by-law in connection with the People's Railway of Guelph, Ont. The total sum that will be invested by these municipalities in the railway proposition, if all the by-laws carry, is $146,000. The amounts to be voted on by the various townships and towns are as follows. Proton township, $36,000; Luther township, $30,000; Garafraxa township, $25,000; Arthur, $20,000; Fergus, $20,000; and Elora, $15,000.

The Owen Sound & Meaford Ry. Co. is to apply to Parliament for power to construct a railway from Southampton, through Owen Sound, Meaford, Thornbury and Collingwood, to Orillia. An endeavor will be made to secure the co-operation of the towns across the three counties of Bruce, Grey and Simcoe, for the purpose of connecting these ports. It is the purpose to try to come to an agreement with either the C. P. R., the Grand Trunk, or the Canadian Northern Railways by which they will take over the charter and construct and operate the railroad.

Mackenzie & Mann, Toronto, Ont., will probably place survey parties in the field early next spring for the new transprovincial line from Stewart, B. C., to Edmonton, north of the Grand Trunk Pacific route. Application for the charter will be made to the Dominion Parliament at the approaching session, and one of the links will be the Alberta & Great Waterways Ry. projected from Edmonton to Fort McMurray, if the firm is successful in its negotiations with the Alberta government to acquire the control of that charter. A bill seeking to transfer the Waterways charter to a new company, it is expected will soon be placed before the Alberta legislature.

It is believed in the railroad circles of Canada that the Canadian Pacific Ry. is considering abandoning temporarily its avowed intention of constructing a branch line between Kingston and Toronto, via Belleville and proceed shortly with the double tracking between Smith's Falls and Toronto. It is also believed that the line from Victoria Harbor to Peterboro now under construction will be extended through to Kingston, and thence to Brockville.

A meeting of citizens of Carleton County, Ont., was recently held at the chamber of the county council and preliminary steps were taken toward the organization of a company to construct a railroad from Ottawa to Kingston following the northwest shore of the Rideau Canal as far as Smith's Falls, passing through City View, Manotick, Kars, Burritt's Rapids and Merrickville. The road will be operated by electricity. About $2,000 has already been subscribed for the project and the following men will seek a charter for the company, which is to be known as the Kingston Electric Ry. Co.: Robert McElroy, M. L. A., Carp; G. L. Dickenson, Mantoick; Thomas Kidd, Burritt's Rapids; F. A. Heney, Westboro; George Boyce, Merivale; J. C. Graham, A. E. Baker, Merrickville; J. E. Caldwell, City View; Ald. J. S. McCann, Kingston; Rev. D'Arcy Clayton, Kars; E. P. McGrath, Ottawa; D. Clark, Manotick.

It is understood that the Government estimates for the coming fiscal year will include a considerable sum for the construction of the Hudson Bay Ry. It is the intention of the Government to vigorously proceed next year with the building of the first 150 miles of the road from The Pas, and tenders will be called for this winter. Tenders for the balance of the line will be called for as soon as the route is definitely located.

The Southern Central Pacific Ry., chartered in 1903, is planning to construct 250 miles of road north and south of Burmis within the next 18 months. This company projects a line to run north and south from Burmis on the Crow's Nest line, and will tap the coal fields of North Kootenay Pass. The line north will run to Calgary and Edmonton. It will also run north through the Peace River country, and from there through the mountains via either Pine Pass or Peace River Pass to the coast on Gardner Canal. James Conmee, M. P., Port Arthur, Ont., is interested.

The cities of Berlin, Waterloo, Conestoga and Elmira are making a strong effort to get the Canadian Pacific to extend its subsidiary line, the Preston & Berlin Electric Ry., through to Elmira.

Announcement has been made that the Grand Trunk Pacific Ry. will apply to Parliament for powers authorizing the construction of a line to enable it to connect with the Hudson Bay road which the Government proposes to build from the main line in Keewatin to the southwestern shore of the bay. The southern terminus of the road will be at a point near the mouth of the Garret and Pasqua Rivers, and from there the distance will be about 40 miles to York Factory on the Nelson River.

Mexico.

The San Pedro bridge over the new Pachura-Ziniapan Ry. has been formally opened by the Governor of the State of Hidalgo. Work on the new road is progressing rapidly, when the heavy work necessary through the mountain passes is taken into consideration. In a few days the line will be open as far as Actopan.

After leaving Actopan the line will pass through Ixmaquelpin, to Zuniapan. The rails of the new line are 70 lbs, the gage standard, and the bridges and tracks are calculated to carry 120-ton locomotives. One cut on this road is 800 meters long and eight meters in depth, while bridges and fills are numerous. The grade averages 1.80 per cent and the curves range about ten degrees. Over 1,000 men are now employed on the building of the line. Richard Honey is the concessionaire and builder of the road.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

✣Bids will be received at once by Edward Young, Secy., Grassy Lake Drainage District No. 1, Youngstown, Ark., for $12,000 worth of bonds to bear 6% interest and to run 20 years. Particulars can also be obtained of Crawford & Hooker, Pine Bluff, Ark.

Colorado.

The Southwest Construction Co., Lamar, Colo., has been awarded the contract for building the Bent-Prowers irrigation system, a project to cost about $1,000,000, and irrigate about 100,000 acres in the southern part of Bent county. It includes a reservoir with a capacity of about 132,000 acre feet of water on the Purgatoire river, 5 miles south of Las Animas. The main canal will be about 126 miles long and run nearly parallel to the Arkansas River, beginning at the Purgatoire river on the west and extending to Wolf Creek, 20 miles east of Lamar. About a year ago a bond issue of $1,000,000 [illegible] by the district. The contract calls for immediate work and for completion of the system within the coming year.

Chicago capitalists are said to have contracted with the State of Wyoming through the State Land Board at Cheyenne, to take over the Oregon Basin project, one of the largest individual irrigation enterprise in the United States, by which 150,000 acres of fine land in the Big Horn basin will be reclaimed. The project, which will involve construction of many miles of canal, a big reservoir, tunnels, etc., will cost upward of $2,500,000. The new company is given five years in which to complete its contract. It is said 25,000 acres will be brought under the canals in time for the 1912 crops. The Burlington railroad has assured the capitalists that it will build through the proposed irrigated area as soon as developments justify.

A deed has been filed at Pueblo transferring water rights in the Orlando ditch, valued at $400,000, from the Ambursen Water Co. to the Pueblo-Rocky Ford Irrigation Co.

Illinois.

The Goggin Contracting Co., Arcola, Ill., has the contract for constructing about 2½ miles of tile ditch north of Ficklin. The contract amounts to about $3,790. Excavation work and hauling has been sublet.

Indiana.

✣Bids will be received until December 3, by William H. Kessler, Supt., Morocco, Ind., for 206,000 cu. yds. of dredge work in Newton County, Ind.

Kansas.

Haskins & Ramsey, Topeka, Kan., have been awarded the contract for constructing the South Side dike at Topeka for the County Commissioners. The contract price was $103,469. The dike will extend from a point on the river northeast of the Santa Fe shops along the south side of the river to a point about three-quarters of a mile west of the Rock Island bridge, being nearly two miles long. It will be constructed most of the way of concrete backed by an earth wall. At the west end, however, much of the dike will be merely an earth bank. The dike will connect with the abutments of the extension to the Melan bridge in crossing Kansas Ave.

The contract awarded Callahan Bros., Omaha, Neb., by the Kaw Valley Drainage Board, of Kansas City, Kan., as noted in our Nov. 9 issue, provides for the improvement of the banks of the Kaw from the upper end of the district, at Turner, to the mouth and along the right bank of the Missouri River, below the mouth to the State Line; to make the banks high enough and strong enough to prevent overflow at times of high water. Following are the principal items in the contract and specifications: Levee construction, 662,800 cu. yds.; revetment paving, 118,800 sq. yds.; willow mattress, 10,600 lin. ft.; three-row pile dike, 2,175 lin. ft.; concrete culvert, 1,600 lin. ft. or 2,600 cu. yds.; concrete wall, 5,975 lin. ft. or 3,290 cu. yds. All of the right of way needed for widening the Kaw channel to 734 ft. below the 5th St. bridge has been granted by the owners of abutting lands who are interested in the improvements except a few small pieces of property below the Ohio Ave. bridge of the Kansas City Southern R. R. These are to be condemned as soon as possible. The plan provides for lengthening and raising all the railroad bridges spanning the Kaw, and also for raising the tracks on either side of the river to conform to the elevation of the banks. These improvements which are to cost the railroads even more than the amount to be expended by the Drainage Board, are all agreed to. Callahan Bros. have placed the contract for the tools, supplies and equipment to be used on the contract with the Contractors' Supply & Equipment Co., 1645 Wazee St., Denver Colo., and that company is now in the market for the following: Three elevator graders, 48 dump wagons, 36 wheelers, 60 drag scrapers, 8 plows, 3 concrete mixers, 12,000 lin, ft. piling, 120,000 ft. ½-in. 7-strand No. 11 wire cable, 250,000 ½-in. cable clamps, 900,000 sq. ft. wire mesh, 10,000 ft. oak or yellow pine timber, 5,000 ft. ⅜-in galvanized steel cable, one car load of nails, 4,000 ft. ¾-in. deformed galvanized steel bars, 2,000 lbs. ¼-in. bolts and rivets, 5,000 ft. ⅞-in. 6x25 flattened strand wire rope, 10,000 ft. ¾-in. 6x25 flattened strand wire rope, 3,000 ft. ⅞-in. 6x19 round strand wire rope and 5,000 ft. ¾-in. 6x19 round strand wire rope.

Maryland.

Plans are under consideration in Talbot County, Maryland, for connecting the waters of Miles and Ford Avon River by a 12-mile canal, 20 to 25 ft. wide. The present plan, it is said, is to build the canal by public subscription and a meeting will be held shortly at Royal Oak to further this plan.

Mississippi.

✣Bids are wanted by Messrs. Johnson, Waldrup & Peden, Commissioners of the Houlka Creek Drainage District No. 2, Chickasaw County, Houston, Miss., for constructing a drainage canal. The canal will be 21,500 ft. long, width: top, 20 ft,, bottom 16 ft.; average depth 5½ ft., and contains 81,634 cu. yds. excavation. In addition there will be 9¾ acres clearing and grubbing and 17.8 acres clearing in right-of-way 60 ft. wide. The line extends from present head of Houlka Canal northwesterly to N. O. M. & C. R. R. It is expected that the work will be done by using a floating steam shovel, beginning in creek channel at railway and working down stream. A loading switch is near this point on the railway. The district contains 1,040 acres of very fine land, against which bonds will be issued for the building of the canal. Timber is all hardwood of medium size and density. Charles Lyon Wood, Columbus, Miss., is the Engineer.

✣Bids will be received until 11 a. m., Dec. 9, by Black Creek Drainage Commissioners, Lexington, Miss., for the digging of a drainage canal from Howard, Miss., to Tchula Lake. Tackett & Elmore, Lexington, Miss., and F. Fontain, Lyon, Miss., Engineers.

Nebraska.

The Pollard-Campbell Dredging Co., 851 Brandeis Bldg., Omaha, Neb., which has the contract for constructing ditches for Pawnee County Drainage District No. 1, as noted in our last issue, can use some good Marion runners and cranesmen. The work is located near Table Rock, Neb., and includes 1,000,000 cu. yds. of earth excavation for ditch work.

New York.

✣Bids will be received at once by Shanley Morrissy, Inc., Mechanicsville, New York, for about 200,000 cu. yds. of dredge work located on the lower end of Champlain Canal, under contract No. 70 at Waterford, N. Y.

North Carolina.

✣Bids will be received until Dec. 6, by D. Bourhner, Chairman Chadbourn Drainage District, Chadbourn, N. C., for $30,000 drainage bonds for the district.

The Brett Engineering & Contracting Co., Wilson, N. C., will begin work about Jan. 1, 1911, on its contract for work on the Chadbourn Drainage project noted in our last issue. This work is located at Chadbourn, N. C., and involves 140,719 cu. yds. of earth excavation. The contract price amounts to about $25,000 and work is to be completed in 300 days. The Brett Engineering & Contracting Co. is in the market for a new or second-hand steam shovel adapted to work in swampy ground. This company was the contractor for the Toisnot project in Wilson County, N. C.

Memphis and Vicinity.

REGULAR CORRESPONDENCE.

Sam Bush was in town last week from his Crosno, Mo. work, where he is doing some fine stunts with the dirt which he has contracted to put into the government levee at that point.

Martin Jennings has gotten his outfit under full headway at Westover, Ark., on the large government enlargement contract. Martin was a little short of labor when he first moved, but is now full handed.

Last week the city was full of delegates to the convention held by the Mississippi Valley Drainage Association on the 17th and 18th, and many old friendships were renewed between contractors and engineers. The convention did some very good work in getting started a memorial to be addressed to the Congress petitioning this body for aid in their gigantic undertaking of recovering millions of acres of swamp lands. Surely with such a good start, only good can come from the movement, and all those who attended the gathering were enthusiastic over the results accomplished.

Capt. Clarke S. Smith, in charge of the local U. S. engineer corps, has been absent from the city for over a week on account of having to be with the Mississippi River Commission on its annual inspection trip of the river and levees.

T. A. Garvin has been awarded a contract by the city of Memphis for the construction of a large concrete retaining wall just back of St. Joseph's Hospital. The wall will be about 20 ft. in height, 100 ft. long and 3 ft. in depth. The contract time is Jan. 1st.

P. McCadden, from his works at Old Town, Ark., reports good progress and is certain of finishing on contract time.

Luther Kerr of the United States Engineers, spent some time last week looking over operations under his charge in the lower St. Francis Levee District.

J. C. Hollis is working on some city streets for Roach & Manigan. He has about 25 of the best teams ever.

Big Bill Beach has accepted a position with J. T. Walsh & Bro., as superintendent of their

Items marked thus ✣ indicate work now open for bids.

Reelfoot Lake Levee job. Bill knows all about building levees and is a good handler of men.

The Tennessee Traction Co., according to Chief Engineer Bushnell will soon be ready to let contract for the construction of its line from Memphis to Jackson, Tenn.

Roach & Stansell have moved their outfit No. 3 from Bryan, Tex., to Clarkedale, Ark., at which latter place the outfit will construct about 50,000 cu. yds. of new levee work for the U. S. Government. Henry McCarten is in charge of the outfit.

The first cars were run on the Lake View Traction line from Memphis to Lake View, Miss., last Saturday, in the presence of the President and Board of Directors. All seemed well pleased with the new line.

The Memphis Union Station Co. has not as yet made award of contract for waterproofing its underpass and pipe tunnel. Chief Engineer Werness has sent out letters to firms asking them to bid on the work, requesting that they make him an alternate bid, using a waterproof wire mesh made by Girvan, Nashod Co., of Philadelphia.

Illinois Central officials here will give out absolutely no information regarding the probable date of beginning work on the Alabama line from Haleyville to Birmingham. Assistant Engineer Brumley was in town not long ago, but would give out no information regarding contemplated improvements.

Vice President Gorman of the Rock Island spent a day in town last week and states that his road contemplates some extensive improvements in this city within the near future. It is believed that they will very materially enlarge their freight yards and erect some new sheds. It is stated that the Rock Island has signed up with the Illinois Central to build a million dollar depot in this city very soon.

Major Dabney of Clarksdale, Miss., one of the best known engineers in the South and an authority on drainage matters, was in town attending the Drainage Convention held last week. The old Major is as pert as ever, and his brain just as clear as it was 20 years ago. Incidentally, the Major talked of his long line of levee in Mississippi, which is said to be the finest stretch of embankment in the world.

Texas.

The State Attorney's Department has approved an issue of $124,000 Brazoria County Drainage District No. 4 bonds bearing 5 per cent interest and payable serially.

A bond issue of $350,000 for drainage purposes has been voted by Wharton County. About 125,000 acres are to be drained, the project including the widening of Tres Palachios Creek to 60 ft. and extending it. The county seat of Wharton County is Wharton.

Utah.

A total distance of 492 ft. was driven in the Strawberry Tunnel of the U. S. Reclamation Service during the month of October. This is said to be the greatest distance driven in any one month since work on the tunnel began. This makes the tunnel 9,700 ft. long, and over half the entire length has been driven. The summit, which is 1,500 ft. above the tunnel, has been passed. The tunnel is now in blue lime, and over a half-mile of concrete bottom has been constructed in the tunnel.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until 3 p. m., December 15, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the miscellaneous changes at the extension to the United States Court House and Post Office at Montgomery, Ala.

Arkansas.

The Pike Development & Power Co., of which former Governor Dan W. Jones, of Little Rock, Ark., is President, is planning to go ahead with its power development work on the Little Missouri River.

California.

✣Bids will be received until 11 a. m., Nov. 30, by Maj. George McK. Williamson, Constructing Quartermaster, Fort Mason, Cal., for the construction complete of five single barracks, including plumbing, heating, electric wiring and fixtures, at Fort Winfield Scott, Cal.

The Standard American Dredging Co., Merchants' Exchange Bldg., San Francisco, Cal., at 42 cts. per cu. yd., was the low bidder Nov. 7 for dredging at entrance to Los Angeles inner harbor for the U. S. Government. Bids were opened Nov. 7. The work includes dredging about 333,333 cu. yds. of hard clay and a small amount of sand.

The City Council of Oakland has granted a franchise to the Southern Pacific Co. for the Oakland mole and 1,085 ft. of additional water front space. This, it is said, makes certain the expenditure by that corporation within five years of $6,000,000 in water front improvements.

Warehouses and sheds all under one roof 750 ft. long are to be built on the Southern Pacific wharf north of 5th St., San Pedro. They include new accommodations for the San Francisco and Portland Steamship Co. and enlarged facilities for the Pacific Coast Steamship Co.

Lucca Dondaro, Downieville, Cal., has been awarded the contract for extending the lower Oro tunnel 400 ft. The tunnel is located just south of Downieville and is owned by Isaac Copeland.

The following bids were received Nov. 7 by the U. S. Engineer at Los Angeles, for dredging a channel 200 ft. wide and 30 ft. deep into the inner harbor at San Pedro. There is, at the present time, $140,000 available from the government appropriation, with which to do this work and the North American Dredging Co., Los Angeles, offered to do the work for that amount. The other bids received were as follows: Standard American Dredging Co., 42 cts. per cu. yd.; San Francisco Bridge Co., 43¾ cts. per cu. yd.; the American Dredging Co., 47¼ cts. per cu. yd., and the Tacoma Dredging Co., 44⅞ cts. per cu. yd.

District of Columbia.

✣Bids will be received until 11 a. m., December 5, by M. Gray Zalinski, Deputy Quartermaster General, U. S. Army, Army Bldg., New York, N. Y., for furnishing fire apparatus.

✣Bids will be received until noon, December 1, by N. E. Mason, Chief of Bureau of Ordinance, Navy Department, Washington, D C., for furnishing armor for naval vessels.

✣Bids will be received until noon, Nov. 30, by N. E. Mason, Chief of Bureau of Ordinance, Navy Department, Washington, D. C., for furnishing 10 14-in. nickel steel breech loading rifled cannon with spare parts and accessories.

✣Bids will be received until 10:30 a. m., December 5, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 612, dredge buckets, locomotive tires, wire cloth, spring wire, rail benders, locomotive torches, coke fork handles, corn brooms, marine brushes, water hose, asbestos gaskets, emery cloth, valves, cocks, pipe fittings, life preservers, hinges, leveling rods, rules, chairs, towels, etc.

Florida.

✣Bids will be received until 11 a. m., December 22, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for quay wall structure at the naval station at Key West, Fla.

Georgia.

✣Bids will be received until December 1, by Lieut. L. C. Brinton, Jr., Quartermaster, Fort Screven, Ga., for putting Russian iron jacket on one 40-h. p. Beggs Stationery boiler, lag and jacket 1-10 in., Worthington duplex steam pump and scaling and painting smokestack.

The State Railroad Commission has approved a $20,000,000 stock and bond issue for the Georgia Power Co. The new company has been reorganized by C. Elmer Smith, President of the S. Morgan Smith Manufacturing Co. of York, Pa. A contract has been made with the Northern Construction Co., of Michigan, for the development of the acquired holdings. Ten million dollars in 5 per cent bonds is to be turned over to the Michigan construction company and held by the Knickerbocker Trust Company of New York, as trustee. In addition the Northern Construction Co., of Michigan, gets 60 per cent of the stock. It is estimated that the Northern Construction Co., of Michigan, will develop the power at an outlay of $11,000,000.

Illinois.

✣Bids will be received until 2 p. m., Dec. 7, by Lieut. F. E. Hobbs, Rock Island Arsenal, Rock Island, Ill., for furnishing and installing an oil storage system at the Rock Island Arsenal.

S. M. Rush & Co., 524 W. 12th St., Chicago, Ill., has submitted to the Board of Public Works of that city the lowest bid for furnishing 2,000 lbs. of Lake Superior ingot copper to the water department. The bid submitted was $.13¾ per lb.

Indiana.

✣Bids will be received until 10 a. m., Dec. 5, by the Depot Quartermaster, Jeffersonville, Ind., for furnishing under Schedule No. 575, miscellaneous supplies.

Kentucky.

As noted in our last issue bids are being asked by Maj. John C. Oakes, U. S. Engineer, Room 415, Custom House, Cincinnati, O., for removing rock ledge at Dam No. 11, Kentucky River, Ky., near College Hill, Ky. The work includes 1,000 cu. yds. of earth excavation and 12,000 cu. yds. of rock excavation.

Maryland.

Following bids were received Nov. 12, by the Secretary of the Navy for constructing a wooden pier at the U. S. Naval Academy, Annapolis, Md.; Sanford & Brooks Co., Baltimore, Md., $28,500; Latta & Terry Construction Co., Philadelphia, Pa., $34,900; W. P. McDonald. Yonkers, N. Y., $32,777; Wm. L. Miller, 19 Milk St., Boston, Mass., $33,743; McLean Contracting Co., Baltimore, Md., $37,300; Noel Construction Co., Baltimore, Md., $38,300; Andrew Miller Co., Dundulk, Md., $36,118; American Paving & Construction Co., Philadelphia, Pa., $36,484.

Massachusetts.

✣Bids will be received until Dec. 1, by P. M. Gallup, Quartermaster, Fort Strong, Boston, Mass., for furnishing one safe, Artillery Special.

✣Bids will be received until noon, Dec. 1, by Lieut. P. M. Gallup, Quartermaster, Fort Strong, Boston, Mass., for repairs to quartermaster's department, on Launch Lieut. H. M. Boutelle.

✣Bids will be received until 3 p. m., Dec. 27, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including drainage system, etc., of the Appraisers' Stores at Boston, Mass.

Items marked thus ✣ indicate work now open for bids.

Following bids were received Nov. 12, at the U. S. Engineer's office, Boston, Mass., for (1) riprap stone at Lovell's Island, and (2) riprap stone at Long Island, Boston Harbor: W. H. Ellis, Boston, Mass., (1) $2.08, (2) $2.18; The Breakwater Co., Philadelphia, Pa., (1) $2.47, (2) $2.57; John Cashman & Sons Co., Quincy, Mass., (1) $2.47, (2) $2.75; Rowe Bros. Co., Richmond, Me., (1) $2.19, (2) $2.19.

Michigan.

The Light and Power Commission of Marquette, Mich., has been considering plans for rebuilding the dam at the foot of Silver Lake, by which water is stored up as a reserve supply for the city electric plant at Collinsville in dry weather. The present dam is 10 ft. high and about 100 ft. long. It is proposed to build the new dam, 15 ft. high, at an estimated cost of $8,000. This dam would be built of wood.

Bids as follows were received Nov. 10, by Col. C. McD. Townsend, U. S. Engineer, Detroit, Mich., for the construction of a rubble mound foundation for a breakwater at Missing point, Mackinac Island: Great Lakes Dredge & Dock Co., Chicago, $1.29 per ton; Quarry Co., Sawyer, Wis., $1.97; Greiling Bros. Co., Green Bay, Wis., $1.58; Thomas L. Durocher, Sault Ste. Marie, $2.80. About 18,000 tons of rip rap will be required.

City Council of Grand Rapids, Mich., has voted to install flood gates and a pump at the junctures of the Butterworth and Lowe tail race at an estimated cost of $2,200. The work is to be done to prevent flooding at times of high water.

Missouri.

✣Bids will be received until noon, Dec. 1, by General Supply Agent, Kansas City Stock Yards, Kansas City, Mo., for wrecking and removing from the premises of the Stock Yards Co., the old Live Stock Exchange Bldg. Building is of brick and the several parts which are all connected are of the following dimensions: 2 three-story and basement buildings, 47 ft. by 68 ft.; 2 three-story and basement buildings, 240 ft. by 47 ft.; 1 three-story and basement building, 140 ft. by 47 ft.; 1 one-story and basement building, 55 ft. by 38 ft.; 1 three-story building, 66 ft. by 51 ft. For further information apply by letter or in person to the General Supply Agent.

Montana.

✣Bids will be received until 3 p. m., Dec. 27, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Missoula, Mont.

New Jersey.

The Pennsylvania Dredging Co., Camden, N. J., was the only bidder Nov. 8, for dredging Tuckerton Creek and Toms River, N. J., its bid being as follows: Tuckerton Creek, 19 cts. per cu. yd., place measurement; Toms River, 24 cts. per cu. yd., place measurement.

George B. Spearin, New York City, has been awarded a contract for the erection of an open pier for the Central Railroad of New Jersey at its Jersey City terminal. The pier will be 133 ft. wide and 800 ft. long and will cost about $75,000.

✣Bids are asked until noon, Dec. 1, as noted in our last issue, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Salem River, N. J. The amount of money available is $12,000, and the estimated yardage is 65,000. It is proposed to widen the channel in Little Salem River to 100 ft., remove the hard bars in front of the city wharves and at the "Brickyard," to widen the channel at sharp bends and to redredge the channel previously improved. The depth of cutting will be from 0 to 9 ft. The material is mud, sand and gravel.

✣As noted in our last issue bids are asked until noon, Dec. 5, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Maurice River, New Jersey. It is proposed to dredge, beginning at French's Bar, about 4¾ miles below Millville, a channel 7 ft. in depth and 100 ft. in width towards the drawbridge in Millville, and if that is reached to continue up stream with the same depth and a width of 60 ft. The depth of cutting will be from 0 to 7 ft. The material is mud, sand and gravel. About $22,500 is available. The yardage is 115,000.

New York.

✣Bids will be received until noon, Dec. 15, by the Commission on New Prisons, George McLaughlin, Albany, N. Y., Secretary, for the construction and completion of a prison plant to take the place of the Sing Sing, on the site selected near Wingdale in the town of Dover, New York. William Beardsley, 49 Market St., Poughkeepsie, is Architect.

✣Bids will be received until 11 a. m., Nov. 30, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for furnishing and delivering 8 asphalt trucks at the yard of the bureau of highways on the north side of 7th St. basin, Gowanus Canal; also two steam asphalt rollers and four fire wagons to be delivered at the Municipal asphalt plant, situated near 6th St. and 2nd Ave., Borough of Brooklyn.

✣Bids will be received until 10:30 a. m., Nov. 29, by R. Waldo, Fire Commissioner, 157 E. 67th St., Borough of Manhattan, New York City, for furnishing and delivering two gasoline propelled pumping engines.

✣Bids will be received until 10 a. m., Nov. 28, by Commanding Officer Torpedo Depot, Fort Totten, N. Y., for furnishing 95,200 ft. mooring chain, 2,500 lbs. proof test and 5,000 lbs. breaking strain.

✣Bids will be received until noon, Dec. 19, by Col. W. M. Black, U. S. Engineer, 710 Army Bldg., New York, N. Y., for dredging and rock removal in Bronx River, N. Y.

✣Bids will be received until 11 a. m., Dec. 5, by M. Gray Zalinski, Deputy Quartermaster General, U. S. A., Depot Quartermaster, Army Bldg., New York, N. Y., for furnishing fire apparatus.

✣Bids will be received until noon, Nov. 30, by Board of Trustees, College of the City of New York, 139th St. and St. Nicholas Terrace, Manhattan, New York City, for labor and material necessary for making alterations in the gymnasium building of the college of the City of New York.

✣Bids are asked until noon, Dec. 12, as noted in the last issue, by Col. W. M. Black, U. S. Engineer, Room 710, Army Bldg., New York City, for dredging and rock removal in Hudson River, N. Y. The work involves the removal of reefs located at various points between Breaker Island and Stuyvesant Light. The work consists in the complete removal of all rock and overlying material projecting above the plane of 12 ft. below lowest stage to a depth of 12½ ft. below the plane of lowest stage. The material to be removed is believed to be sand, gravel, cobblestones, bowlders, hardpan, broken rock and ledge rock. The total estimated quantity to be removed is 86,705 cu. yds.

North Dakota.

✣Bids will be received until 7 p. m., Dec. 5, by C. M. Olson, City Auditor, Wahpeton, N. Dak., for furnishing 500 ft. of fire hose.

North Carolina.

Bids were opened Nov. 12, at Wilmington, N. C., for dredging in Smith's Creek and harbors at Morehead City and Beaufort, N. C., for the U. S. Government, and the contract will probably be awarded Mitchell & Co., 2 Stone St., New York City, at 10½ cts. per cu. yd. The work includes 503,408 cu. yds. mud and sand.

Ohio.

✣Bids will be received until 10 a. m., Dec. 17, by Col. John Millis, U. S. Engineer, 420 Federal Bldg., for dredging Sandusky Harbor, Ohio.

✣Bids will be received until 3 p. m., Dec. 5, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a vacuum cleaning system in the United States Post Office and Court House at Columbus, O.

Oklahoma.

✣Bids will be received until 10 a. m., Dec. 15, by Capt. D. L. Stone, Constructing Quartermaster, Fort Sill, Okla., for installing a cold storage and ice plant in power house new artillery post, Fort Sill.

Pennsylvania.

✣Bids will be received until 10 a. m., Dec. 9, by Commanding Officer, Frankford Arsenal, Philadelphia, Pa., for furnishing 8,000,000 ball cartridges, caliber 30, model 1906.

The Department of wharves, Docks and Ferries of Philadelphia, Pa., has awarded the contract for making repairs to the Arch St. wharf to The Bratton Co., 5,034 Cedar Ave., Philadelphia, at $11,000, and the contract for painting over Arch, Race and Chestnut St. piers was let to Thomas S. Butler Co., 1640 Market St., Philadelphia, at $4,000. Bids were opened Nov. 14.

Rhode Island.

✣Bids will be received until 2 p. m., Dec. 17, by Lieut. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging in Providence River and Harbor, R. I.

Tennessee.

✣Bids will be received until noon, Nov. 29, by Ennis M. Douglass, City Clerk, Memphis, Tenn., for 2,000 ft. of 2½-in. fire hose, rubber, in 50 ft. sections fitted with standard brass couplings, Memphis thread. To be 5-ply and to withstand a pressure test of 400 lbs. per sq. in. on delivery; 3,000 ft. of 2½-in. internal diameter double jacket cotton rubber-lined hose in 50-ft. sections, with standard brass couplings, Memphis thread, to withstand a pressure test of 400 lbs. per sq. in. on delivery; price to be based on delivery to headquarters fire department and delivery to be made Jan. 1, 1911, and payment to be made within 90 days after that date. Cotton hose to weigh not over 62 lbs. and rubber hose not over 72 lbs., per section of 50 ft. All hose to be guaranteed against all defects in material and workmanship for a period of thirty-six months from date of delivery.

Texas.

✣Bids will be received until 9 p. m., Nov. 30, by Duncan Ruthven, Chairman Building Committee, Palacios College, Palacios, Texas, for the erection of a brick building on the campus. Plans may be seen at the Palacios State Bank and at the office of C. W. Bulger & Son, Dallas, Texas, Architects.

Virginia.

✣Bids will be received until 10 a. m., Dec. 15, by Capt. Ernest R. Tilton, Quartermaster, Fort Monroe, Va., for construction of ordinance repair shop including plumbing.

✣Bids will be received until 1:30 p. m., Dec. 12, by John T. Hume, Treasurer, Southern Branch N. H. D. V. S. National Soldier's Home, Va., for furnishing labor and material for fixtures for hospital, repairs to quarters of surgeon and quartermaster and installing electric motor complete in machine shop.

✣Bids will be received until 11 a. m. (eastern time), Dec. 19, by Capt. F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and erecting leaves for two bear trap weirs of dam No. 26, Ohio River.

Washington.

✣Bids will be received until 11 a. m., Dec. 9, by E. C. Long, Quartermaster, 322 Arcade Annex, Seattle, Wash., for furnishing and delivering at Seattle or Tacoma, Wash., or other Puget Sound ports; Portland, Ore., San Francisco, Cal., or other Pacific coast ports accessible to vessels of deep draft, 466,701 ft. of lumber required by the quartermaster's department at Manila, P. I.

City of Bremerton, Wash., will vote Dec. 6 on issuing $15,000 of bonds for constructing a municipal wharf.

The Municipal Board of Sinking Fund Commission of Tacoma, Wash., is now calling for bids for the purchase of $405,000 of bonds to

Items marked thus ✣ indicate work now open for bids.

provide funds for a municipal wharf. In the meantime Owen Woods, Commissioner of Public Works, is advertising for competitive plans for the first structure. A prize of $250 is to be paid by the city for the best design for a permanent dock building. Plans must be submitted not later than Dec. 1. A second prize of $150 is offered for the second best design. [illegible] may be retained to carry out the finished work, in which case the amount of the prize money will be deducted from his commission which shall be based on the regular charges, or he may be retained as consulting architect to see that his designs are properly carried out. He will then be paid a commission on the cost of the work which will be agreed upon before work on the plans is commenced. The building itself is estimated to cost $120,000 and at the outset will be 300 ft. in length, so designed that it may be added to from time to time.

Wisconsin.

✣Bids will be received until 5 p. m., Dec. 1, by Board of School Directors, Milwaukee, Wis., Frank M. Harbach, Secretary, for furnishing school seats and opera chairs for the 23d District School No. 2.

Resolution has been adopted by the Common Council of Milwaukee requesting the board of estimates to include in the budget [illegible] for the purchase of Jones Island. This is the first real step toward acquiring Jones Island [illegible] bor project designed by Isham Randolph, of Chicago, Ill.

Canada.

✣Bids will be received until Nov. 28, by George A. Mitchell, Master of B. & B., 414 Union Station, Toronto, Ont., for the purchase and removal of the following houses, viz: Empress Crescent, 2, 4, 6, 8, 12, 14, 16, 18, 20, 26, 44, 46, 48, 50, 56, 60; Jameson Ave., 53.

Donald McDermid, 43 Avenue Road, Toronto, Ont., has been awarded the contract for the Pelee Island, Ont., wharf extension work for the Canadian Department of Public Works. The contract amounts to $13,000.

Wm. Garson, Calgary, Alberta, has been awarded the contract for constructing a $75,000 post office at Strathcona, Alberta. The structure will be of pressed brick and stone, two stories high with a clock tower.

Mexico.

Preliminary surveys of the Sonoran harbor have been made, looking to its improvement as soon as the work at Mazatlan is well under way. Preparations are being made for the completion of the Manzanillo port works, on which $6,000,000 more will be expended in wharves and a second breakwater projecting from the eastern side of the bay.

BRIDGES—STEEL AND CONCRETE

Alabama.

The railroad and other interests concerned in the construction of a viaduct across the numerous tracks on First Ave. extending from 28th to 32nd Sts. are about to submit to the city of Birmingham a proposition providing that the railroads furnish a certain amount and allow the municipality to build the structure. The cost of the improvement, according to the estimate of the city engineer, is $300,000.

California.

The Board of Supervisors, Los Angeles, Cal., has ordered plans prepared for the construction of a 6-span concrete bridge over the Arroyo Seco, near the Sawston Ostrich Farm. Bid of the Mercereau Bridge & Construction Co. to construct a short structure with dirt fill approaches at $118,750 will be retained.

The Board of Supervisors, San Diego, Cal., has under advisement the bids submitted for constructing a concrete bridge across the Santa Margarita River at San Ysidro. The bids are as follows: Charles Steffgen, $6,260; Knight & Hyde, $6,429; Mercereau Bridge Co., $6,500; Standard Iron Works, $6,690; Young Construction Co., $10,280.

Advices received recently from Oakland, Cal., state that estimates are being made by the county surveyor for the renovation of the Webster St. bridge, to be effected at an estimated cost of $30,000. Several new features will be placed on the bridge, while that structure is undergoing repairs, including steel cables everywhere, heavier flooring of cedar, and a raised sidewalk, with holes below, allowing the wind to blow dust from the bridge. This improvement was discovered by accident, when the bridge-tenders observed that the decking about the trapdoor holes was always clean. The hole acts as a chimney, forcing a draught and keeping the bridge as clean as if swept.

Board of Trade of Pasadena, Cal., and county supervisors are making arrangements for the construction of the proposed new concrete bridge over the Arroyo at Devil's Gate.

Colorado.

The Santa Fe System plans an expenditure of $3,200 for the improvement of bridge No. 328 on the Arkansas Division, located in Colorado.

Connecticut.

✣Bids will be received by the Bridge Construction Committee, Norwalk, Conn., until December 20 for the construction of a reinforced concrete bridge to extend from Washington St., South Norwalk, to the east end of East Norwalk. LeRoy Montgomery, 151 Wall St., Norwalk, is secretary.

Selectmen of Danbury, Conn., have awarded the contract for the construction of a concrete bridge spanning the stream at the north end of Washington Ave. to Luke Sweeney. It is believed that the city is planning to replace all the wooden structures with concrete.

Florida.

✣Bids will be received until December 5 by John C. Calhoun, clerk County Commissioners of Taylor County, Fla., at Perry, Fla., for the construction of a 54-ft. steel bridge across Econfenee River, and for constructing 400 to 800 sq. yds. cement sidewalk for courthouse walks at Perry.

Georgia.

According to advices recently received from LaGrange, Ga., the bond election in Troup County carried by a safe majority, meaning that the county commissioners will spend $200,000 for the improvement of Troup County roads and bridges.

Illinois.

Committee of the Williamson County, Ill., Board of Supervisors has awarded the contract for the construction of a steel bridge across Crab Orchard to the Decatur Bridge Co. at $1,295. J. L. Cox, Murphysboro, is representative of the bridge company.

At the spring election a proposition will be submitted the voters of the city of Chicago, Ill., to issue bonds amounting to about $3,250,000 for the improvement and construction of bridges. The city bridge bureau lists the bridges in the order that it believes they should be built, and with the estimated cost, as follows: Washington St. (bridge out), $360,000; West Indiana St. (bridge out), $250,000; West Thirty-fifth St. (condemned), $260,000; West Chicago Ave. (ordered out), $250,000; East 92nd St. (condemned), $325,000; Belmont Ave. (condemned), $295,000; Lake St., (ordered out), $400,000; Fuller St. (bridge out), $175,000; Weed St. (bridge out), $225,000; Blackhawk St. (bridge out), $175,000; Webster Ave. (condemned), $175,000; La Salle St. (bridge suggested), $360,000.

Following are the itemized bids as opened by B. J. Mullaney, Commissioner of Public Works, city of Chicago, Room 705, City Hall, for repairs to Clark St. bridge, as received from the Ketler-Elliott Erection Co., 112 S. Clark St., Chicago: For furnishing all materials, labor, tools and appliances necessary for removing end floor beams, sidewalk brackets, steel stringers, guard angles, etc., $4,300; oak timbers furnished and built in place, including all necessary bolts, washers, log screws, etc., 3,000 ft. B. M. (approximate) at $95 per M. B. M., $285; white pine timber furnished and built in place, including all necessary bolts, spikes, nails, etc., 2,000 ft. B. M. (approximate), at $80 per M. B. M., $160; yellow pine timber furnished and built in place, including nails, spikes, etc., 2,000 ft. B. M. (approximate), at $78 M. B. M., $702; creosoted wood block pavement furnished and laid in place complete, 130 sq. yds., at $5, $650; additional steel and iron not shown on plan and not included in the lump sum bid, $.10 per pound. Total bid, $6,197; other bids submitted: Jno J. Gallery, $7,298.50; Roemheld Construction Co., $7,730. The contract has not yet been awarded. All bids have been rejected and the work is readvertised for Nov. 29.

Indiana.

✣Bids will be received until 10 a. m., Nov. 25, by Board of County Commissioners, Indianapolis, Ind., for the construction of a bridge over Crooked Creek. Albert Sahm is auditor of Marion County.

The contract for the construction of the new steel bridge over the St. Joseph River at Bristol, Ind., has been awarded the Elkhart Iron & Bridge Co. at $15,500. The structure will be 257 ft. long and 30 ft. wide with 5-ft. sidewalks on either side, and will consist of four spans with concrete floor. By terms of the contract the bridge company will take the old bridge at $1,500.

Iowa.

City of Fort Dodge, Ia., has under consideration the construction of a temporary wooden bridge to span the Des Moines River, at a cost of $2,000, to effect communication between that place and West Fort Dodge.

A proposition was submitted to the voters of Mount Vernon, Ia., on November 8, to levy a tax for the construction of a bridge across Cedar River at a point about a mile and a half above Ellis Park. The cost of the work according to a rough estimate, is $50,000.

Kansas.

The Santa Fe System has planned to renew bridge No. 10, on the Southern Kansas Division, at a cost of $18,000.

The Topeka Bridge & Iron Co., of Topeka, Kan., has been awarded the contract by the County Commissioners at Larned, Kan., for the construction of an 80 ft. concrete arch at Rozel, with an 18 ft. roadway for $5,365. The work includes excavating, pile driving and cement work. Bids were opened Nov. 15 A. W. Shady is Commissioner.

Kentucky.

Two contracts, according to advices from Owensboro, Ky., have been awarded the Vincennes Bridge Co., one at $2,360, for the erection of three 32-ft. steel leg bridges with concrete floor and wings on the Hartford Road; the other for the removal of the big iron bridge at Curdsville to Smock's, at a point about 4 miles up Delaware Creek, for $1,340.

Maryland.

Advices from Elkton, Md., state that several surveyors are making a survey for the proposed removal of the iron bridge over Big Elk Creek, at the foot of Bridge St., to a point several hundred feet further up the stream.

Items marked thus ✣ indicate work now open for bids.

Massachusetts.

City Council of North Attleboro, Mass., has under consideration the improvement of a number of bridges throughout the place.

Minnesota.

Officials of the Minneapolis, St. Paul & Sault Ste. Marie Ry. have notified the county officials that immediate steps will be taken toward the construction of the $10,000 concrete viaduct over its tracks on Arcade St., St. Paul, Minn.

Missouri.

An election will be held December 5 at the city of Springfield, Mo., at which a vote will be cast upon the proposition to issue $100,000 of bonds for the construction of bridges and culverts and improvement of streets.

Officials of the Wabash R. R. have under contemplation the matter of constructing a viaduct over their tracks, to allow the opening of Storm Ave., in Maryville, Mo.

Detailed plans have been received by the Board of Public Improvements for the Compton Ave. viaduct, St. Louis, Mo. A meeting of the Executive Committee of the Terminal R. R. Association, which is to build the structure, will be held soon and the contract let. The work will be entirely of reinforced concrete, except only the roadway.

Montana.

✣Bids will be received until December 7 by Board of County Commissioners, Virginia City, Mont., for the construction of the proposed bridge over the Madison River.

The County Commissioners at Missoula, Mont., recently awarded the contract for the construction of the proposed bridge over the Nine Mile Creek near its mouth to O. E. Peppard, Missoula, Mont., at $2,880. The structure will have an 80-ft. span on concrete piers. The roadway will be 16 ft. wide.

Nebraska.

Material has been shipped to Omaha, Neb., for the construction of a new bridge to be erected by the Great Western R. R. over its tracks on Mason and Nineteenth Sts. It is said that work will begin at once.

An ordinance has been passed by the City Council of Omaha, Neb., ordering the construction of a new viaduct over the railroad tracks on Eleventh St., and it is reported that the railway company will oppose the movement. Plans have also been submitted for the construction of the Locust St. viaduct by the city engineer, and the cost of the work is estimated at $80,000.

New Jersey.

Upon the recommendation of the Joint Bridge Committee, the Board of Freeholders, Newark, N. J., has instructed the County Engineer to prepare plans for the construction of the proposed new bridge over the Passaic River at Bridge St.

New Mexico.

The Santa Fe System has appropriated $4,800 to provide an addition of two stringers to each bridge between Roswell and Carlsbad, New Mexico.

New York.

†Bids will be received until 2 p. m., Nov. 30, by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, 1904 Park Row Bldg., New York, for painting bridges in the Westchester County Watershed.

The contract for the construction of the Franklin St. Bridge, Syracuse, N. Y., mentioned in our last issue, has been awarded to the Steel Storage & Elevator Construction Co., 730 Main St., Buffalo, N. Y., at $38,245. Winslow M. Mead is Deputy Supt. of Public Works, Albany, N. Y.

It has been decided by the courts that the town of Leray, N. Y., will be obliged to assist the town of Rutland in building a bridge across the Black River below Black River Village, upon the new state road to Carthage, at an estimated cost of $10,000.

North Carolina.

At a meeting of the Board of County Commissioners, Greensboro, N. C., it was decided to give a contract for the construction of a steel bridge over the North Buffalo Creek, which runs across Summit Ave. at White Oak, to replace the old wooden structure. The cost of the improvement will be approximately $1,600.

Ohio.

It is reported in Cleveland, O., that the City Council of that place has under consideration the alteration of the Central Viaduct, making it a high level bridge. The work, which, it is estimated, will require an expenditure of $450,000, will be taken up next year. Robert Hoffman is City Engineer.

The contract for the construction of the substructure of the proposed bridge on Dunham Road, near Cleveland, O., will probably be let to T. B. Husband, 3706 E. 71st St., Cleveland; the superstructure to Riverside Iron Co., Martins Ferry, O. John F. Goldenbogen is Clerk of the Board of County Commissioners.

Oklahoma.

The Topeka Bridge & Iron Co. has been awarded the contract by the County Commissioners for the construction of the steel and concrete bridge over the North Canadian River between Oklahoma City and Packingtown, at $55,000. The structure will have a 60-ft. roadway and will have also a double track car line.

Pennsylvania.

The Borough of Edwardsville, according to advices from Wilkesbarre, Pa., has recently appropriated $2,000 for the construction of a new bridge on Main St.

South Carolina.

✣Bids will be received until noon, December 1, by W. B. Wilson, Jr., County Attorney, Rock Hill, S. C., for the necessary labor and material for the construction of a steel bridge over the Catawba River between York and Lancaster Counties. The structure will be approximately 1,200 ft. long

Texas.

The Santa Fe Ry. Co. has made arrangement for the erection of a $12,000 viaduct over its main line tracks in the city of Belton, Texas.

At the election recently held at Richmond, Tex., the bond issue to build steel bridges across the Brazos at Thompson and Orchard carried by a good majority.

Virginia.

Advices from Petersburg, Va., state that the Walnut Hill Corporation has awarded a contract to the Roanoke Bridge & Iron Co. for the superstructure of the viaduct to be erected across the valley of Lieutenant Run. The structure, which will run from the southern terminus of Sycamore St. to the corporation's property south of the city, will be of steel and concrete, 600 ft. long, and will cost between $40,000 and $50,000.

Washington.

Engineering Department of the Great Northern Ry. has completed plans for the construction of the proposed steel and concrete bridge over their tracks at the junction with Walnut St., in Spokane, Wash. The cost of the improvement is estimated at $25,000 or $30,000.

The County Commissioners, at a special session at North Yakima, Wash., voted to construct two new bridges, one across the Sunnyside Canal on the Hanover Road and the other across the Cowiche River at Painted Rocks. The total cost of the work will be upward from $30,000. Bids for the work will be advertised at once.

Wisconsin.

As mentioned in our last issue, a special election was held at Janesville, Wis., to vote on the proposition of constructing two bridges, one at Fourth Ave. and the other at Racine St., to cost $25,000 and $17,000, respectively. The proposition carried by a large majority.

ROADS, STREETS AND PAVEMENTS

Alabama.

The city council of Montgomery, Ala., has decided to pave Madison Ave., from Bainbridge St., to the city limits, with bitulithic.

Mobile County, Mobile, Ala., has voted the issuance of bonds to the amount of $500,000 for road construction.

The county commissioners at Bay Minette, Ala., have passed upon several new roads to be opened in the county. Two will pass near Robertsdale. One will be opened from the section line north of Robertsdale to the Pensacola road, about six miles away, and the other on the section line to the south of Robertsdale and running to the Pensacola road. A third road will be opened from Foley to Magnolia Springs, a distance of six miles.

Arkansas.

✣Bids will be received until December 5, by Directors of Road Improvement District No. 3, Pine Bluff, Ark., for constructing and repairing 9.6 miles of gravel road together with necessary culverts and cross drains. The cost is estimated at $41,000. W. J. Parkes, 107½ Main St., Pine Bluff, Ark., is Engineer of the District.

California.

Flinn & Traecy of San Francisco, Cal., have been awarded the contract by Maj. George McWilliamson, Constructing Quartermaster, Fort Mason, Cal., for constructing asphalt road between Lombard St. gate and guardhouse, Presidio of San Francisco, for $9,900. Bids were opened Oct. 14.

The highway commission has asked the board of supervisors of Los Angeles, Cal., to purchase 1,400 tons of rock for use on a portion of the Long Beach Blvd., and the same amount for use on Willow St.

The board of supervisors at Sacramento, Cal., has taken steps to acquire a strip of land 20 ft. wide along 40th St., from Magnolia to Cypress Ave., Oak Park.

Fairchild, Gilmore, Wilton Co., has been awarded a contract in San Diego, Cal., for paving D St., from 15th to 25th Sts., for $26,131.

The board of supervisors and the people of La Canada and La Crescenta, Cal., recently held a meeting to discuss the proposed highway connecting Pasadena with La Canada via Devil's Gate. It was decided to build the road. The supervisors will also build a 50-ft. road extension from Linda Vista on the west bank of the Arroyo Seco to connect with the La Canada road at Devil's Gate.

Colorado.

The board of aldermen of Denver, Colo., has passed two resolutions providing for a new driveway on the south bank of Cherry creek. One opens for street purposes, a strip of land on the south bank of Cherry creek from Broadway to Downing. The other provides for an appropriation of $97,739 for the purchase of a right of way for a boulevard on the same side of Cherry creek from Broadway to West Colfax.

Georgia.

The citizens of Troup County, Lagrange, Ga., have voted the issuance of bonds in the sum of $200,000 for the construction of roads. W. T. Tuggle is clerk.

The Southern Paving Co., is now working on a $200,000 paving contract in Macon, Ga. The contract calls for 100,000 sq. yds. of brick laid on concrete foundation with stone curb and pitch filler. Engineer C. C. Anderson of Macon has charge of the work.

Idaho.

The city of Boise, Ida., has sold bonds in the sum of $12,830 for the paving of Front St.

Illinois.

Work on the plans for a boulevard in 12th St., connecting Chicago's West Side with the lake front, have been begun by the board of local improvements of Chicago. A corps of 10 engineers and surveyors has been organized to make an extensive survey. Albert F. Keeney is president of the board.

The street and alley committee of the city council of Moline, Ill., is considering a proposition from John D. Cady for the improvement of the tract of land just opened by him. A road which runs from about 11th Ave., nearly to the city limits will be opened.

An ordinance is being prepared in Peoria, Ill., providing for the widening of East Nebraska St., on the south side for 30 ft. for a block and one-half next east of California Ave. An ordinance is also being prepared for the paving with brick the alley from Glendale to Glen Oak Ave., and between Main and Monson Sts.

The board of local improvements of Peoria, Ill., has passed a resolution providing for the paving of South St., with brick to a width of 30 ft. from Adams to Water Sts.

The Wisconsin Granite Co., 520 Chamber of Commerce, Chicago, has been awarded the contract for furnishing and delivering 1,000 cu. yds. of No. 2 granite blocks to the 35th St. yard. Chicago, Ill., by B. J. Mullaney, Commissioner of Public Works, Room 705 City Hall. The contract price is $1.75 per cu. yd.

Indiana.

✣Bids will be received until 2 p. m., December 7, by the Commissioners of Howard County at Kokomo, Ind., for the construction of certain gravel roads in Center Township and one on line dividing Harrison and Honey Creek Townships. A. B. Easterling is Auditor

✣Bids will be received until 2 p. m., December 6, by Commissioner of Miami County, Peru, Ind., for the construction of three gravel roads in Washington Township. Charles Griswold is Auditor of the county.

✣Bids will be received until 11 a. m., December 5, by Commissioners of Scott County at Scottsburg, Ind., for the construction of two gravel roads in Lexington Township. Frank Gardner is Auditor of the county.

✣Bids will be received until 10 a. m., December 7, by Board of County Commissioners, Logansport, Ind., for the construction of roads in Harrison and Boone townships; also road on line between Harrison and Bethlehem townships. George W. Cann is Auditor of Cass County.

✣Bids will be received until 10 a. m., Dec. 6, by Board of County Commissioners, Wabash, Ind., for the construction of gravel roads in Paw Paw and Noble townships. J. P. Noftzger is Auditor of Wabash county.

✣Bids will be received until 1 p. m., December 6, by Board of County Commissioners, Wabash, Ind., for the construction of gravel roads in Chester and Paw Paw townships. I. P. Noftzger is Auditor of Wabash County.

✣Bids will be received until 10 a. m., December 6, by Board of County Commissioners, Crawfordsville, Ind., for the improvement of a public highway. Bennett B. Engle is Auditor of Montgomery County.

✣Bids will be received until 10 a. m., December 6, by county Commissiners at Logansport, Ind., for the construction of two roads in Boone township. George W. Cann is Auditor of Cass County.

✣Bids will be received until noon, December 5, by commissioners of Lake County, at Crown Point, Ind., for the construction of gravel roads in Calumet and North gravel roads in Calumet and North townships. Chas. A. Johnson is Auditor.

✣Bids will be received until noon, December 6, by Board of Commissioners, Jasper County, Rensellaer, Ind. (readvertisement of bids called Nov. 9), for the construction of five stone roads in Keener township. J. N. Leatherman is Auditor.

Daniel Showalter & Son, of Thorne St., Wabash, Ind., have been awarded the contract by the city of Wabash for the resurfacing of Thorne St. with crushed stone to the depth of 7 ins. for $1.30 per lin. ft. Bids were opened Nov. 14.

The citizens of Gary, Ind., have petitioned the county commissioners to improve 15th and 25th Aves., from the present limits of the streets west to Clark Road. The commissioners will consider the matter at a meeting to be held December 5

The Board of County Commissioners, Wabash, Ind., has awarded a contract to Henry Keefer of Huntington, Ind., for the construction of a gravel road in Lagro township. Bids were opened November 9.

Macelin Bros., of Marion, Ind., have been awarded the contract by the county commissioners at Wabash, Ind., for the construction of two gravel roads in Lagro township. Bids were opened November 9.

All bids received by the commissioners of Allen County, Fort Wayne, Ind., on November 12, for the construction of a stone road in Maumee township, have been rejected as being above the estimate. Geo. W. Lindemuth is auditor.

The county commissioners at Rushville, Ind., have awarded gravel road contracts amounting to approximately $40,000, as follows: J. F. Pierce, Leisure road between Posey and Ripley townships, $9,700; Wilk & Co., Rushville, Offutt road in Posey township, $11,992, and for the Walker road in Ripley township for $7,908; Amos W. Stevens, George road in Noble township, $19,240.

Kansas.

A resolution has been presented to the city council of Chanute, Kan., declaring it the intention of the city to proceed with macadamizing Kansas Ave., from Main to Seventh Sts., for a width of not more than 36 ft.

According to advices from Hutchinson, Kan., the farmers of North Hays township are petitioning the county commissioners for four miles of improved road.

Kentucky.

The city of Lexington, Ky., has voted against the issuance of bonds to the amount of $525,000 for street improvements. John Skain is Mayor.

The city of Lexington, Ky., will improve portions of Broadway and East 3rd St., by constructing concrete sidewalks, curbs and gutters. John Skain is Mayor.

Louisiana.

✣Bids will be received until 1 p. m., November 29, by Board of Commissioners, Port of New Orleans, La., for paving on river front from Thalia to Bienville Sts., with small granite blocks on concrete foundation. Hugh McCloskey, 200 New Orleans Court Bldg., is President of the Commission.

✣Bids will be received until 11 a. m., December 7, by George B. Davis, Acting Quartermaster, 416, Hibernia Bank Bldg., for the construction of roads and walks at Fort St. Philip, La.

The City Council of Crowley, La., has awarded the contract for the construction of 33,000 sq. ft. of concrete street crossings to De Jersey & Barnard of Jennings, La., for $.28 per sq. ft.

Maryland.

No bids were received Nov. 15 as advertised for by the County Commissioners at Annapolis, Md., for the improving of the public highway from Shipley Station, 1½ miles south, known as the Annapolis Road, Sec. 2. S. O. Filghman is County Clerk.

The Board of Estimates of Baltimore, Md., will set aside $500,000 out of the Jones' Falls loan for work to be done on the road known as Jones' Falls Road. Plans are to be drawn up, experts will be employed and it is proposed to start work early next year.

Michigan.

The citizens of Berrien County, St. Joseph, Mich., have voted in favor of the good roads proposition. James M. Ball, President of the Berrien County Good Roads Association is interested.

Minnesota.

✣Bids will be received until 2 p. m., November 28 by Board of Public Works, St. Paul, Minn., for the grading of Edmund St., from Albert Ave., to Hamline Ave. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., November 28, by Board of Public Works, St. Paul, Minn., for the grading of Selby Ave. from Marlboro Ave. to Cleveland Ave. R. L. Gorman is Clerk of Board of Public Works.

✣Bids will be received until 2 p. m., November 28, by Board of Public Works, St. Paul, Minn., for the grading of Hamline Ave., from Marshall Ave. to Iglehart Ave., in said city. R. L. Gorman is Clerk of Board of Public Works.

✣Bids will be received until 8 p. m., December 13, by A. M. Childs, City Clerk, Crookston, Minn., for paving the following streets: Ash St., from Houston Ave. to Third St., including 7,143 sq. yds.; E. Third St., from Broadway to Elm St., including 2,381 sq. yds.

The City Council of Minneapolis, Minn., has designated approximately 151,013 sq. yds. of paving to be laid during 1911, which will cost about $300,000.

Missouri.

A meeting of farmers was held recently in the Courthouse at Liberty, Mo., to discuss good roads for the county, and especially to take initial steps towards building a rock road from Liberty to Kansas City.

The Savannah Interurban Line has appropriated the east Savannah road for a distance of four miles to the cities of St. Joseph and Savannah, for the construction of a macadam road between those two cities.

An election will be held in Springfield, Mo., on December 5 to vote on the issuance of $100,000 worth of bonds for street improvement, bridges and culverts. Robert E. Lee is Mayor.

Nebraska.

Contracts for the paving of the alley between 22nd and 23rd Sts., and J and K, the alley between 24th and 27th and E and F Sts., from South Omaha, Neb.; also for the paving of 22nd St., from B to D St., have been awarded to James Parks. The National Construction Co., received the contract for the paving of the alley between 24th and 25th Sts., and L and M, and for the paving of 36th St., from Q to Harrison St.

New Jersey.

The Board of Freeholders at Newark, N. J., has awarded the following contracts: For the grading and paving of Union Ave., Belleville, from Joralemon St., to Avondale road, to Phillip and Pete Jannarone, $13,435; grading and paving Gregory Ave., West Orange, from Mt. Pleasant Ave., to Luddington road, Donato Fusco, $13,833; resurfacing Green Brook Road, Caldwell, R. C. McMains, $1,297; laying a 24-in. pipe for 8,000 ft. along Westville Ave., Caldwell, and for 16,000 ft. along Bloomfield Ave., Verona, to John Barben, at $1 per ft., and $20 each for catch basins.

The City Council of Westfield, N. J., on November 11 awarded contracts for street improvements as follows: Contract No. 1, Weldon Contracting Co., Rahway, N. J.; Contract No. 2, Daniel Donovan, 140 West 25th St., Bayonne, N. J.; Contract No. 3, Monroe Paving Co., 509 Betz Bldg., Philadelphia, Pa. Lloyd Thompson is Town Clerk.

Alex J. Milmoe has been awarded contracts by the Board of Street and Water Commissioners of Newark, N. J., for grading, curbing and flagging Hillside Ave., New York Ave., and Parkhurst St.

The city of Newark, N. J., has awarded a contract to Van Keuran & Son at $5,578, for the paving of Hedden Place, from Orange City line, with granite block on a concrete base.

The Standard Bitulithic Co., has been awarded a contract in Newark, N. J., for the paving of 13th Ave., from South 10th St., to South 12th St., with asphalt, for $4,987.

New York.

Men in the employ of the State Department of Highways of New York have been making surveys and staking out the road between Stafford and Batavia, preparatory to the building of the state road, which, when completed will be a continuous line between the cities of Buffalo and Rochester.

North Carolina.

The city of High Point, N. C., is considering issuing bonds to the amount of $100,000 for improvement and extension of streets, water, electric light and sewerage systems.

Ohio.

✣Bids will be received until noon, December 9, by the Board of County Commissioners, Cincinnati, O., for the improvement under Specifications No. 35, of Hill Road, near the residence of Jacob Stephan in Colerain township.

✣Bids will be received until noon, December 2, by the Board of County Commissioners, Cincinnati, O., for the improvement under Specification No. 110, of North Bend Road, from Harrison Pike of North Corporation line of village of Cheviot in Green township. Fred Dreihs is Clerk.

A resolution has been adopted by the City Council of Lorain, O., providing for the paving of the alley west of Broadway from Seventh St., to 10th St.

A new petition is being circulated by the residents of Blagrove St., in Richwood, O., to be presented to the City Council, providing for the paving of that street.

Plans and specifications have been received by the City Council of Cincinnati, O., for the improvement with brick of Ross alley, between Bremen and Hamer Sts.; Crim alley, between McMicken Ave., and Back St.; Bardes alley, between Vine and Goose Sts.; Ahler alley, between Vine and Bremen Sts.; Benton alley, between McMicken Ave. and Hamer St.; Halpin alley, between Linwood and Greist Aves.; Glonker alley, between Vine and Hamer Sts.; Sprecht alley, between Vine and Hamer Sts.; Benton alley, between Vine and Bremen Sts., and Schede alley, between Vine and Hamer Sts. The council also received approximate estimates for the improvement with wood block of Garrard Ave., between Hopple and Elm Sts., at $8,899, and of Bent alley, between David St. and Bauer Ave., with brick, at $1,545.

Oklahoma.

Plans have been made by Engineer J. W. Stroud for the paving of 15 or 20 blocks of streets in Pawhuska, Okla., at an estimated cost of $2.50 per yd. The material will be brick laid on a concrete foundation with pitch filler. The mayor has charge of the work.

The Blaine County Good Roads Association of Watonga, Okla., has been incorporated at Guthrie with a capital stock of $5,000. William Cronkhite, W. R. Kelly, Seymour Foose, J. M. Tyler, W. B. Piper, A. McBride, Jesse Reeves, Ed. S. Wheelock and D. S. Delaplane are the incorporators.

Oregon.

The following streets of Portland, Ore., are to be paved to the railroad bridge at an estimated cost of $39,000: Oregon, Pacific, East Sixth and East Seventh Sts., eastward. These streets are all located in a paving district.

The following bids for street improvements in the city of Portland, Ore., were opened by the Executive Board of that city on November 14: East 52nd St., from Division to East Lincoln, grading and concrete curbs and walks. J. M. Manning, $3,332; Macleay Blvd., grading and retaining wall. Porter Bros., $9,251; Fiske St., from Trenton St. to Columbia Blvd., grading and concrete curbs and walks. O. Paulsen, $2,332; Peninsula Feed & Fuel Co., $2,430; Missouri St., from Prescott to Webster, grading and concrete curbs and walks. O. Paulsen, $4,110; Bechill Bros., $3,544; Madison St., from Stout to Chapman, bitulithic povement. Warren Construction Co., $3,776; Lane St., District, concrete pavement. Giebisch & Joplin, $15,244; Overton St., from 15th to 17th, bitulithic pavement. Warren Construction Co., $3,638; Park Ave., from King to Ford Sts., bitulithic pavement. Warren Construction Co., $5,870; East 26th St., from Killingsworth to Ainsworth, grading and concrete curbs and walks. Elwood Wiles, $3,091.

Pennsylvania.

The Barber Asphalt Co. has been awarded contracts in Philadelphia, Pa., for the paving of 35 streets. The bids of the Barber Co. varied from $1.40 to $1.60 per sq. yd. The Filbert Paving & Construction Co. received the contracts for the paving of 10 streets, ranging from $1.55 to $1.75 per sq. yd.

According to advices from Kittanning, Pa., John Schaffner, of Butler, has been awarded the contract for the construction of two and one-half miles of state road in Armstrong County. The road is to be of brick, 12 ft. wide, with cement curbing 1 ft. sq.

Tennessee.

Madison Ave., from Front St. to Bayou Gayoso, a distance of 2,340 ft., in Memphis, Tenn., is to be paved with creosoted wood block at an estimated cost of $11,028. Ennis M. Douglas is City Clerk.

The Southern Roofing & Paving Co., of Nashville, Tenn., has been awarded the contract in that city for the construction of granolithic sidewalks on Third, Fourth, Fifth and Bridge Aves., Woodland, Russell and Mark Sts., etc., for 9.99 cts. per sq. ft.

Texas.

✣Bids will be received until noon, Nov. 30, by John B. Ashe, County Auditor, Houston, Texas, for approximately 2,000 yds. of shell to be delivered at Cummings switch or point taking same freight rate for use on Clinton Road. Bidder must specify "pump" or "depper dredge" shell.

Bids received Nov. 14 by John M. Murch, County Auditor, Galveston, Texas, for the improvement of Seawall Blvd., from Ave. H. to 16th St., including approximately 9,300 sq. yds. of concrete curbing, 5,500 ft. of 10-in retaining wall and sidewalks, have been rejected. The work will be re-advertised.

Assistant General Caldwell, at Austin, Tex., has approved an issue of $100,000 of the city of Houston for street paving.

Surveys and estimates have been made for the paving of South Harwood St., in Dallas, Tex., from Forest Ave. to Jackson St. Bitulithic will probably be the material to be used.

An election will probably be held in Bastrop County, Bastrop, Tex., according to advices from Elgin, for the issuance of bonds for the purpose of constructing good roads either in the entire county or in Elgin precinct.

Road District No. 1 of Brown County, including the city of Brownwood, Tex., voted an additional road bond of $50,000 for road improvements on November 14. The district now has 63 miles of graded roads, and about 35 miles of gravelled roads, and with the additional money it is believed all of the roads may be graded out to the district line, and about 75 miles gravelled.

Precinct No. 4, Taylor County, Abilene, Tex., has voted the issuance of bonds in the sum of $100,000 for road improvements.

Utah.

The City Council of Logan, Utah, has awarded a contract to LeRoy S. Hill for the four miles of paving to be laid in the Third Ward.

The City Council of Provo, Utah, has awarded the contract for the sidewalk paving of Third West St., from Center to Sixth South Sts., to S. H. Belman, for $1,954.

Virginia.

The Town Council of Phoebus, Va., has awarded the contract to construct macadamized road from Mellen St. to National Ave., through Willard Ave., a distance of 2,400 sq. yds., to George E. Trice of Hampton, Va., for $2,000.

Washington.

Advices from White Salmon, Wash., state that the Good Roads Club of Trout Lake, at the base of Mt. Adams, has been organized. A. J. Johnson is President; F. M. Coate, Vice-President, and William Coate, Secretary.

Wisconsin.

The County Board of Milwaukee County, Milwaukee, Wis., has set aside $100,000 in the budget for good roads for the county. The Janesville plank road will be the first to be improved and according to James Sheehan, President of the Board; experts in road building will be engaged next January to begin work on the plans so as to have them ready for operations in May.

The Ashland County Good Roads Association at Ashland, Wis., has appointed a committee of five to draw up a resolution to be presented to the County Board at its next meeting, recommending the building of the promised road running south of Ashland to Glidden.

WATER-WORKS AND SEWERAGE

Alabama.

Storm sewers are to be constructed in the north side of Birmingham, Ala., at an estimated cost of $150,000. A large sewer is to be constructed to drain the section from Eighth Ave., across the Frisco tracks, which carries off all the watershed for the whole Northside hill.

Arkansas.

The federal court at Fort Smith, Ark., has ordered that city to pay $422,000 for a plant owned by a private water company, and the city must also pay $100,000 for new extensions to the plant.

California.

The city trustees of Chico, Cal., have accepted the plans and specifications for the storm sewer, which will cost about $35,000.

The board of public works of Oakland, Cal., has awarded a contract to J. F. Greaney for the construction of a sewer on Market St., from Second to Seventh.

Scott & Farley, Bacon Bldg., Oakland, Cal., have been awarded the contract in that city for the construction of a sewer in 14th Ave. and Bruce St., from East 24th St. to East 38th St Bids were opened Nov. 2. James W. Nelson is secretary of the board of public works.

The following bids were received Nov. 7 by the city of Roseville, Cal., for the construction of the proposed sewer system: C. D. Vincent, Oakland, $42,835; Latonrette & Fical Co. of Sacramento, $48,482; D. W. Pierson, Sacramento, $50,866; John Heaney, Oakland,

$53,000; Federal Construction Co. of San Francisco, $57,900; Contra Construction Co. of Oakland, $59,450; Clark & Henery of Sacramento, $75,740. There were several other bids for different parts of the system, such as the excavation, the pipe, etc. It has been recommended that the contract be awarded to C. D. Vincent.

Colorado.

The city council of Colorado Springs, Colo., has established storm sewer district No. 1. The district includes practically all of the territory between Boulder St., on the north, Costilla St., on the south, Cascade Ave., on the west, and Shook's Run on the east. The trunk lines of the storm sewer will run down Cascade Ave., Tejon St., Nevada Ave., Weber St. and Wahsatch Ave. City Engineer Waggener estimated that the sewer lines will aggregate nearly five miles in total length.

The city of Rocky Ford, Colo., will probably hold an election within two months to vote on the question of issuing bonds for completing the Pearl Springs and Faw water propositions and bringing water to Rocky Ford. It is estimated that $200,000 will complete the project.

Florida.

Plans will soon be made for the construction of new sewers and extensions, estimated to cost $8,000, in West Palm Beach, Fla. The work includes 8, 10 and 12-in. mains and laterals. The contract will be let some time after Dec. 6. Franklin Sheen, West Palm Beach, is the engineer, and Carl Kettles is in charge of the work.

Georgia.

✣Bids will be received until 3 p. m. Dec. 12 by R. F. Maddox, Mayor, Atlanta, Ga., for the construction of the Peachtree Creek disposal plant, to be located on Peachtree Creek about five miles from the city, the estimated cost of which is $200,000. Proposals will also be received at the time and place for the construction of the Peachtree Creek and Orme St. intercepting sewers, consisting of approximately seven miles of 48-inch concrete sewer with the necessary manholes, excavation, tunneling, culverts, etc., the estimated cost of which is approximately $270,000. Plans and specifications for the above work will be furnished by Messrs. Hering & Fuller, consulting engineers. 170 Broadway, New York city, or R. M. Clayton, city engineer, Atlanta, Ga., on deposit of twenty-five ($25) dollars, to be held until the return of the plans and specifications.

The city council of Thomaston, Ga., has contracted with Perry Andrews of Atlanta to bore a well in that city for the purpose of securing a water supply. The contract calls for a minimum depth of 350 ft. and a maximum depth of 500 ft.

Illinois.

✣Bids will be received until 2:10 p. m., Nov. 23, by board of local improvements, Pekin, Ill., for the construction of the Second District sewer. The estimated quantities of the materials are as follows: 1,956 lin. ft. 8-in. vitrified tile pipe sewer, 1,929 lin. ft. 10-in. vitrified tile pipe sewer, 4,789 lin. ft. 12-in. vitrified tile pipe sewer, 2,749 lin. ft. 15-in. vitrified tile pipe sewer, 6,100 lin. ft. 18-in. vitrified tile pipe sewer, 803 lin. ft. 20-in. vitrified tile pipe sewer, 1,006 lin. ft. 24-in. brick sewer, 1,939 lin. ft. 30-in. brick sewer, 586 lin. ft. 36-in. brick sewer, 1 outlet bulkhead and apron, 250 lin. ft. 12-in. cast iron pipe, 98 manholes, 131 catchbasins and connections. Said improvement shall be constructed and made in accordance with the ordinance providing for the same, and the maps, plates, plans, profiles and specifications for the same on file in the office of the city engineer of said city.

✣Bids will be received until 2 p. m., Nov. 23 by board of local improvements, Pekin, Ill., for the construction of the Third District sewer, including the following approximate quantities: 1,491 lin. ft. 8-in. vitrified tile pipe sewer, 510 lin. ft. 10-in. vitrified tile pipe sewer, 9,477 lin. ft. 12-in. vitrified tile pipe sewer, 6,137 lin. ft. 15-in. vitrified tile pipe sewer, 17,742 lin. ft. 18-in. vitrified tile pipe sewer, 1,106 lin. ft. 20-in. vitrified tile pipe sewer, 2,531 lin. ft. 24-in. brick sewer, 2,295 lin. ft. 30-in. brick sewer, 510 lin. ft. 36-in. brick sewer, 773 lin. ft. 42-in. brick sewer, 450 lin. ft. 48-in. brick sewer, 190 manholes, 278 catchbasins and connections, 1 bulkhead and apron, 150 lin. ft. 16-in. cast iron pipe. Said improvement shall be constructed and made in accordance with the ordinance providing for the same, and the maps, plats, plans, profiles and specifications for the same on file in the office of the city engineer of said city.

The citizens of Pana, Ill., recently held a mass meeting for the purpose of making some arrangements toward improving the water supply of the city.

✣Bids will be opened by B. J. Mullaney, commissioner of public works, city of Chicago, Room 705, City Hall, Nov. 29, 1910, for furnishing and delivering to the Roseland pumping station, 104th St. and C. & W. I. R. R. tracks, two cast iron suctions and glands, the castings to be of tough gray iron without admixture of inferior materials and must be free from serious defects, such as blow holes, cold sheets, etc.

Construction of sewers in Rockwell St. and Albany Ave., Chicago, Ill., to facilitate the drainage of the 10 sq. miles bounded by 40th and Western Aves., West Kinzie St. and the west fork of the south branch of the river, has been ordered by the board of local improvements. The board will soon ask for bids for the work, which wil entail an expenditure of $810,000. The Albany Ave. sewer will cost about $470,000 and will be four miles long. The Rockwell St. drain, five and one-half miles long, will cost about $340,000. Albert F. Keeney is president of the board.

The contract to be awarded by the commissioners of the Eldred Drainage and Levee District, Carrollton, Ill., on Nov. 11, for a brick building for pumping plant which they are erecting, and frame dwelling for engineer, has been postponed until spring, when the work will be readvertised. Leroy McFarland, Jr., is secretary. Harman Engineering Co., 120 Fredonic Ave., Peoria, Ill., engineers.

Jas. H. Roche, 222 E. 31st St., Chicago, Ill., was low bidder for furnishing and laying 2,000 lin. ft. of house drain pipe, 6-in. internal diameter and ¾ in. in thickness, with an average depth of 10 ft., in Western Ave. from Lawrence Ave. to Montrose Ave., Chicago, Ill., at $1,200. Bids were opened by Chas. A. V. Standish, secretary, board of local improvements, 302 City Hall

Following are the low bids and bidders as received by the Board of Local Improvements, city of Chicago, Chas. A. V. Standish secretary, for furnishing and laying water service pipes in the following streets: W. 108th St., Wentworth Ave. to S. State, 620 lin. ft. of lead water service, 1-in. internal diam., and weighing 4 lbs. per lin. ft., 20 brass taps of ¾-in. internal diam., 20 brass stop cocks 1-in. internal diam., 20 spiral cast iron shutoff boxes of the best quality, 2½-in. internal diam., and 5½ ft. long, Buffalo boxes, 16 ft. out from street line end of water service pipes 15 ft. out from street line, $.64 per ft., Daniel Hardin, 3139 Indiana Ave.; S. Marshfield Ave., W. 66th St. to W. 67th St., 258 lin. ft. of lead water service pipe of best quality, 1-in. internal diam., and weighing 4 lbs. per lin. ft., 12 brass stop cocks 1-in. internal diam., 12 brass taps ¾-in. internal diam., 12 cast iron shutoff boxes 2½-in. internal diam. and 5½ ft. long. Buffalo boxes 13 ft. out from street line, end of water service pipe 12 ft. out from street line, $.66 per ft., Daniel Hardin; S. Albany Ave., W. 36th St. to W. 39th St., 972 lin. ft. of lead water service pipe of best quality, 1-in. internal diam. and weighing 4 lbs. per lin. ft., 46 brass stop cocks, 1-in. internal diam., 46 brass taps ¾-in. internal diam., 46 cast iron shutoff boxes 2½-in. internal diam. 5½ ft. long. Buffalo boxes 14 ft. out from street line, end of service pipe 13 ft. out from street line, $.62 per ft., Daniel Hardin; E. 79th St., Saginaw Ave., Exchange Ave., 1,717 lin. ft. of lead service pipe 1-in. internal diam. and weighing 4 lbs. per lin. ft., 67 brass stop cocks 1-in. internal diam., 67 brass taps ¾-in. internal diam., 67 cast iron shutoff boxes 2½-in. internal diam. 5½ ft. long, Buffalo boxes 10 ft. out from street line, end of service pipe 9 ft. out from street line, 605 cu. yds. of rock excavation under street car tracks, $1.33 per ft., Jas. J. Renn, 367 W. Chicago Ave.

Following contracts were awarded by the Board of Local Improvements, Chicago, Ill., Chas. A. V. Standish secretary, Nov. 17, for the construction of sewers: W. 75th St., Stewart Ave., Princeton Ave., 640 lin. ft., 1 ft. diam., 11.5 ft. deep, 6 manholes and 4 catch basins, M. Pontorelli, 4817 W. Dakin St., $1.90 per lin. ft., total bid $1,216; W. Division St., N. 48th Ave., N. 52nd, 2,680 lin. ft., d. r. 3¾ ft. diam., 15 ft. deep, $5.50 per lin. ft.; W. Division St., N. 52nd Ave., N. 54th Ave., 1,380 lin. ft., d. r. 2½ ft. diam., 14 ft. deep, 10 manholes and 10 catch basins, $3.75 per lin. ft., The Ryan Co., 131 La Salle St., total bid, $19,915; Phillips Ave., E. 90th St., E. 91st St., 670 lin. ft., d. r. 1¼ ft. diam., 6.5 ft. deep, $1.80 per lin. ft.; Phillips St., E. 91st St., E. 92nd St., 630 lin. ft., d. r. 1 ft. diam., 7 ft. deep, 496 cu. yds. rock excavation at $3, Thos. Burke, 4648 McLean Ave., $1.40 per lin. ft., total bid $3,576; Yates Ave., 26 ft. north of line of E. 75th St., E. 75th St. 60 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.75 per lin. ft.; E. 75th St., Phillips Ave., Paxton Ave., 1,710 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.75 per lin. ft, 14 manholes and 13 catch basins, 365 cu. yds. rock excavation at $3 per cu. yd., John W. Brunt, 2447 E. 74th St., total bid, $4,192; W. 40th Pl., S. Kedzie Ave., S. Albany Ave., 675 lin. ft 1¼ ft. diam., 12.3 ft. deep, $1.65 per lin. ft.; W. 40th Pl., S. Albany Ave., S. Sacramento Ave., 675 lin. ft., 1 ft. diam., 10 ft. deep, $1.41 per lin. ft.; W. 41st St., S. Kedzie Ave., S. Albany Ave., 675 lin. ft., 1¼ ft. diam., 12 ft. deep, $1.65 per lin. ft.; W. 41st St., S. Albany Ave., S. Sacramento Ave., 675 lin. ft., 1 ft. diam., 9.8 ft. deep, $1.41 per lin. ft.; W 41st Pl., S. Kedzie, S. Albany Ave., 675 lin. ft., 1¼ ft. diam., 12.7 ft. deep, $1.65 per lin. ft.; W. 41st Pl., S. Albany, S. Sacramento Ave., 675 lin. ft., 1 ft. diam., 10 ft. deep, $1.41 per lin. ft.: W. 41st Pl., S. Kedzie, S. Albany, 675 lin. ft., 1¼ ft. diam., 12.7 ft. deep, $1.65 per lin. ft.; W. 41st Pl., S. Albany, S. Sacramento, 675 lin. ft., 1 ft. diam., 10 ft. deep, $1.41 per lin. ft.; W. 42nd St., S. Kedzie Ave., S. Albany Ave., 675 lin. ft., 1¼ ft. diam., 13.5 ft. deep, $1.65 per lin. ft.; W. 42nd St., S. Albany Ave., S. Sacramento Ave., 675 lin. ft., 1 ft. diam., 9.5 ft. deep, $1.41 per lin. ft.; S. Albany Ave., W. 40th St., W. 42nd Pl., 1,655 lin. ft., 1 ft. diam., 9 ft. deep, $1.41 per lin. ft., 50 manholes and 68 catch basins, M. Pontorelli, total bid $10,595; W. 59th St., S. Kedzie Ave., S. Spaulding Ave., 672 lin. ft., d. r. 3 ft. diam., 14 ft. deep, $5 per lin. ft.; W. 59th St., S. Spaulding, S. Homan Ave., 670 lin. ft., d. r. 2½ ft. diam., 13.5 ft. deep, $4 per lin. ft.; W. 59th St., S. Homan Ave., S. St. Louis Ave., 670 lin. ft., s. r. 2 ft. diam., 12 ft. deep, $3 per lin. ft.; W. 59th St., S. St. Louis Ave., Central Park Ave., 620 lin. ft., 1 ft. diam., 10.5 ft. deep, $1.35 per lin. ft.; S. Sawyer Ave., W. 59th St., W. 58th St., 670 lin. ft., 1¼ ft. diam., 11 ft. deep, $1.46 per lin. ft.; S. Sawyer Ave., W. 58th St., W. 57th St., 670 lin. ft., 1 ft. diam., 9 ft. deep, $1.35 per lin. ft.; S. Spaulding Ave., W. 59th St., W. 58th St., 670 lin. ft., 10 ft. deep, 1¼ ft. diam., $1.46 per lin. ft.; S. Spaulding Ave., W. 58th St. to W. 57th St., 670 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.35 per lin. ft.; Turner Ave., W. 59th St., W. 58th St., 670 lin. ft., 1¼ ft. diam., 11.5 ft. deep, $1.46 per lin. ft.; Turner Ave., W. 58th, W. 57th St., 670 lin. ft., 1 ft. diam., 9 ft. deep, $1.35 per lin. ft.; S. Homan Ave., W. 59th St., W. 58th St., 670 lin. ft., 1¼ ft. diam., 10 ft. deep, $1.46 per lin. ft.; S. Homan Ave., W. 58th St., W. 57th St., 670 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.35 per lin. ft.; S. Trumbull Ave., W. 59th St., W. 58th St., 670 lin. ft., 1¼ ft. diam., 11 ft. deep, $1.46 per lin. ft.; S. Trumbull Ave., W. 58th St., W. 57th St., 670 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.35 per lin. ft.; S. St. Louis Ave., W. 59th Ave., W. 58th Ave., 340 lin. ft., d. s. 1⅔ ft. diam., 11 ft. deep, $2.50 per lin. ft.; S. St. Louis Ave., W. 58th Ave., W. 58th St., 330 lin. ft., d. s. 1½ ft. diam. 10 ft. deep, $2 per lin. ft.; S. St. Louis Ave., W. 58th St., W. 57th Pl., 340 lin. ft., 1¼ ft. diam., 9.5 ft. deep, $1.35 per lin.

ft.; S. St. Louis Ave., W. 57th Pl., W. 57th St., 330 lin. ft., 1 ft. diam., 8.5 ft. deep, $1.15 per lin. ft.; W. 57th Pl., S. St. Louis Ave., S. Central Park Ave., 620 lin. ft., 1 ft. diam., 9 ft. deep, $1.15 per lin. ft.; W. 58th St., S. St. Louis Ave., S. Central Park Ave., 620 lin. ft., 1 ft. diam., 9.5 ft. deep, $1.15 per lin. ft.; W. 58th Pl., S. St. Louis Ave., S. Central Park Ave., 620 lin. ft., 1 ft. diam., 10 ft. deep, $1.15 per lin. ft., 98 manholes and 132 catchbasins, M. Pontorelli, total bid $22,788.

The Kapler-Elliott Erection Co., 112 S. Clark St., Chicago, was low bidder for making the necessary repairs at the 68th St. crib by B. J. Mullaney, Commissioner of Public Works, city of Chicago, Room 705, City Hall. Their bid amounted to $898. Itemized repairs were noted in ENGINEERING-CONTRACTING Nov. 9, 1910.

Following are the low bids and bidders as opened by B. J. Mullaney, Commissioner of Public Works, city of Chicago, Room 705 City Hall, for furnishing and erecting at the Roseland pumping station, 104th St. and Stewart Ave., 4 horizontal water tube boilers, each to develop 300 h. p.: Kroeschel Bros., 440 W. Erie St., $14,200; Edgemoor Iron Co., $14,640; J. G. O'Neil, 217 La Salle St., $14,997. No awards have been made.

Indiana.

✣Bids will be received until 10 a. m. Nov. 28 by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along the alley of Hiawatha St. from Owosso St. to alley south of New York St.

The citizens of Niles, Ind., recently held an election to vote on the issuance of bonds to the amount of $22,000 for the installation of a trunk sewer in the vicinity of Broadway and Sycamore St.

The city council of Shelbyville, Ind., rejected all bids for the completion of the sanitary sewer, each of the three bids received being in excess of the amount appropriated for the work.

Iowa.

The Commercial Sewer Co., of LaPorte City, Ia., has been incorporated with a capital stock of $6,000, to purchase, construct and maintain a sewer system in that city. The officers are: S. J. Tedford, president; E. J. Buchan, vice-president; H. B. Lizer, secretary and treasurer.

The city council of Des Moines, Ia., has awarded the contract for the installation of a 12-in. sewer on East 13th St., from Guthrie Ave. 640 ft. north, to Andrew Ecklund, for $1.54 per lin. ft.

The Lytle Construction Co. has been awarded a contract in Greenville, Ia., for the construction of a sewer system, for approximately $9,300.

The city council of Atlantic, Ia., will probably call a special election soon to vote on the issuance of bonds to the amount of $50,000 for water, light and power.

Kansas.

C. R. Nichols of Caney, Kan., has been awarded the contract by the town of West Liberty, Ia., for the construction of a sewer system in that town for $29,684.

The city council of Coffeyville, Kan., has passed a resolution creating a drainage district No. 1; also a resolution providing for the extension of sewer district No. 2 so as to include Blocks 1 and 8 in Patton's Addition and Block 5 in Upham's Addition.

Kentucky.

C. T. McCracken & Co., 610 Lincoln Bldg., Louisville, Ky., have been awarded the contract in that city for the construction of a sewer in Preston from Water to Fulton, for $30,978. Bids were opened November 15.

The town of Dawson Springs, Ky., on Nov. 8 voted in favor of a bond issue for the purpose of erecting a sanitary sewerage system in connection with the waterworks plant, which is now under consideration.

Louisiana.

The city of New Orleans, La.; has for sale $7,000,000 in bonds, the proceeds of which will be used for the improvement of the sewerage and water works system.

Michigan.

✣City Clerk, Flint, Mich., will receive bids until Nov. 24 for the construction of a sewer on 12th St., between Harrison and Elm Sts.

Bert Freever has been awarded the contract for constructing 420 rods of the Hyatt drain in Brookfield, Mich. The contract will not be completed until next summer.

The citizens of Flint, Mich., have voted the issuance of bonds in the sum of $400,000 to erect a new waterworks system and filtration plant.

Residents of the Fifth Ward in Kalamazoo, Mich., are preparing plans for the rearrangement of the route of the proposed Fulford St. sewer.

The city council of Traverse City, Mich., has begun plans for the construction of a sewerage disposal plant. The entire system will be rearranged and plans submitted for connection with the asylum.

The city of Wyandotte, Mich., has voted the issuance of bonds in the sum of $68,000 for the construction of sewers.

The city of Harbor Springs, Mich., is planning for the erection of a waterworks plant this winter. Bonds in the sum of $45,000 have been sold and plans are being made to get at the construction of the plant as soon as possible.

The board of public works of Allegan, Mich., has awarded the contract for the construction of a sewer in Marshall, Herkimer, Bond and Division Sts. to Peter DeWitt of Grand Rapids, Mich., for $2,396. Bids were opened Nov. 11.

Minnesota.

✣Bids will be received until 8 p. m., December 5, by C. J. Talle, Village Clerk, Kenyon, Minn., for drilling and completion of a deep well at the pumping station in that place. L. P. Wolff, St. Paul, Minn., Consulting Engineer. The well is to be either 8 or 10-in. diameter at the top and is to have a depth of not less than 225 ft. or not more than 350 ft.

E. T. Webster of St. Paul, Minn., has been awarded the contract in Watertown, S. Dak., for the construction of a sewer system for $17,266. Other bids received were Pastorat-Lawrence Co., Duluth, Minn., $20,249; Hess & Rau, Watertown, $21,897. Bids were opened Nov. 13.

The Board of Public Works of Duluth, Minn., has awarded the contract for the construction of a sewer in 61st Alley West, from a point 250 ft. north of the north line of Worden St. to 61st Ave. West, thence in 61st Ave. to a connection with the sewer in Grand Ave., to Charles Eklund for $3,243, and the contract for the construction of a sewer in 39th Ave. West from the south line of Reno St. to Oneota St., thence in Oneota St. from the west line of 38th Ave. West to a sanitary catch basin at 40th Ave. West, and in Magellan St., from east line of lot 9, block 7, Harrington's Addition to 40th Ave. West, to W. E. Kern for $4,805.

The city council of Brainerd, Minn., has rejected all bids received for the construction of sewers in districts Nos. 4 and .

Missouri.

✣Bids will be received until 4 p. m., Dec. 6, by City Clerk, Windsor, Mo., for the necessary labor and material for the construction of the proposed water works system. The approximate estimate of the work is as follows: Street mains, 5,200 ft. of 8-in. Standard Weight Cast Iron Pipe, 4,600 ft. of 6-in. Standard Weight Cast Iron Pipe, 29,500 ft. of 4-in. Standard Weight Cast Iron Pipe, 20,000 lbs. of Cast Iron Specials; hydrants and valves, forty-eight 4-in. hydrants, ten 8-in. valves and boxes, five 6-in. valves and boxes, thirty-five 4-in. valves and boxes; tower and tank, 75,000-gal. tank on a 100-ft. tower; pumping plant, two 300 g. p. m. Gasoline Engine Triplex Pumps, 20-ft. by 25-ft. Brick Pumping House. Plans and specifications will be on file at the office of the City Clerk at Windsor, Missouri, and at the office of the City's Consulting Engineers, Rollins & Westover, Beals Building, Kansas City, Missouri.

✣Bids will be received until 4 p. m., Dec. 6, by City Clerk, Windsor, Mo., for furnishing labor and material for the construction of approximately 3 miles of trunk sewers in the city. Rollins & Westover, Beals Bldg., Kansas City, Mo., are Engineers.

G. W. Kemp has been awarded a contract in Sedalia, Mo., for the construction of a sewer in sewer district No. 34.

The city council of St. Joseph, Mo., contemplates purchasing the waterworks system in the city. President E. A. King of the council has appointed a committee to ascertain what the plant would cost.

Engineers of the Kansas City Terminal Railway Co. have made plans for the construction of the O. K. Creek sewer on the station side between 23rd and 24th Sts., in Kansas City. The work of constructing the sewer will begin as soon as a hill at 24th St. is removed.

Nebraska.

✣Bids will be received 11 a. m., Dec. 16, by Capt. Campbell E. Babcock, Quartermaster, Fort Crook, Neb., for the construction of a reservoir and well.

E. L. Dimmick of Laurel, Neb., has been awarded a contract in Mitchell, S. Dak., for the construction of sewers in various districts of the city for $6,492. The contract calls for the laying of 10,204 ft. of sewer, as follows: Commencing at the corner of Kimball and First, east one block, 366 ft.; commencing at the corner of Fourth and Sanborn one block to Edmunds and north on Edmunds to Ninth St., 2,134 ft.; commencing at the corner of Fourth and Kimball, north to Seventh and one block west on Seventh to Lawler, 1,828 ft.; commencing on Third Ave., east half way between Capital and Winsor, two blocks east to Gamble, with a branch south on Mentzer a half block, 1,260 ft. on Fourth to Burr, 932 ft., and on Court Merrill to McCabe St., 50 ft.

The city council of St. Paul, Neb., is planning on putting in the waterworks extension running north from Dr. Paxton's residence. The material will be ordered this winter, so that the work can be done next spring.

Bids were opened at Beatrice, Nebr., Nov. 15, in accordance with the advertisement issued by the Engineers, The W. K. Palmer Company, Kansas City, Mo., as follows: Des Moines Bridge & Iron Co., Des Moines, Ia., Sec. I, $56,950; Sec. II, $3,000; total, $59,950. Jos. A. Bortenlanger, Omaha, Nebr., Sec. I, $50,000; Sec. II, $2,500; total $53,500. Cooke-Gregory Co., Joplin, Mo., Sec. I, $53,500; Sec. II, $2,000; total $55,500. Mathews Construction Co., Kansas City, Mo., Sec. I, $52,500; Sec. II, $2,500; total $55,000 (awarded contract). Katz-Craig Co., Omaha, Nebr., Sec. I, $62,500; Sec. II, $2,540; total $65,040. Midland Construction Co., Ft. Scott, Kan., Sec. I, $50,894; Sec. II, $2,690; total 53,584. W. D. Lovell, Minneapolis, Minn., Sec. I, $55,000; Sec. II, $3,000; total $58,000.

New Jersey.

A petition has been received by the Caldwell borough council asking for a special election to vote on bonds for the installation of a sewage system for that borough.

New York.

✣Bids will be received until 2 p. m., Nov. 30, by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, 1904 Park Row Bldg., New York, for furnishing driving and connecting wells. Section 1, furnishing driving and connecting wells at the Bayside pumping station, Borough of Queens. Section 2, furnishing driving and connecting wells at the Whitestone pumping station, Borough of Queens.

✣Bids will be received until 3 p. m., Dec. 1, by Park Board, Arsenal Bldg., Borough of Manhattan, N. Y., for furnishing and delivering 600 lin. ft. of 15-in. vitrified sewer pipe for Parks, Borough of the Bronx.

✣Bids will be received until 2 p. m., Nov. 30, by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, 1904 Park Row Bldg., New York City, for hauling and laying water mains and appurtenances in the

Borough of Brooklyn; Sec. 1, in streets within the boundaries of District No. 3; Section 2, in the streets within the boundaries of District No. 4.

✣Bids will be received until noon, Nov. 28, by C. V. Collins, Supt. State Prisons, Albany, N. Y., for the construction of a sewage disposal system at the New York State Prison, Auburn, N. Y. Franklin B. Ware, Albany, N. Y., is architect.

✣Bids will be received until 11 a. m. Nov. 30 by Department of Public Works, Buffalo, N. Y., for the construction of 346 ft. of 10-in. vitrified tile sewer in Worcester Place between Kensington and Leroy Ave.; 368 ft. 15-in., [illegible] ft. of 10-in. and 507 ft. of 10-in. vitrified tile sewer in Tuscaron Rd. and Peconic St. between Abbot Road and Potters Road and Southwest side of Potters Road between Abbot Road and Woodside Ave.; 1,019 ft. of 10-in. tile sewer in Dante Place between Erie and Commercial Sts., in accordance with requirements of State Superintendent of Public Works to cut off sewage from Erie Canal; 1,255 ft. 18-in., 485 ft. of 15-in., 455 ft. 12-in. vitrified tile sewer in Lower Terrace, Erie and Lock Sts. and Lower Terrace between Church and Pearl Sts. George H. Norton is deputy engineer commissioner.

✣Bids will be received during the month of December, 1910, by the Board of Water Supply, New York City, J. Waldo Smith, 722 165 Broadway, Chief Engineer, for four contracts for the pressure tunnel to be constructed from the Hill View reservoir, beneath the Boroughs of The Bronx and Manhattan, to a point near the Atlantic Avenue subway station, in Brooklyn. This tunnel will be driven at from 250 to 700 ft. below the surface and will be lined with concrete. It will range from 11 to 15 ft. in finished diameter and will be constructed from 24 shafts, spaced from 3,000 to 5,000 ft. apart. Its total length will be about 17½ miles. Chambers at the heads of the various shafts are also to be constructed so that through them and the shafts connections for the delivery of the water into the distribution systems can be made.

Plans are being made by James E. Hill, consulting engineer to the board of estimate, New York City, for the installation of sewers in the streets of the Woodhaven section of the city.

The finance and public works committees of the city council of Rochester, N. Y., have decided in favor of the ordinance providing for an appropriation of $500,000 for a new sewer system.

The village of Sea Cliff, L. I., is considering the installation of a modern system of sewers and a disposal plant, and would like to hear from engineers with a view to engaging professional advice.

North Carolina.

The board of aldermen of Wilmington, N. C., has refused to purchase the existing sewer system in that city and has ordered the water and sewerage commission to proceed without further delay the installation of an entirely new system.

North Dakota.

The waterworks committee of the city council of Grand Forks, N. D., is considering he erection of a dam across the Red River, for the purpose of storing up a supply of water n the city for the use of the city waterworks system during the winter months.

Ohio.

✣Bids will be received until noon, December 20, by H. H. Canfield, Clerk, village of Cleveand Heights, O., for furnishing labor and material for the improvement of Euclid Heights Blvd. from Lee Road to Minor Road by constructing an 8-in. water main therein. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., engineers.

✣Bids will be received until Nov. 26 by Director of Public Service, Coshocton, O., for installing 11 10-in. driven wells and connections with the present 20-in. suction pipe by laying about 220 ft. of c. i. 20-in. pipe and 316 ft. of 6-in. cast iron pipe valves.

The citizens of Urbana, O., on Nov. 8 held an election to vote on the proposition of issuing bonds to the amount of $100,000 for the purchase of the waterworks plant.

The board of control of Bellefontaine, O., has awarded Joseph Degnan of Toledo, O., the contracts for the construction of sewer work in that city for $46,010.

The citizens of Russell, O., have voted in favor of the proposition of bonding the city to the amount of $25,000 for the installation of a waterworks system.

The Massillon Iron & Steel Co., of Massillon, O., has been awarded the contract in Canton, O., for furnishing about 800 tons of pipe and 10 tons of special castings for use in improving the Canton waterworks system. The bid was as follows: $21.85 per ton on 4, 6, 8, 12, 16 and 20-in. pipe, and $50 per ton on the special castings.

Gartland Bros., Youngstown, O., are the probable contractors for construction and furnishing material necessary for sewering Truesdale Ave. from Himrod Ave. to Charlotte, in Youngstown, for $1,250. Bids were received Nov. 15.

The director of public works, Youngstown, O., will probably award the contract for furnishing the necessary labor and material for constructing a sewer in Stafford St. from Penn St. to Himrod Ave. to Anthony O'Horo of that city for $400. Bids were opened Nov. 17.

Anthony O'Horo of Youngstown, O., was low bidder for the work of constructing a sewer in Jackson St. from Shelby to Himrod Ave., at $375. Bids were opened Nov. 17.

Miller Bros., Youngstown, O., were the low bidders for the necessary labor and material for the construction of sewers in Caledonia St. between Iram St. and the city limits, at $500. Bids were opened Nov. 15.

Plans have been prepared for extensions to the waterworks system of Cleveland, O., which will include two 25,000,000-gal. pumping engines for the Kirkland pumping station, to replace the two 15,000,000-gal. low-duty pumping engines now in use. The estimated cost of the engines is $250,000. The contract will be let in December. C. F. Schultz is engineer of the city water department.

Oklahoma.

Plans have been prepared by City Engineer F. J. Embree of Okmulgee, Okla., for the improvement of the present water system in that city at an estimated cost of $60,000. The work includes settling basins, pumps, motors, pipe, etc. The deep fork of the Canadian River is the source of supply.

Civil Engineer Alexander Potter, 114 Liberty St., New York City, has been retained by the city of Oklahoma City, Okla., to investigate the entire question of a suitable supply of water for that city. Plans will be completed in about three months.

The city of Muskogee, Okla., has retained Civil Engineer Alexander Potter of 114 Liberty St., New York City, to investigate the entire question of a suitable supply of water for that city, and also to devise a comprehensive system of sewerage and sewage disposal covering an area which will permit the city to grow to a population of 150,000. Plans will be completed in about three months.

Oregon.

Engineer Stannard of Portland, Ore., has prepared plans and estimates for the installation of a waterworks system in North Bend, Ore. At present the city gets its water from a plant in Marshfield.

The Barber Asphalt Co. was low bidder in Portland, Ore., on Nov. 14 for the construction of a sewer in Southeast Laurelhurst district, its bid being $18,255, and for the construction of a sewer in Northeast Laurelhurst district, with a bid of $22,868.

Pennsylvania.

Plans will soon be prepared by Civil Engineer L. E. Chapin of Pittsburg, Pa., for the proposed water works system for Somerset, Pa., at an estimated cost of $25,000. The work will include a new 500,000-gal. reservoir, pump station or power house, and probably an electrical apparatus in present station for new wells. The contract will probably be awarded in February or March. An election is to be held Nov. 26 to vote on the issuance of bonds to the amount of $25,000 for the system. Chas. I. Shaver, Secy. of City Council, has charge of the work.

The citizens of Lebanon, Pa., have voted in favor of the proposition of issuing bonds to the amount of $110,000 for the construction of a house sewer system.

Henry Knipple of Olean, N. Y., has been awarded the contract for laying the pipes and erecting the reservoir in connection with the waterworks system in Sagertown, Pa. The United States Cast Iron Pipe & Foundry Co., of Buffalo, secured the contract for pipe and special castings and the Kennedy Valve Manufacturing Co. of Elmira the contract for hydrants and valves.

Leo Hudson of New York City has been engaged by City Engineer Smith of McKeesport, Pa., to assist him in preparing the plans for the comprehensive sewage system as demanded by the state.

The special committee of the city council of Allentown, Pa., has decided that the only feasible plan for the city to adopt for the installation of a sewer system is to issue bonds.

According to advices from Sharon, Pa., the American Steel Foundries Co. has awarded to William McIntire & Sons the contract for the construction of a 12-in. sewer 3,500 ft. in length to connect with its dwelling houses on McClure Ave. The sewer will be placed on Sharpsville St., extending from Hull to McClure Ave.

The General Supply & Construction Co. has been awarded the contract in York, Pa., to construct the 30-in. sewer at the intersection of Princess St. and Richland Ave. It will be made of brick and have 9-in. walls.

Plans have been completed by the bureau of surveys of Philadelphia, Pa., for a further extension of the Cobb Creek intercepting sewer for a distance of about 700 ft., between Market and Locust Sts.

The water department of Steelton, Pa., has asked the city council for $3,000 for the purpose of making extensive repairs to filter No. 1.

Rhode Island.

Simpson, Bros., Corporation, 166 Devonshire St., Boston, Mass., has been awarded the contract by Lieut. Rodney H. Smith, Constructing Quartermaster, Fort Adams, R. I., for the construction of a 1,000,000-gal. reinforced concrete reservoir at Fort Greble, R. I., for $28,028. The work includes excavation, piping to and from reservoir and pump house and relocating 18-in. terra cotta drain now in place. Bids were opened Nov. 16.

South Dakota.

The City Council of Belle Fourche, S. Dak. on Nov. 17, awarded the contract for the construction of the water works system to the Katz-Craig Co., 615 Brandeis Bldg., Omaha, Neb., for $31,936, for which Carl C Adams, of Belle Fourche, is Engineer. The company's itemized bid is as follows; bids opened Nov. 14:

	Unit price.
[illegible]	[illegible]
200,000-gal. reinf. conc. reservoir	5,900.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
11,530 ft. 6-in. cast iron pipe	1.00
3,615 ft. 4-in. cast iron pipe	.80
[illegible]	[illegible]
6-in. cut-off valves	20.00
[illegible]	[illegible]
Special casting	.04
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Take up and relay, 570 ft. 6-in. c. i. pipe	.50
Take up and relay, 400 ft. 4-in. c. i. pipe.	.40

The city council of Madison, S. D.; has decided to construct a public sewer in the city, and has ordered a special election to vote on the proposition of issuing bonds for the improvement.

Items marked thus ✣ indicate work now open for bids.

South Carolina.

✣Bids will be received until noon, December 1, by J. L. McCarter, Secy., Commissioners of Public Works, Aikin, S. C., for all or part of $78,000 waterworks coupon bonds, to run 40 years with option of redemption after 20 years, to bear interest at 4½ per cent per annum, payable semi-annually on the first day of October and April each year.

Texas.

Dr. T. U. Taylor of the State University, City Engineer Trammell and John B. Hawley, members of the engineering board of Fort Worth, Tex., have been appointed to report upon a future water supply for the city of Fort Worth.

The board of municipal commissioners of Dallas, Tex., has ordered the construction of a storm sewer between the Houston & Texas Central Railway, Ervay St., Live Oak St., and Ross Ave. This sewer will drain approximately 80 acres of land in the downtown district. The approximate cost is not to exceed $20,000.

The following bids were recently received by the board of municipal commissioners of Dallas, Tex., for the laying of 6 and 8-in. sanitary sewer on Seventh, Eighth, Melba and Ninth, Oak Cliff: Dallas Lime & Gravel Co., $2,800, for rock trench and $12 for brick work; J. B. Winslett, Jr., $2,682, with $.18 for rock trench and $12 for brick work; C. W. Olcott, $2,956, with $.17 for rock trench and $12 for brick work: Dallas Home Improvement Co., $3,174, with $.15 for rock trench per foot and $12 for brick work. For the laying of a 6-inch sanitary sewer on Colorado St., Oak Cliff: Dallas Home Improvement Co., $1,309, with $.20 for rock trench and $12 for brick work; C. W. Olcott, $1,286, with $18 for rock and $12 for brick work; Dallas Lime & Gravel Co., $1,287, with $.20 for rock trench and $12 for brick work.

Bids for the construction of sanitary sewer on Melba, Eighth and Davis Sts., Oak Cliff, Dallas, Tex., have been rejected, and new bids will be asked for. The cost of the work will be about $6,000.

The board of municipal commissioners of Dallas, Tex., has approved the recommendation of Commissioners Sullivan and Doran for the purchase of the plant for waterworks at the State Fair Park.

Utah.

The bid of Dale L. Pitt for the construction of sewer extension No. 279, in Salt Lake City Utah, providing a sewer on Second West St. between South Temple and First South Sts., for $1.75 per front ft., has been accepted by the board of public works.

A resolution authorizing a loan of $6,000 for sewer purposes has been passed by the city council of Logan, Utah.

Virginia.

The engineering department of Petersburg, Va., will construct sewers within the next few months at an estimated cost of $10,000. The Brickhouse Run sewer will be extended to Jones St., and new sewers will be built on Gill, Mistletoe, Commerce and Pearl Sts.

Sanitary Engineer R. H. Messer of the Virginia State Health Board, is preparing plans for sewage disposal plants to be installed in Virginia next year.

West Virginia.

The Board of Directors of Park View Improvement Association, Wheeling, W. Va., has awarded the contracts for the construction of the sewer from the town to the creek to Springer & Singer of Elm Grove, and the contract for furnishing the sewer pipe to H. H. Seabright Co., of Wheeling.

Washington.

City Engineer G. N. Miller of Ellensburg, Wash., and his assistants have prepared estimates and a report on the proposed Lake Cle Elum water system. About 15 miles of pipe line, ranging in size from 4 to 14 in. in diameter, will be constructed, and the approximate cost of the system is $250,000.

Phillips & Son have been awarded the contract in Everett, Wash., for the laying of the Maple St. sewer from Fifth to First and on First one block west to the trunk sewer, for $3,035.

The board of health of Spokane, Wash., has issued an order that a sewer be built on East Sprague, between Freya and Lee Sts.

The city council of Pasco, Wash., has passed an ordinance covering the purchase of city waterworks at a sum close to $39,000. Another ordinance was passed for the purpose of perpetual water rights from the Pasco Reclamation Co., for the irrigation of city parks, streets, street sprinkling and fire protection from April 1 to October 1 of each year.

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CHAS. S. HILL } EDITORS
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MYRON C. CLARK . . . . . PUBLISHER
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The Award of the John Fritz Medal to Alfred Noble.

The award of the John Fritz Medal to Alfred Noble is a recognition of the general practitioner in science. Ordinarily we are accustomed to see such prizes go to the inventor, to a Kelvin for his discoveries in cable telegraphy or to an Edison for his phonograph, and not to the man who offers only a lifetime of able accomplishment in the general application of science. In this instance it is the practitioner who receives distinction and moveover the practitioner in civil engineering construction. It is as a builder of bridges, of canals and harbors, of tunnels, that Mr. Noble is known, not as the originator of some epoch marking device like the air brake or the telephone. The award to him, therefore, of the most distinguished of American engineering prizes is not merely a high recognition of the individual man, but it is a brand of honor for the kind of work he did, which is the kind of work that makes up almost wholly the life's task of all civil engineers. For this reason fully as much as for the excellent choice of the man, civil engineers and the builders of civil engineering works should be gratified by the action of the awarding committee of distinguished engineers who have charge of the John Fritz medal "for notable scientific and industrial achievement." To engineers in the home city of this journal the award brings a personal gratification. It was as a Chicago engineer that Mr. Noble did much of the work that has made his record a notable one.

Are Railways Economically Managed?

When a man sees a large machine in operation, particularly one that is doing work of a kind that he himself little understands, the tendency to praise the efficiency of the machine is almost inevitable. Even a trained engineer is apt to gaze upon a great electric power plant with something akin to awe. Its almost silent wheels are generating an electric current of enormous force. A century of mechanical genius finds its final expression in the turbo-generators before his eyes. The individual feels his own littleness in the presence of this greatness.

Whenever outsiders have dared to raise question as to the economic operation of the greatest of machines—the railways—they have been generally silenced by ridicule and by their own feeling of respect for the great railway machine itself. Within recent years, however, certain men who have succeeded in reducing the unit cost of factory production have insistently proclaimed that similar methods would effect similar reductions in the operation and maintenance of railways. Here and there some of these "economy engineers" have had a chance to apply their theories to some degree in railway operation, and with apparent success. Yet they have made little headway in popularizing their methods, perhaps because they claim to be able to accomplish more than is possible, perhaps because the man is rare who will admit that he has been using uneconomic methods all his life and therefore be willing even to try an experimental change.

Judging from the space given to the subject in the daily press, the public is surprised and interested in the bold statement made by Mr. Louis D. Brandeis that the railways of America are unnecessarily spending $300,000,000 a year, or about 18 per cent of the total operating expense. Mr. Brandeis is the attorney representing the commercial organizations of the Atlantic Seaboard in their fight before the Interstate Commerce Commission against an increase in freight rates. He is undertaking to show by expert testimony what reductions in cost have been affected by applying modern methods of management, particularly where bonus and piece rate systems have been used.

In railroad operation bonus systems of payment have seldom been adopted. The crude, old-fashioned wage system is standard; and it will be claimed that no other system is practicable. Unfortunately for such claims, it can be shown that in many departments of railway work bonus methods of payment have been applied with great success. Mr. Harrington Emerson's work in reducing car and locomotive repair costs on the Atchison railway system has had wide publicity for years without contradiction. Bonus payments to locomotive firemen for fuel economizing have repeatedly resulted in decided reductions in coal consumption. We know of many trials of the bonus system on railway work, such as in tie renewals, and in every case with great increase in output of employes.

It is not to the discredit of railway presidents and managers that the bonus system has received scant recognition from them. In most lines of manufacture the same failure to realize the economic possibilities of the system exists. Men are conservative by nature, and it takes years to introduce anything new. Even the Morse patent on telegraphy made its owners very little money in the 17 years of its life, for it took almost that long to secure capital, build lines and *educate the public* to the use of the telegraph.

Selden, the inventor of the gasoline automobile, applied for his patent a dozen years or more before he took out the final papers; and, during all that time, the autocar was in a stage of slow development, not reaching commercial importance until 15 years after the patent application was filed. Let no one think that even a good thing springs into full recognition and success upon the movement.

While no man can even approximate the possible reduction in railway operation and maintenance cost, still it is a certainty that vast sums can be saved. In a year of 300 working days, the average freight car spends 165 days in idleness, and only 135 days actually on the road hitched to an engine. This is bad enough, but, what is worse, the average freight engine travels only 20,000 miles a year, or not quite 55 miles a day. Locomotive repairs and renewals cost 22 per cent of the first cost per annum. Train crews are accustomed to receive a day's wages for a run of 100 miles. Do these sound like records of efficient performance? Every railway manager knows that they are not, and chafes at the conditions that seem to make such performances difficult to better.

The reason why no radical improvement in railway economics has been effected in recent years is not far to seek. There are nearly one and a half million railway employes in America, or more than 600 per mile of railway line, and their average annual compensation is only $700 per man. Even the 5,000 "general officers," at the very top, receive only $3,200 a year per man. *More money must be paid all along the line to effect greater economy of operation.* In this paradox is the whole answer.

The additional compensation, however, must not be in the form of increased daily or monthly wage and salary rates, but in the form of bonuses for increased performance. Train crews should be encouraged to outdo all past records of daily mileage by being given bonus payments for mileage in excess of 100 miles a day. Trackmen and track foremen should be paid a bonus upon ties and rails relaid, distance of track surfaced, etc. Civil engineers should be paid a bonus for economic designs of structures and economic location or relocation of railway lines. Every class of employes should be thus stimulated by bonuses for more efficient performance. This would increase the income of the individuals, but it would so reduce the number of individuals required to handle the present traffic that the cost of operation would be greatly decreased. However, it would not be long before the natural increase in traffic would result in giving employment again to all the men who would be temporarily compelled to seek other places as a result of adopting more economic methods.

The railway rate hearing now in progress at Washington, D. C., should serve to focus the serious attention of railway managers upon the modern methods of management engineering, and particularly upon the fundamental law of most economic management: *All payment for service should be made proportionate to performance.*

Cost of Metering Water.—The cost of operating and maintaining the meter system at Reading, Pa., in 1909-1910 was $4,519.97 for an average of 2,795 meters in service, or at the rate of $1.62 per meter per year, or 40 cts. less per meter than last year. The unit costs for the several subdivisions of operation and maintenance are as follows:

Abandoned as scrap	$0.614
Clerical service	.455
Repairs	.216
Reading	.202
Delivering meter bills	.079
Stationery and supplies	.048
Miscellaneous	.003
Total	$1.617

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Octave Chanute.

Octave Chanute, one of the most widely known of American engineers, died of pneumonia at his home in Chicago on Nov. 23, 1910. He was taken ill while in Paris during the summer, and recovering partially, returned to Chicago in October. Owing to his advanced age, however, he was unable to recover entirely, and his condition was critical up to the time of his death.

Mr. Chanute was born in Paris, France, Feb. 18, 1832, and was brought to the United States six years later. His education was acquired chiefly in New York city, where he spent his boyhood and youth. His career as a civil engineer began in 1849, when he entered the service of the Hudson River Ry., under John B. Jervis, then Chief Engineer. In 1853, at the time he left that road, he was Division Engineer at Albany in charge of the completion of terminal facilities and maintenance of way between Albany and Hudson. He was then only 21 years of age.

After leaving the Hudson River Ry. Mr. Chanute came to Illinois in company with Mr. H. A. Gardner, and entered on the construction of a road between Joliet and Bloomington, now a part of the Chicago & Alton Ry. In 1854 he was appointed Chief Engineer of the eastern portion of the Toledo, Peoria & Warsaw Ry. Under his direction the 112 miles of that line lying between Peoria and the Indiana state line was built. After the completion of the road he remained in charge of maintenance of way until 1861, when he became Division Engineer of the Pittsburg, Fort Wayne & Chicago Ry.

For six months of the year 1862 he was Chief Engineer of Maintenance of Way of the western division of the Ohio & Mississippi Ry., his jurisdiction extending from St. Louis to Vincennes, Ind. He resigned from this position early in 1863 to accept the position of Chief Engineer of Maintenance of Way and Construction of the Chicago & Alton Ry. He remained with that line until 1867. At about this time he acted as Chief Engineer in the design and construction of the Union Stock Yards at Chicago, and was also awarded a premium for a competitive design for a bridge across the Missouri River, at St. Charles, Mo.

In 1867 Mr. Chanute was chosen Chief Engineer of the proposed bridge across the Missouri River at Kansas City, Mo. There were then practically no experience or data available for use in planning the construction of a bridge across that stream. The task was recognized as an extremely difficult one, and the successful completion of the bridge in 1868 attracted widespread attention among engineers. From 1868 to 1871 Mr. Chanute was in charge as Chief Engineer of the construction of a number of lines, all promoted by the same interests, in Kansas. The first line built was the Kansas City, Fort Scott & Gulf Ry. from Kansas City to the north line of the Indian Territory, a distance of 160 miles. The completion of this line was followed by the construction of the Leavenworth, Lawrence & Galveston Ry., extending from Lawrence, Kan., to the Indian Territory. These lines were then connected with a line known as the Kansas City & Santa Fe Ry. Finally the Atchison & Nebraska Ry. was built, extending northward from Atchison. On the completion of this work Mr. Chanute became General Superintendent of the Leavenworth, Lawrence & Galveston Ry. At about this time three small towns at the junction of this line and the Missouri, Kansas & Texas Ry. were merged together, and the name Chanute was adopted for the consolidated town. During the construction of the Kansas railways Mr. Chanute also designed and built the Union Stock Yards at Kansas City.

In 1873 the Erie Ry. planned to make extensive improvements in the way of second tracking, change of gage (from broad to standard gage), and the construction of important extensions. It was planned to expend about $50,000,000. Mr. Chanute was appointed Chief Engineer. Work had scarcely begun, however, when the panic of 1873 came on, and the greater part of the work had to be postponed. Mr. Chanute remained with the Erie Ry. until 1884. He was appointed Assistant General Superintendent in 1875, and discharged the duties of this office in addition to those of Chief Engineer. During this period many important improvements were made and the physical condition of the line brought to a high standard. Under his direction, the Kinzua Viaduct, a structure over 300 ft. in height, was built.

On becoming Assistant General Superintendent Mr. Chanute was placed in temporary charge of motive power and rolling stock. As a result of the improvements brought about by him in locomotives and grades, the standard freight train, which was 18 cars when he took charge, had been lengthened to 35 cars at the time he severed his connection with the road.

O Chanute

In 1884 he removed to Kansas City and opened an office as Consulting Engineer. In this capacity he took charge of the construction of iron bridges on a number of lines then building, the most important being the extension of the Atchison, Topeka & Santa Fe Ry. from Kansas City to Chicago, in 1887 and 1888. Two notable bridges were involved in the construction of this line; the bridge over the Missouri River at Sibley, Mo., and the bridge over the Mississippi River at Fort Madison, Iowa. The Sibley bridge consisted of three 400-ft. channel spans with about 2,000 ft. of iron viaduct approaches. It was begun in March, 1887, and completed in 1888 The Fort Madison bridge consisted of four spans of 237½ ft., one of 275 ft., two of 150 ft., and a draw span of 400 ft. Construction was begun in March, 1887, and completed in December of that year. It was necessary to use pneumatic caissons for some of the pier foundations

In 1889 Mr. Chanute established himself in Chicago as a consulting engineer. In his extended experience he had come to see the advantages and economies resulting from timber preservation, and as chairman of the committee appointed by the American Society of Civil Engineers he had done much to call the attention of engineers to this subject. He now began to devote a great portion of his time to the study of the different processes of timber preservation. Mainly as a result of his studies, but partly because of the high price and limited supply of suitable creosote oil available at that time, he was impressed with the advantages of the zinc chloride process of treatment The Chicago Tie Preserving Co., which he had organized in 1885, treated large quantities of railroad ties and other timbers, mainly by the Burnetizing or plain zinc process. but to a limited extent by modifications of this process At the time of his death this business was carried on under the name of O. Chanute & Co.

In popular estimation the fame of Mr. Chanute will probably always rest on his work in the development of aviation. Engineers, however, while recognizing the value of this phase of his various activities, will regard it as of minor importance in comparison with the work accomplished and the influence exerted in his practice as a civil engineer.

Mr. Chanute was accustomed to regard aviation as the pastime of his old age. No doubt he minimized the importance of this part of his work. That his influence in the development of the art of "heavier than air" flying was of the greatest value there can be no question. He first became interested in the subject in 1874. After pursuing some theoretical investigations he undertook, in 1888, a number of gliding experiments with a type of aeroplane which, from his theoretical studies, appeared to be best adapted for practical development. In 1901 the Wright brothers took up the work, and carried forward the development begun by Mr. Chanute. He aided them constantly with advice and information, and in the making of calculations. In 1894 he published a book entitled "Progress in Flying Machines." In 1897 he presented before the Western Society of Engineers a paper on "Gliding Experiments," and twelve years later a paper on "Recent Progress in Aviation." In the summer of 1910 he was awarded a gold medal by the Aeronautical Society of Great Britain in recognition of his services in promoting the art of aviation. But, great as was his work and influence in aviation, he regarded this as a "side issue" in his career.

Mr. Chanute became a member of the American Society of Civil Engineers in 1868. He was a frequent contributor to the "Transactions" of that society, and served on a number of committees. He was elected a Vice-President in 1880, and in 1891 he was elected President. He entered the Western Society of Engineers in 1869, was elected President in 1901, and became an honorary member in 1909. While President of this society he endowed three medals, known as the Chanute medals, one of each to be awarded annually for the best papers presented to the society in the departments of civil, electrical and mechanical engineering. He was an honorary member of the Institution of Civil Engineers (Great Britain), of the Society of Civil Engineers (France), and of the Chilean Society of Engineers. He was a member of the Canadian Society of Civil Engineers, the American Institute of Mining Engineers, the American Railway Engineering and Maintenance of Way Association, and of [illegible] societies and clubs.

In 1893 he was chairman of the Executive Committee of engineering societies having charge of the International Engineering Congress held in connection with the Columbian Exposition in Chicago.

Mr. Chanute was married in 1857 to Miss Annie James, who died in 1902 and was buried at her old home in Peoria, Ill. He leaves one son and three daughters. Funeral services were held at the home in Chicago at 4 p. m., Nov. 25, and the body was taken to Peoria for burial the following morning. A committee of six, representing the Western Society of Engineers, attended the funeral as honorary pallbearers.

Increasing Channeler Output.—In general, the channeling work on the New York Barge Canal has been more expensive than on other work of record. This is due to the nature of the material encountered. To overcome the difficulties, in part at least, the United Engineering & Contracting Co., of New York, have worked out an effective system of handling their channeling work. Five Sullivan Z. channelers are worked in a row, each machine covering a certain measured distance, which is about 20 ft. The best channelmen are put on the end machines and this keeps the three middle machines hustling to keep up. Each machine requires 1 engineer, 1 fireman and 1 helper. A portable blacksmith shop is maintained near the channelers. One blacksmith and 2 helpers are employed to sharpen drills for the 5 machines. Each machine uses about 1 ton of coal a day and each has accomplished as much as 90 ft. of rock channeled in 8 hours, although the average amount done is much less.

CONCRETE AND REINFORCED CONCRETE SECTION

The Economies of Plain and Reinforced Concrete Retaining Wall Design and Construction.*

It is proposed to discuss in this paper some of the retaining walls recently constructed by the Department of Public Works, Bureau of Construction of the City of Pittsburgh, to review the methods used in their design and the assumptions upon which the designs were based, and to give data relating to costs of such structures.

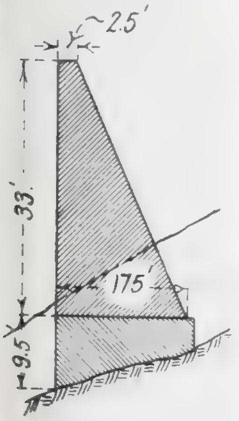

Fig. 1.

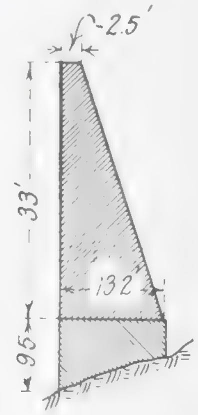

Fig. 2.

DESIGN OF DILWORTH ST. RETAINING WALL.

The Dilworth St. wall was erected during the summer of 1909. In preparing plans for this wall comparative designs were made to determine the most economical type of wall. The site upon which the wall is built is a steep inclined hillside, upon which an old fill about 8 to 10 ft. in depth had been placed. This old fill was of conglomerate material, composed of clay, loam and also contained a large quantity of rubbish.

Test pits were excavated showing that shale of good quality was to be found at a depth of about 9½ ft. below the surface at the deepest section. The character of the material overlying the shale was such that it was deemed unsafe to construct a plain gravity wall without carrying the footing to the shale. The design of the gravity walls for comparison was therefore based upon carrying the footing to rock. The lateral thrusts, however, were computed for a depth of 33 ft. for the deepest section, which section was compared with the cost of constructing a reinforced retaining wall 35 ft. in depth at the same point; for the other depths the comparison and designs were made in a similar manner.

The character of the material used for the new fill for the proposed street was not exactly known but from an inspection of the locality from which the fill was to be taken it was supposed that this fill would be clay mixed with a small portion of shale. This assumption was correct.

In deciding upon the proper coefficient for computing the lateral thrusts to be resisted by the proposed wall, there was taken into consideration the fact that the clay filling would be placed upon a steeply inclined surface and underlaid with several feet of fill of poor character and that this material was underlaid by sloping impervious rock strata. It was therefore deemed advisable that the wall be constructed to resist a fill whose angle of repose ϕ would approximate 33° 42′. Further, on account of the nature of the material underlying the fill, it was considered necessary to provide an additional factor of safety for loads in excess of the normal computed loads. These excess loads might come from a slipping of the earth wedge of the new fill or from the tipping over of this wedge.

It is interesting to note in connection with the assumption as to character of the material and the probable lateral thrusts developed by it, that at the end of the wall where the embankment was filled out to the street line with a new fill, that the bank slipped, the line of rupture being 10 to 15 ft. back of the top of the slope and the toe of the slope rising up five or six feet.

Comparative Designs.—The comparative designs made included tentative designs for gravity walls and for reinforced concrete walls of differing construction. Owing to the profile of the ground the wall was built in three sections of different depths. The reinforced walls consist of three sections, 35, 30 and 21.5 ft. in depth respectively. Beneath the floor of these sections it was proposed to construct piers running down to rock, thus saving a considerable quantity of concrete and excavation. The gravity walls were designed to extend to shale and were therefore of greater depth at the corresponding sections than the reinforced wall. In designing the walls, however, they were all subjected to the same lateral thrusts.

For plain and gravity walls the estimates were based upon the following estimated costs:

Concrete above footings	$6.50 per cu. yd.
Concrete in footings	$5.50 per cu. yd.
Excavation	$0.75 per cu. yd.

For the reinforced walls the estimated costs were as follows:

Concrete in piers	$6.00 per cu. yd.
Reinforced concrete	$8.50 per cu. yd.
Steel reinforcement	$0.04 per lb.
Excavation	$0.80 per cu. yd.
Structural steel	$0.025 per lb.

The prices bid and the contract prices were considerably less than the above. The contract prices were as follows:

Plain concrete in retaining wall	$5.00 per cu. yd.
Reinforced concrete	$5.25 per cu. yd.
Steel reinforcement	$0.0275 per lb.
Structural steel	$0.025 per lb.
Excavation	$0.50 per cu. yd.

The actual unit costs of the work, which are given in Table I were somewhat greater than the contract cost and less than the estimated costs.

Design of Gravity Walls.—The gravity walls were designed for $\phi = 33° 42'$, weight of earth 110 lb. and equivalent fluid pressure $p = 31.5$-lb. per cu. ft. Designs were made for three depths to correspond to the three depths for the reinforced walls as previously stated. For each section two designs and estimates were made. One for a base of 0.4 the height and the other for a base of 0.5 the height.

Proposed Gravity Wall, 35 ft. Section.—This section has a total depth of 42.5 ft. from top of wall to base of footing. The wall is designed for a depth of fill of 33 ft. and the results obtained were compared with a design of the reinforced concrete section for a depth of 35 ft. The dimensions of the gravity walls designed for this section are shown in Figs. 1 and 2.

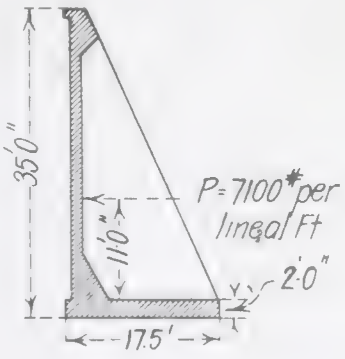

Fig. 3.

Table II gives the results of this investigation. The wall with a base of 0.5h is designed so that the resultant of the lateral thrust developed with angle of repose, $\phi = 33° 42'$, will pass through the middle third.

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*From a paper by Chas. M. Reppert, Division Engineer, Bureau of Construction, Department of Public Works, Pittsburg, Pa., read Sept. 6, 1910, before the Structural Section of the Engineers' Society of Western Pennsylvania and published in its Proceedings for October, 1910.

TABLE I. DILWORTH STREET WALL—COST DATA

	1	2	3	4	5	6	7	8	9
Item of Work.	Estimated quantity.	Estimated cost per unit	Estimated cost per lin. ft. of wall.	Price bid contract price per wall	Contract price per lin. ft. of wall.	Actual quantities placed per lin ft.	Actual contract cost per lin. ft.	Cost Act per unit	Cost Act per lin. ft
35 ft. Reinforced Concrete Wall, 37.5 ft. Long—Per Lineal Foot:									
Excavation .....cu. yd	8.6	$0.80	$ 6.88	$ .50	$ 4.30	9.33	$ 4.67	$0.645	$ 6.02
Reinf. concrete..cu. yd.	5.6	8.50	47.60	5.25	29.40	6.38	33.50	6.68	42.62
Plain concrete ...cu. yd	0.8	6.00	4.80	5.00	4.00	0.70	3.50	4.00	2.80
Steel reinf'mt .... lb	629	.04	25.16	.02¾	17.29	604	16.60	.0245	14.80
Structural steel......lb.	37.8	.02½	.95	.03½	1.32	43.8	1.53	.022	.96
Total per lin. ft.....................			$85.39		$56.31		$59.80		$67.20
Estimated cost of gravity wall b = .5h designed for 33° 42′ = $105.00									
Estimated cost of gravity wall b = .4h designed for 45° = 84.00									
30 ft. Reinforced Concrete Wall, 37.0 ft. Long:									
Excavation . cu. yd	4.5	$0.80	$ 3.60	$ .50	$ 2.25	5.70	$ 2.85	$0.533	$ 3.04
Reinf. concrete..cu. yd.	4.15	8.50	35.28	5.25	21.79	4.38	23.00	6.88	30.13
Plain concrete...cu. yd.	0.24	6.00	1.44	5.00	1.20	0.64	3.20	4.20	2.70
Steel reinf'mt.......lb.	375	.04	15.00	.02¾	10.31	382	10.50	0.277	10.58
Structural steel......lb.	33	.02½	.83	.03½	1.15	38	1.33	0.22	.84
Total per lin. ft.....................			$56.15		$36.70		$40.88		$47.29
Estimated cost of gravity wall base = .4h = 10.4 ft. = $51.20									
Estimated cost of gravity wall base = .5h = 13.0 ft. = 64.30									
*21.5 ft. Reinforced Concrete Wall, 37.2 ft. Long:									
Excavation .....cu. yd.	2.31	$0.80	$ 1.85	$ .50	$ 1.15	3.15	$ 1.58	$0.596	$ 1.88
Reinf. concrete..cu. yd.	2.44	8.50	20.74	5.25	12.80	2.5	13.12	6.806	16.99
Plain concrete...cu. yd.	0.24	6.00	1.44	5.00	1.20	.48	2.40	4.47	2.15
Steel reinf'mt.......lb.	215	.04	8.60	.02¾	5.92	204	5.61	0.278	5.68
Structural steel......lb.	23	.02½	.57	.03½	0.81	26	0.91	0.22	0.57
Total per lin. ft.....................			$33.20		$21.88		$23.62		$27.27
Estimated cost of gravity wall base = .4h = 8.6 ft. = $39.40									

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*Note: Estimated cost of a reinforced concrete wall of cantilever type, 21 ft. high designed for $\phi = 33° 42'$ and stress in steel calc. at 8,000 lbs. per sq. in. under twice the normal thrust was $32.20.

The tabular results show the conditions existing and the comparative factors of safety under different loadings. Under the normal loading P, the resultant as designed, passes through the middle third, the compression at the toe being 8,800 lbs., which would be safe.

Under Q^1 the moment of stability of the wall is considerably reduced and assuming that the concrete does not split under the tension the resultant cuts the base of the 33 ft. section 3.58 ft. from the toe so that but 10.7 ft. of the base would be bearing.

The wall designed with base equal to 0.4 the height has a base of 13.2 ft. As shown in the tabulation the possible development of a thrust, due to a decrease in the angle of repose to 33° 42′, would throw the back of the wall into tension. Under the force Q^1, due to tipping of the earth wedge, and also under Q, due to sliding, which would be more probable in this case, the moment of stability of the wall is very much reduced.

Design of Reinforced Concrete Retaining Wall for Height of 35 ft.—The reinforced retaining wall, a section of which is shown in Fig. 3, was designed so that it would have a resisting value under normal thrust P, equivalent to that of the plain wall with a base of $0.5h$ and that at the same time to be safe under more excessive loads. The wall was, therefore, designed so that the resultant due to the lateral thrust produced by the fill under the assumption $\phi = 33° 42'$ would pass through the middle third and the stresses in the structure to be at working value. Under higher loads, such as might be caused by forces Q or Q^1, or pressures developed by freezing or settlement of fill, the stresses allowed were higher, approaching the elastic limit for maximum possible conditions.

The width of base was determined in accordance with the method stated before under design of reinforced concrete retaining walls. The required width of base as computed was 17.2 ft., and the width taken for the design was 17.5 ft. including a 6-in. toe projection.

Table III gives the results obtained in the investigation and these results may be compared with those obtained in the investigation of the gravity walls. It will be seen that the wall possesses a greater factor of safety than does the gravity wall with a base of $0.4h$ under the same conditions of loading, since the gravity wall of this width base would be in dangerous condition.

In comparison to the gravity wall with a base of $0.5h$ the reinforced wall is fully as safe under normal conditions while under more excessive forces it possesses greater resisting power owing to the type of its construction.

TABLE II.

	co-ef. φ	Thrust lbs. lin ft	Point of application	Equivalent fluid pressure	Overturning moment M_t	Moment of stability M_s	X=dist. toe to c. g. resultant	Base bearing in feet	Comp. at toe lb. per sq. ft. Remarks
P	33°-42″	17,100	⅓h	31.5	188,000	447,000	5.85	17.5	C= 8,800 lbs.
P	45°	10,200	⅓h	18.7	112,000	523,000	6.83	17.5	
Q′		16,400	⅔h		361,000	274,000	3.58	10.7	C=14,300 lbs.
Q		47,000	1/6h		258,000	377,000	4.9	14.75	tension in heel
U′		29,000	⅔h		625,000				
U		58,000	⅓h		635,000				

STABILITY OF PROPOSED GRAVITY SECTION NO. 1

	co-ef. φ	Thrust lbs. lin ft	Point of application	Equivalent fluid pressure	Overturning moment M_t	Moment of stability M_s	X=dist. toe to c. g. resultant	Base bearing in feet	Comp. at toe lb. per sq. ft. Remarks
P	33°-42″	17,100	⅓h	31.5	188,000	176,000	3.04	9.1	*C=12,700 lbs.
P	45°	10,200	⅓h	18.7	112,000	272,000	4.25	13.1	C= 8,900 lbs.
Q′		16,400	⅔h		361,000				
Q		47,000	1/6h		278,000				
U′		16,500	⅔h		361,000				
U		33,000	⅓h		364,000				

STABILITY OF PROPOSED GRAVITY SECTION NO. 2

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*Note—Tension in hall of wall—2,200 per sq. ft.

TABLE III. STABILITY OF WALL.

Thrust	Co-ef. φ	Thrust lb. lin. ft.	Application of thrust	Equivalent fluid p	Overturning moment Ms	Moment of stability Ms	X=dis. toe to c. g. of resultant	Base bearing feet	Comp. at toe lb. per sq. ft.
P	33°-42″	17,100	⅓h	31.5	222,000	[illegible]	5.6	16.8	8,500
P	45°	10,200	⅓h	18.7	133,000	[illegible]	6.8	17.5	8,100
Q′		16,400	⅔h		393,000	[illegible]	3.2	9.6	14,800
U′		47,500	⅓h		[illegible]				
U		26,000	⅔h		620,000				
Q		47,000	1/6h		[illegible]	[illegible]	3.8	11.4	12,500

Estimated cost of section.. = $85.00
Contract cost of section.. = 56.00
Actual cost of section.................................. + 15% = 77.00

It will also be seen that the estimated cost of the reinforced section is about the same as that estimated for the gravity wall with a base of $0.4h$ and is considerably less than that estimated for a gravity wall with a base of $0.5h$.

Comparative Designs for Other Depths—Designs and estimates were prepared for the other depths and the results obtained and the estimated costs are given in Table I.

The conclusions drawn from the comparative estimates made for the 30 ft. and 21.5 ft. heights indicate that the reinforced concrete walls would be as economical to construct as a gravity wall with a base 0.4 the height but that the reinforced concrete type would possess a far greater factor of safety. It was, therefore, decided to construct the entire wall of reinforced concrete.

The reinforced wall as before stated was designed for three depths, 35, 30 and 21.5 ft. respectively from top of wall to bottom of floor. The wall was also designed so as to rest upon piers extended along the front of the wall and underneath each rib.

Design of Front Wall.—The front wall transmits the lateral thrusts to the ribs and is designed as a slab fixed at the ribs. The connection between the ribs and the front wall, see Fig. 4, was designed so as to fix the wall to the ribs and as placed this assumption is practically correct. The bending moments at the centre of the slab were computed in accordance with the formula $wl^2 \div 15$ and at supports $Mc = wl^2 \div 12$. In actual detailing the percentage of steel is varied so as to give convenient spacing to facilitate erection. Diagram No. 1, Fig. 4, shows the triangles of pressure applied to the front wall, the loadings marked thereon being in lb. per sq. ft.

The front wall slabs were designed as follows:

The stress in the steel is equal to 10,000 lbs. per sq. in. under normal loading from the base to the point b which is 18 ft. below the top of the wall. From this point up the wall was considered to be under a uniform lateral thrust of 565 lbs. per sq. ft. with a tension in the steel of 10,000 lbs. It will be seen from an inspection of this diagram that under the load Q^1 the steel at the top of the wall will be stressed to about 18,000 lbs., while at overturning the steel would be stressed to 27,000 lbs. per sq. in. The unit stresses used are low for reinforced concrete work, but in fixing these stresses the character of the construction was taken into account.

In connection with the detailing of this wall it will be noticed at the ribs the rods are placed through holes punched in structural steel angles. This assures the alignment and securing of the rods and at the same time affords a secure manner of tying the front wall to the ribs. As shown on the plan a double line of reinforcement is used in the front wall. Some difficulty was encountered in placing the rods in the back row and it would probably be more economical to design the front wall as a simple slab with bent rods for the negative moment at the points of support.

Design of Rib Reinforcement.—The ribs were computed as cantilevers fixed at the base where they are tied into the floor which is held by the superimposed load of earth. Tentative designs were made for panel spacing of 7.5 and 9.0 ft. The nine foot spacing proved to be the more economical.

The rib rods are run down the back of the wall, some of the rods extending into the projection at the heel and some of them being placed under transverse 1-in. rods which in turn engage the reinforcement in the floor. In this manner the secure anchorage of the rib rods is obtained and the distribution of the stresses between the floor and the rib effected. To insure the bond between the floor and the ribs vertical ties were also added.

The method of designing the reinforcement of the ribs was similar to that employed for designing the front wall. The ribs were investigated in sections 5 ft. apart, the percentage of steel determined and the rods were carried a sufficient distance beyond the point required in order to give secure anchorage, then were bent as shown in order to avoid crushing the concrete.

The stress in the rib reinforcement varies from 10,000 lbs. for the normal loading up to 40,000 lbs. under the ultimate load and were proportioned to develop the same strength as that of the front wall. Stress diagrams for the different sections and under the different loads were drawn similar in form to those prepared for the front wall.

Design of Floor.—Diagram 2, Fig. 4, illustrates the method used in fixing the unit stresses in the floor reinforcement. The floor reinforcement consists of double reinforcement so as to provide for negative moments at the base of the ribs and so as to carry the resultant pressures.

Under the normal thrust *P* the resultant cuts nearly at the middle third so that the upward reaction is a triangle, the maximum pressure being twice the average at the toe; this condition is shown graphically in the diagram being indicated by the pressure triangle *gdf*. The downward pressure caused by the weight of superimposed earth is taken as the weight of the wall plus the earth and considered as uniformly distributed, area *abcd*. The difference between the upward and downward pressure gives the resultant pressure which the floor must be designed to carry. For this condition the resultant pressures are shaded in the diagram.

As the loading is increased beyond that produced by the normal thrusts a greater width of the floor is subjected to the downward pressure at the same time the intensity of upward resultant at the toe increases. In order to proportion the wall so as to give all parts equal strength under the same conditions the floor was designed to take the stressses caused by a loading of twice the normal, the resultant of which cuts the base at a distance of 2.48 ft. from the toe and causes the upward reaction as shown in the diagram. Under *Q* the resultant cuts the base 3.11 ft. from the toe.

The floor was designed so as to take the varying loads, the first 7.5 ft. from the heel being designed to carry the weight of the fill under a unit stress in steel of 12,000 lbs. The next 4.5 ft., which is not subjected to downward pressure, except under the excessive loads, was designed for a unit stress in steel of 16,000 lbs. The front portion of the floor was designed to take the upward resultant caused by the loading *2P*, or twice the normal, the triangle *alh*, showing the loading.

The allowable stress under this loading was 24,000 lbs.

All unit stresses in the floor, however, caused by the normal loading do not exceed 12,000 lbs. In this manner the floor is proportioned so as to develop the strength of the floor and ribs. Under loading approaching the ultimate the upward resultant of course becomes very great and for this reason the change in section between the front wall and floor is made gradual as shown in the typical sections.

Design of Heel Projection.—Under the normal thrust *P* of 17,100 lbs. the weight of the wall being 71,000 lbs., the necessary coefficient to prevent sliding would be 0.24. It was assumed that the tangent of the angle of friction would be not less than 0.33. Under the ultimate thrust to be carried by the wall of 47,000 lbs., deducting the resistance due to friction of 23,000 lbs., leaves a balance to be taken by the heel projection of 24,000 lbs. Under the loading of twice the normal, giving a thrust of 34,000 lbs., the thrust to be taken by the heel projection would be 11,000 lbs. per lin. ft., the projection was therefore designed as a cantilever to resist this thrust of 11,000 lbs. per lin. ft. with unit stress in steel of 16,000 lbs. Under the ultimate loading the stress in steel would be 35,000 lbs. The reason for carrying down this toe projection was that the piers in front of the wall could not be relied upon to prevent sliding without carrying them to considerable depth while the back of the wall being carried into shale excavation afforded an advantageous and economical method of preventing slipping. The design of the heel projection is shown in Fig. 4.

Tie Rods in Ribs.—The vertical tie rods tying the ribs to the floor of the wall were proportioned to carry the resultant downward pressure and transmit the same to the ribs that were carried up through the rib and hooked over the horizontal tie rods.

From the theoretical standpoint these tie rods are not necessary but it was thought that a much more rigid and permanent construction could be obtained if the unit stress in these rods was fixed at 20,000 lbs. per sq. in.

The horizontal tie rods were designed to transmit the lateral thrusts from the front wall to the ribs. The unit stress in these rods was fixed at 20,000 lbs. per sq. in., the stress being taken at this value on account of the liability of excessive loads over any portion of the wall. At overturning, considering the thrust causing overturning as applied either at ⅓ or ⅔ the height, the stresses in these tie rods is about 40,000 lbs., but necessarily varies in different portions of the rib. The horizontal tie rods also insure the distribution of the stresses and make secure the bond between the front wall and the ribs. The horizontal tie rods were made in U-shape, being passed around the structural angles in the front of the wall and hooked around the rib reinforcement in the back of the wall. It will thus be impossible for the ribs of the front wall to separate without tearing out the longitudinal reinforcement in the front wall.

Cost of Dilworth St. Wall.—Table I gives the details of the cost of the three sections of the Dilworth St. wall; column 8 gives the cost account per unit as kept by the engineer

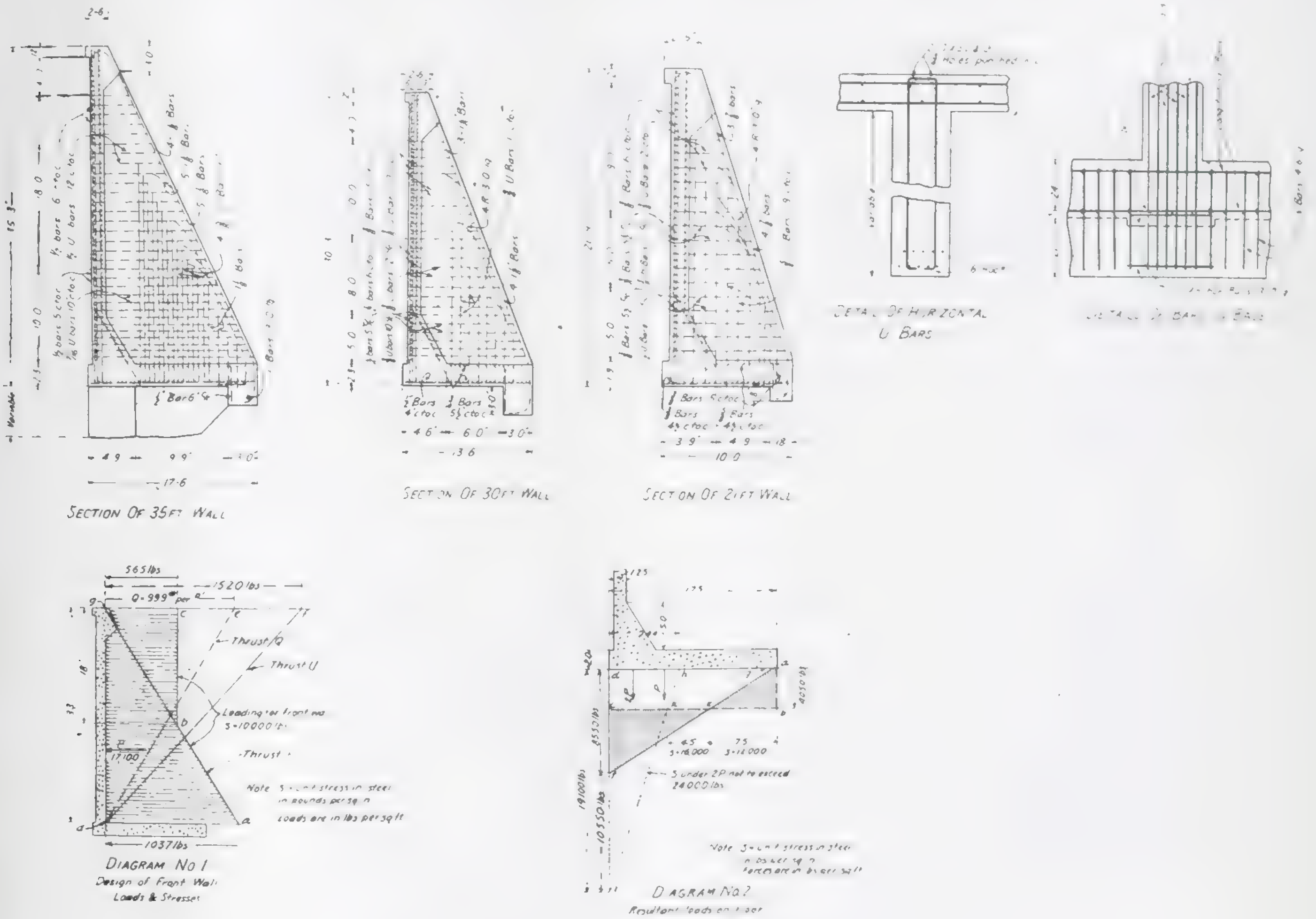


Fig. 4—Reinforced Concrete Retaining Wall.

in charge; the costs are exclusive of general superintendence, of depreciation and interest, and of profit.

Construction.—Concrete was mixed in the following proportions: Plain concrete in piers 1:3:7; reinforced concrete 1:2½:5. The gravel used was Allegheny River gravel conforming to the requirement that it should be graded from fine to coarse ranging in size from 1½ in. to ¼ in.

STANTON AVE. RETAINING WALL.

This wall was constructed during 1908 and 1909. The site of the wall is on Stanton Ave. along the hillside bordering the Allegheny Cemetery. The character of the material is shown in Fig. 5. The slope in front of the wall is steep, extending 500 or 600 ft. to the valley below. The material is mostly red clay underlaid with shale. The slope in front of the wall had slipped, the surface of the ground showing cracks several feet in depth, these cracks extending down the slope several hundred feet. The old wall seems to have failed on account of the slipping of the material in front of it. The filling behind the wall was found to be a mixture of yellow and red clay, which, during dry weather, cracks up and freely admits water. There was no provision for drainage in the old walls, which probably contributed largely to their failure.

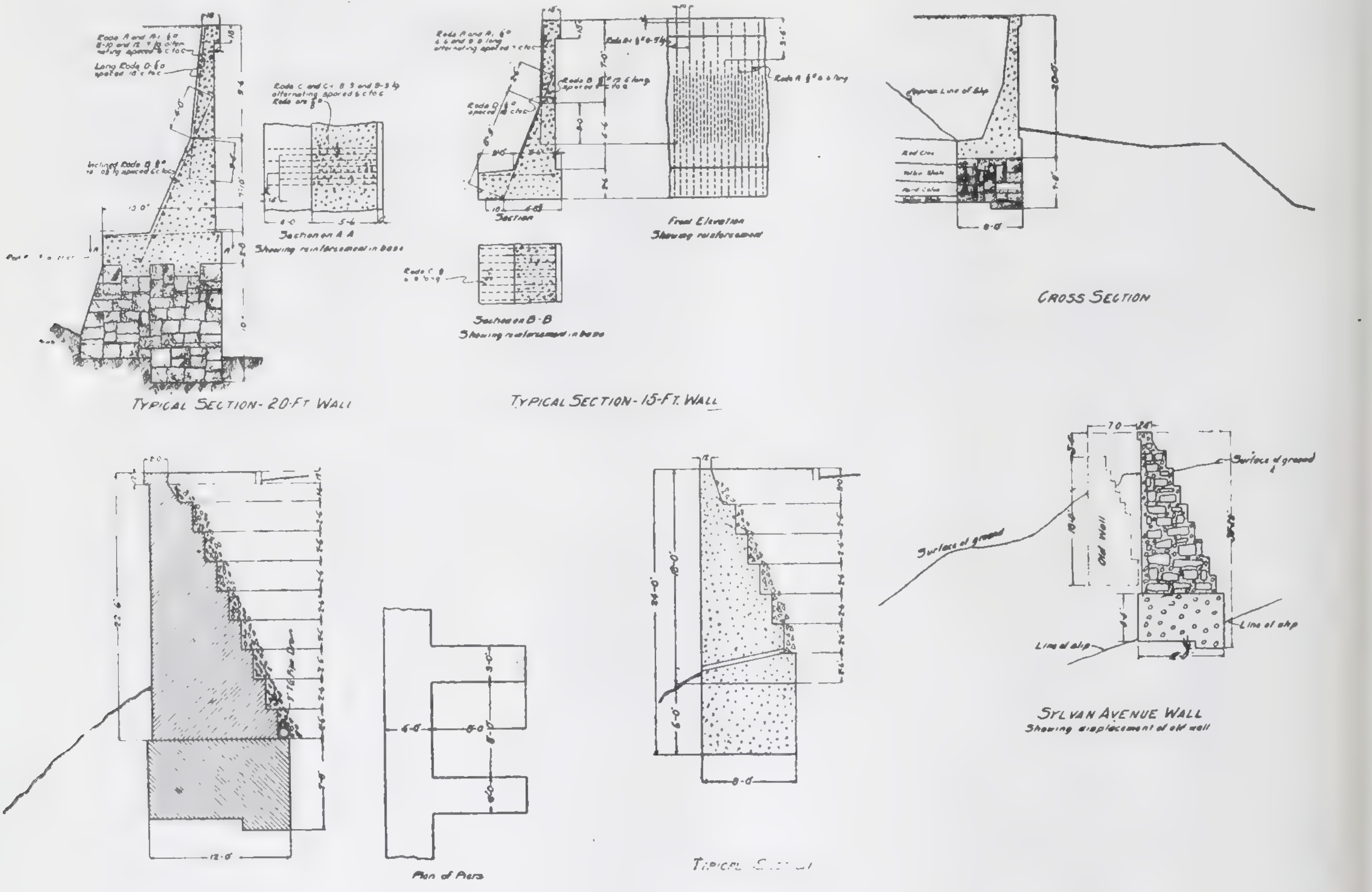


Fig. 5—Stanton Ave. Retaining Wall.

Designs were made for reinforced concrete retaining walls of two depths, 20 ft. and 15 ft. respectively. After the contract was let it was found impracticable to build the wall without carrying the base to shale. Owing to the fact that the slope in front of the wall continued to slide owing to its angle of inclination and also to the fact that it was necessary to go a depth of from 8 to 10 ft. under a portion of the 20 ft. section, it was decided to change the detail of the reinforced wall in some respects. The base was increased from 9 to 10 ft. and the dimensions of the wall at other sections was also increased. No change was made in the quantity of steel. This section was built upon the rubble base as shown in Fig. 5. The reason for increasing the base to a greater width was to transmit the resultant pressure to the rubble base in a safe manner and also, to a limited extent, to provide for a depth of pressure exceeding 20 ft. The original design of the 15 ft. section, Type *B*, was not changed.

The 20 ft. wall, Type *A*, Fig. 5, was originally designed and a portion constructed so that the resultant would pass through the middle third, the angle of repose for the fill being assumed at 45°. The wall was, however, designed with the working stresses in the steel at 8,000 lbs. for a pressure of twice the normal. The moment of resistance of this wall, the weight of fill being taken at 100 lbs. per cu. ft., was 89,300 ft. lbs. per lin. ft.

TABLE IV.—DESIGN OF STANTON AVENUE RETAINING WALL, STABILITY TABLE.

Thrust	Angle of repose	Thrust in lbs per lin. ft	Point of application	Equivalent fluid pressure	Mt per lin. ft	Ms ft. lb per lin. ft	X—distance from toe to resultant	Base bearing	Remarks
P	45°	3,400	⅓h	17.2	22,700	66,600	3.3	all	C. at toe = 4,050 lbs. per sq. ft.
2P	45°	6,800	⅓h	34.4	45,400	44,900	2.23	6.69	C. at toe = 6,400 lbs. per sq. ft.
P	33° 42′	5,720	⅓h	28.6	38,200	51,100	2.32	6.96	C. at toe = 6,100 lbs. per sq. ft.
Q_1		5,500	⅔h		73,500	15,800	0.75	2.25	C. at toe = 18,000 lbs. per sq. ft.

In this design: $\gamma = 100$ lb. cu. ft.; base = 9 ft.; weight of wall and earth = 20,200 lbs. per lin. ft.

Table No. IV shows the stability of the wall under the different conditions. The width of base of this section was 9 ft. and the height was 20 ft.

The stress in the steel was fixed at this figure, under twice the normal thrust, in order to provide for heavier loading coming upon the upper part of the wall and to develop the full strength of the wall.

An approximate method was used to determine these loads coming upon the upper part of the wall. The angle of repose was assumed at 45° and the wedge of earth behind the wall was assumed to be supported equally by the back of the wall and by a line 45° with the horizontal.

Costs.—The estimated costs and contract prices for the units of work were as follows:

Item of work.	Estimated cost.	Contract price.
Excavation per cu. yd.	$ 1.00	$ .58
Reinforced concrete per cu. yd.	10.00	6.73
Plain concrete per cu. yd.	7.50	4.50
Rubble masonry per cu. yd.	5.00	2.85
Steel reinforcement per lb.	.05	.03
Pipe drains, per lin. ft.	1.00	.80
Fence per lin. ft.	1.50	1.75

Based on these prices the estimated cost of the 20 ft. wall with a 9 ft. base was $25.50 per lin. ft. The cost of the reinforced concrete and steel alone was $19.30 per lin. ft. The cost of the 15 ft. wall, Type *B*, with 7 ft. base as designed and built was $16.95 complete per lin. ft., the costs of the concrete and steel being $12.14.

Other prices bid per lin. ft. for this wall varied from $16.50 to $28.20 per lin. ft. For the 20 ft. wall the other prices bid varied from $26.70 to $39.000 per lin. ft.

Tables V and VI give the detail estimate of quantities, estimate of cost and contract prices per unit for the 15 ft. and 20 ft. walls.

Design and Cost of 20 ft. Wall with 10 ft. Rubble Base.—As before outlined this section, which is shown by Fig. 5, was designed for more severe conditions than the original design. The dimensions of the sections of the

TABLE V.—STANTON AVENUE REINFORCED CONCRETE RETAINING WALL, QUANTITIES AND COST PER UNIT OF WORK AND PER LIN. FT. 9 FT. WALL.
TYPE A, 9 FT. BASE.

Description of work.	Unit	Estimated quantity per lin. ft.	Estimated cost per unit	Estimated cost per lin. ft. of wall	Contract price per unit	Contract cost per lin. ft. of wall
Excavation	cu. yd.	6.3	$ 1.00	$ 6.30	$ .58	$ 3.65
Reinforced concrete	cu. yd.	2.22	10.00	22.20	6.73	14.94
Plain concrete*	cu. yd.		7.50		4.50	
Steel reinforcement	lb.	145.0	0.05	7.25	0.03	4.35
Rubble masonry*	cu. yd.		5.00		2.85	
Drains	lin. ft.	1.0	1.00	1.00	.80	.80
Iron pipe fence	lin. ft.	1.0	1.50	1.50	1.75	1.75
Total per lin. ft.				38.25		25.49
Total per lin. ft., concrete and steel only				29.45		19.29

*Used as required.

wall were increased and the base increased from 9 to 10 ft.

Table VII is a tabulation showing the stability of the wall under the different assigned forces, and Table VIII gives the quantities and the cost per lin. ft.

A slip of the trench occurred during the progress of the excavation for one of the 20 ft. sections of the wall. The sheeting was not very securely braced in front of the wall and the stringers were anchored across the street to posts driven in the ground, iron rods being passed from the stringers to the posts. The sheeting was not carried deep enough and the fill slipped underneath the same and caused the trench to cave in.

The entire section, composed of the 20 ft. section of reinforced concrete and a rubble base 10 ft. in depth was designed so that the resultant pressure at the bottom of the rubble base cuts the base at the middle third with $\phi = 45°$.

SYLVAN AVE. WALL

The Sylvan Ave. wall was constructed of rubble concrete masonry to replace an old masonry wall that had failed by sliding and settlement. The surface of the ground in front of the wall slopes sharply down the hill, dropping several hundred feet. There had been an old fill at this point, which the wall was built to retain. After the wall begain to slip, earth was thrown in front of the wall, which, by adding weight to the slope, did not tend to mend matters. As a consequence of the displacement of this wall, the sewer and water lines occasionally broke and, as the street was to be paved with asphalt, it was decided to remove the old wall and build a new structure.

Test pits were dug on the cross-section and the character of the material was found to be an old fill composed of red and yellow clay which, at a depth of 25 ft. to 30 ft., seemed to indicate the presence of a considerable quantity of water.

The wall is built across an old ravine and rock is found at varying depths, near the surface at the end, and at a depth of about 30 ft. in the center. The length of the wall built was about 230 ft.

Comparative designs were made before adopting the final design of a gravity wall of rubble concrete masonry. These comparative designs were based upon a depth of 20 ft., ϕ being taken at 37° 30′ and, for the reinforced sections steel was taken 8,000 lbs. under the normal loading produced. These walls, with the exception of the gravity wall, were designed so that the resultants would cut the middle third. The estimates were based on reinforced concrete at $10 per cu. yd., steel at $0.5 per lb. and excavation at $1 per cu. yd. The estimate cost per lin. ft. of the cantilever, reinforced concrete wall was $28. The estimated cost per lin. ft. of the reinforced concrete wall with ribs was $27.50. The cost of the gravity wall with a base of 11 ft. and the same height the resultant cutting the middle third was $33 per lin. ft., the cost being based on unit cost of concrete of $7 per cu. yd., excavation being the same.

A detailed design was then prepared for a cantilever wall with a base of 14 ft. and a depth of 22 ft. under the same assumptions as to loading and stress. Its estimated cost was $39 per lin. ft., concrete being taken at $10 per cu. yd., steel at 5 cts. per lb., and excavation at $10 per lin. ft.

It was finally decided that, on account of the fact that much of the material in the old wall could be used in a new structure, to construct the wall of rubble concrete masonry.

This wall was designed under the assumption that $\phi = 33° 42'$ and $\gamma = 120$ lbs., the equivalent fluid pressure being 34 lbs. per cu. ft. In calculating the effective depth of the fill to be resisted, the information gained from the excavation of test pits was used and below the point where the material was firm no allowance was made for lateral pressure.

TABLE VII.—STANTON AVENUE REINFORCED CONCRETE RETAINING WALL, STABILITY TABLE FOR WALL, TYPE A, 20 FT. HIGH, 10 FT. BASE, SEE FIG. 5, COMPUTED TO THE BOTTOM OF 24 FT. SECTION.

Thrust	ϕ	Thrust in lbs. lin. ft.	Point of application	P	Overturning moment M_t	Moment of stability M_s	X distance from toe to resultant	Base bearing
P	45°	3,400	1/3 h.	17	22,700	[illegible]	3.8	All
2P	45°	6,800	1/3 h.	34	47,400	64,100	2.8	8.7
P	33° 42′	5,700	1/3 h.	28.6	38,200	71,300	3.20	9.6
Q_1		5,500	2/3 h.		73,500	36,000	1.6	4.8

A typical section of this wall is shown on Fig. 5. The contract prices were as follows:

Excavation for retaining wall	$ .38 per cu. yd.
Plain concrete	5.20 per cu. yd.
Rubble concrete	4.60 per cu. yd.

Under a portion of the wall, piers were built through the firm ground to shale, so that slipping of the wall on the inclined strata of rock might be prevented and, at the same time, saving excavation and concrete. Where these piers were built, a section of plain concrete, 5 ft. in depth, was placed, and longitudinal reinforcement consisting of a double line of one in. bars spaced 12 ins. was placed. The bonding of the upper section of the wall to the piers was secured by placing steel reinforcement in the piers extending up into the plain concrete base. Plain concrete was mixed in proportion of 1:3:6, and the rubble concrete masonry was built in approximately horizontal courses. The stones were bedded in concrete of moderately dry consistency and the joints between the stones were grouted with wet sloppy concrete. The distance between stones and the exterior face of the wall was specified not to be less than 6 ins.

A typical cross-section of the work is shown in Fig. 5, which shows the line of rupture of the slip that caused the failure of the old wall. This figure also shows the position of the original wall and gives a good idea of the extent of its displacement. Although the wall had moved and settled considerably, as shown in this illustration, the wall itself was intact and but very little distorted. The wall, however, had slid off of its base in some places.

MICHIGAN ST. RETAINING WALL

This wall is a heavy reinforced concrete wall of the cantilever type designed for the surcharge of a new fill placed on a steep slope. The wall consists of an arched central portion of reinforced concrete with plain concrete abutments or wing walls at the end. From the back of the wall the embankment slopes up to the street line, the angle of the slope varying with the distance of the wall from the street line. On account of the location of the wall an attempt at ornamentation was made. The wall was designed for a normal pressure of twice that developed under the assumption that ϕ would equal 37° 30′ which approximately equals the angle of inclination of the original surface of the ground. The depth of surcharge was about 5½ ft. The stability and internal resistance of the wall was also investigated under the thrust developed by the forces Q and Q^1. The weight of the wall and the superimposed earth was 25,000 lbs., its moment of resistance was 231,000 ft. lbs. per lin. ft. The steel was computed for stress in steel of 8,000 lbs.

In designing the wall the base was spread, the toe being extended 5 ft. on the front of the wall. This extended base was desirable on account of the steep slope of the existing surface and the fact that a mixed clay and earth fill was to be placed. The estimated cost of the wall per lin. ft. was $46 and the contract cost per lin. ft. was $42.

A comparative design was made for a gravity wall. A gravity wall with a base of 10 ft. and a height of 22 ft. was estimated to cost about $32. Under the thrust developed by the normal loading P, one-half of that applied to the reinforced wall, the back of the wall would be in tension since the resultant cut the base 2.9 ft. from the toe. A gravity wall with a 12-ft. base and 22 ft. high was estimated to cost $37, the resultant cutting the middle third.

On account of the conditions it was thought advisable to build the reinforced wall since the cost was but very little greater and it possessed a much greater factor of safety.

Section.—The section of the wall is shown in Fig. 6. The vertical rods in the back of the wall, ⅞-in. rods spaced 4¼ ins., were extended from the top of the wall to the base. The inclined rods, ⅞-in. rods spaced 4½ ins. c. to c. were tied to the vertical rods and also to the transverse rods in the heel, which were ¾-in. rods spaced 6 ins. c. to c. The end of the inclined rods was hooked over the longitudinal rods in the base. The rods in the extended toe were ⅞-in. rods spaced 4 ins. c. to c. A toe projection was provided but was not necessary in construction owing to the fact that the base of the wall was in shale. The shape of the wall, also, is such that arching action of the reinforced section against the heavy concrete wing walls is provided, and provides a very great factor of safety against overturning.

The proportion of concrete in this wall was 1:3:6.

TABLE VI.—STANTON AVENUE REINFORCED CONCRETE RETAINING WALL, QUANTITIES AND COST PER UNIT OF WORK AND PER LIN. [illegible] WALL TYPE B, SEE FIG. 2, PLATE 2

Description of work.	Unit	Estimated quantity per lin. ft.	Estimated cost per unit	Estimated cost per lin. ft. of wall	Contract price per unit	Contract cost per lin. ft. of wall
Excavation	cu. yd.	6.3	$ 1.00	$ 6.30	$ .58	$ 3.65
Reinforced concrete	cu. yd.	1.44	10.00	14.40	6.73	9.69
Plain concrete*	cu. yd.		7.50		4.50	
Steel reinforcement	lb.	[illegible]	.05	4.05	.03	[illegible]
Rubble masonry*	cu. yd.		5.00		2.85	
Drains	lin. ft.	1.0	1.00	1.00	.80	.80
Iron pipe fence	lin. ft.	1.0	1.50	1.50	1.75	1.75
Total per lin. ft. (except extra base) complete				$21.85		$16.93
Concrete and steel per lin. ft.				18.45		12.12

*Used as required.

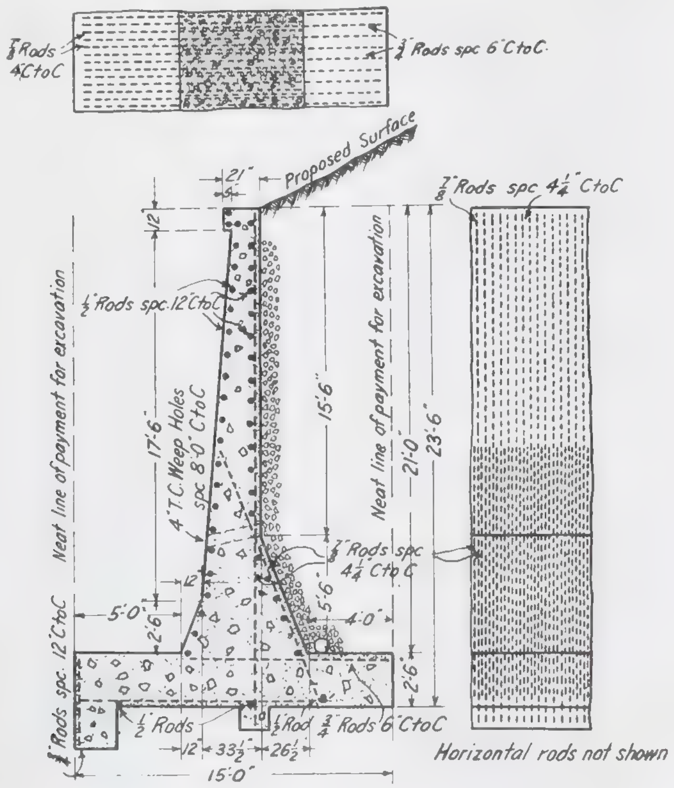

7/8" Rods 4" C to C
3/4" Rods spc 6" C to C
Proposed Surface
21"
12
7/8" Rods spc 4 1/4" C to C
1/2" Rods spc. 12" C to C
Neat line of payment for excavation
17'-6"
4" T.C. Weep Holes spc 8'-0" C to C
15'-6"
21'-0"
23'-6"
5/8" Rods spc 4 1/4" C to C
12
5'-0"
2'-6"
5'-6"
4'-0"
2'-6"
1/2" Rods spc. 12" C to C
1/2" Rods
1/2" Rod
3/4" Rods 6" C to C
12
33 1/2
26 1/2
15'-0"
Horizontal rods not shown

Fig. 6—Michigan St. Retaining Wall.

WASHINGTON AVE. RETAINING WALL

This wall was constructed in 1908. The wall erected is a reinforced concrete retaining wall, cantilever type, 500 ft. long, at each end of which a length of gravity wall of less depth was built, the total length of the gravity walls being 375 ft. The construction of this wall was rendered difficult by the fact that a 6-ft. brick sewer had been built near the street line so that the space available for the base of the wall was restricted. In preparing the contract plans, it was anticipated that the width of base would not exceed four ft.

The Castle Shannon railroad, since electrified, runs along the front of the wall a few feet from its face. The distance from the top of wall to top of rail is about 13 ft. and this may be taken as the effective height of the wall. The new fill behind the wall was from 7' to 9 ft.

The wall was designed for a base of 4 ft. and a depth of 19 ft. from top of wall to bottom of the reinforced wall. It was anticipated that where desired plain concrete would be placed under the base of the reinforced wall.

The concrete was 1:3:6 mix and the wall was built in sections varying from 90 to 60 ft. Fig. 7 shows the detail of a section of this wall and also shows a typical detail of a special section, which was necessitated on account of the lack of clearance between the side of the sewer and the street line.

The wall was designed for a depth of fill of from 7 to 9 ft. and the angle of repose assumed for the fill was 45°. It was assumed that the excavation through the old fill would exert little if any pressure on the wall. The normal thrust developed, with $\phi = 45°$ and $\gamma = 100$ lbs. per cu. ft.,=700 lbs. per lin. ft. of wall. The weight of the wall and the superimposed earth was 9,400 lbs. per lin. ft. The overturning moment calculated to the base of the reinforced section for $h = 19$ ft., is $M_o = 9{,}100$ ft. lbs. per lin. ft. The moment of resistance of the wall about the toe is $M_r = 18{,}200$ lbs. per lin. ft. Under this thrust, the resultant cuts the base about 1 ft. from the toe, the base bearing under the thrust being 3 ft.

While this was considered safe for the character of the fill to be placed, which was to be a mixture of shale and clay, it was thought desirable to carry the base deep, so as to provide an additional factor of safety for overturning. For this reason the depth of the wall was carried 6 ft. below the top of the rail. The steel reinforcement was computed so that the stress on the steel, under the normal thrust developed, by the earth, with $\phi = 33° 42'$, would not exceed 8,000 lbs. per sq. in. Table X gives the quantities, estimated cost and contract cost per lin. ft. of wall.

When the trench was opened up it was found that the line of the sewer was irregular and that, for a considerable portion of the length of the wall, a width of base of from 5 to 6 ft. was available. The base of the wall was therefore made the full width of the trench and horizontal steel reinforcement was placed in this extended heel, the original design only contemplating a 6 in. offset 2 ft. from the base.

The distance from the bottom of the reinforced concrete section to the surface of the shale varied from nothing to 4 ft. With the exception of the first section of 90 ft. the wall was carried to shale, plain concrete being placed under the base of the reinforced section. In order to utilize this depth of reinforced concrete, vertical reinforcement was placed in the back, being hooked over the horizontal rods of the heel.

With a base 5 to 6 ft. in width the wall has a much greater moment of resistance, the moment of resistance of the wall being increased from about 18,000 to about 41,000 ft lbs. per lin. ft.

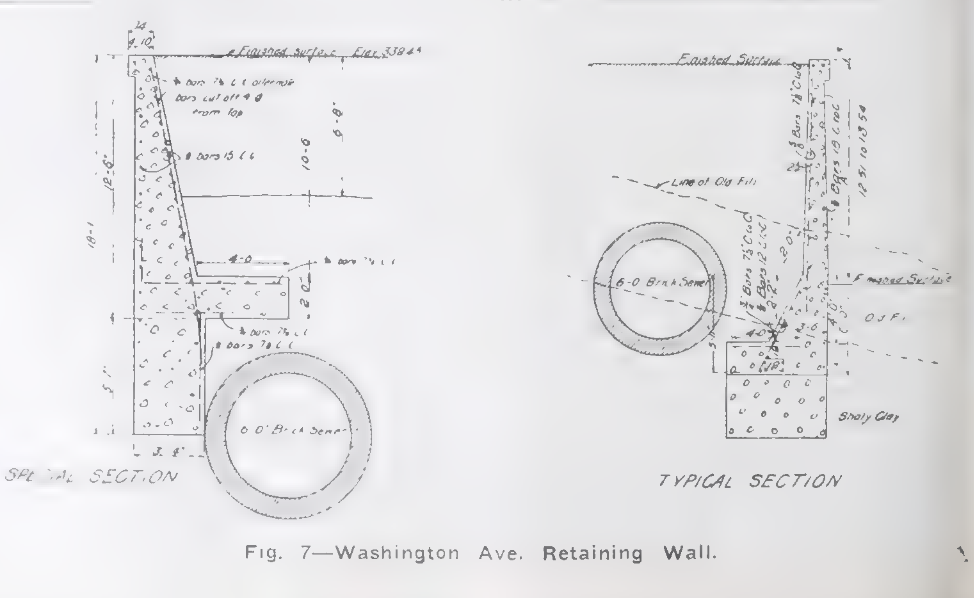
Section.—The section of the wall consists of a thin section 14 ins. wide at the top and 18 ins. at the bottom and from 12.5 to 13.5 ft. in depth. This portion is reinforced with ⅝-in. rods, spaced 7½ in. c. to c. The next section is 4 ft. in depth and its thickness is 18 ins. at the top and 3½ ft. at the bottom, and is reinforced with ¾-in. rods, spaced 7½ ins. c. to c. The transverse rods in the base, which was 2 ft. in thickness, are ¾-in. rods, spaced 7½ in. c. to c. The rods in the upper portion of the wall were cut off alternately 4 ft. from the top.

Expansion and Contraction.—In the first section of the wall 90 ft. in length, the longitudinal reinforcement, placed so as to provide for temperature stresses and to aid in distributing these stresses, consisted of nine ½-in. rods spaced about 19 ins. apart, the percentages of steel in the upper portion being 0.092 per cent. The base of the first section was on hard clay. No cracking of the wall resulted. The next section, however, was carried to rock and this 90 ft. section cracked into three parts of approximately 30 ft. in length. The percentage of reinforcement was increased, sixteen ½-in. rods being placed in the upper 13 ft. of the wall, the percentage of the steel then being 0.165 per cent. This quantity of the steel seemed to be effective in preventing cracks.

In Fig. 8 shows the detail of a special sec-

TABLE VIII.—STANTON AVENUE REINFORCED CONCRETE RETAINING WALL, QUANTITIES AND COST PER UNIT OF WORK AND PER LIN. FT. OF WALL—29' SECTION WITH 10' BASE. SEE FIG. 5.

Description of work.	Unit.	Estimated quantity per lin. ft.	Estimated cost per unit	Estimated cost per lin. ft.	Contract price per unit.	Contract cost per lin. ft.
Excavation	cu. yd.	12.9	$ 1.00	$12.90	$0.58	$ 7.48
Reinforced concrete	cu. yd.	2.32	10.00	23.20	6.73	15.61
Steel reinforcement	lb.	145.0	.05	7.25	.03	4.35
Drains	lin. ft.	1.0	1.00	1.00	.80	.80
Fence	lin. ft.	1.00	1.50	1.50	1.75	1.75
Rubble masonry	cu. yd.	4.10	5.00	20.50	2.85	11.68
Total including 10 ft. rubble base				66.35		41.67
Total exclusive of rubble base				45.85		29.99
Concrete and steel only				30.45		19.96



SPECIAL SECTION

TYPICAL SECTION

Fig. 7—Washington Ave. Retaining Wall.

TABLE IX.—MICHIGAN STREET RETAINING WALL. UNIT COSTS AND ESTIMATED AND CONTRACT PRICES. FOR SECTION SEE FIG. 6.

Description of work.	Unit	Estimated quantities per lin. ft.	Estimated cost per unit	Estimated cost per lin. ft. of wall	Contract price per unit	Contract cost per lin. ft. of wall
Concrete	cu. yd.	3.3	$8.00	$26.40	$8.00	$26.40
Steel reinforcement	lb.	405.0	.05	20.25	.04	16.20
Total per lin. ft.				$46.65		$40.60

tion 60 ft. in length, the construction of which was necessitated by the lack of clearance between the side of the sewer and the street line, the space available being only 3.35 ft. A reinforced concrete platform was placed over the sewer, as shown on the plan, to prevent the wall from overturning. Most of the weight of the wall is carried directly on the front wall. The adaptability and economy of the reinforced type of wall are well illustrated by this design.

MARSHALSEA RETAINING WALL.

This wall was built to protect a power house from a sliding bank of earth. The slope had been cut back to admit of the construction of the power house and the bank was slipping. The country road is at the top of slope and about 50 ft. from the power house, the difference in elevation in this distance being about 40 ft.

It was desired to provide an open space between the side of the building and the wall. It was also considered hazardous and would undoubtedly result in considerable cost to cut back very far into the slope. A study was made of the comparative cost of sloping the earth and moving the county road back and of building a retaining wall. The cost of the retaining wall was found to be less than the other project.

The wall constructed, about 100 ft. in length, is a reinforced concrete wall of the cantilever type with an extended toe and a projection of the base into the rock upon which the wall was built. The wall was designed for heavy conditions, the slope already being in motion and consisting of clay on rock. This wall was erected in 1909. The wall designed is safe under the thrust developed by the formula $h = \frac{1}{2} h^2 \cos \Phi$, *with* $\Phi =$ to 33° 42′. The stresses caused by other loadings, such as Q^1 and Q, were also investigated and the stress in the steel under these loadings do not exceed 16,000 to 20,000 lbs.

The section and details of this wall are shown by Fig. 6. Its construction necessitated cutting back into the bank but 7 ft. and the wall as built possesses a large factor of safety, the total width of base being 11 ft. The moment of resistance of the wall is 97,500 ft. lbs. per lin. ft. The stresses in the steel for the normal loading is 8,000 lbs. except the upper portion of the wall, where the stress is somewhat lower, so as to provide for excessive loads coming on this portion of the wall, as might result from sliding of the earth of the steep bank.

Section.—The arrangement of the reinforcement in this wall is simlar to that of the Michigan St. wall. The reinforcement of the vertical base projection is provided by extending the main vertical reinforcement to the bottom of the projection. Table XI gives the estimated and contract cost of this wall per lin. ft.

The concrete was mixed in the proportion of 1:2½:5, the size of the gravel being specified not to exceed 1½ in. or less than ¼ in. The surface of the wall was finished by rubbing with small molded blocks of cement mortar, water being applied at the same time. The finished surface presents a very satisfactory and uniform appearance.

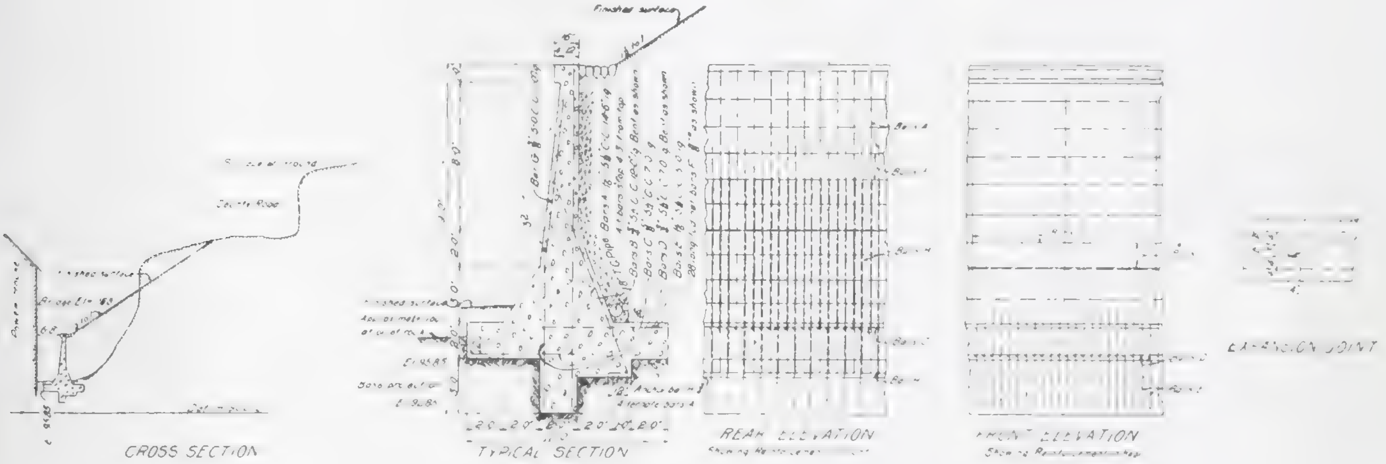


Fig. 8—Special Section of Washington Ave. Retaining Wall.

ALLEGHENY AVENUE RETAINING WALL

This wall, a section of which is shown on Fig. 5, is a gravity wall of concrete and is typical of the practices of this department for such construction and the wall was designed to resist a new fill of about eight feet, the footing of the wall to be carried to such depth below this point as might be required. The unit weight of the new fill was assumed at 110 lbs. per cu. ft. The resultant of the pressures cuts the middle third under the assumption that the equivalent fluid pressure would be about 23 lbs. per cu. ft., which corresponds to an angle of repose for the material of about 42°. The contract price for concrete in this wall was $5.75 per cu. yd., and at this price the wall as shown in the figure with a 6 ft. depth of footing cost $28.75 per lin. ft., for concrete alone. Provision for drainage in walls of this type is made by placing a course of broken stone 12 ins. in thickness from the top of the wall to firm ground, the drainage discharging through terra cotta pipe placed in the wall. The proportion of concrete used is 1:3:6.

These designs were made under the supervision of Mr. N. S. Sprague, Mem. A. S. C. E., the Superintendent of the Bureau of Construction, to whom the writer is indebted for assistance in preparing the designs, and the writer further wishes to acknowledge the assistance of Mr. J. D. Stevenson of this Bureau in preparing this paper.

TABLE XI. RETAINING WALL AT MARSHALSEA. ESTIMATED COST AND CONTRACT PRICE PER UNIT OF WORK AND PER LIN. FT. OF WALL.

Item of work.	Unit	Quantity per lin. ft. of wall	Est. cost per unit	Est. cost lin. ft. of wall	Contract price per unit	Contract price per lin. ft.
Excavation	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.22
Reinforced concrete..............	cu. yd.	2.27	8.50	19.30	7.30	16.57
Steel reinforcement..................	lb.	185.0	.04	7.40	.016	2.96
Plain concrete....................	cu. yd.				6.00	
Total per lin. ft. of wall..............................				$31.95		$20.75

TABLE X.—WASHINGTON AVENUE RETAINING WALL—UNIT COSTS AND COST PER LIN FT. OF WALL. ENGINEERS' ESTIMATE AND CONTRACT PRICES.

Description of work.	Unit	Estimated quantity per lin. ft.	Estimated cost per unit	Estimated cost per lin. ft. of wall	Contract cost per unit	Contract cost per lin. ft. of wall
Steel reinforcement.	lb.	65	$ .05	$ 3.25	$ .0225	$ 1.40
Excavation	cu. yd.	2.0	[illegible]	[illegible]	[illegible]	[illegible]
Concrete, reinforced.............	cu. yd.	1.21	9.00	10.90	6.75	8.20
Plain concrete........	cu. yd.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fence	lin. ft.	1.0	[illegible]	[illegible]	[illegible]	[illegible]
Total per lin. ft. ...				[illegible]		[illegible]

Tentative Programme of Papers for the Annual Meeting of the National Association of Cement Users.

At the annual meeting of the association to be held in New York City, Dec. 12 to 17, 1910, the following list of technical papers and reports are planned to be presented:

"Dustless Concrete Floors," L. C. Wason, President, Aberthaw Construction Co., Boston, Mass.; "Some New Methods in Sidewalk, Curb and Gutter Construction," Jerome B. Landfield, Hotchkiss Lock Metal Form Co., Binghamton, N. Y.; "Report of the Committee on Sidewalks, Roadways and Floors," C. W. Boynton, Chairman; "Report of the Committee on Reinforced Concrete and Building Laws," A. E. Lindau, Chairman; "Web Reinforcement of Concrete Beams," Peter Gillespie, President, Canadian Cement and Concrete Association, Lecturer, Faculty of Applied Science, University of Toronto, Toronto, Canada; "Web Reinforcement of Concrete Beams," Major John Stephen Sewell, Consulting Engineer, Gantts Quarry, Alabama; "Flat Slabs of Reinforced Concrete," Arthur N. Talbot, Professor of Municipal and Sanitary Engineering, University of Illinois, Urbana, Ill.; "Discussion of Flat Reinforced Concrete Plates," Angus B. MacMillan, Engineer, Aberthaw Construction

Company, Boston, Mass.; "Analysis of Result of Load Tests on Panels of Reinforced Concrete Buildings," Emile G. Perrott, Architect, Philadelphia, Pa.; "A Comparison of the Concrete Industry in Europe and America," Dr. Otto Schott, Director, Offenbach Plant, Heidelberg and Mannheim Portland Cement Company, Heidelberg, Germany; "The National Fire Protection Association and Its Work," W. H. Merrill, President, Chicago, Ill.; "Some Thermal Properties of Concrete," Professor Charles L. Norton, Professor, Heat Measurement, Massachusetts Institute of Technology, Boston, Mass.; "Topical Discussion on Fire-Resistive Construction of Buildings and the Effect on Insurance Rates"; "Report of the Committee on Fireproofing," Rudolph P. Miller, Chairman; "Report of the Committee on Insurance," William H. Ham, Chairman; "An Incident of Value of Concrete in Reducing Cost of Insurance," Emile G. Perrott, Architect, Philadelphia, Pa.; "Effect of Electrolysis on Metal Imbedded in Concrete," Cloyd M. Chapman, Engineer-in-charge, Westinghouse, Church, Kerr & Company, New York, N. Y.; "Construction Problems of the Azisconoes Concrete Gravity Dam," Seth A. Moulton, Sawyer and Moulton, Portland, Me.; "Preparation and Handling of Concrete," H. M. Cryder, Vice-President, William P. Carmichael Company, St. Louis, Mo.. "Advantages and Comparative Cost of Spouting Concrete," F. E. Engstrom, Vice-President, F. O. Engstrom Company, Los Angeles, Calif.; "The Use of Compressed Air in the Handling of Mortars and Concrete," G. L. Prentiss, Vice-President, Parsons Manufacturing Company, New York, N. Y.; "Discussion on the Manufacture, Curing, Cost, Etc., of Cement Hollow Building Blocks, Architectural Concrete Blocks, Fence Posts, Drain Tile and Pipe"; "Report of the Committee on Specifications for Cement Products," P. S. Hudson, Chairman; (a) "Proposed Standard Specifications for Architectural Concrete Blocks," (b) "Proposed Standard Specifications for Plain Concrete Drain Tile"; "General Considerations in the Construction of a Cement Products Plant," Charles D. Watson, Consulting Engineer, Syracuse, N. Y.; "Cement Tile Plant—Layout and Operation," C. M. Powell, Assistant Inspecting Engineer, Universal Portland Cement Company, Chicago, Ill.; "Additional Notes on Steam Curing Plants," F. S. Phipps, Manager, Central Stone Company, St. Joseph, Mo.; "Meeting of Section on Treatment of Concrete Surfaces," topical discussion on the artistic treatment of concrete surfaces of various kinds; "Report of Committee on Exterior Treatment of Concrete Surfaces," L. C. Wason, Chairman; "Proposed specifications for Stucco on Metal Lath"; "Comparative Cost and Maintenance of Various Types of Building Construction," J. P. H. Perry, Turner Construction Company, New York, N. Y.; "Concrete Filled Arches," H. H. Quimby, Engineer of Bridges, Bureau of Surveys, Philadelphia, Pa.; "Reinforced Concrete Sewers," J. A. Hooks, Assistant Sewer Commissioner, St. Louis, Mo.; "The Hudson Memorial Bridge," William H. Burr, Professor of Civil Engineering, Columbia University, New York, N. Y.; "Reinforced Concrete Construction in San Francisco and Vicinity," John H. Leonard, Consulting Engineer, San Francisco, Cal.; "Reinforced Concrete School Building," John T. Simpson, President, American Concrete Steel Company, Newark, N. J.; "The Use of Reinforced Concrete for Hospitals and Similar Structures," R. A. McCullough, Chief Engineer for Raymond F. Almirall, New York, N. Y.; "Advantages of Reinforced Concrete for Farm Buildings," Alfred Hopkins, Architect, New York, N. Y.; "The Advantage of Admixtures of Tufa to Portland Cement," J. B. Lippincott, Assistant Chief Engineer, Los Angeles, Aqueduct, Los Angeles, Calif.; "Use of Reinforced Concrete in Sea Water," R. Baffrey, President, Hennebique Construction Company, New York, N. Y.. "The Relation of the Lime Contents of Cement to Durability of Concrete," Henry S. Spackman, President, Henry S. Spackman Engineering Company, Philadelphia, Pa.; "The Insulation of Concrete Structures," Edward W. DeKnight, Manager, Hydrex Engineering Company, New York, N. Y.. "The Waterproofing of Tunnels," A. H. Harrison, Harrison Waterprof Materials Company, New York, N. Y.; "Waterproofing with Water," Cloyd M. Chapman, Engineering-in-charge, Westinghouse, Church, Kerr and Company, New York, N. Y.

ROADS AND STREETS SECTION

City Planning: Relation of Streets, Tramways and New City Districts.

The civic authorities of Continental cities have devoted much attention to the relation existing between streets, transportation facilities and city expansion. In a report presented at the recent meeting of the International Street & Interurban Railway Association at Brussels, Me., M. Wattman, manager of the Municipal Tramways of Cologne, brings out a number of features of European practice regarding these points. We have abstracted the matter that follows from his report:

One of the greatest needs of large cities is the reduction of congestion of population through lateral expansion. This later expansion is made possible only by means of adequate and rapid transportation. With horse cars but little relief could be afforded; but the development of electric railways during the past 20 years provides a possible solution of this problem because it increases enormously the space available for city expansion.

It is a somewhat difficult matter to determine the proportion of people who use the electric cars to go from one point to another within the city in preference to other means of movement. However, figures on this point have been compiled. These figures were obtained by making a record of the number of persons traveling in tramway cars, in other vehicles, bicycles, and on foot, on typical days, past different important points in the cities mentioned. A record taken at two important points in Copenhagen during November, 1907, shows the following: Number of persons in vehicles, 3,181; on bicycles, 4,153; foot passengers, 22,289; in tramway cars, 12,000. In other words, the tramway cars carried 29 per cent of the total number of persons passing the two points considered. At Aix-la-Chapelle during a fete on July 19, 1909, a record was made at ten different points, and it was found that the number of persons traveling in the tramway cars was 259,574, or almost 50 per cent. A simliar census was made in Dresden in 1908, at one of the principal bridges connecting two parts of the city, and it was found that over 50 per cent of the persons were traveling by electric cars. A record taken Sept. 18, 1908, in Lucerne showed 20 per cent. In Cologne a count made on two bridges crossing the Rhine showed 12 per cent foot passengers and 88 per cent tramway passengers.

In general it can be stated that the number of persons carried in the tramway cars is between 20 and 50 per cent of the entire circulation, and this percentage under special conditions will become much larger, as in the case cited in Cologne. It is safe to say, therefore, that in large cities the tramway system occupies a preponderating position in local communication and that its proper and logical development and extension not only have a most important bearing on the development of the city which it serves, but that the expansion of the city is directly affected by the layout of the transportation system, the service given and the speed attained on these cars.

Owing to this close interrelation it would seem almost self-evident that municipal authorities and engineers would obtain the collaboration and advice of the representatives of their local railway systems whenever new portions of the city are laid out so as to determine the best way of serving these sections by tramways. Somewhat strange to say, this is rarely done. Of the 73 companies which have replied to an inquiry on this subject, 60 or 70 per cent stated that they possess no influence with the municipal authorities in regard to this matter, and are never consulted when new streets are laid out. Twelve companies reported that they are consulted in regard to the transportation features in work of this kind when it is supposed that they have an interest in furnishing the service. Finally the officers of 10 tramways, for the most part municipal enterprises, are asked regularly to assist in the establishment of plans of this kind.

This condition of affairs undoubtedly explains the very grave errors made in the offices of municipal architects when it comes to providing transportation facilities in new districts. Undoubtedly the intentions of these architects are the best, but by ignoring what in a sense is the most important and vital part of city planning they make mistakes which forever handicap and hamper the district which they have laid out.

An unfortunate feature of the entire situation is that in older portions of the city all transportation has to be furnished under conditions originally designed for animal traction. It is impossible materially to alter this situation, but in the newer portions of the city full advantage could and should be taken of the great flexibility and adaptability of design possessed by the electric railway system. Among the points which municipal architects through ignorance of the practical conditions of electric railway operation are apt to overlook are the following; width of roadway; position of tracks in the streets; facilities for the establishment of car houses so as effectively to serve the different lines operated by them; facilities for turn-outs and crossovers; locations of crossings; number of railway lines required to serve the communities of different size, etc.

Modern ideas in city planning, very wisely, no longer favor the old idea of the rectangular arrangement of a city with all streets either parallel to or at right angles to each other. Such streets not only give an impression of monotony but their busy corners constitute serious obstacles to the circulation of traffic. Two streams of pedestrians, carriages, bicyclists, electric cars, etc., one on the cross street, the other on the longitudinal street, are forced into the narrow confines of a crossing no broader than each of the streets which meet at that point. The result is not only danger but a cause of delay to all.

Modern city architects seek not only to give their creations a picturesque appearance by avoiding so far as possible the interminable perspective presented by a long and straight street, but also to arrange the crossings of the important thoroughfares in such a way as to avoid, [illegible]stion. The former effect is accomplised by interrupting the straightness of the streets by angles or turns, and by the introduction of squares and plazas, and the latter by providing broad thoroughfares at intervals, still further widening them where they cross other important streets. These broad thoroughfares naturally become the commercial streets of the city, whereas the cross streets are naturally better suited for residential purposes. In the latter greater liberty can be taken in departing from straight lines, whereas the business streets should be arranged so as to facilitate traffic as far as possible. It is indispensable, however, in all work of this character for the engineer or commissioner in charge to realize that the new city or portion of the city which he is designing is not merely a work of art. It is primarily an object of utility and will lose its value if its artistic features hamper or obliterate its useful qualities. Some of the more important of these points, so far as they concern transportation by electric cars, will now be discussed.

The first consideration is the width of the streets. With tracks in the middle of the street and room on each side for one line of carriages the street should have a width of from 33 ft. to 35 ft. when the width of the car is about 7 ft. Cars can make a maximum speed of 10 miles per hour on such streets even if there is considerable traffic, and if the street was slightly wider could make from 11 to 12 miles per hour. It is much better, however, to have the space on each side of the track wide enough to admit the passage of two vehicles side by side or the passage by one carriage of another standing close to the curb. This means a width of street of from 50 ft. to 55 ft., and if the vehicle traffic does not trespass too frequently on the space reserved for the cars the latter can operate at from 12 to 15 miles per hour.

The next step is to provide more or less of a reservation for the cars. This plan will greatly reduce collisions between cars and vehicles. Accidents of this kind can be divded into two classes, one in which the vehicle is crossing the track from a side street and the other in which the vehicle is struck from behind by the car. Of these, the former is not only much less common, because the driver of the vehicle is in a position to see an approaching car, but the consequences are apt to be less serious because the driver is less liable to be pitched forward onto the tracks. A collision between a carriage and a car going in the same direction is impossible if the tracks are on a reservation. When laid in this way, the maximum speed of the cars can be 20 miles per hour, and if the precautions are adopted there is no reason why the speeds cannot be raised to 25 miles per hour, with no more danger than at present. Such reservations can be paved, as on Bismarckstrasse in Berlin, or turfed, as on Hartenbergerstrasse. The cost of track construction and track maintenance on reservations of this kind is, of course, less than in paved streets because T-rails on wooden ties can be used.

A very common construction in Continental cities is one in which the area in the center of the street is reserved for pedestrians and the two tracks are at one side of this reservation. Of the wagon roadways one is outside of the two tracks and the other is on the opposite side of the reservation. The chief objection to this plan is that access to the cars operating on the right hand track is not easy. Another common arrangement of the center reservation type is one in which there is a track on each side of the reservation. When the trees on each side of the reservation are lindens, maple, elms or chestnuts, the maximum distance between the nearest rail and the trees should be not less than 10 ft.; otherwise it will be necessary to trim the trees so much as to injure their appearance. When the two tracks are placed on the same side of the reservation the width of the roadway should be 33 ft. to allow carriages to pass. When the tracks are separated by the reservation, 23 to 24 ft. will answer.

Another construction is where the tracks are on a reservation on each side of the street, in some cases each track being flanked by two rows of trees. In Munich an interesting type of center reservation is employed on the Agnes-Bernauerstrasse. This street is 30 meters wide, of which the first 5½ meters is sidewalk; then comes a wagon road 6 meters wide, a 7 meter reservation for the tramway tracks, a 6-meter roadway, and a 5½ meter sidewalk. The vegetations for the reservation is limited to grass and shrubbery; a somewhat similar arrangement is employed on the Hardenbergerstrasse in Berlin. A most elaborate system of reservation is adopted on boulevards 165 ft. wide between Lille, Roubaix and Tourconig. This boulevard is about 12 miles long and in the form of a Y. On this boulevard, the first 3.5 meters is a sidewalk, next comes a 5.5 meter wagon roadway, then a 8.25 meter reservation lined with trees, for car tracks, a 3.5 meter sidewalk, a 9 meter roadway for automobiles, a 3.25 meter sidewalk a 3.25 meter bicycle path, a 5 meter riding path, a 6.5 meter wagon roadway and a 3.5 meter sidewalk.

Road Making Experiments With Bitumen and Granite.

Some interesting experiments in the use of bitumen and granite in road construction have been conducted by Mr. Francis Wood, Borough Engineer and Surveyor, and are described by him in a recent issue of an English contemporary, The Surveyor, as follows: This experimental work, by the way, has been the subject of a number of misleading news items in the daily press in this country.

The method of road construction is the result of numerous experiments conducted over a period of four or five years. It is an evolution of Macadam's methods. Macadam conceived the principle that stones broken to a size of 2½ in. and laid 6 in. or more in depth would interlock and form a good road; Telford later on saw the defects, and on the top of the macadam laid a coat of fine material. Still later other engineers combined the large stones with small material. Even this does not give at once a stable construction, and the stone has to grind and feed itself with a fine impalpable powder which eventually acts as a cementing agent. The experiments showed that the cost would work out about two and a half to three times the cost of macadam.

As Sir John Macneill many years ago before a commission stated that the weather was responsible for 20 per cent of the wear of the road and the traffic for 80 per cent, it did not encourage a recommendation to adopt a road construction that would cost up to three times the cost of ordinary macadam merely to eliminate the weather effects and so lengthen the life by only 20 per cent. Further scrutiny of the later-day text-books tended to confirm this evidence, and with further data. But superficial examination of macadam roads proved this theory to be misleading and entirely erroneous. A macadam road on a windy day or a very wet day shows that even without traffic the grit and fine material was blown or washed into the channels to a depth of ½ in. The tonnage of slop collected on these days was also much greater than on a dry day, although the traffic was the same.

As a result of a careful examination of the wood paving in Fulham during the past eight years and a census of the traffic and a tonnage of the slop collected in an average week it was conclusively proved that the wear on a wood-paved road is directly due to the traffic, and is a measure of the traffic, and that the weather can have therefore but little effect on the wear. Similar methods were applied to the macadam roads, and it was found that the wear, if the roads had been weatherproofed, would have given off only 300 tons of slop, whereas the actual amount was 3,700 tons, so that it is a liberal allowance to conclude that the traffic is responsible on a water-bound macadam road for 10 per cent of the wear and the weather for 90 per cent. Thus the weatherproofing of a macadam road is very desirable, seeing that there is the prospect of an increase in the life of the road to the extent of nine times that of an ordinary road.

Tar-spraying of the roads has reduced the quantity of slop collected by 3,000 tons, and the above calculation was made after this saving had been allowed for.

In the course of the experiments, too, pitch and dead oil, composites of tar, pitch, bitumen, and other material, and bitumen were used; but the composites and the tar were, almost without exception, failures under heavy traffic. It was with regret that tar had to be abandoned, but a study of the manufacture of tar, its adhesive properties, and so forth, soon brought about the conviction that no reliance ought to be placed on it, and that its nature is against its successful adoption in a permanent road construction, except for those roads which were subjected to light traffic.

A tar-macadam road laid about a month was torn from end to end by the tires of a traction engine, whereas the ordinary macadam road withstood the traffic quite satisfactorily, and would do so for a considerable time.

The successful experiments were with Trinidad Lake bitumen. At first stones of large size were used, and afterwards small material was thought to be the better policy, and a road was laid over two years ago on these lines. It has stood remarkably well considering that it was only 1½ ins. thick on an old macadam road. But it did not justify heavy or continuous traffic. Other experiments on these lines were not encouraging, and the macadam process was resorted to again.

Material of the same specific gravity was essential in order that the stone should be in the same relative positions permanently. The quantity of large stone should be as large as possible consistent with the thickness to be laid and only a minimum quantity of matrix used consistent with the large material being held in position.

Bitumen is a material that is not generally understood. There are all kinds on the market, the majority of them, by their nature, being quite unsuited for road-making purposes. The Trinidad Lake bitumen is a natural substance, and its composition is of so even a character that one section is a replica of another. It has to be specially treated and prepared for this process.

Granite being a well-known wearing substance, and the matrix approximating closely to a material which has stood traffic wear for 17 or 18 years, this material was substituted, so that there is a combination of two well-known wearing substances.

The material is laid on a scarified macadam surface, brought on to the job hot, rolled by an ordinary steam roller, and about 500 yds. can be laid complete for traffic in one day. A section 14 ft. wide was laid through a roadway 32 ft. wide, the edges being unsupported except by the ordinary macadam. Traction engines, motor lorries and motor cabs are traversing this road daily, and there is not the slightest deterioration of the surface.

The cost in Fulham has been between 3s 6d and 4s 6d per superficial yard, and it may be mentioned that the old macadam from a road has been re-used on one road.

Contract No. 37, New York State Barge Canal, has been awarded to the Pipe and Construction Company of Philadelphia, at $2,323,998. The contract is for dredging a channel in the Oswego river, constructing locks Nos. 5 and 6, dams, bulkheads and other structures.

Road Foundations of Cinders, Logs, Plank and Slag.*

The improved roads of this country having foundations of material such as gravel, cinders, broken field stone, brickbats, etc., comprise only a small percentage of our total mileage of improved roads. Broken stone, brickbats, gravel, and materials scarified from old pavements or roads are the most common materials employed for such foundations, and are sometimes used in brick and bituminous construction as well as for regular macadam surfacing. The thickness usually varies from 4 to 12 ins. of such material well rolled and it should be filled as much as practicable with sand or other suitable material. Unless the subsoil is very porous and well drained, it is essential that this class of foundation have an impervious wearing surface. This is especially true of the regions where a cold winter climate prevails, as they would then also be subject to the disintegrating action of water and frost.

Other miscellaneous foundations consist of logs, forming a corduroy road, or of planks. The latter are more common, as they can usually be built at a less cost and give greater satisfaction. Such foundations should only be used when they are necessarily kept wet all the time, as is the case in localities which have to be protected by levees and have water practically at the surface of the ground continuously. It is not practicable to build any considerable length of corduroy foundation on account of its cost being so much greater than one of plank. A corduroy foundation is made by placing logs in the ground longitudinally with the road and about 3 ft. apart, to act as stringers, the upper surface of these logs to be as nearly level as possible crosswise of the road. Logs are then placed across and as close together as possible and spiked to the stringers.

A plank foundation should be built by having 3-in. by 6-in. stringers placed longitudinally with the road and about 3 ft. apart. These stringers should be sunk in the ground so that their upper surfaces are level and even with the ground in the same cross section. One-inch boards should then be laid across the stringers at an angle and spiked to them, on top of which another layer of 1-in. boards should be laid across at the reverse angle and all spiked together. This foundation is then ready to receive the surfacing material, the thickness of which will vary according to the usual governing conditions.

All kinds of slag from iron and steel furnaces and ore smelters have been successfully used in building the foundations for roads. Slags are usually considered purely waste products, and consequently the producers are glad to get rid of them, and will sell them at a price lower than stone or other hard material can be obtained, and this has resulted in the use of slag to a very great extent for road building in localities not too distant from slag dumps.

The slag is usually taken in the crucible or pots in its molten state on a tramway from the furnace plant to where it is dumped. There it accumulates in great piles and is allowed to cool, when it becomes practically a hill or ledge of stone. These dumps are then quarried similarly as is stone, or powerful steam shovels are used to excavate them, and the slag is thus broken into suitable fragments to be used in the foundation of roads, or by being run through a regular rock crusher all sizes desired may be obtained.

The acid slags will only form a physical bond when consolidated by a roller, but the basic slags not only form a physical bond but a chemical reaction takes place in them when subjected to the conditions which usually exist in the foundation of roads, and results in the cementing together of all of the pieces, thus forming a sort of concrete foundation. Therefore, such material forms an excellent foundation when due care is used in its construction. The results obtained have been so satisfactory that slag is being used for the whole depth of the road surfacing material, including the foundation, and in some cases experiments have been made with other materials to bind the slag surface. After more experimental work has been done in this line, it seems probable that such construction will be successful and economical in some localities.

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*From a report by Vernon M. Peirce, Chief Engineer U. S. Office Public Roads, presented at the Second International Road Congress, at Brussels.

WATER-WORKS AND SEWERS SECTION

Costs of Operating Filters, Reading, Pa., Water-Works.

The following costs of operating two sets of filters of the Reading, Pa., water supply are given in the report of Mr. Emil L. Nuebling, Superintendent and Chief Engineer.

Antietam Filters.—These filters consist of three open sand beds 108x144 ft. put in operation May 11, 1905. The period covered by the costs given is from April, 1909, to March, 1910, inclusive, during which time 1,007,625,974 gals. of water were filtered, or an average of 2,760,619 gals. per day or of 2,600,616 gals. per acre.

During December, January and March 5 beds were cleaned of ice varying from 3¾ ins. to 13½ ins. in thickness and having a mean thickness of 6.3 ins. A total of 427 hours of labor were required and the cost was as follows:

Labor	$84.45
Superintendence	3.08
Total	$87.53

This gives a cost per million gallons filtered of 8.68 cts. The volume of ice removed was 1,512 cu. yds., so that the cost per cubic yard was 7 cts.

A total of 61 beds were cleaned requiring 4,952½ hours of labor scraping and wheeling out sand. The cost of this work was as follows:

Labor	$ 980.18
Superintendence	38.42
Supplies	16.90
Total	$1,035.50

This gives a cost per million gallons filtered of $1.0276 cts. The number of cubic yards of sand removed was 2,270, which gives a cost per cubic yard of 4.5 cts.

Washing sand required 1,319 labor hours and cost as follows:

Labor	$248.80
Superintendence	12.06
Supplies and repairs	699.31
Total	$960.17

In explanation of the high cost of supplies and repairs it should be noted that it involved rebuilding of the portable engine and pumps at a cost of $262.60. The cost per million gallons for washing sand was 95.3 cts. The amount of sand washed was 2,669 cu. yds., which gives a cost of 37 cts. per cu. yd. for washing.

To refill the beds required 47.53 labor hours and cost as follows:

Labor	$941.43
Superintendence	24.85
Supplies	11.39
Total	$977.67

This gives a cost per million gallons of 97.03 cts. The yardage of sand handled in refilling was 2,593 cu. yds., which gives a cost of 38 cts. per cu. yd.

Miscellaneous and general costs were as follows:

Care of grounds	$ 635.77
Analysis	69.90
Watching	96.00
General	290.41
Total	$1,092.08

The cost per million gallons for these items was $1.0851

Summarizing we have the following costs per million gallons filtered:

Removing ice	$0.0868
Scraping and wheeling sand	1.0276
Washing sand	0.9530
Refilling beds	0.9703
Miscellaneous and general	1.0854
Total	$4.1231

Excluding cost of analysis and care of grounds we have a cost of $3.42 per million gallons filtered.

Enginemen Filters.—These filters consist of two open beds 40x55 ft. and were put into operation June 11, 1903. The amount of water filtered was 82,851,990 gals. The cost of operation was as follows:

Item.	Total.	Per mil. gals.
[illegible] removing ice	$ 14.71	$0.177
504½ hrs. cleaning	94.29	1.137
Care of grounds	38.65	0.466
Analysis	51.83	0.625
General	123.41	1.490
Total	$[illegible]	$3.897

The cost of removing ice was 11 cts. per cu. yd. and of removing sand, 52 cts per cu. yd. Excluding cost of analysis and care of grounds the cost per million gallons was $2.81.

The New 30-in. Cast Iron Conduit from Lake Skaneateles to Syracuse, Syracuse Water Works.

BY M. B. PALMER*

(In 1894 the city of Syracuse, N. Y., constructed works for securing a water supply from Lake Skaneateles. The works comprised a dam, gate house and intake at the lake, a cast iron pipe line to Syracuse and a storage reservoir in Syracuse, and an improved distributing system. In 1908 work was begun enlarging this original supply by a second conduit and a stand pipe. This new work is the work described by Mr. Palmer in the following paragraphs.—Editors.)

The present water supply from Skaneateles Lake was begun in 1894, the population then being about 100,000. The supply furnished by Conduit No. 1, was then about 13,600,000 gals., and the consumption considerably less than 10,000,000 gals. per day. In the diagram Fig. 1, is shown graphically the supply received from Conduit No. 1 and the future supply from both conduits together with the curve of the probable consumption. It is proposed to let Conduit No. 2 flow directly into the standpipe and such portion as is not consumed by the High Service system will overflow from the standpipe into Woodland Reservoir. (This is the only reservoir in the city used for water supply purposes, the old reservoir being used for play ground and swimming pool). As the standpipe overflow is 108 ft. higher than Woodland Reservoir, the flow into the former will be much less than into the latter It is estimated that the combined supply to the city will be about 23,300,000 gals. per day which will decrease somewhat from year to year, while the consumption will increase approximately as shown by the consumption curve. When the consumption will have become as great as the supply (shown about the year 1924) it is planned to turn the flow of both conduits into the reservoir and as often as it is necessary turn the flow from the reservoir into the standpipe long enough to fill the latter, then back into the reservoir again. The available capacity of the standpipe is 1,200,000 gals., and flowing at the rate of 420,000 gals. per hour, the second conduit will fill the standpipe in three hours. The capacity of the standpipe is sufficient to supply the High Service system for a period of about 6 days.

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*Assistant Engineer, Bureau of Water, Syracuse, N. Y.

View of Standpipe House, Syracuse Water Works.

Material for Conduits.—Large conduits are built mainly of cast iron, steel, reinforced concrete and wooden staves bound with iron hoops. Cast iron is the most used except in the far west where the cheapness and lightness of wood make it desirable for conduits in the mountains. While cast iron will corrode to some extent, corrosion takes place much slower and when free from stray electric currents it seldom becomes a serious matter. It has long been a standard for distributing mains and for conduits 36 ins. and under in diameter and has given good results. Mr. Cavallier of France reports that the conduits which supply the water to the great fountains in Versailles were laid in 1685 or 225 years ago. This evidence, with numerous other instances, would indicate that with proper precautions no practical limit can be given to the endurance of cast iron pipe. One of the heaviest cast iron conduits built is in Scranton, Pa., where a 48-in. line, three miles long has recently been completed. Parts of this line are under a head of 600 ft. and the pipes are 2 ins. thick.

About 20 years ago, conduits made up of riveted steel plates became quite popular. Steel is cheaper in first cost and much lighter to haul than cast iron. It is especially suited for very large sizes and for heavy pressure and when a reliable coating is found it will doubtless become very popular. As mentioned below, where the coatings have failed the steel has deteriorated rapidly. On account of the roughness caused by laps and rivet heads, a 38-in. steel pipe will carry about the same amount of water as a 36-in. cast iron pipe.

The second conduit from Hemlock Lake to Rochester is of a 38-in. riveted steel pipe varying from ¼ to ⅜ in. in thickness. After being in use some ten years leaks began to occur and the city has spent considerable time and money investigating the cause and repairing leaks. It has been found by inquiry that numerous other steel conduits have given the same trouble from corrosion which seems to occur in steel much more than in wrought iron.

The first Syracuse Conduit (which is of cast iron) was put in service in 1894 and recent examinations of the interior made at several points show that the pipe is very free from corrosion or pittings and the coating is apparently in as good condition as when laid.

The fact that a second conduit of cast iron was certain to give a very long service while the life of a steel one is doubtful led the authorities to adopt cast iron although the cost was probably about 30 per cent greater

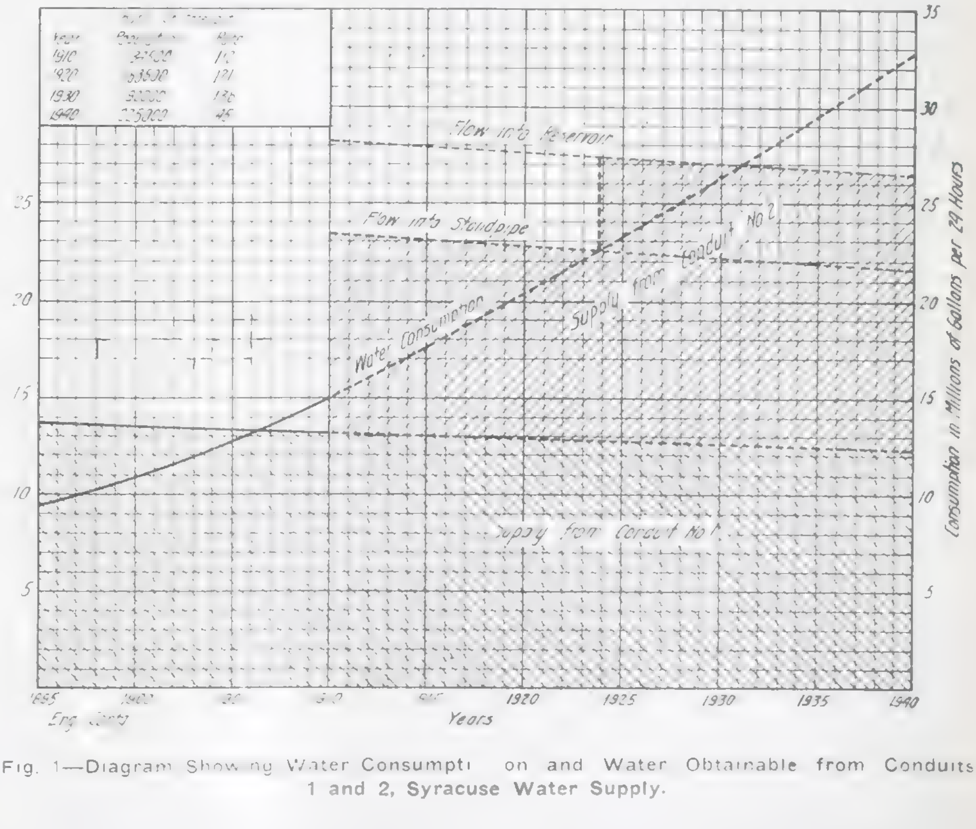


Fig. 1—Diagram Showing Water Consumption and Water Obtainable from Conduits 1 and 2, Syracuse Water Supply.

Size of Conduit.—A study was made as to the most economical size of conduit to lay. The diagram, Fig. 1, shows the probable length of time that a second 30-in. line will serve the city, which is shown as about 21 years. (Since this diagram was made the Federal Census has been taken and the population of the city found to be 137,200 instead of 134,000, as estimated, but it is quite probable that the "rate" or consumption per capita per diem used in the diagram is high enough to balance any underestimate of the population.) A conduit smaller than 30 ins. in diameter would supply the city for so short a period that the small amount saved would be poor economy.

It was found that a 33-in. line would give a considerable larger flow with a less proportionate increase in cost, but inasmuch as this would be investing funds that will be of no value until over 20 years hence and in the meantime a dollar invested at 4 per cent will considerably more than double itself, it was deemed wisest not to go beyond a 30-in. size.

Thickness of Pipe.—A study of the thickness of 30-in. pipe recommended by several associations and municipalities for different heads was made, several of which are shown graphically by Fig. 2. It was found that the general average of thickness follows closely the formula:

$$\text{Thickness} = \frac{(p + p')\,r}{3{,}300} + 0.25 \text{ in.}$$

Where p = static pressure in pounds per sq. in.
p' = pressure allowed for water hammer = 80 lbs.
r = radius of pipe = 15 ins.
0.25 in. = allowance for eccentricity, etc.

It has been found by experience that the lightest weight 30-in. pipe that it is practical to handle on cars and over rough roads is ⅞-in. thick. According to the above formula, this thickness is sufficient for a head of 130 ft. For greater heads, the thickness was increased in proportion to the increased pressure (See diagram Fig. 3). The different classes were made to differ by 1-16 in. each, beginning with Class "*A*" as the lightest and extending to Class "*K*" which was 1½ in. thick, and subject to a head of 480 ft. The static head obtained by closing the valves at the lower end of the conduit was used. The 42-in. pipe used between Skaneateles and Willow Glen was 1 in. thick. No part of this line is under a head of over 25 ft.

When Conduit No. 1 was built, the Legislative act permitting the city to construct that pipe line and take water from Skaneateles Lake, permitted only a 30-in pipe. From Skaneateles to Willow Glen, a distance of 7,500 ft., the only route for a gravity conduit is in the lowest part of the valley following closely the Skaneateles Outlet Creek. As there is only about 7 ft. fall in this distance, in order to keep below the hydraulic grade line, very deep cutting was necessary. Being close to the creek and through quicksand, clay, sand and gravel, the work was so expensive that the contractor soon "went broke" and the work was completed by the city at a cost of about $200,000, or $30 per foot, exclusive of cost of pipe.

View Showing Pipe Crossing Ravine, Syracuse Water Supply.

In order to avoid a repetition of this heavy cost on Conduit No. 2, a study was made of the grades necessary by using a larger pipe as far as Willow Glen. (The Legislative act permitting construction of the second conduit does not restrict the size of pipe). Figure 4 shows the number of million gallons per day that 30, 33, 36, 40 and 42-in. pipes will deliver with falls ranging from three to ten feet in the whole distance (7,500 ft.). It was planned to provide a pipe laid at such a grade that its capacity would be about 10 per cent greater than that of the balance of the conduit so that when both lake and reservoir are low, the pipe in question will always deliver water to Willow Glen as fast as the rest of the conduit will carry it away. In other words, the hydraulic grade line will always be above the pipe at Willow Glen. A connection has been made there to enable a test of the actual elevation of hydraulic grade, being made from time to time. It was decided to use a 42-in. pipe, and assuming the flow of the conduit to be 14,800,000 gals., and adding 10 per cent gives 16,280,000 gals. as the required capacity of the 42-in. Referring to the diagram, Fig. 4, we find that a fall of 4½ ft. will be necessary, and the pipe was laid to this grade, excepting at the upper end where the line is all 12° curves, an additional fall of 10 ins. was put in to overcome this resistance. Thus, the pipe for Conduit No. 2 starts at Skaneateles Gate House with the tops of the pipes at the same elevations and descends only 7½ ft. to Willow Glen, where the old conduit descends 21 ft. in the same distance, thus saving an average of 8 ft. in depth of trench in bad material. The contractors were fortunate in having a dry season. This part of the work was done between August, 1909, and January, 1910. Considerable quicksand was encountered in the bottom of the trench, but by using a double course of close sheeting well braced and kept driven below the excavation, no unusual difficulties were met other than the slow excavation by hand of the quicksand and clay and the large amount of pumping that was necessary to keep the trench unwatered.

Change of Line.—When the first conduit was built, a right-of-way generally 60 ft. wide was obtained. On the steep side hill in Martisco known as "The Alps" it is 100 ft. wide. The first conduit was laid in the center of the right-of-way. The second conduit was laid parallel to and fifteen feet from the first one, except in two places where new locations were made, viz: In the outskirts of Skaneateles Village, beginning at Station 30 and extending to Station 52 the new line is located farther away from the creek and on a straight and shorter line, the saving in distance being 275 ft. The other change was opposite the Village of Mottville, beginning at Wickes Paper Mill, Station 100 and extending to Long Bridge, Station 150. The old line, in this section is located in a very restricted valley between the creek, railroad and high rocky bluffs for part of the way, and in the bottom of a narrow head race and lower down in a narrow highway. To construct a second line alongside the first meant a lot of rock excavation in water and very restricted places to place excavation and store the pipe. The new location is along a highway where there is plenty of room and thence across farm land and meeting the old line at Long Bridge. There was no rock on either of the new locations. An investigation of the route through a section midway on the line, locally known as "The Alps" was made with a view of finding a cheaper line. The present route is along a very steep and rocky side hill for a distance of one mile. The Auburn Branch of the New York Central R. R. is located one-fourth the distance up the slope and the pipe line about two-thirds the distance. When Conduit No. 1 was built, it was necessary to build long stretches of heavy retaining wall to support the pipe and embankment where it crossed numerous gulleys. At that time, a roadway was constructed along the slope just above the pipe line for the purpose of delivering pipe and materials. It was found that the cheapest plan was to locate Conduit No. 2 generally along the above mentioned roadway. The top of the hill was far above the hydraulic grade line and consequently not to be considered and the bottom was so low, wet and soft as to call for 40 per cent heavier pipe, the purchase of a new right-of-way, two extra railroad crossings and the construction of a line through soft wet land. The line was built along the roadway called for the excavation of a great deal of rock, the building of considerable retaining wall and the building of the line in very restricted places.

Gate Valves and Air Valves.—Located about two miles apart along the line and where possible on summits, are small brick houses containing 30-in. gate valves and 4-in. air valves. The gate valves are of the Eddy type of modern design and are operated by a wheel on a bevel gear. Each valve is provided with two 8-in. by-passes to relieve the pressure while closing the large gate. Where the gate houses are not located on a summit, only one air valve was placed in the gate house and that on the lower side of the valve. Where the gate houses are on summits, there is an air valve on each side of the gate valve. The air valves are provided with a 4-in. gate valve between the main and the air valve to shut off the water and repair the air valve when necessary. The air valves were made from a special design by Consulting Engineer Mr. Howard Soule and were made by the Eddy Valve Co. They are operated once every 48 hours by a patrolman who walks the line and opens the air valves to let out the air. The western half of the line is patroled one day and the eastern half the next. Considerable air is usually found at Earll's Gate House, Station 230 toward which the conduits rise for a distance of 7,000 ft. on one side and 14,000 ft. on the other. The farther the water has flowed through the conduit the less air is given off at summits.

Bloff-Offs.—At each depression in the line, a blow-off branch is located of which there are six on the old and seven on the new conduit. The tee-branch on each blow-off is so constructed as to draw from the lowest point of the conduit. The blow-off branches vary from 6 to 10 ins. in size. Each is provided with a gate valve located in a brick and concrete manhole having special steel cover doors that can be securely locked. The end of each blow-off pipe is embedded in a heavy masonry receiver designed quite similar to the end of a masonry culvert. Some of the blow-offs are under such a head that the flow through them is extremely great.

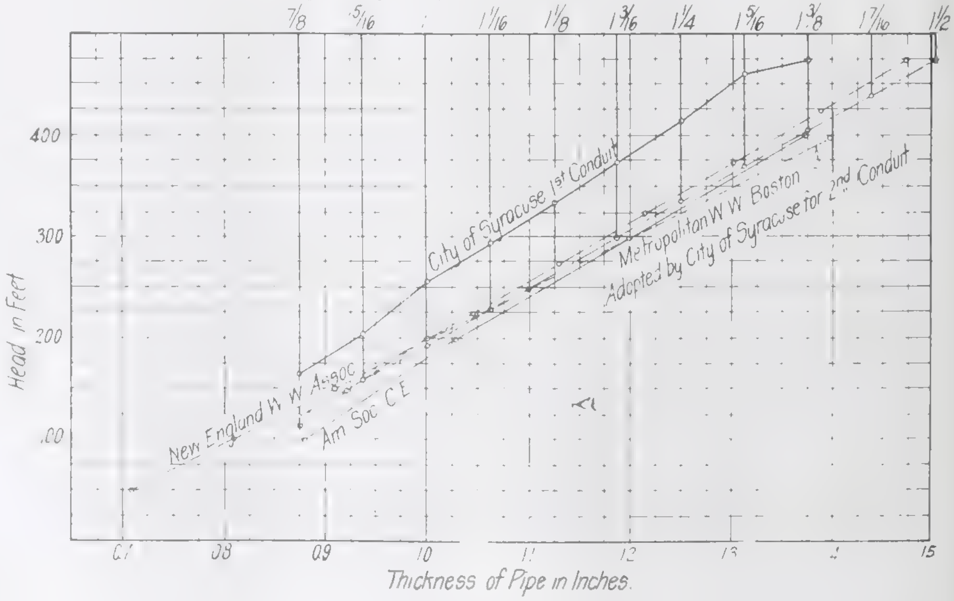


Fig. 2—Curves Showing Thickness of Cast Iron Pipe Used by Various Associations and Municipalities.

Ravines.—The conduits cross three ravines which have very steep slopes and are from fifty to one hundred ft. deep. They are known as Martisco, Camillus and Geddes ravines. Practically the same method of construction was used in the construction of Conduit No. 2 as with Conduit No. 1, except in Camillus Ravine. The pipes in all cases are laid generally parallel to the surface and the short vertical curves are made by using special curved pipes made in 8-ft. lenghts and having a radius of 34½ ft. The slopes of the ravines average about 40° to 44° with a horizontal and three lengths of curved pipe were used at top and three at bottom of each slope (with slight exceptions). To take up the outward thrust on the curves, the pipes were embedded in concrete. In Camillus Ravine was found a thin ledge of shaly rock under which was a soft material for considerable depth. When Conduit No. 1 was built, this rock was dug through before it was known about the soft material underneath (mostly silt and sand) so that it was deemed necessary to place the pipe in concrete on piles. With Conduit No. 2, the rock was not cut through and the pipe was laid in concrete with a widened base. Below this point the stream bed is paved with heavy stone to prevent erosion.

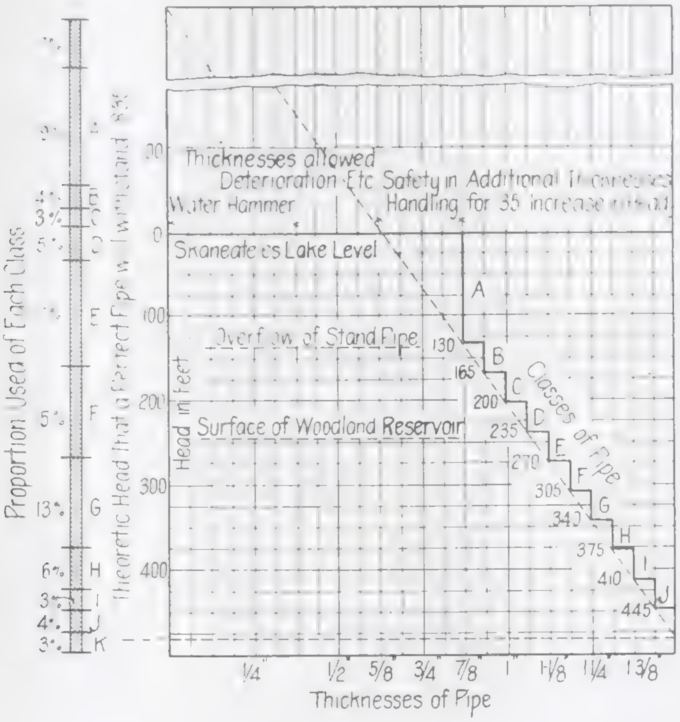


Fig. 3—Diagram Showing Thickness of Cast Iron Pipe, in Syracuse Conduit.

Manholes.—Distributed fairly uniformly along the line and carefully referenced are fifteen manholes. They have covers bolted on which, when the pipe is empty, can be removed to allow a man to enter and make examination of the pipe, if necessary.

Cross-Overs.—Three cross-overs were built connecting Conduits 1 and 2 and at the north end of the reservoir the arrangement of pipes is such as to form a fourth. It is planned that should a leak or break occur in either conduit that the section containing the break could be shut off by means of the gate valves and the cross-overs valves opened and thus the water will flow in both conduits all the way except the section which is out of commission where it will flow in one. In this way a much greater supply will be delivered to the city while repairs are in progress than would be if one whole conduit were out of commission.

Grades and Curves.—A profile of the line was plotted to a large scale and the grades laid out on this profile. Commencing at Willow Glen (the beginning of the 30-in. pipe) the grade is continuously descending to the first blow-off and then continually ascending to the first gate house containing gate and air valves. From there the grade descends to the second blow-off and so on for the whole line. This is done to avoid "pockets" where air can collect in the pipe. The rates of grade and depths of cut are such as to give a cover of 4½ to 5 ft. In some 20 places where hollows were crossed, it was necessary to cover the pipe with embankment. Where marked changes of grade occurred vertical curves were used to avoid a sharp angle in the line. All curves, both vertical and horizontal (excepting at ravines), are made by slight deflections at the joints between pipes. The sharpest curves used on the 42 in. pipe was 12° and on the 30-in. line a few 20° curves were used. Most of the curves ranged from 5° to 10° curves.

Culverts.—There are 16 small culverts on the line at nearly all of which the pipes are in embankment. In nearly all cases, the culverts were extensions of the culverts on Conduit No. 1 and for this reason the extensions were made of the same class of work, i. e., a good grade of rubble masonry.

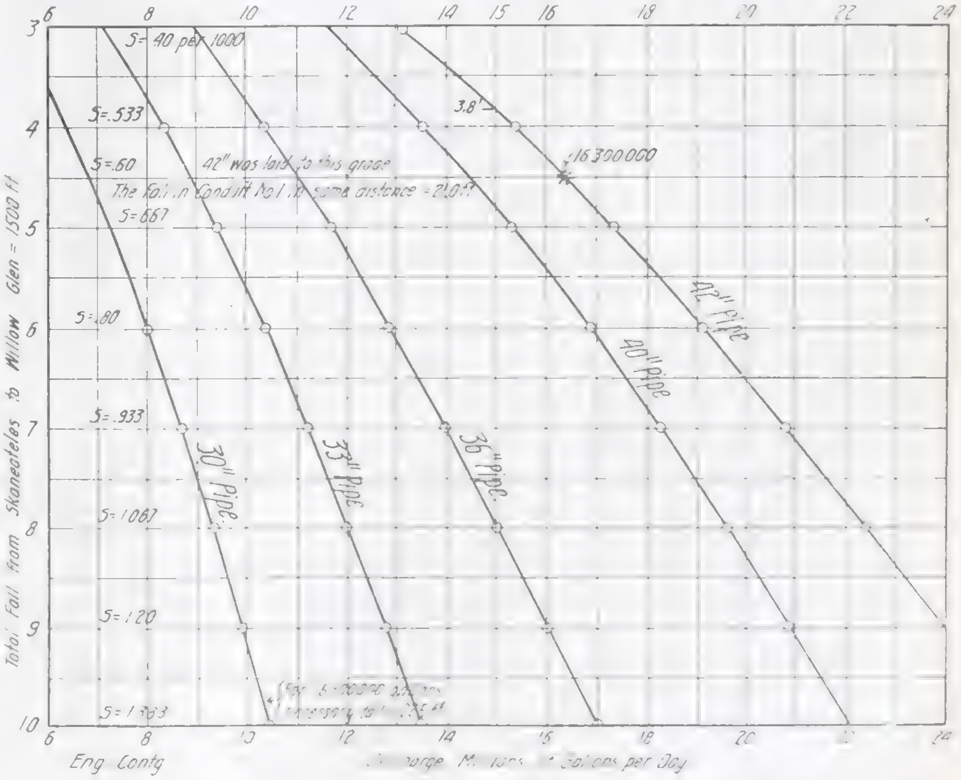


Fig. 1—Diagram of Discharge from Various Sizes of Pipe With Various Slopes

Trenching and Laying.—All the work of constructing Conduit No. 2 was done by contract except in the gate houses at Skaneateles and at the reservoir. Only one classification was made of all materials excavated in trenches or borrow pits. Contractors were furnished with the quantities of earth, hard pan and rock given in the final account of Conduit No. 1. A uniform section having a bottom width of 4½ ft. and side slopes of 1 on 6 was paid for. For the 42-in., a similar trench but 1 ft. wider was allowed. The trenching was done largely with teams and drag scrapers to a depth of 4 to 6 ft. and the balance excavated by hand. The trench was deepened and widened for a length of 4 ft. at each joint to give the calkers room to lead and calk the joints. The pipes were laid to line and grade after the usual practice of laying sewers. Wooden blocks were used to support the pipes in the trench and wedges to keep them to grade and line. Pure pig lead was used in the joints. After a stretch varying from ½ to 2 miles long was calked and before it was backfilled, the ends were closed with pipe plugs and the pipe filled with water and pressure applied with force pumps to test the pipes for air holes, cracked pipe and leaky joints. A pressure about 10 per cent greater than the static pressure from Skaneateles Lake was applied, and while the pressure was on the line was carefully examined for leaks. All joints were required to be tight before acceptance, after which the trench was backfilled. Teams and drag scrapers were used largely for backfilling.

High Service System.—The topography of the City of Syracuse, while quite level in the business section, is partially surrounded with hills. The highlands lie on the northeast, southeast and southwest quarters. The business section is about 404 ft. above sea level and the hilly portions range from 100 to 250 ft. higher. Woodland Reservoir, located in the southwestern part, is about 218 ft. above the business section which gives a hydraulic pressure of a little over 90 lbs. per sq. in. The hilly section to the northeast is not as high as the others and fortunately is well served with the present reservoir. This is largely true of the section to the southwest excepting the extreme southern part which is known as Elmwood. Syracuse University is located on the remaining hill in the southeastern section and is surrounded by a large residence section, a large portion of which is too high to be served by the reservoir. The last two years the consumption of the city has exceeded the supply and the reservoir has been at a low stage. The last six months of 1909 it has been so low as to necessitate closing the gate valves in the distribution system, thus separating this section from the balance of the city and pumping from the lower section into the upper. The rapid growth of the university causing a marked increase in population of this section has made the High Service system a necessity. For some time past the general plan for supplying the High Service has been to construct a second reservoir at an elevation of from 100 to 125 ft. above the present one. When the writer was first engaged on this work, the question of reservoir sites was first taken up. Two sites were investigated, one on Onondaga Hill and the other near Split Rock. The former is much nearer the city and a better site than the latter. Topographic surveys and maps of both were made and about 120 wash drill borings were made on the Onondaga Hill site to obtain an idea of the depth and contour of the rock. Figure 5 gives an idea of the contour of the site and shows the proposed embankments. It was found that a reservoir of the size shown would necessitate a great deal of rock excavation and cost about $300,000. The area of water surface would be 14.9 acres and the volume 92,000,000 gals. As an alternative, plans and estimates were later prepared for a standpipe of steel or reinforced concrete to be located on the knoll immediately west of Woodland Reservoir. A study of the two projects brought out the following points in favor of the standpipe, which was adopted:

It could be located on present reservoir grounds where the present keepers can operate and take care of it.

For the reservoir a new site and right-of-way a mile long would have to be purchased. The cost of about 2 miles of pipe, the loss from evaporation and seepage on the reservoir would be saved.

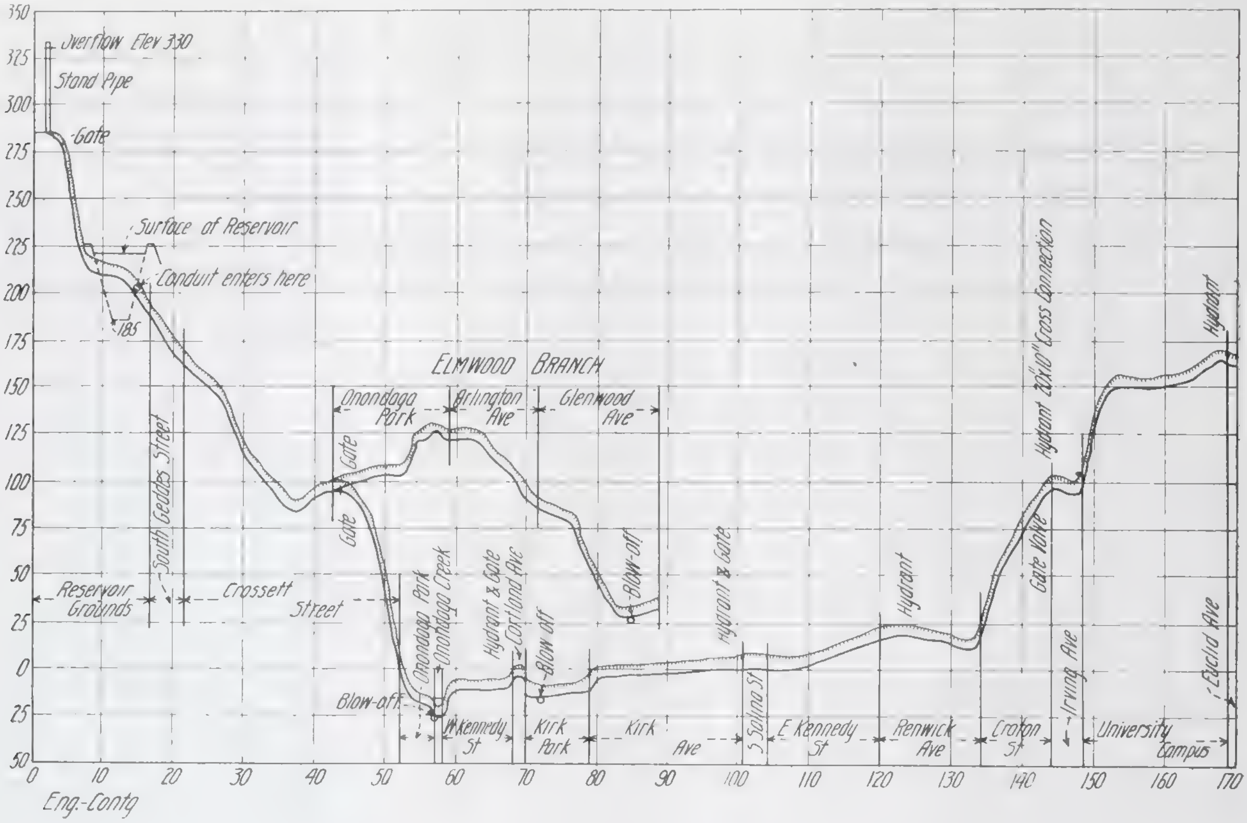


Fig. 5—Profile of High Pressure Line, Syracuse Water Works.

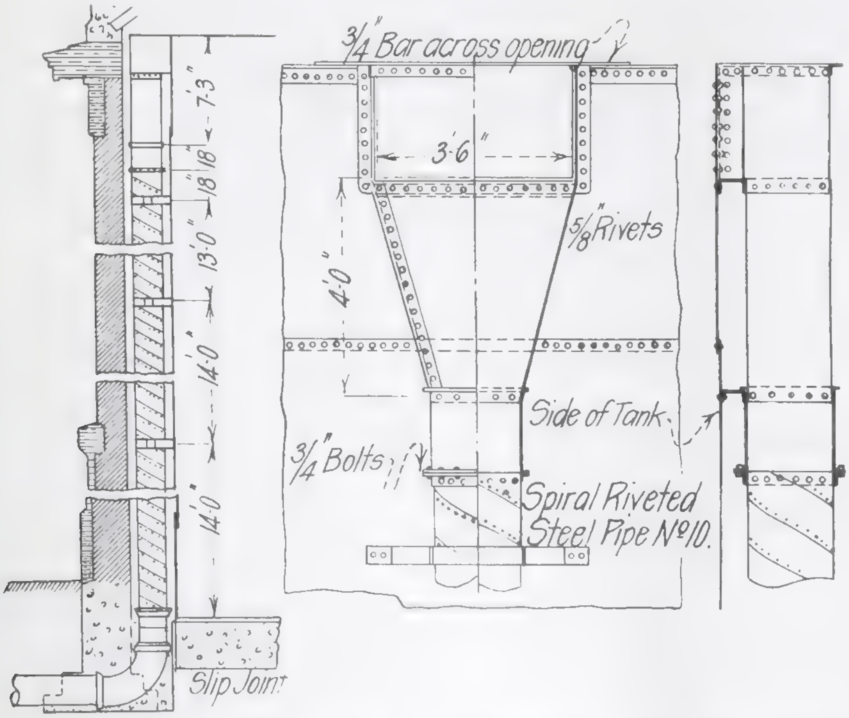


Fig. 6—Diagram Showing Thickness of Steel Plates in Syracuse Standpipe.

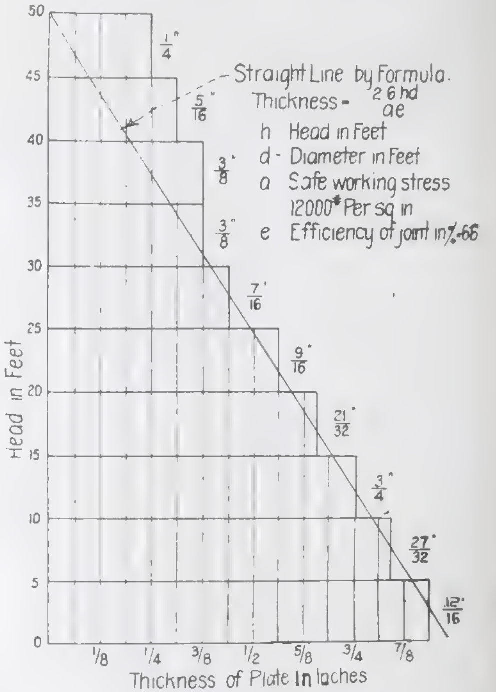


Fig. 7—Outlet Pipe in Standpipe, Syracuse Water Works.

View Showing Method of Laying Cast Iron Pipe, Syracuse Water Supply.

The standpipe could be erected in ¼ of the time necessary to build a reservoir.

The cost of a standpipe would be only $45,000 as against $330,000 for a reservoir and mains leading thereto.

The water surface would be 15 ft. higher in the reservoir than in the standpipe. This additional head is not needed and would decrease the flow of Conduit No. 2 by some 10 per cent. The main argument in favor of the reservoir is the additional storage it would afford. This storage would be available for either high or low service systems.

Standpipe.—As soon as it was decided to build a standpipe, a study of these structures in general was made covering especially the causes of numerous failures. It was found that most tanks that have failed were not enclosed and the water in them often froze to great depths, also that in many tanks the steel was of a very poor grade. In others the joints were poorly designed and poorly riveted. Some have been allowed to rust out until they were seemingly standing mainly through force of habit.

Since the increased application of reinforced concrete, several large tanks of this type have been built of this material, one at Attleboro, Mass., being 50x102 ft. anl one at Westerly, R. I., 40x70 ft. A similar design for a reinforced concrete tank was made at the time the present steel tank was designed, but it was thought that the steel would be the safer structure.

The contract for the foundation and casing tower was let to Jas. E. Leamy & Co., and the steel tank to Reeves Brothers Co., of Alliance, Ohio.

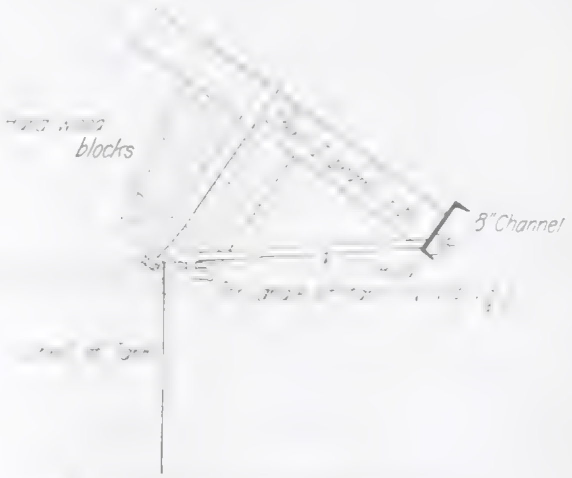


Fig 8—Roof Detail, Syracuse Standpipe

An effort was made to secure the best results possible in the riveting of the joints. Most contractors prefer to use small pneumatic riveters, but unless extreme care is taken the rivet is not fully upset and does not fill the hole back near the head. Also if the plates are slightly sprung it is very difficult to draw them together tight without using a great many bolts and exercising much care. To overcome these, two very probable weak points we specified a jaw compression riveter that would be capable of exerting a pressure of 70 tons on each rivet. Several tank manufacturers refused to bid because they did not care to furnish this type of riveter. A Hanna type of jaw riveter weighing 5 tons was used and operated by compressed air at 100 lbs.

Foundation.—The material on which the standpipe stands is a very hard dry clayey soil, probably capable of safely supporting a load of 3 to 4 tons per square foot. As the load under the tank is only 3,500 lbs. per sq. ft., it was not deemed necessary to put in an elaborate foundation. The foundation under the tank is made of 1:3:6 concrete 2.5 ft. thick and reinforced with ¾-in. steel rods, running in each direction, spaced 2 ft. on centers. The foundation wall under the casing tower is 7 ft. high by 2½ ft. thick, widened out at the base to 6 ft. so as to give about the same load per square foot on foundation as the tank. The two foundations were built separately to do away with shearing tendency around the edge, when the tank is alternately filled and emptied.

Tank.—The steel tank is 66 ft. in diameter and 51¼ ft. high and is made up of 10 courses of plates that build 5 ft. each, except the top course, which is 6¼ ft. wide. Each course is made up of 12 plates. Courses are alternate inside and outside. The bottom plates are of ½ in. thick, 6 ft. wide and of variable length. The bottom plates are joined with a butt strap joint. The thickness of the side plates was determined from diagram Fig. 6, which is based on the formula:

$$\text{Thickness (in inches)} = \frac{2.6\ h\ d}{a\ e}$$

where h = head in feet.
d = diameter in feet.
a = safe working stress = 12,000 lbs per sq. in.
e = efficiency of joints, assumed at .66

The bottom course is 15/16 in. thick and the others of decreasing thickness as shown on the diagram. Double butt strap joints triple riveted were used on the first six courses. Course No. 7 was triple riveted lap joints and the balance of the courses double riveted lap joints. The bottom plates are connected to side plates by a 6x6x¾-in. angles double riveted. The size of rivets used and efficiencey of joints secured in different courses is shown in the diagram Fig. 6. As the tank was likely to be exposed to wind storms before the casing tower was completed, a heavy angle was placed around the top, 6x4x¾ in. to prevent buckling wind when tank is empty.

Inlet and Drain Pipes.—The plan is to have the water supplied by the second conduit branch at the end at the South Gate House and such as is consumed in the High Service system go direct to the distribution mains. The balance will go to the standpipe where it overflows into the reservoir. An 8-in. drain pipe is provided for draining out the mud or sediment that may accumulate in the bottom. The end of the drain pipe is flush with the bottom to facilitate cleaning while the inlet pipe ends 2 ft. above the bottom.

Overflow.— The overflow is placed on the outside of the tank, Fig. 7, so as to leave the inside a smooth cylinder free from any parts where ice can adhere. At the top of the tank is a rectangular opening in the side 3.5 ft. wide by 3.25 ft. high through which the water flows into a steel hopper shaped structure which reduces to an 18-in. spiral riveted steel pipe. At the bottom of the standpipe the pipe changes to 18-in. cast iron which extends down to the reservoir. Probably the greatest flow into standpipe will be 10,500,000 gals. per day, which will give a velocity of 9.2 ft. per second in the overflow pipe which is very high but the line is only 300 ft. long and down a very steep slope.

Casing Tower.—The standpipe is located where it is conspicuous for a long distance in all directions and for this reason it was desirable to erect a structure of as pleasing a design as possible with a reasonable outlay of money. The high cost of a cut stone structure was found to be prohibitive. Several studies were prepared for the masonry shell to enclose the tank and the one adopted is believed to combine a maximum of stability, durability, massiveness and beauty at a minimum cost. The base, cornice and coping are of white cast stone, while the shaft and parapet are of rock-faced vitrified brick. Both the cast stone and vitrified brick are backed with common red brick of a good grade. The tower is circular in form, about 30 ins. thick at the base and 20 ins. in the brick part. The air space between the tank and brick is 30 ins. in which there is a winding stairway to the roof. The cast stone is made from crushed white marble and Portland (Vulcanite brand) cement mixed wet in the proportions to give maximum density and poured into sand molds. The smooth parts of the exterior surfaces are ground with a series of thin carborundum wheels into small parallel grooves, six to the inch. The rock-faced surfaces are obtained by pitching off the edges the same as stone work. Metal ties are used to anchor the stone trimming to the backing wall.

View Showing Erection of Steel Standpipe, Syracuse Water Works.

Roof.—A roof of steel and concrete covers the structure, Fig. 8. The steel frame of the roof is made up of I-beams bent in the arc of a circle. Stiffened expanded metal similar to hy-rib was used to span from lower web of one I-beam or rib to the next. The underside of this metal is plastered and then concrete was deposited on top so as to form a concrete dome shaped roof. There is an opening 3 ft. in diameter in the top of the dome which is surrounded by an iron railing.

Provision has been made to allow visitors to go to the top of the dome, from where a very fine view of the city and surrounding country is obtained.

Contractors' Prices.—The contracts for furnishing all of the cast iron pipe and specials were let to The United States Cast Iron Pipe & Foundry Co. The average cost f. o. b. cars nearest railroad station was $23.60 per ton for the Conduit No. 2 and $22.50 for the high service. The cost of specials in each case was $50 per ton. As the delivery of pipe began some time before the plans were ready for the conduit, it was necessary to let a separate contract for unloading, hauling and distributing the pipe, specials and valves along the line. This contract was let to William Leddy at an average price of 95 cts. per ton. (He had a different price on each section.)

He was furnished with blue prints showing the stations between which different classes of pipes were to be distributed, together with the direction that the hub ends were to be laid. Tall stakes were set along the line where classes changed. The average haul was about 1¾ miles. A similar contract was let for unloading, hauling and distributing pipe for the high service system to The R. S. Weston Truck Co. at 68 cts. per ton. The bids for trenching and laying Conduit No. 2 were asked for on 3 alternatives, viz: For constructing any single section; for any two or more sections or for all four sections. Con-

TABLE I.—CONTRACT PRICES FOR SECTION 1 OF CAST IRON PIPE CONDUIT, SYRACUSE WATER SUPPLY.

Items	Quantities	Price	Amount.
Chopping and clearing, sq. yds.	120	$ 1.50	$ 180.00
Grubbing and clearing, sq. yds.	80	2.00	160.00
Testing pipes under pressure, 1 section	..	1,000.00	1,000.00
Trench excavation, cu. yds.	72,000	.90	64,800.00
Ordinary excavation, cu. yds.	500	.50	250.00
Embankment, cu. yds.	900	.60	540.00
Gravel lining, cu. yds.	20	.75	15.00
Slope wall, cu. yds.	10	3.00	30.00
Box culvert masonry in cement, cu. yds.	30	8.00	240.00
Retaining walls in cement, cu. yds.	20	8.00	160.00
Retaining walls, dry, cu. yds.	20	6.00	120.00
Rubble masonry in cement, cu. yds.	80	8.00	640.00
Cut stone coping in cement, cu. yds.	5	35.00	175.00
Dimension cut stone, cu. yds.	5	35.00	175.00
Brick masonry in cement, cu. yds.	30	20.00	600.00
Concrete masonry, first class, cu. yds.	15	13.00	195.00
Concrete masonry, second class, cu. yds.	50	10.00	500.00
Stone paving, sq. yds.	25	2.00	50.00
Laying 12-in. pipe and specials, lin. ft.	7,550	1.50	11,325.00
Laying 30-in. pipe and specials, lin. ft.	18,600	1.25	23,250.00
Laying 10-in., 8-in. and 6-in. pipe and specials, lin. ft.	100	.50	50.00
Furnishing and laying 4-in. tile drain, lin. ft.	110	.10	11.00
White pine timber and plank in work, M. ft. B.M.	3	50.00	150.00
Hardwood timber and plank in work, M. ft. B.M.	3	50.00	150.00
Hemlock timber and plank in work, M. ft. B.M.	5	35.00	175.00
Wrought iron doors for gate houses, each	2	25.00	50.00
Wrought iron doors for gate vaults, each	2	22.00	44.00
Wrought iron trap doors for gate houses, each	20	18.00	360.00
Wrought iron in work, lbs.	100	.06	6.00
Cast iron in work, lbs.	100	.04	4.00
Steel I-beams, shapes, spikes and nails, lbs.	1,200	.05	60.00
Stone monuments, each	50	2.00	100.00
Tin roofing, sq. ft.	1,000	.11	110.00
Repointing old masonry, sq. yds.	100	.50	50.00
Sodding, sq. yds.	200	.20	40.00
Total			$105,945.00

TABLE II.—CONTRACT PRICES FOR SECTIONS [illegible] AND [illegible] CAST IRON PIPE CONDUIT, SYRACUSE WATER SUPPLY.

Items.	Quantities.	Price.	Amount.
Chopping and clearing, [illegible]	1,150	$ 1[illegible]	$ 1,150.00
Grubbing and clearing, sq. yds.	[illegible]	1.50	555.00
Testing pipes under pressure, 3 sections		1,500.00	4,500.00
Trench excavation, cu. yds.	[illegible]	[illegible]	84,690.00
Ordinary excavation, cu. yds.	[illegible]	.50	1,550.00
Embankment, cu. yds.	[illegible]	.30	2,070.00
Gravel lining, cu. yds.		1.00	50.00
Slope wall, cu. yds.	60	4.00	240.00
Box culvert masonry in cement, cu. yds.	1[illegible]	6.00	900.00
Retaining walls in cement, cu. yds.	220	6.00	1,320.00
Retaining walls, dry, cu. yds.	270	4.00	1,080.00
Rubble masonry in cement, cu. yds.	250	[illegible]	1,500.00
Cut stone coping in cement, cu. yds.	15	25.00	375.00
Dimension cut stone, cu. yds.	1[illegible]	25.00	375.00
Brick masonry in cement, cu. yds.	100	12.50	1,250.00
Concrete masonry, first class, cu. yds.	[illegible]	7.50	412.50
Concrete masonry, second class, cu. yds.	370	6.00	2,220.00
Stone paving, sq. yds.	[illegible]	1.50	645.00
Laying 42-in. pipe and specials	[illegible]	[illegible]	[illegible]
Laying 30-in. pipe and specials, lin. ft.	[illegible]	[illegible]	41,167.50
Laying 10-in., 8-in. and 6-in. pipe and specials, lin. ft.	20[illegible]	.50	100.00
Furnishing and laying 4-in. tile drain, lin. ft.	150	.25	112.50
White pine timber and plank in work, M. ft. B.M.	15	45.00	[illegible]
Hardwood timber and plank in work, M. ft. B.M.	[illegible]	50.00	300.00
Hemlock timber and plank in work, M. ft. B.M.	3	30.00	90.00
Wrought iron doors for gate houses, each	[illegible]	50.00	150.00
Wrought iron doors for gate vaults, each	[illegible]	50.00	250.00
Wrought iron trap doors for gate houses, each	66	10.00	660.00
Wrought iron in work, lbs.	300	.05	15.00
Cast iron in work, lbs.	300	.05	15.00
Steel I-beams, shapes, spikes and nails, lbs.	14,500	.05	725.00
Stone monuments, each	150	1.00	150.00
Tin roofing, sq. ft.	3,900	.12	468.00
Repointing old masonry, sq. yds.	150	1.00	150.00
Painting, sq. yds.	700	.25	175.00
Total			$150,295.50

TABLE III.—CONTRACT PRICES FOR DISTRIBUTION SYSTEM, SPRACUSE WATER SUPPLY.

	Quantities.	Clinton Beckwith.	
Trenching and laying complete 30-in. pipe and specials, lin. ft.	300	$ 1.25	$ 375.00
Trenching and laying complete 24-in. pipe and specials, lin. ft.	4,200	.85	3,570.00
Trenching and laying complete 20-in pipe and specials, lin. ft.	12,100	.90	10,890.00
Trenching and laying complete 12-in. pipe and specials, lin. ft.	4,500	.60	2,700.00
Trenching and laying complete 8 & 6-in pipe and specials, lin. ft.	4[illegible]0	.45	180.00
Setting hydrants	15	10.00	150.00
Removing 8-in. pipe, lin. ft.	1,100	.10	110.00
Testing pipes under pressure, lump sum		500.00	500.00
Concrete masonry, cu. yd.	400	8.00	3,200.00
Brick masonry, cu. yd.	15	12.50	187.50
Steel cover doors for vaults	5	50.00	250.00
Steel reinforcement for concrete, lbs.	1,000	.03	30.00
6-in. vitrified tile, lin. ft.	200	.25	50.00
Total			$22,192.50

TABLE IV.—CONTRACT PRICES FOR STANDPIPE, SYRACUSE WATER SUPPLY.

	Estimated Quantities.	James E. Leamy, Syracuse, N. Y.	
Excavating and grading, cu. yds.	1,100	$ .50	$ 550.00
Class A concrete, cu. yds.	100	17.00	1,700.00
Class B concrete, cu. yds.	600	7.25	4,350.00
Cast or artificial stone trim, cu. yds.	17[illegible]	47.75	8,356.25
Vitrified facing brick, sq. yds.	9[illegible]0	2.70	2,484.00
Backing brick, cu. yds.	560	1[illegible]	5,600.00
Cast iron soil brick, lin. ft.	65	1.00	65.00
Reinforcing steel, lbs.	16,200	2¼	364.50
Expanded metal or sheathing, sq. ft.	4,400	6½	286.00
Doors, door frames, window shutters, lump sum			150.00
4-in. vitrified tile drain, lin. ft.	300	.15	45.00
Steel tank complete, lbs.	430,000	$0.0403	17,329.00
Total			$23,950.75

tracts were let to Lane & Hennessy of Syracuse for Section 1 and to Clinton Beckwith of Herkimer for the other three sections. The items, together with prices, are given in the accompanying tables. The contract for laying the High Service Conduit was let to Clinton Beckwith. This work was done at a price per lineal foot which included cutting and replacing all pavements (about 1,100 ft. of brick and asphalt). The total cost of the work was as follows:

COSTS OF WORK.

Conduit No. 2:	
Pipe and specials	$171,500.00
Unloading and hauling same	19,500.00
Valves (14-30" 3-18" and 7 blow-off gates)	[illegible]
16 air valves	1,000.00
New rights-of-way	2,500.00
Trenching and laying conduit	260,000.00
Miscellaneous work at Skaneateles and Reservoir	6,000.00
Engineering and inspection	40,000.00
Total	$811,000.00
High Service Conduits:	
Pipe and specials	$ 52,000.00
Unloading and hauling same	2,100.00
Valves (24", 20", 12" and 10")	1,800.00
Hydrants and miscellaneous	2,000.00
Trenching and laying pipe—Contract	25,000.00
Trenching and laying pipe (18" overflow done by city)	500.00
Trenching and laying pipe (1,400' of 20" laid by city)	1,500.00
Engineering and inspection	8,000.00
Total	$ [illegible]
Standpipe:	
Foundation and casing tower	$ 24,000.00
Steel tank and steel roof frame	17,400.00
Miscellaneous	100.00
Engineering and inspection	3,500.00
Total	$ 45,000.00
Grand total	948,900.00

Cost of Carpenter Work on a Frame Residence – The following costs are calculated per thousand ft. board measure of lumber used in the construction of a residence at Chicago Heights, Ill., in 1905. Union labor, at 60 cts. per hour for carpenters, was used:

Frame timber	$ 6.00
Bridging (per M. ft. of joists)	3.00
Rough floor and roof boards	6.32
Sheathing	10.40
Siding	[illegible]
Floors, maple, 3-in.	14.00
Floors, Y. P., 3-in.	12.00
Ceiling, Y. P., 3-in.	14.00

Erecting the millwork cost 50 per cent of the value of the material. The above figures are furnished by the contractor, Mr. John McMichaels, Chicago, Ill.

STEAM AND ELECTRIC RAILWAY SECTION

The Cost of the Tri-Borough Subway, New York City.

We gave last week a brief computative basis on the lowest bids received, of the cost per mile of line and per mile of single track of that portion of the New York city Tri-Borough Subway for which bids were received on Oct. 27. The cost per mile of single track reached the enormous figure of $2,000,000. This was for all line including subaqueous tunnels, terminals, crossings under existing subways, etc. Selecting certain stretches of work which involved none of these especially expensive structures and only the normal amount of station construction, briefly straightforward "standard type" subway, the costs per mile of single track ran about $1,200,000. Compared with the cost of the original city subway, which was in round figures $800,000 per mile of single track, this increase of 50 per cent naturally arouses inquiry. In a communication stating the position of the Public Service Commission made last week by Chairman W. R. Wilcox we find an explanation as follows:

> It is believed in view of the cost of rapid transit lines under contracts heretofore made, that its cost is reasonable. The average cost per mile of track of the municipal rapid transit routes now operated by the Interborough was $734,351. In 1907, the President of the Interborough, in a letter to the Rapid Transit Commission giving the reasons why his company was not a bidder on the routes then proposed, stated that his engineers had found that the increased cost through labor, material, methods of construction, etc., would increase the average cost per mile of track by 100 per cent. Within a few days two directors of the Interborough have stated in a conversation that it would cost double the amount if the Interborough subway were to be built now. In the portions of the Triborough not yet under contract the cost on bids submitted and estimates made will be $1,014,000 per mile of track. In other words, the cost per mile of track of the Triborough is only 30 per cent more than the Interborough and nearly 70 per cent less than what officers and directors believe the Interborough could be reproduced for now.
>
> If comparison be made in the cost of construction of the Triborough with the present subway and not with the Interborough figures when it was reluctant to bid, the 30 per cent increase of the Triborough is not an unreasonable amount having in mind the public requirement that construction must be under cover and not in open trenches; that the cost of labor, including employers' liability, has increased and that the size of the structure has been somewhat increased. The increased size of the bore will allow an increase in the width of the cars of the Triborough over the Interborough of 16 per cent. The multiple stations of the Triborough, together with the methods of connection between express and local tracks will make possible the running of trains in less than 1 min. 30 secs., as compared with 1 min. 48 secs., which is the best that the Interborough is able to do because of the delay at stations. In other words, even if trains of the Triborough maintained a headway no better than 1 min. 30 secs., although it is believed possible to operate them at intervals of 1 min. if manufacturers of brakes and signals are able to perfect such devices still further, there will be an increase in the train headway of 13 per cent. Consequently the Triborough, although its cost will be 30 per cent more, will represent an increase in capacity on a conservative estimate of headway and car capacity of almost an identical per cent. In addition to this increase in train capacity of nearly 30 per cent, the stations will accommodate ten cars, which in itself represents nearly 25 per cent additional capacity over what the Interborough is now doing.

Plans for the new power house for the State of New York are so well along that they will be ready for construction about Dec. 1, and bids for the work will undoubtedly be received before the end of the year.

Cost of Car Lubrication On a Mileage Basis.

Lubricating oil is now issued on the mileage basis on the Petaluma & Santa Rosa Ry., of Petaluma, Cal. A contribution by Mr. H. H. Oellig, master mechanic of that company, in the *Electric Traction Weekly,* gives costs of lubrication for the year 1909. The following is the standard issue of lubricants and wool yarn on mileage basis:

Bearings.	Per Bearing.	Total.
2,000-Mile Oiling:		
Armature	½ pt. extra zone paraffine	2 qts.
Compressor	1 qt. extra zone paraffine	1 qt.
Motor axle	½ pt. black train oil	2 qts.
6,000-Mile Oiling:		
Axle journals	½ pt. black train oil	2 qts
Gears	5 lbs. graphite gear grease	20 lbs

Trolley wheels oiled daily.

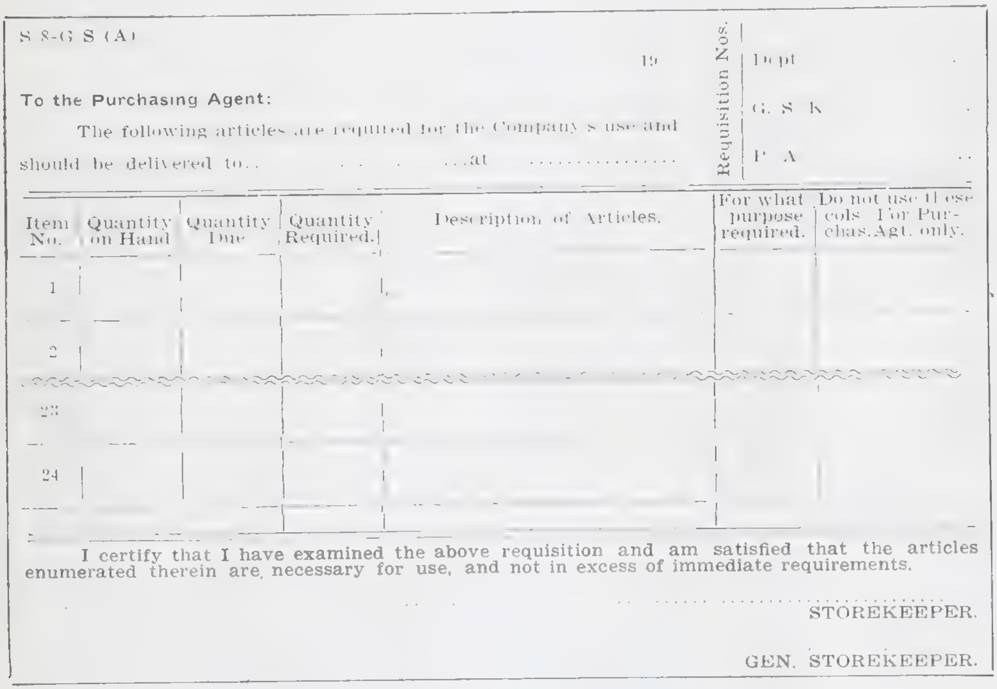
When Car is Overhauled:

Amount of wool yarn in lbs. per bearing:

Armature bearings—Commutator end	¾ lb
Armature bearings—Pinion end	½ lb
Motor axle bearings	1 lb.
Axle journals	2 lbs

The cost of lubricating nine motors during the year 1909 was as follows:

Motor.	Total oil.	Total miles.	Cost per 1,000 miles
51	$ 7.25	40,713	$0.178
53	6.39	31,109	.205
55	10.44	51,888	.201
57	12.56	56,435	.222
59	13.09	49,106	.266
61	9.57	37,409	.255
63	7.69	36,246	.212
65	5.16	17,829	.289
67	1.27	5,463	.232
Totals	$73.42	326,198	......
Average			$0.225



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To the Purchasing Agent:

The following articles are required for the Company's use and should be delivered to............at................

Requisition Nos.
Dept
G. S. K
P. A

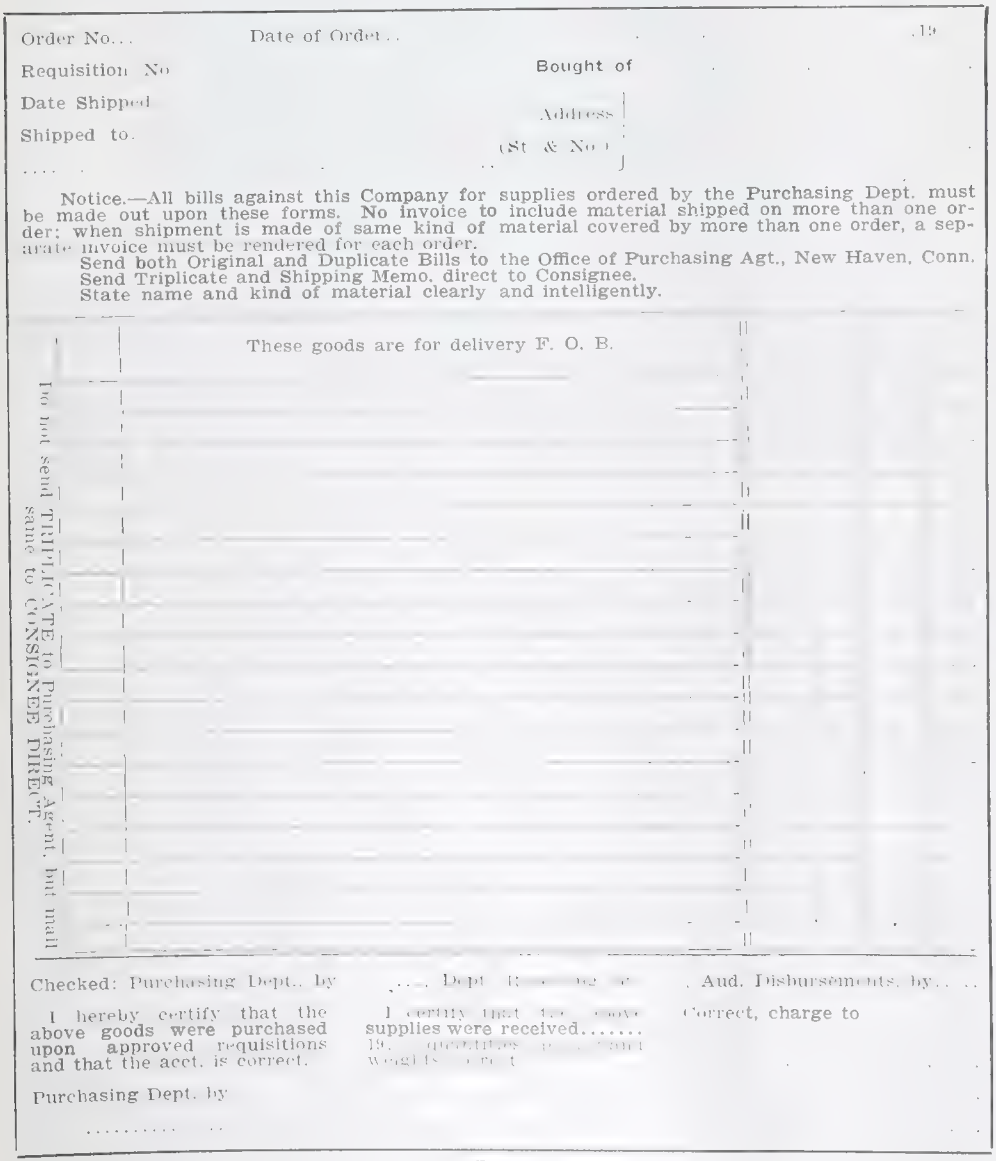
Item No.	Quantity on Hand	Quantity Due	Quantity Required.	Description of Articles.	For what purpose required.	Do not use these cols. For Purchas. Agt. only.
1						
2						
23						
24						

I certify that I have examined the above requisition and am satisfied that the articles enumerated therein are necessary for use, and not in excess of immediate requirements.

.................................STOREKEEPER.

GEN. STOREKEEPER.

Fig. 1.



Order No... Date of Order.. 19

Requisition No Bought of

Date Shipped Address (St. & No.)

Shipped to.

Notice.—All bills against this Company for supplies ordered by the Purchasing Dept. must be made out upon these forms. No invoice to include material shipped on more than one order; when shipment is made of same kind of material covered by more than one order, a separate invoice must be rendered for each order.

Send both Original and Duplicate Bills to the Office of Purchasing Agt., New Haven, Conn.
Send Triplicate and Shipping Memo. direct to Consignee.
State name and kind of material clearly and intelligently.

These goods are for delivery F. O. B.

Do not send TRIPLICATE to Purchasing Agent, but mail same to CONSIGNEE DIRECT.

Checked: Purchasing Dept., by ..... Dept. Receiving by ..... Aud. Disbursements, by.....

I hereby certify that the above goods were purchased upon approved requisitions and that the acct. is correct.

I certify that the above supplies were received....... 19 , quantities [illegible] and weights correct

Correct, charge to

Purchasing Dept. by

....

Fig. 2.

Record Blanks for and Methods of Conducting Stores Department of a Large Street Railway.

BY T. T. LOGIE.*

The methods in use by a large trolley company in conducting its numerous storehouses may be of interest to contractors having large quantities of supplies to handle. The following methods are used by a large eastern company having storehouses which are rated under three classes, namely, large, intermediate and small. These storehouses are directly under the supervision of a storekeeper who in turn is under the general storekeeper. In the large storehouses, those carrying about $100,000 worth of material, the storekeeper is aided by an assistant storekeeper and two clerks. The storekeeper's salary in this class is $20 per week, his clerks receiving from $12 to $15 per week. The intermediate storehouse, carrying a stock worth about $30,000, is conducted by a storekeeper and one clerk The salary of the storekeeper in this class being $17.50 per week and that of his clerk $10. The small storehouse carries a stock of only $3,000 and is usually under the supervision of the master mechanic of that division.

All the materials required for carrying on the work of a division are requisitioned for by the storekeeper of that division. The requisition sheet, Fig. 1, is forwarded to the general manager of the company, who looks it over for unnecessary or expensive articles requiring further consideration. Should there be no such articles he forwards the requisition to the general storekeeper's office. In this office are an inspector of stores and his assistant, who make regular trips to the different storehouses and keep posted on the amount and kind of material carried in each. It becomes their duty to take the storekeeper's requisition and make a transfer order from one storehouse to the other should they find an article on it which some other storehouse has in abundance. In this way a large amount of capital is kept from lying idle and material is less likely to become obsolete before being used. The storekeeper's requisition is then forwarded to the vice president's office for approval and finally to the purchasing agent.

All orders placed by the purchasing agent are made out on triplicate forms, the original going to the consignor of material, the duplicate being retained by himself and the triplicate forwarded to the storekeeper ordering the material. These orders show the general storekeeper's number and the order number. With each order placed, triplicate invoice forms are forwarded on which the material must be billed. When the material is shipped the consignor forwards the original and duplicate invoice to the purchasing agent, and the triplicate to the storekeeper receiving the material. This invoice, shown by sheet, Fig. 2, is checked up in the purchasing agent's office, in regard to quantity, price and discount, and the original form then forwarded to the storekeeper for approval. Should the storekeeper find quantities, quality and weights correct he

---

*South Norwalk, Conn.

C 677.
Stock Card No. Unit...
Article ... . Unit of Price...

RECEIVED			USED							
Req. No.	Date Rec'd.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.	Date.	Quantity.

Fig. 3.

fills in date received, account chargeable, approves the bill and forwards it to the auditor for payment.

A record of all materials taken in or issued out from the storehouse is kept by the storekeeper on cards similar to that shown by Fig. 3. When the material is received a receiving slip, Fig. 4, is made out showing date, description of material, etc. After the original bill has been approved and forwarded to the auditor, the material is entered on the card, Fig. 3, mentioned above, showing the requisition number, date received, unit price and amount received.

As the material is required for use, the man requiring same brings to the storekeeper an order, Fig. 5, signed by his foreman, giving quantity, description of material and purpose required for. After material has been issued the cost of each item is figured and set down, the quantity issued placed on the card, Fig. 3, under the column marked used. The amount chargeable is set down at the bottom of the slip and the slip filed according to date. If an over-supply has been asked for by a foreman a report of the material is made to the storekeeper on form Fig 6 and the material returned to the storehouse. At the end of the month a report of all material issued to the different accounts is forwarded to the auditor, and every six months an inventory of the entire stock is taken, which must check up with the auditor's accounts.

Valuation of Street Railways in Wisconsin.—In the preliminary valuation of the street railway properties of Wisconsin, recently issued by the state tax commission of that state, the valuation for each company is given as follows: Milwaukee Electric Railway and Light Co., $24,400,000; Milwaukee Light, Heat & Traction Co., $6,950,000; Milwaukee Northern Railway Co., $1,650,000; Wisconsin Traction, Light, Heat & Power Co., $1,150,000; Chippewa Valley Railway, Light & Power Co., $1,000,000.

Labor Costs of Handling Coal and Ashes at Locomotive Coaling Stations.

In a recent issue of *Engineering News* Mr. Henry J. Edsall, of the Link Belt Co., presents some data regarding labor costs for operation and maintenance of coal and ash handling stations. The following costs are for large terminal stations. The type of coaling station is not given by the author, but it is assumed to be the Link Belt type.

Coaling Stations.—At Station No. 1 an average of 120 locomotives were coaled per day, and the average amount of coal handled was 550 tons. The cost per day was as follows:

1 foreman, $55 per month	$ 1.80
5 men to unload cars 10 hrs. per day	7.00
2 coal dumpers, 12 hrs. per day	2.80
Total	$11.60
Average cost per ton	$0.021

At Station No. 2 the average number of locomotives coaled per day was 120, and the average tonnage handled 550 tons, as at Station No. 1. The cost per day was as follows:

1 machinery man 10 hrs. per day	$ 1.50
5 men to unload cars 12 hrs. per day	6.50
2 coal dumpers, 12 hrs. per day	2.60
Total	$10.60
Average cost per ton	$0.019

At Station No. 3 the average number of locomotives coaled per day was 76 and the tonnage handled 500. Daily cost was as follows:

½ foreman's time at $66 per month	$ 1.10
1 machinery man at $55 per month	1.80
3 men to unload cars 10 hrs. per day	4.50
2 coal dumpers, 11 hrs. per day	3.30
Total	$10.70
Average cost per ton	$0.021

At Station No. 4 no record is given of the number of locomotives coaled, and it is stated that wages are estimated from those paid at the other stations. It will be noted that the average cost per ton is materially higher than that for either of the other stations. The daily cost as given is as follows:

½ foreman's time at $66 per month	$ 1.10
1 engineer at $55 per month	1.80
½ fireman's time, 11 hrs. per day	0.83
2 machinery men, 11 hrs. per day	3.30

.190 .

Storekeeper:

The following Material has been rec'd this day by.

At .... Signed by

Quantity.	Description of Material.	Name of Shipper.	State Whether Received by Frt., Express or Team.	If Freight State Pro. Number.	Where Stored. State location.

IF MATERIAL IS RECEIVED IN BAD CONDITION NOTE SAME BELOW.

Remarks.

Fig. 4.

REQUISITION ON STOREKEEPER.

No.

Date....................................

TO STOREKEEPER:

Please deliver to bearer the following:

Quantity.	Description.		

To be used for

Foreman.

Charged to account No.........................

Fig. 5.

REPORT OF MATERIAL RETURNED TO STOREKEEPER.

Date........................No.........

To Storekeeper:

The following material received, is returned, not used:

Quantity.	Description.

Material was received from storekeeper on

and was intended to be used for.............

Foreman.

Credited to No.

Requisition No.

Fig. 6.

men to unload cars	4.95
coal dumpers	3.30
Total	$15.28
Average cost per ton	$0.024

Ash Handling Station.—At Station No. 1 ashes were deposited in pits about 50 ft. long and scraped to either of two conveyors, and machinery was operated from 1½ to 3 hours per day. The amount of ashes per locomotive was assumed as 40 cu. ft. The number of locomotives handled was 60. This gives 88 cu. yds. as the amount handled per day. Five day and 5 night men were employed in operating machinery, feeding ashes to some and cleaning fire boxes. Wages were assumed. The cost per day is given as $15, and the average cost per cu. yd., including cleaning fire boxes is given as $0.170.

At Station No. 2 ashes were deposited in hopper and fed directly to conveyors, which had to be operated each time the hopper became filled up.

The average amount handled per day was 120 cu. yds. on the assumption that three 25-ton coal cars hold 120 cu. yds. The number of locomotives handled per day was 75. Cost per day was as follows:

½ of foreman's time at $66 per month	$ 1.10
1 day and 1 night man to operate gates of ash hoppers	3.30
	$ 4.40
6 day and 6 night fire box cleaners, 11 hrs. per day	19.80
	$24.20
Average cost per cu. yd., pits to pocket	$0.037
Average cost per cu. yd., including cleaning fire boxes	$0.202

At Station No. 3 the same style of apparatus was used as at Station 2, the ashes being deposited in hopper and fed directly to conveyors. On the same assumption as to contents of cars (three 25-ton coal cars to 120 cu. yds) 240 cu. yds. were handled per day. The number of locomotives is not given. Following is the cost per day:

½ of foreman's time at $66 per month	$ 1.10
1 day and 1 night machinery man	3.30
1 day and 1 night man to operate gates of hoppers	3.30
	$7.70
10 day and 10 night fire box cleaners	33.00
	$40.70
Average cost per cu. yd., pits to pockets	$0.032
Average cost per cu. yd., including cleaning fire boxes	$0 169

A Comparison of Day Work and Piece Work in Car Repairs.

About two years ago the Third Avenue Railroad Co., of New York city, began to use the piece work system in a limited way in its shops. The experiment met with such decided success that this system of wage payment has since been extended to all departments of repair and construction work. We are indebted to the *Electric Traction Weekly* for the following comparative figures prepared by Mr. McWhirter, superintendent of car equipment of the Third Avenue Railroad Co. After two years of experience with the system it is found, as a general thing, that the cost of production to the company has been decreased 30 per cent and the wages of the men increased 20 per cent. In the following table the wages paid for day work is given for a 10-hr. day:

	Day Work.		Piece Work	
	Rate per man per day	Total cost per job.	Av. rate per day.	Total cost per job.
Scrubbing open cars	$1.60	$6.40	$1.95	$3.90
Touching up and inside painting	2.50	1.25	2.90	.70
Varnishing, first outside coat	2.50	1.25	3.00	1.00
Varnishing, second outside and inside coats	2.50	3.50	2.90	2.90
Painting roof	2.50	1.00	3.10	.75
Painting kicking boards	2.50	.75	3.00	.50
Installing sign guards, steps and trolley boards	2 75	4.95	3.50	3.50
Boring holes for conduit, installing circuit breakers and hangers	2.75	8.25	3.00	6.00
Mounting motors	2.00	4.00	2.25	3.25
Connecting controllers	2.50	1.25	2.85	.95
Making rheostats and trolley taps	2.50	1.25	2.85	.95

Thirty small cars have recently been built on the piece system. Following are unit prices for certain parts of the work:

Building 18-ft. car body	$65.00
Trimming 18-ft. car body	20.00
Building two hoods	3.50
Assembling doors	6.00
Building inside end partitions	7.00
Assembling sides and backs	4.50
Cleaning top and bottom sash rails	3 cts. each

GENERAL ARTICLES AND CLASSIFIED ITEMS

Costs of Masonry and Carpenter Work for a Church Building.

The building was a brick masonry and timber structure constructed at Oak Park, Ill., from September, 1901, to January, 1902, and the following costs are taken from the records of the contractor, John McMichaels, 175 Dearborn St., Chicago, Ill. The work involved rubble masonry foundation walls, concrete footings, brick masonry and timber roof, floors and finish.

Rubble Masonry.—The foundation walls were of rubble masonry about one-fifth of the stone from which were taken from the walls of the old church. The cost per cord of masonry (100 cu. ft.) was as follows:

Materials	Total.	Per Cord
81 cords	$ 619.08	
100 bbls. Portland cement	170.37	
Total material	$ 789.45	$ 9.734
Labor-		
841¾ hrs. masons at 50 cts	$ 420.58	
525¼ hrs. helper at 30 cts	157.55	
296 hrs. helper at 25 cts	73.97	
103 hrs. helper at 20 cts	20.60	
16 hrs. helper at 15 cts	2.40	
Foreman	75.80	
Timekeeper	21.69	
Water boy	12.37	
Night watchman	0.60	
Total labor	$ 785.56	$ 9.698
Grand total	$1,575.01	$19.432

Assuming 5 cu. yds. to the cord of masonry the cost was $3.886 per cu. yd. About 1 2-5 bbls. of cement were used per cord and 1 cu. yd. of sand. Sand was taken from the excavation and is included in labor. It required 105.25 man days to lay 81 cords which is a rate of nearly 0.77 cords per man per day.

Concrete Footings.—A number of small concrete footings in the basement cost for mixing and placing as follows:

395 hrs. labor	$103.49
Foreman	39.20
Water boy	7.16
Timekeeper	6.36
Night watchman	0.15
Total	$156.36

There were 2,400 cu. ft. or 88.9 cu. yds. of concrete in the footings; this gives a cost per cubic yard for mixing and placing of $1.77.

Brick Walls.—The brick building walls averaged 30 ft. in height. All material was carried in hods. The cost of common brick work was as follows per 1,000 brick:

290½ M common brick at $5.70	$1,653.30
340¾ bbls. lime at 45 cts	153.63
42¾ bbls. Louisville cement	24.95
23 bbls. Portland cement	40.00
200 cu. yds. sand	100.00
Total material	$1,971.88
1,328½ hrs. masons at 50 cts	$ 664.25
1,837¼ hrs. helpers at 30 cts	551.21
1,628¼ hrs. helpers at 25 cts	407.06
51 hrs. helpers at 20 cts	10.20
10 hrs. helpers at 17½ cts	1.75
652 hrs. apprentice at $9 per week	122.40
Water boy	3.34
Foreman	176.43
Timekeeper	47.65
Night watchman	43.75
Total labor	$2,028.04

From these figures the cost per 1,000 brick was as follows:

Materials	$ 6.99
Labor	6.79
Total	$13.78

The number of bricks laid per man per day was 800; the rates of helpers' labor to masons' labor was 2⅛ hours to 1 hour; 1 1-6 bbls. of cement were used per 1,000 brick.

Nailing Strips.—The cost of placing nailing strips in cinder concrete floor was as follows:

2,915 ft. B. M. 2x4 in. by 16 ft. at $15.50 per M.	$45.74
42½ hrs. labor at 42½ cts	8.29
36 hrs. labor at 25 cts	9.12
Foreman	2.75
Timekeeper	.0.50
Total	$66.40

The cost per M. ft. B. M. was $22.77. One man laid 149 ft. B. M. per hour. The cost per 100 sq. ft. of floor was as follows:

Material	$1.50
Labor	0.70
Total	$2.20

First Floor Girders.—The costs of the first floor girders was as follows:

3,147 ft. B. M. 10x10 in. Y. P. at $20	$62.94
66 hrs. carpenters at 42¼ cts	28.04
Foreman	1.50
Timekeeper	1.50
Watchman	1.00
Total	$94.98

These girders were pitched for an inclined auditorium floor and one man laid 48 sq. ft. per hour. The cost per M. ft. B. M. was as follows:

Material	$20.00
Labor	10.18
Total	$30.18

First Floor Joists.—The cost of laying 2x10-in. and 2x12-in. joists pitched to an incline for an auditorium floor was as follows:

15,062 ft. B. M. yellow pine joists	$247.49
239¼ hrs. carpenters at 42½ cts	101.54
4 hrs. labor at 25 cts	1.00
Foreman	22.92
Total	$372.95

One man laid 63 sq. ft. per hour. The cost per M. ft. B. M. was as follows:

Material	$ 16.50
Labor	8.33
Total	$ 24.83

Timber Roof.—The timber roof comprised trusses, valley rafters and purlins.

Lumber:	
15,428 ft. B. M. lumber	$332.14
20 hrs. unloading at 45 cts	9.00
34 hrs. unloading at 25 cts	8.50
1½ hrs. unloading at 30 cts	0.45
Total	$350.09
Framing Trusses:	
333 hrs. carpenters at 42½ cts	$141.39
Foreman	62.40
Timekeeper	7.08
Night watchman	7.00
Total	$217.87
Raising Trusses:	
132½ hrs. at 50 cts	$ 66.25
30 hrs. at 30 cts	9.00
35¼ hrs. at 25 cts	17.82
48 hrs. at 42½ cts	20.37
Iron foreman	36 00
Foreman	9.00
Timekeeper	1.00
Total	$159.44
Valley Rafters:	
54½ hrs. labor at 42½ cts	$ 23.16
Waterboy	1.45
Total	$ 24.61
Purlins:	
136½ hrs. at 42½ cts	$ 57.18
Foreman	4.40
Timekeeper	1 00
Watchman	1.00
Total	$ 63.58
Grand total labor	$483.45

Summarizing we have the following cost per M. ft. B. M.:

Material	$ 21.53
Labor	31.34
Total	$ 52.87

The cost of material and labor for rafters was as follows:

13,674 ft. B. M. at $16.85	$229.45
339½ hrs. carpenter at 42½ cts	143.84
Foreman	20.05
Timekeeper	5.50
Night watchman	4.60
62½ hrs. labor at 25 cts	15.62
Total	$419.06

These totals give the following cost per M. ft. B. M.

Material	$ 16.85
Labor	13.86
Total	$ 30.71

The work amounted to 40 ft. B. M. per man per hour.

Bridging costs for materials and labor $3 per M. ft. B. M. of joists.

Boarding Roof.—The cost of covering the roof with 1x6-in. D. & M. flooring was as follows:

15,400 ft. B. M. lumber	$252.80
228 hrs. carpenters at 42½ cts	97.88
12 hrs. labor at 25 cts	3.00
Foreman	18.64
Timekeeper	4.00
Watchman	3.75
Total	$380.07

This gives a cost per M. ft. B. M. as follows:

Material	$ 16.00
Labor	8.26
Total	$ 24.26

Ceiling in Rafters.—The cost of beaded out circling securing rafters was as follows:

9,000 sq. ft. ceiling	$315.00
235½ hrs. carpenters at 42½ cts	100.07
35 hrs. labor at 30 cts	10.50
Foreman	13.20
Timekeeper	2.00
Watchman	2.00
Total	$442.77

These totals give the following costs per M. ft. B. M.:

Material	$ 41.00
Labor	14.20
Total	$ 55.20

The amount of ceiling placed was 38 sq. ft. per man per hour.

Flooring.—The cost of 2x6-in. D. & M. flooring was as follows:

14,411 ft. B. M. lumber	$227.58
101¼ hrs. carpenters at 42½ cts	43.05
56 hrs. labor at 25 cts	14.00
Foreman	19.00
Timekeeper	2.00
Total	$305.63

These totals give the following costs per M. ft. B. M.:

Materials	$ 15.50
Labor	5.42
Total	$ 20.92

About 143 sq. ft. of flooring was laid per man per hour.

Summarizing the cost of carpenter work per unit we have the following:

Floor strips in cinder concrete	$ 7.00 per M. ft.
First floor girders	10.18 per M. ft.
First floor joists	8.33 per M. ft
Truss timbers and valley rafters	31.34 per M. ft
Rafters	13.86 per M. ft
Roof boarding	8.26 per M. ft
Flooring	5.42 per M. ft
Ceiling	14.20 per M. ft

A Comparison of Piston and Hammer Drills by a Practical Drill Runner.

According to Mr. James E. Harding in *Mining Science* the hammer drill is much to be preferred over the piston type. The ability of either one of the machines to break ground, however, depends largely upon the man behind it. This is especially true of hammer drills. Mr. Harding says:

The application of hammer drills to flat work, compared to the length of time that power drills have been used for such work, is of recent date. There is but slight difference between the two types of machines when considering the arrangement of valves, etc., the main difference being in the way the power is applied to the steel. In the piston machine the steel is held rigidly in the chuck and the blow is struck by the movement of the entire steel chuck and piston. In the hammer type of drill the steel is held loosely in the chuck and does not move back and forth, but the blow is struck directly upon the shank end of the steel. Right here comes a point in favor of the hammer drill. It will be readily seen that a large amount of power is lost by the friction of the steel moving back and forth in the hole. Also, in drilling holes with a piston, whether up or down holes, much friction develops from the dust in the one and the mud in the other.

In setting up a column or bar for the two machines, much more care has to be used in case of the piston machines on account of their back kick. A set-up oftentimes that would be kicked down in starting one hole with a piston machine will stand for a round with a hammer drill, which has a big vibration but practically no back kick.

After the set-up is made a drill runner will find that there is much difference in the labor of starting holes. Every man who has run a piston machine knows the pleasure of holding a dancing steel against a slanting surface, with either a chuck wrench or another steel, while a hole is being collared. This difficulty is practically eliminated in a hammer drill, owing to the fact that the steel is not moving and but little difficulty is found in starting a hole on a badly slanting surface. Then, too, after the hole is collared, the rapidity of the running down is far greater with a hammer machine than a piston.

Practically all the hammer machines made are equipped with hollow steel, through which is introduced into the hole at the bottom, where the cutting is going on, to expel the cuttings, either air or water or a mixture of the two. The use of water or air and water running through the steel seems to be the best, as in that case there is no dust, which has sent so many "hard rock" men to an untimely grave with "miners' consumption." Also this method of cleaning the hole keeps the steel up against clean rock at all times, and the force of the blow is not halted by the steel driving through 2 or 3 ins. of thick mud. Perhaps the greatest advantage of this method of cleaning holes comes in drilling "back holes." More good time and profanity is wasted in twisting or kicking a stuck steel out of a mudded hole than in almost any other one thing in mining. The labor of running the different types of machines is not to be compared.

Mr. Harding recalls an experience in a mine in Cripple creek, driving a crosscut through solid syenite which was much harder than any other rock he has ever worked. In that work no less than 90 pieces of steel were sent up each shift. Sometimes the count ran up to 140. This is about all that one chuck tender can handle in one shift and no chuck tender would care for that amount of work as a steady diet.

The average chuck tender will use on an average of 2 minutes to the change and in making the above number of changes in a shift it is not hard to see where much time has gone. Practically all the hammer machines use no chuck bolt, the steel being merely inserted in the chuck and given a half turn to catch the ratchet lugs on the shank. Changing steel involves not more than 30 seconds by a reasonably active man. Incidentally, not a single hard lift is involved, such as is required in setting a chuck nut home.

All the argument is not in favor of hammer drills. The repair account of the two types of machine is greatly in favor of the piston type. As they are now constructed, the hammer type of machine is rather delicate, and on the other hand, the piston machine will stand more rough usage and abuse at the hands of unskilled or careless and ignorant miners than any piece of machinery.

One case is cited where the repair bill of a single hammer machine for a single month amounted to over $280, caused almost entirely by a poor runner. A much higher order of intelligence is required for a runner of hammer drills than of piston machines. One can crank a piston machine by the sound as well as by the feel, but a hammer drill is cranked practically by ear. It gives out a clear, high-keyed ring when running right, and if too close or too far away from the ground the key immediately changes.

An experienced runner on piston machines often gets into difficulty when he tries to run a hammer machine. An instance of this is given in the following case: It was in the Blue Bird mine at Cripple Creek. A hammer machine of the latest model was operating in the south side of one level and an old 2-in. piston machine was running in the north side. The runner of the hammer machine was an old piston man and the runner of the piston machine had had but very little experience in running machines of any sort. The piston machine more than doubled the hammer machine in footage and in the amount of muck broken, and also the piston machine runner had his round in generally an hour before the hammer machine man. So it shows that the ability of either one of the machines to break ground depends largely upon the man behind.

LETTERS TO THE EDITOR.

The Comparative Cost of Contract and Day Labor Work.

Sir: Referring to the comparisons of costs of the Great Northern and the Northern Pacific tunnels, page 423 of your issue of Nov. 16, 1910: The time interval between these two pieces of work is 11 years and one tunnel is 3,969 ft. longer than the other. These two elements may readily account for material differences in cost.

A better criterion is the difference between a contractor's bid and the cost as done by company forces immediately after the bid is made.

Sometimes contract work costs less than company work. Sometimes the reverse is true. The results depend primarily on the ability and experience of the personnel and origination doing the work, be they of the contractor or the company. The experienced engineers of the country know this, and the costs of individual pieces of work do not deceive them.

A contractor's profit is a part of the cost of the work. Many contractors, through incompetence, fail to earn their anticipated profit, but generally succeed in collecting it through the medium of a jury in the end, in which case the company pays the profit twice. Other contractors do their work right at an economical cost and pocket the loss, if any, without litigation.

How a piece of work may best be done is a matter for judgment and experience and a knowledge of available contractors.

In laying 135 miles of water pipe, a certain railroad company contracted the first 37 miles of it. It laid the remainder itself. Trenching, laying and backfilling for 11-in. wood pipe cost by contract 18 cts. per lin. ft. By company forces it cost, including every charge, 7 cts. per ft. The price bid for laying 12-in. cast iron pipe was 28 cts. per ft. It was laid by the company for 15.4 cts. per ft. A corresponding difference in favor of the company work exists for other sizes of pipe.

This same company installed an up to date crushing plant and turned it over to a contractor at 45 cts. per cubic yard of ballast f. o. b. cars. The contractor lost money, proved in Court that the work cost 60 cts. per yard and secured a judgment for $20,000.

The company then took over the operation of the plant and put 100,000 yards of ballast f. o. b. cars at a cost ranging from 29 cts. to 34 cts. per yard, the average cost being 32 cts.

Yours truly,
J. L. CAMPBELL.

El Paso, Tex., Nov. 18, 1910.

(The time interval of 11 years, which our correspondent mentions, operated wholly in favor of the work done by company forces, as wages and cost of supplies, etc., had decreased in that interval.

The editors have in hand actual detailed costs of railway work covering millions of dollars, done both by company forces and by contract. Their conclusion that contract work averages much cheaper than company work is therefore based upon more data than have ever been in the possession of any analyst of railway costs, so far as they have yet learned. —Editors.)

The Chicago Rules for Measuring Excavation and Concrete Work.

Sir: We have read carefully the "Chicago Rules for Measuring Excavation and Concrete Work," published in your issue of Nov. 16, and we think these rules are of great interest to all contractors and engineers who do any work on a unit price basis, or who are engaged in estimating and computing costs of work.

There has evidently been a serious endeavor to construct formulas, or rules, which shall automatically adjust themselves to the cost of varying classes of work in such a way as to include forms and the extra labor of placing concrete in thin work. There appears to be two fundamental errors in these rules to which we would call attention. One is that of pricing labor as material; the other is that of disregarding the cost of form work as a separate and distinct item in the cost of concrete work. To illustrate this point let us apply the rules to the measurement of a wall 6 ins. thick. It would be measured as one 15 ins. thick. Assuming the unit price of concrete to be say 20 cts. per cu. ft., this would then allow 10 cts. for concrete, and 15 cts. additional, which would be applied say 3 cts. to the extra labor of placing in a thin wall, and 12 cts. for the forms to the two sides; but if the concrete were a richer mix and the unit price was 30 cts. we should get 15 cts. for concrete, 3 cts. for extra labor on same, and 19½ cts. for forms, which would cost the same as in the first instance.

The writer holds that the fundamental law of measurement is, that all quantities of materials and labor should be measured net as finally left in the building or structure, and that all extra labors and waste, etc., should be allowed for in price and not in measurement. It follows from this law, that works of a temporary character should not be measured unless they form a distinct labor item which can be separately measured. Thus we do not measure staging for brick masons or painters, sheeting for trenches, etc.; but we do measure forms for concrete, because they are a separate and distinct operation or labor item necessary to the construction of concrete work. It also follows that work requiring more than an ordinary amount of labor to perform should be priced separately, and not paid for by an excess measurement of the ordinary work, and therefore, a concrete pier 1x1x10 ft. should not be priced as 70 cu. ft. of concrete in mass foundation work according to Chicago rules, but should be priced as 10 cu. ft. at a higher price than the foundation concrete, and forms priced separately.

We think we understand the difficulties in the minds of the framers of the "Chicago Rules" which leads them to eliminate all measurement of forms to concrete work, allowing an excess measurement of concrete to pay for the same. First, that of measuring something that cannot be seen when the building is finished. Second, that there is no established unit of measure for forms, and if board feet of lumber are measured, the engineer is afraid that his owner's interests wil suffer, as he has no check upon extravagant use of lumber. It is the practice of the writer's firm to measure and value all form work by the square foot of surface contact, and we believe that this method is superseding the old method of reckoning by board feet, which is still in use by many firms who estimate form work separately. The square foot of surface does give a definite and unchanging unit to measure. There are always the same number of square feet to center in the under side of a floor, although the lumber used on similar work by different companies may vary.

We think the associations who have adopted these rules will find them a continual source of trouble and dispute, and they would have done better if they had recognized the item of form work as a separate item, and devised a separate method of measuring and valuing it, and if they had constructed some rule which should adjust the price according to the character of the work done, rather than inflate the measured quantity of small or thin pieces of concrete work. We believe that it will not be difficult for an unscrupulous contractor to take an unfair advantage of these rules, and that their endeavors to simplify and codify the measurement of concrete work have added to rather than lessened their troubles.

An instance of the actual working of the rules may be of interest—Assume a reinforced concrete floor slab 100x50 ft. and 4 ins. thick carried by 20 reinforced concrete beams 50 ft. long and 1x1 ft. below the slab, the beams resting on 80 concrete columns 10 ft. high and 12 ins. square. Actual quantity of concrete, 3,467 cu. ft. Quantity according to rules: Floor, 2,500 cu. ft.; beams, 1,000 cu. ft.; add for four angles to each beam 4,000 cu. ft.; add for four chambers to each beam 2,000 cu. ft.; columns, 800 cu. ft.; add for four angles to each column 3,200 cu. ft.; add for four chambers to each column 1,600 cu. ft. Total, 15,100 cu. ft. (Nearly 4½ times the actual quantity.) As another instance—Assume a concrete wall 6 ins. thick, 100 ft. long, 10 ft. high, with ten pilasters 18x18 ins. projection. Actual quantity of concrete 600 cu. ft. Measurement according to rules, 1,550 cu. ft.

We suggest that though the engineer and contractor measure in good faith, it would be exceedingly difficult to convince any hard-headed board of directors, or zealous municipal reformer, who had troubled to look into the matter, of the accuracy and justice of such measurements as the above.

Our object in calling attention to this is twofold: First, that we desire to protest against the possible general adoption of similar codes framed upon wrong lines; and second, we want to call attention again to the fact that form work is a separate item in all concrete work, and until this is recognized, and the contractors and engineers measure and price same separately in unit price contracts, trouble and unfairness to one side or the other is bound to result.

Yours truly,
ABERTHAW CONSTRUCTION CO.,
By Leslie H. Allen

Boston, Mass., Nov. 21, 1910.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association—Secy., C. H. Lichty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy. A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy. Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy. C. W. Hunt, 220 W. 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy. Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy. B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy. J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy. S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy. Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy. E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy. Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H Warder, Monadnock Block, Chicago, Ill.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Frick Machinery. Paper 8½x10 ins.; 48 pp Frick Company, Waynesboro, Pa.

A catalog of traction engineers. It illustrates each of the various types and gives a description in connection. Further examples and descriptions are given of various parts.

Flour City Gasoline Engines.—Paper 5¾x9 ins.; 28 pp. Kennard-Haines Co., Minneapolis, Minn

Describes and illustrates gasoline traction engines for all purposes. Engines of 30 and 40 hp.

Water Motors.—Paper 3½x6 ins.; 20 pp. Chicago Water Motor & Fan Co., 40 Dearborn St., Chicago.

A complete pamphlet containing, besides tabulated information on sizes, speeds and costs, a series of illustrations showing the applications of water motors to various purposes. The size of motor recommended for each purpose is given

Wages and Costs of Materials, Canada.—The following were the rates of wages and prices for materials paid in city bridge work in Toronto, Ont., in 1909:

Wages:	
Bridgemen, per hour	25 cts.
Carpenters, per hour	33 cts.
Foremen, per day	$3 to $4
Inspectors, per day	$3 to $4
Laborers, per hour	22 2-9 to 25 cts.
Painters, per hour	25 cts.
Teamsters, per hour	55 5-9 to 65 cts.
Watchmen, per night	$1.50
Materials:	
Cement, per bbl	$1.28
Lumber, white pine plank (rough), per M.	$22.49 to $31.49
Lumber, white pine plank (dressed), per M.	$25.57 to $28.57
Heavy timbers (rough), per M.	$23.49 to $32.49
Sand, per cu. yd	95 cts.
Stone (crushed), per ton	$1.25
Steel, beams and channels, punched, per lb.	2¾ cts
Steel, reinforcing rods, per lb	2½ to 3 cts.
Steel, threaded rods and bolts, per lb	4 cts

Ditching With Dynamite.—This method is used in land reclamation, especially in swampy country which is overgrown with underbrush, and where the ground is too soft to hold a machine. In digging a ditch 3 ft. deep, 4 ft. wide at the top and 1 ft. at the bottom, it is common to use one cartridge of the strength of 60 per cent Atlas B+ in holes 3 ft. deep and not more than 18 ins. to 2 ft. apart, placed on the center line of the ditch. The cartridge should be placed at the bottom of the trench. About the middle of the line one hole is selected as the priming charge hole, which is loaded with two or three charges to one of which a cap and waterproof fuse is attached. This method may be used in making ditches up to 1,000 ft. in length. The number of holes fired at first, however, should be limited until by gaining experience one can determine the adjustment of the charges to suit the particular kind of ground worked. A wider ditch can be made by placing several rows of charges parallel to each other and from 18 to 24 ins. apart. One advantage claimed for digging small ditches by this method is the cracking, for a considerable distance on each side of the ditch, of the impervious subsoil, which always underlies swamp land, so that the water will drain into the ditch through the crevices. Another advantage claimed is in the fact that the material blown out is scattered over a large area and not piled along the bank, thus forming a levee to prevent the drainage of the surrounding area. In dry soil it is not always possible to explode a line of holes with one blasting cap. It is then necessary to fire by an electric fuse and battery connected with each charge. A portion of the material blown out of the ditch will likely fall back in. This can be cleaned out after the ditch is partly filled with water by exploding charges of a half cartridge of 50 per cent to 60 per cent dynamite every 2 to 3 ft. along the bottom.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

It is now believed that the Oregon-Washington Railroad & Navigation Co., an organization incorporated last week to merge numerous lines of the Union Pacific in the Northwestern States, is planning a bond issue in the neighborhood of $150,000,000. It is probable that the sale of these securities will be postponed for some time after their authorization until conditions are ripe for vast construction work.

Plans for the new power house for the State of New York are so well along that they will be ready for construction about Dec. 1, and bids for the work will undoubtedly be received before the end of the year. The building is to be erected at Albany, N. Y., and will cost about $500,000.

Several large public work contracts are now being advertised. In Canada the Marine and Fisheries Department, Ottawa, Ont., is calling for bids for the construction of a buoy depot at Prince Rupert, B. C. This work includes the erection of a buoy shed and machine shop, power house and reinforced concrete chimney, carbide store, store house, offices, dwellings, etc.; the installation of drainage and water systems, the storage of machinery delivered by the department and the erection of a traveling crane of 20 tons capacity. The wharf to be erected is 405 ft. long and 40 ft. wide, with an additional width of 15 ft. over 105 ft. of its length. The wharf is to consist of concrete piles. In New York State the Barge Canal Board is calling for bids for eight contracts for work on the New York State Barge Canal and on the Cayuga and Seneca Canal. These contracts are: Contract No. 48, Erie Canal, Section 8; length, 5.75 miles. Contract No. 51. Erie Canal—Section 5. Canal feeder between Trenton Falls and Nine Mile Creek; length, 5.75 miles. Contract No. 76. Erie Canal—Section 8; length, 5.77 miles. Contract No. 77. Erie Canal—Section 8; length, 6.78 miles. Contract No. 80. Oswego Canal—Section 1. A dam and bulkheads across the Oswego River at Phoenix, N. Y.. Contract No. 91. Erie Canal—Section 1. Building and equipping hydro-electric power plant on the Erie Canal near the east end of Crescent Dam. Contract A. Cayuga and Seneca Canal—Section 1. Constructing Lock No. 1 and Dam No. 1 near Cayuga; length, 0.25 mile. Contract B. Cayuga and Seneca Canal—Section 1. Excavating a channel mainly in the Seneca River, from Montezuma to deep water in Cayuga Lake, from Cayuga Lake to Seneca Falls and from Waterloo to deep water in Seneca Lake; length, 17.2 miles.

Bids were opened last week for two large contracts on the New York State Barge Canal. Holler & Shepard, Rochester, N. Y., were awarded one of these contracts—Contract No. 27A for the completion of the unfinished part of Contract No. 27 in Fort Seward—at $449,498. On the other contract the American Pipe & Construction Co., Philadelphia, Pa., at $2,323,998 was awarded the work. This contract included dredging in the Oswego River between Fulton and Oswego.

Nothing much seems to have been doing the past week in the way of large railroad contractor contracts. The Chicago, Burlington & Quincy R. R. is reported to have let contract for a line from Hudson to Greeley, Colo. The Gulf, Magnolia & Northern R. R., a new Arkansas railroad of which S. Q. Service, Hope, Ark., is President, is said to have asked bids for constructing 46 miles of line from Junction City, Ark., north. Representatives of the Holland capitalists controlling the Cullman Coal & Coke Co., of Cullman, Ala., have been inspecting the property and have announced that construction work will be resumed at an early date on the railroad from Cullman to Julianna. The cost of completing this line is estimated at $800,000.

Among the railroad contracts let recently are the following: Newkirk & Powers, Joliet, Ill., a $32,000 contract for the excavation and foundation work for the new union station at Joliet; M. P. McGrath, Easton, Pa., for the extension of the Easton & Washington Traction Co.'s line from Port Murray to Hackettstown, N. J., the work amounting to about $210,000; Fred T. Ley & Co., Springfield, Mass., for constructing a 42-stall round house for the New York, New Haven & Hartford R. R., at Cedar Hill, near New Haven, Conn.; H. E. Culbertson Co., Cleveland, O., for the grading work for a second track between Ashtabula, O., and Austinburg for the Pennsylvania R. R.; D. A. Rothhammer, Tulsa, Okla., a subcontract for the Interurban Construction Co., of Indianapolis, Ind., for the grading work for an interurban line from Tulsa, Okla., to Sapulpa, Okla., for the Oklahoma Union Traction Co. of Tulsa.

The Labor Question.

Many contractors, during the present season, have been much handicapped in their work by the scarcity of unskilled labor. In many cases the laborers, such as could be obtained, were unwilling to do a fair day's work, were always eager to move on to another job, and preferred to get into the cities even though they were leaving steady employment for the prospect of little or none at all. The increasing scarcity of native-born common laborers has also been very noticeable. Some interesting information regarding present day labor conditions was given recently in a hearing in New York City. The hearing was held by the subcommittee on Labor and Wages of the Congestion of Population Commission on the question of the employment of alien labor on the Catskill Aqueduct work. The main object of the hearing was to find out the reason for the non-employment of the so-called "army of unemployed." It may be noted that the majority of the men employed on the aqueduct system are newly arrived immigrants. The rate of pay for common labor is $1.50 to $1.75 a day. Excerpts from the testimony at the hearing of Commissioner Chadwick of the Board of Water Supply and the representatives of several of the contractors which threw much light on labor conditions are given in The Bulletin of the General Contractors' Association as follows:

"Is it not true that the employment of so many immigrants keeps the rate of pay so low that Americans cannot find it a living wage?" Secretary Marsh of the Commission asked Commissioner Chadwick. "I do not believe so," he replied. "The sole interest of the contractors is to get the best possible results, and I believe they have found that the immigrants do the best work and are steadier. I understand that there has been a good deal of complaint about the eight-hour day. The men would rather work ten and twelve hours and get more money." "Is it not true that the immigrants work for less than the native laborer?" Mr. Marsh asked J. B. Goldsborough of MacArthur Brothers & Winston. "They are the only laborers we can get," he replied. "For the wages you pay?" "That has something to do with it, but not all. We have no trouble getting plenty of labor in the city at the wages we pay. The average laborer prefers to stay in the city even at less money. It is getting out of fashion also for a native American to do a common laborer's work. The Italians are beginning to do the contracting as well. In 15 years I believe there will be few American contractors left in the city." H. W. Nelson, of Rinehart & Dennis, said that he has found it impossible to employ the natives of the district in which contracting work is being done because they want to lay off half the time. "When we bring out men from the cities," said he, "they leave us as soon as they have saved up a little money." "We employed a number of native Americans on our contract," said D. H. Whitmer of the American Pipe & Construction Co., "and many of them left the next day. Not one stayed a week. I do not believe you could get Americans from New York City to go up there and work if you paid them $5 a day." D. O'Connell, of the Bradley Construction Co., said: "The so-called 'unemployed' do not want to work. The more they are paid the less you could get them to do."

To End Labor Wars.

Some society women of London, aided and abetted by a few high sounding titles, have blithely inaugurated a scheme having for its main objects the bringing of capital and labor more closely together for the common good, and the uniting of the employer and employe in more friendly relations. The name of this organization which thus proposes to settle the eternal question of capital and labor is the Handshake Association. The name pretty well conveys the plan of the organization—that employer and employe should shake hands and keep on shaking hands, the idea perhaps being that while thus engaged the interested parties will have only the good old left free for business purposes.

Some Census Figures.

Official figures issued by the U. S. Census Bureau for 18 states show a total gain for those states in the last ten years of 5,151,425 or 21.8 per cent. On the basis of percentage of gain indicated by the returns from the 18 states the population of the United States, including Hawaii and Alaska, is 93,471,000. Including the population of Porto Rico and the other reminders of the late unpleasantness with Spain, the total population of this country is 103,942,000. Of the ten largest cities in the world three are in the United States, New York being the second city, Chicago the fifth and Philadelphia the ninth. Eight cities of the United States have a population exceeding 500,000. In the order of their rank these cities are New York, Chicago, Philadelphia, St. Louis, Boston, Cleveland, Baltimore and Pittsburg. There are 47 cities in the United States which have a population exceeding 100,000. The aggregate population given to these 47 cities is 19,754,237 as compared with 14,991,430 ten years ago. With only

Spokane, Wash., Duluth, Minn., and Superior, Wis., missing, the cities of 25,000 and upwards have an aggregate population of 28,854,243. The final figures of the U. S. Census Bureau probably will show more than 200 cities with a population between 25,000 and 100,000.

Statesmen. It has been stated often that civil engineers take little interest in politics and that they are seldom candidates for electoral offices. This, however, is not the case in Ohio, for a roster of the newly elected general assembly of the state shows that 1-34 of the membership of the State Senate is civil engineers—or more correctly a civil engineer, there being one person of that occupation among the 34 members. Of the 153 members of the House, two are civil engineers. It will thus be seen that on a joint ballot the engineering profession will be represented by three votes. This is a better showing than would be made by the contracting profession, for there are only two contractors in this year's assembly, both being members of the House of Representatives. In comparison with these figures it is worthy of note that 12 out of the 34 members of the Ohio Senate are lawyers; in the House of Representatives 32 out of a membership of 153 are lawyers. When it comes to making a will or a law lawyers are always present.

The Hobo Engineer. A Western friend sends us the following addition to our collection of "Hobo Pomes." The verses were written by "Deacon" O. H. Parsons, formerly with the engineering department of the Union Pacific R. R.:

THE HOBO ENGINEER

I sometimes think I'll quit this life
And settle down and get a wife, By Jove!
Sometimes I think that I would love
To have some place I could call home
And settle down, no more to roam
But Hell, that very thing I've tried
And found myself dissatified.
I've often tried to settle down
To office work and live in town
And act like civilized folks do,
Take in the shows and dances too,
But I'd no more than get a start
'Till "Wanderlust" would seize my heart
And in my night dreams I would see
The great white silence calling me
And at the chance I'd never fail
To drop it all and hit the trail
Back to the solitudes again
With transit, level, rod, and chain
To lead the simple life once more
And do the same thing o'er and o'er
Day after day and week after week.
Sometimes we go to town to seek
A little fun and, sometimes—well,
Sometimes we raise a little hell.
We don't mean to, but then you see
When we've been out two months or three
In silent places where the face
Of white man seems so out of place,
Well—when we hit the "Great White Way"
Our joyful spirits get full sway—
We try to crowd into one night
The joys of many months. 'Taint right?
Well, maybe not. 'Tis not for me
To shape our final destiny,
But when our last survey is done
And tied up to the Great Unknown
And to The Chief our records brought
Of lonely work with danger fraught,
Of hardships cheefully endured
That best results might be secured
Against all this our little sprees
Will seem as ponds compared to seas
And the Angels surely will decide
There's a balance on the credit side
And God, I think, will drop a tear
And bless the "Hobo Engineer."

RAILWAYS, STEAM AND ELECTRIC

Alabama.

It is reported in Huntsville, Ala., that the promoters of the Nashville & Huntsville Ry. will build the line as originally planned. This project has been dormant for the past three or four years.

Construction work is to be resumed early next year on the railroad from Cullman to Julianna, owned by the Cullman Coal & Coke Co., of Cullman, Ala. It is estimated that the cost of the work will be about $800,000. The company is controlled by Holland capitalists.

The Birmingham, Demopolis & Pascagoula Ry. is reported to be planning to begin work shortly on that portion of its proposed line between Demopolis and Linden. Wadsley Finnell, Demopolis, Ala., is the engineer.

The Alabama, Tennessee & Northern R. R. has placed 12 miles of additional trackage in service. It passes a town in Sumter County, Ala., known as Emelle. The railroad has now been constructed to Sucarnoochee Creek, ten miles further south than Emelle.

Work has been started by the Louisville & Nashville Ry. on its new shops at Boyles, near Birmingham, Ala. The plant will include 10 buildings of reinforced concrete and steel, the estimated cost being $654,000.

The City Council of Birmingham, Ala., has granted a franchise to the Tidewater Development Co. for its line through Birmingham. It was noted in our Nov. 16 issue that the contract for constructing the line had been let. The promoters now state that construction work will be started early next year. J. M. Dewberry, Birmingham, is President.

Arkansas.

The Gulf, Magnolia & Northern Ry. has made surveys for an extension to Mineral Springs.

Engineers have been over the proposed routes for the extension of the Memphis, Dallas & Gulf R. R., G. H. Cravens, Chief Engineer, Nashville, Ark., to Graysonia, Ark. It is probable that on the report of these engineers one of the proposed lines of survey will be adopted and construction work commenced.

The Board of Trade of Little Rock, Ark., has been advised that the officials of the Memphis, Dallas & Gulf R. R. Co. have under contemplation the matter of running a line of their road into that city.

Advices from Stuttgart, Ark., state that the Chicago, Rock Island & Pacific System is extending its lines through that city and that $100,000 will be spent for yards and other improvements.

The St. Louis-Southwestern (Cotton Belt) Ry., has completed arrangements for the extension of the Stuttgart-Hazen branch into the latter city at once, and contractors are moving their equipment to that end of the line.

It is expected that the Chicago, Rock Island & Pacific R. R. will continue the construction of the extension from Mena to Stuttgart, about 40 miles, across the Arkansas County, providing the towns along the proposed route offer any encouragement.

The Gulf, Magnolia & Northern R. R., S. Q. Servier, President, Hope, Ark., is reported to have asked bids for constructing 46 miles of line from Junction City north.

California.

The Central California Traction Co., San Francisco, is reported to have completed all the details for the rebuilding of its entire system in the city of Stockton.

Advices from Los Angeles state that the E. L. Doheny Oil, Gas & Asphalt Co. is expending between $2,000,000 and $2,500,000 in improvements and extensions. Seventy miles of railway connecting places at which the companies are operating will be built, the oil storage capacity increased from 600,000 barrels to 4,000,000 and 22 miles of pipe line added to that now in use. Pipe for this purpose is on the ground.

It is reported at Santa Rosa that a contract has been let for the grading of the roadbed of the Santa Rosa-Clear Lake R. R. The contract is said to call for completion of the grade in 20 months from December 1, 1910. The contract price for the grading is about $200,000.

The Utah Construction Co., Ogden, Utah, is shipping a large amount of its railroad construction material from the Natron extension to Humboldt County, Cal., where the company has a contract to build a short line of railway.

The Owens Electric Ry. Co. has filed its articles of incorporation at San Francisco and proposes to construct an electric railroad through the Owens River Valley. Curtis Hillyer, E. A. O'Brien, M. R. Jones, G. Carter and a group of southern capitalists are the incorporators. The letters of incorporation call for a capitalization of $200,000.

The Utah Construction Co., Ogden, Utah, is said to be planning to put between 2,500 and 3,000 men on its contract for completing the 30 miles of road for the Northwestern Pacific extension with Humboldt County. It is said that in the event of unfavorable weather conditions prevailing, the workmen will be concentrated at the tunnel sites, where the work will be carried on throughout the winter and tunnels placed well along toward completion by spring.

Erickson & Peterson, contractors for the construction of the cutoff between Rocklin and Clipper Gap for the Southern Pacific in California, are making good progress, due greatly to the exceptionally fine weather for this time of the year in that vicinity.

Five men were killed on Nov. 23 by a premature explosion of dynamite on a Santa Fe rock cut east of Barstow. The dead are: Richard Lindsay, powder foreman; H. E. Hanlon steam shovel engineer; and three Mexicans. Supt. J. C. Mohler and three Mexicans also were injured.

Bids were opened Nov. 16 by the Board of Public Works of San Francisco for furnishing rails for the proposed municipal Geary St. electric railway. The Pennsylvania Steel Co. asked for steel grooved girder rails, per ton of 2,240 lbs., $34.25; for steel guard rails, $44.25, delivered free on board cars at place of manufacture on a railroad having connection with a transcontinental system. For the same rails delivered free on board barge or dock at ship's side or within reach of ship's tackle at New York, Philadelphia or Baltimore the bid was $38.40 per ton for both types of rail, and for the rails delivered at San Francisco on cars $50 a ton was asked for the girder rails and $60 for the guard rails. Lorain Steel Co. bids were as follows: Steel grooved girder rails on board cars at place of manufacture, $36.90; steel guard rails, $46.90; rails delivered at ship's side within reach of tackle, $38.40 for grooved girder rails, and $48.40 for guard rails; rails delivered in San Francisco, $50 and $60 a ton respectively. This is the first step toward the actual construction of the railway. The progress of the plans for the other necessary supplies are noted elsewhere in this column.

The Tidewater & Southern R. R., which projects a 48-mile line, has completed surveys and has practically secured all necessary capital for construction purposes. Ten miles of the line have already been graded. The route is Stockton, French Camp, Atlanta, Esealon, Modesto and Turlock. John A. Mehling, Stockton, Cal., is President, and J. H. Wallace, Stockton, Cal., is Chief Engineer.

The status of the plans for supplies for the Geary St. municipal railroad at San Francisco, on Nov. 12, were as follows: [illegible] —for furnishing trolley wires; specifications 80 per cent completed. Contract No. 9—For furnishing and delivering tie plates and railroad spikes; specifications 15 per cent completed. Contract No. 10—For furnishing and delivering tie bars and nuts; specifications 15 per cent completed. Contract No. 12—For furnishing and delivering line material; specifications 10 per cent completed. M. Manson is City Engineer of San Francisco.

Colorado.

The Colorado Midland Ry., F. F. Mallon, Chief Engineer, Colorado City, Colo., has preliminary work under way for an extension from Newcastle to Salt Lake City. Another extension southwest of Rifle is also proposed.

Three surveying parties are now in the field for the proposed line of the Grand River, Meeker & Salt Lake R. R., and it is announced that actual construction work will be started not later than the first of the year. The first section of the road is to extend from Chapman to Meeker. George W. Simmons, Denver, is General Manager. The contract for constructing this road has been let to the Meeker-Rangely Construction Co., of Denver, as was noted in a recent issue of this paper.

Work has been started by the construction crew of the Denver, Laramie & Northwestern from the end of the line at the station, Greeley, Colo., north on Seventh St. It is expected by the officials of the company to have steel laid as far as Severance before the severe cold weather comes.

The Chamber of Commerce of Trinidad, Colo., has been discussing plans for the extension of the interurban car line to connect with all the surrounding coal camps in the county.

It is believed that the Union Pacific will, early next year, have construction work started on its cutoff from Fort Morgan to Denver, through southeastern Weld County.

Connecticut.

The New York, New Haven & Hartford Ry. has let the contract for the construction of a 42-stall roundhouse at Cedar Hill, near New Haven, Conn., to F. T. Ley & Co., Springfield, Mass., at $200,000.

Georgia.

The Board of Trade of Stone Mountain is to ask the Georgia Railway & Electric Co., Atlanta, Ga., to extend its Decatur line to Stone Mountain. As proposed the line would be extended for a distance of six miles from Decatur.

The Southern Railway opened bids on Nov. 21 for the steel to be used in the freight sheds to be built at Atlanta, Ga.

The Georgia & Carolina Ry., recently chartered, as noted in our last issue, to construct a 120-mile railway from Augusta to Spartanburg, is capitalized at $100,000 minimum and $2,500,000 maximum. The road will pass through Edgefield, Saluda, Newberry and Whitmire and thence to the city of Spartanburg, the principal place of business being at Edgefield, S. C. The officers of the railway, as set out in the charter, are: A. W. Jones of Milledgeville, Ga., president and treasurer, and A. E. Padgett of Edgefield, secretary. The directors are: A. W. Jones, Milledgeville, Ga.; A. E. Padgett, Edgefield; J. W. Thurmond, Edgefield; L. C. Hayne, Augusta, Ga., and R. C. Neeley, Waynesboro, Ga.

The new railroad from Bowden to Bremen, where a connection is made with the Central of Georgia R. R., was officially opened on Nov. 24.

The Savannah, Augusta & Northern R. R., W. A. Seymour, Chief Engineer, Statesboro, Ga., has a force of men engaged in extending its line from Garfield, its present terminus, to Stevens' Crossing, a distance of 15 miles.

Illinois.

Newkirk & Powers, Joliet, Ill., have started work on their contract for the excavation and foundation work for the New Rock Island union station at Joliet. The foundation work will cost about $31,500.

The County Traction Co., of Chicago, Ill., has been incorporated with a capital stock of $1,000, and proposes to construct and operate street railroads in Cook County. Alexander C. McIlvane, Theodore H. Bean, and John D. Willis are the incorporators.

The promoters of the Petersburg & Pekin Interurban Ry. Co., incorporated several years ago, are reported to be taking steps for constructing the line. John E. Melick, Springfield, Ill., is engineer.

A conference has been held between the city officials of Chicago and the various railroads interested, looking to the elevation of 122 miles of track in the Calumet District of Chicago, at an estimated cost of $7,600,000. The Illinois Central, which will be most affected by the plan, already has prepared estimates on the cost of the work. That railroad will be required to elevate 69 miles of track at a cost of approximately $4,000,000. Included in the territory are some of the road's big freight and switching yards. The Illinois Central has agreed to elevate its tracks from 79th St. to Kensington Ave. and preliminary plans have been made. Other railroads and the number of miles of tracks each will be asked to elevate are: New York, Chicago & St. Louis—79th St. to Stony Island Ave.; main track, 2.21 miles; total, 29.02; Chicago, Rock Island & Pacific—State St. to Jeffrey Ave.; main track, 2.38 miles; total, 5.56; Chicago & Western Indiana—State St. to Stony Island Ave.; main track, 2.23 miles; total, 12 miles; Dalton Branch—111th St. to the Illinois Central; main track, 1.30 miles; total, 3.10; Belt Railway—Pullman Junction to Jeffrey Ave.; main track, .07 mile; total, 2.41 miles; Kensington & Eastern—111th St. to Kensington Ave.; total, 1 mile. A total of 14.19 miles of main track is included in the proposed elevation plans. The total miles of track, which includes switches on freightyards, brings the total up to 122.16 miles. Walter J. Raymer is Superintendent of Track Elevation for the city of Chicago.

Most of the heavy grading work on the branch of the Big Four from Evansville, Ind., to Mount Carmel, Ill., has been finished and a large force of workmen is now engaged in building the bridge across the Wabash River between Mount Carmel and New Harmony, Ind.

The extension of the Illinois Traction system from Morris in Grundy county to Joliet is now said to be assured, the Joliet city council agreeing to adopt an ordinance acceptable to the company. The subject has been before the council for several months but the ordinance previously prepared was not acceptable to the company. With the completion of this extension to Joliet, a distance of 25 miles, and the construction of the line from Mackinaw to Streator, 35 miles, there will be a continuous trolley line all the way from St. Louis to Chicago.

The Western Rys. & Light Co., Champaign, Ill., is planning to have work started shortly on a $300,000 hydro-electric plant at Marseilles. F. R. Winder is the Engineer in charge.

Indiana.

The Board of Public Works of Indianapolis will probably adopt a resolution in a few weeks for the elevation of all of the downtown tracks, beginning at the Union Station and extending as far northeast as Massachusetts Ave. H. W. Klausmann is City Civil Engineer of Indianapolis.

The Erie R. R. has made preliminary surveys for a subway under East Tipton St., at Huntington.

Final surveys are to be started for the proposed line of the Kalamazoo, Elkhart & Smith Bend Traction Co. Eugene Atkins is the promoter of the proposed new line, which is to extend from Bristol, where it connects with the St. Joseph Valley traction line, to Kalamazoo, Mich.

The Lake Shore & Michigan Southern Ry. is said to be planning to construct a third track between Kendallville and Butler.

A conference has been held between William Murdock, president of the Southern Indiana Traction Co., Vice President Henry W. Marshall and General Manager Fletcher M. Durbin which may result in direct traction line connection between Evansville, Indianapolis and Chicago. By closing the gap between Patoka and Sullivan, Ind., a distance of about 40 miles, traction connection would be established between Evansville and the lines leading to the northern end of the state and Chicago. It would then be possible to put on a through car to Chicago by way of Indianapolis. The Southern Indiana Traction Co. is controlled by the same capitalists who own and operate the traction lines entering South Bend and Lafayette, Ind.

Iowa.

A large part of the Iowa & Southwestern R. R. has been partially graded and tracklaying out of Blanchard is to be started soon.

The surveying party that laid out the preliminary line for the Rock Island between Carlisle and Allerton, through Chariton, this year, is now at work making the permanent working survey of the route. The party was recently at Carlisle, and will probably be in Chariton about Christmas time.

The Construction Department on the Iowa Division of the Chicago, Rock Island & Pacific Ry. is closing up all work not yet finished and is preparing to suspend further operations until next spring. During the present season the company has laid 52 miles of new rails, ballasted 41 miles of track, put in two new standard passing tracks, each 3,000 ft. in length, extended the automatic block signal system from Davenport to Council Bluffs, built seven new concrete bridges and reinforced a number of others. These permanent improvements and betterments have been made on the Iowa division at an estimated total expense of $250,000. It is possible that the Rock Island, next season, will extend its second track, which now terminates at Iowa City, westward to Des Moines, and, perhaps, to Council Bluffs.

Kansas.

The commissioners of Kansas City, Kas., have instructed Richard Higgins, the city counselor, to bring mandamus proceedings to compel the Metropolitan Street Railway Co., of Kansas City, Mo., to build a street car line on 7th St. south from Minnesota Ave. to Rosedale.

The Illinois Traction System (McKinley syndicate) has mortgaged the lines and property of the Atchison Railway, Light & Power Co. for $1,500,000 to secure a series of bonds aggregating the same amount. Proceeds of the sales will be part of the money expended on new lines.

The Arkansas Valley Interurban Co., of Wichita, Kan., which has just placed in operation a line from Wichita to Valley Center, is to extend its line to Hutchinson via Newton and Halstead, without delay. The second link from Valley Center to Sedgwick is now having track laid and will be ready for operation within a month. Right of way is now being purchased for the extension to Newton. Cars will be running into Newton in six months. The extension westward to Hutchinson will then be begun. O. A. Boyle, Wichita, is General Manager.

Preparations have been made by officials of the Midland Valley R. R. Co. to start two preliminary surveys for the construction of the proposed extension of the line from Arkansas City into Wichita. One party will go over the one of the proposed routes of entrance into the city of Wichita and the site of the station; the other party will go into Wichita over a different proposed route.

The fact that a quantity of 90-lb. steel rails is being delivered and placed along the right of way of the Santa Fe Between Ottawa and Independence, Kan., gives rise to the report that traffic has so increased that it is necessary to install the heavier rails for a distance of over 100 miles.

Kentucky.

The Bowling Green & Northern R. R. Co. has been incorporated and proposes to build a line from Bowling Green to Leitchfield. The capital stock is $30,000.

The Cape Girardeau, Charleston & Hickman R. R. has received a charter from the Kentucky Secretary of State. The road is capitalized at $600,000 and proposes the construction of a railroad from Ancil in Scott County to a point opposite Hickman, Ky., in Mississippi County. The proposed road will run by way of Charleston, Mo., and will connect with the Cape Girardeau and Thebes Terminal R. R. The system will aggregate about 50 miles of trackage.

The Bowling Green Railway Construction Co., Bowling Green, Ky., has been incorporated with a capital stock of $30,000, the incorporators being B. F. Gardner, M. H. Crump and C. H. Feltner. The incorporation of a railway company to be built from Bowling Green is noted elsewhere in this column.

Louisiana.

The Tensas River Lumber Co., Ltd., G. R. Balch, President, Cincinnati, O., has awarded a contract to R. S. Wilds for grading for a 3-mile line in Concordia Parish, La. No other contracts are to be let.

Michigan.

The Grand Trunk Ry. has petitioned the City Council of Kalamazoo, asking that the city engineer be instructed to establish lines and grades for a track on north Pitcher St. in compliance with the franchise of the Chicago & Kalamazoo Terminal Ry. which the Grand Trunk now owns. Temporary trackage was laid on the street north of the Standard paper mill several weeks ago, which the railway company now desires to make permanent.

Minnesota.

The Duluth Street Ry. Co., Herbert Warren, Manager, Duluth, Minn., is planning to extend its lines in West Duluth to the steel plant. It is estimated that the work will cost the city $10,000. Of this sum $3,000 will be for filling and grading and the remainder for rebuilding bridges and constructing new culverts.

Advices from Chisholm, Minn., state that the Swan River Logging Co. has steel laid for its new railway to within four miles of Bear River. The line will open up the wild land from Chisholm right up to the Bear River country.

Promotion work is well along for the proposed electric railway to run through Elmore, Blue Earth, East Chain, Center Chain, Ceylon, Estherville and on to Worthington. This is the project promoted by G. E. Doyle and H. W. Knight, of Chicago, Ill.

Mississippi.

A meeting has been held at the office of Mosely & Lagrove, West Point, Miss., to consider a proposition for the building of the proposed West Point & Houston R. R.

Surveys are to be started shortly, it is said, for an electric railway to Clarksdale by way of Friar's Point. As proposed the road will be a suburban line from Helena, Ark. From the latter city the cars will cross the Mississippi at Helena by transfer steamer and will then go down the side of the levee to Friar's Point and from that town across the county to Clarksdale. Maj. E. C. Horner, Helena, Ark., is the promoter.

Missouri.

Construction work has been started at Jefferson City on a street railway connecting the principal hotels and the business section with Cedar City and North Jefferson, in Callaway County. This will give the Missouri, Kansas & Texas Ry. and the Chicago & Alton a connection with the state capital, and will greatly decrease the time necessary to traverse the distance by omnibus. Col. Cecil W. Thomas of Jefferson City and George D. Rosenthal of St. Louis, are stockholders in the company.

The Chicago, Rock Island & Pacific R. R. will have work started shortly on extensions of team tracks at the freight house in the West Bottoms in Kansas City.

The promoters of the Springfield & Western Ry. have petitioned the County Court at Springfield for permission to construct a line over the Nicholas cut road. This road is to run from Springfield to Joplin, Mo., with a branch line from Mount Vernon to Pierce City. The entire line when constructed will be 100 miles in length and it is being largely financed by farmers along the route. J. T. Woodfill, Springfield, Mo., is interested.

Montana.

It has been announced by an attorney of the Chicago, Milwaukee & Puget Sound Ry. that the company has practically decided to construct a line into Libby. Nothing was said, however, as to whether it will come in with a branch from the south or with an east and west line which would parallel the through line and take in Spokane and Kalispell.

North Carolina.

The Waccamaw Lumber Co., Bolton, N. C., wants a contractor to fill a 3600-ft. trestle; amount of fill 13,019 cu. yds. Contractor must furnish all tools, cars, locomotives and equipment.

The Micaville Southern Ry. Co., of Black Mountain, N. C., has been chartered with a capital stock of $50,000, and proposes to construct a railroad, ten miles in length, from Micaville, south, all of the line to be in Yancey county. J. Bis Ray is the principal incorporator.

The Mount Airy & Eastern Ry. is reported to have been sold to Northern capitalists, who will extend it. The line at present is 19 miles long, 3 ft. gage. J. L. Camp, Franklin, Va., is Manager.

North Dakota.

Blythe Bros., who have been working on the new Pingree-Wilton branch of the North Pacific have completed this work and have shipped their equipment to Tama, Ia., where they will winter. The work of grading the new road is practically completed with the exception of several bridges and some tressle work, which may not be finished until next spring.

New York.

The Long Island R. R. has work underway at Aquebogue, L. I., on the construction of a new depot and a new freight yard. The company has bought an acre of land on the east of the present station, and extending to the creek. This is to be filled in and a freight yard built there. One of the main sidings to be put in will be 1,400 ft. long.

Ohio.

The promoters of the Youngstown & Northern R. R. have applied to the City Council of Girard for the right to cross Liberty St. and Marshall Road, on the west side. This proposed line is to parallel the new B. & O. line, on the west side, and is to be a connecting link between the Ohio Works and the proposed steel works to be built just northwest of town.

The County Commissioners at Cincinnati have negotiations under way with the Chesapeake & Ohio R. R. for the abolishment of grade crossings on the C. C. & L. R. R. at Cruikshank & Ferguson Roads, Westwood.

H. E. Culbertson Co., Cleveland, O., has been awarded the contract for the grading work for a second track between Ashtabula and Austinburg for the Pennsylvania R. R. There will be a cut of 16 ft. to the mile going west between Ashtabula and Austinburg. The dirt taken from the top of Munson hill will be used to fill in at the foot on the west side. A new overhead bridge will also be installed at Munhon hill. The track laying will be in charge of Pennsylvania engineer, J. C. Carr, and his assistant, Benton Lattin.

Rapid progress is now being made in the work which is being done in filling the long trestle north of the McLean Ave. station of the Chesapeake & Ohio R. R. of Indiana in Cincinnati. A large number of men are engaged at that point working night and day on the $500,000 contract. Work is also progressing well in the construction of the yards at Summit station, northwest from the big trestle. The yards are being leveled, a hill is being cut down and the dirt is being dumped to make the fill at the trestle.

Articles of incorporation have been filed with the Secretary of State by the Toledo & Indiana R. R. Co., Toledo, O. The organization is capitalized at $10,000 and one of the incorporators is Frank G. Miller.

The Defiance Interurban Electric Ry. Co., recently incorporated as noted in our last issue, has placed a contract with the W. H. Schott Co., 39 Jackson Blvd., Chicago, Ill., for the engineering work for the proposed extension to Fort Wayne, Ind., through Paulding, New Haven, Antwerp and other cities. K. V. Haymaker, Defiance, O., is President.

The Baltimore Ohio R. R. is reported to have awarded contracts for the grading for an extension of a branch line along the east bank of the river at Cleveland. It is understood that the first extension will run about one mile south of the Grasselli Chemical plant to the new wire mills of the American Steel & Wire Co. It will eventually, it is said, run to Willow and there join the present branch of the road.

Oklahoma.

The Mountain, Valley & Plains R. R., H. S Wannamaker, Secretary, Amistad, N. Mex., which proposes to build eastward from Cimarron, N. Mex., to Guthrie, Okla., has completed its survey to the latter city and has secured much of the right of way.

The route of the Oklahoma, Texas & Eastern, a new railroad to be built from Valiant, Okla., has been selected and the maps filed with the Indian agent at Muskogee, showing the territory through which the line is to pass. It will be 60 miles long and will penetrate the timber belt of the Choctaw Nation.

The citizens of Alva are raising $100,000 bonus to secure the Des Moines & Santa Fe proposed road, which was chartered several years ago to build eastward from Des Moines, N. Mex., across Southern Kansas and Northern Oklahoma. Alva is to pay one-fourth of the bonus at once, one-fourth when the line reaches Des Moines, one-fourth when it reaches Hooker, about 50 miles east of Alva, and the last fourth when the road is completed into Oklahoma City.

The Oklahoma City & Fort Smith Traction Co., Joseph Kreis, General Manager, Oklahoma City, is reported to have arranged for the financing of its projected line. This company proposes to build a line to the coal fields in the eastern part of the state and ultimately to Fort Smith, a distance of 202 miles. Two surveys have been made.

The Interurban Construction Co., of Indianapolis, Ind., which, as noted in our last issue, was awarded the contract for constructing an interurban line from Tulsa to Sapulpa for the Oklahoma Union Traction Co., of Tulsa, has sub-let the contract for the grading to D. A. Rothhammer of Tulsa. The general contract calls for the completion of the line by June 1, 1911. A. A. Small, Tulsa, is President of the traction company.

Oregon.

It was recently announced at Klamath Falls, Ore., that a line would be built for the Southern Pacific Ry. to Merrill, a city 20 miles south of Klamath Falls, in the near future It is stated that all right of way had been secured and funds for the work has been obtained.

The Pacific & Eastern R. R. has been completed to Butte Falls, Ore., and the company is planning to inaugurate a regular train service to that city as early as possible. The new line belongs to the Hill interests and is 30 miles long extending from Medford, Ore., to Butte Falls and will ultimately extend to some point on the main line of the Oregon Trunk.

The Oregon Railroad & Navigation Co. is laying rails on the Troutdale-St. Johns branch and piledrivers are also at work on trestles where long fills have not been made as yet. Many of the latter occur across the low places west of Troutdale toward St. Johns. Much of the necessary grading has already been completed but it is believed that the work will not be finished before next Autumn. The route of the new line is along the Columbia Slough road on the north side.

The Oregon-Washington Railroad & Navigation Co. has filed its articles of incorporation. The articles provide for a corporation with a capitalization of $50,000,000, controlled by the Union Pacific. The new corporation is authorized to absorb all present and prospective lines of the Oregon Railroad & Navigation Co., the Oregon & Washington R. R. Co., the North Coast R. R. Co. and also many smaller lines in the Pacific Northwest. It is estimated that the total mileage of the consolidation, when the lines were completed, will be about 4,000 miles, not including electric lines.

It is believed that the Oregon Railway & Navigation Co. will in the near future resume work on the Stanfield-Coyote cutoff. The work was halted several weeks ago on instructions from the east. The survey of the cutoff, which will eliminate grades and reduce curves, has already been completed, and all is in readiness for the construction crews. It is likely that the construction work will be let to Twohy Bros., Spokane, Wash., and it is probable that much of the machinery and many of the men now employed to rebuild the road between Pendleton and Yoakum will be used in building the cutoff.

Pennsylvania.

The Chambersburg, Greencastle & Waynesboro Street Ry. Co., R. D. Sefton, General Manager, Waynesboro, Pa., has started construction work on its extension from Pen Mar Park to Blue Ridge Summit, a distance of three miles. The route from Pen Mar through the Cascade section will be for a part of the way, cut out of the rocky side of the mountain. Another part of the line will be through a swampy section, and this much at least the company hopes to have graded before real cold weather.

Grading work has been started for an extension of the line of the West Penn Rys. Co., from Juniata to Bitner.

The York & Glen Rock Ry. Co. is projecting an 11½ mile electric railway from York to Glen Rock, via Paradise and Loganville. Partial surveys for the line have been made. The capital for construction, however, has not been secured as yet and plans for letting construction contracts are indefinite. The Tennis Co., Magee Bldg., Pittsburg, Pa., is interested.

Construction work is to be started shortly on the extension of the line of the Eastern & Washington Traction Co., from Port Murray to Hackettstown, N. J. The extension will cost about $210,000. M. P. McGrath, Easton, Pa., has the contract.

The Lehigh Valley R. R. is to construct a 2½ mile extension at Easton. The extension will be known as the South Side Industrial Siding and will give access to a new section of the city.

The Woodlawn & Southern Street Ry. Co. has been chartered and proposes to build a 7½-mile line in Beaver County. It has $75,000 capital. J. B. Shepherd, Pittsburg, is President, the other incorporators being John L. Moon, Ralph E. Reymer, John W. Adams and Walter L. Copeland.

South Carolina.

Grading work for the Augusta Northern R. R. has been started and the line will probably be completed and in operation in the spring. This road will be 11 miles long and will connect Saluda, S. C., with Wards, S. C. W. J. Montgomery, Marion, S. C., is President

South Dakota.

Voters of Huron, S. Dak., at a recent election, authorized the Chicago & Northwestern Ry. to lay a side track along First St.

Texas.

At a recent stockholders' meeting of the Temple Northwestern Ry. Co., at Temple, Tex., the following officers were elected: President, Charles M. Campbell; vice president, A. F. Bentley; general attorney, W. S. Banks, all of Temple; W. E. Dozier, general manager and chief engineer. Charles M. Campbell, F. F. Downs and A. F. Bentley were elected directors. By this movement the ownership and control of the road is now entirely in the hands of Temple and Gatesville stockholders. Six miles of track have been laid and the roadbed lined up and made ready for traffic, the grading is complete between Temple and Gatesville and timber for bridge building has been distributed along the right of way

A temporary injunction has been granted restraining the Rockport & Port Aransas Pass R. R. from building its line on any part of Harbor Island, which is the property of the state. This road was to be a part of a terminal system that is being constructed at the new port of Aransas Pass. It is said that the road will seek relief at the hands of the Legislature.

The Corpus Christi Street & Interurban Ry. Co., Corpus Christi, is said to be planning to extend its street car line north from Corpus Christi to the Epworth League Grounds.

The Enid, Ocheltree & Western Ry. Co. has applied to the State Railroad Commission for permission to issue bonds. The road has now completed 13 miles of road from Ochiltree to Victory, and has a force of men engaged in the completion of the road for a distance of 22 miles further, or from Dalhart to Dumas. A. E. Wiest, Dallas, Tex., is General Manager.

Work is progressing on the new Houston Belt & Terminal line that is to connect the Brays bayou yards of the company with the belt line east of the city of Houston and it is expected that by Jan. 15 or Feb. 1 the cutoff will be in use. The line is ten miles in length and is a link in the belt line terminals, constructed to relieve that section in the near Fifth ward and before the new terminal passenger station of congestion. The work means a new swing bridge over the bayou a short distance above the Southern Pacific draw. The piers are now in and the steel will shortly be in place. From near this bridge it is planned to construct a branch line to the site of the proposed water terminals along the ship channel.

Announcement has been made by an official of the Kansas City, Mexico & Orient Ry. that there will be no cessation of activity in the construction work until the entire system is completed into Mexico. It is believed that the system will be finished in two years.

The Chicago, Weatherford & Brazos R. R. has submitted a proposition to the citizens of Decatur, Texas, whereby the company will extend their line to that place providing a cash bonus of $40,000 and 17 miles of right of way is given them. It is reported that immediate steps will be taken to meet the requirements.

Grading work is progressing rapidly on the Rock Island, Texico, Farwell & Southern Ry., for which the W. F. Calback Construction Co., Portland, Ore., has the contract. A large number of men and teams with grading machinery are working along the first 41 miles. M. J. Healy, Texico, N. Mex., has a deal now under way for securing ties, rails and equipment.

G. B. Stewart, Mayor of Mineral Wells, Tex., and W. T. Andrews, President of the Stamford & Eastern Ry., Stamford, Tex., recently conferred in regard to the construction of a line into Mineral Wells.

The Gulf Colorado & Santa Fe Railroad will begin shortly, the work of relaying the Dallas-Paris end of the line with heavier steel. Several shipments of rails have arrived at Celeste, Tex., where the work will be started under supervision of Owen Bowman of Joshua.

A statement is reported to have been made by W. L. Carwile, Dallas, Tex., President of the Pecos Valley Southern Ry. now building from Pecos, Tex., to the Davis Mountains via Saragosa and Balmorhea; that the road has been completed to Balmorhea and that material is en route and the grading work nearly finished to San Solomon Bridge Spring, the southern terminus under the present contract. Before the first of January, however, active steps will be taken to extend the road to the proposed connection on the Southern Pacific line probably following the line as located by M. L. Swinehart, the engineer.

Information received from Snyder, Tex., is to the effect that a track laying force on the Santa Fe is working between Sweetwater and Snyder and it is expected that trains will be operating into the latter place by Jan. 1.

The surveying corps of the Palacios, San Antonio & Pecos Ry. was recently working between Carancahua and Edna, and pushing as fast as possible on to San Antonio. From San Antonio [illegible] main line is to be rushed as quickly as possible.

The Texas Southeastern R. R., T. L. L. Temple, President, Texarkana, Tex., is considering building a line to Palestine and thence to Dallas. This road is owned by the Southern Pine Lumber Co., and runs from Lufkin in a westerly direction to a town called Diboll, east of Crockett.

Tennessee.

Preliminary surveys for the proposed line of the Birmingham & Northwestern R. R., from Jackson to Dyersburg, Tenn., have been completed and final surveys are now under way. A final report of the route will be made to the railway company not later than Jan. 1, and immediately afterward, it is announced by the officials of the company, the construction of the road will begin. James Z. George, President of the George Co., Memphis, Tenn., is in charge of the engineering work.

Utah.

Good progress is being made on the construction work on the Los Angeles, San Pedro & Salt Lake Ry. in the Meadow Valley, and it is believed that the work will be completed and the line ready for operation by March 1. Track laying on a part of the line has been started. About 2,000 men are now at work. Work on the eight tunnels is also progressing finely.

The Oregon Short Line R. R. has surveys under way for a possible new line between Owinza and Payette, via Richfield and Kamas prairie. According to an official statement, this line may be accomplished within the next three years, considerable time being required to secure rights of way, while construction will be for quite a distance through a rugged and hard country.

Work is progressing nicely on the contract of the Utah Construction Co., Ogden, for building the Bingham & Garfield R. R. for the Utah Copper Co. Most of the work, however, has been sub-let, the Wasatch Construction Co. having quite a heavy piece of work on the upper end, which is nearly completed. The line calls for many tunnels and these are being bored by various station men, while Myers Bros. and Gibbons Bros. each have a contract for one of the longer ones. The continued fine weather has been a great boon to the contractors and the absence of the usual autumn storms has enabled them to report progress far more extensive than they anticipated. So apparent is this fact that the contract can be easily completed on schedule time.

The Railroad Committee of the Commercial Club, Beaver City, Utah, and a delegation of prominent business men recently held a meeting where it was decided that the citizens would perform work in grading and establishing a right of way equivalent to $50,000 and furnish also $10,000 of cash for the construction of a line of railway from Payson or Nephi to the Grand Canyon of the St. George River.

The Uintah R. R., which runs from Mack, Colo., to Dragon, Utah, is said to have surveys under way for an extension to Vernal. This railroad is owned by the Barber Asphalt Co., and was constructed to reach the Gilsonite deposits in Uintah County.

Vermont.

The Boston & Maine R. R. has staked out a line for a track on the east side of the Connecticut river from Windsor to Lebanon, N. H. It runs from a point near the railroad bridge, across some property to Everett Lane; then parallel with the Central Vermont track up to about one-half mile below Hart's island, where the line, as now intended, will go across the Connecticut river and proceed to Lebanon, N. H. The construction of this line is part of a plan by which the Boston & Maine will get away from using the tracks of the Central Vermont, a Grand Trunk property.

Virginia.

Surveys are under way of the proposed route for a new railroad to be built from Roanoke to Mount-Airy, N. C., via Floyd Courthouse, Va. McGee & Royer, Roanoke, Va., are the engineers.

The Norfolk Railway & Light Co. has asked the City Council of Norfolk, Va., for amendments to its franchise permitting changes in its existing car line routes and the establishment of new routes.

Washington.

The Nooksach Valley Traction Co., Exchange Bldg., Bellingham, Wash., has had work started clearing its right of way north of Bellingham. The company proposes to build a line from Bellingham to Sumas, via Ferndale and Blaine. J. S. Wheeler is Construction Engineer.

Fred E. Sander has applied to the County Commissioners at Seattle for a franchise to build an electric railway to Lake Burien, seven miles south of Seattle.

Although nothing definite has been given out by the officials of the Idaho & Washington Northern R. R., it is believed that plans are being laid for the construction of the extension from Ione to Colville, Wash.

Officials of the Inland Empire System, who recently made an inspection tour of the newly completed roadbed on the Colfax branch, have approved the work and same will be turned over to the operating department at once. Jay P. Graves is General Manager.

The North Coast R. R. Co., F. L. Pitman, Chief Engineer, Spokane, Wash., is reported to have secured practically the entire right of way from Walla Walla to Spokane, for its proposed line. It is believed from this that construction work on the line to Spokane will be started early next year.

Wisconsin.

The Melrose R. R. has completed surveys for its projected 28-mile line from Sparta to Melrose. A. E. Rou, Sparta, Wis., is Chief Engineer, and J. N. Brown, 402 American National Bank, St. Paul, Minn., is President.

The Great Northern Ry., A. H. Hogeland, Chief Engineer, St. Paul, Minn., is reported to be planning extensive improvements on its ore line next spring. These include the double-tracking of about 15 miles of line between Superior and the iron range.

The contract work on the new Soo Cutoff near Glenwood City, Wis., was finished on Nov. 15. The steel will be laid as soon as possible and it is expected to have trains in operation before Jan. 1.

The Milwaukee Northern Ry. Co., of Cedarsburg, Wis., is said to be planning to extend its electric railway northward. The village of Franklin has appointed a committee to attempt to induce the Northern to build its proposed extension through Franklin, which now has no railway connection.

The Commercial Club of Superior, Wis., is to ask the local street railway company to extend its lines in Superior.

It is reported that the Minneapolis, St. Paul & Sault Ste. Marie Ry. is about to purchase the Wisconsin & Michigan Ry. and the Wisconsin & Northern Ry. It is said that if the sale goes through the mileage of both the latter roads will be greatly increased.

The State Railroad Commission will hold a hearing at Madison, Wis., on Nov. 30, on the application of the Fairchild & Northeastern Ry. Co., N. C. Foster, President, Fairchild, Wis., for permission to construct an extension in Eau Claire and Dunn Counties, Wisconsin.

Wyoming.

The Denver, Laramie & Northwestern Ry., W. D. Hodge, Chief Engineer, Denver, Colo., has a party of sixteen surveyors at work on its proposed railroad through Rattlesnake Pass, northwest of Elk Mountain. The engineers have run three lines through that country, one of which goes through Pass Creek Pass. It is reported as quite likely that the latter route will be adopted and a branch line built to Saratoga from the main line, branching off about the Allen ranch on Pass Creek.

Canada.

The Canadian Northern Ry. Co. has a bill before the Alberta Legislature giving it power to construct a railway from Edmonton through the Peace River to the Yukon territory. It is said that the construction of the road will be commenced early next spring by A. C. Mackenzie, president of the Northern Construction Co., of Winnipeg, Man. The bonds for the road, for the sum of several millions, are now on sale in London. The Peace River pass will likely be used to take the line to the Yukon.

Advices from Ogeman, Sask., under date of Nov. 25, state that Neil Keith, a subcontractor for the Lethbridge-Weyburn branch of the Canadian Pacific, is missing. The country has been searched for miles by the mounted police but no trace of him can be found, and the conclusion has been arrived at that he perished in the recent storm.

Arrangements are being made for the construction of the Canadian Northern Line on Vancouver Island. Tenders will be called for immediately for clearing the right of way. The line will run from Victoria to Alberni, via Sooke. The Canadian Pacific R. R. will also proceed at once with the Cowichan Lake branch of the E. & N. Line, which runs from Crofton to Cowichan Lake, a distance of 30 miles.

The Simcoe, Grey & Bruce Ry. Co. is applying to Parliament for a charter to construct a railway from Southampton to Owen Sound, thence to Meaford, Thornbury, Collingwood and Orilla.

The Western Central Ry. Co., incorporated by the Ontario Legislature, is applying for a Federal charter with authority to extend to Windsor the electric lines provincially authorized between Toronto and London. A ferry connection from Windsor to Detroit is the ground for seeking a Federal charter.

The Canadian Pacific Ry. has filed plans of its line into Prince Albert, Sask. It parallels the G. T. P. and C. N. R. right into the heart of the town, ending up on Central Ave., in the block next to the postoffice. The name of this line, which comes from Regina, is the "Regina, Saskatoon & North Saskatchewan branch."

Grading work on the Peoples' Ry. from Guelph to New Hamburg, Ont., is to be commenced at once.

According to the 6th annual report of the Commissioners of the National Transcontinental Ry., now before parliament, the total expenditure for the year was $19,969,126. The total grading done to March 31, 1910, was 1,106 miles, while the total amount of track laid was 813 miles of which 698 miles was in main track and 114 miles in sidings.

The Grand Trunk Pacific is now completed 100 miles east of Prince Rupert and nearly 200 miles west of Edmonton. It is hoped before the end of January to have track at the entrance to the Yellow Head Pass and the entire line linked up by 1913. The line from Winnipeg to Fort William will be opened for passenger traffic early in the spring. If the present rate of progress in grading near Yellow Head Pass continues throughout the winter months a contract will be awarded early in the spring for the line between Aldermere in the Bulkley Valley and Tete Jaune Cache.

Contractors have completed a two years' job of installing heavy steel rails on the Calgary and Edmonton Ry., between Strathcona and Calgary. This improvement will permit fully two hours being clipped off the present schedule between the two cities. The faster service will likely be inaugurated early next spring. The distance from Calgary to Strathcona is 191 miles and the run will be made in about 5½ hours. The completion of the undertaking has been delayed for several weeks owing to a scarcity of heavy rails.

It has been announced, according to advices from Ottawa, Ont., by M. J. O'Brien, the President of the newest Canadian R. R., the Canada & Gulf Terminal Ry., that the road will commence operations at once over the first section which has been completed. The line runs from St. Flavio on the Intercolonial Ry. to Matana, a distance of 40 miles through a well settled part of the Gaspe Peninsula. The route as chosen will, it is said, shorten the Winnipeg-Liverpool time by 30 hours. The company has an authorized capital of $4,000,000 and authority to issue bonds to the extent of $30,000 per mile.

Grading on the Greenway-Wakopa branch of the Canadian Northern Ry., according to advices from Bannerman, Man., has been completed and rails are at present laid as far as Adelpha.

Mexico.

The Mexico Tramways Co., Arpatado 124 Bis., City of Mexico, is reported to have completed preliminary surveys for an electric railway from the City of Mexico to Toluca, a distance of 45 miles, and for an electric railway from the City of Mexico to Puebla, a distance of 125 miles. The chamber of deputies has passed the bill authorizing the building of these two lines. The senate has yet to pass upon it, but it is believed that the permit will be granted, and as soon as possible thereafter, engineers of the company will begin work on the lines.

Grading work has been started for a standard gage railroad from Penjamo, on the Guadalajara division of the National Railways of Mexico southward to Zacapu, a distance of 46¼ miles. Amador y Santacruz is the contractor. The branch will become a part of the National Railways and is intended as a valuable feeder to the main Guadalajara line. Work will be pushed with all possible speed, and since the survey is through a region of exceptionally easy access, it is expected that the line will be in operation within a very few months. Penjamo is an important point on the Guadalajara division, being located in the state of Jalisco, between the stations of Abasolo on the east and Villasenor on the west, about 31 miles southwest of the junction town of Irapuato and about 100 miles east of Guadalajara.

The state of Guerrero, Mexico, by granting a concession to F. E. Olendorf, Taxco, authorizing the construction of a railroad from Naranjo to Taxco, has furnished another link to the network of Mexican railroads. The track, which will be narrow gage, will open the mining district from which Cortez secured the first Mexican silver. Engineers will commence locating the line at once and construction will follow soon after.

A blue print has been prepared by the promoters of the Pan-American Transcontinental Ry. Co., on which is the proposed route of the railway through Uruguay, for which a concession was granted by the Government. The line will extend 370 miles from Colonia on the River Plate opposite La Plata, in Argentina, to San Luis, in the Department of Rivera, on the Brazilian border, from which it will continue to Bage, in Brazil, already connected with a railway which is eventually to extend to Rio de Janiero. A 60-mile branch will be built from a point near the village of Carmen, northeast of Durazno, to Corro Chato, where junction will be effected with the Central Uruguay road. It is stated that the Anglo-American Banking House of London will finance the scheme.

Grading work is under way in the State of Cananea for a railroad which will traverse the Sonora river some distance north. The new line will start from Regreso, the present terminal of the narrow gage railroad from Torres to Minas Prietas. Regreso is nine miles from Prietas and there is a branch road to that point, as there is where the road secures its wood which it uses as fuel. The narrow gage road is being overhauled at present and will be changed to a standard gage road. English capital is behind the new road and it is believed that the English syndicate which recently took over the smelters at Guaymas and Fundicion and the company building the railroad is the same. The new road will reach the Sonora River at a point 12 miles from Ures, from which point it will travel along the valley, possibly to Cananea, or Arizpe. This road will be the means of transporting ores from the many mines in that portion of the state.

Bates & Cash have been making good progress with the contract for the grading work on the Pachuca Railways extension from Pachuca to The Barron Mine, Real del Monte and Cantera. Three kilometers have been completed and ready for the steel, which will not be laid until the line is well advanced into Real del Monte. A force of 40 men with 60 mules and scrapers have been employed for the past two months on the now completed work. This force will be increased to from 500 to 1,000 men as soon as the cross-section surveys in the heavy rock work are entirely completed. The heaviest work is reported to be along the ridge leading to Real del Monte and while the engineers employed in the location of the road spent several months in going over the ground before finally locating the line a 6 per cent grade will be necessary to get over the mountain.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

Bids will be received until 11 a. m., Dec. 14, by Board of Public Works, Oakland, Cal., for furnishing and placing rock portion of a proposed rock and earth embankment in the Key Route Basin in Oakland, Calif. James W. Nelson, Secretary of the Board.

A movement is underway at Bakersfield to expend $100,000 for raising the levee on Kern River through the city.

Illinois.

✣The P. J. Goggin Contracting Co., Arcola, Ill., as noted in our last issue, has a contract for ditch work in the Oakaw Drainage District, four miles north of Ficklin, Ill., on the C., H. & D. Ry. The Goggin Co. will receive bids up to Dec. 5 for digging of trench, laying of tile and necessary backfilling. The work includes the following: 1,200 ft. 20-in. shale drain tile, average cut 5.75 ft.; 1,800 ft. 18-in. shale drain tile, average cut 5.17 ft.; 2,900 ft. 14-in. shale drain tile, average cut 4.35 ft.; 3,400 ft. 12-in. shale drain tile, average cut, 4.82 ft.; 2,400 ft. 10-in. shale drain tile, average cut, 4.28 ft.; 1,418 ft. 8-in. shale drain tile, average cut 4.37 ft. The tile is to be furnished by the National Drain Tile Co., Terre Haute, Ind. Hauling is to be done by O. D. Abercrombie, Ficklin, Ill.

Advices from Alton, Ill., state that the project for building a levee by private subscription to protect about 1,000 acres of land on Missouri Point will be delayed because the owners of 2,000 acres adjoining it desire to be included. Application will now be made for the formation of a levee district for the 3,000 acres.

Three claimants in the North Ford Drainage District case have been allowed damages by a jury in the Circuit Court at McLeansboro. The settlement of these cases assures the construction of the ditch, as all litigation is ended.

Indiana.

✣Bids will be received until 1 p. m., Dec. 10, by County Surveyor at Renssalaer, Ind., for the construction of the Jungles' Davis Ditch. W. Frank Osborn is Commissioner of Construction.

Kansas.

The Callahan Brothers Construction Co., Omaha, Neb., which has the contract for the Kaw Valley drainage work at Kansas City, Kan., as noted in our last issue, has opened offices in the Daniels Bldg., Kansas Ave. and Packard Ct., Kansas City, Kan., for the work, which is to be started at once. About 1,000 men will be employed.

Louisiana.

The commissioners of the Crowley 6th Ward Drainage District, Crowley, La., have accepted the proposition of a Chicago bond company to purchase the issue of $75.000 of drainage bonds, and it is probable that the commissioners will in a short time have the money available to begin the work of dredging, the engineer's surveys having been practically completed.

Missouri.

Louis R. Ash, City Engineer of Kansas City, Mo., is now making a survey and an estimate of the cost of turning the bed of Turkey Creek into the Kaw River near Mill St. in Rosedale. This action is considered necessary on account of the fact that the Kaw Drainage Board will shortly begin the erection of dikes along the Kaw, leaving Turkey Creek as the one place where flood water can break into the West Bottoms.

New Mexico.

Certificates of construction and license to appropriate water for four irrigation projects have been issued by Territorial Engineer Sullivan to Venturo Gallegos of Trinchera, Colo., James A. Gregory of Corrumpa, Charles H. Baird and W. R. Martin of Airolo and Oscar W. McCuiston of Valley. The projects are all in Union County.

New York.

✣Bids will be received until noon, Dec. 21, by F. C. Stevens, Supt. Public Works, Albany, N. Y., for the following canal contracts: Contract No. 48, Erie Canal, Section 8. For the construction of the canal from a point near the N. Y. C. Railroad crossing at Lyons to a point near the West Shore R. R. crossing at East Newark. Length, 5.75 miles. Sheets 1 to 81, inclusive. Contract No. 51, Erie Canal—Section 5. For constructing a canal feeder between Trenton Falls and Nine Mile Creek, together with a gate-house, culverts and all other work appertaining to the contract. Length, 5.75 miles. Sheets 1 to 32, inclusive. Contract No. 76. Erie Canal—Section 8. For the construction of the canal from a point near the West Shore Railroad crossing at East Newark to a point about one-half mile east of Port Gibson. Length, 5.77 miles. Sheets 1 to 49, inclusive. Contract No. 77. Erie Canal—Section 8. For constructing the canal from a point about one-half mile east of Port Gibson to about one-half mile west of Palmyra. Length, 6.78 miles. Sheets 1 to 76, inclusive. Contract No. 80. Oswego Canal—Section 1. For the construction of a dam and bulkheads across the Oswego River at Phoenix, N. Y. Sheets 1 to 14, inclusive. Contract No. 91. Erie Canal—Section 1. For building and equipping hydro-electric power plant on the Erie Canal near the east end of Crescent Dam. Sheets 1 to 23, inclusive. Contract A. Cayuga and Seneca Canal—Section 1. For constructing Lock No. 1 and Dam No. 1 near Cayuga. Length, 0.25 mile. Sheets 1 to 33, inclusive. Contract B. Cayuga and Seneca Canal—Section 1. For excavating a channel mainly in the Seneca River, from Montezuma to deep water in Cayuga Lake, from Cayuga Lake to Seneca Falls and from Waterloo to deep water in Seneca Lake. Length, 17.2 miles. Sheets 1 to 43, inclusive.

Holler & Shepard, Rochester, N. Y., have been awarded Barge Canal Contract No. 27A, providing for the completion of the unfinished part of Contract No. 27 in Fort Edward. The contract price was $149,498.

The State Canal Board, Albany, N. Y., has approved proposed contracts at an estimated cost of between $7,000,000 and $8,000,000 which practically will complete the barge canal, with the exception of the Syracuse and Rochester harbors, the Medina arch and part of the Cayuga-Seneca Canal. The plans approved include those for the construction of the enlarged Erie Canal from Clyde to Palmyra, at an estimated cost of $5,000,000, and for part of the construction work on the Cayuga-Seneca Canal at an estimated cost of $2,200,000. The board also has approved plans for a pier and bulkhead in Oswego at a cost of about $135,000, and for a hydro-electric power plant near the Crescent dam, on the Mohawk River, at an estimated cost of $45,000.

The Marsh & Marsh Co. of Schenectady has been incorporated. The capital is $50,000 and the company will engage in general contracting business. The directors are Noel, Frank E., Flora A. and Elizabeth Marsh, all of Schenectady.

The lowest bid for Contract 37 of the barge canal involving dredging in the Oswego River between Fulton and Oswego was that of the American Pipe & Construction Co. of Philadelphia. The contract was awarded to the above company at $2,323,998.

North Carolina.

Surveys are being made of the Brown Creek swamp district near Wadesboro, N. C., with a view of installing a drainage system. W. K. Allen, Wilmington, N. C., is the engineer.

Ohio.

✣Bids will be received until Nov. 30, at 11:30 a. m., by Cumings & Downer, C. E., Painesville, O., for grading the subdivision site, Wickliffe, Lake County, O., for the Cleveland, Crane & Engineering Co., of Wickliffe, O. The work will include the removal of about 11,000 cu. yds. of material

Porto Rico.

✣Bids are asked until 2 p. m., Jan. 3, at the office of John A. Wilson, Commissioner of the Interior of Porto Rico, San Juan, Porto Rico, for the construction of the following: (1) Carite Dam and appurtenant structures, containing about 150,000 cu. meters of earth and loose rock, the estimated cost of which is about $190,000; (2) Guayabal Dam and appurtenant structures, containing about 73,500 cu. meters of concrete masonry and 82,000 cu. meters of excavation, the estimated cost of which is about $550,000; (3) Patillas Canal and appurtenant structures, including about 32,000 cu. meters of open-cut excavation, 2,060 lin. ft. of tunnels, 2,500 lin. ft. of flumes, 600 lin. ft. of siphons, and 100 bridges, the estimated cost of which is about $70,000. J. W. Beardsley, Guayama, Porto Rico, is Chief Engineer of the Irrigation Service. Official advertisement will be found elsewhere in this issue.

Wyoming.

Advices from Saratoga, Wyo., state that preliminary surveys are being made for an irrigation system on the east side of the Platte River extending from the Conness ranch to a point near Walcott, on the Union Pacific. A large area will be reclaimed. The ditch will be 50 miles long, 52 ft. wide on the bottom, and two tunnels will be required in its construction.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be received until 11 a. m., Dec. 20, by H. J. Lelande, City Clerk, Los Angeles, Cal., for furnishing for the fire department miscellaneous apparatus.

✣Bids will be received until 3 p. m., Dec. 7, by Board of Public Works, San Francisco, Cal., for general construction, lathing, plastering and furring; painting; street work; vacuum cleaning system; heating and ventilating, plumbing, brick work; electric work of Lowell High School building in block bounded by Masonic Ave., Grove, Hayes and Ashbury Sts.

Contracts for the new Washington school in the west end at Alameda, Cal., have been let as follows: Painting and brick work, Klenck & Miller, $20,565; plumbing, M. H. Owens, $4,090; Powell Brothers, carpentry work, vacuum cleaning plant and electric lighting, $26,157.

District of Columbia.

✣Bids will be received until 3 p. m., Jan. 26, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including roof and ground surface drainage system, of the new building for the Bureau of Engraving and Printing, Washington, D. C.

Florida.

Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., on Nov. 21, received bids for removing the wreck of the "Chatham" at the entrance to St. Johns River, Fla., and awarded the contract to Johnston & Virden of Lewes, Del., for $29,500.

Georgia.

✣Bids will be received until noon, Dec. 16, by Board of Health, Atlanta, Ga., for the handling and disposing of garbage, ashes and refuse of the said city. John J. Jentzen is Chief of Sanitary Department of the city.

Contracts for constructing the new addition to the Grady Hospital at Atlanta, Ga., have been let as follows: General construction work, Donaldson & Pearson, at $62,600; for plumbing, Farrell Heating & Plumbing Co., $15,760; for heating system, Peck-Hammond Co., $6,700; for electric work, Kelting Electric Co., New York, $2,950.

The city of Atlanta, Ga., has awarded contracts for the construction of seven new school houses as follows: Ninth Ward school, Moise de Leon, construction of building, $29,100; Wynne Plumbing Co., plumbing, $4,290; Engelhart Heating Co., heating and ventilating, $4,470; Johnson Service Co., heat regulation, $570. Eighth Ward School, George A. Clayton, construction of building, $28,254; Farrell Heating & Plumbing Co., plumbing, $4,226; Engelhart Heating Co., heating and ventilating, $4,470; Johnson Service Co., heat regulation, $570. Fifth Ward school, Donaldson & Pearson, construction of building with plumbing, $32,500; Atlanta Steam Heating Co., heating and ventilating, $4,185; Johnson Service Co., heat regulation, $552. Second Ward school, I. N. Brown, construction with plumbing, $32,500; Farrell Heating & Plumbing Co., heating and ventilating, $4.490; Johnson Service Co., heat regulation, $572. Fourth Ward school, W. P. Francis, construction, $28,680; Jennings-Gresham Co., plumbing, $4,239; Englehart Heating Co., heating and ventilating, $4,470; Johnson Service Co., heat regulation, $570. Lee Street school, Donaldson & Pearson, construction $34,118; M. E. & C. W. Ford, plumbing, $5,321; Moncrief Furnace Co., heating and ventilating, $6,224; Johnson Service Co., heat regulation, $675. Fourth Ward Negro school, Acworth Construction Co., construction and plumbing, $18,466; Moncrief Furnace Co., heating and ventilating, $3,431; Johnson Service Co., heat regulation, $377

Illinois.

✣Bids are asked by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705 City Hall, until 11 a. m., Dec. 3, 1910, for furnishing the steam supply required at the boiler header of heating plant at the new City Hall, Washington St., La Salle St. and Randolph St.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, until 11 a. m., Dec. 1, 1910, for furnishing and erecting four chain grate stokers and two stoker engines at the Roseland pumping station, 104th St. and C. & W. I. R. R. tracks. Bidder must furnish with his proposal plans or illustrated catalogue, giving name of grate proposed, number and dimensions of links or grates, weight of chain per foot, and complete and such other information as shown on plans. The stoker engines shall be the equal to type "E," as made by E. H. Wachs Co., capable of operating all four grates at the same time and shall be designed for 175 lbs. of working steel pressure. Full plans and specifications are on file at the office of the Commissioner.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, until 11 a. m., Dec. 5, 1910, for furnishing one open feed water heater and purifier for the 68th St. pumping station, 68th St. and Oglesby Ave.: the heaters shall be amply capable of heating to 206° F. and purifying feed water for a rated total of 1,000 boiler horse-power, or 30,000 lbs. of water per hour, receiving condensed water at 80° F. and 1/10 of the total water from drips, etc., at 206° F. Bidder shall furnish with proposal plan or illustrated catalogue giving name and type of heater proposed, thickness and kind of material in main plate and of pans, weight of apparatus, dimensions and such other information as shown on complete plans and specifications on file in the Commissioner's office.

✣Bids will be opened by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, at 11 a. m., Dec. 6, 1910, for furnishing and delivering boiler tubes to the Chicago Ave. pumping station, Lake Shore Drive and Chicago Ave. The tubes shall be of special charcoal iron and shall be 3½-inch stay tubes, No. 8 Birmingham gage, 12 ft. 17 in. long, and shall be free from blisters, luminations, etc., and shall be tested before delivery, to 500 lbs. hydrostatic pressure. All tubes are to be threaded and must conform to specifications on file at the office of the Commissioner of Public Works.

Indiana.

✣Bids will be received until 10 a. m., Dec. 17, by the Depot Quartermaster, Jeffersonville, Ind., for furnishing miscellaneous supplies under Schedule No. 574.

Iowa.

A company is being organized by S. E. Irish of Bonaparte, Ia., for the development of the water power at Bonaparte. It is proposed to erect a concrete dam and water power plant.

The city of Newton, Ia., has voted to issue $40,000 of bonds for the erection of a municipal gas plant.

City of Sioux City, Ia., is considering the feasibility of installing a modern municipal electric power plant, capable of furnishing light and power for the city buildings, fire and police buildings, the proposed Morningside subsidiary water station, and for pumping from new wells that are being installed. F. W. Cappeleh, Consulting Engineer, Minneapolis, Minn., has been instructed to make plans and estimates.

Kentucky.

✣Bids will be received until 3 p. m., Dec. 2, by Samuel D. Jones, Business Director, Louisville School oBard, Louisville, Ky., for remodeling of the Overhillst School, work consisting of carpentry, plumbing, plastering, tile work, etc.

Maryland.

✣Bids will be received until 11 a. m., Dec. 7, by Board of Awards, Baltimore, Md., for installing electric wiring in the sewage pumping station building on Eastern Ave. J Barry Mahool is President of the Board.

Michigan.

✣Bids will be received until 3 p. m., Dec. 22, by Col. C. McD. Townsend, U. S. Engineer, Jones Bldg., Detroit, Mich., for the removal of old superstructure and building concrete superstructure on north pier and on pierhead of south pier at harbor or refuge Harbor Beach, Mich. The work will include the following approximate quantities: Removing superstructure, 1,445 lin. ft.; 8,780 cu. yds. concrete sections in place; 10,000 bbls. cement; 4,650 ft. B. M. oak fenders; 17 mooring posts

The Great Lakes Dredge & Dock Co., Chicago, Ill., at $35,760, was the low bidder for repairing the walls of the St. Marys Falls canal at Sault Ste. Marie, Mich. The work is to remove the timber work and all broken rock along about 660 feet of the canal wall, to face the rock with concrete and to build on top of the rock a concrete wall. All the work will have to be done in the dry and must be completed between the close of the present season of navigation and the opening of the 1911 season.

Committees have been appointed at Big Rapids, Mich., with P. W. Hathaway, Secretary, to consider utilizing the power of the Muskegon River. One committee will consider the matter of taking over the upper dam and also the purchase of the Big Rapids Electric Co.'s plant by the city. Another will study the availability of erecting a large new dam at the mouth of Ryan Creek, and the third will study how best to improve the water works on which it is proposed to spend $30,000 in repairs.

Mississippi.

The city of Brookhaven, Miss., has awarded the contract to Harrisburg Engine Works for furnishing and erecting one compound condensing high speed 200 R. P. M. Corliss Valve type engine for direct connection to 200 K. V. A. alternator, steam consumption stated for operating ½, ¾, 1, 1½ loads at 90 per cent P. F., 24-in. vacuum, 140 lbs. steam, for $5,681 Bids were opened Nov. 22.

Missouri.

✣Bids will be received until noon, Dec. 7, by Maj. Edw. H. Schulz, U. S. Engineer, Kansas City, Mo., for removing the wreck of steamboat in the Missouri River at Kansas City, Mo.

New Jersey.

✣Bids will be received until 3:30 p. m., Dec 7, by Board of Fire Commissioners, City Hall, Newark, N. J., for one or more automobile high service wagons with suitable equipment complete to have a carrying capacity of not less than 1,500 ft. of 2½-in. cotton covered hose

✣Bids will be received until 5 p. m., Dec. 6, by Board of Education, Glen Ridge, N. J., for the purchase of thirty-five $1,000 school bonds. Edward D. Street is District Clerk.

✣Bids will be received until 2:30 p. m., Dec. 2, by the Board of Water Commissioners at Atlantic City, N. J., for furnishing in accordance with specifications on file in the office of the water department, one horizontal single cylinder non-condensing Corliss engine. L Van Gilder is Engineer and Superintendent.

New York.

✣As noted in our last issue bids are being asked until noon, Dec. 19, Col. W. M. Black, U. S. Engineer, Army Bldg., 39 Whitehall St., New York, for dredging and rock removal in Bronx River, N. Y., and in East Chester Creek, N. Y. The work in the Bronx River is divided into seven sections. The amount of material to be removed from the seven sections is estimated at 185 cu. yds. of ledge rock, to secure a depth of 6 ft. at mean low water, and 28,000 cu. yds. of material other than ledge rock to secure a depth of 4 ft. at mean low water. The material to be removed for East Chester Creek is estimated at 1,500 cu yds. of ledge rock and 25,000 cu. yds. of other material.

✣Bids will be received 3 p. m., Dec. 14, by T. E. McGarr, Secy., State Commission in Lunacy, Albany, N. Y., for the alterations in main building, construction, including plumbing and electric work at Long Island State Hospital, Brooklyn, N. Y.

✣Bids will be received until noon, Dec. 27, by George Cromwell, President of the Borough of Richmond, New York City, for furnishing all the necessary labor and material for the construction of steam boilers and appurtenances of the Clifton Destructor, Borough of Richmond, City of New York.

Items marked thus ✣ indicate work now open for bids.

✣Bids will be received until noon, Dec. 2, by Calvin Tomkins, Commissioner of Docks, Borough of Manhattan, New York City, for furnishing all the labor and materials required for the repairs to the municipal ferryboat "Richmond."

✣Bids will be received until noon, Dec. 1, by Brigadier-General William Verbeck, Albany, N. Y., for metal filing cases. Franklin B. Ware, Albany, N. Y., is State Architect.

North Carolina.

✣Bids will be received until noon, Dec. 12, by W. J. Hales, City Clerk, Morehead City, N. C., for the construction of 1,000 ft., more or less, of concrete retaining wall at that place.

Ohio.

✣Bids will be received until noon, Dec. 7, by the Board of Trustees of the Ohio State University, Columbus, O., for furnishing all material and labor for the erection of a library at the Ohio State University. Allen & Collens, 6 Beacon St., Boston, Mass., are the architects. Carl E. Steeb is Secy. of the Board.

✣Bids will be received until noon, Dec. 12, by the Director of Public Service of Cleveland, O., for furnishing and erecting in the engine house at the new Kirtland Pumping Station, Cleveland, two vertical triple expansion pumping engines which would have a capacity of 25,000,000 gals. of water in twenty-four hours. Ira O. Hoffman is secretary to Director of Public Service.

✣Bids are asked until 11 a. m., Dec. 19, by Capt. F. W. Alstaeter, U. S. Engineer, Wheeling, W. Va., for furnishing and erecting leaves for two bear trap weirs of Dam No. 26, Ohio River. The site for the work of erection is in the Ohio River about 8 miles below Gallipolis, O., on the Ohio River division of the Baltimore & Ohio R. R. The site of Dam No. 26 is accessible by boat, and there is a railroad siding to the government grounds called "Dam 26, Ohio River." The approximate quantities of material for each bear-trap weir are as follows: Structural steel, 286,550 lbs.; bolts, etc., 9,300 lbs.; iron castings, 4,115 lbs.; steel castings, 10,200 lbs.; and bronze, 550 lbs.

It is stated that a large proportion of the work on the park improvements which the city of Cleveland, O., is now in a position to carry out with the funds derived from the recent sale of $50,000 park bonds, will be done by city labor direct instead of by contract. The grading work at Washington park will be done by contract and bids are now being called

Oklahoma.

✣Bids will be received until 3 p. m., Dec. 28, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a gas piping system and a conduit and wiring system in the United States Post Office at Oklahoma City, Okla.

✣Bids will be received until 3 p. m., Dec. 23, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a heating and ventilating apparatus in the United States Post Office, Oklahoma City, Okla.

Oregon.

✣Bids will be received until 4 p. m., Dec. 13, by the Water Board, Portland, Ore., for furnishing 200 fire hydrants, f. o. b. cars Portland, Ore. Specifications and form of proposal can be obtained at the office of D. D. Clarke, City Hall, Portland, engineer of the water board. Frank T. Dodge is Supt. of the Board.

The Warrenton Development League of Warrenton, Ore., has taken action looking to the dredging of Skipanon Creek from the center of the Columbia River channel down the creek a distance of at least a mile. The cost is estimated at $50,000.

Pennsylvania.

M. P. Wells & Co., Philadelphia, Pa., has been awarded the contract for constructing the new U. S. post office building in Chambersburg, Pa. Work is to be completed by Jan. 1, 1912.

The State Department has granted charters for eight electric companies formed to operate in portions of Berks and Montgomery counties. All of the charters were granted to concerns formed by the Rigg interests of Reading, which obtained charters for eight companies last week. The charters issued were: Edison Electric of Pottstown; Edison Electric of Birdsboro, Union Township, Ontelaunee Township, Lower Pottsgrove Township, Upper Pottsgrove Township, Bern Township and Robeson Township; capital of each $5,000. Walter A. Rigg is Treasurer of all of the companies.

Bids were opened Nov. 23 by the city of Philadelphia for street cleaning for 1911, removal of garbage and snow removal. For street cleaning Edwin H. Vare, Philadelphia, the present contractor, was the only bidder, his bid amounting to $1,340,000. For an additional $32,000 Mr. Vare offered to fulfill all requirements of present specifications and supplement that work by using high-pressure flushing machines twice a week on all asphalt and wood block paved streets, and one such machine daily in Walnut, Chestnut and Arch Sts., and two such machines daily in Market St. between the Delaware and Schuylkill rivers. If the use of "squegee" sweeping machines, combined sprinklers and sweepers, were required to be used throughout the city for cleaning the streets in place of hand brooms, Contractor Vare asked $1,460,000, or an increase of $161,000, as compared with this year's street cleaning contract. For the removal of garbage next year the Penn Reduction Co., which holds the contract this year for $497,988, asked $510,000, and was the only bidder for the work. Edwin H. Vare and James Irvin were the only bidders for next winter's snow removal contracts. Vare's bid was as follows: Double team to manholes and dumps, 5 cu. yd. loads, $1.14 each; 2 cu. yd. loads, 94 cts each, and single team, 1 cu. yd. loads, 30 cts. each. Irvin's bid was $3.20, $2.10, $4.05, $1.60, $1.23 and 85 cts., respectively. The city's bills for snow removal last winter amounted to about $92,000.

Virginia.

✣Bids will be received until 4 p. m., Dec. 1, by W. P. Knowles, Supt. Committee on Light, Richmond, Va., for furnishing, operating and repairing and maintaining 1,200 incandescent mantle street lights in the city.

Washington.

✣Bids will be received until 10 a. m., Dec. 2 by Board of Public Works, C. B. Bagley, Secy., Seattle, Wash., for the construction of a steel picket fence around the Green Lake Low Service Reservoir.

The Scandinavian-American Dredging Co., of Seattle, Wash., has been incorporated with a capital stock of $300,000, the incorporators being O. H. Holdsworth and W. L. Hunter.

The city of Seattle on Nov. 8 voted $1,750,000 for work on the Lake Washington Canal, for improvement of the Duwamish River, and for public dock work.

Wisconsin.

✣Bids will be received until 10:30 a. m., Dec. 5, by Department of Public Works, Milwaukee, Wis., for the necessary labor and material for constructing a pumphouse and laundry for the Municipal tubercular hospital in the town of Wauwatosa.

The following bids were received Nov. 23 by Lt. Col. Graham D. Fitch, U. S. Engineer, Duluth, Minn., for building part of rubble mound breakwater at Superior Entry, Wis., (1) standing for bid per 2,000 lb. ton for 57,200 tons of quarry run of stone delivered in place in breakwater and (2) for 30,800 tons of stone weighing not less than 10 tons each, and (3) total: Great Lakes Dredge & Dock Co., Chicago, Ill. (recommended [illegible] $145,200; A. G. Osman, Duluth, Minn., (1) $1.25, (2) $2.70, (3) $154,660; Buffalo Dredging Co., Buffalo, N. Y., (1) $2.00, (2) $2.50, (3) $191,400.

The bid of Alex. Sang, Duluth, Minn., for rebuilding pierhead to breakwater at Ashland, Wis., has been recommended for acceptance by the U. S. Engineer at Duluth. The total amount of the bid was $7,874, which includes 2,925 tons of rock delivered in place at $1.25 per ton, and $4,218 for the crib and piles complete in place.

Canada.

✣Bids will be received until noon, Jan. 3, by Alexander Johnson, Deputy Minister of Marine and Fisheries Dept., Ottawa, Can., for the construction of a buoy depot at Prince Rupert, B. C. The wage schedule for a 9-hour day, which the contractor will be required to pay, is as follows: Concrete workers, $3.00; carpenters, $5.00; blacksmiths, $4.50; painters, $5.00; plumbers, $5.50; bricklayers, $6.00; engineers, $4.50; firemen, $3.00; machinists, $4.50; laborers, $3.00. The work consists of the erection of a buoy shed and machine shop, power house and reinforced concrete chimney, carbide stone, stone house, offices, dwellings, etc.; the installation of drainage and water systems, the storage of machinery delivered by the department and the erection of a traveling crane of 20 tons capacity. The wharf to be erected is 405 ft. long and 40 ft. wide, with an additional width of 15 ft. over 105 ft. of its length. The wharf is to consist of concrete piles, and these after having been driven in are to be carried up as columns erected in place and braced with horizontal and diagonal members.

✣Bids will be received until 11 a. m., Dec. 15, by Chairman of the Board of Control, Winnipeg, Man., for furnishing an electric traveling crane. M. Peterson is Secy. of the Board.

✣Bids will be received until 4 p. m., Dec. 12, by R. C. Des Rochers, Secy. of Department of Public Works, Ottawa, Ont., for the fittings, Toronto Central Postoffice. Plans and specifications may be obtained at the office of T. A. Hastings, Clerk of Works, Postal Station "F," Toronto.

✣Bids will be received until 11 a. m., Dec. 15, by the Chairman of Board of Control, Winnipeg, Man., for furnishing 500 k. w. motor generator sets. M. Peterson is Secy. of the Board.

An agreement has been entered into between Dominion Government and the Vancouver Drydock & Shipbuilding Co., of Vancouver, B. C., whereby the latter will undertake the construction of a drydock at Roche Point on Burrad Inlet, and near Vancouver, at a cost of $1,214,154. The work is to be started within six months and finished by Dec. 1, 1912. L. Thompson is President and Frank Bennett, Jr., is Secretary.

Mexico.

Extensive improvements are planned by the Mexican Government for the harbors which the new line of the Southern Pacific R. R. of Mexico will reach. The ports expected to receive important benefit from the construction of the road are Guaymas, Topolobampo, Altata and Mazatlan. The government has already adopted plans and awarded contracts for extensive harbor improvements at Mazatlan and Guaymas. The proposed works involve an expenditure of more than $15,000,000 Mexican money. The surveys are now being made preliminary to starting construction work on the breakwaters. It is planned to carry on the work at both Mazatlan and Guaymas at the same time. The Pacific port of Manzanillo, which is reached by the branch line of the National Railways of Mexico, is also to be still further improved by the government by the construction of a second breakwater that will project from the eastern side of the bay, and the erection of another large wharf. The proposed improvements will cost about $6,000,000 Mexican money, the government having already appropriated that sum for the purposes named.

BRIDGES—STEEL AND CONCRETE

Colorado.

The Park Board, Denver, Colo., has ordered that all wooden bridges spanning the City Ditch in Washington Park be replaced by reinforced concrete structures.

Connecticut.

The City Plan Commission, Hartford, Conn., has decided in favor of the construction of a bridge connecting Riverside St. with Pope Park. Frederick L. Ford is City Engineer.

Florida.

✣Bids will be received until Dec. 5 by John C. Calhoune, Clerk of the County Commissioners, Perry, Fla., for the construction of a steel bridge over the Econfenee River. Contract will also be let at the same time for approximately 800 sq. yds. of cement sidewalks at the court house.

Idaho.

The Lewiston Concord Bridge Co., Asotin, Idaho, has been incorportaed with a capital stock of $100,000. The incorporators are Edgar L. Libby, George W. Bailey and Charles F. McDonald, of Lewiston, Idaho

Illinois.

The Joliet Bridge Co., Joliet, Ill., according to advices from Peoria, Ill., has been awarded the contracts for the construction of two new bridges in Radnor and Logan townships as follows: The first, the Section 20 bridge bids were as follows: Big T Rail Co., Elmwood. $1,995; Joliet Bridge Co., Joliet, $1,674; Burnham & Ives, Bloomington, $1,748; Wm. Drimmon & Son, Galesburg, $1,950; Illinois Steel Bridge Co., $1,900; Edward Cooney, Tremont, $1,680; Missouri Bridge Co., St. Louis, $2,080. The bids for Section 30 bridge were: Missouri Bridge Co., $2,881; W. Drinnin, $2,447; Illinois Steel Bridge Co., $2,700; Big T Rail Bridge Co., Elmwood, $2,619; Edward Coney, $2,240; The Joliet Bridge Co., $2,174; Burnham & Ives, $2,300; Miller Bros., Peoria, $2,699.

Following are the low bids and bidders as opened by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705, City Hall, for the renewal of end floor beams and end floor panels of the Clark St. bridge, over the Chicago River: Stroebel Steel Construction Co., 98 Jackson Boul., total $3,690; Kettler, Elliott Erection Co., 112 S. Clark St., total $4,595. Itemized bids of low bidders are as follows, furnishing all materials, tools, labor and appliances necessary for renewing the end floor beams, sidewalk brackets, steel stringers, guard angles, etc., $2,070; oak timber furnished and built in place, including all necessary bolts, washers, lag screws, etc., $240; (3,000 ft. B. M. app.) white pine timber furnished and built in place, including all necessary bolts, washers, spikes, nails, etc., (2,000 ft. B M. approximate), $120; yellow pine timber furnished and built in place, spikes, bolts, etc. (900 ft. B. M. approximate), $540; creosoted wood block pavement, furnished and laid complete, (130 sq. yds. approximate), $650; additional steel and iron, not shown on plans and not included in lump sum bid, built in place, $100. Bids opened Nov. 23, 1910.

Board of Supervisors, Springfield, Ill., have awarded a contract to Frank Miller at $3,490 for the construction of a bridge across Spring Creek, northwest of the city.

The bridge over the Salt Creek on the Illinons Central R. R., near Maynerville, Ill., was recently destroyed by fire and immediate steps will be taken toward its reconstruction The structure was 327 ft long and cost about $3,500.

Indiana.

The contract for the construction of the concrete bridge at Paoli, Ind., was let Nov. 21 to the International Steel & Iron Construction Co., Evansville, Ind., at $2,662. A. B. Horn is County Auditor.

Earl Sparks of Kirhlin, Ind., has been awarded the contract by the County Commissioners at Lebanon, Ind., for the repair of Prairie Creek bridge at Thorntown, for $1,097. Bids were opened Nov. 21.

Iowa.

Advices from Iowa City, Ia., state that a contract for the construction of a steel bridge over the Iowa River near the village of Lone Tree, was awarded the Des Moines Bridge Co., Des Moines, Ia., at $8,900.

Citizens and business men of Council Bluffs and Omaha have been invited to attend a meeting to be held by the West Council Bluffs, Ia., Improvement Club to discuss the matter of constructing a new bridge to connect the Bluffs with Omaha.

Kansas.

✣Bids will be received until Nov. 30 by the Board of Plevna Township, Reno County, Kan., for the construction of a concrete bridge including a total of 22 cu. yds. of concrete. J. E. Davis is Clerk. Plans and specifications can be seen at the office of the County Engineer, Hutchinson, Kan.

✣Bids will be received until Nov. 30 by the Board of Haven Township, Reno County, Kan., for the construction of two reinforced concrete bridges, including a total of 58 cu. yds. of concrete. E. L. Mounts is Clerk. Plans and specifications can be seen at the office of the County Engineer, Hutchinson, Kan.

✣Bids will be received until noon, Dec. 5, by J. W. Niehaus, County Clerk, Leavenworth, Kan., for the construction of a bridge known as the Fulcher Bridge. Plans and specifications can be obtained of the County Engineer or Clerk.

The contract for the construction of a 50 ft. concrete arch bridge over Switzer Creek, in Burlingame, Kan., was awarded to the Topeka Bridge & Iron Co., at $2,145.

Commissioners of Pawnee County, Kansas, have awarded a contract to the Topeka Bridge & Iron Co. for the construction of an 80 ft. reinforced concrete arch bridge over the Pawnee River near Rozel, Kan.

Maryland.

✣Bids are asked by Henry G. Shirley, County Roads, Engineer, Towson, Md., until noon, Dec. 8, for rebuilding the bridge over Back River on Eastern Ave., Baltimore County. Certified check for $1,000 required with bid. Official advertisement will be found elsewhere in this issue.

Michigan.

A meeting was held in Grosse Pointe Township, Mich., to decide on the matter of raising $2,000 for the construction of a bridge on the Cadieux road.

City of Escanaba, Mich., at a recent election voted to issue bonds amounting to $40,000 for the construction of a new steel and concrete bridge across the Escanaba River at Wells.

Minnesota.

At the spring election, Duluth, Minn., the matter of issuing $90,000 of bonds for the construction of a new bridge on E. Fourth St. will be voted upon.

Missouri.

✣Board of Supervisors, Springfield, Mo., will receive bids until 2:30 p. m., Dec. 6, for the construction of five bridges to be located as follows: Santa Margarita River, Los Flores Creek, San Onofre Creek, south branch of San Mateo Creek and the main channel of San Mateo Creek. The five bridges are to have wooden pile approaches, combination wood and steel bodies and cylinder piers of steel and concrete.

An order signed Nov. 11 by the Supreme Court grants the city of Columbia 6 months' time in addition to that already set aside for the construction of the bridge across the Columbia Canal.

The Stone County Court, according to information received from Galena, Mo., has awarded a contract to the Western Bridge Co., Kansas City, at $12,000 for the construction of a bridge across the James River at Galena.

The Missouri Pacific Ry. is considering replacing all wooden bridges on the system with steel.

Subscriptions are now being collected at New Bloomfield, Mo., for the construction of the new bridge over the Town Creek.

New York.

✣Bids will be received until 2 p. m., Dec. 6, by Kingsley L. Martin, Commissioner of Bridges, Department of Bridges, 13-21 Park Row, New York City, for furnishing and delivering wood paving blocks to 3d Ave., 145th St. and City Island bridges.

State Superintendent of Public Works Stevens, Albany, N. Y., has awarded a contract, under Barge Canal Contract No. 82, for the construction of new highway bridge superstructures over the Erie Canal west of the Genesee River in Rochester, to the Groton Bridge Co., Groton, at $28,841.

North Dakota.

✣Bids will be received until noon of Dec. 7 by Arthur G. Lewis, Auditor of Cass County, Fargo, N. D., for the repair of the 32 ft. bridge between Sections 4 Lake and 32 Rochester Townships and the 80 ft. bridge between Sections 3 Lake and 34 Rochester Townships.

Ohio.

✣Bids will be received until Nov. 30 by the County Commissioners at Cleveland, O., for the preliminary work of the High Level Bridge to span the Cuyahoga Valley. Frank R. Landers, County Surveyor. The work will include a series of borings at points on River Road, N. W., and Merwin St., N. W.

✣Bids will be received until 11 a. m. Dec. 17, by the Board of Commissioners, Cleveland, O., for the construction under Report No. 2734, of plank floor on the Brighton Viaduct in Brooklyn Township. Frank R. Lander is County Surveyor.

County Court has instructed the County Highway Engineer to let a contract to the Canton Bridge Co. for the construction of a bridge in Washington Park, Jefferson City, O.

Advices from Miami, O., state that a contract has been awarded the Champion Bridge Co. for building two iron bridges over Snake Creek and Little River, to replace the old wooden structures.

City Engineer's department of Cincinnati, O., has completed plans for the construction of the Gilbert Ave. viaduct. The drawings provide for a concrete and steel structure 900 ft. long with 60 ft. roadway resting on 30 solid concrete piers, forming that number of arches. About $540,000 has been secured and about $200,000 is still needed for the work.

The Canton Bridge Co., of Canton, O., has been awarded the contract in Ottawa, Kan., for repairing bridges for $1,190. The work includes cleaning, painting, adjusting and repairing Main St. and Locust St. bridges. G A. Marcell is City Clerk. Bids were opened Nov. 16.

The County Commissioners at Cincinnati, O., referred a petition for the construction of a new concrete bridge in Sharonville, on the road that leads from Reading Road to Blue Ash, to the county engineer for report

Oregon.

The Oregon Ry. & Navigation Co. wishes to have certain streets on the east side of Portland, Ore., vacated so as to give access to its new steel bridge across the Willamette River.

Items marked thus ✣ indicate work now open for bids.

Pennsylvania.

The Butler Passenger R[illegible] the City Council of Butler, Pa., for a franchise to construct a viaduct 750 ft. long on Center Ave., spanning the Bessemer & Lake Erie and the Baltimore & Ohio R. R. tracks on Center Ave., connecting the main section of the city.

South Carolina.

✣Bids will be received until noon, Dec. 1, by J. DeBruin Kops, Engineer, Savannah, Ga., for strengthening the abutment of Whale Creek bridge, Beaufort County, S. C.

Tennessee.

✣Bids will be received until noon, Dec. 1, by Ennis M. Douglass, City Clerk, Memphis, Tenn., for furnishing the necessary labor and material for the following culvert and pipe work: Peabody Ave. and Melrose St.: 1,630 lin. ft. concrete culvert, 150 lin. ft. concrete culvert rebuilt, 15 inlets, 250 ft. 24-in. pipe, 2,000 cu. yds. excavation. The foregoing quantities are approximate only, and are introduced for the purpose of comparing bids. The work will be let as a whole. Specifications and profiles governing the above work may be seen at the office of the City Engineer.

Texas.

The Santa Fe Ry. Co. has removed all obstacles in the way of erecting a $12,000 viaduct over its tracks in the city of Belton, Tex.

The City Council of Nacogdoches, Tex., and the County Commissioners have agreed to build two concrete bridges, jointly, over the Bonita Creek, one at the Main St. crossing near the passenger depot and the other on South Fredonia St. The contract for both bridges will require an expenditure of about $4,200.

Advices from Crandall, Tex., state that seven spans of the Texas & New Orleans R. R. bridge across East Fork, 2 miles west of that city, were recently destroyed by fire. Immediate steps will be taken for their reconstruction.

Virginia.

The contract for the construction of the superstructure of the proposed viaduct over the valley of Lieutenant Run at Petersburg, Va., has been awarded to the Roanoke Bridge & Iron Co. As planned the structure will be of steel and concrete, 600 ft. long, and will cost about $50,000.

Washington.

Bids were received by the Board of Public Works, Seattle, Wash., Nov. 11, for the construction of a drawbridge across the West Water way at Spokane St. The International Contract Supply Co. at $30,044 was the lowest bidder.

A petition presented to the Board of County Commissioners by State Representative from Buckley, Wash., to rebuild the bridge at that place which was recently washed out by flood was granted.

West Virginia.

Advices from Huntington, W. Va., state that as soon as the concrete piers and abutments are remodeled the Boston & Albany R. R. will construct steel girded bridges to replace structures 125 and 126.

Wisconsin.

On Dec. 8 the city of Superior, Wis., will call an election to vote on the matter of issuing $90,000 of bonds for the erection of a steel bridge across the Nemadji River to connect the Tenth Ward with the remainder of the city.

At a recent session of the County Board at Baraboo, Wis., the matter of appropriating $10,000 for the completion of the bridge across the Wisconsin River at Springgreen was taken up.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until 2 p. m., Dec. 21, by Maj. J. B. Cavanaugh, U. S. Engineer, Montgomery, Ala., for sand and gravel.

Russell County, Seale, Ala., county seat, will hold an election soon to vote on the proposition of issuing bonds to the amount of $100,000 for road improvements.

At a recent meeting of the committee of the Gadsden Business Men's Association, the Gadsden Real Estate Association, the Business Men's Club of Attalia, and interested citizens, plans were formulated for building a boulevard from Gadsden to Attalia.

The street committee of the city council of Birmingham, Ala., has decided to pave 18th St., from Avenue A to H, with brick.

Arkansas.

✣Bids will be received until Dec. 5 by the Board of Directors, District No. 3, Jefferson County, Pine Bluff, Ark., for the construction and repairing of approximately 10 miles of gravel road, including the necessary culverts, drains, etc., in said district. Certified check for $500 made payable to W. D. Hearn, Pres. of the Board, must accompany each bid.

California.

The city council of Oakland, Cal., has ordered specifications from the city engineer's office for the extension of 11th and 12th Sts., to the water front.

The Glenn County Supervisors at Willows, Cal., have decided to open a new road which will pass through the Marshall tract. The road will be about a half-mile long.

The supervisors at Fresno, Cal., will probably grant the petition of Ira H. Wixson for the construction of a public road, 6½ miles west of Fresno, and running from the N. W. ¼ of 5-14-19 through sections 32 and 29-13-19.

According to advices from San Francisco, Cal., the Goetzman Realty Co., is having new surveys made of their Shriners' canyon tract in Mill Valley, with a view to opening up new highways.

The Board of Supervisors of Reading, Cal., has made a contract to purchase from Dr. L. F. Dozier of Anderson the land needed for a right-of-way to extend the Redding-Anderson wagon road half a mile farther down the east side of the railroad.

The proposed election in Coronado, Cal., for the purpose of voting bonds in the aggregate amount of $130,000 for various municipal improvements will be held about the middle of December. The proposed bonds are for the paving of Orange Ave., at an estimated cost of $67,000; for a sewer system east of Avenue A, at a cost of $17,000; for the enlargement of the sewer outlet from 12 to 18-in., estimated cost $10,500; for laying of sewer laterals in alleys, $8,000; improvements in the fire department, including the purchase of new apparatus, $10,000, and city hall, $15,000.

Colorado.

A petition has been drawn up and will be circulated in Trinidad, Colo., for the paving of two miles of the residence district streets. The improvement will cost about $100,000.

Automobilists of Greeley, Colo., county and surrounding towns are contemplating an organization for the betterment of the present roads and the building of new ones.

A movement is on foot in Greeley, Colo., for the forming of a paving district which will include 10 business streets of the city.

The state highway commission of Colorado has urged the state engineer to begin immediate work in surveying and establishing the grade for the portion of the Denver-Fort Collins state road which lies in Boulder County, approximately 30 miles.

Delaware.

Application has been made to the Court of General Sessions at Wilmington, Del., by residents of Brandywine hundred for the appointment of a commission to condemn certain lands for a proposed road to extend from Faulk road to an extension of the Boulevard.

Florida.

Citrus County, Inverness, Fla., county seat, has voted bonds to the amount of $150,000 for the improvement of roads.

The Engineering & Paving Co., of Jacksonville, Fla., has been awarded the contract by the County Commissioners at Jacksonville for paving 8 roads, aggregating about 20 miles, with brick, to a width of 15 ft. Bids were opened Nov. 1. G. L. Barnard, Jacksonville, is County Engineer.

Georgia.

The City Council of Macon, Ga., has passed a resolution for paving portions of First, Second and Fourth Sts.

Citizens of Hancock County, Sparta, Ga., county seat, have voted bonds in the sum of $60,000 for good roads.

The City Council of Macon, Ga., has awarded the contract for the paving of 44 additional blocks, involving 14 streets, while 12 blocks have just been paved, to the Southern Paving Co., for approximately $300,000. Vitrified brick is to be used and it will be laid for $2.08 per sq. yd. Every street leading from the center of the city will be paved to the city limits.

Illinois.

The city officials of Sheldon, Ill., contemplates macadamizing Grove St., and Center St. The contract will be awarded this winter so that work can be begun early in the spring. The paving will be 14 ft. wide. R. F. Meyers is mayor.

The Board of Local Improvements of Peoria, Ill., has passed an ordinance providing for the paving of South St., with brick to a width of 30 ft., from Adams to Water Sts.

The City Counicl of Batavia, Ill., has been petitioned for the paving of Wilson St.

A petition has been circulated in Maroa, Ill., for the opening of a new road beginning half a mile east and one-fourth north of Ospur and running north on the half section line connecting with a road at a point about two miles north of the starting point.

The Board of Local Improvements of Freeport, Ill., is considering street paving work for next year. Estimates on certain jobs have been drawn up by the City Engineer and the board will decide upon next year's plans. Contracts will be let about the first of January for the spring and summer work.

The Board of Local Improvements of Cairo, Ill., has ordered estimates for a number of street improvements. The new streets to be improved are as follows: 15th St., from Commercial Ave. to Cedar St., brick pavement; 20th St., from Ohio to Walnut St., brick pavement; West 34th St., from Washington Ave. to the Big Four tracks, filling; when the street is filled another order will be made for extending the brick paving from Washington Ave. west; Holbrook Ave., from 24th to 28th Sts., filling; all streets between 27th and 33d Sts., filling.

The Board of Local Improvements of Chicago, Ill., is preparing a program for paving the central business district, extending from Kinzie to 12th St., and from Canal St. to the lake. The board has also sanctioned the improvement of 5th Ave., Clark St. and Wabash Ave. Other improvements planned are the paving of Randolph St. and parts of Washington, Monroe, Sherman and Congress Sts.

Mayor George W. McCaskrin of Rock Island, Ill., has urged the early improvement of the Ninth and 12th St. roads from 18th Ave. to the Rock River. Ninth St. will be

Items marked thus ✣ indicate work now open for bids.

resurfaced at an estimated cost of $4,000, and 12th St. will be macadamized for a distance of about two miles.

Indiana.

✣Bids will be received until 1 p. m., Dec. 19, by County Commissioners, Williamsport, Ind., for the construction of a gravel road in Pine Township. R. L. Winks is Auditor of Warren County.

✣Bids will be received until 2 p. m., Dec. 6, by Commissioners of Marion County, Ind., at Marion, for the construction of 5 gravel roads. A. Y. Stout is Auditor.

J. W. Sullivan of Alexandria, Ind., has been awarded the contract by the County Commissioners at Anderson, Ind., for the construction of Charles L. Webb gravel road for $3,875. The work will include grading, draining and graveling. Bids were opened Nov. 22.

Henry Pothast has secured the contract from the board of public works of Indianapolis, Ind., for the construction of a gravel roadway in the alley north of Lowell Ave. Bids were opened Nov. 23.

J. D. Hoss of Indianapolis, Ind., has been awarded the contract by the board of public works of that city for constructing curb on Morris St. Nov. 23.

Iowa.

The City Council of Sioux City, Ia., has adopted a resolution for the paving of the cross streets from 6th St., to 14th St., inclusive, between Pearl and Jackson Sts.

The contract for constructing sidewalks in various parts of Sioux City, Ia., has been awarded to P. C. Hansen & Co., for $0.12 per ft.

City Engineer Keys C. Gaynor of Sioux City, Ia., is making plats for the changing and re-establishing of street grades in Cole's addition.

City Engineer Wilson of Mason City, Ia., has surveyed and cross sectioned for 9,000 lin. ft. of street for proposed paving which the council expects to pass upon this winter.

A river-to-river road, to parallel the Keokuk & Western Railroad from Keokuk to Nebraska City, is being agitated by cities in the southern counties of the state of Iowa. Work in the way of making maps for the preliminary routes has already been started. The road will probably be called "The Corn Belt River-to-River Road."

Kansas.

✣Bids will be received until 11 a. m., Dec. 2, by Capt. J. E. Normoyle, Constructing Quartermaster, Fort Leavenworth, Kan., for the construction of roads, walks, etc., and sewers and water connections to buildings Nos. 328, 329 and 31 at Fort Leavenworth.

✣Bids will be received until Dec. 6 by E. L. Barnhart, Clerk, Road Commissioners, Iola Township, Iola, Kan., for the construction of a section of macadam road on the Humboldt Road.

The City Commissioners of Wellington, Kan., have decided on a resolution to extend asphalt pavement 27 blocks. There are to be paved 10 blocks west on 10th St., from the court house to Olive, and four blocks north on Olive to the county high school; three blocks east on Lincoln Ave., from Washington Ave. to Ash St., and 14 blocks east on Harvey Ave., from C St. to Prairie Lawn Cemetery.

Farmers in Haynes Township, Hutchinson, Kan., have organized a road improvement district and a sand-clay road will be constructed through the sand hills in the township.

Louisiana.

A model road is to be constructed between Baton Rouge and New Orleans by the East Baton Rouge Parish at an estimated cost of $15,000.

The citizens of Pineville, La., have voted the issuance of bonds in the sum of $9,000 for the improvement of Main St., from the traffic bridge to the model road recently constructed by the state and parish.

Maine.

The Asphalt Block Pavement Co., has been incorporated in Augusta, Me., with a capital stock of $100,000, with $5,000 in Indiana. George D. Lindsay of Marion, Ind., is agent.

Maryland.

In the ordinance of estimates for 1911 the Board of Estimates of Baltimore, Md., makes provisions for an expenditure of $500,000 from the $5,000,000 paving loan which Mayor Mahoel will endeavor to have submitted to the voters at the municipal election in the spring.

Michigan.

According to figures given out the state highway department of Michigan at Lansing, that department has expended since July 1, 1910, the sum of $131,719 as the state's portion of the expense of construction of highways during that period. This represents the award on 190 miles of good roads constructed according to specifications of the law governing state awards. The work has been done in 60 counties.

Minnesota.

✣Bids will be received until 2 p. m., Dec. 1, by the Board of Public Works, St. Paul, Minn., for grading Farrington Ave., from Maryland Ave. to Carbon St. R. L. Gorman is Clerk of the Board.

Mississippi.

✣Bids will be received until 7:30 p. m., Dec. 6, by Louis M. Hudson, Street Commissioner, Gulfport, Miss., for furnishing material and labor for the construction of approximately 10,000 sq. yds. of cement sidewalks. Hobart D. Shaw, City Engineer.

An election will be held in Copiah County, Hazelhurst, Miss., county seat, on Dec. 3, to vote on the proposition of issuing bonds in the sum of $50,000 for good roads.

Missouri.

The City Council of Independence, Mo., has awarded to Ratcliffe-Gibson Construction Co. the contract to pave Pleasant St., from the entrance to Mrs. Swope's place to the Missouri Pacific tracks, Lexington branch, with Hassam, for $1.65 per sq. yd. The contract for curbing the same portion of South Pleasant St. was awarded to J. A. Kennedy for $0.39½ per lin. ft. and $11.50 for each curve.

Nebraska.

A new petition is being circulated in Hastings, Neb., for the paving of St. Joe Ave., from Second St. to 12th St.

Property owners in the Hastings Ave. paving district, Hastings, Neb., have filed a communication with the City Council specifying brick as the material to be used in the paving of that street. The street will probably be paved to a width of 30 ft.

New Jersey.

✣Bids will be received until 8 p. m., Dec. 6, by the Shade Tree Commission, Jersey City, N. J., for the construction of roadways in Bayside Park. Specifications and plans will be furnished on application to the commission 28, City Hall. A. T. Hastings, Jr., is Secretary.

New York.

✣Bids will be received until 11 a. m., Dec. 7, by President Alfred E. Steers, Borough of Brooklyn, New York City, for regulating grading, curbing and laying sidewalks on 67th St. from 2d Ave. to 3d Ave. and on 80th St. from 12th Ave. to 13th Ave., together with all work incidental thereto.

Supervisors of Canastota, N. Y., have petitioned the State Road Commission at Albany for more new roads for Madison County in 1911.

City Clerk Salt of Albany, N. Y., has received a communication from the State Highway Commission stating that if it was favorable to the city it would build, at the expense of the state a bituminous macadam road from Columbia St. to the New York Central bridge on the Columbia turnpike.

According to advices from Port Jefferson, L. I., work is to begin early in the spring on a section of the state road to extend across the island from Port Jefferson to Patchogue. Engineers are at work under Lowell Groosman of the State Engineer's office surveying the route.

North Carolina.

✣Bids will be received until noon, Dec. 9, by the City Council of Wilmington, N. C., for the construction of pavement on certain streets. The work consists of approximately 4,263 sq. yds. of macadam pavement. C. R. Humphreys is City Engineer.

The City Council of Charlotte, N. C., has ordered the paving of East Ave. and W. Trade St. with bitulithic.

Ohio.

✣Bids will be received untll noon, Dec. 9, by the Board of Hamilton County Commissioners, Cincinnati, O., for the improvement under specification No. 35 of Hill Road near the residence of Jacob Stephan in the Colerain Township. Fred Dreihs is Clerk.

✣Bids will be received until noon, Dec. 2, by the Board of County Commissioners, Fred Dreihs, Cincinnati, O., Clerk, for the improvement under specification No. 110 of North Bend Road from Harrison Pike to the north corporation line of the village of Cheviot in Green Township. All bids must be accompanied by a bond of $2,000.

✣Bids will be received until noon, Dec. 1, by the Director of Public Service, Cleveland, O., for grading, loaming and otherwise improving that portion of parkway between Harvard Road and Washington Park viaduct. Plans and specifications may be obtained at the Engineer's Office, 303 City Hall Bldg. Ira O. Hoffman is Secretary to the Director of Public Works.

✣Bids will be received until noon, Dec. 5, by F. O. Howell, Clerk, village of Linden Heights, O., for furnishing necessary labor and material for the construction of approximately 190,000 sq. ft. flagstone sidewalks, and also gutters sufficient to drain same.

The city of Youngstown, O., has rejected all bids for the paving of Hillman St. because it is too late to do the work this year.

The Control Board of Cincinnati, O., has authorized Service Director Sundmaker to take up with the City Council the question of paving Eastern Ave. and Spring Grove St.

The Streets and Alleys Committee of the City Council of Canton, O., has reported favorably towards the widening of South Market St. from 8th St. to Wade St.

Patrick Gleason has been awarded a contract in Cincinnati, O., for the paving of Rutland Ave., between Montgomery road and Trimble Ave., for $7,422.

The Connolly Construction Co. has been awarded the contract in Cincinnati, O., for the macadamizing of Sutter Ave., between Beekman and Linden Sts., for $5,545.

City Engineer Shipley of Cincinnati, O., has submitted estimates of cost for the improvement of Clark St., from Freman Ave. to Dalton Ave., with asphalt at $12,718; Walter Ave., with brick, from Gilbert Ave., north, at $6,517; Dupon alley, with brick, from York to Naeher St., at $853; Daniels St., with macadam, from Burnet woods to Alice St., at $9,956; and for retaining walls and concrete steps in Hughes and Mulberry St., at $1.481.

The board of county commissioners at Cincinnati, O., has awarded the contract for the improvement under Specifications No. 39, of the Hamilton Pike through the village of Mt. Healthy in Springfield township to The Tarco Construction Co., of Cincinnati, for $7,860, Nov. 18.

Oklahoma.

✣Bids will be received until 5 p. m., Dec. 1, by F. T. Stackpole, City Clerk, Reno, Okla., for paving various sidewalks. Plans and specifications for the work are on file at the office of the City Clerk.

According to advices from Muskogee, Okla., the New State Fair Association has awarded a contract to I. T. Biles for the placing of 8 ins. of clay upon the race track at the fair grounds.

Items marked thus ✣ indicate work now open for bids.

Oregon.

According to information received from Portland, Ore., the Oregon Highway Association is to be formed to build a macadam pike from the Columbia River to Oregon's southern boundary line. The cost, estimated at $5,000 a mile for approximately 300 miles, will be met by proposed appropriation of the state legislature.

Pennsylvania.

State Highway Engineer Warren F. Cressman of Allentown, Pa., has made an inspection survey of the proposed state highway between Allentown and Reading.

An ordinance is to be prepared in Danville, Pa., for the paving of East Front St., between Ferry and Railroad Sts. A petition was received recently by the borough council asking that a section of Bloom St. between Ferry and Church St. be paved with vitrified brick.

Tennessee.

West Construction Co., of Chattanooga, Tenn., has been awarded the contract in Dalton, Ga., for paving Hamilton, King and Crawford Sts., for $56,820. The work includes 28,000 sq. yds. Bids were opened Nov. 22.

Texas.

Precinct No. 2 of Caldwell County, Lockhart, Tex., county seat, will hold an election Dec. 9 for the purpose of voting on the issuance of bonds to the amount of $25,000 for road construction.

The City Commissioners of Dallas, Tex., have ordered the paving of Houston St., between Main and Elm, with Coffeyville brick. The estimated cost of the improvement is $3,913.

The County Commissioners at Beaumont, Tex., are securing the right of way for the construction of a new shell road from West Port Arthur to Taylor's Bayou. The road will be graded by the county and shelled by the Gulf Refining Co.

W. S. Hipp has been awarded the contract to furnish gravel for the paving of most of the roads and walks in the William M. Rice institute grounds by W. Waldo, in charge of engineering at Houston, Tex. The contract calls for the paving of two miles of road, and in addition 5,000 yds. of gravel.

C. E. Johnson, Superintendent of the Teague, Tex., waterworks, has been awarded the contract for building roads in road district of Freestone County. The work will be started at once.

Virginia.

Warren County, Front Royal, Va., county seat, has voted bonds in the sum of $30,000 for road construction in Front Royal district.

Wise County, Wise, Va., at a special election held Nov. 22, voted in favor of the proposition of issuing bonds to the amount of $700,000 for good roads.

Washington.

In the spring of 1911 the city of Toppenish, Wash., will pave seven blocks of streets.

City Engineer Doolittle of North Yakima, Wash., has submitted plans for the paving of streets on the west side to the City Council. The work, it is estimated, will cost $125,000. Pavement will be laid on West Yakima, Miles and Seventh Aves.

A communication has been received by the City Clerk of Spokane, Wash., asking that the City Council pass the ordinance providing for the paving of North Wall St., from the north city limits to Garland Ave.

West Virginia.

The citizens of Lee District, Mingo County, Williamson, W. Va., county seat, have voted bonds in the sum of $60,000 for road construction.

Wisconsin.

The County Board at Milwaukee, Wis., has set aside $100,000 for good roads in Milwaukee County, as recommended by the County Park Commission. Experts, it is stated, will be employed in January to study local condition and outline plans so that work can be started in May.

The Town Board of Lawrence, Wis., is considering an application for a highway between the farms of Mrs. D. A. Stalker and Mrs. Mary Girard in the town of Lawrence. The proposed road is 200 rods long and would run from the Bain Road to the town of Hobart line.

The Ashland County Good Roads Association of Ashland, Wis., has appointed G. C. Foster to draw up a resolution to be presented to the County Board at its next meeting, recommending the building of the proposed road running south of Ashland to Glidden.

WATER-WORKS AND SEWERAGE

Arkansas.

R. M. Foster of St. Louis, owner of the water plant of Helena, Ark., has been notified by the city council that the city will take advantage of the franchise reservations and take over the water plant next August.

Citizens of Eureka Springs, Ark., have organized for the purpose of improving the sewer system of the health resort before next season.

The citizens of Warren, Ark., are agitating the installation of a sewer system.

California.

✣Bids will be received until Nov. 30 by the city of San Francisco, Calif., for the regrading and resewering of Beale St.

The city engineer of Oakland, Cal., has been instructed to prepare plans and specifications for re-sewering Franklin St., from 14th St., to 20th St.

The city council of Oakland, Cal., has directed the city engineer to investigate a method to dispose of storm water in the vicinity of Stanley Road and Foothill Blvd.

The contract for the construction of a sewer in 14th Ave., from East 24th St. to East 38th St., for the street department of Oakland Cal., has been awarded by the board of public works to Scott & Farley for approximately $10,000.

A bond issue of $26,000 for water works and fire protection for the city of Kingsbury, Cal., has been authorized at a recent election.

The Hopkins Street Improvement club of Fruitvale, Cal., has approved the movement of the city council of that city, calling for the construction of sewers under the Vrooman act.

The city council of San Jose, Cal., has awarded the contract for about 2,400 ft. of sewer pipe to be used in the construction of sewers in North First St., Taylor and 14th Sts., to the Terra Cotta Co., at the following bid: Six-in. pipe, $0.10½ per ft.; 8-in. pipe, $0.16 per ft.; 14-in. pipe, $0.37½ per ft.; 5-in. pipe on 6-in. Y's including 5-in. covers, $0.42 each: 5-in. pipe on 8-in. Y's including 5-in. covers, $0.71 each; 6-in. gutter pipe, $0.06 per ft.; 8-in. gutter pipe, $0.08 per ft. Figures are for goods delivered on the job as required.

An election was held in Covina, Cal., Nov. 29 to vote on the proposition of issuing bonds in the sum of $70,000 for the installation of a sewer system, and in the sum of $3,500 for fire hall and jail.

The Hermosa Water Co., of Cucamonga, Cal., has decided to extend the tunnel in Deer Creek, and to lay 4,000 ft. of 8-in. pipe in the district.

Colorado.

✣Bids will be received until 7 p. m., Dec. 3, by A. B. Tripp, City Clerk, Golden, Colo., for placing 500 cu. yds., more or less, of concrete; 1,000 cu. yds., more or less, loose rock riprap; 45,000 cu. yds., more or less, of earth fill, in the dam to be constructed at the site of the present reservoir on Lookout Mt.

The city council of Colorado Springs, Colo., on Nov. 23 passed an ordinance creating the first sanitary sewer, which will cost about $10,000.

According to information received from Rocky Ford, Colo., C. H. McVay, who is at present driving an artesian well at that city, has closed a contract with the Atchison, Topeka & Santa Fe Railway Co., to sink 36 wells for that company along its line in eastern and southern Colorado and northern New Mexico and western Kansas.

Connecticut.

The board of public works of Waterbury, Conn., intends to extend the main carrier sewer from its present terminus at Washington Ave., to West Main St., in order to have the sewage from the outlets into the Naugatuck river at Bank St., and West Main St., empty into the proposed new sewer. The estimated cost of the work is $100,000. Bonds will probably be sold in the sum of $100,000 for this work.

Delaware.

The city council of Dover, Del., has decided to lay a sewer of 12-in. diameter on American Ave., extending from Division St., around to Pennsylvania Ave. The estimated cost is $2,500.

Illinois.

The following contracts have been awarded by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, in connection with sewer construction: W. 75th St., Stewart Ave. to Princeton Ave., 640 lin. ft. 1-ft. tile pipe, 6 manholes and 4 catch basins, $1,216, M. Pontorelli, 4817 W. Dakin St.; W. Division St., N. 52nd Ave. to N. 54th Ave., 1,380 lin. ft. 2½-ft. brick sewer, 10 manholes and 10 catch basins, W. Division St., N. 48th Ave., to N. 52nd Ave., 2,680 lin. ft., 3¾ ft. brick sewer, $19,915, The Ryan Co., 131 LaSalle St.; Yates Ave., 26 ft. N. of N. line of E. 75th St., 60 lin. ft. 1-ft. tile pipe, $1.75 per lin. ft., E. 75th St., Phillips Ave. to Paxton Ave., 1,710 lin. ft., 1-ft. tile pipe, $1.75 per lin. ft., 14 manholes and 13 catch basins, 365 cu. yds. rock excavation at $3.00 per cu. yd., $4,192, Jno. W. Brunt, 2447 E. 74th St.; W. 40th Pl., S. Kedzie to S. Albany Ave., 675 lin. ft. 1¼-ft. tile pipe, $1.65 per lin. ft., W. 40th Pl., S. Albany to S. Sacramento Ave., 675 lin. ft. 1-ft. tile pipe, $1.41 per lin. ft., W. 41st St., S. Kedzie Ave. to S. Albany Ave., 675 lin. ft. 1¼-ft. tile pipe, $1.65 per lin. ft., W. 41st St., S. Albany to S. Sacramento Ave., 675 lin. ft. 1-ft. tile pipe $1.41 per lin. ft., W. 41st Pl., S. Kedzie Ave. to S. Albany Ave., 675 lin. ft., 1¼-ft. tile pipe $1.65 per lin. ft., W. 41st Pl., S. Albany Ave. to S. Sacramento Ave., 675 lin ft. 1-ft. tile pipe, $1.41 per lin. ft., W. 41st Pl., S. Kedzie to S. Albany Ave., 675 lin. ft. 1¼-ft. tile pipe, $1.65 per lin. ft., W. 42nd St., S. Kedzie Ave. to S. Albany Ave., 675 lin. ft. 1¼-ft. tile pipe, $1.65 per lin. ft., W. 42nd St., S. Albany Ave. to Sacramento Ave., 675 lin. ft. 1-ft. tile pipe, $1.41 per lin. ft., S. Albany Ave., W. 40th St. to W. 42nd Pl., 1,655 lin. ft. 1-ft. tile pipe, $1.41 per lin. ft., 58 manholes and 6 catch basins, $10,595, M. Pontorelli; W. 59th St., S. Kedzie Ave. to S. Spaulding Ave., 672 lin. ft. 3-ft. brick sewer, $5.00 per lin. ft., W. 59th St., S. Spaulding Ave. to S. Homan Ave., 670 lin. ft. 2½-ft. brick sewer, $4.00 per lin. ft., W. 59th St., S. Homan to S. St. Louis Ave., 670 lin. ft. 2-ft. brick sewer, $3.00 per lin. ft., W. 59th St., S. St. Louis Ave., Central Park Ave., 620 lin. ft. 1-ft. tile pipe, $1.35 per lin. ft., S. Sawyer Ave., W. 59th St. to W. 58th St., 670 lin.

Items marked thus ✣ indicate work now open for bids.

1¼-ft. tile pipe, $1.46 per lin. ft., S. Sawyer Ave., W. 58th St. to W. 57th St., 670 lin. ft. 1-ft. tile pipe, $1.35 per lin. ft., S. Spaulding Ave., W. 59th St. to W. 58th St., 670 lin. ft. 1¼-ft. tile pipe, $1.46 per lin. ft., S. Spaulding Ave., W. 58th St. to W. 57th St., 670 lin. ft. 1-ft. tile pipe, $1.35 per lin. ft.. Turner Ave., W. 59th St. to W. 58th St., 670 lin. ft. 1¼-ft. tile pipe, $1.46 per lin. ft., Turner Ave., W. 58th St., W. 57th St., 670 lin. ft. 1-ft. tile pipe, $1.35, S. Homan Ave., W. 59th St. W. 58th St., 670 lin. ft. 1¼-ft. tile pipe, $1.46 per lin. ft., S. Homan Ave., W. 58th St. to W. 57th St., 670 lin. ft. 1-ft. tile pipe, $1.35 per lin. ft. S. Trumbull Ave., W. 59th St., W. 58th St., 670 lin. ft. 1¼-ft. tile pipe, $1.46 per lin. ft., S. Trumbull Ave., W. 58th St., W. 57th St., 670 lin. ft. 1-ft. tile pipe, $1.35 per lin. ft., S. St. Louis Ave., W. 59th St. to W. 58th St., 340 lin. ft. 1⅔-ft. tile pipe, $2.50 per lin. ft., S. St. Louis Ave., W. 59th St., W. 58th St., 330 lin. ft. 1½-ft. tile pipe, $2.00 per lin. ft., S. St. Louis Ave., W. 58th St., W. 57th Pl., 340 lin. ft. 1¼-ft. tile pipe, $1.35 per lin. ft., S. St. Louis Ave., W. 57th Pl. to W. 57th St., 330 lin. ft. 1-ft. tile pipe, $1.15 per lin. ft., W. 57th Pl., S. St. Louis Ave. to S. Central Park Ave., 620 lin. ft. 1-ft. tile pipe, $1.15 per lin. ft., W. 58th St., S. St. Louis Ave. to S. Central Park Ave., 620 lin. ft., 1-ft. tile pipe, $1.15 per lin. ft., W. 58th Pl., S. St. Louis Ave. to S. Central Park Ave., 620 lin. ft. 1-ft. tile pipe. $1.15 per lin. ft., 98 manholes, 132 catch basins, M. Pontorelli, $22,788. Itemized bids were published in ENGINEERING-CONTRACTING. Nov. 23.

The Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, has awarded to Jas. H. Roche, 222 E. 31st St., the contract for laying and furnishing 2,000 ft. of house drains (6-in. diameter) at a cost of $1,200 in N. Western Ave., from Montrose Ave. to Laurence Ave. Work to be completed Dec. 31st. Itemized *bids* were published in ENGINEERING CONTRACTING Nov. 23.

Following bids were received at Pekin, Ill., Nov. 23, for the construction of a sewerage system for which John W. Alvord & Chas. B. Burdick, Hartford Bldg., Chicago, Ill., were engineers; contracts will probably be awarded Nov. 30: District No. 2—Ottawa Const. Co., Ottawa, Ill.. $30,809; Keys & McNamara, LaSalle, Ill., $31,278; Newman Sewer Construction Co., Evansville, Ind., $32,027; Reeb Bros., Belleville, Ill., $33,152; E. R. Harding Co., Racine, Wis., $34,742; Jansen & Zoeller, Pekin, $38,723; Johnson & Thomsen, Racine, Wis., $38,843; engineers estimate, $39,993: Itemized bid of lowest bidder, Ottawa Construction Co., as follows: 8-in. vitrified tile pipe sewers, 1,956 ft., 9.1 ft. cut, $.59; 10-in. vitrified pipe sewer, 1,929 ft., 7.2 ft. cut, $.58; 12-in. vitrified tile pipe sewer, 1,789 ft., 7.6 ft. cut, $.65; 15-in. vitrified tile pipe sewer, 2,749 ft., 7.5 ft. cut, $.85; 18-in. vitrified tile pipe sewer, 6,100 ft., 9.4 ft. cut, $1.13; 20-in. vitrified tile pipe sewer, 803 ft., 9 ft. cut, $1.27; 24-in. vitrified tile pipe sewer, 1,006 ft., 9 ft. cut, $1.40; 30-in. vitrified tile pipe sewer, 1,939 ft., 11 ft. cut, $1.80; 36-in. vitrified tile pipe sewer, 586 ft., 13.8 ft. cut, $3.64; 98 manholes, $30 each, 131 catch basins, $35, bulkhead, $200, 250 ft. of 12-in. cast iron pipe, $2, 10 ft. pipe for catch basin connections $45; District No. 3—Keys & McNamara, LaSalle, Ill., $60,913; Ottawa Construction Co., Ottawa, Ill., $60,954; E. R. Harding Co., Racine, Wis., $62,544; Reeb Bros., Belleville, Ill., $70,715; Johnson & Thomsen, Racine, Wis., $80,780; Jansen & Zoeller, Pekin, Ill., $83,981; engineers estimate, $84,192: Itemized bid of lowest bidder, Keys & McNamara, LaSalle, as follows: 8-in. vitrified pipe sewer, 1,491 ft., 8.5 ft. cut, $.60; 10-in. vitrified pipe sewer, 510 ft., 7.1 ft. cut, $.55; 12-in. vitrified tile pipe sewer, 2,477 ft., 7.5 ft. cut, $.62; 15-in. vitrified pipe sewer, 6,137 ft., 8 ft. cut, $.78; 18-in. vitrified tile pipe sewer, 17,742 ft., 8 ft. cut, $.96; 20-in. vitrified tile pipe sewer, 1,106 ft., 8.2 ft. cut, $1.17; 24-in. vitrified tile pipe sewer, 2,531 ft., 10.6 ft. cut, $1.44; 30-in. vitrified tile pipe sewer, 2,295 ft., 10.9 ft. cut, $1.68; 36-in. vitrified tile pipe sewer, 510 ft., 13.3 ft. cut, $3.46; 42-in. vitrified tile pipe sewer, 773 ft., 15.5 ft. cut, $4.19; 48-in. vitrified tile pipe sewer, 450 ft., 15.4 ft. cut, $4.59; 190 manholes, $30 each; 278 catch basins, $35; bulkhead, $300; 159 ft. of 16-in cast iron pipe, $3; 10-in. pipe for catch basin connections, $.50.

The Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, have awarded the following contracts for furnishing and laying water service pipes: W. 108th St., Wentworth Ave. to State St., 620 lin. ft. lead pipe, 20 brass taps, 20 brass stop cocks, 20 cast iron shut-off boxes, $0.64 per lin. ft., Daniel Hardin, 3139 Indiana Ave.; S. Marshfield Ave., W. 66th to W. 67th St., 258 lin. ft. lead pipe, 12 brass taps, 12 brass stop cocks, 12 cast iron shut-off boxes, $0.66 per lin. ft., Daniel Harding; S. Albany Ave., W. 36th St. to W. 39th St., 972 lin. ft. lead water service pipe, 46 brass stop cocks, 46 brass taps, 46 cast iron shut-off boxes, $0.62 per lin. ft., Daniel Hardin. Itemized bids were given in ENGINEERING-CONTRACTING Nov. 23.

The city of Momence, Ill., contemplates the installation of a sewerage system at an estimated cost of $40,000.

The board of local improvements of Freeport, Ill., has under consideration the building of three new sewers, which are the East Freeport sewer system, an extension of the American St. sewer to drain the district west of West St., and south of Stephenson St., and an extension of the Cottonwood St. sewer to provide drainage for Foley and Whistler Sts., Harlem Ave., and the homes on the north side of Stephenson St., in that district.

Indiana.

✣Bids will be received until 6 p. m., Dec. 20, by Common Council of Shelbyville, Ind., for the construction of a sanitary sewer system. L. E. Webb is City Clerk.

The city of Kokomo, Ind., has decided to run a preliminary survey for the proposed sewer which will drain into the Wildcat creek.

The city council of Kendalville, Ind., has awarded the contract for the construction of the Lincoln and William St. sewer to John W. Childs for $976.

Iowa.

W. B. Carter has been awarded the contract in Sioux City, Ia., for the construction of the Myrtle St. storm water sewer for $0.59½ per ft. and $47 for each manhole. The sewer will be 1,494 ft. in length.

The citizens of Logan, Ia., are agitating the construction of a water supply and sewer system.

The city of Waukon, Ia., has bonds for sale, the proceeds of which will be used for the construction of a sewer outlet.

The Commercial Sewer Co. of Laporte City, Ia., has been organized among citizens of that city to purchase, construct and maintain a sewerage system for the city, with a capital stock of $6,000. The officers are S. J. Tedford, president, H. B. Lizer, secretary-treasurer, and E. J. Buchan, vice president.

Kansas.

Citizens of the eastern part of Parsons, Kan., have asked the city board of commissioners to construct a storm sewer from 12th St., down the alley between Crawford and Clark Ave. The cost of the sewer will be from $1,853 to $2,821.

City Attorney Tyler of Hutchinson, Kan., has presented to the city council of that city an ordinance providing for extension of a drainage sewer for one block in Maple St., from Sherman to Ave. A.

The city of Chanute, Kan., has let the contract for putting in the 16-in. water mains to G. J. Edgar of Rich Hill, Mo. Bonds to the amount of $75,000 have been placed on the market for the extensions.

Maryland.

A committee of five appointed by the Hamilton Improvement Association of Hamilton, Md., to investigate the question of a sewage disposal plant for Hamilton made its report and recommended that action be taken immediately.

The sewerage commission of Baltimore, Md., has passed a resolution requesting the board of estimates to include in the budget for 1911, $400,000 in addition to the $100,000 already asked, to be used for storm water drains in Jones Falls, as outlined in the annual report of Calvin W. Hendrick, chief engineer of the commission. The entire cost of the improvement of the Jones Falls project has been estimated to be about $1,600,000. This will provide for the laying of a storm water sewer along the bed of the stream from Mount Royal Ave., to Baltimore St. The falls will be tunneled from Guilford Ave. to Chase St., and a driveway constructed over it from Chase St. to Baltimore St.

Massachusetts.

Harrison P. Eddy of Worcester and Boston, Mass., has been engaged by the city of Fitchburg, Mass., as consulting engineer and expert of the sewage commission. David A. Hartwell is Resident Engineer.

Michigan.

George Burgess of Hastings, Mich., has been engaged by the village of Otsego, Mich., to make surveys for a sewerage system for that village.

The city of Grand Rapids, Mich., has secured the right of way for the new east side trunk sewer, except across two descriptions of land, and the sewers will probably be constructed next spring.

The citizens of Bessemer, Mich., have voted the issuance of bonds to the amount of $10,000 for public sewer purposes. The sewers are to be built in the Second and Third wards. The work will be started next spring.

Recommendations for the establishment of 10 sewers have been made to the City Council of Kalamazoo, Mich. The propositions are: On Ada St. west to Simpson St.; on Florence St. west to Cobb St.; on Division St. from Washington to Lake St.; on March St., from Washington to Lake St.; on Mill St., between Stockbridge and Washington Aves.; on Drexel Pl., between Park and West St.; on South St., between Rose and West Sts.; on Gilbert Ave. to intersection of Myra St.; on North Willard St., west to Park St.

Minnesota.

✣Bids will be received until 8 p. m., Dec. 5, by the Village Council of the Village of Kenyon, Minn., for drilling and completing the deep well at the village pumping station. L. P. Wolff, St. Paul, Minn., is Consulting Engineer. C. J. Talle is Village Clerk.

T. C. Butler of Virginia, Minn., has been awarded the contract, by the City Council of that city for building a storm sewer on the North Side for $4,062, so as to do away with the sink-hole in that section of the city.

Mississippi.

✣Bids will be received until Dec. 5, by S. S. Griffin, Clerk Board of Supervisors, Yazoo City, Miss., for boring an artesian well.

The mayor and board of aldermen of Osyka, Miss., has awarded the contracts for the construction of a waterworks and electric lighting plant as follows: United States Cast Iron Pipe Co., of Chattanooga, Tenn., for furnishing pipe, $4,500; Columbian Iron Works, for hydrants and valves; Memphis Steel-Construction Co., tank and tower; Henry Worthington, pumps; A. M. Lockett & Co., well at $2,000; Walsh & Weidner, boilers; Walter Castenado, engine; Fort Wayne Electric Works, electric apparatus and Interstate Electric Co., supplies. The total cost of the contracts is about $18,000. X. A. Kramer is City Engineer.

Missouri.

The Steininger Construction Co., of St. Louis, Mo., was lowest bidder for the extension of the Fort Leavenworth, Kan., sewage system, its bids being $51,000. The new sewage line will be about 8,000 ft. long, laid at an average depth of 18 ft.

The Board of Public Works of St. Joseph, Mo., has awarded the contract for a sewer in district No. 46 to John Marnell for $1.40 per lin. ft. This is regarded as one of the most difficult district sewer jobs undertaken in the city for some time.

B. A. Powell has been awarded the contract by the City Council of Mexico, Mo., for the construction of the East Side main sewer for $1,650.

Nebraska.

✣Bids are asked until 7 p. m., Dec. 12, by Mayor C. M. Smith, Hebron, Neb., for furnishing material and the construction of lateral sewers for Sanitary Sewer District Number 1. Engineer's estimate of the cost of same is $11,100. Approximate estimate of material required is: 120 ft. of 8-in. cast-iron pipe, 11,800 ft. of 8-in. vitrified clay pipe, 1,000 ft. of ½-in. galvanized iron service pipe, 4 flush tanks, 22 manholes. Bids will also be received at the same time for constructing a main and outlet sewer, the estimated cost of which is $400. C. H. Meeker, McCook, Neb., is Engineer. Official advertisement will be found elsewhere in this issue.

City Council of David City, Neb., has ordered the establishment of a sewer district, to be known as No. 9. Thomas Wolfe is mayor. T. B. Myers, City Clerk.

Sewer district No. 10 has been established in David City, Neb., by the City Council. Thomas Wolfe is Mayor and T. B. Myers, City Clerk.

A special election will be held in York, Neb., on Dec. 27, to vote on issuing $55,000 bonds for a municipal water plant.

New Jersey.

✣Bids will be received until 8:30 p. m., Dec. 1, by City Council, Elizabeth, N. J., for the construction of a sewer in Erie Ave. from Bayway to a point north of Springfield Road, connecting with the sewers of the Joint Municipalities in Bayway, the following work to be done and material furnished, viz.: For 625 lin. ft. 10-in. pipe sewer, caulked joints; twenty 10x6-in. connections; 265 lin. ft. 8-in. pipe sewer, caulked joints; twelve 8-in. by 6-in. connections; 32 ⅛ turns; 448 lin. ft. 6-in. pipe to curb, caulked joints, to a point 7 ft. below curb; also, inspector's pay at $2.00 per day.

✣Bids will be received until 3:30 p. m., December 1, by the Board of Street and Water Commissioners, Newark, N. J., for the construction of the Avenue C. and Dawson St. storm water sewer. Morris R. Sherrerd is Chief Engineer.

According to advices from Englewood, N. J., municipalities in the Overpeck Valley and along the Hackensack River are vitally interested in proposed legislation looking to the creation of sewage disposal districts with a view to ending the river polution nuisance.

The City Council of New Brunswick, N. J., has been petitioned for the construction of a sewer on Morris St. to John St., and up that street to connect with the sewer already laid on New St.

Residents of Plum St., between Somerset and Hamilton Sts., have petitioned the board of works of New Brunswick, N. J., to lay a sewer through that street.

New York.

✣Bids will be received until 11 a. m., Dec. 13, by the Board of Water Supply, 165 Broadway, New York, N. Y., for Contract 43, for furnishing and delivering certain apparatus and materials, and furnishing, delivering and installing certain other apparatus and materials, at Ashokan, Kensico and Hill View reservoirs and in various structures along Catskill aqueduct in Ulster, Orange, Putnam and Westchester counties, New York. The apparatus and materials consist of 63 6-inch to 72-inch gate valves, 24 6-inch and 12-inch sluice-gates, 10 6-inch check-valves, 2 16-inch stop valves, 7 hydraulic cylinders for gate-valves, 2 motor driven operating mechanisms, 9 hand operating mechanisms and miscellaneous appurtenances.

✣Board of Contract and Supply, Troy, N. Y., will receive bids until Dec. 2, for laying 4,300 ft. of 12-in. water mains in Spring Ave. The city will furnish the pipe and special castings.

✣Bids will be received until 11 a. m., December 7, by Alfred E. Steers, President of the Borough of Brooklyn, N. Y., for three sewer contracts, the largest one being as follows: No. 3—For furnishing all the labor and materials required for constructing a sewer in 42d St., between 14th and 16th Aves. The Engineer's preliminary estimate of the quantities is as follows: 825 linear ft. of 15-in. pipe sewer, laid complete, including all incidentals and appurtenances; per linear foot, $1.90; 700 linear ft. of 12-in. pipe sewer, laid complete, including all incidentals and appurtenances; per linear foot, $1.70; 1,620 linear ft. of 6-in. house connection drain, laid complete, including all incidentals and appurtenances; per linear foot, 75 cts.; 15 manholes, complete, with iron heads and covers, including all incidentals and appurtenances, per manhole, $50; 2 sewer basins, complete, of either standard design, with iron pans or gratings, iron basin hoods and connecting culverts, including all incidentals and appurtenances; per basin, $135; 200 ft. (B. M.) of sheeting and bracing, driven in place complete, including all incidentals and appurtenances; per thousand feet (B. M.), $18.

✣Bids will be received until 2 p. m., December 7, by George McAnney, President of the Borough of Manhattan, New York City, for furnishing all the labor and materials required for the extension and repairs to sewer and appurtenances at 142d St., North River.

Eveline Bros., of Waterford, N. Y., and New Britain, Conn., have just finished Section one of the Woodside sewer system and have been awarded additional contracts for the extension of Sections 2, 3 and 4 of the new sewer system.

City Engineer John A. Giles of Binghamton, N. Y., has received word from Sanitary Engineer George L. Robinson that the plans for the sewage disposal plant which are in course of preparation, would be completed and ready for submission to the State Department of Health by Dec. 1.

City Engineer John A. Giles of Binghamton, N. Y., has completed the plans for the intercepting sewer system which is to connect with the sewage disposal plant it is planned to erect on the south side of the Susquehanna River opposite Riverside Park, and will submit them to the state department of health for approval. Sanitary Engineer J. L. Robinson of New York City has charge of designing the sewage disposal plant.

A special election of the electors of Fairport, N. Y., will be held in the town hall on Dec. 6, for the purpose of deciding whether the village board shall issue a note for $1,000 for the services of a competent engineer to draw up plans and specifications for a new sewer system.

The work of constructing the sewerage system and disposal plant in Yorkville, N. Y., authorized by a vote of the taxpayers of that village last October, will not be commenced this year. The amount appropriated for the improvement was $22,000. W. E. Cooper is President of the village board.

A special meeting of the Intercepting Sewer Board of Syracuse, N. Y., was recently held to consult with Chief Engineer George W. Kittredge and Division Engineers Torrence and Preston of the New York Central Railroad regarding plans for constructing the intercepting sewer in South Franklin St., under the New York Central tracks. Franklin St. will probably be tunneled between the tracks in West Fayette St. and West Washington St.

The village board of Silver Springs, N. Y. has received a report from the state board of water commissioners approving the plans submitted to the commissioners last August and authorizing the village board to put down wells and install a pumping station of sufficient supply of water. Bonds were recently voted in the sum of $14,000 for this purpose.

North Carolina.

✣Bids will be received until noon, Dec. 15, by the Board of Public Works Commission, Fayetteville, N. C., for furnishing and installing two filter units of 1,500,000 gals. per dav each, with all piping machinery and appurtenances connected therewith; the construction of a plain and reinforced concrete sedimentation basin, filtered water well, etc.; construction complete of a brick filter and power building. John K. Strange, Fayetteville, N. C., is Engineer in charge.

✣Bids will be received until 8 p. m., Dec. 5, by John A. Weddell, Clerk, Tarboro, N. C., for laying approximately one mile each of 6 and 8 in. cast iron bell and spigot water mains and specials and setting about 16 fire hydrants.

Ohio.

✣Bids will be received until noon, Dec. 1, by Board of Control, Akron, O., for the construction of a storm water sewer in and along Euclid Ave., from Schell Ave. to Wabash Ave. C. C. McCue is Clerk.

Sol Mendelson has been awarded the contract in Elyria, O., by the board of control, for the construction of a sewer on Louisiana and River Sts., for $2,000.

Herring & Son have been awarded the contract in Wooster, O., for the improvement of Nold Ave., from Beall to Spink by sewering and grading.

The board of control of Alliance, O., has awarded the contract for constructing the old fair ground storm sewer and the North Union Ave. sanitary sewer, known as sewer No. 70, to C. A. Childers and Joe Perry, respectively.

The Director of Public Service, Lorain, O., has awarded contracts to Faragher & Randall & M. J. Burke of Lorain for the construction of sewers as follows: West 25th St., sanitary sewer from Lexington Ave., westerly to the west line of Lorain Stone Co.'s addition in Granger St.; E. 34th St., sanitary sewer from Milton Ave. to Elyria Ave.; Livingston Ave., sanitary sewer from W. 32d St. southerly to W. 35th St.; W. 32d St., sub-main sewer from Broadway to Lexintgon Ave. in W. 32d St. L. B. Johnston is Clerk.

Pennsylvania.

The C. T. McCracken Co. of Pittsburg, Pa., has been awarded the contract for the reconstruction of the Preston St. sewer, in Louisville, Ky., from Water to Fulton Sts., for $30,978. Other bidders were B. C. Milner & Sons Co., and the Henry Bickel Co., of Louisville, who bid $42,000 and $43,000, respectively.

The city council of Hazelton, Pa., has decided to construct a 12-in. terra cotta sewer on East Diamond Ave., between Carson and Seybert Sts., to connect with the sewer at that point.

Plans have been outlined by Borough Engineer Damon at a meeting of Lansdowne, Pa., city council for an extension of the sewer from the Griswold Worsted Co. property 830 ft., to connect with more than a half-mile of sewer that was never used.

South Carolina.

The Board of Public Works of Rock Hill, S. C., has recommended to the City Council to give it authority to offer Martin Maloney of Philadelphia, Pa., owner of the water and electric plants of Rock Hill, $100,000 for both plants.

South Dakota.

The Northside Water Co., of Orient, S. D., has been incorporated with a capital stock of $5,000.

A special election has been called in Madison, S. D., for Dec. 6, for the purpose of voting on the proposition of bonding the city for $65,000 for a proposed sewage system. Complete surveys have been made by City Engineer Trimmer

The city of Lake Preston, S. Dak., has voted the issuance of bonds to the amount of $5.000 for improvements at the waterworks.

Texas.

The Brownsville Sewerage Board, Brownsville, Tex., has awarded a contract to the Texas Machine & Supply Co., of Dallas, Tex., for the necessary machinery to complete the septic tanks of the company.

The city of Bryan, Tex., contemplates acquiring distributing system of present water company, or may decide to construct a system. A sewer system is also proposed. The amount available is $45,000.

The city of Dallas, Tex., is advertising for bids for constructing a sewer line from Trinity River to Oakland Ave., to serve Mount Auburn addition and adjacent territory. The City Engineer has estimated that the work will cost $21,484.

The City Council of Yoakum, Tex., has passed an ordinance setting aside $3,500 for the installation of a sewerage system. Additional funds will be secured from the citizens.

The contracts recently entered into by the city of El Paso, Tex., with Sorenson & Morgan for the construction of Sections 1 and 3 of the sewage disposal plant, and with W. E. Anderson for Section 2, will probably be held up owing to the fact that the plans and specifications call for the erection of the disposal plant on Chamizal territory, the title to which is in dispute between the United States and Mexico.

Plans have been completed by the O'Neil Engineering Co., of Dallas, Tex., for the construction of a new waterworks in San Augustine, Tex., at an estimated cost of $235,000. R. H. Hall is mayor of San Augustine.

Washington.

Plans and specifications have been filed by the Board of Public Works with the City Council of Spokane, Wash., for a sewer on Main Ave., from Cedar to Ash Sts. The proposed improvement will cost $2,814.

The Board of Health of Spokane, Wash., has filed petitions of property owners with the City Clerk requesting that a water main be laid on Fifth Ave., between D and C Sts., to cost $400, and one on 16th St., between Madelia and Pittsburg Sts., to cost $426.

Wisconsin.

✣Bids will be received by the City Council of Portage, Wis., until Jan. 3, for the construction of sewers in that city.

Hans C. Hansen has secured the contract from the Board of Public Works of Racine, Wis., for the laying of a sewer and building manholes on Hubbard St., at $1.12 for pipe and $28 for manholes.

Permission has been granted to the Water Commission by the City Council of Sparta, Wis., to secure bids for the installation of a new pump, of 1,500,000 gals. capacity per day, at the waterworks station.

The city council of Rhinelander, Wis., is considering the purchase of the waterworks.

Bonds have been voted in Prescott, Wis., for the installation of a waterworks system.

Wyoming.

✣Bids will be received until 8 p. m., Jan. 6 (Mountain time), by the Board of Trustees, Buffalo, Wyo., for furnishing all labor and material for the construction of a system of sewerage at that place. All bids must be accompanied by a certified check for $1,000. The work will include 6,390 lin. ft. of 6-in. pipe sewer, 11,450 lin. ft. of 8-in. pipe sewer, 1,910 lin. ft. of 10-in. pipe sewer, 4,340 lin. ft. of 12-in. pipe sewer, 700 lin. ft. of 15-in. pipe sewer, with necessary house connections; 51 manholes, 15 flush tanks, 22 lamp holes, outlets and other appurtenances. The minimum depth of the excavation is 5 ft., the maximum 18 ft., the average 9 ft. Plans and specifications may be obtained of Hayden M. White, City Clerk, Buffalo, Wyo. E. L. Clarke is engineer in charge. Official advertisement will be found elsewhere in this issue.

Canada.

✣Bids will be received until Feb. 1 by J. W. Breakey, Sec.-Treas., Souris, Man., for furnishing and delivering during the spring and summer of 1911 the following material: Approximately 40 tons of 12-in. Standard C. I. waterpipes; approximately 85 tons of 8-in. Standard C. I. waterpipes; approximately 200 tons of 6-in. Standard C. I. waterpipes; approximately 150 tons of 4-in. Standard C. I. waterpipes, and special castings; 75 fire hydrants; 6 8-gate valves; 15 6-gate valves; 24 4-gate valves; 45 C. I. valve boxes; 20,000 lbs. pig lead; 2,000 lbs. oakum; 2,000 ft. of 20-in. Standard vit. sewer pipe; 900 ft. of 18-in. Standard vit. sewer pipe; 3,250 ft. of 15-in. Standard vit. sewer pipe; 4,750 ft. of 12-in. Standard vit. sewer pipe; 7,050 ft. of 10-in. Standard vit. sewer pipe; 13,350 ft. of 8-in. Standard vit. sewer pipe, and specials.

The board of control of Winnipeg, Man., awarded the following contracts for furnishing materials for the Domestic waterworks system: Canada Iron Corporation, Montreal, Que., water pipe at $37.50 per ton, total bid, $47,538; I. McAvity & Sons, St. John, N. B., valves, $3,523, and the Canadian Fairbanks Co., Winnipeg, Man., hydrants, $37 each. Bids were opened by M. Peterson, Secy., of board, Nov. 14.

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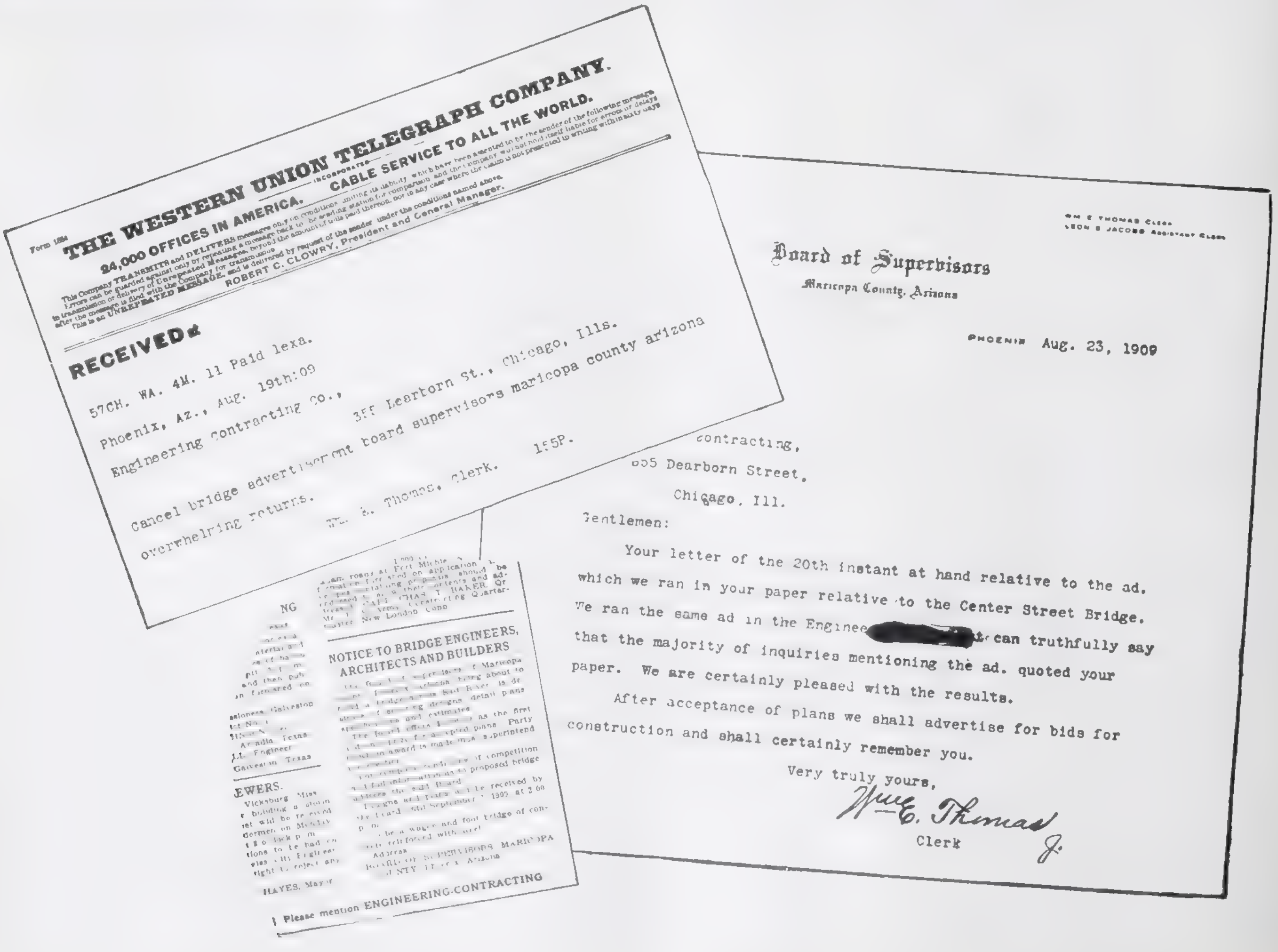

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An Incorrect Method of Determining When a Pavement Should Be Relaid Because of Increasing Repair Costs.

This problem in engineering economics appears to be quite simple, namely to determine when it ceases to be economic to patch an old asphalt pavement. Nevertheless, rules of thumb and positively incorrect methods of solving the problem are in vogue in all the large cities, so far as we know. At any rate, in the discussions at the recent convention of the American Society of Municipal Improvements (see Engineering-Contracting, Nov. 16, 1910) there were several city engineers who furnished solutions of the problem, not one of which is correct.

In New York city, it was stated, the practice is to resurface an asphalt pavement when its annual repairs reach 30 cts. per sq yd.

In Washington there is no rule, and the same holds true of Detroit and Kansas City.

In Harrisburg the specifications provide for entire renewals of pavement under guarantee when 50 per cent or more must be renewed. Mr. H. S. Sprague, Superintendent of Construction, of Pittsburg, is of the opinion that it will be economical to make asphalt repairs considerably in excess of 50 per cent of the surface area of the street.

Mr. George H. Norton, Deputy Engineer Commissioner of Buffalo, gives the following opinion:

> Theoretically an asphalt surface should be renewed when annual cost of repairs equals interest and depreciation charges on a new pavement, or is less to the extent that a new surface is worth more than the old for traffic accommodation."

Mr. Norton's criterion is the same that Mr. George M Tillson, Chief Engineer, Bureau of Highways of Brooklyn, has advocated (see Engineering-Contracting, July 17, 1907), but, as shown on page 33 of the second edition of Gillette's "Handbook of Cost Data," this method is mathematically illogical, and leads to wholly incorrect results. In the same book, pages 27 to 32, a correct solution of the problem is given, and, without going into the mathematics, we shall briefly indicate the process.

This problem is one involving a determination of the minimum unit cost of a pavement during a long period of years. In other words it consists in finding the minimum quotient obtained by dividing the sum of the first cost of the pavement and the total cost of repairs by the economic life of the pavement, using the word pavement to designate only that part that wears out under traffic. Since the problem involves solving for a minimum, the solution is most easily made by the aid of the differential calculus, although other methods may be used, such as a graphic plotting of the costs and a method of approximations which will lead to results close enough for most purposes.

Using the differential calculus, Mr. Gillette deduces three important formulas, which are expressed as: (1) Assuming the curve of annual repairs to be a straight line; i. e., repairs increasing steadily every year from the beginning; (2) assuming the curve of annual repairs to be a parabola; and (3) assuming no repairs for a period of years, followed by a period of uniformly increasing repairs. The rules are general, applying as well to a machine or other structure as to a pavement, and they are:

1. *When annual repairs increase steadily by a constant ratio, it ceases to be economic to retain a structure or machine in service after the aggregate repairs exceed the first cost of the structure or machine.*

2. *When annual repairs increase steadily according to the curve of a parabola, it ceases to be economic to retain a structure or machine in service after the aggregate repairs exceed half the first cost of the structure or machine.*

3. *When a machine or structure, whose first cost is C, requires no repairs for a period of years (K,) and then the repairs increase annually by a regular rate (a,) the economic life in years (y) is given by the formula:*

$$y = \sqrt{\frac{2C}{a}} + K^2$$

It will be noted that this method involves determining the curve of annual repair costs. It will not suffice to know what average repair costs are. Unfortunately most published data on repairs are not accompanied by statements of age, without which the data are useless in solving this particular problem in economics.

Within recent years it has become the fad for engineers to belittle the usefulness of higher mathematics in solving the so-called practical, everyday problems. There is likely to be a decided change in opinion on this matter as we come to see how frequently the calculus can be used advantageously in solving problems in economics.

The use of calculus and logic in determining the most economic bridge span, where a series of spans occur, well illustrates our point. On page 1,489 of Gillette's "Handbook of Cost Data" is given Mr. J. A. L. Waddell's solution of the economic span problem, from which Mr. Waddell deduced his celebrated rule:

"For any crossing, the greatest economy will be attained when the cost per lineal foot of the substructure is equal to the cost per lineal foot of the trusses and lateral systems."

Incidentally it may be added that this rule applies to trestles, viaducts, elevated railways, etc. A similar rule can be applied in determining the most economic spacing of floor beams, both for reinforced concrete and for wooden or steel floors. The economic spacing of studs or uprights used in concrete forms may be similarly worked out.

Since all problems in engineering economics involve solving for a minimum unit cost of production, and since an equation may be deduced to express the variable unit cost in any case it is evident that there is a wide field for the development of concisely stated economic rules derived by the application of differential calculus, as above indicated

The Cost of Concrete Work for the Gatun Locks.

The cost of 760,210 cu. yds. of concrete masonry laid in the Gatun Locks of the Panama Canal up to Oct. 1, 1910, was $7.54 per cu. yd. On a succeeding page we describe the plant and methods employed and give itemized costs of construction for a period of six months and also for another period of three months. These costs are noteworthy. They exhibit a very satisfactory rate of decrease as the construction has advanced. The average cubic yard cost for the first five months of construction was $8.54; for the succeeding six months it was $7.52, and for the final three months of our record it was $7.02. The final and lowest cost, however, not only does not show the economy vaunted in the reports of Isthmian excursionists but is on the whole rather high. The items which make up the total considered individually present the same fact

Referring to Table II, which represents the lowest cost averaged for any considerable volume of work, it is plain that no item is notably low and that some of them are rather remarkably high. Approximately, the costs of materials—cement, sand and stone, including rubble—aggregate about five-sevenths of the total. This ratio is about normal, but the absolute cost of materials is high. Canvassing the several items it will be seen that the high item is crushed stone which costs as much nearly as all the other masonry materials. Incidentally it may be noted here that rubble is being got onto the work ready for placing at $1.35 per cubic yard of stone. This is a round cost considering that this stone is largely waste rock from the Culebra Cut and excavation cost is, therefore, not included. The amount of rubble used has, however, been so small that it forms a rather negligible item of the total masonry cost. In the nine months to Oct. 1, 1910, the volume of rubble has been only 5 per cent of the volume of masonry; for the last three months of this period the proportion was 9 per cent rubble and its cost was only 1.7 per cent the total cost of masonry. We believe that a much larger percentage of rubble could have been safely and wisely employed, but this is aside from our more specific purpose to consider the construction costs actually obtained and we will return to our subject.

When crushed stone costs $2.32 per cubic yard of 1:3:5 concrete, we have ample warrant for asserting that its cost is high. It will be observed that $2.32 is the cost of stone per cubic yard of concrete, the other materials of which, cement and sand, aggregate in cost $2.79. The actual cost per cubic yard of stone for concrete was for the first six months of 1910, $2.63 unloaded at Gatun. This stone was secured from the Canal Commission's

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quarry and crushing plant at Porto Bello, about 20 miles from Gatun, is transported mostly by barges and is unloaded into the stock piles at Gatun as described in a succeeding column. We shall in our next issue present in detail the items comprising the totals for quarrying, crushing, transporting and unloading, but it will be sufficient for our purpose to give here the totals only. They are as follows:

Item.	Per cu. yd.
Quarrying	$1.21
Crushing	0.37
Towing	0.46
Unloading	0.43
General division expenses	0.08
Total	$2.55

The remaining 7 cts., about, is made up by prorating over the whole yardage the cost of extra rail transportation for some 63,000 cu. yds. at 45½ cts. The total cost of $2.62 it will be noted includes no charge for administration and general expenses, which on other classes of the canal work have, it will be noted, run in amount per unit well above the Division expenses. Passing this matter, however, there is in the above list not a single item that is not excessive. In our next issue with the more detailed analysis of the stone costs at hand we shall present figures in support of this statement; here we merely note the fact in support of our original contention that concrete costs at Gatun exhibit nothing of notable economy. We may note here, also, that sand dredged into barges, towed 35 miles and unloaded at Gatun has cost $1.92 cts. per cubic yard.

Turning to the other items of Table II, it will be noted that plant charges have been 96 cts. per cubic yard and division and general administration expenses have been 32 cts. per cubic yard. The cost of mixing concrete and placing concrete and rubble has been 45 cts. per cubic yard exclusive of power, plant charges, forms, pumping and administration expenses.

In presenting the above remarks we have not gone behind the reported figures. These do not permit a critically careful analysis. Labor costs are not separated, nor is it clear exactly what is included under certain items. The concrete plant at Gatun is one of the largest if not the largest ever installed for a single work. The magnitude of the work warranted this. The plant was designed to reduce all labor to a minimum. It has performed, in so far as it has been called upon, the mechanical operations which it was planned to perform with, we imagine, reasonable success. It has never worked or more correctly, perhaps, it has never been called upon to work to nearly its nominal capacity. The cost of maintaining it has been surprisingly high. Finally in considering progress and costs of concreting at Gatun, it must be remembered that the work is for the most part exceedingly massive and very simple. Structurally the work is an excellent one for securing low costs.

CONCRETE AND REINFORCED CONCRETE SECTION

Large Portable Plant for Crushing, Mixing and Placing Concrete on Catskill Aqueduct.

The plant which is making the greatest headway on the cut and cover work of the Catskill Aqueduct is a portable plant. This plant was designed by Chas. Longenecker & Co., 150 Nassau St., New York City, and was intended to build 30 lin. ft. of aqueduct per day, but during the first part of its operation certain improvements were made so that it could build 45 ft. a day, and later, the organization of the various crews was arranged so that 60 ft. of aqueduct could be built in a day.

Contract 11, on which the portable machine operates is being carried on by the H. S. Kerbaugh Co., and consists of both cut and cover work and 3,470 ft. of grade tunnel. The cut and cover work is nearly 5 miles in length but, the tunnel divides this into two sections, the northerly one being about 4 miles long and the southerly one approximately 1½ miles long. This article deals only with the last named section upon which the portable machine is operated.

The cut and cover type of the aqueduct is that part of the concrete pipe, carrying water to the city of New York which is built in a side hill cut, later to be covered with earth and grassed. The excavation here is mostly in compact earth containing a few boulders. The type of aqueduct designed for this class of foundation is shown by Fig. 2. In case loose ground is encountered, the base is widened as shown by the dotted line in the figure.

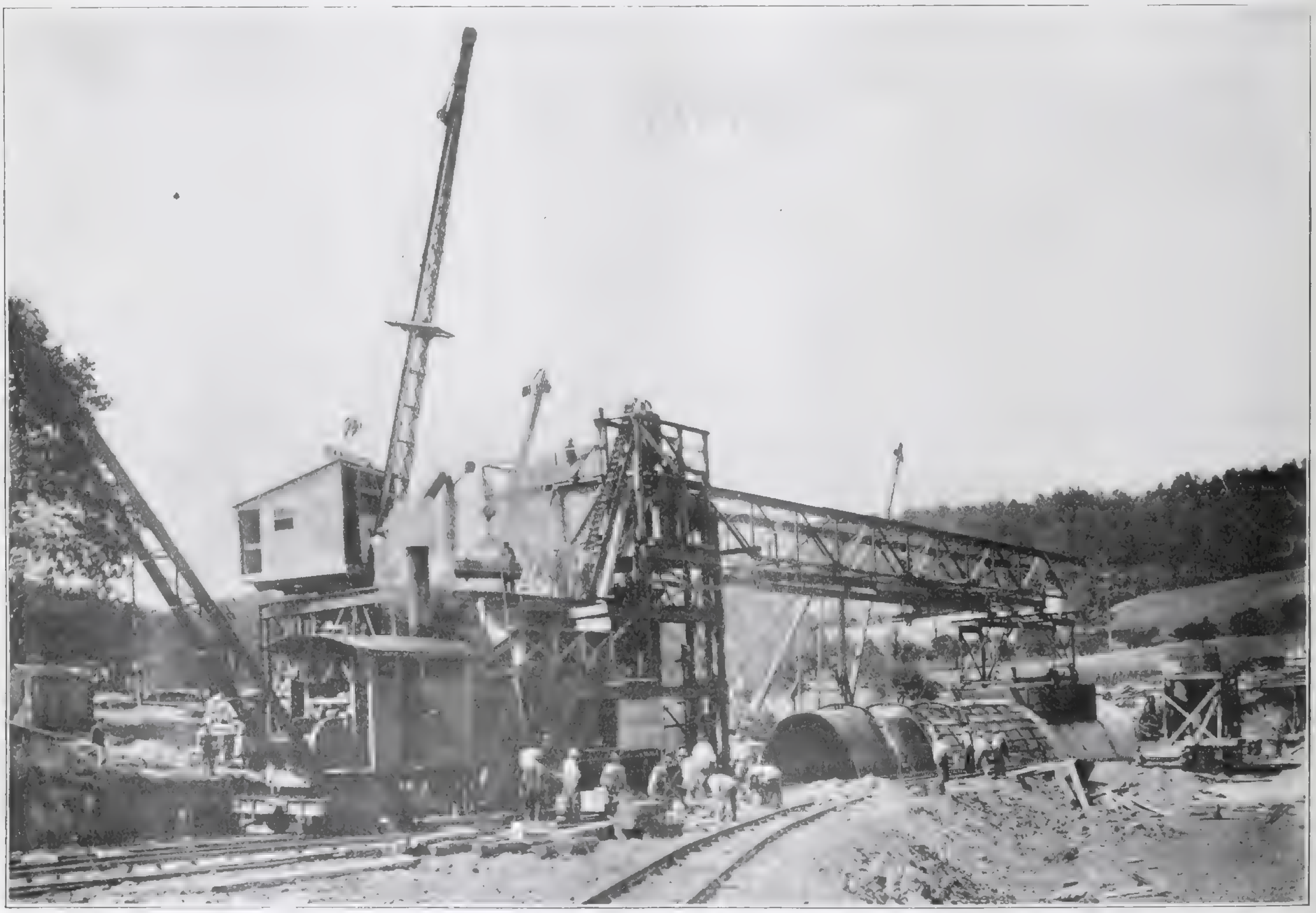


Fig. 1—View of Portable Plant Used for Crushing, Mixing and Placing Concrete on Catskill Aqueduct.

Excavation.—The line of the aqueduct excavation follows, to a certain extent, the contour of the ground and makes a more or less uniform depth of excavation of about 12 ft. This was taken out in two cuts by a 60-ton Marion shovel operating a 2½ cu. yd. bucket.

The first cut was made before any concreting was started, and the second cut, which included the remaining 8 ft. in depth, has been taken out as the concrete work proceeded. The steam shovel precedes the concrete plant about 150 yds. and deposits its spoil into side dump cars alongside the trench.

These cars are hauled by Porter dinkey engines, back along the completed work and dumped to form the cover over the arch. When sufficient earth is deposited at the side of the arch an inclined track is laid to the top of the aqueduct and along the top, thus making possible the dumping of cars to either side.

The steam shovel engineer has developed great accuracy in cutting to the lines on this work and very little trimming has been necessary. About 8,000 cu. yds. per month was excavated by the steam shovel.

Laying Key Blocks and Invert.—Before laying the invert, key blocks are laid transversely across the trench every 7½ ft. These concrete blocks are 2 ft. wide and are laid so that their surfaces come within 6 ins. of that of the finished invert. The forms for the blocks consist of steel channels bent to take the curve of the invert. They are set in position, one on each side of a key and are kept from spreading by 1 in. rods, which are bent over the top of the key and webs of the channels.

The invert is placed in alternate sections of 15 ft. The only forms necessary for this work are the hollow boxes, shown in Fig. 3, which form the keys for the side walls of the aqueduct. The concrete was at first brought from the mixer in narrow gage cars, as shown in Fig. 3, but, later a portable mixing plant on a flat car was substituted. The concrete aggregates for this plant are mixed dry at a crusher plant at the north end of the contract and brought alongside the portable mixing plant. Cement is added here and the concrete is mixed in a 1 cu. yd Smith mixer located on the flat car. A small derrick is located on the flat car for handling the stone and cement from the material train. The mixer discharges concrete into a chute which carries it out over the trench. The chute may be swung to any position for spreading the concrete.

In finishing the invert no extra grout is used. Instead of this a 2-in. steel shaft about 16 ft. long is used to roll the surface. With this method an excellent surface is made.

Four alternate sections of invert including key blocks are finished by one gang in 8 hours, thus making 60 ft. of completed invert per day.

Main Plant.—The balance of the concrete work is performed by the main plant. This plant consists of two principal parts: The first is the crushing and mixing plant and the second part serves both to handle the concrete and the outside forms.

The first part consists of a steel frame work mounted on two 60-ft. steel flat cars, placed side by side and bolted together. These cars, as shown in the accompanying drawing, Fig. 4, run on two standard gage tracks on ties made of heavy timbers. The ties are made of timbers 8 ins. wide which are built up to fit the curve of the invert. They are spaced 3 ft. from c. to c. The upper portion is supported on the two cars as shown. On the lower floor is a No. 4 McCully gyratory crusher. This feeds into a 16-in. bucket conveyor which carries the material to a revolving screen at the top of the plant. The rejects from here go through a No. 3 crusher, through the sand rolls and again to the bucket conveyor and revolving screen. The sand and stone bins below the screen have a capacity of 20 cu. yds. of sand and 40 cu. yds. of stone.

Below the bins are the measuring hoppers and a Hains mixer. The mixer dumps directly into Hains buckets which are picked up by the electric hoists and carried to the forms. Two buckets are used for handling the concrete from the mixer. Each has four wheels fastened to the rim. These are used to run on a short track which supports the bucket while being filled from the mixer spout. The track is slightly inclined and just long enough to hold the two buckets at one time. When the full bucket is picked up by the hoist, the empty bucket runs in under the spout and is ready for filling.

That part of the plant used in placing the concrete and handling the outside forms, consists of a two-truss, steel bridge 140 ft. long, upon which travel the several hoists for the different purposes described below. The bridge is supported under one end by a pivot bearing on the main plant and under the other end, by a similar bearing carried by a series of steel saddles which in turn rest upon the concrete arch of the aqueduct. The traveling hoist for handling the concrete buckets is suspended beneath the bridge. It is equipped with one 11 H. P. motor for hoisting and two propelling motors of 3 H. P. each. Three sets of tracks are provided for this carriage so that when the machine is being operated around a curve, that set of tracks is used which will suspend the carriage more nearly over the center of the work.

On top of the bridge is another traveler which is provided with over-hanging arms to which chain hoists are attached for handling the outside forms. The traveler is equipped with two motors of 5 H. P. each.

At the rear support of the bridge is another chain hoist which is equipped with a 5 H. P. motor. This hoist is suspended from an I-beam over the center line of the aqueduct (shown on the drawing in the rear end view of plant). The saddles, each of which are 2 ft. wide are picked up by the hoist, turned 90°, carried forward through the supporting frame, and reset ahead. When several saddles are set ahead the entire plant is pulled forward. This process is repeated about five times in moving 60 ft.

Forms.—The forms used on the work were made by the Blaw Collapsible Steel Centering Co., of Pittsburg. They are of sheet steel braced with ribs made of extra heavy angles. The forms are built to fit the inside perimeter of the aqueduct. They are built in 5 ft. lengths and are hinged at a point about 2 ft. above the invert. The bottom 2 ft. of the forms can thus be turned in on the hinges and the entire form supported on an A-frame carriage. The carriage is equipped with vertical and lateral screws which are fastened to the angle iron braces and are operated to hold the form in such a shape and position that it will telescope through the forms in place. The carriage runs on a standard gage track and is operated by a 30 H. P. motor; 15 ft. of forms are handled by the carriage at one time. An interesting feature in connection with the forms is in their adaptability for use on either the 200 ft. radius curves or on tangents. The sections are exactly 5 ft. wide

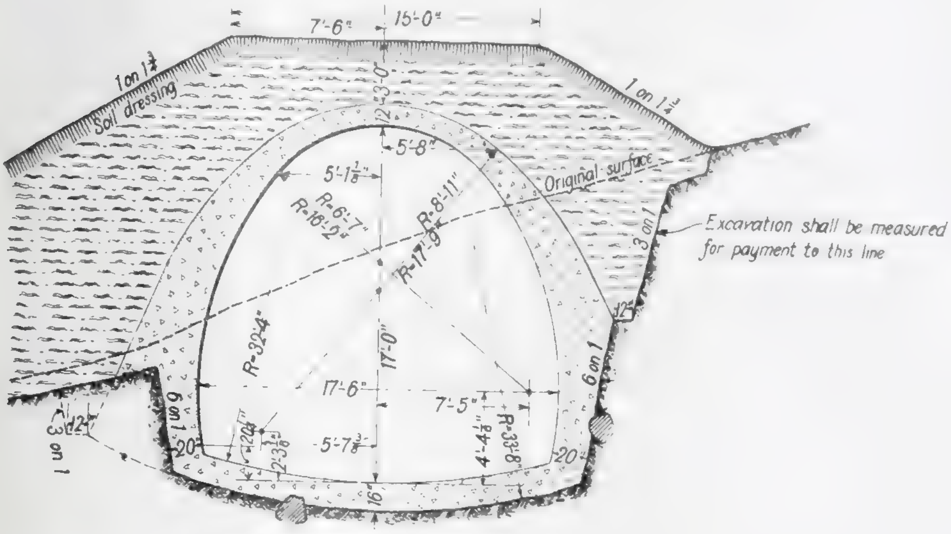


Fig. 2—Section of Concrete Aqueduct Showing the Type Handled by the Portable Plant.

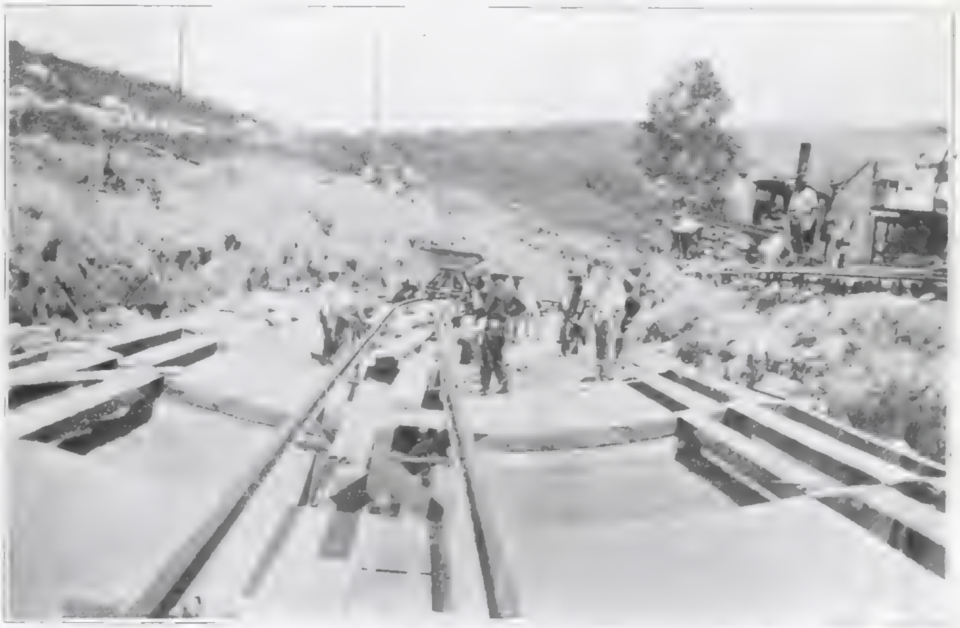


Fig. 3—View Showing Method of Laying the Invert for the Aqueduct.

[illegible] and a fraction of an inch less in width on the opposite side. When the 5-ft. dimensions are placed end to end on one side the forms take a curve of 200 ft. radius. When the long and short dimensions are placed alternately, end to end, the forms then are on a tangent line. All curves on the aqueduct are laid out to this standard radius.

Operation of Plant.—Two tracks parallel the line of the aqueduct work upon which the material for concrete is brought. The stone and cement are brought in wooden skips and the skips are handled from the cars to the plant by the derricks shown on the drawing. Of these two derricks one is an improvised wooden derrick with mast and small bullwheel, and the other, a 3-ton revolving Miller crane made by the Portland, Maine, Electric Co. It has a 50-ft. boom and is equipped with a 30-H. P. motor. This crane was not sufficient, however, to handle in one day the amount of material required for 60 ft. of arch, and for this reason the above mentioned wooden derrick was installed. The stone for concrete is brought from the spoil dump of the Peak tunnel, one mile north, where it is loaded onto the cars by a 20-ton Marion shovel.

The operation of the plant proper requires several gangs of man some of which are employed on the plant only for a short time each shift, the rest of their shift being spent at other work. The concrete work for the 60 ft. of arch is started at 8 a. m., and is carried to completion. This usually requires about 7 hours and the men are given one full shift and allowed to go when completed. The amount of concrete poured is about 171 cu. yds. The crew required for operating the plant, for concreting alone, is as follows:

1 hoist engineer
2 foremen
1 electric craneman
2 men feeding crusher
2 men at screen.
4 men charging mixer
1 man attending water
2 men carrying cement.
4 men operating lower mixer hoppers and Hains bucket.
2 men hooking skips to derricks.
1 foreman on placing concrete.
4 men spading inside forms.
2 men dumping bucket
4 men inside forms (2 on each side).
2 men calking forms.
1 water boy for plant.

Besides the force employed during the main shift of concreting are several gangs, as follows: For collapsing 60 ft. of inside forms and loosening outside forms, 1 foreman and 7 men, 8 hours; for shifting 60 ft. of inside forms and setting them up, 1 foreman and 7 men, 8 hours; for moving main plant, 1 Porter dinkey engine with engineer, 1 foreman and 7 men, 2½ hours; for shifting ties and rails, 1 Browning locomotive crane and engineer, 1 foreman and 6 men, 1 hour; banking outside forms with earth, 1 foreman and 6 men, 4 hours.

These gangs work at certain hours during each day in accomplishing their part of the work. The collapsing gang comes on at noon and goes into the section of aqueduct built the previous day, loosens the stay bolts which pass through from the inside to the outside forms and prepares these forms for shifting. This gang then goes outside and shifts the outside forms ahead by means of the traveler on the top of the bridge. These forms are piled ahead in a convenient place for resetting. When this is done, the concreting is also completed, and the main plant is ready for shifting. The saddles at the rear end are picked up, run forward and placed ahead. Short sections of track are riveted on top of the saddles so that in placing them ahead new track is made for the rear support of the bridge to run on. The whole machine is then pulled ahead, a few feet at a time by a small dinkey engine attached to the main plant by a cable.

At 6 p. m. an inside form gang comes on and collapses the inside forms in 15 ft. sections, moves them ahead and sets up the four 15 ft. sections in about 7 hours. At midnight another form gang oils the inside forms, picks up the outside forms which have been piled ahead and sets them up, puts in the stay bolts, sets the bulkhead and makes everything ready for the concrete work to begin again at 8 a. m.

There are in use 180 ft. of inside forms; 60 ft. being concreted, 60 ft. being under green concrete which supports the saddles, and 60 ft. of forms being moved. Of the outside forms 120 ft. only, are used.

In concreting special effort is made to keep the top of the inside forms cleaned, as the cement mortar when allowed to dry on, spoils the finished surface. The forms are, of course, oiled, but on the top, where all the concrete is dropped, it is impossible to oil the form until just before it is finally covered with concrete. In order to clean the form, therefore, after each bucket of concrete is discharged a steam hose is used to blow live steam on the form and clean it off. The hose nozzle consists of a 1 in. pipe about 2 ft. long. This scheme is new and works excellently. The steam is supplied from a boiler at 100 lbs. pressure. The boiler is located on the main part of the plant and is used also to operate the auxiliary derrick.

Another scheme is used on this work which is that of putting a set of 2-in. steam pipes against the bulkhead for hastening the setting of the concrete next to it. Before steaming or drying was tried, the bulkheads and the wooden keys attached on the inside of them sometimes stuck to the concrete. It was then difficult and dangerous to the concrete, to pull the bulkhead while the concrete was so green, but under the new method the bulkhead is easily and safely pulled.

The electric current for the operation of the motors is supplied over a high tension system at 33,000 volts from the Newburgh Heat, Light & Power Co. It is stepped down to 2,200 volts at the compressor plant, operated on another part of the work, and is again stepped down at the machine by a bank of three 50 k. w. transformers which are carried on a narrow gage truck.

The above described movable crushing and mixing plant cost about $30,000. Since it was built, nearly $10,000 has been spent in making changes and repairs. The plant is working very efficiently but it is a question whether a $40,000 investment in plant is worth while (considering that only about 30,000 yards of concrete have been placed by it), unless a large amount of similar work can be contracted for.

The work is being done for the Board of Water Supply of New York City, J. Waldo Smith, Chief Engineer, by the H. S. Kerbaugh Co. of Philadelphia. Mr. William B. Gray is superintendent, and Mr. G. Dallas Dixon, Jr., secretary and treasurer. The contract lies in the Esopus Division of the Northern Aqueduct Department, Mr. Robert Ridgway, Department Engineer, Mr. Lazarus White, Division Engineer and Mr. Elwood Avery, Section Engineer.

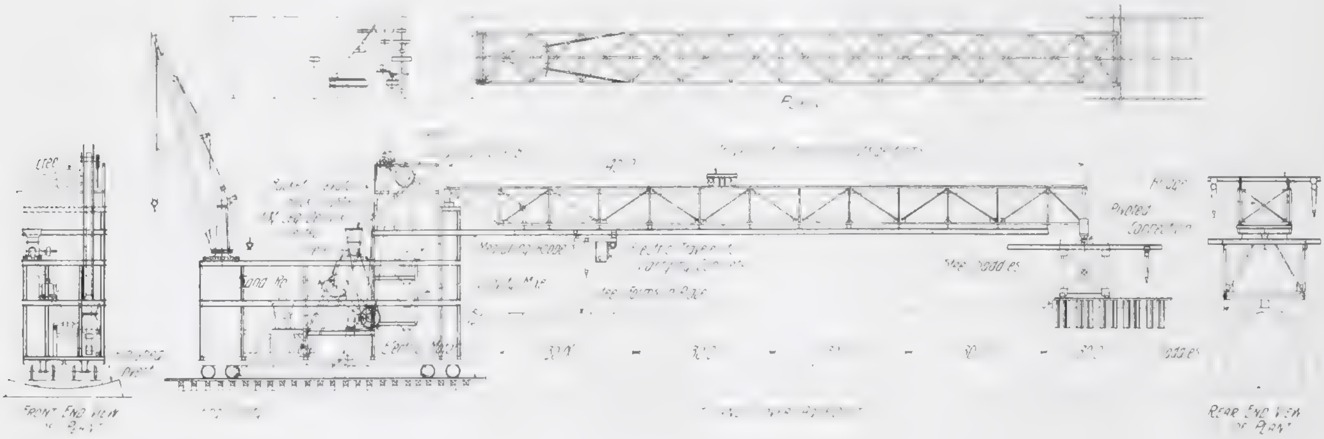


Fig. 4—General Plans Showing Elevation, Plan and End Sections of Portable Plant.

Methods and Costs of Concrete Work at the Gatun Locks of the Panama Canal.

The Gatun locks of the Panama Canal contain 2,085,000 cu. yds. of concrete and perhaps the largest and most elaborate concrete mixing and handling plant in the world has been installed for their construction. These locks are in a flight of three pairs and as each pair has a usable chamber length of 1,000 ft. the total length of this lock structure not including approaches is some 3,750 ft. Each step of the flight consists of two parallel locks side by side. The lock structure, roughly, for each pair comprises two side walls and a dividing center wall, with a heavy floor under all. These structures are not solid but contain filling and emptying culverts as shown by the three sections of Fig. 1; these sections alternate. It will be observed that the work is very massive the side walls being from 40 to 50 ft. thick, at the buttom and the center wall 60 ft. thick and all walls some 80 ft. high. The concrete work is, therefore, essentially mass work.

The general arrangement of the handling plant is shown by Fig. 2. It consists of (1) a battery of cableways spanning the receiving dock and tracks and the stock piles; (2) a material railway extending from the stock piles to a mixing plant at one side of the lock site, and (3) a second battery of cableways spanning the lock structure. The following is a general description of the plant and its operation:

Assembling of Materials.—It is estimated that 2,250,000 bbls. of cement will be required for the concrete. This cement is shipped from New York after it had been tested at the plant of the Atlas Cement Co., Northhampton, Pa. From the docks in Colon or Cristobal it is carried in barges up the old French Canal to the cement storage dock at Gatun. There it is unloaded by electric cranes and stored as will be described. Rock is quarried and crushed at Porto Bello, about 17 miles east of Colon, and is towed in barges to Cristobal and then to Gatun. Sand is dredged at Nombre de Dios, about 35 miles east of Colon, and is towed in barges to

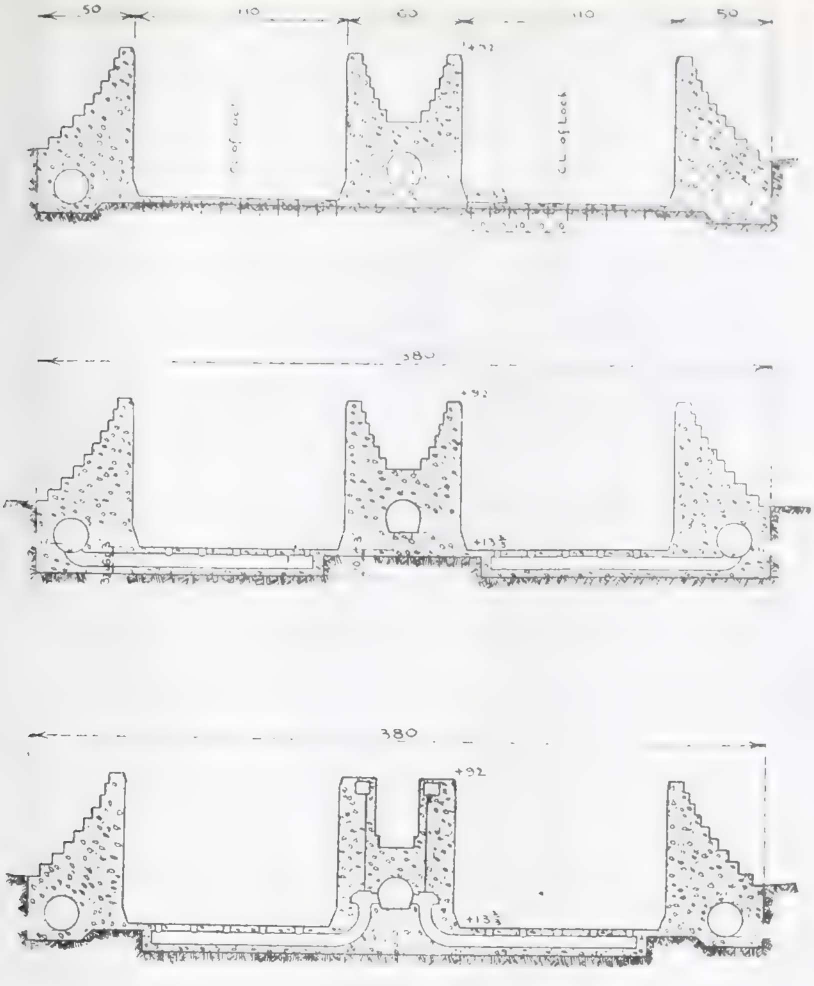


Fig. 1—Typical Cross Sections of Gatun Locks, Showing Wall, Floor and Culvert Construction.

Gatun. In a succeeding issue we shall give the methods and costs of securing the crushed stone and sand.

Unloading and Storage.—The unloading at Gatun from vessels and barges is done by 2 duplex and 1 single cableways. The unloading cableways as shown span the boat slip and they handle sand and stone only. They operate with self-digging automatic grab buckets of the two-blade type, 70 cu. ft. capacity. These [illegible] from the barges and carry it to the storage piles; the maximum carry is 675 ft. The cement in barrels is unloaded by traveling cranes and stored in a cement house of 100,000 bbls c.apacity. The arrangement of the unloading cableways, cement house and sand and gravel storage is shown by Fig. 2. The cement dock has a frontage of 490 ft. along a slip that leads from the old French canal, and is 110 ft. wide. Cement is unloaded from barges by 10 traveling cranes of the 3-motor type. Over the tracks on which the material cars run are 30 hoppers for cement, each hopper with a valve 15x30 ins. The cement is dumped into the hoppers and the valves regulate the charging. The material cars run beneath the sand and rock storage piles in two tunnels, and the cars are charged with sand and rock in the same way as with cement. There are 22 valves, each 15 ins. square under the sand pile, and 46 valves 15x30 ins. under the rock pile.

Railroad from Storage Piles to Mixers.—Two railroads of 24-in. gage lead from the cement dock and storage piles to the concrete mixers, the total length of each road being about 4,700 ft. The railroads are entirely separate from one another, as the object of their being in duplicate is that one may be in service while the other is undergoing repairs. The cars in which the materials are carried are individually driven by three-phase motors, chain geared to the axles, taking an alternating 25-cycle current of 220 volts from two inverted collecting rails laid between the traction rails. Each car is started, stopped, or reversed by the operation of a master switch, so located that it can be controlled from either side. When this switch is thrown the car starts and automatically comes up to speed, and whether traveling on the level or on the heaviest grade on the mixer plant incline the speed never varies more than 10 per cent. When the empty cars descend the grade from the mixers to the storage piles their motors are reversed into generators and power is returned to the line. Automatic magnetic brakes stop the cars in case of accident and thus anticipate collisions. The cars are built of steel, are divided into two compartments, one for sand and concrete, and one for rock, and have a ca-

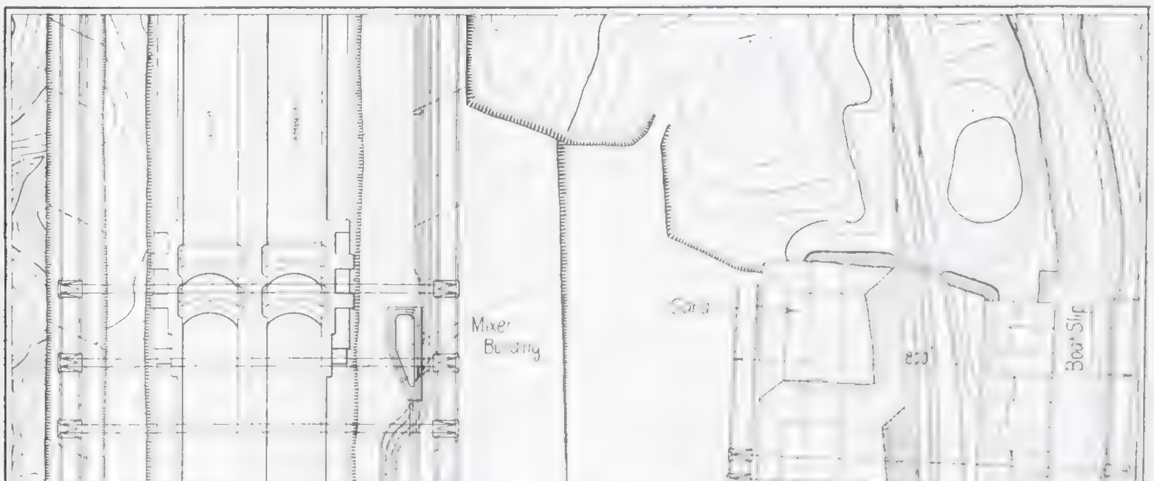


Fig. 2—Plan of Concrete Construction Plant at Gatun Locks.

pacity of 80 cu. ft. They are of the hinged, side door type and when over the hoppers of the mixers their doors are opened by hand.

Mixing Plant.—Eight Chicago Improved Cube mixers of 64 cu. ft. capacity each, belt driven from shafts, capable of making 180 revolutions a minute, with 14 revolutions a minute for the cube, compose the main mixing plant. These mixers are erected above the level of the cars into which they discharge. They are charged by gravity, that is, the material cars run up an incline to a platform over the mixers where they dump into charging hoppers of 90 cu. ft. capacity, so designed as to throw the materials into the mixers. The mixers receive and discharge their load without stopping or slowing down, and one operator controls the charging and discharging. The mixers are mounted in one file 8 deep, and 4 of them discharge over a railroad on the east side, and 4 over a road on the west side of the mixing plant. In addition there is at the south end of the locks a supplementary steam driven plant of 2 cube mixers.

Concrete Carrying Railroad.—A railroad of four tracks runs along the west bank of the locks, two tracks on either side of the mixer plant. A train, consisting of a locomotive and two flat cars, each car carrying one bucket, stops alongside two of the mixers and receives concrete from them. It then runs to the point of the bank where the cableway is waiting, and the cableway deposits two empty buckets and picks up the loaded ones. The train then backs up on the return track and waits its turn to switch alongside the mixers. There are 12 locomotives and 24 flat cars in this service. The locomotives are 12 ft. long, 6½ ft. wide and 5½ ft. high above the deck. They have single trucks with rigid wheel base, and a required draw-bar pull of 2,000 lbs. They are propelled by two reversible, waterproof, railway motors, one on each axle, taking current from a third rail. The cars are built entirely of steel, are 18 ft. long and 7 ft. wide, with the deck 2 ft. 8 ins. above the rails, and are mounted on double trucks of eight wheels with a 4 ft. base. Each car has a receptacle for two buckets, and will carry a load of 12 tons.

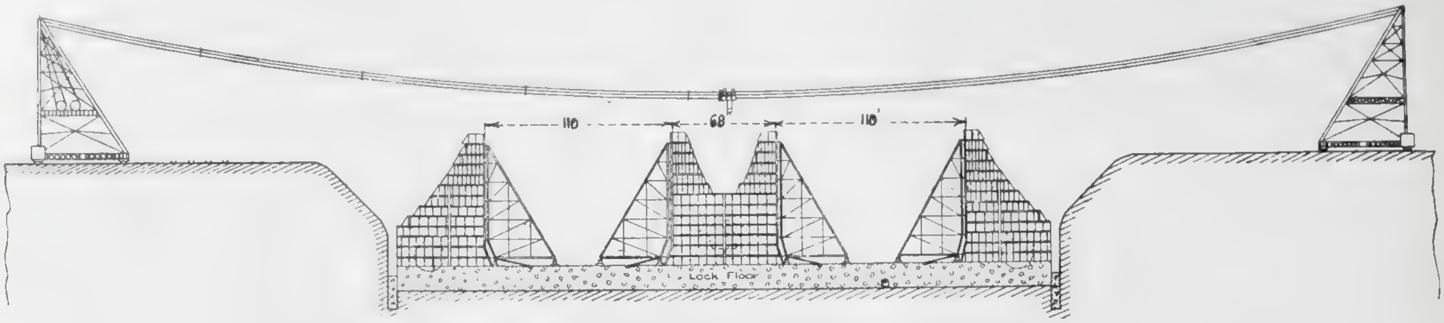


Fig. 3—Sketch Showing Concrete Laying Cableway and Forms.

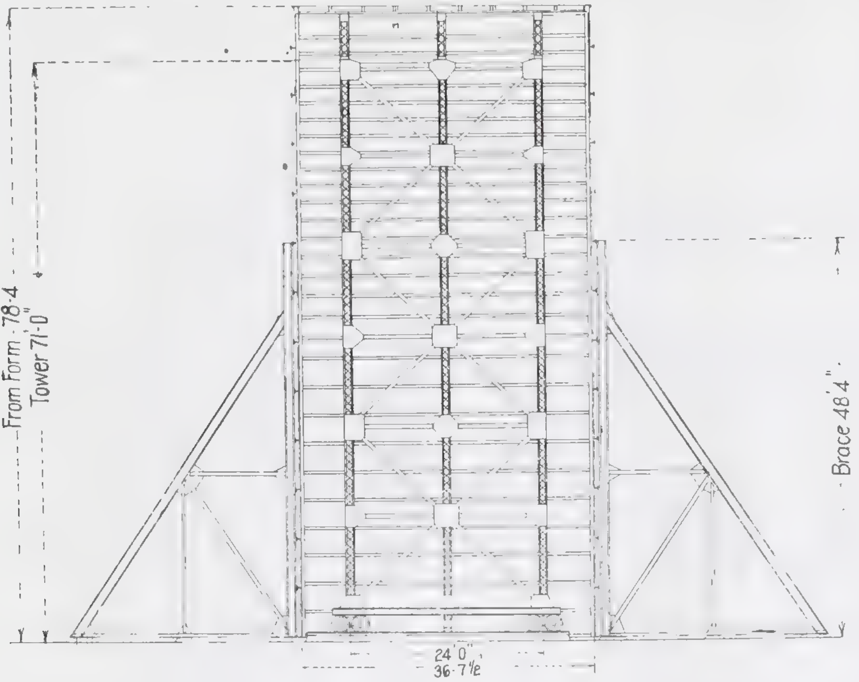


Fig. 6—Rear Elevation of Forms for Gatun Lock Walls.

Cableways Over the Lock Site.—There are eight of these cableways arranged in pairs, each pair stretching from a steel tower on the west bank of the locks to a similar tower on the east bank, a distance of 800 ft. (Fig. 3.) The towers are 85 ft. above the tracks on which they move along the banks above the lock site. Each of the tail towers on the east bank moves synchronously with the tower opposite it on the west bank, and the movement of each pair is controlled from the control station in the head tower on the west bank. The carrying cable is a locked steel wire 2¼ ins. in diameter, and on this cable a traveler is pulled back and forth over the lock chamber. On the traveler is a pulley through which runs a cable to lift material and drop it. The maximum distance the traveler is required to run is 670 ft., the greatest lift 170 ft., and the carrying capacity is not less than 6 tons, with 20 trips an hour.

TABLE I.—DETAIL COST OF 397,731 CU. YDS. OF CONCRETE MASONRY LAID IN THE GATUN LOCKS DURING SIX MONTHS, JANUARY-JUNE, 1910.

Item.	Per cu. yd.
Concrete, 386,946 cu. yds.	
Cement	$1.9786
Stone	2.3038
Sand	0.7602
Mixing	0.2438
Total	$5.2864
Rubble stone, 10,785 cu. yds.	$3.0625
Masonry, 397,731 cu. yds.:	
Concrete, as above	$5.1431
Rubble stone, as above	0.0831
Forms	0.4952
Placing	0.4282
Reinforcement	0.0111
Pumps	0.0332
Power	0.0726
Maint. equipment	0.1971
Plant, arbitrary	0.6035
Division expenses	0.1051
General expenses	0.3523
Total	$7.5245

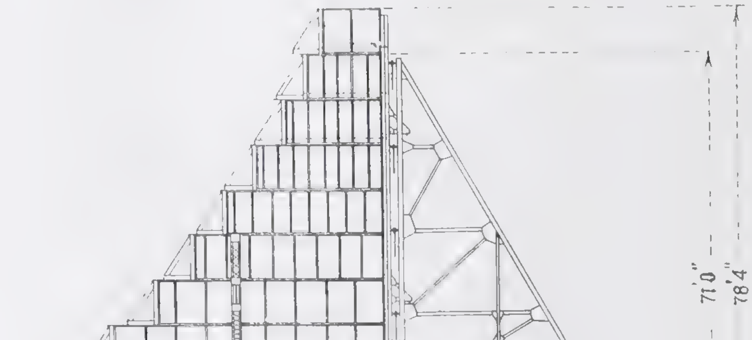


Fig. 5—End Elevation of Forms for Gatun Lock Walls.

The machinery for operating is mounted in the head towers on the west bank of the lock site. It consists of a motor of 150-h.p. to turn the hoisting and conveying cable drums, a motor of 25 h.p. to run the dumping device, and a motor of 25 h. p. in both head and tail towers to propel the towers. One man operates a cableway, controlling all the movements by switches located on a platform on each head tower. In addition to delivering concrete in the locks the cable ways are used to lift material from the lock site and dump it by an aerial dumping device, to handle forms for the concrete work, and handle the parts of the gates and the gate operation machinery.

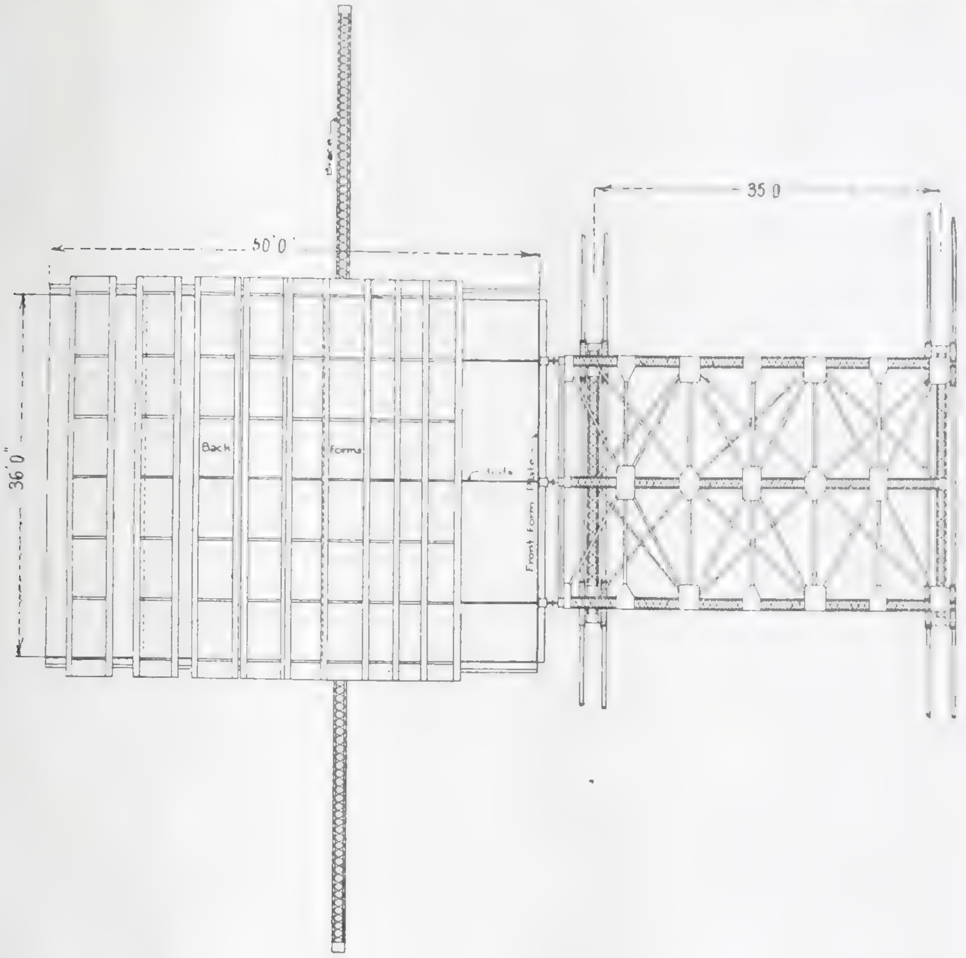


Fig. 4—Plan of Forms for Gatun Lock Walls.

Power Plant.—Power is supplied by an electric generating plant. Six water tube boilers of the Keeler type, each with a nominal rating of 400-h. p. and generating steam at 250 lbs. absolute pressure and 150° F. of superheat, supply steam to three Curtis, 1,500 k.w., vertical steam turbine base condenser generators. The plant is modern in all respects. After the canal is completed this plant will be used as an auxiliary to the hydraulic power plant for operating the locks. During the year ending June 20, 1910, this plant supplied power at a cost of 2.65 cts. per kilowatt hour. This cost included a plant charge which is based on the entire absorption of this plant cost during the estimated time of its operation.

Forms.—The construction of the main wall forms is shown by Figs. 4, 5 and 6. As will be seen a steel tower mounted on wheels carries a steel plate 36 ft. long and the full height of the wall. This steel plate is so hung from the tower that it is adjustable to line and surface by means of jacks. The end forms and the back forms are steel plates 6 ft. wide and varying in length to suit the sections. For culverts collapsible steel forms are used.

TABLE II.—DETAIL COST OF 246,407 CU. YDS. OF CONCRETE MASONRY LAID IN THE GATUN LOCKS DURING THREE MONTHS, JULY-SEPTEMBER, 1910.

Item.	Per cu. yd.
Concrete, 224,144 cu. yds.:	
Cement	$[illegible]
Stone	[illegible]
Sand	[illegible]
Mixing	[illegible]
Total	$[illegible]
Rubble stone, 22,263 cu. yds.	$1.3510
Masonry, 246,407 cu. yds.:	
Concrete in place	$1.816[illegible]
Rubble stone in place	[illegible]
Wood forms	[illegible]
Steel forms	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	$[illegible]

Concrete.—The concrete used is 1:3:6 mixture for the main body of the work. Next to the culverts a 1:2:4 mixture is used, Finished horizontal surfaces are 1:3 mixture. In the body concrete rubble stone are embedded to an amount in the entire work of about 3 per cent of the total volume of the masonry.

Concreting was begun in August, 1909, and up to Nov. 1, 1910, there had been placed 847,160 cu. yds. The detail costs of 644,138 cu. yds. of this amount are given in Tables I and II. Table I covers the first half of 1910 and Table II the third quarter of the same year. In these tables the costs of the plain concrete and of the rubble stone are given separately according to the volume of each and then these costs are presented over the combined volume to obtain the costs per cubic yard of masonry.

As the concrete plant at Gatun is both elaborate and designed to operate with a minimum of labor charge it is interesting to note that mixing and placing costs 66 cts. per cu. yd. as in Table I and 46 cts. per cu. yd. as in Table II. These are practically labor costs since forms, power, maintaining equipment, plant costs and all overhead charges are provided for elsewhere. It will be observed too, taking Table II which shows the lowest cost for masonry, that excluding materials (concrete, forms, reinforcement) the cost has been $2 per cu. yd. of concrete in place. The cost of forms as shown by both tables runs about 50 cts. per cu. yd.

EARTH AND ROCK SECTION

Progress and Cost of Excavation on the Panama Canal for the Year Ending June 30, 1910.

Construction costs of the Panama Canal work are given with more than usual detail in the latest report of the Isthmian Canal Commission. A year's work is covered by the figures but it is only for the last six months of the year, or since the Commissioners new cost keeping system was inaugurated, that the costs are analyzed in particular detail. The year considered is that ending June 30, 1910. Since the report was dated the Commission has made public some of the costs for the three months to Oct. 1, 1910. The following tabulations cover all of these periods for excavation work both in main channel and for canal structures.

For construction purposes the canal is divided into three parts known as the Atlantic, the Central and the Pacific divisions. Roughly, the Atlantic Division includes the main channel to Gatun, the Gatun Locks and Gatun Dam and collateral works; the Central Division is mainly the Culebra Cut, and the Pacific Division includes the locks at Pedro Miguel and Miraflores and the main channel to the Pacific. In the Central Division the great bulk of the excavation is dry and in the other two divisions it is mostly dredging.

ATLANTIC DIVISION.

The main bulk of the dry excavation in this division was done on the cut at Mindi approaching the Gatun Locks. The work was done by two 70-ton Bucyrus shovels and one Model 91 Marion shovel. The tota' amount excavated was 324,716 cu. yds., 91,572 cu. yds. of earth and 233,144 cu. yds. of rock. The cost per cubic yard of this excavation was for 1910 as follows:

Total division expenses	$0.6132
General expenses	0.0756
Total	$0.6888

The total excavation in this cut from the beginning of work up to June 30, 1910, has been 1,476,821 cu. yds. at a total cost of 67.87 cts. per cu. yd. As will be seen, administrative and general expenses have amounted to slightly over 12 per cent. of the total cost.

The dredge excavation for the yar 1910 on this division was 4,955,660 cu. yds., which cost as follows:

Total division expenses	$0.2360
General expenses	0.0265
Total	$0.2625

The work was done by 1 suction dredge, 2 dipper dredges and 3 ladder dredges. The amount excavated by each class of dredge and the cost per cubic yard during six months, January-June, 1910, are shown in Table I. Table II gives the itemized cost of excavation by all dredges for the same period. It will be noted how large an item transportation of spoil from the dipper and ladder dredges makes. The item "plant arbitrary" being used

TABLE I.—DETAIL COST PER CUBIC YARD OF DREDGING ON THE ATLANTIC DIVISION BY CLASSES OF DREDGES.

Item	Suction dredges.	Ladder dredges.	Dipper dredges.
Yards excavated	1,395,339	950,288	166,374
Operation per cu. yd.	$0.0331	$0.0515	$0.0684
Repairs per cu. yd.	0.0366	0.0592	0.1647
Total per cu. yd	$0.0697	$0.1107	$0.2331

TABLE II.—DETAIL COST OF DREDGING 2,512,001 CU. YDS. FROM ATLANTIC DIVISION PRISM.

Item.	Per cu. yd.
Dredges:	
Operation	$0.0424
Repairs	0.0536
Total	$0.0960
Tugs, Clapets, Barges, etc.:	
Operation	$0.0754*
Repairs	0.0485*
Total	$0.1239*
Mining	$0.0105
Operating small boats	0.0039
Other repairs	0.0022
Dikes	0.0078
Clearing	0.0008
Plant, arbitrary	0.0601
Division expenses	0.0132
General expenses	0.0335
Total	$0.2831

*These units are based on the yardage handled by dipper and ladder dredges alone which was 1,116,662 cu. yds. The suction dredges, which handled the remaining 1,395,339 cu. yds., carry their material to the dumps. Distributing the cost of operation and repairs to tugs, clapets, barges, etc., over the total yardage gives a unit cost of 5.51 cts., which added to the other items named gives the final total of 28.31 cts. per cu. yd.

TABLE III.—DETAIL COST OF DREDGING 1,383,794 CU. YDS. OF EARTH AND ROCK, ATLANTIC DIVISION, JULY TO SEPTEMBER, INCLUSIVE, 1910.

Item.	Cubic yards.	Per cu. yd.
Dikes	1,383,794	$0.0135
Clearing	1,383,794	0.0006
Operation, suction dredges	851,484	0.0326
Repairs, suction dredges	851,484	0.0159
Operation, ladder dredges	391,733	0.0621
Repairs, ladder dredges	391,733	0.0632
Operation, dipper dredges	128,946	0.0665
Repairs, dipper dredges	128,946	0.0941
Operation, pipe line dredges	11,631	0.1761
Repairs, pipe line dredges	11,631	0.2126
Operation, tugs, scows, etc.	520,679	0.0681
Repairs, tugs, scows, etc.	520,679	0.0538
Drilling	103,506	0.0995
Blasting	103,506	0.1582
Small boats	1,383,794	0.0020
Repairs, misc. equipment	1,383,794	0.0015
Plant, arbitrary	1,383,794	0.0580
Division expense	1,383,794	0.0158
General expense	1,383,794	0.0254
Total	1,383,794	$0.2656

Note: The volume of excavation was 92.52 per cent earth and 7.48 per cent rock.

TABLE IV.—DETAIL COST OF EXCAVATING DRY 536,709 CU. YDS. FROM GATUN LOCKS.

Item.	Per cu. yd.
Mining	$0.0921
Loading	0.0758
Tracks	0.1404
Transportation	0.1177
Pumps	0.0246
Maint. equipment	0.0582
Plant, arbitrary	0.1054
Division expenses	0.0306
General expenses	0.0699
Total	$0.7150

TABLE V.—DETAIL COST OF EXCAVATING DRY 33,843 CU. YDS. FROM GATUN LOCKS FOUNDATIONS.

Item.	Per cu. yd.
Mining	$0.4943
Loading	1.4178
Transportation	0.1531
Maint. equipment	0.1593
Plant arbitrary	0.1054
Division expenses	0.1849
General expenses	0.3957
Total	$2.9105

TABLE VI.—DETAIL COST OF EXCAVATING DRY 79,770 CU. YDS. FROM GATUN SPILLWAY.

Item.	Per cu. yd.
Mining	$0.0808
Loading	0.2615
Tracks	0.0653
Transportation	0.2026
Pumps	0.0423
Maint. equipment	0.1137
Plant, arbitrary	0.1055
Division expenses	0.0267
General expenses	0.0998
Total	$0.9982

TABLE VII.—DETAIL COST OF EXCAVATING DRY 4;720 CU. YDS. FROM GATUN SPILLWAY FOUNDATIONS.

Item.	Per cu. yd.
Mining	$0.0182
Loading	3.2526
Transportation	0.1879
Maint. equipment	0.1406
Plant, arbitrary	0.0924
Division expenses	0.2534
General expenses	0.5785
Total	$4.5236

TABLE VIII.—DETAIL COST OF EXCAVATION FROM GATUN LOCKS AND SPILLWAY FOR THREE MONTHS, JULY-SEPTEMBER, 1910.

Quantities.	Locks.	Spillway.
Cubic yards excavated	217,532	48,606
Cost, Items.	Per cu. yd.	Per cu. yd.
Drilling	$0.0245	$0.0002
Blasting	0.0398	0.0049
Loading by power	0.0769	0.0646
Tracks	0.1345	0.0607
Transportation	0.1444	0.0602
Pumps	0.0365	*0.0016
Power	0.0089	......
Maint. equipment	0.0856	0.0484
Plant, arbitrary	0.1100	0.1100
Division expenses	0.0434	0.0238
General expenses	0.0775	0.0488
Total	$0.7820	$0.4232

*Cost for trestles.

TABLE IX.—DETAIL COST OF EXCAVATION FOR FOUNDATIONS FOR GATUN LOCKS AND SPILLWAY FOR THREE MONTHS, JULY-SEPTEMBER, 1910.

Quantities.	Locks.	Spillway.
Cubic yards excavated	23,955	8,187
Cost Items.	Per cu. yd.	Per cu. yd.
Drilling	$0.2082	.....
Blasting	0.2005	.....
Loading by power	0.1427	......
Loading by hand	0.7870	$0.5926
Transportation	0.1201	......
Trestles	0.0168	0.0058
Dumps	......	.....
Pumps	0.0010	.....
Maint. equipment	0.1391	0.0102
Plant, arbitrary	0.1100	0.1100
Division expenses	0.1875	0.0811
General expenses	0.2842	0.1040
Total	$2.1971	$0.9037

TABLE X.—DETAIL COST OF EXCAVATING 17,674,804 CU. YDS. ON THE CENTRAL DIVISION FOR TWELVE MONTHS ENDING JUNE 30, 1910.

Items.	Per cu. yd.
Loading:	
Steam shovel	$0.0888
Hand	0.3442
Drilling and blasting	0.1190
Transportation	0.1522
Dumps	0.0657
Tracks	0.1001
Division office and supervision	0.0150
General surveys	0.0003
Clearing	0.0046
Division structures	0.0013
Drainage and sumps	0.0052
Plant arbitrary	0.1300
General expenses	0.0652
Total	$0.7368

TABLE XI.—DETAIL COST OF EXCAVATING DRY, BY CONTRACT, 150,664 CU. YDS. FROM CENTRAL DIVISION PRISM.

Item.	Per cu. yd.
Contract price	$0.3501
Plant arbitrary	0.1300
Total	$0.4801

TABLE XII.—DETAIL COST OF EXCAVATING 4,492,440 CU. YDS. IN THE CENTRAL DIVISION, JULY-SEPTEMBER, 1910.

Items.	Per cu. yd.
Drilling	$0.0518
Blasting	0.0568
Loading	0.0528
Tracks	0.1092
Transportation	0.0898
Dumps	0.0600
Pumps	0.0031
Maint. equipment	0.0895
Plant	0.1000
Division expenses	0.0142
General expenses	0.0490
Total	$0.6762

TABLE XIII.—DETAIL COST OF DREDGING 2,761,632 CU. YDS. FROM PACIFIC DIVISION PRISM.

Item.	Per cu. yd.
Dredges:	
Operation	$0.0512*
Repairs	0.0407*
Total	$0.0919*
Tugs, Clapets, Barges, etc.	
Operation	$0.0645
Repairs	0.0269
Total	$0.0914
Mining	$0.0323
Operating small boats	0.0033
Other repairs	0.0088
Clearing	0.0070
Plant, arbitrary	0.0909
Division expenses	0.0078
General expenses	0.0245
Total	$0.3174

*These units are based on the yardage handled by dipper and ladder dredges alone, which was 1,598,334 cu. yds. The suction dredges, which handled the remaining 1,253,298 cu. yds., carry their material to the dumps. Distributing the costs of operation and repairs to tugs, clapets, barges, etc., over the total yardage gives a unit cost of 5.09 cts., which added to the other items named gives the final total of 31.74 cts. per cu. yd.

TABLE XIV.—DETAIL COST PER CUBIC YARD OF DREDGING ON THE PACIFIC DIVISION BY CLASSES OF DREDGES.

Item.	Suction dredges.	Ladder dredges.	Dipper dredges.
Yards excavated	1,253,298	1,277,568	230,766
Operation per cu. yd.	$0.0444	$0.0481	$0.1053
Repairs per cu. yd.	0.0300	0.0420	0.0909
Total per cu. yd.	$0.0744	$0.0901	$0.1962

TABLE XV.—COST OF DREDGING JULY-SEPTEMBER, 1910, PACIFIC DIVISION.

	Quantities, cu yds.	Unit cost.
Dikes	......	.....
Clearing	1,496,336	$0.0017
Op'n seagoing suction dredge	713,036	.0422
Repairs seagoing suction dredge	713,036	.0164
Operation ladder dredges	576,470	.0580
Repairs ladder dredges	576,470	.0384
Operation dipper dredges	206,830	.0657
Repairs dipper dredges	206,830	.0468
Operation pipe line dredges	....	.....
Repairs pipe line dredges	....	.....
*Op'n tugs, clapets and scows	783,300	.0604
*Rep'rs tugs, clapets and scows	783,300	.0465
Drilling	67,607	.2312
Blasting	67,607	.2251
Operation drill barges	67,607	.1500
Operation rock breakers	67,607	.0849
Small boats	1,496,336	.0033
Repairs misc. equipment	1,496,336	.0061
Plant, arbitrary	1,496,336	.1100
Division expense	1,496,336	.0082
Total division cost	1,496,336	$0.2971
Admin. and general expense	1,496,336	$0.0305
Total cost	1,496,336	$0.3276
Earth excavation—per cent	1,428,729	95.48
Rock excavation—per cent	67,607	4.52

*Based on yardage handled.

throughout the tables which follow may also be explained here.

The report says:

A system of arbitraries was adopted with a view of absorbing into the construction cost all expenditures for plant and equipment, based on estimated cost and the estimated amount of work to be accomplished. This method contemplates the absorption of the total expenditures for plant and does not take into consideration any salvage which may be realized after the completion of the work.

Table I covers six months work only, the following figures show the work done by each type of dredges for the full year.

	Suction.	Ladder.	Dipper.
Cu. yds. earth	2,729,593	1,701,583	114,042
Cu. yds. rock	....	337,529	72,913
Total	2,729,593	2,039,112	186,955
[illegible]	6.64 cts	26.42 cts	36.23 cts

These unit costs do not include plant, general items or mining.

Mining comprises drilling and blasting. The drill barge used consists of an old French hull which was overhauled and fitted with 8 Star well drills. The individual boilers were removed from the drills and a central boiler was installed. The drills were placed 4 on each side of the barge in quincunx order. The two lines of drills are 22 ft. apart and the drills in each line are 15 ft. apart. The barge usually drills and loads a full set of 8 holes per day. The cost of operating this drill barge has been for 1910 as follows:

Rock, 90,776 cu. yds.	8.7 cts. per cu. yd.
Earth & rock, 174,578 cu. yds.	4.5 cts per cu. yd.

The average division costs (not including general expenses) for mining for dredge ex-

TABLE XVI.—DETAIL COST OF EXCAVATING DRY [illegible] CU. YDS. FROM PACIFIC DIVISION PRISM.

Item.	Per cu. yd.
Loading	$0.1242
Tracks	0.1959
Transportation	0.0712
Dumps	0.0475
Pumps	0.0218
Maint. equipment	0.0134
Plant, arbitrary	[illegible]
Division expenses	0.0213
General expenses	0.0661
Total	$0.7009

cavation from August, 1908 to June 30, 1910, has been 7.7 cts. for rock and earth combined and 16.9 cts. for rock alone. Of the first amount 1.2 cts. and of the second amounts 2.6 cts. were for dredging.

By distributing the cost exclusive of mining proportionately to the number of yards of rock and earth removed by each dredge which handled both, and inversely as the relative outputs of each when working exclusively in earth and rock, the following approximate segregation of division costs has been made for those dredges which handled both:

	Dipper		Ladder	
Item.	Yards.	Per cu. yd.	Yards.	Per cu. yd.
Earth	83,150	$0.24	66,226	$0.18
Rock	1,317,509	0.20	303,698	0.60
Total and average	1,400,659	$0.22	369,924	$0.58

The cost of dredging on this division for the three months, July 1 to Oct. 1, 1910, is given in Table III.

Besides the dry excavation in prism at Mindi there was during the year several hundred thousand cubic yards of excavation for the Gatun locks and spillway structures. The excavation from the Gatun locks works amounted to 839,302 cu. yds., which was removed mostly by steam shovel. The detail cost of this excavation for the six months to June 30, 1910, is given in Table IV. In addition there were 33,843 cu. yds. excavated for the lock foundations. This was mostly hand work smoothing and finishing foundation bed on rock and ran high in cost as shown by Table V covering six months' work to June 30, 1910. The spillway excavation amounted during the year to 122,487 cu. yds., of which 79,770 cu. yds. were excavated in the six months to June 30, 1910, at the costs shown in Table VI. The smoothing and finishing work for the spillway foundations amounted to 4,728 cu. yds. of excavation, the cost of which is shown by Table VII. Considering the whole year ending June 30, 1910, the costs were as follows:

Work	Per cu. yd.
Gatun locks	$0.9074
Gatun locks foundations	2.9105
Gatun spillway	1.0891
Gatun spillway foundations	4.5236

TABLE XVII.—DETAIL COST OF EXCAVATING DRY 48,884 CU. YDS. FROM MIRAFLORES LOCKS.

Item.	Per cu. yd.
Mining	$0.2450
Loading	0.2717
Tracks	0.3350
Transportation	0.1839
Dumps	0.0258
Pumps	0.0691
Maint. equipment	0.1028
Plant, arbitrary	0.1000
Division expenses	0.0360
General expenses	0.1503
Total	$1.5196

For the three months from June 30 to Oct. 1, 1910, the detail costs of excavations was as given in Tables VIII and IX.

TABLE XVIII.—DETAIL COST OF EXCAVATING DRY 64,036 CU. YDS. FROM MIRAFLORES LOCKS FOUNDATIONS.

Item.	Per cu. yd.
Mining	$0.7281
Loading	0.4603
Tracks	0.3104
Transportation	0.1009
Dumps	0.0256
Pumps	0.0717
Maint. equipment	0.0618
Plant, arbitrary	0.1000
Division expenses	0.0881
General expenses	0.2491
Total	$2,1960

CENTRAL DIVISION.

The Central Division comprises chiefly the Culebra Cut. During the year ending June 30, 1910, there were excavated 17,832,177 cu. yds. of which 17,806,111 cu. yds. were from prism and were made up as follows:

Item.	Cubic yards.
Earth	[illegible]
Soft rock	[illegible]
Hard rock	2,656,780
Total	17,806,111

Of the total excavation 17,558,364 cu. yds. were excavated by steam shovel and locomotive cranes operating grab buckets; 116,440 cu. yds. were excavated by hand by force account and 157,373 cu. yds. were excavated by contract. The steam shovel excavation was hauled by dirt trains from 1 to 24 miles, or an average of 12 miles, to dumps.

Blasting.—A total of 12,158,996 cu. yds. of material were mined during the year. The drilling was done by 153 well drills and 235 tripod drills, all operated by compressed air. The aggregate lengths of hole drilled was 4,354,704 ft., so that nearly 2.8 cu. yds. were excavated per lineal foot of hole drilled. The amount of explosive used was 7,071,352 lbs., which gives 1.57 cu. yds. of rock blasted per pound of explosives.

Excavating Plant.—A total of 61 steam shovels were employed and averaged 155.8 cu. yds. per hour, while under steam, and 236.1 cu. yds. per hour worked. The remaining plant used was as follows:

Locomotives	161
Cars	2,824
Locomotive cranes	7
Pile drivers	4
Unloading plows	36
Spreaders	14
Track shifters	6
Unloaders'	28

Tracks.—The total mileage of work track on this division was 200 miles. To provide running and loading tracks for the steam shovels in the cuts approximately 213 miles were removed, 219 miles laid, 10 miles renewed, and 1,534.6 miles shifted. In addition 556 frogs and switches were removed and 927 laid during the year.

The itemized cost of excavating 17,558,364 cu. yds. by shovel and 116,440 cu. yds. by hand during the year is given in Table X. As noted above an additional 157,373 cu. yds. were excavated by contract at the cost given in Table XI. The cost of all excavation for the year was as follows:

Items.	Per cu. yd.
Total division expenses	$0.6699
General expenses	0.0646
Total	$0.7345

The cost of excavating 58,815,543 cu. yds. from the beginning of work to June 30, 1910, has been as follows:

Items.	Per cu. yd.
Total division expenses	$0.8414
General expenses	0.0980
Total	$0.9394

In studying Table **X** it will be noted that the 11.9 cts. per cubic yard cost for drilling and blasting is the cost when distributed over the total yardage excavated. Considering only the 12,158,996 cu. yds. actually blasted this item of cost is 17.27 cts. per cubic yard.

The cost of excavation for three months, July-September, 1910, since the above records is shown in Table XII.

PACIFIC DIVISION.

The work excavation on this division aggregated 8,260,256 cu. yds., of which 6,990,391 cu. yds. were dredge work and the remainder dry excavation mostly for lock structures.

Dredging.—Six dredges were worked, 1 suction dredge, 1 dipper dredge and 4 ladder dredges. The material handled was mostly earth disposing river channel and stripping subaqueous rock for the operations of rock breaking. Three methods were used for breaking rock to dredgeable size, drilling with well drills on land, drilling from drill bulb under water, breaking under water with a Loebnitz rock breaker. An average of 12 land drills drilled during the year 86,827 lin. ft.; 345,865 lbs. of dynamite were used and 274,339 cu. yds. of rock were broken. About 0.8 cu. yds. of rock was broken per pound of explosive and 3 cu. yds. per lineal foot of hole drilled. The drill barge was 112x38⅔ ft., and three drill frames were mounted to travel along a track on one side. The range of travel of the drills from one position of the barge was 85 ft. The holes were drilled 5 ft. apart in rows 6 ft. apart. This barge worked 4 months during the year with the following record:

Hours worked	1,040
Lineal feet hole drilled	7,508
Feet of hole drilled per hour	7.22
Number of holes drilled	407

TABLE XIX.—DETAIL COST OF EXCAVATING DRY [illegible] CU. YDS. FROM PEDRO MIGUEL LOCKS.

Item.	Per cu. yd.
Mining	$0.1375
Loading	0.2414
Tracks	0.4146
Transportation	0.1276
Dumps	0.0308
Pumps	0.0795
Maint. equipment	0.2023
Plant, arbitrary	0.0834
Division expenses	0.0445
General expenses	0.1620
Total	$1.5236

The Loebnitz rock breaker was in service 2,845 hours and the penetration per hour was 17.5 ft.

The cost of dredging for this six months to June 30, 1910, is given in Table XIII. Table XIV shows the cost of dredging by classes of dredges. The itemized cost of dredging for three months, July-September, 1910, is shown by Table XV.

Dry Excavation.—The dry excavation comprised 99,700 cu. yds. in prism and various amounts in lock pits and foundations. Table XVI gives the itemized cost of excavation on prism. The costs of lock pits and foundation excavation are given for six months to June 30, 1910, in Tables XVII, XVIII, XIX and XX. Table XXI gives the cost of preparing lock foundations at Miraflores and Pedro Miguel for three months, July-September, 1910.

TABLE XX.—DETAIL COST OF EXCAVATING DRY 44,948 CU. YDS. FROM PEDRO MIGUEL LOCKS FOUNDATIONS.

Item	Per cu. yd.
Mining	$0.8574
Loading	1.2368
Tracks	0.1407
Transportation	0.1867
Dumps	0.0575
Pumps	0.0278
Maint. equipment	0.0898
Plant, arbitrary	0.0804
Division expenses	0.1422
General expenses	0.3319
Total	$3.1512

SUMMARY.

In the preceding tables we have given the unit costs for various portions of the excavation work for various periods as the information was presented in sufficient fullness for details to be arrived at. General costs may be obtained for the main parts of the work from its beginning until Oct. 1, 1910. The costs of dry excavations has been as follows:

Work.	Cubic yards.	Per cu. yd.
Atlantic division, prism	1,476,871	$0.6799
Atlantic spillway	1,467,425	0.7222
Gatun locks	4,297,052	0.6699
Central division, prism	63,321,815	0.9207
Pacific division, prism	240,063	0.8899
Pedro Miguel locks	1,018,657	0.9698
Miraflores locks	1,350,135	1.0535

TABLE XXI.—COST OF EXCAVATION JULY-SEPTEMBER, 1910, PREPARING FOUNDATIONS FOR PEDRO MIGUEL AND MIRAFLORES LOCKS.

Quantities.	Pedro Miguel.	Miraflores.
Excavations, cubic yards	27,604	38,128
Cost Items.	Per cu. yd.	Per cu. yd.
Drilling	$0.0476	$0.4316
Blasting	0.1148	0.1060
Loading by [illegible]	0.2260	0.1736
Loading by [illegible]	[illegible]	0.5929
Transportation	0.2462	0.1499
Tracks	0.1340	0.2272
Dumps	0.1093	......
Pumps	0.0377	0.0752
Maint. equipment	0.1292	0.0423
Plant, arbitrary	0.3925	0.0792
Division expenses	0.1249	0.1100
General expenses	0.3563	0.3221
Total	$3.0796	$2.3099

The great bulk of the excavation in the above items is steam shovel work and except in certain portions of the lock pit work the conditions for attack are good. The item of chief interest is the prism excavation in the Central Division (Culebra Cut), which has cost 92 cts. per cu. yd.

The average cost of excavation preparing foundations has been as follows:

Work.	Cubic yards.	Per cu. yd.
Gatun spillway	12,910	$2.2280
Gatun locks	57,798	2.6149
Pedro Miguel locks	72,552	3.1239
Miraflores locks	102,164	2.2385

The cost of wet excavation with dredges has been as follows:

Work.	Cubic yards.	Per cu. yd.
Atlantic division, prism	19,527,577	$0.2354
Gatun dam	38,425	0.5216
Gatun locks	188,533	0.1830
Pacific division, prism.	24,533,666	0.2447

In this tabulation the first and last items are chiefly of interest.

Some Costs of Hauling With Traction Engines.

The hauling of materials and supplies from railway to construction camps for the Los Angeles Aqueduct work is done largely with traction engines. These engines are made by the Holt Manufacturing Co., Stockton, Cal., and are gasoline operated and rated to develop 45 hp. at 550 r. p. m. To permit operation across the desert country where deep sand exists the engines are provided with a rolling platform traction. The following figures of the cost of operating 15 of these engines for February, 1910, are rearranged and reduced to unit costs from a table given in the *Engineering Record*:

	Total.	Per ton mile
Engine 1020:		
Supplies	$145.28	$0.1171
Shop repairs	154.75	0.1248
Labor, crew	148.50	0.1197
Depreciation	50.00	0.0403
Total	$498.53	$0.4019
Engine 1021:		
Supplies	$ 24.16	$0.0145
Shop repairs	72.97	0.0439
Labor, crew	149.75	0.0901
Depreciation	50.00	0.0300
Total	$296.88	$0.1785
Engine 1025:		
Supplies	$ 54.41	$0.0322
Shop repairs	36.23	0.0214
Labor, crew	133.87	0.0792
Depreciation	50.00	0.0295
Total	$274.51	$0.1623
Engine 1026:		
Supplies	$ 78.99	$0.0343
Shop repairs	29.67	0.0131
Labor, crew	153.75	0.0677
Depreciation	50.00	0.0220
Total	$312.41	$0.1371
Engine 1028:		
Supplies	$ 55.72	$0.0282
Shop repairs	87.51	0.0443
Labor, crew	165.50	0.0838
Depreciation	50.00	0.0253
Total	$358.73	$0.1816
Engine 1030:		
Supplies	$ 70.96	$0.0281
Shop repairs	193.01	0.0766
Labor, crew	155.62	0.0617
Depreciation	50.00	0.0200
Total	$469.59	$0.1864
Engine 1033		
Supplies	$ 23.09	$0.0314
Shop repairs	83.05	0.1129
Labor, crew	28.50	0.0387
Depreciation	50.00	0.0680
Total	$184.64	$0.2510
Engine 1034:		
Supplies	$ 70.65	$0.0264
Shop repairs	147.63	0.0552
Labor, crew	167.25	0.0625
Depreciation	50.00	0.0187
Total	$435.53	$0.1626
Engine 1035:		
Supplies	$ 75.39	$0.0453
Shop repairs	121.92	0.0733
Labor, crew	140.25	0.0843
Depreciation	50.00	0.0300
Total	$387.56	$0.2329
Engine 1036:		
Supplies	$ 49.90	$0.0347
Shop repairs	246.00	0.1710
Labor, crew	139.25	0.0968
Depreciation	50.00	0.0347
Total	$485.15	$0.3372
Engine 1037:		
Supplies	$ 87.90	$0.0418
Shop repairs	158.75	0.0755
Labor, crew	163.25	0.0776
Depreciation	50.00	0.0238
Total	$459.90	$0.2187
Engine 1039:		
Supplies	$ 70.48	$0.0288
Shop repairs	66.96	0.0271
Labor, crew	136.50	0.0552
Depreciation	50.00	0.0202
Total	$323.94	$0.1313
Engine 1041:		
Supplies	$ 38.92	$0.0415
Shop repairs	44.59	0.0474
Labor, crew	120.28	0.1279
Depreciation	50.00	0.0532
Total	$253.79	$0.2700
Engine 1042:		
Supplies	$ 68.26	$0.0564
Shop repairs	86.05	0.0711
Labor, crew	132.00	0.1091
Depreciation	50.00	0.0413
Total	$336.31	$0.2779
Engine 1069:		
Supplies	$ 41.07	$0.0299
Shop repairs	77.51	0.0564
Labor, crew	69.00	0.0503
Depreciation	25.00	0.0182
Total	$212.58	$0.1543

Summarizing these figures we have the following:

Item.	Total.	Per ton mile.
Supplies	$ 955.18	$0.0367
Shop repairs	1,606.60	0.0612
Labor, crew	2,003.27	0.0771
Depreciation	725.00	0.0279
Total	$5,290.05	$0.2029

In addition there were the following expenditures for repairs not included in the above monthly items.

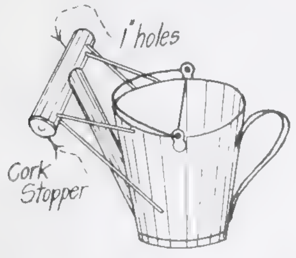
Shop repairs, to trucks	$ 87.11
Shop repairs, miscellaneous	132.47
Field repairs, miscellaneous	335.29
Total	$554.87

This adds 2.13 cts. per ton mile, making the total cost for repairs 8.25 cts. per ton mile and the total cost of haulage 22.42 cts. per ton mile.

ROADS AND STREETS SECTION

Notes on Road and Street Work.

Life of Wood Block Pavement.—Mr. W. Calder, City Engineer of Prahrau, Victoria, Australia, in a paper presented before the Melbourne Engineering Society last June, states that pavements of untreated red gum blocks laid in Toorah Roads and Chapel St., Prahau, in 1889, are still in use. When some of the blocks were removed for repairs in 1907 the actual wear was found to be only ½ in. The blocks are now failing from wet rot at the bottom where they rest on the concrete.



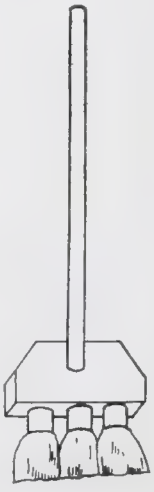
Tar Can with Horizontal Spreader.

Dust Producing Effects of Horses.—The dust producing effects of the pounding and screwing action of the shod feet of the horse on the road surface is well known. The amount of dust caused by the excrement from horses, however, is not so well known. An English engineer, Mr. W. E. Higgins, estimates that a horse will produce from 7 to 8 long tons of manure per annum, a considerable portion of which is distributed about the streets. During dry weather this manure becomes pulverized under traffic and is added to the dust produced from other sources.

Clay Expansion Joints for Wood Block Pavement.—To provide for expansion in wood block pavements, Mr. Mountain, City Surveyor, of Melbourne, Australia, who has had a wide and extended experience with this class of pavement since 1880, has found the most satisfactory material to be pugged and tempered clay. This practice has also been followed with the latest wood block pavement laid in Prahau, Australia. The clay joints should break bond to prevent the tendency to longitudinal rutting by wheeled traffic.

Increase of Property Value by Street Improvement.—It is a pretty well recognized fact that the improvement of a street or a road will increase the value of the adjoining property. It is seldom, however, that actual figures of this increase are given. In Kansas City, Mo., the extensive system of boulevards have all been constructed under the assessment plan. The general district of assessment adjoins the boulevard for a block or more in each direction, but most of the expense falls on the abutting property. The boulevards are made out of 50 or 60 ft. streets widened to 100 ft., and in some cases 110, and additional width is allowed where a street railway was to use part of the space. There are wide parkways with trees and grass and flowers, in uniform plan, and maintenance cost is divided between the city and the property owners. The City Record, of Boston, Mass., states that the increase in value of frontage through boulevard construction is thus given by R. F. Weirick, a landscape architect. On Benton Boulevard, land worth $15 to $20 a ft. before the improvement increased to $45 to $60, and the cost of construction was $8.53 per ft. On Linwood, $50 a ft. before changed to $80 to $100, the cost being $7.99. On Harrison, property worth $8 to $15 a ft. advanced to $70, cost being $6.17. On Gladstone, property valued at $40 to $45 per ft. rose to $85 to $100, on a cost of improvement of $8.88.

Tar Spreading Can and Tar Brush.—In treating road surfaces by tar painting in England watering cans provived with horizontal spreaders are sometimes used. This type of spreader, states Mr. G. Betram Hartfree, Surveyor to the Urban District of Alton, England, in a paper read before the Institution of Municipal and County Engineers, is preferable to the rose spreader as a more uniform covering is obtained. The accompanying cut shows the type of watering can used by Mr. Hartfree in his work at Alton. The spreader is perporated with ¼-in. openings and has a



Brush for Brushing in Tar.

6 in. half cover. A special tar brush, as shown in the cut, was used in brushing the tar.

Road Surface Treatment with Asphalt Oil.—During 1908 and 1909 the engineers of Hamilton County, Ohio, treated 15½ miles of macadam road with asphalt oil for dust prevention purposes. The work was described by J. M. Harper, of Cincinnati, at the last annual meeting of the Ohio Engineering Society. The first two roads were oiled without any particular specifications and bids were received for furnishing and applying the oil as one item. It cost 4⅞ cts. per sq. yd. For the remainder of the roads specifications were prepared which provided that separate bids will be received, one for furnishing the oil and so much per gallon, f. o. b., in ten cars at designated localities, and the other for cleaning the roadway, handling and applying the oil, these last three items to be bid upon by the sq. yd. The next contract that was let per 10½ miles resulted in the aggregate cost being 2¾ cts. per sq. yd. A portion of the specifications under which the roads were treated follows:

> The surface of the macadam, when dry must be thoroughly swept free from dust. The sweepings will be deposited off and away from the sides of the metalled surface so as not to form banks and to assist in retarding the growth of vegetation next the macadam roadway. After the roadway has been satisfactorily cleaned in sections of such length as may be determined, the oil will be applied to one side only on the perfectly dry, warm surface of the roadway. The application will be made by a machine or appliance, adapted for the purpose at the rate of ½ to ¾ of a gal. per sq. yd. When streaks appear or a surplus of oil occurs in depressions, or, owing to the lateral camber of the road, the oil flows to and gathers at the sides, hand brush brooms must be used to obtain an equal distribution. As stated, only one-half of the roadway will be treated at a time; as fast as one side is finished, the contractor will be required to block it against traffic for such a length of time as may be indicated, depending in a great measure upon weather conditions and temperature. When the material has properly set, the portion oiled will be thrown open to travel and the other side treated and blocked as prescribed. No oil will be applied during or immediately after a rain, as the roadway surface must be clean and thoroughly dry and warm during the treatment. It is absolutely necessary that the oiling be performed as rapidly as is consistent with thorough application in order to avoid inconvenience to traffic.

The Indiana Refining Co.'s liquid asphalt was used in the work. The oil cost the county on an average 2.58 cts. per gallon, and the quantity used averaged 6 gals. per sq. yd. This makes the average cost of the oil 1.548 cts. per sq. yd. The cost of the application was 1.375 cts. per sq. yd., and the total cost for oil and treatment was 2.92 cts. per sq. yd.

Experimental Bituminous-Macadam Pavements on White Plains Road, Bronx Borough, New York City.

A comparative test of various binders of a bituminous macadam pavement is now being conducted by engineers from the office of the Commissioner of Public Works of Bronx Borough, New York City. In order to make an actual test under traffic conditions of the bituminous macadam constructed with the various binders an experimental strip of pavements has been laid on the White Plains Road, between Boston Road and Burke St., in the Bronx. This strip consists of 18 sections of pavements, differing in methods of construction and materials used. The sections vary in lengths from 150 to 350 ft. The binders used are in accordance with various specifications for tar, asphalt, and asphalt and tar mixed. As a basis for comparison a section of ordinary water bound macadam was laid adjoining the penetration work. There are no crossroads on White Plains Road between Boston Road and Burke St., so all the sections will be subjected to the same amount of traffic. Accurate data on the cost of construction of the various strips have been kept; data on the cost of maintenance will also be kept. A census of traffic will also be taken.

The following is a description of the work:

Section 1 is about 325 ft. in length and is a bituminous macadam built under the specifications of the Barber Asphalt Paving Co. with its binder and resting on a 4-in. concrete foundation. It was built by the mixing method, with heated paving gravel and sand; the mixing was done at the paving company's asphalt plant.

Section 2 is of the same length as the first, and was laid under the supervision of engineers of the Commissioner of Public Works of the Borough. The sand and stone were heated and an asphalt binder used; the mixing was done at an asphalt plant. The pavement consists of a 4-in. foundation of 1½-in. stone and a wearing surface of ¾ in. stone and sand and an asphalt binder 2 ins. thick.

Section 3 is about 150 ft. long and was also laid under the supervision of the Borough engineers. It consists of a 2-in. wearing surface on a 4-in. concrete foundation. The sand and stone were heated, an asphalt binder used, and the mixing done at an asphalt plant.

Section 4 has a length of about 325 ft. and was built under the direction of the Standard Oil Co.'s experts, by the mixing method, using the company's "special" asphalt binder. The foundation is composed of a 4-in. course of broken stone. The wearing surface is 2½ ins. thick and is composed of ¾ in. stone, chips and sand, heated, and mixed by hand on a board platform.

Section 5 of the same length as the preceding, was put down by the Texas Co. with Texaco asphalt binder. The foundation is of broken stone, 4 ins. thick, and the wearing surface is 2½ ins. in thickness. The stone for the wearing surface was mixed cold in a Ransome concrete mixer.

Section 6 is about 300 ft. in length; it consists of a 4-in. broken stone foundation and a 2½-in. Amiesite wearing surface, mixed at the plant, shipped to the work and laid cold, in the usual manner.

Section 7, of nearly the same length as the preceding section, was surfaced with a cold asphaltic mixture supplied by the Sicilian Asphalt Paving Co. The foundation is a 4-in. course of broken stone.

Section 8 is about 200 ft. long; it consists of the usual 4-in. broken stone foundation and a 2-in. wearing course of ¾-in. stone and chips mixed hot with Tarvia X, under the direction of the Barrett Manufacturing Co. The mixing was done by hand on a board platform.

Section 9 is a short section of about the same length as Section 8, and was laid under the supervision of the engineers of the Borough, using the hot mixing method. Three different mixtures of tar and asphalt were used as binders. The foundation is a 4-in. course of broken stone and the wearing surface is 2½ ins. in thickness. The mixing was done by hand on a board platform.

Section 10 is about 350 ft. long. The foundation is a 4-in. course of broken stone and the wearing surface, a hot mixture of ¾-in. stone, chips, and a tar binder conforming to the specifications of the United States Office of Public Roads is 2½ ins. in thickness. The mixing was done by hand on a board platform.

Section 11 is a 100-ft. stretch composed of a 4-in. broken stone foundation and a 2½-in. wearing course of ¾-in. stone and sand, built by the penetration method under the direction of an expert from the Barrett Manufacturing Co.'s Boston Office. Three applications of binder were made, a special mixture being used in the second and Tarvia X in the first and third.

Section 12, about 200 ft. in length was to have been constructed as Wadsworth macadam, but the approach of cold weather before the work could be undertaken prevented the use of this material, which is laid without heating. Instead in this section the engineers of the Borough put in an asphalt macadam treated by the penetration method on a foundation of 4 ins. of 1½-in. stone and screenings built up as an ordinary macadam road, then 2½ ins. of 1½-in. stone were spread and rolled, and the asphalt binder poured, ¾-in. stone spread and rolled, and a squegee coat applied.

Section 13 is of the same length as Section 12. It is a Hassam pavement 6 ins. in thickness, constructed in the usual manner by grouting a broken stone roadway with a cement grout.

Section 14 is about 200 ft. long and it is water-bound macadam section built in accordance with the borough specifications and put down, as already noted, as a basis for comparison.

Section 15, about 150 ft. in length, was built by the penetration method using Tarvia X as a binder. 1½-in. stone were used to a depth of 6 ins. and a squegee coat applied.

Section 16 is about the same length as the preceding. It is similar to section 15, but was built under specifications of the Barber Asphalt Paving Co., with one of its binders. The penetration method was used.

Section 17 is of practically the same length as Section 16. It was built by the penetration method under the specifications of the Standard Oil Co., and with one of the Company's asphalt binders; 1½-in. stone were used to a depth of 6 ins., and a squegee coat applied.

Section 18 is the most northerly section. It is an old macadam roadway given a surface treatment with sand and a binder supplied by the Standard Oil Co.

The work is in charge of Mr. William H. Connell, Assistant Commissioner of Public Works of the Borough of the Bronx, to whose preliminary report we are indebted for the above information.

Methods of Constructing Tar Macadam at Prahran, Australia.

An interesting deviation from the usual method of constructing tar-macadam by laying and rolling the different grades of stone in well defined layers was employed by Mr. W. Calder, City Engineer of Prahran, Victoria. This work was described by Mr. Calder in a paper read before the Melbourne University Engineering Society in June last, and from this paper we have taken the notes that follow. The municipality of Prahran has 1⅗ miles, with a total area of 27,400 sq. yds. of tarred macadam of different grades and methods of construction, and as all have proved more or less satisfactory, it is proposed to extend this class of work in the future. As to the durability of the tar macadam pavement at Prahran, Mr. Calder states that a section of ¼ mile in length was laid in Commercial road, east of Chapel St., in 1902, and has during eight years required but little attention save for minor patching and tar painting of portions that appeared rough on the surface. Formerly this was one of the worst roads in the municipality. It required recoating with metal every third year, and in wet weather the road scrapers and mud carts were familiar objects in the street. To all appearance this road is as sound as when first laid, the only defect noticeable being a somewhat uneven and wavy surface. Mr. Calder states that the cost of reconstruction of this road was high—namely $1.44 per sq. yd., the reason being that the road bed had to be excavated to obtain the desired convexity, and as the foundation was wet the sub-bed was drained by means of stoneware pipe drains. The depth of the coat consisted of 6 in. of tarred 2½-in. metal, with a binding about 1½ in. thick of ¾-in. tarred chippings, and sealed with a light coat of tarred toppings, sufficient only to fill all surface interstices, laid on a foundation of 4 in. of cinders and 6 in. of ordinary dry metal. It is estimated that the increased economy in maintenance and cleansing in this road has been 75 per cent, and the expense and inconvenience of the mud cart has no longer to be borne. This street carried what may be termed fairly heavy traffic.

In 1903 Greville St., for a distance of 19⅓ chains, was recoated with ordinary dry metal, the binding being composed of tarred chippings, sealed with a light coat of tarred toppings, the additional cost of the tarred material and rolling being 32 cts. per sq. yd. Only nominal repairs have been necessary in this road since the work was done. This street carries light traffic only.

In 1907 a section of Toorak Road, between Chapel and River Sts., was recoated with ordinary macadam. Trouble was experienced here formerly, as the road has a somewhat steep gradient, and the metal continually became disintegrated by the feet of horses, particularly adjoining the strip of paving along the tramway track. An improved method of treatment was adopted in this section. The dry 2½-in. metal was first sprinkled with distilled tar, then a coating of tarred chippings spread over the larger metal before rolling. The surface was then sealed with tarred toppings. The reason for this method is obvious. The tarred chippings wedged between the stones by the roller filled the interstices, and made the mass more homogeneous, thus preventing the moving and consequent abrasion of the stone under traffic. The only object of the surface dressing of toppings is to prevent the penetration of surface water to the body of the road, and on gradients steeper than, say, 1 in 18 or 1 in 20, it is inadvisable to make the surface too smooth, a surface dressing of dry toppings being sufficient. Recently, when the construction of the Prahran-Malvern tramway rendered it necessary to reconstruct High St., the sides of the road for a total length of 83 chains between the Avenue and the Armadale Railway Station were constructed of tarred macadam by a method which Mr. Calder has not before seen followed, and which, in his opinion, is a great improvement on the former methods described.

Like most of the old roads, High St. was imperfectly formed with a high crown and irregular foundation, which rendered it necessary to excavate the old metal as well as the sub-bed. The method of procedure was as follows: After scarifying, the old metal was forked over and the clean metal, thus freed from stone, dust and other dirt, laid aside for future use. The foundation was then excavated to the proper level, and when trimmed to shape the old metal was spread and rolled with the steam roller. The sub-bed consisted of good, dry loam. This was considered a sufficient foundation, and the old metal being partly pressed into the subsoil by the roller prevented the subsoil being squeezed up into the clean, new material. A coat of 2½-in. bluestone was then spread so as to form a 4-in. layer of stone after rolling, and this stone was sprinkled with distilled tar from rose cans. A layer of 1½-in. metal to have a finished thickness of 2 in. was then spread and lightly rolled. Over this a coat of tarred screenings to have a finished thickness of 1 in. was spread and rolled. In order to fill all interstices and seal the surface, sufficient tarred bluestone toppings free from stone dust were then spread and again rolled, and finally a surface dressing of clean, coarse, gritty sand was spread and the whole well rolled. The road therefore consists of a crust 7 in. in thickness (exclusive of the 2 in or 3 in of old metal rolled into the bed) of a well compacted and homogeneous body as free as possible from voids, which was considered sufficient with a reliable natural foundation such as described.

Mr. Calder states that this finished road is as nearly perfect in appearance as any road can be not having a concrete foundation. It is smooth, even, and practically without the hollows or waves frequently noticed in tar macadam, the surface appearance being like asphalt. The steepest portion of the road has a gradient of 1 in 21, and the cross-curvature is about 1 in 35. The road was at no time during construction closed against traffic, including omnibus traffic, which was allowed to use the road as soon as completed. With the usual method of constructing tar macadam by laying and rolling the different grades of stone in well-defined layers, there is a tendency for the topmost layers to peel or be ground off under traffic, and if comparatively thin surface layers of fine grade are superimposed over a body of dry 2½-in. stone which contains many voids, the tendency is for the stone beneath to move and rock beneath the weight of traffic, and the inevitable result is a broken and uneven surface. With cement concrete we are careful to obtain an aggregate composed of different sizes of stones so proportioned as to ensure a mass free from voids, and it would appear that similar reasoning should be followed in laying tar concrete.

It will be noted that only sufficient topping is used to afford a smooth and waterproof surface, and that the larger 1½-in. and ¾-in. grades of stone are brought near the surface to form the wearing crust. The roller used is one of Aveling & Porter's 10-ton rollers, with a Morrison's scarifier attached. Many engineers are of the opinion that a wavy surface is caused by the use of a heavy roller, and while a lighter roller would be most useful at certain stages of the process of laying the materials, Mr. Calder is of opinion that the hollows are most frequently caused by attempting to roll too great a thickness of loose and unbound metal, which is pushed in front of the roller wheels, or neglecting to thoroughly consolidate the foundation. For successful work in tar macadam it is essential that the different operations of the work should be carefully supervised by skilled men, that the tar should be distilled, and that the metal and smaller grades of stone should be thoroughly dry, as if wet, or even damp, the tar will not adhere to it.

Of the pavement laid in High St., a section 58 chains in length, having an area of 10,922 sy. yds., was done by the council's own day laborers, and a section of 25½ chains, with an area of 4,480 sq. yds., was constructed under contract. The total cost, including excavation and forming of the foundation, of the section done by day labor was $8,190, or 74 cts. per sq. yd., as compared with 91 cts. per sq. yd. at contract rates.

The council possesses its own quarries, stone crusher and tar distilling plant, and the whole of the work of mixing was performed by hand. Recently a machine has been added to the plant for mechanically mixing screenings and toppings, by which means the cost of mixing tar screenings has been reduced from $2.28 per load by hand to 72 cts. per load by machine, and of toppings from 38 cts. per load by hand to 4 cts. per load by machine, but the apparatus was not installed until the completion of the work in High St. The Prahran council also now owns a 5-ton road roller, suitable for tar macadam. With these and other proposed labor-saving appliances, considerable economies will be effected in future operations of a like nature. High St. is a street of medium to fairly heavy traffic, and as there exists in the same street sections of wood pavement, compressed asphalt and tar macadam, all laid during the same season, there is opportunity for interesting comparisons regarding the relative durability and economy of upkeep of these various pavements under similar traffic conditions.

The reason of the increased durability of tarred macadam, as compared with ordinary dry macadam or tar-painted macadam, is that in the former the stones are coated with a protective covering of a tough and adhesive material. In roads constructed of dry macadam it is impossible to compact the mass by rolling, and there will remain about 20 per cent of voids in the mass of stones. Under the action of traffic the stones are ground together, and the surfaces and edges worn away. The result of this action may be observed when the road metal is picked up for repair or other reason. It is then found that the old road stones have a rounded appearance, the edges having been worn away. The grinding action is hastened should water have obtained access to the stone. Tar painting by sealing the surface of the road and preventing the admission of surface water certainly lengthens the life of the road by keeping a dry sub-bed and retarding surface disintegration by weather and traffic, but it does not prevent the abrading action which goes on beneath the surface. Also the adhesive action of the tough tar coating affords a lateral support to the adjacent stones composing the road crust, and the angle of resistance to a surface load is considerably increased. If it be assumed that the line of pressure induced by a loaded wheel is at an angle of 25° from the surface downwards to the foundation, with a load on the wheel of 10 cwt., the weights upon the road bed would be approximately 26 cwt. per square foot, in the case of a 7-in. thickness of metal, and if it be assumed that with tar macadam this angle is increased to 40° allowing the same thickness of road crust, the weight per square foot upon the subsoil would be reduced to 8.5 cwt.

That this increase in the power of tar macadam to distribute the load is not exaggerated, but rather underestimated, may be realized by actual experiment, or noted in every-day experience. An ordinary tar-paved footpath, 3 in. in thickness, may be torn up in sheets 3 ft. or 4 ft. in width, and these slabs will have considerable power to resist a cross-breaking strain.

Again, a scarifier attached to a steam roller will tear up an ordinary dry macadam road with comparative ease to a depth of 3 in. or 4 in., but recently, when a tar-paved crossing, 3 in. in thickness, had to be torn up on account of adjacent road works, the work was effected with the greatest difficulty by the same means.

The American Association for Highway Improvement.

A comprehensive movement to turn to practical account all of the efforts that are being made to further the work of road improvement in all parts of the United States was launched at Washington, D. C., on Nov. 22, by the organization of the American Association for Highway Improvement. The purpose of the association is to harmonize and correlate the work of all state and county associations, as well as all of the interests, and in fact all organized effort for road improvement, to the end that practical results may be obtained in the form of the best possible road laws and the best possible administration of roads in the states and counties. The association will maintain permanent offices in Washington and will seek to concentrate effort upon specific problems and at points where help is most needed.

The officers of the new organization are as follows:

President, Logan Waller Page, Director of the U. S. Office of Public Roads.

Vice-President, W. C. Brown, President of the New York Central & Hudson River R. R. Co.

Treasurer, Lee McClung, Treasurer of the United States.

Secretary, J. E. Pennybacker, Jr., chief of road management in the Office of Public Roads. Mr. Pennybacker will resign his present position to give his entire attention to his new duties.

Executive Committee: Mr. Page, chairman; W. W. Finley, President of the Southern Railway; B. F. Yoakum, chairman of the executive committee of the St. Louis & San Francisco R. R. Co.; Alfred Noble, Consulting Engineer, New York; Hon. Lafayette Young, Des Moines, Ia.

Committee on Ways and Means: B. F. Yoakum, chairman; James S. Harlan of the Interstate Railroad Commission, vice-chairman; James McCrea, President of the Pennsylvania R. R.; R. D. Chapin and Joseph W. Jones, representing the automobile industry; other members are to be appointed later.

Board of Directors: Louis Hill, President of the Great Northern Ry., chairman; the officers and committee members noted above; Dr. E. J. James, President of the University of Illinois; Bryan Lathrop, of the Lincoln Park Commission, Chicago; John M. Goodell, Editor of the Engineering Record; Melville E. Stone, General Manager of the Associated Press; Walter Page, Editor of "World's Work"; Leonard Tufts, of Pinehurst, N. C.; John A. Stewart, President of the International League for Highway Improvement; Robert P. Hooper and George C. Diehl, representing the American Automobile Association; A. G. Spalding, of the San Diego County, Cal., Highway Commission; C. S. Barrett and Clarence Wilson.

The constitution of the association provides that the regular membership of the association shall be composed of all persons who shall sign the roll of membership at the time of organization, or make written application to the Secretary and pay annual dues for one year in advance, membership to begin with written acceptance by the Secretary.

The associate membership is to consist of all members of state and other organizations for road improvement, co-operating with this association, provided, that a roster of such membership shall be filed with the Secretary by said organization.

The sustaining membership is to consist of all persons or organizations who shall sign the roll of sustaining membership at the organization of the association or make written application to the Secretary and pay annual dues for sustaining member one year in advance, membership to begin as soon as written acceptance shall have been received from the Secretary.

The annual dues for regular members of the association is $5, payable in advance. The annual dues for sustaining members is $100, payable in advance. Associate members are not required to pay annual dues to this association.

Regular members of the association will be entitled to participate in its proceedings, and vote upon all questions that may come before the association. Associate members will be entitled to participate in discussions of questions before the association, but will only vote as duly accredited delegates from organizations co-operating with this association, the basis of representation to be one vote for each 50 paid up members of such co-operating organizations, as evidenced by rosters filed with the Secretary of the association. Sustaining members will not be entitled to participate in discussions, or to vote upon questions before the association.

WATER-WORKS AND SEWERS SECTION

Methods and Cost of Sinking and Lining a Dug Well on Long Island.*

BY J. L. IN[illegible]

Underlying Long Island, for the greater portion of its length, there is an abundant supply of water of excellent quality for both commercial and household purposes. On account of the rolling nature of the ground the depth to the strata of water-bearing sand varies, in places being only 10 or 15 ft. below the surface.

The well here described was sunk during January and February, 1910. The work was done by a contractor on a day-labor basis, without a percentage. Prices for the rent of the plant and cost of materials and labor were agreed upon previous to the commencement of the work. This was found very satisfactory. As the contractor had other work to which he wished to move his plant there was no disposition on his part to go slow and the work was pushed as rapidly as possible.

As the amount of water required of this well was to be about 800,000 gals. per day it was decided to place a circular concrete lining with an external diameter of 9 ft. 6 ins. in it, if, after continuous pumping for a period of one week, it showed no diminution in capacity. In order to accommodate this lining a clear area 9 ft. 10 ins. by 9 ft. 10 ins. was required at the second ring of sheeting.

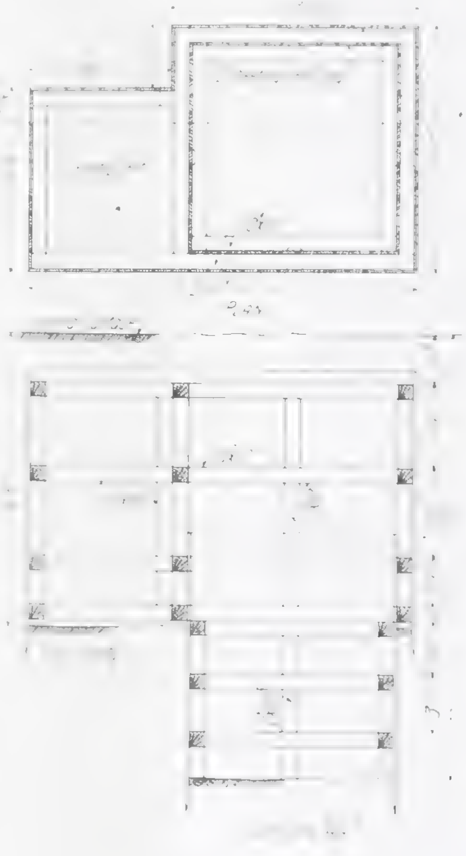
In order to make the well as small as possible and place the pumps low enough to develop their greatest capacity, a pump pit, 8 by 10 ft. was excavated at one end of the well, as shown on the plan. This arrangement was also necessary in order to work the pumps while the concrete lining was being placed. The excavation of this pump pit was carried down until the lowest pump had a lift of about 12 ft. at the final depth of the well.

The plant comprised a double-drum engine and stiff-leg derrick with 35 ft. mast and 45 ft. boom; two No. 9 Cameron pumps; and an 8-in. centrifugal pump with gasoline engine attached. Steam was supplied to the derrick engine and the Cameron pumps by two boilers of the locomotive type of 130 hp. The pumps were arranged in the pit in tiers, the upper pump being above water level. This made it possible, in case of accident to all the pumps, allowing the hole to fill with water, to repair the upper pump and with it unwater the hole sufficiently to repair the others.

The excavation consisted of 3 ft. of clay, the top 6 ins. of which was frozen, and for the remainder of the depth sand and sand and gravel. For the first 5 or 6 ft. the material was cast out of the hole by hand but below that depth two 1 cu. yd. buckets, handled by the derrick, were used. The greater portion of the excavated material was loaded on cars and hauled away. As this was used in completing an adjacent embankment no charge for its disposal is made in the following costs.

Water was encountered at a depth of about 11 ft. and increased rapidly in quantity as the excavation proceeded. After a depth of about 15 or 16 ft. was reached pumping was required continuously both day and night. It was found necessary to pump all night in order to be ready for the excavating gang in the morning, it requiring between 6 and 10 hours to unwater the hole. In order to dispose of this water an open timber flume 24 ins. wide, 12 ins. deep and about 400 ft. long was constructed to the manhole of an adjacent sewer.

As shown on the plan all rangers, braces and corner posts were 10 x 10 in. yellow pine timber, with 2 x 10 in. intermediate posts treenailed to the rangers. All sheeting was 2 x 10 ins. x 16 ft. beveled on the lower edge and driven by hand. There were 220 cu. yds. of excavation in the well. On account of the weather and a couple of breakdowns to the pumps it took about six weeks to complete the excavation and sheet the well. The following prices were paid for rent of plant, material and labor:


Timbering for Dug Well.

Engine and derrick, per day	$2.00
Pumps, per day	3.00
Boilers, per day	[illegible]
Lumber, per M ft. B.M.	[illegible]
Coal, per ton	4.00
Gasoline, per gallon	0.16
Stone, per cu. yd., delivered	2.20
Cement, per bbl.	[illegible]
Foreman, per hour	[illegible]
Engineer, per hour	[illegible]
Pumpman, per hour	0.35
Timekeeper, per hour	0.35
Carpenters, per hour	0.35
Helpers, per hour	0.225
Laborers, per hour	0.19

The timekeeper, besides his regular duties, looked after supplies and acted as assistant foreman.

The cost of 220 cu. yds. excavation was as follows:

	Total.	Per cu. yd
[illegible] Timber:		
30 hrs. carpenters at 35 cts	$ 10.50	
[illegible]	6.75	
[illegible]	5.70	
Total	[illegible]	[illegible]
Building Flume:		
[illegible]	[illegible]	
55 hrs. carpenters at 35 cts	19.25	
[illegible]	[illegible]	
[illegible]	[illegible]	
Total labor	$ 46.05	[illegible]
1,120 ft. B.M. lumber	$ 34.63	$0.157
Grand total	[illegible]	[illegible]
Unloading and Erecting Head Plant:		
[illegible]	[illegible]	
93 hrs. carpenters at 35 cts	32.55	
[illegible] hrs. helpers at 22½ cts	[illegible]	
13 hrs. timekeeper at 35 cts	4.55	
380 hrs. laborers at 19 cts	72.20	
[illegible]	[illegible]	
[illegible]	[illegible]	
Total	[illegible]	[illegible]
160 hrs. watchman	30.40	0.138
Grand total	[illegible]	[illegible]
Framing Timbers and Sheeting:		
50 hrs. foreman at 55 cts	$ 27.50	
25 hrs. timekeeper at 35 cts	8.75	
337 hrs. carpenters at 35 cts	117.95	
257 hrs. helpers at 22½ cts	57.82	
Total labor	$212.02	$0.964
7,625 ft. B.M. lumber	236.38	1.074
Grand total	$448.40	$2.038
Excavating and Sheeting:		
263 hrs. foreman at 55 cts	$144.65	
100 hrs. timekeeper at 35 cts	35.00	
1,731 hrs. laborers at 19 cts	328.89	
405 hrs. engineer at 50 cts	202.50	
Total labor	$711.04	[illegible]
33 dys. derrick and engine at $2	$ 66.00	
15 dys. boiler at $3	45.00	
27.536 tons coal at $4	110.14	
Total	$221.14	$1.005
Grand total	932.18	4.237
Pumping:		
[illegible]	[illegible]	
489 hrs. pumpman at 35 cts	171.15	
46 hrs. timekeeper at 35 cts	16.10	
Total labor	$287.25	$1.306
72 dys. pumps at $3	$216.00	
32 dys. boiler at $3	96.00	
58.742 tons coal at $4	234.97	
46 gals. gasoline at 16 cts	7.36	
Total	$554.33	[illegible]
Grand total	841.58	3.826
Grand total all work	$2,580.12	$11.727

As the well was 25 ft. deep the cost per foot depth was $103.20.

The lining for the well was a cylindrical shell of reinforced concrete, 12 ins. thick, with an internal diameter of 7 ft. 6 ins. and 26 ft. in height. It was reinforced its entire length with No. 10 expanded metal lapped 1 ft. at joints. An opening 2 ft. 6 ins. square was left about half way up to receive the suction pipe. Three rows of 4-in. farm tile were inserted in the lower 5 ft. to act as weep holes.

As the bottom of the well, when excavation was suspended, was fine sand, it was deemed advisable to rest the lining on short piles driven to hard pan. For that purpose a pair of leads was suspended from the derrick, low-red into the hole and the piles driven by means of a drop hammer. These piles, ten in number, were spaced 2 ft. 7½ ins. apart and radially 4 ft. 3 ins. from the center of the well. This placed them on the center of the lining. The piles were short butts brought from another job and averaged 7 ft. under cut-off. A platform of two 6 x 8-in. timbers placed side by side and laid flat, was spiked to the piles. On this platform the forms for the lining were built.

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*Forest Hills, Elmhurst, Long Island.

The lining was built in two sections; the first section was 12 ft. in height and the second section was 14 ft. Owing to the contracted space in which it was necessary to work and on account of the thickness of the lining being only 12 ins., it would have been impossible to have gotten a satisfactory job had it been attempted to complete the concreting in one operaiton.

The expanded metal was bent to the required radius and several sections in height were securely wired together on the ground, picked up by the derrick and lowered into position in the form.

Timber beams to carry the foot valve and strainer were placed in the lower section and steel beams and channels to carry the length of suction pipe placed in the upper section. Galvanized iron ladder rods were provided to allow of easy access to the well in the future.

Concrete was mixed by hand on a platform directly over the forms and shoveled into place. Long, flat-bladed, wooden poles were used for tamping the concrete and flushing the mortar to the face. The sand was taken from the excavation and required screening. Concrete was mixed in the proportion of 1 part cement, 2½ parts sand and 5 parts stone; the stone being commercial ¾-in.

After the removal of the forms the space between the lining and the sheeting was filled with screened gravel and coarse sand to the water level and above that to the finished ground surface with clay. The clay was used to prevent as far as possible ground water seeping into and impairing the quality of the water in the well. The clay was obtained quite close at hand and its cost is included in the backfilling. The finished surface of the ground was graded in all directions from the well at a slope of 1 on 25 in order to carry off surface water. The well was protected by an octagonal cover of 2-in. plank with a hinged trap door, 4 ft. by 2 ft. 6 ins., and fastened by a padlock.

There were 25.5 cu. yds. of concrete in the lining, and the cost per cubic yard was as follows:

Rigging Pile Driver, Driving, Cutting Capping:		
29 hrs. foreman at 55 cts.	$ 15.95	
10 hrs. timekeeper at 35 cts	3.50	
175 hrs. carpenter at 35 cts	61.25	
15 hrs. helpers at 22¼ cts	3.38	
63 hrs. laborers at 19 cts	11.97	
30 hrs. engineer at 50 cts.	15.00	
Total labor	$111.05	$4.355
218 ft. B.M. timber	6.76	
3 dys. derrick and engine at $2	6.00	
3 dys. boiler at $3	9.00	
Pile driver	28.00	
3.559 tons coal at $4	14.24	
Total	$ 64.00	$2.510
Grand total	175.05	6.865
Building Forms, Placing Reinforcement:		
113 hrs. foreman at 55 cts	$ 62.15	
45 hrs. timekeeper at 35 cts	15.75	
382 hrs. carpenters at 35 cts	133.70	
92 hrs. helpers at 22½ cts	20.70	
293 hrs. laborers at 19 cts	55.67	
50 hrs. engineer at 50 cts	25.00	
Total labor	$312.97	$12.273
76 ft. B.M. beams	2.35	
Channels, expanded metal, etc.	93.00	
6,175 ft. B.M., forms and bracing	191.43	
Total materials	$286.78	$11.246
9 dys. derrick and engine at $2	$ 18.00	
9 dys. boiler at $3	27.00	
10.678 tons coal at $4	42.71	
Total	$ 87.71	$3.440
Grand total	687.46	26.959
Pumping:		
52 hrs. engineer at 50 cts	$ 26.00	
164 hrs. pumpman at 35 cts	57.40	
Total labor	$ 83.40	$3.271
51 dys. pumps at $3	153.00	
17 dys. boilers at $3	51.00	
20.169 tons coal at $4	80.68	
32½ gals. gasoline at 16 cts	5.20	
Total	$289.88	$11.368
170 hrs. watchman at 35 cts	32.30	1.267
Grand total	$405.58	$15.906
Unloading Stone and Screening Sand:		
26 hrs. foreman at 55 cts	$ 14.30	
278 hrs. laborers at 19 cts	52.82	
Total	$ 67.12	$2.632
Mixing and Placing Concrete:		
30 hrs. foreman at 55 cts	$ 16.50	
10 hrs. timekeeper at 35 cts	3.50	
220 hrs. laborers at 19 cts	41.80	
20 hrs. engineer at 50 cts	10.00	
Total labor	$ 71.80	$2.816
2 dys. derrick and engine at $2	4.00	
2 dys. boiler at $3	6.00	
2.373 tons coal at $4	9.49	
27¼ bbls. cement	35.05	
41 cu. yds. stone	90.20	
Total	$144.74	$5.675
Grand total	216.54	8.491
Stripping Forms, Running Plant, Finishing:		
83 hrs. foreman at 55 cts	$ 45.65	
30 hrs. timekeeper at 35 cts	10.50	
212 hrs. carpenters at 35 cts	74.20	
25 hrs. helpers at 22½ cts	5.63	
453 hrs. laborers at 19 cts	86.07	
32 hrs. engineer at 50 cts	16.00	
Total labor	$238.05	$9.335
208 ft. B.M. timber in cover	6.45	
Hinges and lock	2.50	
3 dys. derrick and engine at $2	6.00	
3 dys. boiler at $3	9.00	
3.559 tons coal at $4	14.24	
Total	$ 29.24	$1.489
Grand total	267.29	10.824
Grand total, all work	$1,827.99	$71.677

As the lining was 26 ft. high the cost per foot height was $70.31.

(This article records some unusually high costs. The following summaries from the figures give the items:

	Per cu. yd.
Excavation:	
Unloading timber	$ 0.104
Building flume	0.366
Erecting plant	1.156
Framing timbers and sheeting	2.038
Excavating and driving sheeting	2.038
Pumping	3.826
Total	$11.727
Concrete Lining:	
Pile foundation	$ 6.865
Forms and reinforcement	26.959
Unloading stone and screening sand	2.632
Mixing and placing concrete	8.491
Removing plant and finishing	10.824
Total	$71.677

It is plain that a number of the items which the author charges against concrete are general charges and should be separated, but this does not wholly account for the high cost. It is not plain why forms and reinforcement should have cost $27 per cu. yd. of concrete, nor why many of the other items should have reached the amounts given.—Editors.)

Cost of Operating Filters for Twelve Months, Philadelphia Water Supply.*

Lower Roxborough Filters.—This station consists of a storage reservoir of 12,838,000 gals. capacity, giving a period of 1.26 days' sedimentation; 5 covered filter beds, having a combined area of 2.65 acres; 11 preliminary filter tanks, with a combined area of 0.2586 acres, and a covered clear water basin of 3,000,000 gals. capacity.

During the year there were filtered at this station 3,880,399,000 gals. of water, or a daily average of 10,631,230 gals., corresponding to an average rate of 4,010,000 gals. per acre per day. The filters are operated at rates between 5,000,000 and 6,000,000 gals. per acre per 24 hours.

The total cost of operation, not including the cost of the wash water, was $16,462.65, or $4.24 per million gallons filtered, of which the laboratory cost was 54 cts. per million gallons filtered.

The preliminary filters were operated at an average rate of 45,220,000 gals. per 24 hours per acre, at a total cost of $1.45 per million gallons of water filtered by the sand filters. The cost of labor and wash water was $1.08; replacing slag and furnishing new sponge cost 37 cts. per million gallons. The average turbidity of the applied water for the year was 30, and the effluent average 12.00, the average reduction in turbidity being 58.22 per cent. The removal of bacteria by the preliminary filters for the year averaged 60.7 per cent. The water, before passing to the filters, had an average sedimentation of 1.25 days.

The maximum quantity filtered by the sand filters in one day was 12,900,000 gals., equivalent to a rate of 4,900,000 gals. per day per acre. The filters were washed for the entire year by the "Brooklyn" method. The total number of runs or washings of the sand filters for the year was 57, an average of 11 per filter. The average time between scrapings was 32.4 days, and the average amount filtered between cleanings was 68.4 million gallons equivalent to 129 million gallons per acre. The cost of labor and water for washing by the "Brooklyn" method was only $0.40 and about 1,400 gals. of wash water were used per million gallons filtered.

Upper Roxborough Filters.—This station consists of a storage reservoir of 147,032,000 gals. capacity, giving a period of about 9.3 days' sedimentation; 8 covered filter beds of a combined area of 5.6 acres and a covered clear water basin of 8,000,000 gals. capacity.

During the year there were filtered at this station 4,982,151,000 gals. of water, an average of 13,649,730 gals. per day, corresponding to an average rate of 2,437,000 gals. per acre per day.

The total cost of operation was $15,829.30, or $3.18 per million gallons of which the laboratory cost was 44 cts. per million gallons filtered. This includes all the items connected with the operation of the station, but does not include the cost of pumping water from the storage reservoir or sedimentation basin to the filters.

In Filters Nos. 1, 3, 4, 6 and 8, 3,407 cu. yds. of sand were replaced at a cost of 23 cts. per cubic yard.

The total number of runs or cleanings during the year was 65, an average of 8 runs to each filter, the average time between scrapings being 45 days. The average amount filtered between cleanings was 76,600,000 gals., or 109,500,000 gals. per acre.

Three methods of washing were used during the year, and their average runs were as follows:

Scraping and ejecting..16 runs—average 43.7 days each.
Brooklyn method..18 runs—average 55.4 days each.
Nichols separators..31 runs—average 41.6 days each.

And the cost of labor and wash water was respectively $0.49, $0.28 and $0.61 per million gallons of water filtered, or an average price of $0.48.

The average amounts filtered between runs for the three above methods of washing were 90,200,000, 85,700,000 and 74,900,000 gals., and the wash water required was 2,200, 1,300 and 1,200 gals. per million gallons of water filtered respectively.

Belmont Filters.—The Belmont Filter Station is comprised of a sedimentation basin of 70,000,000 gals. capacity, giving a period of 1.8 days' sedimentation; preliminary filters consisting of 9 filter tanks, having a capacity of 40,000,000 gals. per 24 hours; 18 covered sand filters, having a combined area of 13.23 acres, and a covered clear water basin with a capacity of 16,500,000 gals.

The filters are operated at a nominal rate of 3,000,000 gals. per acre per 24 hours, and the total quantity filtered during the past year was 13,762,700 gals., at an average yield of 37,706,000 gals. per day, corresponding to an average rate of 2,790,000 gals. per acre per 24 hours. The maximum amount of water filtered in any one day was 44,467,000 gals.

Filter No. 4 was continued during the year at a rate of 6,000,000 gals. per acre per day, with results as good as those obtained from filters operating at the usual 3,000,000 rate.

The preliminary filters were started on October 23, 1907. They were operated at a rate of 75,000,000 gals. per acre per 24 hours this year, and have materially increased the length of runs or time between scrapings of the slow sand filters without any decrease in efficiency.

The total cost of operation was $44,441.38, or $3.23 per million gallons filtered, which included a charge of $8,233.73 for operations of the preliminary filters and $4,318.68 for laboratory expenses, the cost of preliminary filtration being $0.60 per million gallons and the laboratory charge $0.316 per million gallons.

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*Extract from the annual report of Fred. C. Dunlap, Chief, Bureau of Water, Philadelphia, Pa.

Two methods of cleaning the filters were used. During the year 16 filters were washed by the Brooklyn method, the remaining two being cleaned by the usual method of scraping and ejecting. There were 165 runs or cleanings during the year, an increase of 82 runs over the previous year; 152 of these runs were on filters cleaned by the Brooklyn method and 13 by the usual method. The average length of runs by the Brooklyn method was 40 days, the amount filtered between runs being 89,130,000 gals., or 118,520,000 gals. per acre. The average length of runs by the usual method of cleaning was 59.2 days, the average amount filtered between scrapings being 135,493,000 gals., or 181,507,000 gals. per acre.

While the length of runs of quantity filtered with the Brooklyn method was not so large as with the usual method, it proved economical on account of the short time it was necessary to have the bed out of service, the low labor cost of cleaning and the saving in not having to replace the sand.

Sixteen filters were operated for the entire year by the Brooklyn method. The items of cost, etc., in the process of cleaning are as follows:

Number of runs	152
Av. length of runs, days	40.7
Av. m. g. filtered per run	89.13
Av. m. g. filtered per acre per run	118.52
Av. cost of water to wash per m. g. filtered	$0.05
Av. cost of labor to wash and spade per m. g. filtered	$0.65
Total cost of washing and spading sand in place (water and labor), per m. g. filtered	$0.70
Av. gallons water used to wash sand in place per m. g. filtered	3,630

One filter was cleaned by the usual method of scraping and ejecting for the entire year and another one for a portion of the year. The items of cost, etc., were as fololws:

Number of runs	13
Av. length of runs, days	59.2
Av. m. g. filtered per run	136.5
Av. m. g. filtered per acre per run	181.5
Av. cu. yds. sand scraped per m. g. filtered	0.94
Av. cost to scrape per m. g. filtered	$0.28
Ay. cost to remove per m. g. filtered	0.14
Av. cost to wash per m. g. filtered	0.03
Av. cost to scrape, remove and wash per m. g. filtered	0.45
Av. cost to clean, including replacing sand, per m. g. filtered	0.70
Av. gals. of water used to remove and wash per m. g. filtered	2,350

In Filters Nos. 4, 5, 6, 8, 9, 11, 15 and 16, 7,225 cu. yds. of sand were placed during the year at a cost of $0.27 per cubic yard.

Torresdale Filters.—The Torresdale Filter Station consists of sixty-five 0.75 acre covered beds, a covered clean water basin of 50,000,000 gals. capacity, preliminary filter plant consisting of 120 concrete tanks, approximately 60x20 ft., and containing 1,140 sq. ft. of filtering surface, with a capacity of 240,000,000 gals. of water per 24 hours.

The total amount of water filtered during the year was 73,558,000,000 gals., a daily average of 201,528,800 gals., equivalent to a rate of 4,050,000 gals. per acre per day. The daily average amount filtered since March 1, 1909, was 217,000,000 gals., and the maximum amount filtered in any one day was 248,000,000 gals.

The cost of operation, not including the cost of operating the low lift Pumping Station or the cost of wash water (which is included in the expense of the Pumping Station), was $125,594.47, or $1.70 per million gallons of water filtered. Of this amount $19,580.18 was the cost of operating the preliminary filters and $10,858.52 the cost of the Laboratory, or $0.26 and $0.15 per million gallons filtered, respectively.

Since February 15 the filters have been operated at rates approximating 6,000,000 gals. per day per acre, the average rate since the above date being 4,200,000 gals. per acre per day.

Two methods of cleaning were employed, *i. e.*, the regular or scraping and ejecting method and the use of Nichols' Separators. The total number of runs or cleanings was 840 during the year, an average of about 13 cleanings per filter, having an average length of 26.2 days. The Nichols method was used for 695 cleanings and the average cost was as follows:

Number of cleanings by Nichols method	695
Av. length of runs, days	26.2
Av. million gals. filtered per run	91.7
Av. m. g. filtered per acre per run	119.8
Av. cost of water to wash per m. g. filtered	$0.01
Av. cost of labor to scrape and wash per m. g. filtered	0.40
Cost of water wasted	0.01
Total cost per m. g. filtered	0.42
Av. number of gals. wash water per m. g. filtered	1,000
Av. depth scraped per run, ins	0.71

In Filters Nos. 2, 4, 5, 6, 9, 10, 11, 12, 15, 16, 17, 20, 21, 22, 23, 26, 27, 28, 30, 35, 36 37, 39, 40, 42, 45, 47, 53, 55, 56, 57, 58, 60, 61, 63, 64 and 65, 45,016 cu. yds. of sand were replaced at an average cost of $0.23 per cubic yard.

Methods and Cost of Pneumatic Calking With Lead Wool of 30-in., 36-in. and 48-in. Gas Mains.*

The first attempt at pneumatic calking was made by this company† in the Summer of 1900 on a 30-in. main, the joints being the regulation cast lead and yarn with the depth of lead about 3½ ins. The experiment did not succeed for two main reasons:—the first of these being the impossibility of calking the lead back for more than ½ in. or ¾ in. from the face of the hub, the balance of the joint remaining in the same condition as when first poured. The more pressure applied, the tighter this ½-in. or ¾-in. ring is driven until finally the hub splits. The second reason for failure was the inability to reduce the amount of time taken to calk the joint. Given the same amount of calking time for both hand and compressed air joints, the cost of the latter would naturally be higher on account of the operation and depreciation charges on the plant in use.

With the advent of lead wool and its adoption by this company to the exclusion of cast lead, the question of pneumatic calking again came to the front. While lead wool joints are more efficient than those made with cast lead, there are two factors which make them more expensive. The first of these factors—the cost of the raw material—we are unfortunately unable to control. The second factor is the length of time necessary to calk the joint. When we consider that it takes two experienced calkers ten hours to yarn and calk one 48-in. lead wool joint, it is evident that the labor cost is a rather large item. Anything which will reduce the calking time without a corresponding increase in labor will result in a material reduction in the cost per joint.

With this end in view, it was decided early this Spring (1910) to make a series of tests on pneumatic calking, with the idea of introducing it on the large mains to be laid during the Summer. At the time, there was in process at our 111th St. Yard, a school of instruction for lead wool calkers, and by carrying on our tests at this time and place we were able to secure a very fair comparison between the hand and air work.

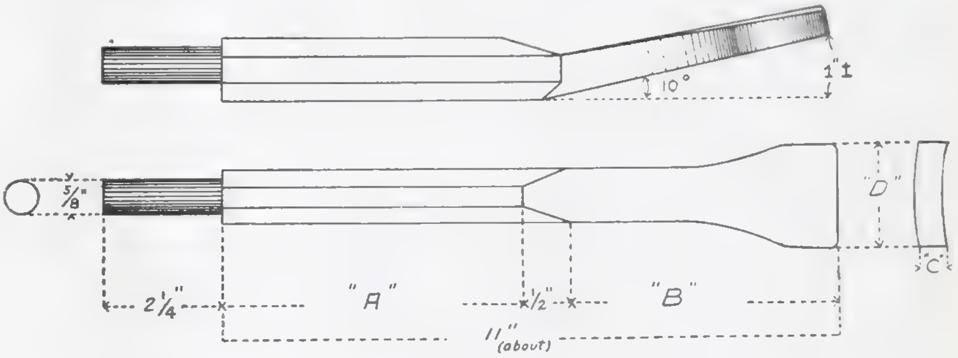
For this hand calking instruction, a number of specially prepared 30-in., 36-in. and 48-in. joints had been set up. These consisted of very short split hub sections held firmly together by wrought iron bands, with spigot pieces 4 or 5 ft. long inserted in the hubs, the whole joint being firmly held in place by posts and braces. These joints were yarned and calked, a record of the time kept for each operation, and on completion, the removal of the split hub made it possible to inspect and weigh the lead wool contained in the finished joint. This weight was compared with the average weights of cast lead and lead wool usually contained in a joint of the size in question. In addition to this, a random section of the lead wool was cut out with a hack-saw and its specific gravity obtained to determine how nearly the lead wool had been compacted to the density of cast lead.

Lead wool is calked in the following manner: The material comes from the manufacturer in strands about ½ in. in diameter and from 2 to 3 ft. long, each strand being twisted up to about the shape of an old fashioned cruller. These are straightened out and re-rolled until we have a fairly hard strand not quite as thick as it was originally with a slight taper at each end. These strands are calked into the joint separately, taking care, of course, that the breaks do not come directly over one another, and when the face of the hub is reached the joint is finished off in the same manner as with cast lead.

The first joint attempted was a 48-in., which had been previously yarned by hand. We used a small gasoline driven compressor of about 50 cu. ft. capacity, and were furnished with hammers by the Ingersoll Rand Co., who also sent an expert to give us any assistance necessary. No attempt at speed was made on this joint, as it was necessary to instruct several green calkers in the handling of the hammers and also to do some experimenting in order to produce a proper calking tool.

The hammer used was an Ingersoll Rand "Imperial" chipping-hammer, with a 3-in. stroke. The tool which we finally found to give the best results was forged from a ⅞-in. hexagonal steel tool blank, and similar in shape to that shown by Fig. 1.

On the completion of this 48-in. joint, the split hub was removed for inspection. The lead wool was found to be very well compacted, the few irregularities being due, no doubt, to the calker's failure to put enough of his weight against the tool. The yarn had



Tool for Pneumatic Caulking of Gas Mains.

Size of pipe.	—30-in.—				—36-in.—				—48-in.—			
	A	B	C	D	A	B	C	D	A	B	C	D
Yarning iron	6¼	1¾	[illegible]	1⅞	[illegible]	[illegible]	[illegible]	[illegible]	6½	[illegible]	[illegible]	[illegible]
Caulking tool No. 1.	6¼	1¾	[illegible]	1⅞	[illegible]	1½	[illegible]	[illegible]	6½	[illegible]	[illegible]	[illegible]
Caulking tool No. 2.	..	.			[illegible]	[illegible]	[illegible]	[illegible]	6½	[illegible]	[illegible]	[illegible]
Caulking tool No. 3.									6½	[illegible]	[illegible]	[illegible]
Finishing tool	6¼	1¾	[illegible]	1⅞	[illegible]	1½	[illegible]	[illegible]	6½	[illegible]	[illegible]	[illegible]

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*A paper presented at the Fifth Annual Meeting of the American Gas Institute, 1910, by Colin C. Simpson, Jr.

†Consolidated Gas Company of New York.

been driven back about ¼ in. and was hard enough to have made in itself a gas-tight joint. The weight of the lead wool was a few pounds lighter than the average, but taking into consideration the fact that this was the first attempt, and that the calkers were absolutely unfamiliar with their tools, the result was more than encouraging.

As it was necessary to come to a decision in a very few days, whether or not we should adopt pneumatic calking, it was decided to make the balance of the tests on 30-in. pipe, this being an average size and taking very much less time to calk than 48 in.

A 30 in. joint was, therefore, yarned up and the Ingersoll Rand representative volunteered to calk this against time. The joint was completely calked by this one man in an hour, as against 5½ hours, the average time for hand work. Inspection of this joint showed it to be quite as well compacted and to weigh several pounds more than hand calked joints of this size.

An Italian calker, who had handled air hammers before, was then placed on this joint and supplied with a helper to roll and place the lead wool, enabling him to calk continuously. Francisco kept at it pretty steadily and finished his joint in 45 minutes. On inspection, it proved to be quite as good as the first, with the exception of being about 4 lbs. lighter. No attempt was made at pneumatic yarning as we had, at the time, no tool blanks of sufficient length to forge out a set of yarning irons. We decided, however, to try this out during the Summer's work, and I might add here, that it has been more than successful. The information obtained by these tests was then placed before the head of the Department of Mains and Services. He decided that the scheme was worthy of an extensive trial under working conditions, and authorized the purchase of two portable compressors with sufficient tools and equipment for each to work a gang of 6 or 8 calkers.

There were a dozen or more makes of portable compressor outfits on the market, any one of which would probably have answered our purpose, though unfortunately, no one of them had been used before on this sort of work. The ideal outfit to meet the working conditions should embody the following main features:

Light Weight—so as to be easily moved from one place to another without the aid of horses.

Self Contained Water Cooling System—the cost of a hydrant connection in New York City is about $4 per day.

Simple Gasoline Engine—Gasoline is cheap and easily obtained and most gasoline engines may also be run with gas. Steam is too expensive for an outfit of this size and as both the direct and alternating currents are used in different parts of New York city, two sets of motors would be necessary if an electric drive were adopted.

Air Capacity of about 50-75 Cubic Feet—this will take care of seven or eight hammers—the maximum necessary to use under average working conditions.

Moderate Cost—the more expensive the outfit, the greater the depreciation charge, which in turn naturally affects the cost per joint.

Table II is a statement showing the cost, air capacity, etc., of the different outfits investigated. We finally placed an order for one of the Abenaque Ingersoll Rand type and one National Brake and Electric Co. outfit. These two outfits are radically different—our idea being to try out both types and adopt the more successful of the two for future installations. The hammer adopted was the Ingersoll Rand "Crown" chipping-hammer, having a piston stroke of 3 ins. With a gang of 8 calkers working, it is necessary to have 10 of these tools. Then, if a calker has any difficulty with his hammer he is given one of the spare tools and the trouble, usually nothing serious, can be remedied by either the foreman calker or the compressor engineer.

We had some little trouble at first with these hammers, due no doubt, to the lack of experience on the part of the men handling them. The barrels became loose after working for an hour or so, allowing some of the air to escape, and several of the handle bolts snapped off. We were unable to find the reason for this ourselves and complained to the manufacturer. An expert was sent up on the work from the factory to investigate, and reported as follows:

> I found four hammers at work on the job, all with loose handles, which, from watching the operators, I am satisfied was caused by failure of the men to hold the hammers up hard against the tool while working. This caused the piston to strike the front end of the hammer, which resulted in the shock being transferred to the thread on cylinder and handle, thus causing an expansion of the handle.
>
> Relative to the breakage of bolts, I removed the bolts that were in the hammer and replaced them with nickel steel bolts brought by me from the shop for this purpose, and by placing the lock washer under the head of the bolt instead of under the nut, I found that it gave the desired results, i. e., a tight handle, as after watching the tools for three hours longer in actual service, I found that none of the handles came loose.
>
> The split handle complained of was the result of the same cause, inasmuch as the constant jarring had split the handle and the constant tightening of the bolt under the split handle caused it to spread. I would recommend that these broken handles be replaced and will endeavor, on future orders for this company, to supply the handle bolts of the kind I have used with lock washers under head and nut.

Very little difficulty of this kind has since been experienced with the hammers. Their work has been quite satisfactory and the troubles we do have can generally be traced back to a green or inexperienced calker. The yarning and calking sets were forged by our own blacksmith from a special 1-in. octagonal steel tool blank 11 ins. long. Figure I shows the shape and dimensions of the tools used on the different sizes of pipe. These tools are the product of quite some experimenting with different shapes and sizes, and give excellent results. As different joints of any size of pipe vary considerably in width, it is necessary to have several calking sets with different thicknesses of face to meet these conditions. The broad faced finishing tool is only used in facing off the last strand of lead wool.

Where it was possible to place the compressor alongside the trench near the joints to be calked, the tool hoses were all run from a manifold tee. This manifold was in turn connected to the air receiver by a 3-in. rubber hose. This plan is much more satisfactory than that of running a long wrought iron pipe line, the friction and air leakage losses being reduced to a minimum. Of course, there were cases where it was impossible for the compressor to stand alongside the trench, and the wrought iron line consequently had to be run.

The first gang of compressed air calkers was started on a 48-in. line. The men were allowed to go along slowly at first until they became accustomed to the work and no cost figures were kept for two or three weeks.

A certain amount of trouble was anticipated at the start, as men of this class are naturally opposed to anything tending to reduce hand labor and will try in their own quiet way to do what they can to "Beat the Game." And they did for a short time.

As first organized, the gang consisted of 9 calkers, 8 of them working in pairs and 1 acting as a foreman, his duties being to assign the men to their joints and to inspect the finished work. There were also two laborers rolling the lead wool for the calkers and a compressor engineer. After several weeks work with this organization, a cost report—given in detail below—was turned in. This report covered the last three days only of the third week's work:

*Number of joints yarned and calked	19
Calkers at 30 cts. per hour	$ 91.00
Laborers—rolling lead wool at 19 cts. per hour	11.40
Compressor engineer at 30 cts. per hour	9.00
Total labor cost	$110.40

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*All yarning done by hand.

TABLE II.—SHOWING COST, AIR CAPACITY, ETC., OF DIFFERENT TYPES OF PORTABLE COMPRESSORS.

Make of outfit.	Cu. ft. free air per min. del'd	At press of	Weight complete	Type compressor	Comp. cooling system.	Motive power.	Cooling system.	Cost complete.	Remarks.
Abenaque	78	100	7700	8x8 Ing.-Rand "NE I" single stage water jacketed.	4 water cooling tanks with rotary circulating pump.	15 h.p. 1 cyl. Abenaque gasoline.	4 water cooling tanks.	$1425	Highly recommended by users.
Abenaque	61	100	[illegible]800	6x8 Franklin single stage water jacketed.	do	do	do	$1325	Well spoken of though Abenaque people claim to sell more of the I. R. type.
Chicago Pneum. Tool Company	70	90	over 7000	6x8 Franklin single stage water jacketed	Water circulation	1 cyl. Chicago Pneum. Gas & Air cyl. are cast in one piece and work in tandem with a single piston rod.	Water circulation	$1250	More or less experimental. No outfits of this type in market at time we purchased.
Fairbanks Morse	70	80	8900	8x8 Fairbanks Morse.	Water circulation from tanks.	12 h.p. 1 cyl. gasoline.	Water circulation from tanks.	$1120	Could obtain no data from users.
Bury	94	90	9000	9x8 Class B. B. Bury.	Water circulation from tanks.	20 h.p. gasoline 1 cyl.	Water circulation from tanks.	$1825	Rather heavy; unable to obtain recommendation from users.
Nat'l Brake & Elec. Co.	100	90	8000	7½x8 3 cyl. Nat. Brake & Electric	Water circulation with radiator.	4 cyl. gasoline marine type 27 h.p.	Water circulation with radiator.	$1900	Users of smaller sizes speak very highly of same. This outfit built specially for us.

Gasoline—29 gals. at 11 cts.	$ 3.19
Lubricating oil, ½ gal. at 50 cts.	.25
Repairs and renewals	...
Total cost	$113.84
Cost per joint	5.99
Average time taken to yarn and calk joint	6 hours

To this figure must be added a depreciation charge on the plant in use, of about 30 cts. per joint. This is, of course, a very hard figure to determine absolutely. If we take the cost of the plant complete as $1,900 and figure that it will last for six years, and average 1,000 joints per year, the depreciation cost per joint will be as stated above. Adding this 30 cts. gives us a total cost per joint of $6.20. To complete 19 joints in three days by hand, would mean a gang of 12 calkers and a foreman with some overtime. The cost per joint would figure as follows:

380 hours calkers at 30 cts.	$114.00
60 hours laborers rolling lead wool at 19 cts.	11.40
32 hours foreman at 30 cts.	9.60
Total cost	$135.00
Cost per joint—(hand)	$7.11
Cost per joint—(air)	6.29
Saving air over hand—per joint	$ .82

While there was an actual saving of 82 cts. per joint, it was nothing like the result we had expected, and it was decided to observe the work more carefully and see whether it was not possible to cut the cost still further. A little personal investigation developed the following points:

The foreman being a calker himself and naturally in sympathy with his men and their desire to "beat the game," was making no attempt to push the work and had finally established a rule that one hammer to each pair of calkers was all that was necessary. Consequently, one man remained idle while the other calked his side of the joint.

The men rolling lead wool worked fast enough only to keep the calkers supplied and stopped whenever there was no calking going on. As a matter of fact, one able bodied boy could have rolled in a day enough wool to keep the gang supplied for a week. Then the yarning was being done by hand, making the cost of yarning a joint actually greater than that of calking it.

It was quite apparent that the whole proposition was one of system. Pneumatic calking is much quicker and easier than hand work. Keep the calkers busy all the time with their work laid out intelligently in advance; have the tools, yarn and lead always at hand so that it is unnecessary for a man to leave the trench and the result will be a considerable saving both in money and time.

As a result of this investigation, the force was reorganized according to the following scheme: A foreman who was not "one of the gang" was placed in entire charge of the calking and given to understand that his job depended on his ability to push the men and reduce the time per joint. He was furnished with blank reports (see Fig. 2), and instructed to forward one properly filled out each night to the main office. This report served two purposes: it allowed the work to be followed very closely by the interested parties at headquarters and also caused the men themselves to brace up, knowing that their individual results were being watched. We were also able to keep better informed about the compressors and tools, and to compare the result obtained with different types. The report was, of course, checked up by the Field Engineer before being turned in, and he was able to tell at a glance whether any time was being wasted.

It was decided at this time to yarn all joints by air. This proved quite successful, the yarning time being cut from two hrs., 15 min. to as low as 30 min. The lead rolling force was cut to one man who was sent away from the work to the storeroom and kept busy whether the calkers were working or not. Still another improvement was made by providing the gang with a laborer acting as a tool man. Quite a lot of time had formerly been wasted by the men in running around looking for tools. The average Irish calker when looking for anything, with the possible exception of a fight, has about as hard a time finding it as our well known friend Diogenes. When tools were needed it was up to the tool man to provide them—enough spare hammers being kept in reserve to immediately replace any needing repairs or adjustment. The calkers were under no circumstances allowed to leave the trench during working hours. With these changes, the gang made a fresh start and the results shown by the next cost report turned in were more than gratifying.

The conditions under which the work covered by this report was done were unusually severe. The joints were all in a loose rock trench running through very low ground, the presence of salt water making it impossible to calk at high tide. The cost per joint would naturally be higher under these conditions, as a certain amount of time is lost in shifting the whole gang to another part of the work when driven out by the water. The greater speed possible with pneumatic calking was especially valuable to us here, as we were able to complete a whole joint between tides instead of having to leave it when partly completed and then come back the next day and clean out the mud before being able to continue.

Following is an abstract from the cost report:

Total number of joints yarned and calked	39
All labor charges (calkers, foreman, toolman, leadman and compressor engineer)	$189.46
Gasoline, oil and repairs	5.44
Total cost 39 joints	$194.90
Cost per joint	$ 5.00
Plus depreciation on plant per joint	0.30
Total cost per joint	$ 5.30

This cost would undoubtedly have been lower still, but for the fact that half of our hammers had been sent to the Ingersoll Rand repair shop to be fitted with lock nuts and washers, as recommended by their expert.

It would not be quite fair to compare this cost per joint with the cost of hand calking in a dry trench. If it requires 10 hours for 2 men to yarn and calk a 48-in. joint under normal conditions, it would certainly take 12 hours to do the same amount of work in a tide water trench. On this basis, the cost per joint would have been as follows:

2 calkers 12 hours each at 30 cts. per hr.	$7.20
Labor rolling lead—(per joint)	0.30
Foreman calker—(per joint)	0.40
Total cost per joint—hand calking	$7.90

There was, therefore, a saving of $2.60 per joint, or about 33 per cent.

The daily cost reports to date on this particular line, have checked this figure very closely—the saving of air over hand work averaging about 30 per cent.

On the line in question, there were roughly 750 joints. Taking the average cost per hand calked joint as $7.11, the total cost of hand calking would have been $5,332.50. The total saving, using air tools, would, therefore, be very close to $1,600 so that the outfit will practically pay for itself in the first season's work.

These figures are quite conservative. While the weather conditions were ideal there was quite a little time lost in shifting the compressor around, as pipe was being laid at two different points on the line and it was never possible to have a straight run to calk of more than 300 ft. There were also days when there was no pipe ready for calking. When this condition arose, the foreman and compressor engineer overhauled and cleaned the compressor and the air hammers, and the calkers were put to work as laborers.

The ability to calk several joints quickly proved of great value on this line in allowing some rather bad street intersections to be finished up and back-filled with the least possible delay. While the money value of such a saving would be rather hard to compute, it must be quite an item when we consider the maintenance of intersecting pipes and sewers, sheeting, shoring, temporary bridges, night and day watchmen, and the ever present possibility of accidents to vehicles and pedestrians while the street is open.

We were quite pleased to find that we were able to get from 10 to 15 per cent more lead wool into these joints by means of the pneumatic tools than we had previously been able to get by hand. This proved conclusively that pneumatic calking gives a more compact, and consequently a more nearly gastight joint than the old method.

The second compressor to arrive was the National Brake and Electric outfit, this was placed on a 36-in. line and after spending some time breaking in the calkers, a gang was organized along the ideas described above. The same difficulties were experienced at first. A few tools were broken, the compressor stopped unexpectedly a few times, but finally things were licked into shape and we began to get results. The compressor on this line was larger than that on the 48-in., and it gave excellent service drilling rock, at the same time running enough hammers to keep all the calkers busy. At the present writing, there has been more rock drilling on this line than calking, so there is still room for improvement in the cost figures. This will, undoubtedly, come with practice and systematization of the work.

Taking an average daily report from this line, the cost per joint figures as follows:

*Total labor and compressor cost	$17.75
No. joints yarned and calked	9 3-5
Cost per joint	1.85
Plus depreciation on outfit, per joint	0.30
Total cost per joint	$ 2.15

Also 41 ft. of 1 in. hole drilled at a cost of 21 cts. per ft.

The cost of hand calking per joint would have been as follows: To do nine 36-in. joints in a day would take a gang of 10 hand calkers at an average rate of $2.75 per day. A pair of good hand calkers can do two joints in a 10-hour day, but the average will be a little less than that. No time for a foreman calker is charged in as the pipe foreman on this line looks after the calking and for a given number of joints his time would be the same for both compressed air and hand work:

10 calkers at $2.75	$27.50
Labor rolling lead	1.00
Total cost—nine joints	$28.50
Cost per joint	$ 3.17

This gives a saving per joint in favor of compressed air calking of $1.02, or about 32 per cent—very close to the average percentage of saving on the 48-in. work.

It will undoubtedly be possible to cut the cost, per joint, on the air work still further when it is not necessary to drill the rock and calk at the same time. The drills use a large amount of air and make it impossible to run more than 6 calking hammers. The compressor can easily run double that number and the fixed charge per joint (which is a fair-sized item) could, therefore, be cut in half. The calkers will also in time become more expert, thus increasing the number of joints per day. The working conditions on this line were not as severe as on the 48-in. line previously described, but when we stop to consider that more than half the calkers were absolutely green (not even having a hand calker's experience), the results are very encouraging. Calkers are not always numerous in New York city and if it is possible to break in absolutely green men as quickly and satisfactorily as this, our troubles are ended in this direction.

The compressor outfit furnished by the National Brake & Electric Co. proved quite satisfactory. A $2 per day laborer who had never seen a gasoline engine before was able to run it without any trouble, and the repairs cost next to nothing. The only possible objection to this outfit was the inability to move it readily on account of its weight. We expect to purchase a smaller outfit of this type of half the air capacity and about one-third of the weight to be used for calking. The

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*On this work we were able to obtain calkers at an average of $[illegible] per day as against $3.00 on the 48-in. line.

DAILY REPORT—COMPRESSED AIR CALKING.

48th-134th St. Line. Type of compressor, Ingersoll-Rand-Abenaque: Type of hammers, Ingersoll-Rand. Weather, fair, morning; showers, afternoon. Date, Aug. 9, 1910.

Name.	Grade.	Rate.	Total hours worked	No. joints caulked.	Joint No.	Time yarning.	Time caulking	Total time for joint	Weight of yarn, pounds.	Weight of lead, pounds.	Time on work other than compressed air caulking—State nature of work.	Compressor. Total hours running.	Compressor. Gals. gasoline used.	Compressor. Qts lub oil used.	Compressor. Repairs.	Hammers. Total No. on hand.	Hammers. No. in use.	Hammers. Repairs	Remarks.
E. Gutry	Caulker	$3.00	10	2	1	50′	2:45	3:35	13½	157	All hands made 300′ shift with compressor.	7:10	8	1	None	8	7	None	Delayed 1 hour 30 minutes waiting for joint holes to be dug. Also delayed ½ hour by paymaster's wagon
D. Mahoney	Caulker	3.00	10		2	50′	2:55	3:45	14¼	160									
T. Dillon	Caulker	3.00	10	2	1	50′	2:55	3:45	14¼	158									
D. Cregan	Caulker	3.00	10		2	45′	2:50	3:35	14	158									
C. Gruber	Caulker	3.00	10	2	1	45′	2:45	3:30	13	143									
H. Daniels	Caulker	3.00	10		2	45′	2:45	3:30	13¾	155									
B. Costello	Caulker	3.00	10	2	1	45′	2:50	3:35	14¼	166									
F. Hogan	Caulker	3.00	10		2	50′	2:50	3:40	14	168									
T. Skelley	Foreman caulker	3.00	10																
S. Salt	Comp. engineer	3.00	10																
M. Cunningham	Tool man	1.90	10																
Labor rolling lead wool		2.56																	
Total		$34.46		8															

Total labor and compressor cost (compressed air caulking only), $35.36. Total number of joints (compressed air caulking only), 8. Average cost per joint, $4.42 + depreciation, .30 = $4.72. Hand, $7.11. Saving, $2.39, or 33%.

G. A. SHERRON, Field Engineer.

larger compressor will then be used exclusively for rock drilling where it is not necessary to make as many shifts.

It might be well to add here, that a compressor need not be looked upon as a dead loss during the winter months, or when no outside work is in progress. There are many ways in which compressor air tools can be used to advantage on repair jobs around the works, and the testing of long stretches of main becomes an easy matter with the ready supply of air at any required pressure always at hand.

We were so well pleased with the results on the 48-in. and 36-in. lines that a third compressor outfit of the Ingersoll Rand-Abenaque Type was ordered for use on the 30-in. work. This compressor, unfortunately, arrived a little behind schedule and we were only able to use it for two weeks when the work was temporarily suspended on account of a delayed shipment of pipe. The results obtained in these two weeks were quite promising though, and with very little practice a pair of calkers would be able to do five joints per day, as against two by hand. This would give a saving of about 30 per cent and possibly better, as the working conditions here are ideal. The calking gang was organized on the same basis as that described for the 48-in. line, and past experience enabled us to eliminate most of the troublesome features.

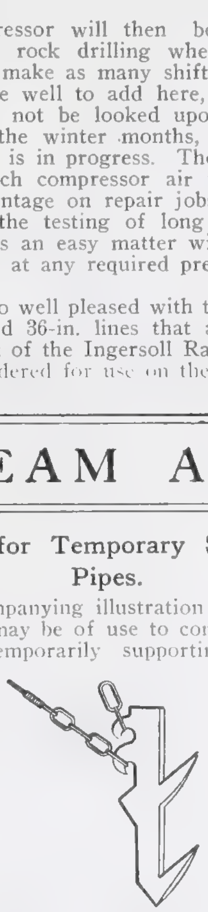
The average air pressure carried on the receiver gage was about 70 lbs. This gave from 50 to 65 lbs. pressure at the tool and was found quite sufficient. The compressors were all fitted with unloaders, which when set for any given pressure, regulated the air supply automatically.

From the results obtained on these three lines, it would certainly seem that pneumatic calking of lead wool joints gives better and quicker work with a considerable saving in cost. The calkers themselves are better satisfied as their work is much easier and it takes considerably less time to break in a man as a pneumatic calker than it does to get him in shape to swing a 3½-lb. hammer for 10 hours. As I have stated before, the supply of calkers in New York city is not always equal to the demand.

STEAM AND ELECTRIC RAILWAY SECTION

A Hook for Temporary Support of Pipes.

The accompanying illustration shows a device which may be of use to contractors as a means of temporarily supporting pipes on construction work of various kinds. The hook is driven into a timber, and the pipe is supported by a short piece of chain or wire looped around it. It can be taken out of the timber with a crow-bar and used repeatedly. We are indebted to the *Engineering and Mining Journal* for the illustration.



Hook for Supporting Pipes.

A Correction.—A misprint in our issue of Nov. 30, 1910, is made in the article on Costs of Masonry and Carpenter Work for a Church Building, p. 492. The number of bricks laid per man per day is given as 800 and should be 1,400. It may also be noted here that the apprentice brick layers averaged about ½ the number of bricks per day as the experienced men.

Hydraulic Dredge Record Broken.—The 20-in. dredge "Champion," on contract 25, New York Barge Canal, excavated during October 500,352 cu. yds. of material

Illuminating the Point of Sight in Underground Surveying.

The usual method of illuminating the point of sight is to place a light behind the plumb bob, and to interpose a transparent paper or tracing cloth. For preserving this cloth or paper in good condition, a simple device is used by Mr. Lee Frazes of the Boston Mine, Costa Rica, and is described by him in the *Engineering and Mining Journal*. A small frame is made by using two small round wood rollers for the two sides, and two sticks as spreaders for the ends. The spreaders are slotted at each end to fit over the rollers. Rubber bands are used to prevent the frame from falling apart. On one roller a number of pieces of paper are rolled, to be used by fastening from one roller to the other. When one piece is soiled it is discarded and a fresh piece is taken from the roll.

Method of Cutting Timbers by the Use of an Air-Hammer Drill.

In all work requiring extensive cutting of timbers, especially where mortise and tenons are made, all work is usually done by hand. The practice of cutting timbers for mines and shafts in the Lake Superior copper country has developed the use of an air-hammer drill with a moil bit, for this purpose. The tool used is described by Mr. S. H. Hill in the *Engineering and Mining Journal*. The standard tool for this work is the Hornet hand hammer drill manufactured by the Ingersoll-Rand Co.

The hand drills now on the market vary in weight from 20 lbs. up. A moil or sharp edged bit (which at no place can exceed the diameter of the steel itself) is inserted in place of a regular drill bit. It is held in place by a special bushing made to fit around the shank of the bit. The bushing is held in place in the end of the drill by means of a dowel pin and the bit is prevented from being shot through the bushing by means of a collar fastened to the head of the bit. It is claimed that this tool saves considerable time where a large amount of timber has to be cut.

Permeable Dike Construction for Protecting a Bridge Substructure, Chicago, Milwaukee & St. Paul Ry.

The Pacific Coast extension of the Chicago, Milwaukee & St. Paul Ry., constructed under the name of the Chicago, Milwaukee & Puget Sound Ry., crosses the Missouri River at Mobridge, S. D. The bridge at this point has been fully described in a paper by Mr. J. H. Prior, published in ENGINEERING-CONTRACTING of June 8, 1910. Briefly, there are three 420-ft. through pin-connected truss spans over the main channel, approached from the east by one 125-ft. deck span, and from the west by 283 ft. of steel trestle connecting with a long timber trestle. The timber trestle will ultimately be filled. A portion of the trestle is built over the old channel of Grand River, a new channel having been excavated, as shown by Fig. 1.

At the site of the bridge the low-water channel is 1,450 ft. in width and the ordinary high-water channel about 100 ft. wider. The total length of the main channel structure is 1,271 ft. between centers of piers. The low-water channel is thus narrowed about 179 ft., the east pier being placed at low-water line and the west pier set out into the low-water channel this amount.

For protecting the foundations of the west pier and for the purpose of filling that portion of the channel lying behind the pier, a structure common to the Missouri River, a permeable dike, was built. The location of this dike is shown in Fig. 1. The dike extends on a tangent up stream from the pier for a distance of 500 ft., then curves in to meet the river bank at a point about 1,200 ft. north of the pier. There are four transverse dikes extending from the main dike to the shore. The location of the structure and the elevations of the enclosed space are shown in Fig. 2. It is expected that the west bank will be protected from further encroachment by the stream, and that the space behind the dike will be filled in gradually through the silting action of the river. It is stated that this space has already been filled to an average depth of 4 ft. since the dike was built.

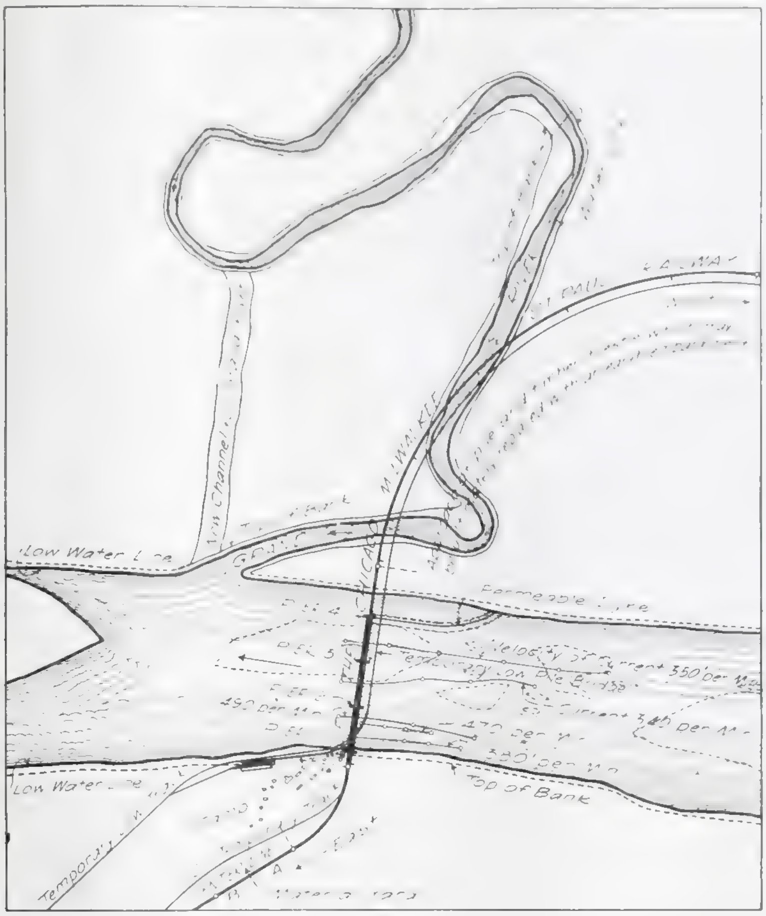


Fig. 1—Location of Bridge and Permeable Dike at Mobridge, S. D.

As will be seen from the illustration, Fig. 4, the main dike consists of three rows of piling 10 ft. apart, the piles in each row being driven 10 ft. centers. The piles in each row are braced longitudinally, and the rows are braced diagonally, the piles in the middle row being staggered with reference to those in the outer rows. All piles are driven to a minimum penetration of 25 ft. Two wales extend along the stream side of each row. These wales con-

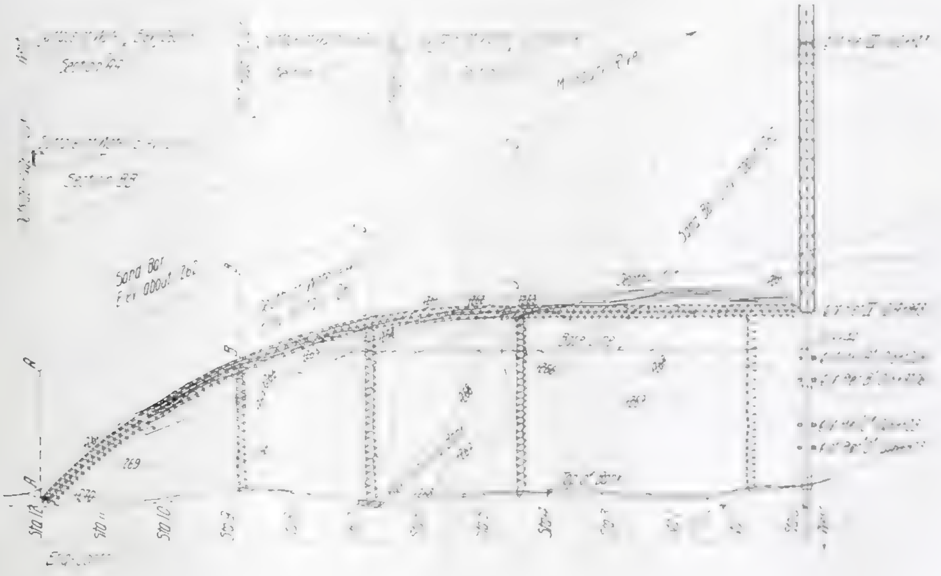


Fig. 2—General Plan Showing Location of Longitudinal and Transverse Dikes at Mobridge, S. D.

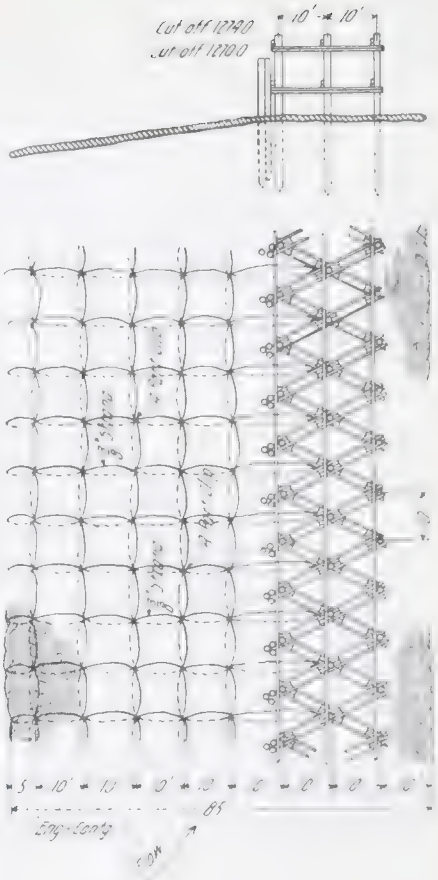


Fig. 3—Plan of Woven Brush Mattress.

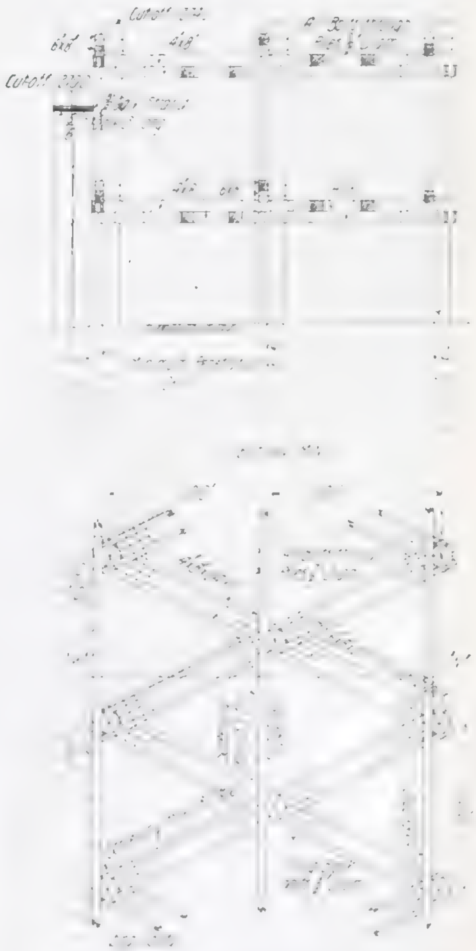


Fig. 4—Structural Details of Permeable Dike.

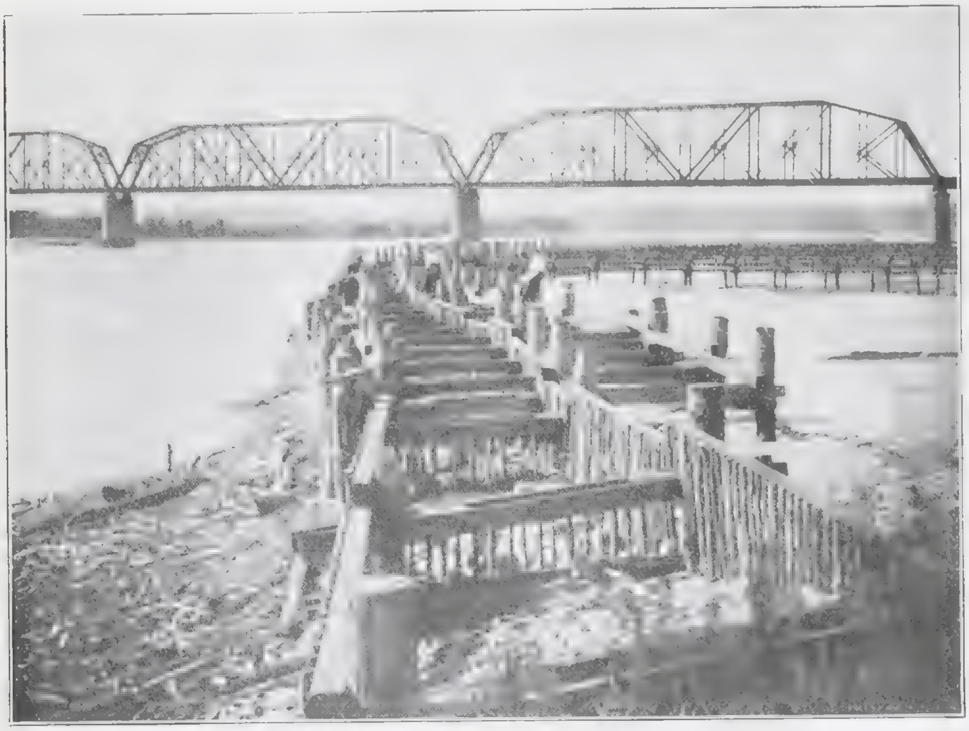
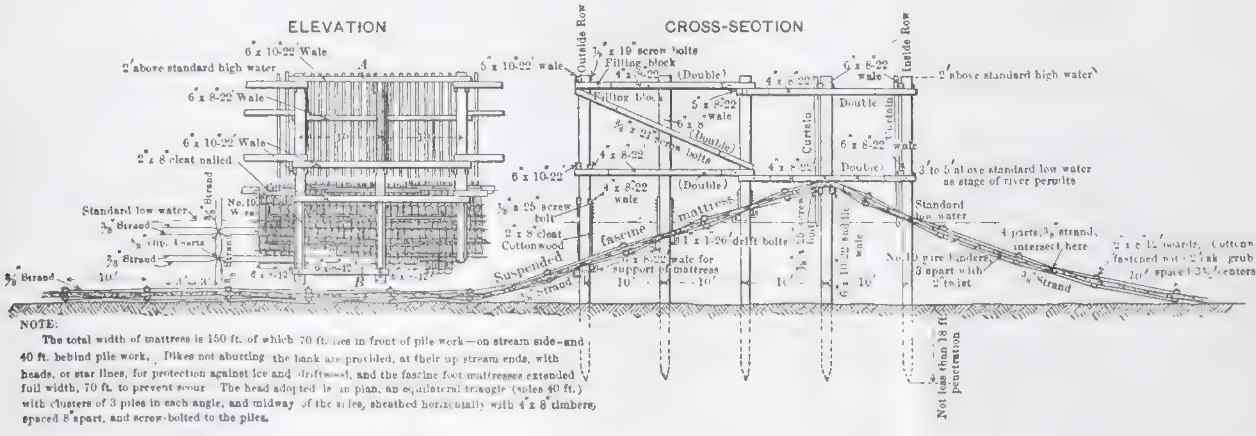


Fig. 5—View of Permeable Dike, Mobridge, S. D., when Partially Completed.

sist of 6 x 8-ins. x 22 ft. pieces attached to the piles by ⅞ in. bolts. The wales are about 8½ ft. apart vertically, and rest on the transverse bracing. The upper transverse bracing is 2 ft. below the top of pile, which is 6.7 ft. above ordinary high water. The transverse bracing consists of 4 x 8-in. pieces, double, with filling blocks as shown. On the wales of the outer and middle rows and on the cross bracing are spiked, vertically, screening poles consisting of saplings about 3 ins. in diameter, and spaced 8 ins. and 15 ins. centers, as shown by Fig. 4.

For a distance of 480 ft. from the upper end of the dike guard piles are driven in clusters of three at each bent. Then for 260 ft. clusters of three piles and two piles alternate. Below this all bents have clusters of two piles. Where two piles are used they are placed in the positions shown as *C*, *D*, in Fig. 4. Guard piles are bound together at the top by eight round turns of ⅜-in. galvanized strand, several under a tension of 500 lbs., and attached to piles by 3/16-in. staples 3 ins. long. The top of guard piles is 4 ft. below that of the bent piles.

The foot mattress, details of which are shown by Fig. 3, is an ordinary brush mattress, 85 ft. wide, bound together at intervals of 10 ft. with ⅜-in. galvanized steel cable. On the river side it extends 55 ft. out from the outer line of the dike.



NOTE:

The total width of mattress is 150 ft. of which 70 ft. lies in front of pile work—on stream side—and 40 ft. behind pile work. Dikes not abutting the bank are provided, at their up stream ends, with heads, or star lines, for protection against ice and driftwood, and the fascine foot mattresses extended full width, 70 ft. to prevent scour. The head adopted is in plan, an equilateral triangle (sides 40 ft.) with clusters of 3 piles in each angle, and midway of the sides, sheathed horizontally with 4" x 8" timbers, spaced 8" apart, and screw-bolted to the piles.

Fig. 6—Typical Permeable Dike as Built by U. S. Government.

The work was designed in the office of Mr. C. F. Loweth, Engineer and Superintendent of Buildings of the C., M. & St. P. Ry.

As will be seen from the foregoing, the methods of the Government in building permeable dikes were followed closely in this work. These methods have been exhaustively treated in a paper by Mr. S. Waters Fox, published in the *Transactions* of the American Society of Civil Engineers for June, 1905. Beginning with a system of depositing silt by means of "Brownlow weeds," experiments led gradually to the modern and successful permeable pile dike, of which there are a great number along the Missouri River.

The five-pile dike illustrated by Fig. 5 is typical of the Government practice in the construction of longitudinal dikes. As will be noted, this plan possesses two distinctive features not used in the work described above: the vertical transverse brace, and the suspended fascine mattress.

The fascine mattress was adopted in preference to the woven mattress, because it was thought to offer better prevention against scour, and because of its greater strength. Compact willow brush fascines about 8 in. in diameter are employed, of a length equal to the width of the mattress. At intervals of 3 ft. the fascines are bound and attached to each other by two continuous No. 10 galvanized wires, which are brought together between the fascines and twisted for a length of about 2 ins. Galvanized wire, ⅜ in. in diameter, is used at top and bottom for strengthening the mattress longitudinally and transversely. Transverse strands are placed 10 ft. apart and there are, in the design shown, thirteen longitudinal strands between the river edge and the shore edge of the mattress. The crest of the mattress is supported at the fourth row of piles (from the river side) by 2x6 in. wales, and at the third, second and first rows by 6x8 in. wales. The crest of the mattress is placed at an elevation of from 3 ft. to 5 ft. above standard low water, as the stage of the river at the time of installing will permit.

About 1 ton of rip-rap per lineal foot is used to sink the mattress, the greater part of it being placed on the outer edge, only enough being placed on the suspended portion of the mattress to overcome its buoyant effort. The inshore portion of the mattress serves principally to catch overpour, and it is allowed to assume a natural position, with little or no ballast.

Owing to the difficulty and expense of installing, the suspension feature, while successful, has been virtually abandoned in recent construction. Where installed, the space under the suspended mattress has filled rapidly with silt, providing a sub-bank with stable slope. The space between the screening poles on the outer row of piles and the crest of the mattress then filled, and a permanent bank was formed out to the line of the dike. It was then only necessary to prove and spawl the upper bank in order to have a new fixed bank of desired height and location.

Costs of Locomotive Repairs.

At the recent annual convention of the American Railway Master Mechanics' Association the committee on Locomotive and Shop Operating Costs submitted an interesting report on a part only of their subject, the repairs of locomotives. The subject is admittedly a difficult one. The usual method of determining the pay-rolls by appropriation is far from satisfactory, and if persisted in beyond certain limits, results in deterioration of power. The condition that exists is that of certain work to be done, and the cost depends on the efficiency with which this is accomplished. The amount of work as a whole, and as required by individual locomotives, varies widely. In the matter of supervision of expense, particularly of running repairs, it seems doubtful if much more can be done than to watch closely the amount and distribution of labor of the repair forces at each terminal with reference to the amount of business handled. The cost of running repairs is usually about one-half of the total cost of locomotive repairs.

In comparing the expense of maintenance with the results obtained the most important statement ois the performance sheet. The form of this statement, as well as the units used, varies considerably with different roads. There is a tendency to adopt some unit that will afford better comparison than the engine mile. The committee recommends a unit based on weight on drivers, or trac[illegible] most closely proportioned [illegible] tenance. As between these two units there is little to choose, but as the tractive power unit represents more closely the service delivered, it is thought to be preferable.

In this connection the costs of maintaining locomotives as submitted to the Interstate Commerce Commission for the fiscal year ending June 30, 1909, are interesting. In the following table of costs, for which we are indebted to the *American Engineer*, the unit employed corresponds closely to the one recommended by the committee. Tihs is the "work unit," which is equal to traction effort in pounds multiplied by locomotive miles and divided by 1,000,000, the latter figure being an arbitrary one used for reducing results to a convenient size for comparison. The wide variation in costs is due to differences in operating conditions—mainly, differences in grades and curvature—prevailing on the different roads. No division is made between running and shop repairs.

COSTS OF MAINTAINING LOCOMOTIVES

PER WORK UNIT

New England	
New York, New Haven & Hartford	[illegible]
Boston & Maine	2.75
Average	3.03
Eastern District	
[illegible] R. R.	[illegible]
Pennsylvania Co.	2.80
New York Central	[illegible]
Baltimore & Ohio	2.35
Erie	[illegible]
Lake Shore & Michigan Southern	1.95
[illegible] & R[illegible]	[illegible]
Lehigh Valley	3.65
Delaware, Lackawanna & Western	[illegible]
Average	[illegible]
[illegible]	
P., C., C. & St. L.	2.90
Southern R[illegible]	[illegible]
Louisville & Nashville	3.00
Illinois Central	3.80
Average	[illegible]
Middle Western District—	
[illegible] & [illegible]	[illegible]
Chicago & Northwestern	2.70
Chicago, Rock Island & Pacific	[illegible]
Missouri Pacific	3.20
[illegible]	[illegible]
St. Louis & San Francisco	3.70
Average	[illegible]
Southwestern District	
Southern Pacific	4.35
Atchison, Topeka & Santa Fe	3.30
Average	[illegible]
Northwestern District	
Northern Pacific	[illegible]
Chicago, Milwaukee & St. Paul	2.70
Great Northern	2.15
Average	2.42
Canadian Pacific	3.90

GENERAL ARTICLES AND CLASSIFIED ITEMS

A Comparison of the Cost of Operating Different Classes of Buildings with Central Station and Isolated Plant Service.*

In the following discussion the total yearly operating cost is given for heat, light, power and engineers' service for repairs, etc., in a number of buildings in New York City, which information has come first hand and is authentic. The term "cost of electric plant" refers to the extra engineering investment in excess of the cost of a heating plant only. Depreciation is figured at 5 per cent and interest at 5 per cent on the original investment.

OFFICE BUILDINGS.

The Terminal building, at Park avenue and Forty-first street, is twelve stories high and contains an electric plant which cost $12,000. This building was formerly on Edison service. During the past year all the offices and stores have been rented and the electrical output has increased to an annual total of 156,340 K. W. hrs. From October, 1909, to June, 1910, inclusive, 125,430 K. W. hrs. were produced with a total fuel bill of $2,528. During the preceding period from October, 1908, to June, 1909, inclusive, the electrical output was only 91,770 K. W.-hrs. and the coal bill was $2,145. This shows what effect the filling of the building had upon the operating costs, the increased output of 33,660 K. W.-hrs. costing only $383 in coal, the fixed charges remaining the same.

Following is a summary of the operating costs for light, heat and power during the past twelve months:

Screenings at $2.22 per ton	[illegible]
Wages	[illegible]
Water for boiler	[illegible]
Repairs, oil, ash removal and miscellaneous (not including lamps)	[illegible]
Total	[illegible]
Less sale of electricity	[illegible]
	$6,866
Ten per cent charges against [illegible]	[illegible]
Net total cost	[illegible]

Had the electricity been purchased from an outside source and the heat been produced on the premises, and men employed for repairs, etc., the cost would have been as follows:

No. 1 buckwheat coal at $3.35 per ton	†$2.000
Fireman, eight months	[illegible]
Engineer and building [illegible]	[illegible]
Electricity, 156-340 K W-hrs. [illegible] kilowatt hour	[illegible]
Care of elevators and repairs to heating system, plumbing and wiring	[illegible]
Oil and grease	[illegible]
Total estimated cost	$12,067
Less sale of electricity	400
Net total cost	$11,667

This shows a saving of $3,601 attributable to the independent electric plant, which means that the plant will pay for itself in about three years. It means that a capital of $12,000 is invested and earns $3,600 a year, or 30 per cent per annum; and this, after paying 5 per cent interest on itself and 5 per cent for depreciation.

On lower Broadway, there is an office building twelve stories high and covering an area of 50x150 ft., which is equipped with an electric plant delivering 117,235 K. W.-hrs. per year, although the building is only about half rented. Of this amount, 38,755 K. W.-hrs. are for power and 78,480 for light. The first cost of the entire engineering equipment of the building was:

Three Ames engines	$4,770
Three dynamos	3,600
Wiring of entire building	7,100
Boilers and piping for entire building	20,400
Storage battery	3,000
Switchboard	1,600
All mason work	2,000
Stack	1,100
The operating costs per year are:	
No. 1 buckwheat coal at $3.35 per ton	2,214
Labor	3,329
Miscellaneous, including lamps	1,598
	7,141
Receipts from tenants for electricity	1,710
	$5,431
Fixed charges, 10 per cent of plant cost	1,400
Total net yearly cost	$6,831

At the market rate of 5 cts. per K. W.-hr., the electricity alone is worth $5,862. Coal and labor for heating would easily aomunt to $2,400 more and skilled engineer is necessary to repair elevators, etc., whether electricity is made or bought. Therefore, this plant is already saving almost $3,000 per year, and when the building is fully rented the power plant will make a record to be proud of.

The Security Mutual Life Insurance Company's building, at Binghamton, N. Y., contains two hydraulic elevators and an electric plant which delivers 340,000 K. W.-hrs. per year. The costs for the year's run during 1909, were as follows:

No. 1 buckwheat coal at $3 per ton	$4,062
Wages	[illegible]
Miscellaneous	800
	$8,070
Sale of electricity	600
	$7,470
Ten per cent fixed charges	1,500
Total operating cost	$8,970

It is estimated by the consulting engineer that it would cost $3,200 per year in coal and labor to run this building in case electricity were purchased from an outside source. If this estimate is correct, the 340,000 K. W.-hrs. are generated at a cost of 1.6 cts. per kilowatt-hour.

In New York City there is an office building partly occupied by the owners, who are publishers of an evening newspaper. This building uses less electricity than the Security Mutual Life Insurance building, and yet it pays $12,000 per year for electricity alone.

The total comparative costs are as follows:

New York newspaper building, for heat [illegible]	[illegible]
[illegible]	[illegible]
Difference	$13,430

It should be remarked, however, that in the case of the former the labor charges are high because of the newspaper union conditions; also the New York building has a greater number of hydraulic elevators. Yet, when considering the cost of electricity alone in the New York building it will be found to be greater by 25 per cent than the cost of heat, light and power at Binghamton; hence the labor and coal prices are not large factors.

[illegible]

The Langedorf building is twelve stories high and occupies a plot 100x100 ft. The building originally had Edison service. A plant was designed consisting of two units, only one of which was installed at first. The original installation, with provisions for the additional unit, cost about $8,300 and consisted of a Corliss engine belted to a 125-K. W. dynamo. Blowers were installed to facilitate the burning of refuse and sawdust from the woodworking plant. From July, 1909, to Jure, 1910, the cost of heat, light and power was as follows:

Screenings at $2.22 per ton	$3,178
[illegible]	[illegible]
Ash removal, repairs and miscellaneous	950
Water from deep wells	000
	$7,057
[illegible]	[illegible]
	$4,202
[illegible]	[illegible]
Total net cost	$5,032

This represents the cost of producing 180,910 K. W.-hrs., heating the building, furnishing live steam, repairing elevators, repairing the plant, cost of oil and miscellaneous, but not including lamps.

The following is the estimated yearly cost if electricity had been purchased:

[illegible]	[illegible]
Chief engineer and superintendent	1,200
Fireman	660
[illegible]	[illegible]
Care of elevators, repairs, oil and grease	350
[illegible]	[illegible]
Less sale of electricity	2,835
[illegible]	[illegible]
[illegible]	[illegible]
Difference in favor of generating electricity	$ 4,938

Late this past summer authorization was given for the completion of the plant with the addition of a 150-horsepower Brownell engine and an 80-kilowatt dynamo. These will cost approximately $2,800 and are to be kept in reserve for an emergency. This building is a typical New York City loft building and contains a complete printing establishment, making a specialty of night work and delivering on the judge's desk at 9 a. m., the complete testimony and court proceedings of the day before. It also contains wood-working machines, buffing machines, hot tables and glue pots requiring live steam.

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*Abstract of an address before the Blue Room Engineering Society of Greater New York, Oct. 29, 1910, by C. M. Ripley, Vice-President Engineering Supervision Co., New York.

†It is not apparent why the author chose coal at $3.35 per ton for the heating plant, and coal at $2.22 per ton for the combined heat and power plant. In either event the charges would have been in favor of the combined plant.—Editor.

A nine-story loft building at 213 Grand St. has two elevators and a small electric plant, the cost of the equipment being as follows:

Electric wiring for entire building	$ 850
One Ridgway engine	1,435
One 75-kilowatt Sprague dynamo	1,182
One 125-horsepower Titusville boiler	875
Steamfitting, including pumps, radiators, etc.	4,950
Meters and later installations	213

This plant began operating last February and up to September 1, 1910, during part of which time the building was only partly rented, the operating costs were as follows:

Screenings at $2.06 per ton	$ 596
Labor (the engine room force operates one elevator)	879
Edison service	150
Repairs, ash removal, water and miscellaneous	450
	$2,075
Ten per cent charges on equipment	500
Total cost	$2,575

During this time the receipts from tenants were $2,803, including two tenants who purchase live steam the entire year at $160 per year. Therefore, the net operating cost for the first seven months has not only been a negative quantity for furnishing heat, hot water, public lights and electric power for pumping and for two elevators, but has actually shown a profit of several hundred dollars. As the electric output increases, this record should become even more favorable.

The Weil & Mayer buildings, at 580,590 Broadway, consist of three twelve-story loft buildings containing a total of seventeen electric elevators. The record of these buildings illustrates the advantage of supplying neighboring customers with heat, light, power and hot water. The actual cost of producing heat, light, power and live steam for twelve months were as follows:

Screenings at $2.50 per ton	$ 6,830
Wages	8,617
Water for boilers from deep wells	000
Repairs, ash removal, oil, miscellaneous	1,881
	$17,328
Less sale of electricity	13,336
	$ 3,992
Ten per cent charges against plant	2,000
Net total cost	$ 5,992

This amounts to but little over $150 a month for each building for complete service of heat, light and power for pumping and elevators. The electricial output for the year was 402,000 K. W.-hrs. The following figures are a fair estimate of the cost of heat, light and power had the buildings been operated together and electricity bought from an outside source:

402,000 K. W.-hrs.	$18,780
No. 1 buckwheat coal at $3.35 per ton for heat and live steam	4,500
Wages, including fireman	4,100
Oil, grease, ash removal, repairs, miscellaneous	1,000
Total	$28,380
Less sale of electricity	13,336
Net operating cost when buying electricity	$15,044
Actual net operating cost when producing own electricity	5,992
Saving by producing own electricity	$ 9,052

If the three buildings had been operated separately, the following estimate would have applied:

No. 1 buckwheat coal at $3.35 per ton for each building	$ 1,500
Wages, including fireman	1,800
Electricity for each building	6,700
Repairs, oil, etc.	400
Total for each building	$10,400
Total for three buildings	31,200
Less sale of electricity	13,336
Net total cost for three buildings operated separately, if buying electricity	$17,864
Actual net total cost producing electricity and operating together	5,992
Saving by operating buildings together and producing own electricity	$11,872

The conclusion to be drawn from these figures is that by operating the three buildings together $2,820 is saved yearly, and by producing their own electricity an adidtional yearly saving of $9,052 is effected. The saving of $9,052 is equivalent to the annual income on a capital of $180,000 invested at 5 per cent, yet the actual cost of the plant was only $20,000; and being installed twelve years ago it paid for itself in two and a half years. Also, the annual earning power of the plant is about 45 per cent per annum on the investment.

HOTELS.

The Hotel Hargrave covers an area 50x200 ft., is twelve stories high and contains three hundred guest rooms, two hundred baths, a restaurant, four electric elevators and complete ice and electric plants, but no laundry. Being a hotel, there is a 24-hour service. The electric plant, including a storage battery, cost $13,063. The operating costs for the past year were:

Screenings at $2.22 per ton	$ 6,237
Wages	4,895
Boiler water (estimated)	150
Ash removal	120
Repairs, oil, lamps and miscellaneous	1,400
Total	$12,802
Ten per cent charges against plant	1,306
Total net operating cost	$14,108

This is the cost of producing 289,877 K. W.-hrs. of electricity, ice, refrigeration, heat and hot water.

The estimated cost of running this hotel in case electricity were purchased from an outside source is as follows:

Edison service, 289,877 K.W.-hrs. at 5 and 4½ cts. per kilowatt hour	$13,944
No. 1 buckwheat coal at $3.35 per ton for heat, ice and hot water	4,500
Wages	3,480
Repairs, ash removal, oil, water, etc.	600
Total net operating cost if buying electricity	$22,524
Net total cost when making own electricity	14,108
Saving by making own electricity	$ 8,416

Thus the plant paid for itself in less than two years, or looking at it in another way, it pays 65 per cent per annum on the investment.

It happens that when this hotel was half its present size it did not have any electric plant, and our office is in possession of the records of operating expense for the ice and heating plant before it was supplemented by the electric plant. It is from these records that I estimate the cost of the ice, heating and hot-water service.

ELECTRIC PUMPS VERSUS STEAM PUMPS FOR HYDRAULIC-ELEVATOR SERVICE.

At the Security Mutual Life Insurance Company's building, in Binghamton, a series of four different tests was run upon the elevators. One week the electric-elevator pump was used and the next week the steam-elevator pump. The coal consumption, electrical output and number of elevator trips were carefully noted. The following data give in brief the result of a typical test run for two five-day periods:

	Electric pumps.	Steam pumps.
Coal burned, tons	17.3	20
Number of elevator trips	3,937	3,363
K.W.-hrs. of electricity	4,780	3,230

This shows that 18 per cent more service was delivered with 16 per cent less fuel when electric pumps were used. With coal at $3 per ton, the electric pumps saved $8.10 during the five days' test, but if the additional 1,550 K. W.-hrs. required to run these pumps had been bought from an electric company at 5 cts. per K. W.-hr. it would have cost $77.50. Or, if bought as low as 3 cents per K. W.-hr. the electricity would have cost $43.50, entirely wiping out the saving of $8.10 in fuel which the electric pumping effected.

APARTMENT HOUSES.

The Hendrik Hudson apartment house on Riverside drive is nine stories high and contains seventy apartments. Being 200 ft. on the side facing the river it is exposed to the cold winds from that direction. The boilers are used for heating and in the coldest days for pumping also. All the electricity is furnished by the New York Edison Company.

It has been found that central-station electric service is more profitable in a medium-sized apartment house without a refrigerating plant than in any other type of building in New York City, except the theater. This is because the cost of operating the plant to provide a 24-hour service is high and yet the consumption of electricity is much smaller than in an office building of the same size with a 12-hour service. Also, the consumption is much less than in a hotel of the same size, as is also the elevator travel. In an apartment house the income for light, etc., from the tenants is almost negligible during the summer months where the tenants go away for the summer.

From August, 1909, to July, 1910, the operating costs at the Hendrik Hudson were:

Screenings at $1.98 per ton	$ 2,185
Wages	2,233
Edison service	5,105
Miscellaneous, including lamps	1,149
Total operating expense	$10,672
Less sale of electricity	4,059
Total net operating expenses	$ 6,613

The total consumption of electricity was 102,103 K. W.-hrs. It is necessary to use 100,000 K. W.-hrs. per annum in order to obtain the 5-cent rate in New York, and the custom is to sell to the tenants at 10 cents per kilowatt-hour. In winter the pumping is done largely by steam, the pressure being kept at about 60 pounds. The exhaust is used to help heat the building besides furnishing hot water for about one hundred and fifty bathrooms. The fuel costs $1.98 per ton and in addition the garbage and refuse are burned under the boilers.

Personals.

Mr. John A. Dent, recently with the oil pipe line service of the New York Transit Company, has been appointed Instructor in Mechanical Engineering at the University of Illinois.

Mr. H. B. Dirks, Instructor in Mechanical Engineering at the University of Illinois, has resigned to accept a position as Assistant to the General Manager of the National Machinery Company, Chicago, Illinois.

Mr. Curtis Dougherty, Engineer of Maintenance-of-Way of the Alabama Great Southern R. R., has been appointed Chief Engineer of that company. The position of Engineer of Maintenance-of-Way has been abolished.

Mr. Amos Slater, a consulting mining engineer engaged in coal examinations and installation of coal plants of all kinds, announces the removal of his office from the American Bank Building to the Henry Building, Seattle, Wash.

Mr. C. W. Raynor, Assoc. M. Am. Soc. C. E., has resigned his position as Chief Engineer with the C. G. Sheely Contracting Company of Denver, to accept a similar position with the Coast Bridge Company at 407-9 Railway Exchange, Portland, Oregon.

The Bryan-Landon Co., with offices at Cebu and Iloilo, P. I., announce that they are entering the Indent business in addition to their present engineering and contracting business, and that they expect to cover the entire southern Philippine Islands. They state that they would be glad to receive from American manufacturers catalogues, price lists and literature of their products. These should be sent in duplicate, one set for each of their offices.

A party of about fifty railroad men, composed of executive and engineering officers of railroads having headquarters in Chicago, visited the College of Engineering of the University of Illinois Nov. 9. The object of the visit was the inspection of buildings and equipment, and a discussion of the possibility of a closer educational alliance between the University and railroads. After an inspection of the plant the visiting party expressed their belief in the need of the College for ampler facilities, especially along the lines of railway and transportation engineering.

Mr. Don Juan Whittemore, who has been Chief Engineer of the Chicago, Milwaukee & St. Paul Railway since 1863, resigned on Dec. 6. He was born at Milton, Vt., in 1830, and is therefore now past 80 years of age. He was educated at the Bakersfield Academy, in Vermont, and after serving on various roads became Assistant Chief Engineer of the La Crosse & Milwaukee Railroad in 1860. When, in 1863, that road was merged into the Chicago, Milwaukee & St. Paul, he became Chief Engineer of the system. During his forty-seven years of service as Chief Engineer the St. Paul has developed from an unimportant road to one of commanding position as a great transcontinental line, the most important development having been the recently constructed Pacific coast extension. He was director of the American Society of Civil Engineers in 1881 and president of that society in 1889. While retiring from active service, he will continue his connection with the road as Consulting Engineer. Mr. Whittemore will be succeeded as Chief Engineer by Mr. C. F. Loweth, Engineer and Superintendent of Bridges and Buildings.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

An interesting development of the past week is the number of fair sized railroad construction contracts that are being lined up for letting in the near future. Among these contracts are the following: Cullman Coal & Coke Co., Cullman, Ala., for completing its 24 mile line, which is to extend from Cullman to Juliana; the Rome & Northern R. R., for a 20-mile line from Rome, Ga., to Rockmart; the Temiskaming & Northern Ontario Ry., for a 32-mile branch from a point near Kelso to the Porcupine District in Canada; and the Omaha & Western Iowa Traction Co., Omaha, Neb., which has announced that it will be in the market within the next 60 days for all material in connection with building of its 90-mile electric railway.

There seems to be much active construction work proposed for southern railroads just at the present time. The Florida East Coast Ry. is reported to have let a contract for a 100-mile line from Titusville, Fla., to Lake Okeechobee in the Everglades. It is also reported that construction work will be started early next year on the proposed Western of Georgia Ry., which is to extend for Franklin to Aberdeen, Ga. I. L. McCord, 42 Broadway, New York, is said to have the contract.

Bids will soon be asked on irrigation work near Stockton, Cal., which will cost about $3,000,000. The work is to be done for the South San Joaquin Irrigation District and for the Oakdale Irrigation District. Edwin Duryea, Jr., Humboldt Bank Bldg., San Francisco, Cal., is the Engineer.

One of the largest municipal contracts of the past week was for constructing surface water conduits at Atlantic City, N. J. William J. Root, 20 Broad St., New York, at $895,188, was the low bidder.

It is now stated that the Passaic River Sewerage Commission expects by next April to have awarded the contract for the proposed $11,000,000 intercepting sewer, which is to take care of the sewage of a number of New Jersey cities, including Paterson, Passaic and Newark.

Two fair-sized bridge contracts are now being advertised. One of them calls for the construction of the substructure for the Broadway bridge for the city of Portland, Ore., and the other calls for the construction of a concrete bridge over the James River for the city of Richmond, Va. Bids for the Portland work are to be opened Jan. 2, and bids for the Richmond work are to be opened Feb. 1. The latter work will cost about $225,000.

Several fair-sized railroad construction contracts have been let recently. Among them are the following: Kipple & McLean, San Francisco, Cal., sub-contract from the Utah Construction Co. for work in the Northwestern Pacific extension in Humboldt County, Cal.; L. J. Smith Construction Co., Kansas City, Mo., for betterment work to the 109-mile branch line of the Missouri Pacific from Fort Scott, Kan., to Topeka; Jos. Pope, Jefferson City, Mo., for the grading work for a new street railway being constructed in that city; J. Murphy for 100,000 cu. yds. of grading work on the A., J. & P. Ry. between Godfrey and Jerseyville, Ill., from M. Conroy, Godfrey, Ill., the general contractor, the other sub-contractors on the work being Dick, Pat and Tim Ryan, Chas. Nagel, Jerry Wolff, S. Hanipen, S. Shurts, and Frank Reed; Eslick & Hartnett, Spokane, Wash., a $250,000 contract for work on the construction of the Canadian Northern Ry. on Vancouver Island; the Northern Construction Co., Winnipeg, Man., which recently secured the contract for the first 60 miles of the Canadian Northern Ry. from Vancouver to Chilliwack, has also been awarded the contract for the work as far east as Hope, B. C., a distance of 79 miles from New Westminster; Carl Hall & Co., Duluth, Minn., for about 75,000 cu. yds. of earth excavation on the Great Northern R. R. near Grand Rapids, Minn.; James D. Dorney, Philadelphia, Pa., a $284,320 contract for street grading work in connection with the elevation of the tracks of the Port Richmond Branch of the Philadelphia & Reading Ry. in Philadelphia, and the McNichol Paving & Construction Co., Philadelphia, at $200,000 contract for similar work.

The Pennsylvania Rail Order.

The placing by the Pennsylvania R. R. of an order for 150,000 tons of steel rails for 1911 delivery has done much to counteract the pessimistic reports that the railroads would make no important purchases of iron and steel this year. This order, by the way, is the largest one awarded by the Pennsylvania since 1906; last year the order was for 137,665 tons. In a general sense the magnitude of the order may be taken as an expression of the confidence of the Pennsylvania in the business outlook. It is generally understood that the other large railroads have been holding back their rail orders so that they could get a line on how the management of the Pennsylvania viewed the situation. Now that that railroad has placed its order it is expected that the New York Central Lines, the New York, New Haven & Hartford, Atchison, Topeka & Santa Fe, the Delaware, Lackawanna & Western, and other roads, which have been figuring on their next year's requirements, will come forward with their orders. Steel rail contracts aggregating 110,000 tons have already been placed by the Erie, the Norfolk & Western, the Lehigh Valley and the Louisville & Nashville. These contracts and the ones to come will mean much activity in the iron and steel trade, the effects of which will be felt in all lines of business.

Road Construction work.

Road builders have no reason to complain that the present season has been a dull one for their [illegible] of work. Probably more miles of improved highways have been constructed this year than in any preceding year; and even this excellent record will be far exceeded next year. Millions of dollars' worth of bonds for road improvement purposes were voted at the general election in November, and much of the money will be available for work next year. Since the general election many counties, principally in the southern states, have held elections solely for the purpose of voting on the issuance of bonds for good road purposes. It is a sign of the general enlightenment regarding the advantage of improved highways that almost invariably these bond issues have carried by large majorities. Only the other day three counties in Virginia voted bond issues [illegible] amount of $1,500,000. An interesting feature in connection with these last three bond issues is that the counties are adjoining and the road improvement work in one county will be practically a continuation of the good roads building in the other counties. The many bond issues, from the $18,000,000 one of the state of California and the $2,000,000 one of Wayne County, Michigan, down to the $50,000 ones of some of the smaller counties in the south, all indicate that the good roads movement has advanced from the talking stage to the working stage, and that the coming year will see more actual highway construction work than has been done in any previous year.

Beaver Dams and D—— Beavers.

The [illegible] organization of dam builders in the world, the beavers, have been [illegible] again down in New Jersey, according to press dispatches [illegible] that a land company at Stanhope, N. J., recently decided to construct an artificial pond in a section which was being developed, and in building the dam the engineers tore down a dam which had been built at the same spot by beavers. The engineers' work was completed only a short time ago; the beavers in the meantime had remained in seclusion so long that they had been entirely forgotten. A few days later, however, there appeared another and a larger dam of beaver manufacture, below the masonry dam, and before the men awoke to what was going on their new masonry dam was entirely submerged. Inasmuch as the beavers have made a larger pond than the engineers had planned, the latter are said to be inclined to pass by the slight on their work and to accept the gift. The New Jersey engineers may believe that beaver dams are a good thing, but out near Steamboat Springs, Colo., according to another press report, there is a certain rancher who has a different opinion. Beavers on his ranch have dammed up his irrigation ditch so that the flow of water through his land has been stopped. A few nights ago they filled the ditch with such a strong dam that it took two men an hour to demolish it and permit the water to plow unobstructed. The very next night the beavers did another construction job only a few yards from the first. That was also demolished, but to no avail, as the beavers immediately erected another dam. As a final resort, the rancher applied to the State Game Commission for permission to kill the beavers, claiming unless this was done that they would next be damming up Bear River and would thus deprive a number of other farmers of waters necessary for irrigation. This rancher profanely and simply expresses his opinion of beaver dams by transposing the word dam.

River and Harbor

According to the recommendations of the Chief of Engineers, U. S. Army, the appropriations needed [illegible] work for the fiscal year ending June 30, 1912, aggregate $30,095,698. Of this sum $7,368,077 is for works under continuing contracts, $85,260 is for the prevention of deposits in

New York Harbor, $15,000 is for the California Debris Commission, and $22,627,361 is for river and harbors (general), including Mississippi River Commission, and examinations, surveys and contingencies. The general estimates of $22,627,361 are applied to 211 works. Of this amount about 10 per cent is for the restoration or maintenance of completed projects at 136 localities, so as to secure the continuance of benefits resulting from past expenditures. Practically 70 per cent is for the prosecution of work on the Ohio, Columbia, Delaware, Mississippi, Detroit and Hudson Rivers and at 11 important harbors. The remaining 20 per cent is for the prosecution and completion of 82 other works. Included in the total of $22,627,361 is a lump sum estimate of $400,000 for examinations, surveys and contingencies, for which there may be no special appropriation. According to the recommendations the Mississippi River Commission will get large appropriations; these include the following: Continuing improvements from head of Passes to the mouth of the Ohio River, $3,000,000; from the mouth of the Ohio River to the Missouri River, $1,000,000; from the Missouri River to Minneapolis, $1,250,000, construction of lock and dam between St. Paul and Minneapolis, $250,000. Another large recommended appropriation is one of $2,000,000 for improving the Ohio River below Pittsburg by the construction of locks and dams to secure a navigable depth at nine feet and to complete the improvements within 12 years. Under the estimates for continuing contracts are the following recommended appropriations: For 35-ft. channel at Boston, Mass., $1,100,000; St. Marys River, Mich., $500,000; improving Black Warrior, Warrior and Tombigbee Rivers, Alabama, $500,000; for construction of locks and dams in the Ohio River below Pittsburg, $1,705,000.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Alabama Great Southern R. R. (Queen & Crescent Route) is having plans made for the enlargement of its car shops at Gadsden, Ala.

The sum of $50,000 is reported to have been subscribed for the construction of the proposed railroad up Lookout Mountain. A company will be organized shortly, with the idea of having the road in operation next summer. Louis Hart, owner of Bellevue hotel, a summer resort located on Lookout Mountain, about a mile from Gadsden, Ala., is the promoter.

The Cullman Coal & Coke Co. has secured the capital for the completion of its proposed 24 mile railroad from Cullman, via Trimble and Bremen to the new mining town of Juliana, and will perhaps let construction contracts in January, G. H. Ten Broek, Mercantile Bldg., St. Louis, Mo., is President and Jenkins W. Jones, Cullman, Ala., is Chief Engineer.

Arkansas.

The Memphis, Dallas & Gulf Railway Co. has absorbed the Antoine Valley Railway and the Ultima Thule, Arkadelphia and Mississippi Ry. These two latter lines are short roads owned by lumber interests, but lie in the line through which the Memphis, Dallas & Gulf is projected as a trunk line, the objective points of which are Memphis, Tenn., and Dallas, Texas.

The Crittenden R. R., now operating 27 miles of standard gage line, is considering building a 5-mile extension from Crittenden, Ark. H. C. Hawley, Earle, Ark., is General Manager.

Arizona.

The survey of the El Paso and Southwestern extension down the San Pedro River from Benson has been completed, and work is now in progress preparing for a change of the line between Fairbanks and Benson.

It is reported in Prescott that work will be started next year on a railroad connecting that city and Camp Verde. Right of way is said to have been obtained by the Humboldt & Verde Valley R. R., a new company.

The work of double tracking the Albuquerque Division of the Atchison, Topeka & Santa Fe Coast lines, is progressing rapidly, and according to reports received from Winslow, Ariz., orders have been issued to inaugurate actual service between that city and Dennison, a distance of 13 miles.

California.

Construction work on the Fresno-Hartford Interurban R. R. is reported to have been started. F. S. Granger, Fresno, Cal., is the promoter, and the road will be built under the direction of J. B. McDonald, superintendent of construction of the Hudson Counties Co., which is back of the road.

The status of plans for supplies for the proposed Geary St. municipal street railway on Nov. 19 were as follows: Contract No. 1, for furnishing and delivering steel rails, bids opened Nov. 16, as noted in our last issue. Contract No. 2, for furnishing and delivering joints, plates and rail fastenings. Plans and specifications prepared. Contract No. 3, for furnishing and delivering rail bonds. Plans and specifications 98 per cent completed. Contract No. 4, for furnishing trolley wires. Specifications 80 per cent completed. Contract No. 5, for furnishing and delivering special track work. Plans and specifications 70 per cent completed. Contract No. 6, for furnishing and delivering trolley poles. Plans and specifications 60 per cent completed. Contract No. 7, for furnishing and delivering cast iron trimmings for trolley poles. Plans and specifications 15 per cent completed. Contract No. 8, for furnishing and delivering redwood railroad ties. Specifications 15 per cent completed. Contract No. 9, for furnishing and delivering tie plates and railroad spikes. Specifications 20 per cent completed. Contract No. 10, for furnishing and delivering tie bars and nuts. Specifications 15 per cent completed. Contract No. 11, for furnishing and delivering street cars. Contract No. 12, for furnishing and delivering line material. Specifications 10 per cent completed. M. Manson is City Engineer of San Francisco.

Kipple & McLean, San Francisco, have taken a sub-contract from the Utah Construction Co., Ogden, Utah, for work on the Northwestern Pacific extension in Humboldt County. They have established a camp along the Fruitland Hill in the vicinity of Eureka. Willett & Burr, San Francisco, also have a subcontract, their work being located between Dyerville and Shively.

The promoters of the proposed railroad between Fresno and Monterey, as reported to have stated that they will be able to obtain the necessary financial backing to build the road. E. R. Shaw, Hollister, Cal., is interested in this project.

It is believed at San Bernardino that the San Pedro, Los Angeles & Salt Lake R. R. is planning to provide its own line from that city to Daggett, between which points the tracks of the Santa Fe are now used. The erection of a roundhouse and light repair shop at Daggett is part of the plan.

Extensive improvements are planned by the Southern Pacific R. R. for its system in Solano County. Among the improvements decided upon by the big corporation is the double tracking of its entire system from Benicia to Sacramento, the construction and operation of another car transfer ferry between Port Costa and Benicia and the extension of the road from Vallejo to Benicia. The work of preparing for the double track which is to be run from Sacramento to Benicia is already under way and considerable of the roadbed has been constructed through the Suisun marshes. The plans for the new car ferry which is to assist the old steamer Solano have been drawn and are now on file at Oakland pier.

Grading for the Butte & Plumas R. R. at the end of last month was completed from Berry Creek to Oroville with the exception of two miles of light work near that town. The piers for the bridge that will cross the Feather river have been completed. The upper structure is now being built. Rails and ties for the 25-mile stretch to Berry creek have been secured and landed at Oroville and when rail laying starts in the near future, Chief Engineer Dunbar estimates that the steel will go down at the rate of one mile a day and that the road can be ready for operation within 40 days thereafter.

The Town Trustees of San Rafael, Cal., have awarded an electric street railway franchise to George D. Shearer, a real estate dealer, at his bid of $350. The franchise covers the principal streets and requires that work must be commenced in four months and be completed in two years. The railway will be operated by an overhead trolley and will have standard gage tracks. The purchaser of the franchise is acting on behalf of a number of capitalists, who within a few weeks will incorporate a company for the purpose of building the road.

It has been announced in San Bernardino, Cal., by G. T. Wiswell, a railroad civil engineer of New York, that his associates have decided to construct a 36-mile railroad connecting the mines of Lida and Hornsilver and Bonnie Clare with the San Pedro, Los Angeles & Salt Lake R. R. and the Tonopah & Tidewater. The road will be standard gage and will be laid with 70-lb. rails. A. D. Goodenough of the Lidy Valley & California R. R. Co., is at the head of the project.

The Chicavalla Valley Ry. Co., which projects a 52-mile line, has completed surveys. No construction contracts have yet been let A. H. Koebig, Sr., 902 Broadway Central Bldg., Los Angeles, Cal., is Chief Engineer and R. M. Teague, 515 Tajo Bldg., Los Angeles, is President.

The officials of the Southern Pacific Ry recently took an inspection trip over the preliminary survey run for the line from Vallejo to Benicia, Cal., and it is believed that the matter will be taken up within a short time. O. E. McCormack, San Francisco, Cal., is First Vice-President of the company and was, according to reports, in the party which made the trip.

Colorado.

The Grand Junction & Grand River Valley Ry. Co., Mining Exchange Bldg., Colorado Springs, Colo., has practically secured all right of way for a proposed extension from Grand Junction to Clifton.

The Royal Butte tunnel on the line of the Denver, Laramie & Western R. R. was holed though on Nov. 21. This tunnel is located about two miles from Moan's Ranch, Colo., and work on it has been under way by J. B. Orman, the contractor, for about six months. The tunnel is 18x22 feet and is driven through solid granite. It is the only tunnel on the survey of the new road between Denver and Yellowstone Park. J. B. Orman, who also has the contract for the heavy grading work through this part of the country, has a large gang of men working here, and he expects the grade through the mountains between Scott and Laramie will probably be completed by the time the rails are laid to the foothills. He also has a large construction gang at work on the grade between Greeley and Severance, and the rails are being laid out of Greeley.

The Denver City Tramway Co., Denver, will in about six weeks probably begin work on an extension of its Cherokee line at Denver through the Almeda subway to South Lipan St., thence south to West Virginia Ave., east to South Jason, south [illegible], then south through what [illegible] property, passing Overland Park [illegible] subdivision and then to the [illegible] line.

Kansas-Colorado R. R. has been sold at a receiver's sale to J. F. Springfield of Hutchinson, Kan., and Charles Sutton of Lawrence, Kan. Their bid was $15,000. The only other bidder was George McLagan, who offered $14,850. The property includes a grade 22 miles long from Pueblo to the [illegible] Creek stone quarries, 1½ miles of track and other properties. It is understood that the new purchasers will complete the railroad and may build from Pueblo to Fowler.

The Chicago, Burlington & Quincy R. R. has secured a complete right of way through Greeley. Everything indicates that the railroad begins construction work on its Greeley-Hudson line early next year. In fact some reports have it that the contract has already been let.

It has been announced in Denver, Colo., that the matter of constructing the Dotsero cutoff will be taken up at once. The route of the proposed line is from Dotsero, on the Rio Grande to some point 30 miles distant on the Moffat road shortening the distance between Denver and Glenwood Springs and Grand Junction about 213 miles.

Connecticut.

The New York, New Haven & Hartford R. R. is to erect a $1,500,000 depot at New Haven, Conn. It will stand at a point slightly to the southeast of the present office building of the company.

Florida.

Two routes have been surveyed for the construction of the Florida Ry. to Live Oak and the proposition has been submitted to the city officials for deciding. The company has contracted for 200,000 cypress ties and new steel is being secured for the work. Frank Drew, Live Oak, Fla., is President.

The Florida East Coast Ry., J. R. Parrott, President, St. Augustine, Fla., is reported to have awarded a contract for the construction of a line from Titusville to Lake Okeechobee, a distance of about 100 miles.

Georgia.

The St. Simons Island Ry. Co. has been chartered with a capital stock of $20,000 and proposes to build a line of railway on St. Simons Island, which lies just off the coast of Georgia. This line will form the nucleus of other lines to radiate north and south from the terminals, along the coast on either side of the island. The incorporators are Frank D. Aiken, A. Fendig, F. D. M. Trachan, J. B. Wright, H. F. Dunwoody, J. H. Whitmore, W. O. Macpherson, George H. Smith and N. W. Walker, all of Brunswick, Ga., and M. Kaiser, of New York.

The Rome & Northern R. R., H. M. Smith, Chief Engineer, Rome, Ga., is reported to be planning to have work started soon on the construction of a line from Rome to Rockmart. This line would be about 20 miles long.

It is reported that construction work on the proposed Western of Georgia Ry. will be started early next year. This road is to extend from Franklin to Aberdeen, Ga., via Newnan, Ga. I. L. McCord, 42 Broadway, New York, is said to have been awarded the construction contract.

Illinois.

The Decatur Southern Traction Co. of Decatur, Ill., has filed notice of an increase in its capital stock of from $25,000 to $1,500,000. This company was organized several months ago with the purpose of constructing an interurban line south to Pana, in Christian County, and also extending into contiguous territory. R. McCalman, Decatur, Ill., is Chief Engineer.

The Pekin & Petersburg Interurban Ry. Co., noted in our last issue, has filed its articles of association. John E. Melick, Springfield, Ill., is the Engineer.

The Chicago, Terre Haute & Southeastern Ry. Co. of Illinois has been incorporated, the incorporators and board of directors being Michael D. Lawlor, Chicago; Oliver A. Bestel, Chicago; Charles G. Flaeger, LaGrange; Frank H. Stanwood, Oak Park; Emil A. Stake, Chicago. The route of the railroad is to be from a point of connection with the Southern Indiana Railway on the Indiana State line near Quaker Hill, through the Illinois counties of Edgar, Vermillion, Iroquois, Kankakee and Will to Chicago Heights. The incorporators are the new owners of the Southern Indiana Ry., a former Walsh line.

It is reported that the Chicago & Northwestern Ry. will probably take up next year the matter of building a cutoff from Rock Island Junction to Nelson, running a mile or so south of Rock Falls. This short line in all probability will cross Rock River near Como. The present main line after leaving Rock Island Junction runs northeast into Sterling and from there to Nelson it bears southeast. This proposed cutoff would shorten the distance a couple of miles, besides avoiding two curves and giving an almost direct air line to the Mississippi.

Good progress is being made between Godfrey and Jerseyville on the construction of the new Alton, Jerseyville & Peoria Ry. As soon as the grading is completed, the work of laying rails will be pushed. Equipment for a power house has been purchased, and work on its construction will start at once. Orders for new cars have been placed. Everything indicates that cars on the new road will be in operation from Alton to Jerseyville early in the new year. An extension to Fieldon and Hardin is now under consideration, and it is said that if local support is given the extension will be built. The railway company has moved its central office from Jerseyville to Alton.

Train service was inaugurated on December 1 via the Cairo & Thebes Ry., over twenty-four miles of track connecting the Thebes Bridge across the Mississippi river with the $1,000,000 terminal in Cairo. Actual work of construction was under the supervision of the Cairo promoters, who are supposed to have been backed by the Louisville & Nashville.

The Bloomington, Decatur & Champaign R. R. Co. has been incorporated with a capital stock of $3,525,000 and proposes a line to be constructed from Bloomington through the counties of McLean, DeWitt, Macon, Piatt and Champaign to the City of Champaign. The capital stock is $3,525,000, and the incorporators and board of directors are B. E. Bramble, of the Illinois Traction System, W. H. Carnahan, George R. McComb, L. Campbell and E. S. Cole, all of Champaign, Ill.

It is reported that the Evansville & Terre Haute R. R., W. J. Jackson, General Manager, Chicago, Ill., is considering building an extension south to Joppa, Ill., to connect there with the Frisco-Eastern Illinois line.

M. Conroy, Godfrey, Ill., general contractor for the grading work on the A. J. & P. Ry. between Godfrey and Jerseyville, Ill., now has his work all covered, the last piece of work consisting of 10,000 cu. yds., having been let to J. Murphy. The other sub contractors now on the work are Dick, Pat and Tim Ryan, Chas. Nagel, Jerry Wolff, S. Hanipen, S. Shurts, and Frank Reed.

It is reported that the Chicago & Alton Ry. is planning the construction of a system of switch tracks from the main line at Lockport, Ill., to the proposed plant of the Texas Oil Co. W. D. Taylor, Chicago, Ill., is Chief Engineer of the Alton Ry.

Secretary of State at Springfield has issued articles of incorporation for the Elgin Belt Ry. Co., with headquarters at Elgin, Ill. The company is capitalized at $25,000 and proposes the construction of a line from Batavia to Des Plaines. The incorporators and first board of directors are Philip Feiter, Joseph Newman, M. C. Eppstein, J. M. Blackburn and C. F. Terhune.

Indiana.

The Commercial Club, of Richmond, Ind., Chas. W. Jordan, secretary, is taking steps for securing an electric railway connecting Union City, Ind., with Richmond and running from there to Harrison, O., to connect with Cincinnati. The towns through which the line from Richmond to Harrison would run are Abington, Clifton, Cedar Grove, Liberty, Roseburg, Dunlapsville, Quakertown, Tanfield, Brookville and New Trenton. The line would pass through good towns north to Union City. The traction line would cross nine railroads, branches of the Pennsylvania, New York Central, Cincinnati, Hamilton & Dayton, and the Cincinnati, Indianapolis & Western companies. The idea of the Commercial Club is to circulate petitions along [illegible] to sign them as possible, and to present them in a combined form to traction companies in this section of the State.

Engineers representing a Chicago construction company have been over the route of the proposed Fort Wayne-Defiance interurban line. It is said that if their report is favorable the project will be financed by Chicago capitalists.

Officials of the Cleveland, Cincinnati, Chicago & St. Louis Ry. were recently at Warsaw inspecting property with a view to establishing extensive shipping yards. Other places are also under consideration for a location of these yards.

Advices from Chesterton state that Attorney F. J. L. Meyer, representing the South Shore electric railway, has secured a franchise from the town board of Porter to build an electric line from that place to the South Shore main line. He has incorporated the Porter, Chesterton & South Shore Railway Co.

Iowa.

Track laying has been started on the south extension of the Atlantic Northern & Southern Ry. and H. S. Rattenborg, Atlantic, Ia., President of the company, expresses his belief that if the weather continues to be good, cars will be operating over the new line about January 1.

Service was inaugurated on Dec. 5 on the Fort Dodge, Des Moines & Southern Electric line, the new railway recently completed between Rockwell City and Fort Dodge Junction.

Engineers of the Iowa & Omaha Short Line R. R., now under construction, have been laying out the terminal grounds in Council Bluffs for the early commencement of building operations. Plans are now being formulated for the extension of the line east from Trevnor, and Civil Engineer Ernest E. Cook, of Council Bluffs, has been engaged to make a preliminary reconnaissance of the line. George W. Adams, Council Bluffs, is President.

Kansas.

The L. J. Smith Construction Co., Kansas City, Mo., has been awarded a contract for betterment work on the Kansas, Nebraska & Dakota Ry. This is a branch line of the Missouri Pacific and extends from Fort Scott to Topeka. It is 109 miles long.

Representatives of the McKinley syndicate, owners of the street railway system at Atchison, have been inspecting the proposed route for the interurban line between Atchison and Leavenworth, and the Atchison coal mine. One of the necessities of the proposed interurban lines is a powerhouse, and it is said if the coal mine deal goes through the plant will be located at Atchison.

The Omaha & Council Bluffs Street Ry. Co. has accepted the resolution of the city council of Council Bluffs, accepting the company's proposition for extensions of its lines at that city, and adding several other extensions to the list submitted by the company.

The Atchison, Topeka & Santa Fe Ry., H. A. Tice, Division Superintendent, Dodge City, Kan., will probably spend $125,000 in the spring on the construction of the new switch yards in the east part of the city of Hutchinson, the erection of a large round house and the establishment of car repair shops, coal chutes and other improvements. The blue prints have been prepared for some time by the engineering department.

An ordinance is before the City Commissioners of Kansas City to grant the Kansas City Terminal Ry. Co. of Kansas City, Mo., the right to cross Mill St., 5th St. and 12th St. in the Armourdale district of Kansas

City, with switch tracks. The company now is building 16 miles of switch track in the Armourdale district, and needs permission to cross the streets named.

Surveys, estimates and profiles have been completed for about one hundred miles of the Southwestern, Kansas & Colorado Ry., a road that is being built from Hardner in Barbar County, Kansas, west through Commanche, Clark and Meade Counties. R. W. Scott is President, A. A. White, Vice President and General Manager, Coldwater, Kansas, and The Titus Co., Consulting and Contracting Engineers, Arkansas City, Kan., are Engineers for this road.

Kentucky.

The Paducah Traction Co., Paducah, Ky., now has surveys under way for an extension its tracks to Tyler and Lone Oak, suburbs of Paducah. Lone Oak is about four miles from the city, while Tyler joins the southern limits. Construction work on the extensions will probably be started in the spring.

Good progress is being made with the construction of the Chicago, Memphis & Gulf R. R. Steel is being laid from Tiptonville, Tenn., towards Hickman at the rate of three-quarters of a mile a day. Bondurant & Mosby, who have the contract for the grading from the Fulton County line to Hickman, are making rapid progress and will have all of the grading done by Jan. 1.

Louisiana.

Grading work is well under way for the proposed Lake Arthur & Jennings & Northern R. R. It is planned to have this road completed so as to haul freight by May 1 next. The grading work now being done is mostly in the vicinity of Jennings. E. P. Fox, Jennings, La., is General Manager and has charge of the construction work.

The St. Louis & San Francisco R. R. is reported to have secured control of the New Orleans & Great Northern Ry. It is said that the latter line will be extended to Jackson, Miss., thus making a trunk line to St. Louis and Chicago.

The St. Louis & San Francisco R. R. is said to have made arrangements to build into Lake Charles. The report states that in less than six months trains will be in operation over the Lake Charles branch. The Frisco now passes within 15 miles of the city, crossing the Iron Mountain at Kinder.

The Shreveport & Memphis Ry. Co. has been chartered and proposes the construction of a railroad extending southeastwardly from Eldorado, Ark., to Minden, via Homer, a distance of 45 miles. It is expected that later the road will be extended to Shreveport on the south, and ultimately to Memphis on the north. The survey is said to have already been made between Eldorado and Minden. C. O. Ferguson and A. R. Johnson of Homer, La., are interested.

Maine.

Information forwarded from Lewiston, Me., states that construction work on the Portland, Gray & Lewiston R. R. has been suspended for the season and that all crews have been paid in full, and grading will not be resumed until the frost is out of the ground. The track is graded from Littlefields to two miles beyond Gray Corner, which is equivalent to two-thirds of the grading for the entire line. When operations are resumed another year the crews will begin at Deering Junction and come north. Rails will be laid and trolley wire hung ten miles to the gravel pit on Morrison hill. Then while the grading crews are completing their work to where the construction was suspended the ballasting crews will be working between Morrison Hill and Deering Junction. After filling in this gap the graders will be taken to the Auburn end of the line, while the ballasters will push ahead as fast as possible over the grading done this year. Forty thousand ties and the necessary poles for the first ten miles will be delivered at Deering Junction and distributed along the way.

Maryland.

The Cumberland Valley R. R., M. C. Kennedy, General Superintendent, Chambersburg, Pa., has had engineers in the field running lines between Hagerstown, Md., and the Potomac river. Several surveys have been made on both sides of the present track, the object being, it is understood, to get a lower-grade line to the Potomac to facilitate the handling of freight. There is a heavy grade from the river to Halfway and another from Halfway to a point near Hagerstown. One of the routes for the proposed new line cuts through the eastern section of Halfway, crossing the Williamsport turnpike at Snook's store and through the Hebrew Cemetery; thence westward, diverging to the north and striking the river at a point some distance above the company's bridge over the Potomac. It is said that if the new line is built a new bridge will have to be erected over the Potomac.

Massachusetts.

The New York, New Haven & Hartford R. R. has purchased a tract of land alongside of the Parker mill railroad station in Warren. Additional land is to be purchased in the vicinity for the purpose of making extensive improvements in connection with the double-track system, work on which is now well under way between Fall River and Warren.

All plans for the construction of the four tracks through Lynn, Mass., by the Boston & Maine R. R. have been filed with Charles S. Mellen, president of the company and the Board of Directors. Nothing definite has as yet been decided upon.

Michigan.

A mortgage for $250,000 has been filed by Jerry Boynton, Grand Rapids, Mich., as President of the Grand Rapids Electric Co. The mortgage covers the right of way of a line in Gladwin, Kent, Montcalm, Isabella, Clare and Ottawa counties, and one to be built in Allegan, Kalamazoo, Barry, Calhoun, Branch and Hillsdale counties, starting at Grand Haven.

Minnesota.

The Duluth Street Ry. Co., Duluth, Minn., is reported to have plans well along for an extension to New Duluth and ultimately to Fond du Lac.

Wick O'Connell & Co., Houghton, Mich., are making good progress with their contract for constructing the Canadian Northern tunnel near Duluth. A short time ago the railroad engineers changed their plans for one of the approaches to the tunnel and a cut 100 ft. long and 14 ft. deep will have to be made to accord with this change. This delays the actual tunnel boring considerably. It had been hoped to get at the face of the rock to be tunneled before winter set in, but the change makes this impossible and much work will yet have to be done in the open air before the gangs can work in the shelter of the rock.

Erick Ericksen, a sub contractor on the Canadian Northern R. R. work, has moved his camp from West Duluth to Spirit Lake.

Right of way agent, William L. Scism, of the Twin City & Lake Superior Ry. Co., Minneapolis, Minn., has been working in the vicinity of Pine City, Minn., negotiating for right of way through that place.

The International Bridge & Transfer Co., according to advices from Big Falls, Minn., has under construction a railroad south from that village for the transportation of lumber. It is believed that it will become a part of the Soo Ry. System.

Tracklaying on the Canadian Northern railroad extension from Virginia to Duluth, Minn., is under way, the work being done by the Walsh Construction Co., Davenport, Ia. It is expected that 25 miles of steel can be installed this year. The general contractors for the work are Foley, Welch & Stewart, St. Paul, Minn.

The Canadian Northern Ry. is reported to be planning to purchase the Backus-Brooks R. R., which was built out of International Falls down the river. It is said that the purpose of the Canadian Northern is to extend the line to Beaudette and avoid the 60-mile run through Canada on all freight destined for Duluth and intermediate points. The distance from Loman to Beaudette is about 45 miles.

The Northern Minnesota Ry. Co. is being organized for the purpose of building a new line in Northern Minnesota. The main line will be from Cusson, a station on the main line of the Duluth, Rainy Lake and Winnipeg line of the Canadian Northern, 47 miles north of Virginia to Crane Lake. Edward Hines, of the Edward Hines Lumber Co., Chicago, Ill., is President.

The St. Paul Railway Promotion Co. has completed surveys for its projected electric line between St. Paul and Mankato as far as West St. Paul, and the field engineering work has been about completed for the winter. It is hoped to begin construction work in the spring. Kay Alexander, Metropolitan Bldg., St. Paul, Minn., is Chief Engineer.

Duluth and the Ranges.

BY PETER E. MEAGHER.

Mr. H. C. Hansen, member of the contracting firm of Winston Dear Co., and General Superintendent for their work on the Iron Range, was a caller here at this office a few days ago. They are very busy at the present time. One of their contracts which they have on the Range is for stripping about 8,000,000 yards of overburden from an iron mine. Their work is progressing very nicely on this contract. The equipment they are using at the present time consists of 125, 12-yd. Western air dump cars, three Bucyrus steam shovels, two American and two Baldwin 60-ton locomotives. They also have one or two other contracts under way at the present time, but are using narrow gage plants on those. They expect to work both night and day shift throughout the coming winter.

Mr. F. R. Jones, of Jones Brothers, Columbus, O., came in to see us last week. They are very busy at the present time, having a great deal of work. They have some very good work that they wish to sublet. Any contractors interested in the same, by writing Jones Brothers, Columbus, O., will receive full information.

Edward Hingston, traveling representative of the Bucyrus Co., was here for a few days last week. He reported business very good, and that his firm was selling quite a number of steam shovels.

Mr. J. L. Williamson, sub-contractor for Dale & Bumgardner, came into see us last week, and went away with a large crew of foreigners to use on his work. Dale & Bumgardner have closed down all of their steam shovel work, but have some team work to finish, and Mr. Williamson is doing the same.

Mr. Melvin Pattison, General Manager of Sales for the Brown Hoisting Machinery Co., Cleveland, O., spent a couple of days with us here recently. They have just about completed their contract of building a $1,000,000 coal dock here for the Pittsburg Coal Co. We enjoyed our visit with Mr. Pattison very much, and trust that he will again be here in the very near future.

Mr. J. A. Brandenberg, railroad contractor, was a caller at this office last week He has some team work on the Canadian Northern Ry. near Duluth.

Mr. G. A. Sill, representing the United & Globe Rubber Manufacturing Co., of Trenton, N. J., was a caller last week looking up business in his line.

Mr. Andrew Porter, of the contracting firm of Porter Brothers, spent a few days in our city last week, and left for his home at Spokane, Wash.

Carl Hall & Co. were awarded a contract by the Great Northern Railway Co. for about 75,000 yds. of earth excavating on the Great Northern R. R., near Grand Rapids, Minn., work to be started immediately.

Contractors and others, when in this vicinity, are cordially invited to make the offices of Peter E. Meagher, 409 West Michigan St., Duluth, Minn., their headquarters.

Missouri.

The St. Louis, Montesano & Southern Ry., originally capitalized at $4,000,000, and whose actual investment is said to approximate $150,000, has been sold by the Sheriff of St. Louis County to John O'Laughlin, of St. Louis, for $3,200 on a third deed of trust. Mr. O'Laughlin is said to be acting for a syndicate, and the general supposition is that he is representing the stockholders. The object, as understood in St. Louis County, is to reorganize the company and complete the line. Several projects are under way for constructing an interurban electric railway from St. Louis to Farmington and Illmo. The Montesano line could become a part of one of them, or it could be built as a distinct enterprise. The company has 1.5 miles of track, and it has a power house on the Lemay Ferry road. It has right-of-way on the Lemay Ferry road from the St. Louis city limits to Montesano.

Jos. Pope, Jefferson City, Mo., has a subcontract for the construction of the new street car line in Jefferson City, noted in our last issue. Waddell & Harrington, Kansas City, Mo., are the engineers.

The Commercial Club of Butler, Mo., has appointed a committee, of which S. W. Dooley is Chairman, to raise $25,000 for getting an electric railway through Butler.

The Heinz-Young Construction Co., 602 Roe Bldg., St. Louis, Mo., as previously noted in these columns, has been awarded the contract for constructing the road of the Mexico, Santa Fe & Perry Traction Co., from Mexico, Mo., to Columbia and Fulton, Mo. The earth excavation will be quite light and there will be only a small amount of rock excavation. Three or four small bridges, none over 75 ft., will be required. There will also be about 100 yds. of trestle work, and some concrete work and culverts. None of the work is to be sublet. The construction company is in the market for tools, supplies, equipment, etc.

St. Louis Items.

BY A. D. KOENIG

President William K. Kavanaugh and all other officers of the Lake-to-the-Gulf Deep Waterways Association, are heartily pleased with the results of the fifth annual convention which ended Saturday night. Many of the delegates departed for their homes within a few hours after adjournment. They were as unanimous in their praise of St. Louis hospitality as of the beneficial results of the annual gathering of the organization.

Officers of the East Side Levee and Santary District, East St. Louis, Ill., who are building a system of levees and canals to protect East St. Louis and all of the East Side from high water, have announced that bids will be opened Jan. 9 for the work of building four highway bridges over the diversion channel, which is now being dug to divert the water of Cahokia Creek into the Mississippi River. These four bridges will take the place of the highways destroyed by the digging of the channel and will be built at the St. Louis and Alton road, the Grolmes road, the Poag road and the Wanda road. Each of the bridges will be 270 ft. long. The main span of each will be 50 ft. long and there will be two other spans of 60 ft., making three spans to each bridge. The estimated cost of the four bridges is $45,000. The bridges will be of steel. The roadway of the St. Louis-Alton bridge will be 24 ft. wide; that of the Wanda bridge 20 ft. wide, and the Poag and Grolmes bridges each will be 16 ft. wide. When these four bridges are completed, the work of preparing for the construction of five railroad bridges will be begun. The diversion channel will be 4½ miles long and 50 ft. wide. It will divert the waters of the Cahokia from north and south to due west, emptying in the river. About 100,000 cu. yds. of dirt have been taken out of the channel and the Levee Commissioners believe this part of the work will be finished by May 21. The entire work of the commission will amount to approximately $6,500,000. The members of the commission are Henry D. Sexton, G. Locke Tarlton, C. L. Gray, C. T. Jones and Thomas F. Leyden.

The House of Delegates last week unanimously killed the proposed bill to lease the Water Works Railway to the Baden Traction Co., introduced simultaneously in both houses recently. The Railroad Committee of the House, headed by E. J. Russell, reported the bill adversely, and Delegate Eigel, another member of the committee, moved to suspend the rules and immediately file the bill. There were no votes against his motion. While a similar bill is still pending in the council, the proposition of the Baden Traction Co. to lease the railroad is dead for at least the balance of this season. Even if the council should pass the measure, which is not improbable, it would not even be considered in the House. The bill was introduced at the request of Henry Cornet, a real estate man, and proposes to lease the road for ninety-nine years to the company, composed of Cornet and four or five other St. Louisans.

Work has been practically stopped for the winter on the free bridge piers, now nearing completion, because of the cold weather. President Maxime Reber of the Board of Public Improvements, issued an order that no work is to be done on the piers on any day which begins with a temperature of 7 degrees below freezing unless there is a likelihood of an immediate rise in temperature. This is expected to eliminate about all the days between now and March, with just about enough exceptions to allow the contractors to put the one remaining pier above any probable rise in the river. The purpose of stopping work is to prevent possible bad setting of concrete in the piers. With the exception of the outer rim of the piers they are built entirely of concrete and the temperature conditions affect concrete before it hardens to such an extent that should the pier be built in freezing weather it might crack and damage the bridge. One of the piers is completed, however, and two more are above any probable water stage. Only one needs to be hurried and there is not likely to be any important rise in the river until next spring. Some of the steel for the bridge has been placed on the ground and everything is being put in readiness to rush the superstructure work next summer. No steel will be placed this winter, however, even if the piers were entirely completed, and the only effort to be made on the piers is to keep them above water and finish them in time to take advantage of the first suitable weather next spring for the steel work. Work has also been postponed until spring on the proposed Compton avenue viaduct. Mr. Reber says permission will not now be granted for the breaking of ground for that structure until the winter is over, because but a few weeks' work could be done and a start would close the crossing to 150 vehicles a day all winter.

Burke & Joseph, Fort Smith, Ark., have sub-let their work on the Kansas City Southern to the following contractors: J. J. McAdams, Peters Brothers, H. W. Kolkmeyer, E. C. Caldwell, Benn Tally, Mahoney & McInerney, Pat Madden, B. B. Gager, J. B. Dorris & Co. In addition to the above they are operating two steam shovels of their own, also a team and rock camp. The work is located near Marble City, Okla.; Gans, Okla.; DeQueen, Ark., and Horatia, Ark.

L. J. Smith of the L. J. Smith Construction Co. spent a day with us last week. Mr. Smith reports having a prosperous year. Also that the new locomotive and machine shops that he bought in Kansas City a couple of weeks ago is doing a nice business.

The North Alabama Construction Co. has shipped in its outfit from the south and moved same onto S. H. R. Robinson's ditch work across the river from here.

Montana.

A considerable amount of new railroad construction work for Montana is proposed for next season, as has been noted at various times in these columns. The following summary of some of the larger work may be of interest: The Northern Pacific will complete the work on the Glendive-Helena cutoff, which at present is in the embyro. The surveys for this road were made, but actual construction was not begun on account of the stringency of the money market. The proposed route will decrease the distance from St. Paul approximately 85 miles. The cutoff will furnish the Northern Pacific with a much easier grade than it has at present and will tap a section of the country that is now without railway facilities. The definite announcement of the proposed completion of this work was made at Miles City by President Howard Elliott of the Northern Pacific while en route to the Spokane apple show. Another road that will be built next year will be a cutoff on the Great Northern from Mandan via Lewistown, to a point on the Billings & Northern. Actual construction work was begun on this line, but was discontinued during the depression of the money market. The means for the building of this road have now been raised and President J. J. Hill of the Great Northern has issued a statement that the work will be commenced as soon as the ground thaws in the spring. This route will shorten the Great Northern line to the coast almost 100 miles. The Big Blackfoot Ry. Co. will probably resume its building operations up the Blackfoot, as the work has been carried along too far to be dropped at this stage. Grading has been done along nearly the whole line and the stretch between Bonner and Potomac is almost completed. The bridge across the Blackfoot has been built and considerable money expended.

Nebraska.

The Omaha & Western Iowa Traction Co., 3901 North 18th St., Omaha, Neb., will within the next 60 days be in the market for all material in connection with the building of its projected 90-mile electric railway. This road is to extend from Sioux City to Council Bluffs and Omaha, its route including the following towns of Iowa: Salix, Sargents Bluffs, Sloan, Whiting, Onawa, Blenco, Little Sioux, River Sioux, Mondamin, Modale, Missouri Valley, Kramer, Murrays, Frazier Station, Honey Creek, Reels, Crescent City and Four Corners.

Nevada.

The Nevada Copper Belt R. R. Co., W. C. Orem, President, Salt Lake City, Utah, has completed financial arrangements for finishing its extension from Wabuska to the Mason Valley smelter site, and to Mason, Nev., and on to the Nevada Douglas properties in Smith Valley. The line to the smelter site is completed, and the line to Mason Valley is done and in successful operation, and the road for practically two miles south of Mason is laid. Much of the grading for the line has been done already into Smith Valley, and not to exceed seven miles of grading remains unfinished to the Nevada Douglas. This unfinished portion follows the foothills from the pass, and it will be the easiest part of the line to build.

New Jersey.

The Central R. R. of New Jersey has plans for the construction of new car shops to be built at Red Bank to do the work that is now being done at Lakehurst and South Lakewood. The cost of the improvement is estimated at $500,000.

The Millville, Tuckahoe & Ocean City R. R. Co., recently incorporated, is reported to have secured the right of way for a projected line from Ocean City to Millville. The company is said to have acquired the street railway at Ocean City, and is planning to reach Millville by way of the turnpike at 34th St. The cars of the company will be run by Edison storage batteries. W. Scott Hand, Ocean City, N. J., is President.

The State Public Utilities Commission has approved the application of the Wildwood & Delaware Bay Short Line R. R. Co., of Wildwood, N. J., for the privilege of issuing bonds and for the right to construct a new railroad to Wildwood. The proposed road will extend out Oak Ave. across the Wildwood extension tract by bridge across the inland waterway and on across the meadow ground and the main land to the Cape May branch of the Reading Railroad. Construction of the road will be started in a few days.

New Mexico.

Proposition has been made to the Railroad Committee of the Commercial Club of Roswell, N. Mex., by Col. Fred A. Beall, of New York, for building a new railroad out of Roswell. He offers to build from Roswell first to Fort Worth.

The Chicago, Rock Island & Pacific Ry. is reported to have definitely decided to construct an extension of its line from Tucumcari to Knowles, N. Mex. It is said that more than $500,000 has been subscribed in aid of construction of the line through the upper plains country.

New York

At a meeting held to consider the application of the New York Dock Co., New York, for permission to construct and operate a railroad line along the water front, subject to the Inter-State Commerce Commission and the Public Service Commission, the Manufacturers' Association was strongly in favor of the project, but recommended restrictions in regard to the location of the wharves, etc.

North Carolina.

The last rail was laid and the last spike driven on the Winston-Salem Southbound R. R. on Nov. 23. The new road runs from Winston-Salem to Wadesboro, a distance of 93 miles, and will be operated by the Atlantic Coast Line, which owns a half interest in the enterprise, the other half belonging to the Norfolk & Western.

Ohio.

The County Commissioners at Lima, O., have granted the Ohio Electric Ry. Co., Cincinnati, O., a right of way for double trackage through a mile strip to be used to reach the new Gramm motor works and steel foundries at Lima. The extension will cost about $15,000 and work has already been started.

The Chamber of Commerce of Hamilton has taken up the proposition of the extension of the Indianapolis & Connersville Traction Line to Hamilton, connecting with the Indiana road at Liberty, Ind. The company is contemplating making Harrison, O., its terminal at present.

The Buckeye Lake Railway Terminal & Transportation Co. has been incorporated with a capital stock of $15,000. The incorporators are: A. E. Boone, H. A. Axline, J. L. Holden, Julius Hollinger and Lawrence Kilner, of Columbus. The company proposes to build a line from Columbus to Zanesville through Millersport, and to build a terminal station at Buckeye Lake.

The Norfolk & Western Ry. is preparing to shortly begin double tracking through Chillicothe. The City Council has passed ordinances granting rights of way.

The City Engineer of Youngstown, O., is preparing plans for the lowering of the Erie railroad tracks from Watt St. to West Lakes crossing. This will do away with most of the dangerous grade crossings in the city.

The Union Depot Co., of Columbus, is now having plans drawn for an extension of its depot. It is planned to extend the sheds and take in four additional tracks.

The Defiance Interurban Ry. Co., which projects a 102 mile line from Fort Wayne to Toledo, has secured the capital for preliminary work, and surveys for the proposed line are now under way. Construction contracts will be let next year. K. V. Haymaker, Defiance, Ohio, is President, and the W. H. Schott Co., Chicago, Ill., is Chief Engineer.

Oklahoma.

The Oklahoma Union Traction Co., of Tulsa, which recently let contracts for an interurban line to Sapulpa, is also to extend its city line at Tulsa, making a loop in the business district.

Advices from Carmen, Okla., state that bonds in the sum of $7,000,000 have been floated to furnish money for the construction of the proposed St. Louis, Bartlesville & Pacific Ry. The proposed line, if constructed according to present intentions, will run from Webb City, Mo., to Carmen, entering Oklahoma near Miami and going from that town directly west to Carmen. It is stated that Bartlesville probably will be made a division point, and that the general headquarters of the company and the railway shops will be placed there.

The double track of the Missouri, Kansas & Texas has been completed from Durant north to Atoka and was opened for traffic Nov. 19.

Construction work on the Cherryvale, Oklahoma & Texas Ry. Co., according to a reported statement of George Masters, of Perry, Okla., a director, will be continued during the winter months across Oklahoma southeast into Arkansas, coming from Cherryvale, Kan., south to Bartlesville, and thence southeast through Nowata and Muskogee. The other line to be constructed runs southwest from Cherryvale through Pawhuska and Perry to Guthrie and Geary on the Rock Island line to Amarillo, Tex.

R. L. Robertson of Duncan, head of the proposed Ardmore & Lawton R. R. has been in Philadelphia for the purpose of arranging for the construction. The road from Ardmore via Duncan to Lawton, an air line of 60 miles, would penetrate a country not touched now by an east-and-west line.

Engineers of the Clinton, Oklahoma & Western R. R. have completed surveys for the line from Shattuck to Butler, and will start work on another line from Butler into a point in Texas, probably Canadian City. Guy V. McClure, Clinton, Okla., is Chief Engineer.

A party of officials of the Midland Valley R. R., according to information received from Tulsa, Okla., recently visited that city with a view of securing financial aid to build the extension from Arkansas City to McPherson, where a connection will be made with the Union Pacific thus placing Tulsa on a through line from Seattle to New Orleans, La. E. M. Alvord, Muskogee, Okla., is General Manager of the railroad.

The last portion of the necessary right of way for the new belt line in Oklahoma City, Okla., has, according to information received from that place, been secured. It is planned by the company to connect the packing plants and stock yards with the various railroads. The grading has been completed from the stockyards to a point ¼ mile southeast of the junction of the Frisco and Santa Fe main lines.

A letter received recently from Garvin, Okla., states that the Choctaw Lumber & Veneer Co. is taking up the steel on the last spur of the Red River long road and is using the material for the construction of the new railroad to Little River north of Garvin.

The Red River Valley & Texas R. R. Co. is reported to have awarded the contract for constructing its line to a New York company. This company, it is said, will place its engineers in the field about Jan. 1. The railroad, as proposed, is to extend from Ardmore, Okla., to Chillicothe, Tex. F. L. Mercer, Walter, Okla., is President

Oregon.

The United Rys. Co., Portland, Ore., has placed in operation its line between Burlington and Banks, 13 miles. The motive power will be steam for the present. However, early next year the line will have been electrified from Portland to Banks.

Engineers of the Nevada-California-Oregon Ry. have been running preliminary surveys on the west side of Goose Lake, in order to make estimates which will enable a decision as to which side of the lake the proposed extension from Alturas to Lake View will run The directors of the road have made an appropriation for this extension and the work will be rushed. Construction work is already under way, and it is said that contracts for 40 additional miles will be let shortly. Geo. S. Oliver, Reno, Nev., is Chief Engineer.

At the recent convention of the Oregon Development League at Salem, Ore., the following statement, according to press reports, was made by Theo. B. Wilcox, President of the League: "Last June, James J. Hill, the empire builder of the Northwest, gave me his word that he would not only invade the territory of the Harriman system, known as the state of Oregon, but gave me permission to quote him. The exact words used by Mr. Hill were: "More miles of railroad will be built in Oregon during the next five years than any state in the union except Montana. I would have done it before if I had got the money together."

Advices from The Dalles, Ore., state that construction work on the Portage Ry. has reached its western extremity of the right of way and within a short time all the steel will be laid. The bulkheading and riprapping is nearly completed and teams are busy dredging out along the river side so that boats can get up to the wharf. The bulkheading, which was placed next to the river along the western end, at the place where the current will strike in high water, was made by driving piling, 40 feet long, until only about eight feet remained above the surface of the ground. To this piling planks three inches thick were spiked and behind this was filled in with rock and heavy clay which was tramped down until it was almost as solid as rock. On the surface of the grade rock will be laid with heavy clay, in such a way that it will be practically impossible for it to wash out when covered by high water.

President E. E. Lytle, Pacific Ry. & Navigation Co., has set May 1, 1911, as the date for the driving of the golden spike and formal opening of the new line from Portland, Ore., to Tillamook. The work, when completed, will represent an outlay of close to $4,200,000.

The long standing mystery as to the backers of the North Coast R. R. has at last been solved, according to newspaper dispatches from the coast. According to these reports the North Coast was an original Harriman enterprise. Instead of having been an independent movement by capitalists who designed to sell the constructed road and surveys to one of the existing transcontinental lines, it is said that E. H. Harriman originally conceived the idea of building the North Coast and financed the work from the first. Mr. Harriman's plans, it is said, grew out of the dissolution of the Northern Securities Co. by the courts and the consequent failure of the merger of the Northern Pacific and Union Pacific systems. Believing that he had control of the Northern Pacific, Mr. Harriman thought it unnecessary to occupy the north bank of the Columbia River, but with the dissolution of the Northern Securities Co. he found he had lost control of the Northern Pacific and had permitted Hill to get in ahead of him on the north side of the Columbia River gorge. The attitude of high officials of the Harriman lines in the West indicated that even they knew nothing concerning the interests back of the North Coast until recently. Operations of the North Coast engineers and construction camps were watched and reported on by Harriman's confidential agents as closely and as systematically, it is said, as if it were a feared rival.

Construction work has been started on the street railway system at The Dalles. Frank P. Phillips, who was a contractor on the North Bank road a few years ago, has the contract for the construction of the electric road.

Pennsylvania.

As noted in our last issue the Chambersburg, Greencastle & Waynesboro Street Ry. Co. has started work on its extension from Pen Mar Park to Blue Ridge Summit. John W. Warehime is superintendent in charge of the work from Highfield and Baker Sefton is in charge of the work near Pen Mar.

The State Department has approved the articles of merger of the Scranton and Binghamton R. R., to construct and operate a line from Factoryville to the New York and Pennsylvania State line and the Montrose & State Line R. R. to construct and operate a line from Montrose to the State line. The former company has a capital of $500,000 and

. 50 mile line and will tak[illegible] the [illegible] company, which has a capital of $30,000.

The Tuscarora Valley R. R., N. H. Suloff, President, Port Royal, Pa., will shortly begin work on an extension from Blair's Mills, Pa., to Cherry Run, W. Va., a distance of 58 miles.

An ordinance is before the Borough Council of Chambersburg to permit the Cumberland Valley R. R. Co. to build a high line through that place. The cost of this improvement will be $350,000 to $450,000.

The Eyre-Shoemaker Contracting Co., Arcade Bldg., Philadelphia, Pa., which has the contract for the construction of the new Baltimore & Ohio R. R. line from Somerset to Acosta, tapping the Jenner coal fields, has commenced work of laying an additional track from Rockwood to Somerset over a new right of way acquired last Summer. The new property is about 100 ft. distant from the present track and will eliminate several heavy curves.

The Connellsville & State Line R. R. is working on its right of way in the southern part of Somerset County, Pa., near Meyersdal and Rockwood and other towns.

At a meeting of the directors of the newly organized Pennsylvania Southern Railroad Co., the survey and route made by W. P. Coulter, Punxsutawney, Chief Engineer, were adopted. As proposed the line will run from a point between Heidrick and Holden Stations on the Pittsburg, Summerville & Clarion R. R. to Sutton Station on the J. F. & C., a distance of about 1 mile. The following are the officers of the new road: President, G. W. Megeath of Omaha, Neb.; Vice-President and General Manager, H. Buckingham of Clarion; Secretary, Theo. L. Wilson of Clarion; Treasurer, Joel Thompkins of Clarion; Directors, Theo. L. Wilson of Clarion, G. W. Megeath of Omaha, W. J. James, James B. Borland, Charles E. Smith, John E. Butler and James S. Carmichael, all of Franklin.

The following contracts for street grading work in connection with the elevation of the tracks of the Port Richmond branch of the Philadelphia & Reading Ry., in Philadelphia, have been awarded by that city: James D. Dorney, Philadelphia, at $284,320, for making a depression of 10 ft. in Frankford and Lehigh Aves. and adjacent streets which will pass under the elevated railroad tracks; McNichol Paving & Construction Co., 19th and Westmoreland Ave., Philadelphia, at $200,000, for changing the grade of Kensington and Lehigh Aves. and adjacent streets.

Tennessee.

The Tennessee Rapid Transit Co., chartered last summer, is now making plans for constructing its proposed line to Lewisburg. The company also proposes to build a line to Springfield, Clarksville and other points. This company was chartered by J. M. Gray, Jr., Joe Frank, R. T. Wilson, R. L. Burch, J. L. Parks, Jr., of Franklin, R. M. Wilson and Perkins Baxter.

The Louisville & Nashville R. R. has formally approved the subway ordinance adopted by the City Council of Memphis. It is expected that the Southern Ry. will shortly approve the plan, as will the St. Louis & San Francisco. The ordinance provides for the construction of eleven subways.

But three miles of the double tracking on the 13 mile spur of double track on the Southern Ry. lines between Chattanooga and Ooltewah Junction remain to be placed before the entire construction work is completed. The remaining uncompleted strip is between Summit and Ooltewah Junction and will be ready for use by the first of next year. Trains have been running for several weeks on ten miles of the double tracking between the above points.

The St. Louis & San Francisco is reported to have secured control of the New Orleans, Mobile & Chicago Ry., formerly the Mobile, Jackson & Kansas City. It is said that the latter road will be extended to a point near Cairo from Middleton Junction, Tenn., and become part of the Chicago & Eastern Illinois, giving this road an outlet to the gulf at Mobile and New Orleans.

Texas.

The Texas City Traction Co., which originally planned a line from the water front at Galveston to the west side of the Logan tract and north about a mile, has decided to double its capital stock and extend the line to Nadeau and La Marque. The distance to the latter point is nearly five miles. The company is said to have made all arrangements for material and expects to get surveyors in the field within a short time. Motor cars will be used, and the company will probably commence operations with two such cars. Fordyce Ridley, Galveston, Tex., is interested.

The St. Louis & San Francisco R. R. late last month completed track laying to the town of Callon, 28 miles southwest of Brady on the Menard Division.

Proposition has been made to Shafter Lake to build a trunk line railroad via that place. The proposition proposes that Shafter Lake raise a $50,000 bonus.

The Nueces River Valley R. R. Co., Beeville, is now closing up final details preparatory to beginning construction work on its line from Beeville to Eagle Pass. Officials of the company have decided to have the line touch Oakville, the county seat of Live Oak County, instead of going nine miles south of that point as at first stated. This decision on the part of the promoters and engineers was made after the survey on a straight line from Clareville beyond the river was made and the route was found impracticable owing to the rough country it would traverse.

B. F. Yoakum, chairman of the board of directors St. Louis & San Francisco Ry. (Frisco System) is reported to be negotiating with the owners of the San Antonio & Arkansas Pass R. R. with a view to its purchase and incorporation with the Frisco system.

Steel has been laid, according to advices from Lometa, Texas, on the SanSaba extension, seven miles from that city, and work is being rushed as rapidly as possible. The Morey-Faulbacker Construction Co., St. Louis, Mo., has moved its camp to mile 15 across the Colorado River, having completed its work at the Lometa camp.

Surveyors of the Middle Buster R. R. according to information recently submitted from Belton, Texas, have made a permanent survey from a point 18 miles north of that city.

At a conference held at Cotulla, Texas, recently between the promoters of the Nueces Valley R. R., which is to run from Beeville to Eagle Pass, it developed that it was intended to construct the line by the river valley route and that construction work will be started not later than January 1.

The Quannah, Dublin, Rockport & Gulf R. R. has secured about $500,000 of capital for construction purposes, and now has work under way. This company projects a line of a total length of 500 miles. The route is Quannah, Dublin, Belton, Taylor, Lockart and Rockport. L. E. Walker, Austin, Tex., is President.

The Gulf Coast & Provident City Ry. Co., J. G. Reeves, General Manager, Provident City, Tex., has filed an application with the railroad commission for authority to issue $50,000 of stock. This road is now in course of construction from Pierce to Provident City, Wharton County, a distance of 30.25 miles. The commission recently made, through its engineer, a valuation of the property of this road and placed it at $721,972.

The State's Attorney's Department has approved the charter of the Rock Island, Texico, Farwell & Southern Railway Co. This road is capitalized at $200,000, $150,000 of which is declared to have been paid in. Headquarters are to be maintained in Farwell, Parmer County. The total length of the proposed road is about 75 miles. It commences at Farwell, running thence in a southeasterly direction through the counties of Parmer and Bailey, to a point near the center of Bailey county, thence in a southerly direction through the counties of Bailey and Cochran to a point on the south line of Cochran County, about five miles east of the territory of New Mexico. The [illegible] H. J. Heale, M. F. Calback, Jr., S. H. Withers, D. A. Linthicum, M. F. Calback, Sr., all of Texas, and J. W. Childers, K. K. Runnels, T. B. Martin and Thomas J. Allen, all of Texico, N. M. Construction work on this road is now under way.

The recent merging of the railroad terminal and other buildings of the Aransas [illegible] Alexander Brown & Sons, Aransas Pass will result in the early completion of the construction plans of the consolidated concern, it is announced. The transaction, which has just been consummated, involved about $1,500,000. The railroad terminal system of the Aransas Pass Channel and Dock Co. is partly finished.

A company has been organized at Aransas Pass and Rockport to build an electric interurban railroad between the two towns. The original incorporators of the company are Charles F. Hoff, president; W. H. Vernor, first vice president; Charles Johnson, second vice president; R. W. Newbury, secretary; A. F. Bruhl, treasurer, while H. Brooke, O. C. McLeod, S. A. Clevinger and J. J. Todd are also on the board of directors. The charter is being prepared to send to the attorney general, and it is hoped to announce the definite plans of the company in a short period. Already a good part of the right of way has been secured between the two towns, while options have been taken on other lands along the proposed route, which will be near the beach, with a suggestion of resorts to be built along the line.

Advices from San Antonio state that residents of that city will probably organize a construction company with a capitalization of $500,000 for the building of a railroad to Brownsville. On Dec. 8, a meeting will be held at the chamber of commerce to take the necessary steps looking to the formation of this corporation. It is believed that this company with bonuses aggregating approximately $600,000, the bonding of the road will be a certainty and that finances can easily be raised for its construction. While no definite announcement has been made it is understood that thus far there has been subscribed about $65,000 as a nucleus for the construction company. It is planned to build a road to the border almost on an air line and going either by way of San Diego or Alice. The route through either of these cities will differ little. In an air line the road proposer would pass through sections of Bexar, Atascosa, Live Oak, Nueces, Hidalgo and Cameron counties. From Live Oak county there will come a liberal bonus for a road of this kind. One owner of land in that county has tentatively agreed to give a bonus approximating $50,000. Not alone has Live Oak responded liberally, but it is understood that the owners of large ranches along the contemplated route will be equally as liberal in their donations to see the project become a reality.

Virginia.

It is now understood that the Carolina, Clinchfield & Ohio Ry. is formulating new plans for the extension of the northern terminus of that road to some point on the Big Sandy branch of the Chesapeake & Ohio other than Elkhorn City. The northern terminus of the road is now Dante, Va. The old survey called for its completion north from Dante, Va., to Elkhorn City, W. Va., which is on the Big Sandy branch of the C. & O. Between Dante, Va., and Elkhorn City, W. Va., is an extremely high range of mountains. The cost of building the 40 miles between these two points will mean the expenditure of a vast sum of money. It is understood that two routes, one to the northwest and the other to the northeast from Dante, are now being surveyed. The terminus of each of the proposed routes will be at some point on the Big Sandy branch of the C. & O. other than Elkhorn City. Either of the proposed routes, it is claimed, will cost less to build than over the present survey directly north from Dante to Elkhorn City.

Washington.

The latest information received from Chesaw, Wash., is to the effect that work on the [illegible] Kettle River Valley R. R. [illegible] extended west from Midway through the Kettle

Valley toward the coast, is progressing rapidly. The new company is building on the old Midway & Vernon right of way, which has practically been completed from Midway a number of miles west, and for which the defunct Midway & Vernon will be paid, according to the Board of Appraisers estimate of value, $62,000. The grading is now completed for about fifteen miles, and it is expected that rails will be laid as far as Rock Creek, seven miles from Chesaw, before the end of the year. About 150 men are employed on the grading work. The tracklaying machine has been expected for some time.

Plans are under way by August Lovegren, Preston, Wash., who owns a large amount of timber land in Patton and Scoggins Valleys to organize a company known as the Willamette Valley & Coast R. R. Co., for the purpose of constructing a railway line into those regions. It is also proposed to lay out a townsite known as Cherry Grove and to build modern lumber plant, including planing mills, dry kilns, etc.

The city engineer of Spokane, Wash., and engineers of the Northern Pacific Ry. Co. are to take up the matter of preparing plans for the construction of new grades for the railroads, in that city.

The Northwest Engineering & Construction Co. has been incorporated, according to advices from Spokane, Wash., and will enter into a general engineering and construction business. D. Headington is President and E. B. Miller is Chief Engineer of the company. It is stated that the latter official was recently associated with the Stone & Webster Engineering Corporation, Tacoma, Wash.

A statement has been made by the officials of the North Coast R. R., F. L. Pitman, Spokane, Wash., Chief Engineer, designating the following constructed, partly constructed and telegraph lines of the company: A line from Attalia, a point on the line of the Snake River Valley Railroad Company, in Walla Walla County, Wash., to North Yakima; a line from Sunnyside junction, a point on the last named line in Yakima County, Wash., to Sunnyside, Wash.; a line from North Prosser, Wash., to Prosser, Wash.; a line from Granger, Wash., through Toppenish to a point near Fort Simcoe, Wash.; a line from some point hereafter to be selected on the line from Granger-Fort Simcoe, in Washington, thence northerly to Parker siding, in said state, a point on the Attalia-Yakima line, south of Yakima city; a line from Benton through Hanford, White Bluffs, Beverly and Wenatchee to the mouth of the Okanogan river, all in Washington; a line from a point on the Attalia-North Yakima line, south of Richland, thence through Richland to Hanford, all in Washington; a line from Spokane through Cheney, Cow Creek Junction and Hooper, to a connection with the line of the Snake River Valley Railroad Company, near Ayer, all in Washington; a line from a point on the last named line near the crossing of the Snake river, southerly to Walla Walla, all in Washington; a line from Cow Creek Junction, a point on the line from Spokane to Ayer, through Connell and Ringold bar to Priest Rapids Junction, between Benton and Hanford, all in Washington; a line from a point on the Spokane-Ayer line, south of Sprague, thence in a northwesterly direction to Davenport, all in Washington

Wisconsin.

H. Cash, President, New Lisbon, Wis., is considering building an extension in a southwesterly direction through Vernon, Richland and Grant counties to Dubuque, Ia. The Wisconsin Southwestern Ry. Co. has been incorporated to build the extension.

Further information regarding the extension of the "Blueberry Line" of the Minneapolis, St. Paul & Sault Ste. Marie Ry. is now at hand. It is said that the Barron-Ridgeland branch will be extended to Prairie Farm and the Chicago division will be reached at Emerald by way of the new line which is now being built under the name of the Prairie Farm & Southern. This will give the Soo road a direct line into the Ashland district and the twin cities, and more than a third of the distance will be covered by using branches already built. The new construction will be between Mellen, on the Ashland branch of the Chicago division, and Reserve the north end of the Blueberry line and from Ridgeland to Prairie Farm on the south end.

The Hillsboro & Northeastern Ry., W. H.

The Chicago & Northwestern Ry. has made surveys from its main line toward Lowell, for the location of a spur.

Surveys have been completed by Engineer Blodgett, of Bloomington, Wis., for the proposed railroad from Woodman to Bloomington. Rough estimates place the cost of the 24-mile line at about $300,000.

Plans are under way to secure the construction of a spur track to be used jointly by the Chicago & Northwestern and Milwaukee roads to connect with the new national rifle range established on the southwest corner of the military reservation east of Sparta. In order to construct the spur track an extra appropriation will have to be procured, either by introducing a bill in congress or by allowance of the war department. This money will be expended in purchasing the right of way for the spur track, which according to the survey must run nearly its entire distance outside of the reservation. The spur will leave the main lines at the crossing four miles east of Sparta and run southeast for a distance of one mile.

The State Railroad Commission in the near future will conduct in Milwaukee the final public hearing in the application of the city for a change of grades of the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern Railway Companies north of Greenfield Ave. The principal point of controversy is the grade to be ordered at the Reed St. crossing of the Milwaukee road.

Wyoming.

Information sent in from Rock Springs, Wyo., is to the effect that Kilpatrick Bros., Beatrice, Nebr., who have the contract for construction work on the new Union Pacific, have a large force of men at work, and it is believed that the work will be pushed right through to completion. It is said that the road will extend some 35 miles north to coal fields of inestimable value.

Canada.

The Grand Trunk Ry. has negotiations under way for the purchase of land on the Canadian side of the Detroit River. If the negotiations go through the company will build a line from the yards in Windsor, Ont., around to the Michigan Central terminal station and make a connection somewhere near there with the Michigan Central tunnel.

The Montreal & Southern Counties Ry. Co., of Montreal, is said to have plans under way for an extension of the Southern Counties across the peninsula to Chambly Basin and Richelieu. In connection with the plans the old Ceneral Vermont is to be electrified and run in connection with the new electrical railway.

P. Hartnett and S. A. Eslick, composing the firm of Eslick & Hartnett, Spokane, Wash., have been awarded a contract for work on the construction of the Canadian Northern Ry. on Vancouver Island. The contract is said to amount to about $250,000 and to involve considerable rock work. Construction work is to be started this month.

The Western Railway Co., incorporated by the Ontario legislature, is seeking a federal charter. It desires that its electric railway, authorized to be constructed from Toronto to London, with branches to Stratford, Woodstock and Wellesley, may be extended from London to Windsor in the same province and connecting therewith that ferries may be maintained across the Detroit river.

The Western Coal & Coke Co., of Montreal, Que., is to build a railway to the Beaver Creek Collieries to the southwest of the town of Pincher Creek, Alberti. A new survey has shortened the line by three or four miles. It is expected that the line will be finished in the early summer. It will connect with the C. P. R. at Pincher Creek.

The Northern Construction Co. of Winnipeg, Man., which recently secured the contract for the first 60 miles of the Canadian Northern Ry. from Vancouver to Chilliwack, has also been awarded the contract for the work as far east as Hope, B. C., a distance of 79 miles from New Westminster. Construction will be prosecuted throughout the winter months. Tenders for the construction of the first section of the island line out from Victoria, B. C., will be called for at once. Rails for the Fraser Valley section have been ordered from the steel works at Sydney, Cape Breton, and will be shipped around the horn to reach Port Mann by the end of April. No additional contracts for construction up the Fraser beyond Hope will be awarded until the railway commission announces its decision on the Canadian Northern application for approval of its right of way through a portion of the Fraser canyon near Lytton. M. H. MacLeod, Winnipeg, Man., is General Manager of the Canadian Northern.

The Canadian Northern Ry. is applying for a charter for a railway from Stewart, at the head of the Portland Canal, across northern British Columbia, north of the Grand Trunk Pacific to the eastern borders of the province, there to connect with a line to Edmonton.

The Provincial Government has passed an order in council providing for the building of a branch of the Temiskaming & Northern Ontario Railway from a point on the main line near Kelso to Porcupine. The distance will probably be 30 or 32 miles, and the cost about $430,000. This work will be done under the powers given by legislation last session, and will be proceeded with without delay. S. B. Clement, North Bay, Ont., is Chief Engineer.

Advices from London, Canada, are to the effect that an announcement has been made by William MacKenzie, that the Canadian Northern Ry. will build an extension of the line through London to Sarnia.

Grading work on the Canada Northern Ry., between Belleville, Ont., and Trenton is now nearly completed. The location is exceptionally favorable, there being no deep cuts and little filling or elevating. Culverts are being built and there is a small steel bridge to be erected east of Belleville. Work is being rushed. The grade is generally highly favorable, but there is some heavy grading where the line crosses two railways leading into the cement works at Belleville.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arkansas.

In order to complete 500,000 cu. yds. of levee work from the Rock Island R. R. to Mound City, Ark., by June 1 Roach & Stansell, of Memphis, have rushed one of their big levee outfits from Bryan, Tex., to Clarkdale, Ark. Six cars were necessary to transfer the 300 teams, 175 men, tents and cooking apparatus.

The contract for the construction of the ditches in Drainage District No. 1 of Lincoln County has been awarded to McAllister & Peterson of Zion City, Ill., at 12 cts. for the main and 17 cts. for the lateral.

California.

Bids will soon be asked on irrigation work near Stockton, Cal., which will cost about $3,000 000. The irrigation systems to be built are those of the South San Joaquin Irrigation District and the Oakdale Irrigation District. The former district on Dec. 30, 1909, voted bonds to the amount of $1,875,000; the Oakdale Irrigation District has voted bonds to the amount of $1,600,000. The construction work to be done is about as follows: By the two districts jointly: Masonry diversion-dam, about 80 ft. high, in Stanislaus River Canyon, with head-works. About 3 miles of 1,700 cu. ft. sec. canal in canyon, all concrete-lined, on side hill slopes, principally sound slate excavation. Includes enlargement of two 1,000 ft. tunnels. Tunnel to carry canal out of canyon, 2,900 ft. long and about 15 ft. by 15 ft. In sound slate, concrete-lined. About 3 or 6 miles of 1,700 cu. ft. sec. canal, all in hard-pan, largely concrete-lined. Flume or inverted-siphon of permanent construction, to carry 1,700 cu. ft. sec.; about 1,900 ft. long and 60 ft. max. head. By the South San Joaquin District alone: About 8 or 5 miles of 850 cu. ft. sec. canal to edge of district, in hard-pan, probably unlined. Earth dam about 60 ft. high by 3,400 ft. long, to store about 48,000 acre-feet. Distribution system, consisting of about 55 miles large canals, about 400 miles 45 cu. ft. sec. ditches, both mainly in sandy ground; large number of concrete drops and head-works, some highway and railroad bridges, etc., etc. Drainage works by the Oakdale District alone. By the Oakdale District alone. A somewhat similar irrigation system, with somewhat less mileage in distribution system. A large inverted siphon to carry the supply across the Stanislaus River. Correspondence is solicited by Edwin Duryea, Jr., Chief Engineer, South San Joaquin Irrigation District, 4315 Humboldt Bank Bldg., San Francisco, Cal., from such contractors as can secure bidders for the bonds at par, and no other than such contractors can be considered. This means is taken to bring the project before the greatest number of such contractors in the least time. Bids will be considered preferably for the South San Joaquin System as a whole; or the work may be divided into several parts, for which separate bids will be considered. Further information regarding this work will be found on Advertising Page 54.

The Thompson Bridge Co., San Francisco, Cal., has been awarded the contract for the extension of dike No. 12 at Marc Island for the U. S. Navy Department. The contract price was $102,000.

City Engineer McCay, of Oroville, has prepared plans and specifications for the deepening and widening of the channel of Dry creek in the southeastern section of the city, west of 3rd Ave. The Truckee Lumber Co. has agreed to make some costly openings in the channel where it passed through the property, and the Valley Contracting Co. will do likewise.

About $2,400 is to be expended for strengthening the channel of the San Gabriel River and for building a protection wall above the city of Elmonte. The Elmonte Improvement Club is raising funds for the work.

R. M. Tague of San Dimas has filed with the County Recorder at Riverside, a claim to 350,000 ins. of water from the Colorado River for the irrigation of Palo Verde lands. Tague has an application before Congress to build an intake dam.

Colorado.

Work is to be started shortly on the Sedgwick reservoir, in Sedgwick County, by D. A. Camfield, of Greeley, Colo., for the Camfield Development Co. The new irrigation district lies east of Julesburg and includes 16,000 acres, the irrigation system for which will cost $670,000.

A considerable amount of irrigation work is proposed in Eastern Weld County the coming spring. Among the reservoirs and ditches to be built are the Park reservoir and ditches 1, 2 and 3. The Wild Horse Reservoir & Land Co., of Denver, will build the Wild Horse reservoir and canal system, to cost $25,000.

The Pawnee Irrigation District, organized at Sterling, Colo., last summer, is to ask for a bond issue. It is estimated that it will require about $500,000 to complete the work and arrangements are being made by the directors to finance the proposition. Some 22,000 acres of table land lying to the west of Sterling will be brought under irrigation by the system.

Idaho.

The Twin Falls Land & Water Co., Twin Falls, Idaho, has recently filed applications for the extension of the Bruneau project. The additional applications include 40,000 acres more of land than it had been expected would be irrigated. The main canal of the Twin Falls Co. is to be enlarged and the storage capacity of the American Falls reservoir will be 3,036,000 acre feet of water. The entire project runs 20 miles south back of the Snake River and is bounded on the east by the Salmon River and on the west by the Bruneau River.

Indiana.

E. R. Edwards has been awarded the contract for constructing the Ault ditch in Madison Township, Tipton County, for $1,349.

Bids will be received by Edward C. Faith, Ditch Commissioner, Washington, Ind., for the construction of Colbert Ditch in Daviess County.

Kansas.

Col. C. F. Morse, of the Kansas City Stock Yards Co., Kansas City, Mo., has been awarded the contract to build a dike for the left bank of the Kaw River from Kansas Ave. to point 1,080 ft. below the Central Ave. bridge. On the right bank of the river the dike will extend from the Kansas Ave. bridge to Central Ave. The plans for this improvement are well under way.

Bert C. Wells, City Engineer of Wichita, Kan., has submitted a plan to the City Commissioner for a new system of riprapping material to be placed along the banks of the Little Arkansas River. This riprap consists of piling, oak plank and stone, which will be placed in the bends of the river, where the high water washes the bank. The riprap work will probably be done this winter.

Minnesota.

✣Bids will be received until 2 p. m., Dec. 9, by Ole O. Holmen County Auditor, Slayton, Minn., for the construction of county ditch No. 21, including approximately 13,552 cu. yds. of excavation. The cost of the work is estimated at $1,346.

✣Bids will be received until 1 p. m., Dec. 17, by John A. Berg, County Auditor, Buffalo, Minn., for the construction of a county ditch, No. 13, estimated to cost $2,827.

North Carolina.

✣Bids are asked until Dec. 29 by the Commissioners of Lyon Swamp Drainage District, B. F. Keith, chairman, Wilmington, N. C., for drainage work in Pender and Bladen Counties, North Carolina. The work includes excavating 13 miles of canal, from 16 to 24 ft. bottom width, requiring approximately 345,000 cu. yds. of excavation, and the construction of a dam on Cape Fear River—36,000 cu. yds. fill. W. K. Allen, Room 27, I. O. O. F. Bldg., Wilmington, N. C., is Engineer of the District.

Plans have been completed for the reclamation of 7,000 acres of land near Swanquarter, N. C., in Hyde County. The land will be diked all around and the water pumped out. It is estimated that it will require three 20-in. centrifugal pumps to make the necessary discharge wing under a 7 ft. head of water. A reservoir canal will be excavated requiring the moving of approximately 75,000 cu. yds. of dirt. The estimated cost of plant is about $20,000. This work has not yet been advertised pending the issuance of drainage bonds. Geo. Makely, Swanquarter, N. C., is Chairman of the Commission, W. K. Allen, Room 27, I. O. O. F. Bldg., Wilmingtonfi N. C. is Engineer.

New York.

The American Pipe & Construction Co., 112 North Broad St., Philadelphia, Pa., as noted in our last issue, has been awarded Barge Canal Contract No. 37, for dredging in the Oswego River between Fulton and Oswego. The itemized bids of the above contractor for the work was as follows:

Clearing, lump sum	$1,000.00
[illegible]	[illegible]
1.5 M. ft. B. M. sheeting and bracing	45.00
[illegible] lin. ft. [illegible]	[illegible]
[illegible] sq. ft. [illegible]	[illegible]
10,800 cu. yds. forming embankment	.18
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] M. ft. B. M. [illegible] in lock gates	100.00
9,000 lin. ft. foundation piles	.30
46 M. ft. B. M. wooden sheet piling	45.00
8,000 sq. ft. steel sheet piling	1.00
[illegible]	[illegible]
[illegible] wall	[illegible]
[illegible] paving	2.00
[illegible]	[illegible]
200 cu. yds. second-class riprap	2.75
[illegible]	[illegible]
[illegible]	[illegible]
378,800 lbs. structural steel	.04
104,000 lbs. metal reinforcement	.02½
[illegible]	[illegible]
[illegible]	[illegible]
533,000 lbs. metal in lock gates	.04¾
167,500 lbs. metal in buffer beams	.05
67,500 lbs. metal in lock valves	.09
[illegible] gate [illegible], Class A	[illegible]
[illegible] gate hoists, Class B	[illegible]
5,000 lin. ft. fiber ducts	.10
3,800 lin. ft. drilling bolt holes in rock	.40
1 field office	500.00
2 storehouses	1,000.00
Cofferdams, pumping, bailing and draining	38,000.00
For maintaining highway traffic	100.00
For maintaining navigation	500.00
20 for removing buildings	100.00
For removal of bridge superstructure	300.00
Total	$2,323,998

Contract 27A for work on the New York Barge Canal awarded Holler & Shepard, 224 E & B Bldg., Rochester, N. Y., as noted in our last issue, includes 360,000 cu. yds. earth excavation, 162,000 cu. yds. embankment, several small steel bridges, 13,000 cu. yds. concrete masonry and 30,000 lin. ft. piling. The work is located at Fort Edward, N. Y.

Ohio.

The Commissioners of Champaign County, held a hearing at Urbana, O., the county seat, on Dec. 1, on the report of County Engineer Swisher, for the proposed dredging of Mad River north from the Pan Handle bridge to a point on the Pin mill road near the north county line.

Texas.

R. L. Leonard, 1768 Monroe Ave., Memphis, Tenn., has been awarded the contract at $24,900 for the construction of about four miles of levee and the completion of eight miles of partially completed levee for Brazos County Improvement District No. 1. Bids were opened Nov. 19 at Allenfarm, Tex.

Oklahoma.

A resolution is before the City Council of Oklahoma City for straightening and deepening the Canadian River in its course through the city. It is estimated that the drainage scheme will cost $500,000. J. W. Burke is City Engineer of Oklahoma City.

Texas.

The Navigation Board, composed of the Commissioners of the city of Houston and the county, has voted favorably upon the petition of citizens for the creation of a navigation district of Harris County as a whole, and for the issuance of bonds to the amount of $1,250,000 for the improvement of the Houston ship channel. The Commissioners have designated Tuesday, Jan. 10, 1911, as the day upon which the election to vote on issuing bonds will be held. In connection with the ship channel bond issue, but as a separate proposition, the question of whether $500,000 in

Items marked thus ✣ indicate work now open for bids.

bonds shall be issued by the city of Houston for the construction of a viaduct across the ship channel at the foot of Main St. will be submitted to the qualified voters of that city. Both propositions will be submitted on the same day, but under the law must be voted upon separately. H. B. Rice is Mayor of Houston, Tex.

The Attorney General has approved an $18,000 bond issue voted by a sub-division of Milam for the construction of levees. The district comprises 3,824 acres of land on Little River. Cameron is the county seat of Milam County.

Utah.

The Weber & Davis Counties Canal Co. has work underway widening the mouth of the canal in Weber Canyon. Concreting work on the canal has been about completed and the company will soon take up the work of raising its dam. This latter work will cost about $110,000. D. W Bostaph, Ogden, Utah, is Chief Engineer.

Wyoming.

A proposition has been made to the State Land Board to take over the Oregon Basin Project in Big Horn County. This matter will come before the Board about Dec. 28, but at present no contract has been executed. Robert P. Fuller, Cheyenne, Wyo., is State Commissioner of Public Lands.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Arkansas.

Kitchen & Lewis, of St. Louis, Mo., have been awarded the contract for the temporary heating plant at the new State Capitol at Little Rock, Ark. The accepted bid was $36,800. The contractors must agree to have the plant in operation by January, the date of the meeting of the Legislature.

California.

✣Bids will be received until 10 a. m., Dec. 15, by C. A. Lohr, Constructing Quartermaster, San Diego, Cal., for the construction of a reinforced concrete morgue building at Fort Rosecrans, Cal.

✣Bids will be received until December 16, by Maj. H. P. Young, Depot Quartermaster, San Francisco, Cal., for furnishing 2,000 lbs. black harness leather, 350 lbs. latigo lace leather, 1,000 lbs. cropped skirting leather, 750 lbs. sole leather and 1,000 lbs. of black harness traced leather.

Colorado.

The last round of holes was fired in the Newhouse tunnel on Nov. 17, thus practically completing one of the greatest mining tunnels in Colorado. The length of the tunnel is 21,968 feet. It starts below Idaho Springs, crosses the mines of Russel gulch, Quartz hill and the Nevadaville section of the county, cuts the veins at depths varying from 1,500 to 1,800 ft. below the surface and is now draining those sections of a large amount of water that has been standing in the mines for years. The tunnel ends in the properties of the Gunnell Mining Co. within the limits of Central City.

Connecticut.

✣Bids will be received until 3 p. m., Dec. 21 by Lieut. Col. Harry Taylor, U. S. Engineer, New London, Conn., for dredging in New Haven Harbor, Conn.

✣Bids are asked until 3 p. m., Dec. 21, by Lt.-Col. Harry Taylor, U. S. Engineer, New London, Conn., for dredging in New Haven Harbor, Conn. The general location of the work is in the upper portion of New Haven Harbor between Tomlinson's bridge and the 20-ft. anchorage basin. The work is in three sections. (1) The proposed 15-ft. anchorage basin, located to the southward of the City Wharf and to the eastward of Canal Wharf, with maximum breadth of about 1,000 ft. and maximum length of about 3,000 ft.; estimated yardage, 153,000. (2) Twelve-ft. channel from proposed 15-ft. anchorage basin toward Brewery St., 100 ft. wide and 12 ft. deep at mean low water and about 1,500 ft. long, located parallel to Canal Dock and with its westerly side 130 ft. distant therefrom; estimated yardage, 52,000. (3) Restoring to project depth of 20 ft. those portions of the main channel between Tomlinson's bridge and the 20-ft. anchorage basin where shoaling has taken place. The upper portion of this channel for a distance of about 2,000 ft. below Tomlinson's bridge is 300 ft. wide, and the lower portion for a distance of about 2,500 ft. above the 20-ft. anchorage basin is 400 ft. wide; the section between these, which includes the turn opposite Long Wharf, varies in width from 300 to 750 ft. Within the area above described considerable shoaling has taken place, but it is not expected that the entire area will have to be redredged, but only those places where the existing depth is now 19 ft. or less. Estimated yardage for redredging the main channel 200,000.

The J. S. Packard Dredging Co., 31 Market Square, Providence, R. I., was the low bidder Nov. 30, for dredging and constructing pile dolphins at Fort H. G. Wright, N. Y. Bids were opened by Capt. F. T. Arnold, Constructing Quartermaster, U. S. A., New London, Conn.

Delaware.

✣Bids will be received until Noon, December 10, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging harbor at Wilmington, Del.

✣Bids will be received until Noon, December 17, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for jetty construction and repairs at mouth of Mispillion River, Del.

✣Bids are asked until noon, Dec. 23, by Maj. R. R. Raymond, U. S. Engineers, 6th and King Sts., Wilmington, Del., for jetty work at mouth of Broadkill River, Delaware. The work consists of reinforcing the northern or convex side of the existing jetty extending across Lewes Sound about 545 ft. in length, and to build a spur dike, one end abutting and fastened to the northern or convex side of the jetty and extending along Lewes Sound in a northerly direction for 75 ft. The present jetty will be reinforced by a lower wale of 6-in. by 8-in. timber extending its entire length. Sheet piling will be closely driven in two rows, one binding the other and overlapping joints, and fastened to the wales by spikes, two spikes to every sheet pile, the top of sheet-piling to be cut off even with the top of upper wale.

✣Bids are asked until noon, Dec. 17, by Maj. R. R. Raymond, U. S. Engineer, 6th and King Sts., Wilmington, Del., for jetty construction and repairs at the mouth of the Mispillion River, Delaware. This work consists of extending the south jetty from its present outer end in a southeast direction parallel to the dredged channel, about 1,800 lin. ft. The jetty will consist of two parallel rows of piles on lines 6 ft. between centers, and the piles in each row 2 ft. between centers. The piles are to be secured in position by wales, tie rods, screw bolts and drift bolts. The space between the two rows of piling is to be filled with stone upon a bed of brush. The outer end of jetty extension will be closed with piles similarly spaced and fastened at the sides of the jetty, and be protected by a second row of piles, outside of the wales, extending across the end and along the front of the jetty for a distance of 10 ft.; these protective piles to be screw-bolted to the jetty piles through the wales. At the outer end of the finished jetty, on the corner next to the channel leading into the river will be a cluster of 7 piles bolted together, but not fastened to the jetty. The length of new jetty constructed will depend upon the price bid.

District of Columbia.

✣Bids will be received until December 12, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Circular 612-B butchers' blocks, oilcloth, glassware, etc.

✣Bids will be received until December 27, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing for reinforcing 2,300,000 lbs. mechanical bond steel rods and 165,000 lbs. round steel rods; also 50,000 ft. of flooring, 50,000 ft. of ceiling and 3,678,640 ft. of miscellaneous lumber.

✣Bids will be received until Dec. 7, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing 24 emery wheels, 8-in. diameter.

✣Bids will be received until December 8, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing 1,00 pieces air brake hose, 1⅜x22 in. long without couplings.

✣Bids will be received until Dec. 8, by Capt. F. C. Boggs, Isthmian Canal Commission, Washington, D. C., for furnishing three complete sets of tiling for boiler settings on pipe line dredges.

✣Bids will be received until 3 p. m., January 14, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including roof and ground surface drainage system, of the new building for the Bureau of Engraving and Printing, Washington, D. C.

Georgia.

✣Bids will be received until Noon, December 17, by Robert F. Maddox, Mayor, Atlanta, Ga., for remodeling building on the northwest corner Marietta and North Forsyth Sts., for new city hall. The structure was formerly the U. S. Postoffice and Custom House. A. Ten Eyck Brown, 607 Forsyth bldg., is architect.

✣Bids will be received unitl 3 p. m., January 7, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office at Waycross, Ga.

✣Bids will be received until Noon, December 22, by S. H. Willis, Clerk, Commissioners Court, Greensboro, Ga., for renovating the county jail.

Illinois.

✣Bids will be received until 11 a. m., Dec. 8, by Board of Public Works, Chicago, Ill., for making borings in Lake Michigan to determine the elevation of bed rock. B. J. Mullaney is Commissioner of Public Works.

✣Bids will be received until 8:30 p. m., Dec. 12, by Fred W. Luther, Secy., Woodbine School, Hawthorne, Ill., for electric wiring and fixtures for same in the new Morton Park and Grant Works schools, located in the town of Cicero, Ill., School District No. 99.

Kansas.

W. C. Wells, City Engineer, of Wichita, Kan., has completed plans and specifications for the city for an electric sand pump and boat. This will be used to pump sand out of the channel of the Little Arkansas River. The pump and boat will be of modern equipment and will be used in dredging the channel of the Little River north of the new Central Ave. dam.

Kentucky.

Bids were opened Nov. 28 by the Board of Public Works, of Louisville, Ky., for furnishing 1,900 street signs. The following companies submitted bids: Nicholas Sign Co., Clyde, O.; D. Elmer Roberts, Racine, Wis.; Enamel Street Sign Co., Louisville; Adams &

Items marked thus ✣ indicate work now open for bids.

Sullivan, Louisville; H. S. Gosnell, Louisville; E. N. Winston, Louisville. The contract will amount to about $15,000.

Michigan.

✣Bids will be received until 8 p. m., Jan 19, by Board of Public Works, Grand Rapids, Mich., for the construction of buildings, filters and equipment for the city of Grand Rapids, Mich. Hering & Fuller, 117 Broadway, New York City, Engineers.

Louisiana.

✣Bids will be received until 10 a. m., January 16, by Favrot & Livaudais, Ltd., Architects, 839 Gravier St., New Orleans, La., for the erection and entire completion of a two-story and basement, fireproof courthouse at Lake Charles, La., for the Parish of Calcasieu.

Maryland.

✣Bids will be received until 11 a. m., December 14, by Board of Awards, Baltimore, Md., for the furnishing of both pole type and subway type oil-cooled transformers for the Public Parks and Squares of Baltimore. William S. Manning is General Superintendent of the Park Commission.

Massachusetts.

✣Bids will be received until noon. Dec. 12, by Fire Commissioner, Fire Department, Boston, Mass., for dredging dock building wharf, extending wharf to the harbor line and preparing berth. Plans and specifications may be obtained of the Commissioner.

✣Bids will be received until noon, Dec. 9, by Superintendent of Streets, Sanitary Division, Boston, Mass., for repairing stables at Sanitary yard, North Grove St.

Bids as follows were received Nov. 23 by Col. F. V. Abbott, U. S. Engineer, Boston, Mass., for dredging in Merrimac River, Mass., (1) being price per cu. yd. for dredging, scow measurement, below and above Rocks Bridge; (2) price per cu. yd. for removing boulders exceeding one cu. yd. each below and above Rocks Bridge. John R. Burke, Wollaston, Mass., (1) $250 and 62 cts., (2) $15 and $15. Commonwealth Dredging Co., Boston, Mass., (1), $2.25 and 57 cts., (2) $10 and $10.

Massachusetts.

✣Bids will be received until Noon, December 27, by Col. F. V. Abbott, U. S. Engineer, Boston, Mass., for removing the wreck of the Schooner Nat Ayer in Boston Harbor, Mass.

Minnesota.

✣Bids will be received until 1 p. m., Dec. 9, by Board of County Commissioners Warren, Minn., for the necessary labor and material for the erection of janitor's apartments, electric light fixtures, cement floor in basement, plumbing and vault fixtures in the court house at Warren.

The city of Thief River Falls, Minn., is having plans prepared for a dam to be built across Lake River, four miles south of the city. The dam will be erected for the city electric plant.

Captain Fugina of Fountain City has been awarded the contract from the government for the furnishing to Captain J. D. Du Shane, in charge of river improvement work between Winona and St. Paul, of 70,000 cu. yds. of brush to be used in the improvement work between Winona and Lake Pepin. Captain Fugina will cut most of this brush this winter.

Missouri.

✣Bids will be received until Noon, January 5, 1911, by Maj. Edward H. Schulz, U. S. Engineer, Kansas City, Mo., for construction of about 13,000 ft. standard revetment on Missouri River about 6 miles below Kansas City. Official advertisement will be found elsewhere in this issue.

New Jersey.

✣Bids will be received until 3:30 p. m., Dec. 7, by Board of Fire Commissioners, Charles S. Smith, Clerk, Newark, N. J., for furnishing the following f. o. b. Newark, N. J.: One (1) or more automobile, high-service wagons, with suitable equipment complete, to have a carrying capacity of not less than 1,500 ft. of 2½-inch cotton covered hose. Detailed plans and specifications to accompany each bid. One (1) automobile, runabout type, capable of carrying two passengers. Detailed plans and specifications to accompany each bid. Ten thousand (10,000) ft., more or less, of 2½-inch fifty-foot length fire hose, three-ply solid woven, cotton cover, four-ply rubber lining, or of a standard equally as good or better. Samples to be submitted. Couplings to be of brass, the material to be equal in quality, weight and other essential features to the couplings now used by the city of Newark on 2½-inch hose, to contain in raised letters N. F. D., and in raised figures, both the number and the month and year of delivery. The thread of coupling to be Higbie patent. All hose to be delivered from time to time, subject to the orders of the fire commissioners. One (1) motor-driven lathe, 24-inch belting, six feet six inches between central figures with all attachments.

New York.

✣Bids will be received until noon, Dec. 21, by Trustees of Public Buildings, Albany, N. Y., for the construction and plumbing of a power house and conduits for the New York State Capitol and Education Building at Albany, N. Y.

✣Bids will be received until 3 p. m., Dec. 8, by Park Board, Arsenal Bldg., 5th Ave., Manhattan, New York City, for furnishing all the necessary labor and material for the construction of a comfort and shelter building in Winthrop Park, Borough of Brooklyn.

Returns from all counties of the state, with the exception of five, on the question of bonding the state in $2,500,000 for the development of the Palisades Park is as follows: In favor, 334,062; against, 274,303. This is a majority of 59,759 in favor of the plan and it is not probable that this will be offset by the vote from the missing counties, which are Fulton, Nassau, Orleans, Rensselaer and Rockland. The proposal submitted in connection with the Palisades Park project contemplates a bond issue to the amount of $2,500,000 for the extension and beautification of the projected park on the western shore of the Hudson, below Newburg. The ratification by the voters will insure to the state the gift of 10,000 acres of forest land in the highlands of the Hudson, which was tendered by Mrs. E. H. Harriman, widow of the late railroad man, contingent on favorable action by the voters on the bond issue.

No bids were received Nov. 29 by the Commissioner of Fire Department, city of New York, for two gasoline propelled pumping engines. The same will be readvertised.

Ohio.

✣Bids will be received until noon, Jan. 2, by Board of Education, City Hall, Cincinnati, O., for the necessary labor and material for the completion of a new school building on the 14th District School lot on the northeast corner of Freeman Ave. and Poplar St. C. W. Handman is Business Manager.

✣Bids will be received until Noon, December 21, by Board of City Hall Commissioners, Cleveland, O., for furnishing the necessary labor and material for the excavating, footings and foundations up to grade for the City Hall building. Plans and specifications can be seen at the office of J. Milton Dyer, 825 Cuyahoga Bldg., Cleveland, O., the architect. A certified check for $5,000 must be filed with each bid and made payable to the city of Cleveland, O. Edward A. Roberts, Clerk.

The Monongahela & Western Co., Pittsburg, Pa., at $11,167, was the low bidder for removing Sand Creek dike in the Ohio River and dredging the channel at that point for the U. S. Government.

Oklahoma.

The Oklahoma Quarries & Construction Co., of Oklahoma City, has been incorporated with a capital stock of $100,000, the incorporators being John M. Wheeler, Daniel B. Ridpath and E. J. Heavener.

Oregon.

✣Bids will be received until 8 p. m., Dec. 10, by Directors of School District No. 2 of Lincoln County, at Toledo, Ore., for the construction of a high school building at that city. Charles H. Burgraff, Albany, Ore., is Architect.

Pennsylvania.

The Raymond Concrete Pile Co. of New York and Chicago has been awarded the contract for the foundations, including Raymond concrete piles, of a traveling craneway at the Allegheny plant of the Pressed Steel Car Co., Pittsburg, Pa.

Rhode Island.

The Hannan & Daly Dredging Co., of Ogdensburg, N. Y., which has had a large portion of its plant at work in the harbor at Boston for four years, has been awarded a government dredging contract at Newport, R. I., and within a short time will remove the large elevator dredge, Denver, to the Newport harbor. The company also received a contract from the city of Boston for work to be done in the Mystic River.

✣Bids are being asked until 2 p. m., Dec. 17, as noted in our Nov. 23 issue, by Lt.-Col. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging in Providence River, R. I. The work is located in Providence River between Gaspee Point, about 3½ miles below Fields Point in Providence Harbor, and Buoy No. 11, about ½ mile below the latter point. The work consists in widening and straightening the channel by dredging from a line just above Gaspee Point, to about black buoy No. 11 below Fields Point, covering a total length of about three miles, so that there shall be a minimum bottom width of 600 ft., with enlargements at the two bends within the limits of the work to a bottom width of about 800 ft., all with a depth of 25 ft. at mean low water. The channel has been dredged to a depth of 25 ft. at mean low water and now has a width of about 400 ft. It is proposed to straighten the channel by cutting off the bends and to widen the channel where necessary by dredging on one or both sides of the present channel, as shown on the maps above referred to. The estimated amount of dredging required is 1,098,240 cu. yds. measured in the scow. It is intended to award the work as a whole to one bidder.

South Carolina.

✣Bids will be received until Noon, December 15, by town of Yorkville, S. C., for mechanical gravity filtration plant with capacity of from 250 to 500 gals. per minute. Plant to be complete. Loss of head gauges, controllers, pump and motor belts, pulleys, shafting hangers, ready for operation. A certified check for $250 must be filed with each bid John G. Barnwell is Superintendent of the Water Works.

Tennessee.

The J. R. Watkins Co., of Winona, Minn., manufacturers of patent medicines, has awarded a contract to the Ferro Concrete Construction Co., of Cincinnati, for the erection of a 6-story office, laboratory and warehouse building at the northwest corner of Iowa and Kentucky Ave., Memphis. The building will be 60 by 160 ft., built of reinforced concrete throughout and fireproof.

Texas.

The City Council of Temple, Tex., is investigating the feasibility of establishing a city crematory for the reduction of all municipal garbage, offal and general refuse. It is estimated that the plant will cost between $5,000 and $10,000. M. O. Woodward is City Secretary of Temple

Utah.

The Lehi-Tintic Mining Co., George Nichols, Manager, American Fork, Utah, is to drive an 800-ft. tunnel to open up and explore its territory of over 240 acres in the northeastern part of the Tintic district. The property is located six miles northeast of Eureka

Items marked thus ✣ indicate work now open for bids.

Virginia.

✣Bids will be received until December 10, by Capt. C. C. Rorebeck, Quartermaster, Fort Monroe, Va., for furnishing 520 electric fixtures, 300 ft. cable, 200 lbs. assorted nails, 40 lbs. assorted tape and 3,000 ft. rubber covered wire.

The Manufacturing Light & Power Co., of Strasburg, Va., has been incorporated with a capital stock of $50,000, and proposes to develop electric power from the Shenandoah River near Strasburg.

Washington.

✣Bids will be received until 11 a. m., January 28, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for a general foundry building at the navy yard, Bremerton, Wash.

✣Bids will be received until 11 a. m., January 21, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for an oil storage house at the Puget Sound Navy Yard, Puget Sound, Wash.

West Virginia.

✣Bids will be received until 11 a. m., December 22, by Capt. F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and erecting steel locks gates and furnishing and delivering Poiree dam trestles, gate recess covers and tank pit covers.

Canada.

✣Bids will be received until 4 p. m., Dec. 21, by R. C. Des Rochers, Secy. Department of Public Works, Otatwa, Ont., for additions and alterations to the Public Building, Peterboro, Ont. William Blackburn, Peterboro, Ont., is architect.

✣Bids will be received until noon, Dec. 28, by F. J. Griffiths, Secy.-Treas., City of Sherbrooke, Que., for the construction of a concrete dam and power house in the Magog River near Rock Forest. Ross & Holgate, 80 St. Francois Xavier St., Montreal, Que., Engineers. Each tender must be accompanied by a marked check for $5,000.

✣Bids will be received until noon, Dec. 22, by City Commissioners, Calgary, Ont., for supplying one 1,500 H. P. synchronous motor generator; also one motor generator exciter set, including switchboard instruments, etc. W. D. Spence is City Clerk.

Mexico.

The Maya River Power & Land Co., Denver, Colo., is reported to have financed its hydro-electric projects in Mexico and is said to be about ready to let construction contracts. The plans which have been adopted call for the building of three great dams and the installation of that number of hydro-electric plants. These plants will have an aggregate capacity of 300,000 hp. The surveys that have been made for the proposed dam across the Maya River in the State of Sonora call for a structure 170 ft. high, 260 ft. long at the top and forming a reservoir of a capacity of 10,280,000,000 cu. ft. of water. The dam across the Humaya River will be 228 ft. high, 708 ft. long at the top and will form a reservoir of a capacity of 11,384,500,000 cu. ft. of water. The dam across the Santiago River will be 215 ft. high, 145 ft. long at the top and will form a reservoir of a capacity of 9,360,000,000 cu. ft. of water. The hydro-electric plant that the company will install on the Santiago River will furnish power chiefly for the Southern Pacific Railroad of Mexico.

BRIDGES—STEEL AND CONCRETE

Alabama.

Advices from Cullman, Ala., state that the Virginia Bridge & Iron Co., Roanoke, Va., has been awarded the contract for the construction of a four deck-girder bridge, consisting of seven 80-ft. spans, one 60-ft. span and two 90-ft. spans; two half through bridges of 80 ft. spans and one 60-ft. half through. The work will include 6,480 cu. yds. of concrete for which H. B. Arnott & Co., Birmingham, Ala., has the contract.

California.

The Improvement Club, of College Hill, has succeeded in securing an appropriation of the supervisors at San Francisco, Cal., for $10,500 for the construction of the Richland Ave. bridge across the tracks of the Southern Pacific. Plans for the improvement are being prepared and it is expected that bids for the work will be asked soon.

Committee has been appointed by the Supervisors of Nevada and Yuba Counties, Cal., to take up the matter of purchasing the toll road and bridge over the Middle Yuba at Frenan's Crossing.

Connecticut.

Engineering experts who have been studying the matter of dredging the channel of the river in the vicinity of East Washington Ave., Bridgeport, Conn., recommend the construction of a new bridge at an estimated cost of $60,000.

Florida.

Commissioners of Dade Couny, Miami, Fla., have awarded the contract for the construction of two steel bridges, one over the Little River and the other over the Snake River to the Champion Bridge Co.

Idaho.

The County Commissioners, Boise, Idaho, have awarded the engineering contract to LaPointe & Fox for the proposed new reinforced concrete bridge to span the Boise River in place of the old structure at 9th St. It is planned to have the new bridge completed before the highwater in the early spring.

Illinois.

✣Bids will be received until noon, Jan. 9, by Board of Trustees, East Side Levee and Sanitary District, Sexton Bldg., East St. Louis, Ill., for the construction of four highway bridges over Cahokia Creek Diversion Channel, Madison County, Ill. Each structure will have two 60-ft. spans and one 150-ft. span, structures Nos. 1 and 2 having 24 and 20 ft. roadways respectively and 2 and 3 having 16 ft. roadways. The bridges will rest on two piers about 23 ft. high and two abutments about 16 ft. high, and will have reinforced concrete floors and macadam wearing surfaces. Official advertisement will be found elsewhere in this issue.

Providing the city officials of Peoria, Ill., can induce the Chicago, Rock Island & Pacific and P. & P. U. Rys. to furnish the necessary funds a viaduct approach will be built for the new steel bridge at that place.

The wooden bridge at Troy Grove, near Ottawa, Ill., was recently destroyed by fire and the same will be replaced by a steel structure in the spring.

Thomas G. Pihlfeldt, City Bridge Engineer, Chicago, Ill., has plans prepared for the construction of a bridge to take the place of the present structure at Lake St., and to take care of the traffic while the change is made at an additional cost of $100,000. The bridge proposed is of vertical lift type and would cost $400,000.

Aldermen of Peoria, Ill., have approved the plans and specifications for the removal of the debris at the bottom of the Illinois River and the construction of a new bridge at that site. Plans will now be printed and placed in working order by Engineers Hedrick & Cochrane, after which bids will be advertised.

Highway Commissioners of Ruyle Township, Ill., have awarded a contract to Nelson Bros., Jerseyville, Ill., at $1,050 for the construction of a steel and concrete bridge.

The Supervisors of Williamson County, Ill., have awarded a contract to the Decatur Bridge Co. at $1,250, for building a steel bridge over Crab Orchard Creek, one mile south of Marion, Ill., on Court St.

City Council of Moline, Ill., has ordered the improvement of the Rock River bridge at once, upon the recommendation of the Bridge Committee. The work will include planking and new rails.

Indiana.

✣Bids will be received until 2 p. m., Dec. 7, by Board of County Commissioners of Pike County, at Petersburg, Ind., for the construction of four bridges in Logan Township. F. R. Bilderback is County Auditor.

The County Council at LaGrange, Ind., has appropriated the sum of $12,409 for the construction of bridges over the new Fly Creek ditch.

Iowa.

The City Council will hold a meeting Dec. 12, at 8 p. m., in Marshalltown, Ia., for considering and determining the cost and proportion of expense of the proposed Third Ave. viaduct to be borne by the Northwestern and the Iowa Central Railways.

The Supervisors of Dubuque County, Ia., at Dubuque, are to take up the matter of constructing a bridge on the county line in Sec. 3, Washington Township, petitioned for by Fred Loes, et al.

Business interests in Burlington, Ia., are contemplating taking steps toward securing the construction of a new bridge in that city suitable for interurban traffic; it is estimated that such an improvement would necessitate an expenditure of several thousand dollars.

Kansas.

✣Bids will be received until noon, Dec. 7, by J. A. Hunter, County Clerk, Newton, Kan., for the erection of three pile bridges in the county.

Information received from Galesburg, Kan., states that a petition is being circulated in that vicinity for presentation to the County Commissioners, asking that a bridge be constructed across the Shaw Branch of Labette Creek.

Salina, Kan., business men are advocating the construction of a new concrete bridge over the Smoky Hill River, at Iron Ave., to replace the old steel structure which they favor being moved to Mulberry St.

The Board of County Commissioners, Leavenworth, Kan., have ordered the reconstruction of three new bridges, one in Tonganoxie Township, one in Alexandria Townshi and one in Stranger Township.

Massachusetts.

✣Bids will be received until noon, Dec. 12, by Superintendent of Streets, Street Department, Boston, Mass., for repairing bridge over Neponset River.

Citizens of Cambridge, Mass., are to raise funds for the construction of a reinforced concrete bridge over the Charles River, at Boylston St., 12 ft. above the water level, according to specifications approved by the U. S. Engineers. The cost of the work has not yet been determined, but is estimated at about $300,000.

Michigan.

✣Bids will be received by the Commissioners of Delta County, Escanaba, Mich., until 2 p. m., Dec. 20, for the construction of a concrete highway bridge over the Escanaba River at Wells, Mich. John A. Semer, Escanaba, Mich., is Clerk of the County. Official advertisement will be found elsewhere in this issue.

It has been suggested by Horatio S. Earle, former State Highway Commissioner of

Michigan, that a bridge be constructed across the straits of Mackinac, wiping out all sectional lines of the northern and southern peninsula. The length of the span would be 3½ miles.

Missouri.

The Twelfth St. Traffic Way Commission, Kansas City, Mo., has approved the detailed plan for a viaduct as outlined in the resolution adopted by the Board of Public Works recently, and the next step will be the adoption of the plans and specifications for the work and the presentation of ordinances to the Council to do the grading and to construct the viaduct. The estimated cost of the entire improvement is estimated at $1,425,000.

The County Court at Columbus, Mo., has awarded the contract for the construction of eight new steel bridges throughout the county, at an aggregate cost of $6,100.

Nebraska.

At a regular meeting of the County Commissioners, Franklin, Neb., Nov. 16, it was voted to put a steel bridge across the Republican River east of Riverton. Bids for the work will be called at once for the improvement, which, it is estimated, will require an expenditure of $8,000.

The City Engineer's force, Omaha, Neb., has begun the plans for the construction of the viaduct over Eleventh St., which is to replace the oldest structure in the city. It is thought that the project will meet no opposition.

It is reported in Omaha, Neb., that the Union Pacific Ry. Co. is planning the construction of a new bridge over the Missouri River to replace the old structure east of the Union Station, and that the Engineering Department was soon to take up the matter of preparing plans for the same.

New York.

Mayor Gillmore, Utica, N. Y., has been advised by State Engineer, Albany, N. Y., that plans and specifications are being prepared for the construction of a bridge over the Barge Canal in North Genesee St., with a 42-ft. roadway and 6-ft. passages on each side of the main passage. The contract for the work will be let sometime next summer.

According to recent communications from Troy, N. Y., The Boards of Supervisors, Saratoga and Rensselaer Counties, New York, have adopted resolutions declaring that public sentiment demands that the Waterford bridge crossing the Hudson between the two counties be made free, and recommending that the State Highway Commission take the matter in hand. The structure is valued at $125,000.

Joseph Casey, 136 Liberty St., New York City, has been awarded the contract by the Central Park Board of New York City for repairs to three bridges in Forest Park for $1,298. Bids were opened Nov. 17.

North Carolina.

✣Bids will be received until noon, Dec. 21, by Capt. Earl I. Brown, U. S. Engineer, Wilmington, N. C., for the construction of fender piers for highway bridge over Core Creek, near Beaufort, N. C.

North Dakota.

Advices from Drayton, N. D., state that the County Commissioners have taken action refusing to make an appropriation of $25,000 for the construction of the proposed bridge across the Red River at that place. It is believed that an election will be held to decide the matter.

Ohio.

✣Bids will be received until 11 a. m., Dec. 2, by Board of County Commissioners, Youngstown, O., for furnishing the necessary labor and material for the construction of a steel bridge 405 ft. in length over Powers Run, on Powers Way, in Youngstown Township. A certified check made payable to C. T. Truesdale, Treasurer of Mahoning County, for the sum of $5,000, must be filed with each bid. W. B. Jones is County Auditor.

Bids were recently advertised by the Commissioners at Zanesville, O., for the substructure of the 5th St. bridge. It is planned to have this work ready for the concrete by April 1, and to start steel work about the first of May.

Special meeting of the Newport General Council has been called in Newport, Ky., for the purpose of taking up the matter of building a viaduct at the head of Monmouth St., to eliminate the present grade crossing.

The County Commissioners have been requested by the Chamber of Commerce and the Southside Building and Improvement Association, Columbus, O., to take up the matter of constructing a new steel bridge over the Scioto, at West Mound St., capable of bearing street car traffic.

Citizens of Nile, O., will take definite steps toward securing the construction of a new bridge over the Mahoning River at that place the coming year.

Oklahoma.

The Oklahoma Union Traction Co. is to solicit the aid of the city of Tulsa and Tulsa County, Okla., in building a new double deck bridge over the Arkansas River at Tulsa, for the Sapulpa Interurban line.

Information received from Muskogee, Okla., states that the county voted by a large majority a bond issue of $150,000 to provide funds for the construction of 33 new bridges.

Oregon.

✣Bids will be received until Jan. 2, by the city of Portland, Ore., for the construction of the proposed Broadway bridge substructure. Ralph Modjeski, Chicago, Ill., is Consulting Engineer.

The Mount Hood Ry., Joseph W. West, Mount Hood, Ore., Chief Engineer, has work under way on the trestle that will form the approaches to the bridge over the Sandy River. The work will require about 1,400 ft. of trestle on one side of the river and about 400 ft. on the other side.

Pennsylvania.

The American Railways. Co. and Delaware & Hudson Ry. will, in connection with the straightening of the Lackawanna River at Lover road, let a contract this winter for the construction of a viaduct in Scranton, Pa. George H. Burgess, Albany, N. Y., is Chief Engineer of the D. & H. Co.

A hearing will be held at Pittsburg, Pa., by Engineers of the U. S. Army, in regard to raising the bridges spanning the Allegheny River at Pittsburg, Pa.

The County Commissioners have authorized Hartley-Zeigler Co., contractors for building the College Ave. bridge, York City, Pa., to begin active construction work at once. The contract price of the improvement is $28,294.

South Carolina.

It is reported that the County Supervisors, Greenville, S. C., on Nov. 29, let a contract for the construction of two steel bridges. one at Cordan Falls, near Fork Shoals, and the other on the road from Fountain Inn to Fairview Church, over the creek. J. P. Goodwin is Supervisor.

South Dakota.

Engineer Trimmer has presented his estimate of the cost of a sewerage plant to meet the needs of the city of Madison, S. Dak., at $64,585. This estimate covers the cost of main pipe, excavating trenches, back-filling, manholes, covers for the same, flush tanks, septic tanks, 2 acres of ground for the disposal station, construction of filter beds, 2 motor driven centrifugal pumps, engineering and incidental expenses.

Texas.

✣Bids will be received until 10 a. m., Dec. 10, by George L. Fearn, Dallas, Tex., County Auditor, for construction of the Oak Cliff approach to viaduct. The work will include 50,000 cu. yds. of earth embankment and 300 yds. of reinforced concrete. A certified check for $1,000, payable to John L. Young, County Judge, must be filed with each bid.

✣Bids will be received until 10 a. m., Dec. 21 by the Board of County Commissioners, Dallas, Tex., for the construction of three swing bridges, the work including furnishing and erecting three swing spans of 212 ft. each. Plans and specifications are on file at the office of the County Engineer. George L. Fearn is County Auditor.

The City of Houston, Tex., in connection with the Ship Channel proposition, mentioned elsewhere in this issue, will vote Jan. 10 an issuing $500,000 of bonds for the construction of a viaduct across the channel at the foot of Main St.

An agreement has been reached by the city officials of Belton, Tex., and those of the Santa Ry., whereby the company will construct a viaduct over its tracks on North Main St., and the city will pay certain damages in consequence of the Mayor removing the old viaduct. The cost of the new structure is estimated at $16,000.

The Railroad Commission, Austin, Tex., has instructed the St. Louis, Brownsville & Mexico Ry. to make temporary repairs and to replace approaches to bridge of the company over the Colorado River, between Bay City and Buckeye. C. B. Rodgers, Kingsville, Tex., is General Manager of the company.

Virginia.

✣Bids will be received until 4 p. m., Feb. 1, by Charles E. Bolling, City Engineer, Richmond, Va., for the erection and construction of a reinforced concrete bridge over the James River, not to exceed a cost of $225,000. Each bid must be accompanied by a certified check for $5,000, payable to the City Treasurer. Official advertisement of the work will be found elsewhere in this issue.

Committee of Roads and Bridges, Danville, Va., will probably take up the matter shortly, of securing plans for the construction of a highway bridge over Dan River. J. O. Magruder is City Engineer.

The Roanoke Bridge Co., of Roanoke, Va., has been awarded the contract by the County Commissioners at Madison, Va., for the construction of three bridges of steel, two 50 ft. and one 40 ft. long in Madison County, for $3,842. Bids were opened Nov. 22. P. St. J. Wilson is State Highway Commissioner, Richmond, Va.

Washington.

Board of County Commissioners, Wenatchee, Wash., have awarded a contract to J. W. Quigg for constructing a wing dam for the bridge at Cashmere. Chelan County will furnish all material and the contractor will be paid 9½ per cent of the cost of the material for his share.

Advices from Ritzville, Wash., state that the County Commissioners have let contracts for the construction of three bridges across Crab Creek on the Othello Road, 360 ft. long with 60 ft. of steel, one across Second Coulee 174 ft. long with 60 ft. of steel, and one over the Coulee 84 ft. long with 60 ft. of steel. The work will be done by the Coast Bridge Co., Portland, Ore., at a cost of $7,723.

A contract for the erection of a temporary bridge to replace the one recently washed out by a log jam, over the White River at Buckley, Wash., has been awarded by the County Commissioners to Hickleman & Waite, of that city, for $1,020. The new structure will be 80 ft. long.

West Virginia.

It is reported in Fairmont, W. Va., that plans are under way by the Engineering Department of the Baltimore & Ohio R. R., for the construction of the double track bridge over Monongahela River. A. W. Thompson, Baltimore, Md., is Chief Engineer of the company.

Canada.

The Railway Commission, according to advices from Belleville, Ont., on Nov., 29, held a meeting with the Canadian Northern Railway officials in regard to the construction of the proposed bridge over the River Moira.

Items marked thus ✣ indicate work now open for bids.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until 11 a. m., December 7, by Maury Nicholson, City Engineer, Birmingham, Ala., for the construction of certain bithulithic paving and vitrified brick or granitoid gutters.

The city council of Huntsville, Ala., has awarded the contract for cleaning the streets of the city to Frank E. Murphy. All paved streets are to be swept three times each week, and all garbage is to be hauled to a point beyond the city limits.

Probate Judge J. E. Camp of Talladega, Ala., has secured the services from the agricultural department at Washington, D. C., of D. H. Winslow, a road engineer, who will examine the county roads and aid the county officials with expert advice.

The citizens of Cullman, Ala., at a recent mass meeting, voted to issue bonds for the building of sidewalks on all the principal streets in the business section.

California.

On Nov. 8 the counties of California voted the issuance of bonds to the amount of $18,000,000 for the construction of good roads throughout the state. Probably the first to take action since the election is the Sacramento Valley Development Association, which held a meeting Nov. 19 to investigate the feasibility of securing good roads for the Sacramento valley. A committee consisting of the following was appointed to act at once upon the matter: Morris Brooks of Sacramento; E. Franklin, of Colfax, Placer County; H. P. Stabler, of Yuba City, Sutter County; G. W. Pierce, of Davis, Yolo County; and J. W. Kaerth of Colusa, Colusa County. State Engineer N. Ellery, Sacramento, Cal., is preparing a bill which he will present to the legislature, asking an appropriation of $250,000 for the purpose of making the necessary surveys that will be required throughout the state to carry into effect the $18,000,000 bond issue for good roads.

At a recent election the citizens of Vernon City, a suburb of Los Angeles, Cal., voted the issuance of bonds to the amount of $100,000 for the completion of a well-paved highway to Long Beach from the business district of Los Angeles. The paving will be done on the portion of Santa Fe Ave. within the city limits of Vernon. Gesner Williams is city attorney of Vernon.

The Chamber of Commerce of Santa Cruz, Cal., has adopted a resolution requesting the supervisors of Santa Cruz County to begin the construction of a mountain road between Santa Cruz and San Jose. S. A. Palmer is president of the chamber and John H. McIsaac is secretary.

It is the joint plan of the two counties of San Bernardino and Riverside, San Bernardino and Riverside, county seats respectively, to build a road between Redlands and Beaumont. The road will be constructed within the new few months.

Rife, Cave & Frenzell of San Dimas, Cal., were the only bidders for the improvement of a portion of San Dimas Ave., and part of the Covina, Lordsburg, road bids for which were received last week by the Board of Supervisors at Los Angeles. Their lump bid was $3,863 for grading, macadamizing, oiling, culverts, etc.

Plans have been prepared by J. C. Fountain of Huntington Beach, Cal., and contracts will be let within 30 days for the construction of 28 blocks of petrolithic pavement in Huntington Beach. Cement curb will be laid on 17 blocks of the streets. C. F. Sorenson of Huntington Beach is the official in charge.

Colorado.

Citizens of Clear Creek and Jefferson county, Colo., are planning the construction of a state highway from Denver through Golden to Idaho Springs. Mayor George Kimball of Idaho Springs is interested.

Commercial bodies of the Clear Creek district, Colo., have appropriated $15,000 for the conversion of the present narrow road between Idaho Springs and Denver into a wide highway. It is proposed to have the Legislature assist in making it modern in every respect. C. P. Allen is president of the State Highway Commission. Dr. F. L. Bartlett, president of the Denver Chamber of Commerce, is interested.

Florida.

✣Bids will be received until 7:30 p. m., January 5, by W. F. Divine, City Clerk, St. Petersburg, Fla., for grading paving with vitrified brick laid flat, and curbing with granite 2d St., from First Ave. north to Seventh Ave., North. The roadway is 30 ft. wide. M. W. Spencer is Civil Engineer in charge.

The county commissioners at Tavares, Fla., are considering a project which provides for a hard clayed road from Mount Dora, through Sorrento and on to the Wekiwa river, a total distance of about 14 miles. The Orange county officials, Orlando, Fla., contemplate taking up the road at the river, the dividing line between Orange and Lake counties, and carrying it through the remaining 10 miles to Sanford.

A subscription paper is being circulated among the people of Palatka, Fla., for the purpose of raising a fund sufficient to hard surface Kirby St., from the point where the pavement will end to Palatka Heights, thence north to connect with two hard surfaced county roads.

The city council of St. Augustine, Fla., recently decided to make street paving improvements to the amount of $30,000 during the next few months.

Illinois.

The township board at Urbana, Ill., has been petitioned for the opening of a highway from the Perkins school house to the northern extension of Coler Ave. If the project goes through the new highway will begin at the northeast corner of section 8, run westward to the west side of the Saline ditch, thence northwestward along the ditch to a point east of the southeast corner of Woodlawn cemetery and thence west to the extension of Coler Ave.

The Clayton Automobile club has been organized at Clayton, Ill., with G. A. Shank as president and W. H. Craig secretary, to aid in securing the construction of good roads throughout the county.

Indiana.

✣Bids will be received until 10 a. m., Dec. 21, by County Commissioners, Fort Wayne, Ind., for the construction of highways in Maumee Township. George W. Lindemuth is Auditor of Allen County.

The board of county commissioners of Marion County, Indianapolis, Ind., has been advertising for bids for about 350 carloads of stone with which Marion county roads will be improved. Improvements will be made on the Crawfordsville pike, the National road west of the city, the Maywood road and the Pendleton road.

Iowa.

The city engineer of Mason City, Ia., has plans for the construction of over 14,000 ft. of paving, over two and one-half miles in length, for next year. Most of the paving will be of concrete.

According to Mayor Thomas Maloney of Council Bluffs, Ia., the paving of Broadway St., is to commence as soon as the frost is out of the ground.

Kansas.

A movement has been started by the business men and farmers of Coffeyville and Independence, Kan., to build a macadam road from Leavenworth west to the Jefferson County line.

Louisiana.

Bids were opened as follows last week by the board of port commisisoners at New Orleans, La., for the granite roadway from Thalia St., to Bienville, paralleling the levee, for which A. C. Bell is engineer; (1) standing for lin. ft. headers in place; (2) standing for cu. yd. concrete pavement foundation; (3) stand for sq. yd. new granite foundation, and (4) standing for sq. yd. old granite:

	(1)	(2)	(3)	(4)
A. L. Patterson & Co.	50c	$5.65	$2.15	$1.10
Louisiana Bitulithic Co	45c	5.70	2.12	1.90
Standard Paving and Contracting Co.	30c	6.00	1.89	60
Etta Contracting and Construction Co.	45c	4.75	2.18	90
Jas. A. Craven & Co.	40c	5.50	2.30	80
Grasser Construciton Co	38c	4.22	1.03	73
J. E. Ramsey, of Salisbury, N. C.	50c	5.40	2.60	80

Finance committee of the city council of New Orleans, La., has accepted the following bids for street improvements in the city; Grading the neutral ground of St. Claude Ave., from Montegut to Delery Sts., Hampton Reynolds, $19,640; installing subsurface drainage in connection with paving of Erato St., from Carondelet to Magnolia; Richard Brock, $41,104; paving Soniat St., from Coliseum to Magazine, Standard Paving & Construction Co., $7,432; repaving Seventh St., from Prytania to Camp, Barber Asphalt Co., $10,638; subsurface, etc., in connection with paving Seventh St., as above, Barber Asphalt Co., $8,675; installing subsurface drains, etc., in connection with paving of Jeannette St., from Carrollton Ave. to Audubon, Joseph A. Craven & Co., $17,561; paving of Jeannette St., as above, $17,013; subsurface drains, etc., in connection with paving Seventh St., from Prytania to St. Charles Ave., Barber Asphalt Co., $4,515; repaving Seventh St., as above, Standard Paving & Construction Co., $7,557; paving Erato St., from Carondelet to Magnolia, Southern Bitulithic Co., $34,754; subsurface drains, etc., in connection with paving Soniat St., from Coliseum to Magazine, Richard Brock, $8,024.

The finance committee of the city council of New Orleans, La., has approved the following bids: Installing subsurface drainage, culverts, curbs, etc., in connection with the paving of Rendon St., from Dumaine to De Soto, Standard Paving and Construction Co., $6,234; subsurface drains, culverts, etc., in connection with the paving of the lake side of Claiborne St., from Esplanade to Elysian Fields, Barber Asphalt Co., $15,542; subsurface drains, culverts, etc., in connection with the paving of Octavia St., from Freret to Robertson, Barber Asphalt Co., $4,247; paving Octavia St., from Freret to South Robertson, Barber Asphalt Co., $2,448; paving lake side of Claiborne St., from Esplanade to Elysian Fields, Barber Asphalt Co., only bidder, $44,269; paving Rendon St., from Dumaine to De Soto Standard Paving and Construction Co., $13,004.

Michigan.

The citizens of Wayne County, Detroit, Mich., county seat, have voted the issuance of bonds to the amount of $2,000,000 for the construction of good roads. John S. Haggerty is chairman of the board of supervisors of Wayne County.

The board of county road commissioners of Bay City, Mich., has decided to extend Gibson road for a mile and a half. Thomas Goodman is supervisor.

The Covington township board, Covington, Mich., has prepared a petition to be presented to the board of supervisors Dec. 8, asking for

Items marked thus ✣ indicate work now open for bids.

the transfer of four towns, 48-32, 48-33, 47-32 and 47-33, in L'Anse township, to Covington township. If the towns are transferred it is proposed to bond the township for the construction of a highway connecting Marquette with Baraga, Houghton and Gogebic counties.

Minnesota.

Citizens of Rushford, Minn., have started a good roads movement and are securing a subscription to a fund for that purpose. The highways leading into the city are to be improved.

According to advices from Duluth, Minn., a new automobile road is to be built between that city and Port Arthur, Ont., this coming summer. The road will be constructed along the north shore of Lake Superior.

Mississippi.

The Board of Supervisors at Gulfport, Miss., had bonds for sale Dec. 6 in the sum of $50,000 for road improvements.

Missouri.

The board of public works of St. Joseph, Mo., has granted the request of John H. Van Brunt, general manager of the street railway of that city, for permisison to pave between the rails on South Eighth St., Messanie to Olive, and in Messanie, Sixth to Eighth Sts., with vitrified brick. The paving will probably be deferred until spring.

The board of public works of Kansas City, Mo., on Nov. 29, adopted plans and specifications for the following work: Artificial stone curbing—Schaefer, from Washington to Broadway; Fortieth, from Euclid to Garfield; Twenty-sixth Terrace, from Walrond to College, Fortieth, from Woodland to Michigan; Michigan, from Thirty-ninth to Fortieth; Jackson, from a point 167.79 ft. north of Norledge place to Norledge place. Asphalt pavement—Schaefer, from Washington to Broadway; forty-third from State line to Belleview Ave., south of Forty-third. Rock asphalt pavement—Holly, from Twenty-seventh to Twenty-ninth. Portland cement concrete pavement—Jackson. from a point 167.79 ft. north of Norledge Pl., to Norledge Pl.; alley between Chestnut and Benton, from Twenty-fifth to Twenty-sixth; alley between Grand and McGee, from Independence to Sixth. The following resolutions for public work were adopted by the board of public works last week, public hearing of property owners set for Dec. 12: Repairing asphalt pavement—Charlotte, from Fifteenth to Sixteenth.

Nebraska.

An ordinance has been introduced in the city council of Lincoln, Nebr., creating alley paving district No. 59, being the alley between C. and C. and 10th and Ninth Sts.

The city council of South Omaha, Nebr., has been petitioned to pave T St., from 36th St., to 44th St., and 22d St., from Q to Y Sts.

City council of Lincoln, Neb., on Nov. 21, awarded the contract for paving districts No. 113 and No. 183 to M. Ford of Omaha, Neb., for $2.06 per sq. yd., total bid, $49,399. Other bidders were National Construction Co., South Omaha, Neb., $2.09, and Barber Asphalt Co., $2.11. District 113 is B St., from Seventh to 11th, and district 183 is C St., from 19th to 27th, B St., from 19th to 20th, and 19th St., from A to D Sts.

New York.

✣Bids will be received until Dec. 9, by Town Board of Inlet, N. Y., for the construction of a public highway from Sixth Lake Dam to Lime Kiln Lake. William E. Bill is town clerk.

✣Bids will be received until 3 p. m., Dec. 8, by Department of Parks, Arsenal Bldg., 5th Ave., Borough of Manhattan, New York City, for furnishing all the labor and materials necessary for the resurfacing of the speedway of Ocean Park way between Ave. J and King's Highway, Borough of Brooklyn.

✣Bids will be received until 3 p. m., Dec. 8, by Park Board, Department of Parks, Arsenal Bldg., 5th Ave., Borough of Manhattan, New York City, for all labor and materials required for setting new blue stone coping and resetting old blue stone coping on a concrete foundation and erecting and completing brass rail fence in the Borough Hall Park, Borough of Brooklyn.

The following amounts are to be raised in towns of Suffolk County, Riverhead, N. Y., county seat, for highway purposes for 1911: Babylon, $15,891; Brookhaven, $50,700; Easthampton, $9,200; Huntington, $58,500; Islip, $38,400; Riverhead, $16,200; Shelter Island, $5,025; Southhold, $20,325; Southampton, $10,850, and Smithtown, $8,400. The towns are also to be benefited by part of the State's $50,000,000 raised to build stone roads.

John J. Shea Contracting Co., 500 5th Ave., New York City, has been awarded the contract for repaving with undressed granite blocks the roadway of Southern Blvd., from Willis Ave. to 138th St., for $55,662. Bids were opened Nov. 22 by the President of the Borough of Bronx, New York City.

Engineers are in Livonia, N. Y., going over the proposed state road which is to be built across the town from the Geneseo town line on the west to the Richmond town line on the east. It is understood that this road will be constructed during the coming year.

The city authorities of New York City have decided to open Roosevelt Ave., from Woodside to Flushing in the Borough of Queens. The new highway will practically be a continuation of Skillman Ave., and will extend from a point near Seventh St., Woodside, near the intersection of Skillman and Woodside Aves., about three miles east to Flushing, where connections will be made with the highways leading to the residential territory on the Sound and East River front of the borough. The complete construction cost of the new avenue, including grading and paving will probably exceed $2,000,000.

An underground street, the first of its kind in the world, under St. George's hill, on upper end of Manhattan Island, is to be built. The street will be 1,000 ft. long and will be built to enable persons who will use the new subway station at St. Nicholas Ave., and 190th St. The tunnel will be 16 ft. wide and 16 ft. high., and will cost approximately $500,000. Nelson P. Lewis, chief engineer of the board of estimate of New York City, is interested.

Ohio.

✣Bids will be received until Noon, Jan. 3, by Director of Public Service, John W. Lowe, Circleville, O., for paving with vitrified brick Court St. The work includes the following approximate quantities: 41,883 sq. yds. brick pavement, including 6-in. concrete foundation, 2-in. sand cushion and cement or asphalt filler; 16,540 lin. ft. straight curb Berea; 940 lin. ft. circular curb Berea; 1,670 lin. ft. stone edging; 24,636 cu. yds. excavation; Grading at street and alley intersections; 528 lin. ft. 24-in. sewer in place; 615 lin. ft. 18-in. sewer in place; 10 catch basins, 4 manholes. O. W. Stiles, Circleville, O., is engineer. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until Noon, Dec. 7, by Director of Public Service, Cincinnati, O., for furnishing the necessary labor and materials for improving Marion Ave., from Isabella St. to Mt. Vernon Ave., by grading, setting concrete combined curb and gutter and macadamizing the roadway.

✣Bids will be received until Dec. 17, by the County Commissioners, Urbana, O., for the improvement of the Wayne township road for a distance of one mile from the property of B. F. Miller. The contractor will be given until March 1 to complete the work.

Ordinances have been passed by the city council of Cincinnati, O., authorizing bond issues of $9,500 for the improvement of Maplewood Ave., from McCormick Pl. to Helen St.; $22,000 for paving eight alleys, running east and west from Vine St., and north of Liberty St.; $6,000 for the improvement of Cass alley, and $2,000 for the purchase of two lots on Baltimore Ave., west of the North Fairmount school, for the purpose of erecting a retaining wall to prevent a landslide at the point.

The city council of Bellaire, O., has passed the following resolutions for street improvements: For improving Pine alley, from 45th to 46th Sts., by grading; to improve Cherry alley from Crescent to 31st Sts., by grading and paving; to improve 32d St., from Washington St. to Central Ave.; to improve Chestnut alley from 38th St. to Indian run; to improve Franklin St., from 35th to 38th Sts.; to improve sidewalks in South Bellaire.

According to the statement of County Engineer Sam Harper the Boulevard road of Portland, O., is to undergo a course of extensive repairs. The first half of the pike immediately after leaving the Chillicothe pike will be straightened and the whole road throughout its course to Timmonds Ave., will be graded and repaired. Fences will be moved back to the 42 ft. limit.

City Engineer George W. Tonson, of Toledo, O., has been asked by council committee on public improvements to furnish the city with estimates of the proposed cost of paving of Cherry St., between Summit and Bancroft Sts., as asked by the Cherry Business Men's club.

Citizens of Washington St. in Springfield, O., are urging the paving of that street with asphalt instead of brick.

City Engineer Shipley of Cincinnati, O., has estimated the cost of paving Melish Ave., from Burnet Ave. to Reading Road, at $31,885. The material will be wood block for part of the street.

The Board of Commissioners of Cleveland, O., awarded the contract for the grading of Granger Road at Station 45 in South Newburg Township to Romano Bros., for $2,688. Bids were opened Nov. 26.

Plans have been prepared and contracts will be let about March 1 for the construction of about five miles of brick pavement in Canton, O., on a concrete foundation, with cement or tar filler. City Engineer Phil H. Weber is engineer for the work and Warren Barr, City Clerk, has charge.

Oklahoma.

The electors of Oklahoma County, Oklahoma City, Okla., recently voted in favor of authorizing the county commissioners to issue good road bonds to the amount of $500,000 for the establishment of a road district under the new law. Eight townships are proposed to be consolidated into the first road district as follows: Council Grove, Oklahoma Crutcho, Choctaw and Elk, running across the county east and west through Oklahoma City, and the townships of Edmond, Britton, Oklahoma and Greeley, running north and south. The two roads to be built will extend to the county line and will intersect at Oklahoma City.

The board of park commissioners of Oklahoma, Okla., is planning as an addition to the new park boulevard, a double road shade drive from Northwest park to Belle Isle, a distance of more than three miles along North Creek. The new driveway will be 100 ft. wide with two roads, one on each side of the creek.

Oregon.

A subscription paper is being circulated in Eagle Point, Ore., to gravel the road from the new depot to the county road.

The Oregon Highway association has been formed in Portland, Ore., to aid in securing the construction of a trunk highway crossing the state from north to south. John S. Beall of Portland is interested.

The Barber Asphalt Co., has been awarded the contract by the executive committee of the board of public works of Portland, Ore., for the paving of the streets surrounding Ladd Park in the southwest quarter of Laurelhurst. This work comprises about three blocks each on East 33rd and East 39th Sts., about six blocks each on East Ankeny and East Oak Sts., and a couple of blocks of East Ash St.

Bids for improvement work on 36 streets were received Nov. 25 by the City Executive Board of Portland, Ore., as follows: Maywood Drive district improvement, grading and concrete curbs and walks, J. W. Sweeney Construction Co., $39,972; three separate improvement districts on Macleay Blvd., grading and concrete curbs and walks, Portland Cement Pile & Equipment Co., $18,655, $19,878 and $36,657; East Glisan St. from Union to

Grand, Hassam pavement, Oregon Hassam Paving Co., $2,264; Emerson St. from Kerby to Patton, Hassam pavement, Oregon Hassam Paving Co., $24,484; Custer St. from Kelly to Taylor's Ferry road, grading and concrete curbs and walks, Joplin & Meeks, $2,176; East Burnside St. from East 74th to East 82d, grading and concrete curbs and walks, G. K. Howlett, $5,306; California St. district, grading and concrete curbs and walks, Joplin & Meeks, $1,373; Constance St. from Union to East 7th, bitulithic pavement, Warren Construction Co., $5,796; Claybourne St. from East 14th to Milwaukee, grading and concrete curbs and walks, Giebisch & Joplin, $2,318; Denver Ave. from Killingsworth to Jessup, grading, O. Poulson, $459; East 40th St. from East Taylor to Hawthorne, Hassam pavement, Oregon Hassam Paving Co., $7,000; Klickitat St. from Union to East 7th, asphalt paving, Elwood Wiles, $6,011; East Lincoln St. district, grading and concrete curbs and walks, Giebisch & Joplin, $3,900, O'Neill & Co., $4,120; East Market St. from East 34th to Glenn, asphalt pavement, Barber Asphalt Co., $4,404; Northrup St. district, Hassam pavement, Oregon Hassam Paving Co., $3,541; Oberlin St., grading, R. J. De Buhr $174, Peninsula Feed & Fuel Co. $193; Princeton St. from Portsmouth to McKenna, grading and concrete curbs and walks, R. J. De Buhr $4,256, Peninsula Feed & Fuel Co., $4,975; Parkside Drive district, bitulithic pavement, Warren Construction Co., $5,489; Spokane Ave. from East 19th to East 23d, grading and concrete curbs and walks, Giebisch & Joplin, $3,038; Skidmore St. from Maryland to Court, bitulithic pavement, Warren Construction Co., $13,830; East 61st St. from East Stark to East Burnside, grading and concrete curbs and walks, G. K. Howlett, $3,642; East 69th from East Yamhill to East Taylor, grading and concrete curbs and walks, G. K. Howlett, $487; East 12th St. from Tillamook to Thompson, bitulithic pavement, Warren Construction Co., $2,347; East 13th St. from Killingsworth to Ainsworth, grading and concrete curbs and walks, Giebisch & Joplin, $4,282; East 26th St. from Alberta to Killingsworth, grading and concrete curbs and walks, Giebisch & Joplin, $4,049; East 25th St. district, Hassam pavement, Oregon Hassam Paving Co., $10,497; East 28th st. from Francis to Cora, grading and concrete curbs and walks, Keenan Bros., $2,959; Stephens Bros., $2,836; East 32d St. from Alberta to Prescott, grading and concrete curbs and walks, Giebisch & Joplin, $4,428; East Washington St. from East 22d to East 30th, grading and concrete curbs and walks, Giebisch & Joplin $2,410, O'Neill & Co., $2,654; Union Ave. from East Salmon to East Belmont, Hassam pavement, Oregon Hassam Paving Co. $11,350, Pacific Bridge Co., $12,797.

Pennsylvania.

State Highway Commissioner William Hunter, Harrisburg, Pa., is reported to have said that $1,000,000 is inadequate for the 98,000 miles of roads in the state of Pennsylvania and that an effort would be made to have the next appropriation increased to $3,000,000. Applications are on file at his office for the construction of 4,800 miles of road.

The board of trade of the 21st Ward, Philadelphia, Pa., William F. Dixon, president, is taking steps looking toward the construction of a boulevard in that ward, 100 ft. wide, for a distance of six miles.

The county commissioners at Pittsburg, Pa., have awarded the contract for paving the Ardmore Blvd., between Wilkinsburg and East Pittsburg, a distance of four miles, with brick, to Booth & Flinn. The paving will be 18 ft. wide.

Texas.

✣Bids will be received until Noon, Jan. 9, by City of Houston, Texas, Dan C. Smith, Jr., Clerk, for the issue of $100,000 4½% Street paving bonds bearing date the 26th of Sept. 1910. Official advertisement will be found elsewhere in this issue.

The city council of Amarillo, Tex., on Nov. 23, awarded the contract for street improvements in the sum of $75,000 to Ocklander Bros., of Dallas, Tex. Vitrified brick will be put in for $2.49 per sq. yd.

Petitions have been presented to the county commissioners' court, Palestine, Tex., for opening up and extending county roads, the most important being an order to open Trinity St., to a continuation with the New Boston road.

The commissioners' court at Aspermont, Tex., has closed up the contract with Austin Bros., of Dallas, to construct 10 miles of clay road, more or less, in the county. The following roads are to be clayed: Aspermont and Reed Crossing road, Aspermont and Gatling road and Aspermont and Guthrie road, and other roads. Work is to begin at once.

The contract for the building of the Transcalcasieu road from the Sabine river to Vinton has been awarded to Mayor E. W. Brown of Orange, Tex. The building of the road is to begin within 90 days and completed within six months.

Temple, Tex., city council has ordered City Secretary M. O. Woodward to advertise for bids for paving North Main St., and West French Ave., with durable paving material, the work beginning at the site of the new postoffice and extending about one mile into the residence district.

Anderson County citizens, Palestine, Tex., county seat, have voted in favor of the $.15 tax for the building and maintenance of good roads. About $30,000 will now be available for good roads each year.

The Board of Municipal Commissioners of Dallas, Tex., has let the contract for the paving of Haskell Ave. to the Texas Bitulithic Co. for $2.30 per sq. yd. The paving will extend from Ross to Pacific Sts. and will be laid on a five-in. gravel concrete base. The estimated cost of the work is $31,768.

Virginia.

Lee County, Jonesville, Va., county seat, voted Nov. 29 to issue bonds in the sum of $300,000 for the construction of good roads.

Scott County, Gate City, Va., county seat, voted Dec. 6, on the proposition of isuing bonds in the sum of $500,000 for the construction of good roads.

It is proposed by automobilists of Richmond, Va., and Newport News to construct a new highway between those cities. The highway will be connecetd with other highways, thus necessitating the construction of but 46 miles of road. W. A. Post of the Newport News Automobile association, is interested.

Citizens of Wise County, Wise, Va., county seat, are preparing to vote on a bond issue of $700,000 to be expended in building highways.

Washington.

Two mass meetings of business men of Waitsburg, Wash., were recently held to discuss plans for improving Main St., by paving or macadamizing.

The city council of North Yakima, Wash., has approved plans of City Engineer Doolittle for the laying of asphalt to the amount of 36,000 sq. yds. and 1,500 sq. yds. of brick in what is known as the West Yakima improvement, 2½ miles of paving in all. The improvements include the west end of Yakima Ave., and several cross streets and will cost about $125,000. The contract for the work will be let early in January.

Following bids were opened Nov. 26, by the board of public works of Seattle, Wash., for the improvement of lots 1, 2, 7 and 8, block 4, McNaught's addition, grading: Lewis & Wiley (awarded contract), $6,153; Agassiz & Hadley, $6,167; Crawford Plate grading and paving: Gravel base, Allan & Hull, $8,343; J. Ruthe, $9,708; S. Normile (awarded contract), $7,890; Clinker base, Allan & Hull, $8,343; J. Ruthe, $9,708; S. Normile, $7,889.

Board of Public Works, Seattle, Wash., has awarded the contract for grading and curbing Walnut Ave., et al., to the West Coast Construction Co. of that city for $32,520. Bids were opened Nov. 18.

West Virginia.

✣Bids will be received until Dec. 8, by the Board of County Commisisoners, Marlinton, W. Va., for the construction of a road from Bucks Run Hill for a distance of about 4,000 ft. in Pocahontas County.

Wisconsin.

A subscription amounting to $1,100 has been raised by Chas. Flume of LayFayette, Wis., for the improvement of the sand road between Sparta and Angelo.

Ashland County, Ashland, Wis., county seat, will spend $9,000 to build a county road from Ashland to Butternut.

The town board of DePere, Wis., on Nov. 22 granted the application for a highway between the farms of Mrs. D. M. Stalker and Mrs. Mary Girard in the town of Lawrence. The proposed road is 200 rods long and will run from the Bain road to the town of Hobart line.

The Milwaukee county board, Milwaukee, Wis., has set aside $100,000 for good roads as recommended by the park commission. Experts will be employed in January to study local conditions and outline plans so that work can be started, if possible, in May. James Sheehan is chairman of the board.

The park commission of Milwaukee County, Milwaukee, Wis., is planning to establish a boulevard on Lake St., from the lake to the Milwaukee river. The road will be 150 ft. wide.

The Douglas county board at Superior, Wis., has levied $221,790 for running the county during the coming year. Of that amount $54,000 will be used for the construction of roads and bridges.

The county supervisors at LaCrosse, Wis., have decided to invite A. R. Hirst of the state highway department at Madison, to LaCrosse to outline plans for next season's road work in the county. Oscar Hulberg is supervisor.

The town board of Lawrence, Wis., was recently petitioned for the construction of a new highway between the farms of Mrs. D. H. Stalker and Mrs. Mary Girard in the town of Lawrence. The proposed road is 200 rods long and would run from the Bain road to the town of Hobart line.

Plans have been submitted to the county board of Milwaukee County, Wis., by the county park commisison providing for a 150 ft. road from the western city limits on Vliet St., to the eastern limits of Wauwatosa, a 150 ft. road on Burleigh St., from the western limits to the South Fond du Lac road.

WATER-WORKS AND SEWERAGE

Alabama.

✣Bids will be received until 11 a. m., Dec. 21, by Maury Nicholson, City Engineer, Birmingham, Ala., for the construction of certain storm sewer mains and branches thereto at an estimated cost of $300,000.

The City Council of Huntsville, Ala., has appropriated $1,000 for use in finding a new water supply.

The City Council of Birmingham, Ala., has ordered the extension of the sanitary sewer. The work is to be done on Jemison St., Brignoli, Percy, 19th St., Spring St., and on Park Circle, in the north end of the city. A short line will be laid on the south side from Court St., to South St.

Arkansas.

✣Bids will be received until 3 p. m., Jan. 2, by Commissioners of Sewer District No. 1, Fordyce, Ark., for the construction of approximately 6 miles of sanitary sewers almost entirely 8 in. William J. Parkes, 107½ Main St., Pine Bluff, Ark., is Engineer. Official advertisement will be found elsewhere in this issue.

California.

✣Bids will be received by Board of Trustees, Oroville, Cal., until Jan. 3, for the construction of the new proposed sewer system in that place.

✣Bids will be received from 10 to 11 a. m., Dec. 21, by Board of Public Works, Oakland, Cal., for furnishing labor and material for the following propositions: For the construction of an extension to the main lake sewer from the western end of the existing sewer to a point 30 ft. northerly of the northern line of Yerba Buena Ave., for the Street Department. For the construction of an extension of the Thirty-sixth St. main outlet sewer from the western end of the existing sewer to a point 30 ft. northerly of the northern line of Yerba Buena Ave., for the Street Department. For dredging western end of the northern line of Yerba Buena Ave., for the Street Department. For dredging a channel and constructing levees with the dredging spoil in the "Key Route Basin," for the Board of Public Works, all said proposed improvements being in the city of Oakland, Alameda County, Cal.

The City Engineer of Wilmington, Cal., has finished plans for sewers in that city. The district to be covered appears to be all the inner harbor territory. Most of the streets in the business section are to be raised several feet so as to give a fall for the sewers into the bay.

The City Engineer of Oakland, Cal., has been instructed to prepare plans and specifications for resewering Franklin St., from 14th St., to 20th St.

The contract for the construction of the main sewer in the Belmont Annexed territory in Fresno, Cal., has been awarded to Joe House, of Oakland, for $37,900. Vitrified sewer pipe will be used.

Lerch & Hardy have been awarded the contract in Los Angeles, Cal., for laying sewers from Cherry Ave., to Lemon Ave., for $.69 per lin. ft.

Steps are being taken in Winters, Yolo County, Cal., to raise funds for the installation of a sewer system.

At a conference held between City Attorney Carleton Gray and P. N. Haviland, City Sewer Engineer, the plans for the new sewer system for Oroville, Cal., were decided upon. The Board of Trustees is asking for bids for the construction of the system, which will cost more than $100,000.

The construction of sewers in section C-2 of the North point main sewer system has been authorized by the Supervisors at San Francisco, Cal., at a cost not to exceed $85,000.

The Temescal Water Co., which will supply water to Corona, Cal., for domestic use, at a cost of $60,000, has made arrangements for a new 20-in. pipe line from its artesian wells in Temescal to this city. The line will be of concrete and steel and will have a capacity of 200 in. ?

Preliminary plans for an addition to the Porterville, Cal., City Water Works, have been adopted and within 20 days bond election to provide $75,000 will be held. According to the detailed plans which have been drawn by the City Engineering Department, it is proposed to drive a 16-in. well on the Murry addition at the base of Murry Hill.

Connecticut.

The Board of Sewer Commissioners of Ansonia, Conn., awarded the contract for the construction of Section "D" of the Ansonia sewer system to O'Neil Bros. & Nero of Hartford, Conn., for $15,162. The work includes 893 ft. of 27-in. vitrified pipe, 1,420 ft. of 24-in. vit. pipe, 1,331 ft. of 18-in. vit. pipe, 2,900 ft. of 15-in. vit. pipe and 35 manholes. V. B. Clarke is engineer. Bids were opened Nov. 17.

Delaware.

Lon. W. Clifton, of Dover, Del., has been awarded a contract by the City Council of that city for the construction of the new sewer main from Division St., northward to the Palmer home on American Ave., and eastward to the westerly side of Pennsylvania Ave.

T. Chalkley Hatton, consulting engineer of Wilmington, Del., is preparing plans for a new water supply plant for Skuylkill Haven, Pa. The construction of the plant will require several miles of cast iron pipe and will cost btween $50,000 and $100,000.

District of Columbia.

A committee composed of Asa E. Phillips, Supt. of Sewers; E. H. Thomas, Corporation Counsel, and Dr. William C. Woodward, Health Officer of the district, Washington, D. C., will soon present a plan to connect the sewer systems of towns within a radius of several miles of the district, to prevent the pollution of the Potomac and Anacostia Rivers and Rock Creek. The plan already advanced is to connect the various subsidiary sewerage systems into one great central system and discharge the outflow into the Potomac River below the city.

✣Bids will be received until 2 p. m., Dec. 19, by the Commissioners of the District of Columbia, for the construction of sewers in the District.

Georgia.

✣Bids will be received until 2 p. m., Dec. 20, by Board of Aldermen, Dalton, Ga., for furnishing all material and labor necessary for the construction of a system of sanitary sewers at that city. The work will include approximately 6 to 9 miles of pipe sewers from 8 to 15 in. in diameter and disposal plants complete. A certified check for $2,000 payable to the Mayor must accompany each bid. Plans and specifications can be seen at the office of the City Clerk, Dalton, Ga., or can be obtained of H. S. Jaudon Engineering Co., Box 582, Savannah, Ga., and Box 576, Atlanta, Ga.

The town of Kirkwood, Ga., will sell bonds Dec. 20 in the sum of $60,000 for sewer and water improvements. E. M. Willingham, Mayor, 540-542 Whitehall St., Altanta, Ga.

The Sewer Committee of the City Council of Atlanta, Ga., has awarded the contract for the building of the Proctor Creek disposal plant to the Municipal Engineering & Construction Co., of Chattanooga, Tenn., for $95,686. The contract for furnishing cement for the construction of the intercepting sewers was awarded to the Campbell Coal Co., of Atlanta, for $1.25 per barrel.

The citizens of Dublin, Ga., voted Dec. 6 on the proposition of issuing bonds to the amount of $30,000, for the purpose of paving streets and to improve the light and water plant.

The R. O. Campbell Coal Co. has been awarded the contract by the city of Atlanta, Ga., for furnishing and delivering 6,000 barrels of Portland cement for $1.5565 per barrel and $.07½ for all sacks returned. The cement is to be used for constructing the Proctor Creek intercepting sewer and is to be delivered on the line of the sewer. Bids were opened Nov. 21. R. M. Clayton is City Engineer.

Illinois.

✣Bids are asked by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Secretary, Room 302 City Hall, for constructing sewers in the following streets: Bids to be opened 11 a. m., Dec. 12, 1910: East 104th St., 275 ft. east of east line of Wabash Ave. to S. State St., 645 lin. ft., 1 ft. tile pipe, average depth 10 ft.; S. Wabash Ave., 1st alley south of East 103rd St., to 1,273 ft. north of north line of E. 107th St., 855 lin. ft., 1 ft. tile pipe, average depth 8.5 ft., 12 manholes and 12 catch basins, work to be completed June 1, 1914, estimated cost, $2,254.50; Balmoral Ave., N. Robey St., to N. Winchester Ave., 420 lin. ft., 1⅔ ft., internal diameter, double strength tile pipe, average depth, 9.5 ft.; Balmoral Ave., N. Winchester Ave. to N. Lincoln St., 420 lin. ft., 1½ ft. internal diameter, double strength, average depth, 8.0 ft.; N. Lincoln St., Balmoral Ave., to 620 ft. north, 630 lin. ft., 1¼ ft. internal diameter, average depth 8.0 ft.; N. Lincoln St., 620 ft. north to Bryn Mawr Ave., 640 lin. ft., 1 ft. internal diameter, average depth, 8.0 ft., wing sewers, 15 lin. ft., 1¼ ft. internal diameter, average depth, 8.0 ft., 16 manholes and 12 catch basins, work to be completed June 1, 1911; estimated cost $4,118; street car tracks in Robey St. and in Balmoral Ave., railroad tracks crossing Lincoln St., north of Balmoral Ave., sewer in Balmoral Ave., 11 ft. south of north line, contractor will rebuild all catch basins and hydrant basins disturbed by prosecution of work; Manistee Ave., from E. 83rd St. to E. 84th St., 670 lin. ft., 1⅔ ft. internal diameter double strength tile pipe, average depth 10½ ft.; Manistee Ave., from E. 84th St. to E. 85th St., 670 lin. ft., 1½ ft. internal diameter double strength tile pipe, 8½ ft., average depth; Manistee Ave., from E. 85th St. to E. 86th St., 670 lin. ft., 1¼ ft. internal diameter tile pipe, 8 ft. average depth; Manistee Ave., from E. 86th St., to E. 87th St., 670 lin. ft., 1 ft. internal diameter tile pipe, 6½ ft. average depth, 20 manholes and 31 catch basins. Work to be completed July 1, 1911; $6,000 estimated cost; macadam pavement on 83rd St., Phillips Ave., from E. 90th St. to E. 91st St., 670 lin. ft., 1¼ ft. internal diameter tile pipe, 6½ ft. average depth; Phillips Ave., from E. 91st St. to E. 92nd St., 630 lin. ft., 1 ft. internal diameter tile pipe, 7.0 ft. average depth, 10 manholes and 10 catch basins, 496 cu. yds. of rock (estimated) at $3, $1,488. Work to be completed July 1, 1911. Outlet 16 ft. deep, estimated cost $4,000; N. 40th Ave., Diversey Ave. to Schubert Ave., 669 lin. ft., 2 ft. brick sewer, single ring, average depth 12.0 ft.; N. 40th Ave., Schubert Ave. to Wrightwood Ave., 670 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 10.0 ft.; Parker Ave., N. 40th Ave. to N. 41st Ave., 671 lin. ft., 1¼ ft. internal diameter tile pipe, 8½ ft. average depth; Parker Ave., N. 41st Ave. to 320 ft. west, 360 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.5 ft. Schubert Ave., N. 40th Ave. to 210 ft. west of N. 41st Ave., 910 lin. ft., 1 ft. internal diameter tile pipe, average depth, 9.0 ft., wing sewers 70 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.5 ft., 25 manholes and 31 catch basins, work to be completed June 1, 1911, estimated cost $6.000; W. 40th St., S. Western Ave. to S. Rockwell St., 1,325 lin. ft., 3 ft. internal diameter, double ring brick sewer, average depth 12.5 ft.; S. Rockwell St., W. 40th St., to W. 39th Pl., 325 lin. ft., 3 ft. internal diameter brick sewer, double ring, average depth 13.7 ft.; S. Rockwell St., W. 39th Pl. to 110 ft. north, 150 lin. ft., 1 ft. internal diameter tile pipe, average depth, 8.0 ft.; W. 39th Pl., S. Rockwell St. to Archer Ave., 480 lin. ft., 3 ft. internal diameter brick sewer, double ring, average depth 12.7 ft.; W. 39th Pl., Archer Ave. to S. California Ave., 915 lin. ft., 2 ft. internal diameter brick sewer, single ring, average depth 12.8 ft.; W. 39th Pl., S. California Ave. to S. Francisco Ave., 675 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 10.8 ft.; W. 39th Pl., S. Francisco Ave. to S. Sacramento Ave., 680 lin. ft., 1 ft. internal diameter, average depth 9.5 ft.; W. 39th Pl., S. Rockwell St. to alley west of S. Campbell Ave., 525 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.5 ft.; W. 43rd St., S. Western Ave. to S. Rockwell St., 1,325 lin. ft., 3½ ft. internal diameter brick sewer, double ring, average depth 14.5 ft.; W. 43rd St., S. Rockwell St. to S. California Ave., 1,345 lin. ft., 3 ft. internal diameter brick sewer, double ring, average depth 13.5 ft.; W. 43rd St., S. California Ave. to S. Francisco Ave., 675 lin. ft., 2½ ft. internal diameter double invert brick sewer, average depth 12.5 ft.; W. 43rd St., S. Francisco Ave. to S. Richmond St., 335 lin. ft. 2 ft. internal diameter, single ring, brick sewer, average depth 11.7 ft.; Archer Ave., W. 39th Pl. to W. 39th St., 475 lin. ft., 1 ft. internal diameter tile pipe, average depth 10.7 ft.; Archer Ave., W. 39th Pl. to S. California Ave., 1,125 lin. ft., 2½ ft. internal diameter double invert brick

Items marked thus ✣ indicate work now open for bids.

sewer, 13.5 ft. average depth; Archer Ave., S. California Ave. to S. Sacramento Ave., 1,730 lin. ft., 2 ft. internal diameter brick sewer, single ring, average depth 11.5 ft.; S. Artesian Ave., W. 40th St. to alley south of W. 39th St., 510 lin. ft., 1 ft. internal diameter, average depth, 9.0 ft.; S. Artesian Ave., W. 40th St. to 660 ft. south of W. 40th St., 665 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 2.0 ft.; S. Artesian Ave., 660 ft. south of W. 40th St., to W. 42nd St., 665 lin. ft., 1 ft. internal diameter, average depth 9.0 ft.; S. Artesian Ave., W. 43rd St. to W. 42nd St., 665 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 10.5 ft,; S. Campbell Ave., W. 40th Ave. to alley south of W. 39th St., 505 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.5 ft.; S. Campbell Ave., W. 40th St. to 665 ft. south, 665 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 10.0 ft.; S. Campbell Ave., 660 lin. ft. south to W. 42nd St., 665 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.0 ft.; S. Campbell Ave., W. 43rd St. to W 42nd St., 665 lin. ft., 1¼ ft. internal diameter tile pipe, average depth 10.5 ft.; S. Maplewood Ave., W. 40th St. to W. 40th Pl., 555 lin. ft., 1½ ft. tile pipe, double strength, average depth 12.0 ft.; W. Maplewood Ave., 660 ft. south to W. 42nd St., 695 lin. ft., 1 ft. internal diameter pipe sewer, average depth, 8.5 ft.; W. Maplewood Ave., W. 43rd St. to W 42nd St., 660 lin. ft., 1¼ ft. tile pipe, average depth 10.5 ft.; S. Rockwell St., W. 40th St. to W. 40th Pl., 555 lin. ft., 1½ ft. internal diameter, double strength tile pipe, average depth 12.0 ft.; S. Rockwell St., W. 40th Pl. to Montgomery St., 385 lin. ft., 1¼ ft. tile pipe, average depth 11.0 ft.; S. Rockwell St., Montgomery St. to W. 43rd St., 1,085 lin. ft., 1 ft. internal diameter tile pipe, average depth 10.5 ft.; S. Talmon Ave., W. 43rd St. to W. 42nd St., 665 lin. ft., 1 ft. internal diameter tile pipe, average depth 11.5 ft.; S. Washtenaw Ave., W. 43rd St. to W. 42nd St., 665 lin. ft., 1 ft. internal diameter, average depth 10.5 ft.; S. Fairfield Ave., W. 43rd Ave. to W. 42nd Ave., 665 lin. ft., 1 ft. internal diameter tile pipe; W. 42nd St., 1st alley west of Rockwell St., to 1st alley east of California Ave., 970 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.5 ft.; S. California Ave., W. 39th Pl. to W. 40th St., 320 lin. ft., 1½ ft. internal diameter, double strength tile pipe, average depth, 11.7 ft.; S. California Ave., W. 40th St. to W. 40th Pl., 340 lin. ft., 1 ft. internal diameter, average depth 11.7 ft.; S. California Ave., Archer Ave. to 655 ft. south, 655 lin. ft., 1½ ft. internal diameter, double strength tile pipe, average depth 10.7 ft.; S. California Ave., 655 ft. south to W. 43rd St., 985 lin. ft., 1 ft. internal diameter tile pipe, average depth 10.0 ft.; S. Mozart St., W. 43rd St. to W. 42nd St., 660 lin. ft., 1¼ ft. internal diameter tile piple, average depth 9.7 ft.; S. Mozart St., W. 42nd St. to 1st alley south of Archer Ave., 515 lin. ft., 1 ft. internal diameter tile pipe, average depth 8.0 ft.; S. Francisco Ave., W. 43rd St. to 1st alley south of Archer Ave., 900 lin. ft., 1 ft. internal diameter tile pipe, average depth, 8.6 ft.; S. Richmond Ave., W. 43d St. to W. 42nd St., 665 lin. ft. 1 ft. internal diameter tile pipe, average depth 8.9 ft.; W. 40th St., S. California Ave. to S. Francisco Ave., 665 lin. ft., 1¼ ft. internal diameter, average depth 9.7 ft.; W. 40th St., S. Francisco Ave. to S. Sacramento Ave., 680 lin. ft., 1 ft. internal diameter, average depth 8.0 ft. W. 40th Pl., Archer Ave. to S. Francisco Ave., 710 lin. ft., 1¼ ft. internal diameter, average depth 10.5 ft.; S. Francisco Ave., W. 40th Pl. to Archer Ave., 565 lin. ft., 1 ft. internal diameter tile pipe, average depth 9.0 ft.; W. 40th Pl., S. Rockwell St. to S. Tahnan Ave., 305 lin. ft., 1¼ ft. internal diameter, 10.8 ft. average depth; Brighton Pl., Archer Ave. to W. 40th Pl., 785 lin. ft., 1 ft. internal diameter tile pipe, average depth 10.5 ft.; S. Talman Ave., W. 40th Pl. to 685 ft. north, 685, 1 ft. internal diameter tile pipe, average depth 8.5 ft.; Montgomery St., Archer Ave. to S. Rockwell St., 1,435 lin. ft., 1 ft. internal diameter tile pipe, 8.7 ft. average depth, 268 manholes and 332 catch basins, work to be completed Oct. 1, 1911, estimated cost, $81,075; street car tracks in Archer Ave. Note—Contractors will take care of all water service pipes crossing their excavation; this applies to all jobs.

✣Bids will be received until 11 a. m., Dec. 10, 1910, by B. J. Mullaney, Commissioner of Public Works, city of Chicago, Room 705 City Hall, for furnishing regular tug service and service to the 2-mile crib for the winter season of 1910-11. The accepted tug must pass the inspection of a representative of the city, after having complied with the requirements of the United States government. The hull of the tugs, if of wooden construction, must be armored with iron plates, securely and properly fastened in place. The engine, boiler and appurtenances must be of sufficient size to drive the tug (accepted for regular service) through 8 inches of solid ice. Full specifications may be had upon application to the Commissioner of Public Works. This is the second advertisement of this proposal.

The proposition to construct a dam spillway and reservoir and to extend the water mains and waterworks of McLeansboro, Ill., and to issue bonds to the amount of $20,000 to pay for the same, was voted in favor of Dec. 1.

The board of local improvements of Rockford, Ill., has ordered the Southeast End sewer to be built. Work will be started in the spring.

According to Mayor George Sanderson of Galesburg, Ill., work will probably be started on the construction of the Third ward trunk sewer next spring. The estimated cost of the work is between $30,000 and $40,000. The sewer will start at Cedar Fork on West St., and from Cedar Fork to Losey St., will be six ft. in diameter. From this point to the north line of Dayton St., it will be 4 ft. in diameter. The length of the brick part of the sewer will be about one and one-half miles.

A petition has been filed in the county court at Princeton, Ill., for the creation of sewerage district No. 12, which is to drain all of the southeastern portion of the city of Princeton. The estimated cost of the sewer is $25,000

Plans are under way by the board of local improvements of Freeport, Ill., for the construction next year of a sanitary sewer system in East and West Freeport. The plans will call for the construction of nine miles and a half of sewer.

The Ottawa Construction Co., of Ottawa, Ill., on Nov. 30 was awarded the contract for the construction of the entire sewerage system for the city of Pekin, Ill., including Districts No. 2 and 3, for which bids were opened Nov. 23, for $91,763. John W. Alvord & Chas. B. Burdick, Hartford Bldg., Chicago, Ill., are engineers for Pekin. The itemized bid of the successful bidder appeared in ENGINEERING-CONTRACTING of Nov. 30.

Commisisoner of Public Works B. J. Mullaney, of Chicago, Ill., has recommended to the finance comimttee an appropriation of $325,000 to purchase 75,000 ft. of feeder mains for installation in the district that will be served by the Roseland pumping station.

William Moran & Co., of Joliet, Ill., has been awarded the contract in Bellwood, a suburb of Chicago, Ill., to lay about 1,500 ft. of water main for approximately $1,800. Work is to be started at once.

Following is the low bid received by B. J. Mullaney, Commisisoner of Public Works, City of Chicago, Room 705 City Hall, for furnishing chain-grate stokers and stoker engines for the new Roseland pumping station, W 104th St. & C. & W. I. R. R. Illinois Stoker Co., 204 Dearborn St., Chicago, $4,190.

Following is the low bid received by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705 City Hall, for furnishing and delivering to the Roseland pumping station, 104th St. & C. & W. I. Ry., 2 cast iron suctions and glands, according to specifications previously published in ENGINEERING-CONTRACTING; Jas. A. Brady Foundry Co., 35th St. & Ashland Ave., $.05 1-8 per lb.

Indiana.

The board of public works of Gary, Ind., has taken up the proposition of providing a sewer system for the suburb of Tolleston. John W. Alvord, Hartford Bldg., Chicago, Ill., recently prepared plans for a system for Tolleston and estimated the cost at $181,000.

The Shiehan Construction Co., of Indianapolis, Ind., has been awarded the contract by the Board of Public Works of that city for the construction of a sewer in and along the alley of Hiawatha St., from Owosso St., to alley south of New York St. Bids were opened Nov. 25.

Iowa.

The city council of Corydon, Ia., has sold bonds to the amount of $45,000 for the installation of a waterworks and sewerage system. Preparations for the same are now under headway.

The citizens of Ottumwa, Ia., voted Nov. 22 in favor of purchasing the plant of the Public Water Co., for $280,000.

Kansas.

The city of Newton, Kan., recently voted the issuance of bonds to the amount of $50,000 to enlarge and improve the waterworks facilities.

The city council of Mound City, Kan., will call a special election soon to vote on the proposition of issuing bonds for the installation of a water system.

Maryland.

Following bids were received Nov. 16 by the board of awards of Baltimore, Md., for sanitary contract No. 58, McMechen St. interceptor; Calvin W. Hendrick, Chief Engineer, Sewerage Commission, Baltimore: McCay Engineering Co., 9 E. Lexington St., Baltimore, Md. (awarded contract), $43,652; B. F. Sweeten & Son, 820 Sharp St., Baltimore, Md., $44,864; Wm. McCarthy & Co., 1007 American Bldg., Baltimore, Md., $45,987; Ryan & Reilly, 411 American Bldg., Baltimore, Md., $46,888; James Ferry & Sons, Pittsburg, Pa., $51,068; The Whiting-Middleton Constr. Co., Sexton Bldg., Baltimore, Md., $56,061; W. H. & C. F. Thompson, 600 Law Bldg., Baltimore, Md., $56,817; Irwin Brothers, 413 American Bldg., Baltimore, Md., $61,462.

Massachusetts.

✣Bids will be received until noon, Dec. 9, by Superintendent of Streets, Sewer Division, Boston, Mass., for the construction of pipe sewers and drains in Willow and Center sts., West Roxbury.

✣Bids will be received until noon, Dec. 9, by Superintendent of Streets, Boston, Mass., for pipe surface drains in Litchfield St., between Western Ave. and Lincoln St., Brighton.

Michigan.

The city of Wyandotte, Mich., will sell bonds Dec. 15, in the sum of $68,000 for the extension of sewers on West and South Wyandotte Sts. John L. Sullivan is city clerk.

Following were low bidders for the construction of three sewers in Detroit, Mich., bids opened Nov. 23, by Board of Public Works Commissioner Haarer: Russell St., 820 ft., J. J. Affeld, $4,888; Trumbull Ave., 1,163 ft. William Porath, $7,659; Harbaugh Ave., 1,630 ft., Julius Porath, $11,961.

W. N. Sager, it is reported, has been awarded the contract in Saginaw, Mich., for the construction of the proposed intake and pump well at the east side pumping station for $16,745. E. P. Stone is president of the water commissioners.

The city of Flint, Mich., awarded the contract for the construction of a sewer in 12th St., from Harrison to Elm Sts., to Timothy Lynch, 12th St., Flint, at $.50 per ft., for 10-in. sewer and $.25 per ft. for 4-in. sewer connections. Bids were opened Nov. 21.

It is planned to construct a new waterworks system in Flint, Mich., at an estimated cost of $400,000. The work would include a new filtration plant, pump house and extensions. Plans have not as yet been made. N. L. Fisher, Supt. of Waterworks, is the official in charge.

Minnesota.

E. T. Webster of St. Paul, Minn., has been awarded a contract by the city council of Watertown, S. Dak., for the construction of a sewer for $17,266.

The city council of Mankato, Minn., has decided to call a special election soon to vote on the proposition of issuing bonds for a waterworks system. Engineer Brewer of St. Paul, Minn., has estimated the cost of the improvement at $20,000.

Missouri.

M. Costello was low bidder for the construction of sewers in districts Nos. 68, 111 and 122, St. Joseph, Mo., the bid being $.45 for 8-in. sewer pipe; $.55 for 10-in. pipe; $.65 for 12-in. pipe; $.70 for 15-in. pipe; $1.08 for 18-in. pipe and $1.48 for 21-in. pipe. For district No. 69, the bidders were Skilbred, $1.30 per ft.; E. F. Migney, $1.20; John Marnell, $1.24; Oscar H. Schmidt, $1.40.

St. Joseph, Mo., is considering the advisability of taking over the water plant of that city and operating it under municipal supervision. The purchase price is to be covered by a bond issue.

James A. Pringle has been awarded the contract in Centralia, Mo., for the construction of sewer laterals in District No. 1 at the following figures: No. 1, $1,171; No. 2, $1,654; No. 3, $1,850; No. 4, $2.33; No. 5, $2,916; No. 6, $1,005; No. 7, $1,548; No. 8, $2,709. The approximate cost is $.74 per ft., for 10 ft. deep trench; $1.05 for a 12 ft. deep trench, $.44 extra for Y's, $45 each for manholes and $85 for flushing tanks. A contract was also awarded to the same contractor for putting in 2½-in. water pipes back of the main business section for $.12 per ft., for the 2½-in. pipe and $.10 per ft. for the 3-4-in. pipe.

Nebraska.

✣Bids will be received until 1 p. m., Dec. 9, by Board of Trustees, Stratton, Nebr., for furnishing all material and labor and material for the construction of a complete system of water works for the village, consisting of one shallow tube well, brick power station, one power pump, standpipe 12x60 and system of water mains, pipes, hydrants, and valves and one 15-hp. gasoline engine. Fred Shotbolt is Village Clerk and Charles F. Sturtevant, Holdredge, Nebr., is Consulting Engineer. Each bidder must submit with his bid a certified check for $500, payable to village clerk.

✣Bids will be received until 11 a. m., Dec. 16, by Capt. C. E. Babcock, Constructing Quartermaster, Fort Crook, Nebr., for the construction of a reservoir and well at the Fort.

The city of Wymore, Neb., held an election Dec. 1, to vote on the proposition of issuing bonds in the sum of $57,000 for the construction of a water plant and an electric light plant.

Wynot, Neb., is planning the installation of a new waterworks system at an estimated cost of $8,000. Plans have not as yet been prepared. The contract will be let this winter. Arnold C. Koenig, Omaha, Neb., is the engineer and F. A. Kindwall, City Clerk, has charge of the work.

New Mexico.

✣Bids will be received until 11 a. m., Dec. 24, by Capt. J. R. McAndrews, Constructing Quartermaster, Fort Bayard, N. M., for furnishing and installing complete two compound duplex steam pumps.

New Jersey.

It is reported that Engineer Edlow W. Harrison, of Jersey City, N. J., who is connected with the Passaic River Sewerage Commission, stated Nov. 25, that by next April the commission expects to have the contract for the proposed $11,000,000 intercepting sewer awarded and the work started. That improvement will take care of the pollution of Garfield, Wallington, Boiling Springs, part of Rutherford and other Bergen County towns on the Passaic River, besides caring for the sewage of the cities of Paterson, Passaic, Newark, Montclair, Harrison, Kearney and East Newark. The sewer will conduct the sewage to the meadows south of Newark, and from there the sewage, after being screened, will be pumped through a tunnel under Newark Bay and Greenville into New York Bay.

William G. Root of 20 Broad St., New York City, was the lowest bidder for the contract to install a surface water conduit in Atlantic City, N. J., his bid being $845,188. This proposal is $35,000 below the lowest bid received in a former competition.

New York.

✣Bids will be received until 11 a. m., Dec. 13, by Cyrus C. Miller, President of the Borough of The Bronx, New York city, for six sewer contracts, the largest being No. 4, for regulating grading, setting curbstone, flagging the sidewalks, laying crosswalks, building approaches and placing fences in Albany Road, from Van Cortlandt Park south to Bailey Ave.; Bailey Ave., from Albany Road to Sedgwick Ave.; Sedgwick Ave., from Bailey Ave. to Fordham Road. The Engineer's estimate of the work is as follows: 26,600 cu. yds. of earth excavation; 8,500 cu. yds. of rock excavation; 188,500 cu. yds. of filling; 16,000 lin. ft. of new curbstone, furnished and set; 2,300 lin. ft. of old curbstone, rejointed and reset; 59,500 sq. ft. of new flagging, furnished and laid; 12,000 sq. ft. of old flagging, rejointed and relaid; 10,300 sq. ft. of new bridgestone for crosswalks, furnished and laid; 9,000 cu. yds. of dry rubble masonry, in retaining walls, culverts and gutters; 150 cu. yds. of concrete; 500 lin. ft. of vitrified stoneware pipe, 12 ins. in diameter; 200 lin. ft. of vitrified stoneware pipe, 18 ins. in diameter; 10,000 ft. (B. M.) of lumber, furnished and laid; 11,150 lin. ft. of guard rail, in place; 1,700 sq. ft. of old bridgestone for crosswalks, rejointed and relaid; 7,500 pounds of steel bars, furnished and in place; 1 receiving basin, complete; 6 receiving basins, to be rebuilt. The time allowed for the completion of the work will be 500 working days. The amount of security required will be $65,000.

✣Bids will be received until 11 a. m., Dec. 14, by Alfred E. Steers, President of the Borough of Brooklyn, New York city, for two sewer contracts, the larger being No. 1, for furnishing and delivering all the labor and materials required for constructing sewer in 16th Ave., between Bath and Benson Aves., in the Borough of Brooklyn (contract of the Long Island Contracting and Supply Co., declared by the President of the Borough of Brooklyn to have been unnecessarily delayed as per Section "Z" of the contract). The Engineer's preliminary estimate of the quantities is as follows: 45 lin. ft. of 15-in. pipe sewer, laid complete, including all incidentals and appurtenances; 690 lin. ft. of 12-in. pipe sewer, laid complete, including all incidentals and appurtenances; 8 manholes, complete, with iron heads and covers, including all incidentals and appurtenances; 1,250 lin. ft. of 6-in. house connection drain, laid complete, including all incidentals and appurtenances; 1,800 ft. (B. M.) of sheeting and bracing, driven in place, complete, including all incidentals and appurtenances. The time allowed for the completion of the work and full performance of the contract will be 40 working days. The amount of security required will be $1,300.

John E. Donovan, 2205 Richmond Terrace, Port Richmond, N. Y., has been awarded the contract by the President of the Borough of Richmond, George Cromwell, New York city, for constructing a sewer in Monroe Ave., for $7,579. Bids were opened Nov. 22.

C. W. Weddle Co., Inc., Broadway, Flushing, N. Y., has been awarded the contract for constructing 12 ft. section 3 ft.-6-in. by 13 ft.—storm sewer for $485. Bids were opened Nov. 17.

The village of Fairport, N. Y., held an election Dec. 6 to vote on the proposition of raising $1,000 for the services of an engineer to draw up plans and specifications for a new sewer system.

✣Bids will be received until 2 p. m., Dec. 22, by the Board of Trustees, Oriskany Falls, N. Y., for the construction of a gravity system of waterworks, consisting of a 13,000,000-gal. reservoir, concrete dam, approximately 25,000 ft. of 12, 10, 8 and 6-in. pipe, 37 hydrants, 36 valves and all accessories, material, tools and labor necessary to complete the system. A. M. Scripture, New Hartford, N. Y., is Engineer.

It is reported that City Engineer Fisher of Rochester, N. Y., has stated that bids will be advertised for within a month for the construction of the intercepting sewer, estimated to cost $500,000. The entire system is estimated to cost $1,500,000.

At a recent mass meeting of the residents of North and West Corona, Corona, N. Y., a committee composed of J. W. Caveny, Louis Schoedel, I. R. Moody and others, was named to set in operation the building of sewers by private subscription.

Ohio.

✣Bids will be received until Noon, Dec. 19, by Nelson J. Brewer, Clerk of the Village of Euclid, O., for furnishing the necessary labor and material for the construction of improvements on Woodcliff Ave., from Euclid Road to Roseland Ave., including the installation of a 6-in. water main. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., engineers.

✣Bids will be received until noon, Dec. 12, by Director of Public Service, Cleveland, O., for furnishing and erecting in the engine house at the Kirtland St. Pumping Station two vertical triple expansion pumping engines with a capacity of 25,000,000 gals. of water each 24 hours. Leslie C. Smith is Superintendent of Water Works.

Ordinances have been passed by the city council of Cincinnati, O., authorizing bond issues of $125,000 for pipe for the waterworks department, and $1,500 for a sewer in Rittenhouse St.

The citizens of Glendale, O., have voted against the proposition of issuing bonds to the amount of $15,000 to improve the village waterworks.

The board of control of Columbus, O., has awarded the contract for the making of sewers to drain the new Mound St. viaduct, to the firm of Geigele, Garnes & Co., for $1,700.

The city of Lorain, O., has sold bonds to the amount of $21,500 for the construction of sanitary sewers on East Erie Ave., East 32d St., and Denver Ave.

Advices from Cincinnati, O., state that Civil Engineer Charles Cornelius has completed designing and taking levels for a new sewer, to lead from the Wilhelm apartment bldg., on Burnet Ave., Avondale.

The city council of Urbana, O., has passed an ordinance providing for the issuance of bonds in the sum of $4,716 for the construction of Taft Ave., and a sewer in the same.

The city council of Akron, O., has passed ordinances providing for the issuance of bonds to the amount of $60,000 for a storm water sewer plant, and $25,000 for a main trunk sewer from the towpath along the Little Cuyahoga river through Glendale park and cemetery, and $10,000 to erect a sewage and garbage disposal plant.

Following were low bidders at Coshocton, O., for the construction of two new waterworks wells: Cast iron pipes, J. B. Clow & Sons, Chicago, Ill., $851; wrought pipe, C. A. Turner, Pittsburg, Pa., $819; manhole covers, Keagy & Lear, Coshocton, $297; valves, Coffin Valve Co., Boston, Mass., $225; drilling wells, J. B. Workman & Son, Danville, $700. James Westwater of Columbus, O., bid $14,800 on the contract as a whole.

The city council of Kenton, O., contemplates the construction of a new waterworks plant at a cost of $80,000. The present plant has been condemned as unsafe by the state building inspector.

Frank Burns was low bidder at Cincinnati, O., for the laying of the water mains to Delhi, his bid being $24,975. The United States Cast Iron Pipe & Foundry Co., was low bidder for furnishing the pipe with a bid of $42,369.

The Board of Public Affairs of West Carrollton, O., has awarded contracts for pumping station, reservoir, pipe and machinery in connection with the waterworks system for that city as follows, bids opened Nov. 16: Ernest Kroemer, 647 Oak St., Dayton, O.,

Items marked thus ✣ indicate work now open for bids.

reservoir, $2,216; Fairbanks Morse Co., Cincinnati, O., two triplex pumps, one motor, one gasoline engine, $3,069; United States Cast Iron Pipe & Foundry Co., Cincinnati, O., 3,000 ft. of 8-in. pipe at $22.25 per ton.

Oregon.

City Attorney H. E. Collier has been instructed by the city council of St. Johns, Ore., to prepare papers looking toward the condemning of a strip of land across the Weyerhaeuser holdings north of the city for a sewer. This is the first of a series of sewer extensions planned by the council.

Bids will again be received by the city of Portland, Ore., for the construction of the Holgate-Kenilworth district sewer, on the southeast side. Former bids were reconsidered so as to admit the territory which included Ivanhoe just east of Williams' addition and because they were considered too high. It is estimated that this sewer will cost over $100,000.

The executive committee of the board of public works of Portland, Ore., has awarded contracts for the sewers in the sections of the addition of Laurelhurst known as the northeast and southeast quarters, which lie east of East 39th St., and between East Halsey and East Stark Sts., to the Barber Asphalt Co., for approximately $40,000.

Following bids were received Nov. 25 by the City Executive Board of Portland, Ore., for the Holgate St. extension of Brooklyn district sewer: Paquet, Giebisch & Joplin, $104,372; Jeffrey & Buffton, $109,299; Lundstrom & Sandeberg, $107,579.

Pennsylvania.

✣Bids will be received until Dec. 7, by Council of Archbald, Pa., for the construction of sewers in that borough. A. B. Dunning is Borough Engineer.

The Lehigh Valley Motor club, Calvin E. Ahlum Vice President, Allentown, Pa., has purchased enough galvanized pipe of 12-in. in diameter, to do away with the cross bars in the country roads of Lehigh County, which number between 400 and 500. The township supervisors will lay the pipe according to plans prepared by Deputy State Highway Engineer, Warren W. Cressman, of Allentown.

The borough of Masontown, Pa., has been granted a permit to erect a sewer system by the state health department conditioned upon taking steps towards ultimately constructing a sewage disposal plant. The borough is now taking steps towards securing such a plant and will likely let the contract to some engineer in the near future.

City Engineer Herbert A. Holstein of Titusville, Pa., is working upon the proposed plans for a sewage disposal system in that city. When completed they will be presented to the board of health at Harrisburg for its approval.

Highway Commissioner Caldwell at Harrisburg, Pa., Nov. 23, opened the following bids received for the construction of sewers in a number of streets: Sycamore, Fourteenth to Fifteenth—Henry Opperman, $1,617; Sycamore, Rolliston to Seventeenth—Stucker Bros.' Construction Co., $87; Paxton, Hanna to Sixteenth—W. H. Lynch, $684; Showers, Tuscarora to Nagle—Stucker Bros.' Construction Co., $356. Rudy, Delaney to Twentieth—W. G. Wallenbeck, $1,297; Derry, Eighteenth to East Eighteenth—W. H. Lynch, $785; Swatara, Eighteenth to Twentieth—W. G. Wallenbeck, $1,094; Prune, Kittatinny to Swatara—Stucker Bros.' Construction Co., $623; Jonestown road Cameron to Walnut—Stucker Bros.' Construction Co., $1,033.

The city of Franklin, Pa., is considering the installation of a sewerage system with a sewage disposal plant at an estimated cost of $54,000. C. F. Melbus of Albright & Melbus, of Philadelphia, is the engineer.

The citizens of Somerset, Pa., voted Nov. 27 in favor of the proposition of issuing bonds to the amount of $25,000 for the construction of a municipal water plant.

Geo. M. Harris of Meadville, Pa., is the probable contractor for the construction of sewers on Alden & Alfred Sts., in that city, bids for which were opened Nov. 16.

South Dakota.

The city council of Aberdeen, S. Dak., has instructed the city engineer to secure estimates from two of three engineers as to the cost of constructing a sewage disposal plant to clear up the "Moccasin." Plans for the plant will be prepared at once.

The Jasper Water Co., of Pierre, S. Dak., has been incorporated with a capital stock of $60,000.

Bonds to the amount of $40,000 have been voted for improvements to the waterworks at Huron, S. Dak., and plans are being prepared by L. P. Wolff, engineer. The improvements will include a new pumping station, pumping plant, concrete reservoir, steel tower and tank.

Texas.

✣Bids are now being asked by W. A. Hiddleson, City Clerk, El Campo, Tex., for the construction of the following sanitary sewers: 2,500 ft. of 12-in.; 2,100 ft. of 8-in., and 3,000 ft. of 6-in. sewers and one septic tank. John A. Norris is City Engineer.

The Brownsville Sewerage Co., of Brownsville, Tex., recently awarded the contract for pumping machinery for the sewage disposal plant to the San Antonio Machine & Supply Co., of San Antonio, Tex.

The Municipal Commissioners, of Dallas, Tex., have awarded the contract for laying a storm sewer in the region of Swiss, Nussbaumer and Peak Sts., to C. W. Olcott for $14,622, and for laying a 6-in. sanitary sewer on Oakland Ave., near Texas and Clarence, to C. W. Olcott, for $1,879.

The Municipal Commissioners at Dallas, Tex., have awarded the contract for laying a storm sewer on Collett, between Reiger and an alley between Worth and Crutcher, to Joe B. Winslett, Jr., for $1,636.

Messrs. Duff and Watley, of Greenville, Tex., have asked the City Council of Honey Grove, Tex., for a franchise to put in and operate a swerage system in that town.

It is reported that the city of Dallas, Tex., is advertising for bids for constructing a sewer line from Trinity River to Oakland Ave. This line would serve Mount Auburn addition and adjacent territory. The City Engineer has estimated the cost of construction at $21,484.

F. H. Lancashire, of Dallas, Tex., has been in Corpus Christi, Tex., conferring with the municipal authorities in regard to the installation of a sewerage system in that city, for which he has been engaged to supervise the construction of the same. The estimated cost of the system is $140,000.

Board of Municipal Commissioners of Dallas, Tex., has awarded the contract to the Dallas Lime & Gravel Co., at $19,391 for the construction of a storm sewer to drain the area bounded by Masten, Ross, Central and Live Oak Sts. The sewer will be of various sizes, from 48 ins. down. Some will be of reinforced concrete and the rest of vitrified pipe.

The City Council of Georgetown, Tex., is making arrangements to take over the Georgetown Water, Electric & Power Co., from N. N. Coler & Co., of New York city, on or before Jan. 1, 1911. At the recent election the city voted $45,000 in bonds for the purpose of buying the plant for $13,500; the remaining $31,500 of the issue will be used for betterment of the light and water service.

The Board of Municipal Commissioners, of Dallas, Tex., has set aside $75,000 for the completion of the pumping station and its equipment at White Rock reservoir. The contract was recently awarded to the Hughes-O'Rourke Construction Co. for the work of clearing the land for the purpose and erection of a traveling crane in the new pumping station, for the construction of the reinforced concrete chimney at the station, for the purchase and installation of boilers and for the surge tanks at the station.

The City Commissioners of Dallas, Tex., have approved plans for the construction of a reservoir dam near the junction of the Clear and West Forks of the Trinity to provide water for the duel system. The dam will be constructed by a syndicate at an estimated cost of $30,000.

An election is to be held in Rusk, Tex., on Dec. 12, to vote on issuing bonds to the amount of $18,000 for the purpose of building a waterworks system.

The Howe Deep Well Water Co., of Howe, Crayson County, Tex., has been incorporated with a capital stock of $3,000. The incorporators are William H. Bean, J. B. Phillips and C. H. Haizlep.

An election is to be held in Gainesville, Tex. Dec. 14, to vote on the proposition of issuing bonds to the amount of $150,000 for the purchase of the Gainesville Water Co.

A contract will soon be let by the city of Rogers, Tex., for the construction of a new waterworks system, estimated to cost $12,000. The work will include standpipe or tower and mains. J. D. King is the official in charge.

The McMullen Townsite Co., of Tilden, Tex., will start work about March on the construction of a waterworks system in connection with the development of about 640 acres of land. Geo. G. Ehrenborg, Civil Engineer, Tilden, Tex., is the engineer for the work.

Utah.

The City Council of Provo, Utah, has accepted the contract of the James Kennedy Construction Co., of Fargo, N. D., for sewer district No. 11, amounting to $30,000.

Virginia.

Contracts for two main branches of the Virginia Ave. sewer were awarded to I. J. Smith & Co., by the Streets Committee of the City Council of Richmond, Va. The Hampton St. branch is estimated to cost $26,170, and the Winder St. branch $26,368. Contract was also awarded to I. J. Smith & Co., for a sewer in Rowland, Meadow and other streets, to cost $12,847, and to S. P. Clay for a sewer on Dance and other streets, to cost $7,357.

The Board of Control of Norfolk, Va., has taken steps looking toward the construction of the connecting canal for Lakes Bradford and Joyce. City Engineer W. T. Brooke and Water Engineer T. B. Dornin have been requested to ascertain at once the cost of the right of way for the canal.

Superintendent E. E. Davis, of Richmond, Va., has outlined plans for the enlargement of water mains and general improvements in the water supply of Washington Ward.

Washington.

✣Bids will be received until 11 a. m., Dec. 10, by Lieut. A. L. Sneed, Constructing Quartermaster, Fort George Wright, Wash, for sinking one 10-in. tubular well at that post.

The city of Pasco, Wash., contemplates issuing bonds for sewer construction and other improvements.

The Board of Public Works of Spokane, Wash., has instructed City Engineer Morton Macartney to draw up plans and specifications for a combination sewer and storm drain for Union Park. The residents of Union Park have also asked the City Council to spend $4,000 for the installation of a filter device provided with wells sunk to the level of the Spokane River to carry away flood waters underground.

The City Council of Toppenish, Wash., has decided that the city shall have a complete sewer system. At a recent election the sum of $35,000 in bonds was voted for that purpose. It is proposed to have the system completed by the first of May.

The Municipal Commission of Tacoma, Wash., probably will instruct Commissioner Owen Woods, of the Department of Public Works, to call for bids on two large drain pipes to carry water under North 29th and North 30th Sts., at Hanlin Gulch, Old Town.

M. Schilling has been awarded the contract by the city of Yacolt, Wash., for the installation of a municipal water system at the end of the Yacolt Northern Pacific branch, in the northern part of Clark County, for approximately $10,000.

George C. Arrowsmith, of the Pacific Light & Power Co., of North Yakima, Wash., has received orders to immediately begin extending the company's water system farther up the Naches River, moving the intake from its present location to a reservoir at the end of the power canal. The cost of installation will be about $32,000.

West Virginia.

✣Bids will be received until 1 p. m., eastern time, Dec. 19, by Board of Commissioners, Huntington, W. Va., for building two trunk sewers in the city as follows: Single ring brick sewer 3 by 4 ft., on west Seventeenth St., approximately 2,300 ft.; Single ring brick sewer 3 by 4 ft., W. 7th St., approximately 1,700 ft. Plans and specifications are on file in City Engineer's office. Payment to be made the contractor in cash by the city of Huntington. Contractors will be required to submit $500 certified check with his bid made payable to City Treasurer. A. B. Maupin is City Engineer.

Wisconsin.

A. Vowinkel has been awarded the contract in Sheboygan, Wis., for the construction of a new 10-in. vitrified pipe sewer in South 14th St., between Wisconsin Ave. and South Water St., a distance of 467 ft., for $.58 per lin. ft., and $25 each for manholes.

Canada.

✣Bids will be received until noon, Dec. 13, by Board of Control, Toronto, Ont., for supply of 303 ft. of rivetted steel pipe, 6 in. in diameter. G. R. Geary is Chairman of the Board of Control. Plans and specifications may be obtained of the City Engineer.

The citizens of Victoria, B. C., held an election Nov. 24, to vote on a bylaw for the appropriation of the holdings of the Esquimalt Waterworks Co., at a figure in the neighborhood of $2,000,000.

Neil Low, Parish of Neadingly, has been awarded contract in St. James, P. O. Manitoba, for sinking a well at the corner of Ness Ave. and Brooklyn St., in D. G. S. 35, St. James, for $1.75 per ft. Bids were opened Nov. 27.

TRADE NOTES.

The Nye Steam Pump & Machinery Co. is building a new plant at Western Ave. and Huron St., N. E., Chicago, Ill., where it will manufacture its new model high pressure pumps.

The management of the Pittsburg Engineering Agency, Pittsburg, Pa., has formed a business company under the trade name of The American Service Co., which will immediately take over the Inter-State and Pan-American territorial representation of the Associated Bureau Service, comprising the several bureaus of Technical Reference, American Trade Catalog, and Engineering and Industrial Research. Offices have been opened in the Bessemer Bldg., Pittsburg, Pa., where in addition to the above service a technical reference library of Trade Catalogs will be maintained for general convenience of the Pan-American Organization. The first named bureaus are maintained in the interest of the technical profession and industrial corporations gratis, the aim being to develop an effective central clearing house of technical intelligence and applied service that will directly appeal to the rapid executor desiring instant attention to details.

NOTICE TO CONTRACTORS.

Sealed bids will be received by the Board of County Road Commissioners of Delta County, Michigan, at the office of the County Clerk at Escanaba, until 2 o'clock p. m., December 20, 1910, for the purpose of constructing a concrete highway bridge over the Escanaba River at Wells, Mich.

Each bid must be accompanied by a certified check for $2,000 as a guarantee that the successful bidder will sign the contract.

A surety bond for an amount equal to the amount of the bid will be required of the successful bidder.

Bidders shall furnish detail drawings of structures bid upon.

Bids will be received on the bridge complete with approaches, filling, roadway and sidewalks and the removal of the old bridge and also on each of these items separately.

Further information, outline plans and specifications may be obtained from the Engineer, D. A. Brotherton, Escanaba, Mich.

The Board of County Road Commissioners reserve the right to reject any or all proposals.

JOHN A. SEMER,
County Clerk.

Escanaba, Mich.

NOTICE TO BOND BUYERS.

ONE HUNDRED THOUSAND DOLLARS ($100,000.00) STREET PAVING BONDS OF THE CITY OF HOUSTON, TEX.

Sealed bids will be received by the City of Houston, Tex., until 12 o'clock noon, Monday, January 9, 1911, for the issue of one hundred thousand dollars ($100,000.00) four and one-half per cent (4½%) street paving bonds bearing date the 26th day of September, 1910. Interest payable semi-annually at the office of the Union Trust Company in the City of New York; said bonds to run thirty (30) years with an option reserved by the City of Houston to pay same at the expiration of twenty (20) years.

Each bid for the above issue of bonds must be accompanied by a certified check on a Houston bank, payable to H. B. Rice, Mayor, for one per cent (1%) of the face value of said issue as a guarantee of good faith; bonds to be delivered and money paid in Houston, Tex.

The City of Houston reserves the right to reject any and all bids.

H. B. RICE, Mayor.
DAN C. SMITH, JR., City Sec'y.

ADVERTISEMENT
for
CONSTRUCTION OF HIGHWAY BRIDGES
over
CAHOKIA CREEK DIVERSION CHANNEL,
MADISON COUNTY, ILLINOIS.

Office of Board of Trustees,
The East Side Levee and Sanitary District.
Sexton Building.
East St. Louis, Ill., November 23rd, 1910.

Sealed proposals, in duplicate, for the construction of Four (4) Highway Bridges over Cahokia Creek Diversion Channel, Madison County, Illinois, in accordance with Ordinances numbered 5 and 11 of The East Side Levee and Sanitary District and the plans and specifications for the same, now on file in the office of said District, will be received at this office until twelve o'clock, noon, standard time, January 9th, 1911, and then publicly opened. Copies of plans and specifications may be had on application by mail or in person. All proposals must be made on the printed forms prepared by The East Side Levee and Sanitary District.

DESCRIPTION.

The work included in the contract covers the construction of the following bridges:

Bridge No. 1, [illegible] spans of 60 feet each, and 1 span, 150 feet.

Bridge No. 2, 16 foot roadway, 2 spans of 60 feet each, and 1 span, 150 feet.

Bridge No. 3, 16 foot roadway, 2 spans of 60 feet each, and 1 span, 150 feet.

Bridge No. 4, [illegible] spans of 60 feet each, and 1 span, 150 feet. Bridge No. 4 shall be designed and con- [illegible] foot sidewalk being constructed on the West side at some later date.

Each bridge will have two (2) piers about 23 feet high and two (2) abutments about 16 feet high, and will have reinforced concrete floors and macadam wearing surfaces.

Proposals for said work must be accompanied by a money deposit in the form of a certified check from some satisfactory banking institution in the City of East St. Louis, Illinois, or St. Louis, Missouri, issued by a national or state bank in good standing within the State, and payable at sight to the President of The East Side Levee and Sanitary District, for Five Per Centum (5 per cent) of the amount of the proposal.

The bidder to whom award is made will be required to enter into a written contract with The East Side Levee and Sanitary District, with good and approved security in the amount equal to the amount of contract, within ten (10) days after being notified of the acceptance of his proposal.

The contract which the bidder and guarantors promise to enter into is fully set forth in the blank forms which can be inspected at this office and will be furnished, if desired, to parties proposing to put in bids. Parties making bids are to be understood as accepting the terms and conditions in such form of contract.

Upon completion of the work according to the contract, plans, specifications and agreements as determined thereunder by the engineer, including extra work when authorized by the engineer in charge in accordance with the terms and conditions of the contract, the said engineer shall make to the contractor, a statement setting forth the work done by said contractor, together with the amount due the said contractor therefor, and shall certify the same in writing under his hand. The obtaining of the certificate of the engineer as to the work done, and the price thereof, shall be a condition precedent to the right of the contractor to be paid the sum due him under the terms of this contract.

The Board of Trustees reserves the right to reject any and all bids.

LOCATION.

The proposed work is located in Edwardsville and Chouteau Townships, near Poag Station, Madison County, Illinois, on the Wabash Railroad and Edwardsville line of the Alton, Granite and St. Louis Traction Company, and is convenient to switch tracks of the Wabash, C. & A., C. C. C. & St. L., C. & E. I. and C. P. & St. L. Railroads.

H. D. Sexton,
President, Board of Trustees,
The East Side Levee and Sanitary District.

PAVING.

Sealed bids will be received until noon on Tuesday, Jan. 3, 1911, for paving with vitrified brick of Court street, Circleville, Ohio. The approximate quantities are as follows:

41,883 sq. yds. brick pavement, including 6-in. concrete foundation, 2-in. sand cushion, cement or asphalt filler.
16,540 lin. ft. straight curb, Berea.
940 lin. ft. circular curb, Berea.
1,670 lin. ft. stone edging.
24,636 cu. yds. excavation.
Grading at street and alley intersections.
528 lin. ft. 24-in. sewer in place.
615 lin. ft. 18-in. sewer in place.
10 catch basins.
4 manholes.

Write John W. Lowe, Director of Public Service, Circleville, Ohio, for specifications, blank forms, etc.

Contract to be entered into in five days. Work to begin as soon as weather is suitable.

The right to reject any or all bids is reserved.

(Proposal Advertisements Continued on Page 55.)

$3,000,000 OF IRRIGATION WORK

NOTICE TO CONTRACTORS AND FINANCIERS.

San Francisco, Cal., Dec. 1, 1910.

The attention of Contractors and Financiers is called to the opportunity which will soon be open to bid on the **construction of about $3,000,000 of Irrigation Work near Stockton, California.**

The Irrigation Systems to be built are those of the **South San Joaquin Irrigation District** and the **Oakdale Irrigation District.** The former contains about 71,000 acres, is 18½ miles long east and west by 6 miles average breadth north and south, and lies along the north side of the Stanislaus River, a large Sierra Nevada stream. The north-west corner of the South San Joaquin District is only 5 miles from Stockton, a city of about 25,000 inhabitants at the head of San Francisco Bay navigation. Stockton is a railroad center, and the South San Joaquin District is intersected by the Southern Pacific and the Santa Fe Railroads, while the Western Pacific runs along its western edge and another Southern Pacific line a mile east of its eastern boundary, through the Oakdale District. The wagon-roads are numerous and excellent.

The Oakdale District, of about 65,000 acres, lies east of the South San Joaquin District, and south of it along the south bank of the Stanislaus River and is adjacent to the well-known Modesto and Turlock Irrigation Districts now in full operation.

Both Districts were organized in 1909 under the Wright-Bridgeford Law, a California Law governing the organization and operation of Mutual or Citizens' Irrigation Districts. Such districts have the status of municipalities and are administered by a Board of Directors elected by the people. The districts have the power to issue bonds or to raise money by direct taxation. The bonds are a lien upon the lands. By the law, these bonds are 30-year bonds bearing 5 per cent interest, and are redeemed from the 21st to the 30th years. They cannot be sold for less than par and cannot be used in (direct) payment for construction, lands or existing irrigation-systems. **Under these conditions, no bids will be considered unless accompanied by separate and distinct guarantees that a purchaser will be found for a block of bonds at least as large as the particular contract contemplated, at a rate for the bonds not less than their par or face value.**

The South San Joaquin Irrigation District was organized (by a public election) on May 11, 1909. On June 15th the writer was retained as Chief Engineer, and on June 20th began his field-examination and surveys. The preliminary surveys were completed in August, and on Oct. 8, 1909, a Report was rendered to the Directors, with studies of several sources, and with Maps, Designs and Estimates of Cost for the complete Irrigation System recommended. A Bond Election was then called and on Dec. 30, 1909, bonds to the amount of $1,875,000 were voted by a majority of about 5 to 1.

Some time later, the Oakdale Irrigation District (of which Oakdale, population about 1,600, in the center of its District and on the Southern Pacific, Santa Fe and Sierra railroads, is the principal town) voted $1,600,000 bonds by a majority of nearly 40 to 1.

Soon after the election at which the South San Joaquin bonds were voted, studies and cost-estimates were begun by the writer to determine the advisability of purchasing the only adverse irrigation-system and water-rights; and after protracted negotiations an agreement was closed with the owners for its purchase.

The proceedings and bonds of both Districts have been passed on favorably by Judge E. A. Bridgeford of San Francisco, the author of the Bridgeford law (Wright-Bridgeford or amended Wright law). All the municipal irrigation districts of California (five in all, including the South San Joaquin and the Oakdale) are now working under this law. As an additional safeguard, the Directors of both the South San Joaquin and the Oakdale Districts started confirmation proceedings for the bonds in the Courts, as provided for in the Bridgeford law, and favorable decisions are expected before the close of the present month.

The South San Joaquin bonds were received from the printers in June, 1910, and after the required legal advertisement in local papers, $459,500 of them were sold at par on July 20, 1910, $325,000 of the proceeds being used to purchase a half-interest in the old irrigation-system, $20,000 for final locations and plans and for other District expenses, and the remainder for the purchase of reservoir-lands. The other half of the old irrigation-system was purchased in a similar way by the Oakdale District, and on July 1st, 1910, the two Districts took over the old irrigation-system and since then have been operating it themselves jointly, irrigating about 3,000 acres in each District.

On July 7, 1910, as soon as subscriptions had been received guaranteeing the sale of some bonds, a survey-party was put in the field by the South San Joaquin District and the final location, plans and estimates of that system were begun. The surveys of 1909 resulted in developing a good system at a reasonable cost; but the object of the present surveys is to develop the best system at the least cost. The surveys and estimates for the Supply Canal (about 15 miles long) are now nearly completed, and show the practicability of a much better canal than that of the preliminary report, at a cost materially less.

On May 12, 1910, a special tax of $35,000 was voted by the people of the South San Joaquin District, by a majority of about 4 to 1, $20,000 for the completion of the engineering plans and $15,000 for other District expenses. These taxes are now being received and the engineering plans are being rushed to completion. A similar tax of $30,000 has been voted by the Oakdale District by a majority of about 33 to 1.

The official assessed valuation of the South San Joaquin District, which was the basis of the $35,000 tax levy, was $2,870,968.85 or at the rate of about $40 per acre. From the general practice of California Assessors, this corresponds to an actual value of about $80 per acre without improvements, or to about $5,750,000 real value for the 71,000 acres. The land is all under cultivation and three years ago, before the irrigation movement began, its general average price was $60 per acre. The ruling price is now about $85 per acre, with very few owners who care to sell at that price.

The assessment of the Oakdale District (improvements not being included) was about $2,200,000.

The construction work to be done is about as follows:

By the Two Districts Jointly:

Masonry Diversion-Dam about 80 ft. high in Stanislaus River Canyon, with Head-works.

About 3 miles of 1,700 cu. ft. sec. Canal in Canyon, all concrete-lined, on side-hill slopes, principally sound slate excavation. Includes enlargement of two 1,000 ft. Tunnels.

Tunnel to carry canal out of Canyon, 2,900 ft. long and about 15 ft. x 15 ft. In sound slate, concrete-lined.

About 3 or 6 miles of 1,700 cu. ft. sec. canal, all in hard-pan, largely concrete-lined.

Flume or inverted-siphon of permanent construction, to carry 1,700 cu. ft. sec.; about 1,900 ft. long and 60 ft. max. head.

By the South San Joaquin District alone:

About 8 or 5 miles of 850 cu. ft. sec. canal to edge of District, in hard-pan, probably unlined.

Earth Dam about 60 ft. high by 3,400 ft. long, to store about 48,000 acre-feet.

Distribution-System, consisting of
About 55 miles large canals.
About 400 miles 45 cu. ft. sec. Ditches.
Both mainly in sandy ground.

Large number of Concrete Drops and head-works, some Highway and Railroad bridges, etc., etc.

Drainage-Works.

By the Oakdale District alone:

A somewhat similar Irrigation System, with somewhat less mileage in Distribution-System.

A large Inverted-Siphon to carry the supply across the Stanislaus River.

Correspondence is solicited from such contractors as can secure bidders for the bonds at par, and no other than such contractors can be considered. This means is taken to bring the project before the greatest number of such contractors in the least time.

Bids will be considered preferably for the South San Joaquin System as a whole; or the work may be divided into several parts, for which separate bids will be considered.

EDWIN DURYEA, JR.,
Chief Engineer, S. S. J. Irrig. Dist.,
1315 Humboldt Bank Bldg.,
San Francisco, Cal.

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A Method of Appraising Non-Physical Railway Values.

Elsewhere in this issue we present an abstract of a paper by Mr. Henry Earle Riggs, published in the Proceedings of the American Society of Civil Engineers, dealing with the methods employed in making the Michigan State appraisal of railroad properties. On the completion of the physical appraisal, the "non-physical" or "intangible' values of the properties were estimated under the direction of Prof. Henry C. Adams. In Mr. Riggs' paper the methods employed by Prof. Adams are somewhat briefly treated; necessarily, these methods are still more briefly treated when presented within the limits of an abstract. The following, which is given as matter of information only, is taken from Prof. Adams' paper in Bulletin 21, U. S. Bureau of the Census:

The assumption is made that it is impossible to arrive at separate values for the different elements of the non-physical value of a property; that these elements must be treated as one complex whole; and that their value can be determined only by a study of the income accounts.

The non-physical value of a property is defined as being the difference between the actual physical value (some elements of which are intangible in their nature, but are necessary parts of cost of production), and the total value of the property as a business proposition. It is assumed to consist of the following elements: the franchise, or the right to be a corporation and to use public property; the possession of traffic not exposed to competition; the possession of traffic through connections; the benefits of economies due to density of traffic; and value due to organization and vitality of industries served.

In the method employed by Prof. Adams the estimation of non-physical value is based directly on surplus earnings. The surplus earnings are determined in the following manner: From the gross operating income are deducted the operating expenses exclusive of taxes. To this is added the net income from investments, the resulting figure being termed the "total available corporate income." From this income are deducted a percentage for return on invested capital, taxes on physical elements, rents on property not covered by appraisal, interest on current liabilities, and permanent improvements charged to income; the result being a surplus or a deficit. The surplus, if any, when capitalized, represents the non-physical value of the property. The sum of the physical and non-physical values represents the total value of the property. In case there is a deficit, or no surplus, the property is considered as having no non-physical value. Mr. Riggs carries the method a step further and proposes that a deficit should also be capitalized, and deducted from the physical value.

Three elements that are matters of judgment and subject to some uncertainties enter into such a computation. These are, the apportionment of operating expenses among the different states on interstate lines, the rate of interest that should be allowed invested capital, and the rate at which the surplus should be capitalized.

In the Michigan appraisal these matters were subjected to careful investigation. The apportionment of operating expenses on interstate lines was based, in general, on car mileage. On branch lines this basis could not be used without modification. Interstate business originating or terminating on branch lines was found, on account of the main line haul, to have for the branch line a value greatly in excess of that indicated by an apportionment on a car mileage basis. It was therefore necessary to adopt a "constructive" mileage for the branch lines that would apportion to them their fair share of the operating expenses due to interstate business.

In determining the rate of interest that should be allowed invested capital, consideration was given to the market rate for money loaned on security of undoubted value. This rate was found to be 5 per cent. Since the physical property is subject to direct taxation [illegible] was made in this rate. The resulting figure, 4 per cent., was considered as being the fair market rate at which money could be loaned on non-taxable security.

The final operation, the capitalization of the surplus, presented serious problems. Here the security, instead of being stable like the physical value of the property, fluctuates from year to year. On account of this element of instability, it was necessary to make a study of the sources of income of each property, to determine the degree of stability of the surplus, and to assign such a rate as seemed fair. In general this rate was about 7 per cent. In some cases it ran much higher than this, the Manistee & Northeastern R. R. being capitalized at the rate of 10 per cent. On the other hand, certain union depot properties, because of the fact that their income was a matter of contract, were capitalized at as low a rate as 5 per cent.

Opening of the McKinley Bridge.—The McKinley Bridge, which crosses the Mississippi River from Venice, Ill., to St. Louis, Mo., and affords the Illinois Traction System, an electric interurban line, an entrance into the latter city, was formally opened Nov. 10. The Illinois Traction System operates 550 miles of interurban line in Illinois, extending from St. Louis northward through Springfield and Peoria to Morris, while other lines run to Bloomington, Decatur, Champaign and Danville. The bridge is named after Congressman Wm. B. McKinley, head of the system.

The bridge is 8,500 ft. long, composed of the main structure, 2,514 ft. 4 in. long between end piers, and of two approach viaducts. The three main spans are each 517½ ft. long center to center of end pins, and are composed of two pin-connected Pratt trusses with curved top chord and subdivided panels. They allow a clear headroom below of 50 ft. The bridge is designed for continuous lines of 75-ton cars on both tracks, and a live load of 100 lb. per square foot or a road roller weighing 35,000 lb. on the roadway.

The designer and chief engineer of the bridge was Mr. Ralph Modjeski of Chicago, who was represented on the work by Mr. F. E. Washburn, resident engineer. Mr. R. D. Smith, as construction manager, was the Illinois Traction System's representative on the work. The contractors for the main bridge superstructure were the Pennsylvania Steel Co. of Steelton, and for its erection the Missouri Valley Bridge & Iron Co. of Leavenworth, Kan., who were also contractors for the substructure. The steel in the viaducts was furnished by the Strobel Steel Construction Co. of Chicago.

Storage Reservoirs.—The New York State Water Supply Commission has made plans for a third storage reservoir. The dam for the reservoir is to be built on the Genesee River above the falls in that river, and will create a lake 15 miles long, extending from Portage up the bed of the river so as to cover portions of Wyoming, Livingston and Allegheny counties. It will store 18,000,000 cu. ft. of water, and its area, when filled, will be 13½ square miles. The cost is estimated at $4,584,000. The other two storage reservoirs are being built at Delta and Hinckley, in Oneida county, and are to be feeders for the enlarged canal. The Delta reservoir will have an area of 4 1-3 square miles and the Hinckley reservoir of 4.46 square miles. The capacity of the former will be 2,750,000,000 cu. ft., and the latter 3,445,000,000 cu. ft. The cost of the proposed Genesee dam is to be borne by the counties of Monroe, Wyoming and Livingston, the city of Rochester, the villages and the individual property owners in the improved district in proportion to the benefits each will receive. The new reservoir, besides preventing an annual loss of property, will conserve about 30,000 H. P. which will be sold for the benefit of the state.

Gates for Panama Canal Locks.—The manufacture of 46 mitering gates weighing 58,000 tons was begun by the McClintic-Marshal Co. of Pittsburg in October and the first shipment of the material for the Gatun locks has been made. Special machinery to the value of $100,000 was necessary for their manufacture. The heaviest single pieces of steel weighs about 18 tons. The plates range in thickness from 7/16 in. at the top to 1 in. at the bottom. The weight of the largest leaf is 600 tons. The leaves are 47 1/3 ft. to 82 ft. high, 65 ft. long and 7 ft. deep.

During the month of October the steam shovels on the Central Division of the Panama Canal took out 258,842 cu. yds. of earth [illegible]

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Don Juan Whittemore.

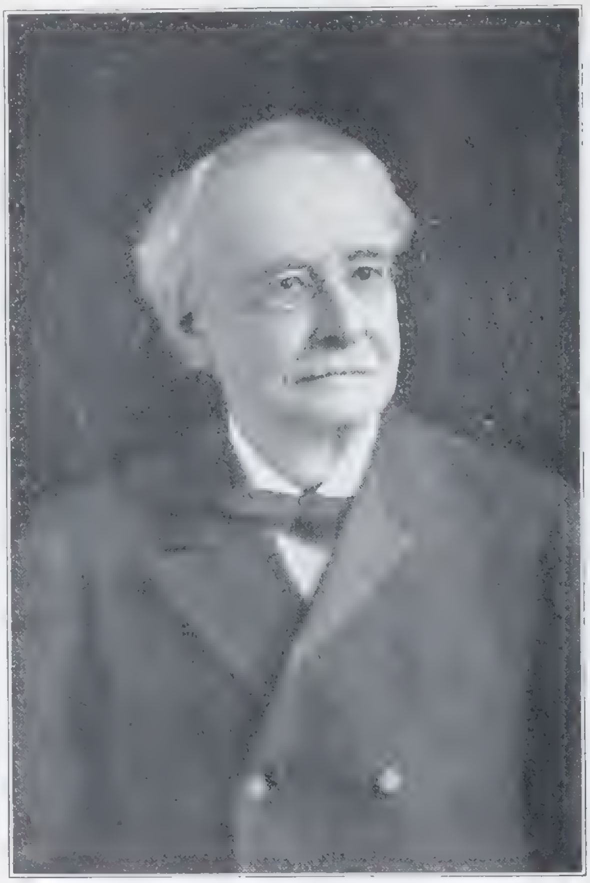
The resignation of D. J. Whittemore as chief engineer of the Chicago, Milwaukee & St. Paul Ry., on Dec. 6, 1910, closed the active, official career of a notable railway engineer. Mr. Whittemore began railway engineering in 1847 at the age of seventeen. He terminated his work 63 years later on his eightieth birthday. For 57 of these 63 active years his services were devoted, with slight interruption, to one railway, and for all but ten years of those services he was the head of that railway's civil engineering department. There are few records of continuous service in railway engineering which equal this, and in recognition the Chicago, Milwaukee & St. Paul management has made Mr. Whittemore Honorary Consulting Engineer an office created for the man

Don Juan Whittemore was born Dec. 6, 1830, at Milton, Vt. He received his education in the district schools and at the "academy" at Bakersfield, Vt. His schooling was brief as young men nowadays look upon the time required for an education, but in those days engineering education was obtained by practice under a master and not from books or in schools. Indeed, there were no schools and only a few books for engineers. At the age of seventeen, therefore, Mr. Whittemore began his engineering training as a member of the engineer corps of the Vermont & Canada R. R. Two years later, in 1849, he was appointed assistant chief engineer of the construction of the line being built by this company between Swanton, Vt., and Rouse's Point, N. Y. When this line was completed Mr. Whittemore assumed charge of construction as assistant engineer of a division of the Great Western Railway of Canada. This position he held until 1852, when he moved West and took charge of construction as engineer for the contractor of the Central Ohio R. R., being built from Zanesville, O., to Wheeling, W. Va. Another move west was made the following year when, in July, 1853, Mr. Whittemore was appointed assistant chief engineer of the La Crosse-Milwaukee Railway, one of the first links in the great 9,000-mile chain of railways which has been forged by the Chicago, Milwaukee & St. Paul Ry. Co., organized ten years later. Mr. Whittemore remained four years with the La Crosse-Milwaukee railway, then, in 1857, he became chief engineer of the Southern Minnesota R. R., a land grant line, and he held this position for two years. The young engineer's ambition next led him to a foreign field, and he spent six months in Cuba as assistant engineer on construction of the Ferro-Carril del Oeste.

Mr. Whittemore returned from Cuba in 1860 to resume the position he had left seven years before as assistant chief engineer of the La Crosse-Milwaukee Ry Three years later the Chicago, Milwaukee & St. Paul Ry. Co. was organized to take over the La Crosse-Milwaukee and other properties and Mr. Whittemore was made chief engineer of the new company. From that time until a few days ago Mr. Whittemore's engineering history has been the engineering history of the Chicago, Milwaukee & St. Paul Ry. From a short line in Wisconsin this railway has grown to a system extending from Lake Michigan to Puget Sound and whose ramifications cover Wisconsin, Illinois, Iowa, Minnesota and the Dakotas and reach southwest into Missouri. The great western rivers have been bridged, the Rocky Mountains have been crossed and tunneled and thousands of miles of plains railway built, and over all these engineering problems Mr. Whittemore has been the directing head. Few railway engineers have done more and few engineers in any line have written or spoken less of what they have done. Had the latter fact been different this would have been an easier story to tell and a far more interesting story to read.

In 1847, when Mr. Whittemore began engineering, stage coaches and canal boats were far more familiar means of transportation than were railways. The railway system of the United States was barely 16 years old; in truth, it was not a system but a number of isolated and scattered lines, mostly in the east. Railway structures, railway motive power and equipment, railway operating methods and railway traffic were widely different in 1847. It is the lot of few engineers to have witnessed the change; still fewer have personally labored throughout in bringing about that change—Mr. Whittemore has done both. To those who have understanding, nothing more is needed to indicate his life's task.

Mr. Whittemore's reticence regarding his work has been mentioned. This was broken only when within the circle of his intimate friends. Then, often, he spoke freely of men and affairs and incidents in railway development and spoke with a charm of manner and wealth of illustration which made the occasion memorable. It was, moreover, not merely as an engineer or as a railway man that he spoke, but as a wide reader and observer. Incidentally it may be remarked that Mr. Whittemore's chief pleasure in his retirement from active service probably lies in the anticipation of the leisure it will give him for study and investigation.



D J Whittemore

To rivet popular attention one must be spectacular. Mr. Whittemore was never this. It takes an engineer, therefore, to appreciate his work, and the recognition of engineers has been accorded it. Mr. Whittemore was welcomed to membership by two of the greatest engineering bodies in the world, the Institution of Civil Engineers of Great Britain, and the American Society of Civil Engineers. In 1884 he was elected President of the American society. He is also a member of the American Society of Mechanical Engineers and of the Western Society of Engineers. The last society made him an honorary member on his eightieth birthday. Mr. Whittemore received the degree of Civil Engineer from the University of Vermont and the degree of Doctor of Law from the University of Wisconsin. The great railway whose construction he has directed from its beginning is his degree *cum laude*.

Mining Rock Without Explosives.

A method of mining rock without explosives is conceived and described by Mr. G. E. Wolcott in the *Mining and Scientific Press*. If the system ever should be adopted it will revolutionize mining methods. The author describes the method as follows:

The operation begins by cutting a horizontal channel at the bottom of the drift extending the full width of face, or as much wider as may be found necessary. This cut is made slightly deeper, say 6 in., than it is expected to break the ground. Following this the second channel is cut in similar manner at a distance above the first, depending on the character of the rock to be broken. After the completion of this channel, wedges are driven by pneumatic power into the second channel to break the block of ground between the two channels, which would have to be removed on account of the lack of space at the bottom of the drift. The amount of rock broken between the two channels would depend upon two factors; first, the character of the rock, and second, the power of the pneumatic machinery employed in breaking. In the sketch it is assumed that five channels would be necessary for the whole breast, making the blocks each a little less than 21 in. thick. After the removal of the first block, the others follow in a similar manner, except that after the first block is removed it should be possible to insert a trolley or car under the succeeding blocks to catch the rock as it is broken. In this manner the shoveling of from one-half to three-fourths of the rock broken may be avoided, resulting in a material saving.

For a 4 by 7 ft. tunnel from 60 to 85 ft. of channeling would be necessary to break a depth of 3 ft.

In shaft sinking it is assumed that at least two machines will be employed, one or more in each end of the shaft. The central block is in this case removed first and presents the most difficult part of the work, in that the rock must be removed as broken. After the removal of the central block the others follow toward the ends and are removed as broken. It is assumed that mucking and breaking will proceed simultaneously, so that the bottom of the shaft will be cleared for another round almost as soon as the preceding one is broken. An interesting feature suggests itself in the possibility of avoiding a large proportion of the mucking by breaking the rock directly into especially prepared receptacles, which may then be hoisted a short distance and dumped directly into the regular hoisting bucket or skip.

Mr. Walcott estimates the cost of a shaft 6x12 ft. to be from $9 to $13 per foot, and the cost of 4x7 ft. dirft to be from $4 to $5.67 per ft. of advance. A raise 4½x10 ft. is estimated to cost from $6.87 to $9.93 per lin. ft.

However, these estimates are based on extremely optimistic conditions. The channelers must be sufficiently powerful to channel 100 sq. ft. in an 8 hr. shift and in addition a new machine must be devised to wedge and break out the blocks of rock. The estimate is based on a cost of 16 cts. per sq. ft. of channeling and 4 cts. for wedging and breaking per sq. ft. of channeled surface. The figure for channeling is very low even for open cut work and we therefore believe that when applied to underground work, will average considerably higher.

CONCRETE AND REINFORCED CONCRETE SECTION

Design and Computations for a Cellular Reinforced Concrete Dam.*

Briefly, the dam is built in the general outline of a solid concrete dam, but instead of being solid concrete, it is built like a honeycomb, the cells being vertical. The dam will be somewhat thicker than a solid concrete dam, owing to the difference in weight between earth and concrete. After the concrete work is finished, the cells are filled with earth and rocks laid down in water, so in the end the dam is practically a solid mass. Figure 1 indicates the construction.

To illustrate the manner in which this dam works out, I will take a specific instance. In this case the dam is 185 ft. high and 1,370 ft. along the crest. The material in this dam is proportioned with due consideration to all the strains that may come upon it. The principal strains are: (a) the pressure of the water when the reservoir is full; (b) the pressure of the earth filling when the reservoir is empty; (c) the weight of the superimposed material on the foundations.

The dam is considered, for the sake of calculation, as consisting essentially of a face wall supported in the rear by buttresses. The auxiliary walls which are parallel to the face wall and which complete the enclosure of the cells are considered only as supports to prevent the buckling of the buttresses, as resistance to shear strain and as weight to resist overturning. Their great stiffening effect on the entire structure, and their support and assistance to resisting the strain of the water pressure is not considered. Moreover, the strength of the earth filling in shear and its supporting effect in resisting transverse and longitudinal pressure is disregarded because I wished the structure to be strong enough to withstand all strains without counting on this assistance.

The computations are, therefore, as follows: (1)—The proportioning of the dam as a whole so as to resist overturning; (2)—The proportioning of the face wall; (3)—The proportioning and spacing of the buttresses; (4)—The proportioning and spacing of the walls parallel to the face wall, which we will call the auxiliary walls.

In a measure, these problems are worked backward, for the general form of the dam and the general nature of the strains suggest a certain arrangement which is assumed at the outset, although the proof of its fitness is the last thing arrived at in the course of the calculations. Thus it is assumed that the cells will be 20 ft., as measured longitudinally on the face wall, and will, of course, be narrowed as the radial buttresses approach the center of curvature of the dam. As measured transversely to the dam, the first tier will be 20 ft., the second 25 ft., and the third and balance, 30 ft., measurements being center to center of retaining walls. The spacing of these walls was decided upon after several calculations to determine the maximum economy in the proportionment of concrete and earth. The only way to decide this matter seemed to be by the "cut and try" method, so five different designs were figured out, and the one presented gave the best results. I think it is self-evident that the face part of the dam should have more concrete and less earth-filling than the rear part, and our "cut and try" calculations verified this assumption. Several formulas were found which almost fitted this case, and it is entirely possible that theoretic perfection may yet be attained, but the present design is sufficiently attractive from a practical standpoint.

As mentioned above, the nature of the several problems continually involves using the ultimate result in the primary calculation. It is therefore more simple, and better suited to the purpose of this article, I think, to assume the entire design as shown on the cross sections presented herewith, and proceed with the calculations to ascertain what the factors of safety may be.

(1)—To ascertain the factor of safety of the entire dam to resist overturning. To do this the dam is considered in progressively increasing segments, beginning at the top and going down, the last segment being the entire dam. The width of the base of each segment is determined by the graphic method given by Bulkely on p. 184 of "Facts, Figures and Formulae for Irrigation Engineers." The factor of safety consists in the fact that the resultant falls in the middle third of the base of the dam and also in the fact that the dam is arched against the water pressure.

It is evident that for the dam to yield, all the longitudinal walls must be crushed by the longitudinal component of the water thrust and that the buttress walls must be crushed by the overturning moment. By calculations given later on, it will be seen that the factor of safety in the buttresses is 8, without reinforcing. To this must be added the factor of safety protecting the crushing of the longitudinal walls. These walls are supported every 20 ft., at least, by the transverse walls so they cannot yield by buckling, neither can the dam as a whole yield by buckling, if properly curved, as in this case, and not too long in proportion to its thickness.

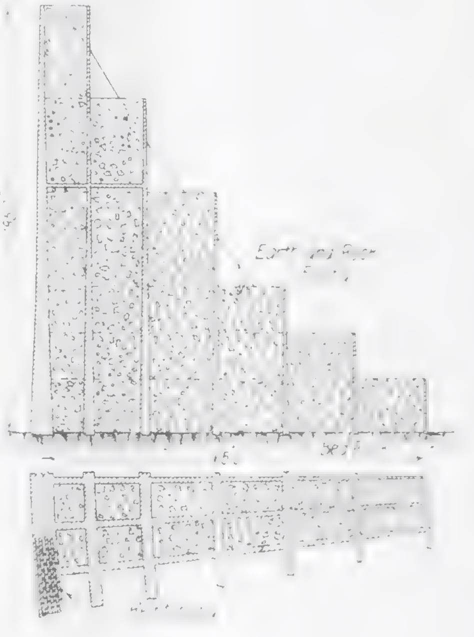


Fig. 1—Sketch Sections of Cellular Concrete Dam.

For the purpose of finding out what factor of safety is contributed by arching the dam against the water, two horizontal segments will be considered, namely, the top 10 ft. and the bottom 10 ft. Measured at right angles to the line of pressure, the upper segment is 1,270 x 10 ft. and the walls meet the buttresses at an angle of 35° to the line of pressure.

The strain then is

10 [illegible]

[illegible]

62.5 lbs. [illegible] water.

This [illegible], it is proper to divide this in two.

3,968,750

[illegible]

As it does not meet the abutment parallel to the line of pressure, but at an angle of 35°, it should be multiplied by the secant of 35°.

1,984,375 × 1.22 = 2,420,937 lbs.

This strain is met by two walls having a total cross-section of 17.5 ft. Each foot will, according to Kidder (p. 227, Architect's and Builder's Pocket Book), resist 440,000 lbs., without reinforcement.

17.5 × 440,000 = 7,700,000.

The factor of safety, then, is

7,700,000 [illegible]

2,420,937

Figuring the bottom 10 ft. in the same manner, we find a factor of 1½. The average will be about 2¼. It is more important to have the top of the dam supported by the arching effect than the bottom, because in this case the bottom is short and so wedged in between cliffs that it is abundantly secure.

The factor of safety in the buttresses alone is 8. As the dam could not yield in one way without yielding in the other, it is proper to add these two factors of safety together, making a total of 10¼, which will be increased about 12 per cent by the reinforcement (total, 16) and an unknown amount by the earth filling.

It is, of course, conceivable that the distribution of the material might be so at variance with the changes of pressure in depth, that the above calculations, with regard to the factor of safety of the arch, would not hold. This matter, however, has been closely considered and each horizontal cross-section has been designed with regard to the shearing strain, which is closely related to the strains above considered.

(2)—The proportioning of the face wall. In this case it is assumed that the water comes flush with the top of the dam. The parapet or extra height of any dam varies with the nature of the case and in this recitation it is omitted. The theoretical width of the face wall at the top is zero. It is, however, designed to be 2 ft. thick to resist wave action. The entire width on top, counting earth filling and enclosing walls, will be 23 ft. 4½ ins. As the pressure against this wall varies as the depth, and as the top is unnecessarily thick, the bottom is the place to test the factor of safety. In so doing, we will neglect the strengthening effect of the [illegible]

The face wall is divided into vertical panels by the buttresses, the one in the center measuring 20 ft. horizontally and 185 ft. vertically. These panels may be considered as consisting of horizontal slabs or simple beams being supported at each end and being subjected to a uniform load between supports. When the reservoir is full, there will be a pressure on the outside of each slab equal to the weight of the water over the slab considered. When the reservoir is empty, the weight of the earth filling may press outwardly against the slab. The water pressure is easily figured and the maximum possible pressure of the earth filling can be readily ascertained, but there are other possible strains not so easily estimated. There is an indeterminable strain due to a possible slight yield of the dam by reason of its elasticity and this yielding may cause a strain considerably greater than the pressure that caused it. Thus supposing that the pressure against the dam should be increased by a violent flood or earthquake, the dam would then be forced against the abutments and the elasticity of the curved walls would allow a little yielding such that the face would be a little out of the perpendicular. This condition would add to the strain on the slab in question a small percentage of the superimposed dead weight. As this is an indeterminable factor, it is necessary to have an unusually high factor of safety in the face wall.

[illegible]

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*Abstract of a paper by George J. Bancroft before the Colorado Scientific Society, Oct. 1, 1910.

used in computing the water pressure on the slab:

g = center of gravity of outer surface of slab exposed to water pressure.

d = vertical distance from g to water surface, measured in feet = 184.5.

A = area of slab exposed to pressure measured in sq. ft.

w = weight of a cubic foot of water in lbs.

L = length between supports in inches = 168.

W = total pressure on slab

In this case

$A = 11$ sq. ft. (The slab is 20 ft. long center to center of buttresses, but only 14 ft. long in the clear.)

$D = 184.50$.

$w = 62.50$ (approximately)

It is evident that

$W = A \times w \times D = 11 \times 184.50 \times 62.50 = 161,437$

The pressure moment in inch pounds =

$$\frac{W.L}{8} = \frac{161,437 \times 168}{8} = 3,390,177 \text{ in. lbs.}$$

Weight of face wall, central slab =

$$\frac{8+2}{2} \times 184 \times 20 \times 150 = 2,760,000 \quad \text{(approx.)}$$

One-fourth weight of dirt above floor =

$$\frac{17.5 \times 13 \times 110 \times 80}{4} = 500,500$$

Total weight = 3,260,500 lbs.

Our beam therefore must stand a pressure of 3,390,177 in. lbs. and the foundation for this segment must be strong enough to carry a load of 3.260.000 lbs.

The following are the notations, formulas and respective dimensions used in the formulas to calculate the strength of the face wall as assumed above.

The coefficients have been calculated to correspond to the material used, both with regard to concrete and steel. Concrete will be first class 1 : 3 : 5 mixture and steel of good quality. *See Webb and Gibson, "Reinforced Concrete," pp. 49 and 50.

Mo = Ultimate resisting moment in inch pounds.

b = breadth of slab transverse to pressure = 12".

d = depth from the face under compression to the center of gravity of the steel reinforcement, in this case = 82" as shown later.

C = compressive strength of concrete in lbs. per sq. in. = 2,700 in our case. (Webb and Gibson.)

Ec = Initial modulus of elasticity of concrete = 3,000,000.

Es = Modulus of elasticity of steel = 30,000,000.

$$R = \text{Ratio of Moduli} = \frac{Es}{Ec} = \frac{30,000,000}{3,000,000} = 10$$

S = Tensile strength of steel = 55,000 lbs

p = Percentage of steel =

$$\frac{7C^2R}{12S(CR + .667S)} = \frac{7 \times 2,700^2 \times 10}{12 \times 55,000\ (2,700 \times 10 + .667 \times 55,000)} = .0121$$

Webb and Gibson p. 62.

This percentage of steel amounts to $96 \times 12 \times .0121 = 13.94$ sq. ins. of steel for each tabular segment 1 ft. thick. This may be done by placing 6 round bars, 1⅛ in. in diameter, in layers 6 ins. apart and spaced 4 ins. from each other, beginning 4 ins. from the face. This gives a value to d of 82 ins.

K = Ratio of depth from compressive face to neutral axis to the total effective depth, d.

K = From table on page 61, Webb and Gibson, = .424.

Y = Distance from compressive face to center of gravity of compressive stresses.

$Y = .357\ Kd = .357 \times .424 \times 82 = 12.4$

(See Webb and Gibson, p. 59).

$Mo = p\ b\ d\ S\ (d - Y) = .0121 \times 12 \times 82 \times 55,000 \times (82 - 12.4) = 48,016,750$.

In other words, our slab will withstand a pressure of 48,016,750 in. lbs., and the maximum normal load that can come on it is 3,390,177 in. lbs.

The above calculations show that when the reservoir is full, the face wall has a factor of safety against normal water pressure alone of about 14, considering the face wall as a simple beam supported at both ends, but it is also a cantilever. Owing to the reversal of pressure when the dam is empty the wall must be reinforced on both sides and hence with regard to the buttresses it is both simple beam and cantilever, which doubles the factor of safety, making it 28, and this is disregarding entirely the fact that the face wall is backed up with earth which, in turn, is held in place by all auxiliary walls. It is evident, I think, that so far as the important feature of water pressure is concerned, the face wall is more than amply strong.

It has been suggested that the dirt filling of the cells would act as a liquid in exerting pressure, because this filling will be packed with water. I think this extreme view is unwarranted; nevertheless, it is easy to compare the relative strains of external and internal pressure by assuming such a condition. We have taken 110 lbs. per sq. ft. as the weight of a cubic foot of water-packed earth and rock. The weight of a cubic foot of water is commonly taken at 62.5 lbs. If, then, the earth filling were a liquid, it would exert a pressure greater than that of water in proportion to the relative weights or

$$\frac{110}{62.5} = 1.76$$

The earth column is, however, divided by the sill-floor so that we have 105 ft. of earth as against 184.5 ft. of water. The factor safety, then, will vary inversely as the relative height and weights $\frac{105 \times 110}{62.5 \times 184.5} = 1.003$.

In other words, the face wall as designed is equally strong to resist internal or external pressure, even if the earthen filling is regarded as a liquid. It is obvious, however, that the horizontal reinforcing of the buttress must be fastened by tie bars to those of the face wall and be strong enough to prevent parting, so it is planned to hook the horizontal reinforcing bars of the buttress over the horizontal bars of the longitudinal walls.

The next test in order is to ascertain what crushing strain this wall will stand.

Kidder gives the crushing strength of unreinforced concrete (1 part cement, 2 parts sand, 6 parts broken rock), at 440.000 lbs. per sq. ft. As we have in the bottom slab 20×8 ft. = 160 sq. ft., the resisting strength is 70,400,000 lbs., while, as previously computed, the weight above this slab is only 3,260,500, and so we have a factor of safety of 20 when disregarding the reinforcement.

The face wall is then abundantly strong from all standpoints.

We will now consider the buttresses. These are subjected to two main strains. There is shear strain and pressure exerted by the overturning moment and the direct water pressure. As in this design the resultant of the graphical computation of the overturning moment strikes the base line ⅓ the distance from the toe, it is sometimes assumed that all of the resultant pressure is applied along the imaginary line of the resultant and is met by the resistance of the buttress wall equidistant on both sides of this line. This means that the pressure will gradually increase from face to rear and the extreme rear will bear twice the average pressure. As the buttress is 165 ft. long and 3 ft. thick at the bottom, we have, $165 \times 3 = 495$ sq. ft. of material in compression and each square foot will stand 440,000 lbs., (not counting the reinforcement), or a total of 217,800,000 lbs., which acts through a moment arm of 110 ft., the product being 23,958,000,000. The water pressure on the panel supported by this buttress is 21,332,720 lbs., (as shown above), which acts through an arm of moment of 61.6 ft., the product being 1,314,067,272, the factor of safety by this method of computation being 17, on the average or 8½ for the rearmost portion. This will be much increased by the reinforcement and by the supplementary resistance of the earth filling and auxiliary walls. Perhaps a better way to figure the factor of safety of the buttresses is as follows:

The water pressure acts in a horizontal line inducing shear strain. The strength of concrete in shear is one-half what it is in compression.

Owing to the fact that these buttresses are tightly held on both sides by the auxiliary walls and the earth filling, they cannot yield by buckling and if they yield at all, it must be of shear or crushing. We may, therefore, double all the horizontal pressure and add to it all the vertical pressure and if the wall is sufficiently strong in compression it surely will be in shear. When considered in this way, however, it is proper to consider all the material that will be in shear. This includes a segment of the face wall 20 ft. wide, and a similar segment of all the auxiliary walls. There will be a total of 910 sq. ft. of reinforced concrete to resist the shear and pressure. This material, disregarding the reinforcement is capable of standing a pressure of $910 \times 440,000 = 400.400,000$.

The total pressure is as follows:

	Lbs.
Double the water pressure as given above	42,665,440
Weight of aux. walls	3,150,000
Weight of buttress	3,073,750
Weight of each above sill-floor	2,002,000
Weight of face wall	2,760,000
Total	55,641,190

As the power of resistance is 400,400,000 lbs., and the maximum strain 55,641,190 lbs., it is plain that we have a factor of safety of 7.1, which will be much increased when the reinforcement of the concrete and the resistance of the earth filling are considered.

Thus it will be seen that the lower section of the dam as designed is amply strong. In the same way each section taken at 5, 20 and 40-ft. intervals, has been checked and the dam is abundantly strong on each section.

The arched floor is calculated as a horizontal slab which must be able to carry the dirt filling. Taking a 1-ft. segment, the load will be:

$$1 \times 20 \times 80 \times 110 = 176,000 \text{ lbs.},$$

and its own weight $= 20 \times 1 \times 1 \times 150 =$ 3,000.

The total weight upon the slab is 179,000 lbs. With a safety factor of 4, the ultimate load will be

$$4 \times 179,000 = 716,000 \text{ lbs.}$$

To compute the required thickness of the arched floor, the same nomination as above is used.

And from the above formula,

$Mo = p\ b\ d\ S\ (d - Y)$, we deduce,

Assuming that $P = 1$ per cent and $D = 12$, we find from equation (6) Webb and Gibson that $Y = .357\ Kd$. From table on page 61 we find $K = .422$, so $Y = .151d$ and $d - Y =$ .849 d.

As $Mo = 716,000$ lbs., we obtain

$$d = \sqrt{\frac{.0121 \times 12 \times 55,000 \times .849}{716,000}} =$$

$$\sqrt{\frac{716,000}{6,780}} = \sqrt{118} = 11 \text{ ins.}$$

The sill-floor, then, will be 1 ft. thick, assuming that the reinforcing is 1 in. from the surface. It will also be arched to increase its strength.

The reinforcing for each part of the dam has been figured out, as given above for the face wall. Although there was some variation in results it was not sufficient to adopt different percentages for different parts of the dam, and 1 per cent is a good average reinforcement for all parts, but the face wall which will be 1.2 per cent on each side or 2.4 per cent altogether.

In the particular instance given above, a solid concrete dam will require 300,000 cu. yds. of concrete. The cellular dam will require 300,000 cu. yds. of dirt filling and 50,000 cu. yds. of reinforced concrete.

300,000 cu. yds. concrete at $5	$1,500,000
300,000 cu. yds. dirt at 20c	60,000
50,000 cu. yds. reinf'ced concrete at $12	600,000
Total	$ 660,000

Methods and Costs of Constructing Concrete Masonry for the Pedro Miguel and the Miraflores Locks of the Panama Canal.

In constructing the Pedro Miguel and the Miraflores locks for the Panama Canal use is being made of a radically different type of plant than is used at Gatun, as described in our last issue. Instead of cableways the main handling units are cantilever cranes of the general type used on the Great Lakes for handling ore and coal. The same general type of cranes are used at both Pedro Miguel and at Miraflores, but differences in arrangement and construction make a separate description advisable for each plant.

The lock structures at Pedro Miguel and at Miraflores are, like that at Gatun, in pairs. At Miraflores there are two pairs in flight with a combined lift of 85 ft., and at Pedro Miguel one pair, with a lift of 30 ft. The masonry sections forming the structures are indicated in Figs. 1 and 2, which show the handling plants at Pedro Miguel and at Miraflores, respectively. The following are descriptions of the two plants.

PEDRO MIGUEL HANDLING PLANT.

The essential features of the installation at Pedro Miguel are: (1st) storage trestles, for unloading and storing sand and stone; (2nd) beam cranes, for handling raw material and mixing concrete; (3rd) narrow-gage road, for transporting concrete, and (4th) chamber cranes, for placing concrete.

Storage Trestles.—In the forebay of the locks framed trestles have been erected on both sides of and parallel to the canal axis; each has an average height of 28 ft. and a length of 800 ft. available for storage. Sand and crushed stone are delivered on the trestles in trains made up of 12-cu. yd. dump cars, and the former is dumped on the outside and the latter on the inside in order to minimize the average distance of conveying the aggregates to the mixers. The total storage capacity is 45,000 and 55,000 cu. yds. of sand and stone, respectively, which will supply the mixers for 17 days of 8 hours.

Berm Cranes.—Two berm cranes only are used at Pedro Miguel, and are installed between the trestles on two parallel 5-ft. gage tracks, 50 ft. centers. The cranes are entirely of steel and consist of a tower 50 x 40 ft., supporting balance cantilever arms that extend well over the storage trestles, with ample clearance for a locomotive. From the lower chords of the cantilever trusses are hung continuous trolley tracks equipped with two trolleys—one for each arm—arranged to operate 2½-cu. yd. Hulett excavating buckets, by means of which sand and stone are taken from storage and conveyed to bins located on the crane towers. There are four bins, each of 15 cu. yds. capacity; two being used for stone and two for sand. Beneath the bins is a cement floor 2,000 sq. ft. in area on which may be stored 6,000 bags of cement. Two cement hoppers of 10 bbls. capacity each are hung from this floor.

Cement is delivered direct from box cars to an elevator attached to the tower framing and deposited by the latter on a horizontal conveyor running across the cement floor to the gratings over the hoppers, but the bags of cement may be taken off before reaching the hoppers and stored on the floor. The bins and hoppers are equipped with chutes which discharge into either one or both of the measuring hoppers that are attached to the two concrete mixers located lower down on the towers.

The mixers are 2-cu. yd. Chicago Improved cube machines operated by electric motors, and are provided with long spouts for dumping direct into buckets on the narrow-gage cars alongside. Each mixer is provided with an electrically operated recording instrument which shows graphically the time consumed in mixing each batch. The water required for mixing is supplied through automatic measuring tanks placed on the towers.

Power for operating the cranes is transmitted by an overhead line from the Miraflores power house to a substation at Pedro Miguel, where it is converted into 550-volt direct current by two 500-kilowatt rotaries and supplied to the cranes through a feeder rail supported on brackets attached to the cross-ties of one of the crane tracks. All motors, except for the concrete mixers are in a machinery house located on top of the tower truss. All operations, however, are controlled by master switches in the cabs of the trolleys, so that the operator is always immediately over and in plain view of the bucket. A 65-hp. compound-wound motor geared through two reductions to the cable drum is used for hoisting, and a 21-hp. power compound-wound motor for trolleying. In both of these movements dynamic braking is used. The elevator and conveyor are driven by a 15-hp. compound-wound motor and each mixer by a 40-hp. shunt-wound motor. One of the hoisting motors is also used for traversing the crane by connecting through friction clutches to the traversing drums after having disconnected from the hoisting drum the arrangement being such that the two movements of hoisting and traversing can not be accomplished at the same time.

Narrow-Gage Road.—A narrow-gage railroad is used for transporting mixed concrete from the berm to the chamber cranes. The difference in elevation between the forebay and bottom of the lock chambers is overcome by means of trestles with a grade of 2.5 per cent. The tracks are laid with 70-lb. steel rails, which enables the locomotives to attain a greater rate of speed than would be safe on the light rail usually employed. The equipment consists of twelve 11½-ton Porter locomotives and 24 steel flat cars, all equipped

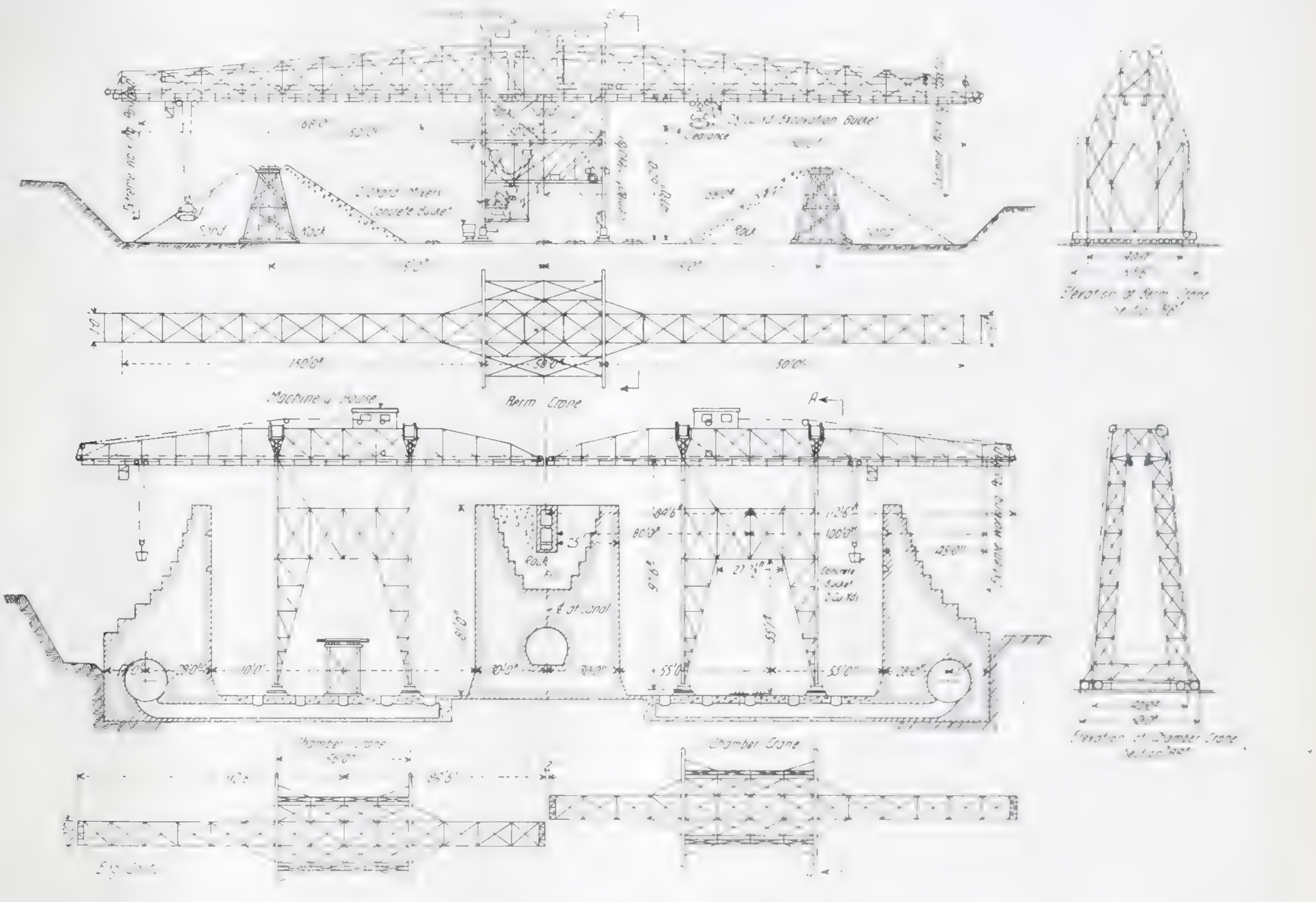

Fig. 1—Concrete Handling Plant at Pedro Miguel Locks.

with air; each car is large enough to hold two buckets of 64 cu. ft. capacity. A train consists of two cars and each of the latter carries a bucket so placed that when alongside a berm crane the buckets may be filled from the corresponding mixers without moving the crane. The trains alternate in going into the respective lock chambers and stop under the first chamber crane reached; the latter places an empty bucket on one of the cars and picks up a loaded one from the same car; the train then moves to the next crane, where the operation of exchanging buckets is repeated, after which it returns on the up track to the mixing cranes with the two empty buckets.

Chamber Cranes.—Four chamber cranes—two in each lock—are in service at Pedro Miguel. Their function is to place concrete, handle forms, and the steel or cast members that are embedded in the masonry. They are steel cantilever cranes made up of a tower 56x40 ft., carried on four heavy freight-car trucks which run on two 5-ft. gage tracks located on the floors of the locks. Each tower supports a cantilever arm 53 ft. 6 ins. long, extending over the center wall, and one 81 ft. 6 ins. long, extending over the side wall. A continuous trolley runway 191 ft. long is suspended from the cantilevers and lower truss of the tower; the trolley is designed to run the entire length of the runway and to handle a 64-cu. ft. concrete bucket. All operations, including opening and closing the bucket, are controlled by the operator in the trolley cab. As in the case of the berm cranes the machinery is in a house on top of the tower and is actuated by direct electric current supplied from the same source. For hoisting and trolleying 47-hp. and 21-hp. motors, respectively, are used, and a 15-hp. motor for traversing the entire machine; the latter is controlled by a switch so located that the operator may reach it from his cab when in a certain position.

Concreting.—The work of concreting with the regular mixing and placing plant as above described was begun in March, 1910, but the entire plant was not in operation until July 15, 1910. In order to begin placing concrete while the regular plant was being erected two temporary plants were installed, one consisting of three ½-cu. yd. mixers and one consisting of two 2-cu. yd. mixers. During the year ending June 30, 1910, all plants laid an aggregate of 166,868 cu. yds. of masonry, including 1,656 cu. yds. of rubble. The temporary plants laid about 91,000 cu. yds. of the total.

Costs.—The cost of 310,299 cu. yds. of concrete masonry at Pedro Miguel since the beginning of work has been $5.81 per cu. yd. The detail costs of laying 131,354 cu. yds. of masonry in the first six months of 1910 are given in Table I. Similar detail costs for the succeeding three months of July-September, 1910, are given in Table II.

MIRAFLORES HANDLING PLANT.

At Pedro Miguel the high and unstable banks which flanked the lock site made it necessary to store the sand and stone as described in the forebay at one end of the locks' structure. This necessitated the railway described to handle the mixed concrete to within reach of the chamber cranes. At Miraflores the conditions were such that the concrete materials could be stored along the lock on both sides and no intermediate railway was necessary between the berm cranes and the chamber cranes. The Miraflores plant, therefore, includes the following elements: (1st), Storage trestles for sand and stone; (2d), berm cranes for handling raw material, mixing and placing; and (3d), chamber cranes for placing.

Storage Trestles.—The storage trestles are located on both sides of the lock site and under the outer arms of the berm cranes. Sand and stone are delivered in the same manner as at Pedro Miguel.

Berm Cranes.—Two berm cranes on each side of the locks will be used at Miraflores. They will consist of steel towers with cantilever arms extending over the storage trestles and booms 144 ft. long projecting over the side walls of the locks. Those at Pedro Miguel will be dismantled and re-erected at Miraflores with the following modifications: One of the cantilever arms will be removed from each and used as the outer arms for the two additional cranes, and all four will be equipped with booms. The towers are equipped with bins, hoppers, and 2-cu. yd. mixers, as at Pedro Miguel, but the operation differs in that one excavating bucket operated on the cantilever supplies sand and stone, while the boom carries a trolley equipped with a 64-cu. ft. concrete bucket, into which the concrete is dumped direct from the mixers. The boom is hinged and has a vertical range of 25° and may swing horizontally through an arc of 50 ft. It will not be necessary to unhook the bucket from the boom trolley wither to receive or discharge the concrete which will be deposited directly in the side walls and into a transfer hopper, from which it is discharged into the chamber crane buckets to be conveyed to the middle wall. All operations are controlled from the trolley cabs, and the motors are the same as now in use at Pedro Miguel.

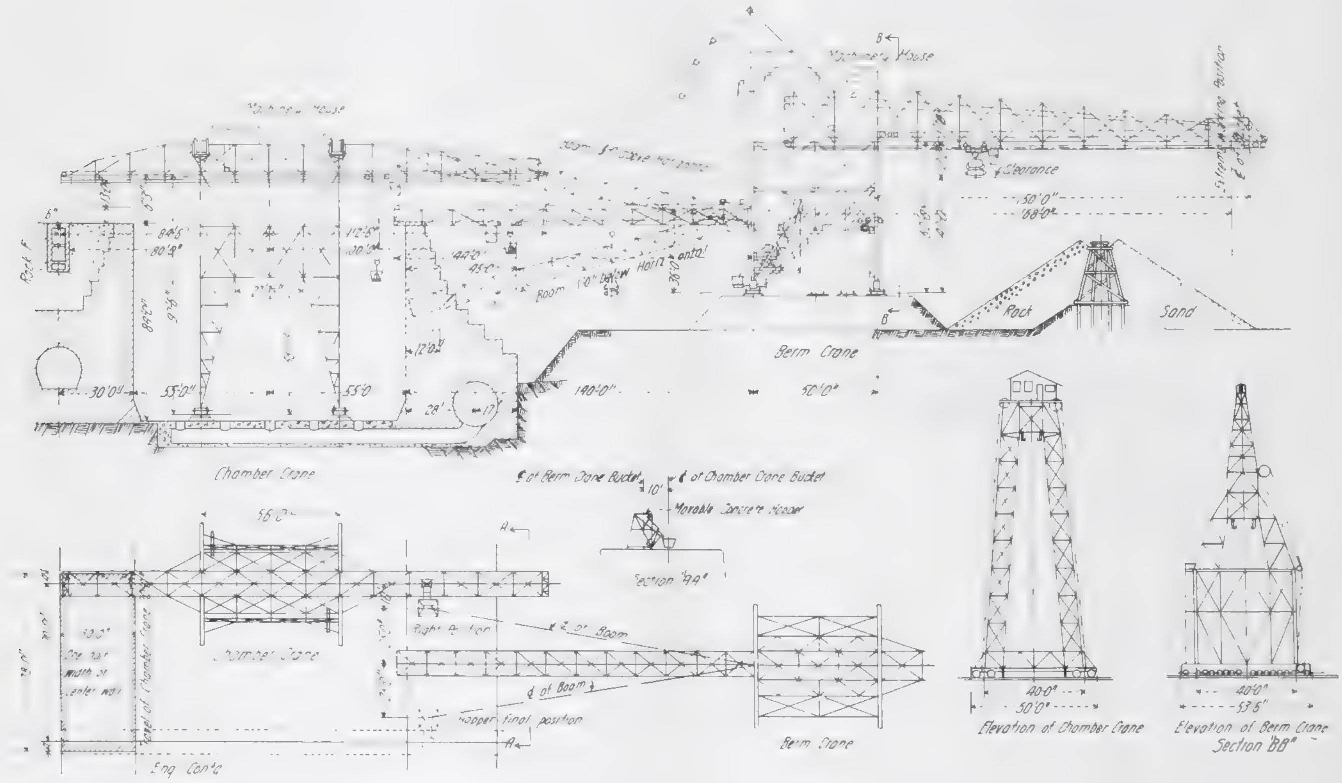

Fig. 2—Concrete Handling Plant at Miraflores Locks.

TABLE I.—COST OF CONCRETE MASONRY IN PEDRO MIGUEL LOCKS, JANUARY-JUNE, 1910.

Item.	Per cu. yd.
Concrete, 131,354 cu. yds.:	
Cement	$1.8449
Stone	1.2609
Sand	0.7354
Mixing	0.1559
Total	$3.9971
Rubble stone, 1,659 cu. yds.	0.9642
Masonry, 133,013 cu. yds.:	
Concrete as above	$3.9473
Rubble stone	0.0120
Forms	0.6808
Placing	0.5331
Reinforcement	0.0028
Pumps	0.0418
Power	0.1075
Maint. equipment	0.0880
Plant, arbitrary	0.1569
Division expenses	0.0965
General expenses	0.3849
Total	$6.3496

TABLE II.—COST OF CONCRETE MASONRY IN PEDRO MIGUEL LOCKS, JULY-SEPTEMBER, 1910.

Item.	Per cu. yd.
Concrete, 141,763 cu. yds.:	
Cement	$1.6414
Stone	0.9056
Sand	0.3270
Mixing	0.1437
Total	$3.0177
Rubble stone, 1,667 cu. yds	1.4427
Masonry, 143,430 cu. yds.:	
Concrete as above	$2.9826
Rubble stone	0.0168
Wood forms	0.2907
Steel forms	0.0763
Reinforcement	0.0455
Placing	0.2523
Pumps	0.0408
Power	0.0554
Maint. equipment	0.1403
Plant, arbitrary	0.6655
Division expense	0.0686
General expense	0.2485
Total	$4.8833

TABLE III.—COST OF CONCRETE MASONRY IN MIRAFLORES LOCKS, JULY-SEPTEMBER, 1910.

Item.	Per cu. yd.
Concrete, 27,222 cu. yds.:	
Cement	$1.6282
Stone	[illegible]
Sand	[illegible]
Mixing	0.7557
Total	[illegible]
Rubble stone, 338 cu. yds	0.4036
Masonry, 27,835 cu. yds.:	
Concrete	$3.5819
Rubble stone	0.0049
Wood forms	[illegible]
Steel forms	0.1429
Placing	0.3214
Reinforcement	0.2492
Pumps	0.0616
Power	[illegible]
Maint. equipment	0.1676
Plant, arbitrary	0.4500
Division expenses	[illegible]
General expenses	[illegible]
Total	$6.1045

Chamber Cranes.—The chamber cranes at Pedro Miguel will be dismantled upon the completion of the work there and rebuilt at Miraflores. They perform the same functions as described for Pedro Miguel.

Concreting.—Concreting was begun at Miraflores in June, 1910, and during that month 1,630 cu. yds. were concreted at a cost of $8.11 per cu. yd. This work was done with a temporary plant of 2½-cu. yd. mixers. The work of this plant and of small fractions of the permanent plant during July-September, 1910, is given in Table III.

CONCLUSION.

With the publication of the above tables it is possible to compare the concrete costs of the three lock structures in a tentative way. Full comparison will not be possible until the plant at Pedro Miguel and particularly that at Miraflores have been in operation for a longer period of time. The figures are as follows for the last three months' work of record:

Concrete, per cu. yd.:	Gatun.	Pedro Mig.	Miraflores.
Cement	[illegible]	[illegible]	[illegible]
Stone	2.32	0.91	0.90
Sand	0.91	0.33	0.37
Mixing	0.18	0.14	0.76
Total	[illegible]	$3.62	[illegible]
Rubble stone, per cu. yd.	1.35	1.44	0.40
Masonry, per cu. yd.:			
Concrete	$4.82	$2.98	$3.58
Rubble	0.12	0.02	0.00
Forms	0.47	0.37	0.68
Placing	0.28	0.25	0.32
Plant	0.88	0.81	0.62
Administration	0.32	0.31	0.58
[illegible] ment	0.12	0.14	0.31
Total	[illegible]	[illegible]	$6.10

Separating out the masonry materials it will be seen that the cost of cement, sand and stone at the three works, compares as follows:

	Per cu. yd.
Gatun	$5.11
Pedro Miguel	2.88
Miraflores	2.90

Neglecting the work at Miraflores which has been done with a temporary plant, it will be seen that the difference in cost between concrete in place at Pedro Miguel and at Gatun is due almost wholly to the difference in costs of concrete materials at the two works. These differences are more fully presented in the succeeding section of this issue.

EARTH AND ROCK SECTION

Electrically Operated Shovels.*

During the past six years great strides have been made in the application of electricity to power operated shovels. At present a number of them are being successfully used in grading operations, gravel pits, stone quarries, brick and tile yards, cement plants and in placer ore mines. These shovels are fully equal in power and capacity to steam shovels and may be built for any service desired.

Equipment.—The mechanical equipment of an electrically operated shovel, i. e., the dipper, boom, car and trucks, is built along the familiar lines of the steam shovel. The power equipment consists of a motor of from 50 to 200 hp. to operate the hoist, and two motors of from 25 to 80 hp. to swing the boom and operate the thrust. The hoist and swing motors are located in the car, and are geared to the drums through suitable reducing gears. The thrust motor is mounted directly on the boom, and communicates its motion to the bucket staff through reducing gears connected to a pinion engaging a rack on the staff. The motors are of the crane or mill type, with high torque characteristic, and may be for either direct or alternating current. They are reversing and are under perfect control. When desired the controllers may be connected to the ordinary hand lever used on steam shovels, so that a steam shovel engineer can operate the electric shovel without any trouble. Data in regard to the sizes, capacities and motors required are given in Table I.

The power is ordinarily taken from trolley wires, or from a transformer located near the cut, the feed cables from the power circuit to the car being wound on a retractile reel in the cab and drawn in or paid out as the cut advances. The wiring in the car is enclosed in conduit, and is well protected from moisture and mechanical injury.

The chief objection in the past to electrically operated shovels has been the possibility of damage to the hoist motor when stalled, due to the bucket digging in too deep, or striking a rock or other obstruction in the bank. The heavy current taken at such times was liable to cause a burn-out, while if the motor was properly protected by fuses or circuit-breakers, their continual opening caused annoying interruptions of service. This difficulty has been overcome by the use of automatic magnet switch control, which protects the motor against such overloads by cutting resistance into the circuit when the current exceeds a certain value.

The accompanying diagram shows the connections for such a method of control. The master controller has two running positions in either direction. The first position connects the motor to the line with all the armature resistance in series, the second position energizes magnet switches *VI*, *VII* and *VIII* through the accelerating relay *IX*. These switches short-circuit the resistance in sections, each successive step being delayed until the current in the accelerating relay falls below a fixed value. The various positions are interlocked, so that it is impossible for the switches to close in wrong order. The master controller can be thrown from full speed forward to full speed reverse, without damage to the motor, as the starting switches for either direction cannot close until all the control switches are opened and full armature resistance has been connected into the circuit. The reversal is thus made in the least possible time consistent with the safety of the motor.

In case of an overload on the motor, safety relay *X* opens, breaking the control circuit of switches *VI*, *VII* and *VIII*, and cutting all the armature resistance into the circuit. The motor will then exert its full starting torque continuously until the overload is removed, when the resistance will be automatically short-circuited again. This feature of the control is especially valuable for shovel work, as frequently a stone or log may be dislodged by a steady pull when it cannot be moved by a sudden jerk. If the overload current exceeds the value for which the overload relay *XI* is set, the line switch *V* opens, disconnecting the motor from the line. On moving the master controller to the off position, magnet switch *V* is reset, and the motor may be started again in the usual way.

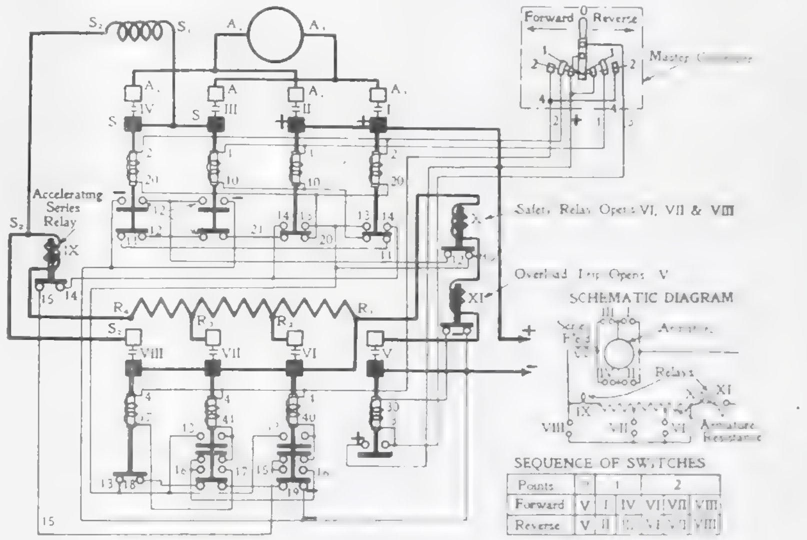

Diagram of Connections for Electrical Con trol of Steam Shovels.

TABLE I.—ELECTRIC POWER SHOVELS.

Weight of Shovels. Tons.	Size of Dipper. Cu. Yds.	Hp. of Motors. Hoist.	Thrust.	Swing.
30	1	[illegible]	[illegible]	[illegible]
35	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	25	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
65	2	100	35	35
95	3⅓	150	50	50
100	4	200	80	80

Where a more flexible control is desired a five point master controller is used. In this case, each of the switches which cut out armature resistance is controlled by a separate point on the master controller. The amount of resistance in the circuit is, therefore, under the constant control of the operator. At the same time the controller can be thrown immediately to the full speed position, and the motor will be automatically brought up to speed as rapidly as the accelerating relay will allow.

The motor driving the thrust may be operated either by a drum controller or by automatic magnet control. The motor and its controller must be of such a design that the motor wil be able to develop a heavy torque for short intervals of time while standing still, or rotating very slowly. Its duty is to jam the dipper against the bank and hold it there while the hoist operates. As soon as the dipper strikes the bank the thrust motor ceases to revolve, except very slowly, but must still exert full torque in order to keep the dipper against the face of the cut. Its characteristics should, therefore, be such that it may be stalled frequently for a minute or more at a time and still keep developing full-load torque without injury.

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*A paper by W. H. Patterson in the Electric Journal for November, 1910.

The motor driving the swinging boom may be operated by hand control if provided with a magnetic brake to stop the motor quickly and keep the circuit-breaker from opening if the motor is reversed quickly; or may be operated by automatic control without a brake. The operator can place the bucket with greater precision and ease with the automatic control on account of the rapidity with which the magnet accelerates the motor. The controller panels and switches are placed in the rear of the car, while the faster switches or drum type controllers are placed in the front within easy reach of the operator. This makes a very compact and accessible equipment.

Operating Costs.—While the initial cost of electric shovels is more than that of steam shovels, their operating cost is much less. They can ordinarily be operated by a smaller number of men; the hauling of coal and water is dispensed with; their power economy is greatly superior to that of the steam shovels, and they can be handled with greater precision and rapidity. In addition the electric shovel is comparatively noiseless in operation, which is a great advantage for city use.

Some interesting data in regard to the cost of operation of electric shovels has been obtained by the Vulcan Steam Shovel Co., of Toledo, O. One of these shovels, has been operated by the Milwaukee Electric R. & Light Co. for several years, at a consumption of approximately 100 kw-hrs. per ten hour day. It is used for loading gravel at a gravel bank and is operated by two men, who load from 300 to 400 cu. yds. of gravel per day. The average daily expenses of operating this shovel are:

One engineer	$2.00
One craneman	1.75
Electric power at 1.5c per kw.-hr.	1.50
Oil, waste, repairs, etc.	.75
Total	$6.00

The Chautauqua Traction Co., of Jamestown, New York, has been operating a shovel equipped with a 75-hp. hoist motor, since 1907. This shovel is used in loading a mixture of gravel, sticky clay and sand, which is very hard to dig, and is operated by 2 men on the shovel and 2 pitmen. The current consumption on a special test averaged 163 kw-hrs. per 8 hour day, and 534 cu. yds. of material were loaded in an average day. The total expenses per day, including the pitmen, were $8.80, or approximately 1⅔ cts. per cu. yd. The maximum capacity of this shovel is about 1,000 cu. yds. per 8 hours. If operated at this capacity, the power consumption would be increased in proportion to the output, but the labor charges would be the same as figured in the above statement. This would bring the cost of shoveling down to about 1 ct. per cu. yd.

Perhaps the most promising field for electric shovels is in connection with electric traction lines, where electric power is usually available at a very low rate. For this service they are mounted on standard gage trucks equipped with air brakes, and may be hauled on the regular tracks, or may be equipped with a trolley and made self propelling, the maximum speed being about 5 miles per hour. Great economy can also be effected by the use of electric shovels in any territory where coal is hard to procure and water power is comparatively cheap, as experience has shown that with current at 2 cts. per kw.-hour, or less, their cost of operation is only about half that of steam shovels. And as part of this saving is obtained by decreased labor costs, and the cost for power is only about one-third the total cost of operating the shovel, local circumstances may determine a saving at considerably higher power rates.

Cost of Quarrying and Crushing Stone and of Dredging Sand for Concrete Construction on the Panama Canal.

The several million cubic yards of crushed stone and sand required for concrete for the Panama Canal locks are being secured from quarries and sand deposits operated by the Canal Commission. On the Atlantic side for the Gatun Locks and Spillway crushed stone comes from a quarry at Porto Bello, some 20 miles from Gatun, and sand comes from a deposit at Nombre de Dios, about 35 miles from Gatun. On the Pacific side the quarry is located at Ancon, and the sand deposits at Point Chamè. All four of the places of supply are now fully developed and distinct cost figures, covering nine months' work, are available. The following paragraphs outline the plant and methods employed at each place, and also give separately the cost at each for the period stated.

CRUSHED STONE.

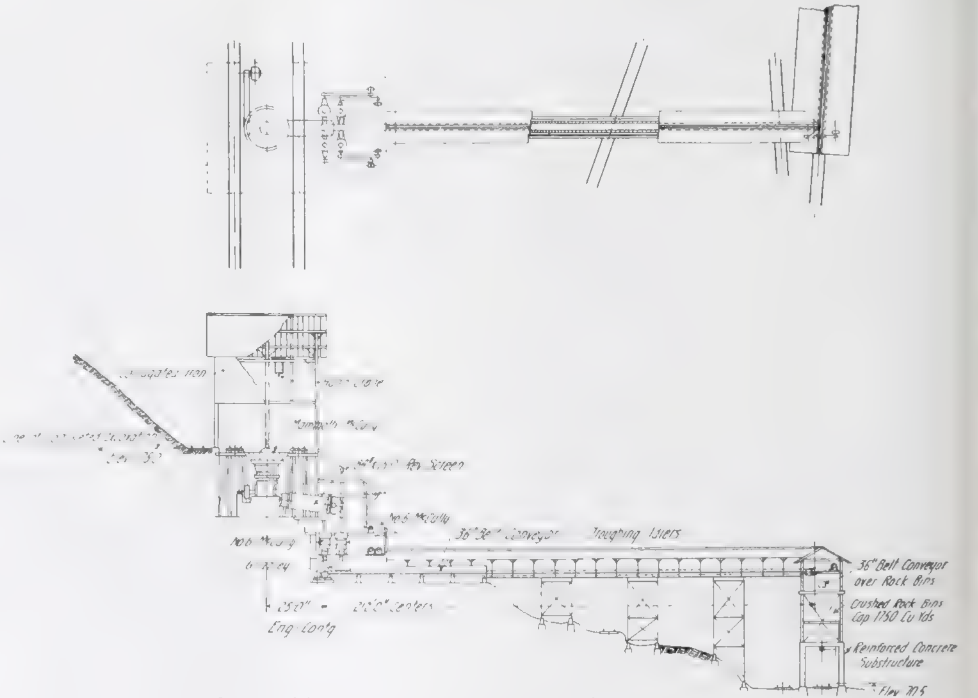
Porto Bello Quarry.—The Porto Bello quarry is developed on the flank of a rock hill, rising from the water's edge at an angle of 30° to 45°. The quarry flow is developed at elevation 88 and between this horizontal and a vertical plane on contour 260 there are roughly 4,000,000 cu. yds. The charging flow of the crusher house is at quarry flow level and the general movement of the rock is descending to storage bins at the water's edge. During the year the quarry face was opened up for a length of 2,500 ft., with a maximum height of 140 ft. The rock is andesitic trap weighing 163 lbs. per cu. ft. It has an overburden of earth which has to be stripped. The stripping is done by hydraulicking natural rock gulleys in the face of the hill serving as flumes for the waste.

The crushing plant is in duplicate; each unit consists of one No. 9 and three No. 6 McCully crushers with screens, etc. On June 30, 1910, a No. 21 McCully crusher was being erected to feed the two No. 9 crushers. A power plant, a pumping plant for hydraulicking, storage bins, machine shop, quarters and commissary for 600 to 700 men compose the remaining main features of the plant. Automatically operating conveyors take the crushed stone to the storage bins.

The drilling is done with 3⅝-in. Ingersoll-Rand and Wood drills with smaller Sergeant and Sullivan drills for breaking large rock. Vertical and toe holes are employed. The holes are spaced from 6 to 14 ft. apart and the vertical holes have a maximum depth of 24 ft. The blasting is done with 60 per cent dynamite in charges ranging from 15 to 50 lbs. per hole. There is much breaking of large stones required. The blasted rock is loaded by 70-ton, 1¾-cu. yd. dipper Bucyrus shovels onto 6-cu. yd. dump cars hauled in 7-car trains by locomotives to the crusher house floor. As stated above, the crushed stone is delivered by conveyors to the bins. From the bins it is chuted into barges, using 6 chutes simultaneously and loading a 700-cu. yd. barge in one-half to three-fourths hour.

The barges are towed by sea from Porto Bello to Colon and thence by the old French canal to Gatun, where they are unloaded by cableway and brag buckets as described in our issue of Dec. 7, 1910.

Up to Dec. 27, 1909, the plant was worked a 12-hour day and from that time to June 30, 1910, a 16-hour day. The maximum month's output was 74,184 cu. yds. in June, 1910, during which the time was divided as follows: 70.15 per cent crushing, 19.72 per cent undergoing repairs, and 10.13 per cent idle waiting for barges and because of other delays. The output of the crushers was 176 cu. yds. per hour in service and 251.3 cu. yds. per hour crushing.



No 6 McCully
Troughing Idlers
36" Belt Conveyor over Rock Bins
Crushed Rock Bins Cap 1750 Cu Yds
Reinforced Concrete Substructure
Elev 70.5
Eng Contg

Rock Crushing Plant at Aucon Quarries, Panama Canal.

The costs of stone production at Porto Bello are available in detail from June 1 to Oct. 1, 1910. Production costs comprise quarrying and crushing, or f. o. b. barges. The costs of towing and unloading into stock for the same period are also given by items.

The costs given for the first six months of 1910 are based on a yardage of 404,924 cu. yds. The cost of quarrying was as follows:

Item.	Per cu. yd.
Stripping	$0.0360
Drilling	0.0875
Blasting	0.2949
Loading	0.1596
Transportation	0.1086
Tracks	0.0601
Power	0.0447
Maint. equipment	0.0776
Plant arbitrary	0.3401
Total	$1.2091

Crushing 404,924 cu. yds. costs as follows:

Item.	Per cu. yd.
Operation of crushers	$0.0559
Stone bins and conveyors	0.0413
Maint. equipment	0.0573
Power	0.0481
Plant arbitrary	0.1751
Total	$0.3777

The cost of producing crushed stone at Porto Bello is therefore as follows:

Quarrying per cu. yd.	$1.21
Crushing	0.38
Total	$1.59

The cost of towing 404,924 cu. yds. in barges from Porto Bello to Gatun Locks was as follows:

Item.	Per cu. yd.
Operation of tugs and barges	$0.1680
Maintenance of equipment	0.0666
Plant arbitrary	0.2240
Total	$0.4586

At Gatun the crushed rock is unloaded from the barges into stock piles by means of cableways operating grab buckets. The cost of this operation was as follows:

Item.	Per cu. yd.
Operating cableways and cranes	$0.1679
Maintenance of equipment	0.0692
Power	0.0166
Plant arbitrary	0.1731
Total	$0.4268

Of this 404,924 cu. yds. an amount of 63,405 cu. yds. required extra rail transportation at the following cost:

Item.	Per cu. yd.
Operating trains	$0.2571
Maintaining equipment	0.0740
Repairs to tracks	0.0657
Dumping in storage	0.0548
Total	$0.4516

Prorating this extra railway charge over the whole 404,924 cu. yds. adds $0.07 per cubic yard to the above items. There has also to be added a charge of 8.54 cts. per cubic yard for division administration and general expenses. Including these and giving the cost to the nearest cent we have the following summary:

Item.	Per cu. yd.
Quarrying	$1.21
Crushing	0.38
Towing	0.46
Unloading	0.43
Extra rail transportation	0.07
Division expenses	0.08
Total	$2.63

The cost of stone production for July-September, 1910, the three months following the above half-year, was as follows based on a yardage of 207,654 cu. yds.:

Quarrying:	Per cu. yd.
Stripping	$0.0313
Drilling	0.0618
Blasting	0.2919
Loading	0.1257
Transportation	0.0926
Tracks	0.0596
Power	0.0387
Maint. equipment	0.1251
Plant arbitrary	0.3401
Total	$1.1658
Crushing:	
Operating crushers	$0.0473
Stone bins and conveyors	0.0367
Power	0.0395
Maint. equipment	0.1064
Plant arbitrary	0.1751
Total	$0.4050
Total production	$1.5708
Towing:	
Operating tugs and barges	$0.1304
Maint. equipment	0.0433
Plant arbitrary	0.2240
Total	$0.3977
Unloading:	
Operating cableways, etc.	$0.1142
Power	0.0202
Maint. equipment	0.0759
Plant arbitrary	0.2030
Total	$0.4133
Rail Transportation Extra, 58,459 cu. yds.:	
Operating trains	$0.0821
Repairs to tracks	0.0025
Dumping in storage	0.0724
Maint. equipment	0.0436
Total	$0.2006

Prorating this extra railway transportation over the total yardage and adding division administration and general expenses we have the following summary:

Item.	Per cu. yd.
Quarrying	$1.17
Crushing	0.40
Towing	0.40
Unloading	0.41
Extra rail transp.	0.06
Division expenses	0.11
Total	$2.55

Ancon Quarry.—This quarry for the Pacific locks is located on the side of Ancon Hill facing Balboa. The quarry is of the side hill type and Fig. 1 shows the arrangement of the crushing plant which consists of one No. 12 and four No. 6 crushers. The blasted rock is loaded into cars by steam shovels, hauled over a series of switchbacks to the crushers and from the storage bins is taken by train to the stock piles at Pedro Miguel and Miraflores.

To open up the quarry required 2,384 cu. yds. of grading and [illegible] cu. yds. of grading. The quarry was prepared for operation in October, 1909, when a slide occurred which delayed operations until some 40,960 cu. yds. of displaced rock had been removed. The plant finally began operations Feb. 10, 1910, and the quantities and cost data given were practically the period between the above date and Oct. 1, 1910. The cost data follow:

During the first six months of 1910 a total of 175,174 cu. yds. of stone were produced at the Ancon quarries. The cost of this stone for quarrying was as follows:

Item.	Per cu. yd.
Stripping	$0.1736
Drilling	0.1388
Blasting	0.0927
Loading	0.0689
Transportation	0.1402
Tracks	0.1741
Power	......
Maint. equipment	0.0855
Plant arbitrary	0.2300
Total	$1.1038

It will be observed that no charge for power is entered as is the case at Porto Bello. The cost of crushing at Ancon was as follows:

Item.	Per cu. yd.
Operating crushers	$0.0355
Stone bins and conveyors	0.0089
Power	0.0528
Maint. equipment	0.0033
Plant arbitrary	0.0649
Total	$0.1654

The total cost of production, quarrying and crushing was, therefore, $1.2683 per cu. yd. As stone from Ancon is transported direct by rail and dumped from a trestle there are no touring or unloading charges as at Porto Bello. The cost of rail transportation was as follows:

Item.	Per cu. yd.
Operating trains	$0.0728
Maint. equipment	0.0010
Repairs to track	0.0209
Dumping in storage	0.0438
Plant arbitrary	0.0500
Total	$0.1885

Adding the cost of division administration and summarizing we have:

Item.	Per cu. yd.
Quarrying	$1.1038
Crushing	0.1654
Transporting	0.1885
Division expenses	0.0455
Total	$1.5032

The corresponding costs for the three months, July-September, 1910, were as follows:

Quarrying:	Per cu. yd.
Stripping	$0.0224
Drilling	0.0613
Blasting	0.0486
Loading	0.0471
Transporting	0.0704
Tracks	0.0259
Maint. equipment	0.0146
Plant arbitrary	0.2500
Total	$0.5403
Crushing:	
Operating crushers	$0.0192
Stone bins and conveyors	0.0063
Power	0.0298
Maint. equipment	0.0031
Plant arbitrary	0.0792
Total	$0.1376
Transporting:	
Operating trains	$0.0524
Repairs to tracks	0.0137
Dumping in storage	0.0102
Maint. equipment	0.0147
Plant arbitrary	0.0500
Total	$0.1410
Division expenses	$0.0247
Grand total	$0.8436

SAND.

Sand for concrete rock on the Atlantic Division is taken from the sea beach at Nombre de Dios, dredging a channel through the shallow water to the deep sand deposits inshore. Several methods of excavation were employed and some of the excavation was rehandled and the particulars of operation are not clearly reported. In a general way 54,390 cu. yds. were obtained by pipe line dredge; 13,632 cu. yds. by a 1¼-cu. yd. clamshell temporarily mounted on a barge; 4,010 cu. yds. by clamshell dredge, and 109,841 cu. yds. by locomotive cranes. In addition, 92,200 cu. yds. were dredged in developing the channel to the deposits and some 22,052 cu. yds. were rehandled. The cost of this development work is charged into the sand costs for the six months up to June 30, 1910. The record of dredging and costs are given in Table I. The detail operating costs for the six months up to June 30, 1910, were as follows:

The records cover a total of 148,844 cu. yds., of which 83,072 cu. yds. are classed as excavation and 65,772 cu. yds. as dredging. The cost of excavation was as follows:

Excavation (83,072 cu. yds.):	Per cu. yd.
Cleaning and blasting	$0.0080
Loading	[illegible]
Tracks	0.0701
Transportation	0.1119
Dumps	0.0061
Pumps	0.0149
Maint. equipment	0.1076
Total	$0.4332

The cost of dredging was as follows:

Dredging (65,772 cu. yds.):	Per cu. yd.
Operating dredges	$0.3082
Maint. equipment	0.1310
Total	$0.4392

The above two costs averaged over the total yardage gives the average cost of production and adding plant arbitrary charges we have:

Item.	Per cu. yd.
Production cost	$0.4358
Plant arbitrary	0.3871
Total	$0.8229

The cost of touring 35 miles to Gatun was as follows for the total 148,844 cu. yds.:

Towing:	Per cu. yd.
Operating tugs and barges	$0.2645
Maint. equipment	0.1280
Plant arbitrary	0.2310
Total	$0.6235

The cost of unloading 148,844 cu. yds. from barges at Gatun was as follows:

Unloading:	Per cu. yd.
Operating cableways and cranes	$0.1466
Maint. equipment	0.0729
Power	0.0174
Plant arbitrary	0.1179
Total	$0.3548

In addition to the above costs there was an additional expense for transporting 28,958 cu. yds. by rail into storage. The cost of this per cubic yard transported was as follows:

Rail Transportation:	Per cu. yd.
Operating trains	$0.1550
Maint. equipment	0.0476
Repairs to tracks	0.0313
Dumping in storage	0.0466
Total	$0.2805

Prorating this extra charge over the total yardage, adding the division administration expenses and summarizing we have:

Item.	Per cu. yd.
Excavation	$0.8229
Towing	0.6235
Unloading	0.3548
Extra rail transp.	0.0546
Division expenses	0.0596
Total	$1.9154

Figures corresponding to the above covering the total 87,430 cu. yds. of sand excavated during July-September, 1910, are as follows:

Excavation (29,503 cu. yds.):	Per cu. yd.
Blasting	$0.0195
Loading by cranes	0.1978
Tracks	0.1182
Transportation	0.0921
Trestles	0.0100
Dumps	0.0099
Pumps	0.0322
Maint. equipment	0.1669
Total	$0.6466
Dredging (57,927 cu. yds.):	Per cu. yd.
Operating dredge	$0.3688
Maint. equipment	0.3236
Total	$0.6924

Averaging excavation and "dredging" costs over the total 87,430 cu. yds. we have:

Production:	Per cu. yd.
Production cost	$0.6769
Plant arbitrary	0.4677
Total	$1.1446
Towing:	
Operating tugs and barges	$0.2282
Maint. equipment	0.0843
Plant arbitrary	0.2310
Total	$0.5435
Unloading:	
Operating cableways and cranes	$0.1174
Power	0.0238
Maint. equipment	0.0550
Plant arbitrary	0.1370
Total	$0.3332

The extra charge for transporting 24,859 cu. yds. by rail into storage was as follows:

Rail Transportation:	Per cu. yd.
Operating trains	$0.1442
Repairs to tracks	0.0027
Dumping in storage	0.0006
Maint. equipment	0.0688
Total	$0.2163

Prorating this extra rail charge over the total yardage, adding division administration expenses and summarizing we have:

Item.	Per cu. yd.
Excavation	$1.1446
Towing	0.5435
Unloading	0.3332
Extra rail transp.	0.0615
Division expenses	0.0907
Total	$2.1735

Chamè Deposit.—Sand for the Pacific Division work is secured by dredging from a bay formed by Point Chamè, which is about 20 miles up the coast from Balboa. A self-propelling ladder dredge is worked, discharging into 500-cu. yd. barges, which are towed to Balboa and there unloaded by cranes into storage bins from which it is chuted into cars for transportation to the lock sites. Three unloading cranes are employed, each having a single cantilever 33 ft. long extending beyond the dock face. Each crane is provided with a 3-cu. yd. clamshell bucket and has a hoisting speed of 300 ft. per minute.

The Chamè sand has been shipped to the Atlantic Division and widely used for the work of other departments. During the year ending June 30, 1910, 235,860 cu. yds. were produced and distributed as follows:

Atlantic Division	101,748 cu. yds.
Pacific Division	126,869 cu. yds.
Other departments	7,243 cu. yds.
Total	235,860 cu. yds.

The cost of sand production at Chamè for the six months ending June 30, 1910, was as follows:

Dredging:	Per cu. yd.
Operating dredges	$0.1205
Maint. equipment	0.0952
Plant arbitrary	0.0300
Total	$0.2457
Towing:	
Operating tugs and barges	$0.1158
Maint. equipment	0.0494
Plant arbitrary	0.0600
Total	$0.2252
Unloading:	
Operating cranes	$0.0845
Maint. equipment	0.0528
Power	0.0262
Plant arbitrary	0.0949
Total	$0.2584
Grand total	$0.7293

The last total is the cost of sand in bins ready for chuting into cars. During the six months 116,385 cu. yds. were shipped by rail to the stock piles at Pedro Miguel and Miraflores and 66,783 cu. yds. to the Atlantic Division. The cost of rail transportation to Pedro Miguel and Miraflores was as follows:

Rail Transportation:	Per cu. yd.
Operating trains	$0.0836
Maint. equipment	0.0271
Repairs to tracks	0.0206
Dumping in storage	0.0228
Plant arbitrary	0.0660
Total	$0.2201

Adding division administration expenses we have the following cost for sand in stock pile at Pedro Miguel and Miraflores.

Item.	Per cu. yd.
Dredging	$0.2457
Towing	0.2252
Unloading	0.2584
Rail transportation	0.2201
Division expenses	0.0270
Total	$0.9764

The cost of transporting by rail 66,783 cu. yds. to the Atlantic Division was as follows:

Item.	Per cu. yd.
Operating trains	$0.2548
Maint. equipment	0.0688
Dumping in storage	0.0175
Plant arbitrary	0.1000
Total	$0.5411

The Atlantic Division was charged for this sand an average of $0.8077 per cu. yd., which added to the above total gives a cost in storage of $1.2488.

The figures corresponding to the above for the three months, July-September, 1910, are as follows:

Dredging:	Per cu. yd.
Operating dredges	$0.0868
Maint. equipment	0.0384
Plant arbitrary	0.0300
Total	$0.1552
Towing:	
Operating tugs and barges	$0.1057
Maint. equipment	0.0209
Plant arbitrary	0.0600
Total	$0.1866
Unloading:	
Operating cranes	$0.0466
Power	0.0270
Maint. equipment	0.0679
Plant arbitrary	0.1100
Total	$0.2515
Rail Transportation:	
Operating trains	$0.0494
Repairs to tracks	0.0117
Dumping in storage	0.0169
Maint. equipment	0.0141
Plant arbitrary	0.0900
Total	$0.1821
Division expenses	$0.0253
Grand total	$0.8007

Methods of Driving the Utah Metals Company's Tunnel, with Some Unit Costs.

The Utah Metals Company has under construction a tunnel 11,000 ft. long. It is to be used for the transportation of ore through the mountain to the Tooele smelter. This tunnel is 8x9 ft. in section and is now excavated for 3,900 ft. of its length through quartzite and occasional belts of limestone. The tunnel is on a 0.3 grade. The method of construction is described by Leroy H. Palmer in Mines and Minerals, from which article we abstract the following notes on the methods and costs given.

Drilling is done by two Ingersoll-Sergeant 3¼-in. piston machines mounted on the same bar. The ordinary round consists of 12 holes, 3 cut holes with as much pitch as the ground will stand, 3 breast holes with a slight angle downwards, 3 uppers at a slight angle, and 3 lifters with just sufficient angle to carry water. This round is varied to suit the nature of the ground, and frequently three or four additional holes are drilled. The holes are charged with 40 per cent dynamite, 50 to 70 lbs. to a round, and fired by hand. Three shifts are at work and each breaks a little over 4 ft. in the regular sized drift.

The formation so far encountered is sufficiently firm to stand with little support. Whatever timbering is needed consists of stulls or posts with head-boards and a few full drift sets. If bad ground is encountered, a drift set with the cap framed in three segments so as to form a rough arch will be used.

The timbers, of which there is an abundance on the property, are undressed. The track is 24-in. gage, of 30-lb. rails on ties whose centers are 24 ins. apart. The cars have a capacity of 42 cu. ft., with slope bottom, so that by throwing a catch one side is released and the rock slides out. They are hauled in trains of four by a Baldwin-Westinghouse locomotive. Ventilation is effected by a 48-in. Sirocco fan direct-connected to a 15-h.p. direct-current motor. It is used as a blower while the men are drilling and as an exhauster after blasting.

It was installed inside the tunnel 2,300 ft. from the portal where it gives a much higher efficiency. The fan has a capacity of 5,300 cu. ft. of air per minute and the object in changing its position was to balance to a certain degree the length of the intake and discharge pipes, and to use it as an exhaust fan all the time.

The cost of driving the average 10½ ft. in two shifts is as follows:

16 men at $3.50	$56.00
90 lbs. explosive at 16 cts	14.40
2 engineers	7.00
Blacksmithing	7.00
Superintendence and engineering	10.67
Total for 10.5 ft.	$95.07
Cost per lineal foot	9.15

The Ingersoll-Sergeant drills are operated by air which is furnished from the company's hydroelectric plant. A Pelton wheel is belted to an Ingersoll-Sergeant two-stage compressor, (9½x15x10 in.) which can be run at 140 revolutions per minute, thus giving a capacity of 400 cu. ft. of free air per minute. The compressor works to 100 lbs. The air is carried in a 6-in. line to a point 200 ft. within the portal of the tunnel where the line is reduced to 4 ins. and carried to a receiver near the working face. From the receiver the machines are fed by a 2-in. line.

The tunnel water is carried away with a drain at the side in which is laid a flume 24x24 ins. The flow of water, 380 gals. per minute, is piped in a 5-in. line to the power house and directed against an 18-in. Pelton wheel direct-connected to a 3-kw. direct-current generator which supplies the lighting system.

It will require about 2 years more to complete the remaining 7,000 ft. of the tunnel.

Road Improvement Conference.—The American Society of Civil Engineers will hold three meetings for discussing road construction and maintenance. These meetings will be held at the headquarters of the society, 220 West 57th St., New York city, on Jan. 20 and 21, the days following the annual meeting of the society. The topics to be discussed are as follows:

(1) Preliminary investigations.
(2) Relative value of three methods of carrying on work:
  (a) That in which both labor and material are furnished by the contractor.
  (b) That in which the material is supplied by the party of the first part and the labor by the contractor.
  (c) That in which both the labor and material are supplied by the party of the first part.
(3) Systems of maintenance.
(4) The use of water, calcium chloride, light oils, etc., as dust palliatives.
(5) Surface treatment with tars, heavy oils, etc.
(6) The use of bituminous materials by penetration methods.
(7) The use of bituminous materials by mixing methods.

The discussion on each of the above topics will be presented by an engineer specially selected for that purpose, and such presentation will be limited to ten minutes; the discussion of each of the subsequent speakers will be limited to five-minute talks in order that everyone interested may have an opportunity to give his views and that the resulting discussion, when edited and collated under the rules of the Society for publication, may be a concise summary of present-day practice.

All engineers interested in road building, whether members of the Society or not, are invited to be present and take part in this discussion.

Unit Costs of Carpenter Labor on Four Two-Story Buildings.—The following is the cost of labor per thousand feet board measure of lumber on four frame flat buildings built in the City of Chicago in 1906, with union labor at 60 cts. per hour. The buildings were each two stories in height and were 21 ft. 6 ins. wide by 34 ft. in depth:

Frame timber	$10.90
Bridging (per M. ft. of joists)	3.00
Sheathing and rough floors	8.36
Shingles	2.22
Siding	14.57
Flooring, Y. P.	15.00
Flooring, maple	15.00

The millwork was bought by board measurement and was made up on the job. The carpenter work for making up and setting the millwork cost 58 per cent of the cost of the material. We are indebted to Mr. John McMichaels, contractor, of Chicago, Ill., for the above figures.

ROADS AND STREETS SECTION

Drainage Areas and Areas of Waterways for Highway Culverts and Bridges.*

At the present time practically all of the culverts are too small to carry the water that comes to them. The matter of the required area is one that has been given very little attention. When a new culvert is to be constructed the township commissioners generally each make a guess as to the area required and then agree by a majority vote as to what the size should be, which size is largely determined by the amount of money that is available for a particular structure or how many of the commissioners live in that neighborhood. There is no excuse whatever for this unbusinesslike guessing method, for the railroad companies have made accurate surveys of drainage areas and computed the run-off from the maximum rainfall per hour, and have designed their structures according to these scientific methods, and in most cases have had an opportunity to determine from practical use as to whether their computations were correct or not.

The factors entering into the problem of the probable run-off are the area of the drainage basin, the maximum rainfall per hour, the slope of the surface, the character of the soil, whether it is porous or compact, and whether it is cultivated or wooded. Table I has been prepared by the Engineering Department of the Atchison, Topeka and Santa Ft Ry. for the approximate areas of waterways for average drainage areas in Eastern Kansas and Missouri, where the rainfall is about 35 ins. per year:

TABLE I. DRAINAGE AREAS AND APPROXIMATE AREAS OF WATERWAYS.

Column D = Areas drained in sq. miles.
Column A = Areas of waterway in sq. ft.

D	A	D	A	D	A
.01	2.0	4.8	443.0	60.0	1,650.0
.02	4.0	5.0	455.0	65.0	1,720.0
.04	[illegible]	[illegible]	483.0	70.0	1,780.0
.06	10.5	6.0	509.0	75.0	1,840.0
.08	13.5	6.5	533.0	80.0	1,900.0
.10	16.0	7.0	556.0	85.0	1,960.0
.15	25.0	7.5	579.0	90.0	2,015.0
.20	32.0	8.0	601.0	95.0	2,065.0
.25	38.0	8.5	622.0	100.0	2,120.0
.30	44.0	9.0	641.0	110.0	2,220.0
.40	56.0	9.5	660.0	120.0	2,315.0
.50	66.0	10.0	679.0	130.0	2,405.0
.60	74.0	11.0	710.0	140.0	2,500.0
.70	81.0	12.0	740.0	150.0	2,580.0
.80	88.0	13.0	775.0	160.0	2,665.0
.90	[illegible]	14.0	805.0	170.0	2,745.0
1.0	100.0	15.0	835.0	180.0	2,820.0
1.2	120.0	16.0	865.0	190.0	2,900.0
1.4	140.0	17.0	890.0	200.0	2,970.0
1.6	160.0	18.0	920.0	220.0	3,115.0
1.8	180.0	19.0	945.0	240.0	3,245.0
2.0	200.0	20.0	970.0	260.0	3,370.0
2.2	220.0	22.0	1,015.0	280.0	3,495.0
2.4	240.0	24.0	1,060.0	300.0	3,615.0
2.6	260.0	26.0	1,100.0	325.0	3,770.0
[illegible]	[illegible]	28.0	1,140.0	350.0	3,900.0
3.0	300.0	30.0	1,180.0	375.0	[illegible]
3.2	321.0	32.0	1,220.0	400.0	4,165.0
3.4	340.0	34.0	1,255.0	450.0	4,385.0
3.6	357.0	36.0	1,290.0	500.0	4,610.0
3.8	[illegible]	38.0	1,320.0	550.0	4,825.0
4.0	[illegible]	40.0	1,350.0	600.0	5,030.0
4.2	403.0	45.0	1,435.0	650.0	5,230.0
4.4	417.0	50.0	1,510.0	700.0	5,420.0
4.6	430.0	55.0	1,580.0		

It will be noted that a normal drainage area containing one square mile, or 640 acres, requires 100 sq. ft. of water-way area. These figures can be very easily kept in mind and water-ways for drainage areas up to 4 square miles readily determined, even though the table containing the tabulated data is not at hand by multiplying the area in square miles by 100.

These tables contain the most reliable information yet available and since the drainage basins have been carefully surveyed and record of the maximum rainfall kept and the structures designed from this data have been in practical use for a number of years, makes such information of inestimable value and the areas of the water-ways given here are as nearly correct as it is possible to learn at the present time and in the construction of new culverts these tables should be carefully consulted after the drainage area and the character of the slopes and soil have been determined. It should be remembered, however, that these water-ways are for average drainage areas.

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*From a paper by W. S. Gearhart, State Highway Engineer of Kansas, presented at the 7th Annual Convention American Good Roads Congress, Indianapolis, Ind., Dec. 6-9, 1910.

Dust Prevention Work on County Roads and Suburban Streets in the District of Columbia.

Experiments were conducted during the last fiscal year by the Superintendent of County Roads of the District of Columbia in the use of oil in connection with dust laying on the county roads. According to the annual report of the Engineer, Department of the District of Columbia for the fiscal year ended June 30, 1910, these experiments were attended generally with good results, the most important of which was that the dust was kept down at all periods of the day instead of drying out at intervals, as is apt to happen when the roads are sprinkled.

Experiments were made in the use of emulsion oils, heavy oils, and granulated calcium chloride as dust layers; heavy tar and asphaltic binders have also been employed. Good results in some cases have been obtained from the use of calcium chloride, which, by absorption of atmospheric moisture in ordinary weather, keeps the streets in a proper state of dampness without creating mud or permitting dust. This treatment, states the report, is especially adapted to macadamized residential streets, and is well adapted for climates where the average amount of moisture in the air is considerable. The emulsion oil is stated to have been found well adapted to residential streets and also to macadamized roads with heavy travel. The report states that the heavy oils, such as those containing 40 to 50 per cent asphalt, which are applied directly without emulsifying, seem better adapted to suburban roads, and particularly to those where there is little if any foot travel and a large amount of automobile travel.

The following is a summary of the operations in the use of dust preventives, other than water, during the last fiscal year. A total area of about 40,000 sq. yds. on Georgia Ave., New Hampshire Ave. and Rock Creek Church Road was treated with soap, G. R. Co.'s emulsion and standard emulsifying oil. The report states that good results were obtained with the use of the soap and the G. R. Co.'s emulsion and that fair results were obtained with the standard emulsifying oil. The cost of this treatment was as follows:

[illegible]	[illegible]
Soap, 500 lbs.	17.75
G. R. Co. emulsion, 4,700 gals. at 4¼ cts.	199.75
Standard emulsifying oil, 6,423 gals. at 5 [illegible]	[illegible]
Total (40,000 sq. yds. at 2.14 cts.)	$865.38

The labor cost per sq. yd. was about .82 ct. and the material cost about 1.32 cts.

An estimated area of 18,000 sq. yds. on Massachusetts Ave. from Rock Creek to Wisconsin Ave., was treated with I. R. Co., liquid asphalt. Good results were obtained. The cost of this treatment was as follows:

Labor	[illegible]
I. R. Co. liquid asphalt at 6⅛ cts. per gal.	500.00
Total (18,000 sq. yds. at 4.33 cts.)	$778.83

The labor cost per sq. yd. was about 1.55 cts. and the material cost was about 2:77 cts.

An area of 1,000 sq. yds. on 14th st., n. w., between Taylor and Varnum Sts. (west side) was treated with 10 bbls. of standard road oil No. 4. The report states that good results were obtained for two or three months. On Nichols Ave. from Wilmington to Atlantic Sts., an area of 6,000 sq. yds. was treated with 10 bbls. I. R. Co. emulsion and fair results were obtained. The oil was donated, and the labor cost of the application was about 1.3 cts. per sq. yd. Portions of Union Station Plaza, Monroe St. and Newton St. were treated with glutrin, one carload being used. The results obtained were good for about one month, afterwards the glutrin washed off. The glutrin was donated, the only costs of the application being for labor and freight over the glutrin.

Applications of fused calcium chloride were made to an area of about 78,000 sq. yds. of the streets of Mount Pleasant. Two cars of fused calcium chloride were used, and the treatment diminished watering about one-half while in use July 16 to Nov. 1. The cost of this treatment was as follows:

[illegible]	[illegible]
[illegible]	[illegible]
Total (78,000 sq. yds. at $0.0092)	$718.57

The labor cost per sq. yd. figured out at about $0.0029 and the material cost at about $0.0063.

Notes on Road and Street Work.

[illegible] Automobile [illegible] Track.—The Moline Automobile Co., of East Moline, Ill., has had completed recently a quarter mile track on which to test and try out its automobiles. The track is paved with concrete, and for fear there would be too much slippage if the surface was made dead smooth, the surface was broomed before hardening. The concrete is 8 ins. thick, divided into 12x16 ft. sections and has a base of cinders. It is stated that there is no slippage at moderate speeds, and that the track is giving perfect satisfaction.

[illegible][illegible]ing the fiscal year ended June 30, 1910, the Superintendent of County Roads of the District of Columbia treated an estimated area of 114,000 sq. yds. with a preparation for killing the weeds. The preparation was the American Horticultural Co.'s weed killer, and the result obtained, according to the last annual report of the Engineering Department of the District of Columbia was good. The cost of the application was as follows:

[illegible]	[illegible]
[illegible]	[illegible]
Total (114,000 sq. yds. at 1 ct.)	$1,144.62

The labor cost per sq. yd. figures out at about .035 ct. and the material cost about .065 ct.

[illegible] Scotland.—With a view to collecting and tabulating information the Scottish Road Surveyors association in the spring of 1909 issued a series of questions to all its members regarding progress with improved systems of road maintenance and efforts made to abate road dust, keeping in view the findings of the First Industrial Road Congress at Paris. In a report presented at the Second International Road Congress at Brussels, Mr. Robert Drummond, County Surveyor of Renfrewshire, states that the summary of replies received to the questions clearly indicated that many experiments for the abatement of dust had been carried out during the summer of 1904, and also that new methods on road maintenance had been largely adopted with satisfactory results. The use of mud is gradually being abandoned on all main or primary roads, and instead basalt or whinstone chippings are largely used, and when these are not available pit sand or gravel. In the villages and around urban populous places the new metaled surfaces are either bound with tarred chippings or with a tar composition sprayed by means of spraying machine or by treating the metal with a coating of tarred chippings. Mr. Drummond states that the additional costs of the new methods as against the old system of binding with mud and wa-

ter are as follows: Binding with basalt or whinstone chippings, pit sand or gravel, 2 cts. per superficial yard; binding with tarred basalt or whinstone chippings, 4 cts. per superficial yard; where the metal is tarred, the cost of tarring and binding it with tarred chippings is about 10 cts. per superficial yard. For painting or spraying the road surface is being largely adopted and has been found not only to abate the dust nuisance but to prolong the life of the road surface and materially add to the comfort of all road users. The work is done by machine at a cost varying from 1½ cts. to 2 cts. per superficial yard exclusive of sweeping and sanding. This, Mr. Drummond states, is effective for one season only on roads carrying heavy traffic, but where the traffic is light it may suffice for longer.

*Earth Roads.**—A road should be located with regard to the topography of the country in order to insure ease of construction and of maintenance. This forbids the usual policy of locating the road along the land lines regardless of drainage, distance or heavy grades. A sufficient width of right of way should be provided. Forty feet is the legal minimum for a first-class road and is recommended for most conditions. Having secured the proper location and determined the needed width for the traveled portion, the ditches should be located, all obstructions, such as stumps, removed, and the roadway proper given a uniform crown. Sand beds and soils that are too light to remain firm during the dry weather should have clay mixed with the native soil to form a wearing surface. If the soil is too heavy and sticky to be good in wet weather, sand should be put upon the surface and allowed to work in during the wet weather, care being taken to preserve the crown. The ditches should be cut to a definite grade, that is, they should have a definite fall all the way to some natural drainage outlet. No road is properly drained when it is crowned up and side ditches are cut, unless these side ditches will empty themselves by continuous flow into the natural water courses. Again, these side ditches should not carry the water any further than is absolutely necessary to get it into some other outlet. "Ditch the side ditches" is a splendid epigram in road work. Having built the road properly, we should adopt a much higher ideal of road maintenance than we have had in the past. Heretofore we have "worked the roads" to the extent of patching up badly washed places and taking out an occasional stump. The idea of preventing ruts and preserving the crown of the road seems never to occur to the average overseer. Dust is also largely the consequence of ruts and tracks, for their thin edges when dry are easily crushed and pulverized to a dust. It is here that the road drag becomes of value. After a road has been given the proper crown and its ditches properly constructed, it should be dragged after every rain while the soil is still soft and plastic. If properly done, this will not only prevent the formation of ruts and maintain the crown of the road, but each dragging of the wet surface makes it cake just that much harder in the same way that the dirt cakes when plowed while too wet. This puddling action on the surface of the road after each rain gradually makes the surface harder and more impervious to water. And so the road gets better the longer the dragging is kept up. For this purpose nothing is better than the simple splitlog drag or a similar design made of 2x12 in. pine timbers. These homely road tools can be made at such a trifling expense that every overseer in the county should be provided with at least one of them. Then instead of "warning out all the hands" at one time to "work the road," one man at a time could be called upon to take the drag and go over all the road assigned to that overseer after each rain. The men assigned to each overseer could be taken in turn and for themselves and team be given credit for 2½ days' time on their five days' work due for the year. In this simple manner our much denounced law for "working the road" could be made very effective and no new legislation would be needed in that connection. The result of such systematic work on any road that has been properly graded, if continued for one year, will be truly gratifying.

Notes on Road Location—The following notes on road location have been taken from a paper, "Earth Gravel and Macadam Roads," presented by M. O. Eldredge, U. S. Office Public Roads at the last annual meeting of the Illinois Society of Engineers and Surveyors at Cairo, Ill., Jan. 26-28, 1910. Wherever possible roads should be located on straight lines between terminal points. In hilly or mountainous country, however, the attempt to keep roads straight between terminals often leads to the serious error of heavy grades. Straightness and grade must therefore be handled together. The best location is one which is straight in general direction, is free from steep grades, is located on solid ground and serves the largest possible number of people. Roads should be located for the benefit of the public as well as for the private land owner. If county officials would apply to each badly located road some simple formula like the following, they would be justified in relocating many roads. For example: The diagonal road on a 160 acre tract is .70 mile and saves .30 mile in going around it. Assuming 3,000 tons of traffic and a cost of 25 cts. per ton per mile, the public would save $225 by the short route. This is enough to pay the interest and sinking fund on at least $4,000, which would be sufficient to pay for the whole farm at $25 per acre. The $225 alone would in most cases pay the damage and in many other cases there would be no damage. If the short road is on a better grade than the long one the saving would be still greater. The elimination of one or two steep hills on a line of road will frequently enable horses to draw three or four times as much as they could draw on the old road. It takes approximately four times as much power to draw loads up 10 per cent grades as on a level, but on a 4 per cent or 5 per cent grade a horse can usually draw, for a short time, as much as he can draw on a level. A 4 per cent or 5 per cent grade is therefore considered the maximum on roads subject to heavy hauling. Many steep grades may be avoided by locating the road around instead of over the hill. It is often no further around a hill than over it—the bail of the bucket is no longer when held in a horizontal position than in a vertical. By going around we avoid two steep hills. If the road must pass up a steep hill or mountain side, the steepness of the grade may be decreased by increasing the length of the road. In other words, eleminate steep grades by locating the roads on curved zigzag lines, and not in a straight line from the bottom to the top of the hill. These curves as well as the tangents should be carefully plotted. This improves the looks of the road and does not add materially to its cost. In studying the relation of grade to distance the following calculation is interesting: To lift a ton 1 ft. high requires 2,000 ft. lbs. of energy; on a road the surface of which offers 100 lbs. of tractive resistance per ton the same energy would roll the ton a horizontal distance of 20 ft. To save 1 ft. of grade the road may therefore be lengthened 20 ft. Roads should never be located so close to stream beds as to be subject to overflow, or on ground which is constantly damp and marshy. The earth road should have at least six hours of sunshine every day. This can be secured either by locating the road with southern or western exposure, or by having such brush and trees as impede the drying action of the sun and wind removed. With gravel and stone roads, this is not so necessary, as a certain amount of moisture is needed on such roads, especially in the summer time. Relocating roads is not an engineering problem alone. One must also consider the effect of the road on those who now live upon it. Many farmers dislike to have the road placed back of their house or out of sight of it. It requires tact and good judgment to secure a suitable location without arousing harsh antagonism.

Effects of Temperature and Moisture on Road Surface Treatment.

It is generally recognized that the success of a road surface treatment for dustlaying depends to a large extent upon the condition of the road as to temperature and moisture at the time of the treatment. Some interesting information regarding these road surface conditions are given in a recent issue of our English contemporary, *The Surveyor*. It is stated there that experiments have shown that approximately 18 to 22 per cent of an average macadam road consists of dust and fine particles of stone, small enough to pass through a fine sieve of 40 meshes to the inch, and of this 14 per cent is as fine as cement. Thus 18 to 22 per cent weight of a macadam road consists of very fine particles—that is, after all moisture has been removed—but it is also worthy of note that after a period of 12 hours without rain and with about six hours' bright sunshine, the fine material extracted from a macadam road contained approximately 20 per cent of moisture, although the road surface was apparently quite dry. The following experiment is cited in *The Surveyor* to show that the presence of moisture in a road is detrimental to its successful treatment with a tar composition:

A quantity of fine material extracted from a macadam road and containing 20 per cent of moisture was divided into two portions, both of which were well compressed in a mould into small slabs 6 ins. square by 2½ ins. thick. On the surface of both an equal quantity of a reliable tar compound was poured, one of the slabs having been previously dried. After a period of 24 hours the tar composition had penetrated ⅞ in. into the dry slab, but only ⅜ in. into the slab containing 20 per cent of moisture. It is therefore evident that moisture prevents the penetration of a tar composition.

Portions of both slabs were examined microscopically after the penetration of the tar composition, when it was found that in the dry slab the particles were thoroughly coated with the tar composition and the interstices between the particles were also full of tar composition. In the other slab the penetration was seen to be irregular; the particles were only partially coated and some of the interstices were void, instead of being filled with the tar composition.

Apparently, then, even where a tar composition does penetrate a damp road, the tar does not get hold of the fine particles or fill the interstices as in the case of a dry road. Further, the dry slab after some days set into a fairly stable cake, which could be handled without breaking, but the moist slab showed no signs of setting. It further appears, therefore, that moisture resists the binding action of the tar composition. It will readily be seen that the effect of moisture in a road to be treated with any tar compound is extremely detrimental, but temperature also plays an important part.

As to the effect of temperature it is stated that roads were treated with a particular composition applied by the same machine, one road being treated about midday and the other about midnight. In the first case the temperature of the road exposed to the sun's rays was about 80° F., while the temperature of the road treated at midnight was about 40° F. In the first case the tar composition readily penetrated the road, while in the other case the cold road-surface chilled the composition, causing it to congeal on the surface. Much of it never penetrated the road; but was subsequently carried off the road-surface by the traffic.

Panama-David Railway Survey.—Five field parties have recently completed the surveys for a railroad 350 miles long from Panama to David. This distance includes a branch line 65 miles long to Pedasi, and a 4-mile branch to Anton. The survey was conducted by the engineering department of the Panama R. R.; was begun Apr. 1 and completed Nov. 15, 1910.

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*From a paper by Robert J. Potts, Division of Highway Engineering, at A. & M. College of Texas, presented at a recent Texas convention.

WATER-WORKS AND SEWERS SECTION

Method and Cost of Form Work for Groined Arch Reservoir and Conduits, Pittsburg Filtration Works.*

In building the Pittsburg Filtration Works there were used about 334,000 cu. yds. of concrete. This concrete varied from heavy mass work in foundations for machinery to reinforced concrete in walls and floor slabs, and from straight way work on walls and floors to the more intricate work necessary for ground arch vaulting. The forms varied as greatly as the concrete due to the many different conditions under which work had to be performed and the work offered many problems in forms for solution.

During the three years of active concrete work many different engineers, superintendents, foremen, carpenters and laborers were affiliated with the work and in this way were brought together many different ideas and experiences. The object of this paper is to describe the various methods used and the results secured rather than to give a description of the work as a whole. Some of the items may be rather elementary to one having just this experience, but may be of interest and instructive to many other readers.

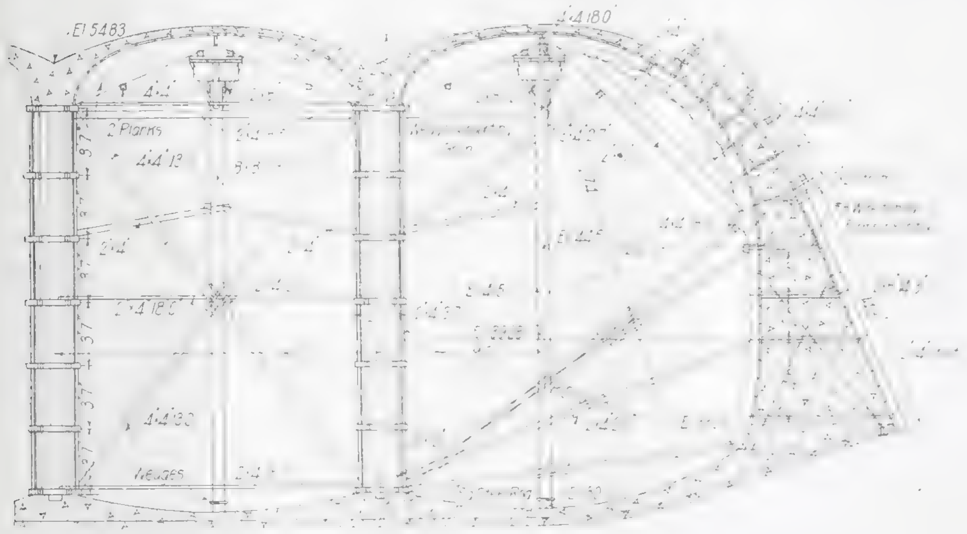

Fig. 1—Forms for Filtered Water Reservoir Showing in Elevation Piers, Walls and Groined Arch Vaulting.

Material for Forms.—Probably the first thing to consider in the building of forms is what material to use. The choice will be influenced very largely by the number of times the forms may be used. They may be constructed of wood or metal, the latter was used chiefly in conduits and piers or forms having curved or irregular surfaces, while wood was used in all classes of work and almost entirely in walls and structures having plain surfaces.

The kind of lumber is influenced greatly by the cost and supply. White pine lumber is probably the easiest worked and will give the smooth face essential to the best work. The pine will prove very expensive for ordinary work, and spruce, fir, Norway pine and some grades of southern pine are more commonly used. For braces and uprights the quality is not of great importance, there is a point, however, where an inferior grade of lumber is not economical, as the increased number of times a piece of lumber may be used and the lesser quantity due to greater strength will outweigh the savings in first cost due to inferior quality.

Kiln dried lumber is not best as it will swell too much when wet, and green lumber is not good as it will not swell sufficiently to make the forms tight. The best quality is a middle grade or partly dry.

When the contract is large, comparable in size to the Filtration Works, it will facilitate the work to buy the lumber in the rough and mill it on the site. This will often save delay due to delivery, will save in cost, and the waste can be kept at a minimum.

The proper thickness for the lumber (this applies chiefly to the sheathing) is a question which varies greatly with the contractor. Curved and irregular shaped forms can be made more easily with 1-in. lumber, and where there is much cutting the waste is less. On the other hand if a form is to be used but once the loss in wrecking thin boards is much greater than will occur with thicker, and more uprights or studs will be necessary to support 1-in. sheathing than 2-in. It was found more satisfactory in the majority of work to use 1.5 or 2-in. sheathing in preference to thinner wood. The thickness and spacing of studs and braces is entirely a question of load to be carried, and can be easily proportioned to the particular piece of work.

Design of Forms.—It is advisable to have the form and braces designed by a competent man, as often the foreman or carpenter in the field does not have the knowledge or experience necessary. It is often the case that a piece of form work will be over braced, or by reason of inexperience the bracing will be so arranged as not to secure the maximum results from the minimum labor and material. Frequently also the forms are underbraced and give away during filling. All this can be best remedied with a design made by a competent man which can be done at a small cost.

Where the forms are used but once and wrecked it is advisable to have the joints between boards V-shaped with the vertex towards the concrete, known as a beveled joint, as the boards can be removed much more easily and with less waste due to breakage than if a tongue and groove joint had been used; and if the lumber is not too green the joints will swell shut and be just as tight. For forms used a number of times best results will be had from tongue and groove joints. The tongue and groove tends to make the several boards act more as a unit and the force necessary to break the bond between the concrete and form, which is applied more or less on a single board, will not distort the face of the form as quickly as without this unit action. The alternate swelling and shrinking due to the wetting and drying will not cause the trouble in a tongue and groove joint that would be experienced in a beveled joint.

In the design of forms, it is of importance to look to their removal, as upon the speed of removing and the number of times forms can be used with the minimum amount of repairs, rests the economy of the design. The forms should be designed in as large sections as can be conveniently handled. In deciding size, the removal of forms will have a greater bearing than the placing, as the removing of forms must largely be done by hand, often in cramped places, while the placing or building will be in the open and can be facilitated by cableway or derrick. It will be found very difficult at times to break the bond between a form and the concrete without damaging the form. Often it was necessary to have as many as 12 men pulling on a block and falls and then the ribs pulled from the sheathing before the bond could be broken.

In forms to be wrecked, spikes and nails should be very sparingly used; sufficient nails to hold the form together is all that is required, as the concrete will furnish all the pressure necessary to hold the sheathing to the studs. It will not then be necessary to use sledges and bars in wrecking, and when the forms are removed the lumber will be in much better shape and can be more economically worked. The building of forms without nails has been tried. The studs were placed and the sheathing, consisting of 6-in. boards with tongue and groove joints, were placed as the work progressed. The experiment was on conduit and the advantage claimed was easy removal of forms and complete access to all parts during filling. The results showed delay in placing concrete due to waiting on the placing of the sheathing and a rough and very unsatisfactory surface after removal. It is best to completely set up the forms, nailing just sufficiently to hold in place, and, if advisable, to remove certain parts to facilitate filling; they having been once fitted can easily be replaced.

Support of Forms.—There are a number of methods for supporting the forms from the interior while filling; by means of wooden struts, bolts, concrete struts and wiring. A very satisfactory method is the use of wooden struts and wire; the struts to maintain the proper distance and the wire to tie the forms together. The struts must always be placed where the sheathing is supported by a stud and the wire should loop to the stud; then by twisting the wire with a short bar, the forms can be drawn tight and held rigidly in place during filling. When the concrete has been placed to the level of the strut it can be removed and the weight of the concrete will then hold the forms apart. In first placing the struts they should be lightly nailed, the wiring will hold them in place, and they will be more easily removed.

On removing the forms the wires should be cut close to the concrete, the ends stoved in with a punch and the surface smoothed over. The finishing is the one point more or less open to criticism, as it takes considerable care to make a good job and unless the contractor is watched this part of the work will be shirked and ugly rust streaks will deface the concrete. A great advantage in the use of wire lies in the fact that a form can be tied down to prevent floating and can be tied and cross tied at any angle. No. 8 wire will fulfill the requirements of most work.

When the space between forms is so narrow that the removal of the struts becomes a troublesome task, concrete struts can be used. Concrete struts are previously cast and placed in the same manner as wooden, and can either be broken with a tamper when the concrete is placed to the proper level, or if they have been cast with a water stop they can remain in the wall. The greatest difficulty is in preventing a void immediately under the strut. The breaking will do away with this possibility. Care must be exercised to avoid a water channel along the side of the strut.

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*A paper by J. D. Stevenson, formerly Division Engineer, Bureau of Filtration, Pittsburg, Pa., read Sept. 20, 1910, before the Engineers' Society of Western Pennsylvania, and published in the October Proceedings.

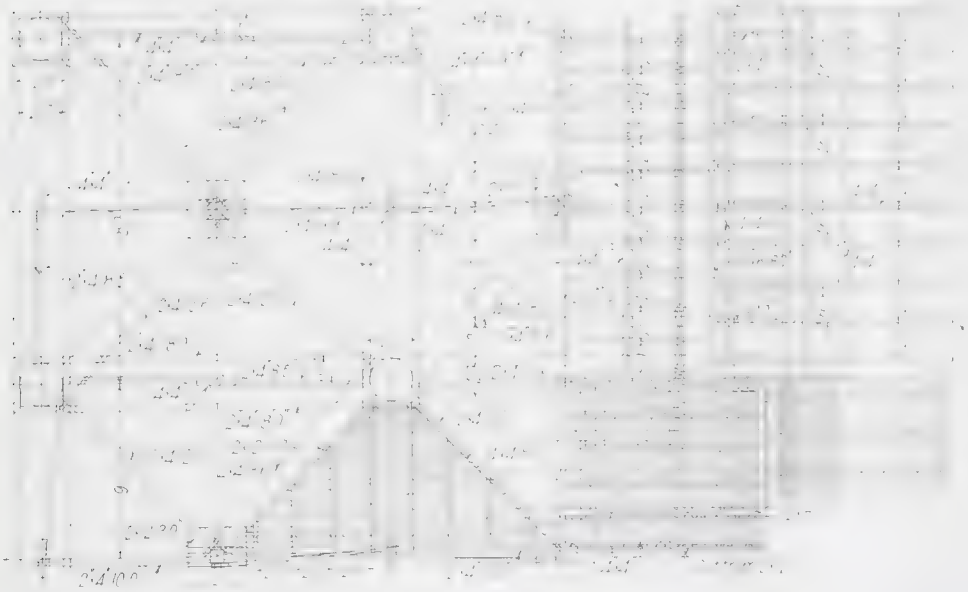

Fig. 2—Forms for Filtered Water Reservoir Showing in Plan Piers, Walls and Groined Arch Vaulting.

Bolts are used in several ways. In one method a pair of bolts is screwed into a nut which is placed in the central portion of the concrete and when the concrete has partly set the bolts are removed, the nut being allowed to remain. The space which was occupied by the bolt is filled with grout. Another method is to fit the bolt with threads and a cap on either end. The cap screws on the bolt and extends about 3 ins. into the concrete; the cap is removed and the bolt allowed to remain. The latter is much more expensive than the first mentioned method. In large work involving the using of the same forms a great many times the use of the bolts is very satisfactory and the small nut lost each time is of little value.

The forms, in addition to the interior bracing, should be braced on the outside; this is generally accomplished by bracing to the earth or to adjoining structures. The number of braces and the size are points peculiar to each individual piece of work. This portion of the form work is probably more neglected than any other. Forms are either underbraced or the braces which are placed do not assist in the support. Often during the filling when a strain has been placed on the forms many of the braces will be found loose. The exterior bracing must be relied on for holding the form to alinement. On the filtration works alinement was necessary only within very liberal limits. Butt bracing is more secure than splices, the salvage will be greater and the cost of reworking the lumber less.

In building a structure in a number of lifts it will often be found advantageous to terminate each lift of forms in a short section, say 3 ft. high. This section which is tied together by wires and securely held to the concrete by the bond can be left, upon removing the forms, as a base upon which to build the next lift.

Coating Forms.—Forms are covered, or coated, to decrease the bond between the form and the concrete and thus permit easy removal or to give the concrete surface a smooth finish. The latter is important in the case of conduits, where the friction loss is a factor.

Covering wooden forms with metal has a number of objections; it is an added expense and does not increase the life, as the metal readily breaks and tears when removing, and if the form is strained in the handling the metal covering makes it harder to put back in shape. The rents, although smoothed down, still have irregularities which will catch in the concrete and the next removing will leave them in far worse shape. If metal is necessary a complete metal form is more economical.

Painting the forms greatly facilitates their removal and also increases the life of the forms and makes them much easier to clean. The pores of the wood and the cracks are filled with the paint and the grout is thus prevented from entering. A satisfactory method is to coat the forms after cleaning with cold water paint and after they have been erected give another coat. This is particularly applicable to conduit forms and was used very satisfactorily on the by pass conduit.

Forms were often oiled on the filtration work and for walls and roof vaulting this was very satisfactory. Other dressings composed of various proportions and combinations of soap, paraffine, kerosene, etc., are used but are more expensive and more troublesome to prepare and apply, and have little advantage over oil, or cold water paint.

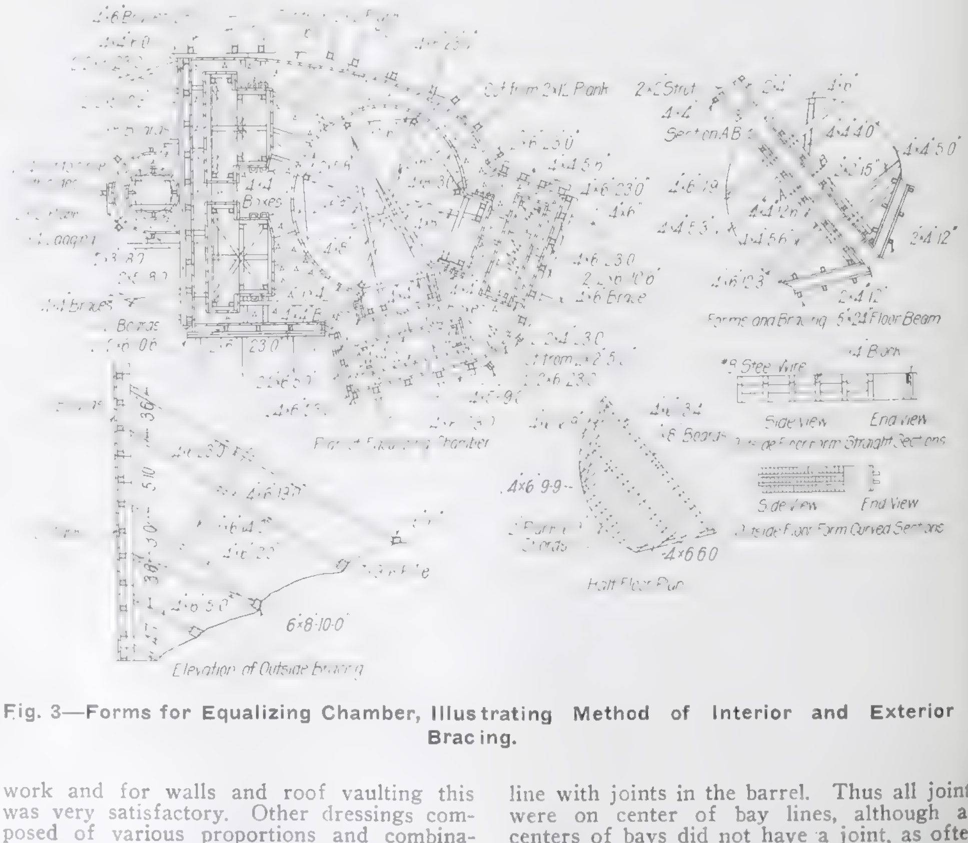

Fig. 3—Forms for Equalizing Chamber, Illustrating Method of Interior and Exterior Bracing.

Buoyancy of Forms.—The tendency of a form to lift during filling will cause much trouble if not properly cared for. In a wall section which has considerable batter, a hook made of reinforcing steel, imbedded in the foundation offers an admirable arrangement to which to tie the forms, the tie being made with No. 8 wire.

Conduit forms and box forms are often loaded with pig iron, lead or other heavy material. As this is always more or less expensive and troublesome, the contractor is liable to take chances by underloading. A form failing in this way is a very serious problem as it is impossible to force it back in shape without removing part, if not all of the concrete placed. Under this same heading comes the rolling of forms which applies more to conduits and is mostly caused by uneven filling, that is, filling higher on one side of the barrel than on the other. The best method of preventing this is by care in filling, to keep a uniform level on both sides of the barrel. In trench work where there is sufficient depth the upward or side movement of forms can be cared for by bracing to the sides of the trench.

Joints Between Monoliths.—The placing of joints and the method of making joints is generally decided by the engineer and often proper consideration is not given the contractor in making the decision. The location of joints will govern to a large extent the possibility of cracks and this is a large factor in the design of the work, and it may also greatly affect the cost of the form work and in this way the contractor. A study from both the engineering and construction point of view as to the effects of placing joints should be carefully made.

In the filtered water reservoir the location of joints was made after thorough study. The sides converge at the rate of one span of the arch in width, or 18 ft., in every nine spans in length. By this arrangement one set of forms could be used seven times, or practically the life of the forms. Referring to Figs. 1 and 2, the joints betwen sections of wall were placed directly over joints in the floor, joints in the barrel arch over joints in the wall and joints in roof groins were in line with joints in the barrel. Thus all joints were on center of bay lines, although all centers of bays did not have a joint, as often two bays, or 36 ft., were built monolithic. This located definitely the points to be affected by expansion and contraction and proper arrangement of keying could be made so as to prevent leakage. It also was the most economical design for the contractor.

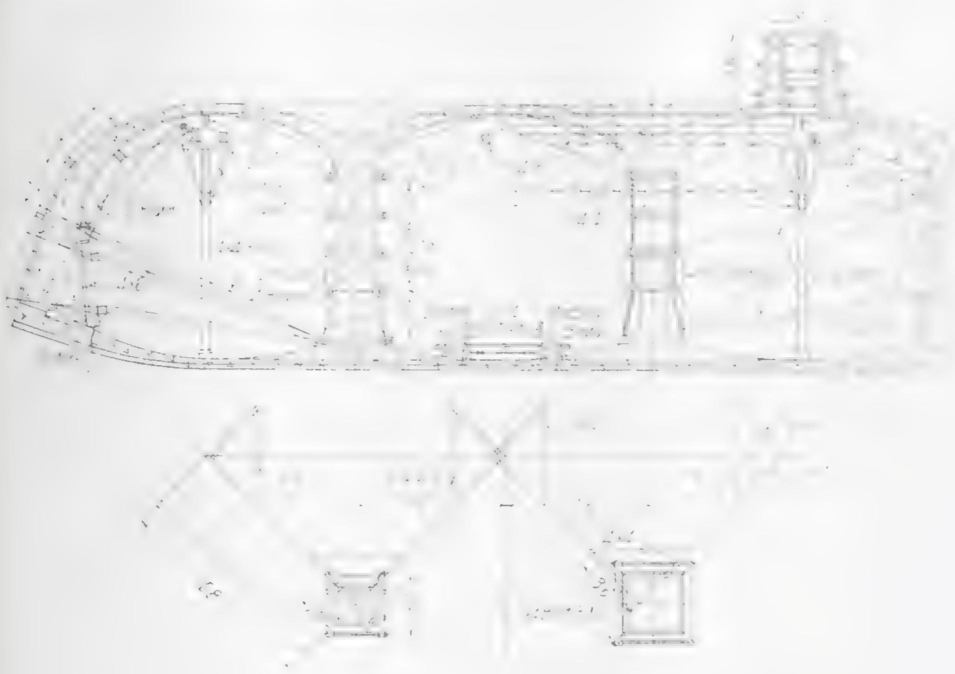

Fig. 4—Cross Section Through Filter Showing Pier, Wall and Groined Arch Forms.

The design of a key between monolithic blocks varies a great deal. Some keys are to prevent slipping of one surface on another, while in other places the key is for water tightness. A key similar to a tongue and groove in lumber, the sides being slightly battered, is more generally used; it varies in size with the bulk of the structure. For vertical joints the groove will be constructed in the forms and is generally designated as a depressed key. On horizontal joints it will be found that a raised key, or the tongue, is more easily constructed for the reasons that the forms for it will not float, it is more easily held to a fixed location and removed, and can be cleaned better when placing the next section. Keys of the tongue and groove type are not necessarily water tight, they only make the path to be traveled by the water longer and change the direction of travel.

For work requiring a large degree of water tightness a sheet of metal will give best results; sheet lead, copper, galvanized iron or similar metal imbedded three or four inches in one monolith, doubled back on itself and extending the same distance into the next monolith. The doubling back is for the purpose of allowing for movement due to expansion and contraction.

Care of Forms While Filling.—In filling forms the platform for mixing or dumping should be independent of the forms. This will prevent a shock caused by dumping. In no case should the concrete be dumped from a bucket directly into the forms, unless a bucket especially adapted to spreading is used, as this is likely to distort the forms and will often affect the uniformity of the finished concrete. By dumping a bucket on the platform the shock is taken up by the platform and at the same time the concrete will receive a mixing which will tend to remove any stratification which has occurred in transportation.

Before filling it is advisable to turn a hose on the forms, thoroughly wetting them. This will not only wash the foreign matter from the forms but will cause them to swell and prevent leakage. During the filling a carpenter should be constantly in attendance calking with cotton or jute any leaks and seeing that the braces are not loosened or disturbed.

Often trouble will arise in the removing of the struts, especially in thin walls heavily reinforced as the available room for the removal of the struts is small, and usually the forms and steel are covered with mortar, making a most disagreeable place in which to work. The struts should be removed as they are reached and careful watch kept so as to remove all.

Removing of Forms.—The time for the removal of the forms cannot but be left to the discretion of the engineer, as the time required for concrete to set varies greatly and largely depends on weather conditions and the particular brand of cement used, also the bulk of the structure will affect the removal. Often in cases of walls and structures requiring treatment of the surfaces to produce a finish it is necessary to remove the forms at the earliest possible date and while the concrete is green. The question of length of time in cases of this nature can only be solved by previous experience.

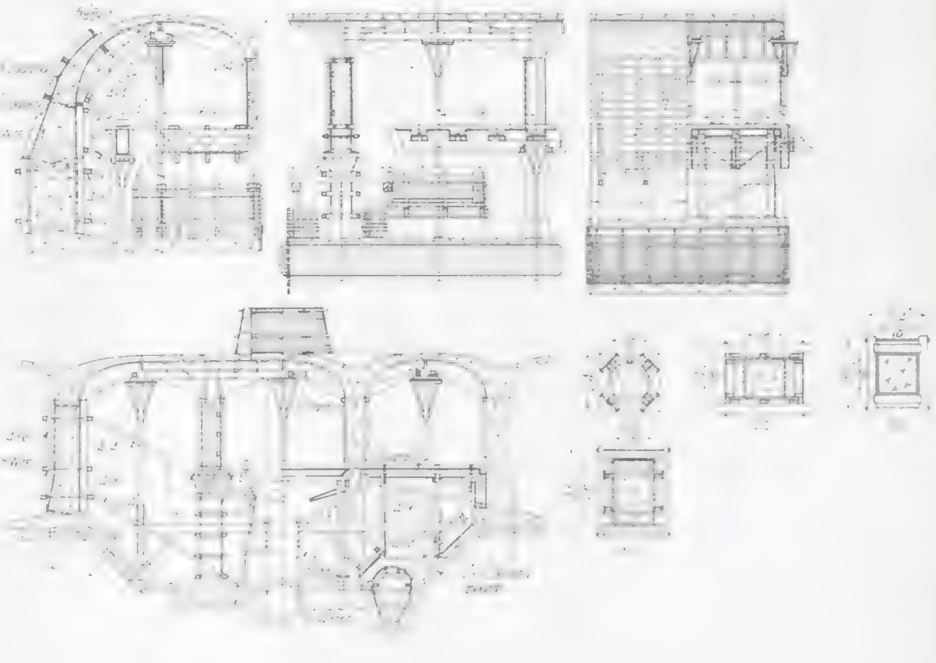

Fig. 5—Cross Section Through Filter Gallery Showing Forms and Bracing.

Partly as an experiment and partly to facilitate the work, the forms for a few piers 20 ins. in diameter, 8.5 ft. high, on the new filters were used twice in one day. That is, the forms were filled in the morning, removed and again set up and filled about noon; removed and again set at close of day ready for filling the first thing the following morning. The piers were not loaded for three weeks after casting. They have now been in use over 1½ years and no trouble has been experienced. The general custom was, however, to remove the bracing from the forms the following day and to allow the forms to remain up 72 hours. A schedule of time for removing forms under average conditions on the filtration work was as follows:

Floor forms—the following day.
Pier forms—after the third day.
Wall forms—after the second day.
Vaulting forms on galleries—after ten days.
Vaulting forms on filters—after six days.
Conduit forms varied from the following day to three days.

The work of removing forms is frequently, and unfortunately, placed in the hands of laborers and, as a result, the forms are broken and destroyed to the extent of costly repairs. In taking down forms the bracing or props should never be knocked out and the forms allowed to fall. This is not only liable to damage the forms, but the impact is liable to damage other work. The forms should always be easied down by a cable or other similar method. In roof vaulting the method of cable and drum described more in detail in another portion of this paper is very satisfactory. Sledges and bars should be used with the greatest of care, if at all. It will at times be very difficult to break the bond between the concrete and forms and the use of block and falls will be necessary. This will have to be done in a careful manner to prevent the twisting or distortion of the form. It is well to start a form by use of a wooden wedge rather than exert a great force by block and falls.

The forms upon removal should be thoroughly cleaned of all cement. This can be done by scraping and will prove rather costly, but the thoroughness of this cleaning will greatly affect the speed of removal and the surface finish of the concrete in later work; so the additional cost spent in scraping is saved in other ways. It is much easier to remove the concrete which has adhered to the forms immediately upon the removal of the forms and the longer a form stands the harder it will be to thoroughly clean it. As soon as the forms are removed they should be cleaned and any necessary repairs made and the forms piled in some convenient place. The piling, although a small matter, will often cause much trouble; if the forms are carelessly piled, having bearings at points that will allow them to sag, the forms are liable to set to this untrue shape and endless trouble in setting them to line and grades will be experienced.

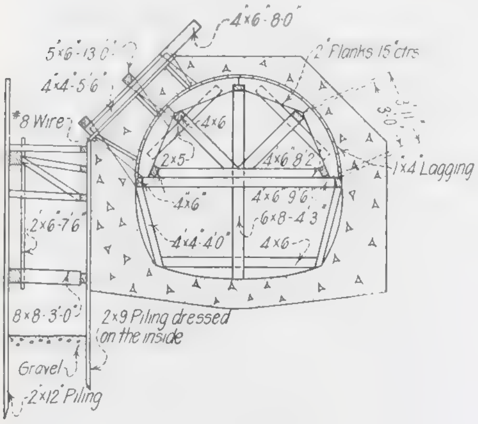

Fig. 6—Forms and Bracing for 10⅓ Ft. Suction Trunk.

Steel Reinforcement.—There is no particular choice in the kind of a bar best to use as being easiest to hold in place, except that a bar having a twisted or irregular surface will hold without slipping, better than a smooth straight bar.

An example of a method of placing and holding steel can be presented in a brief description of the equalizing chamber built at the Brilliant Pumping Station. This chamber, 38 ft. deep, contained 445 cu. yds. of concrete and 20,000 lbs. of steel or about 0.0034 per cent reinforcement based upon the sectional area. Some of the walls were only 18 ins. thick throughout the entire height. Figure 3 shows the form work.

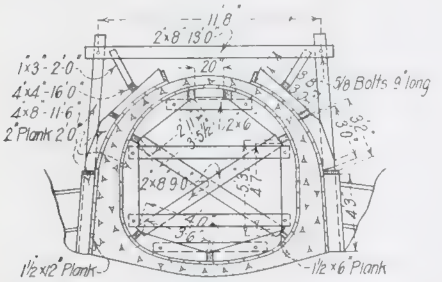

Fig. 7—Forms and Bracing for 9½ Ft. Filtered Water Conduit.

The vertical rods in the walls of the chamber, numbering about 200 rods being for the most part ½ in., were to extend into the foundation sufficiently, 20 diameters, to develop the strength of the rod. Joints between successive days work were made at the level of the floor and to avoid having these rods extending up in the way of the form building and the necessity of supporting the rods at the top, which supports would be greatly in the way, bars 40 diameters long were placed one-half in the foundation concrete and one-half extending above the concrete foundation, to which, after the second lift forms were completed, were wired the vertical bars.

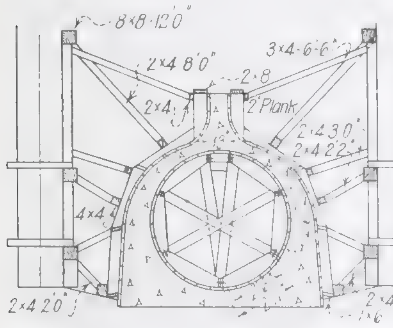

Fig. 8—Forms and Bracing for By-Pass Conduit.

The inner and outer forms were wired together and spacers of wood used. The location of the wires was made with an eye to the placing of the reinforcement so that as many as possible of the vertical rods could be tied to the wires. The horizontal reinforcement, which was largely in the shape of hoops, varied from 1 in. to 0.375 in., was tied to the vertical bars, and where possible laid on the tie wires. It was also necessary in several places to add 0.375 in. or 0.25 in. bars for support. This arrangement of steel proved very satisfactory. The test was very severe, as due to the narrowness of the space between forms the ramming affected the steel, and the removing of the spacers often necessitated a man using the steel as a ladder to go down in the forms.

The method used in the gate chambers was somewhat different. Here mostly horizontal bars were used. After the form was checked for trueness nails were driven in the side of the forms at the location of the bar. The bars were all cut and placed in racks easy for access. When the concrete was placed level with a nail a bar was laid in the concrete. This method involves close inspection and maintaining the concrete level to insure proper construction. In the floors and beams a similar method was followed; the bars were all cut and fitted, then laid to one side. A layer of concrete was placed slightly in excess of the distance from face to steel. The steel was then laid on the concrete and the bars tied together and the remainder of concrete placed.

In the equalizing chamber the steel required careful bending. There were 27 different shapes. A record kept by the writer on the bending of 10,325 lbs. extending over a period of 10 days showed a cost of: 0.88 man hours per 100 lbs. for blacksmith and of 1.66 man hours per 100 lbs. for helpers. At the prices paid, or 25 cts. per hour for blacksmith and 16 cts. for helper this cost was 48.9 cts. per 100 lbs. In addition to this was chargeable 0.24 man hours per 100 lbs. for the layer out, which work was done by the boss carpenter at a cost of 20 cts. per 100 lbs., the total cost being 68.9 cts. per 100 lbs. In bending the steel a large platform was built and all shapes laid out full size, cleats were nailed at points of curvature and the rods bent to fit.

Description of Piers.—Figure 1 shows the form work for a 21.5 ft. circular pier 27 ins. in diameter, being one of 720 piers supporting the roof of the reservoir. The sketch is fully dimensioned. The forms are in three sections each 7 ft. 2 ins. long, each section consists of two semi circular pieces of No. 16 galvanized steel, flanged on the vertical edge, the flanges of the two halves being bolted together between two pieces of 2 x 4-in. lumber. The sections are clamped at top, bottom and middle point by a wooden collar made in four pieces and held by bolts.

The first intention was to make up the 7-ft. 2-in. sections on the ground and build them into place in the pier. About 20 piers were built in this way and proved very unsatisfactory, as the third points, or joints, were not rigid enough. The remaining pier forms were built complete on their sides and raised into place by the cable way.

The carpenters plumbed the forms with plumb bobs and the engineer corps checked the work with a transit. The piers were braced in sets of four, horizontally at top, bottom and center and cross braced from top to bottom. This allowed an unobstructed passage between the sets of four piers for the moving of the filling platform.

The removal of the forms was accomplished by removing all the collars and loosening all the bolts in the flanges, working from the top down. The lower section of metal was then removed and the upper two allowed to slide down the pier; the second was removed allowing the top to slide down and be removed. Thus a large amount of work was accomplished from the floor which saved considerable time. Before using the metal again it was thoroughly scraped and cleaned.

The metal and collars were renewed at intervals, in some cases they were used 20 times. The greatest trouble was caused by the indenting of the edges, permitting leaks which caused wash streaks in the surface of the piers. As the pier forms became older this trouble increased and it became necessary to calk with yarn around the bottom and at joints.

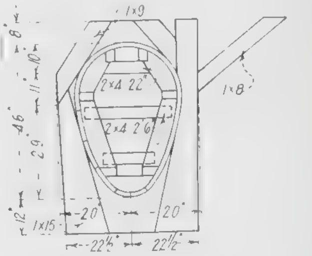

Fig. 9—Inside Forms and Bracing for Drain.

At first the forms were built to the neat required height and filled level with the top of form. The concrete when setting would shrink from one to 1.5 in. and it was found necessary to make the forms higher so as to allow for this shrinkage. It was then found advisable to build the forms to a greater height so that the finished pier would be 1 or 2 ins. higher than required. This allowed the roof forms to butt against the pier and prevent lateral movement.

The pier forms contain 488 ft. of lumber and 688 sq. ft. of metal. The bracing contained 507 ft. of lumber. The cost as compiled by the writer for form work on four piers, 12.68 cu. yds., is given in Table I. This is an average from a number of observations taken at random and extending over a period of 8 months.

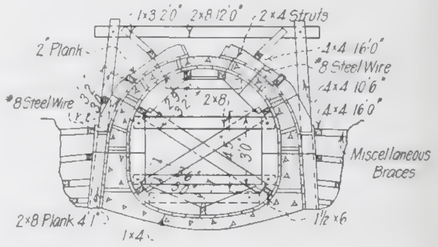

Fig. 10—Forms and Bracing for 8⅓ Ft. Filtered Water Conduit.

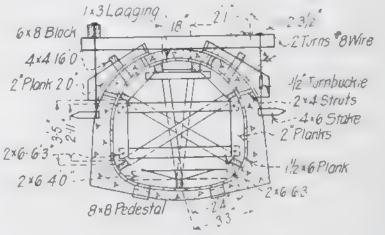

Fig. 11—Forms and Bracing for 7 Ft. Filtered Water Conduit.

The piers in the last filters built were molded in a steel form which offered a great many advantages. The form was very different from that used on the reservoir. They were used 20 times with practically no repairs, and were very easily and quickly removed and reset. In part of this work piers were built separate from the roof, the remainder were built monolithic with the roof. The piers built separate from the vaulting were braced from pier to pier at the top, a pair of rails were hung to the piers and on these rails were set kegs of bolts, which happened to be on hand, to load down the pier and prevent floating. The piers built monolithic with the roof did not require any greater loads than that furnished by the vaulting.

On the first filter beds the piers were square and built of wood. Figure 5 shows the design of these pier forms. They were all built monolithic, with groined arch vaulting. The forms were used on an average of ten times and consisted of four sides held together by bolts, the removal of the bolts allowed the form to collapse.

Barrel Arch.—Figures 1 and 2 show the design of what was known as the barrel arch form. This form was for that portion of the wall from the springing line of the arch to the center of the first bay. The inside shape was a quarter of a 12 ft. circle and the outside an arc of a 15 ft. circle. These forms caused more trouble than any others on the reservoir. The inside was built in three equal sections, each 9 ft. long and 5 ft. 10 ins. wide on the chord. The ribs, 2 x 12 ins., were placed on 21-in. centers and lagging was 1 x 3 in., southern pine, tongue and grooved and dressed on both sides.

The outside forms were built in three sections, the first section being 3 ft. of the wall form which was left wired to the wall when removing the back wall form; this gave a solid base upon which to build. The second was placed before filling and fastened to the inner form by wires and wooden interior struts and held on the outside by an outrigging extending up from the wall. The third was placed after the filling had reached the top of the second form and was wired to the inner form.

The remainder of the arch or a little over one-third of it was screeded, no form being used on the outside.

Some trouble developed after the third using and was entirely due to the manner of removal. The bracing extending from the top to bottom, shown in Figure 1, was not removed and the forms were not taken down in three sections, but the entire form was removed at one time. The method of removing was to hitch a set of falls to one of the upper corners to break the bond and at times twelve men broke the rope before the form left the concrete. It was not uncommon to pull off several ribs in an attempt to break this bond. The result was that this pulling greatly distorted the form. This first showed up in the inability to make a good joint between forms and finally necessitated rebuilding the forms. The trouble could have been eliminated by removing the forms in three pieces rather than in one. The barrel arches on the filters, Fig. 4, were similar, but one-half the length. On these there was no particular trouble.

The barrel arch in filtered water reservoir contained 0.92⅓ cu. yd. per running foot and the units placed were 36 ft. long or 33¼ cu. yds. The cost of forms is given in Table II.

The cost is an average from a number of observations made by the writer. The cost of hauling out is rather high and unusual, the forms, however, were of awkward shape and very large, and had to be hauled on a truck by hand a distance as great as 300 ft. The floor over which they were hauled consisted of inverted groins with piers every 18 ft. The trimming and trueing at 58 cts. a yard is due to the trouble previously explained in this paper.

Walls.—The wall forms shown in Fig. 1, are in accordance with the general practice in such work. All forms were made in 9-ft. sections and from top to bottom in one unit. The method for preventing the forms from raising is shown in the illustration and consisted of hooks set in the first layer of concrete and wires tying the forms to these hooks.

The forms were used on an average of 10 times and the only repairs made were a board now and then, where the bar in removing had splintered or broken the forms. The edges of the forms become more or less frayed and this was cared for by a metal strip tacked over the joint. This practice was permissible in this work as the face would not be exposed. In finished surfaces it should never be used, as the metal leaves a surface entirely different from the wood and very readily noticed.

The regular wall in the reservoir contained 2.33½ cu. yds. per running foot and as a rule the wall was built in 36-ft. sections or 84 cu. yds. This amount varied within a yard as the point where the wall ceased and the barrel started was not closely defined. The cost of forms is given in Table III. This cost is a weighted average as in this work there was a great amount of variance. Often the cable way was used in removing forms and the cost cut down, then again the forms would be in bad shape and require much repairing. As an example on the

21st wall form cost	$0.73 per cu. yd.
23rd wall forms cost	[illegible] per cu. yd.
24th wall forms cost	[illegible] per cu. yd.
25th wall forms cost	.12 per cu. yd.
26th wall forms cost.	.19 per cu. yd.

Groined Arch Forms.—Figures 1 and 2 show groined arch forms in elevation and plan. Each pier top was molded on forms built in four triangular sections, the joints between sections being on centers of arches and on diagonal lines between piers. The ribs were 2-in. white pine placed on the diagonal line and on 2-ft. centers between the diagonals, the decking was 1-in. southern pine tongue and grooved. The forms were well oiled before filling.

The pier edge of each form rested on a collar bolted to the piers. The piers, having been built 2 ins. higher than the springing line of the arch, prevented any horizontal movement in the form. The four corners were supported by 8 x 8-in. posts and midway between corner posts were placed 4 x 4-in. posts. The proper elevation on the top of arch was first secured by placing wedges between the top of post and form. Later it was found that dumping the concrete disarranged these wedges and their use was discontinued and 0.5-in. boards were used and toenailed. This allowed only an adjustment of 0.5 in. which was considered close enough.

The joint between forms on the top was made by a crown strip which varied from 2 to 4 ins. wide. The corner joints were finished by a 1-in. triangular strip which relieved the rough corner. The forms being square and piers round required a filler in the corners. This filler was first made of plaster paris mixed with excelsior, but was unsatisfactory as the breakage was high and it was impossible to use it a second time. The cost of the fillers in plaster paris was about 27 cts. each. Later wood was used and the work was finished using wood. On Contract 11 the contractor used a metal filler cut from No. 16 gage sheet iron. This filler was used over and over, the first cost being 10 cts. each. Figures 4 and 5 show the forms used in filter work which are very similar to those of the reservoir. The roof and pier were placed monolithic in this work.

The method followed in placing forms was to first erect the shoring on the piers, then by cableway erect the corner posts and brace them to the piers. The arches were then lifted by cableway and placed in position resting on the piers and the corner posts. Most of this work was done at noon, in the evening, or on Sunday as at these times the cableway was not in use on the concrete. A crown strip was placed between the forms on the top so as to allow adjustment. This strip had to be ripped from boards and this was done by hand requiring considerable time.

Removing the forms on the reservoir was done by means of a cable allowed to slip over a drum placed on the roof, a hole having been left in the concrete over the center of gravity of the form. It was necessary to resort to a set of blocks and falls to break the bond between concrete and forms.

In placing the concrete in the vaulting some trouble was experienced in securing the proper thickness. The concrete from the sides would occasionally work down into the center over the pier. This trouble was experienced in Columbus, O., where in place of 6-in. thickness they found only 2 ins. of concrete and a test was made on one of the weakest arches. A load of earth was placed to the depth of 4 ft., when cracks developed in a vertical plane passing through two piers and a deflection of 13/32 in. was recorded. The work was remedied by placing a patch on the upper surface 4 ins. thick.

This same trouble was encountered on the Pittsburg work to a lesser extent. The maximum occurred where in place of 7.25 ins. we had 4.75 ins. of concrete. The error was discovered in 10 sides out of the 64 first placed and was remedied by patching, and further trouble of same nature was prevented by using a screed board at right angles to the line of piers instead of on the diagonal as had previously been used.

On Contract No. 1, the filters, the total amount of arch centering placed was 2,130,012 sq. ft. There were 240,000 sq. ft. of forms actually made to complete the work, an average of ten times use for each form. The actual cost was $0.0435 per sq. ft. placed; this cost includes plant charges, administration charges, material, etc.

On Contract No. 2, the reservoir, there were placed 243,390 sq. ft. of vaulting forms and there was actually made about 20,000 sq. ft. The cost was $0.096 per sq. ft. placed, or about $3.50 per cu. yd. of concrete placed. This cost is a final cost including everything chargeable to the forms.

For a detailed cost Table IV was prepared from information gathered by the writer:

Four forms made one pier top or...	8.1864 cu. yd.
Lumber in one pier top...................	1,000 ft.
Lumber in posts and bracing.	400 ft.
Lumber in shoring on piers..............	150 ft.

To the above cost must be added a charge for hauling the forms from the place of removal to the place of setting. This varied greatly and from observations cost 15 man hours per 100 ft. hauled.

Gate Chambers.—The forms for gate chambers throughout the work were more or less similar and the same principle in form work was used throughout. The structures were rather irregular in shape, some portions of the forms could be used twice, but the greater portion had to be wrecked and the lumber partly used in rebuilding. The greater portion of the forms were built of 1.5-in. southern pine lumber surfaced on both sides; the portions plain in shape were decked horizontally and the portions curved or irregular were decked vertically. The forms were wired together and the exterior and interior braced. The dumping platform was built independent of the forms. The placing of reinforcement is explained in detail elsewhere in this paper. The first section was built to the sub floor level; the second to a point about 3 ft. above the top of the gates, and the third up to the floor level including beams. The floor slabs were placed later.

Conduit.—The construction of conduit forms was governed greatly by the place they were to be installed and the surroundings. A conduit in a trench offers different requirements than conduit in the open. Figure 6 shows six conduits and the forms used on each. The inner form or barrel is generally first placed. This is held to the proper elevation by piers, or saddles, separately cast, and the tops set to grade. The steel is next placed and then the outer forms.

Care must be exercised to prevent the form

TABLE I.—COST OF FORMS FOR PIERS SUPPORTING GROUND ARCH RESERVOIR ROOF; TOTAL 12.68 CU. YDS. OF CONCRETE IN FOUR PIERS.

Item	Total.	Per Cu. yd.
Shoring, 12 hrs. carpenter at [illegible]	[illegible]	[illegible]
Cleaning, 15 hrs. labor at 15 cts....	2.25	0.18
Making:		
15 hrs. carpenter at 30 [illegible]	[illegible]	
15 hrs. labor at 15 cts..............	2.20	
Total ...	[illegible]	[illegible]
Setting:		
[illegible] carpenter at 30 [illegible]	$0.23	
1¼ hr. laborer at 15 cts............	0.19	
¼ hr. cableway at 50 cts..........	.12	
Total	[illegible]	[illegible]
Plumbing and bracing, 15 hrs. carp. at 30 cts..........................	4.50	0.35
Grand total	$17.29	$1.37

TABLE II.—COST OF FORMS FOR BARREL ARCH FILTERED WATER RESERVOIR, PITTSBURG, PA.

	Total.	Per cu. yd.
Fabrication at Mill:		
240 hrs. at 35 cts.....	$84.00*	$0.31
Taking Down:		
1 foreman 2 hrs. at 30 cts..........	0.60	
9 laborers 18 hrs. at 20 cts........	3.60	
Total	$4.20	$0.13
Hauling Out:		
1 foreman 1½ hrs. at 30 cts......	$0.40	
12 laborers 16 hrs. at 20 cts........	3.20	
Total	$3.60	$0.11
Cleaning and Repairs:		
1 foreman 5 hrs. at 35 cts.........	$1.75	
4 carpenters 20 hrs. at 30 cts......	6.00	
2 helpers 10 hrs. at 20 cts.........	2.00	
Total	$9.75	$0.30
Placing:		
Cableway ⅓ hr. at $2..............	$0.66	
1 foreman ⅓ hr. at 40 cts........	0.13	
3 carpenters 1 hr. at 35 cts........	0.35	
5 laborers 1⅔ hrs. at 15 cts........	0.25	
Total	$1.39	$0.04
Trimming and Trueing:		
1 foreman 10 hrs. at 35 cts........	$3.50	
4 carpenters 40 hrs. at 30 cts......	12.00	
2 helpers 20 hrs. at 20 cts..........	4.00	
Total	$19.50	$0.58
Grand total	48.94	1.47

*Used 8 times.

floating or rolling and in filling the bottom. The bottom is sometimes cared for by placing grout tubes, or by simply smoothing up after the removal of the forms. In a number of conduits on the reservoir work a board was left off the outside forms just above the invert and through this opening the bottom was successfully filled by tamping. The filling of one side and allowing the concrete to run under and seek its level on the opposite side, thus assuring filling in the bottom, is rather dangerous practice as there is great chance of moving the inside form or barrel.

The by pass conduit, shown in Fig. 6, is 7 ft. in diameter and about 1,200 ft. long, built in 36-ft. sections, contained 48.8 cu. yds. and 3,600 lbs. steel per section, and was built after the roof of the reservoir was in place, the piers and roof being used to brace against. The barrel was placed on concrete saddles and painted with cold water paint. The reinforcement was next placed and then the outside forms. The braces were all fitted and marked and they together with all except the bottom outside form were removed and stored conveniently for easy access. The barrel was held down by braces to the roof and held laterally by braces to stringers placed along the piers. When the concrete reached the level of the top of the bottom form, the second form was placed and so on until the top was reached. After the concrete was placed to a depth level with the top of the barrel it was found that there was no tendency to rise and the braces to the roof were removed.

TABLE III.—COST OF WALL FORMS, FILTERED WATER RESERVOIR, PITTSBURG, PA.

	Total.	Per cu. yd.
Fabrication in Mill:		
110 hrs. carpenters at 35 cts......	$38.50*	$0.038
Taking Down:		
1 foreman 10 hrs. at 35 cts......	$ 3.50	
2 carpenters 20 hrs. at 30 cts....	6.00	
4 laborers 40 hrs. at 20 cts........	8.00	
Total	$17.50	$0.208
Setting Up:		
1 foreman 10 hrs. at 35 cts......	$ 3.50	
6 carpenters 60 hrs. at 30 cts....	18.00	
4 helpers 40 hrs. at 20 cts........	8.00	
Total	$29.50	$0.350
†Grand total	$50.20	$0.596

†This does not include cost of material. *Used 12 times.

Trouble was experienced with the first three forms; they started to give during filling, but the knowledge gained in those mishaps was sufficient to show the weak points and work progressed nicely until a change of superintendents placed a man in charge who decided to cut expenses, and the first forms built gave away. After that the work proceeded to completion without a mishap and the test showed up very satisfactory.

The forms in this conduit were all bolted together; the inside or barrel form collapses by dropping the top section. The time required to build one section was three days and the time to fill it was seven hours.

The forms including bracing contained 6,350 ft. of lumber. The lagging was 1 in. southern pine and the ribs 2 in. white pine. The cost of a 36-ft. section as compiled from a number of observations was:

	Time	Rate	Cost	Times used.	Cost per cu. yd.
Building forms at mil.	489	$0.35	$171.15	10	$0.36
Carpenter work in field—					
Carpenter	227¼	.35			
Helpers	191¼	.20	$83.39	1	1.70

including taking down, placing steel, etc.

TABLE IV.—COST OF VAULTING FORMS FOR FILTERED WATER RESERVOIR, PITTSBURG, PA.

	Total.	Per cu. yd.
Making of Groins at Mill:		
120 hrs. at $0.35...............	$42.00*	$0.42
Setting Groins:		
1 foreman ¼ hr. at 35 cts...........	$0.09	
3 carpenters ¾ hr. at 30 cts.........	0.225	
6 laborers 1½ hr. at 20 cts..........	0.30	
1 cableway ¼ hr. at $2.00..........	0.50	
	$1.115	$0.14
Setting Corner Posts:		
Cableway 1-10 hr. at $2.00..........	$0.20	
3 carpenters 3-10 hr. at 30 cts......	0.09	
	$0.29	$0.03
Intermediate posts, 3 carpenters 1½ hr. at 30 cts................	$0.45	$0.05
Shoring piers, 2 carpenters 3 hrs. at 30 cts........................	0.90	$0.11
Trimming and trueing, 4 carpenters 3 hrs. at 30 cts..............	1.20	$0.15
Taking Down Groins:		
1 foreman 1⅓ hrs. at 30 cts.......	$0.40	
5 laborers 6⅔ hrs. at 20 cts........	1.35	
5 laborers 6⅔ hrs. at 15 cts........	1.00	
Total	$2.75	$0.33
Grand total	$10.20	$1.22

The forms for the seven foot filtered water conduit shown in Fig. 6 is a good example of form work for a conduit in a trench. In this conduit no outside forms except one on either side of the top was necessary. The sections were 30 ft. in length, contained 22 cu. yds. of concrete and 2,660 lbs. of steel. One foreman, 4 carpenters and 4 helpers took down the back forms, set them up ahead and placed the steel ready for filling at the rate of one section a day. Two sets of forms were used and they were removed the following day as early as 10 o'clock; thus while filling one section another was being prepared. The cost of setting up the forms and placing steel was $1.15 per cu. yd. and the cost of bending steel 40 cts. per 100 lbs.

The 48-in. conduit was a plain circle inside with perpendicular sides and semicircular top outside. The drain was located in a 21-ft. fill, placed in sections varying from 20 ft. to 50 ft. in length and contained 0.387 cu. yd. of concrete and 35 lbs. steel per lineal foot of conduit. The forms were built in the mill and used six times in the field:

	Per cu. yd.
Lumber	$0.72
Mill work	.30
Bending steel	.23
Carpenter work in field............	2.13
Total	$3.41
Total, lin. ft. of drain	1.59

STEAM AND ELECTRIC RAILWAY SECTION

The Reasons for and Methods Employed in Appraising the Value of Railway Properties, with Special Reference to the Michigan Valuation.*

The industrial and economic development of the past two decades has opened many new lines of special work in the profession of Engineering, none of which is more difficult and complicated or of greater ultimate value to the public at large than that of the appraisal or valuation of the property owned and operated by public service corporations; and none of the fields of engineering specialization requires greater care or calls for more skill, experience, integrity, or sound judgment.

The question of railroad valuation, involving as it does the largest industry of the nation, naturally takes first place in a discussion of this subject. So many of the principles of railroad valuation, however, are applicable to the valuation of other corporate properties that it is not desirable to limit the discussion to that subject.

The reasons for requiring that valuations be made may be broadly divided into two general classes.

First.—As a Matter of Public Interest.—The public, and particularly the investing public, requires valuations in order to guard against unworthy and dishonest corporation securities, to be assured that corporations are bearing their legitimate and proper share of the burden of taxation, and to furnish a proper basis for fixing equitable and just rates for the services rendered by the corporation.

Under this class would come all appraisals made for information to be used as a basis for legislation relative to:

(a) *Taxation of Corporations.*—Such were the valuations in Michigan and Wisconsin.

(b) *Rate Regulation.*—This was the reason which prompted the work in Minnesota and Nebraska.

(c) *Limitation of Capitalization.*—The regulation of issue of stocks and bonds was the purpose of the Texas valuation.

(d) *Fixing a Price for Sale.*—Many of the waterworks and electric light valuations were made in order to determine a fair price to be paid for the property at the expiration of the franchise.

(e) *The General Information of the Public.*—To be used in connection with the fixing of terms for franchise renewals, etc., etc.

Second.—As a Matter of Corporation Necessity or Expediency.—Valuations are made in order to guide large investors, to secure a safe and up-to-date basis on which to negotiate a sale, a purchase, or a reorganization of the property, or a consolidation with other like properties, and to secure justice to honestly administered corporations.

There has been much argument regarding the desirability and expediency of such appraisals. It is not the intention of the writer to discuss this question. It is assumed that all such questions have been settled before a valuation is ordered, and this paper is confined to a discussion of the methods which should be used in arriving at a correct figure of cost of reproduction and depreciation.

A valuation, regardless of the purpose for which made, should be such as to secure a "fair value" of the property under consid eration Appraisers will encounter, among other difficulties, the fact that human selfishness is a dominant quality, and that attempts are sometimes made to influence a valuation from selfish motives; also that human machines are not exact duplicates, and that allowance must be made for a large measure of error, on account of the personal equation of the men engaged on the work, as individual errors of judgment are frequent on any work of magnitude. This personal element must be corrected by uniformity of method, by constant checking, and, as far as possible, by subordination of personality to system.

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*Abstract of paper entitled "The Valuation of Public Service Corporation Property," by Henry Earle Riggs, Proceedings, American Society of Civil Engineers, Vol. XXXVI, page 1369.

All properties being appraised should be considered as operating properties. One which is dead, inert, and not in use, cannot be considered as coming under such a discussion as this, and such properties are not treated in this paper. The term "going concern" is not used in connection with the physical property, any element of value implied by the term, over and above the "overhead charges," being treated as an intangible or non-physical element of value.

Explanation of Terms.

In order that there may be no doubt as to the exact meaning of the terms used throughout this paper, a few definitions or explanations are submitted:

Appraisal, or Valuation.—These words are used interchangeably, and refer to the engineering work of determining the present worth of both physical and intangible properties of corporations.

Cost of Reproduction.—This expression refers to the estimate of cost of reproducing the physical properties as they exist on the date of the appraisal, all elements entering into the cost being considered as new and not affected by the elements of depreciation or obsolescence.

Cost, or Original Cost.—These terms refer to the actual amount of money paid for the property, either when it was originally constructed, or in its condition at the time of appraisal, the latter case being the original cost plus the cost of additions and betterments, less abandoned, replaced, or worn-out property. This figure ought to be represented by the "book cost," but it is not often that "book cost" and "actual cost" are the same.

Present Value, or Present Physical Value.—These terms are used in describing the physical property as reproduced after it is affected by all elements of depreciation or appreciation. The use of the word "value" in this expression is unfortunate, as it may lead to some confusion. It must be kept clearly in mind that, where this term is used, it refers only to physical property as depreciated, and is in no case intended to refer to the final or "fair" value of the property.

Non-physical, or Intangible, Value.—These terms are used to represent those elements, entering into the final worth of the property as a business concern, which arise out of the operation of the property and are not attachable to the physical property.

What is "value?" In defining the exact meaning of this term, as applied to the property of a public service corporation, a number of elements must be taken into account. Standard authorities give many definitions of the term. As a definition of that estimate of worth which an engineering commission should report as the result of a complete appraisal, the writer submits the following:

The value of a property is its estimated worth at a given time, measured in money, taking into account all the elements which add to its usefulness or desirability as a business or profit-earning proposition.

There are two classes of elements entering into the final value:

(1) *The "Physical Property Element of Value.*—This consists of those things which are visible and tangible, which are capable of being inventoried, their cost of reproduction determined, and their depreciation measured. The property is considered as an operating entity, and, being so considered, carriers as part of the physical value, those costs and charges which are an inseparable part of the cost of construction but do not appear in the inventory of the completed property.

(2) *The Non-Physical" or "Intangible" Elements of Value.*—These are those things which, added to or taken from the worth of the physical property, make up the value, and include whatever accrues to the property by reason of its operation, or by reason of grants, contract rights, competition, or location, which at the time of appraisal affect favorably or unfavorably the worth of the property.

The physical property is that which enables the corporation to do business. Without physical property it could not produce the commodity which it sells. The amount of money actually invested in acquiring that physical property represents the measure of capital on which it is morally entitled to earn interest and profit; and, in the stage of promoting and financing the enterprise, all hope of earnings is based on the amount of money required to construct the property. These considerations lead the writer to contend that the true method of valuing a corporate property is first to determine the cost of reproduction of the property and its depreciation, and modify this figure by any applicable positive or negative non-physical elements of value.

The Michigan State Appraisals.

ORGANIZATION

The State Legislature of Michigan, at the session of 1899, passed an act creating a Board of State Tax Commissioners and outlining and prescribing their duties. This act authorized the board to "inquire into and ascertain the value of the property of corporations paying specific taxes under any of the laws of this State."

The ultimate object of this valuation was the passage of such laws that all taxable property in the State might be taxed uniformly. On September 1, 1900, Prof. Mortimer E. Cooley was appointed Appraiser of Properties. Immediately thereafter the following general organization was mapped out:

1. *Administration.*—All matters of general policy in regard to the conduct of the work, all matters relating to negotiations and conferences with officials of corporations, all transactions with the State Tax Commission, the Governor, or the Board of State Auditors, and the entire direction of all relations with the public through newspapers and other channels, were retained by the appraiser, who was the final arbiter on all matters referred to him regarding the details of the work.

2. *Civil Engineering.*—The appraisal of all property which in the course of construction would fall under the supervision of the civil engineering department of a road, including land, roadway, bridges, and structures, was in charge of the writer.

3. *Mechanical Engineering.*—The appraisal of all motive power, rolling stock, and property which in the course of construction would fall under the supervision of the mechanical engineer, including power and electric plants, shop tools and machinery, water stations, etc., was in charge of Mr. Theodore H. Hinchman, Jr., of Detroit, Mich.

In the matter of the final assembling of figures, computation of percentage values, and compilation of final results, Mr. Hinchman and the writer worked together with joint general supervision.

4. *Telegraphs.*—The inspection and appraisal of all telegraph properties was under charge of Mr. William S. Conant, of Detroit, Mich.

5. *Telephones.*—The appraisal of all telephone properties was directed by Mr. William J. Rice, of New York.

6. *Vessel Properties.*—All vessels belonging to companies whose property was involved by the appraisal were inspected and appraised by Herbert C. Sadler, Professor of Naval Architecture and Marine Engineering at the University of Michigan.

The magnitude of the work was appalling. There were seventy-eight different incorporated companies, owning some 10,000 miles of railroad, scattered over 54,000 square miles of [illegible] number of small unincorporated railroads, telegraph, telephone, plank road, and other corporations, many of which had no records, no complete inventory, and no department organized so that the information could be readily secured. A careful and complete method of work was therefore necessary.

To strengthen the work further, to eliminate the element of personal error, to guard against the danger of dulled perceptions due to constant application to the work, and to forestall, if possible, every point of objection to methods, a Board of Review was chosen by Appraiser Cooley to whom were referred:

(*a*) The methods of inventory and valuation [illegible]

(*b*) All points on which special discussion or difference of opinion were noted in the working conferences;

(*c*) Questions as to elements of value in the physical property which were in themselves not tangible or capable of inventory, and finally,

(*d*) The results of the whole work.

The members of this board were chosen on account of pre-eminent standing in the Profession, and on account of experience and prominence in railway engineering. The board was composed of four men, as follows: Octave Chanute, chairman, George W. Vaughn, Charles E. Greene and Charles Hansel. These gentlemen were employed in a consulting capacity and were not engaged in any detailed work of the appraisal.

OFFICE AND FIELD WORK.

The preliminaries of the organization having been completed, and the forms prepared, a portion of the working force was brought on the ground, and the work was actively commenced. It was subdivided into four parts:

(1) Office inspection, or inventory;
(2) Field inspection;
(3) Computation;
(4) Compilation for the permanent record.

Making the Inventories.—Office inspection, or the preparation of inventories, was assigned usually to parties of one or two experienced men with from two to four younger engineers as assistants in the computing room. These men went to the general offices of the railroad companies and made a complete examination of maps, profiles, bridge and building records, records of motive power, rolling stock, etc. They made, for the use of the field men, inventories of the property and abstracts of real estate. All inventories were made up for roads or for divisions of roads, with each class of property listed separately.

Field Inspection.—Field inspectors were not permitted to place a money value on any structure, but were expected to examine it, to make a full description of it in all particulars, and to assign to it a percentage which should represent the present value or the depreciation from a similar new structure rated at 100 per cent. They were furnished with the records of the office inspection covering the district assigned, and with necessary notebooks, tape lines, estimate blanks, etc.

The Chicago & Northwestern Ry. had no records of any sort, all construction papers having been destroyed by fire. This company organized and placed in the field four complete engineering parties, each under one of their own engineers, and with each party was sent one field inspector. The line was carefully surveyed and cross-sectioned, and complete records of every building and structure were made, side-tracks were measured, and data taken for rail and ballast charts, etc. All work was done in the presence of the field inspector, and he was given copies of all notes. He placed his own percentage of description on everything. The estimates, made up independently by the Chicago & Northwestern engineers and the appraisal staff, using in the latter case the same unit prices as applied elsewhere in the Upper Peninsula, varied less than 2 per cent.

Special Valuations.—Certain special structures, such as ore docks and ore and coal-handling machinery, the more important bridges and station buildings, as well as work equipment and special equipment, were of such a character as to require the services of experts in their appraisal.

Computation.—After the completion of the field inspection, all notes were placed in the hands of the computing force. This organization consisted of two classes of men, engineers brought in from field inspection, and younger engineers. All computations were made independently by two men, and all work was checked carefully.

Filing in Office.—The system of filing and record keeping had the merit of being simple and inexpensive. The vault in the appraisers' office was arranged so that large manila envelopes, each of sufficient size to hold all the reports, notes, maps, etc., of each road or division, could be filed vertically. Each road was given a number; if there were several divisions, each division was given a letter, as "15-*A*," "15-*B*," etc., and each division was filed separately. Every report, book, map or other paper was stamped with its road or division number or letter, and given a sheet number. In issuing papers for work, the entire file was taken and kept together at all times.

The State of Michigan is made up of two peninsulas, widely separated, with radically different conditions prevailing as to certain items of the cost of construction.

Computation Tables.—This appraisal involved seventy-eight incorporated and forty-seven unincorporated railroads. It was necessary to adopt such a system as would apply uniform methods and prices to all like property. Accordingly, the field inspectors were assembled, and, after conference, it was determined to prepare a set of tables, covering all classes of railway construction, material, and structures, values being computed for 100 per cent value, and for each 10 per cent depreciation. These tables covered different weights, sizes, and types of structures and material, and were all computed on the basis of the agreed estimated cost.

Unit Prices.—The unit prices were the result of a most careful study and discussion. For many items, such as clearing, grubbing, earthwork, masonry, etc., the price was fixed by agreement during the discussion at a figure which represented the fair average cost of this particular item during the 5-year period preceding the appraisal.

For rails and rail structures, an average price was secured from market quotations for a period of 10 years, a price was determined as the value of scrap, and the percentage of depreciation was applied to the wearing value of the rail. The unit price was $28; the agreed scrap value was $12, leaving $16 as the wearing value of the rail. If an inspector reported rail at 90 per cent, or at 30 per cent, this percentage was taken from the $16 wearing value and to this was added the scrap value. The tables were arranged so that, for any weight of rail and any percentage, the cost of reproduction and the present value could be taken from the tables in dollars per mile. The same was true of bolts, spikes, angle-bars, fish-plates, and frogs and switches.

In the case of material such as ties, where no scrap value could be attached, the percentage was applied directly to the first cost.

In the case of bridges, the tables gave weights per foot and per span for various lengths, types of structures, and loadings, and only the cost of reproduction was estimated.

Estimated costs per cubic foot were deduced for buildings of various standard railroad types and per square foot for depot platforms. These figures were obtained by reducing to this basis the cost of a large number of buildings of known cost, by comparison with data obtained from railroad companies and from a number of engineers who had kept such records, and by consultation with architects. These building tables did not apply to the more elaborate and costly structures, all of which were appraised specially.

Ballasting, track laying, and surfacing were divided into three and four classes, in order to cover the different general types of railroads, and prices per mile were fixed. On Upper Peninsula roads ballasting was estimated at a higher price than on Lower Peninsula roads, while ties and timber construction were estimated at a lower figure.

In addition to these prices, secured by averaging several years' quotations, or by agreement of experienced construction engineers, many valuable figures were obtained from manufacturers of locomotives, cars, mechanical equipment, and bridges; and in several cases access was given to the mechanical cost data of the larger roads. Specifications for locomotives, cars, and shop tools were sent out to builders with a request that they give average prices for a period of years.

From all this mass of data the unit prices for the valuation were determined. For locomotives, values were plotted for engines of different weights, in order to establish a curve, and curves representing deterioration, scrap value, and major repairs were also plotted, so as to ascertain diagramatically the value of an engine of given weight and stated condition.

Classification.—All work of computation was classified in strict accordance with the Interstate Commerce Commission's classification of construction accounts, to which were added one or two classifications not recognized by that commission.

Compilation.—After the computations were completed they passed to the compilers, who arranged and classified them, and prepared the final report. The compilation was done after the completion of all the other work, and the disbanding of the organization, a small force being retained by the state to compile and put in permanent form all the papers of the appraisal.

SPECIAL PROBLEMS OF THE MECHANICAL DEPARTMENT.

The Civil Engineering section dealt wholly with fixed property located entirely within the State; and the work offered no special difficulties in the way of assignment of values. It is true that, when the question of terminal values was under discussion, the Wisconsin & Michigan R. R. offered a very pretty example, in that the revenue-producing half of its mileage lay in Michigan, while its shops, yards, docks, and car ferries, comprising the great bulk of its physical property, were in Wisconsin.

The Mechanical Department, however, was compelled to handle the valuation of moving property, and to assign values as between the States on such a basis as would be fair to all parties. The courts have been inclined to view the distribution of values between territorial units on the track-mileage basis as being a fair one. The study of the problem in Michigan indicates that while this method, perhaps, is just in most cases, it will not hold in all. Assignment was made upon several bases, as follows:

(*a*) Main-line mileage;

(*b*) Total track-mileage;

(*c*) Car- and locomotive-mileage of equipment operating in Michigan.

(*d*) Car- and locomotive-mileage, entire equipment;

(*e*) Freight-car mileage of the entire system.

The results secured by these different methods show, in many cases, very little difference; all are close, and no injustice is worked by any method, while, in other cases, the figures are widely divergent.

The situation with reference to each separate road had to be judged on its merits. In the case of the Lake Shore & Michigan Southern Ry., an apportionment of locomotive and passenger-car equipment on the basis of equipment mileage or equipment operating in the State, and for freight cars on the basis of car-mileage of total equipment, was found to be most fair.

In making the assignment of values, this study was made for all interstate roads, and such basis used as was apparently most fair in each case, the department making a special effort not to assign to Michigan undue values or those which could not be sustained.

Freight Car Inspection.—One of the most perplexing problems which was faced by the Mechanical Department was the proper and satisfactory inspection and valuation of freight equipment. The freight cars owned by the companies were scattered over the United States and Canada, and the inspection of any considerable percentage of those owned by any company was, of course, an impossibility. The fact that these cars had beeen purchased in series, so that there were considerable numbers in a group, all of the same age, and built according to the same specifications, made possible a valuation by groups. The acceptance, however, of any arbitrary percentage of depreciation by years, or the acceptance of the rules of depreciation of the Master Car Builders' Association, without making independent investigation with a view of establishing the correctness of the rule, appeared to be unwise.

The several companies submitted carefully prepared statements of equipment. Prices were furnished by the leading manufacturers, and in many cases were secured from the books of the railroad companies. In order to determine the condition of the equipment, the inspectors of the department personally examined 32,000 freight cars in Michigan and adjoining States. These reports were analyzed, with the result that the inspection fully confirmed and justified the use of the rule for depreciation of the Master Car Builders' Association.

Locomotives.—The inventory of locomotive equipment was secured from the companies, and checked against reports and the equipment register. Personal inspection was made of every locomotive in the State, then a complete description was prepared, and the percentage of depreciation assigned. Curves of depreciation had been computed and plotted, and the figures of the inspectors were compared carefully with the curve in order to eliminate possible errors.

Vessels.—Professor Sadler's appraisal of vessels involved a personal examination of every vessel. This survey included:

(*a*) The hull of the vessel and general equipment;

(*b*) The machinery and boilers.

An independent estimate of the cost of reproduction and depreciation was made, and, wherever possible, this was checked by comparison with the detailed original cost. In case of material difference, various shipbuilders were consulted, and independent estimates of cost were secured. In every case these latter estimates were confirmatory of the estimated cost of reproduction, which figures were used throughout the appraisal.

OVERHEAD CHARGES.

There are certain expenses connected inseparably with the construction of any public work, which, on the completion of that work, are not capable of physical identification, but which, nevertheless, belong to and must be a part of the cost of the physical property. These expenses are legitimate; and, as long as the property is operated, a very large part, if not all, of the entire expense remains in the present value of the property as a "going concern."

Appraiser Cooley and his staff took up the discussion of these items and disposed of those which were carried into the valuation by the placing of a percentage. These items are:

Engineering.—This covered all the cost of preliminary and location surveys, design, and supervision of construction of the work, and all expenses connected therewith. This was covered by a charge of 4 per cent of the cost of reproducing the permanent way, and structure, but not the equipment.

Legal Expense.—This item is inseparable from the construction work, and was fixed at one-half of 1 per cent of the cost of the same items as affected by the engineering charge.

Organization Expense.—This covered the cost of promotion, financing, and general supervision of construction, together with general office expense. These items were covered by an application of 1½ per cent of the cost of the above items.

Interest.—This item is intended to cover interest on money during the period of construction. The length of time taken to build would, of course, be variable. It was assumed that 3 per cent on the entire cost of construction and equipment would be conservative, and this figure was used.

Discount on Bonds.—This was not included, for the reason that it was considered, not as a proper capital charge, but rather as an adjustment of the interest rate to the existing market condition, and as chargeable to interest account and not capital.

In computing the overhead charges, no allowance was made for working capital, and no addition to the physical valuation was made to cover any such element as "going concern value."

RIGHT-OF-WAY VALUES.

Land values were the subject of a great deal of discussion during the appraisal of 1900, but subsequent investigation as to actual railroad purchases resulted in quite radical changes in some of the figures in the later valuations.

The 1900 appraisals methods were as follows: Work in Detroit, Grand Rapids, Saginaw, Bay City, and some other large cities was assigned to special appraisers, who visited the cities, examined critically all the property, conferred with leading real estate men and experts in values, and placed an estimate per acre or per square foot. This part of the work was done with great care, and was substantially unchanged in the later appraisals.

In all other land valuations, in cities and villages, and country right of way, a personal examination was out of the question without making a very large and expensive addition to the staff, as the field engineers generally were not familiar with realty values, and could not take the time to make the large number of inquiries. The appraiser did not see his way clear to organize a special department, therefore the matter was turned over to a subdepartment of the Civil Engineering Section, the work of which may be briefly outlined, as follows:

Lands were classified as:

(1) Farm land,
(2) Barren land,
(3) Villages having a population of less than 500,
(4) Villages from 500 to 3,000,
(5) Cities having less than 10,000,
(6) Cities having more than 10,000.

The percentage of waste land was fixed as a result of interviews with roadmasters, superintendents, and other officials and employes of the roads, by reports from field inspectors and others.

Letters of inquiry were sent to real estate men and bankers in every county in the State (some 500 being communicated with), as to land values in the town or county of each. From the responses to these letters, supplemented by much personal inspection, the values of the various classes of land were determined by a system of averages. The naked land values were then taken, and to them were added, as follows:

South of a line east and west through Saginaw, 125 per cent plus a fixed charge varying from $8.50 per acre downward was added to the so-called naked land values for farm land. No waste land values were considered in this district. North of this east and west line: Farm land, 100 per cent and a fixed charge of $3 per acre and upward; waste land, 200 per cent plus a fixed charge of $3 per acre; for all village lands, 125 per cent plus $8.50, fixed charge; for all city lands, 100 per cent plus $8.50, fixed charge.

The fixed charges were intended to cover the expense of acquiring abstracts, recording deeds, etc. Slightly different figures were made for the Upper Peninsula.

The result of this work was a set of very low figures in many counties, the average price per acre hardly reaching the going price of improved farm lands. There was so little time to review these figures after they were in shape that they were used in 1900, although the appraiser was convinced that they were generally too low.

In the appraisal of 1902 a very careful study of real estate values was made. The offices of Registers of Deeds in ten or twelve counties were visited, a careful abstract of all railway transfers for a period of 10 years was taken off, the acreage determined, the average price per acre for different classes of land computed, and then a very careful study of transfers of adjacent improved and unimproved lands was made. As a result, material increases were made in the farm land values, waste land values were eliminated, the 1900 valuation, made by special appraisers in large cities, was practically unchanged, while very radical changes in the way of equalization of values of lands in villages and small cities were made.

There can be no doubt that a railroad right-of-way costs much more than an equal acreage of farm lands. The writer has always been inclined to hold the view that an ordinary right-of-way through good farming country would cost from two to three times farm prices. The added value for railroad purposes is due to the three elements:

(a) Continuity,
(b) Severance or damages,
(c) Changed earning power.

all of which the farmer or owner has cognizance of in making his price. But, it is fair to assume that a railroad company can purchase large tracts of land for gravel pits, or a narrow strip adjoining, and widening its existing right-of-way, at about market prices, as the elements of severance, abutting damages, etc., are absent.

As an illustration of the difference between market value and right-of-way value, the Toledo Urban & Interurban right-of-way, in Lucas county, Ohio, was bought by the writer in 1904 at an average net price of $329.21 per acre. The average assessed valuation is $55 per acre. The going value of farm lands will range from $100 to $225; probably a fair average is $135 per acre. The prices paid by Michigan railroads are fully sustained by these personal experiences.

NON-PHYSICAL VALUES.

The physical valuation, as represented by two figures—the cost of reproduction of the physical property, and its present value—was submitted to the Board of State Tax Commissioners as the work of Professor Cooley, and in most of the literature descriptive of it, it has been termed the "Cooley Appraisal."

After the completion of Professor Cooley's work, his figures were submitted to Professor Henry C. Adams, who had been making a study of the income accounts of the various companies, and to whom had been assigned the duty of determining the non-physical or franchise values of the properties.

Professor Adams held that the non-physical element of value was not a simple commercial element, but included:

The franchise—to be a corporation; to use public property.

The possession of traffice not exposed to competition.

The possession of traffic through connections.

The benefit of economies due to density of traffic.

The value due to organization and vitality of industries served.

He also held that, as nothing visible or tangible gave support to this value, it must be determined on the basis of information secured from the income accounts of the company.

Briefly, Professor Adams' method was to make an analysis of the income accounts, and, after providing for operating expenses and taxes, to deduct, as an annuity properly chargeable to capital, a certain percentage of the appraised value of the physical properties. Any remainder was capitalized to give the true value of the immaterial element, or the business value.

The following assumed case is given as an example of Professor Adams' method: A railroad is found to have a physical value of $15,000 per mile, with net earnings amounting to $1,000 per mile. In this case 4 per cent of $15,000, or $600, would be deducted from the net earnings as a return on invested capital. The remaining $400 would be capitalized at 5 per cent, making $8,000. This sum added to the physical value is equal to $23,000, which is taken as the "fair value" per mile of the property.

COST AND RESULTS OF THE WORK.

No complete statement of the total cost of the work of valuation in Michigan has ever been issued as a public document. The cost of the work, including salaries of appraiser, engineers, assistants, clerks, all expenses of the Board of Review, all expenses connected with Professor Adams' non-physical appraisal, also all office rent, stationery, supplies, telegraph, telephone, and railroad expenses, printing and binding—in short, every dollar chargeable to the Michigan railroad appraisal of 1900—footed up to $70,604.21. The exact mileage of roads in the State was:

Main track	7,082.35 miles
Second track	[illegible] miles
Branches	730.92 miles
Spurs and sidings	[illegible] miles
Total	10,882.80 miles
Average cost per main-line mile	$9.97
Average cost per total-track mile	6.50

The exact figures of cost of the subsequent work of appraisal, or the costs of the litigation, are not available to the writer. In a general way it may be said that the cost to the State of the railroad tax cases was not far from $75,000, and that the expenses of the second and third appraisals were less than $50,000, so that, to date, the entire cost to the State of Michigan is less than $200,000 for the appraisals and the litigation growing out of them.

As illustrating the results of the work the following is taken from the Attorney-General's report for 1906:

> These cases are among the most important in the history of the State. They constitute the last step in subjecting railroad property in Michigan to taxation on the same basis and at the same rate as other property is taxed, and secure practical uniformity and equality of taxation between railroad and other property.
>
> As a result of these cases the various railroad corporations paid in taxes $4,787,478.15, and as penalty thereon $1,158,321.18, a total amount of $5,945,799.43 for the years 1902, 1903 and 1904. The 1905 tax being paid soon after the decision of the Supreme Court, nothing was paid under the former law (specific tax on earnings) and, of course, there was no penalty on the 1905 taxes as they were paid before May 1, 1906.

In short, the roads are paying to the State of Michigan an average of $1,595,826.05 more per year than they paid under the old law, and to date the State has received about $10,750,000 more from taxes than it would have received under the old specific tax law.

Railroad development in Michigan has received no appreciable check, and notwithstanding a 2-ct. fare and the bearing of an equal burden of taxation, the properties are maintained, and improvements, double-tracking and betterments of general standards fully keep pace with similar work in other States.

Review of Some Methods of Valuation.

Much of the available literature on the subject of valuations is in the form of papers descriptive of waterworks appraisals and arbitrations, many of which have been made, and a few of which have been the subject of valuable papers and discussions before learned societies.

Before the American Waterworks Association, D. W. Mead and J. W. Alvord, Ms. Am. Soc. C. E., have presented papers which have been quite fully discussed. The chief point of interest in these papers is the treatment of the intangible element termed "going value." Mr. Alvord advances the argument that, after the determination of physical present value, there should be added, to determine the fair value, two non-physical elements; the "going" or "business" value, and the franchise value. The first element is defined as that special value which is "built up by the energy, perseverance and solicitation of the officers in charge, as distinct from the inert plant itself."

The method advocated by Mr. Alvord as the most rational one for computing this value is described as follows:

> It is assumed that a new plant will be constructed, the inception of which is coincident with the data of arbitration. Such new plant is to be of an equal capacity with the older plant under consideration, and a due allowance of time in which to construct this new plant, and the necessary capital to be invested in it from time to time is estimated. At the completion of this new imaginary plant, it is assumed that it commences to obtain business in that community from those who are not previously accustomed to the free use of public water, except in a general way; that it is to require the business ability and consequent increase in number of customers which the earlier and older plant went through within the early years of its existence. An assumption of the amount of business thus created for each year for a period of years in advance is carefully computed and estimated by the board of arbitration. The losses of interest upon capital invested are duly fixed, as well as the first absence and later addition of revenue from hydrant rentals, and a table is prepared showing each year, the total business developed and the total losses, if any. After this is completed a forecast is made of the business of the older works for the same period of time in the future that it takes the business of the new works to equal the business of the old works. If the business of the old works is found to be a growing one it will be a longer period that the new works will require to overtake it than will be the case if the business of the older works is stationary or decreasing. In general, the differences which might be called the debits and credits of this new imaginary plant and the debits and credits of the older working plant are reduced to their present worth at the time of appraisement, and an estimate is made up which will adequately represent the financial advantage which the old works (already fully equipped and in running order and having a large number of profitable customers) will have over the new works, where everything must be built and customers secured.
>
> It is necessary in making this supposititious estimate of the new plant to consider it in no way a competitor of the older works; there is not supposed to be competition between the new and the old, but it is left to the experience of the board of arbitration to consider how long it would take the new company to build new works, and build up business for the new works, until they have overtaken the business of the old company should it continue to occupy the same territory.

In addition to the element of going or business value, Mr. Alvord considers the franchise value, and presents two methods for its determination:

First.—The physical value, depreciation, and going value are entirely neglected, and the entire valuation is fixed on the basis of its earning power throughout the remaining life of the franchise and its probable sale value.

The probable net revenue for each year of franchise life must be estimated and capitalized at a sum, which, if put at interest, would pay such yearly revenue and extinguish itself at the end of the franchise period. To this must be added the physical value of the plant at the end of the franchise period.

Second.—The cost of reproduction, depreciation, and present physical value are ascertained, and the going value computed. Then it is determined whether or not the net revenue is paying interest on a capitalized value greater than that indicated by the sum of the physical and business values. If such capitalized figure is less than this combined value, there is, of course, no franchise value; if it is more, there is a franchise value which should be determined by estimating, for the remaining years of the franchise, the excess income over and above that necessary to cancel all obligations (including interest on the physical and business values), and the reduction of these several sums to a basis of present worth.

Court Decisions.

In various decisions the United States courts have laid down a few rules, which may be regarded as fixed and definite and must be followed; but there are many important questions yet to be decided. The value to be determined must be a "fair value" of the property being used for the convenience of the public. The par value of stocks and bonds may not alone be considered (although it may be considered), the market value of stocks and bonds, original cost plus cost of additions, the probable earning capacity, the cost of reproduction, depreciation, appreciation, all these, and any others that will throw light on the "fair value" must be taken into account and given the weight to which they are entitled. Any fictitious book values due to overissues of stock and bonds are to be given no weight, but the appraisal must give the fair value, in the light of all the facts, of the property in actual use at the time of the appraisal.

The decisions of the courts do not in general give recognition to a separate element of value called "going concern value" or "going value" in addition to other non-physical values, but rather recognize the fact that certain non-physical elements of value, by whatever name they may be called, must be taken into account in arriving at the fair and equitable final figure of value of a live and operating concern for the purpose of carrying out a contract of sale.

As illustrating the recognition by the courts of the elements of "intangible value" in an operating property the following is quoted from the decision of Judge Brewer in the case of National Waterworks Co. vs. Kansas City (62 Fed., 853):

> The difficult question, however, still remains; and that is, what is the "fair and equitable value," which by the statute and ordinance the city is to pay for the water-works? Capitalization of earnings will not show this, because that implies continuance of earnings, and a continuance of earnings rests upon a franchise to operate the water-works. The original cost of construction cannot control, for original cost and present value are not equivalent terms. Nor would the mere cost of reproducing the water-works plant be a fair test, because that does not take into account the value which flows from the established connections between the pipes and buildings of the city. * * * A complete system of water-works, such as the company has, without a single connection between the pipes in the streets and the buildings of the city would be a property of much less value than the system connected as it is with so many buildings and earning, in consequence thereof, the money which it does earn. The fact that it is a system in operation, not only with a capacity to supply the city but actually supplying many buildings, in the city—not only with a capacity to earn but actually earning—make it true that the "fair and equitable value" is something in excess of the cost of reproduction.

Physical Values and Methods for Their Determination.

It is desirable, in closing this paper, to indicate such general methods of procedure in valuation practice as may be said to have been thoroughly established by precedent.

The fact has been emphasized, again and again, by every writer on the subject, that problems of this class are not capable of exact mathematical solution; that, no matter how much care may be exercised in the execution of the work, the result is tempered by the personal judgment of the men engaged on it, and that only when it is executed by men of experience, sound judgment, and high moral worth can it have a definite, final, and just result.

This feature of appraisal work cannot be too strongly emphasized. The value of the work depends on the character of the men doing it, their experience in design, construction, and operation of properties, and their absolute fairness and freedom from prejudice.

It is necessary to differentiate between such elements as should attach to the physical value, or capital remaining in the plant, and the purely intangible or franchise values. It is contended by the writer:

That the Physical Value, or present value of the physical property, should fairly represent the actual capital invested in the property at the date of appraisal; that it should be made up of the sum of the various elements which constitute the cost of reproducing the property, together with any appreciation which may have been added to any of them, less all depreciation.

That the Non-Physical Value is the difference between the "fair value" as defined by the courts, or the reasonable value of the property as a business or producing property, and the physical value, or actual present worth; and that the only proper method for determining such values involves a study of income accounts.

This Non-Physical Value may be: Positive, or a value in excess of the physical property, or negative, or less than the physical value. In the case of a property having a negative intangible value, a deduction should be made from the physical value.

It is further contended that, in making the physical appraisal, the purpose of the appraisal should not be permitted to modify the figures.

It is not necessary to go minutely into detail as to the various steps to be taken in making the appraisal of physical property. Each appraisal will offer some problems peculiar to itself, and no general set of rules can be laid down which will be applicable to all cases. It is deemed sufficient to call attention to general matters of major importance and to refer to some points which have not been mentioned in the preceding narrative, omitting argument in the case of such as have there been fully discussed.

The distinction should be kept in mind that any element of value which belongs to the property by reason of its physical existence is classed as an element of physical value. The property is considered as an operating property in the sense that it is reproduced complete, ready to operate; and any expense, or any element of value needed to complete it, is an element of the physical value, but any value arising as a result of surplus earning power, any good-will value, going-concern value, or value due to established business, strategic location, favorable traffic arrangements, etc., should be considered as intangible values.

The valuation of physical property is naturally divided into four parts: I.—The preliminary study. II.—The field inspection. III.—The computation. IV.—The preparation of the final figure.

THE PRELIMINARY STUDY.

The preliminary steps should include a general examination of the property, a study of its corporate history, an examination of its records, maps and profiles, and the preparation of an inventory of its property.

Few sets of records are corrected to date, and many additions and erasures will of necessity have to be made in the field.

In making a field inspection, it is of great assistance to be able to refer to maps of large yards, to profiles, to standard plans, and to drawings of the principal structures, so that the investigation of office records should include a careful examination of the maps of principal terminals, with a view to securing such as will simplify the field inspection. The investigation should be extended to cover a study, not only of the engineering office data, but also statistical data to be derived from the records of the auditor, superintendent, and superintendent of motive power, and should cover earnings, operating expenses, car and locomotive mileage, and such other data as will facilitate the distribution of such elements of value as are not localized, together with such other statistics as will furnish a thorough knowledge of the property and its operations.

THE FIELD INSPECTION.

The field inspection, to be of the greatest value, should be made by civil or mechanical engineers of long experience, preferably by men who have had charge of their respective departments on railroads of considerable extent, or of properties similar to that under investigation. Each particular structure or piece of equipment should be examined and its condition noted; special features should be fully described and careful record made of everything that would tend to affect the value.

The inspection in the field, in addition to the placing of a percentage for depreciation, should involve a complete check of the inventory, a correction of all errors, due to the construction of new property or the destruction or removal of old, and a compilation of all information required for a complete, correct, and intelligent appraisal of the physical property by the computing office. Every appraisal is different, and every property offers new problems and diverse conditions. These must be met, and therefore the field inspector must call particular attention to all matters specially affecting the values of the property he is inspecting.

It is impossible to anticipate all these conditions in advance, although the use of carefully prepared blanks and the standardizing of the form in which the data are gathered greatly simplify the work, not only in the office, but in the field.

THE COMPUTATION.

On the completion of the field work, with all the preliminary data in the office, the computation must proceed, and with this part of the work there are many questions which must be taken up, considered and definitely answered.

The classification and arrangement of the information as to the property to be valued, the costs and prices of the various materials entering into construction, the making and checking of such tables as may be required for estimating, the computing, checking, filing, indexing, and the various other routine details of work need not be referred to specially, as they must be worked out for each appraisal. The matters of principle that will be met are more important, and, while it would be impossible to mention all that may come up, it may not be amiss to refer to a few.

(*a*) In making an appraisal of several properties, to what extent shall these properties be grouped or classified?

(*b*) What unit prices shall be assigned in the estimates of cost of reproduction, and how shall they be determined?

(*c*) How shall right-of-way and real estate values be ascertained? Shall such elements as appreciation, or any increments due to the purpose for which the land is used, be treated as physical or non-physical values?

(*d*) What method shall be finally adopted in determining depreciation? What elements shall depreciation be made to cover?

(*e*) What elements of cost or appreciation shall be treated as parts of the physical property, although not capable of inventory, and what shall be treated as non-physical?

(*f*) Is an allowance for contingencies a proper item to include in an appraisal?

(*g*) What weight shall be given the matters of adaptability, proper or improper design, and the economics of location?

(*h*) How shall the values of such property as locomotives, cars, etc., be geographically assigned?

(*i*) What is the effect upon values of large terminals?

(*j*) Should an allowance be made by reason of rapid development of the art?

These are not by any means all the perplexing questions that arise; each valuation offers some that are special, but these cover the more important points.

(*a*) *Classification of Properties.*—In making an appraisal involving the properties of a large number of companies, such for instance as any of the state railroad appraisals, it becomes evident that there are certain properties which are small, badly run down, and either built to serve a very limited trade or located in a territory which has not developed, and that such properties cannot be compared equitably with the large trunk-line roads, or even with smaller roads in a good territory and doing a good business. It is certain that these carriers are entitled to some classification which will separate them from the more prosperous roads. Many of these roads would not be built today under any circumstances, yet their maintenance and continued operation is absolutely essential to the people of the district served by them.

Whether this classification should be undertaken at the time of making the appraisal of physical property, and an attempt be made to classify unit prices, or whether this should be taken up in connection with the intangible values, and solved, as far as the valuation is concerned, by the adoption of such a method as will affect these physical values by a subtractive or negative non-physical value, or whether the entire matter should be left for the subsequent work of rate-making or assessment, is one which must be determined at the outset of the physical valuation.

It is the writer's opinion that the application of an intangible subtractive value is the proper solution, except in the case of roads which would not today be rebuilt. In fixing a uniform price for identically the same labor or material, whether on a small poverty-stricken road or a main trunk line, no serious injustice is done, provided the price fixed is one which, from a strictly engineering standpoint, is a reasonable figure for cost of reproduction. The differences in class are due, not to special differences in cost of physical property, but rather to differences in earning ability on account of good or poor territory served, efficient or inefficient management, or other reasons not connected with the physical structure; hence such differences are reflected in the earnings, and are clearly elements to be adjusted in the non-physical valuation.

(*b*) *Unit Values.*—Unit prices should be determined before any actual figures are made. They should be made up from the most complete data available and reviewed by all the experienced men engaged on the appraisal. Averages of either 5 or 10 years should be used in preference to current prices on all such material and equipment as is fairly stable.

In the case of such materials as lumber and ties, the price of which has been steadily rising due to the growing scarcity of the material, a price based upon a long average is unfair to the corporation, and it would appear to be proper to use current prices. There can be no hard and fast rule which will be applicable to all appraisals. The unit prices must be such reasonable figures as can be sustained in Court.

(*c*) *Right of Way and Real Estate.*—The valuation work which has been accomplished during the past decade, and the study of values for taxation and rate making, have brought into prominence the perplexing features of land values as applied to corporation property. It is comparatively simple to fix within very close limits the reproduction cost of tracks, bridges, locomotives, or any of the other elements of physical structure. Not so with the land. A few years' development may change farm land right of way into city right of way, surrounded by factories, or it may change desirable residential property adjacent to a road into slums.

In the case of railway properties it is quite evident that the following facts can be sustained: The actual cost of property purchased for railway purposes will range from two and one-half to five times the selling price of similar and adjacent property used for other purposes. While the actual percentage will vary somewhat, as between land in cities and in the country, and as between fully settled districts well served by roads and sparsely populated regions, yet the difference is very marked, and is capable of determination by an examination of the public records.

In establishing figures for use in a valuation, it would appear to be better to base them on an analysis of actual transfers than to undertake to fix values by any methods of examination and personal appraisal. Enough instances of the wide divergence of expert opinion have been cited to show conclusively that such a method, applied to the thousands of acres of a large corporation, may lead to serious error.

(*d*) *Depreciation.*—In placing depreciation it is desirable to secure the opinion of the man who inspects a bridge, or building, or locomotive, as to its physical condition. It may be desirable to use the check secured by the fact that the age of the building is known and also the average life of structures of its class.

Allowance should be made, not only for wear and tear due to use, and decay due to the elements, but also to cover that which is due to obsolescence, or the fact that the facility is of an antiquated or inefficient type, and has been superseded in general use by more efficient and economical devices; this may be called commercial depreciation, as distinguished from physical depreciation. The method to be used in placing depreciation is clearly one of the important things that must be determined by each set of appraisers, and, while the writer believes that the use of expectancy tables would greatly facilitate the work in many cases, the data on which to found a complete set of tables and to support them and justify their use are often lacking; therefore, any use of tables should be safeguarded in every possible manner, and personal inspection of fixed property should always be made.

(*e*) *Immaterial Elements of Physical Property.*—There are certain expenses, inseparable from the construction of any public works, which are a necessary and proper part of the cost, and are arranged for in the original financing, but are not capable of identification after the completion of construction work. These expenses are: (1) organization, (2) legal expenses, (3) engineering, (4) administration, (5) general expense.

Any value which attaches to the property by reason of any money expended during the construction is part of the physical property values; while any value due to the operation of the property which is in excess of the physical value is a non-physical or intangible element. If the correctness of this position be conceded, then all the foregoing items are charges against the physical property, and, as long as it is an operating property, these items of value remain part of the physical property, and the writer contends that they should not be considered as affected by depreciation, as long as the property is a going concern.

(*f*) *Contingencies.*—The writer believes it to be proper practice to add liberally for the contingency item. He would advocate the use of such a percentage of physical values as appears proper in each appraisal to cover the error due to the extreme difficulty of securing an exact inventory and construction history of the properties.

(*g*) *Design.*—It is extremely difficult to treat this as a physical element. It is impossible to reduct it to terms of dollars and cents by any usual or customary methods. It is impossible to separate it from any one of half a dozen other items that may be brought up. It opens the door to endless speculation as to what might or might not take place under somewhat different conditions. For these reasons, it was treated in the Michigan appraisal as a non-physical element of value and dismissed from all consideration in the physical appraisal. This was clearly proper, and the subject is only referred to here for the purpose of making clear that it was fully studied and a definite conclusion reached.

(*h*) *Apportionment of Values.*—While the courts have viewed as equitable the distribution of values between territorial units when made on a track mileage basis, every state appraiser, thus far, has concerned himself only with the fixed physical property in his own state, together with his proportionate share of the floating property. The methods that may be considered are track mileage, car mileage, locomotive mileage and train mileage.

The method finally used must be such as will give the fairest result for the property under consideration. In some cases one or more of these methods will give a fair value, while in other cases the same system would be most unjust.

(*i*) *Terminals.*—There is not one feature of the entire problem so big with possibilities, and so far from solution, as that of terminal property values and their proper assignment. The influence on the value of the property, of the ownership of terminals in such cities as Chicago, New York, Jersey City, Hoboken, Pittsburg, Detroit, St. Louis, Kansas City, and other large centers of population is tremendous, yet a very large part of the railroad mileage entering those cities belongs to roads which have their largest mileage outside the state in which the terminal is located.

There can be no doubt that the influence of a large terminal affects in a measure the value of every mile of line owned by the company; that this influence is greatest on the principal and direct lines, and less as more remote parts of the system are reached. As yet, no plan has been suggested for determining what this value is or for appportioning it.

The final solution in Michigan was to treat terminal properties within the state exactly as other property was treated, and to assume that, if there was any value assignable to Michigan by reason of outside terminals, it would appear as a non-physical value through the earnings.

(*j*) *Development of the Art.*—Is any value assignable to property on account of expenditures by reason of the rapid development of the art? The rapid development in the art of electricity, the congestion of traffic in streets of cities, the enormous increase of train movements, and the use elsewhere of newer types of cars, have compelled the abandonment of millions of dollars' worth of property and the investment of other millions in new and improved facilities to provide for the increased movements of traffic and increased safety to the public. These changes are not due to the fact that the original installation was defective, but to the demands of the public for frequent, safe and speedy service, demands which are perfectly reasonable. The query is: should a corporation which complies with public demands be compelled to lose capital invested in facilities which have not yet paid for themselves; and which, under a continuance of conditions which existed when they were installed, or any that might then have been anticipated, would normally have a useful life of several more years, and which were abandoned, not by reason of being worn out or unfit for service, but purely because facilities of a more modern type were called for?

The writer inclines to the view that, as far as appraisal is concerned, the value due to the remaining life of the abandoned facility, where such abandonment was in response to legal requirement, and where no element of corporate necessity due to increased efficiency or economy of the new facility enters into the computation, should be added to the value of the facility replacing it. Any consideration that is given such claims by an appraiser must be most careful, as the inference to be drawn from the decision of the Court in the Knoxville Water Case (212 U. S. 1) is that such elements of value will receive scant consideration unless most fully supported.

THE PREPARATION OF THE FINAL FIGURE.

The final form of the work is, of course, so much a matter of personal judgment that even a suggestion may appear to be useless. The use of such a classification as will conform approximately, if not exactly, with that adopted by the Interstate Commerce Commission is more desirable now than it was 10 years ago, as all the roads in the country are using this classification in their accounts, and the more nearly uniform the work of various state appraisals, the better the results will be.

Non-Physical Values and Methods for Their Determination.

In the published articles treating on the subject of valuation, much stress is laid on the intangible or non-physical elements of value. They have been termed "going concern values," "business values," "good will values," "franchise values," as well as "non-physical" and "intangible" values.

The writer cannot agree with those who would place any of these elements of value in the physical appraisal.

Methods for securing the present physical value of a property have been thoroughly discussed. It is believed that the physical values, when secured along the lines suggested, are definite enough to be accepted as a fair estimate of the amount of capital actually invested in the property, and that, if a sufficiently large force of men experienced in the construction, operation and financial management of the kind of property under investigation is engaged on the work, the element of uncertainty due to errors of personal judgment can be largely eliminated.

The next question to be determined is whether there is, at the time of the appraisal any non-physical value, and, if so, to select a method for computing it that will give a result that can be definitely supported as to the particular property under investigation. A study of the income accounts of the property being valued should be made. If the property is not earning a sufficient sum to pay its operating expenses, and taxes, and to set aside a fund to cover depreciation and obsolescence, there is clearly no intangible value of any sort to be added to the physical value. If, however, after all these charges are taken care of, there is a net earning which is large enough to pay 4 or 5 per cent on the physical property and still leave a surplus, is it not perfectly reasonable and proper to hold that this surplus represents earnings on all intangible elements of value?

The contention that all the different elements of non-physical value merge into one intangible value, not capable of separation, will doubtless be objected to by many engineers and corporation managers. Able arguments have been made in favor of a separation of the intangible elements; but no one has offered a method of separating them. While there is universal recognition of their existence, in the case of many properties, they are supported by nothing visible or tangible. They are practically inseparable, one from another. They are not always present, and the application of any such arbitrary rule as that suggested by Mr. Alvord would make it possible to place values which were purely fictitious. Therefore, it follows that, if they are to be considered at all, they must be treated as parts of one intangible value, and that value must be derived from a study of the income account of the property.

After a study of the question in all its bearings, and especially with reference to the decision of the courts, the writer reaches the following conclusions regarding non-physical values:

1.—That all the different non-physical elements of value are inseparable.

2.—That in the case of very many properties, no non-physical value can attach, and in many cases this value will be a negative or subtractive quantity.

3.—That in the case of properties located so as to secure either a monopoly of business in a congested territory, or in which the construction, location, strategic position, or economic excellence of design, is such that, on a schedule of rates which is fair and reasonable for competitors less advantageously situated, an earning is secured which is in excess of usual returns, a non-physical value of considerable magnitude may very properly be assigned.

4.—That, for the computation of non-physical values, the income account of the property under consideration affords the only legitimate basis, but even then consideration must be given to duration of franchise, reasonableness of rates, and other modifying conditions, and also, possibly, the purpose for which the appraisal is made may determine whether or not a non-physical value may be used. The language of the court in the Knoxville and Omaha cases apparently leaves this a very open question.

This brings us substantially to the conclusion reached by Professor Adams in 1900, and a careful study of the method laid down by him shows nothing that cannot be accepted as fair and reasonable. His plan should be extended so as to cover subtractive values or the case of properties showing a deficit.

This method has the merit of being based on the actual earnings and expenses of the company under investigation and on the value of the physical property as already computed. It does not introduce a mass of purely supposititious figures, nor depend on hypothesis. The proposition is simply this: If a property earns only its operating expenses, including therein proper depreciation reserves, taxes, and such a percentage on its actual invested capital as could be earned by that capital if invested in good non-taxable bonds or other like security, it is worth no more than its physical property is worth. If it earns more than that, it is due to the franchise, going concern, or other intangible elements of value, and to determine that value, capitalize the surplus.

In making a computation of intangible values the income account should be arranged over a period of years to avoid violent fluctuations of gross or net earnings, and a depreciation reserve should be determined for such years.

Professor Adams covered the depreciation in the Michigan work in the 4 per cent annuity which was deducted before non-physical values were computed. The writer is inclined to go a step farther than Professor Adams, and hold that, before any intangible values can be attached to the property, it should earn not only all operating expenses, taxes, and reserve for depreciation, but also interest on the actual investment equivalent to the return that would be had were the money invested in a non-taxable bond, say 4 per cent, and that any earnings in excess of such a sum might be termed properly "earnings on franchise," or intangible values.

On this basis, then, a rule would be formulated, being that of Professor Adams, with some modifications:

1.—Deduct from gross earnings from operation the aggregate of operating expenses, including in operating expenses an annual sinking fund to amortize the depreciation and obsolescence, and the remainder may be termed "income from operation."

2.—To this income from operation add income from investment, giving "total income," which represents the amount at the disposal of the corporation for the support of its capital and for the determination of its annual surplus.

3.—From "total income," deduct taxes, rents paid for lease of operated property (provided such property is not included in the appraisal), and improvements chargeable to income. The remainder represents the income after all charges against operation of property, and maintenance of the integrity of the capital investment have been cared for.

4.—From this remainder (3) deduct such a percentage of the value of the physical property (representing invested capital) as would equal the income of that capital if invested in government or other non-taxable bonds. The remainder would represent surplus, which capitalized at a proper rate, would equal the value of intangible or non-physical properties, which is to be added to the appraised value of the "physical property."

5.—If, instead of a surplus, a deficit occurs, a careful study of all the conditions surrounding the operations of the property should be made, and, if there be no reasonable expectation of increase of earnings, or other modifying conditions, a proper figure, based on the average deficit, should be determined, and, as a negative intangible value, deducted from the value of the physical property.

6.—In the determination of rates, to be used in computing income and for capitalizing surplus or deficit, the greatest of care must be exercised to adopt such figures as will be proper and absolutely just.

BOOK REVIEWS.

General Specifications for Concrete Bridges.—By Wilbur J. Watson. J. B. Savage Co., Cleveland, O. Paper, 8x11 ins., 66 pp., illustrated, $1.

This set of specifications has been developed from the author's experience as a civil and architectural engineer, but with due consideration, especially in matters of notation and allowable stress, for the standards adopted by the various national societies. All details likely to arise in concrete bridge construction are covered, as well as such collateral subjects as pavements for bridges. Designing tables and data, and form of contract, are also given. The book is now in its second edition.

Blue Book of Pittsburgh Standardized Reinforcement for Concrete.—Pittsburgh Steel Products Co., Pittsburgh, Pa. Leather, 4x6½ ins.; 397 pp.; illustrated.

This book contains tables and data for use in the design of reinforced concrete and is arranged after the manner of the standard hand books on structural steel. While applicable in a limited way to reinforcement generally, it is designed especially to meet the needs of the users of the reinforcement manufactured by the Pittsburg Steel Products Co. All tables have been prepared from formulas recommended by a joint committee of the American Society of Civil Engineers and a number of other national societies.

Walter Powers of the Cascade Range: Part 1, Southern Washington.—By John C. Stevens. U. S. Geological Survey, Washington, D. C. Paper, 6x9 ins.; 94 pp.; maps and illustrations.

Probably no area in the United States possesses more possibilities in the way of water power development than that traversed by the Cascade Range. This book covers in an exhaustive way that portion of this area lying in southern Washington. Following some general papers relating to conditions and laws governing precipitation, stream flow and hydraulic development, each river and drainage basin is described and analyzed. One chapter is devoted to tables of precipitation. Many illustrations and maps are included in the book.

Rock Drills.—By Eustace M. Watson. McGraw-Hill Book Company, New York. Cloth, 6¼x9⅜ ins.; 358 pp.; illustrated; $4.

This book is a valuable collection of essays on rock drills and rock drill work. The author makes no claim to have treated the subject exhaustively, but has aimed to gather together, and place between the covers of one book, descriptions of the leading makes of English, Australian, and American drills of both piston and hammer types, and also to give such details of their actual use, as would enable a novice to approach them with some previous knowledge. At the same time, as stated in the preface, the book is intended to assist the engineer and manager to choose machines most suited to his particular needs, and to maintain and work them at the highest efficiency.

The first four chapters deal with the history, and describes the mechanical construction of piston, hammer and electric drills of leading makes. The next five chapters contain information as to the operation and handling of various drills; drills designed to use air expansively; notes on the practical applications of the philosophy of rock drilling; and repairs and methods of maintenance of drills.

Two chapters are devoted to explosives and theories of blasting. The author has described the various explosives commonly known and gives detailed information as to their use and handling. The chapter on the Theory of Blasting is a very valuable resume of the literature published on that subject. The five remaining chapters of the book deal with examples of rock drill work; methods of drilling used for various classes of work; some drill tests; the subject of dust and its prevention; and notes on the use and consumption of compressed air and steam in connection with rock drill work.

Applied Statics.—By T. R. Loudon. Canadian Engineer Press, Toronto, Ont., Canada. Cloth, 6x9 ins.; 164 pp.; illustrated; $1.00.

This work is designed primarily as an elementary text to be used in connection with lectures in the schools of Applied Science and Engineering at Toronto University. Each step is worked out in detail to meet the needs of the beginner. But the advanced student will also find much of interest in the work. The simultaneous use of equation, for instance, can hardly be regarded as an elementary subject, and the experienced designer will doubtless find something of value in the chapter devoted to this subject.

In this second edition three chapters and an appendix have been added. The added material includes a set of miscellaneous problems, which cover stresses in pulley chains and crank arms, simultaneous use of equation, and a detailed discussion on the determination of stress in bridge and roof truss members. As a whole, the work covers the subject sufficiently for all practical purposes. An attractive feature is the provision, at the end of each chapter, of several blank pages for sketches and memoranda.

Year Book for 1910, American Society for Testing Materials.—Cloth, 6x9 ins.; 308 pp.; illustrated; $5.

With this volume the American Society for Testing Materials begins the publication of a "Year-Book" in addition to the regular issue of the "Proceedings." The standardization of specifications is considered one of the most important functions of the Society, and a large portion of this volume is devoted to standard specifications for steel and iron for various purposes, copper wire, timbers and other building materials, and standard methods of testing. The remainder of the book is given to Society matters and to an account of the organization and methods of the International Association for Testing Materials, with which this Society is affiliated.

PERSONALS.

Mr. Richard R. Harris has been appointed General Manager of Sales of the Pittsburg Steel Products Co.

Announcement is made by Chas. G. Armstrong, Consulting Engineer, New York City, that he has taken into partnership with him his son, Francis J. Armstrong, under the firm name of Charles J. Armstrong & Son.

Irving W. Patterson, Jun. Am. Soc. C. E., has recently resigned from the position of Resident Engineer with the State Board of Public Roads of Rhode Island to accept the position of Assistant Engineer with Arthur H. Blanchard, Consulting Highway Engineer, Providence, R. I.

Mr. James Gallagher, at one time a prominent contractor, died at his home at Ebensburg, Pa., on Dec. 5, at the advanced age of 105 years. Before his retirement from the contracting field thirty years ago he had acquired a fortune in railroad construction in this country and in South America.

Mr. George W. Ristine, formerly connected with the Colorado Midland Railway, is now Consulting Engineer of the Midland Continental R. R., a new line being built through the Red River Valley, in North Dakota. This railroad will be 212 miles in length and will serve as a feeder for several transcontinental lines.

Arthur H. Blanchard, M. Am. Soc. C. E., Associate Professor of Civil Engineering, Brown University, Providence, R. I., and Consulting Highway Engineer, has recently been appointed Expert and Consulting Engineer to the United States Office of Public Roads by the Secretary of Agriculture and the Director of the Office of Public Roads.

The Railway Specialty and Supply Co., Monadnock Block, Chicago, announces that on Dec. 1 it changed its name to "The P. & M. Co." This change was made because of the frequent confusion of the old name with the numerous other supply and equipment companies in the railroad trade, and also for the purpose of identifying the name of the company with its principal product, the P. & M. boltless anti-rail creeper.

William H. Bryan, Chief Civil Engineer of the Board of Education of Chicago, died suddenly in his room at the Plaza Hotel in that city on Dec. 6. His death is thought to have been due to heart failure. Following a civil service examination, in which Mr. Bryan took high rank, he became Chief Civil Engineer of the Board of Education on Nov. 28, succeeding Thomas J. Watson, who died about a year ago. He was 45 years of age at the time of his death.

Mr. Walter Brinton, who has been, since 1895, superintendent of the manganese steel department of the Taylor Iron and Steel Co.'s plant at High Bridge, N. J., has resigned from that position to become consulting engineer for the Edgar Allen American Manganese Steel Co., with plants at Chicago Heights, Ill., and New Castle, Del. Mr. Brinton will make his headquarters at the New Castle plant.

Col. L. H. Gardner, a well-known authority on water works operation, died at his home in New Orleans on Nov. 23, in his seventy-fourth year. Col. Gardner was for years General Superintendent of the New Orleans Water Company. He was one of the founders of the American Water Works Association, was president of that asso-[illegible]

At the annual meeting of the board of directors of the Baltimore & Ohio R. R., Dec. 8, the following executive officers were re-elected: Mr. Oscar G. Murray, Chairman of the Board; Mr. Daniel Willard, President; Mr. George F. Randolph, First Vice-President; Mr. J. V. McNeal, Fourth Vice-President and Treasurer; Mr. C. W. Wolford, Secretary, and Mr. Hugh L. Bond, Jr., General Counsel. Mr. George L. Potter, Third Vice-President, was not re-elected, in accordance with his own request, and this office was not filled. The appointment of Mr. A. W. Thompson, formerly Chief Engineer, as General Manager of the company's lines was confirmed.

Mr. Allerton L. Cushman, for ten years in the service of the Government, announces the establishment at Washington of the Institute of Industrial Research, of which he is director. It is stated in the announcement that the Institute will undertake the investigation of industrial problems in all lines, but particularly those relating to metallurgy, agricultural chemistry, hydraulic cements, paint technology and chemical industry. Attention will also be given to road building and paving problems, and to the preparation of expert evidence to be used in litigation. Research will be along scientific lines, but results are to be interpreted in a practical way. Associated with him in this work are Mr. Henry A. Gardner and Dr. N. Monroe Hopkins.

Directory of Principal Civil Engineering Societies.

American Railway Bridge and Building Association.—Secy., C. H. Lenty, 215 Jackson Blvd., Chicago, Ill.

American Society for Municipal Improvements.—Secy., A. Prescott Folwell, 239 West 39th St., New York, N. Y.

American Society for Testing Materials.—Secy., Edgar Marburg, Univ. of Pa., Philadelphia, Pa.

American Society of Civil Engineers.—Secy., C. W. Hunt, 220 W. 57th St., New York, N. Y.

American Society of Engineering Contractors.—Secy., Daniel J. Hauer, Park Row Building, New York, N. Y.

American Street and Interurban Railway Association.—Secy., B. V. Swenson, 29 W. 39th St., New York, N. Y.

American Water-Works Association.—Secy., J. M. Diven, Charleston, S. C.

Boston Society of Civil Engineers.—Secy., S. E. Tinkham, 60 City Hall, Boston, Mass.

Canadian Society of Civil Engineers.—Secy., Clement H. McLeod, Montreal, Can.
tenance of Way Association.—Secy., E. H. Fritch, Monadnock Block, Chicago, Ill.

Engineers' Club of Philadelphia.—1317 Spruce St., Philadelphia, Pa.

Engineers' Club of St. Louis.—Secy., A. S. Langsdorf, Washington University, St. Louis, Mo.

Engineers' Society of Western Pennsylvania.—Secy., E. K. Hiles, 803 Fulton Bldg., Pittsburg, Pa.

National Association of Cement Users.—Pres., Richard L. Humphrey, Harrison Bldg., Philadelphia, Pa.

New England Water-Works Association.—Secy., Willard Kent, Narragansett Pier, R. I.

Roadmasters and Maintenance of Way Association.—Secy., W. E. Emery, P. & P. U. Ry., Peoria, Ill.

Society for the Promotion of Engineering Education.—Secy., Henry H. Norris, Cornell University, Ithaca, N. Y.

Technical Society of the Pacific Coast.—Secy., Otto Van Geldern, 865 Pacific Bldg., San Francisco, Cal.

Western Society of Engineers.—Secy., J. H. Warder, Monadnock Block, Chicago, Ill.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Centrifugal Pumps.—Paper, 7¾x10⅝ ins., 128 pp. The American Well Works, Aurora, Ill.

Catalog 117 is probably the most complete pump catalog published by this company, and contains all the information which could be desired in this line. It is completely illustrated, contains tables of sizes of machines and parts, and various other information suitable for incorporation into an hydraulic engineer's notebook.

Gravity System.—Paper, 6x9 ins., 32 pp. Wm. B. Hough Co., Agents, 1336-7 Monadnock Bldg., Chicago.

A catalog describing the gravity system of depositing concrete in forms for buildings. Shows systems used on various types of buildings and gives information as to the use and design of the type, which is patented by the Concrete Appliance Company.

Cast Iron Pipe.—Card, 3x5 ins. Cast Iron Pipe & Foundry Co., Bristol, Pa.

A table of standard thicknesses and weights of cast iron pipe.

Double Headed Nails.—Circular, 6x9 ins. The F. A. Neider Co., Augusta, Ky.

A circular describing an economical nail used for form construction.

Marathon Grinder.—Paper, 10x4 ins., 8 pp. Johnson Engineering Works, First National Bank Bldg., Chicago.

A catalog which illustrates and describes a multiple roll grinding or tube mill using iron rods instead of flint pebbles.

Crushers.—Paper, 3½x6½ ins., 16 pp. Sturtevant Mill Co., Boston, Mass.

A pamphlet which illustrates and gives abridged data regarding each of the various crushers, mills, rolls and screens illustrated.

Gasoline Truck.—10¾x7½ ins., 64 pp. Mack Bros. Motor Car Co., Allentown, Pa.

A well illustrated catalog with short descriptions of each of the various cars and parts of cars which are shown.

Acme Wagons.—Paper, 7⅜x5⅛ ins., 64 pp. Acme Wagon Co., Emigville, York Co., Pa.

A complete catalog of Acme wagons and carts, illustrating various types, giving detailed descriptions as to weights and dimensions of each type. Bobs and cutters are included. Prices of extras are given.

Floor Outlets.—Paper, 6x9 ins., 16 pp. Steel City Electric Co., 1207 Washington Ave., Pittsburgh, Pa.

In this catalog Fullman adjustable water tight floor outlets are illustrated and described in detail. Price lists are given.

Wrought Iron Pipe.—Paper, 3⅜x6 ins., 16 pp. The Susquehanna Iron Company, Columbia, Pa.

A pamphlet containing useful tables of sizes, weights and prices of wrought iron pipe.

Contractors' Tools.—Cloth, 4x6 ins., 278 pp. The Champion Blower and Forge Co., Lancaster, Pa.

A complete illustrated catalog of blowers, forges, both stationary and portable, blacksmiths' tools, power drills. Prices are given with each machine listed or illustrated and the book contains a complete alphabetical index.

Street Illumination.—Paper, 8x10½ ins., 28 pp. The General Electric Co., Schenectady, N. Y.

A reprint of the paper read before the National Electric Light Association on the subject of "Street Illumination." This pamphlet compares the results obtained from the use of luminous and flame arcs with those resulting from the use of open and enclosed carbon arcs. The subject is treated from the standpoint of the illuminating engineer and is discussed in detail.

The pamphlet contains halftone illustrations showing street illumination by luminous arcs in various cities. There are also numerous diagrams. The subject is treated exhaustively and should be of great interest and assistance to all interested in this branch of engineering.

The number of the pamphlet is B-3006.

Indian "Timberasphalt."—Paper, 8x9 ins.; 4 pp. Indian Refining Co., Inc., Cincinnati, O.

A wood preservative catalog explaining the methods of use of the oil for various purposes, the method of treatment, advantages, etc.

Spades and Tampers.—Paper, 4x8½ ins.; 8 pp. Harold L. Bond Co., 383 Atlantic Ave., Boston.

A pamphlet which illustrates and describes the uses of the Ross concrete spade and the Andrews concrete tamper, two patented tools for concrete work.

Arrowsmith Tools.—Paper, 2⅝x5⅜ ins.; 36 pp. Arrowsmith Concrete Tool Co., Arrowsmith, Ill.

A memorandum book which illustrates the various Arrowsmith Tools in actual use.

Hayward Bucket and Digging Machinery.—Paper, 9x12 ins.; 78 pp. The Hayward Co., New York City.

This catalog is complete with half tone engravings showing Hayward Buckets and Digging Machinery in actual operation on numerous classes of work. Among the machinery, it illustrates and describes, orange peel buckets, clam shells, excavators, dredges, coal handling machinery, traveling derrick, fittings, etc.

Automatic Railway.—Paper, 9x6 ins.; 12 pp. The Automatic Transportation Co., 2933 Main St., Buffalo, N. Y.

This catalog illustrates and describes a new and interesting system of transportation adapted especially to rough country and mining districts.

Bristol Recording Gages.—Paper, 8x10½ ins.; 48 pp. The Bristol Co., Waterbury, Conn.

A very complete catalog illustrating and describing Bristol pressure and vacuum gages for every purpose. Various samples of charts are shown with tables of sizes and prices.

The Mixer.—Paper, 4½x8 ins.; 32 pp. Koehring Machine Co., 615 Germania Building, Milwaukee, Wis.

An illustrated pamphlet showing the various stages in the manufacture of Koehring Concrete Machinery.

Bituminous Roads.—Paper, 6x9 ins.; 20 pp. Warren Bros. Co., 59 Temple Place, Boston, Mass.

Reprints of articles published in various technical journals with some corrections.

"Clipper" Blast Hole Drills.—Paper, 8x11 ins.; 4 pp. Loomis Machine Co., Tiffin, O.

Containing various illustrations of drills at work under different conditions.

Steel Forms.—Paper, 6x9 ins.; 96 pp. The Blaw Collapsible Steel Centering Co., Westinghouse Building, Pittsburg, Pa.

This catalog gives complete descriptions and illustrations showing the Blaw System of steel centering and straight wall forms. Photographs are taken with the idea of showing the methods of operation with the use of the forms.

Irrigation by Pumping.—Paper, 10⅝x7¾ ins.; 32 pp. The American Well Works, First National Bank Building, Chicago, Ill.

Bulletin No. 118 is illustrated and gives practical information on selection of types of wells, with drawings, cost of pumping, with illustrations and descriptions of installations.

Wyckoff Creosoted Wood Block.—Paper, 6x9 ins.; 16 pp. The Wyckoff Pipe & Creosoting Co., Inc., Stamford, Conn.

A description of this company's wood blocks for paving, method of creosoting, laying and various points of advantage.

Wyckoff Pipe and Creosoting.—Paper, 6x9 ins.; 32 pp. The Wyckoff Pipe & Creosoting Co., 50 Church St., New York.

This catalog illustrates and describes wood conduits, giving shapes, sizes, etc. The same is also given for creosoted crossarms, poles, and creosoted materials of all kinds.

The Pedestal Pile.—Paper, 6x9 ins., 64 pp. MacArthur Concrete Pile and Foundation Co., 11 Pine St., New York.

This catalog contains a comprehensive description of the methods of making and placing pedestal concrete piles, is completely illustrated and replete with diagrams and tables giving data of various kinds to show bearing properties and comparisons of different kinds of piles.

Drawing Materials and Surveying Instruments.—Cloth, 6x9 ins., 560 pp. Eugene Dietzgen Co., 181 Monroe St., Chicago, 214 E. 23rd St., New York.

This is the new (ninth) edition of the general catalog of the Dietzgen Co. and shows the complete line of material manufactured and kept in stock, as well as some special goods made to order. It contains complete illustrations, descriptions and prices of all engineers', office and field instruments and materials.

Paint.—Paper, 6¼x4⅜ ins., 28 pp. National Lead Co., 111 Broadway, New York.

A little booklet which gives information about pure white lead in a series of illustrated articles. The booklet is Volume III, No. 6, and entitled, "The Dutch Boy Painter."

Cyclone Drills.—Paper, 6¾x9¾ ins., 128 pp. The Cyclone Drill Co., Orrville, Ohio.

Catalog A-50 just issued by the above company is a complete general catalog for well drilling and prospecting machinery. It contains illustrations of various machines, auxiliary parts and tools. Descriptions and prices are given.

Friction Clutches.—Paper, 4½x7 ins., 35 pp. The Carlyle-Johnson Machine Co., Manchester, Conn.

This catalog deals almost exclusively with the driving of machinery through friction clutches, special attention being paid to the driving of machinery from line shafting, countershafting, etc. There is special mention made of clutches for cut-off coupling work for use in connection with marine motors, as a one-way clutch for which work this type of clutch is particularly adapted. The lists are very complete, extending to clutch parts, which are numbered to correspond to the numbers indicating the parts on sectional views.

Cement.—Paper, 6x9, 20 pp. Universal Portland Cement Co., 115 Adams St., Chicago.

The monthly bulletin for December containing illustrated descriptions of various concrete construction.

Typewriter Supplies.—Paper, 3½x6 ins., 44 pp. The Smith Premier Typewriter Co., 20 E. Van Buren St., Chicago.

A pamphlet giving illustrations, prices and descriptions of all typewriter accessories.

Troy Dump Boxes.—Paper, 3½x6⅝ ins., 16 pp The Troy Wagon Works Co., Troy, Ohio.

A booklet illustrating and giving a general description of the construction of removable dump boxes for wagons.

Wyoming Shovels and Scoops.—Paper, 6x3¼ ins., 28 pp. The Wyoming Shovel Works, Wyoming, Pa.

A brief description, with illustrations, of various shovels, scoops and spades of various shapes to suit various purposes.

Contractors' Supplies.—Paper, 6x9 ins., 4 pp Al. H. Hoffman, Spokane, Wash.

The monthly bulletin containing illustrations and descriptions of supplies for contractors' equipment.

Obelisk Waterproofing.—Paper, 12x9 ins., 4 pp 1 Madison Ave., New York.

Reprint of an article published in the Literary Digest describing waterproofing as a prevention of ruins.

Aggregate.—Paper, 6x9 ins., 16 pp. Edison Portland Cement Co., 1133 Broadway, New York City.

Illustrations of buildings constructed with Edison cement.

Peteler Cars.—Paper, 8½x11 ins., 1 p. Peteler Car Company, Minneapolis, Minn.

Illustrations of narrow gauge cars, tracks and appliances.

Bordo Blow-Off Valves.—Paper, 3½x6 ins., 12 pp. L. J. Bordo Co., Philadelphia, Pa.

Containing illustrations of valves and joints and tables of prices and dimensions.

Waterproofing.—Paper, 3¼x6 ins., 8 pp. Harrison Waterproof Materials Company, 30 Church St., New York City.

A description of the Harrison integral method of waterproofing concrete.

The Kerosine Bugaboo.—Paper, 4x6 ins., 10 pp Gas Traction Company, Minneapolis, Minn.

A comparison of costs of operation of traction engines using different fuels.

Ditching Machine for Relocation of Panama Railroad.—A railroad ditching machine was recently placed in service on the new line of the Panama R. R. It is operated over the tops of flat cars of a work train and propels itself over two portable track sections on the cars, and which it transfers from one car to another. The machine is equipped for using either a 9/16 cu. yd. dipper or a clamshell bucket of the Haywood patent of ¾ cu. yd. capacity. Ditches can be dug by the machine from 5 ft. to 36 ft. wide, working from the top of a flat car. It may be used as a steam shovel, handling 90 cu yds. per hour, and can load coal, ties or rails. It can also be used on surface track as a locomotive crane. The machine is built by the American Hoist & Derrick Co. of St. Paul, Minn., and is operated by two men, an engineer and fireman.

Florida East Coast Ry.—Advices from St Augustine, Fla., state that the Florida East Coast Ry., J. R. Parrott, President, St. Augustine, has awarded the contract for the construction of 135 miles of new lines to cost more than $1,500,000, to the Kissimmee Valley Construction Co., a Delaware corporation. Work is to begin within 30 days and be completed in three years. The new road will extend from Maytown to Whittier, and thence to Lake Okeechobee, in the heart of the Everglades. A branch will reach to Fort Bassinger, on the Kissimmee River.

Bids are now being asked by the Board of Water Supply of New York City for three contracts for the construction of portions of the $25,000,000 distribution tunnel under New York City for the Catskill water supply. The contracts now being advertised are Nos. 63, 65 and 66. Contract 63 calls for a circular tunnel in rock, 15 ft. inside diameter and 21,260 ft. long. Contract 65 calls for a circular tunnel in rock, 15 ft. and 14 ft. inside diameter, and Contract 66 calls for a circular tunnel in rock, 14 to 12 ft. in diameter. Bids are to be opened Dec. 24.

The average output per month of all the shovels working on the relocation of the Panama R. R. from January to October, inclusive, was 30,676 cu. yds per shovel

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week.

Three large contracts for rock tunnel work are contracts are for the con- now being advertised by the Board of Water Supply of New York. These struction of portions of the distribution tunnel under New York City for the Catskill water supply. The contracts now being advertised are Nos. 63, 65 and 66. Contract 63 calls for a circular tunnel in rock, 15 ft. inside diameter and 21,260 ft. long. Contract 65 calls for a circular tunnel in rock, 15 ft. and 14 ft. inside diameter, and Contract 66 calls for a circular tunnel in rock, 14 to 12 ft. in diameter. Bids are to be opened Dec. 24.

Announcement has been made that the Florida East Coast Ry. has awarded a contract for the construction of a new 135-mile line in Florida. The new line is to extend from Maytown to Whittier and thence to Lake Okeechobee in the heart of the Everglades. A branch line will also be built to Fort Bassinger on the Kissimee River. The contract has been let to the Kissimee Valley Construction Co., a Delaware corporation.

Among the railroad construction contracts let recently are the following: Foster-Creighton-Gould Co., Nashville, Tenn., for the pipe tunnel for the Memphis Union Station, the butterfly train sheds at the Caroline ave. underpass, all at Memphis, Tenn.; the St. Louis Construction Co., Pratt, Kan., H. P. Wells, President, for constructing the line of the Kansas & Southeastern R. R., from Almena, Kan., to Anthony, Kan.; C. E. Coon Construction Co., Omaha, Neb., for constructing the projected line in Wisconsin of the recently incorporated Wisconsin & Southwestern Ry. Co.

Bids are now being received on two fair-sized railroad construction contracts. One of them is in Mexico and the other in Canada. The former piece of work calls for the clearing, grading and masonry on 32 kilometers of change of line on the National Railways of Mexico, near Ortiz, Chihuahua. Bids for this work are to be opened Dec. 15 at the City of Mexico. The other contract calls for the construction of the road bed and structures of the following sections of the Manitoulin & North Shore Ry.; Crean Hill, mile 22.7 west of Sudbury, to connection with present line at Espanola; Espanola, south to a point at or near mile 61. Bids are to be opened Jan. 2 by R. S. McCormick, Chief Engineer, Sault Ste. Marie, Ont.

Contracts are reported to have been let for the new 35-mile line of the Colorado & Southern Ry. from Wellington, Colo., to Cheyenne, Wyo. Bids for the work were opened Dec. 5 at Denver, Colo.

The City of Pittsburg, Pa., is preparing to get some action out of its recently voted public improvement bond issue of $10,305,000. Ordinances calling for the expenditure of $6,000,000 of this sum are now before the City Council.

The New York State Water Supply Commission has made plans for a third storage reservoir. The dam for the reservoir is to be built on the Genesee River above the falls in that river, and will create a lake 15 miles long, extending from Portage up the bed of the river so as to cover portions of Wyoming, Livingston and Allegheny counties. It will store 18,000,000 cu. ft. of water, and its area, when filled, will be 13½ square miles. The cost is estimated at $4,584,000. The other two storage reservoirs are planned by the State Barge Canal Board.

The largest drainage contract let recently appears to have been the one secured by R. H. & G. A. McWilliams, 39 Jackson Blvd., Chicago, Ill. This contract calls for the construction of drainage ditches for the Little River Drainage District in the south end of Shawnee County, Oklahoma. About 18,000 acres of land are to be reclaimed.

Developments of the past week indicate that plans for the new $25,000,000 union station for the Pennsylvania and other railroads in Chicago are progressing finely. It is believed that the officials of the five railroads that now use the Union Station will early next year unite in a joint petition for a permit to build the passenger station. Accompanying this request is expected to be a further appeal for the vacation of Canal St. for two blocks between Madison and Adams Sts. It is believed that the new station is to be constructed by a holding company.

Commission Plan of City Government.

The commission form of city government seems [illegible]. During the past year there has been a steady increase in the number of cities which have adopted this form of municipal government, and at the present time over 100 cities in the United States are being run under some form of commission government. Uniform success seems to have attended this form of municipal government in all of the cities in which it has been tried. As is well known the change of form in city government was first tried at Galveston, Tex., as a measure of expediency due to the disastrous tidal wave. At Des Moines, Ia., the occasion was different. In the latter city the municipal government had nearly always been hopelessly inefficient, extravagant and wasteful. In both of these cities the results obtained have been very gratifying to the advocates of the plan. In Des Moines, as a result of the commission rule, the city for the first time in its history is living within its income, and in addition the tax levy has been slightly decreased. At Houston, Tex., similar results have been obtained. When the commission form of government was inaugurated in that city in July, 1905, there was a floating debt of over $400,000 and an empty treasury. The city had no credit, and it is stated that there was not a single merchant who desired to transact any business with the local government. In five years the city paid the debt and has made permanent improvements costing $1,500,000, besides paying nearly $200,000 bonded debt and acquiring a surplus of over $120,000, and the tax rate has been reduced 30 cts. on the $100. The gas rates have been reduced from $1.50 per 1,000 ft. in 1905 to $1.05, and next year the price will be $1. The water rates have been reduced from 50 cts. a 1,000 gals. to 15 cts. The tax rate has been reduced from $2 to $1.70 on the $100. The real taxable values of the city are about $250,000,000. This is assessed at $62,000,000. Personal property is seldom if ever taxed, and that at the option of the assessed. In spite of the reduction in the tax rate, the salaries of the school teachers, firemen and policemen have been increased. The success of the commission form of government is a pretty good argument against the old idea that no branch of government can be conducted unless conducted on the theory that the executive, legislative and judicial functions rest in different bodies.

Day Labor Work in England.

In England many cities [illegible] struction by day labor in- [illegible]. Quite recently the Town Council of Norwich in reversal of its general policy, decided to ask bids on a piece of public work. In connection with the decision the City Engineer, [illegible] made the following statement of his reasons for preferring that the work be done by contract instead of day labor:

> [illegible] ience near St. Giles' Gates by contract instead [illegible] sion that much of the extra labor engaged by me, or on my behalf, is not satisfactory. The men are not as expeditious as should be the [illegible] corporation as having a "bottomless purse," and to consider there is no special necessity for them to exert themselves. My freedom of action in dealing with employees is not the same as that of a contractor. It is not uncommon for my action to be called in question by members of the Council for discharging men with whom I am not satisfied, and while the evidence upon which I have acted would be considered quite sufficient by a contractor in dispensing with the services of men, yet in my case it might not be sufficient to enable me to answer the very numerous detail questions often put to me. There are a large number of men who may be described as in the regular employ of the corporation, many of them having been selected out from time to time as the most satisfactory of those casually employed; these men can be relied upon to earn their wages and often a bit more. This enables me to carry out the regular work of the corporation with generally satisfactory results, but it is when a sudden expansion of staff is necessitated by some special work, generally of a building character, that I have difficulties in getting works carried out to my own satisfaction as regards cost of labor.

All of which goes to show that human nature in Norwich, England, does not differ very much from human nature in Norwich, Conn., U. S. A.

Method for Crossing a Railroad Track.

Obstructive tactics are sometimes resorted to by [illegible] prevent another company from building its tracks across the line of the first company. In some cases a string of freight cars is left at the point of the proposed crossing; sometimes a switch engine is run back and forth. Out in Missouri a railroad company took the latter method to prevent a construction company from carrying material across its tracks. The construction company was building a bridge across the Mississippi River, and it desired to cross the railroad company's tracks at a certain point with material for the bridge. The railroad objected, and to make its objections more emphatic switch engines were run by the point it was desired to cross so frequently that it was dangerous to approach the track. The construction company decided to try some obstructive tactics on its own account. [illegible] track was a large girder for one of the spans of the bridge. The crane was used to pick up the girder and suspend it in the air about 10 or 15 ft. from the ground, so that it swung to and fro over the track. This effectually stopped the movement of the [illegible] at such a height above the tracks that it would have raked off the smokestack and the cab, had the engine collided with it. After that the railroad was willing to arbitrate, and the construction company experienced no further trouble in getting its material across the tracks.

Early Railroad Promoters.

The golden days when all that the promoter of a new railroad required was an impressive manner and a persuasive voice are a thing of the past. But the stories of the exploits of some of these early "empire builders" still remain with us. There was that excellent promoter who, after collecting the bonuses and everything else in sight, explained the delay in beginning construction work by stating that his 5,000 tons of steel rails had been lost in transit, and endeavored to take up another collection in order to secure a new supply. There was also that still more excellent promoter who built eight miles of railroad with only two miles of rails. This latter event happened in one of the Southern States which had offered a bonus of $5,000 per mile for every mile of railroad constructed in the State. The law provided that the County Surveyor should measure each mile of track as laid, and a certificate from him that the track had been laid was the same thing as a warrant on the State treasury for $5,000. The promoter secured a lot of second hand rails and began work. His road started at an isolated point and wandered away following the line of least resistance as to grades and carefully avoiding all bridges. His supply of rails were exhausted when he had laid two miles of track, but after collecting his $10,000 from the State he cheerfully took up the first mile of rails and ties, and thus had material for the third mile. Thus he laid and collected for it, and then with the torn up second mile of track he built the fourth mile. This process was repeated, so the story goes, until the man from whom the promoter had stolen the rails and ties had him arrested.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Surveys for the Mobile & West Alabama R. R. have been made from Mobile, Ala., to Florence, Ala., a distance of 300 miles, and it is probable that steps will be taken shortly to place the first section under construction. At a recent meeting of the stockholders, the statement was made that now was the most apportune time for beginning the construction of the road. Over $30,000 has already been spent on engineering work. The road will penetrate the coal belt of Alabama. The directors of the road are as follows: J. W. Whiting, Charles D. Willoughby, Ferd Forcheimer, Adam Glass, H. Austill, of Mobile; L. A. May, of New York; M. E. McDonald, of Scranton, Pa.; N. G. Wing, of Demopolis; F. S. Moody, of Tuscaloosa; Horace E. Parker, of New York, and T. C. Vonstorch, of Texas.

The Birmingham & Edgewood Electric Ry. Co., of Birmingham, has filed a mortgage on its right of way, trackage and other appurtenances to secure an issue of $100,000 6 per cent 20-year bonds. It is expected that the floating of this issue will insure the operation of cars between Birmingham and the new residence suburb of Edgewood by early spring.

Right of way is reported to have been guaranteed for the proposed new line of the Birmingham Railway, Light & Power Co., Birmingham, Ala., to connect Hueytown with Bessemer. The proposition is to connect the line at the terminus of the pipe works division and extending it through Hueytown on to Corey and Ensley. The new line will pass through Dolomite and Woodward and will open up about six miles of thickly settled section of the country.

Arizona.

The County Supervisors at Phoenix, Ariz., have refused to grant a franchise for the use of the county roads for an electric railway from Phoenix to Mesa. It is probable that the interested parties, Goldman and Stone, of Phoenix, will file a second petition and get a private right of way.

The Port Lobos R. R. has two forces of engineers in the field, one of 22 men, surveying south from Sasco, Ariz., to the Mexican line and now reported about 25 miles south of Sasco. The other party is said to be working north from the Mexican line.

Arkansas.

As a charter has been issued to George D. Locke, Rogers, Ark., for the Ozark Land & Lumber Co. to develop new timber lands, it is believed that the Arkansas, Oklahoma & Western R. R., of which G. D. Locke is Vice President and General Manager, will build a line from Monteto a connection with the Iron Mountain at Bald Knob.

California.

The Western Pacific Ry. is reported to have acquired right of way for a new railway from Oakland to Los Angeles. The plans are said to provide for a line running south from Oakland over the company's road to Niles, and there branching out to Irvington, Warm Springs, Milpitas and East San Jose, where a 30-acre tract, now occupied by the Ruehl-Wheeler nursery, has been secured within a mile of the heart of the business section. Passing throught East San Jose the road continues through the Coyote section, thence to Gilroy and Hollister, crossing the Coast Range mountains through Pacheco Pass, coming out into the San Joaquin valley by Maricopa, and then making direct for Coalinga and the rich oil country, thence on to Los Angeles. The report is interesting and if true, may mean that the Santa Fe will at once rush the work of securing a right of way from Oakland through the Santa Clara valley and on south to a junction with its main line.

The City Railway Co., of Los Angeles, Cal., has been incorporated with a capital stock of $5,000,000, fully subscribed, for the purpose of building extensions and new lines for the Los Angeles Railway Corporation, the H. E. Huntington Company, controlling all of the Los Angeles street car lines. The incorporators of the company are S. M. Haskins, Howard Huntington, Geo. C. Ward, C. A. Henderson, J. E. Brown, Albert Crutcher, and W. E. Dunn.

It has been announced that the city council of Oakland, Cal., has adjusted the difficulties regarding the right of way at 20th and Poplar Sts., over which the Key Route and the Santa Fe System have been contending for some time and the latter company will be allowed to build over the tracks of the former.

Among the new work planned by the Southern Pacific R. R. is the extension of the Sunset Western R. R., 2½ miles. The line runs through the oil fields out of Bakersfield, Cal., and will be extended across the sections of the American Oil Co., No. 25 and 26.

The work of double tracking the Southern Pacific line between Reno, Nev., and Truckee has been resumed, according to information from Oakland, Cal. At present there is a double track from Sparks to Lawton, a distance of 15 miles.

It is rumored in Daggett, Cal., that as soon as the construction crews complete the Salt Lake high line through Meadow Valley Wash in Nevada, they will be transferred to the Mojave River valley to start work on the construction of the proposed San Pedro, Los Angeles & Salt Lake R. R. line, from Daggett west, thus completing its route through Riverside junction, eliminating all traffic contracts with the Santa Fe and Southern Pacific. Engineers who have looked over the region are of the opinion that the Salt Lake will not cross the mountains in Cajon Pass, but select a route where a grade will be less heavy. It may be that Devil's Canyon will be chosen. In that event some tunneling will be necessary, though only in one point, to avoid climbing to the crest.

It is believed in Oroville, Cal., that the crew of engineers who ran a line down the middle fork of the Feather River recently were under the employ of the Southern Pacific. The survey was started near Beckwith Pass and ran down the middle fork to a point a few miles above the mouth of Fall River.

The Mountain Valley & Plains R. R. Co., chartered some time ago to build a line eastward from Cimmarron, N. Mex., to Guthrie, Okla., has filed with the Secretary of State, declaration of intention to build the line from the present New Mexico terminus to San Francisco, Cal. H. S. Wannamaker, Armstead, N. Mex., is Secretary of the company.

At a recent meeting of the East San Jose Board of Trustees, sentiment was expressed in an informal discussion to the effect that the board would co-operate with the Chamber of Commerce with the city of San Jose and the Western Pacific R. R. regarding the construction of a line into that town and a station. C. M. Levey, San Francisco, Cal., is Vice President and General Manager of the Western Pacific.

The Tidewater & Southern Ry., which projects a 48 mile line from Stockton to Turlock, via French Camp, Escalon and Modesto, has completed surveys and has secured the construction capital in part. Construction work is being done by company forces. Jas. A. Mehling, Stockton, Cal., is president, and J. H. Wallace, Stockton, is chief engineer.

Engineers said to be in the employ of the Hill Roads are running a line through Deer Creek Canyon in Butte County. This pass offers a route for an easy-grade railroad across the Sierra into Butte county. The Southern Pacific has long had its eye on this pass and has run different survey lines through it.

The Vallejo & Northern R. R. Co., Fairfield, Cal., is considering a plan for securing a joint grade with the Good Roads Club from Woodland to Sacramento. The railroad has had three surveys of the grade made, and these are under consideration by the committees. The plan is to have the grade wide enough to accommodate both the tracks for the railroad and leave room for a public highway. The grade is to be as straight as possible between the two cities, thus offering a short and well-built highway.

Good progress is being made with the electric plant of the so-called Holley electric line above Porterville. The dam is now nearly completed and as soon as this is done work will be commenced on the 6-mile concrete flume. The electric railway is to extend from Porterville to Springville, and from Porterville to Tulare and Visalia. The first section to be completed will be between Porterville and Tulare. H. H. Holley, Visalia, Cal., is one of the promoters.

The contract for furnishing steel rails for the Geary St. municipal electric railway at San Francisco, Cal., has been awarded to the Pennsylvania Steel Co., at the following bid: For furnishing and delivering steel rails f. o. b. cars at the place of manufacture on a railroad having connection with a transcontinental railway system. steel grooved girder rails, $34.25 per ton of 2,240 lbs.; steel guard rails, $44.25 per ton of 2,240 lbs.

Colorado.

The Fairview & Intermountain Ry. Co., has had most of the grade completed for its projected line. The contract for laying the rails will not be let at present. The projected length of this line is 25 miles, and it is to extend from Delta, Colo., to Fairview Coal Mines, and the town of Cedar Edge in the first district. Watson Zeigler, Fort Collins, Colo., is President, and Chas. G. Mantz, 1154 Clarkson st., Denver, Colo., is Secretary and Treasurer.

The Colorado & Southern Ry., H. W. Cowan, Chief Engineer, Denver, Colo., has plans under way for improving and enlarging its freight yards at Greeley next year.

A meeting of the stockholders of the Grand River, Meeker & Salt Lake R. R. Co., a new railway, will be held at office of the company, Room 527 Ernest & Cranmer Bldg., Denver, Colo., at 10 a. m. Dec. 15, to take action on authorizing 5 per cent gold bonds for the sum of $15,000,000, secured by a mortgage on all the property and franchises of the company. William D. Lippitt is President and John T. McClure is Secretary.

E. A. Sunderlin, Colorado Springs, Colo., General Manager of the Grand Junction & Grand River Ry. Co., was recently in Clifton to determine the route for the proposed extension of the interurban railway system of that road through that place to Glenwood Springs. It is probable that the line will cross the Grand River at Clifton and take in the Orchard Mesa district.

Bids are reported to have been opened at Denver on December 5, by the Colorado & Southern Ry., H. A. Cowan, Chief Engineer, Denver, for the grading work for a line from Wellington, Colo., to Cheyenne, Wyo. The new line will be about 35 miles and will require much heavy grading. The road will enter Cheyenne on an embankment more than 50 ft. high, on which the line will be carried across the Crow Creek valley. The Union Pacific will be crossed just west of the city on a viaduct 40 ft. above its rails. Five miles from Cheyenne, at Speer Station, the Colorado & Southern will go under the Union Pacific tracks through a subway, and from that point to Greeley the two lines will not be parallel, but will diverge on convex curves. At Greeley they will again come together. It is announced that dirt will be flying before the end of the year.

Announcement has been made that the Vidler Tunnel through Mount McClellan will be completed within four months. Work on this tunnel has been under way for the last five months. With the completion of the tunnel construction work will be started on the Montezuma & Western R. R., which will connect with the Argentine Central R. R., and furnish a route through the Vidler tunnel into the Montezuma District. The same interests that own the Argentine Central will construct the new road, which is to extend from Waldorf, on the Argentine Central line, a distance of 17 miles to Keystone. D. W. Brown, Denver, Colo., is President of the Argentine Central Ry.

M. E. Gilbert and C. B. Gilbert, contractors, of Lamar, Colo., were recently in this city, Pueblo, figuring on some railroad work. They stated that work on the Two Buttes reservoir had been completed.

The Law Committee of the Chamber of Commerce, Denver, Colo., at a special meeting recently held at that city, discussed the advisability of formally launching a proposition to have the state construct a tunnel through the continental divide west of Denver to be used as a public highway for any and all railroads which may desire a short route across the range. Upon investigation it was found that about $150,000 for the preliminary work would be almost immediately available. Charles D. Hayt, former Justice of the Supreme Court, is one of the committee.

Florida.

J. J. Brophy, Pittsburg, Pa., is promoting a plan for a traction line to be constructed from St. Augustine to Tampa in the near future. The plan proposed is to incorporate the line into three separate companies, one to operate from Tampa to Kissimmee, one from Kissimmee to Sanford, and one from Sanford to St. Augustine. Half of the capital stock of each company is to be taken by local people

Advices from St. Augustine, Fla., state that the Florida East Coast Ry., J. R. Parrott, President, St. Augustine, has awarded the contract for the construction of 135 miles of new lines to cost more than $1,500,000, to the Kissimmee Valley Construction Co., a Delaware corporation. Work is to begin within 30 days, and be completed in three years. The new road will extend from Maytown to Whittier, and thence to Lake Okeechobee, in the heart of the everglades. A branch line will reach to Fort Bassinger, on the Kissimmee River.

Georgia.

A meeting was held at Clarkston, Ga., on Dec. 5 to hear committee reports on the proposed car line to be constructed to Stone Mountain from some point in Atlanta or Decatur. The plan has been under consideration for some time. Bucher Scott, Scottdale, and S. H. Venable, Stone Mountain, Ga., are members of the committee appointed to work out the best plan of securing this line and to cooperate with the officials of the Georgia Railway & Electric Co. in building it.

Good progress is being made with the plans now under consideration for building a railroad from Ocilla, Fitzgerald and Rochelle to Hawkinsville. J. A. J. Henderson, Ocilla, Ga., is interested.

The Chattanooga & Atlanta R. R. Co. has been chartered and proposes the operation of through trains between Chattanooga and Atlanta, Ga., using the tracks of the Chattanooga Southern to Harrisburg, the Rome & Northern to Rockmart, and the Seaboard Air Line to Atlanta. The links between Rome and Rockmart and Trion and Harrisburg have yet to be constructed. E. F. Blomeyer, Chattanooga, Tenn., General Manager of the Chattanooga Southern R. R., is one of the incorporators of the new company.

The Macon Railway & Light Co., Macon, Ga., is to extend its Vineville and South Mason line to Rice's Mill. According to agreements entered into with the land owners the extension will be built before July next.

A mass meeting was held at Alpharetta, Ga., on Dec. 6 to discuss plans for assisting in the construction of an interurban railroad from Atlanta to Creighton and Cumming, via Alpharetta. The following representatives of the Atlanta Northeastern R. R., which proposes to build the line, were present: J. L. Murphy, Atlanta, Ga., Vice President; Dr. S. F. West, Treasurer; Dr. J. R. Duvall, Secretary; R. P. Jones, Attorney; A. H. Fowle, assistant to the Vice President.

Surveys have been started by J. W. Wright, Jr., for the new railroad from Carrollton, Ga., via Villa Rica to some point on the seaboard. It is stated that $65,000 is already available for beginning construction work on the road. Mr. Wright has just completed the grading of the new railroad to Bowden, and will probably be awarded the contract for grading from Carrollton.

Idaho.

It has been announced in Bliss, Idaho, that the entire force of men working at Rupert on the Rupert-Bliss Cutoff will soon be transferred to Bliss and the work will commence at the Y by the first of January. A large amount of the necessary material has already been delivered to the site of the Y.

According to reports received in Shoshoni, Wyo., the Chicago & Northwestern Ry. intends to begin construction of 215 miles of road west of Shoshoni to St. Anthony, Idaho. A preliminary survey for this line was made about two years ago. A very significant point in the rumor is the fact that one of the largest sub-contractors on the new Burlington line, who is just now completing his work, has decided to keep his stock and equipment near the proposed Northwestern line.

At a meeting recently held at Wallace, Idaho, the formal transfer of the Idaho Northern R. R. to officials of the Oregon Railroad & Navigation Co. was consummated. At the meeting were B. F. O'Neil, representing the Idaho Northern; J. P. O'Brien, Portland, Ore., General Manager of the Oregon Railroad & Navigation Co.; Judge Cleland and Attorney Moody, Portland, Ore.

Illinois.

Announcement has been made that Myron J. Carpenter, of Chicago, Ill., now receiver for the John R. Walsh roads, will be elected President of the Chicago, Terre Haute & Southwestern R. R. The election will take place within a few days, and at that time plans will be revealed for the extension of the Walsh roads into a trunk line system. Plans already have been made for the construction of the new road into Indianapolis and it is said further extension will be made to Cincinnati. A terminal site has been obtained in Indianapolis. Chicago will be the northern terminal, according to present plans, either by its own track from Chicago Heights, its present terminus or by a traffic agreement.

The Des Plaines Valley R. R., a subsidiary company of the Chicago & Northwestern Ry., has acquired 50 acres of land near Maywood. The property was acquired for use as a switch yard.

The Decatur Southern Traction Co., Decatur, Ill., has filed a mortgage in favor of the Knickerbocker Trust Co. of New York, which has agreed to finance the company. This is said to remove all obstacles in the way of construction, and ground will be broken this month, weather permitting. Surveyors will lay out the line from Pana to East St. Louis next week. From Pana the line will go to Witt, and southwest to East St. Louis, using the new McKinley bridge on the Mississippi.

Plans for a new joint railroad station in Chicago are reported to have been considered by the officials of the five railroads that now use the Union Station, and it is believed that early next year these railroads will unite in a joint petition for a permit to build a passenger station costing approximately $25,000,000. Accompanying this request is expected to be a further appeal for the vacation of Canal Street for two blocks between Madison and Adams Sts. It is believed that the new station is to be constructed by a holding company, the stock of which will be held by the five railroads now using the Union station—the Pennsylvania, the Panhandle, the Alton, the Burlington, and the Milwaukee and St. Paul. It will require about five years to complete the structure, and in the meantime the roads will have to make some other terminal arrangements. The Milwaukee & St. Paul will use the old Chicago & Northwestern station at Kinzie and Wells Sts., the Burlington and Alton will use the Grand Central station, and the Pennsylvania and Panhandle will continue to operate from the old Union station, according to report.

The City Council of East St. Louis, Ill., has extended the franchise rights in East St. Louis of the Southern Traction Co. one year. The company is backed by capitalists, coal mine owners and coal land lessees of St. Clair, Williamson, Carter and other counties of Southern Illinois, where the mines and lands of the "outer group" coal mines are located. It was stated at the council meeting that a considerable part of the rail had been laid between East St. Louis and Belleville and that cars would be in operation between Belleville and East St. Louis by the first of next June. The Southern Traction line has applied to the St. Louis Municipal Assembly for a franchise to use the new municipal bridge and certain St. Louis streets.

The recently incorporated Pekin & Petersburg Interurban Ry. Co. has applied to the city council of Pekin for a franchise to operate in that city. As previously noted in these columns, John E. Mellick, Springfield, Ill., is the Engineer for the company.

Indiana.

Preliminary surveys have been completed for the proposed interurban line from Michigan City to Whiting, and the engineer, E. H. Bell, Philadelphia, Pa., has forwarded his report to C. H. Geist, Philadelphia, the promoter of the project. The report of the engineer is said to recommend the building of the line from Michigan City to Whiting instead of making the eastern terminus at Chesterton, as was at first proposed. If the line is built according to the report it will have its starting point at Michigan City and will pass through all the intervening cities and towns between that point and Whiting such as Chesterton, Miller, Aetna, Gary, Buffington and Indiana Harbor, and by connection with other lines will afford transportation to Valparaiso, Hammond, East Side, South Chicago and Chicago as far as 63d St.

Regarding the project of the Commercial Club of Richmond, Ind., for securing a 50-mile electric railway from Richmond, Ind., to Harrison, O., we are advised that surveys have not been made as yet, nor has a company been organized, or a chief engineer secured. Chas. W. Jordan is secretary of the Commercial Club of Richmond, Ind.

Iowa.

The Charles City & Western Ry., of Charles City, now under construction, is considering plans for further extensions. One of these proposes to extend the road to the northeast to connect with the Great Western either at Elma or Alta Vista. The other is to extend the line in a southwesterly direction from Marble Rock, its present terminal, to connect with the Northwestern probably at Dumont. A third plan proposes to extend the line to Hampton to connect there with the Great Western, Iowa Central and St. Paul and Des Moines. The latter project is remote according to the management. The proposals will be laid before the stockholders, who are called to meet at Charles City in January when one of the plans will be probably adopted.

Kansas.

The probable route for the electric railway of the Manhattan Electric Ry. Co. to Fort Riley has been announced. It is now stated that the line will run out either Colorado or Yuma Sts., and across the Rock Island tracks at the southwest edge of Manhattan. W. R. West, Manhattan, Kan., is President.

The Kansas & Southeastern R. R. has let the contract for the constructidon of its line to the St. Louis Construction Co., Pratt, Kan., H. P. Wells, President. The road is projected to run from Almena, Kan., in the northern part of the state to Anthony. Grading will be started in Lincoln and Naron townships. J. W. Guffey, Arkansas City, Ark., is overseeing the work.

According to information received at Pretty Prairie, Kan., W. F. Brown, President of the Wichita, Kinsley, Scott City and Denver Line, the road for which bonds were recently voted announces that the grade from Turon west across Stafford County and six miles over into Edwards County has been completed and right of way about cleared up into Kinsley. The latter city is preparing to vote a $50,000 bonus for the project.

Work has been completed by the Missouri Pacific Ry. reballasting with rocks and cinders and installing 85-lb. rail on the line from Wichita, Kan., to Yates Center, a distance of about 100 miles. It is believed that in the spring the company will improve other stretches of its lines in Kansas.

The Atchison, Topeka & Santa Fe Ry. has appropriated about $1,000,000 for improvements in Kansas. Of this amount over $400,000 is for new buildings and headquarters and shops to be built in Topeka, and $587,697 is for new depots, track changes and shop buildings at various points.

Announcement is reported to have been made by C. W. Kouns, Topeka, Kan., General Manager of the Atchison, Topeka & Santa Fe Ry., that a new Union depot and a system of elevated tracks would be constructed at Wichita, at a cost of $1,500,000. The companies interested in the improvement are the Santa Fe, Rock Island, Frisco and Orient. Representatives of the four companies agreed upon the plans at a meeting in Chicago last week. Work will start early in the new year. The Santa Fe likely will have charge of the construction, the other companies sharing in the cost.

Grading work is well along in the new railroad being built from Westmoreland to Wamego, and over 100 teams are now on the work. The grade in the road between Westmoreland and Louisville has already been completed. The road will be operated by a local company. It is believed that capital will be secured and the road extended to connect with the Rock Island opposite Wamego, and that it will also be extended toward Omaha. The C. E. Coon Construction Co., Omaha, Neb., is the general contractor. Six or eight sub-contractors are at work.

Kentucky.

The Queen & Crescent Route is said to have had plans made for improvements of the shops of the company at Somerset, Ky. It is understood that it is planned to spend $70,000 in making the proposed improvement.

Louisiana.

Advices from Jennings, La., under date of Dec. 3, state that grading on the Lake Arthur, Jennings & Northern R. R. has practically been completed from Lake Arthur to that city and arrangements have been made by the right of way agent of the company with the Southern Pacific officials to cross the latter's tracks at Jennings.

Maine.

The Atlantic Shore Line R. R., according to reports, has been sold at Alfred, Me., to a reorganization committee by order of the Supreme Court to foreclose a mortgage of $1,191,500 held by the Knickerbocker Trust Co., of New York, as trustee. The price paid was $115,000 above the mortgage.

Massachusetts.

The New York Central & Hudson River R. R. is reported to be considering building a branch line from Shaftsbury, Vt., to North Adams, Mass., so as to connect the Rutland R. R. with the Boston & Albany, and the Harlem line into New York city.

The Union Street Ry. Co., E. S. Wilde, Superintendent, New Bedford, Mass., is considering a number of improvements for the southwestsection of the city of New Bedford. These include a new car line west from Acushnet Ave. on River Road to Bolton Road.

Residents of Townsend have been in conference with the Board of Trade of Fitchburg, Mass., C. F. Wilson, Secretary, in an effort to secure street railway connections between Townsend and Fitchburg.

Michigan.

A conference will be held some time next month by city officials of Detroit and representatives of the Michigan Central, Lake Shore and Wabash Railroads, looking to the separation of grades at the crossing of Fort St. west in Detroit. The work will require the raising of the track levels about 10 ft.

Work has been started clearing the right of way for the branch of the Detroit & Mackinac Ry., H. S. Waterman, Chief Engineer, East Tawas, Mich., which is to be built from Posen to Rogers City. Operations will be continued all winter.

Surveys have been made by the Pere Marquette R. R., J. F. Deimling, Chief Engineer, Detroit, Mich., for a branch from the main line, north of Charlevoix, to Walloon Lake, near Kahler's Corners.

The Michigan Central R. R., G. H. Webb, Chief Engineer, Detroit, Mich., is said to be considering extending the Detroit & Charlevoix line, from East Jordan, its present terminus, to Charlevoix, giving a direct line from Charlevoix to Detroit.

Minnesota.

Specifications are reported being prepared at the St. Paul offices of the Great Northern Ry. and the Northern Pacific Ry. for the lumber requirements of the Hill lines for next year. It is said that these roads will be in the market about Jan. 1 for 200,000,000 ft., which will be the biggest single order ever given by these roads for Washington timber. The lumber desired is of all lengths with ties, bridge timber, finishing, dimensions and various construction stuff.

Construction work is reported to be under way on the Northern Minnesota Ry., mentioned in this column in our last issue. This is to be a logging road and is to extend from Cusson, a station on the Canadian Northern, for 47 miles north of Virginia, Minn., to Crane Lake. The road will run a few miles east of Harding at the north end of the Crane Lake portage. The line skirts Elephant Lake and at this point a branch will be built to Lake Kobettogama. The main line will be 32 miles in length, running northeast from the Canadian Northern's road to Virginia. The branch from Elephant Lake will be 30 miles long and will extend slightly west of north. The road will be operated by the Hines interests and will transport logs from timber districts owned by the Virginia & Rainy Lake Co. to the mills at Virginia. It will also open up new fishing and hunting grounds. The officers are as follows: Edward Hines, Chicago, President; G. W. Lindsay, Duluth, Vice President; S. J. Cusson, Duluth, Secretary and Treasurer.

The City Council of Minneapolis, Minn., has passed an ordinance, granting the Great Northern Railway Co. permission to construct, maintain and operate a spur track extending into Van Buren St. and across Twelfth Ave. northeast from the main line of the Great Northern.

The Chicago, Milwaukee & St. Paul Ry. will submit a plan to a Council Committee of St. Paul early next month for eliminating the grade crossing of the St. Paul Short Line at West 7th St. The proposition to be submitted by the railroad company in January will deal with the lowering of the railroad track grade or with tunneling under the present grade. Owing to the topography of the railway right of way it is believed that any improvement which contemplates lowering the grade at West 7th St. to a depth sufficient to accommodate an overhead grade would necessitate a change in the grade from Chestnut St. to Merriam Park. It was suggested that perhaps the grade could be lowered from Chestnut St. to Victoria in an open cut and that a tunnel could be built from Victoria with the other outlet near Selby Ave. Such an improvement will necessitate a large outlay of money, and the railroad company is desirous of submitting a plan which, if followed, will work to the mutual advantage of the city and the company. Such an improvement as is contemplated would wipe out all of the grade crossings from Chestnut St. to Merriam Park.

Missouri.

Tracklaying on the Missouri Inland Southern Ry. will be started some time in January, arrangements to this effect having been made. About 12 miles of road bed between Rolla and Houston is now ready for the ties. E. E. Young and C. H. Evers, National Bank Bldg., Rolla, Mo., are in charge of this road.

Montana.

As noted in our last issue work will probably be resumed in the spring on the construction of the Big Blackfort Ry. Additional information concerning this report has just been received from Missoula, and it is stated that one of the sub-contractors who was formerly engaged on the work has been notified to be ready to get into the field immediately the winter weather breaks after the first of the year. He was told that the work on the construction of the new line will be started as early as possible and that the track will be ready to be turned over to the operating department within a few months' time after work starts.

New Jersey.

The City Council of Lambertville, N. J., has taken action on the granting of a franchise for the projected trolley freight line between that place and Trenton.

The Railway Committee, John W. Eyles, chairman, of the Board of Trade, of Sea Bright, N. J., is taking steps for securing a one-mile trolley extension at Sea Bright.

The State Public Utility Commission has approved the ordinance passed by Bloomfield Council granting permission to the Public Service Ry. Co., of Newark, N. J., to construct an extension of the turnout in Broad St., north of Bloomfield Ave., to a point south of Washington St. This is to connect the turnout and the single track in Glenwood Ave. with the double tracks in Bloomfield Ave.

Working plans for the proposed new railroad stations in Bloomfield and Watsessing, to be erected by the Delaware Lackawanna & Western R. R., have been forwarded to Building Inspector George M. Cadmus, of Bloomfield.

New York.

The Brooklyn & Jamaica Bay Ry. Co., Horace J. Subers, President, New York City, has applied to the State Public Service Commission for a certificate of [illegible] sity for the construction of its proposed trolley road to the northern shore of Jamaica Bay, Long Island.

The State Public Service Commission has authorized the Hoosick Falls R. R. Co. to issue common capital stock to the amount of $100,000 to be used to [illegible] erty, rights and franchises formerly belonging to the Bennington & North Adams St. Ry. Co. within the state. The New York, New Haven & Hartford R. R. Co., which controls the property, has been authorized to acquire and hold the capital stock of the Hoosick Falls road thus authorized. C. Q. Richmond, Pittsfield, Mass., is General Manager of the Bennington & North Adams Street Ry. Co.

The New York Central & Hudson River R. R. has started preliminary work upon a new passenger station to be built at Watertown. The improvements will cost between $200,000 and $300,000.

As a result of a recent inspection of the Buffalo & Susquehanna R. R. by representatives of the bond holders, it is said that much betterment work will be undertaken next year.

International Traction Railways of Buffalo has incorporated with a capital stock of $100,000, and proposes to operate a railroad in the Abbott Road, Buffalo, between Cazenovia St. and the southerly line of Buffalo. The directors include Morris Cohn, Jr., Niagara Falls; Robert L. Fryer, O. P. Letchworth, Buffalo; Thomas E. Mitten, Chicago; Edmund B. Osler, Toronto, and Nelson Robinson, New York.

The Halite & Northern R. R. Co. has been incorporated with a capital stock of $100,000. The road is to be operated by steam, electricity or other motive power and is to be of standard gage. It is to operate in Halite, Livingston County, on the line of the Pennsylvania R. R., to a connection with the Genesee and Wyoming R. R., at a point about one-half in a southerly direction from the station thereof and will be approximately 3.22 miles long. The directors are: William A. Hazard, Edward W. Brown, Ashley Bigelow and Duncan A. Holmes, of New York; Wilton W. Sealby, Harry S. Keating, of Brooklyn; Gouverneur O. Parks, of Sheepshead Bay; Edwin M. Bennit, of Hackensack; Herbert G. Buckley, of Corona, Queen borough.

The Elmira Water, Light & R. R. Co., Francis G. Maloney, Superintendent, Elmira, N. Y., will probably begin construction work in the spring on an extension of its trolley line to Southport Corners. Permission to construct the new line has been obtained from the Common Council, the town board of Southport and the state highway commissioner. It is now necessary to secure only the permission of the Public Service Commission.

The Schenectady Ry. Co., Schenectady, N. Y., has promised to construct street car lines about the plant of the American Locomotive Co. if the common council of Schenectady will grant other franchises for new lines. The terminal question is also involved.

North Carolina.

Announcement has been made at Salisbury, N. C., that a railroad is to be built from Winston Salem by way of Spencer, Salisbury, Concord and Monroe, to connect with the Atlantic Coast Line on the south, and the Norfolk and Western on the north. The road is to run parallel with the new Southbound for a considerable distance from Winston, and, traversing Rowan, will open up a granite belt. A preliminary survey has been arranged, and, it is said, the building of more than 100 miles of road is assured.

North Dakota.

Northern Pacific Engineers have been making surveys of the land along the tracts just west of Sixth Ave. N. W., Mandan, N. Dak., which was recently purchased for the extension of the switching yards, and it is expected that the work of filling in the bottom lands and extending the yards will be started as soon as the cold weather breaks up. The work will probably include the construction of a new freight depot. S. J. Bratager, St. Paul, Minn., is Principal Assistant Chief Engineer.

The project for the extension of the Devils Lake & Northern [illegible] dent, Devils Lake, N. Dak., into Canada, has again been taken up, and indications are that the extension will be built in the near future. The plans propose [illegible] Pelican Lake region of Manitoba, connecting with the Canadian Northern, probably at Wawanesa.

Ohio.

The Pennsylvania R. R. is reported to have acquired land at E. 55th St. and Euclid Ave., Cleveland, as a site for an independent passenger station, the erection of which is to begin in April. This would seem to indicate the road's intention to withdraw from the union depot. The scheme is said to be to run a four-track system through the city with which the new station will be connected. The situation suggests that the Pennsylvania has parted from the New York Central people, and will no longer participate in the movement for a new union station in Cleveland.

The County Commissioners at Zenia have granted a franchise permitting the Ohio Electric Railway Co. to enter Osborn by a new route eliminating several dangerous curves. By the new route the road will not pass through the village, but will touch only the corporation line.

Plans are reported under consideration by Youngstown & Southern Electric Ry. Co., Youngstown, for double tracking the entire line between Youngstown and Leetonia.

Work will be started this month on the new trackage of the Norfolk & Western Ry., through Chillicothe. L. E. Sturm & Co., Columbus, O., have the contract for a considerable part of this work, their contract including the extension of the overhead crossing at 7th St., the building of a new sewer, the paving on the new street, and walks to be built alongside the track from 7th St. to Eastern Ave.

Oklahoma.

Surveys are to be started at once, it is said, for a new interurban line from Oklahoma City to Muskogee, a distance of 180 miles. From the latter point it is planned to extend the line to Fort Smith. Routes by way of Shawnee and also by way of Chandler and Davenport are under consideration. The Muskogee Electric Traction Co., R. D. Long, Chief Engineer, Muskogee, Okla., is interested.

The first regular train was run over the Missouri, Oklahoma & Gulf, from Muskogee to Denison, Tex., on Dec. 5, a distance of 212 miles.

Citizens of Alva, Okla., according to advices from that place, are raising a bonus of $100,000 to secure the construction of the Des Moines & Santa Fe R. R. through that place. The company was chartered several years ago to build eastward from Des Moines, N. Mex., across the Southern Kansas and Northern Oklahoma, through Hooker, Alva to Oklahoma City.

The Chamber of Commerce of Oklahoma City has formed an organization of which C. G. Jones is a member, to provide terminal facilities for the Fort Smith & Western Ry., and such other roads as may require similar provisions. The organization will incorporate a terminal company, and at a later date may erect a union station. The first steps, however, will be to secure suitable grounds for the terminal for the Fort Smith & Western Ry.

Advices from Tulsa state that grading work on the St. Louis, Bartlesville & Pacific Ry. will probably be started by Jan. 1. This road is reported to have floated $7,000,000 of bonds and it is said that F. M. Overless, who has been instrumental in promoting the project, is now looking to the completion of the plans.

Oregon.

About $1,000,000 is to be spent within the next year in improving the terminal facilities of the Southern Pacific & Oregon R. R. & Navigation Co., in Portland, according to a reported statement of J. P. O'Brien, Portland, General Manager of the Hariman lines in Oregon. Among the improvements under consideration is a proposition to construct additional shops in East Portland at an aggregate cost of approximately $700,000.

The Farmers' Electric Ry. Co., of Vale, Ore., which [illegible] Nov. 30, proposes to build an electric railway from Vale to the mouth of the Malheur Canyon, 12 miles southwest from Vale. Ultimately this line will be constructed to Ontario, 16 miles east of Vale. A street car service for Vale is also part of the plan. R. D. De Armond and Fred L. Johnson, Vale, Ore., and G. W. Thomas, Ontario, Ore., are interested.

The Oregon Coast Ry. Co. of Astoria, Ore., is reported to have interested eastern capitalists who may finance the proposed electric railway to be constructed from Astoria to Seaside and Tillamook. A branch leading up to Lewis and Clark Rivers to the Nehalem Valley is also proposed. Linwood, Haines, Philadelphia, Pa., was recently in Astoria investigating the project.

The Pittsburg & Gilmore R. R Co., which recently constructed a line from Armstead, Mont., to Salmon City, Idaho and completed surveys down the Salmon River toward the coast, has opened offices at Portland, Ore.

Advices from the new town site of Metolius, Ore., state that although Nelson Bros., contractors, plan to have the line constructed to that point by Jan. 26, it is believed that if work progresses as rapidly in the future as in the past, the line will reach there before that date. Considerable work is being done at Metolius, including the construction of a round house, turntable and a yard covering 15 miles or more.

The Portland Subway Co., of Portland, Ore., has been incorporated with a capital stock of $100,000 and proposes to build a subway under the Williamette River at Portland. The incorporators are L. Y. Keady, A. K. Bentley, an attorney, with offices in the Lumbermen's Bldg., Portland, and A. E. Hammond. The latter was employed to the preliminary engineering for the subway company.

Surveys have been made by George A. Kyle, until recently chief engineer of the Oregon Trunk, for an extension of the 6-mile railroad now operating between Medford and Jacksonville. The route as surveyed runs from Jacksonville to Rugh in the Applegate Valley. N. F. Barnum is owner of the road. Grading will be started at once, and will be comparatively light.

The citizens of Newport, Ore., are making efforts to have the Corvallis & Eastern R. R., Corvallis, Ore., build an extension around the bay to Newport.

Erickson & Petersen are working about 400 men on the Southern Pacific grade at the mouth of the Sprague River. It is stated that these contractors will keep their camp open all winter.

Pennsylvania.

City Engineer Masterson of Johnstown, Pa., is now working on estimates for the elimination of grade crossings at Fairfield, Laurel and Delaware Aves. and Broad St., in the lower end of the city, together with the construction of a subway for foot passengers, vehicles and trolley cars at Fairfield Ave. and at Broad St., a subway for foot passengers at Delaware Ave. and a bridge at Laurel Ave. An ordinance providing for the work will probably come before the city council this month. According to this the Pennsylvania R. R. will pay a large share of the cost of construction and maintenance of the bridge and subways, the city, the Johnstown Passenger Ry. Co. and the Cambria Steel Co. also coming in for shares of the expenses to be incurred.

Right of way is being secured for an extension of the Black Lick & Yellow Creek R. R., A. W. Lee, President, Clearfield, Pa., from Burns Summit to Possum Glory, a distance of four miles. The extension will give two outlets for the new coal field being developed in that vicinity.

The Midland Railroad of Pennsylvania has increased its capital stock from $435,000 to $2,000,000 and has given notice of the issuance of $2,000,000 bonds.

The Titusville Electric Traction Co., W. J. Smith, President, Titusville, is considering building a two-mile extension. This would cost about $25,000 and would include the construction of a new bridge over Oil Creek. If the extension is built attempts will be made to buy or lease from the Pennsylvania R. R. the old line from the Tryonville station to Canadohta Lake, which could be electrified or used as a road for the operation of a gasoline car service.

Public meeting of owners of all the manufacturing plants at Mohnton and vicinity has been held at the Mohnton National Bank to urge the Pennsylvania R. R. Co. to extend its lines from Reading to Shillington, Mohnton, Adamstown, Ephrata and then connect with the Downingtown branch, giving another connection from Reading to Lancaster and the West.

The Philadelphia & Western R. R. Co., of Philadelphia, has begun work at Norristown, Pa., on the construction of the substructure of its bridge over the Schuylkill River, to be used in connection with its new line from Strafford to Norristown.

The city council of New Castle, Pa., has granted an extension of six months to the franchise of the New Castle & Beaver Falls Street Ry. Co., in which to commence actual construction work on the proposed line to Beaver Falls.

The Pennsylvania R. R. has been granted the right to use certain streets in Northumberland, and in return will build a subway on Water St., 20 ft. wide, sidewalks 10 ft. wide on each side. The subway is to be not less than 13 ft. in the clear and paved with vitrified brick.

The Philadelphia & Western Ry., of Philadelphia, Pa., operating an electric railway, has purchased land near Strafford for its proposed branch line to connect with the tracks of the Pennsylvania at that point.

Work was started early this month on the double tracking of the Lehigh Valley R. R., between Hazleton and Delano. The work will be completed in about six months.

George W. Beard & Co., Reading, Pa., have been awarded the contract for the erection of a foundry building for the Philadelphia & Reading Ry., at the east side of the old pattern shop of the Reading Company at Seventh and Bingaman Sts., Reading. It will be a one-story brick structure with a slag roof. It will be 80 ft. in length and 40 ft. wide. A skylight will extend the entire length. Work has been started.

Tennessee.

The promoters of the proposed Lewisburg & Nashville Interurban Ry. Co. have made a proposition to build the road as far as Cornersville, provided the people of Marshall County subscribe for $150,000 of capital stock. This is the project being promoted by the Tennessee Rapid Transit Co., mentioned in these columns last week. J. L. Parks, Franklin, Tenn., is interested.

Mass meeting has been held at Franklin, Tenn., to take steps looking to the construction of the proposed interurban line from Franklin to Fayetteville and Shelbyville. As surveyed the line would pass through one of the richest sections of Williamson, Bedford and Lincoln Counties.

It is now said that a definite proposition will be made shortly to the citizens of Asheville, N. C., for an extension of the Knoxville, Sevierville & Eastern Ry. This extension will be part of the proposed line from Knoxville to Charleston, S. C.

Foster-Creighton-Gould Co., Nashville, Tenn., has been awarded the contract for the pipe tunnel for the Memphis Union Station Co., at Memphis, Tenn.; also the butterfly train sheds and Carolina Ave. underpass. The pipe tunnel will require something like 2,000 yds. of concrete and 200 tons of reinforcing. The train sheds will require 250 or 300 tons of structural steel; and the Carolina Ave. underpass about 225 tons of structural steel. It is expected to sub-let all grading and metal work.

Texas.

The Enid, Ochiltree & Western R. R. has completed surveys and has secured the capital for the construction of its 113-mile line from Dalhart to Ochiltree, Tex., through Hartley, Moore and Hansford Counties. Construction work is under way, the company doing its own work. Geo. M. Perry, Ochiltree, Tex., is President and A. E. Wiest, Jr., Dalhart, Tex., is Vice President and General Manager.

Advices from Houston under date of Dec. 7 state that the Houston-Galveston Interurban had been completed from Texas City Junction to a point opposite Harrisburg and that work is now practically suspended pending the construction of the bridge over Bray's bayou. It is believed that the interurban construction work proper will be completed some 30 days previous to the completion of the causeway. Overhead work will be started within a short time and ballasting is being rapidly completed. The work of construction is simple, as an absolutely level grade and dry weather could have made possible. This road is being built for the Stone & Webster Engineering Corporation, of Boston, Mass.

As a result of recent traffic agreements between the Frisco and Houston & Texas Central R. R., it is expected that E. H. R. Green, of Terrell, Tex., owner of the Texas Midland R. R., will find it necessary to construct an extension to that road.

Arrangements have been made by the Santa Fe System, whereby the cities along the Pacific Coast will get a new short line to the Gulf of Mexico. It will be accomplished by the construction of a cut-off between Texico on the Belen Line and Coleman on the Gulf line, about 300 miles. It will reduce the distance between Los Angeles and Galveston exactly 509 miles, making the entire distance 1,845 miles.

It has been announced by H. F. Mitchell, Vice President and General Manager of the Chicago, Weatherford & Brazos Valley R. R. Co., which is building a road north from Weatherford, Tex., by way of Bridgeport and Decatur to Gainesville that a line would also be built south from Weatherford through Buckner and Lipan to Brownwood. J. W. Pigg, Weatherford, Texas, is the contractor for the work.

The Pecos Valley Southern Ry. has been completed from Saragosa to Balmorhea at the foot of Davis Mountains. Construction work further southward to a point near Phantom Lake is now underway. Surveys are now to be made for a route to a connection with the South Pacific at Alpine or Marfa. W. L. Carville, Dallas, Tex., is president.

Utah.

The Denver & Rio Grande R. R. is reported to have had a large engineering corps in the field between Marysvale and St. George, Utah, checking up former surveys and making changes for the new construction south. A corps is reported surveying towards Beaver City, and it is said that construction to that point will be started upon the completion of the survey.

The Jordan Valley Ry. Co., chartered some months ago to construct a railway up into Little Cottonwood Canyon from Sandy, Utah, plans to have the work completed some time in the spring. The roadbed will be graded and 65-lb. rails laid standard gage. A connection will be made with the Denver & Rio Grande R. R. at Sandy and Midvale. It is believed that the new mine will increase the output of the Alta mines considerably.

The Utah Light & Ry. Co., Salt Lake City, Utah, is planning three extensions to its street railway service at Salt Lake City. These include a line to Halliday and an extension of the East Second South St. line to the site of the new East Side High School.

The Denver & Rio Grande R. R. is having surveys made for a third track from Soldier Summit to Tucker. Surveys are also being made for a double track from Tucker to Thistle. It is probable that construction work on both improvements will be started early in the spring.

Virginia.

Residents of Rappahannock County, Va., have subscribed $42,000 toward building a railroad from that county to Warren County. The proposed road, if built, will probably cross Chester Gap, in the ridge.

The "Rivermont Tunnel" which is being built for the Southern Railway Co. through the city of Lynchburg, Va., was completed on the night of Dec. 7. This tunnel has been under construction since April, 1906. The work was begun by Mr. A. E. Elevier, sub-contractor, under W. J. Oliver, of Knoxville, Tenn. When the excavation in August, 1909, was completed except 400 ft. of the bench, it caught fire, burned out and fell in carrying a street car track, water and gas mains with it. The top of the tunnel being a mica sand formation, and the tunnel double track, made this a very difficult piece of work to complete. After the disaster of the fire, the work was taken up by J. N. Stone & Co., in December, 1909, and driven rapidly and successfully to completion. An interesting feature of the work is that it has been done without a mishap of any kind and without killing or injuring a man. Mr. Stone met with a great deal of discouragement in the beginning of the work by other contractors claiming the tunnel could never be rebuilt on account of the material to be encountered, and the tunnel being so wide; however, he began the work and pushed it to completion. The Southern Ry. expects to be operating trains through the tunnel by Dec. 20.

The Atlantic Coast Line Ry. is said to be planning to erect additional piers and to enlarge the present piers at Pinners Point, Norfolk, Va.

Washington.

The Tacoma Eastern R. R., John Bagley, General Manager, Tacoma, Wash., is securing right of way for its extension to Toledo, Wash. It is expected that grading work will be started as soon as weather conditions permit.

The Tacoma Railway & Power Co., L. H. Bean, General Manager, Tacoma, is planning to build a 1½-mile single track extension to Bismarck, a suburb of Tacoma. The work will cost about $25,000.

A franchise is being sought of the city council of Port Townsend by H. W. Potter, representing a monorail system of railways planned to connect Fort Worden, Port Townsend and Irondale. He offers to complete the line by Oct. 1 if work is started by April 1.

West Virginia.

Commissioners of Hancock County will hold a hearing on Dec. 19 at New Cumberland, W. Va., on the application of the Pittsburg, Steubenville & Wheeling Ry. Co. for a franchise to build its trolley roads in that county. The company proposes to build its line from Carnegie, Pa., to Steubenville, thence through Brooke and Hancock Counties, West Virginia, up the Ohio River and touch Chester, W. Va., and connect with through lines now operating into Wheeling along the Ohio River. W. E. Hildebrand, Pittsburg, Pa., is President.

Officials of the Buckhannon & Northern R. R. Co. have instituted condemnation proceedings for rights of way in Marion County. It is said that but six suits are necessary for the company to complete the securing of the entire right of way between the Pennsylvania state line and Rivesville, Marion County. It is further stated that the construction of the road would be commenced just as soon as the suits are settled. S. D. Brady, Morgantown, W. Va., is Chief Engineer.

The Chesapeake & Ohio Ry. is reported to have altered its plans for the construction of the line to join the Guyandotte valley and Piney extensions, because of the determination of the county court of Logan county to compel the company to maintain the county road, which would have been confiscated by the original plan. The connecting line, according to the new plan, will be built up Big Huff Creek, through the town of Oceana; up Laurel Fork of Guyam River, and thence to the Piney extension at Maben.

Wisconsin.

Work is being pushed as rapidly as possible on the 15-mile extension of the Escanaba & Lake Superior Railroad Co.'s 15-mile extension and track has been laid about 10 miles. The route is through the virgin forest and will connect with the main line of the road at Ralph, Wis. C. W. Kates is Superintendent of the work.

The Badger Electric Railway & Lighting Co. has been granted the right by the Town Board of Whitewater, Wis., to use the old steam railroad grade through the bluffs. This grade was established in the '60s, and is still in excellent condition, though it was never used, the old company being bought out by what's now the St. Paul line. As contemplated, the road will run through Heart Prairie, near Millard, through Elkhorn and Springfield to Geneva. It is proposed to construct the line in the summer of 1911 and to operate it a year from now.

The Wisconsin & Southwestern Ry. Co., recently incorporated, projects a 150-mile line, the route being through Hillsboro, Richland Center, Boscobel, Woodman, Bloomington, Betown, Wis., and Dubuque, Ia., with branches to Lancaster and Shullsburg, Wis. Surveys have been made in part and the capital for construction has been partially secured. The construction contract has been let to the C. E. Coon Construction Co., Omaha, Neb. Chas. F. Cash, New Lisbon, Wis., is Chief Engineer of the railway, and W. H. H. Cash, New Lisbon, Wis., is President and General Manager.

A contract, according to advices from Glenwood City, Wis., has been awarded F. J. Mann, Wauwatosa, Wis., for making a fill near the point east of Downing, where the new Downing-Ceylon cut-off branches from the main track, to which the Downing depot will be moved as soon as the site is ready.

The Chicago, Milwaukee & St. Paul Ry. will probably soon send a representative to Manitowoc to consider the possibilities of constructing an extension to that city.

Canada.

Bids are asked by R. S. McCormick, Chief Engineer, Manitoulin & North Shore Ry., Sault Ste. Marie, Ont., until noon Jan. 2, for the construction of the roadbed and structures of the following sections of the Manitoulin & North Shore Ry.: Crean Hill, mile 22.7 west of Sudbury, to connection with present line at Espanola; Espanola, south to a point at or near Mile 61. Plans, profiles and specifications may be seen at the office of the Chief Engineer, Sault Ste. Marie, Ont.

The Niagara Falls, Dunnville & Welland Electric Ry. Co. has applied to the Stamford Township Council for a right of way through that section. This company projects a line to run from Niagara Falls to Welland, and on to Dunnville. The road will extend from the Queen Victoria Park to Drummondville, out Lundy's Lane to a point near Allenburg, thence south [illegible] Welland. From Welland it will run south to the Air Line Junction and then due west along the Forks Road to Dunnville. It is planned to extend the line to Port Dover at a later date. Between Welland and Dunnville the road will run over the highways for the most part, but between Welland and Niagara Falls it will have a private right of way the greater part of the distance. It will be for both passenger and freight and mail and express service. A local service will also be put on between Welland and Niagara Falls with an hour schedule. The road will bridge the Welland River and the Welland Canal at Port Robinson. The cost is estimated at about $1,000,000. F. R. Lawlor, Dunnville, Ont., is President, and F. E. Misner, Welland, Ont., is Secretary.

Application is to be made at the present session of parliament for a charter for a railway, as follows: Main line—From Lloydminster, Sask., via St. Paul, de Metis and Lac la-Biche, to near Fort McMurray, near the junction of the Clearwater and Athabasca Rivers. Branches—(a) From a point on the main line south of the Saskatchewan River, westerly to near Bruderheim and onward to Edmonton; (b) from Lloydminster southerly via Medicine Hat to near the Milk River Crossing of the international boundary; (c) from Lloydminster or a point on (b) southwesterly via Buffalo Lake to near Black Falls and Red Deer, Alta.; (d) from Lloydminster or a point on (b) southwesterly near Manitou Lake near Scott to Saskatoon; (e) from Lloydminster or a point on the main line northerly via Cold Lake to Lac la-Loche and the headwaters of the Clearwater River; (f) from Lloydminster via Elbow, near Fort Pitt via Dore Lac and Lac-la-Rouge to Hudson Bay or a point on the Hudson Bay Ry. The name of the company which is to apply for the charter has not been given out. The solicitors for the applicants are H. R. Hall and H. C. Lisle, of Ottawa.

The Canadian Government now has already in hand or in view over $23,000,000, from western land sales to be devoted to the construction of the Hudson Bay Ry. Under the legislation of 1908 respecting the disposal of western lands for pre-empted homesteads, and the [illegible] of the cost of the Hudson Bay Ry., 16,375,000 acres have already been sold, either as purchased homesteads or pre-emptions. The payments received on purchased homesteads now total $627,000, and payments received on pre-emptions total $667,000. The amount still to be paid on the purchased homesteads is $1,100,317, and on the pre-emptions, $21,678,717.

Mexico.

Bids will be received until Dec. 15 by H. M. Taylor, Director of Construction, National Railways of Mexico, Buenavista Station, Mexico City, Mex., for clearing, grading and masonry on 32 kilometers of change of line near Ortiz, State of Chihuahua. Each bid must be accompanied by a certified check for $20,000 payable to the Ferrocarriles Nacionales de Mexico. Plans, profiles and specifications may be seen at the office of the Director of Construction.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Colorado.

Stockholders of the Larimer and Weld Division of the Windsor Reservoir Co. held a meeting Dec. 10 to consider the purchase of No. 8 reservoir, northwest of Eaton.

The Sedgwick Irrigation District will on Dec. 27 sell $670,000 of bonds of the district. Bids for the bonds will be received until 10 a. m. Dec. 27, by S. H. Carlson, Secretary, Julesburg, Colo.

The Old Fort Reservoir & Irrigation Co. is planning an extensive irrigation development. The object sought is to develop storage capacity in the bed of the South Platte River, 1½ miles west of Fort Morgan, to approximately 110,000 acre-feet, by the building of a dam with a possible height of 65 ft. which would back water up the river about 12 miles. The water is to be used for the irrigation of lands in Phillips or Sedgwick counties in the eastern part of the state, and is to be conveyed thereto by means of a canal to have a capacity of about 600 sec. ft. and a total length of approximately 117 miles. Secondary storage has also been found along the line of the canal which can be developed to 20,000 acre-feet, making a total storage capacity of 130,000 acre-feet. It is contemplated to water approximately 100,000 acres of land. Preliminary surveys have been in progress since early in the year on the reservoir sites and canal line, and borings have been made at the proposed site of the dam in the river, disclosing a suitable foundation for such a structure. A permanent survey of the reservoir in the river is now under way, after which preliminary plans and estimates for the dam will be made up. The cost of the entire system will probably run between $2,500,000 and $3,000,000. H. R. Oliver, Times Bldg., Fort Morgan, Colo., is Chief Engineer of the company.

Indiana.

✣Bids will be received until 11 a. m., Dec. 24, by Superintendent of Construction of Scott County at Scottsburg, Ind., for the construction of a ditch. Allen Maggard is Superintendent of Construction.

Kentucky.

Advices from Hickman, Ky., under date of Dec. 8, state that the Levee Board of that city was taking bids for the construction of a levee to protect the western part of the town. Over $10,000 has been subscribed for the levee.

Louisiana

The Second Drainage District of Pointe Coupee, La., is reported to be considering extending the drainage canal to Lake Bayou. The board is said to have on hand about $20,000 of bonds or that amount which it can issue and also $15,000 in cash money. With that amount of money the board would be able to extend the drainage to Lake Bayou and have money enough left to cut the piece of land separating Bayou Lettsworth from Crooked Bayou and to cut Simms Canal connecting Crooked Bayou with Moreau. To do this work it will be necessary for the board to get a small land dredge to make these two land cuts. A proposition to do the work has been made by Contractor Labarre. The Commissioners of the Second Drainage District of Pointe Coupee are as follows: H. P. Phillips, President; O. Lacour, George Mercier, George Murphy and E. A. Fisher.

New Mexico.

The Camfield Development Co., 315 Century Bldg., Denver, Colo., has just awarded the contract for the building of the reservoir dam in connection with the Las Vegas Irrigation Project in New Mexico. The construction of this dam will require about one year's time. No further contracts will be let until next spring, the remaining work requiring much less time for construction than the dam.

New York.

Larkin & Sangster, Lockport, N. Y., have placed two 70-in. steam shovels at work on their barge canal contract at Lockport, and it is probable that the tunnel around the locks in the city will be completed this winter. The contractors are now demolishing the locks. The masonry is being blasted.

J. W. Cooper, of Cleveland, has been awarded a sub-contract by the Ludington Contracting Co., for work on the Barge Canal in Albion, N. Y. The sub-contract covers the work from the west village line east to Tanners Bridge. Work on it is to be started about Dec. 15.

The State Water Supply Commission, Albany, N. Y., has made plans for the erection by the state of a third storage reservoir. The cost is estimated at $4,588,000. The other two dams are planned by the State Barge Canal Board, Albany. The Water Supply Commission's dam will be built on the Genesee River above the falls in that river, and will create a lake 15 miles long, extending from Portage up the bed of the river so as to cover portions of Wyoming, Livingston and Allegheny counties. It will store 18,000,000 cu. ft. of water, and its area, when filled, will be 13½ square miles. The barge canal dams are being built at Delta and Hinckley, in Oneida county, and are to be feeders for the enlarged canal. The Delta reservoir will have an area of 4 1-3 square miles and the Hinckley reservoir of 4.46 square miles. The capacity of the former will be 2,750,000,000 cu. ft., and the latter 3,445,000,000 cu. ft. The cost of the proposed Genesee dam is to be borne by the counties of Monroe, Wyoming and Livingston, the city of Rochester, the villages and the individual property owners in the improved district in proportion to the benefits each will receive. The new reservoir, besides preventing an annual loss of property will conserve about 30,000 H. P. which will be sold for the benefit of the state.

Ohio.

✣Bids will be received at 10 a. m., December 20, at the door of the Franklin County Court House, Columbus, O., for the construction of the Leap County Ditch, located about 4 miles northwest of Hilliard in Brown township. The work includes 173 cu. yds. excavation and backfill, including the hauling and laying of the following tile or sewer pipe and sewer pipe connections: 2,584 lin. ft. 24-in. (2d class) sewer pipe. 14 pieces 24-in. x 8-in. Y branches. The following 2d class sewer pipe furnished f. o. b. cars at Hilliard, Ohio, on P., C., C. & St. L. Ry. 2,584 lin. ft. 24-in. (2d class) sewer pipe. 14 pieces 24-in. x 8-in. Y branches. The work must be done in accordance with the specifications and profile on file in the office of Hugh K. Lindsey, County Surveyor, Franklin county, Ohio. The furnishing and delivering of the sewer pipe and Y branch connections f. o. b. cars Hilliard will be sold separately from the work of excavation and hauling and laying of same.

County Engineer Swisher, of Urbana, O., has submitted his report to the County Commissioners at Urbana on the proposed improvement of Mad River north of the Pan Handle bridge, near Westville. The total estimated cost is $61,580. The total excavation is 670,890 cu. yds., at an estimated cost of 9 cts a yard. It is proposed to begin the improvement at the Pin mill road southwest of West Liberty, where the channel will be 18 ft. wide on the bottom. The width increases from station to station down the river until it is 26 ft. wide on the bottom at the railroad bridge where it will join the other improvement, being at that point of the same width. The average depth below the surface will be 9 ft. The deepest cut is 16 ft., while in some places it is only 4 ft. A right of way of 200 ft. is required. Six bridges will have to be removed and replaced, which is estimated at $200 each, adding $1,200 to the cost.

Daniel E. Weage, Coldwater, Mich., has been awarded a contract by the Commissioners of Clark County at Urbana, for dredging Mad River for a distance of 1½ miles. The contract price was: Clearing and grubbing, $250; excavating, 9.97 cts per cu. yd.; total, $7,401. The work is to be completed by March 15, 1911.

Oklahoma.

R. H. and G. A. McWilliams, 39 Jackson Blvd., Chicago, Ill., have been awarded the contract for constructing drainage ditches for the Little River Drainage District in the south end of Shawnee County. Their price was as follows: 11 cts. per yd. for 2-dredge work and 9.9 cts. per yard for 1-dredge work in bonds, or 9.8 cts. per yd. for 2-dredge work and 8.7 cts. per yd. for 1-dredge work, for cash. All bids for construction of bridges across the ditch were rejected. The Little River drainage ditch will reclaim 18,000 acres of the county.

J. A. Fox, Norman, Okla., Commissioner of Cleveland County is formulating a plan to straighten Little River through to Pottawatomie County.

Memphis and Vicinity.

(REGULAR CORRESPONDENCE.)

The Memphis Union Station Co. has awarded contract to Foster, Creighton & Gould, of Nashville, Tenn., for the construction of a reinforced concrete underpass and pipe tunnel for the new Union station being constructed in this city. The contract is a large one, and the interest in the letting was very keen. Resident Engineer Shultz states that the work will be begun at once, and will be hurried through to a rapid completion.

R. L. Leonard, of Memphis, has been awarded a contract by the Brazos County Improvement District No. 1, for the construction of 178,000 yds. of levee work in Brazos County, Texas. The price bid was 13½ cts. per cu. yd. Bob has already sub-let a portion of the work to A. D. Montgomery, and states that he will have the entire contract covered within a remarkably short time. Payment for the work will be made in cash.

A survey of the Jackson & Dyersburg Ry. has been practically completed, and the officials of the road state that they will advertise for bids for its construction within the very near future.

Capt. E. C. Tollinger, U. S. A., was a visitor in the city last week. Capt. Tollinger is in charge of the Government levee work in Mississippi, and he seems well pleased with the progress which the forces in his district are making. The Captain is a great admirer of Memphis and her enterprises, and always delights in a visit to this town.

G. C. Weathers has just bought a Browning drag line machine, which he will use on his contract with Roach & Stansell, in the Lower St. Francis District. George will load the dirt into wagons from the machine, and haul the dirt to the embankment. The Browning machine is equipped with a fifty-foot boom, which George considers best for the sort of work he is going to do with his machine.

O. E. Gamill has finished his levee work in Texas.

A prominent official of the Cotton Belt Ry. states that there is no truth in the report that his road will make any extensive improvements in or about Memphis. This official points out the fact that his road owns no property in this city, nor does it even enter Memphis over its own rails, and states, therefore, that it is not logical to assume that it would be interested in making any extensive improvements here.

Despite a denial of the report that the Rock Island, I. C. and Frisco had perfected an agreement whereby they would build a costly Union station in this city, one high up in one of the roads concerned states that it will not be long before such a station is a certainty.

J. W. Brownell & Co. were awarded the contract by the city of Memphis for laying approximately 1,500 lin. ft. of sewer pipe, and the construction of various culvert work in this city. The contract price was $5,234, and work will be begun as soon as the signatures are attached to the contract.

Texas.

Advices from Galveston state that a third drainage district, embracing something like 21,000 acres, to take in all the land between Virginia Point on the south and drainage district No. 2 on the west, Dickinson bayou on the north and Galveston bay on the east is proposed. It is stated that about $50,000 will be required for the work, natural drainage facilities being offered by Dickinson and Highland bayous, Moses Jones and Swan lakes and by Galveston bay. Laterals and drainage will be necessary and by the building of such a large amount of valuable acreage will be made possible.

Mexico.

Francisco Rodriguez has applied to the Department of Fomento, City of Mexico, for the concession to use 500 liters of water per second from the San Juan Viejo River in the state of Michoacan. The water is to be used for irrigation purposes.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be received from 10 to 11 a. m., December 28, by Board of Public Works, Oakland, Cal., for the necessary labor and material for the construction of a two-story frame fire engine house on the north side of Ninety-Third Ave. near East Fourteenth St., Elmhurst for the Fire Department. James W. Nelson is Secretary.

✣Bids will be received until noon, Dec. 31, by Brig. Gen. Charles E. L. B. Davis, U. S. Engineer, 726 Chronicle Bldg., San Francisco, Cal., for dredging in Redwood Creek, Cal.

The Industrial Commission, of Richmond, Cal., has appointed a committee to look into the advisability of issuing harbor improvement bonds. A report, after an investigation, is held, will be made at a meeting of the commission this month.

District of Columbia.

✣Bids will be received until 2 p. m., Dec. 15, by Commissioners of the District of Columbia, Washington, D. C., for the construction of a branch library at Takoma Park, D. C. G. F. Bowerman is Commissioner for constructing building.

✣Bids will be received until noon, Feb. 6, by Beekman Winthrop, Secy., Navy Department, Washington, D. C., for constructing by contract four submarine torpedo boats Nos. 32 to 35. A circular defining the chief characteristics of said vessels is now ready for distribution among prospective bidders.

✣Bids will be received until 2 p. m., Dec. 18, by J. A. Holmes, Purchasing Agent, Post Office Department, Washington, D. C., for the furnishing of 20 sets of 2-in. anti-friction castors for truck baskets or warehouse cars.

✣Bids will be received until 11 a. m., Dec. 30, by Capt. H. L. Pettus, Quartermaster, Washington, D. C., for constructing a brick addition to superintendent's lodge at the Raleigh, N. C., National Cemetery.

✣Bids will be received until 11 a. m., Dec. 30, by H. L. Pettus, Quartermaster, U. S. Army, Washington, D. C., for furnishing 302 pieces white pine culls, 1,594 ft. do.; 32 pieces tongued and grooved and 860 ft. white pine culls.

✣Bids will be received by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., at 10:30 a. m., Dec. 27, for furnishing by steamer, free of all charges on dock at either Colon (Atlantic Port), or Port of Acon (Balboa, Canal Zone) (Pacific Port), Isthmus of Panama, lumber and mechanical bond steel rods.

Bids as follows were received Dec. 3 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for dry dock pumping equipments at the U. S. Navy Yard, Puget Sound, and the naval station, Pearl Harbor, Hawai, (1) standing for complete pumping equipments, in accordance with plans and specifications, (2) for the work complete, with such modifications of methods and details as bidders desire. Camden Iron Works, Camden, N. J., (1), $310,500 Westinghouse equipment, $331,700 General Electric equipment; (2) $305,000 Westinghouse equipment, $321,700 General Electric equipment. Alberger Pump Co., New York, N. Y., (1), $323,454. D'Olier Engineering Co., Philadelphia, Pa., (1), $347,645. Chas. C. Moore & Co., San Francisco, Cal., (1) $378,643 or $384,037. Allis-Chalmers Co., Milwaukee, Wis., (1) $366,888, $366,238; (2) $357,038, $356,388. Henry Worthington, New York, N. Y., (1) $353,357, $338,888; (2) $335,976, $327,142.

Florida.

✣Bids will be received until noon, Jan. 5, by George R. Spaulding, U. S. Engineer, Jacksonville, Fla., for dredging in Sarasto Bay, Fla.

✣Bids will be received until noon, Dec. 23, by Capt. George R. Spalding, U. S. Engineer, Jacksonville, Fla., for removal of wreck Magic City in St. John's River, Fla.

Georgia.

✣Bids will be received until 11:45 p. m., Dec. 19, by Lieut. L. C. Brinton, Jr., Quartermaster, Fort Screven, Ga., for furnishing the necessary labor and material for the construction of an extension to the present wharf at Fort Screven.

Wilkinson Machine Co., Savannah, Ga., has been awarded the contract by Lieut. L. C. Brinton, Jr., Quartermaster, Fort Screven, Ga., for putting one Russian iron jacket on a 40-hp.

Items marked thus ✣ indicate work now open for bids.

Beggs stationary boiler, lag and jacket 1-10 in., Worthington duplex steam pump and scaling and painting smokestack for $170. Bids were opened December 1.

Illinois.

✣Bids will be received until 11 a. m., December 22, by Board of Public Works, Chicago, Ill., for furnishing labor and material for the installation of a steam heating system in the Fire Department building at East 93d St. near South Chicago Ave. A certified check for $150, payable to B. J. Mullaney, Commissioner of Public Works, must be filed with each bid.

Indiana.

✣Bids will be received until 10 a. m., December 21, by Board of Public Works, Indianapolis, Ind., for the painting of Tomlinson Hall.

✣Bids will be received until 10 a. m., December 17, by Commissioners of Wells County at Bluffton, Ind., for the supplies for all county offices such as books, tablets, stationery, pencils, etc. O. D. Garret is Auditor of Wells County.

✣Bids will be received until 10 a. m., Dec. 19, by Depot Quartermaster, Jeffersonville, Ind., for furnishing under Schedule 576, miscelaneous supplies.

✣Bids will be received until 10 a. m., Dec. 23, by Depot Quartermaster, Jeffersonville, Ind., for furnishing under Schedule No. 577, f. o. b., Jeffersonville Depot, Ind., a quantity of lumber.

Kansas.

✣Bids will be received until 2 p. m., Dec. 20, by Constructing Quartermaster, U. S. Military Prison, Fort Leavenworth, Kan., for furnishing and delivering f. o. b. cars at Normoyle Junction (north of Fort Leavenworth station on Missouri Pacific Ry.) 10,000 barrels of Portland cement.

✣Bids will be received until Dec. 22, by Capt. R. B. Powers, Quartermaster, Fort Riley, Kan., for furnishing 45,000 ft. oak bridge plank, 2,000 ft. yellow pine and 2,500 lbs. of wire nails.

The Vulcan Iron Works submitted the lowest bid to Capt. J. E. Normoyle, Constructing Quartermaster, Fort Leavensworth, Kan., for furnishing and delivering f. o. b. terminal railroad, Fort Leavensworth, one 40 to 45 ton standard gauge locomotive, two standard gauge air brakes and air dump cars, and two standard gauge flat cars. Bids were opened Dec. 5.

Louisiana.

✣Bids will be received until 10 a. m., Jan. 16, by Favrot & Livaudais, Ltd., Architects, 839 Gravier St., New Orleans, La., for the erection and completion of a two story and basement fireproof court house at Lake Charles, La., for the Parish of Calcasieu.

The government steamer Hyacinth has arrived at New Iberia, La., with all preliminary machinery for work on the locks for Bayou Teche. The locks are to be located in the banks of the bayou entirely out of the channel. Extensive excavations will have to be made for the lock foundation considerably below the present bed of the stream, as well as below the proposed depth after deepening. The original plans called for a 6-ft. channel over the lock sills. As the Teche is to carry a 9-ft. channel below the locks, and in consequence of the raising of the water above the locks so as to give a 6-ft. channel to Arnaudville, there will be a 10-ft. channel for considerable distance above the locks, which are to be located at Keystone plantation, four miles below St. Martinville, where the Spanish Lake outlet flows into the Teche. The work will be done by day labor, under the direction of J. L. Dickey of the U. S. Engineers' Office, New Orleans, La.

Maine.

✣Bids will be received until 3 p. m., Jan. 16, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the extension, remodeling, etc., including plumbing, gas piping, heating apparatus, and electric conduits and wiring system of the United States Post Office and Custom House at Bath, Me.

Michigan.

✣Bids will be received until 3 p. m., Dec. 19, by Fire Commission, George W. Stockwell, Secy., for furnishing the Detroit, Mich., Fire Department with one auto fire engine capable of delivering at least 700 gals. of water per minute from suction having 10 ft. lift. Bids will be received with or without chemical tank having capacity of 30 gals. and reel holding 250 ft. of four ply chemical hose.

The contract for the concrete piles and foundations for a building for the Buhl Malleable Co., Detroit, Mich., has been awarded to the Raymond Concrete Pile Co. of New York and Chicago; Smith, Hinchman & Grylls, Detroit, architects and engineers.

Minnesota.

The United States Steel Corporation is reported to have made an appropriation for rebuilding Dock No. 1 at Two Harbors. The dock is of wood and is to be rebuilt of steel.

Missouri.

✣Bids will be received until noon, Jan. 5, by E. H. Schulz, Maj. U. S. Engineer, Kansas City, Mo., for construction of about 13,000 ft. standard revetment on Missouri River about 6 miles below Kansas City.

Nebraska.

✣Bids will be received until 11 a. m., Dec. 30, by Capt. W. L. Clarke, Constructing Quartermaster, Fort Omaha, Neb., for the construction of a garbage crematory at the fort.

New Hampshire.

✣Bids will be received until 11 a. m., Jan. 7, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for furnishing and installing one electric motor driven capstan at the navy yard, Portsmouth, N. H.

New Jersey.

✣Bids will be received until 2 p. m., December 29, by New Jersey State Armory Commission, State House, Trenton, N. J., for furnishing the necessary labor and material for the complete erection of an armory at Elizabeth, N. J. Dennis F. Collins is Brigadier-General.

✣Bids will be received until noon, Dec. 28, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for removing the wreck of Steamer Brazoria, lying sunk in Absecon Inlet, N. J.

B. H. Brooks & Co., 50 Church St., New York City, has been awarded the contract at $11,103 by the city of Elizabeth, N. J., for the completion of the city recreation pier located on Staten Island Sound at Elizabethport. The work, which consists in putting a superstructure on the pier, will be commenced as soon as possible. The contract calls for the job to be finished next spring.

The following bids were received Dec. 1 by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging in Salem River, New Jersey: River & Harbor Improvement Co., Philadelphia, Pa., 19.4 cts. per cu. yd.; American Dredging Co., Philadelphia, Pa., 21.5 cts. per cu. yd.; The Rickards Dredging Co., Philadelphia, Pa., 30 cts. per cu. yd. About $12,000 is available for this work. The estimated yardage is 65,000 and the material is mud, sand and gravel.

Bids as follows were received Dec. 5 by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging in Maurice River, New Jersey: American Dredging Co., Philadelphia, Pa., 17 cts. per cu. yd; River & Harbor Improvement Co., Philadelphia, Pa., 23.8 cts. per cu. yd.; the Rickards Dredging Co., Philadelphia, Pa., 14 cts. per cu. yd. About $22,500 is available for the work. The yardage is 115,000 and the material is mud, sand and gravel.

New Mexico.

The Territorial Engineer of New Mexico has granted the Gila River Power Co., composed of Silver City, N. Mex., and New York capitalists the right to use the waters of the Gila River in Grant County for the developmenlt of electric power. About 15,000 H. P. is to be developed.

New York.

✣Bids will be received until noon, December 20, by Calvin Tomkins, Commissioner of Docks, Department of Docks and Ferries, Pier "A," Borough of Manhattan, New York, N. Y., for furnishing all labor and material under Contract No. 1257 for repairing the pier at the foot of W. 80th St., North River, Borough of Manhattan.

✣Bids will be received until noon, December 21, by Calvin Tomkins, Commissioner of Docks, Department of Docks and Ferries, Pier "A," Borough of Manhattan, New York, N. Y., for furnishing all labor and materials under Contract No. 1259 required for making repairs to the pier between 51st and 52d Sts., South Brooklyn, Borough of Brooklyn.

✣Bids will be received until noon, Jan. 5, by U. S. Engineer, S. W. Roessler, New York, N. Y., for dredging in Bay Ridge Channel, N. Y.

✣Bids will be received until 10 a. m., Dec. 19, by Commanding Officer, Torpedo Depot, Fort Totten, N. Y., for furnishing 212,400 ft. steel wire rope, 5,000 ft. 2-4-in. wire rope clips and 2,500 ¾-in. oval thimbles.

✣Bids will be received until 3 p. m., Jan. 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a conduit and electric wiring system in the United States Assay Office, New York, N. Y.

✣Bids will be received until 3 p. m., Jan. 12, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for metal vault linings, doors, etc., in the Extension to the U. S. Assay Office, New York, N. Y.

John N. Robins Co., 19 Whitehall St., New York City, has been awarded the contract by the department of docks and ferries of that city for repairing the municipal ferry boat "Richmond," for $9,300. Bids were opened Dec. 2.

North Dakota.

S. N. Knott & Co., of Minneapolis, Minn., has been awarded the contract by the city of Wahpeton, N. Dak., for furnishing 500 ft. of fire hose at 75 cts. per ft. Bids were opened Dec. 5.

Ohio.

✣Bids will be received until 10 a. m., Dec. 20, by Board of Trustees, Boys' Industrial School, Lancaster, O., for furnishing labor and material necessary for installing compressor, piping, etc., for the light, heat and power plant of the Boys' Industrial School at Lancaster, O. F. C. Gerlach is Secretary of the Board.

✣Bids will be received until noon, Dec. 21, by Director of Public Service, City Hall, Cincinnati, O., for the manufacture and delivery, f. o. b. Cincinnati, of one 48-in. cast iron bronze mounted, hub end, swing check valve, test pressure 250 lbs. per sq. in. A certified check for $200 must be filed with each bid. John J. Wenner is Clerk.

✣Bids will be received until noon, Jan. 4, by John C. Oakes, Maj. U. S. Engineer, Cincinnati, O., for the construction of three steel flat boats and three steel barges.

Oklahoma.

The Gulf Pipe Line Co., Beaumont, Tex., is planning to have work started shortly on an extension of its main oil pipe line from the Osage reservation, just north of Tulsa to Bartlesville and Nowata. The pipe for the line has been purchased and deliveries will begin in a few days. Rights of way have been secured and the company's field force has been organized. The extension line will be about 40 miles long and the total investment will be over $1,000,000 in the counties of Osage, Washington and Nowata.

Oregon.

✣Bids will be received until 10 a. m., Jan. 6, by A. L. Barbur, Auditor of the City of Portland, Ore., for supplying said city with playground apparatus according to plans and specifications on file at the office of the Auditor.

✣Bids will be received until 5 p. m., Dec. 23, by R. H. Thomas, Clerk, School District No. 1, Multnomah County, Ore., Room 402, Tilford Bldg., Portland, Ore., for the erection of a high school on the block 202, City of Portland, Ore.

Texas.

✣Bids will be received until Jan. 9, by County Commissioners, San Antonio, Texas, for rebuilding and remodeling Bexar County Jail in that city. Plans and specifications are on file at the office of the County Auditor, or Henry T. Phelps, Architect, 707 Gunter Office Bldg., San Antonio, Texas.

The City Commissioners of Port Lavaca, Tex., are considering providing a dock for the accommodation of boats entering the harbor. The harbor channel will have a maximum depth of 8 ft.

Virginia.

The following bids were received Dec. 2 by the committee on the improvement of James River, Richmond, Va., for constructing a new wharf: H. M. Allport & Son, Richmond (four designs), $40,985.58, $42,214.29, $38,757, $79,065; Thomas Phee Construction Co., Chicago, $67.50 per lin. ft.; Raymond Concrete Pile Co., New York (two designs), $31,830 and $24,500; Charles F. Wathers, Pittsburg, $17,163; I. J. Smith & Co., Richmond, $74 per lin. ft.; Minor Engineering Co. (two designs), $33,320 and $35,680; Allsop & Pierce, Newport News, $25,000. The last bid was for a pile and timber construction. The others were for various kinds of concrete construction.

Washington.

The Central Power Co. has constructed a dam on the Chehalis River at Pe Ell, and L. A. Webb, the manager of the company, filed a water right with the auditor of Lewis County. The company is to take 1,000 cu. ft. of water from the river at Pe Ell, to be used for electrical purposes. Dams, flumes, pipes, etc., will be constructed to develop the power.

Wisconsin.

The Arpin Lumber Co., Grand Rapids, Wis., has suspended construction work for the winter on the large concrete dam which it is erecting across the Chippewa River, six miles from Couderay. The concrete work is completed, but the gates will not be put in place until next summer. Work will begin in the early spring on the gates and canal. Work on the dam was started in the spring of 1909.

Canada.

✣Bids will be received until noon, Dec. 15, by J. D. McLean, Assistant Deputy and Secretary, Department of Indian Affairs, Ottawa, Ont., for the undermentioned timber to be taken out by Indians of Garden River Reserve, namely: 100,000 ft. B. m., Pine sawlogs: 360,000 ft. B. m., hemlock sawlogs; 10,000 ft. B. m., each of Spruce, Balsam, Birch and Cedar, also 200 cords Hemlock bark to be taken from the 360,000 ft. of sawlogs. Tenders should state the prices that will be paid for each kind of timber and Hemlock bark, delivered, part of the timber on Garden River, Echo River, St. Mary's River, Root River, and the hemlock on the shore, over and above the Crown dues as per tariff. An accepted check drawn on any Canadian chartered bank for the sum of $100 should accompany each tender, which in the event of failure to carry out the undertaking will be forfeited to the department.

✣Bids will be received until 4 p. m., Dec. 19, by R. C. Desrochers, Secy., Department of Public Works, Ottawa, Ont., for fittings, racks, etc. Ottawa Military Store buildings.

✣Bids will be received until noon, Dec. 26, by Chairman of the Building Committee at the office of Darling & Pearson, 2 Leader Lane, Toronto, Ont., Architects, for the erection and completion of a Nurses' Home in connection with the General Hospital.

The Vancouver Dry Dock & Shipbuilding Co., N. Thompson, President, Room 102, 319 Pender St., W., Vancouver, B. C., will next spring commence to build its dock and works at Roche Point on Burrard Inlet, about five miles from the city of Vancouver, where the company has some 7,000 ft. of deep water frontage and 600 acres of land. The financing of this proposition has just been completed in London and the work of clearing land at Roche Point is now under way. Other industries are also arranging to locate here. The company has obtained a subsidy from the Dominion Government for this work, of 3½ per cent yearly for 25 years on $1,250,000, for the building of a steel pontoon dock of a lifting capacity of 15,000 tons. The company has now amalgamated with the Imperial Car, Shipbuilding & Dry Dock Corporation, Ltd.

Mexico.

The Cia de Real del Monte of Pachuca, Mexico, has awarded a contract for the construction of the aerial tramroad which is to connect the Barron mine and intermediate points with the large mill of Loreto in Pachuca to the Pachuca Foundry Co. The tramroad will be about 3½ miles in length. The towers will be constructed throughout of structural steel and the tramroad is to have a capacity of handling 40 tons per hour per day of 10 hours. Work on the excavations for the tower foundations has already been commenced. All the necessary plans have been placed in the hands of the foundry people and the surveys for the line completed by the Real del Monte Co.

Fernando Liceaga has asked for a concession from the Mexican Government granting him the right to use 25,000 liters of water per second from the Santiago River, in the state of Jalisco. The water is to be used in the generation of motive power.

Providing for the erection of new docks at the port of Punta Ensenada, Lower California, a contract has just been agreed upon between the Mexican Department of Communications and Public Works, City of Mexico, with Charles E. Race. Work on the new dock must be begun not later than July 19, 1911.

BRIDGES—STEEL AND CONCRETE

Alabama.

It has again been proposed to replace the old woden trestle of the Traction Co. at the north end of Ripley St., Montgomery, Ala., with a reinforced concrete structure having a roadway, a footway and a portion for car tracks. The cost of the work would be borne by the company and the city.

California.

The Southern Pacific Ry. Co., which early in October was instructed to build a new drawbridge in the west basin of the inner harbor, Los Angeles, to replace the trestle bridge, has applied for an option to construct a bridge of the direct lift type. A hearing was recently held on the matter by Capt. W. F. Stokey, Acting U. S. Engineer of that district.

Advices from Chico, Butte County, Cal., state that efforts will be made to secure permission to open up several streets through the estate of Annie E. K. Bidwell. The work would require the construction of several bridges.

It has been announced that Brig. Gen. Charles E. L. B. Davis, U. S. Engineer, San Francisco, Cal., will probably award a contract to Frederick C. Roberts & Co., 461 Market St., San Francisco, Cal., at $16,100, for furnishing and installing electric machinery on the following drawbridges over the tidal canal, Oakland Harbor, Cal.: Park St. Bridge, Fruitvale Ave. Bridge, High St. Bridge.

Board of Public Works, San Francisco, Cal., has received two bids for regrading Beal St. involving 67,642 cu. yds. of material and constructing a bridge over the same street at Harrison St. Foster & Vogt bid 82.5 cts. per cu. yd. for excavation and $31,997 for constructing bridge; Healy & Tibbets Const. Co., 268 Market St., San Francisco, Cal., 78 cents per cu. yd. for excavation and $38,764 for constructing bridge.

Colorado.

State Engineer C. W. Comstock and Commissioners of Delta County, at Delta, Colo., have awarded a contract to the Pueblo Bridge Co., for the construction of a state bridge two and a half miles west of that city. The structure will have a 190 ft. steel span and 160 ft. of trestle. The contract price was $11,500.

The United States Government has remitted a check to the State of Colorado for $20,617, which is 5 per cent of the receipts for government land disposed of in that state. As customary the amount will be added to the State Bridge and Road fund.

It has been announced by Fred Bullen, Manager of the Pueblo Bridge Co., building the structure over the Arkansas River in Pueblo, that sheet steel cofferdams will be sunk by the company in the bed of the river under the levee walls of the present Union Ave. bridge. Excavators will work until a depth of 10 ft. is reached and if no bed rock is encountered, piling will be driven and concrete piers will be constructed thereon. It is expected that all the necessary steel will be on hand by the last of February, and that work will be pushed through to completion.

Illinois.

The construction of repairs on the old iron bridge over the Mackinaw River in Kansas Township, Woodford County, is being agitated, according to advices from Eureka, Ill. The improvement of the structure which is 260 ft. long, would necessitate an expenditure of about $1,500, and it is believed that, as the bridge is within 30 rods of the Woodford-McLean County line, the counties will do the work jointly.

It has been decided by the Supreme Court of Illinois that Highway Commissioners will no longer be responsible for the reconstruction of bridges along highways which have been removed for the enlarging of the drainage ditches. The matter will now be taken up by the Drainage Commissioners.

City Council of Chicago, Ill.. has under consideration the reconstruction and improvement of 25 bridges according to instructions of the Federal Government. Plans for the following have already been obtained and government permits are in possession of the Commissioner of Public Works: Chicago Ave. bridge, $280,000; Indiana St. bridge, $250,000; Washington St. bridge, $360,000; Thirty-Fifth St. bridge, $260,000; Ninety-Second St. bridge, $325,000. The following bridges are also to be undertaken during 1911 after the approval of the bond issue: Belmont Ave. bridge, $90,000; Lake St. bridge, $400,000; Fuller St. bridge, $175,000; Blackhawk St. bridge, $250,000.

At a meting of the North End Improvement Association, Aurora, Ill., the construction of the proposed Illinois Ave. bridge was discussed and plans considered. It has been decided that the structure will have an 18-ft. roadway and 6-ft. walks, and it is proposed that two-thirds of the cost of the work be paid by the city and the other third by subscription.

Iowa.

✣Bids will be received until December 21, by Carroll County Auditor, Carroll, Ia., for the construction of the substructure and superstructure of all bridges that may be needed during the year of 1911. Peter Stephany is County Auditor.

Items marked thus ✣ indicate work now open for bids.

Information received from Atlantic, Ia., states that the Kimballton Construction Co. has completed all bridges and culverts on the south extension of the Atlantic Northern and Southern Ry. The cost of the work amounted to $26,000.

Kansas.

Howard Everetts, Hutchinson, Kan., has been awarded the contract by the board of Plevan Township, Reno County, Kan., for the construction of a reinforced concrete bridge including a total of 22 cu. yds. of concrete for $277. Bids were opened Nov. 30 at Hutchinson, Kan.

The Leavenworth Bridge Co., Leavenworth, Kan., on December 5, was awarded the contract for the construction of the 40-ft. steel and concrete bridge on Delaware and Fourth Sts. The contract price was $1,414. H. C. Perkins is Engineer.

C. H. Everett, 122 W. 13th St., Hutchinson, Kan., has been awarded the contract by the Board of Haven Township, Reno County, Kan., for the construction of two concrete bridges, one 20 ft. span, two miles from river, plain concrete, $7.75 per cu. yd., reinforced concrete, $13.70 per cu. yd., and one span 12 ft., seven miles from river, for $9, plain concrete, and $14 for reinforced concrete. Bids were opened Nov. 30.

Kentucky.

At a meeting of the Committee of the Whole of Both Boards, Covington, Ky., plans were accepted for the new Willow St. viaduct and instructions given to the City Engineer and Railroad and Bridge Committee to prepare the necessary ordinance for the construction of the viaduct. An ordinance will also be prepared providing for the condemnation of 5 ft. of property on the south side of Willow St. to provide the necessary extra land for the structure. The cost of the improvement is estimated at $20,000.

Louisiana.

The Supreme Court has recently decided that the city of Shreveport, La., has authority over its bridges and streets and that the railroads must repair the Murphy St. viaduct, the structure in question, with concrete, stone or metal, but not wood.

Maine.

The construction of a bridge between Portland and Knightville in South Portland, Me., is being advocated. It is thought that the Boston & Maine, the Maine Central and the Portland R. R. Co. can be induced to take up the matter jointly.

Massachusetts.

The County Commissioners at Fitchburg, Mass., have granted a decree for the extension of Fifth St. for the proposed $100,000 bridge and highway to connect Water and Summer St. sections.

A hearing was held bv the Harbor and Land Commissioners, according to information received from Boston, Mass., on the petition of the New York Central R. R., lessee of the Boston & Albany, for authority to widen its bridge over the Charles River at Cottage Farm, in order that another track may be installed on the structure.

The Highway Committee has voted to recommend to the City Council of Springfield, Mass., that the plan of the bridge submitted by the Berkshire St. Ry. Co., for crossing the Housatonic River at Elm St., be adopted. The cost of the improvement, which is about $5,000, will be borne entirely by the company.

Minnesota.

A resolution has been passed by the County Board of Blue Earth County at Mankato, Minn., for the acceptance of the proposition of the Chicago, Milwaukee & St. Paul R. R. to pay one-third the cost of the construction of an overhead bridge near the Mitchell Crossing, provided the State Highway Commission and private subscription would provide the other two thirds.

The Assembly Committee on Streets, St. Paul, Minn., has reported favorably on a resolution authorizing the city comptroller to set aside from the bridge fund $2,400 for the construction of a foot structure across the railroad tracks at Hamline Ave., near the Northern Pacific Shops.

A delegation of representative business men of Duluth, Minn., at a recent meeting decided against the issuance of $90,000 for the construction of a steel bridge acrcss the Nemadji River at East Fourth St. and favored the construction of a combined trestle and fill, which would cost about $26,000.

Missouri.

The lowering of the grade where the Missouri Pacific Ry. Lexington branch passes under the Main St. bridge in Rock Port, Mo., is regarded as the first step toward replacing the old wooden structure with a modern reinforced concrete bridge.

Advices from St. Louis, Mo., state that the House of Delegates will probably pass a bill instructing the Missouri Pacific R. R. to erect a viaduct over its tracks on Chouteau Ave., between Tiffany and Vandeventer Ave., with the proviso the city bear the damages resulting to abutting property.

Board of Railroad Engineers have promised to submit to the Board of Public Works, St. Joseph, Mo., by December 15, plans and blue prints for the elimination of all grade crossings.

It has been announced by Hugh C. Gilbert, Presiding Judge-Elect of the Jackson County, Independence, Mo., Court, that during the next four years no steel or wooden bridges will be constructed where it is possible to find suitable foundations for stone or concrete structures.

At a recent meeting in the rooms of the Commissioners, Kansas City, Mo., citizens seemed in favor of the construction of the proposed viaduct over the Rock Island and Union Pacific tracks at 18th St. in Armourdale instead of Mill St. as proposed.

Nebraska.

Fifth ward property owners, Omaha, Neb., interested in the construction of a viaduct over the railroad tracks on Paul St. are in favor of changing the site to Nicholas St. as proposed in the past.

New Jersey.

Board of Freeholders, New Brunswick, N. J., recently passed a resolution authorizing the County Collector to issue bonds amounting to $9,000 for repairing the Raritan Landing bridge.

New York.

✤Bids will be received until Noon, December 21, by F. C. Stevens, Superintendent of Public Works, Albany, N. Y., for constructing a highway bridge over the Erie Canal at South Washington St., Rome, Oneida County, N. Y. and completing the same on or before June 1, 1911. Plans may be seen and blank forms for proposals and specifications may be obtained at the office of the superintendent of Public Works, at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division, at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the western division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Special Committee appointed to look into the proposition of acquiring a plaza for an approach to the Brooklyn Bridge from the Brooklyn end, has recommended that the property be taken over by the city in case special legislation can be put through which will place the burden of taxation on the entire borough instead of the abutting property owners.

Citizens of Salamanca, N. Y., have voted to construct a concrete bridge to span the Allegany River at Main St., to replace the present iron structure which has been condemned. The cost of the improvement is estimated at about $70,000.

Ohio.

✤Bids will be received until 11:15 a. m., December 26, by Board of County Commissioners at Ravenna, O., for the construction of a Kreodone floor 18 ft. by 139 ft. 4 in. on the Summit St. bridge over the Cuyahoga River in Kent. Bids must be accompanied with a certified check or cash of $100. J. B. Shewell is County Surveyor.

✤Bids will be received until 11 a. m., Dec. 22, by Board of County Commissioners, Youngstown, O., for the necessary labor and material for the construction of a steel bridge 405 ft. in length over Powers Run on Powers Way in Youngstown township. W. B. Jones is County Auditor.

A plan is now under consideration by Public Service Director, Cleveland, O., for the abolishment of the Union Ave. Grade Crossing. Bonds amounting to $2,000,000 were recently voted to provide funds for the project. It is planned to divert the route of the road between the Belt Line and the Erie R. R., making the distance between the two greater in order that a subway may be built in one instance and a bridge in the other.

A. L. Agate, Elyria, O., has been awarded the contract by the county commissioners at Cleveland, O., for the preliminary works of the High Level bridge to span the Cuyahoga valley. The work will include a series of borings at points on River Road, N. W., and Merwin St., N. W. Bids were opened Nov. 30.

It was decided at the last meeting of the City Council of Napoleon, O., to urge the Commissioners of Henry County to take immediate steps toward repairing the present bridge over the Maumee River or replacing it with a new structure.

Oklahoma.

✤Bids will be received until 9 a. m., December 16, by C. A. Wightman, Engineer, Deep Fork Drainage District No. 1, at the office of the County Clerk, Chandler, Okla., for the construction of about 50 steel bridges. The cost of the work is estimated at $82,000.

✤Bids will be received by the County Clerk, Muskogee, Okla., until 6 p. m., December 28, for the construction of 33 county bridges, 23 of which will be of steel and 10 of concrete. Plans and specifications for the work can be obtained of the County Clerk, W. E. Looper.

Oregon.

✤Bids will be received until Noon, Dec. 30 (instead of Jan. 2 as noted in our last issue), by the Mayor and Executive Board of Portland, Ore., for the construction of the substructure of a bridge over the Willamette River on a westerly extension of Broadway St. in that city. Plans, specifications and bidding papers will be on file in the City Engineer's office at Portland, or may be obtained from Ralph Modjeski, Monadnock Building, Chicago, Illinois, by sending with order a guaranteed deposit check of twenty-five dollars, which amount will be refunded later if papers be returned in good order. L. L. Barber is Auditor of the City of Portland.

The last step toward the completion of the large bridge over the Willamette River at Portland, Ore., was taken Nov. 27, when the large draw span 252 ft. long and 850 tons in weight was placed safely in position ready for operation. The structure is the first of its type in that city.

Plans and specifications prepared by the County Court at Corvallis, Ore., for the construction of the proposed bridge across the Willamette River at that place have been submitted to the War Department of the United States for approval. The bridge, according to the proposed plans, is estimated to require an expenditure of about $55,000.

Pennsylvania.

✤Bids will be received until December 24, by William H. Ford, Arcade Bldg., Philadelphia, Pa., for the superstructure, operating machinery and equipment for a railway and highway Scherzer rolling lift bridge over Great Channel at Stone Harbor, New Jersey, for the South Jersey Realty Co. The bridge is to be a single 1 leaf type railway and highway span 60 ft. center to center of bearings, and includes approximately 146,000 lbs. of structural steel, 24,000 lbs. of track and segmental castings, 9,000 lbs. of machinery and 300,000 lbs. of cast iron and composition in the counterweight. Plans and specifications can be obtained of William H. Ford, the engineer.

Residents of Cambria City, Pa., and Miners-

Items marked thus ✤ indicate work now open for bids.

ville, have prepared an ordinance for submission to the City Council providing for the erection of a new bridge over the Conemaugh River. It is planned to ask the city for an appropriation of $40,000, the county for $25,000 bringing the amount available up to $65,000. As the structure is estimated at $75,000, the balance will be raised by popular subscription.

City officials of Philadelphia, Pa., recently made an inspection trip to the proposed opening of Henry St., from Midvale Ave. to the Falls of Schuykill, where it is proposed to construct a concrete bridge across the Wissahickon Creek, as provided in a bill recently introduced into the Council.

Rhode Island.

At the session of the Board of Aldermen, Providence, R. I., December 1, a resolution was adopted appropriating $16,000 for the repairing of Crawford St. bridge.

South Carolina.

The contract for the construction of the bridge over the Catawba River at Ivey's Mill, 10 miles east of Rock Hill, S. C., between York and Lancaster counties has been awarded to the Roanoke Bridge Co., Roanoke, Va., at $17,800. Other bidders on the work were as follows: Belmont Iron Works, Richmond, $24,378; York Bridge Company, York, Pa., $22,275; Porter & Boyd, Charlotte, $20,750; Carolina Engineering Company, Burlington, N. C., $19,900; Southern Bridge Company, Birmingham, Ala., $18,179; Penn Bridge Company, Pa., $18,000.

Bids were received December 1, at Savannah, Ga., for strengthening abutment to Whale Branch Bridge. R. R. Legare, Beaufort, S. C., will probably be awarded the contract, which includes piling, concrete, excavation. J. De Bruyn Kops, Savannah, Ga., is Engineer in Charge.

Texas.

An agreement, according to advices from Coleman, Texas, has been reached between Coleman and McCulloch counties in regard to the Colorado River bridge question, whereby each county will pay one-half the cost. It has been decided to construct two bridges, one at Waldrop to cost $15,896, and the other at Stacy to cost $21,484.

The County Commissioners, according to advices from Cuero, Texas, have awarded a contract to C. H. Horton, Austin, Texas, at $12,095 for rebuilding the Clear Creek bridge. When completed, the new structure will be 8 ft. higher than the old one.

Washington.

The International Contract Co., Central Bldg., Seattle, Wash., has been awarded the contract for the construction of the drawbridge at Spokane St. The contract price was $30,044. Bids were opened Nov. 11.

It is rumored in Spokane, Wash., that the officials of the North Coast R. R. Co., have awarded the contract for the construction of the bridge over Hangman Creek and the Spokane River west of the city, to the Missouri Bridge & Iron Works, Leavenworth, Kan However, no definite statement has as yet been secured.

A contract was recently awarded by the County Commissioners to Gerrick & Gerrick, Seattle, Wash., for building a bridge at Entiat over the Entiat River. The structure will include 120 ft. span over the river and is estimated to cost $15,000.

West Virginia.

✣Bids will be received until 2 p. m., December 15, by Board of County Commissioners. Wheeling, W. Va., for the construction of a concrete arch bridge over Woods Run, Bethany Pike, Ohio County, W. Va. Plans and specifications can be obtained at the office of the County Road Engineer, A. S. Bell, Room 7, City Bank Bldg., Wheeling, W. Va., or at the office of the Commissioners. Fred H. Frank is Clerk.

ROADS, STREETS AND PAVEMENTS

Alabama.

Elmore County, Ala., will spend $170,000 for good roads. The bonds have been voted and will be offered for sale in January and the work will proceed at once. The Solomon-Norcross Co., Engineers, Atlanta, Ga., have been appointed to layout and supervise the work. Work will begin at once upon the construction of 284 miles of roadways, covering the entire county.

The Department of Roads of Dallas County, Selma, Ala., has awarded the contract for grading and graveling 32 miles of public road to Newell & Bradford, Brown-Marx Bldg., Birmingham, Ala. Bids were opened Dec. 5. W. S. Keller, Selma, Ala., is County Engineer.

Citizens of Elmore County, Wetumpka, Ala., county seat, have asked the board of revenue that the road from Montgomery to Ware's Ferry be completed.

The DeKalb County Good Roads association at a recent meeting held at Decatur, Ala., acted favorably in regard to the proposed election for an issue of $300,000 in bonds for good roads. Fort Payne is the county seat of DeKalb County.

Arkansas.

Woodsmall & McCarthy, Southern Trust Bldg., Little Rock, Ark., have been awarded the contract by the city of Pine Bluff, Ark., for the construction of gravel roads, approximately 10 miles in length for $42,980. Bids were received Dec. 5 by Directors of Road Improvement District No. 3, Pine Bluff.

California.

The Chamber of Commerce of Oroville, Cal., is taking steps to have a portion of the $18,000,000 state bond issue for good roads expended in that section in the building of a state road. The route proposed for the road is from Oroville up the Middle Fork of the Feather river through Butte and Plumas counties, and thence into Lassen and Modoc to the Oregon line.

The Sacremento Automobile Club is advocating the construction of a good road between Sacremento and Davis. Gilbert P. Beere is President of the club.

The Board of Water Commissioners of San Benardino, Cal., has ordered work to be started at once on the road up Reservoir Hill.

The residents of El Dorado County, Placerville, Cal., county seat, are asking for a share of the recently voted $18,000,000 bond issue by the state of California, for the continuation of the Placerville and Lake Tahoe road to the Sacramento Valley, from the present terminus at Smith's Flat.

The South Elmhurst Improvement Club of Elmhurst, Cal., has decided to begin work at once on the macadamizing of Walter Ave. Clara, Louisiana and Bearlin Aves. are also ready for macadamizing.

Florida.

✣Bids will be received until December 23, City Clerk, Fernandina, Fla., for the paving of Center St. from 5th to 11th St. with vitrified brick. Plans and specifications can be seen at the office of G. L. Baltzell, the City Clerk.

✣Bids will be received until 6 p. m., December 21, by City Clerk, St. Augustine, Fla., for grading, curbing and paving Orange St. with either vitrified brick, bituminous or asphalt pavement. Plans and specifications can be seen at the office of John M. Carrera, City Clerk.

The County Commissioners at St. Augustine, Fla., are pushing the work of improving and extending the county roads in St. Johns.

Georgia.

Landscape Gardener E. F. Katzenstein of Atlanta, Ga., has completed specifications for grading in Tatnall square, Macon, Ga., where considerable improvements have been planned by the city council.

The citizens of Hancock County, Sparta, Ga., county seat, have turned down the proposition of issuing bonds to the amount of $50,000 for the construction of good roads.

Illinois.

✣Bids will be received until 11 a. m., Dec. 15, 1910, by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302, City Hall, for paving the following streets and alleys: Ellen St., Lincoln St. to alley S, alley N. of Potomac Ave., alleys E. of N. Robey St., 1465 lin. ft. concrete curbing, 1,900 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete foundation with 2-in. sand cushion and 305 lin. ft. sandstone curbstones on limestone blocks, 30 ft. roadway in Ellen St., 15 ft. roadway in alleys, alley between 47th St. and 48th St., Michigan Ave. and Indiana Ave., 1,200 lin. ft. concrete curbing, 1,200 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base with 2-in. sand cushion, 18 ft. roadway, estimated cost, $3,579.00; alley between south line 42nd St. and north line 43rd Pl., Michigan Ave. and Indiana Ave., 1,190 lin. ft. concrete curbing, 1,180 sq. yds. repressed vitrified paving brick on 6-in Portland cement concrete base with 2-in sand cushion, 18 ft. roadway, estimated cost, $3,365.00; alley between north line 38th St., south line 37th St., State St. and Dearborn St., 1,200 lin. ft. of concrete curbing, 940 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete foundation with 2-in. sand cushion, 14 ft. roadway, estimated cost, $2,783.00; alley between a line 97.5 ft. north of north line of E. 45th St. and 409.5 ft. north of north line of E. 45th St., Evans Ave. and Cottage Grove Ave., 630 lin. ft. concrete curbing, 630 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete foundation with 2-in. sand cushion, 18 ft. roadway, north and south alleys between 26th St. and 28th St., Wabash Ave. and Michigan Ave., 1,610 lin. ft. concrete curbing, 1,830 sq. yds. repressed vitrified paving brick on 6-in Portland cement concrete base with 2-in. sand cushion roadways 16 ft., 22 ft. and 7 ft., estimated cost, $5,435.00; alley, south line of E. 42nd St., north line E. 43rd St., Evans Ave. and Cottage Grove Ave., 1,170 lin. ft. concrete curbing, 620 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete foundation with 2-in sand cushion, 9.5 ft. roadway, estimated cost, $1,985.00; alley E. 42nd St., E. 43rd St., Langley Ave. and Evans Ave., 1,170 concrete curbing, 920 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base with 2-in. sand cushion, 14 ft. roadway, estimated cost, $2,798.00; alleys, E. 41st St., E. 42nd Pl., Drexel Blvd., Ellis Ave., 2,110 lin. ft. concrete curbing, 2,620 sq. yds. repressed virtrified paving brick on 6-in Portland cement concrete base with 2-in sand cushion, roadways 38 ft., 22 ft., 18 ft., 1 new catch basin, 8 old manholes to be adjusted, 1 old catch basin to be adjusted, 9 new covers with iron lids to be furnished, 20 lin. ft. 9 in. tile pipe, estimated cost, $7,820.00; alleys, E. 42nd Pl., E. 43rd St., Ellis Ave. and Berkeley Ave., 970 lin. ft. concrete curbing, 840 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete foundation, with 2-in sand cushion, roadways 12 ft. and 18 ft. estimated cost, $2,552.00; alleys, Bowen Ave., E. 42nd St., Vincennes Ave. and St. Lawrence Ave., 1,100 lin. ft. concrete curbing, 620 sq yds. repressed vitrified paving brick on 6-in.

Portland cement concrete base with 2-in. sand cushion, roadway 12 ft., estimated cost, $1,980.00; alley, E. 35th St., E. 37th St., Grand Blvd. and Vernon Ave., 2,510 lin. ft. concrete curbing, 1,960 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base with 2-in. sand cushion roadway, 14 ft., estimated cost, $5,992.00; alley Woodlawn Ave., Lake Ave. and E. 46th St., 1,400 lin. ft. concrete curbing, 1,170 sq. yds. repressed vitrified paving brick on 6-in Portland cement concrete base with 2-in sand cushion roadway, 14 ft., estimated cost, $3,565.00; alley Hyde Park Blvd., 52nd St., Woodlawn Ave. and Kimbark Ave., 890 lin. ft. concrete curbing, 890 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base with 2-in. sand cushion, roadway 18 ft., estimated cost, $2,661.00; N. Campbell Ave., north line Austin Ave. to southwest line of Grand Ave., with exceptions 1,160 lin. ft. 30 ins. by 5 ins. sandstone curb on limestone blocks, 1,300 cu. yds. earth cutting, 2,500 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base, with 2-in. sand cushion, 365 lin. ft., 12-in. tile pipe sewer, including 125 yds. of rock excavation, 4 new catch basins, 3 new manholes, roadway 38 ft., estimated cost, $8,940.00; Cullom Ave. west line N. Clark St. to east line N. Ashland Ave., 2,060 lin. ft. granite concrete combined curb and gutter on cinders or sand, 400 sq. ft. concrete sidewalk, 1,900 cu. yds. earth cutting, 3,420 sq. yds. asphalt pavement complete on 6-in. Portland cement concrete base, 4 new catch basins, 8 old manholes to be adjusted, 2 old catch basins to be adjusted, 2 new covers with iron lids, 20 lin. ft. of 9-in. tile pipe, 2 cast iron gratings, roadway 32 ft. less gutters, estimated cost, $10,989.00; N. 41st St., north curb line Hirsch St., south line W. North Ave., 2,600 lin. ft. granite concrete combined curb and gutter on cinders or sand, 200 cu. yds. earth cutting, 4,150 sq. yds. asphalt pavement complete on 6-in. Portland cement concrete foundation, 4 new catch basins, 10 old manholes to be adjusted, 11 old catch basins to be adjusted, 2 new covers with new lid, 8 lin. ft. 9-in. tile pipe, 2 cast iron gratings, roadway 30 ft., estimated cost, $12,500.00; Evans Ave., south line E. 43rd St. to north line E. 47th St., except intersections 44th St., 45th St., 46th St., 3,600 lin. ft. granite concrete combined curb and gutter on cinders or sand, 1,250 lin. ft. granite concrete gutters, 80 sq. ft. concrete sidewalk, 8,400 sq. yds. asphalt pavement complete on 6-in. Portland cement concrete foundation, 2 new catch basins, 19 old manholes to be adjusted, 16 old catch basins to be adjusted, 20 new covers with iron lids, 100 lin. ft. 9-in. tile pipe, 4 cast iron gratings, roadway 34 ft., estimated cost, $22,950.00; W. 50th St., west line Ashland Ave. to west line Robey St., 4,560 lin. ft. sandstone curb on limestone blocks, 270 lin. ft. old curbstone to be reset, 650 sq. ft. concrete sidewalk, 2,000 cu. yds. earth filling, 9,110 sq. yds. repressed vitrified paving brick on 6-in. Portland cement concrete base with 2-in. sand cushion, 2 new catch basins, 8 old manholes to be adjusted, 26 old catch basins to be adjusted, 34 new covers with iron lids, 300 lin. ft. 9-in. tile pipe, 26 cast iron gratings, roadway 30 ft., estimated cost, $28,361.00; W. 52nd St., west line Loomis St. to east line S. Ashland Ave., 2,660 lin. ft. granite concrete combined curb and gutter on cinders or sand, 300 sq. ft. concrete sidewalk, 4,510 sq. yds. asphalt pavement complete on 6-in. Portland cement concrete base, 3 old manholes to be adjusted, 12 old catch basins to be adjusted, 3 new covers with iron lids, 50 lin. ft. 9-in. tile pipe, 12 cast iron gratings, roadway 30 ft., estimated cost, $12,500.00; W. 53rd St., west line S. Ashland Ave. to east line S. Robey St., except intersections 4,540 lin. ft. sandstone curb on limestone block, 20 sq. ft. concrete sidewalk, 1,500 cu. yds. earth filling, 7,600 sq. yds. repressed vitrified paving bricks on 6-in. Portland cement concrete foundation with 2-in. sand cushion, 12 old manholes to be adjusted, 12 new covers with iron lids, 40 lin. ft. 9-in tile pipe, 4 cast iron gratings, roadway 30 ft., estimated cost, $23,500.00; Fleetwood St., W. North [illegible] west line of Elston Ave., except intersections, 2,350 lin. ft. sandstone curb on limestone blocks, 450 cu. yds. earth cutting, 4,860 sq. yds. repressed vitrified paving brick on 6-in Portland cement and concrete base with 2-in. sand cushion, 1 new catch basin, 12 old manholes to be adjusted, 9 old catch basins to be adjusted, 4 new covers with iron lids, 8 lin. ft. 9-in. tile pipe, 4 cast iron gratings, roadway 34 ft., estimated cost, $13,488.00; N. Hamlin Ave., south curb line Dickens Ave. to south line Fullerton Ave. produced except intersections, 4,120 lin. ft. granite concrete combined curb and gutter on sand or cinders, 2,300 cu. yds. earth cutting, 6,590 sq. yds. asphalt pavement complete on 6-in. Portland cement concrete base, 10 new catch basins, 16 old manholes to be adjusted, 18 old catch basins to be adjusted, 4 new covers with iron lids, 20 lin. ft. 9-in tile pipe, 10 cast iron gratings, roadway 30 ft., estimated cost, $19,500.00. All Portland cement concrete bases to be composed of 1 part cement, 3 parts sand and 6 parts stone, all joints in brick pavement to be filled with coal tar and surface dressed with ½ in of sand, all asphalt pavement to be swept with natural hydraulic cement.

C. H. Degenhardt has been awarded the contract in Alton, Ill., for the paving of 17th St., from Liberty to Henry and of Forest Ave., from 17th to its terminus for $1.19 per yd., and $.50 for curbing and guttering.

Ordinances have been prepared for the paving of State and Elm Sts., in Alton, Ill., and for paving the alley in the rear of 3rd St., from the middle of the block between Ridge and Henry to Oak St.

County Surveyor O'Brien and the Urbana Highway Commissioners, Urbana, Ill., have surveyed the route of the new road, to run from Cunningham Ave., to near the Blackberry school house. It will be necessary to build a bridge with a 54-ft. span over the drainage canal.

Indiana.

✣Bids will be received until 1 p. m., Jan. 2, by Board of County Commissioners, Williamsport, Ind., for the construction of a gravel road on the line between Pike and Steuben townships, in Warren County. Robert L. Winks is Auditor.

✣Bids will be received until 1 p. m., Dec. 29, by Board of County Commissioners, Bluffton, Ind., for the construction of four gravel roads in Wells County. O. D. Garrett is Auditor.

Peck & Taber have been awarded the contract for the construction of a macadam road in Washington Township for $12,809 by the County Commissioners, Peru, Ind. Bids were opened Dec. 6.

The County Commissioners at Peru Ind., have awarded H. C. Modlin & Co. contracts for the construction of two gravel roads in Washington Township for $5,979 and $5,450. Bids were opened Dec. 6.

The Commissioners of Scott County at Scottsburg, Ind., have awarded the contracts for the construction of gravel roads in Lexington township as follows: Robt. W. Peacock, Austin, Ind., $17,304; C. C. James, Lexington, Ind., $4,701, and J. H. Cortner, Scottsburg, $3,372. Bids were opened Dec. 5.

The County Commissioners at Kokomo, Ind., have awarded the contract for the construction of N. P. Bogus gravel road to Neis & Co., Frankfort, Ind., for $4,027, and for the construction of Rhinehart macadam road to W. F. Smith & Co., of Rensselaer, Ind., for $4,770. Bids were opened Dec. 7.

Geo. Sewell, Laketon, Ind., has been awarded the contract by the County Commissioners at Wabash, Ind., for the construction of a gravel road in Paw Paw township for $5,380.

A. F. Hipskind of Wabash, Ind., has been awarded the contract by the county commissioners at that city for the construction of a gravel road in Noble township for $18,230. Bids were opened Dec. 6.

W. W. Crane of Hedrick, Ind., has been awarded the contract by the County Commissioners at Williamsport, Ind., for the construction [illegible] township for $5,000. Bids were opened Dec. 5.

According to advices from Rensselaer, Ind., it is proposed to build a new gravel or stone road from Baum's Bridge south, through Wheatfield, Walker and Barkley townships, to give a direct route from Indianapolis and Lafayette to Chicago. The townships north of the Kankakee river in Porter county are planning to build new macadam roads from the river to Kouts.

George B. Lynch of Darlington, Ind., has been awarded the contract by the County Commissioners at Crawfordsville, Ind., for the improvement of John B. Layne et al. stone road for $7,699. The work includes grading, graveling and draining. Bennet B. Engle is County Auditor. Bids were opened Dec. 6.

The County Commissioner of Putnam County, Greencastle, Ind., have awarded the contract for the construction of a gravel road, 13,957 ft. long, in Jackson and Franklin townships to A. G. Day of Greencastle for $6,500. Bids were opened Dec. [illegible]

Iowa.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for the necessary labor and material for the construction of pavement on 14th St. from the east line of Pearl St. to the west line of Jackson St. The roadway will be of 5-in. concrete.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for furnishing the necessary labor and material for the paving of 6th St. from east line of Nebraska St. to the west line of Jackson St. with 5-in. concrete corrugated. The work must be completed before August 1, 1911.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for furnishing the necessary labor and material for the construction of 5-in. concrete pavement on 8th St. from the east line of Douglas St. to the west line of Nebraska St. and with 5-in. concrete corrugated from the east line of Nebraska St. to the west line of Jackson St. E. O. Wesley is Superintendent of Streets and Public Improvements.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for the paving of 13th St. from the east line of Douglas St. to the west line of Pierce St. with 5-in. concrete corrugated, and from the east line of Pierce St. to the west line of Jackson St. with 5-in. concrete. E. O. Wesley is Superintendent of Streets and Public Improvements.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for furnishing the necessary labor and material for the paving of 14th St., from the east line of Pearl St. to the west line of Jackson St. with 5-in. concrete and with cement curbs for the east line of Nebraska St. to the west line of Jackson St. E. O. Wesley is Superintendent of Streets and Public Improvements.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for furnishing the necessary labor and material for the paving of 12th St. from the east line of Pearl St. to the west line of Douglas St. with 5-in. concrete corrugated; and from the east line of Douglas St. to the west line of the alley between Douglas and Pierce Sts. with 5-in. concrete corrugated; and from the west line of the alley between Douglas and Pierce St. to the west line of Pierce St. with five 5-in. concrete corrugated, and from the east line of Pierce St. to the west line of Jackson St., with five 5-in. concrete, in accordance with plans and specifications prepared by the city engineer and on file in the office of the city clerk.

✣Bids will be received until 9 a. m., Dec. 17, by City Clerk, Sioux City, Ia., for furnishing the necessary labor and material for the paving of 6th St. from the east line of Nebraska St. to the west line of Jackson St. with 5-in. concrete corrugated. E. O. Wesley is Superintendent of the Streets and Public Improvements.

The City Council of Oelwein, Ia., has decided to do considerable amount of paving this coming year. The amount decided upon is as follows: N. Frederick St., from bridge to 8th St.; 1st Ave. east, from E. Charles St., to 7th St.; E. Charles St., from Rock Island Ry. tracks to 7th Ave.; South Frederick St., from Great Western main tracks to 8th St.

The Commercial Club of Eddyville, Ia., is agitating a movement for the construction of the proposed river to river road via Eddyville. George Hartman is President of the club.

Kansas.

Business men of Wichita, Kan., at a recent meeting adopted resolutions requesting the city council to call election for property owners to vote on the issuance of $60,000 in bonds for street paving.

Louisiana.

The Board of Port Commissioners, New Orleans, La., has awarded the contract for paving on river front from Thalia to Bienville St., with small granite blocks on concrete foundation to Grasser Contracting Co., of New Orleans for $56,457. Bids were opened Nov. 29.

The Finance Committee of the city council of New Orleans, La., has approved the following bids for improvements in connection with paving: Installing subsurface drainage, culverts, curbs, etc., in connection with the paving of Rendon St., from Dumaine to De Soto, Standard Paving and Construction Co., $6,234; subsurface drains, culverts, etc., in connection with the paving of the lake side of Claiborne St., from Esplanade to Elysian Fields, Barber Asphalt Co., $15,542; subsurface drains, culverts, etc., in connection with the paving of Octavia St., from Freret to Robertson, Barber Asphalt Co., $4,247; paving Octavia St., from Freret to South Robertson, Barber Asphalt Co., $2,448; paving lake side of Claiborne St., from Esplanade to Elysian Fields, Barber Asphalt Co., only bidder, $44,269; paving Rendon St., from Dumaine to De Soto, Standard Paving and Construction Co., $13,004.

The Board of Aldermen of Opelousas, La., has awarded the contract to lay 10,600 ft. of concrete sidewalk and 2,200 ft. of concrete curb on the west side of Liberty St., to Kelley & Jones.

Minnesota.

The City Council of Crookston, Minn., has passed resolutions providing for the paving of Houston Ave., and three other streets with Westrumite instead of asphalt. The paving contemplated for next year will cost between $50,000 and $75,000.

Mississippi.

On Dec. 3 the First Beat of Copiah County, Hazlehurst, Miss., county seat, voted in favor of issuing bonds in the sum of $75,000 for the improvement of roads. I. N. Ellis, H. J. Wilson and Melville Ramsey have been appointed road commissioners. It is expected that work will be started within a few months.

J. B. Silves & Son of Alliance, O., have been awarded the contract by the city of Gulfport, Miss., for the construction of approximately 10,000 sq. yds. of cement sidewalks for $.94½ per yd. Bids were opened Dec. 6 by Louis M. Hudson, Street Commissioner.

Missouri.

The 365 Day Road Association has been formed in Carthage, Mo., by automobile and business men of that city, with 125 men subject to monthly assessment to create a fund to better the 329 miles of gravel roads of the county and build new ones.

New Jersey.

A petition has been received by the Board of Freeholders of Middlesex County, from property owners in Madison township, New Brunswick, N. J., county seat, asking that a piece of road between the Old Bridge and Englishtown road be graveled so as to make one continuous gravel road between Monmouth and Middlesex counties.

The Hudson County Boulevard Commission of Jersey City, N. J., has been organized. John Haas is chairman, John D. O'Gorman, secretary, and John Sweeney, clerk.

Van Kueren & Son have been awarded the contract by the board of Works of Newark, N. J., for grading, curbing and flagging Carlisle and Clay Sts., for $5,041

New York.

✣Bids will be received until 11 a. m., Dec. 21, by Alfred E. Steers, President of the Borough of Brooklyn, New York city, for 18 street paving contracts, the largest being No. 1, as follows: For regulating, curbing and paving with asphalt on a concrete foundation the roadway of Blake Ave., from Van Siclen Ave. to Logan St., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 14,084 sq. yds. asphalt pavement (five years' maintenance): 1,969 cu. yds. concrete for pavement foundation; 1,030 lin. ft. new curbstone, set in concrete; 5,840 lin. ft. old curbstone, reset in concrete. The time allowed for the completion of the work and the full performance of the contract is 40 working days. The amount of security required is $9,000.

✣Bids will be received until 2 p. m., Dec. 19, by George McAneny, President of the Borough of Manhattan, New York city, for regulating and paving with asphalt block pavement on concrete foundation the roadway of 176th St., from Amsterdam to Audubon Ave. The engineer's estimate of quantities included is: 1,310 sq. yds. of asphalt block pavement; 260 cu. yds. of Portland cement concrete; 500 lin. ft. of new bluestone curbstone furnished and set; 30 lin. ft. of old bluestone curbstone, redressed, rejointed and reset; 3 noiseless heads and covers for sewer manholes furnished and set; 2 noiseless heads and covers for water manholes furnished and set.

The U. S. Wood Preserving Co., 165 Broadway, New York City, has been awarded the contract in that city for furnishing and delivering wood paving blocks to 3rd Ave., 145th St., and City Island bridges for $12,956. Bids were opened Dec. 6 by Kingsley L. Martin, Commissioner of Bridges, Department of Bridges.

The Town Board of Alexandria Bay, N. Y., has been petitioned for a new highway in the town, to run along the west side of Otter creek across the lands of William Norton to the property of Henry Archer, Frank Lee, William Estes and others.

A club is to be formed by the automobile owners of Sodus, N. Y., to work in conjunction with the state association for the furtherance of the good roads movement. Especial effort will be put forth by the club for the building of the proposed state road from Oswego to connect with the improved road from Union Hill to Rochester. Attorney H. L. Kelly of Sodus is interested.

Ernest Woods has been awarded the contract by the board of contract and supply of Syracuse, N. Y., for grading Thomas St., from Manlius to Kline for $3,895

North Carolina.

The municipal and commercial bodies of Raleigh, N. C., are adopting resolutions calling on the U. S. government to establish and maintain an adequate improved driveway from the city out to the National cemetery, one mile from the corporate limits.

Ohio.

✣Bids will be received until 10 a. m., Dec. 20, by County Commissioners, Woodsfield, O., for the grading and macadamizing of one mile of road in Canton Township in Monroe County. The cost of the work is estimated at $8,375. James C. Wonders, Columbus, O., is State Highway Engineer.

✣Bids will be received until noon, Dec. 22, by Director of Public Service, Cincinnati, O., for furnishing and delivering f. o. b. cars at Cincinnati, O., five or more two-horse flushing machines for street cleaning purposes. John J. Wenner is Clerk.

✣Bids will be received until noon, Jan. 6, by Board of County Commissioners, Cincinnati, O., for the improvement under Specifications No. 32, of the Dick Road from Howard's Creek, to the Oxford Road in Crosby Township. Fred Dreihs is Clerk.

The County Commissioners at Cincinnati, O., have awarded the contract for the improvement under Specifications No. 110, of North Bend Road from Harrison pike of north corporation line of village of Cheviot in Green Township to R. E. Cash, 115 Ehrman Ave., Cincinnati, for $11,177. Bids were opened Dec. 2.

R. Deckard & Son of Bowling Green, O., have been awarded the contract by the city council of the village of Linden Heights, O., for the construction of approximately 190,000 sq. ft. of flagstone sidewalks for $.12¾ per sq. ft. Bids were opened Dec. 5.

Thomas H. Gibbons of College Corner, O., has been awarded the contract by the commissioners of Union County, Liberty, Ind., for the construction of a gravel road in Center township for $2,810. The work includes grading, draining and paving with broken stone. Bids were opened Dec. 5.

Baldwin Bros., Cleveland, O., have been awarded the contract by Cumings & Downer, C. E., of Painesville, O., for grading the subdivision site, Wickliffe, Lake County, O., for the Cleveland Crane & Engineering Co., of Wickliffe. The work will include the excavating and spreading of about 11,310 cu. yds. of earth and the grading of a new road, and will cost $.23 per cu. yd. Bids were opened Nov. 30.

The Village Council of Genoa, O., has passed an ordinance providing for the paving of streets and the installation of sewers.

The County Commissioners at Urbana, O., will soon award the contract for building the new stone road north out of St. Paris one mile into Johnson township.

The City Council of Canton, O., has passed resolutions to improve Arch St. and Bluff St., by grading and for the paving of Logan Ave., from Lake St. to Aultman Ave.

A petition is being circulated by the property owners on North D St., in Hamilton, O., asking for the paving of that street.

Director L. A. Thorp of Painesville, O., according to information from that city, states that in the near future plans would be discussed as to the advisability of paving Main St., Walnut St. between St. Clair and State, and State St. from Walnut St. to the Nickel Plate R. R.

The City Council of Montpelier, O., has passed a resolution directing that a survey of Empire St., from the depot to Main St., and Main St., from Monroe St. to the fair ground be made and that a grade be established and plans and specifications for paving be made.

Property owners of Youngstown, O., recently held a meeting and passed a resolution to ask for the macadamizing of the state road from Tibbetts Corners to the Howland township line. The road runs from Cleveland to Pittsburg and is known as the Federal road in Youngstown.

The City Council of Norwood, O., has decided to hold an election Jan. 24 to vote on the issuing of $18,000 worth of bonds to pay for resurfacing all macadam streets in the city, and $6,000 for oiling streets.

City Engineer George W. Tonson of Toledo, O., has estimated the cost of repaving Cherry St., between Summit and Bancroft at $45,220. The total number of feet to be paved is 6,000 and it is estimated that if asphalt, asphalt block or bitulithic is used the cost will be $2.50 per ft.

The Council Committee of Streets, Cincinnati, O., has decided to recommend to the city council that Walter Ave., Walnut Hills, be paved with wood block.

The City Council of Youngstown, O., has decided to repave Market St., from the viaduct to Warren Ave.

The City Council of Girard, O., has passed a resolution providing for the paving of State St.

Oklahoma.

The City Council of Pawhuska, Okla., has let the contract to Howard Walton of Coffeeville, and E. A. Hanna of Ochelta for the construction of more than $100,000 worth of paving. The price is $2.33 per sq. yd. for cement base, vitrified brick and asphalt filler, with $.65 per yd. for curb and gutter.

✣Bids will be received until December 20, by T. C. Hughes, City Engineer, Tulsa, Okla., for the construction of seven miles of brick and asphalt pavement.

Oklahoma County has voted five hundred thousand dollars for the construction of county roads leading east and west and north and south of Oklahoma City. It is the plan to construct these roads up to date in every respect, but the plans and specifications are not yet completed neither is the route of the road definitely determined. However, the preliminary work is progressing rapidly and it is hoped within 90 days to be able to have some definite information about this work. W. C. Burke is City Engineer of Oklahoma City.

Oregon.

Advices from Metolius, Ore., state that Nelson Bros., Oregon Trunk line contractors, have accepted a contract for grading 10 miles of streets in that town.

The City of Portland, Ore., will sell bonds Dec. 14 in the sum of $50,000 for the purchase, construction and installation of incinerating plants. A. L. Barbur is City Auditor.

The Street Committee of the City Executive Board of Portland, Ore., has awarded contracts for the improvement of 27 streets at a cost of $267,456, as follows: E. 40th St., from Hawthorne Ave. to E. Taylor, Hassam pavement, Oregon Hassam Paving Co., $7,252; E. Glisan St., from Union to Grand, Hassam pavement, Oregon Hassam Paving Co., $2,264; Emerson St., from Kerby to Patton, Hassam pavement, Oregon Hassam Paving Co., $24,484; Oberlin St., from Portsmouth to Van Houten, grading, R. J. Debuhr, $174; Klickitat St., from E. 7th to Union, asphalt pavement, Elwood Wiles, $6,013; E. Burnside St., from E. 74th to E. 82d, grading and concrete curbs and walks, G. K. Howlitt, $5,306; California St. district, filling and curbs and walks, Joplin & Meeks, $1,373; Constance St., from Union to E. 17th, bitulithic pavement, Warren Construction Co., $5,796; Princeton St., from Portsmouth to McKenna, grading and concrete curbs and walks, R. J. Debuhr, $4,265; E. Lincoln St. district, grading and curbs and walks, Giebisch & Joplin, $3,900; E. Market St., from E. 34th to Glenn, asphalt pavement, Barber Asphalt Paving Co., $4,404; Parkside Drive, bitulithic pavement, Warren Construction Co., $5,489; Spokane Ave., from E. 19th to E. 23d, grading and concrete curbs and walks, Giebisch & Joplin, $3,038; Claybourne Ave., from E. 34th to Milwaukie, grading and concrete curbs and walks, Giebisch & Joplin, $2,318; Skidmore St., from Maryland to Court, bitulithic pavement, Warren Construction Co., $13,830; E. 61st St., from E. Stark to E. Burnside, grading and concrete curbs and walks, G. K. Howlitt, $3,642; E. 12th St., from Tillamook to Thompson, bitulithic pavement, Warren Construction Co., $4,347; E. 69th St., from E. Yamhill to E. Taylor, grading and concrete curbs and walks, G. K. Howlitt, $484; E. 13th St., from Killingsworth to Ainsworth, grading and concrete curbs and walks, Giebisch & Joplin, $4,282; E. 28th St., from Francis to Cora, grading and concrete curbs and walks, Stevens Bros., $2,836; E. 27th St. district, bitulithic pavement, Warren Construction Co., $139,363; E. 26th St., from Alberta to Killingsworth, grading and concrete curbs and walks, Giebisch & Joplin, $4,049. E. 32d St., from Alberta to Prescott, grading and concrete curbs and walks, Giebisch & Joplin, $4,428; Union Ave., from E. Salmon to Belmont, fill and macadam roadway, Oregon Independent Paving Co., $11,350; E. Washington St., from E. 27th to E. 30th, grading and concrete curbs and walks, Giebisch & Joplin, [illegible]

Pennsylvania.

The City Council of Harrisburg, Pa., on Nov. 28, let contracts for the paving of streets as follows, M. B. Cowden, City Engineer: The Barber Asphalt Co., 40 streets, 58,922 sq. yds., for $119,800; Central Construction Co., 12 streets, 19,330 sq. yds., for $40,000. Granite curbing is included in nearly every case. The paving of Hop St., and of Forrest, from 5th St., to 6th St., were not awarded

Tennessee.

The Memphis-Bristol Highway Commission has been organized to put into effect the plan for building a highway across the state. The following officers have been elected: W. M. Casetty, President; A. W. Willis, Vice-President; George A. Gowan, Secretary-Treasurer; Hamilton Parks, Attorney.

Texas.

The City of Houston, Tex., will sell bonds Jan. 9 to the amount of $100,000 for street paving. H. B. Rice is Mayor and Dan C. Smith, Jr., City Secretary.

At a recent meeting of the Cross Plains Townsite Co., Cross Plains, Callahan County, Tex., the directors authorized the grading of 10 miles of streets in the new townsite. The main streets are to be 110 ft. wide and will be graveled. The other streets will be 8 ft. wide.

The City Council of Hillsboro Tex., has closed a contract with Civil Engineer E. L. Dalton of Dallas, Tex., to superintend the paving of the court house square and the streets of the city within the fire limits, for which an issue of $40,000 of street improvement bonds were recently sold. The work of paving will probably begin early in the spring.

The County Commissioners at Crockett, Tex., have purchased four road building and working machines for use in building and improving the roads in the county.

The Ten Thousand Club of Smithville, Tex., has appointed a committee to look into the matter of calling a bond election for good roads in that precinct.

The Magnolia Park Land Co. of Houston, Tex., has awarded contract for clearing and grading 7½ miles of streets in Magnolia Park to R. L. Armstrong and M. C. Otto, of Houston. The former will clear the streets of 1,849 stumps and other obstructions, and the latter will grade, gutter and lay culverts, etc. Work is to begin at once. The excavation work amounts to 2,573 cu. yds., and 40,639 lin. ft. of grading, and upward of 50 tile and metal culverts will be put in.

The Board of Municipal Commissioners of Dallas, Tex., has accepted the bid of the Texas Bitulithic Co., for paving Grand Ave., from Ervay to Holmes St., and Holmes from Grand to Pennsylvania at $2.30 per sq. yd.

The Alvin Business League of Alvin, Tex., plans to connect Houston and Alvin with three shell and gravel roads in the near future. One road as planned will go west from Alvin, passing through Manvel, Arcola and [illegible] Another will go north from Alvin through Alvin Heights, passing three miles west of Pearland and meeting the Harris County-Chocolate Bayou road near Clear Creek. The third road would be the completion of the Houston-Alvin road, shelling to the Harris county line. Plans and blueprints for these roads have been prepared.

The city of Canadian, Tex., held an election Dec. 8 to vote on the proposition of issuing bonds for street improvements.

The city of Dallas, Tex., has voted the is- [illegible] permanent street pavements.

Virginia.

According to advices from Norfolk, Va., the street committee of the city council is outlining plans for the paving of Effingham streets carried south to Columbia or South St., instead of stopping at Hight St.

An election will be held in Smith County, Marion, Va., to vote on the proposition of issuing bonds in the sum of $50,000 for improving roads in Rich Valley District. Election Dec. 22.

An election is to be held in Scott County, Gate City, Va., Dec. 14, to vote on the proposition of issuing bonds to the amount of $300,000 for road improvements.

Lee County, Jonesville, Va., has voted the issuance of bonds to the amount of $364,000 for the construction of good roads.

Washington.

John L. Stanley has been awarded the contract in Seattle, Wash., for grading and constructing wood curb and gutters and concrete sidewalks on 32nd Ave., south and Washington St., for $2,710. Bids were opened Nov. 11 by C. B. Bagley, Sec'y, Board of Public Works.

J. A. Zinkan has been awarded the contract in Seattle, Wash., for grading Washington St., and 31st St., south for $3,042. Bids were opened Nov. 11 by C. B. Bagley, Secy. Board of Public Works.

Andrew Peterson & Co. have been awarded the contract in Seattle, Wash., for grading and curbing E. 47th St., et al. for $13,651. Bids were opened Nov. 11 by C. B. Bagley, Secy. Board of Public Works.

The Commercial Club of Tacoma, Wash., has formed the Pierce County Good Roads Association for the purpose of promoting and educating a public sentiment in favor of the construction, care and maintenance of good city, county and state roads. Frank N. McCandless, Tacoma, is President, and H. E. Post of Tacoma is Secretary and Treasurer.

Steps have been taken by the Improvement Club of Waitsburg, Wash., toward paving Main St., from 3rd St., north to Main St. bridge.

The Seattle Commercial Club of Seattle, Wash., is considering the proposition to amend the constitution so as to enable the state to issue its bonds for a comprehensive scheme of road building.

Canada.

According to advices from Victoria, B. C., Hon. Thomas Taylor, Minister of Public Works, proposes a scenic trunk road from the Pacific to Winnipeg, going through British Columbia, Alberta, Saskatchewan and Manitoba.

WATER-WORKS AND SEWERAGE

Alabama.

The Board of Public Works of Mobile, Ala., has inspected the territory forming the first district with the idea of extending the water and sewer systems of the city. The board has ordered the improvement and it is estimated that it will cost more than $250,000.

The city of Mobile, Ala., has sold bonds to the amount of $117,000 for improving Broad St., and bonds to the amount of $29,000 for paving and improving Water St., south from Eslava to Texas.

The town of Wetumpka, Ala., has employed the Solomon-Norcross Co., Engineers, Atlanta, Ga., to make a betterment report on their present water works and [illegible] plans for a sewer system.

Arkansas.

J. K. Riffel is planning a new sewer district for the territory between 25th and 27th Sts., and between Park Ave. and the county hospital grounds in Little Rock, Ark.

✣Bids will be received about the first of the year by the City of Corning, Cal., for the construction of water works and sewer system. The estimated cost of the work is $69,000. W. F. Lunning, Red Bluff, is Engineer.

Engineers Haviland and Tibbets of Oakland, who recently prepared plans and will supervise the building of the new sewer system for Oroville, Cal., have been asked by the city trustees to make some changes in the plans.

The city of Covina, Cal., voted Nov. 29 on the proposition of issuing bonds to the amount of $70,000 for the construction of a sewer system and a municipal building.

The City Engineer of Oakland, Cal., has been instructed to prepare plans for the sewering of the Allendale district under the Vrooman 10-year bond act.

According to advices from Stockton, Cal., 93 towns and cities of California will contribute to the grand total of $4,126,866, which it is estimated will be spent in the state this year for sewers and better water. An analysis of the data compiled by the State Engineer Inspector results in the following tabulations: The total probable expenditure in the State for sewers and better water will amount to $4,126,886 by the end of the year. A total of $917,094 has already been voted on for new sewers and disposal plants and $838,772 for extensions and improvements of established sewer systems. The cost of proposed sewers yet to be voted on is estimated at $1,225,300. This makes a total probable expenditure for sewers of $2,981,166. Bonds for new water systems have been voted on to the amount of $846,000 and there are planned expenditures estimated at $300,000, or a total probable expenditure of $1,146,000.

General Manager Atwood of the Land & Water Co., of Yucaipa City, Cal., is having plans prepared for the extension of the existing water system, as soon as the rains make the ground workable.

Plans are being prepared by Dickinson & Watkins, State Bank Bldg., Little Rock, Ark., for the construction of a new water system for Portland, Ark., estimated to cost $35,000. The work will include elevated tank, pumps, compressors, fire hydrants, pipes, valves, etc., for complete system. The water supply will be secured from deep wells. The contract will be let in 60 or 90 days.

Colorado.

The City Council of Colorado Springs, Colo., has established a sanitary sewer district. The estimated cost of the improvement is $9,156.

Mayor Avery of Colorado Springs, Colo., is reported to have stated that plans have been prepared for the increasing of the water storage system of that city by nearly 500,000,000 gals., at a cost of $80,000. Five of the mountain resevoirs are to be made larger.

The Denver Union Water Co., Denver, Colo., of which D. H. Moffat is President, contemplates making new extensions and completing those begun, so as to increase the water supply. The company, it is said, will expend $350,000 on these improvements. The first will be the building of a 48-in. conduit from Platte canon to Marsden Lake, a distance of about 11 miles. The company then will extend the 40-in. line from where it now ends, a distance of about two miles, to the Ashland Ave. reservoir, then a 30-in. conduit running from Platte canon reservoir to the High Line ditch, then extensions in the Capitol hill district down Speer blvd., construction of the main conduit from University Ave. to Logan and 12-in. mains on Fourth Ave. and Humboldt St., to Washington St., with six and 12-in. mains intersections.

The city council of Golden, Colo., has passed an ordinance for the north side sanitary sewer district, which embraces all that part of the city north of Clear Creek.

District of Columbia.

✣Bids will be received until 2 p. m., December 19, by Commissioners of the District of Columbia, Washington, D. C., for the construction of sewers in the District.

Georgia.

✣Bids will be received about the latter part of January by W. J. Marshall, R. F. D. Lizell, Ga., for the construction of water works and electric light plant for the town of Roberta, Ga. The work will include rock and cement dam, dynamo to generate electricity, pump to supply tank with water, piping and wires.

The election which was to be held in Marietta, Ga., on Dec. 1, to vote on the authorization of issuing bonds for sewer extension and improvements, was called off on account of the small registration.

The citizens of Rome, Ga., voted Dec. 6 on the proposition of issuing bonds to the amount of $275,000 for the improvement of the sewerage and water systems, the building of new school houses, and additional street paving.

The citizens of Dublin, Ga., on Dec. 6 voted the issuance of bonds to the amount of $30,000 for the improvement of the light and water plant and to pave streets.

The City Council of Macon, Ga., contemplates placing a bond issue of $1,000,000 for the purchase of the present water system in Macon and extending, enlarging and improving. The Board of Arbitration has fixed the price of $699,000 for the water system.

Idaho.

Boise City, Ida., solds bonds Dec. 2 in the sum of $12,530 for the construction of lateral sewer district No. 108. Emily L. Savidge is City Clerk.

Illinois.

✣Bids will be received until Dec. 15 by the Board of Local Improvements, Lombard, Ill., for a water distribution system including cast iron pipe, hydrants, valves, valve boxes, connections, etc. George W. Sturtevant, Fisher Bldg., Chicago, Ill., is Engineer.

✣Bids will be received until 8 p. m., December 20, by R. J. Welch, Village Clerk, Franklin Park, Ill., for the construction of 5¾ miles of water mains from 4 to 10-in. in diameter. H. L. Emerson, 1118 Chamber of Commerce Bldg., Chicago, Ill., is Engineer.

✣Bids will be received until 11 a. m., December 21, by Board of Public Works, Chicago, Ill., for furnishing the labor and material for cleaning and tuck pointing of walls of the Harrison St. Pumping Station. A certified check for $100, payable to B. J. Mullaney, Commissioner of Public Works, must be filed with each bid.

The Board of Local Improvements of Bloomington, Ill., has adopted the Engineer's estimate for the work of extending the Orchard Lane sewer from its present outlet to the eight ft. sewer at Stillwell St.

The Board of Local Improvement of Carlinville, Ill., has let the contract for the sewer on the east end of First South St. to the Castle Improvement Co., of that city. The sewer will be of tile and will run on each side of the street in the boulevard, beginning near the residence of C. W. Vankirk, and terminating at the east end of First South St.

Sanitary Engineer Langdon Pearse, in charge of the experimental station for disposing of sewage at 39th St. and the lake, Chicago, Ill., speaking before the Neighborhood Club of River Forest, a suburb of Chicago, advocated the establishment of a system for the purification of the sewerage water in the Des Plaines River, where it runs through River Forest, Forest Park, Maywood and Riverside. The cost of such a system for purifying the water of these four villages should not exceed $100,000.

The proposition of issuing $20,000 bonds to construct a dam spillway and reservoir and to extend the water mains and water works of McLeansboro, Ill., carried Dec. 1.

Jno. Mohr & Sons, 349 W. Illinois St., Chicago, Ill., were low bidders for furnishing new boiler tubing to the Chicago Ave. pumping station, Lincoln Park Blvd. and Chicago Ave., at $0.19 per lin. ft. B. J. Mullaney is Commissioner of Public Works.

Indiana.

Engineer E. E. Watts, 105 S. Main St., Princeton, Ind., has submitted plans for a sewerage system for the town of Jasper, Ind. The estimated cost of the improvement is $25,000.

The contract for constructing the Virginia St. sewer in La Porte, Ind., has been awarded to William Reinhart for $2,023. The sewer runs on Virginia Ave. from Rumely to Lawrence St., on Lawrence St. from Virginia Ave. to Ohio St., and on Norton St. from Virginia Ave. to Ohio St. The specifications call for 850 ft. of 24-in. sewer, 310 ft. of 12-in. sewer and 310 ft. of 10-in. sewer.

Kansas.

✣Bids will be received until 7:30 p. m., Dec. 20, by Ray B. Roberts, City Clerk, Peabody, Kans., for the necessary labor and material for an extension of present water works system. Bids must be accompanied by a certified check payable to City Treasurer, for $400. J. W. Mavity, Lyndon, Kan., is Engineer. The work includes about 4,000 ft. 4-in. cast iron pipe; 1,600 ft. of 6-in. cast iron pipe; 3,800 lbs. special; 12 hydrants, 4 valves, 4-in.; 2 valves, 6-in. Official advertisement will be found elsewhere in this issue.

Kentucky.

✣Bids will be received until Dec. 16 by the Board of Public Works, Louisville, Ky., for the construction of eight lateral sewers, estimated to cost $14,000. The work will be done on the following streets: In 18th St. from Garland to Duncan; in Park St. from 6th to 7th; in Green St. from Hancock to Clay; in Jefferson St. from Oak to Shelby; in Baxter Ave. from Broadway to Rogers St.; in Brook St. from Avery to Lee; in Madison St. from Clay to Campbell; in Hert St. from Bardstown Rd. to Tyler Park.

✣Bids will be received until noon, Dec. 30, by Commissioners of Sewerage, 605 Equitable Bldg., Louisville, Ky., for the construction of Section "C.," Middle Fork Sewer, Contract No. 76, including the construction of about 2,700 ft. of concrete sewer, diameter 33-in., including 2,700 ft. of earth excavation, depth 5 ft. to 30 ft. and about 600 cu. yds. of concrete. Plans and specifications may be seen at the office of the Commissioners, and at the office of Harrison P. Eddy, Consulting Engineer, 14 Beacon St., Boston, Mass.

The following bid on the work of constructing the 8th and St. Catherine Sts. sewer in Louisville, Ky., bids for which were received by the Sewer Commissioners of that city, Dec. 2: Guild & Co., Chattanooga, Tenn.; James Ferry & Sons, Pittsburg, Pa.; Harry Bickell Co., Louisville; L. W. Hancock Co., Louisville; C. T. McCracken & Co., Columbus, and B. C. Miller & Co., Louisville. The estimated value of the contract is $50,000, there being 3,000 ft. of sewer to be constructed. Contracts will probably be awarded Dec. 17.

Louisiana.

The City Council of Hammond, La., has decided to issue bonds in the sum of $100,000 for the installation of a sewer system.

Maryland.

✣Bids will be received until 11 a. m., December 21, by Board of Awards, Baltimore, Md., for Contract No. 61, for furnishing the necessary labor and material for the construction of lateral sewers in District No. 40-C, including 45,000 lin. ft. terra cotta pipe sewer, 8 to 24-in. diameter; 15,000 lin. ft. of 6-in. house connections. Separate bids will also be received at the same time for Contract No. 11, for the construction of storm water drains, including 1,445 ft. of 36-in. and 30-in. brick and concrete drain; 355 ft. of 24-in. terra cotta drain; 450 ft. inlet connections; 14 inlets. Harry W. Rodgers is Secy., Sewerage Commission. C. W. Hendrick is Chief Engineer.

✣Bids will be received until 11 a. m., December 21, by Board of Awards, Baltimore, Md., for the furnishing and delivering of the following supplies to the water board: Lumber, wood, oils, brick, cement, cast-iron work, lead-lined iron pipe, cast-iron pipe and fittings, brass castings, feed, [illegible] paints, waste and rope, [illegible] pipe, pipe fittings, valves, etc., for the year 1911. Alfred M. Quick is Water Engineer.

The citizens of Silver Springs, Md., at a recent meeting named a committee consisting of State Senator Blaire Le, Mark Stearman, Gist Blair, Jr., Herbert Cissel, R. Holt Easley, Woodbury Blair and Samuel D. Waters, to organize a company for the construction of a sewer system for Silver Spring. It is understood that three miles of sewer proposed will cost $21,000. The plan is to connect with the Takoma Park system.

Masachusetts.

The State Board of Health of Massachusetts has approved the plan of the city of New Bedford, Mass., to install a new intercepting sewerage system. Wm. F. Williams is City Engineer.

Michigan.

City Engineer Terry of Flint, Mich., has been instructed to prepare plans and specifications for the construction of a sewer on W. 2nd St., between Grand Traverse and Beach Sts.

The City Council of Kalamazoo, Mich., has authorized the immediate building of a sewer on Fulford St., estimated to cost $15,000. Bids for this work will be advertised for shortly.

Minnesota.

The Engineering Department of Duluth, Minn., has estimated that $70,000 would pay for a sanitary trunk sewer from the end of the Woodland car line to Tischer's Creek, emptying at St. Marie St. This would also provide for septic tanks.

City Engineer S. S. Chute of St. Cloud, Minn., has completed the plans and specifications for the proposed sewer system No. 5. The new system will give a sewer to all lots not already provided between 16th Ave., on the west and the river on the east, and St. Germain St. on the south and the Great Northern tracks on the north.

Max Holland of Cannon Falls, Minn., has been awarded the contract by the city of Kenyon, Minn., for the drilling of a deep 10-in. well for $3.90 per ft. Bids were opened Dec. 5.

Missouri.

The immediate construction of a permanent sewer in the West End of St. Louis, Mo., for the River Des Peres is again being agitated by residents and property owners of Washington Heights and Parkview.

The proposition to vote bonds in the sum of $475,000 for public improvements, included in which was $100,000 for building a septic tank and $100,000 for constructing, extending and repairing the general sewerage system, was defeated Dec. 5 in Springfield, Mo.

F. C. Brooks & Sons have been awarded the contract by the city of Windsor, Mo., for the construction of approximately three miles of trunk sewer in that city. Rollins & Westover, Beal Bldg., Kansas City, Mo., are Engineers. Bids were opened Dec. 6.

Montana.

Plans have been prepared by C. W. Thorpe, Engineer, Bozeman, Mont., for the construction of a new water system for Harlowton, Mont., estimated to cost from $15,000 to $20,000. The work includes 3,600 ft. of 8-in. main, a concrete reservoir with centrifugal pump and gasoline engine for fire protection. The supply of water will be obtained from wells. The contract for this work will be let in February. A. F. Anderson is Mayor.

C. M. Thorpe, Engineer, Bozeman, Mont., has prepared plans for the construction of a new water works system for Townsend, Mont., estimated to cost $25,000. The work will include wells, pumping outfit, storage tank and 10-in., 6-in. and 4-in. mains. The contract will be let some time in the spring. Geo. Faltemeyer is Mayor.

Nebraska.

✣Bids will be received until Dec. 15 by City Clerk, Lincoln, Nebr., for water pipe as follows: 74 [illegible] 6-in.; 35 tons of 12-in.; 170 tons of 16-in. and 5 tons of special. J. Tyler is Commissioner of Water.

The citizens of Wymore, Nebr., on Dec. 1 voted in favor of the proposition of issuing bonds to the amount of $57,000 for a water plant.

New Jersey.

The Jersey Paving Corporation has been awarded the contract by the Board of Works of Newark, N. J., for the construction of Ave. C and Dawson St. storm sewers, for $5,253.

The Township Committee of Millburn, Millburn, N. J., has authorized the sale of 12 $1,000 sewer bonds for the construction of a sewer system.

The Borough Council of Fort Lee, N. J., has sold bonds to the amount of $50,000 for the construction of sewers. V. B. Kelly is Councilman.

The Newark, N. J., Common Council has voted to enter into a contract at a cost of $6,250,000 for the purification of the Passaic River. The project is to build a trunk sewer with branches to extend from the Passaic Falls to an outlet under New York Bay near Robbins Reef. The total estimated cost of the sewer will be $12,250,000.

The Water Department of the city of Atlantic City, N. J., awarded contracts Dec. 6 for furnishing one horizontal single cylinder non-condensing Corliss engine to A. D. Granger C., 90 West St., New York City, for $3,183. Bids were opened Dec. 2.

Louis Jacques, Elizabeth, N. J., has been awarded the contract by the City Council for the construction of a sewer in Erie Ave., from Bayway to a point north of Springfield Road, connecting with the sewers of the Joint Municipalities in Bayway, for $1,003. Bids were opened Dec. 1.

New York.

✣Bids will be received until 11 a. m., December 1, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for 20 sewer contracts, No. 1 being the largest, as follows: For furnishing all the labor and material required for the construction of outlet sewers in Coney Island Ave., between Terrace Place and Reeve Place; and in Reeve Place, between Coney Island Ave. and Sherman St.; and tributary sewer in Coney Island Ave., between Windsor Place and Terrace Place, and a sewer basin on the northwest corner of Sherman St. and Seeley St. The Engineer's preliminary estimate of the quantities is as follows: 381 lin. ft. of 30-in. brick sewer, laid complete, including all incidentals and appurtenances; per lin. ft., $6.75. 628 lin. ft. of 24-in. pipe sewer, laid complete, including all incidentals and appurtenances; per lin. ft., $5.75. 307 lin. ft. of 18-in. pipe sewer, laid complete, including all incidentals and appurtenances, per lin. ft., $4.35. 75 lin. ft. of 12-in. pipe sewer, laid complete, including all incidentals and appurtenances; per lin. ft., $3.25. 13 manholes, complete, with iron heads and covers, including all incidentals and appurtenances, per manhole, $55. 1 sewer basin, complete, of either standard design, with iron pans or grating, iron basin hood and connecting culvert, including all incidentals and appurtenances; per basin, $150. 6 sewer basins reconnected, including all incidentals and appurtenances; per reconnection, $10. 80,000 ft. B. M. of sheeting and bracing, driven in place, complete, including all incidentals and appurtenances; per thousand feet B. M., $18. 2,000 ft. B. M. of foundation planking, laid in place, complete, including all incidentals and appurtenances; per thousand feet B. M., $25. The time allowed for the completion of the work and full performance of the contract will be 100 working days. The amount of security required will be $5,000.

✣Bids will be received until 11 a. m., December 24, by Board of Water Supply, 165 Broadway, New York City, for Contract 67, Catskill aqueduct, for the construction of a portion of the city tunnel of the Catskill aqueduct, a circular tunnel in rock, 12 ft. and 11 ft. inside diameter: From the northerly end of the work in Union Square, at 14th St., the tunnel line extends in a general southerly direction through the Borough of Manhattan, under 4th Ave., the Bowery, Delancey, Allen, Hester and Clinton Sts.; thence beneath the East River to the foot of Bridge St., in the Borough of Brooklyn, and through this Borough under Bridge St. and Flatbush Ave. to the terminal shaft, Shaft 23, at 3d Ave. and Schermerhorn St., and from Flatbush Ave. under Lafayette St. to the terminal shaft, Shaft 24, in Fort Greene Park. The work will be carried on through six shafts, spaced from 3,800 to 5,200 ft. apart, and varying in depth from 310 to 740 ft. An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable. The Board reserves the right to reject any and all bids. Two or more bonds, the aggregate amount of which shall be $700,000, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York to the amount of $75,000. Time allowed for the completion of the work is 54 months from the service of notice by the Board to begin work. Pamphlets containing information for bidders, forms of proposal and contract, specifications, etc., and pamphlets of contract drawings can be obtained at the above address, upon application in person or by mail, by depositing the sum of $10 in currency, or check drawn to the order of the Board of Water Supply, for each pamphlet, or $20 for each set. This deposit will be refunded upon the return of the pamphlets in acceptable condition within thirty days from the date on which bids are to be opened.

✣Bids will be received until 11 a. m., December 24, by Board of Water Supply, 165 Broadway, New York City, for Contract 66, Catskill Aqueduct, for the construction of a portion of tre city tunnel of the aqueduct, a circular tunnel in rock varying from 14 to 12 ft. inside diameter: From the northerly end of the work in Central Park, near 8th Ave. and W. 99th St., the tunnel line extends in a general southerly direction under Central Park, 6th Ave. and Broadway to 14th St., in Union Square. The work will be carried on through six shafts, spaced from 2,300 to 4,550 ft. apart, and varying in depth from 200 to 250 ft. An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable. The Board reserves the right to reject any and all bids. Two or more bonds, the aggregate amount of which shall be $900,000, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York to the amount of $100,000. Time allowed for the completion of the work is 52 months from the service of notice by the Board to begin work. Pamphlets containing information for bidders, forms of proposal and contract, specifications, etc., and pamphlets of contract drawings can be obtained at the above address, upon application in person or by mail, by depositing the sum of $10 in currency, or check drawn to the order of the Board of Water Supply, for each pamphlet, or $20 for each set. This deposit will be refunded upon the return of the pamphlets in acceptable condition within thirty days from the date on which bids are to be opened.

✣Bids will be received until 11 a. m., December 24, by Board of Water Supply, 165 Broadway, New York City, for Contract 65, of the Catskill Aqueduct, for the construction of a portion of the city tunnel of the Catskill aqueduct a circular tunnel in rock 15 ft. and 14 ft. inside diameter: From the northerly end of the work at Aqueduct and Burnside Aves, near University Heights, the tunnel line extends in a general southerly direction under Aqueduct and Lind Aves., in the Borough of The Bronx, to the crossing under the Harlem River at 167th St., near Highbridge; thence beneath Highbridge, St. Nicholas and Morningside Parks and connecting streets, in the Borough of Manhattan, to Central Park, near 8th Ave. and W. 99th St. The work will be carried on through 7 shafts, spaced from 2,500 to 5,100 ft. apart, and varying in depth from 260 to 475 ft. An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable. The Board reserves the right to reject any and all bids. Two or more bonds, the aggregate amount of which shall be $900,000, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York, to the amount of $120,000. Time allowed for the completion of the work is 42 months from the service of notice by the Board to begin work. Pamphlets containing information for bidders, forms of proposal and contract, specifications, etc., and pamphlets of contract drawings can be obtained at the above address, upon application in person or by mail, by depositing the sum of $10 in currency, or check drawn to the order of the Board of Water Supply, for each pamphlet, or $20 for each set. This deposit will be refunded upon the return of the pamphlets in acceptable condition within 30 days from the date on which bids are to be opened.

✣Bids will be received until December 24 at 11 a. m. by the Board of Water Supply at 165 Broadway, New York, N. Y., for Catskill Aqueduct, Contract No. 63, for the construction of a portion of the city tunnel of the Catskill Aqueduct a circular tunnel in rock 15 ft. inside diameter and about 21,260 ft. long. From the northerly end of the work in Yonkers, about 200 ft. north of the New York City line, between Jerome and Mount Vernon Aves., the tunnel line extends in a general southerly direction through the Borough of The Bronx, under Van Cortlandt Park and Jerome Park Reservoir, and thence beneath the old Croton Aqueduct and Aqueduct Ave. to Burnside Ave., near University Heights. Tunnel construction will be carried on through five shafts, spaced from 3,500 to 5,000 ft. apart, and varying in depth from 215 to 240 ft. An approximate statement of the quantities of the various classes of work and further information are given in the Information for Bidders, forming part of the contract. At the above place and time bids will be publicly opened and read. The award of the contract, if awarded, will be made by the Board as soon thereafter as practicable. The Board reserves the right to reject any and all bids. Two or more bonds, the aggregate amount of which shall be $800,000, will be required for the faithful performance of the contract. No bid will be received and deposited unless accompanied by a certified check upon a National or State bank, drawn to the order of the Comptroller of the City of New York, to the amount of $100,000. Time allowed for the completion of the work is 40 months from the service of notice by the Board to begin work. Pamphlets containing information for bidders, forms of proposal and contract, specifications, etc., and pamphlets of contract drawings can be obtained at the above address, upon application in person or by mail, by depositing the sum of $10 in currency, or check drawn to the order of the Board of Water Supply, for each pamphlet, or $20 for each set. This deposit will be refunded upon the return of the pamphlets in acceptable condition within 30 days of the date on which bids are to be opened.

The United States Cast Iron Pipe & Foundry Co. of New York City, has been awarded the contract by the East Orange Water Commissioners of East Orange, N. J., for furnishing 180 tons of cast iron pipe, 6 and 8 ins. in diameter, for $21.20 a ton and 25 tons of specials for $47 per ton.

✣Bids will be received until 8 p. m., Jan. 11, by Board of Trustees of Angola, Erie County, N. Y., for furnishing the materials and constructing a system of water works for that place. The work includes 850 tons of cast iron pipe; 50 fire hydrants; 38 valves and boxes; pumping station, Impounding well, etc.; 2 power pumps, 2 gas engines; steel standpipe, etc. Plans and specifications may be obtained with blank forms of proposals at the office of the Clerk, George L. Peck, Angola, N. Y., or at the office of the Engineers, Witmer & Brown, 2 Chapin Block, Buffalo, N. Y.

A special election was held in Fairport, N. Y., Dec. 6 for the purpose of voting on the proposition of raising money to secure the services of a competent civil engineer to draw plans and specifications for a new sewer system.

A petition has been circulated through the 5th ward of Binghamton, N. Y., asking the Common Council to construct a trunk sewer down Park Creek.

Following bids were recently received by the Department of Public Works of Buffalo, N. Y., Francis G. Ward, Commissioner, for the construction of a 10-in. tile sewer in Dante Place: John M. Fahning, $2,200, 18, 15 and 12-in. tile sewer in Lower Terrace; William Franklin, $8,500, 15, 12 and 10-in. tile sewer in Tuscarora Rd. and Peconic St.; W. G. Smith, $2,500, 10-in. tile sewer in Worcester Place; John M. Fahning, $950.

The United Clay Companies, 39 Cortlandt St., New York City, has been awarded the contract by the Arsenal Central Park Board, Clinton C. Smith, Secy., for 600 ft. of vitrified sewer pipe for Parks Bronx, for $182. Bids were opened Dec. 1.

North Carolina.

All bids received Dec. 5 by John A. Weddell, Clerk, Tarboro, N. C., for laying approximately one mile of each 6 and 8-in. cast iron bell and spigot water mains and specials and setting about 16 fire hydrants, were rejected.

Ohio.

The City Council of Coshocton, O., has decided to build S. 10th St. sewer. The Council has also appropriated $2,000 additional for new water works wells.

The Board of Control of Piqua, O., has awarded the contract for the building of the north western sewer to the Backus Construction Co., of Dayton, O., for approximately $10,000.

The County Commissioners at Cincinnati, O., have received a communication from the North Fairmount Improvement Association of Cincinnati, requesting that the Board take steps to provide a trunk sewer for the Millcreek Valley.

The State Board of Health has ordered the city of Lima, O., to construct a filtration plant. The City Board of Health and Council will take up the problem, and will probably order the plant built.

McAtlonon Bros., 192 W. Buchtel Ave., Akron, O., have been awarded the contract by the city of Akron for the construction of a sewer along Euclid Ave., from Schill to Wabash, for $1,067. The work includes 20-in. and 24-in. sewer. Bids were opened Dec. 1.

F. J. Backus of Dayton, O., has been awarded the contract by the city of Piqua, O., for the construction of a sewer on parts of Vine St., Madison Ave. and Lincoln St. Bids were opened Nov. 28.

Geo. J. Bock & Son of Coshocton, O., have been awarded the contract by the city of Galion, O., for the construction of a sanitary sewer in the 5th District of the city. The work includes 2080 ft. of 15-in. sewer; 247 ft. of 12-in. sewer; 1,218 ft. of 10-in. sewer; 8,205 ft. of 8-in. sewer; 1,131 ft. of 6-in. sewer; 4,123 ft. of 4-in. sewer. Bids were opened Nov. 28.

Oklahoma.

✣Bids will be received until Jan. 1 by Board of Trustees at the office of George E. Pinkston, City Clerk, Kiowa, Okla., for the extension of the water and electric light plant. Plans and specifications can be seen at the office of the Superintendent.

According to information received from Tulsa., Okla., the Gulf Pipe Line Co. will begin immediately the extension of its main line from the Osage reservation, just north of Tulsa, to Bartlesville and Nowata. The extension will be about 40 miles long and the total investment will be over $1,000,000 in the counties of Osage, Washington and Nowata.

Oregon.

The City Executive Board of Portland, Ore., has awarded the contract for the construction of the proposed Holgate St. extension of the Brooklyn district sewer to Paquet, Giebisch & Joplin for $104,372. Bids were opened Nov. 25.

Pennsylvania.

✣Bids will be received until noon, Jan. 17, by Charles T. Straughn, County Controller, Pottsville, Pa., for general contract, including increased water supply, sewage disposal plant, power plant, elevator, heating, ventilating, plumbing and electric wiring complete for the construction of a building for the insane at Schuylkill Haven, Pa. Plans and specifications can be obtained at the Controller's office on or after Dec. 16

The Saegertown, Pa., City Council has sold bonds to the amount of $13,000 for the water works improvements.

Ordinances have been introduced in the Common Council of Pittsburg, Pa., calling for the expenditure of $6,000,000 of the $10,305,000 bond money. Part of the money will be used for constructing the Negley Run and Try St. drainage basins and for improving the parks.

Pitt Contracting Co., Fulton Bldg., Pittsburg, Pa., has been awarded the contract by the Brookville Water Co., Brookville, Pa., Geo. W. Heber, Secy., for the necessary labor and material for the construction of reinforced concrete settling basins and a dam. The work includes the following approximate quantities: 2,150 yds. earth excavation, 30 yds. rock excavation, 1,510 yds. embankment, 490 yds. rubble concrete, 526 yds. reinforced concrete, 208 yds. plain concrete, 340 sq. yds. slope paving, 230 ft. of 12-in. cast iron pipe. Bids were opened Nov. 19.

South Dakota.

The citizens of Madison, S. Dak., voted Dec. 6 in favor of the proposition of issuing bonds to the amount of $65,000 for the building of a sewer system.

Tennessee.

The Court of Civil Appeals has upheld the $500,000 sewer bond issue which was voted on in the election of Oct. 14, 1909, by the city of Nashville, Tenn. The Board of Public Works, it is now stated, will construct sewers in the Northern, Eastern, Western and Southern portions of the city. George W. Stainback is Chairman of the Board.

Texas.

A home company is being organized in Bartlett, Tex., to put in a $12,000 sewerage plant. Plans have been outlined by an engineer.

City Secretary Hiddleson of El Campo, Tex., has outlined plans for the construction of a sewer system for that city. The city recently voted bonds for this improvement in the sum of $140,000.

An election was held in Pecos, Tex., Dec. 10 to vote on the proposition of issuing bonds to the amount of $25,000 for the construction of a sewer system. The O'Neil Engineering Co., of Dallas, has prepared plans and specifications for the system, which will cover

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What Will Be, to the Isthmian Canal Commission, the Salvage Value of the Construction Plant at Panama?

On July 1, 1910, the cost of plant for the construction of the Panama Canal had been in round figures $25,700,000. Of this total $3,888,000 were expended during the twelve months immediately preceding the date named. The stage of progress reached by the various parts of the canal construction makes it reasonable to assume that future plant expenditures will be comparatively small. At least all the more bulky items of plant are now in place and future purchases should naturally be limited to items bought to replace worn out plant. It is safe to assume, however, that by the time the canal is completed a total of $30,000,000 will have been spent for the purchase of construction plant. The estimated construction cost of the canal is $297,766,000, so that the first cost of plant will have been something over 10 per cent of the total construction cost, if the canal is completed within this estimate. What may the Canal Commisison expect in the way of reimbursements from salvage on this plant?

Before considering this question it is interesting to note the division of the plant expenditure, so far, over the various parts of the canal work. It was as follows on July 1, 1910:

	Cost.
Atlantic Division:	
Dry excavation	$ 206,270
Dredging excavation	2,071,371
Gatun dam and spillway	[illegible]
Gatun locks	2,004,114
Gatun power plant	194,462
Porto Bello quarry	1,053,314
Nombre de Dios, sand	396,061
Transportation	1,514,391
Colon breakwater	449,179
Central Division:	
Dry excavation	[illegible]
Pacific Division:	
Dry excavation	[illegible]
Dredging excavation	2,842,217
Pedro Miguel locks and dams	821,381
Miraflores locks and dams	[illegible]
Ancon quarry	[illegible]
Chamé sand	[illegible]
Miraflores power plant	493,627
Total	$25,771,496

The cost accounting system adopted by the Canal Commisison provides for the entire absorption of plant cost by the time the work is completed. This provides for the maximum possible plant cost. There will be some salvage. What will it be? The minimum amount will be the scrap value of the plant; the maximum amount will depend on the market for and the market price of second-hand machinery at the time of sale. One can only speculate what these will be.

The character of the plant is the first consideration in determining the possible markets. No records are available for a complete listing of the plant, but one may arrive at many of the principal items and the following partial list is presented:

Dump and flat cars	3,800
Locomotives	295
Steam shovels	140
Barges	65
Dredges	18
Pile drivers	17
Tugs	10
Spreaders	[illegible]
Unloaders	27
Track shifters	10
Cranes (railway)	60
Cranes (cantilever)	12
Cableways	[illegible]

In addition there are the equipment of two quarrying and crushing plants, half a thousand or so rock drills, several hundred miles of railway track and hundreds of machine shop and construction tools, pumps, engines, etc. Altogether there are few of these items for which there is not a constant demand for construction and transportation work.

The available markets are the United States and the South American nations, and in both markets the disposition must be gradual and the purchasers will be widely scattered. To reach either market all except the floating plant must be dismantled and shipped by steamer to ports several hundred to a thousand miles distant. It is plain, therefore, that whatever the actual value of the various plant is as working machines at the isthmus, the transportation charges to available markets and the selling costs will be high. Whether the Canal Commission itself disposes of the plant piecemeal or whether it sells it in a lump to a single dealer, these storage, transportation and marketing charges must be borne by the plant. In a word the various machines and tools will fetch at the Isthmus only a fraction of the market price of similar articles in the United States.

So much for the market for the canal plant. What will be its condition as working tools when its services at Panama are finished? It has been the policy of the Canal Commission to maintain its plant to a high standard, if high maintenance and repair expenses are criteria of conditions. We believe as a matter of fact that a very efficient working condition has been maintained. Naturally, however, with a service extending over five or six years and with often continuous and in many cases severe work, many of the machines will have reached their limit of economical use and will have a very small market value as second hand plant.

No attempt has been made in these remarks to set specific figures of salvage, nor does it seem practicable to do so without so many qualifications that they mean nothing. It has been such common practice of writers on the Panama Canal work to assume that something handsome in salvage was sometime to be credited to the canal construction account, that a review of the possibilities is desirable. To one who reviews the chances in detail they must, we think, appear very moderate. It has to be kept in mind that it is not the absolute amount but the proportion that we have to consider. If, as a recent writer states, or, more properly, guesses, the "salvage will be several million dollars," it forms no great item. Assuming that "several million" means five million, this would be only 17 per cent of the total cost of the plant and less than two-tenths of one per cent of the total estimated construction cost of the canal.

One cannot help feeling that the Canal Commission in charging plant cost complete to construction costs is not to be credited with extreme liberality, but with just ordinary conservatism. Certainly, no contractor would think of doing differently when he could figure salvage on plant to come to no more than a fraction of one per cent of the total cost of the work.

Salvage on Cement Bags at Panama.

About 90 per cent of the bags in which cement is shipped to the Isthmus for use in the Pacific Division locks are saved and returned to the manufacturers, who allow 8½ cts. apiece for them. The cement is shipped in a bag enclosed within another bag, both made from material of the same grade and weight, the allowance to each bag of cement, therefore, representing 17 cts. As fast as the bags of cement are emptied at the mixers they are loaded into box cars and carried to an old building, formerly used as a storehouse by the Pacific Division, situated a little north of the yard office at Miraflores, where they are sorted and baled. From 20 to 30 men, under a white foreman, are constantly employed in the sorting shed, and at the present time, a day's work in sorting and preparing for shipment represents from 25,000 to 35,000 sacks. The good bags are packed in bales of 100 each, and the torn or otherwise damaged bags, in bales of 50 each. The damaged bags are mainly utilized by filling them with sand for the construction of dikes. The bags are shaken before they are placed in the baling press, and the sweepings resulting therefrom amount to 50, or more, barrels a day. This cement is in good condition; is used in concrete operations in the locks, and the value of it pays the wages of the force employed at the sorting shed, including the foreman, but does not take into account the cost of gathering up the bags at the lock sites, and the haulage to the shed, which amounts to a small fraction of a cent per bag. Many of the bags sent to the States months ago are now returning filled the second time, and are still whole, capable of being used again. A statement of the number of good bags returned to the manufacturers from the beginning of concrete operations at the Pedro Miguel and Miraflores Locks, and the value thereof, is shown in the following table:

Month.	No. of bags.	Value.
To April 25, 1910	740,000	$ 62,900.00
May	180,000	15,300.00
June	180,626	15,353.22
July	182,516	15,513.86
August	120,016	10,201.36
September	[illegible]	45,950.32
October	600,000	51,000.00
November	661,300	56,210.50
Total	3,205,050	$272,429.26

The cost of handling, less freight charges, during the month of October was $983.71 for 600,000 bags returned.

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CONCRETE AND REINFORCED CONCRETE SECTION

The Gatun Spillway, Panama Canal, with Some Costs of Construction.

To provide for the flood discharge of the artificial lake formed by damming the Chagres River at Gatun there will be a spillway located about midway of the dam crest. This spillway is to be a concrete channel 1,200 ft. long and 300 ft. wide at the upper end of which is a dam fitted with gates for regulating the flow. The plan of the Gatun Dam and spillway and of the adjacent locks is given in Fig. 1. Figures 2 and 3 show the general features of the spillway dam structure.

The largest known discharge of the Chagres River into Gatun Lake would render necessary a 2,000-ft. spillway, assuming an uncontrolled overfall and a maximum crest depth of 5 ft. Because of the expense of such a long structure resort was made to a weir with crest gates which gives a greater depth of overfall and consequently a greater volume of flow than is possible with an uncontrolled crest of the same length. Figure 2 is a plan of the spillway weir or dam which was adopted and Fig. 3 gives typical weir sections.

Referring to Fig. 2 it will be seen that the necessary development of crest is obtained by throwing the trace of the dam into a circular arc bending upstream. This form, as will be seen, directs the discharge toward the center where the energy of the converging stream will partly neutralize itself. To complete the neutralization, two rows of baffle piers are placed on arcs of circles concentric with the dam crest as shown by Fig. 2. These baffle piers are to be of concrete faced on the upstream side with cast iron plates, and project about 10 ft. above the surface of the apron. The dam has an ogee section made up of a parabola, a short tangent and an arc of a circle leading to the flat apron below the dam. The parabola is such that when a stream of water flowing over the crest is 6 ft. or more in thickness the nappe will adhere to the downstream face. The crest of the dam is divided into 14 bays 45 ft. wide by 13 piers and 2 abutments. Between consecutive piers Stoney gates will be placed, rising on trains of live rollers which move on castings set in grooves in the piers.

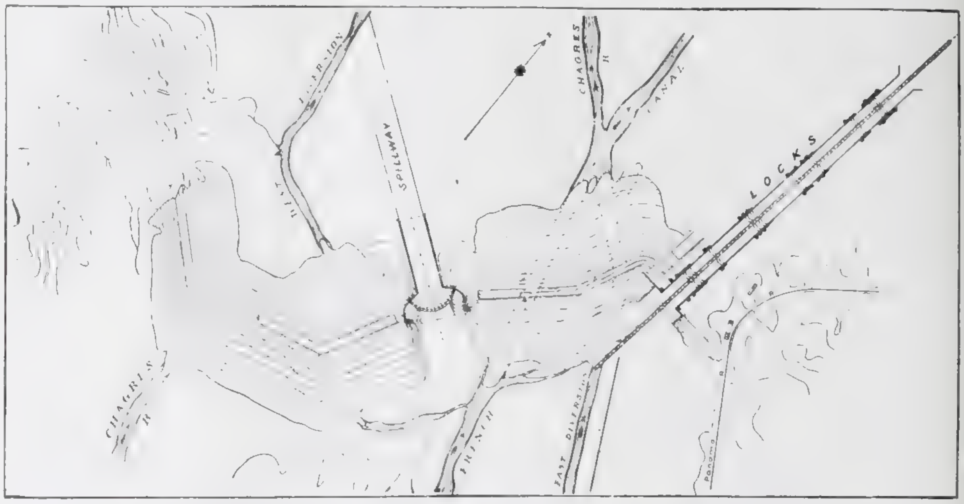

Fig. 1—Map Showing Location of Gatun Dam, Spillway and Locks.

During the last year the main dam fill has been carried up to an elevation which shuts off all the natural channels of discharge for the Chagres. The river discharge is now going through the spillway channel and will continue to do so until the main dam has reached a height well above the crest level of the spillway dam. Then only will it be possible to build the spillway dam. When the dam is built it will have to be constructed in a channel through which a stream is flowing at the rate of from 10,000 sec. ft. in the wet season to 3,000 sec. ft. in the dry season. To permit of this construction piers have been built projecting upward above low water from the foundation, on the site of the upstream face and about 20 ft. apart. Between these piers stop plank will be placed and

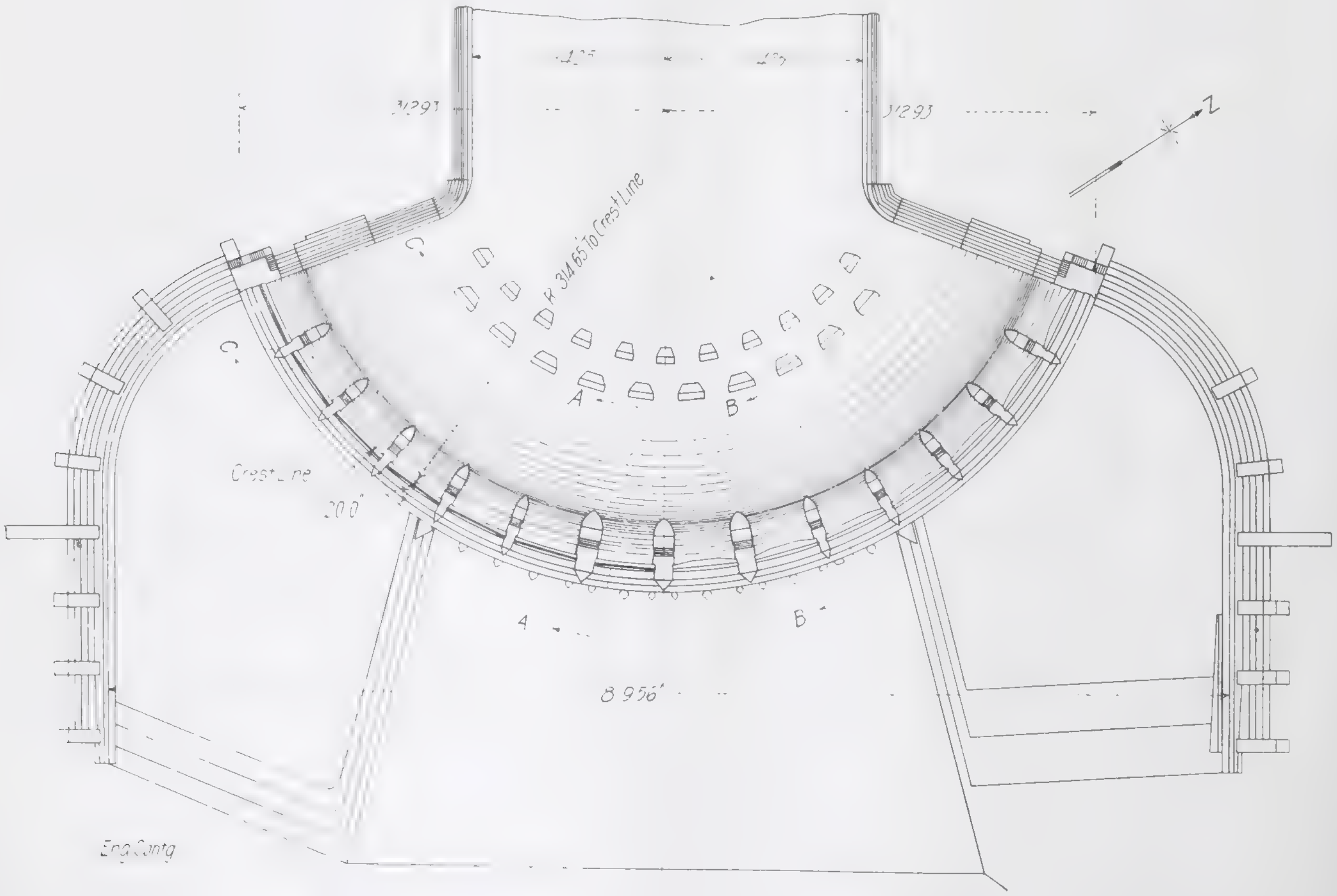

Fig. 2—Plan of Gatun Spillway.

the concrete laid behind the protection of the cofferdam thus formed. In addition there will be built under the three center gate piers culverts extending under the dam. These culverts with the stop plank will keep the rise of lake level at a rate such that the concrete dam construction can be maintained safely in advance of it. When the dam is completed to crest level these culverts will be filled with concrete.

The concrete work of the Gatun spillway comprises the dam structure shown in Figs. 2 and 3 and floor and wall work for the spillway channel. The concrete laid to Oct. 1, 1910, was 94,606 cu. yds., at an average cost of $8.61 per cu. yd. Detail costs of the concrete work for six months to June 30, 1910, and for three months, July-September, 1910, were as follows:

For the three months July-September 30, 1910, 9,716 cu. yds. of concrete were manufactured at the following cost:

Item.	Per cu. yd.
Cement	$1.8490
Stone	2.4294
Sand	0.6492
Mixing	0.3420
Total	$5.2696

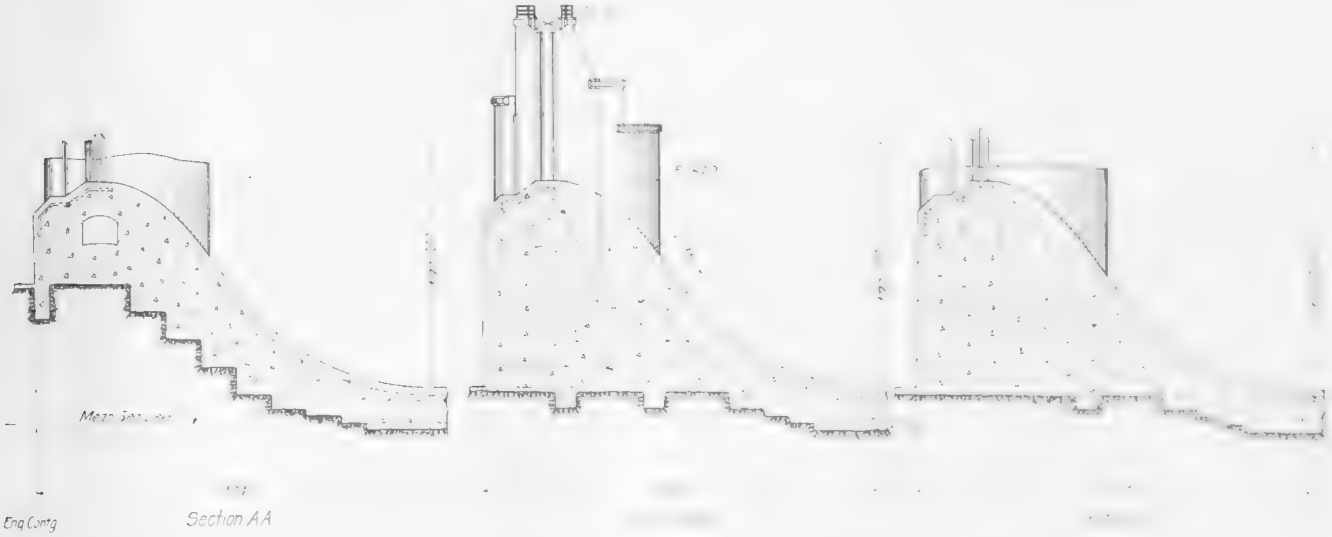

Fig. 3—Weir Sections of Gatun Spillway.

In addition to the above volume of concrete a total of 791 cu. yds. of rubble stone were used in the work, making a total volume of masonry of 10,510 cu. yds. The cost of this masonry was as follows:

Item.	Per cu. yd.
Concrete	$4.8731
Rubble stone	0.1227
Wood forms	0.7583
Placing	0.6834
Maint. equipment	0.3772
Plant arbitrary	0.6160
Division expenses	0.2127
General expenses	0.1669
Total	$7.8103

This total is 50 cts. per cu. yd. less than during the six months to June 30, 1910, when an aggregate of 33,085 cu. yds. of concrete and rubble stone was placed at the following itemized cost:

Concrete (32,801 cu. yds.).	Per cu. yd.
Cement	$2.0105
Stone	2.4160
Sand	0.6443
Mixing	0.4471
Total	$5.5179
Rubble stone (284 cu. yds.)	$4.4261
Masonry (33,085 cu. yds.)	Per cu. yd.
Concrete	$5.4706
Rubble stone	0.0380
Forms	0.5955
Placing	0.7592
Maint. equipment	0.2453
Pumps	0.0477
Plant arbitrary	0.6164
Division expenses	0.1440
General expenses	0.4026
Total	$8.3193

Grouting Natural Soils for Bridge and Building Foundations.

By [illegible]*

Grout, for the subject of this paper is a liquid cement mortar of neat cement or with various parts from ½ to 6 of fine sand added. Owing to the various diversified opinions of the efficacy of grout as a part of general construction, its use in America has been confined principally to brick and stone paving, filling in the roofs in tunnel lining, and washing concrete surfaces. The principal objections to grout are: (1) It won't set up and never attains its full strength, and (2) it doesn't fill the voids.

As regards the first objection, it is hard to see why there should be any difference in the setting up qualities of grout when poured into loose rocks, and concrete, as the result in both cases is the same, viz., stones joined together by cement mortar; the second objection can be easily overcome by having the grout of suitable consistency and applied under sufficient pressure to fill up all spaces.

That these objections are lightly held is shown by the extensive use of grout in subaqueous foundations by British engineers, both in England and India. A notable and successful undertaking was the building of a breakwater at St. Helier in the Channel Isles. The entire foundation was first filled with large stones and gravel. Then divers sunk 3-in. pipe with open ends into loose rock, spacing them 10 feet apart. Through these pipes was pumped a neat cement grout, until the voids were filled. The maximum depth for these operations was 60 feet.

Six years ago at Winchester, England, the foundations of the Cathedral, which had been gradually failing, gave way altogether, and caused serious damage, even threatening the edifice with entire destruction. Of course the papers were full of suggestions for the repairs, and although it was finally decided to underpin the building, the novel suggestion of Mr. F. A. Lart, M. Inst. C. E., to solidify the natural ground under the foundations by injecting a grout of liquid cement, caused much scientific and professional discussion. Mr. Lart's method, which was placed before the Cathedral authorities, is as follows:

Drive into the ground to any suitable depth, preferably the maximum of the required foundations, a 3-in. iron pipe, perforated for the lower 4 ft. with ¼-in. holes, the bottom end of the pipe to be tightly closed, with the upper end so arranged as to connect with a pump which forces the grout through this pipe under pressure. These pipes were to be arranged to take in about 6 sq. ft. of surface. When the ground was sufficiently saturated about the pipe, (this was known when the grout reached the surface), it could be withdrawn and used over again. By this means the whole structure could be cheaply and efficiently underpinned with a monolithic mass of concrete of sufficient width and thickness to bear any structure of modern times.

Unfortunately, the Cathedral authorities did not adopt this plan, and are still underpinning.

During the past few years the writer has met with several instances in bridge and building foundations where the adoption of Mr. Lart's method would have saved hundreds of dollars in excavation alone, and believes that very little consideration would soon convince engineers and architects of the great economic advantages of this system. Of course it is understood that this method of treatment is not intended for rock, clay or similar materials, but sand, gravel, peat and other porous soils which do not contain any chemicals injurious to cement, are all available. Neither is it claimed that the concrete formed in this manner is as good as the regularly mixed cement and rock and sand, but it is a foundation immovable in the soil and of it and is obtained at less cost. Bridge foundations in gravelly river beds can be made in the same manner without the great expense of coffer dams, pumping and wet excavation; and old and weak foundations can be strengthened and repaired.

Any doubts as to the grout spreading away from the pipes can be easily set at rest by a little digging, and in the cessation between one day's work and another the surface will be sufficiently rough and uneven to make a perfect bond.

There cannot be any fear as to the grout not setting up, for it is a well known fact that concrete sets harder and faster when buried under ground than when exposed to the air.

As a typical instance of the application of this method, the headworks of several of the irrigation canals in Egypt, built in alluvial soil, were undermined by piping and became utterly useless. This undermining was, however, effectually stopped by pumping large quantities of grout, thus solidifying the gravel underneath the structure.

The style of pump generally used for this grouting is a centrifugal, driven by steam or electricity, and was generally used throughout France, although the diaphragm is generally coming into favor.

Writing in the *Annales des Ponts et Chausses* Mr. Suquet, engineer of roads and bridges, gives the following cost of injecting grout under ground with a Greathead machine. The latter machine consists of an air compressor with two cylinders, whose pistons worked by a beam exhausted into the grout tanks and forced the grout through a hose by air pressure. When the tank was empty, the pump was stopped until it was refilled. The grout is stirred mechanically. The gang was as follows: One foreman at 1 franc per hour; two laborers at 0.75 franc per hour; one mason at 0.85 franc per hour to plug grout holes; and the net cost per ton of material handled, 7 francs, cement costing 54 francs per ton, sand 7 francs per cubic metre, the total cost per ton for neat cement grout being 63 francs, and one part cement and two of sand, 40 francs. The capacity of the Greathead machine is about 10 tons per day.

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*2419 California St., Denver, Colo.

The Design of Retaining Walls.

BY EDWARD GODFREY.*

Retaining walls, like dams, were among the most ancient of engineering necessities. Like dams they are among the most recent to be accorded critical attention in the matter of their design. The design of dams is in such a primitive state that in all the works on dams, so far as the writer can discover, there is not one word concerning the upward pressure of water that may, and as a rule does, work its way into horizontal joints and under the base of a dam—the force that has been the cause of practically all the great failures of masonry dams. The great Austin dam failure was discovered to be due to this eight years after the failure. Colleges are beginning to mention it in their courses after agitation by the writer begun in 1904.

The destructive force that is almost neglected in the case of retaining walls is the effect of frost. Much has been done in the way of working out elaborate formulas for the supposed pressure of earth against the back of a retaining wall. The exact direction and point of application of the forces acting on the back of a wall can be very nicely determined—theoretically. When the real wall is constructed, sometimes the earth will stand vertically with little or no sharing, while the masonry is being put up, this in spite of possible thousands of tons of horizontal force which (on paper) is being exerted.

Of course there is or may be horizontal force exerted against the back of a retaining wall. The writer would not belittle calculations, *per se*, of this force to arrive at a basis for proportioning the wall. But when the theory of pressures is founded wholly on assumptions which may at times be erroneous to the extent of the infinite ratio of a finite quantity to zero, the case is one where simplicity is more in keeping with facts than elaborate formulas.

Before the real nature of the planets was discovered, supposed scientists worked out intricate rules to describe the paths of the planets among the stars. There is a great deal of mathematical junk in engineering books that is of no more use to any one than those rules would be to a modern astronomer.

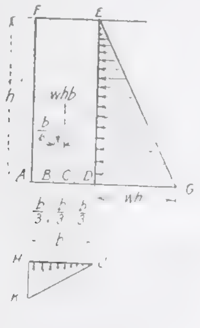

Fig. 1.

When men want to know at what slope earth may safely lie and not be beaten down by storms and the changes of temperature, they do not take a lump of mud and let it slide down a mud incline to get the coefficient of friction and from this to find the angle of repose. This might be done in such regular and uniform materials as dry sand or grain. But vastly more reliable data are obtained by observation on embankments that have stood the weather or have perhaps been subjected to the partial leveling that nature demands before she will permit them to remain stable and undisturbed.

In the simple matter of the brick walls and windows of a building, if their capability to resist a wind pressure of 40 or 50 lbs. per sq. ft. were a test of their ability to stand, but few would remain standing. Here too experience has been the prime factor in determining the proportions.

Many structures admit of exact calculations and exact theories for their stresses are in place, but retaining walls are not among these. Safe proportions for a retaining wall may be arrived at in a manner somewhat similar to the derivation of the rule for the slope of embankments; that is, by observing the proportions of walls that have remained stable. Empirical rules based on such observations point to the fact that if a solid masonry wall has a height about three times as great as its thickness, it will retain ordinary earth with complete stability. The design of a retaining wall would then seem to be a simple matter for such cases, merely the making of a wall of a thickness one-third of its height. But there are other features that must be taken care of, and these are of equal importance with the thickness of the wall.

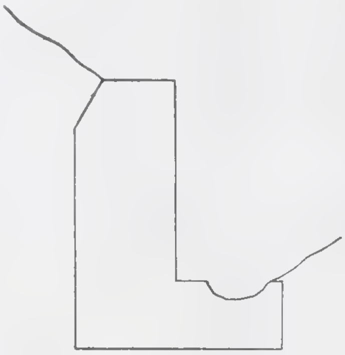

Fig. 2.

In order to arrive at a basis for determining the stability of a retaining wall of other than the rectangular shape and avoiding the excessive theoretical calculations so often made use of, it will be assumed that a masonry wall of rectangular cross section and having a height three times its thickness is stable against the pressure of ordinary earth or fill. A fluid pressure will be assumed on the back of the wall, and friction of the fill against the back of wall will be ignored. For stability the resultant pressure on the base must fall within the middle third. If it falls at *B* (Fig. 1), the edge of this middle third, there will be no uplift on the base. The shaded triangle *H J K* will represent the pressure on the soil. Moments around *B* should then balance; that is, the moment of the weight of the wall will balance the moment of the horizontal force of the backing. For a foot of length of wall, if W = the weight per cubic foot of the masonry and w the equivalent fluid weight per cubic foot, we have $W\,h\,b \times \frac{b}{6} = w\,h \times \frac{h}{2} \times \frac{h}{3}$, or if $h = 3\,b$, $W = 9\,w$.

If then the weight of masonry be 150 lbs. per cubic foot and the weight of earth fill be 100 lbs. per cubic foot, the equivalent fluid weight is 16⅔ lbs. per cubic foot, or one-sixth of the weight of the fill. It is very much simpler to consider the pressure of the fill as a fluid pressure of say one-sixth or one-fifth of the weight of fill per cubic foot than to use the intricate formulas for earth pressure which fail so conspicuously to justify their existence.

A retaining wall of any considerable size is a heavy structure, and heavy structures demand special provision against settlement. Settlement in a retaining wall is tantamount to failure, because it is invariably unequal settlement, disturbing the perpendicularity of the wall, destroying its alinement, and giving rise to cracks. In other structures such as buildings, settlement may take place without serious consequences if that settlement be small, provided the design has been made with a view of making the settlement uniform. This latter can readily be done by the simple expedient of making the areas of the footings proportional to the load. In a retaining wall the greatest pressure will be under the outer edge of the wall; settlement here means that the wall will lean outward. It is also true that the smallest resistance of the soil against pressure is at this same outer edge, since soil will resist very much less pressure near its surface than at a point some distance below the surface. Furthermore the conditions in a retaining wall are unfavorable in the matter of the softening of the ground by the action of the rain at the very place where such softening has the most harmful effect. Ground water at the base of a retaining wall will soften the soil and make it more yielding. Sometimes in railroad work there is even a gutter at the base of a retaining wall. These conditions do not exist in a building where the cellar is kept dry and the surface of the soil that is nearest to the level of the footings of walls does not undergo this softening action.

One way that would suggest itself to overcome the difficulty would be to build the retaining wall deeper. This not only adds largely to the expense but increases the soil pressure, thus defeating to some extent its own end. Another way is to drive piles under the wall near the outer edge of the same, so as to increase the bearing power of the soil at this critical locality. This would no doubt be an excellent and economical method of insuring the stability of a retaining wall in many cases.

Still another method is to use a wide slab for a footing under the wall, as indicated in Figs. 2 and 3. In stone work flags would have to be used. In mass concrete of course a concrete slab could be used. A little steel reinforcement would add greatly to the efficiency of the slab. In railroad work the same slab might be made to act as a gutter, carrying the water away that might otherwise act to soften the soil at the base of the wall.

It is seen from Figs. 2 and 3 that by anchoring the wall into the slab at the back, the stability against overturning would be very greatly increased. This cannot well be done in ordinary masonry, but in concrete it could very readily be accomplished.

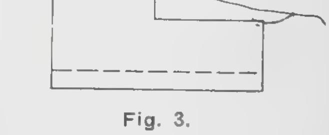

Fig. 3.

It is further seen that if the slab projected under the soil at the back of the wall still more stability would result by reason of the fact that the slab would be loaded with a large weight of superimposed earth. A T or L shape is then a logical shape for a retaining wall. Such shapes are not possible in ordinary masonry; that is, they would not have the required strength. In reinforced concrete, however, they are both practicable and economical. The projection at the front of the wall does not need to be very large, except where the soil is particularly soft. At the back the projection should be a large fraction of the height in order to take hold of sufficient earth to give the required stability. The wall will then be L shaped in cross section.

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*Monongahela Bank Building, Pittsburg, Pa.

A simple L shape of uniform cross section in a retaining wall would mean that the base slab and the vertical wall would have to act as cantilevers. Cantilever slabs are not economical, and they are difficult to reinforce. Two cantilever slabs meeting at right angles would be specially troublesome to reinforce because of the difficulty of carrying stresses around the corner.

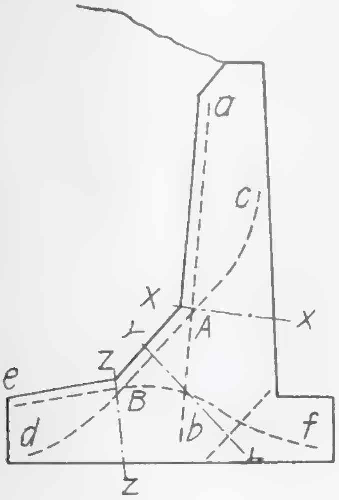


Fig. 4.

Figure 4 shows a suggested form for an L-shaped wall. Three series of reinforcing rods are used. Rods *a b* would reinforce the cantilever whose critical section is *X X*. Rods *e f* would reinforce the cantilever whose critical section is *Z Z*. Rods *c d* are needed to reinforce the corner. The section *Y Y* could here be used as the critical section. If a single curved rod were used in place of these three from *a* around to *e*, the tendency, when this is under tension, would be for the rod to pull out and break off the overlying concrete. Each rod can in this arrangement run beyond the points *A* and *B* far enough to get the full anchorage value, say 50 diameters. Rods *e f* can further be curved down as indicated to reinforce the projection at the heel of the wall.

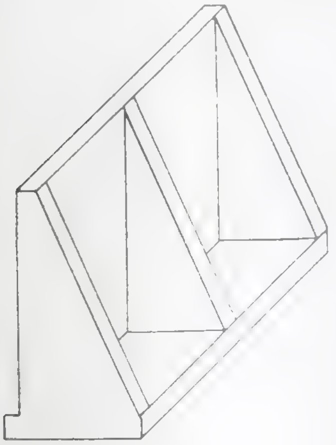


Fig. 5.

In order to make the two slabs of an L-shaped retaining wall act as simple beams and not as cantilevers these slabs may be joined by ribs or counterforts at intervals in which rods are embedded. An oblique projection of such a wall is shown in Fig. 5, viewed from the rear.

It is an absurdly simple proposition that the rods in the counterfort or rib act merely to tie together the horizontal slab and the vertical slab. The vertical slab is subject to horizontal pressure from the earth back of it. The rods in the ribs resist that pressure, and in order to have something against which to pull they must be anchored down into the horizontal slab, which is able to resist the pull by reason of the weight of earth upon it. In spite of the simplicity of this proposition this three-cornered counterfort is anlayzed in books as a beam. Besides this, in nearly all the walls built on this plan rods are thrown in in a most senseless and wasteful manner. In one example of a wall 45 ft. high there are nearly 100 horizontal rods varying from ⅜ to 1 in. square, besides 22 rods 1¼ ins. square placed diagonally close to the back, all of this in a single counterfort. In this structure there are tons of steel positively wasted. In other examples there are meshes of horizontal and vertical and diagonal rods that cannot possibly be good for more than a small fraction of their tensile strength.

Figure 6 shows the two ways in which one of these retaining walls could fail. The real strength of all this mass of steel rods is merely the little anchorage value of the short ends that are embedded in the vertical and the horizontal slabs. It is a cardinal principle of good design in reinforced concrete that a short end of a rod is entirely inadequate to anchor it for its full value.

Another glaring fault in the common method of design, illustrated in Fig. 6, lies in the useless intermeshing of the rods. A single curved rod running from the horizontal to the vertical slab and anchored in each would perform all and more than all the duty that a horizontal and a vertical rod, as shown in Fig. 6, can perform. The long rods *A* and *B* are absolutely useless for the greater part of their length. A single short rod from *A* around to *B*, with end anchorage at *A* and *B*, would be far more effectual than these two rods combined.

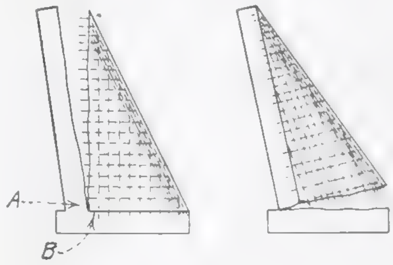


Fig. 6.

Another serious fault in this common design lies in the difficulties and uncertainties in the matter of execution. A mesh of rods in any event is a serious menace to the proper placing of concrete. A little misplacement of a rod whose short end is depended upon for anchorage could result in the rod being totally useless. Rods could very readily be omitted, even under the eye of a watcher, where such a large number is called for. It would be extremely difficult to hold 100 loose rods in place during the pouring of concrete and to be sure that none of them has been dislodged in the operation.

The writer has devised and patented a scheme for reinforcing a retaining wall such as that shown in Fig. 5 that obviates all of these difficulties. The design is shown in Fig. 7. It is to be noted that the rods in the ribs, instead of being indiscriminately placed in horizontal and vertical positions, are all placed diagonally. Each rod has an easy curve near the end and is anchored for its full value in both the horizontal and the vertical slab. The office of the rib is here recognized as being merely to protect these rods from corrosion. It is not a beam in any sense and should not be filled with a useless lot of shear rods.

The anchorage for the rods in the design shown is an angle through which the rods pass. The rods have a nut on each side of the metal to hold them in place and in bearing against the metal. The same angle has holes in the other flange through which the rods pass that are used to reinforce the slabs. For a wall of this sort to fail this anchoring angle would have to be torn out, and it would pull with it the slab reinforcement. Besides being designed for the actual stresses in the wall and amply capable of resisting them, this reinforcement has many practical advantages.

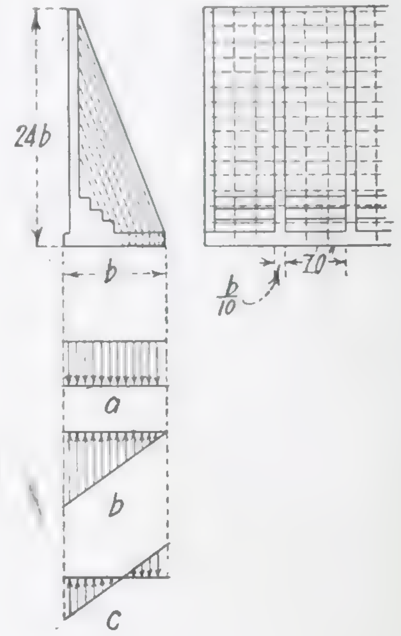


Fig. 7.

There is no mesh of rods in the rib to interfere with the flow of concrete. The rods are parallel and almost in the direction of the flow of concrete; they are further in only one plane.

Fig. 8.

The entire harp-like reinforcement of a rib can be put together on the ground and raised to place as one piece. A few braces will hold the whole in place, and interference with placing the concrete is for this reason also reduced to a minimum.

The small number of rods makes omission of any of them noticeable. Furthermore such omission would show up in vacant holes in the angles and could readily be detected.

It is almost impossible for any of the rods to be displaced during the pouring of the concrete.

The writer has devised a standard retaining wall with proportions and reinforcement as shown in Fig. 7. The several features will be taken up in order. It will be noted that the height of the wall is 2.4 times the base. It was found by trial using three walls having bases 5, 10, and 15 ft. respectively, and heights 12, 24, and 36 ft. respectively, earth at 100 lbs. per cubic foot and concrete at 150 lbs. that walls of the dimensions shown in Fig. 7 would be stable against a horizontal fluid pressure of about 18 lbs. The stability of these walls would then be equivalent from this standpoint to that of walls of solid concrete having a height three times their thickness. Furthermore the stability of the reinforced concrete retaining wall is based on the assumption that there is a plane of cleavage vertically over the back edge of the slab, as only the weight of earth directly above the slab is considered. If the wall should turn over, it would have to lift more than this portion of the backing, so that the reinforced wall has this extra element of stability.

The volumes per bay for the three walls referred to (12, 24, and 36 ft. in height) were found to be 96.6, 452.8, and 1,168.5 cu. ft. respectively. Solid masonry walls of the same height and having bases one-third the height would contain 3.73, 3.39, and 3.14 times as much in volume of masonry, respectively, as the reinforced concrete walls.

The centers of gravity of these three walls were found to be 1.43 ft., 3 ft., and 4.66 ft., respectively, from the heel of wall. The respective volumes of earth over the slab are 332.3, 1,377.2, and 3,206.3 cu. ft. The centers of gravity of these volumes are located at 2.96 ft., 5.97 ft., and 9.01 ft., respectively, from the heel of wall.

One peculiarity respecting these three walls is that the resultant center of gravity of earth and concrete is in each case almost exactly in the center of the slab. This makes it proper to assume that the pressure due to the weight is uniformly distributed over the base, as shown at *a*, Fig. 7, as the stiffness of the bottom slab is sufficient to give this distribution. The reaction of the earth under the slab will be uniformly varying from zero intensity at the toe of the wall to double the intensity of the uniform load at the heel of the wall, as at *b*. The difference between these sets of forces or the forces shown at *c* must be resisted by internal stresses in the concrete. On the left half of the bottom slab the forces are seen to be upward. If the construction were a reinforced slab, it would require the principal reinforcement in the upper part. For simplicity of construction it is desirable to avoid this. The close proximity of the vertical wall makes it possible to throw this force directly into that wall by means of the steps at the junction of wall and slab. These steps could of course be replaced by a chamfer or slope, if the latter were found to be simpler of construction.

On the right half of the bottom slab there is a vertical load downward varying in intensity from zero at the middle to an amount at the edge of the slab which may be taken as the weight of superimposed earth and of the slab itself. This is close to $250 \times b$ lbs. per square foot. Taking the effective span of the slab as 7½ ft. the bending moment on the extreme right edge is $250\ b \times 7\frac{1}{2} \times 7\frac{1}{2} \div 8 = 1{,}758\ b$. This is in foot pounds per foot width of slab.

In order to give clearance for the angles shown in Fig. 7, the steel rods are placed one-sixth of the depth of the slab from the bottom. Following the method employed by the writer in his book, "Concrete," the effective depth of the slab is found to be two-thirds of its depth out to out. As this latter is $3/20\ b$, the effectice depth (that is, the distance from center of steel to center of compression in concrete) is $1/10\ b$. For an area of steel $= A$, in square inches per foot width of slab and a stress of 12,500 lbs. per square inch we have an allowed bending moment of $12{,}500\ A \times 1/10\ b = 1{,}250\ A\ b$ ft. lbs.

Equating this to $1{,}758\ b$, found above, we have: $A = 1.406$.

This can be made up of four ⅝-in. diameter rods. It is thus seen that for any size of retaining wall ⅝-in. round rods, spaced 3 ins. apart, will take the tensile stress in the bottom slab at the extreme right edge. The spacing of rods can be increased toward the middle of the slab. It is better to increase the spacing than to use varying sizes of rods, as the ordering of material is simplified. An arbitrary maximum spacing of 12 ins. is used here for the left half of the slab to tie the concrete together.

To prevent cracking of the slab due to deflection upper rods are added, as shown in Fig. 7. These are made 5 ft. long and spaced 6 ins. apart, thus making their area one-half of the maximum bottom reinforcement. It is the writer's practice to design slabs as simple beams, using the clear span, and to reinforce across the support with one-half of the area required in the slab, so as to prevent cracks and consequent weakening of the slab in shear. Note that the clear span here is not the clear distance between ribs, since the steel angle *F* and not the rib supports the slab.

As the writer has shown in his book, "Concrete," when the area of steel does not exceed 1¼ per cent of that of the concrete in a slab the stress in the concrete will be within safe limits. It is seen that the area *A*, found above, is 1¼ per cent of that of a slab 12 ins. wide and 9.4 ins. deep. For a base of 5 ft. the depth of slab is 9 ins.; hence a lower limit of about 5 ft. should be adhered to for this standard. For smaller walls the thickness of parts for a wall of 5-ft. base could be maintained and the span between ribs varied to suit the bending moment found. Thus for a wall having 2½-ft. base (one-half of the standard 5-ft. wall), the load on the slab will be approximately one-half of that on the 5-ft. wall. (The height of this wall would be 6 ft.) A 9-in. wall with the standard reinforcement will be good for a span $\sqrt{2}$ times the standard, or 10.6 ft., say 10 ft. clear.

The span of 7 ft. in the standard wall is found as follows: Let s = clear span in feet. The end shear in 1 ft. width of slab is $250\ b \times \frac{1}{2}\ s = 125\ b\ s$. The shearing strength of a slab $3/20\ b$ feet deep and 1 ft. wide, at 40 lbs. per sq. in. on the gross area is $3/20\ b \times 12 \times 12 \times 40 = 864\ b$.

Then from the equation $125\ b\ s = 864\ b$, we find $s = 9.91$ ft.

Since this remains true for all sizes of standard walls, it is seen that the shear is taken care of in all walls. In walls of less than 5 ft. in base, and having a thickness of slab equal to the 5-ft. standard, shear will also be taken care of, since the slab will have a greater relative depth than in the standard wall.

The reinforcement in the front wall is found as follows: It will be seen in the standard retaining wall that the depth from top of wall to top of steps is $1.9\ b$. The intensity of horizontal pressure is therefore $1.9\ b \times 1/6 \times 100$ lbs. per sq. ft. This gives a moment on a foot depth of wall $= 223\ b$ ft. lbs. The moment of resistance of the reinforced slab, found as above, is $12{,}500\ A \times \frac{2}{3} \times \frac{b}{10} = 833\ A\ b$.

From $223\ b = 833\ A\ b$, we have $A = .267$ sq. in.

This would be made up by one ⅝-in. round rod for every foot of depth of wall. This reinforcement is carried up to the top of the wall and is used as indicated on the lower portion of the wall and on the bottom, though theoretically less reinforcement would be required. The purpose is to tie the wall together. Near the top of wall this extra reinforcement is especially useful in resisting local effects of frost in the ground, which are more intense near the surface. Extraneous load on the backing would also affect the wall the greatest near the surface.

It is well to chamfer off the inner edge of a retaining wall at the top, as indicated in Figs. 2, 3, and 4, so that the effect of the expansion of surface ice will be deflected.

The rods in the rib take the downward force shown at *c*, Fig. 7, the amount of which at the right edge is at a rate per foot close to $250\ b \times 7 = 1{,}750\ b$ lbs. On a retaining wall of 5-ft. base the load in a foot is 8,750 lbs. At 12,500 lbs. per sq. in. this would require four rods ½ in. in diameter. For a 10-ft. base four 11-16-in. round rods are required, etc. By giving these rods the same horizontal spacing at the bottom as those in the bottom slab and varying the rate of spacing in the same manner, the vertical load is taken care of. The rods start vertical and hence the vertical load measures their stress and not the component in the diagonal direction. Of course straight rods could be used, by employing beveled washers, in which case the stress would be the diagonal component of the vertical load.

The horizontal force against the vertical wall is less than the weight of earth on the slab which is carried by the rods in the counterfort, hence the same rods will be sufficient to resist the horizontal force on this wall.

The work of the steps at the junction of vertical wall and slab is to resist an upward pressure varying from zero at the foot of the steps to a maximum under the vertical wall. Reinforcement is not needed in these steps, because of their mass and because they are supported on three sides.

The projection at the heel of wall does not need reinforcement, because its amount is only one-third of the depth. If a large projection were needed here on account of soft soil in the foundation, reinforcement should be used.

Anchors that take the full stress of rods should have their areas about 20 times the section of the rod. This condition would govern the size of the flange of angle to which rods in the rib connect. These angles could vary from about 2½x2½x5/16 in. for small sized walls to 4x3x⅜ in. for large walls.

The rods in the ribs should be bent with easy curves and not with sharp bends. Sharp bends are totally out of place in rods reinforcing concrete. The radius of the curve of bend should be about 20 times the diameter of the rod.

A retaining wall built on this or any other plan should have the backing well drained. This plan admits of ample provision for drainage by means of weep holes through the slabs. In order that these do not fill with mud, some loose stone should be laid around them.

In a wall built after this plan at Melwood Ave., Pittsburg, the bottom slab was inclined. This made a pocket, into which drainage could be carried. The maximum height is 64 ft. The anchoring pieces are ⅝-in. plates instead of angles. Plates do not afford a ledge or shelf for the concrete slab to rest upon, but in this case this was offset by the fact that the reinforcing rods for the slabs were curved in an arc. However, these rods, where they entered the ⅝-in. plate, were bent normal to the plate. This makes the anchoring value of the plate to depend largely upon shear in these rods. Of course adhesion to the side of the ⅝-in. plate will help to anchor the plate, but adhesion of concrete to a flat surface is not of very great value, because the element of grip is lacking.

The rods in these ribs may vary from 1¼ in. to 1⅝ in. They have forked loops at the ends and turnbuckles for adjustment. They are connected to the anchor plates by means of cotter pins. The front wall is 18 ins. thick, the bottom slab is 2 ft. thick, and the rods are 1 ft. thick. The spacing of ribs is 10 ft. and the maximum width of bottom slab is 29 ft. 6 ins. At the highest portion of the wall there is about 2,400 cu. ft. of concrete per bay. A solid wall 64 ft. high and having a base one-third of the height would have nearly six times this amount of concrete in 10 ft. of its length. The economy of this form of retaining wall is therefore manifest.

The accompanying plans, Fig. 8, which were kindly furnished the writer by L. W. Anderson, city engineer of Grand Rapids, Mich., show part of some extensive flood protection work constructed in Grand Rapids. The writer's design of retaining wall was used in this work. The anchors for the rods in this work consisted of angles, as used in the writer's standard plan. Mr. Anderson states: "There has been no difficulty in rapidly placing the counterfort reinforcement as a whole, setting and plumbing the same. The rods are quickly and accurately placed by common help with very little attention on the part of the inspector. Every rod has its proper location, and there is very small chance of reinforcement being misplaced or omitted."

EARTH AND ROCK SECTION

Friction in Small Air Pipes.

During the past year, at the University of Missouri, some valuable experiments were made for determining the losses of pressure due to friction in compressed air pipes of ½ in., ¾ in., 1 in. and 2 ins. in diameter. The experiments were carried on, under direction of Professor E. G. Harris, by Messrs. Albert Park and H. K. Peterson; the results are given in the September Bulletin of the university, from which the following is abstracted:

The equipment consisted of one single stage Rand imperial type air compressor of 77 cu. ft. per minute free air capacity and pressure up to 100 lbs. per sq. in. gage; one two stage Laidlaw-Dunn-Gordon air compressor of 110 cu. ft. free air capacity and 150 lbs. gage pressure; one detached air receiver of 25 cu. ft. capacity, and one drum especially constructed for measuring air by orifice. This drum is supplied with orifices cut in No. 14 copper plate and ranging from ½ in. to 3½ ins. in diameter. The necessary pressure gages were standard Crosby gages. They were tested and the necessary corrections determined by a standard gage tester. A special differential gage was constructed for the work and as the lost pressure ran as high as 30 lbs. the glass tubing was made 6 ft. long. In cases of great difference in pressure, mercury was used in the tube, but where the difference was small water was used. The free air volume was controlled by the speed of the compressors, the pipe connections being so made that the discharges could be united, but the pressure when both compressors were in operation was limited to 100 lbs. per sq. in.

With each size of pipe two sets of runs were made, one with two elbows in the line of pipe and one with 16 or 18 elbows. In each set of runs, the range of pressure was from zero to about 10 atmospheres.

Formulas Used in the Computations.—The object of these experiments was to find the value of c in the following formula:

$$f = c\frac{l}{d^5}\frac{V_a^2}{r}$$

f = loss of pressure in pounds per square inch.

l = length of pipe in feet.

V_a = volume of free air passing—cu. ft. per sec.

d = diameter of pipe in inches.

r = ratio of compression—atmospheres.

c = experimental coefficient.

The weight of 1 cu. ft. of free air at Rolla, Mo., was computed at 0.073 lbs.

The f in the formula was computed from the differential gage readings, as follows:

$$f = \frac{62.5 \times 13.6}{1728}D'' \text{ or } f = \frac{62.5 \times 13.6}{1728 \times 2.54}D'$$

where D'' equals the difference in the mercury column in inches and D' equals the difference in centimeters.

The r used in the formula was the average and was obtained thus:

$$r = \frac{P - \frac{1}{2}f + p_a}{p_a}$$

where P equals the gage pressure at the entrance and p_a equals the absolute pressure of the atmosphere in pounds per square inch, which is approximately 14.2 at Rolla, Mo.

If the lengths of straight pipe had been the same in the experiments with the greater and with the less number of elbows, the loss due to the extra elbows could have been found directly, but since the lengths were unequal the loss was calculated as follows:

Let f_2 and f_n represent the friction loss in the pipe with two elbows and in the pipe with the greater number, respectively.

Let l_2 and l_n represent the lengths in the two cases.

Let e represent the loss of pressure due to one elbow.

Let $a = \frac{l_2}{d^5}$ and $b = \frac{l_n}{d^5}$,

$$\text{then } f_2 = c\frac{l_2}{d^5}\frac{V_a^2}{r} + 2e = ca\frac{V_a^2}{r} + 2e \qquad (A)$$

$$\text{and } f_n = c\frac{l_n}{d^5}\frac{V_a^2}{r} + ne = cb\frac{V_a^2}{r} + ne \qquad (B)$$

Multiply (A) by $\frac{n}{2}$,—subtract one from the other,—solve for c and get

$$c = \frac{\frac{n}{2}f_2 - f_n}{\left(a\frac{n}{2} - b\right)\frac{V_a^2}{r}} \qquad (C)$$

In this equation it is assumed that the $\frac{V_a^2}{r}$ is the same for the values of f_2 and f_n, but the experiments could not be controlled to this extent. To over come this difficulty, the values of f_2 and f_n were platted as vertical ordinates over $\frac{V_a^2}{r}$ as horizontal ordinates and smooth curves drawn through the points with the intention of taking therefrom values of f_2 and f_n corresponding to any desired values of $\frac{V_a^2}{r}$ and with these to compute the c.

These points when platted seem to indicate that values of f_2 and f_n can be taken to vary as the ordinate to a straight line over the values $\frac{V_a^2}{r}$ except in the case of the 2-in. pipe; but even in that case the curve is so flat that for practical purposes a straight line can be drawn up to where the velocity of air in the pipe exceeds 50 ft. per second.

Assuming then that f_2 and f_n vary directly with $\frac{V_a^2}{r}$ in cases with and without elbows, the solution of equation C is much simplified for it can now be written:

$$C = \frac{\frac{n}{2}g - h}{\frac{n}{2}a - b}$$

where $\frac{f_2}{V_a^2/r} = g$ and $\frac{f_n}{V_a^2/r} = h$ [illegible] corresponding lines.

Formulas for Solving the Resistance Due to Elbows.—Write equations (A) and (B) thus:

$$f_2 = g\frac{V_a^2}{r} = ca\frac{V_a^2}{r} + 2e$$

$$f_n = h\frac{V_a^2}{r} = cb\frac{V_a^2}{r} + ne$$

Solve for e and get

$$e = \left[\frac{g + h - c(a+b)}{n+2}\right]\frac{V_a^2}{r}$$

From this the value of e for any value of $\frac{V_a^2}{r}$ can be computed, but it is much more convenient to find the length of straight pipe that will for all values of $\frac{V_a^2}{r}$ give the same loss as one elbow. This can be done as follows:

If, in the formula for loss in a straight pipe, viz.:

$$f = c\frac{l}{d^5}\frac{V_a^2}{r}$$

we make $f = e$ and compute l, the length so computed will be the equivalent length sought. Thus:

$$\left[\frac{g+h-c(a+b)}{n+2}\right]\frac{V_a^2}{r} = c\frac{l_e}{d^5}\frac{V_a^2}{r}$$

$$\text{Whence } l_e = d^5\left[\frac{\frac{g+h}{c} - (a+b)}{n+2}\right]$$

Using the values determined by the tests, the values of l_e are as follows:

Diameter of pipe, ins.	½	¾	1	2
Length of straight pipe, in ft., giving loss equivalent to one elbow...	6.5	5.9	8.2	12.3

These results are for standard short-turn elbows.

It is noteworthy that these results differ radically from the equivalents given in other publications.

The observations on elbow resistance do not cover a sufficient number of diameters to warrant any general conclusions or any effort to determine the law of variation. More such experiments over a wider field are needed.

Average Values of Coefficient of Friction.—In addition to the values of the friction coefficient c as herein determined for pipes up to 2 ins., we have presumably reliable data on larger pipes from which the coefficient has been determined as follows:

Experiments by Guttermuth and Reidler on Paris mains in 1890—diameter 12 ins.,

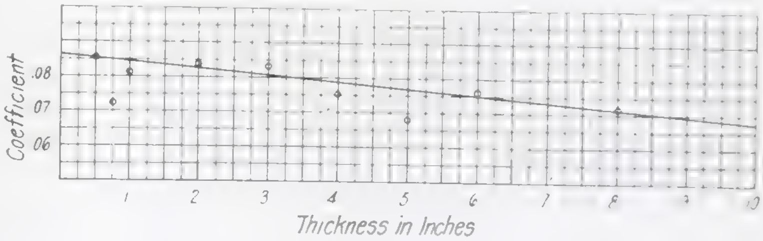


Diagram Showing Friction of Air in Pipes.

neglecting the evidently abnormal cases, $c = .050$.

Experiments by Stockhalper at St. Gothard tunnel; $d = 8$ ins.; $c = .062$.

Experiments by Devillez at Levant Du Flenn, 1879; $d = 5$ ins.; $c = .057$.

Experiments by Lorens at Offenbach, 1892; $d = 4$ ins.; $c = .066$.

Experiments by Devillez at Levant Du Flenn, 1879; $d = 3$ ins.; $c = .072$

These computed values of c are here tabulated:

Diameter (ins.).	½	¾	1	2	3	4	5	6	8	12
Friction coefficient	.075	.061	.071	.073	.072	.066	.057	.056	.062	.050

These results are shown platted on Fig. 1. The coefficients for ¾ and for 5-in. pipes seem abnormal and were neglected in locating the straight line average.

The straight line shown on Plate 6 gives the equation $c = .076 - .00188d$, and from this the following coefficients were obtained and are recommended for practice until more complete data are obtained:

Diam. of pipe. Ins.	Coefficient
½	0.075
1	0.074
1½	0.073
2	0.072
2½	0.071
3	0.070
3½	0.070
4	0.069
4½	0.068
5	0.067
6	0.065
7	0.063
8	0.061
10	0.059
12	0.054

Progress and Costs of Filling for the Gatun Dam, Panama Canal.

The Gatun Dam which impounds the waters of the Chagres River to form Gatun Lake is a combined rock and earth fill structure nearly 1½ miles long measured on its crest, ½ mile wide at its base, 400 ft. wide at water level and 100 ft. wide on the top. The location and trace of the dam are indicated by the plan published in connection with another article in the preceding section of this issue. Figure 1 shows a cross-section of the dam. Briefly the dam consists of two rock piles about 1,200 ft. apart between which is earth fill made up as indicated by Fig. 1.

The method of construction is briefly as follows: Trestles are built along the lines of the rock embankments and from there material brought in on trains is dumped to form the dry fill. The hydraulic fill is accomplished by means of hydraulic dredges taking material from pits above and below the dam. As the upstream face of the dam is completed the paving is placed. The amount and average cost of work to Oct. 1, 1910, were as follows:

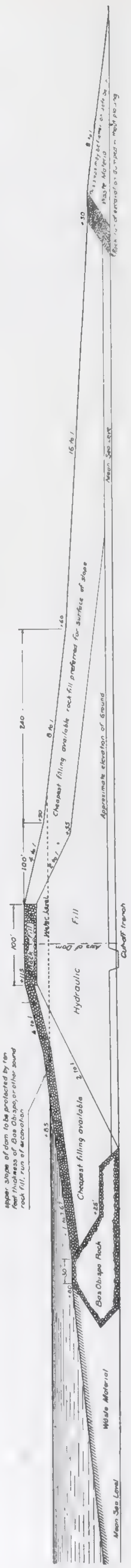
Item.	Cu. yd.	Cost per Cu. yd.
Dredging	38,425	$0.5216
Dry filling	5,432,806	0.4046
Hydraulic filling	4,979,557	0.2649
Paving	40,411	0.3097

The total volume of fill completed is thus 10,412,363 cu. yds., which is approximately half of the work. In figuring these yardages car or place measurement plus 25 per cent swell is used for dry fill and for wet fill borrow pit measurements less losses ascertained by cross-section when practicable, otherwise estimated.

The costs of filling and paving are available in detail for the first six months of 1910, and also separately for the three months, July-September, 1910.

The cost of dry filling for these six months to June 30, 1910, was as follows, the figures being arranged for a total of 1,558,401 cu. yds.:

Item.	Per cu. yd.
Tracks	$0.0485
Trestles	0.0107
Transportation	0.0630
Filling	0.0637
Maintenance, equipment	0.0037
Plant arbitrary	0.0548
Division expenses	0.0118
General expenses	0.0280
Total	$0.3099


upper slope of dam to be protected by ten feet thickness of Bas Obispo, or other sound rock fill, run of excavation
100'
+115
Rock Fill
100'
240
4 to 1
+90
8 to 1
+60
16 to 1
+30
8 to 1
Water Level
+85
+80
30'
1 to 2.67
4 to 1
2 to 1
Axis of Dam
Hydraulic
Fill
Cheapest filling available
Cheapest filling available rock fill preferred for surface of slope
+55
+25'
Bas Obispo Rock
Waste Material
Mean Sea Level
Cut-off trench
Approximate elevation of Ground
Mean Sea Level
Waste Material
Rock run of excavation dumped without placing

Typical Section of Gatun Dam Panama Canal.

For the three months, July-September, 1910, the corresponding items arranged for 632,987 cu. yds. were as follows:

Item.	Per cu. yd.
Cleaning site	$0.0053
Tracks	0.0678
Trestles	0.0051
Transportation	0.0760
Filling	0.0915
Maintenance, equipment	0.0102
Plant arbitrary	0.0770
Division expenses	0.0220
General expenses	0.0315
Total	$0.3864

The stone used for dry fill is that excavated largely from the Culebra Cut, and it is hauled in dump car trains from Culebra to the dam. The above costs do not, of course, include any charges for excavation.

The present number of hydraulic dredges working on hydraulic fill is four, the fourth dredge having begun work on June 28, 1910, so that the work from Jan. 1 to June 30, 1910, is the work of three dredges. The amount of hydraulic fill for this period was 1,556,745 cu. yds., and its unit cost was as follows:

Item.	Per cu. yd.
Dredging	$0.0952
Relay pumps	0.0053
Pipe lines	0.0336
Wood flumes	0.0001
Power	0.0234
Small boats	0.0009
Maintenance, equipment	0.0587
Clearing	0.0395
Plant arbitrary	0.0615
Division expenses	0.0072
General expenses	0.0245
Total	$0.3499

The corresponding items for the three months, July-September, 1910, arranged for 1,326,335 cu. yds. as follows:

Item.	Per cu. yd.
Clearing site	$0.0053
Clearing for dredge	0.0069
Dredging	0.0658
Relay pumps	0.0019
Pipe lines	0.0189
Power	0.0083
Small boats	0.0011
Maint. equipment	0.0280
Plant arbitrary	0.0490
Division expenses	0.0077
General expenses	0.0147
Total	$0.2076

The total amount of paving up to Oct. 1, 1910, was 40,411 cu. yds., the cost of which is given separately for two periods as follows:

Item.	May-June.	July-Sept.
Volume, cu. yds.	18,374	22,037
Cost:		
Filling	$0.2178	$0.1789
Plant arbitrary	0.0548	0.0770
Division expenses	0.0166	0.0212
General expenses	0.0189	0.0293
Clearing site	.....	0.0053
Total	$0.3081	$0.3117

Cost of Dynamite at Panama.—Records of the Panama Canal show that 55.77 per cent as much dynamite was used during August, September and October, 1910, as for the corresponding months in 1908, and 57.02 per cent as much as in 1909.

The saving for the three months of 1910 over those of 1908, amounts to 431.03 long tons, or $115,939. The cost of handling, loading and shooting is estimated at $30.00 per long ton in addition to the cost of the dynamite, or $12,930 additional saving. The amount of dynamite used per cubic yard of rock excavated has been as follows:

	Long tons dynamite.	Cu. yds. rock.	Pounds explosive per cu. yd.
August, 1908	322.21	907,746	0.796
Sept., 1908	324.65	1,054,526	0.629
October, 1908	327.75	1,015,143	0.72
August, 1909	297.90	1,043,355	0.64
Sept., 1909	360.20	1,107,649	0.73
October, 1909	295.20	1,196,297	0.55
August, 1910	191.30	1,177,621	0.36
Sept., 1910	199.05	1,114,765	0.40
October, 1910	153.23	1,076,678	0.32

Cost of Compressed Air.—The total output of all the air compressor plants employed on the Panama Canal work during the year ending June 30, 1910, was 7,227,203,513 cu. ft. of free air and the average cost was 4.03 cts. per 1,000 cu. ft.

The Construction of the Spiral Tunnels on the Canadian Pacific Railway. Methods and Progress.

The completion of two spiral tunnels on the Canadian Pacific Ry., which are a part of the relocated line through the Selkirk Mountains in British Columbia, eliminates one of the steepest grades (4.5 per cent compensated) on any standard gage railway.

The tunnels are built on 10° curves and a grade of 2.2 per cent, which, in the tunnels, is reduced to 0.06′ per degree of curvature or to a grade of 1.6 per cent. The length of tunnel No. 1, as shown by Fig. 1, is 3,206 ft. and the length of No. 2 is 2,890 ft. In section the tunnel is 22 ft. 6 ins. wide and 16 ft. 3 ins. high to the springing line, with a semicircular arch of 11 ft. 3 ins. radius. Where timbering was not necessary these dimensions were somewhat less, but allowed for the placing of a future concrete lining, 2 ft. thick, as shown by the section in Fig. 3.

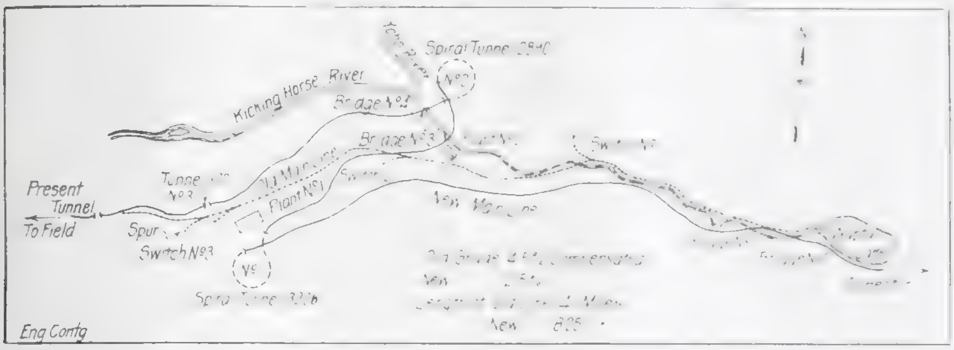


Fig. 1—Map of Location of the Grade Reduction, Canadian Pacific Railway in British Columbia.

The tunnels were driven through crystallized limestone which was somewhat uniform in tunnel No. 1, with a dip of 20° to the northeast, but which in tunnel No. 2 was very irregularly stratified. The strike, of course, was made at all angles to the face, as each tunnel made a turn of over 230°.

The entire work, which includes the construction of the spiral tunnels, a 710-ft. tunnel on tangent, four steel bridges over the Kicking Horse River, in all 8.2 miles of line, was let under contract to Macdonnel, Gzowski & Co., of Vancouver, B. C., in 1907. The cost of the work was originally estimated at $1,270,000. The contractors were on the ground in September, 1907, and the work on tunnel No. 1 was commenced in January, 1908. The work on both tunnels was prosecuted continuously from that time until June, 1910, when the tunnels were completed. Tunnel No. 2 was started a month later and finished a month earlier than tunnel No. 1. An average of 176.9 ft. per month was made on tunnel No. 1 for 18 months, and 171.3 ft. per month progress was made on tunnel No. 2 for 17 months. Each tunnel was worked with two headings.

Plant.—It was first intended to do the mucking by hand but after a short trial it was decided to install four Marion shovels for this purpose. These shovels were operated by compressed air and their use necessitated doubling the compressor and boiler capacity of the plant. The plant furnishing compressed air and light to tunnel No. 1 was located near switch No. 3 of the old railway line as shown by Fig. 1. This was about 250 ft. below the elevation of the tunnel portal. The plant for tunnel No. 2 was located at the river about 1,500 ft. from the portal. A list of the entire plant used is as follows:

Boilers:

2 100 hp. (return tubular).
4 80 hp. Jencks locomotive type.
2 100 hp. Jencks locomotive type.
1 100 hp. Brady-Mumphard.

Engines:

1 Comstock Climax engine; 7x10 ins., 25 hp.
1 Comstock Climax engine; 4x5 ins., 4 hp.
1 American hoisting engine with boiler, 7x10 ins., 25 hp.
1 Little Giant Hoisting engine, [illegible]x7 ins., [illegible] hp.

Air Compressors:

[illegible] Straight line, Ingersoll-Sergeant [illegible] x30 ins.); capacity 1,425 cu. ft. free air per min.
1 Air Straight line, Ingersoll-Rand (20 and 20 x30 ins.); capacity 1,100 cu. ft. free air per min.
1 Cross-compound American-Rand; air cylinders 22 and [illegible]x16 ins.; steam cylinders [illegible] and 24x16 ins.; capacity 1,050 cu. ft. of free air per min.

Pumps:

1 Atlantic, 7x[illegible]
[illegible] Fairbanks-Morse [illegible] piston plunger pattern; 6x4x6 ins. to 8x5x12 ins.

Generators:

2 Westinghouse d. c., 6 kw., 125 volts.
1 General Electric d. c., 25 kw., 250 volts.

Drills and Shovels:

22 Canadian-Rand Little Giant rock drills.
6 Ingersoll-Sergeant rock drills.
4 No. 20 Marion steam shovels (operated by air).

The effect of the 6,000 ft. elevation above sea level and the cold winter was shown on the mechanical equipment. The effect was in the reduction of the atmospheric pressure about 3 lbs. per sq. in., and a reduction of the temperature. During very cold weather difficulty was experienced by the freezing of the moisture in the air lines. This trouble occurred where the pipes were practically level, but not inside the tunnels. In order to obviate this difficulty additional air receivers were placed in the lines, but they served only partially to overcome it.

Excavation.—The top heading and bench method was used in driving the tunnel. The heading included the area described by the semicircular arch and the bench included the balance of the tunnel section. Two shifts of 10 hours each were worked each day, with the exception of the shovel crews, who mucked their round. In each heading 6 to 8 drills on four columns were used, with 1 driller and 1 helper for each drill used. Figure 3 shows the approximate location of the drill holes for both timbered and untimbered sections. There were two rows of cut holes about 12 ft. deep. The cut holes were from 2 to 3 ft. from the center line and were [illegible] so as nearly to cross the center line. The location of the side holes was varied considerably according to the character of the rock.

The bench, which was kept 10 to 12 ft. back from the face of the heading, was drilled with 6 down holes sloped as shown by Fig. 3; also a row of 6 lifter holes, 12 ft. deep, pointed so as to reach about 1 ft. below the sub-grade. The rock was crystallized limestone and very brittle. The center line of the tunnel being, as it was, on a circular arc, the rock strata were encountered at all angles to the drill holes and small pieces broke off inside the holes and jammed the bits. Various shapes of bits were tried, but the use of small pieces of iron, thrown into the hole, proved most effective.

The shovels were used almost entirely for the mucking, with the exception of sufficiently mucking back from the heading to allow the setting up of the drills, and this was done by the drillers and helpers.

The mucking was usually completed by the time the down holes in the bench were drilled and the shovel was then moved back about 150 ft. until the lifter holes were drilled and all holes were fired.

The cut holes were loaded for springing. They were then sprung and fired. The side rounds, the down bench holes, and the lifters were shot at one time. The bench, being kept close to the heading, allowed the muck to be thrown down with that from the bench. The bench was kept as nearly vertical as possible.

The shovels were equipped with special short booms and dipper arms, and shallow dippers for rock work. They were equipped for operation by steam, but the boiler was used as an additional receiver for the compressed air. The shovels were operated on a track close to one side of the tunnel and each was supported on the inner side by a jack. A narrow gage (2 ft.) double track was used for the 4-yd. home-made dump cars and this track was kept close up to the shovel. At the end of this track, near the bench, it merged into a single track used for loading. Cars came in on one track and went out on the other, requiring about 1 minute for an exchange of single cars. The cars were pulled up grade by horses and ran down grade by gravity.

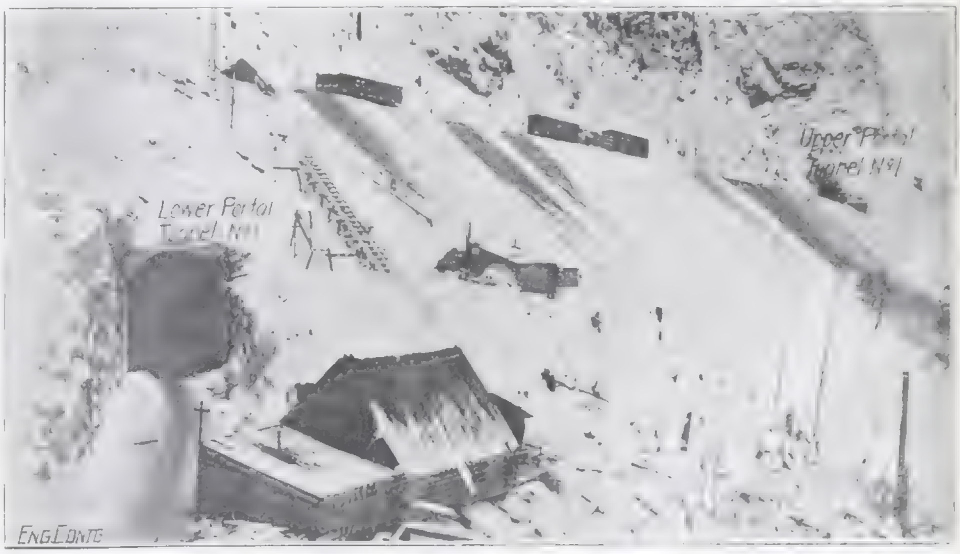


Fig. 2—View of the Upper and Lower Portals of Tunnel No. 1

[illegible] timbering. When this was done the bench was left about 50 ft. from the heading. The permanent timber plates were put in, each segment was trimmed off and was then lagged and wedged up. Before shooting the bench the wall plate was securely blocked up and the last full length post was protected by old timbers laid against the walls.

When a 50 ft. bench was used the muck from the heading had to be wheeled back in wheelbarrows and dumped over the bench where it could be handled by the shovel. The size of the timber gang varied according to the conditions. Part of the timbering had to be kept close up to the work to support the ground, but for a certain portion it was possible to wait until the excavation had been completed. In this case a "jumbo" car was used to facilitate the handling of timbers and packing. The timbers for the tunnel work were cut from the surrounding mountains.

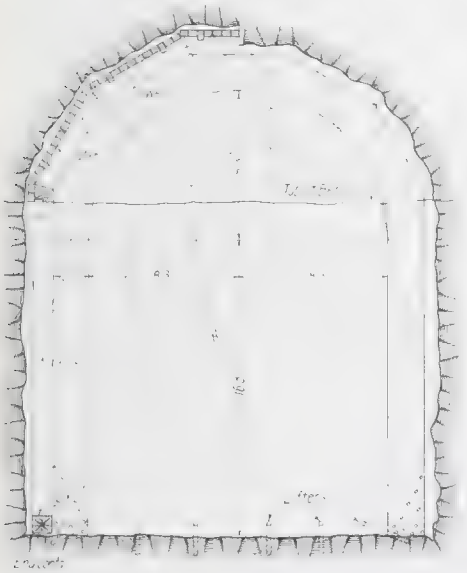


Fig. 3—Sketch Showing the Location of the Holes in the Heading and Bench Used for Both Tunnels.

The wages paid on the work were as follows:

Machinemen (drillers), (per day)....	$ 5.00
Machinemen (helpers), (per day)....	4.00
Muckers (per day)...	2.75
Laborers (per day)...	2.50
Shift foremen (per day)...	6.00
Muck foremen (per day)...	4.00
Timbermen and carpenters (per day)	$3.00- 3.25
Shovel runners (per month & board)	150.00
Trainmen (per month and board)....	110.00
Electricians (per day)...	3.50
Pumpmen (per day)...	3.50
Fitters and pipe men (per day).....	3.00- 3.50
Engineers (per day)...	4.00
Firemen (per day)...	3.50

They were all charged $5.25 per week for board.

TABLE I—MONTHLY PROGRESS ON TUNNELS.

1908.	Tunnel No. 1.	Tunnel No. 2.
January	31[1]	
February	198[2]	55[1]
March	208	111
April	226	122[2]
May	277	157[3]
June	244	118[2]
July	180[3]	153[2]
August	158	107[3]
September	173	219
October	165[3]	301
November	158	277
December	200	252
1909		
January	156[4]	244[4]
February	150	215
March	217	231
April	197	287
May	170	63
June	76	

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[1]Started one heading.
[2]Working both ends.
Water and bad ground.
[4]Freezing troubles.

Total lin. ft. for tunnel No. 1, 3,184.

Average monthly progress in tunnel No. 1, 176.9.

Total lin. ft. for tunnel No. 2, 2,912.

Average monthly progress in tunnel No. 2, 171.3.

Water troubles took care of themselves in the headings going up grade, but in the down grade headings sump holes (3x3x3 ft.) had to be made. The sump holes were excavated from time to time as the heading progressed and the water running into these was kept down by pump operated by compressed air.

Engineering.—As a rule 20-ft. centers were given on the 10° curves. The foreman was also provided with a table of offsets, to be used between the points given with an instrument, so that he could determine his center at any time. The headings all closed within ¾ in. for alinement and the error in closing the grades was practically nothing. The contractors for the entire work were Mcdonnell, Gzowski & Co. of Vancouver, B. C. We are indebted to Mr. C. S. Gzowski, a member of the firm, for the information given.

Facing Culebra Cut; Recommendations of Board on Revetment and Retaining Walls.

The board appointed for the purpose of determining, so far as present conditions permit, whether the faces of Culebra Cut should be revetted or protected by grouted rubble or concrete facings has submitted the following recommendations, which have been approved:

(1) The board is of the opinion that it is undesirable to attempt, under ordinary circumstances, to put in revetment for the purpose of protecting the faces of the Cut, until the full depth of the Cut has been reached.

(2) For the reason just stated, the board believes that unless something unforeseen should occur, there is no necessity, nor is it advisable, to begin any revetment work, properly so-called during the next dry season.

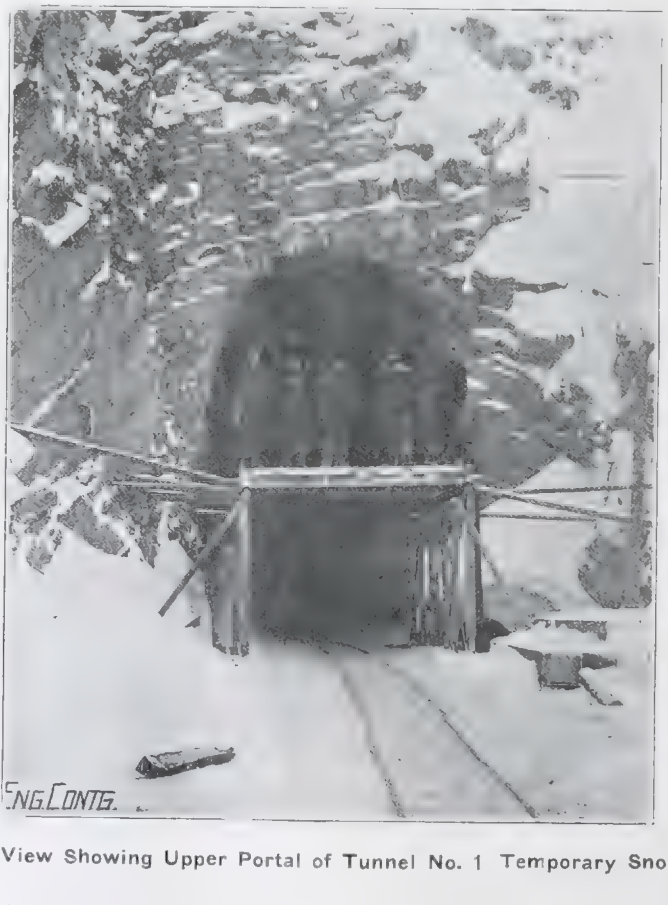

Fig. 4—View Showing Upper Portal of Tunnel No. 1 Temporary Snow Shed.

(3) The board is of the opinion that the preservation of a maintenance track on the east berm of the Canal is eminently desirable, if this result can be accomplished at a reasonable cost, and believes that the progress of the work up to the present time has not shown conclusively that such a track cannot be maintained without undue expense. The board, however, is unwilling to enter at the present time upon a policy which, in order to maintain the berm, might involve a large expenditure, before the possibility of such maintenance shall be conclusively established. For this reason, it believes that during the next dry season, the construction of retaining walls, or other supports, to the berm should [illegible]tions where such support is necessary for construction purposes, and finds as the result of the inspection already described, but a single locality where it is prepared to recommend that measures be taken during the next dry season to support the berm, to-wit:

That portion of the 95-foot level on the east side of the Canal between stations 1870 and 1880, at the foot of the old Paraiso slide, where it believes that construction work requires the preservation of the track on the 95-foot level.

(4) The excavation has not yet reached the full depth at the point just mentioned, and the board suggests the following treatment for this locality, to-wit:

That after the dry season has set in a cut be made to full depth, or perhaps a little deeper than the bottom of the Canal, along the front of the unstable bank, extending into the bank outside of the side slope of the Canal, a distance sufficient to form the foundations for a retaining wall or support, the actual distance of the cut into the bank being determined by the manner in which the bank acts when the cut is being made. If the face of the bank remains reasonably stable and does not slide into the Cut, it may be possible to take out two shovel cuts before building the support. If so, the support may be constructed of riprap stone, with a dry facing, and probably without the use of concrete or mortar. If, on the other hand, the bank shows signs of moving when the first shovel cut is taken, a concrete retaining wall, back filled with dry rubble, will probably better meet the situation. The length of bank requiring this treatment is about 900 feet.

The board making the report consisted of Lieut. Col. H. F. Hodges, Lieut.-Col. D. D. Gaillard and Civil Engineer (U. S. N.) H. H. Rousseau.

For use during cold weather, when the trains of the Pennsylvania railway entering the New York station through the electrified-tunnel zone are disconnected from their steam locomotives, steam generated in electric boilers will be used to maintain the temperature in the cars and to keep the train connections from freezing. These boilers will utilize the 600-volt direct current from the third rail, generating steam at 80 pounds pressure.—*Compressed Air.*

ROADS AND STREETS SECTION

Asphalt Pavement Repairs in Manhattan Borough, New York City.

In the Borough of Manhattan, New York city, there are 305 miles of paved streets, street asphalt and asphalt block, both under and out of guarantee, which are in charge of the Borough Department of Highways. The methods of keeping these streets in repair were described by Mr. George W. Tillson, Chief Engineer of Highways, in a paper on "The Street Pavement Problem in the Borough of Manhattan" presented before the Society of Municipal Engineers of New York city. The following notes have been taken from Mr. Tillson's paper:

The out-of-guarantee, or maintenance streets, as they are called, are repaired by contract and paid for per square yard of pavement laid. In order to facilitate the entire work the borough is divided into six inspection districts. These sections are divided into divisions, generally six, each division being in charge of an inspector and each section being in charge of a chief inspector. The division inspectors report to the chief inspector, who in turn reports to the assistant engineer in charge.

The division inspectors patrol their divisions daily, making notes of all defects in the pavement from whatever cause, whether by wear and tear, fire, plumbers, corporations, water department or builders. These are all located and recorded on a prepared blank which is forwarded to the main office. The clerk in charge of this branch sends to each contractor a copy of the list when the same refers to a guaranteed pavement. The maintenance streets are looked after directly by the engineer in charge.

In addition to the above, on Friday of each week the chief inspectors report to the engineer all streets in their respective districts that are in disrepair. These lists are also sent to the contractors and each one is expected to repair all the streets on his list before the end of that week. This plan has been in effect for about three years and has produced admirable results. The author believes it is impossible to keep the streets in good condition without a competent and systematic inspection.

In compiling statistics of the repairs to asphalt pavements in different cities the unit has generally been the cost per square yard. This, while somewhat satisfactory, is not entirely so, as the cost of doing the same work varies considerably. If, however, the percentage of the maintained pavement actually removed be given, an exact comparison can be made. The following figures have been made up by both plans and relate to the repairs of sheet asphalt pavements out of guarantee in the Borough of Manhattan during the last five years, the figures for 1910 being estimated:

	Percentage of pavement removed	Cost per sq. yd.	Cost per sq. yd. actually repaired
1906	23	$0.34	$1.48
1907	18	.20	1.11
1908	15	.177	1.18
1909	12	.117	.98
1910	13	.113	.87

It would seem from the above figures that the limit of the reduction had about been reached.

Mr. Tillson states that it seems impossible to obtain reliable figures as to the cost of keeping streets in repair. The amount of money spent in the different cities for such purpose can be learned, but that is a different proposition, as probably no American city spends enough to keep its streets in good condition.

The P. J. Carlan Construction Co., New York city, was the low bidder at $2,894,000 for the entire prison and $698,000 for deductions as provided in the specifications. Award of contract was held up by a restraining order from the court.

Two Years' Experience in Dust Suppression Work on the Roads of Essex County, New Jersey.*

The writer, a few years ago, read a paper before this society detailing the disadvantages of the common road dust on macadam roads, both from a domestic and hygienic point of view. In that paper he expressed rosy views of the future and detailed with hopefulness the ease with which a smooth dustless highway could be attained and the small cost with which it could be maintained. The writer's hopes still exist for the future dustless highway, but he is not so sanguine as to the ease of its attainment or of its low cost.

There are two or three main factors in the dust question at large before the mechanical details can be considered. The first is to a certain extent psychological or more properly sociological. Macadam roads in this age are no novelty, and the dust arising from their use has been contemporaneous with their existence. As a rule until within the last few years, when the dust in a locality reached the limit of patient endurance the residents on that particular road made arrangement for systematic sprinkling and paid for it themselves. This was the accepted custom for years, adopted as a necessity and paid for without a murmur. The sprinkling very often has not been done judiciously and the condition of the macadam surface was in many cases seriously impaired by undue wetting. Suddenly, with rather extraordinary unanimity, the community as a body, whether they were sprinkling payers, or non-sprinkling payers, whether their roads were dusty by travel or dustless by lack of travel, demanded that the dust suppression should be a task for the municipal executive, and that such suppression should be immediate, positive and universal.

This change of sentiment so overweening and insistent has put new cares and duties on the municipal office upon which they devolved. The resultant of their efforts, in a short period, can be collated and analyzed and a crystallized practice evolved. In this article are the experiences of a single locality and is written as a contributing note to the many other experiences that may be had. The second main factor is physical, and may be classified generally as the bond of the mineral aggregate used in the road. In pavements of stone or brick or wood, the size of the aggregate is sufficient to resist crushing, and what movement may be occasioned is prevented by proper joints. In asphalt, bithulithic and tar pavements this crushing and moving is obviated by the injection of a plastic medium to hold the aggregate together and in all the pavements above enumerated the dust question is not imminent.

With the use of broken stone or gravel surfaces the consolidation is affected by compression and motion. This compression is affected by steam rollers or the iron tires of wheels. This final consolidation is attained when there is a complete cessation of movement of the aggregate particles. With this cessation of movement a finished smooth surface is the realization, the smoothness of the surface depending upon the size of the aggregate. In old times before the use of the steam roller the wagon wheel was the only instrument of consolidation, and while such practices would now be considered heathenish there is no questioning the fact that when the consolidation was affected by that method that it was more perfect than the results of steam roller use.

It must not be supposed that the consolidation of the pure stone was effected without any other medium. As a matter of fact for [illegible] [illegible] is more important than all, water; and it may be truly said that all macadam surfaces until within a few years have been water bonded. Water, direct, or moisture in some form, was used in construction, and moisture was necessary for its maintenance. The absence of moisture made the road dusty and dry. A judicious application of water rendered it acceptable, and if our climatic arrangements were similar to other localities where it rains for half an hour every afternoon the dust question would never arise. It may be noted that the words "iron wheels" were used in the preceding paragraph, and at this juncture it may be proper to allude to another physical question in road maintenance, and that is the effect of the different kinds of wheels on the surface of macadam.

As has been stated, the application of an iron tire to macadam has a general tendency to consolidate the surface, and it may be stated as a positive truth that rubber inflated tires have no such action on the surface, and there is positively no consolidation, but, due to the resiliency of the tire, a constant moving action. This movement is practically in ratio of speed, the greater the speed the greater the movement and disturbance, so, therefore, with the gradual withdrawal of iron-tired wheels and the substitution of rubber the maintenance of a macadam surface entered an entirely new phase, and that is the prevention of the disturbance of the aggregate. As above stated, the water bond surface has and can give satisfaction, but its application and use may be considered prohibitive on almost all highways except those in thickly settled communities, and some other bonding material has been found to be an economical necessity. The selection and application of this mending medium is now the concern of thousands of men interested in road work and it is proper that success or failure should be truthfully recorded.

The first really intelligent expose of the effect of binding media was made by Mr. Blanchard, of Rhode Island, who constructed sample roads of short lengths, with different binding material, detailing the cost and announcing the successful results in surface maintenance. The materials used by him were tar, asphalt and asphaltum oils, and from the experience deduced by his experiments certain formulæ were established by eminent chemists for the proper classification of the bonding media to guide the tyro in onward progress. At this onset the enterprising American seemed to plunge in with every conceivable panacea for dust removal. Claims of all kinds were made for different materials, either for dust suppression or dust elimination, so that any selection was difficult and would always be accompanied by the sinister criticism of the rejected. That was about the condition of affairs when the community with which the writer is interested began its efforts.

Taking a system of 150 miles, 8 or 10 miles urban, 50 miles suburban and the balance rural, it may be readily seen that uniform treatment would fail to give good uniform results. It was then decided to renew with broken stone and bituminous binder about 25 miles and coat with heavy asphalt oil about 60 or 70 miles and let the balance in remote sections be left as of old. The renewals were started with ordering the stone fairly early in the spring, according to the usual custom, and at the same time the oil was ordered. The character of this oil was determined by the formula prepared by the chemists. The stone duly arrived on time, but the oil did not turn up until about six weeks later, and in the meantime the loose stone were kicking all over the road. This was trouble No. 1, and this trouble has been continually happening, of course, to the inconvenience of the public and the extra cost of the work. The oil used was supposed to contain 96 to 98 per cent of asphalt, and had to be heated before application. Special sprinklers had to be prepared, and delay was occasioned there. When the oil was applied to the stone careful rolling had to be maintained to obtain proper consolidation, and this necessitated the use of screening to prevent sticking, but after due persistence a proper surface was obtained, in some cases so good as to tempt exhibition. Probably 5 to 6 miles were treated in this manner, and it was thought that the trouble was over. Far from it. As the hot weather continued the new surface began to creep and crawl, until the bumps in some places were 6 ins. high in a wave 2 ft. in length, and where bumps did not form ruts would appear, from no apparent cause. In fact, the renewal of the surface by the penetration method with heavy asphalt oils was a complete failure, and after three months was positively abandoned, probably only 30 per cent efficiency being obtained, for it must be noted in addition that in small patches the same stone, the same oil and the same supervision did give good and satisfactory pavement. But of course 30 per cent efficiency is not engineeringly proper, and there was good excuse for the abandonment of this type of work.

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*Paper by James Owen, County Surveyor, Newark, N. J., read before the New Jersey Sanitary Association, at Lakewood, N. J., Dec. 1, 1910.

The new construction work done under the same auspices gave no better results. The specifications were approved by the State Highway Commissioner of New Jersey, prepared as far as the oil was concerned by competent chemists, the roadway carefully built by responsible contractors, duly inspected and oil tested, and when the work was finished was a most satisfactory piece of construction. One road was built in the fall of 1909, passed through the winter, and shortly after the spring opened systematically broke itself into pieces, necessitating a complete renewal of the surface. From this experience all contracts for asphaltum oil interjected by the penetration method were amended and the roads built under the old water bonding method, and when the surface was worn smooth a coating of surface oil was applied. This same process is now applied to renewals, the surfacing is done in the old way and then coated with surface oil with 45 to 46 per cent of asphalt.

In the dust suppression by the use of surface oil better success was attained, in fact it was found that when the applications were being made the demand for relief became so insistent that no section of road was allowed to be left out. The first attempts were made with heavy oils heated and applied hot, with the idea that one application would be sufficient for the season. Difficulties arose with that practice, as on steep grades the foothold for horses was uncertain, and a coating of sand or screenings became necessary, entailing extra expense. Lighter oils were subsequently used, with about 45 per cent of asphalt, and that application proved successful. One application in the rural sections allayed the dust for the season, and in the more traveled localities two coats were sufficient. Some curious experiences have been noted in the application of surface oil. The most important is that if the surface be broken before application there was no binding tendency, especially with automobile travel, and the loose stone still continued loose. If a binder of clay or sand were first applied without consolidation the oil was useless. It was therefore found of paramount necessity to have a smooth consolidated surface before the application of the oil. In the early spring, when the wind sweeps the road clear of detritus, disintegration is always imminent, which can be stayed by sprinkling loam or sand on the surface, which with average travel will immediately consolidate and a smooth surface be acquired. Then, and only then, should the oil be applied. Very complete traveling surface was by that means obtained, and if a coating of screenings be applied after the sprinkling of the oil the result is ideal.

This outline will give the experience of the last year. Profiting by such experience the following practice was decided upon. In construction use no penetration of heavy oil, but construct the road as of ordinary macadam and provide after complete consolidation of surface a coating of 45 per cent oil, using about ½ gal. per sq. yd., and in the maintenance contract for the year provide for two applications in that period. With this practice entire satisfaction has been realized. In the renewal work the broken stone is spread, rolled and packed and screened in the usual manner, and when the surface is smooth 45 per cent oil is applied, also giving satisfactory results.

The result for the year in the system with which the writer is acquainted is outlined in the following table, which may be interesting. The figures are furnished by Mr. Eager, who is the County Superintendent of Roads for Essex county in this State.

An analysis of cost of road repairs for Essex county, 1910, shows that the amount expended in repair account was approximately $95,000. This divided into the following heads, oiling, renewing macadam surface, cleaning gutters and trimming sides, is as follows:

For oiling roads, amount expended, $11,887.71—coating 1,254,000 sq. yds., at a cost of 9½ cts. per sq. yd.	$11,887.71
Renewing surface, including broken stone, screenings and rolling—291,692 sq. yds., at 20 cts. sq. yd.	58,338.40
Cleaning and trimming gutters—240 miles, or 1,267,200 ft., at 2 cts. per ft.	25,344.00
Total	$95,570.11

The resultant of this expense is that 75 per cent of the system is now in good repair, the remaining 25 per cent consisting mostly of roadways in towns and cities and villages with a concentration of automobile travel and is not satisfactory. The use of macadam surface on the county highways in the city of Newark has been abandoned and pavements of granite, asphalt and bithulithic have been substituted. These are permanent improvements. The treatment on about 30 miles in the cities and towns alluded to is a matter of much solicitation. It is apparent that an ordinary macadam surface, even when oiled, is not satisfactory, and relief must be obtained. To this end there are various patent pavements on the market. Amiesite, Filbertine, Warranite, and what is known as road asphalt. These all use the broken stone with a plastic mixture injected, in most cases asphalt. They have generally given satisfaction and their application will afford the relief in the districts mentioned. The financial question here enters. Taking the experiences before the automobile era, the cost of maintaining a good surface upon the Essex county roads was 3 cts. per sq. yd. per annum. This was increased in later years to about 5 cts. and including the oiling amounts to 6 cts. The patent pavements alluded to cost from 80 cts. to $1.20 per sq. yd. It is obvious that those pavements must last 15 to 20 years to be on the same monetary basis as ordinary repairs. Whether such endurance will prove to be a fact is problematical. If not, the only other recourse is to educate the community to furnish more money to be in accord with their greater desire. Having secured a reasonable dustless road with surfacing oil the aftermath must be considered, and it comes in two shapes, first, the peeling of surface where oil is applied, and the muddy condition in wet weather. The surface peeling is a serious menace. Roads that have been in good condition for years, upon the application of heavy oils become pitted, holey, and uncomfortable for travel. As far as experience has shown, the heavier the oil the greater the pitting, but against that is the other alternative, the lighter the oil the more frequent the application necessary. At what point shall the judicious balancing of these two factors be decided upon. As the writer stated he has abandoned the 90 per cent oil entirely and uses the 45 per cent. On examination of roads, where a 35 per cent oil is used the pitting does not seem to occur; therefore, he is of the opinion that it is more advisable to use the 35 than the 45 per cent oil, even though extra application be necessary. The maintenance of the surface is a desideratum and should be positively insisted upon.

As to the muddy conditions in wet weather that is a problem not yet economically solved. It must be noted that the detritus worn from the surface is clogged with oily particles, does not blow away, and so accumulates and does not wash away on flat grades as the oiliness seems to retard the movement. Of course it has been suggested that such waste can be swept off, but this is too costly a proposition on a large system. The muddiness is greatly relieved on the asphaltic surfaces. One other dustless preparation that the writer has used with success is tarvia, and for light travel or for steep grades it is of great service. It does not roll like the asphaltum oils, but has a tendency to peel after it has been in use a year or so. The writer of this article has endeavored only to depict his personal experiences. The failures may be said to have been caused by lack of intelligence and lack of experience, but as he has heard of other failures quietly whispered he thinks it is not amiss to let the public somewhat into his confidence, trusting that his endeavors and those of others may finally reach a crystallized practice acceptable to all.

Asphalt Block Pavement at Washington, D. C.

The city of Washington, D. C., probably has a larger area of asphalt block pavement than any other city of its size in this country. On July 1 last the total area of this type pavement in Washington was 623,132 sq. yds. The prices paid at Washington for the construction of asphalt block pavement during the fiscal year ended June 30, 1910, were as follows: Within city limits, $1.65 per sq. yd. for 4-in. pavement; outside city limits, $1.80 per sq. yd. for 4-in. pavement; 5-in. asphalt block pavement, within city limits, $1.80 per sq. yd.; 3-in. asphalt block pavement in 4-in. concrete base, $2.00 per sq. yd. The prices for laying asphalt block pavements for the fiscal year 1911 was $1.65 per sq. yd.

The main features of the specifications under which the asphalt block pavements have been constructed are as follows:

Asphaltic blocks.—(a) The size of the block will be 5 by 4 by 12 ins. for gravel base and a variation of ¼ in. from these dimensions will be sufficient ground for rejecting any block.

(b) All bids must be accompanied by a specimen block of the size and quality described in these specifications, labeled with the name of the bidder and locality of the factory. Bids not accompanied by specimen blocks will not be accepted. The blocks will be tested for specific gravity. All blocks furnished must be equal in quality to the sample, as determined by the Engineer Commissioner.

(c) The blocks will be composed of asphaltic cement, mineral dust, and crushed stone.

Asphaltic cement.—The asphaltic cement must be practically free from water and shall not at any time reach a temperature high enough to injure it.

If an asphalt is accepted that is readily affected by water, some provision satisfactory to the Engineer Commissioner must be made to guard against the results of such action, and such work must be included in the price bid.

The asphaltic cement must comply with the following requirement and must in any case be subject to the approval of the Engineer Commissioner.

(1) For the purpose of testing the asphaltic cement its composition shall be so regulated by the addition, if necessary, of standard fine absorbent mineral dust that it will contain 50 per cent of bitumen soluble in carbon bisulphide. This cement must be so tough at 32° F. that prism 1 centimeter square by 8 centimeters long between support will not break under impact at center with less than 15 centimeter drop of 25 gramme weight.

(2) This cement must not be softer than 60 penetration when tested at 115° F.

(3) When this cement is heated in an open tin at a temperature of 300° F. for 18 hours in a hot-air oven, it must not show a loss by volatilization of over 3 per cent, and it must not be hardened over 50 per cent by this heating.

The asphaltic cement must be thoroughly agitated before drawing from storage and while in use in the supply kettles, so as to insure a uniform cement.

These tests shall be made by uniform methods, descriptions of which are on file in the office of the Engineer Commissioner.

Mineral dust.—This shall be any fine, absorbent, inorganic dust not acted on by water, the whole of which shall pass a 30-mesh screen, and at least 85 per cent pass a 100-mesh screen.

Crushed stone.—The crushed stone in use shall be from any tough, hard rock, and shall not contain any appreciable amount of soft ingredients, such as mica, soft sandstone, or shale. On sifting, not more than 3 per cent shall be retained on a 3-mesh per inch screen, at least 40 per cent must be retained on 20-mesh per inch screen, and at least 12 per cent must pass a 100-mesh per inch screen. If the stone does not contain the desired fine material, mineral dust can be added to make up the deficiency, and in any case at least 5 per cent of such mineral dust shall be used.

Asphaltic block mixture.—The materials complying with the above specifications shall be mixed in proportions by weight, depending upon their character, which will be determined by the Engineer Commissioner, but in any mixture the percentage of bitumen soluble in carbon bisulphide shall not exceed the limits, 6 to 9 per cent.

If the proportions of the mixture are varied in any manner from those prescribed, the blocks will not be accepted.

The stone and dust and the asphaltic cement must be mixed while hot, and the mixture must be compressed into blocks by methods meeting with the approval of the Engineer Commissioner.

Samples of all material entering into the composition of the pavement shall be supplied to the inspector of asphalt and cements when required, in suitable tin boxes and cans, and he shall have access to all branches of the works at all times.

Blocks for 4-in. pavement are to be manufactured with a total minimum compression of not less than 360,000 lbs. per block, press pressure. Those for 5-in. pavement are to be manufactured with a total minimum compression of not less than 240,000 lbs. per block, press pressure.

Grading and subgrade.—The space over which the pavement is to be laid having been excavated to the proper depth below the surface of the pavement when completed, any objectionable or unsuitable matter below the bed will be wholly removed and the space filled with good gravel or other acceptable material, compactly rolled or rammed. The bed will then be trimmed so as to be parallel to the surface of the pavement when completed, and the entire roadbed will then be thoroughly compacted by rolling a roller weighing at least 10 tons, or by thorough ramming at places which cannot be reached by the roller. No extra allowance will be made for trimming and rolling, but the volume of earth, etc., removed will be paid for as grading of its class.

ASPHALT-BLOCK PAVEMENT ON GRAVEL BASE.

Gravel base.—Upon this bed, as above, is to be laid a base of good bank gravel, or other approval material, to be screened from all pebbles measuring more than 1½ ins. in their largest dimensions, so as to be 5 ins. thick when thoroughly compacted. The gravel will then be thoroughly compacted by rolling with a roller weighing at least 10 tons, or by heavy ramming at places, which can not be reached by the roller. The rolling will be continued until the gravel base cracks under the roller without compressing further. Upon this will be placed a layer of fine, sharp sand washed and dried, 2 ins. in thickness, to serve as a bed for the blocks, which will be laid directly upon and embedded in it with close joints. Special care will be observed to make the surface of this bed of sand exactly parallel to the surface of the pavement when completed. Should the material found in the space to be occupied by the gravel bed be approved by the engineer for such use, it may be left in place and used as such bed after being satisfactorily trimmed and compacted.

Any material removed from the street in grading that is suitable may, with the approval of the engineer, be used in place of the gravel base if not needed for public use.

Method of laying blocks.—The asphalt blocks are to be laid on the bed of sand at right angles to the line of the street, and with such crown as the engineer commissioner may direct; each course to be of blocks of a uniform width and depth, and so laid that all longitudinal joints shall be broken by a lap of at least 4 ins. In laying the blocks the pavers must stand or kneel upon the blocks already laid and not upon the bed of sand. Each course of blocks will be driven against the course preceding it by a heavy maul, in order to make the lateral joints as tight as possible, and the longitudinal joints will be closed by pressing each course in the direction of its length by a lever. When thus laid the blocks will be immediately covered with clean, fine sand, entirely free from loam or earthy matter, perfectly dry, and screened through a sieve having not less than 20 meshes to the inch. This will be swept or raked into the joints and the blocks will then be carefully rammed by placing a plank or iron plate over several courses and ramming it with a heavy rammer. The ramming will be continued until the blocks reach a firm, unyielding bed and present a uniform surface, with proper grade and crown. Any lack of uniformity in the surface must be corrected by taking up and relaying the blocks. When the ramming is completed a sufficient amount of fine, dry sand, as above described, will be spread over the surface.

Setting and resetting curb.—Setting 6 by 20 in. granite and bluestone curb:

This curb will be set in the following manner: A trench parallel to the curb line, having a depth of 24 ins. below the top of the curb, when set, and 20 ins. wide, will be excavated to receive the curb and its gravel bed; the dimensions of the trench, in width, will be 14 ins. from the curb line toward the building line of the street, and 6 ins. from said curb line toward the center line of the street. In this trench thus prepared the curb will be set, and brought to line and grade with plumb face. Spalls of stone, hard-burned brick, or other acceptable substance, prepared for the purpose, will be used to adjust the stone to grade, and these spalls will be so placed and adjusted as to support the curbing permanently, and afford a firm and stable support for it, without the use of small chips and fragments, used as "shimming" pieces, to wedge the stone in place. After the stone has been properly placed and adjusted to line and grade the trench will be filled with gravel of approved quality to within 8 ins. of the top of the curb; the filling to be done in layers of not more than 3 ins. in depth and thoroughly compacted by suitable ramming. Close contact joints and even surfaces must be made, and the lines and grades furnished strictly followed.

Setting 8 by 8 in. gran. curb.—This curb will be set in the following manner: A trench parallel to the curb line, having a depth of 15 ins. below the top of the curb when set, and 18 ins. wide, will be excavated to receive the concrete and the curb. The dimensions of the trench in width will be 14 ins. from the curb line toward the building and 4 ins. from the curb line toward the center line of the street. In the trench thus prepared a bed of concrete will be laid, filling the trench to a depth of 5 ins., composed of 1 part of Portland cement, 4 parts of clean concrete sand, and 10 parts of screened pebbles, the material to be mixed and laid under the same conditions as prescribed for laying cement concrete base under current specifications for sheet asphalt pavements. On the base prepared and laid as above, the curb will be placed before the concrete has set, and adjusted to line and grade by setting it to a firm, unyielding bearing in a bed of freshly made concrete, by the use of heavy wooden mauls. The face of the curb must be plumb and true to line, and the top of it carefully set to grade with close and even contact joints. After the stone has been set to line and grade, the trench on the foot walk side will be immediately filled with concrete to within 5 ins. of the top of the curb, which will be thoroughly rammed and compacted, after which it will immediately be covered with earth to prevent injury to it through too rapid evaporation, etc. Any portion of the concrete base of the curb that would interfere with the laying of block must be removed immediately after the curb has been set.

Guaranty.—All work under this contract will be guaranteed and kept in repair by the contractor without cost to the district for a period of five years from date of its acceptance by the commissioners. This date shall be the same as that of the completion of the last street thereunder. Ten per cent of the cost of this work will be retained and disposed of as provided for by law.

It is further expressly understood and agreed that if any of the pavements laid should, for any reason whatsoever, within the period of five years, prove inferior to the best laid in the district prior to July, 1904, then the contractor shall, on demand of the commissioners, remove such defective pavements and relay them with new material of approved quality. The Engineer Commissioner shall decide the question of inferiority.

On expiration of guarantee for maintenance the work is to be inspected, and all imperfections must be corrected where and to such extent as the engineer shall direct, upon which the engineer will accept the same in writing, and until such acceptance the guarantee shall be in force. Repairs that may become necessary during the guarantee period will be made by the contractor when ordered by the engineer.

Important Hydro-Electric Development.—The Pacific Coast Power Company has under construction, about 20 miles from Tacoma, a hydro-electric development which involves many interesting features. The water is taken from the White River and carried in an earth ditch about 5 miles to the main reservoir. This reservoir is made up of several existing lakes and its capacity is large enough to supply sufficient water to operate the power plant for 3 or 4 months. From the reservoir two tunnels 3,000 ft. long will be built to carry the water to the head basin. From here an 8-ft. steel pipe line for each turbine will be built. These lines will be about 2,200 ft. long and supply the turbines with water at a head of 480 ft. The turbines, of which two will be installed at present, are the largest ever built. Under the above head they have a maximum capacity of 20,400 hp. at 360 r. p. m. Each will be direct connected to a 60 cycle, 3 phase, 6,600 volt generator. The flow of water to the turbine will be controlled by a butter-fly valve over 7 ft. in diameter, the largest of its type ever built. These turbines and accessories are being furnished by the Allis-Chalmers Company of Milwaukee. The Stone & Webster Engineering Corporation, of Boston, are the engineers, and Mr. S. L. Shuffleton, western representative for this corporation, is in direct charge.

Unloading Ore from Vessels.—The following records are given for unloading iron ore from vessels with 15 ton Hulett cranes. The work was done on Sept. 3, 1910, at the docks of the Pittsburg & Conneaut Dock Co., at Ashtabula, O.

Total tons unloaded	35,855
Number machines	4
Tons per machine	8,964
Total average time each machine	20 hrs. 51 min.
Total average lost time each machine	1 hr. 41 min.
Net average working time each machine	19 hrs. 10 min.

About 90 per cent of the ore was taken out by the machines without the aid of shovelers.

A new tunnel under the East River, New York, will be driven from Astoria, Long Island, to 132d St. and Locust Ave., Borough of The Bronx, for the Consolidated Gas Company. It is to pierce the rock about 250 ft. below the tidewater level. The section planned is 19½ ft. wide and 19½ ft. high, with a circular roof and vertical side walls about 8 ft. high. It is to be lined with concrete and will contain two 72-in. gas mains set in concrete in the bottom—*Compressed Air.*

WATER-WORKS AND SEWERS SECTION

Some Comments Upon Water Works Management.*

SUGGESTED BY THE RECENT SPECIAL REPORTS OF THE U. S. COMMERCE AND LABOR DEPARTMENT.

When your secretary asked me to address you upon some subject that might be of interest to water works managers, it occurred to me that the recent "Special Reports" of the United States Commerce and Labor Department, Bureau of the Census, upon "Statistics of Cities having a Population of over 30,000," to which I had recently given serious study and which I found to contain some valuable information relating to the financial condition of municipal water works—though fragmentary and in some respects inconclusive—might be of some interest to you. If you have not already seen them they are worthy of your attention.

TABLE I—STATISTICS

FROM U. S. DEPARTMENT OF COMMERCE AND LABOR;
HAVING A POPULAT

Group	No. of Cities	Population	Length of Main Pipes in Miles	Total Mil. Gals supplied to pipes.	Net Estimated Cost of System.	Present Estimated Value of System	Outstanding Debt.	Earnings (not "actual")			Cos		
								Total	Collections for Services to Public	Value of Services to City. (Estimated.)	Total	Total Expenses of Operation	Expenses Payment Sal., Wag Misc. Ob
I	13	12,375,463	12,286 7	721,274	$417,34[illegible]564	$377,825,909	(1) $154,104,252	$36,488,830	$30,906 104	$5,582,726	$39 532,639	$25,583,787	$12,719
II	22		5,870 7	140,825	117,045,116	128,775,722	67,146,380	12,146,794	10,483,039	1,663,755	13,043,143	7,677,217	3,596,
	20 (2)	3,285,351	4,842 2	121,297	103,652,836	115,831,145	61 408 100	10,317,893	8,806,636	1,511,262	11,789,297	6,972,244	3,265,
III	37	2,364,110	3,470 2	101 052	77,120,681	80,622,461	33,650,447	7,531,055	6,396,285	1,134,770	8,745,677	5,450,095	2,719,
IV	39	1 543 286	2,872.4	65,739	40,563,099	45,397,491	20 972,750	4,636,446	3,864,802	771,644	5,147,802	3 195,526	1,730,
GRAND TOTAL	107		24,500 0	1,028,890	$652,070,460	$632,621,583	(3) $275,873,829	$60 803,125	$51,650,230	$9,152,895	$66,469,261	$41,906,625	$20,766,
GRAND TOTAL	105	19,568,210	23 471 5	1,010,362	$638,678,180	$619,677,006	(3) $270,135,549	$58 974 229	$49,973,827	$9,000,402	$65,215,415	$41,201,652	$20,435,

(1) Excluding outstanding debt of Washington, D. C
(2.) Excludes Seattle and Los Angeles.
(3) Excluding outstanding debt of Washington, D. C

NOTE OMISSIONS—Group I, New Orleans; II, Indianapolis and Denver; III, Taco.

The first report of this kind published by the United States Government covered, I believe, the operations of the year 1905, and there are now available such reports for the years 1905, 1906, and 1907, and later ones will doubtless follow. I shall limit my remarks to the water works statistics contained in the report for the year 1907, published in 1910, since this report is the most up to date and contains the greatest amount of information. I might also add that some of the bases of comparison were slightly improved by the assumption made in the 1907 report as compared with those of the 1905 report.

Upon Pages 91 to 93, of the 1907 report, is a brief statement or explanation with reference to the "Financial Data for Water Supply Systems," and in Table 39, Pages 372 to 377, will be found facts adduced. Table 39 has been summarized in the accompanying Table I, which is identical with the report except for omission of incomplete data concerning certain cities noted.

Incomparability of Certain Data.—It is necessary at this point to call attention to the danger of attempting to compare certain of the figures submitted, and to discriminate between those data which should be reliable for purposes of comparison and those which are likely to be incomparable on account of the difference in the accounting methods used in different cities and the basis or assumption upon which the information collected by this bureau have been based. The Department itself calls particular attention to this danger of attempting to compare the results in certain lines, especially those relating to net cost and present value of system, inasmuch as

> Among such differences the following are conspicuous: (1) Many cities make no distinction between cost and present value; (2) in cities that have purchased water-supply systems, the value of the franchise is included in the reported cost in some cases, and in both reported cost and present value in other cases; (3) the allowance for depreciation, overlooked in the great majority of cities, is excessive in a few cities; similarly the appreciation of real property values is usually ignored, but in a few cities furnishes an important addition to the present value.

The outstanding debt, of course, furnished no criterion of cost or value of the works, though it should, taken in conjunction with the latter (were the latter correct), furnish a criterion of the extent to which past generations had been taxed for the benefit of the present and future generations in the liquidation of the water debt.

In many, perhaps most cities, no charge is made for water used for municipal purposes. An estimate has therefore been made by the Bureau of the "value of services to the city computed on the basis of 44 cts. per capita for all cities of Group I, 46 cts. for Group II, 48 cts. for Group III, and 50 cts. for Group IV."

The annual depreciation has been estimated on a basis of 2 per cent of the present value, as shown in the tabulations. Here again it will be noted that owing to the uncertainty concerning the accuracy of the estimate of the present value of these works the allowance for depreciation is also approximate only. Engineers are in the habit of basing depreciation upon reproduction cost rather than present value of the works, for the reason that the depreciation takes place upon the physical structure rather than upon the so-called intangible values, such as going value or franchise value of the plant. It should also be noted that this depreciation allowance is based upon the so-called straight line method under which the depreciation fund is not assumed to enjoy any accretions from interest or earnings upon it from year to year, the 2 per cent allowance corresponding to a 50 year assumed length of life.

The taxes for the works reported have been based upon the assumption of the reported "present value of system," and the basis of taxation in force, and rate of tax in the cities served by these works, reported elsewhere in this special report.

The interest on present value of system is based upon the "present value of system," a rate of interest being used corresponding to the average rate paid upon the water debt in the several cities, which must vary therefore with the credit of the city and is not uniform throughout the tabulation.

The relation between earnings and costs of services is therefore open to the same doubts as to accuracy, so far as certain items go, as apply in the data reported upon earnings and costs of services. The unit "Earnings," "Expenses of Operation," and "Interest" are approximate only in character, owing to the fact that the earnings include an estimate of value of services to the city (in free water, for municipal purposes in addition to the actual

TABLE II. U. S. COMMERCE AND LABOR BUREAU SPECIAL REPORT OF 1907

Estimated Earnings (gross income plus allowance for public service)*, Expenses of Operation (including allowance for taxes and depreciation), and Interest (upon estimated present value, with rate of interest corresponding to rate paid upon water debt), per capita and per million gallons of water supplied, for cities having a population of upwards of 30,000.

Group	No. of cities	Cities having population of	—Per Capita— Earnings	Expenses of operation	Interest†	—Aver. per mil. gals. supplied— Earnings	Expenses of operation	Interest
I	[illegible]	Above 300,000	$2.79	$1.96	$1.07	$50.59	$35.47	$19.34
II	[illegible]	100,000-300,000	2.68	1.69	1.18	86.37	54.62	38.18
III	[illegible]	50,000-100,000	2.38	1.71	1.04	75.89	54.56	33.18
IV.	45	30,000- 50,000	2.17	1.47	0.90	73.59	49.84	30.58
	117		$2.64	$1.82	$1.07	$59.63	$41.01	$21.08

*The assumed allowances are for: Group I., 44c per capita; Group II., 46c per capita; Group III., 48c per capita; Group IV., 50c per capita.

†The present value of the system upon which the interest charge is based, is of doubtful accuracy, probably considerably less than the actual present value.

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*Paper by Leonard Metcalf, of Metcalf & Eddy, Consulting Civil Engineers, Boston, Mass., read at the annual meeting of the Pennsylvania Water Works Association at Atlantic City, N. J., Oct. 20, 1910.

TABLE III—BASED UPON U. S. COMMERCE AND LABOR BUREAU SPECIAL REPORT OF 1907, OMITTING CITIES FOR WHICH THE DATA IS INCOMPLETE, AS BELOW‡.

Estimated Earnings (gross income plus allowance for public service*), Expenses of Operation (including allowance for taxes and depreciation) and Interest [illegible] with rate of interest corresponding to rate paid upon water debt [illegible] gallons of water supplied [illegible]

Group	No. of cities	Cities having population of	—Per Capita— Earnings*	Expenses of operation	Interest†	Average per million gallons supplied Earnings	Expenses of operation	Interest
I	13	Above 300,000	$2.91	[illegible]	$1.19	[illegible]	[illegible]	$24.24
II	[illegible]	100,000-300,000	3.07	2.07	1.45	86.69	58.28	39.85
III.	33	50,000-100,000	3.16	2.30	1.39	87.50	63.25	37.25
IV.	39	30,000-50,000	3.03	2.09	1.23	90.51	60.12	[illegible]
	105		$3.06	$2.17	$1.34	$84.56	$58.68	$36.17

*The assumed allowances are for: Group I., 44c per capita; Group II., 46c per capita; Group III., 48c per capita; Group IV., 50c per capita.

†The present value of the system, upon which the interest charge is based, is of doubtful accuracy, probably considerably less than the actual present value.

‡Omissions in Group I. New Orleans. Group II. Indianapolis and Denver. Group III. Tacoma. Group IV. Spokane, Binghamton. Springfield, Ill., Kalamazoo, Sacramento and Fort Worth.

NOTE.—The averages in this table have been obtained by finding the mean, or average, of the average values for the individual cities.

gross income; the expenses of operation include allowances estimated for depreciation and taxes; the interest is based upon a present valuation, of doubtful accuracy and a rate corresponding to the credit of the city or of its water department.

BLIC WATER WORKS

. OF THE CENSUS. SPECIAL REPORT UPON STATISTICS OF CITIES
OVER 30,000 1907

August, 1910

ation	Taxes	Interest on Present Value of System	Relation between earnings and Costs of Services — Excess of — Total earnings over Total Costs of Services	Total Expenses of Operation	Payments for Sal. Wages Misc. Objects and Depreciation	Collections for Services to Public over Payments for Sal., Wages & Misc. Objects	Per Capita — Earnings include Allowance for Public Service	Expenses of Operation	Interest	Average per Million Gallons supplied — Earnings include Allowance for Public Service	Expenses of Operation	Interest	
556,518	$5,307,470	$13,948,852	$3,043,809	$10,905,043	$16,212,513	$18,183,305	$ 37.84 $ 2.91	$ 28.83 $ 2.22	$ 15.44 $ 1.19	$ 727.51 $ 55.96	$ 564.05 $ 43.39	$ 315.16 $ 24.24	Average
575,516	1,505,025	5,365,926	896,149	4,469,577	5,974,602	6,886,363				1,919.25 87.24	1,237.99 55.27	854.03 38.84	Average
316,624	1,389,651	4,817,053	1,471,399	3,345,654	4,735,305	5,540,657	61.43 3.07	41.43 2.07	29.00 1.45	1,733.72 86.69	1,165.60 58.28	796.94 39.85	Average
12,450	1,117,729	3,295,582	1,214,622	2,080,960	3,198,689	[illegible]	104.13 3.16	75.88 2.30	45.95 1.39	2,887.62 87.50	2,087.62 63.25	1,229.11 37.25	Average
407,949	557,279	1,952,276	511,356	1,440,920	1,998,199	2,134,504	118.02 3.03	81.43 2.09	50.14 1.23	3,529.79 90.51	2,344.97 60.12	1,457.02 37.35	Average
552,433	$8,487,503	$27,605,445	$5,[illegible]	$18,896,500	$27,384,003	$30,883,541				$ 84.71	$ 58.26	$ 35.02	
393,541	$8,372,129	$24,013,763	$6,241,186	$17,772,577	$25,144,705	$29,537,845	$ 3.05	$ 2.17	$ 1.34	$ 84.56	$ 58.68	$ 36.17	

[illegible] bold face are "totals" from [illegible]

okane, Binghamton, Springfield, Ill., Kalamazoo (Mich.), Sacramento, Fort Worth.

Comparable Facts.—While the unreliability of certain of the information contained in these reports is apparent and is well recognized and commented upon by the Government officials—who have done a very valuable work in bringing to the public's attention the urgent need of more rational methods of accounting and of compiling and reporting data upon such bases as to make them strictly reasonable or capable of comparison—some other facts are comparable and of value to you as operators.

It is to certain of the latter facts—the actual earnings and operating expenses of the public water works, reported in this Government report—that I desire to call your attention, as bearing upon the danger of direct comparison of water rates without careful study of the "reasonable rate" based upon the real value of the particular works under question, the character of service rendered by them, etc.

The facts relating to physical plant should be reliable, as should be the "collections for services to the public" which correspond to gross actual income; the "payments for salaries, wages and misc. objects" which correspond to the ordinary operation and maintenance expenses of taxes, depreciation, fixed charges, or profits; the "excess of collections for services to the public, over payments for salaries, wages, and miscellaneous objects," meaning thereby the difference between gross actual income and operation and maintenance expenses as defined above.

Description of Tables.—With this preamble I submit for your consideration certain tabulations taken from the Government report for the year 1907, above referred to, and others based upon them.

Table II is abstracted directly from the Government report. It shows in substance the gross earnings (including an allowance for public water service), the expenses of operation (including operation and maintenance expenses, and allowances for taxes and depreciation, but excluding fixed charges and profit), interest (computed at a rate corresponding to that paid upon the water debt, based upon the reported, probably inaccurate, "present value of system"), all per capita and per million gallons of water pumped or supplied, and for each of the 4 groups into which the cities have been divided—comprising cities having a population: 1st, above 300,000; 2nd, between 100,000 and 300,000; 3rd, between 50,000 and 100,000; 4th, between 30,000 and 50,000.

In *Table III* is shown a similar tabulation, differing from *Table II* only in the omission of certain cities for which the data furnished in the Government report was incomplete. The omissions were as follows: In Group I, New Orleans; in Group II, Indianapolis and Denver; in Group III, Tacoma; in Group IV, Spokane, Binghamton, Springfield, Ill., Kalamazoo, Sacramento, and Fort Worth.

In *Table IV*, based upon the Government report, are shown the maximum, minimum, and mean values in each of the four groups cited, of the actual gross income (earnings) without allowance for water used for public service) per capita, and operation and maintenance costs per capita (including the Government's estimate for taxes, but excluding allowance for depreciation, fixed charges, and profit.) The omissions noted in Table III apply also in this table, for the same reason.

In *Table V* are shown, for the four groups cited, the actual gross income, the operation and maintenance expenses (including estimated taxes, but excluding depreciation, fixed charges, and profit) and the net income (being the difference between the actual gross income and the operation and maintenance charges, including in the latter taxes, but excluding allowances for depreciation, fixed charges, and profit), per capita, per mile of pipe, and per million gallons of water pumped.

Significance of Tables IV and V.—What, it may be asked, is the significance of the results shown in Tables IV and V, which give the actual gross income, the operation and maintenance expenses (including estimate for taxes but excluding allowances for depreciation, fixed charges, and profit), per capita, per mile of pipe, and per million gallons of water pumped or "supplied to the pipes?"

As I interpret them, it is this: Under the prevailing rates the public water works in this country have gross actual annual incomes (without allowance, in the majority of cases, for water used for municipal purposes) of approximately $2.58 per capita of population,

TABLE IV—BASED UPON U. S. GOV'T REPORT—PUBLIC WATER WORKS—ACTUAL INCOME AND OPERATING EXPENSES.

(Including estimated taxes (excluding depreciation, fixed charges and profit), omitting cities for which data are incomplete.*)

Group	No. of cities*	Cities having population of	Actual gross income per capita‡ Max.	Min.	Mean	Oper. & maintenance costs per capita, includ'g U. S. Govt. estim. for taxes, exclud'g deprec., fixed charges and profit. Max.	Min	Mean	Net income per capita, includ'g estim'd [illegible] allowance for de. [illegible] charges. Max.	Min.	Mean
I.	13	Above 300,000	$4.31	[illegible]	$2.43	$2.17	[illegible]	$1.58	[illegible]	[illegible]	[illegible]
II	[illegible]	[illegible]	[illegible]	1.18	2.61	2.56	[illegible]	1.38	[illegible]	[illegible]	[illegible]
III.	33	50,000-100,000	3.85	1.64	2.68	3.44	0.77	1.62	2.27	—0.25	1.06
IV	[illegible]	[illegible]	6.35	0.92	2.52	[illegible]	0.66	[illegible]	[illegible]	[illegible]	[illegible]
Grand total	105		$6.35	$0.92	$2.58	$4.07	$0.66	$1.52	[illegible]	—$0.47	$1.06

*Note [illegible] Group I New Orleans [illegible] Seattle. III., Tacoma IV., Spokane, Binghamton, Springfield (Ill.), Kalamazoo, Sacramento, Fort Worth.

‡Found by averaging the per capita figures for each of the cities in the several groups.

TABLE V.—STATISTICS OF PUBLIC WATER SUPPLY SYSTEMS.

(Computed from Report of U. S. Dept. of Commerce and Labor, Bureau of the Census, upon "Statistics of Cities having a Population of over 30,000, 1907," by Metcalf & Eddy, omitting cities for which data are incomplete.†)

		Actual Gross Income			Operation and maintenance (incl. estimated taxes, excl. deprec. and fixed charges).				Net income (excl. allow. for deprec. and fixed charges).			
Cities having population of	No. of cities	Per capita	Per mile of pipe	Per Mg.	Per capita	Per mile of pipe	Per Mg.	% of gross income	Per capita	Per mile of pipe	Per Mg.	% of gross income
Over 300,000	13	$2.43	$2,098.21	$46.16	$1.58	$1,323.74	$30.47	66.8	$0.85	$774.47	$15.69	33.2
100,000-300,000	22	....	1,779.23	73.89	....	923.08	37.55	53.1	....	856.15	36.34	46.9
100,000-300,000	20*	2.61	1,791.99	72.80	1.38	969.83	39.00	55.6	1.23	822.16	33.80	44.4
50,000-100,000	33	2.68	2,044.82	73.72	1.62	1,286.68	45.01	61.5	1.06	758.14	28.71	38.5
30,000- 50,00	39	2.52	1,466.69	75.88	1.49	887.31	43.30	62.3	1.03	579.38	32.58	37.7
Gd. average...	107	....	$1,785.98	$71.19	....	$1,070.86	$41.08	60.7	....	$715.12	$30.11	39.3
Gd. average...	105	$2.58	$1,788.54	$70.94	$1.52	$1,082.58	$41.43	61.3	$1.06	$705.96	$29.51	38.7

*Excludes Seattle and Los Angeles.

†Note omissions: In Group I., New Orleans. II., Indianapolis and Denver. III., Tacoma. IV., Spokane, Binghamton, Springfield (Ill.), Kalamazoo, Sacramento and Fort Worth.

$1,800 per mile of pipe, $71 per million gallons of water supplied, and operating and maintenance expenses (including allowance for taxes, but excluding allowances for depreciation, fixed charges, and profit), of $1.52 per capita of population, $1,100 per mile of pipe, $41 per million gallons of water supplied corresponding to 61 per cent of gross actual income, and net annual income of approximately $1.06 per capita of population, $700 per mile of pipe, $30 per million gallons of water supplied, corresponding to 39 per cent of gross actual income.

The question arises, is this so called net income sufficient to provide a reasonable allowance for depreciation and for fixed charges? Let us see.

The Government statistics of "net cost of system" and "present value of system" are admittedly neither reliable nor comparable, as reported for the different cities, and obviously the "outstanding debt" is of no significance except as indicating the extent to which past generations have contributed to the liquidation of the water works debt, and thus have been taxed for the benefit of the present and future generations. Moreover, for our purposes here the Government's method of computing the interest is unsatisfactory, as it involves the relative credit of the several cities and the probably erroneous estimate of present value of the works. Therefore we are forced to base our conclusions upon certain assumptions.

If we assume a "per capita value of the works" of $25, an annual depreciation allowance of 1 per cent, based upon value, not upon reproduction cost of the works, and fixed charges of 4 per cent, corresponding to best city credit conditions, we should require for,

Depreciation, 1% of $25.......$0.25 per capita
Fixed charges, 4% of $25.......$1.00 per capita

Total $1.25

If we assume a per capita value of works of $50, an annual depreciation allowance of 2 per cent of the value of the works, fixed charges of 4 per cent, we should require for,

Depreciation, 2% of $50.......$1.00 per capita
Fixed charges, 4% of $50.......$2.00 per capita

Total $3.00

or if we assume, as reasonable for average conditions, a per capita value of $35, a depreciation allowance of 1 per cent (based upon the value, not the reproduction cost of the works), and fixed charges corresponding to city conditions of 4 per cent, we should require for,

Depreciation, 1% of $35.......$0.35 per capita
Fixed charges, 4% of $35.......$1.40 per capita

Total $1.75

As against these depreciation and fixed charge requirements we have seen above that the Government report indicates an average net income, applicable to these uses, of approximately $1.06 per capita of population.

Broadly speaking, therefore, it appears that the net income of our public water supplies, upon prevailing rates and existing methods of supplying free water for municipal uses, is not sufficient to meet a proper depreciation allowance and fixed charges corresponding to the value of these works. Obviously, no water company could do business upon such a basis. Moreover the rate (4 per cent) upon which the fixed charges have been figured, is entirely inadequate for such works, if privately owned.

I do not appear before you as an exponent either of municipal or of private ownership of water works. Whether the present method of operating these public works is desirable, or not, is not at issue here, nor whether it is wiser to pay the cost of public water service by charging higher rates for domestic and manufacturing service than by direct tax for water used for municipal purposes, nor yet whether it is desirable, in the interest of a conservative public policy and to assist the city to meet such possible emergencies as conflagration or earthquake, to charge off the water debt at a more rapid rate than depreciation requirements alone would make necessary.

The significant point which I desire to call to your attention is one well known to you already—that it is not safe to compare water rates found in different cities, without full knowledge of all existing conditions, including the value of the works and the character of the service rendered. Therefore, if the attempt is made to compare your water rates directly with those charged in neighboring cities, you should inquire immediately what the conditions of operation and allowances for depreciation and fixed charges may be, or, in other words, what the financial policy in the operation of these works is.

Were you in the position implied by the Government statistics, with an average net annual income of $1.06 per capita, applicable to depreciation, fixed charges, and profit, you might well find yourself with an annual deficit of between $1.25 and $1.75 per capita, derived as follows:

Average per capita net income, applicable to depreciation, fixed charges and profit (as per U. S. Government Report)...... $1.06
Depreciation 1¼% on $35.........$0.43
Fixed charges, 5 % on $35......... 1.75
Profit, 1½% on $35......... 0.52

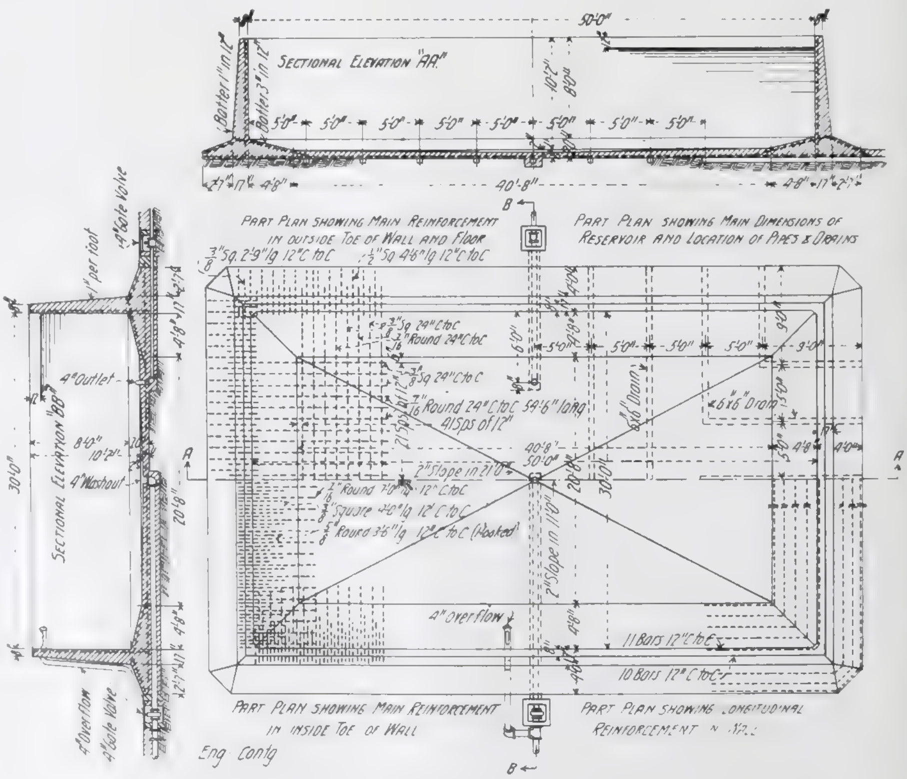
$2.70 2.70

Deficit per capita..................... $1.64

While these figures are only approximate, as the operating cost under private ownership is probably considerably less than that shown for public ownership, they serve to bring home the lesson to be drawn from these Government statistics, which has already been pointed out—that water rates cannot be compared equitably at their face value, without due allowance for difference in value of works, character of service rendered, and any other important factors—and they show that upon the government's average figures for gross and net annual income for municipal water works, under prevailing rates, these works are not earning a reasonable depreciation allowance and fixed charges corresponding to the probable present value of these works, and that private works or corporations could not earn a reasonable return upon the value of their plants upon water rates yielding such an average net income as that reported by the Government.

Cost of a 100,000-Gallon Reinforced Concrete Reservoir at Panama.

In providing water works for supplying water for domestic and construction purposes at Panama quite general use has been made of reinforced concrete for reservoirs, stations and other structural work. In our issue of Dec. 15, 1909, we illustrated the construction and gave the cost of constructing the 1,000,000-gal. reservoir at Ancon. The accompanying cuts show a reservoir of one-tenth this capacity built at Naos Island for supplying the quarantine station. Figure 1 gives plans and sections of the reservoir structure, Fig. 2 shows the inside wall reinforcement, and Fig. 3 shows the wall forms.



Sectional Elevation "AA"
50'0"
Batter 1" in 12"
Batter 3" in 12"
10'2"
8'0"
5'0"
40'-8"
4'8"
11"
2'7"
B
Part Plan showing Main Reinforcement in outside Toe of Wall and Floor
Part Plan showing Main Dimensions of Reservoir and Location of Pipes & Drains
3/8" Sq. 2'9" lg 12" C to C
1/2" Sq 4'6" lg 12" C to C
4" Gate Valve
1" per foot
4" Outlet
Sectional Elevation "BB"
8'0"
10'2"
30'0"
4" Washout
20'8"
3/8" Sq 24" C to C
7/16" Round 24" C to C
3/8" Sq 24" C to C
7/16" Round 24" C to C 54'6" long
41 Sps of 12"
21 Sps of 12"
6'0"
9'0"
6"x6" Drain
40'8"
50'0"
A
2" Slope in 21'0"
1/16" Round 7'0" lg 12" C to C
3/8" Square 4'0" lg 12" C to C
5/8" Round 3'6" lg 12" C to C (Hooked)
2" Slope in 11'0"
4" Overflow
11 Bars 12" C to C
10 Bars 12" C to C
4" Overflow
4" Gate Valve
Part Plan showing Main Reinforcement in inside Toe of Wall
Part Plan showing Longitudinal Reinforcement
Eng. Contg

Fig. 1—Plans and Sections of 100,000-Gallon Reinforced Concrete Reservoir.

The structural features of the Naos Island Reservoir correspond to familiar practice. A 1:2½:5 concrete was used and water tightness was secured by a ½ in. plaster coat of 1:1 mortar. Medium steel was used for reinforcement. The following are the general items of cost of construction.

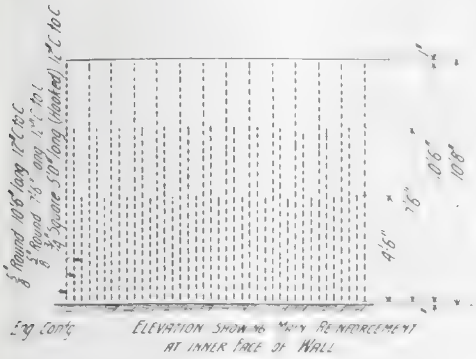

⅝" Round 10'6" long 12" c to c
⅝" Round 7'6" long 12" c to c
¾" Square 5'0" long (Hooked) 12" c to c
1'
9'0"
10'8"
7'6"
4'6"
Eng Contg
ELEVATION SHOWING MAIN REINFORCEMENT AT INNER FACE OF WALL

Fig. 2—Details of Inside Wall Reinforcement.

The work required an expenditure in labor for clearing and grubbing the site of $131. Excavation for the foundation required the removal of 305 cu. yds. of clay and boulders and cost for labor $410, or $1.35 per cu. yd. of excavation.

The reservoir contained 192 cu. yds. of concrete, which cost as follows:

	Total.	Per cu. yd.
Materials:		
[illegible] bbls. cement	$ 447	$2.328
80 cu. yds. sand	160	0.833
150 cu. yds. rock	770	4.010
Total	$1,377	$7.166
Labor, mix. and placing concrete	592	3.083
Reinforcement:		
Labor	$ 120	$0.625
Materials	216	1.124
Total	$ 336	$1.749
Forms:		
Labor	$ 352	$1.833
Materials	231	1.203
Total	$ 583	$3.036
Grand total	2,888	15.034

To these are to be added the following other costs:

Laying 400 ft. 3½. pipe:	
Labor	$ 186
Materials	125
Total	$ 311
Transportation:	
Labor	$ 460
Materials	86
Total	$ 546
Labor building incline	125
Miscellaneous:	
Labor	$ 334
Materials	320
Total	654
Grand total	1,636

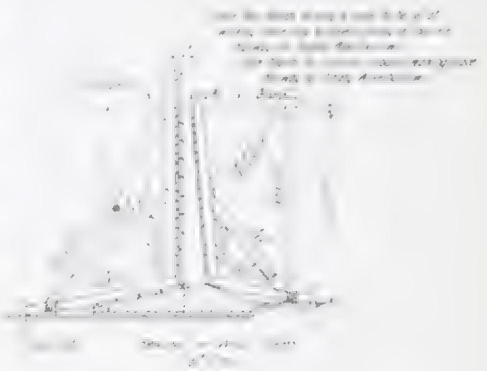


Fig. 3—Details of Wall Forms.

Including clearing and grubbing and excavation the total cost of the reservoir was $5,065 or $5.065 per 1,000 gals. storage capacity.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Reorganization of the Boston City Engineering Departments.

A CONTRIBUTOR

An important reorganization of the Street and Water Departments and the City Engineer's office of the Boston City Government will go into effect Feb. 1, 1911, under the terms of an ordinance passed by the City Council on Nov. 14, and signed by Mayor Fitzgerald on Nov. 29, 1910.

The new scheme was devised by Louis K. Rourke, now Superintendent of Streets, who will be the Commissioner of Public Works under whose supreme authority the three city departments named will be grouped by the terms of the new act. Mr. Rourke came to the service of the City of Boston from the Panama Canal work where he had been for four years Assistant Division Engineer and Acting Division Engineer in the Culebra Division. During his stay on the Isthmus Mr. Rourke had a large share in planning the reorganization of the administrative system, so far as it concerned construction, which was put into effect during the years 1906-07 by Colonel Goethals. A little study of the situation in Boston showed Mr. Rourke the need of a better administrative scheme, and the new plan is the result of his efforts.

The present division of powers between the three departments is shown by the diagram, Fig. 1, though this diagram does not, of course, disclose all the facts of the present situation. The obvious points about it are these: The heads of the three engineering departments, namely, the Water Commissioner, the City Engineer, and the Superintendent of Streets are appointed by the Mayor subject to the approval of the Civil Service Commission; and are removable by him. Except for the requirement of the Civil Service Commission's approval, these three places are "political" places, so called. As a matter of history, the late William Jackson, who was reappointed City Engineer for many years, kept his department entirely out of politics; but the other two departments, especially that of streets, were well recognized as political plums, and their administration for many years past has been very largely political.

Under the existing plan it will be seen that the Water Commissioner has under him the Income Division, which renders bills for water service but which does not receive the moneys paid in on these; and the Distribution Division which includes everything relating to the laying, maintenance and repair of water mains and service pipes. This function, of course, means the opening of streets and the repair of street surfaces after the pipe work is completed.

Under the Superintendent of Streets the Sewer Division was the one which furnished innumerable occasions for conflict with the Distribution Division of the Water Department. The Sewer Division had of course the right to open streets, but it was under no compulsion to coöperate with the Water Department so as to avoid needless opening of streets, and there was no agreement between the two departments with the object of avoiding unnecessary street openings or of repairing the surface after such opening so as to satisfy the standards of the street department. It will be obvious without further illustration, that these two departments, dealing often simultaneously with street surfaces and sub-surfaces, and quite independently of each other, gave rise to a large waste of money and labor, and great and unnecessary inconvenience to the public through obstruction of streets. Each of these two Departments had its own engineering staff. Meanwhile, the City Engineer was responsible only for the designing of new construction, mainly in the way of bridges. He had no control over or responsibility for maintenance. Apart therefore from this duty of designing new structures, the City Engineer's staff was merely a consulting body. The heads of the Water and Street Departments might ask the City Engineer's advice or not, as they chose.

The main outlines of the new plan are shown in the diagram, Fig. 2. The three present departments are merged, and the whole mass of functions is separated under three divisions which are subordinate to the Commissioner of Public Works, who is the responsible head under the Mayor. Bridges and ferries are grouped under one division engineer into a department by themselves. The functions of the old Water and Street Departments are then divided in accordance with the scheme followed in German cities into underground and overground divisions. The new sewer and water division will have entire charge of the design, construction and maintenance of all water mains and service pipes and all sewers. It is evident, therefore, that every piece of work requiring the digging up of streets will be under a single head, and the responsibility for useless excavation

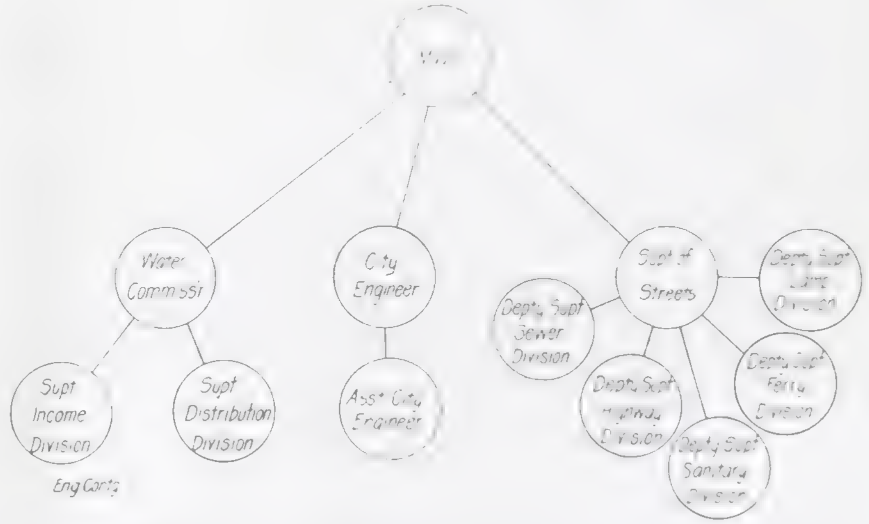

Water Commiss'r
City Engineer
Supt of Streets
Supt Income Division
Supt Distribution Division
Ass't City Engineer
Dep'y Supt Sewer Division
Dep'y Supt Lamp Division
Dep'y Supt Highway Division
Dep'y Supt Ferry Division
Dep'y Supt Sanitary Division
Eng Contg

Fig 1—Diagram of Old Organization of Boston's Public Works Department.

and tearing up can be easily placed. The head of this department will also have under him for the present the Income Division, or bill rendering office of the present water department.

Paving, street cleaning and watering, the collection of garbage and household refuse and street lighting are all put under the Division Engineer in charge of the Highway Division.

Two main principles are the foundation of the new organization. The first of these principles is the concentration of responsibility. It will be evident from a glance at the diagram showing the present organization, that between the Water and Sewer Divisions there is endless possibility of conflict and that the only means of avoiding or harmonizing these conflicts is through the intervention of the Mayor himself; a scheme which is practically unworkable. Under the new plan the Commissioner of Public Works will be directly responsible to the Mayor for all engineering and construction matters. Under him each Division Engineer will be responsible to the Commissioner for everything within his own division, and the functions grouped under each division are selected in such a way that each division head will be free from interference with his work by any other division head.

The second principle of the new organization is that not only shall the Commissioner of Public Works be an engineer, but that the heads of the divisions under the Commissioner shall be engineers. This part of the scheme has led to some criticism on the ground that the head of the division ought to be a good executive, and that it is a well known fact that not all engineers have executive ability. Mr. Rourke's contention is, however, that the engineer who plans or designs work is the proper one to have control of construction and maintenance under his plan; and that it is just as easy to find an engineer with the necessary executive ability as to find a politician with the same executive qualification. Under the existing scheme in the past the engineers who have grown up in the several departments have been, so to speak, side-tracked, or pocketed. A striking illustration of their impotence on the side of control or direction is afforded by the present order of things in the Sewer Division. In this division there are four resident engineers, each having, theoretically, the oversight of construction in his own district, but it works out this way: When a resident engineer sees that a gang of laborers is building, for instance, a piece of sewer in a way not authorized by the plans, he is entirely lacking in authority to order the foreman of that gang to make the work conform to the design. He must instead report the fact of this departure from the design to the chief inspector, who may then, if he chooses, report the matter to the head of the Department. This head of Department may then, if he is not restrained by the political influence of the contractor whose men are at fault, order the incorrect work rebuilt in accordance with the design.

In the actual administration of the new department of Public Works, the Commissioner should and probably will have very little to do with the details of the work under his general charge. Every engineering problem in any division will supposedly be worked out by the engineering staff of that division to a solution which receives the approval of the Division Engineer. This finished scheme will then be presented to the Commissioner for his criticism, and the nature of most municipal engineering is such that the Commissioner, being a competent engineer himself, should need little time or study to determine whether the plan is essentially right or not. The details would of course have to be left to subordinates under any form of organization. Where engineering plans or construction matters involve two, or all, of the division, the division engineers will meet the Commissioner in conference on the whole matter; this conference giving all the advantages of action by a Board, with the further advantage of the certainty of a final and authoritative decision by a technical expert.

The ordinance creating the new Department of Public Works specifies in great detail the duties of the Commissioner of Public Works. It specifies in the first place that the Commissioner, whose salary is to be $9,000, shall be a civil engineer of recognized standing in his profession.

In regard to the appointment by the Commissioner of the heads of Divisions, the ordinance after providing that the commissioner shall create such divisions of the Department as he deems necessary, lays down the following rule: *Each division of the Department created or changed by said Commissioner, with the exception of the Water Income Division, shall be in charge of a civil engineer of recognized standing in the profession and an expert in the duties which may devolve upon him, such Division Engineer to be appointed without regard to party affiliations or residence at the time of appointment, each head of a Division to devote his whole time to the work and to receive an annual salary of not more than $5,000 with no other fees or emoluments.*

In appointing an engineer as the head of a Division, the Commissioner is required to file with the City Clerk, for inspection by the public, a certificate declaring that his appointee is a civil engineer of recognized standing in the profession, that in the Commissioner's opinion he is an expert in the work that would devolve upon him, that he is a person especially fitted by education, training or experience to perform the duties of the Department, and that the appointment is made solely in the interest of the city.

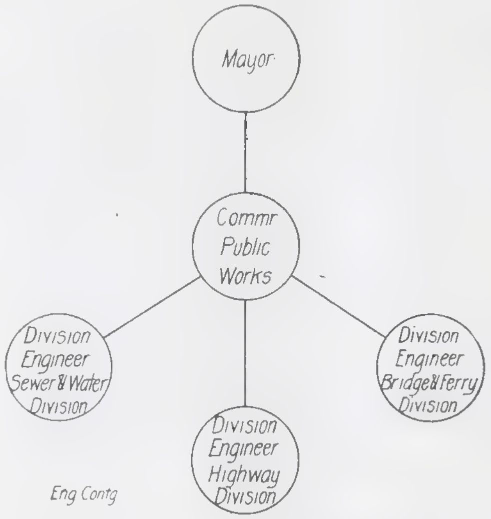

Mayor
Commr Public Works
Division Engineer Sewer & Water Division
Division Engineer Highway Division
Division Engineer Bridge & Ferry Division
Eng Contg

Fig. 2—Diagram of New Organization of Boston's Public Works Department.

The completeness of the Commissioner's control over public work and the fullness of his power to see that any public work is properly done is shown in the provision of the ordinance which says that the Commissioner

> Shall have authority to order any public work, whether done by a department or under contract or otherwise, to be discontinued, reconstructed or removed, whenever in his opinion said work fails in any manner to comply with or fulfill the terms, conditions, specifications and requirements of any such contract or agreement, or fails in his opinion to conform with proper engineering standards.

The provision in regard to the Commissioner's certificate of fitness in regard to the head of each division appointed by him was put into the ordinance in an attempt to bring these positions as nearly as possible under Civil Service protection. The new City Charter has no provision that would explicitly lay upon the Civil Service Commission the duty of certifying to the fitness of the Commissioner's nominees for the Division Engineers. And as the City Council could not lay this duty upon the Commission, which is a body appointed by State authority, it tried to meet the need by the provision already cited for the filing of a certificate of fitness by the Commissioner himself.

Mr. Rourke, who will be the new Commissioner, stated to the City Council during the hearings on the reorganization plan, that he would appoint Frank A. McInniss, at present Assistant City Engineer, as Division Engineer of the underground or Sewer and Water Division; that James H. Sullivan, the present Deputy Superintendent of Highways in the Street Department, would be made Division Engineer of the overground or Highway Division, and that Frederick H. Fay, of the present engineering department, would be made Division Engineer of the Bridges and Ferry Division. These three men are all civil engineers and they stand at the top of the engineering lists of the Civil Service Commission.

Cost Keeping System of the Fort Orange Construction Co., on the New York State Barge Canal.

The cost keeping system employed by the Fort Orange Construction Co., of Albany, N. Y., involves the preparation and use of a timekeeper's record book for each contract. As nearly every contract differs from another the arrangements of these books necessarily differ, but in all the following purposes are kept in mind:

(1) To secure monthly a summation of cost under each heading under which the bids were made; (2) to secure daily a record of all labor and material charged to each plant employed on the work.

To illustrate the system a specific "contract" is selected; this is Contract No. 11, New York State Barge Canal which comprises the construction of three locks and the excavation of a short section of prism with the usual collateral work. The monthly book furnished the timekeeper on this work contains 24 pages. The first page contains two columns for recording the weather conditions during the month. The next 12 pages are for the payroll. These pages are ruled and arranged as shown by Fig. 1. The data for each column of names runs across the double page. The next four pages are devoted to the work of steam shovels, one page being used for each shovel, as shown by Fig. 2. One page, Fig. 2, is given for the concrete mixing plant, and one page to the concrete placing plant, Figs. 3 and 4. The daily distribution of labor costs is made on a double page, which is shown by Fig. 5. Each of these items is numbered, and the subdivisions lettered, as shown. The letters and numbers are used for abbreviation where necessary, in other accounts of the work. The last three pages of the book are given up to "Remarks" as explained below.

On the back of the cover a summation of the monthly costs of the work is given. These consist of the totals as taken from the pages which are shown by Fig. 4. The book when filled can be folded to a 4 x 9 ins. size for filing and the sum totals for the month will then appear on the outside for ready reference.

Finally, but not the least important, is the list of instructions which is printed on the inside of the covers of the book, for information of the timekeeper. These instructions are quite complete and are as follows:

> This book is meant to be applicable to this contract only.
>
> The essence of this plan of time and cost keeping and its distribution is that it be done in values instead of time and that it be done daily—or oftener—while all the pertinent facts are fresh in memory.
>
> The storekeeper and timekeeper will be advised from time to time as to the value of all materials received, and the "Stores" account will be charged with such quantities and values.
>
> The storekeeper will be required to open such accounts as may be necessary to the end of knowing at any and all times, both the quantity and value of each item of his stock and the quantity and value of portions thereof issued,

	Name or Number	Occupation	1	2	28	29	30	31	Total Time	Rate	Amt.	Deduct	Pay'bl.	Remarks
	Totals													

Fig. 1

STEAM SHOVEL No. 2

Date	No. of Cars Loaded	Kind of Material	Time Worked and Lost						Brief Reason for Lost Time	Daily Labor Cost			Monthly Value of Supplies Issued		
			Shovel		Trains		Drills			Loading	Transport and Unloading	Drilling			
			W	L	W	L	W	L							
1													Steam Shovel	Coal	
2														Oil	
3														Waste	
4														Repair parts	
5														Miscellaneous	
6														Total	
10													Loco & Car	Coal	
11														Oil	
12														Waste	
13														Repair parts	
14														Miscellaneous	
15														Total	
19													Drills	Coal	
20														Oil	
21														Waste	
22														Repair parts	
23														Dynamite	
24														Black powder	
25														Leading wire	
26														Fuse	
27														Caps	
28														Drill steel	
29														Miscellaneous	
30														Total	
31															
Totals															

Fig. 2

CONCRETE MIXING PLANT

Date	Total Yards Mixed	Daily Labor Cost	Cost of Transportation	Distribution of Concrete								Hours Time Worked	Monthly Value of Supplies Issued	
				Lock 4	Lock 5	Lock 6	Core Walls	Retaining Walls	Piers	Decks	Spillways Guard Gate & Culverts			
1													Fuel	
2													Oil	
3													Waste	
4													Repair Parts	
5													Crushed Stone	
6													Sand	
7													Cement	
8													Water Supply,	
9													Freight	
15													Total	
16													CREDIT	
17													Freight on Cement	
18													Cement Bags Ret'd	
31														
T't'l														

Fig. 3.

[illegible] used [illegible] thereof.

All [illegible] and cost of handling at our terminal will constitute part of the cost of the articles on which such charges— [illegible]

[illegible] what [illegible]

When any doubt exists as to the proper distribution of any cost, refer the matter at once to the General Manager.

The timekeeper will visit all portions of the work as nearly as practicable at the beginning and end of each half day or half shift and satisfy himself that all time to be shown on the following pages has actually been spent on the work.

He will see to it that each foreman is provided with an ordinary time book—not like this—in which the foreman shall record the names or numbers of his men and the time worked by each. The timekeeper will collect these books and turn them over to the General Manager monthly or oftener, as required.

Each morning, or daily, the timekeeper will check with the foreman on the previous day's time. If any discrepancy exists, investigate thoroughly and adjust the difference THEN.

Leave a few lines between the time record of the several gangs and give each a name that will help to locate them—for instance, "Concrete mixing gang" or "Steam Shovel No. 1—drilling gang."

For this contract, ONE time book like this monthly should suffice for the time of ALL the men and will be used also as the pay roll. It must be kept securely in the timekeeper's office and be filled in in ink. A similar book will be used in the field to collect the data for the office copy.

It will be seen that the pages herein especially provide for separate daily records of (a) each steam shovel gang with its drills and trains, (b) the concrete mixing plant and (c) the concrete placing plant. These features of the work will generally be those of most importance and it is therefore suggested that the time and distribution of cost of these gangs be accounted for first; it will then be found a simple matter to account for all other labor, and then the sum of all will represent the total daily distribution.

Be sure that the total amount distributed equals the total cost of the day's work and that the monthly totals balance each other.

At the end of each month the timekeeper will procure from the party or parties who board the men a list of the amount due from each man and enter same in the column for deductions opposite each name, and in the next column—"Remarks"—the name of the party to whom the deduction is payable.

No deduction shall be made nor orders for money honored in favor of any party until an order to that effect has been given by the General Manager, and no deduction shall be made except for board and hospital or doctor's fees. The names of the parties to whom deductions are payable will be entered on the pay roll, followed by the words—"For sum of deductions."

Distribution.—For the subdivisions of account No. 13—under (a) will go the first cost of the materials and all expense involved in delivering and housing them ready for the mixer; (b) will include all further costs of concrete except forms and will be further subdivided on the pages provided herein for the concrete mixing and placing plants. Items (c) and (d) of this account seem to explain themselves.

Under account No. 28 (a) will include all costs of purchase, freight and handling, up to such time as the machine or article has been put in working order; (b) will include all materials and labor required for repairs and maintenance of the machinery and plant, but the labor ordinarily spent in keeping them in working order, such as cleaning, wiping, washing out flues and for similar purposes must be charged to the work on which the machine may be engaged. While these charges will ultimately be condensed under this one general heading the timekeeper and storekeeper will keep separate records of each steam shovel and locomotive—to be shown fully under "Remarks."

The separate features of cost of other machinery need not necessarily be divided between

CONCRETE PLACING PLANT

Date	Total Yards Placed	Daily Labor Cost	Lock 4		Lock 5		Lock 6		Core Walls		Retaining Walls		Piers		Decks		Spillways G'ard gate & Culverts		Hours Time Worked	Value of Labor on Forms	MONTHLY VALUE OF SUPPLIES ISSUED
			Con	Fill.	Con.	Fill.	Con.	Fill	Con.	Fill.	Con.	Fill.	Con.	Fill.	Con.	Fill	Con.	Fill.			
1																					Fuel
2																					Oil
3																					Waste
4																					Repair Parts
5																					Timb'r for F'rms
6																					Hdw. for Forms
7																					Reinforcement
8																					Stone Fillers
15																					Total
16																					CREDIT
17																					Frt. on Cement
18																					Cem. Bags Ret'd
31																					
Total																					

Fig. 4

DAILY DISTRIBUTION OF LABOR COSTS

Date	1 Clearing	2 Grubbing	3—All Excavation			4 Sheeting and Bracing	5 Rock Channeling	Embankment		8 Lining	9 Spruce Lumber (Fenders)	10 White Oak Lbr (in locks)	Foundation Piles		13 Concrete		14 Wash Wall	12-in. Vitrified Pipe		17 Cobble Stone Paving	18 Steel Castings	Iron Castings		21 Structural Steel	22 Metal Reinforcement	23 Expansion Bolts	24 Log Chain in Fenders	25 Gas Pipe Railing	28—Machinery and Plant	
			a Loading	b Transp't	c Drilling			6 1st Class	7 2nd Class				11 15 ft. long	12 20 ft. long	b Mixing, Delivering and Placing	d Labor on Forms		15 Laying	16 Backfilling			19 Plain	20 Machined						a First Cost	b Maintenance & Repairs
1																														
2																														
3																														
4																														
5																														
31																														
Total																														

Fig. 5

the various machines, though it is desired that it be done to such a degree as may be practicable.

In a general way, the foregoing remarks will apply to all the other charges to be distributed, with the possible exception of both kinds of Embankment and of Lining. For all of these, charge only the cost of leveling off and compacting—the balance of the cost is part of that of unloading under "All excavation."

The cost of grading the branch line from the D. & H. Co.'s tracks; the cost of cement sheds, storehouses, blacksmith shops, cement mixing plant, water tanks and pipe lines will each be kept separately, at the outset, together with tallies of all material entering into their construction, and these features of cost will be fully shown on the last pages hereof under "Remarks," but they will constitute part of the cost of "Machinery and Plant" until the completion of the contract, at which time such costs can be apportioned to such other accounts as may seem desirable.

Remarks.—Under "Remarks," on the last pages hereof, make full notes of all important events connected with the works, bearing in mind that paper is cheap and that notes and dates, which may seem of minor importance at the time, may later be of great importance. This is particularly true where accidents have occurred and where actions to recover damages are likely to ensue, though, perhaps, not until several months later. In such cases the exact time and date and the names and addresses of witnesses and the causes of the trouble must be ascertained as quickly and completely as possible and a separate report of same made to the General Manager, who will report to headquarters.

Briefly, these "Remarks" should constitute a diary of the progress of the work.

Discharge Checks.—On the last page where time of men is shown the timekeeper will enter the date and amount of each item of cash received during the month and the total of all discharge checks paid. The latter will be forwarded to headquarters with the pay roll. Indicate the number of his discharge check opposite the name of each man discharged.

Finally—When in doubt ask for instructions.

The Influence of Pure Science in Engineering.*

The title of my address, "The Influence of Pure Science in Engineering," is one in which the nomenclature requires perhaps some explanation. The distinction between pure science and engineering is one, not of method, but of aim. The methods employed by the physicist and the qualities of mind called into play in his investigations, are to a very large extent the same as those used by the engineer in the higher and more pioneering branches of engineering. It is the aim that is different. The physicist endeavors to discover new properties of matter, new physical phenomena, for the sake of extending his knowledge of nature and without any thought as to their utility or the possibility of their application to the service of man. Faraday, when he discovered electromagnetic-induction, was not thinking of the electric light, or electric traction or the foundation of a great industry, he was just trying to get to know something about electricity; and so it is with all great discoveries.

It is not the business of the physicist in his researches to concern himself at all with their utility; this can very well take care of itself or be left to others to develop. It is a very striking feature in the history of science that almost every advance in pure physics has been turned to account by the engineer, the manufacturer, or the doctor. To take an example. Could anything be, at first sight, more remote from practical application than the study of the passage of electricity through gases; beautiful and interesting though the phenomena with which it has to deal undoubtedly are, they seemed for long quite remote from any practical application. Yet it is to the study of these phenomena that we owe the discovery of Röntgen rays, which are now throughout the world used for the alleviation of human suffering. Again, the purely mathematical theory of the transmission of electrical waves along conductors, as developed by Mr. Heaviside, was the origin of Pupin's successful system of long-distance telephony. No one can foresee in its early stages the possibilities which may be latent in any scientific discovery.

Nothing could, I think, be more disastrous to the progress of engineering than that the workers in pure science should hamper themselves by considerations as to the utility of their work, or confine their attention to points which have an obvious practical application. With such limitations, details in existing processes might be improved, but those great advances which have revolutionized industries would be lacking. If this policy had been pursued in the past we should still be traveling by stage coaches, though, doubtless, these would have been greatly improved since the time of our ancestors.

Applied science is even more indebted to the pioneer who discovers and opens up new regions of thought than to the man who improves the cultivation of long-settled regions of known fertility. The province of applied science, of engineering, is to survey the facts known to science, and to select those which seem to have in them the possibilities of industrial application; to study and develop them from this point of view. This development, I should think, can generally best be done in laboratories or research workshops attached to works engaged in active trade. Here there are opportunities of testing the results on a commercial scale, here is available that technical knowledge of detail which often means the difference between success and failure, and here, too, are probably available greater supplies of money and greater incentives to success than are at the disposal of government, municipal or university bodies. The success of works' laboratories in Germany and the United States, and to a growing extent in this country, is one of the most striking features in modern industrial development. The sums spent on these institutions are sufficient almost to take the breath away of one who has only been accustomed to the expenditure of a laboratory devoted to pure physics, but I have never heard that the firms who have established these laboratories regret their expenditure, indeed, I have been told by some that they regard it as their most profitable investment, and certainly the balance sheets of the firms whose laboratories are on the most extensive scale do not suggest that they are ruining themselves for the cause of science.

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*From the presidential address of Sir J. J. Thomson, before the Junior Institution of Engineers, Nov. 15, 1910.

A closer connection with pure science would, I think, be of the greatest service to engineering and commerce in this country. Great strides in this direction have been made in recent years, but we are, I think, still behind Germany in the importance we attach to pure science, and in the eagerness with which new discoveries are applied to industrial purposes. The case of the aniline dye industry has been made the text of many a sermon, but we have not even yet taken the lesson to heart, for it is easy to find instances which are quite parallel, and which have occurred within the last few months. Let me give you one, to judge from the number of "Thermos flasks" one meets with, and the prevalence of advertisements full of descriptions of their virtues, the manufacture of these flasks must constitute a large and I should think profitable business. I am told, however, that none of these flasks is made in England. Yet the Thermos flask is an English invention, it is nothing but what is known to physicists as the "Dewar vessel," a double vessel where the inside is separated from the outside by a vacuum, which was invented by Sir James Dewar for the purpose of storing liquid air without too much evaporation, and was described by him some years ago; although the discovery was made and first published in England, no English manufacturer took it up, but left it to their foreign rivals to make it the basis of an important trade.

One way in which the connection between pure science and industry could be strengthened would be by closer relations between the workers in science and industry. Let me give an instance of what I mean. A physicist or a chemist comes across some new fact which he thinks might conceivably have an application to industrial processes. He may not, however, be interested in that aspect of it, and even if he were he is very unlikely to have the appliances to work out the thing satisfactorily from the manufacturing point of view. If, however, he were in touch with the manufacturers and engineers, he would know who were the people most likely to be interested in it and who possessed the best facilities for investigating it. He could then suggest to these that it may be worth looking into the thing in their laboratory, and probably in some cases valuable results would ensue. No doubt this does go on to some extent in this country at present, but I believe it prevails to a much greater extent in Germany than it does here.

The spirit I should like to see spread throughout British industry is the exact antithesis of that expressed by the saying: "Oh, that is all very well in theory, but it does not work in practice." This saying is really a contradiction in terms, for if the theory is right and the practice is right the two must be consistent and it should be the aim of workers in pure and applied science to make them agree, unless they do something which is wrong somewhere. Of course theories are sometimes wrong, and then the physicist or chemist is to blame, but dare I suggest here that it is sometimes the practice that is wrong and not the theory? A chemist finds that you get a substance *C* when you mix two pure substances *A* and *B*; the practical man goes to the nearest chemist or grocer, asks for some *A* and *B*, takes what the shopkeeper gives him, mixes them, and does not get *C*, then he says, "Oh, those theorists." Is this example entirely extravagant; is it a parody? Have not some of you known something analogous to it in the course of your own experience?

To unite and harmonize these two essential things, theory and practice, should be the mission of applied science. I have mentioned some cases in which the practical application lagged far behind the theory. The converse is, however, quite as common; it very often happens that when a subject is applied to practical purposes and tried on what may be called an engineering scale, it develops far beyond the stage it has reached in the laboratory or in the portfolio of the mathematician. Practice, as in the case of aviation at the present time, outstrips theory, and progress has to be made by trying one thing after another until something is found which is successful. Multitudes of instances where this has occurred could be given; to take only two, there are many phenomena in wireless telegraphy which have not yet received any adequate explanation, and there are others which, though now understood, were not so until long after their existence had been discovered by those engaged in the practical development of that process.

Again, from what I remember of the lectures on chemistry to which I listened more than 30 years ago, I imagine that the sulphuric acid industry was in full vigor before chemists were agreed as to exactly what it was that did happen when that substance was being manufactured. There are, however, just the cases when research laboratories in connection with the works may render most efficient aid, and where investigations skilfully conducted by scientific workers acquainted with the results met with in practice may lead to a much more rapid development of the subject and the saving of large sums of money. The practical man in this case is just in the position of the physicist when he meets with a new phenomenon for which at first he can see no explanation; the same qualities of mind are required, and though the scale of the experiments may be different, the general method of attack will be much the same in the two cases. It is the object of applied science to keep theory and practice at the same level, by raising the one underneath, not by pulling down the other. Theory and practice do better work when they are driven abreast than in tandem.

The more intimate the relation between theory and practice, between the workers in pure science and those engaged in the application of science to the arts, the greater will be the opportunities of deepening the faith in science of the practical man and the reliance he places on its conclusions and anticipations. For in the case of science familiarity breeds confidence and not contempt. I admit that this confidence does not come at once. For example, when one first begins to do practical work in the laboratory and to verify by experiments the principles taught in the text-books, I think the impression one derives from one's first attempts at practical work is that there is a great deal of truth in the saying of a former tutor of Trinity College, that the principle of the constancy of the laws of nature was never discovered in a laboratory. A cynic, too, has remarked that if you wish to believe in the laws of nature never try an experiment.

These, however, are only the feelings of the novice, and with greater experience and knowledge of practical work they are replaced by a continually increasing confidence in the conclusions we draw by abstract reasoning from the laws of nature. This confidence in the results obtained by scientific reasoning should, I imagine, be an almost indispensable qualification for the engineer who wishes to open new ground.

Method of Securing and Recording Costs in the Panama Canal Work.*

The cost-keeping methods of the commission consist of:

1. Monthly compilations of cost data made in the chief engineer's office, which are worked up as a permanent record of the work accomplished and are used to indicate generally the efficiency with which the various portions of the work are being carried forward.

2. Division cost records kept in the various division offices consisting of both monthly records in detail and also of daily performance and unit cost sheets, in order to give the division engineers daily information on unit costs and keep them in close touch with the work in their respective divisions.

[Form 132 C. E.]

ISTHMIAN CANAL COMMISSION.

Correct:

ABSTRACT OF EXPENDITURES.

.... for the month of .... 191 Title

(Department or division.)

Account No.	Detail.	Total	Labor	Material (including plant and subsistence stores).	From other divisions.			Miscellaneous claims.	Arbitraries	General administrative expenses	General expenses		
					Labor.	Material	Service						
1	2	3	4	5	6	7	8	9	10	11	12	13	14

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*Extract from the report for the year ending June 30, 1910, of H. H. Rousseau, Civil Engineer, U. S. N., member Isthmian Canal Commission.

[Form C. E., 220.]

ISTHMIAN CANAL COMMISSION.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

.... department or division

Monthly statement of operations, miscellaneous plants.

For report of operations of rock crushers, sand plants, concrete-block plants, truck gardens, electric light and power plants, air compressors, and field repair shops (such as Cocoli, Cucaracha, Cunette, and Gatun shops), also Lirio planing mill and the printing plant.

Operations of .... month of .... 19...

Balance from last report..............

Expenses during month

Labor and supervision ....

Material ....

Transportation ....

Other expenses..........

Total expenses during month..........

Total debits ....

Credits:

Output (taken up in material account)

Balance to next account..........

Remarks:

(Signed) ....
Head of department or division.

[Form C. E. 221.]

ISTHMIAN CANAL COMMISSION.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

.... division. .... shop.

Monthly manufacturing account statement covering work done on manufacturing orders during the month of .... 19.....

Manufacturing order No. (Form 159-C. E.)	Shop order No.	Description of work.	For division or department.	Per cent status.	Charges current month.			Total charges to date.	Estimated cost.	Bill or invoice No.
					Labor.	Material.	Total.			

[Form C. E. 222.]

ISTHMIAN CANAL COMMISSION.

DEPARTMENT OF CONSTRUCTION AND ENGINEERING.

.... division ....

Monthly work report for the chairman and chief engineer.—Statement of construction and repair work authorized, performed, and in progress for month of .... 19.....

[Totals of the following reports to be carried on this report: C. E. 220, Operation miscellaneous plants; C. E. 221, Manufacturing account statement; C. E. 223, Foundry operations; as well as shop superintendence, repairs and renewals of shop machinery and tools, and shop expenses.]

Shop order or authority.	Description of work.	For division or department.	Per cent complete.	Charges current month.				Total charges to date.	Estimated cost.	Remarks.
				Labor.	Material.	Other expenses.	Total.			

The monthly cost reports forwarded to the chief engineer's office in connection with the cost keeping include the following forms:

No. 132—C. E.—Monthly statement of total expenditures by account numbers. (Size, 17 by 11 inches.)

No. 220—C. E.—Monthly statement of operations, miscellaneous plants. (Size, 8 by 13 inches.)

No. 221—C. E.—Monthly manufacturing account statement covering work done on manufacturing orders. (Size, 17 by 18 inches.)

No. 222—C. E.—Statement of construction and repair work authorized, performed, and in progress. (Size, 17 by 18 inches.)

No. 223—C. E.—Report of foundry operations. (Size, 8 by 16 inches.)

No. 261—C. E.—Report of expenditures for construction work. (Size, 17 by 14 inches.)

No. 263—C. E.—Expenditures for plant and equipment. (Size, 17 by 14 inches.)

The headings of these forms, or the forms themselves, are as follows:

Since July 1, 1909, all expenditures for plant, including all charges under that head accruing to that date, have been distributed to the different construction accounts in proportion to the benefits received by each. The plant arbitrary for each kind of work was established by dividing the total estimated expenditures by the total estimated quantity of work, and each month's costs include an allowance for plant cost, obtained from the quantity of work performed multiplied by the plant arbitrary. Upon the completion of the work all plant costs will have been absorbed by the work. The plant arbitraries are to be revised at intervals not greater than one year, so as to make the distribution of plant costs in the monthly cost statements as uniform as practicable.

The construction divisions fill out and forward to the chief engineer's office by the 20th of each month the above mentioned forms, covering the cost of work during the preceding month, except Form No. 132, which is received from all departments and divisions not later than the 25th of the month following the one it covers and which contains the statement of total expenditures classified by accounts. From this data the detailed monthly cost sheets are compiled in the chief engineer's office for the different classes of work.

Construction work costs include "division cost" plus "general expenses." "Division cost" is made up of all labor and material costs directly applied to the work plus plant arbitrary. "General expenses" include the expenses of the chief engineer's office, of the quartermaster's and subsistence departments, of the examiner of accounts' office, and disbursing office, expenses in the United States, and miscellaneous.

For the different classes of work costs are compiled under the following headings:

Atlantic division:

Dry excavation, prism.
Dredging excavation, prism.
Gatun dam—
  Dredging excavation.
  Dry filling.
  Hydraulic filling.
  Paving dam.
Gatun spillway—
  Dry excavation.
  Preparing foundations.
  Masonry.
  Ironwork.
  Back filling.
Gatun locks—
  Dry excavation.
  Dredging excavation.
  Preparing foundations.
  Masonry.
  Ironwork.
  Back filling.
Construction Gatun-Mindi levee.
Colon breakwater.
Stone production.
Sand production.
Operation, power houses.

Central division:

Dry excavation—
  Prism.
  By contract.
Dredging excavation, prism.
Clearing canal line.

Pacific division:

Dry excavation, prism.
Dredging excavation, prism.
Pedro Miguel Dam—
  Dry excavation.
  Dry filling.
  Concrete in dam.
Pedro Miguel locks—
  Dry excavation.
  Preparing foundations.
  Masonry.
  Ironwork.
  Back filling.
Miraflores locks—
  Dry excavation.
  Dredging excavation.
  Preparing foundations.
  Masonry.
  Ironwork.
  Back filling.
Miraflores dam—
  Dry excavation.
  Concrete in dam.
  Dry filling.
  Hydraulic fill.
Stone production.
Sand production.
Operation, power houses.

[C. E. 223.]

REPORT OF IRON FOUNDRY OPERATIONS

.... shops

For the month of .... 191..

Material	Weight.	Cost.	Amount.	Cost per ton.	Total.
Pattern material					
Coke					
Coal					
Charcoal pig iron					
Pig. No. 1					
Pig. No. 2					
Pig. No. 3.					
Pig. No. 4..					
Iron scrap					
Steel scrap..					
Proportion material expense for running shops.					
Total raw material expense.....					

Supplies	Amount.	Cost per ton.	Total.
New Tools.			
Repairs, tools and machinery			
Flour, facing.			
Nails, sand, etc			
Total expense supplies			

Labor	Amount	Cost per ton	Total.
Proportion labor expense for running shops			
Core room			
Molding .			
Cleaning castings			
Cupola			
Patternmaking ...			
Repairs, tools and machinery..............			
Cleaning foundry .			
Miscellaneous labor.........................			
Total labor...			
Add 5 per cent for supervision			
Total labor expense....................			
Total exp.—material, supplies, and labor.			

SUMMARY.

Total charcoal pig iron.		Total gray iron castings.	
Total pig No. 1........		Total steel castings	
Total pig No. 2..			
Total pig. No. 3..		Total output	
Total pig No. 4.........		Total returned gates .	
Total iron scrap		Total loss in melting .	
Total steel scrap			
Total returns. ...			
Total weight		Total weight.	
Total expense.		Total weight good castings	
Average cost per pound			
Average cost per pound iron			
Average cost per pound material			

REMARKS.

. ... pounds iron castings made at a total cost of $, or per pound.
. ... pounds steel casting made at a total cost of $, or per pound.
Labor expense is ...... per cent of total cost of operation.
Material expense is ...... per cent of total cost of operation.
.... castings made, average weight of each ...... pounds
.... patterns made, average cost of each $.....
Loss in melting is . .... per cent of total output.
Return is ...... per cent of total output.

Slides in Culebra Cut; Preliminary Report of Chief Geologist, U. S. G. S.

A preliminary memorandum relating to side slopes in Culebra Cut, submitted to the President, through the Chief Engineer, on November 15, by Dr. C. W. Hayes, Chief Geologist of the United States Geological Survey, follows:

The practicable side slope depends on (1) depth of excavation; (2) character of materials, and (3) geological structure. Examination of the cut indicates that serious difficulty through failure of slopes will be experienced only in the section between Empire and Pedro Miguel, or between stations 1720 and 1880. Small slides occur outside of this section, as at La Pita, but they are due to exceptional conditions and will be relatively unimportant.

CHARACTER OF MATERIALS

Within the section defined above occur four distinct classes of materials in excavation, viz:

1. *Sedimentary Rocks.*—This class includes: *(a)* volcanic agglomerates composed wholly of material ejected from volcanoes in the form of angular fragments varying in size from the finest dust to several inches in diameter; deposited in water but very imperfectly bedded; generally bluish green in color; moderately hard when first exposed, but crumbling rapidly in contact with the air.

(b) Fine grained clays; blue, red or black; composed largely of fine volcanic dust, which has been transported and deposited by water and is, therefore, well bedded; like the agglomerate, moderately hard when first exposed, but crumbling even more rapidly in contact with the air.

(c) Lignitic coal or black carbonaceous clay; beds, one to three feet thick, interstratified with red and blue clay of *(b)*.

These beds—*(a)*, *(b)* and *(c)*—with some unimportant sandstones and limestones constitute the Culebra formation of tertiary age.

2. *Intrusive Igneous Rocks.*—These are chiefly large masses of dark colored andesitic rock, which have been forced upward into the sedimentary beds, in some cases in a fluid condition, but more generally after having solidified. The intrusion was accompanied by tilting and crushing of the previously horizontal sedimentary beds. The andesite is generally intersected by numerous joints, but does not disintegrate readily on exposure and where supported below will stand in vertical slopes. Gold Hill and Contractor's Hill are examples of these andesitic intrusive masses. All the other high hills in the Culebra section of the Zone are apparently due to the presence of similar rocks.

3. *Lava Flows.*—A flow of light gray trachytic lava, 20 to 30 ft. thick, occurs conformably interbedded with the Culebra clays throughout the central portion of the cut. Its relations are exactly those of a sedimentary bed. The trachyte does not disintegrate readily, but by reason of its abundant points, it does not afford any support to the clays above.

4. *Residual Clays.*—All the rocks in this region are more or less deeply weathered and the original surface is everywhere covered with a residual deposit, generally clay, dark red in its upper portions and varying shades of red and yellow below. This clay is derived directly from the rocks on which it rests and is thinnest over the intrusive andesites, because they decay less rapidly than the sedimentary rocks. It is thickest over those portions of the sedimentary rocks which have been so fractured as to permit the easy percolation of surface waters. It is usually separated from the underlying unweathered rock by sharp line, indicated by an abrupt change in color and texture.

FAILURE OF SIDE SLOPES

The original three on two slopes have failed to stand at numerous points. Varying conditions have given rise to three classes of failures which may be designated (1) surface flows; (2) structural breaks, and (3) surface disintegration.

1. *Surface Flows.*—Wherever the residual clay described above rests upon an inclined rock surface and the lateral support of the mass is removed, as is done when a trench is excavated, the portion of the mass lying above the unsupported side tends to flow down the sloping surface. The material has no cohesion within itself and very slight adhesion to the underlying rock. It acts like a viscous fluid and may flow on slope as low as one on seven or eight. Having started as a purely surface flow it may gather sufficient momentum to carry down portions of the underlying unweathered rock, particularly if the latter has previously been deeply fractured. The Cucaracha and Paraiso sides are of this type. Between Gold Hill and Paraiso, a series of andesitic intrusions, east of the Canal, have given the sedimentary beds a westerly dip. They form a series of troughs pitching down toward the Canal. Moreover, the sedimentary beds, in addition to being tilted, have been deeply fractured and "slickensided," so that their cohesion is greatly reduced and the movement which started in the surface clays has extended some distance below the base of the clays and involved the underlying unweathered rock.

2. *Structural Breaks.*—Every variety of rock has a limiting strength and if loaded beyond this limit will be crushed, or will flow. The crushing strength varies between very wide limits and is always lowered when one or more sides of the block are unsupported

[Form 261-C. E.]

ISTHMIAN CANAL COMMISSION.

.... Division.

Construction expenditures for month of ...., 191.....

Account.			Current month.						Fiscal year to date.					
No.	Title.	Unit.	Work done, quantity.	Labor.	Material.	Charges from other divisions.	Total.	Unit cost	Work done, quantity.	Labor.	Material.	Charges from other divisions.	Total.	Unit cost

[Form 263-C. E.]

ISTHMIAN CANAL COMMISSION.

....

Plant and equipment expenditures for the month of ...., 191..

Items.	Labor	Material	Charges from other divisions.	Total.	Total cost to date.	Completed cost.	Estimated cost.	Remarks.

laterally. The weakest member in the sedimentary series occurring in the Culebra Cut is the lignite, or lignitic clay. When the lateral support is removed from a lignite bed it tends to give way under the weight of the overlying rocks and a slide results. The same result may occur, even if the weak bed is not cut through, but merely unloaded by excavating down nearly to it. In this case it flows out from under the load and bulges up in the excavation. This type of slide has occurred at various points between Empire and Gold Hill, and, in nearly every case, the immediate cause appears to be the failure of a lignite bed under the unbalanced pressure due to the excavation.

This type appears to offer more serious difficulties than the surface flows, and the obvious prevention is in making the slopes sufficiently low so that the weakest rock subjected to the unbalanced pressure shall not be loaded beyond the limit of its crushing strength. It seems reasonably certain that in the section of the Canal threatened by sildes of this type less material will have to be removed if the slopes are lowered before the break occurs than afterwards.

3. *Surface Disintegration.*—As previously stated, all the sedimentary rocks of this region tend to disintegrate very rapidly when exposed to the air. They first crumble into small angular fragments and eventually into the finest powder. Slopes cut in such rocks will rapidly disintegrate and crumble until they reach an angle on which the products of disintegration will lie and form a protective mantle. Vegetation will, of course, greatly assist in this protection. While the failure of the Canal slopes from this cause will not be a serious matter, it will involve the removal of a large amount of material in the aggregate, and constant attention for a long time.

Under certain conditions this surface disintegration becomes a more serious matter. For example, the contact between the intrusive andesite of Contractor's Hill and the sedimentary clays dips away from the Canal at an angle of 55°. The crumbling of the clays below the contact leaves the andesite mass overhanging, and the overhang will increase as the Canal is carried to its full depth and more clay is exposed. With a rock so much fractured as the andesite, this condition is unsafe and the exposed surface of the underlying clay should, therefore, be protected from further disintegration.

RECOMMENDATIONS.

1. A competent geologist should be employed on the Isthmus until the Canal is completed.

2. The geologist should continues the record of geologic facts, as revealed by the excavation, constructing a series of accurate cross sections. The work already done along this line by Messrs. Nichols and Raggi is extremely valuable and their zeal and intelligence cannot be too highly commended.

3. Additional core drill records should be obtained under the direction of the geologist, particularly to determine whether, or not, sedimentary beds of exceptional weakness occur in such position as to cause landslides of the structural break type.

4. The geologist should afford assistance to the engineers in determining the most econofical slope for each section of the Canal, and the slope should be fixed, not arbitrarily, but in view of the known geologic conditions.

Contract for Excavation.—The contract for excavating 112,450 cu. yds. of earth from the Canal prism, opposite Gorgona, has been let to Llewellyn Swain of Empire at 21½ cts., a yard. There were 11 bidders. The work will be done for Mr. Swain by B. B. Duncan of Las Cascadas. The unusually low price is due to the fact that about 10,000 yds. of the material can be cast over into the Chagres River; 5,000 can be so dislodged with dynamite that the river will carry it away, and the longest haul on the balance is not over 150 ft.

PERSONALS.

Mr. William Michel, Engineer of Maintenance of Way of the Hocking Valley Ry., has been appointed Chief Engineer of that road.

Mr. William Cleburne, who took a prominent part in the original survey of the Union Pacific R. R. through the wilds of the far west, died at his home in Newport, Ky., Dec. 17, at the age of 86. He was a brother of General Patrick Cleburne, a noted Confederate officer.

Mr. Martin A. Knapp, Chairman of the Interstate Commerce Commission, has been nominated by the President as Chief Justice of the recently created Court of Commerce. Nominations of other justices are: Robert W. Archbold, William H. Hunt, John E. Carland and Julian W. Mack.

Mr. George Burkhoff, a retired building contractor of Chicago, died of heart disease on Dec. 14, at the age of 83. He was born in the Netherlands, and came to Chicago in 1869. He was the first contractor to start work in Chicago after the big fire, building hundreds of residences in all parts of the city.

The St. Louis Railway Club held its annual smoker and Christmas entertainment at the Southern hotel, St. Louis, Dec. 9. Mr. L. O. Armstrong, of Montreal, gave a talk on points and views along the Canadian Pacific Ry., illustrated by stereopticon views and motion pictures. Following Mr. Armstrong's talk a vaudeville entertainment was given.

Mr. E. V. W. Rossiter, who has been vice-president of the New York Central & Hudson River R. R. since 1900, died at his home in Flushing, L. I., on Dec. 11. He was born at St. Louis, Mo., on July 13, 1844. Entering the service of the Hudson River R. R. as a clerk at the age of 15, he served continuously with that road and its successors until the time of his death.

Mr. Benjamin Sullivan Church, who was for years prominently identified with the Croton Aqueduct work, died on Dec. 10. He was born at Belvidere, N. Y., on April 17, 1833. After graduating from Dartmouth College he became a topographer on the Croton Aqueduct. He was chief engineer for the Aqueduct Commission from 1883 until 1888, and consulting engineer until 1889.

Mr. Frank S. Gorton, secretary and treasurer of the Chicago Edison Co., and secretary of the Standard Pneumatic Tool Co., until his retirement from active business in 1903, died of heart failure in his apartments at the Congress hotel on Dec. 12. He was born in Rochester, N. Y., Aug. 1, 1847, and was a graduate of Rochester University. After serving for four years as treasurer of the Western Edison Co., he became secretary and treasurer of the Chicago Edison Co., in 1887, being one of the organizers of that company.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, **tell** us and we will notify promptly the **leading** manufacturers.

Consulting Engineers.—Paper 3¼x6¼ ins., 32 pp. Robert W. Hunt & Co., 1121 Rookery, Chicago, 90 West St., New York.

This booklet outlines the work done by the various departments of the company's business, covering inspection, tests and consultation in all branches of engineering.

Drawing Tables.—Paper 6x9 ins., 8 pp. Keuffel & Esser & Co., 127 Fulton St., New York.

A pamphlet relating to the Hudson drawing tables giving illustrations, complete descriptions and prices.

Road Machines.—Paper 5½x8½ ins., 4 pp. Petrolithic Pavement, 336 Pacific Electric building, Los Angeles, Cal.

A description of a scarifier or rooter of increased capacity.

Smith Fertilizer Mixer.—Paper, 6x9 ins., 12 pp. The T. L. Smith Co., Majestic building, Milwaukee, Wis.

A catalog which covers the special type of mixer which is now manufactured for mixing fertilizer. Diagrams, descriptions, sizes and illustrations.

Smith Glass Mixer.—Paper, 6x9 ins., 12 pp. The T. L. Smith Co., Majestic building, Milwaukee, Wis.

A special equipment now manufactured for the use of glass producers. Contains tables, illustrations and various useful information.

Smith Hand Mixer.—Paper 3¼x6 ins., 16 pp. The T. L. Smith Co., Majestic building, Milwaukee, Wis.

An illustrated description of the 3 cu. ft. hand mixer, covering the principles of the mixing action, output, operation and information regarding the construction of the machine.

CONTRACT NEWS SECTION
of
ENGINEERING-CONTRACTING

The Doings of the Week.

Four big rock tunnel contracts in New York have gone a glimmering for the present. These tunnels are to be constructed under New York city for the Catskill water supply, and bids were to have been opened Dec. 24. Last week, however, the proposal advertisements were withdrawn, it being stated that the form of contract lacked the approval of the city corporation counsel, which is a legal requirement in New York for advertising bids. The work will be readvertised at a later date.

Present indications are that iron and steel manufacturers will shortly announce a cut in the price of their products. This will undoubtedly result in the placing of many long delayed orders, which will give a boom to the iron and steel trade.

Bids for the new prison to be erected at Wingate to take the place of Sing Sing Prison were opened Dec. 15 at Albany, N. Y. The P. J. Carlan Construction Co., New York city, was the low bidder at $2,894,000 for the entire prison and $698,000 for deductions as provided in the specifications. Award of contract was held up by a restraining order from the court.

Work on the construction of a levee on the west bank of the Colorado River in connection with the work of protecting the Imperial Valley, California, was started on Dec. 12. The contractors on this work are J. A. Maxey, first nine miles, 426,000 cu. yds., at from 19 to 22½ cts.; R. P. Marable and John Mulligan, sections 8, 9 and 10, about six miles, 336,000 cu. yds., at 28 cts.; J. C. Norton, sections 11, 12 and 13, at lower end of work, 325,000 cu. yds., at 36 cts. A portion of the work near the Abejas River crossing, which will be occupied by the railway, and the grading required for five miles of track will be assigned to W. K. Bowker of the C. M. Ranch Co., who already has 500 head of stock equipment of scrapers, wagons, tools, etc., on the ground.

Developments of the past week indicate that definite action may be taken soon for the construction of the long projected freight belt line at Columbus, O. The Columbus Connecting R. R. Co. has been incorporated to build and operate the road. A double track line 32 miles long is planned, and the cost is estimated at $6,000,000.

Railroad construction contracts let recently appear to be few and far between. The principal contract seems to be the one let by the Colorado & Southern Ry. for the construction of the proposed line from Wellington, Colo., to Cheyenne, Wyo., a distance of 32 miles. Kilpatrick Bros. & Collins, Beatrice, Neb., are reported to have been awarded the contract. Among the other contracts let recently are the following: Furtwangler & Smith, Birmingham, Ala., for the completion of 2½ miles of track for the Birmingham & Edgewood electric car line at Birmingham; Glynn Constructing Co., Brunswick, Ga., for constructing the two mile line of the St. Simons Ry. Co. on St. Simons Island, just off the coast of Georgia.

It has been announced officially that unless something unforeseen happens the National Transcontinental Ry. will be completed from Winnipeg to Moncton by the end of next year, with the exception of the connecting link of the Quebec bridge. Pending the completion of the bridge a car ferry service will be operated across the St. Lawrence.

The J. B. Arpin Dredging Co., Grand Rapids, Wis., has just been awarded a fair sized ditch contract in Roseau County, Minnesota. The contract calls for the construction of Judicial Ditch No. 19, the contract price being $87,712.

Late reports regarding the construction work on the Western Maryland extension from Cumberland, Md., to Connellsville, Pa., indicate that the line may be opened for traffic by Oct. 1, 1911, instead of Nov. 1, the original date. At the end of November about one-third of the grading and about 45 per cent of the concrete work had been completed.

The elimination of grade crossings in a number of Ohio cities promises much work in the near future. In Cleveland grade crossing work will be started as soon as the railroads submit satisfactory plans to the city. In Youngstown the Erie R. R. is to submit plans in the near future for grade elimination on the main line of the Erie between Himrod Ave. and Westlake's crossing. The total cost will be about $2,100,000, of which the city's share will be about $600,000. In Cincinnati the Department of Track Elevation and Subways of the city is considering plans for eliminating the grade crossing at Mitchell Ave. and the B. & O. R. R.

The Passing of the K., S. & G. Ry.

The "most accommodating" railroad in the State of Kansas has gone out of business. This railroad was the Kansas, Southern & Gulf and it was operated by the State of Kansas. As originally planned, it was to run from the Dakotas and Canada wheat fields to the Gulf, but after 18 miles of line had been built in Kansas something happened and no further mileage was ever built. When it commenced operation the railroad had two engines, four box cars, two flat cars, a combination smoker and baggage car and a coach. For many years the road was operated and the bond interest was paid. Then the engines and cars and track became so bad that considerable amounts had to be paid for needed repairs. As a result the interest on the bonds was defaulted and the bondholders ordered the road abandoned. The State of Kansas then took charge on the ground that the road had received bonds from the county to help in the building, and that the road had certain obligations to fulfill. If the bondholders would not operate the line the state would, and accordingly a receiver was appointed. The receiver took the money on hand and made needed repairs. Then he traded off the two locomotives for one that was better than either of the two. The number of employes was reduced to one, this man serving as engineer, conductor, station master, brakeman and everything else. Under orders from the state the passenger rates were boosted to 5 cts. per mile, and the freight rates were raised until they were about six times as high as other roads were allowed to charge. The railroad was run on an accommodating schedule. If a farmer's wife had eggs that she wanted taken to either end of the line and traded for calico, or the farmer wanted a plowshare sharpened, they flagged the train at the crossroads, explained what they wanted done, and the engineer handled the business, bringing the goods back on the return trip. For this service the road charged a small fee. If a passenger saw a flock of ducks in a pond beside the right of way and had a gun, the train would be stopped while he took a few shots at them. Despite all these accommodations and the high rates the road did not pay. Finally the engine got into such bad shape that it could not be repaired and as the road had no money to buy a new engine, the receiver early in November had the following notice posted along the line:

> Owing to the [illegible] I have accumulated as receiver of the Kansas, Southern & Gulf Railroad during the last eighteen months, I have resolved to resign as receiver and give others desiring to accumulate a fortune a chance for the position. On account of the condition of the engine the road will be unable to handle any freight after Nov. 15.

Prophecies That Went Wrong.

Now that the census bureau his issued the figures showing the population of the country at the last census, it is interesting to see how far the early prophecies of the country's growth have differed from the actual figures. In his annual message of 1862, Abraham Lincoln estimated that in 1900 this country would have a population of 103,208,415. This estimate was based on the rate of increase that had been maintained on an average from the first national census in 1790, until that of 1860. Assuming the rate of increase as 34.6 per cent, President Lincoln figured that in 1910 the population would be 138,918,536, in 1920, 186,984,335, and in 1930, 251,680,914. An earlier prophecy on the growth of this country is given in a history of the United States published in 1820. In this history the author takes the figures for the census in 1790, 3,950,000, the figure for the census in 1800, 5,305,666, and for 1810, 7,230,514, and estimates that at this rate of increase the number of persons double in less than 25 years. On this basis he obtained the following results: Population in 1810, 7,230,514; in 1835, 14,461,028; in 1860, 28,922,056; in 1885, 57,844,112; in 1910, 115,688,224; in 1935, 231,376,48; and in 1910, 462,752,896. The author of this 1820 history then goes on to say:

> Allowing that in the United States, including Louisiana, there are two millions of square miles, or twelve hundred and eighty millions of acres, in 150 years there would be about 230 persons to a square mile, or not three acres to a person. That the present territory of the Union may increase in population, in the above proportion, for a century, is not at once to be considered improbable, though many causes may conspire against it.

To Reform Milwaukee.

Considerable surprise has been occasioned by the fact that the Socialists who are now in power at Milwaukee have instigated no radical attempts at reform in the municipal government of the city. This lack of action on the part of the Socialists has evidently been but the quiet that precedes a storm, if one may judge from the radical bills which have been prepared by the Socialist rulers of Milwaukee for presentation to the Legislature. These bills include the following: Complete home rule for Milwaukee, thus divorcing the city and county from all legislative interference by the state in internal affairs. Municipal slaughter and cold storage houses and a municipal ice plant, carrying with it the right to sell ice to consumers at cost. Authority to raise the bond limit, so as to enable the municipality to take over at any time it elects any or all public utilities, the intention being to condemn the street car and lighting systems of the city. Authority to acquire lands on which to erect homes for working men, to be sold at cost. Authority to conduct at least four municipal hospitals, in addition to the Johnstone Emergency Hospital, now conducted by the city, and recently placed under Socialist doctors as trustees. To make automobile speeding a prison offense. To permit the city to do plumbing work for householders at cost. To allow the city to bid on its own work, the object being to break up an alleged ring of contractors. To establish a city printing plant and a municipal pawn shop.

To Secure Good Roads. Some four years ago the little city of Watseka, Ill., let a contract for macadamizing two of its streets. So well was the work done that this summer when the matter of letting the contract for macadamizing several other streets came up the citizens were strongly in favor of having the same contractor do the work. An investigation was made and it was found that the contractor had become interested in another business that required his time and capital and that he was no longer seeking contract work. Even this did not daunt the desire to have him do the work. Finally, one of the citizens of Watseka came forward with a proposition offering to advance all the cash necessary if the contractor would take the job. The latter accepted the proposition, and according to a local paper, the new thoroughfares are "a credit to the city as well as to the contractor."

RAILWAYS, STEAM AND ELECTRIC

Alabama.

⦿Furtwangler & Smith, 301 First National Bank Bldg., Birmingham, Ala., have been awarded tne contract for the completion of 2½ miles of track necessary to carry the Birmingham & Edgewood electric car line to the foot of Shade's mountain. Work will begin at once.

The Alabama Traction Co., C. G. Abercrombie, president, Montgomery, Ala., has placed orders for ties and rails, and will probably start work late this month. Track laying will likely be started early in January.

The Chattanooga Southern R. R., C. H. Fisk, chief engineer, Chattanooga, Tenn., is said to be securing right of way through Gadsden for a branch line to reach the plant of the Southern Iron & Steel Co.

The Gadsden & Birmingham Ry. Co., a subsidiary company of the Chattanooga Southern Ry., has filed its articles of incorporation. The primary object is to secure an entrance to Birmingham, and it is probable that a line will be built from Gadsden to Ragland, on the Seaboard Air Line, where a connection will be made and the tracks of the Seaboard Air Line used. In any event, it is the intention of the company to give a through line from Birmingham to Chattanooga. A force of engineers is now located in Gadsden making a survey from there to Ragland. It will take several weeks to complete this work. E. F. Bromeyer, Chattanooga, Tenn., General Manager of the Chattanooga Southern R. R., is President of the Gadsden & Birmingham Ry.

Advices from York, Ala., state that track-laying crew of the A. T. & N. R. R. is almost within sight of that town and it is expected by Engineer Toxey to have the line completed by the first of the new year.

Arkansas

The Chicago, Rock Island & Pacific, according to advices from Little Rock, Ark., is now constructing new terminals at Biddle, a town situated near that city. The improvement when completed will cost, it is estimated, about $1,000,000. Work on the new buildings is now pushing forward as rapidly as possible as the company wishes to complete the yards and buildings by January 1, 1914.

California.

Grading work on the Santa Rosa & Clear Lake R. R. is now under way, and beginning early next year the road will be rushed to completion between Santa Rosa and Clear Lake. P. M. Reynolds is chief engineer.

The Havens interests in the Oakland Traction Co. and the San Francisco, Oakland & San Jose Ry. (Key Route) have been sold to Frank M. Smith. It is probable that this will result in extensive development work to both railroads. The first work will probably be done along the western water front at Oakland, where the Key Route holdings lie, and where the company has recently received a franchise from the city. Wharves, piers and slips of the most modern type are to be constructed, and a deep water harbor that will accommodate the largest vessels is planned for. Along with this the corporation land will be filled in, warehouses constructed and all preparations made for handling the commerce which will follow the development of water front facilities. The next point where work will be started is probably the extension of the Key Route electric lines through the southern portion of Alameda county. With the Southern Pacific extending one of its new lines to San Leandro a competing line will be constructed by the Key Route, now that it has become allied with the Santa Fe through the combination of interests held by Smith. J. Q. Brown, Oakland, Cal., is general manager and engineer.

Engineers in the employ of the Mountain Quarries Co. of Auburn are making a survey for a railroad from the quarries, on the El Dorado county side of the American River, three miles from Auburn, to Rocklin. It is said that the Southern Pacific Co. is behind the plan to run the railroad through this section.

F. S. Kershaw of Ashland, Ore., acting for a Chicago syndicate, has bought 103,000 acres of timber land from Dr. E. B. Perrin and others in Tehama county for a price said to be in the neighborhood of $2,000,000. The tract is about 30 miles from Redwood and mills and factories will be erected. As it is isolated from the railroad, it is predicted one will be constructed.

The Hanford & Summit Lake R. R., now built out about eight miles from Hanford, has started preliminary surveys for an extension to Fresno. It is proposed to start building from the Hanford & Summit Lake road at a point near Hardwick, after the railroad has been brought across Kings River on one bridge. The route into Fresno will, in a general way, be along Elm avenue. Charles King, Hanford, is president.

The Los Angeles-Pacific Co., 431 South Hill St., Los Angeles, Cal., is reported to have awarded a contract for the construction of about ten miles of electric railway from Hollywood, over the Cahuenga Pass to Lankershim and the San Fernando Valley. The contract price for the new construction is said to be in excess of $450,000.

The Pacific Gas & Electric Co. of San Francisco has absorbed the Monterey County Gas & Electric Co. and will extend the trolley road formerly owned by the latter company to Salinas. It is said that work will begin at once on the Monterey and Salinas line and that the 20 miles of roadbed will be rushed to completion. The Monterey line will also be reconstructed with double broad gage track from Pacific Grove through Monterey to Del Monte and will be newly equipped with latest modern rolling stock.

The Northern Electric Co., Chico, Cal., now operating a line from Sacramento to Marysville and Chico, is reported to have closed a deal for the purchase of the George Bryte ranch in Yolo county just across the Sacramento River from Sacramento. The price paid is stated to be $150,000 for 1,000 acres. The company already owns considerable land adjoining this farm and plans extensive developments on the tract. As soon as the new bridge now building across the river at the foot of M St., Sacramento, is completed work on the terminal on the Yolo side will commence. It is said that the owners of the railway will build a new city to be known as West Sacramento. The terminal of the road will be on the other side of the river, and shops, switching yards, etc., will be laid out there. Wharves, docks and warehouses will be built along the river front, which the company owns.

The Santa Fe System plans to expend $8,000 for interchange tracks with the Central California Traction Co. at Stockton, Cal.

The Santa Fe System will soon construct a spur track at Antioch, Cal., to accommodate the California Paper & Board Mills.

The Santa Fe System has planned to line its tunnel near Muir, Cal., at an estimated cost of $40,000.

Progress is being made with the promotion steps for the new railroad from Fresno to Monterey. A company capitalized at $1,500,000 is being formed to build the road. This is the project being promoted by A. Albrecht of Fresno and E. R. Shaw of Coalinga.

The Southern Pacific Co. has a party of 40 surveyors and helpers at work making a preliminary survey for another route over the Tehachapi mountains. The survey is in progress between Trevis and Tehachapi and will provide for a line between 40 and 50 miles in length. It is said to be the company's intention to build an entirely different route from the famous "loop" now in operation. The present route goes over Tehachapi pass along the right bank of Tehachapi creek while the survey now being made is along the left bank of the creek. It is planned to reduce the grade on the new route materially. The present track has a grade of about 2.25 ft. to the mile while the maximum grade of the survey now being made is said to be only 1.15 ft. The new route will necessitate the building of new tunnels and new stations along the way.

In a hearing before the City Council of Oakland on the application of the Southern Pacific Co., for a 50-year franchise for an electric road in 7th St., a statement was submitted showing that the Southern Pacific Co. will expend $10,500,000 in electrizing on a double track basis the entire 50½ miles comprising the Alameda county suburban lines. The total amount of this investment proposed for 7th St. is reported at $723,500. This expenditure includes: For roadbed, $466,300; for overhead structure, $61,350; for equipment, $116,700, and for the proportionate cost of power houses and substation, $79,150.

Advices from Riverside, Cal., state that steel laying on the extension of the Crescent City line to Bloomington is again underway and will be completed between Bloomington and Crestmore townsite near the plant of the Riverside Portland Cement Co. shortly.

The first steel was formally laid on the new Butte & Plumas Railroad at Oroville, Cal., which will extend from that city to Stanwood, a distance of 32 miles and eventually to Plumas County, Cal., a distance of 51 miles from Oroville. The road will pass under both the Southern and Western Pacific grades and will follow along the detour of Dry Creek to the plant of the Truckee Lumber company. The Southern Pacific company has been at work for nearly a month raising its tracks about 10 ft. for a distance of a mile south of

✣indicates work now open for bids. ⦿**indicates a contract let recently.**

its station here so that the new road could cross beneath it. More than 400 men are at work on the Southern Pacific job and 600 on the Butte and Plumas. Four engines, forty two flatcars and ten box cars arrived for the B. & P. Co. and a few passenger cars will reach here within the next few weeks. The road will cost, when completed, about $475,000 and will open up a timber and apple country. It is understood that when the big holdings of the Truckee Lumber company in the hills are cleared of timber, that a subsidiary corporation will be organized to place the thousands of acres on the market for apple land.

The construction of a branch line of the Santa Fe System is under way to the new Anaheim Sugar factory at Anaheim, Cal.

The City Council of Oakland, Cal., has under consideration the matter of granting the Southern Pacific Ry. Co. a mole franchise.

A conference was recently held by Commercial organization of Lindsay, Cal., and C. H. Holley, Chief Engineer of the Holley Railroads, which are to build out of Porterville, within 18 months, in regard to securing free right of way through the Lindsay orange districts.

City Council of Oakland, Cal., recently passed an ordinance granting the Southern Pacific Co. a fifty year franchise on the western water front.

Colorado.

⊙It is reported that H. W. Cowan, Denver, Colo., Chief Engineer, Colorado & Southern Ry. Co., has awarded the contract for the construction of the proposed line from Wellington to Cheyenne, a distance of 34 miles to Kilpatrick Bros. & Collins, Beatrice, Nebr. The completion of this line, which it is estimated will require an expenditure of about $1,000,000, will furnish a direct route from Denver to the fertile Big Horn district and bring it into close touch with Denver markets.

The Laramie, Hahns Peak & Pacific R. R., which is being constructed from Laramie, on the main line of the Union Pacific in Wyoming toward Routt county is pushing grading work at a fast rate and it is expected that contracts for the completion of the line to Walden, Colo., will be let about January 1. Two grading outfits are at work now. One of these is in Fox park and the other on the Coalmont end of the line. The road, while independent of the Union Pacific, will be a valuable feeder for that system. Boston financiers, who are interested in the road, recently announced while in Denver that it would be rapidly extended to Steamboat Springs and reports have reached Denver recently that the line is to be continued west of Steamboat Springs.

French and Holland capitalists, according to reports from Greeley, have negotiations under way to purchase the bonds of the Greeley, Denver & Northwestern Ry. Co. If this is done it is believed the railroad will be built within 10 months. The bond issue of the company is $2,000,700. This road proposes an electric line between Denver and Greeley and ultimately to tap the Routt county coal fields.

The Del Norte & Pagosa R. R. Co., according to advices from Pueblo, proposes to build a new railroad in the counties of Archuleta, Mineral and Rio Grande. It will be about 150 miles in length and will start from Juanita on the Denver & Rio Grande in Archuleta county, and run in a northerly direction to Pagosa Springs. From this point the road will run northwesterly through Mineral county to Del Norte in Rio Grande county. This company was incorporated the latter part of November, the incorporators being Whitney Newton, James Q. Newton, E. F. Richardson, S. W. Ryan and H. N. Hawkins. The capital stock is $50,000.

Florida.

⊙In our last issue it was stated that the contract for constructing 135 miles of new lines for the Florida East Coast Ry. had been let to the Kissimmee Valley Construction Co. This construction company is located at Jacksonville, Fla., and W. F. Coachman is President of it.

The Florida Warehouse & Dock Co., of which Frank Drew, Live Oak, Fla., is president, has purchased a large tract of land at Jacksonville, and reports from that city indicate that the land may be used for the erection of a large terminal station. Mr. Drew is also president of the Florida Ry. Co., which has now been graded from Grand Crossing to within a short distance of White Springs in Hamilton county.

City council of Jacksonville is to make an effort to require the Jacksonville Electric Co. to double track its Fairfield line, from Florida Ave. to its eastern terminus.

Information from Sanford, Fla., states that the last spike was driven December 8 thus completing the construction of the new Sanford & Everglades Ry. and the Sanford Traction Company's lines.

Georgia.

⊙The Glynn Contracting Co., Brunswick, Ga., has been awarded the contract for constructing the two-mile line of the St. Simons Ry. Co., the incorporation of which was mentioned in our Dec. 7 issue. The line is to be built on St. Simons Island, which lies just off the coast of Georgia. This line it is said will form the nucleus of other lines to radiate north and south from the terminals, along the coast on either side of the island. F. D. Aiken, Brunswick, Ga., is president.

Preliminary surveys will probably be started early next year for the extension of the Ocilla Southern R. R. through the central portion of Georgia. If the extension is built it will give a direct line through the center of the state, running directly north and south along the ridgeway, through the finest agricultural portion of Georgia and shortening by 25 miles the distance to Macon and Atlanta between several of the places along the line. The Ocilla Southern R. R. at present is 17 miles in length and connects Ocilla and Alapaha. The extension will be approximately 100 miles in length, extending north and south from Ocilla and will take in Nashville or Adel, Alapaha, Ocilla, Fitzgerald, Abbeville and other towns. It is proposed eventually to extend to the east and the west coasts. J. A. J. Henderson, Ocilla, Ga., is President.

Construction work is now under way on the proposed line of the Atlanta & Carolina Electric Ry. Co. The company projects a line having a total length of 222 miles. Of this 13 miles will be in the city limits of Atlanta. From there the route passes the following cities and towns: Panthersville, Snapfinger, Lithonia, Conzers, Walnut Grove, Monroe, Good Hope, High Shoals, Watkinsville, Athens, Crawford, Lexington, Washington and Augusta. F. R. Edmonds, 551 Candler Annex, Atlanta, Ga., is Superintendent of Construction.

In connection with the plans for physical connection of the Rome & Northern, H. M. Smith, Rome, Ga., Chief Engineer, with the Chattanooga Southern R., Charles Hicks, Chattanooga, Tenn., General Manager, for which purpose the Chattanooga & Atlanta Ry., mentioned in our last issue, was incorporated, a trackage agreement has been reached by the officials of the two first roads. The agreement sets forth that the Rome & Northern is to build at once an 8-mile extension north from Gore to Trion and the Chattanooga Southern a 6-mile extension south from Harrisburg to Trion. On both the rails are to be of 85-pound steel and the grade not more than 1 per cent. The Chattanooga Southern further agrees to relay its tracks between Trion and Chattanooga with 85-pound rails, not later than March 1, 1912, and to allow the Rome & Northern terminal facilities at Chattanooga. The R. & N. will pay a rental of $30,000 per annum, half the taxes, a wheelage proportion of the cost of maintenance, and a percentage of the increased cost of terminals at Chattanooga. The agreement takes effect immediately, and lasts for 99 years. The papers are signed by the presidents and secretaries of the two companies. Surveyors are now in the field, mapping out the connection between Gore and Harrisburg. Later it is expected that a link between Rome and some point on the Seaboard, probably Rockmart, will be built, thus giving a new trunk line between Chattanooga and Atlanta.

Idaho.

Information from Bliss, Utah, states that work will be started about January 1 on the Rupert-Bliss branch. Materials have already arrived at that city for the construction of the line. The new town of Lowell Park will be constructed at the junction of the branch with the Oregon Short Line one mile east of Bliss.

It has been announced at Meadows, Idaho, that the extension of the Pacific & Idaho Northern Ry. now under construction will be completed to that place within a few weeks if no abnormal weather conditions make work impossible. Engineers in charge of the work are Stuart French, T. J. Holland, A. W. Bainbridge, H. L. Keyes and Howard Yost.

Illinois.

A corps of 15 engineers is now in the field surveying the route of the Central Illinois Traction Co.'s proposed line from Centralia to Springfield. The line will follow the Illinois Central railroad to Sandoval, from where it will proceed along the B. & O. tracks to Beaver Creek. Greenville, Hillsboro and Pawnee will be touched by the road. Isaac Smith, C. E., St. Louis, Mo., is president and J. W. Gullett, Springfield, Ill., is secretary of the Central Illinois Traction Co.

The city council of Pekin and the county supervisors have granted a franchise to the Pekin-Petersburg Interurban Ry. Co. for lines in Pekin. The company proposes to have certain lines in the city in operation within a period of seven months from the date of the granting of the franchise; another line within twelve months, and all three lines within two years. John E. Mellick, Springfield, Ill., is chief engineer.

The directors of the Waukegan, Rockford & Elgin Traction Co., Waukegan, have decided to continue grading work throughout the winter and voted to have the steam shovel keep right on all winter without interruption. The directors also voted to instruct the engineers to proceed at once with laying a route to Fox Lake from Wauconda in order to have everything ready in the spring to let the contract for the work of building the line between those two points.

The Northwestern Engineering & Construction Co., W. E. Elliott, general manager, Milwaukee, Wis., which, as previously noted in these columns, has the contract for constructing the line of the Moline-Sterling Traction Co., will probably start some of the construction work this winter. This road is to be 110 miles in length, including a branch from Sterling to Princeton and a stub line to Morrison. The cost is estimated at $23,000 per mile.

The city of Bloomington has negotiations under way with the Big Four and Lake Erie railroads looking to the construction of a subway at Front and Allin Sts.

The Calumet & South Chicago Ry. Co., Chicago, has certified to the Illinois secretary of state to an increase in capital stock from $7,000,000 to $10,000,000.

Congressman William McKinley of Champaign, President of the Illinois Traction System, in connection with George G. Duncan of Portland, Me., and T. B. McCauley of Montreal, Que., are reported to have bought the street railway system of Bridgetown, Barbados Island. It is planned to turn the present antiquated mule car line into an electric system. Bridgetown is a city of 25,000 inhabitants.

The Galesburg & Great Eastern R. R., Willis Smith, President, Majestic Bldg., Chicago, Ill., now operating ten miles of standard gage line, is said to be considering a plan for electrifying its system and extending its tracks from Wataga to Galva.

Indiana.

The commissioners of Clinton County have granted the Logansport, Frankfort & South-

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ern Traction Co. a franchise to build, operate and maintain a traction line in Clinton County, work to begin on the road by Jan. 1, 1912, and to be completed and cars to be running by Jan. 1, 1914. The same company has a franchise in Cass County and will ask for one in Carroll County. The line from Frankfort will run northeast, passing through Middlefork, Burlington, Deer Creek, Camden and on to Logansport. Toledo capitalists are behind the enterprise and they are said to be ready to begin work as soon as the weather will permit.

It is now believed that the Southern Michigan Ry. Co., South Bend, Ind., will next year begin an extension of its electric railway from Niles, Mich., thus giving trolley connection between South Bend and Buchanan, Mich. It is understood that work will be started in the spring. The new line will require the construction of a large bridge over the St. Joseph River.

An appropriation has been made for building a 50,000 gallon water tank at Seymour, Ind., for the Baltimore & Ohio Southwestern Ry.

All of the grade for the 32 miles of road of the Evansville, Mount Carmel & Northern has been completed, but the steel will not be laid until the bridge across the Wabash River at Mount Carmel, Ill., has been finished. Five piers for this bridge have been finished and the remaining four piers are now in various stages of completion. Some of the false work for the construction of the steel bridge is now being placed in position, but it is likely the bridge will not be finished before spring. It is likely, however, that the piers may be completed by Jan. 15. "When the bridge at Mount Carmel is finished the laying of steel will begin, and it is thought that trains may be running over the line by the first of May. When the bridge is finished the steel for the tracks from Mount Carmel, Ill., to Evansville, Ind., will be shipped over the Cairo division of the Big Four to the western terminus of the Evansville, Mount Carmel & Northern.

Some progress has been made toward securing the traction line to connect Harrison, O., with Union City or Portland by way of Richmond, Ind. A committee has been appointed to take general management of the promotion, and also a committee to go over the proposed route and collect such data as will be needed to pass upon the feasibility of such a project. The Commercial Club of Richmond, Ind., Chas. W. Jordan, secretary, is interested in the project.

Stein & Lamb, grading contractors, Gary, Ind., have completed their work at Gary for the U. S. Steel Corporation and are now open for other work. Stein & Lamb have moved over 4,000,000 cu. yds. at Gary for the U. S. Steel Corporation since they began work there in May, 1906.

Iowa.

Negotiations for the sale of the Crooked Creek R. R. have been completed and the legal transfer will take place early next month. It is now said that the railroad has been bought by Boston parties and that the road will be extended on to Hampton to a connection with the road being built to that place from Charles City. The company has an old survey and right of way, the time limit on which expires in 1912. W. H. Whiteford, Lehigh, Ia., is general manager Crooked Creek R. R.

The route of the proposed Iowa City-Ottumwa interurban line may be changed so that it will not pass through Keota and Wellman. If changed the route will pass through Kinross, South English, Sigourney, Hedrick, Russell, Highland, Rutledge and the Amish settlements, instead of the country adjacent to Keota and Wellman. Frank Tanner, Iowa City., Ia., is the promoter.

The Iowa City Electric Ry. Co. has completed 1½ miles of its city lines at Iowa City and in the spring of 1911 will build 2½ miles of additional line. The capital for construction has been secured and the work will be done by the company. The material contracts for the new work have not been let as yet. J. O. Schulz, Iowa City, is President.

Shanty house talk at Carroll, Ia., credits the Chicago Great Western R. R. with a plan for building a line between Sioux City and Carroll to connect at the latter place with the Fort Dodge and Omaha Line.

It has been announced by officials of the Charles City & Western Ry., according to reports from Nora Springs, Ia., that three plans are under consideration for the extension of the system. One of these proposes to extend the road to the northeast to connect with the Great Western either at Elma or Alta Vista. The other is to extend the line in a southwesterly direction from Marble Rock, its present terminal, to connect with the Northwestern probably at Dumont. A third plan proposes to extend the line to Hampton to connect there with the Great Western, Iowa Central and St. Paul & Des Moines. The latter project is remote, according to the management. The proposals will be laid before the stockholders, who are called to meet at Charles City in January, when one of the plans will be adopted.

It is reported that surveys and blue prints have been finished by the Rock Island R. R. surveyors in Wayne County and the camp has been moved to Chariton. The crew, which consists of 18 men under W. C. Beach, is working toward Des Moines.

Information received from Atlantic, Ia., states that the advent of cold weather has not served to stop the work of laying track on the Atlantic Northern & Southern south extension and that work is progressing at a good rate. The crews are out about five miles at that end of the line and will commence from the Villisca end at once.

Kansas.

Several of the Mexican laborers employed on the construction work on the Santa Fe in Kansas joined the revolutionary forces in Mexico during the recent unpleasantness. Most of these men have now returned to work. One man joined a party of 30 revolutionists in Chihuahua. On the second day of his enlistment he encountered a troop of Mexican regulars. He at once retreated in good order toward the United States, and did not stop until he had reached a Santa Fe work train in Kansas, where he exchanged his lieutenant's uniform for overalls and a shovel.

Profiles and estimates have been finished for 87 miles of the line of the Southwestern Kansas & Colorado Ry. and right of way is now being secured. Contracts for construction work have not been let as yet. J. H. Titus, Arkansas City, Kan., of the Titus Co., consulting and constructing engineers, is chief engineer.

About 40 miles of roadbed have been graded for the Wichita, Kinsley, Scott City & Denver Air Line R. R. and over 100 teams are now at work on the grade between Turon and Kinsley. The contract has been let for the grading of another ten miles. There are but 20 miles yet ungraded between Kinsley and Turon. It is expected this will be completed during the winter and in the spring the grading force will be headed for Wichita from Turon. The Wichita, Kinsley, Scott City & Denver Air Line Ry. Construction Co., M. C. Tubbs, President, Kinsley, Kan., is constructing the road.

The annual meeting of the stockholders and directors of the Dakota, Kansas & Gulf R. R. was recently held at Beloit, Kan. The company is organized to build from Beloit, Kan., to Kearney, about 116 miles. The survey has been completed and everything is now ready to let a construction contract, and it is expected now that such a contract will be let soon. In any case the probabilities are strong that active construction work will start early next spring. The Kearney, Nebr., directors of the company are Mayor J. W. Patterson and W. H. Roe and W. L. Hand.

A project is under consideration involving the construction of a railroad from Hutchinson, Kan., to Patterson, where a connection will be effected with the St. Louis & San Francisco Ry. Samuel Adamson, Hutchinson, Kan., is interested in the proposition.

Kentucky.

Preliminary surveys have been started by Mr. Wiswell, a New York engineer, for the proposed interurban railway from Murray, Ky., to the Tennessee River.

The Louisville & Nashville R. R., W. H. Courtenay, Chief Engineer, Louisville, Ky., has submitted to the Board of Public Works of Louisville, Ky., plans and specifications for the enlargement of its water front freight terminals, by the installation of ten additional tracks from 2d St. to Preston St. The estimated cost of the improvements is $75,000.

Louisiana.

At a recent meeting of the stockholders of the New Orleans, Mobile & Chicago R. R. the proposition of extending the road to New Orleans was considered. It is said that if New Orleans subscribes $1,000,000 work on the extension will be started at once.

It is reported that a deal is on between the city of Alexandria and the Alexandria Electric Street Railway Company whereby the street car line may be bought and operated by the city. The project has been under consideration for several months, but the price could not be agreed upon, but now that this matter seems to have been agreed upon, a deal may soon be closed. It will of course have to be approved by the vote of the citizens.

It is believed that construction work will be commenced early next year on the Alexandria & Western R. R., which projects a line from Alexandria to Leesville, La. G. F. Cotter, Alexandria, La., is President.

Maryland.

The Wicomico Electric & Power Co. of Salisbury, Md., has applied to the State Public Service Commission for approval of its plans for constructing an electric railway from Salisbury to Nanticoke Point, a distance of about 30 miles. The charter for the road was passed by the legislature of 1908. The proposed route of the road traverses a fertile and well populated section of Wicomico County. It is estimated that the road can be built and equipped for about $750,000. It is stated that road will be built by a Philadelphia contractor, who will accept the bonds in payment. Ex-Senator M. V. Brewington, Salisbury, Md., is interested.

Work is in progress electrifying the Thurmont division of the Frederick Railroad Co. and will be completed about February. When it is finished a street car service will be maintained from Montevue Hospital at Frederick, Md., to Schleysville.

Massachusetts.

The Boston & Maine R. R. has secured options on nearly all the property that it needs for its contemplated improvements in Lynn. It is estimated that the road can be built and property in that city, office and factory buildings, will have to be razed to make way for the tracks. The plan is to four-track that road from West Lynn to the point where the Gloucester branch leaves the main line. It is probable that the two raised tracks through Lynn will be ready for the next summer schedule. Work will begin within a short while on the clearing of the right of way so that the occupants of some buildings will have to move out in two months and all will have to be out within three months.

The Berkshire Street Ry. Co., Pittsfield, Mass., has petitioned the legislature to enact such legislation as shall permit the company to build or purchase a line of railway in the state of Connecticut to connect with the company's proposed line to the Connecticut state line and from there to extend into the state of Connecticut to some convenient terminus in the town of Canaan.

The Boston & Eastern Electric Ry. Co. has filed a petition with the House of Representatives asking that the next Legislature authorize the construction of the road, the petition requesting that the Legislature enact such a law as will insure the issuing of the certificate of exigency to the company by the Railroad Commissioners. John H. Bickford, 110 State St., Boston, Mass., is Chief Engineer.

Michigan.

The city of Pontiac, Mich., has asked that the state railroad commission held a meeting with representatives of the Grand Trunk and Detroit United Ry. to determine if a separation of the grades is necessary at the crossing of the Grand Trunk and D. U. R. R. tracks on South Saginaw St., Pontiac.

Minnesota.

J. A. Johnson & Son, Chisholm, Minn., have finished their 20-mile contract on the Swan River Log Co. line from Chisholm to Sturgeon Lake, Minn.

Stakes are being set for the proposed electric railway from Albert Lea to Worthington and it is said that the promoters plan to have the line in operation by next fall. This road will start at Albert Lea, going through Bricelyn and then to either Elmore or Blue Earth, then to Pilot Grove, East Chain, Hansburg, Ceylon, Dunnell, Petersburg, Loon Lake and within one mile of the north end of Spirit Lake, Soo Valley, Spafford and Worthington. H. W. Knight, Chicago, Ill., is the promoter.

The proposed electric railway to connect Chisholm, Hibbing, Virginia, Eveleth and Gilbert is reported to have been financed and it is said that if the towns of the range grant franchises within a reasonable period the line will be constructed and ready for operation by next fall. Several thousand dollars are said to have been expended in surveying and other work. Washburn, Baily & Mitchell of Duluth are reported to be interested in this project.

The Minneapolis, St. Paul & Sault Ste. Marie Ry. is said to be planning to build a line into Crookston. It is known that surveys have been underway from Plummer southwest, passing through Red Lake Falls and Gentilly, and it is believed that these are being made for the line into Crookston. Options on large tracts of land along the route between Plummer and Crookston are said to have been secured and a 40-acre tract in the latter city is reported to have been obtained for terminals.

Directors of the Moorhead, Leach Lake & Duluth R. R., whose proposed line runs from Moorhead through the White Earth Indian Reservation, through Leach Lake and to Duluth, Minn., are making efforts to interest eastern capitalists in the project and thus effect an air line from the crossing to the head of the lakes. The company, which was incorporated about 15 years ago, is capitalized at $5,000,000 and has a clear title to the right of way through the White Earth Indian Reservation. W. J. Bodkin, Fargo, N. Dak., is President of the company.

Duluth and the Ranges.

BY PETER F. MEAGHER.

Richard Evans, who is working three steam shovels on the Canadian Northern Railroad near Duluth, came in to see us last week and reported his work in very good condition.

C. J. A. Morris of St. Paul was a caller in the city and said there was nothing new with him at the present time.

A. J. Perrin of Carl Hall & Co. was a caller and said they had their boarding-cars in on their work on the Great Northern Railroad, and would rush same as fast as possible.

C. A. Russell of the Vulcan Steam Shovel Co. spent two or three days with us here recently. He reported steam shovel business very good with his firm at the present time.

P. C. Pastoret and W. L. Lawrence of the Pastoret-Lawrence Co., general contractors, were callers last week, and reported they had finished up all of their work for this year and do not expect to start anything new until early next spring. They had a very successful season.

Tom Walsh of the Johnson-Carey Co., which has a large contract on the Canadian Northern near Duluth, was in to see us last week. He said that everything was progressing very nicely with them.

G. A. Jones and F. R. Jones of Jones Brothers, railroad contractors, Cleveland, O., were callers at this office this week. They have a great deal of work under way in various parts of the country and are very busily engaged on the same. They have just completed their contract of stripping the Crosby mine at Nashwauk, Minn., and are up here for the purpose of closing down the work.

F. E. Maurice, equipment man from Winnipeg, spent a couple of days with us here recently. He reported that prospects for business in his line were very good.

A. E. Hitchcock of the MacArthur Brothers Co., contractors of Chicago, Ill., was in the city for a day or two this week.

The labor situation in Duluth at the present time has changed somewhat from my previous letter. A great many of the iron mines have closed down in this territory and that has thrown quite a few men out of employment. However, they are all finding work in the woods, on railroad construction and on other different lines. There are just about men enough here to make the employers happy. Wages have been reduced about 10 per cent. That is not out of the ordinary, as it is always done at this season of the year.

Missouri.

Engineering crew of the St. Louis Iron Mountain & Southern R. R., working in the vicinity of Crane, Mo., has given rise to a report that the company has under consideration the construction of a branch line from Van Buren, Ark., over the Boston Mountains to Crane, connecting with the White River Line. E. F. Mitchell, St. Louis, Mo., is Engineer of Construction, St. Louis, Iron Mountain & Southern Ry.

New Jersey.

The Millville, Tuckahoe & Ocean City Ry. Co., mentioned in our Dec. 7 issue, has secured practically all right of way for its projected electric line. The proposed route of the road begins either at 34th St., Ocean City, or at or very close to 20th St. If at 34th St., it will follow the turnpike to the close vicinity of Beesley's Point or to the point itself. If at 20th St., trestles will carry the track to Beesley's or close vicinity. From Beesley's the track will follow a line close to the river or the Tuckahoe state road to Tuckahoe, thence through Marshallville to Head-of-River, thence by the county road to Millville, the entire distance being about 30 miles. The road will be single track, with a heavy rail, and the rolling stock will be the Beach car equipped with the Edison storage battery. W. Scott Hands, Ocean City, N. J., is president.

The road committee of the Board of County Freeholders, Newark, has been considering the question of the abolition of the Bloomfield Ave. grade crossing of the Lackawanna R. R. at Montclair. The railroad has made a proposition that it will bear one-half of the cost of the construction charges and one-half of the outlay necessary for property damages if the town of Montclair and the Public Service Railway Co. will share the balance of the cost. The railroad wants the town to accept these terms, with the understanding that it assent to the abolition of all other grade crossings in the place on a similar basis.

New York.

The Schenectady Ry. Co., Schenectady, has had an engineer go over a route for the construction of a trolley line from Rexford Flats to Waterford.

The Ontario Ry. Co., S. M. Conant, president, has applied to the Town Board of Wilson for a franchise to build and operate a trolley line 1½ miles in length connecting Wilson station, village and harbor, the line to be built in the public highway.

A company is to be formed to build an electric railway from Dunkirk to Jamestown. Preliminary surveys for the line are now under way. The proposed route is through Fredonia, Laona, Lily Dale, Cassadaga, Moons, Sinclairville, Gerry and Ross Mills. Among those interested in the plan are A. N. Broadhead of Jamestown, president of the Jamestown Railway Co. and the Chautauqua Traction Co.; John Wurtenburg of Cassadaga, Thomas Fitzgerald, A. R. Maytum, Kirby Hayward and William Sterns of Fredonia and Mayor Harry James and Thomas Cummings of Dunkirk.

The Syracuse Rapid Transit Ry. Co., Gridley Block, Syracuse, will double track its line from Bridge St. to the westerly terminus in Solvay within a year and a half. The extension will cost about $86,000.

The Public Service Commission has issued a certificate of public necessity and convenience to the Interborough Co., New York City, authorizing the construction of third tracks to the Second, Third and Ninth Ave. elevated roads. Plans are also to be approved for the extension of Ninth Ave. road through Jerome Ave. to Woodlawn and Third Ave. line to White Plains.

North Carolina.

The Isothermal Traction Co. has applied to the City Council of Asheville, N. C., for a franchise through that city. Under the terms of the desired franchise actual work of construction is to be started within 18 months and completed from Gastonia to Asheville and the road in operation within a period of three years.

Construction work may be started soon on the street car system in Charlotte, franchise for which was granted to Paul Chatham.

Ohio.

The Erie R. R. is to submit plans in the near future to the city council of Youngstown for grade elimination on the main line of the Erie between Himrod Ave. and Westlake's crossing. The total cost will be about $2,100,000, of which the city's share will be about $600,000.

The Cleveland, Cincinnati, Chicago & St. Louis Ry. is reported to have plans under consideration for building a belt line across Clark County south of Springfield to handle through freight. It is said that surveys have been made and that according to these the belt line is to be started at Medway and will circle around south of Springfield and across the D., T. & I. tracks to Cold Springs, where it will connect with the Cincinnati division It is further said that the matter of constructing the line is in the hands of the New York Central officials for a final decision. An expenditure of over $2,000,000 would be necessary for the construction of the line.

The Baltimore & Ohio R. R. has been purchasing land for an additional track between Holloway and Flushing, a distance of five miles.

Preliminary arrangements are reported well along for the construction of the Lake Erie & Youngstown R. R. from Conneaut to Youngstown, and it is said that actual construction work will be started soon. Surveys have been made and some grading accomplished. The road will tap a district which would produce considerable traffic, both passenger and freight, and could connect Youngstown with a territory which has heretofore been inaccessible to that city. The line, when it is completed, will join directly with the Youngstown & Southern if the terminals are connected up on Front St., Youngstown, and form a lake to river line. John H. Ruhlman, Youngstown, O., is president.

The Department of Track Elevation and Subways of the city of Cincinnati is considering plans for eliminating the grade crossing at Mitchell Ave. and the B. & O. R. R. There is now a dip in the B. & O. tracks from about Dodsworth to Clifton Ave., and the plan is to begin the elevation of the tracks at Dodsworth Ave. This would make an overhead crossing at Mitchell Ave. The whole scheme would cost about $1,000,000, as it would mean the elevation of about two miles of track.

The city council of Lebanon has extended the franchise of the Lebanon & Xenia Traction Co. for two more years, and reports state that this makes it probable that actual construction work will be started soon.

A considerable part of the right of way has been secured for the proposed 34-mile interurban line between Beaver Falls, Pa., and Columbia or Leetonia, O., and it is announced that construction work will be started early next year. The new road will connect with the Beaver Valley traction lines, Youngstown & Ohio and Youngstown & Southern Rys. L. M. Keyes, East Palestine, O., is promoter.

It now looks as though definite steps would be taken shortly for the proposed belt line for Columbus, O. The Columbus Connecting R. R. Co. was incorporated last week to build and equip the steam railroad which will result in detouring all through freight trains around the city. Plans for the road have been made by Engineer Stanley D. Pugh, New Hayden Bldg., Columbus, O., one of the incorporators. The road, as planned, will encircle the city with a double-tracked line 32 miles long, which at no point will come nearer than six miles to the Statehouse. At some points it will be as far as nine miles from the Capitol. If more than two tracks are needed they will be built. It will be equipped with 15 locomotives and 100 cars, and its cost will be $6,000,000.

The Western Ohio Ry. Co., Lima, O., operating traction lines between Piqua and Findlay and Lima and Celina, has decided to enter the commercial field for the sale of heat, light and power to municipalities along its right of way. The company has taken a franchise for street and domestic lights in Rawson, Lockington and Beaverdam, and has made a bid to light Sidney. Franchises will be asked in Sidney, Anna, Botkins, Wapakoneta, Cridersville, Bluffton and Celina.

Plans have been submitted to the Board of Directors of the Cleveland, Cincinnati, Chicago & St. Louis Ry. calling for appropriations for new construction work on the system for the year 1911. Action on these items for betterment outlined in these plans will not be taken by the board before some time next year. In February, 1910, appropriations for the improvements, aggregating over $5,000,000, which have been in progress since last spring, were made by the Board of Directors of the Big Four. George P. Smith, Cincinnati, O., is Chief Engineer.

Good progress has been made with the track improvement work of the Cleveland, Cincinnati, Chicago & St. Louis Ry. The greater part of the 1910 work has either been finished or is nearing completion. The second track from Shelby, O., to Greenwich, O., 12 miles in length, has just been finished. The double-tracking from Indianapolis to Anderson, 30 miles, has been completed, except four miles located in the vicinity of Pendleton, Ind. The remainder of the second track on this division was put into commission last week. On the Cairo division of the Big Four 18 miles of second track has just been completed between Chrisman, Ill., and Lyons, Ill. This second track is now in the service, with the exception of four miles of relocation track work in the vicinity of Woodyard station, upon which work is now progressing. The relocation work will be completed by Feb. 1. Six miles of double-track between Harrisburg, Ill., and El Dorado, Ill., which was begun last summer, is now finished. Four miles of second track, from Harrisburg, Ill., south has just been laid, but it has not yet been ballasted. The relocation work on the Middletown-Miamisburg division of the road—7½ miles—will not be finished before next summer. The 25-stall roundhouse at Mattoon, Ill., now in process of construction, will not be finished for several weeks.

Double track work on the Baltimore & Ohio Southwestern Ry. between Blanchester and Cozaddale, east of Cincinnati, which has been in progress for the past several months, is being pushed with vigor and much of the work has already been finished. This work will likely not be completed this winter unless the weather for the next three months is particularly propitious for the completion of the contract. When this work has been completed the road will have a double track from Midland City to Cozaddale—a distance of 13½ miles. This contract will cost the road $150,000.

A project is under consideration for the construction of an electric railway from Norwalk to Ashland, via New London and Savannah. The plan proposes the building of a line from New London village to connect with the Sandusky, Norwalk & Mansfield line at North Fairfield, thereby saving the cost of building about twelve miles of road if a line should be built from Norwalk out Benedict Ave. and through Olena and Fitchville to New London. Sherman Culp, Norwalk, O., is President of the Sandusky, Norwalk & Mansfield Electric Ry. Co.

The Columbus, New Albany & Johnstown Traction Co., Columbus, O., is planning to extend its line to Johnstown and thence to Mt. Vernon and Mansfield.

The directors of the Chesapeake & Ohio Ry. have authorized the purchase of 15,000 tons of steel rails for renewal work during 1911. During that period it is expected that the double tracking of the Cincinnati division will be completed.

Board of directors of the Marietta & Lake R. R. Co., according to advices from Cambridge, O., at the last meeting voted $100,000 for the extension of the line from Washington, O., to Freeport.

The Erie Railroad Co. has, according to reports from Pittsburg, Pa., awarded the contract for the construction of 6 miles of grading for double track from Barceville to Windham, O. L. P. Baker, Youngstown, O., is Division Engineer.

Oklahoma.

The Oklahoma-Kansas Ry. Co., M. C. Harper, secretary, Baxter Springs, Kan., is reported to have taken over the 5-mile electric line between Miami and Hattonville, Okla. The owner of the 5-mile line is said to have secured franchises and right of way for an electric railway from Miami to Joplin, and these rights were taken over by the Oklahoma-Kansas Ry. Co., which plans to start construction work on the line at an early date. The route of the road is as follows: Beginning at Miami, the line will extend through Hattonville, Quapaw, Lincolnville, Sunnyside, Baxter Springs, Riverton, Galena and with Joplin the terminal. At some point in Quaker Valley, a farming section between Galena and Baxter Springs, a spur is to be built to Columbus, Kan., to connect with the Heim line operating between that city and Pittsburg. From Batxer Springs a spur also will be built to the reunion grounds.

Chamber of Commerce, Shawnee, Okla., has voted $100,000 for the first railroad proposition to the northeast of the city. It is stated that the offer will be made good as that city is very much in need of such a line.

Negotiations are under way between the officials of the Fort Smith & Western Ry. and the St. Louis & San Francisco and Missouri, Kansas & Texas R. R., whereby the first company can make trackage arrangements for entering Oklahoma City. The F. S. & W. now operates over 200 miles of main line between Fort Smith, Ark., and El Reno, Okla., via Guthrie, and eventually will build into Oklahoma City, Okla. W. M. Bushnell, Fort Smith, Ark., is General Manager of the Fort Smith & Western R. R.

Surveys are being run by engineers of the Missouri, Oklahoma & Gulf R. R. for the construction of two extensions, one from Wapanucka to Bromide, 7 miles, and the other from Dewar to Okmulgee. Work is to be started at once. J. J. Harrison, Durant, Okla., is Chief Engineer.

Engineers of the Clinton & Oklahoma Western R. R., recently constructed from Clinton west to Butler, near the Texas Panhandle line, are now running a line to Cheyenne, Okla., and northwest to Canadian Texas. Guy V. McClure, Clinton, Okla., is Chief Engineer.

It is reported that Eugene Tilleau, Hutchinson, Kan., is promoting the construction of a new railroad from Alva, Okla., to Beaver City, the county seat of Beaver County, in northwestern Oklahoma.

Oregon.

The Willamette Valley & Coast Railroad Co. has been incorporated with a capital stock of $100,000 and proposes the construction of a line from a point on the Southern Pacific between Forest Grove, Ore., and Gaston to Cherry Grove on the Lovegren holdings. The incorporators are August Lovegren, Phillip Lovegren and Levi A. Lovegren.

The Oregon-Washington Railroad & Navigation Co. has petitioned the City Council of St. Johns, Ore., for a franchise to construct a side track connecting the plant of the Lauthers Co. with Bradford St.

Pennsylvania.

A considerable amount of electric railway construction work is proposed for the near future in the vicinity of Allentown. The Lehigh Valley Transit Co., Allentown, has completed plans for the expenditure in the next four months of from $400,000 to $500,000 for the betterment of passenger traffic arrangements between Allentown and Philadelphia. This expenditure is on the part of the Lehigh Valley Transit Co. alone, not counting more than $2,000,000, which will be expended by E. B. Smith & Co. and Brown Bros. & Co., Philadelphia bankers, for extensions to the Philadelphia & Western, whose new lines will connect at North Wales with the present Philadelphia division of the Lehigh Co. The Lehigh Co. is also said to be endeavoring to obtain the bonds of the Quakertown Traction Co., whose line runs between Quakertown and Perkasie, and if it be unable to come to an agreement with the bond holders, it proposes to build a line between these boroughs. A cut-off is to be built between Perkasie and Sellersville, the right of way for which has been obtained, and on which work will be begun shortly. This line will extend from a point north of Perkasie to the south of Sellersville, and it will not only eliminate eight sharp curves, but will be a mile and a half shorter than the present line. The cost of this cut-off will be $100,000. Construction has been far advanced on the Lehigh Mountain cut-off. As soon as the new line of the Philadelphia & Western has been completed to North Wales by way of Norristown all through trolley cars between Allentown and Philadelphia will run to 69th St. and there will be a local service on that part of the Philadelphia division of the Lehigh Valley Transit Co., which extends from North Wales to Chestnut Hill.

William Pickett & Co. have started work on their contract for the extension of the trolley line at Washington, Pa., from its present terminus on West Chestnut St., near the B. & O. crossing, down the Gordon valley to Hayes Ave.

Good progress is being made with the construction work on the Western Maryland's extension from Cumberland, Md., to Connellsville, Pa., a distance of 87 miles. The company's officers now entertain the hope that the line can be opened up for traffic by Oct. 1, 1911. The original date set for the turning over of the new line by the construction company was Nov. 1, 1911. At the end of November about one-third of the grading and about 45 per cent of the concrete work had been finished. Tunneling was progressing at the rate of 18 ft. a day and at this rate the long tunnel, which will measure 4,300 ft., will be ready for track laying in the spring or early summer. Rails will be laid on portions of the line about April 1, and these sections will soon thereafter be opened for traffic. Culverts and bridge piers and all tunnels except the long tunnel will be constructed to accommodate the double track. Bridges will be of concrete and steel construction.

It looks now as though construction work will be started this month on the new electric railway between Reisterstown, Md., and Hanover, Pa., a distance of 20 miles. Philadelphia capitalists are said to have underwritten $600,000 of bonds for the construction of the line. A right of way has been secured along the Hanover pike from Reisterstown to Hanover. Grade crossings will be avoided by the construction of overhead bridges. John Pierce Bruns, Baltimore, Md., is said to be interested.

Good progress is being made with the extensive improvements of the Pennsylvania R. R. at Greensburg. The tunnel east of the city has been done away with and entrance made through a double-track open cut.

South Carolina.

The Greenville Interurban Ry. Co. is reported to have taken bids for constructing its proposed interurban line from Greenville to Williamston, S. C. The line will be about 17 miles long and will cost about $500,000. Some reports have it that the contract has been let to Wm. J. Oliver, Knoxville, Tenn. H. H. Prince, Greenville, S. C., is one of the promoters.

South Dakota.

At a recent meeting of the State Railroad Commission, Pierre, S. Dak., connecting tracks were ordered between the Great Northern and the Chicago, Milwaukee & St. Paul R. R. at Vienna in Clark County and at Lennox in Lincoln County, South Dakota.

Texas.

A meeting of business men of San Antonio has been held at the Chamber of Commerce in that city for the purpose of starting a campaign for the building of a railroad from San Antonio to Brownsville. The working idea of the men who are behind the movement is to form a construction company with $500,000 paid-in capital stock. This sum will float the bonds and the $600,000 to $800,000 which can be secured as bonuses from the cities and towns touched by such a road will be sufficient to build the road.

The Texas Southeastern R. R., E. C. Durham, secretary, Diboll, Tex., is formulating plans for building an extension from Lufkin to Dallas, a distance of 130 miles. The extension will run via Palestine and will traverse a rich agricultural region besides forming a new and direct route between Dallas and other points in north Texas and the southeastern part of the state. The road now runs between Lufkin and Diboll, 18 miles, with a branch line running from Diboll to Vair, 10 miles. The road was constructed primarily as a logging line, and it penetrates pine forests owned by the Southern Pine Lumber Co. One object in constructing the proposed extension is to open for development large tracts of timber land owned by the company near Palestine. The general offices of the road are at Diboll.

Surveyors for the Quanah, Seymour & Dublin Ry. will probably complete the line to Belton by Dec. 25. This road is surveying a line between Quanah and Rockport, and has lately taken up the matter of continuing the road from Belton to Salada, 12 miles south of the former place.

A street car line is to be constructed to East Dallas Heights if a bonus of $15,000 is raised. Over $12,000 of this sum has already been secured. The proposed line will be about two miles in length and will extend from the fair grounds to a point near the Joe Lawther home place on White Rock, and will connect with the city lines at Dallas. W. E. Franklin, Dallas, is interested.

Financial arrangements are said to have been made for the building of the Jacksboro-Oran cutoff. This line will be 18 miles in length and will be a connecting link between the Weatherford, Mineral Wells & Northwestern Ry. and the Gulf, Texas & Western. B. B. Cain, Dallas, Tex., is general manager of the Gulf, Texas & Western Ry.

A mass meeting was held at Bryan, Tex., on Dec. 14 to discuss ways and means by which to build a railroad from the city into the Brazos bottom district. There had already been formed at a previous date a company and a large amount of stock subscribed for. The meeting was well attended and much more stock was subscribed.

The State Attorney General has approved the charter of the Port Bolivar Iron Ore Ry. Co. This proposed road, whose capital stock is $50,000, will be constructed from Longview, Gregg County, through the counties of Gregg, Upshur, Harrison, Marion and Cass, to a point in Cass County about ten miles north of Hughes Springs, between the present line of the Missouri, Kansas and Texas and the north boundary line of the county, 50 miles distant from Longview. The principal office is to be in Longview. The incorporators are L. P. Featherstone, Fox Winnie, L. C. Luckel, W. D. Myers, W. C. Brothers, Eugene A. Wilson, Lewis A. Featherstone, Murrell L. Buckner and T. B. Stinchcomb.

The Santa Fe System has planned to spend $17,000 on new track construction at Canyon City, Tex.

The Santa Fe System has planned to fill in behind the bulkhead on the north line of pier No. 3, at Port Bolivar, Tex., and has appropriated $3,000 to cover the cost of construction.

The Santa Fe System has appropriated $166,000 to cover the cost of a new brick building at Temple, Tex. It is to be 240 ft. by 62 ft. and when completed will be used as a Harvey house.

According to the terms of a contract signed by members of a committee representing the bonus contributors to the Neches River Valley R. R. Co., active construction work is to be commenced on the proposed line from Beeville to Eagle Pass by January 1, 1911. Beeville is to get the shops and general offices for a term of fifty years, and all repair work on the road or laterals that may be constructed later is to be done in the shops of the company at that place.

After traveling over the proposed [illegible] railroad from Belton, Tex., to Salado, L. E. Walker, President of the Middle Buster R. R., submitted a proposition to the latter town offering to build via that place for a bonus of $20,000. Surveyors are now reported to be working two miles south of Sparta, Texas, in the Cowhouse Valley, locating the road, and will soon work into Belton.

Material has been shipped to Aransas Pass, Tex., for the construction of a 5-mile line of railroad to connect the newly projected harbor improvements with rail communication. Work will be started at once, it is said.

A contract has been signed by the Railroad Committee of Shafter Lake, Texas, and F. A. Beall, New York City, whereby the latter will have a trunk line railroad constructed through Shafter Lake within two years, opening up communication between the Gulf of Mexico cities and northern markets.

Utah.

The Salt Lake & Ogden Ry., 161 South Main St., Salt Lake City, Utah, is reported to have made surveys for a branch electric railway from Lagoon toward Hooper and Syracuse.

The Ogden Rapid Transit Co., Ogden, Utah, will at an early date extend its line from the Hermitage in Ogden to Huntsville.

The filing of the articles of incorporation for the Utah & Grand Canyon Railroad Co. is the latest move toward the advancement of railroads in Southern Utah. The company is capitalized at $150,000, which capital is divided into shares of $100 each, and proposes the construction of a line from Lund, Iron County, to St. George, Washington County, Utah, a distance of 85 miles, and from Marysvale to Panguitch, a distance of 55 miles. Frank A. Dudley of Niagara Falls is president; Frank H. Reed of New York City, first vice president; Frank Harris of Chicago, second vice president; Russell B. Merchant of New York, secretary and treasurer; S. L. Seldon and Thomas C. Gillespie of New York and Victor E. Huntsacker of Salt Lake City, additional directors.

A corps of surveyors working in the mountains on the east side of Ogden Canyon, Utah, is believed to be under the employ of the Burlington System, running a line for the construction of a connecting link of a transcontinental railroad line of the above system.

Virginia.

The Richmond & Chesapeake Bay Ry. Co., Wm. Northrop, General Manager, Richmond, Va., is planning to extend its electric railway northward from Ashland, Va., in the spring. The line will probably be extended to Doswell, about 10 miles north of Ashland.

Washington.

Surveys have been completed and the construction capital has been secured for the projected 35-mile electric line from Bellingham to Mt. Vernon, Wash. The general contract for the engineering and construction is [illegible] Stone & Webster Engineering Corporation, which has opened construction offices at Bellingham, Wash.

The Nooksack Valley Traction Ry. Co., according to advices from Bellingham, will let construction contracts this month for the first 3½ miles of its line from Bellingham.

Representatives of the Chicago, Milwaukee & Puget Sound Ry. are reported to be negotiating for right of way to bring the line into Olympia. It is now said that the road will enter the city by a branch that follows along the northern shore line of Black Lake, comes in over Mud Bay Logging Co.'s right of way, and touches deep water in Olympia, by following down the draw at Butler's Cove. The Milwaukee is also contemplating construction of the long looked for belt line around the Olympic peninsula, connecting with the present line on the Chehalis River, construction work to be pushed northward from near Elma. Some time during the summer next year it is said that the branch line will be pushed on into Olympia, giving the company a salt water outlet without forcing it to go back to Tacoma.

It is believed here in Tacoma, Wash., that the Northern Pacific Ry. will include in its budget for 1911, under improvements at the head of the Bay, the construction of a large amount of additional trackage, a new water supply system and track scales, requiring an expenditure of $50,000.

Engineers working in the vicinity of Metaline Falls, Wash., are believed to be under the employ of the Idaho & Washington Northern Ry. running lines for the extension of that system. W. C. Smith, Spirit Lake, Idaho, is Chief Engineer of the company.

The City Council of Everett, Wash., has granted a franchise to the Chicago, Milwaukee & Puget Sound Ry. to enter that city. The company is permitted to cross several streets transversely at grade. Commercial bodies and shipping men indorsed the passage of the act.

West Virginia.

The Baltimore & Ohio Southwestern R. R., A. W. Thompson, Chief Engineer, Baltimore, Md., will early next year have construction work started on a large amount of side-tracking on its right of way between Parkersburg, W. Va., and St. Louis.

Wisconsin.

The Milwaukee Western Electric Ry. Co., 914 Majestic Bldg., Milwaukee, Wis., has secured 65 per cent of the right of way for the road between Milwaukee and Fox Lake.

The Minneapolis, St. Paul & Sault Ste. Marie Ry., Thos. Green, chief engineer, Minneapolis, Minn., has started condemnation proceedings for a strip of land about six miles long in the city limits of Superior. The land will be used for railroad yards, right of way and other purposes. The strip of land starts in South Superior, central division, past the cemetery, into and through Butler park, through section 34-49-14, into Fairmont park, into the nineteenth division, into section 16-49-14 and then across Billings park to the ore dock site on St. Louis bay. The line along which the property is to be condemned is the one leading to the Soo ore dock. Most of the property has been purchased and the condemnation proceedings will affect only those owners who are holding out for high prices.

Canada.

The Canadian Pacific Ry. is to apply at the present session of the Canadian Parliament for an act authorizing it to construct the following lines of railway: From a point at or near Wilkie on the company's Pheasant Hills branch, in a southerly and easterly direction to a junction with the company's Moose Jaw branch in township 30, range 16 or 17, west 3d meridian, Saskatchewan; from a point at or near Kerr Robert on the company's Moose Jaw branch, in a northeasterly and easterly direction to a junction with the line described [illegible] 19 or 20.

west 3d meridian, Saskatchewan. The company will also apply to parliament for an act to incorporate a railway company under the name of "The Canadian Intermountain Ry. Co.," with power to lay out, construct, and equip a line of railway operated by steam, electricity, or other power for the carrying of freight, passengers, and express. Commencing at a point at or near Coutts, thence northerly to the Milk river, thence in a general westerly direction to the town of Cardston, thence in a general southwesterly direction to the western boundary of Alberta at the summit of Kishemench Pass, thence in a general westerly direction in British Columbia to the Flathead river, thence in a general northerly direction to a point on the Canadian Pacific railway at or near the city of Fernie. From a point at or near the Milk river in Alberta in a general easterly direction by the most feasible route to Estevan in Saskatchewan. Power is asked to construct the following branch lines: (A) From a point on the said railway at or near the junction of the Calder creek and Flathead river, to a point at or near the town of Elko. (B) From a point at or near Cardson, Alberta, to Lethbridge. (C) From a point in or near township 3, range 1, west of the 4th meridian, Alberta, to Medicine Hat. (D) From a point in or near township 4, range 19, west of the 3d meridian to Swift Current. (E) From a point in or near township 6, range 29, west of the 2d meridian, to Moose Jaw, with power to build other branch lines in the province of British Columbia not exceeding in any one case 20 miles in length.

The Grand Trunk Pacific Ry. is perfecting plans for an early start on construction operations for its line to Grand Prairie. Engineers who have made preliminary examination of the country state that fewer engineering obstacles will be met with than on any other possible route, and that the territory to be opened up is most suitable for agriculture and stock raising. It is understood that the railway company has approached the provincial government seeking a bond guarantee for this road.

Official statement has been made that if nothing unforeseen happens the National Transcontinental Ry. will be completed from Winnipeg to Moncton by the end of next year, with the exception of the connecting link of the Quebec bridge. Pending the completion of the bridge a car ferry service will be operated across the St. Lawrence.

T. C. Ross of Victoria, B. C., is making good progress with his contract for clearing the right of way for the first five miles of the Cowichan Lake extension of the Esquimalt & Nanaimo Ry., H. J. Cambie, Chief Engineer, Victoria, B. C. About 50 men are employed and the work will be completed early next year.

A report from Nelson, B. C., states that the Canadian Pacific Ry. will build a short line in East Kootenay from below Elko and Galloway, on the Crow's Nest branch, southerly to its undeveloped coal fields at Waldo and Bayne's Lake.

It is now believed that the grading of the last 30-mile section of the Alberni branch of the Esquimalt & Nanaimo Ry. from the Little Qualicum River to Alberni, will be completed this month. The line will probably be in shape for tracklaying in February, and will be opened for traffic between Nanaimo and Alberni not later than April. Janse & McDonnel have the grading contract.

The Montreal Tramways & Power Co. has been organized in London, England, the object of the company being to construct, issue and purchase or otherwise acquire tramways and street railways in Canada or in any Province thereof, and to equip and maintain the same and carry on the business of manufacturers of rolling stock, etc., and to supply electricity for light, heat and power, and to adopt an agreement with the Imperial Trust Co., Montreal. C. O'Malley, 4 St. Mary Axe, London, E. C., is one of the incorporators.

The Imperial Traction Co. is to apply to Parliament for incorporation. The company proposes to construct and operate a line of railway, telegraph and telephone lines from Hamilton to Guelph, Guelph to Berlin, Berlin to Stratford, Stratford to St. Mary's, St. Mary's to London, London to Ingersoll, Ingersoll to Woodstock, Woodstock to Brantford, Brantford to Hamilton, with extensions from a point between Brantford and Hamilton to Niagara Falls from a point between St. Mary's and Stratford to Lake Huron, following the shore to Sarnia, also to build docks and control ferry boats.

Grading outfits of the Canadian Northern R. R. contractors, according to information received from Edmonton, Alta, have been placed in winter quarters and all work will be stopped for the winter excepting by those contractors who have rock work. Of the 345 miles of new track constructed in Alberta this season, 265 miles were built under the government guarantee. In Saskatchewan the company has done more grading and steel laying this year and some work has also been done in Manitoba, making a total approximately 800 miles of new track laid in Manitoba, Alberta and Saskatchewan during the year. Work will be started as soon as possible in the Spring on the Peace River system and it is expected to lay a greater mileage in 1911.

Neil Keith, the railroad contractor of Winnipeg, whose mysterious disappearance from his construction camp at Maryfield, southwest of Moose Jaw, Sask., caused much alarm some seven weeks ago, was found in the hills south of Moose Jaw on Dec. 14 frozen to death. When Mr. Keith disappeared foul play was at first suspected and for several days the surrounding country was thoroughly scoured, not only by men of the construction gangs, but also by members of the mounted police force, but without avail. Mr. Keith was in a poor state of health at the time and it was thought that he could not have gone so far from his location as he had evidently done. In a shanty, about 7 miles from the camp where he was last seen, there was found last week his outer clothing, watch, chain, and other valuables, also $35 in cash in the pockets. Further search was made and his body was found.

Information received from Ottawa, Ont., states that work of building the new branch of the Temiskaming & Northern Ontario Ry. from Kelso into the Porcupine District is to be done by the railway commission and Joseph M. Bourke has been appointed manager of construction. The plans are being rapidly gone ahead with and the work will soon begin, the object being to have the branch completed by July 1 of next year. Steam power will be used at first and probably electricity later. The construction will cost $15,000 a mile. The officers of the Temiskaming & Northern Ontario Ry. are at North Bay, Ont. S. B. Clement is Chief Engineer.

Mexico.

The Department of War, City of Mexico, has had surveys made and will have construction work started at once on a 4-kilometer railroad for the transportation of high explosives, other ammunition and arms from the Santa Fe powder factory of the national factory of arms and munitions of war. The Santa Fe powder factory is situated out in the open country beyond Chapultepec, and the ammunition factory is four kilometers further out

Formal indorsement has been given by the Mexican Government to the plans of the Vera Cruz, Tabasco & Campeche Railroad Construction Co. for construction of a railroad between Santa Lucrecia, a station on the Tehuantepec National R. R. and Campeche, where the proposed line will make connection with the United Railways of Yucatan. It is announced that preliminary details for the early construction of this line are being rapidly worked out and that it will soon be definitely decided which of two routes under consideration will be selected. One runs to the north through the lowlands of Vera Cruz and Tabasco, and the other follows the southern route, where the country is mountainous. A number of large towns and a territory rich in forests and agricultural possibilities are adjacent to both routes. It is said that the southern route will probably be chosen. The distance by either route between the two proposed terminal points is about 450 miles.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

Arizona.

⊙Bids were opened Nov. 25, at Yuma, Ariz., by J. A. Ackerson, engineer in charge of work for the protection on Imperial Valley, California, for the U. S. Department of the Interior, for the construction of a levee on the west bank of the Colorado River. The bids received were as follows: W. K. Bowker—Section O-1,400, 1,212,765 cu. yds. new levee, at 51.3 cts. per cu. yd., 640.93 acres clearing at $60 per acre, 219.72 acres grubbing at $250 per acre. Shattuck-Edinger Co.—Sections O-1,400, 1,212,765 cu. yds. new levee at 50 cts. per cu. yd., 640.93 acres of clearing at $50 per acre, 219.72 acres of grubbing at $175 per acre. J. C. Norton—Any three sections O-709, 32½ cts. per acu. yd., for new levee; clearing, $40 per acre, and grubbing, $80 per acre; any three sections, 700-1,000, 34 cts. per cu. yd. for new levee, $45 per acre for clearing and $85 per acre for grubbing; any three sections 1,000-1,400, 38 cts. per cu. yd. for new levee, $50 per acre for clearing and $90 per acre for grubbing. J. H. Maxey—Sections 0-100, 107,781 cu. yds. new levee at 19 cts., 50.2 acres clearing at $25, 17.23 acres grubbing at $50, section 100-200, 77,158 cu. yds. new levee at 20 cts., 50.22 acres clearing at $25, 17.22 acres grubbing at $50; sections 200-300, 77,137 cu. yds. new levee at 21 cts., 50.22 acres clearing at $25, 17.22 acres grubbing at $50; sections 300-400, 99,825 cu. yds. new levee at 22 cts., 50.22 acres clearing at $25, 17.22 acres grubbing at $50. A. C. St. John—Sections 0-100, 107,781 cu. yds. new levee at 34 cts., 50.3 acres clearing at $50, 17.23 acres grubbing at $100; sections 100-300, 154,295 cu. yds. new levee, 34 cts; 10.44 acres clearing at $60, 34.44 acres grubbing at $120; sections 300-500, 188,097 cu. yds. new levee at 34 cts., 101.66 acres clearing at $80, 34.85 acres grubbing at $160; sections 500-700, 270,044 cu. yds. at 35 cts., 101.66 acres clearing at $85, 34.85 acres grubbing at $160; sections 700-900, 143,172 cu. yds. at 37 cts., 100.44 acres clearing at $80, 34.44 acres grubbing at $160; sections 900-1,100, 195,339 cu. yds. at 38 cts., 101.06 acres clearing at $80, 34.64 acres grubbing at $160; sections 1,100-1,400, 153,637 cu. yds. at 39 cts., 85.37 acres clearing at $80 29.27 acres grubbing at $160. The following awards for the levee work have been made by the Colorado River Land Co., S. A.: J. A. Maxey, first nine miles, 426,000 cu. yds. at from 19 to 22½ cts. R. P. Marable and John Mulligan, Sections 8, 9 and 10, about six miles, 336,000 cu. yds., at 28 cts. J. C. Norton, Sections 11, 12 and 13, at lower end of work, 325,000 cu. yds., at 36 cts. A portion of the work near the Abejas river crossing which will be occupied by the railway and the grading required for five miles of track will be done by force account. This work has been assigned to W. K. Bowker of the C. M. Ranch Company, who already has 500 head of stock equipment of scrapers, wagons, tools, etc., on the ground. The work has been staked out for some time and actual construction began Dec. 12. Both Maxey and Marable & Mulligan begin their work on that date and Norton will soon follow. The clearing and grubbing is done by the contractors at rates ranging from $25 to $50 per acre for clearing, and $50 to $90 per acre for grubbing. Lumber for the main camp at Andrade reached there Dec. 12, and a force of carpenters began rushing quarters to completion. An equipment of five boarding cars with supplies is on the siding at Andrade.

Arkansas.

The Southern Land & Development Co. of Pine Bluff, Ark., and Danville, Ill., has been incorporated with a capital stock of $125,000, of which $2,600 has been subscribed. The incorporators and officers are W. T. Hartz, president; J. H. Collins, vice-president; James Gould, secretary and treasurer; William Acton, Edw. McCusker, Eli Myers. All the above are from Danville except James Gould, who lives in Pine Bluff.

California.

The City Trustees of Sacramento have passed a resolution directing the Southern Pacific R. R. Co. to immediately proceed to raise the north levee from Front St. to 12th, to a height 5 ft. above high-water mark, to correspond with the rest of the city's levee protection.

The Supervisors of Siskiyou County, Yreka, Cal., have established the Scott Valley levee district, the first levee district in that county. It contains 8,400 acres and lies along the Scott River and Big slough between Etna and Fort Jones. The land is rich, but it has never been cultivated because it is overflowed every winter.

The Turlock Irrigation District, of Turlock, has voted to issue $1,260,000 of bonds for the building of a storage reservoir and the enlargement of the irrigation canal which serves the section. The vote was 1,220 for and 457 against.

Colorado.

T. D. Jones, Denver, Colo., Engineer for the Poudre irrigation system has filed with the County Recorder at Pueblo, a preliminary map of the Poudre No. 2 reservoir. The specifications call for an expenditure of $1,500,000 and a dam will be constructed across the Poudre canon, which will empound nearly 5,000,000,000 cu. ft. of water. Among the projects which the construction of the reservoir entail are the tunneling of the Medicine Bow range and a tunnel through Green mountain.

Land owners in the vicinity of Carr, Dover and Nunn and in Western Larimer County will vote Jan. 16 on the formation of an irrigation district embracing 80,000 acres of land. This is a flood water proposition and is to be built by Rollo Wilson and E. F. Smith of Denver.

The North Sterling Irrigation District, John E. Fetzer, Secretary, Sterling, Colo., has offered for sale $60,000 of bonds of the district. Bids for the purchase of the bonds will be received until 2 p. m., Jan. 5.

Indiana.

✣Bids will be received until 10 a. m., Dec. 24, by Drainage Commissioner of Daviess County, Washington, Ind., for the construction of a ditch. Albert F. Annen is Drainage Commissioner.

⦿Contracts for the Rock Run drainage improvements have been let at Goshen as follows: John McMann, of Goshen, first section on a bid of 6.6 cts. a cu. yd. and the second section at 7 cts. The contract for the main line extension was awarded to A. M. Lutes of Milford, at 18.55 cts. per cu. yd. Lateral B, known as the Gardner-Berkey ditch, went to A. M. Lutes for 18.30. Lateral C. known as the Musser, was not sold, there being no bids. The bids were based on the cubic yards of dredge work. The estimated cost of the dredge work on the main stream is approximately $26,500. The cost of the laterals will be about $2,000. The main extension is 3,800 ft. long; lateral B, 6,000 ft. long; lateral C, 3,700 ft. long.

⦿John Hack & Son of Lowell, Ind., have been awarded the contract for construction of a ditch in Jasper County, the contract price of which is $23,000.

Surveys for the proposed Bozeman levee along the Patoka and Wabash rivers will be started shortly. The first camp will be located on the Patoka, seven miles from Princeton. The second camp at East Mt. Carmel on the Wabash and the third at Grayville, Ill. A distance of 80 miles will be surveyed.

Iowa.

The County Supervisors of Carroll County, Carroll, Ia., have established a drainage project which, it is estimated, will cost $200,000, and which will drain 30,000 acres of rich bottom land in Grant and Pleasant Valley townships. The ditch proper will be 25 miles long.

Kansas.

Bert C. Wells, City Engineer, Wichita, Kan., has about completed estimates of the cost of extending the drainage canal of Wichita from Zimmely St. south to the Big Arkansas River. Rough estimates place the cost of excavating the canal from its present mouth at Zimmerly St. to the river, a distance of 2½ miles, at about $40,000. The canal now extends from 23rd St. to Zimmerly St., a distance of 3½ miles. This section of the canal was constructed several years ago by the Northern Construction Co., and cost about $41,000.

Kentucky.

⦿Roach & Stansell, Memphis, Tenn., have been awarded the contract for the levee work at Hickman, Ky., mentioned in our last issue. The levee will begin at the intersection of the Nashville, Chattanooga & St. Louis R. R. at Washington St., and extend westerly around the city. Work is to be completed within two months.

Minnesota.

⦿A. Folstad, Balaton, Minn., at 11½ cts per cu. yd., has been awarded the contract for constructing County Ditch No. 21 in Murray County. The work includes 13,552 cu. yds. of excavation. Bids were opened Dec. 9 at Slayton, Minn.

⦿The county commissioners at Roseau, Minn., have awarded the contract for the construction of judicial ditch No. 19 to J. B. Arpin Dredging Co., Grand Rapids, Wis., at $87,712. Bids were opened Dec. 8 by A. G. Lundgren, county auditor.

Missouri.

A project is under consideration for the reclamation of a large amount of land in New Madrid, Mississippi and Scott counties, Missouri. The name of the district will probably be the Tri County Drainage and Levee District. This district will comprise all of the land lying east of what is known as the New Madrid-Sikeston ridge, which extends north to the foot hills near Cape Girardeau. It is intended to completely reclaim these lands for agricultural purposes by a complete system of drainage and levees. This movement is meeting with the support of nearly all of the land owners in the district and it is expected the work will begin within the next 18 months. The petition will be ready to present to the court in April, after which a board of directors will be elected and the engineering work started. W. D. Knott, New Madrid, Mo., is interested.

Oregon.

W. H. Mason, Klamath Falls, Ore., at $63,600, was the low bidder for the work of diverting Lost River from its present channel and turning it into the Klamath south of Klamath Falls, for the U. S. Reclamation Service. Bids were opened Nov. 30.

South Dakota.

Contract drawings and specifications covering about 28 miles of the North Canal for the Belle Fourche irrigation project have been prepared. During November weather conditions for work on the Belle Fourche project were favorable but labor was scarce. At Belle Fourche dam 2,600 sq. yds. of paving blocks and 1,700 cu. yds. of gravel foundation were placed on the upper slope of the dam during the month. Satisfactory progress was made on the construction by force account of the drainage system at the toe of the dam. The whole contract of which the dam forms a part is 95.5 per cent completed. Excavation of the Nine-Mile lateral was continued throughout the month with satisfactory progress. F. C. Magruder, Belle Fourche, S. Dak., is Project Engineer.

Memphis and Vicinity.

[illegible]

The outfit of J. T. Walsh & Bro. at Cape Girardeau, Mo., has been the center of a great deal of excitement lately. From reports, it would appear that the Government levee near Cape Girardeau crosses a private railroad, of which a Mr. Houck is president. According to Capt. Smith, the United States Engineer in charge of the work, the railway Co. had been notified to prepare for the levee crossing its tracks, but when the time came to put the levee in at this point, the railroad company objected, and placed cars in the way of the contractor, in order to prevent him from constructing the embankment. One night, so the report goes. Tim Shea, the Superintendent for J. T. Walsh & Bro. had the cars pushed out of the way, and early next morning had a 5-ft. lift across the open cut. The railroad company then attempted to back an empty car onto the embankment, and after having got a flat car half way up the fill, abandoned the attempt. Tim put his stump puller to work, and pulled the car off, and practically filled the open place with dirt. The latest development was the attaching of the outfit of J. T. Walsh & Bro. by Mr. Houck, and the matter being turned into the United States court. Those who have knowledge on this subject, fear that Mr. Houck and his associates are in a very precarious position, on account of meddling with Uncle Sam in this proposition.

Jimmy Omberg states that he has about completed all of his work, and as soon as he finishes the subway for the Union Station, will be in a position to look around for some new contracts.

The big loop at Rosedale, Miss., on which four outfits have been engaged for the past six months, will be finished by Jan. 1st, according to the Engineer in charge. Only Lowrance Brothers are left, and according to Charley Lowrance, his outfit will start dressing this week.

Henry McCarten, in charge of Roach & Stansell's camp No. 3, is now hard at work on a piece of Government levee at Clarkedale, Ark. Henry's outfit helped build the big levee along the Brazos River, in Texas.

"Big Bob" Leonard is as happy as a school boy over his levee work recently secured in Texas. Bob has already placed several outfits on the job, and has the dirt flying in good fashion.

Sam Bush blew in from his Cresno, Mo., work, looking hale and hearty with a genial smile on his face, induced by the wonderful progress his outfit is making at this point.

G. C. Weathers has finally got his machine on his levee contract near Wilson, Ark., and George expects to make a killing with this machine, and says he is going to show his brother contractors that old "shave-tail Ned" is a back number.

Aderholdt Brothers are looking for some good grader work. Their address is Rena Lara, Miss., and from all reports, they will be ready to move on some new job by the first of the year.

H. P. Stricher is doing wonders with his large street contracts in this city. By the first of Spring, the "Big Boy" thinks he will be ready to bid on all the new street contracts which the city will have.

J. H. Weatherford is perhaps the busiest man in Memphis these days. Heiskell has a large quantity of work under way, and in his capacity as City Engineer, passes on practically all the problems in connection with the vast amount of new improvements the city is making. But Weatherford is possessed of a

✣indicates work now open for bids. ⦿indicates a contract let recently.

wonderful capacity for work, and combined with his rare good judgment, he accomplishes more than many two men can do.

W. J. Shackleford and Robert Somerville, of the Mississippi Levee Board passed through Memphis last week, on their return from Washington, D. C., where they have been attending the Water Ways convention, both being members of the National Association. W. J. is Chief Engineer of the Levee Board, and states that he expects to have some new work to offer contractors during the coming Spring.

S. S. Morriss, General Superintendent of the Y. & M. V. R. R., went to Chicago last Thursday on matters connected with his company. S. S. does not indicate just when his road will do the steam shovel work on the Clarksdale Division, but it is believed that he may have something good to offer within a short time.

Lowrance Brothers state that they have their Arkansas River work well in hand, and will finish there on contract time. Arkansas River has, for many years past, been a bugaboo to levee builders, and of late years, few contractors have had the nerve to take over any work in that district, but the Lowrance boys took the bull by the horns, and it would appear that their efforts will be crowned with wonderful success.

George Miller, at Alhambra, Miss., is in the market for some new work, and any contractors who have any to offer can't make a mistake by placing George on the large end of the contract.

According to Chief Engineer Covington, of the St. Francis Levee Board, the final mile of this contract, which has extended over a period of two years, will be finished about Jan. 1st. Roach & Stansell of this city, were the contractors, and have had many difficulties to battle with. The main draw back was the Spring floods of the Mississippi River, but these hustling people have fought away at the proposition until they finally succeeded in conquering all obstacles.

Capt. Clarke S. Smith, United States Engineer, has returned to the city after a trip to, Vicksburg, Miss., on his private boat, the Oleander.

C. H. Collins, with a force of 20 teams, is working away on the Huntington Short Line, and according to Chris, his forces will be ready to move on some new contract by Christmas day.

C. C. Price, of Arkansas City, is in the market for some new work. Price has a twenty-five team outfit.

P. McCadden ran up from his work at Old Town, Ark., last week, and spent several days in the city.

All railroads which will enter into the construction of various subways in this city, have accepted an ordiannce drawn up by City Engineer J. H. Weatherford, by which actual work on subways will begin not later than Feb. 1st, 1911.

Mike Roach, of Roach & Stansell, is in Texas, looking after the moving of several of the latter firm's large outfits, from the Brazos River levee to Memphis, work having been completed on the Burleson County Levee.

Wyoming.

Engineers are now working on plans for an irrigation project for reclaiming a large area of land in Southern Wyoming. The plan is to raise water from the North Platte River to the lands which form a high ridge between Wyoming and Colorado, many miles in width, by means of a gigantic siphon, after which irrigation can be made at will. U. S. Senator Francis E. Warren, Cheyenne, Wyo., is interested.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be received immediately by Board of Public Works, Los Angeles, Cal., for sale of one Jeffrey "A-2" electric coal drill, complete with truck, cable, motor, etc. (slightly used); five Jeffrey "-5" electric rotary drills, complete with trucks, cables, motors, etc. (slightly used, 3 new); ten Jeffrey rotary hand drills, complete (3 slightly used—7 new); 148 Jeffrey steel augers—various sizes and diameters. (One-third used, balance new). Official advertisement will be found elsewhere in this issue.

✣Bids are asked until noon, Dec. 31, as noted in our last issue, by Brig. Gen. Chas. E. L. B. Davis, U. S. Engineer, 726 Chronicle Bldg., San Francisco, for dredging in Redwood Creek, Cal. This work calls for dredging a channel 150 ft. wide on the bottom and 5 ft. deep at mean low water for a length of 3,000 ft., involving a total yardage of approximately 100,000 cu. yds. The amount of money available is about $12,000.

⊙Advices from Carbondale state that John Peterson has been awarded the contract for building the tunnel through Red Point hill above Carbondale, which is being built for W. M. Dinkel and Fate Girdner, and will be used in place of the flume which runs around the ridge of the hill. The tunnel when completed through the hill will be between 700 and 1,000 ft. long.

⊙The Board of Public Works, Oakland, Cal., has awarded the San Francisco Quarries Co. the contract for supplying and placing rock in the proposed embankment at the Key Route Basin. The bid of the company, which was the lowest of the five submitted, was 94 9-10 for the rock, total of $47,450. This will be the largest single contract in the improvement of the Key Route Basin and will entail an expenditure of $350,000 appropriated from the harbor bond issue funds. The dredging spoil is to be placed behind the bulkhead and in the space between Oakland Mole and the north line of Fourteenth street extension—the fill, as it is called. The work at the Seventh street extension will be first commenced. The reclaimed area will consist of perhaps 300 acres. The channels will be divided into three sections—A, B and C. A is the approach channel and will run along the proposed bulkhead parallel to Oakland Mole, with a depth of 20 ft. below high tide and with a width at the bottom of 500 ft. Channel B will be 25 ft. deep and 400 ft. wide and channel C the same in depth and 300 ft. in width.

Colorado.

The Buenaventura Drainage, Transportation & Tunnel Co. of Boulder, Colo., has been incorporated with a capital stock of $50,000, the incorporators being Hal Sayre, R. H. Sayre and H. A. Hicks.

Delaware.

⊙The American Dredging Co., Philadelphia, Pa., at 7.4 cts. per cu. yd. place measurement, has been awarded the contract for dredging harbor at Wilmington, Del., for the U. S. Government. Bids were opened Dec. 10 at Wilmington.

Florida.

✣Bids are asked until noon, Jan. 5, by Capt. Geo. R. Spalding, U. S. Engineer, Jacksonville, Fla., as noted in our last issue, for dredging in Sarasota Bay, Fla., and for sale of dredge "Suwannee." The dredging requires the removal of 177,550 cu. yds. place measurement of sand, mud and shell from various shoals. About $27,000 is available for the work.

Illinois.

⊙The Great Lakes Dredge & Dock Co., Chicago, Ill., submitted the low bid for borings to bed rock for the commissioner of public works, city of Chicago. The bidder agrees to submit an analysis of all borings taken at a price of $12 per foot or submit borings with no analysis at $5 per foot. The contract has not been awarded.

Iowa.

✣Bids will be received until 2 p. m., January 5, by State Board of Education, Capitol Bldg., Des Moines, Ia., for the erection and completion of a gymnasium for the use of the Iowa State College, Ames, Ia. D. A. Emery is Secretary of the State Board.

✣Bids will be received until 1 p. m., January 16, by the Sisters of Humility, St. Joseph's Convent, Ottumwa, Ia., for the erection and completion of a brick academy building and boiler house, including all labor and material. John O'Connor, 1115 Fleming Bldg., Des Moines, Ia., is Architect.

The Keokuk & Hamilton Water Power Co. is making rapid progress with the preliminary work for its hydro-electric development at Keokuk, and it is expected that concrete work will be started soon. A construction camp and temporary warehouses have been laid out on the Iowa side of the river. The Stone & Webster Engineering corporation, Boston, Mass., is reported to be financing the enterprise. The dam will be 5,800 ft. in length, of reinforced concrete, 37 ft. in height and 37 ft. in thickness at the base, 7 ft. of its base being sunk into the rock bottom of the river. The spillway will extend four-fifths of its length, straight across the river, and the remainder, 1,400 ft. in length, will be occupied by the power house which will contain 30 turbine engines attached to dynamos.

Lundy & Wood, who are interested in the water power development at Eldora, are reported to have secured control of a number of water power sites between Iowa Falls and Eldora, either by option or actual purchase. This will give these parties four valuable sites and it is stated that they propose to build dams at Steamboat Rock, Hardin City and Eagle City with a view to conserving the water in the Iowa River for use at their hydro-electric plant at Eldora.

Indiana.

✣Bids will be received until 10 a. m., December 21, by Board of Public Works, Indianapolis, Ind., for the furniture for the City Hall.

✣Bids will be received until 10 a. m., January 14, by Board of County Commissioners, Greenfield, Ind., for the steam heating apparatus for the County Infirmary. C. H. Troy is Auditor of Hancock County.

✣Bids will be received until 1 p. m., January 19, by Board of County Commissioners, Brookville, Ind., for the repair and remodeling of the County Court House. Charles A. Miller is Auditor of Franklin County.

Kansas.

✣Bids will be received by R. V. LaDow, Superintendent of Prisons, Washington, D. C., for furnishing and delivering at the U. S. Penitentiary, Leavenworth, Kan., lumber required for the building of scaffolding in connection with construction work.

The City of Horton, Kan., is contemplating the installation of an electric light plant, and is desirous of learning the approximate cost of installing a plant for a town of 4,000. B. B. Norris is City Clerk.

Kentucky.

The following bids were received Dec. 9 by Major John C. Oakes, U. S. Engineer, Cincinnati, O., for removing a rock ledge at Lock No. 11, Kentucky River, Kentucky, (1) standing for 1,000 cu. yds. earth excavation and (2) for 12,000 cu. yds. rock excavation: Skene & Richmond, Evansville, Ind., (1) 75 cts. per cu. yd., (2) $2.40 per cu. yd.; Johnson & Virden, Lewes, Dell., (1) $2,

✣indicates work now open for bids. ⊙indicates a contract let recently.

(2) $6; the Ohio River Contract Co., Evansville, Ind., (1) 50 cts., (2) $1.50.

Louisiana.

The Jackson Parish Police Jury, Vernon, La., have directed L. L. Thurmon & Co., of Dallas, Tex., to submit plans and specifications for a $50,000 courthouse and $10,000 jail.

Michigan.

✣Bids will be received until noon, December 31, by J. A. Semer, County Clerk, Escanaba, Mich., for the purchase of $40,000 Delta County bond issue. Official advertisement will be found elsewhere in this issue.

Minnesota.

Work will probably be started early next year on the reconstruction of ore dock No. 1 of the U. S. Steel corporation at Two Harbors. The work will be done for the Duluth & Iron Range R. R. W. A. Clark, Duluth, Minn., Chief Engineer. This structure, which is of wood, is the oldest of the six piers of the Duluth & Iron Range system. It is to be dismantled and rebuilt of steel and concrete. The work, it is estimated, will cost $1,500,000. The remodeled No. 1 pier will be 1,390 ft. long and 73 ft. above the water line and will have a storage capacity of 65,000 tons.

The Carnegie Fuel Co., C. P. White, Vice-President, Minneapolis, Minn., is said to be planning to let contracts about Jan. 1 for the plant for its new coal docks to be erected at West Duluth.

Mississippi.

✣Bids will be received until January 2, by Board of Supervisors, Lucedale, Miss., for the construction of a new court house and jail.

✣Bids will be received until noon, January 8, by Capt. Clarke S. Smith, U. S. Engineer, Vicksburg, Miss., for steel hull, self-propelling hydraulic dredge, steel pontoons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontoons and pipe line, upper works, steam plant propelling machinery, electric plant, pumping engine, condenser plant, evaporator sand pump, suction pipe and ladder, cutter head, gear and engine, winches and refrigerating plant. Official advertisement will be found elsewhere in this issue.

The R. W. Hinton Co. of Lumberton, Miss., has sold 8,000 acres of cut-over land near Lumberton to German farmers in Illinois. The Germans will begin at once on extensive developments on the property preparatory to a big colonization scheme.

Missouri.

✣As noted in our last issue bids are asked by Maj. Edward H. Schulz, U. S. Engineer, Kansas City, Mo., until noon, Jan. 5, for the construction of about 13,000 ft. of standard revetment on the left bank of the Missouri River, in Randolph Bend, about six miles below Kansas City, Mo. The mattress is to be 12 ins. thick and 86 ft. wide; the shore edge to be not more than 3 ft. above standard low water, to be made of bar growth willow, cut not longer than one week in advance of delivery and use, ½ to 2 ins. diameter at the butt end and 10 to 25 ft. long. The slope is to be paved with one-man stone, either sandstone or limestone of good quality, or other hard stone that will not disintegrate under action of air or water. The stone is to be in pieces approximately rectangular in cross section, and weighing on an average 100 lbs., no piece to be less than 25 nor more than 200 lbs. The paving is to commence at the top of the slope and work down, each stone to be placed by hand, slanting up hill, and to a depth normal to the face of the slope of at least 8 ins. at the top and 12 ins. at the bottom, and to extend from the top of the slope to the water and into the water 18 ins. For the next 10 ft. a compact layer of stone 12 ins. thick is to be placed on the mattress by casting into the water.

New Jersey.

Bids were opened Dec. 8 by the Board of Education of Jersey City for the erection of the Technical and Industrial High School in that city. [illegible] Jersey City, N. J., at $456,500 was low bidder for the entire work. For Sec. 1 comprising mason work, structural steel and iron work [illegible] work, roofing and metal work, painting, plumbing and gas fitting, [illegible] was low bidder. For Sec. 2, comprising heating, power [illegible] work, the Commercial Construction Co. at $126,644 was low bidder.

⊙The contract for constructing a municipal hospital for the city of Camden, N. J., has been let to John A. Carter & Co., at $33,900.

New York.

✣Bids will be received until 2 p. m., January 9, by Constructing Quartermaster, Madison Barracks Harbor, N. Y., for the construction of a forage storehouse at that post.

✣Bids will be received until 11 a. m., December 22, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Washington, D. C., for dredging at outboard end of launching ways at the navy yard, New York, N. Y.

✣Bids will be received until noon, December 23, by Commissioner of Docks, Calvin Tompkins, Department of Docks and Ferries, Pier "A," Borough of Manhattan, New York, N. Y., for furnishing under Contract No. 1260, all labor and materials for making repairs to pier at E. 5th St., East River, Borough of Manhattan.

✣Bids are asked until noon, Jan. 5, by Col. S. W. Roessler, U. S. Engineer, Army Bldg., New York City, as noted in our last issue, for dredging in Bay Ridge Channel, New York Harbor. This contract is for the continuance of the improvement of Bay Ridge Channel. Work will be begun on the easterly half of Bay Ridge Channel, making it 600 ft. wide and 40 ft. deep, starting at the outer 40-ft. curve now nearly opposite 92nd St., South Brooklyn, and extending up and along the South Brooklyn shore to or towards Erie Basin Bulkhead, the northerly end above 40th St. to be widened to the eastward as provided in the original project and plans. Thereafter, should the amount of the funds available permit, work will be done in the westerly half making the same depth and width from the outer 40-ft. curve northward. It is not anticipated that this contract will permit of an extension of the work into Red Hook Channel. The sum of $150,000 is immediately available for the work.

Bids were opened Dec. 15 by the State Commission on New Prisons, Albany, N. Y., for the construction of the new prison in Wingdale, Dutchess county, to take the place of Sing Sing Prison. The P. J. Carlin Construction Co. of New York was the low bidder at $2,894,000 for the entire prison and $698,000 for deductions as provided in the specifications, which eliminated a group of buildings, including the warden's residence, chapel, recreation building, south industrial shop, store house and condemned and punishment cells. The company agrees to complete the contract by Aug. 30, 1913. The other bidders were: John T. Brady & Co., New York, $3,344,047; deduction, $613,110; complete work in two years and six months. Hudson Valley Construction Co., Troy, $3,340,126; deductions, $646,128; complete work in two years and six months. R. T. Ford Co., Rochester, $3,670,000; deductions, $700,000; complete work by Nov. 1, 1913. Thomas J. Dwyer, New York, $4,100,000; deductions, $491,000; complete work Nov. 1, 1913. Shortly after the bids were opened the commission was served with an order restraining it from awarding the contract.

Pennsylvalia.

✣Bids [illegible] ary 11, by Trustees of the Pennsylvania State Lunatic Hospital, Harrisburg, Pa., for the erection and completion of a nurse's home. [illegible] Board of Trustees, and approved by the Board of Public Charities, can be seen at the office of J. A. Dempwolf, Architect, York, Pennsylvania, or at the office of Dr. H. L. Orth, Superintendent. Individual sets of drawings and specifications will be furnished on application to said architect by depositing with him $25 [illegible] return of the drawings and specifications. Certified checks in the sum of $4,500 must accompany said proposals, which checks will be returned to the unsuccessful bidders. Dr. H. L. Orth is Superintendent of the Pennsylvania State Lunatic Hospital.

✣Bids will be received until Noon, January 11, by H. C. Newcomer, Lieut. Col. U. S. Engineers, Pittsburg, Pa., for furnishing and installing a water power air compressor plant at Lock 1, Monongahela River, Pittsburg, Pa.

✣Bids will be received until 11 a. m., December 23, by Chauncey B. Baker, Constructing Quartermaster, 26th St. and Gray's Ferry Road, Philadelphia, Pa., for the necessary la- [illegible] heating system in Building No. 10 at that depot.

✣Bids will be received until Noon, January 17 [illegible] at the office of the County Controller, Pottsville, Pa., for the general contract including masonry, carpentry, iron and steel, ornamental iron, roofing, painting, fire proofing, plastering, etc., labor and materials complete, for the construction of a building for the Insane at Schuylkill Haven, Pa.

The Newport Construction Co., Newport News, Va., was the low bidder Dec. 12, for the construction of the U. S. Government building at Carbondale.

The Flood Commission, of Pittsburg, Pa., is making rapid progress with its survey work and will make public its report in January. The flood commission in its work at Pittsburg decided to go into the matter as completely as possible, and when its report is ready every phase of the cause of the floods will be shown and an adequate working plan to prevent them for all time will be advocated.

Texas.

✣Bids will be received until January 9, by Commissioners Court of Bee County, Beeville, Texas, for the construction of a new court house. Plans and specifications may be seen at the office of the clerk or Architects, Stephenson & Heldenfels, Beeville, Texas. A certified check for 10 per cent the amount bids must accompany each proposal.

✣Bids will be received until 9 a. m., December 28, by the Union National Bank, Houston, Texas, for the construction of its new bank and office building in that city. Plans and specifications may be obtained at the office of Mauran & Russell, Chronicle Bldg., Houston, and Chemical Bldg., St. Louis. A certified check for $20,000 must accompany each bid.

The Bowers Southern Dredging Co. has launched its new dredge Robert P. Clark, which has been under construction in Galveston for the past seven months. The hull of the new dredge is 175 ft. long, with a 40-ft beam and a depth of 16 ft. The machinery consists of a 22-in. hydraulic pump, having a capacity of about 600 yds. per hour. The dredge is self-propelling, having twin screws, and carries a fully equipped machine shop and blacksmith shop for repairs. Five separate engines are on board, the steam being furnished by a pair of marine boilers said to be the largest ever brought South. The first work of the new dredge will be in Bolivar channel.

Virginia.

⊙The Raymond Concrete Pile Co. of New York and Chicago has been awarded the contract, at $33,780, for constructing a reinforced concrete pile bulkhead wharf for the city of Richmond. Bids for the work were opened Dec. 2.

Wisconsin.

The Wisconsin River Power Co., Magnus Swenson, President, Madison, Wis., is reported to have preliminary work underway for the construction of its power dam at Prairie du Sac. It is said that contracts for the construction of the dam will be let early in January.

Preparations are underway for having construction work started early next year on a power dam in the Bad River near Mellen. A.

✣indicates work now open for bids. ⊙indicates a contract let recently.

E. Appleyard, Ashland, Wis., Manager of the Ashland Light, Power & Street Ry. Co., is interested in the project.

Canada.

The Central Canada Power Co., Ltd., of Toronto, Ont., has been incorporated with a capital stock of $10,000,000 and authority to carry on hydraulic and electrical power business throughout Canada. The incorporators are nominally given as Strachan Johnston, R. H. Parmenter, A. J. Thomson, W. S. Morlock and N. B. Wormwith, members of a Toronto legal office.

⊙The following contracts have been let by the Public Works Department of Canada: Providence Bay, Ont., wharf extension, contractor, Chas. H. Sherwood of Port Arthur, $15,438. Brockville, Ont., pier, contractor, Samuel Gowan of Brockville, at $6,500.

Mexico.

Engineer F. W. Gundlach, of Vera Cruz, and seven men had a somewhat unpleasant experience early this month. They were marooned upon a block of concrete 16 ft. square, constructed for a light-house base, 5 miles out in the gulf on a reef, during the heavy storm that lasted for 48 hours, beginning Dec. 5. When the water is smooth, at low tide, the block is only 5 or 6 ft. above the water. When the storm came up, the men seeing that no vessel was in sight and that the water was beginning to break and throw spray over them, secured a piece of an old railroad rail, about 8 ft. long. They stuck one end into a hole in the concrete block and with a piece of rope tied themselves to the rail. They stood up until they could stand it no longer, and then lay down all huddled together. Every big wave that broke over them seemed a momentary relief, as the water appeared warm to their bodies, the cold wind having chilled them to the bone. The only thing they had to eat during all the time they were marooned was three oranges. Mr. Gundlach divided them into eight equal parts. After the first night and during the course of the following day two of the men lost their minds and when the boat came to their rescue these two, with two others, had to be carried into the boat. The crew of eleven men from the gunboat "Veracruz" very nearly lost their lives when their boat struck on the block and broke in many pieces.

BRIDGES—STEEL AND CONCRETE

Arkansas.

It is rumored in Little Rock, Ark., that the Argenta Street Railway System, which is trying to get a foothold in Little Rock, is contemplating the construction of a bridge over the Arkansas River in that city at the foot of Broadway. It is said that an effort will be made to have Pulaski County contribute $150,000 toward the cost.

California.

⊙Advices from Madera, Cal., state that the County Supervisors have awarded the contract for the construction of the bridge over Cottonwood Creek to the Pacific Construction Co., at $8,200.

⊙Advices from Santa Ana, Cal., state that the contract for the construction of the proposed bridge across the West Fourth St. Channel has been let to A. E. Bird, at $1,287.

The Board of County Supervisors, San Diego, Cal., received the following bids for the construction of five combination wood and steel bridges over creeks and rivers on the Coast Road; also for bridge over Bonnie Brae Creek in Sweetwater Valley: Santa Margarita River, C. Steffgen, $7,940; Knight & Hyde, $7,765; Gallagher Construction Company, $9,995; Mercereau Construction Company, $9,100; Young Construction Company, $10,250. Los Flores Creek, Steffgen, $3,325; Knight & Hyde, $3,352; Gallagher, $4,400; Mercereau, $3,600; Young, $4,300. San Onofre Creek, Steffgen, $6,310; Knight & Hyde, $6,016; Gallagher, $7,682; Mercereau, $7,000; Young, $8,220. South San Mateo Creek, Steffgen, $580; Knight & Hyde, $531; Gallagher, $693; Mercereau, $400; Young, $320. San Mateo Creek, Steffgen, $7,140; Knight & Hyde, $6,939; Gallagher, $8,841; Mercereau, $7,800; Young, $8,900. Bonnie Brae Creek, Steffgen, $2,615; Knight & Hyde, $1,964; Gallagher, $2,243; Anderson Company, $3,000; W. A. Russ, $1,610.

Colorado.

Commissioners of El Paso County Colorado have taken up with the State Board of Highway Commissioners, Denver, Colo., the matter of constructing two new bridges and the construction of a road from Colorado Springs to Uted Pass.

It has been announced in Denver, Colo., that the state has paid to the city $50,000 toward the construction of the West Colfax viaduct, and the extension of Broadway from its present terminus at Welton St. to the northwest city limit.

The Larimer St. Improvement Association of Denver, Colo., has been formed and will take steps to secure the construction of a viaduct over the tracks of the Union Pacific Ry. at 40th St. The officers of the organization are Seth B. Bradley, President; George Dunklee, Vice President; F. F. Davis, Secretary, and T. C. Hitchings, Treasurer.

The Santa Fe system has planned to construct a concrete pier at bridge No. A-567 over the Colorado River at Needles, Cal., at a cost of $138,000.

Florida.

✣Bids will be received at once by L. C. Haines, Purchasing Agent, Florida East Coast Ry., 26 Broadway, New York city, for superstructure of bridge across St. John's River at Cooke Ferry, Volusia County, Fla. The structure will be 50 ft. in clear.

The Board of Trade of Fernandina, Fla., is taking steps toward securing the construction of a bridge across the Nassau River and marsh in such a place as to make the distance to Jacksonville about 25 miles. A committee has been appointed to investigate the feasibility of such a venture.

Idaho.

✣Bids will be received until 10 a. m., Dec. 29, by W. L. Cuddy, County Auditor, Boise, Idaho, for the necessary labor and materials for the construction of steel highway bridges at 9th St., Boise City, across the Boise River near Barbertown in Ada County, Idaho, respectively, and resetting a third bridge at Eagle Island, across the Boise River in Ada County. Plans and specifications can be obtained of the County Auditor or LaPointe & Fox, 312 McCarty Bldg., Boise, Idaho.

⊙The contract for the construction of the new bridge across the Lemhi River at Barracks Lake has, according to advices from Salmon, Idaho, been awarded E. L. Emigh.

Illinois.

✣Bids will be received until 8 p. m., Dec. 30, by George F. Simmons, Commissioner of Public Works, Peoria, Ill., for the construction of a bridge across the Illinois River at Bridge St. and for removal of piers, piling, an old wooden bridge and the debris of a fallen reinforced concrete bridge from the site of the new structure.

⊙The Strobel Steel Construction Co., 98 Jackson Blvd., Chicago, has been awarded the contract for the repairing of the Clark St. bridge over the Chicago River by B. J. Mullaney, Commissioner of Public Works, Room 705, City Hall; the contract price is $3,690. Itemized bids and specifications for repairs published in ENGINEERING-CONTRACTING Nov. 30, 1910.

Bids have been received by the City Council of Rock Island, Ill., for the construction of the Rock River bridges. The only bids considered were the following: The first amount shows the bid on the double span bridge, the second the single span and the third amount the bid on concrete work per cubic yard: Milwaukee Bridge Co., $15,900, $9,300, $9; Central States Bridge Co., $16,500, $10,250, $14.20; Penn. Bridge Co., $16,677.25, $10,792, $13.50; Clinton Bridge Co., $15,400, $9,200, $13.20; Joliet Bridge & Iron Co., $16,900, $9,900, $15. The bids call for the rebuilding of the bridges, abutments and special concrete work necessary.

The contract of Edward Cooney, Tremont, Ill., for the construction of the new iron bridge over the Mackinaw River at Waltmire ford has been completed and Board of Supervisors who inspected the work have accepted same. The cost of the improvement was $7,988.

Plans and blue prints have been received by the City Council of Rockford, Ill., for the construction of the proposed new viaduct at Winnebago St. As proposed the structure will have a 19-ft. roadway 47 ft. 5 in. above the base of the viaduct. City officials believe the width of the viaduct is not great enough.

Indiana.

✣Bids will be received until 10 a. m., Jan. 5, by Board of Commissioners of Daviess and Knox Counties, at Vincennes, Ind., for the construction of a bridge over White River. John T. Scott is Auditor of Knox County.

⊙The contract for the construction of five steel bridges in Pike County, Ind., has been awarded to A. H. Kinman, Petersburg, Ind., at $1,150. Bids for the work were opened Dec. 7. F. R. Bildenback is County Auditor.

Iowa.

✣Bids will be received until Jan. 4, by the Board of County Supervisors, Marshalltown, Ia., for the construction of 3 reinforced concrete bridges in Marshall County, Ia. The estimated cost of the structures is $11,000. The largest will be 130-ft. span.

The bridge fund of Cass County is reported to be getting short and the County Board at Atlantic, Ia., is contemplating issuing bonds in the sum of $40,000 to straighten out the fund.

City Council of Cedar Rapids, Ia., has passed a resolution of necessity for the construction of a bridge at 3d Ave. If no obstacles are encountered to delay the necessary legislation Jan. 9, bids for the new concrete structure will be advertised for about Feb. 1.

Kansas.

⊙Advices from Newton, Kan., state that a contract was awarded Dec. 7 to B. H. Northcott & Son, Hesston, Kan., at $1,267, for the construction of three pile bridges, 46 ft., 62 ft. and 92 ft. long, all having a 16-ft. roadway. J. A. Hunter is County Clerk.

⊙Advices from Leavenworth, Kan., state that four bridge contracts have been let by the Commissioners of that county, two of which were situated in High Prairie township and the other two in Stranger township. Bridges No. 285 and 276 were awarded J. W. Orr; Fulcher Bridge went to the Leavenworth Bridge Co. and the Wheat Bridge to J. B. Tierny.

⊙County Commissioners, according to information received from Wichita, Kan., have awarded the contracts for the construction of three wood bridges in South Frant township and one in Salem to the Wichita Construction Co., at $1,240. The contract for the construction of the steel bridge in Delano township was let to the Missouri Valley Bridge Co., Kansas City, Mo., at $1,001.

✣indicates work now open for bids. ⊙indicates a contract let recently.

Advices from Lawrence, Kan., state that it has been decided to construct a new 46-ft. bridge over Toy Creek to replace the old wooden structure 160 ft. long in the southeast part of the county.

The Santa Fe system has made plans to renew its bridge, No. 39, on the Southern Kansas division.

Information received from Lawrence, Kan., state that County Commissioners have viewed the site of the proposed bridge across the creek in the southwestern part of Marion township.

Advices from Wichita, Kan., state that a bill is to be introduced at the coming session of the legislature providing for the construction of a $20,000 bridge over the Arkansas River on 13th St. without the matter being voted upon by the people. The County Commissioners are in favor of the movement.

Maryland.

Baltimore County Commissioners at Towson, Md., recently received bids for the construction of a concrete bridge over Back River at Eastern Ave., specifications for which do not include a steel draw or the approaches to the structure. Andrew Miller & Co., at $34,924, was low bidder.

Massachusetts.

⊙The contract for repairing Neponset bridge, Boston, Mass., was awarded on Dec. 12, to Fawler Bros., 16 City Square, Boston, at $1,523. L. K. Rourke is Superintendent of Streets.

It has been announced at Springfield, Mass., that the Slade's Ferry bridge over Taunton River, between Fall River and Somerset, will be reconstructed.

Upon the recommendation of the Superintendent of Streets, Mayor Fitzgerald, Boston, Mass., has sent a communication to the City Council requesting $10,000 to provide the engineering plans for the proposed new Chelsea North bridge. It is believed that a suitable structure can be erected for about $250,000.

Michigan.

It has been decided by the Grosse Pointe, Mich., Township Board to construct a bridge over Fox Creek on the Cadieux Road. An engineer is now preparing plans and specifications for the proposed reinforced concrete structure, which will, it is estimated, cost $2,100.

Minnesota.

The report of the expert and City Engineer L. W. Clarke, Stillwater, Minn., who recently investigated the condition of the present bridge over the St. Croix River shows that practically the reconstruction of the structure will be necessary. The estimated cost of the improvement is $19,393.

City Council of Duluth, Minn., at its next meeting will decide as to the next step to be taken in regard to the construction of the proposed bridge for the Nemadji River between Allouez and the East End. The Mayor favors the construction of a creosoted timber structure, which would cost about $35,000 complete.

Missouri.

Plans have been presented to the city by Waddell & Harrington, Consulting Engineers, Kansas City, Mo., for the construction of the proposed new reinforced concrete bridge over the Blue River at 15th St., Kansas City. As soon as the city engineer, L. R. Ash, goes over the work, the Board of Public Works will proceed with the matter.

The Chicago, Milwaukee & St. Paul R. R. Co. is making preparations for the construction of the proposed bridge at the Government Way and Garden Sts., De Soto, Mo. It is estimated that the work when completed will cost $65,000.

Nebraska.

✣Bids will be received until noon, Jan. 10, by H. F. Chapin, County Clerk, York, Nebr., for the construction of steel and wooden bridges that may be built in the County of York for the year of 1911. Each proposal must be accompanied by a certified check for $500.

✣Bids will be received until Noon, January 10, by Board of County Supervisors, Geneva, Neb., for furnishing all material and labor for the construction of all county bridges, both bent and pile, steel and wooden required by Fillmore County. All bids must be accompanied by a certified check for $500. Uriah F. Stanard is County Clerk.

A committee representing the Bayard Precinct, recently met a number of citizens of Bridgeport, Nebr., to discuss the construction of the proposed bridges over the North Platte River in Morrill County, at Bayard, Bridgeport and Broadwater.

New York.

⊙The Raymond Concrete Pile Co., New York and Chicago, has been awarded the contract for the foundations of the pedestal and walls of the bridge to be constructed at Glisan St., Portland, Ore., for the Oregon Railway & Navigation Co. G. T. Forsyth, Portland, Ore., is Bridge Engineer of the railroad company.

Engineer William S. Manning of Syracuse, N. Y., is planning the construction of a 250 ft. bridge in connection with the construction of the Bridge St. extension.

A meeting of the Grade Crossing Commission, Niagara Falls, N. Y., was held December 6, to take up the estimates for the construction of the 11th St. bridge over the New York Central tracks at the north end of the city.

State Barge Canal Officials have informed Supervisor F. L. Waldorf of Clyde, N. Y., that plans have been completed for the construction of two new bridges over the canal at that place, and that contracts will be let for the work early in the Spring providing for the completion of the work by October 1. The Crowell-Sherman-Stalter Construction Co., which has the contract for the construction of a 14.2 mile stretch of the barge canal in that vicinity, has also taken the contract for removing the present structures.

At a recent meeting of the Buffalo Grades Crossing Commission plans for the construction of the proposed new viaduct across the New York Central tracks at Eleventh St., between North and Grove Aves., were agreed upon. According to the estimate of I. L. Harper, Buffalo, N. Y., Engineer of the Commission, the substructure will cost $45,000 and the superstructure $70,000. Bids for the work will probably be advertised soon.

North Dakota.

At an adjourned meeting of the County Commissioners held at Pembina, N. Dak., it was voted to grant the petition of the city of Drayton, N. Dak., for $25,000 to aid in the construction of the proposed bridge over Red River at that place.

Ohio.

✣Bids will be received until Noon, January 13, by Board of County Commissioners, Cincinnati, O., for the construction under Specification No. 125, for the concrete bridge on Cooper Ave. in Lockland, Springfield Township. All bids must be accompanied by a bond for $2,000. Fred Dreihs is Clerk of the Board.

⊙Information received from Lima, O., states that the contract for the construction of the Geiger Bridge in Sugar Creek township has been awarded to the Home Engineering & Construction Co., Canton, O., at $717. The structure is to be of steel with a creodone floor.

The following bids were received by the County Commissioners, Warren, O., for the necessary labor and materials for the construction of the large concrete culvert bridge over Little Squaw Creek at Mosier Lane: National Concrete Co., Indianapolis, Ind., earth excavation, $1 per yd.; rock excavation, $1.50; concrete masonry, $7.25 per yd.; reinforcing steel, 4c; L. H. Link, Youngstown, excavation, earth, 50c; rock, 60c; concrete, $6.93; steel, 4c; fill, 50c yd.; Quigley & Meeker, Fowler, excavation, earth, $1; rock, $2; concrete, $7.48; steel, 3½ and 4c, Smith & Dennis, Warren, excavation, earth, 70c; rock, $1.25; concrete, $6.84; steel 3½c; fill, 40c; G. H. Galdini, Niles, excavation, earth, 75c; rock, $1.50; Young, Niles, excavation, 70c and $1.45; concrete, $7.45; steel, 3c; fill, 24½c; Wyncoop, McGormley & Co., Toledo, excavation, 35c and $2; concrete, $7.86; steel, 2½c; fill, 30c.

Surveyor of Franklin County, Columbus, O., is making plans for the construction of the proposed bridge over Blacklick Creek to provide the extension of East Broad St. The cost of the work, it is believed, will be about $18,000.

County Commissioners, Columbus, O., have decided to condemn three bridges in Franklin County, the Kings Ave., the Mound St. and the Williams bridge between Franklin and Norwich townships. The aggregate cost for the replacement of the structures is estimated at $100,000.

In connection with the proposed improvements of the Toledo & Ohio Central Ry., Bucyrus-Toledo-Thurston Division, it is planned to construct a new solid steel bridge at Bucyrus, O., to replace the present structure. J. A. Stocker, Columbus, O., is Chief Engineer of the T. & O. C. Ry.

Oklahoma.

Excavation has been started by the Oklahoma Union Traction Co., near the Frisco Bridge over the Arkansas River, where the interurban company expects to construct a new bridge for the proposed Tulsa and Sapulpa line. A. A. Small, Tulsa, Okla., is President of the company.

Special County Engineers, according to advices from Muskogee, Okla., are making surveys for the construction of a bridge over the Arkansas River at Haskell and Webber Falls. The structure will be built by the County Commissioners out of the fund provided by the $140,000 bond issue recently authorized by a vote of the people for bridge purposes.

Pennsylvania.

Board of County Commissioners, York, Pa., at a recent meeting decided to issue bonds in the sum of $30,000 to provide funds for the reconstruction of the College Ave. bridge.

Engineers said to be under the employ of the Lackawanna Railroad now constructing a line into Catasauqua, Pa., are drafting plans for the construction of a $500,000 bridge to enable that company to run trains out of the borough overhead on their way to Allentown, Pa. A. E. Deal, Hoboken, N. J., is Bridge Engineer of the Delaware, Lackawanna & Western Ry.

It has been announced by M. W. Easby, Engineer of the American Railways Co., Scranton, Pa., that plans for the construction of the proposed viaduct at Mulberry St. will not be completed before the first of the year.

Two estimates will be prepared by engineers of the city and railroad concerned for the construction of the proposed Seventh St. viaduct, Altoona, Pa., along revised plans.

Tennessee.

At a recent meeting of the City Council of Knoxville, Tenn., the initial step was taken toward securing the construction of a new concrete structure across the Southern Railway tracks on Gay St., now known as the Gay street bridge.

Texas.

At a meeting of the Houston Launch Club, Houston, Texas, which County Judge A. E. Amerman and County Commissioner J. B. Marmion attended, the matter of constructing a new bridge over Bray's Bayou was taken up. The proposed structure would permit the extension of the Houston Electric down the Harrisburg road.

Utah.

At a meeting of the County Commissioners, Ogden, Utah, December 5, authority was granted the road supervisor at Plain City to erect a new bridge across Dick's creek.

✣indicates work now open for bids. ⊙indicates a contract let recently.

Virginia.

The Municipal Engineering Department, Lynchburg, Va., has completed plans for the construction of a $200,000 reinforced concrete bridge over the James River at that point. The structure will be 1,081 ft. long with approaches aggregating 300 ft., and it will be 60 ft. above the low water. Grade crossings with the Chesapeake and Ohio and Norfolk & Western Rys. will be eliminated by the improvement and it is expected that the companies will contribute at least one-half the cost.

Wisconsin.

O'Keefe & Orbison, Contractors of Appleton, Wis., have completed their contract on the construction of the $1,000,000 steel and concrete Chicago & Northwestern Railroad bridge over Little Lake Butte des Morts. The work required two years' time.

Plans have been made by the Northwestern Engineering & Construction Co., Milwaukee, Wis., for the construction of the traction line bridge over the Rock River at Prophetstown, Ill. The structure will be built to accommodate two tracks and will consist of five 100-ft. spans resting on concrete piers. The estimated cost of the work is $55,000.

Plans are being prepared by L. J. Klug, Superintendent of Bridges, Milwaukee, Wis., for the construction of the proposed new Oneida St. bridge. The channel at that point is 80 ft. wide; the structure will have a 40-ft. roadway with a 12-ft. sidewalk on each side and is estimated to cost $125,000. The completion of the work will require about nine months' time.

ROADS, STREETS AND PAVEMENTS

Alabama.

⊙The Southern Bitulithic Co., has been awarded the contract in Birmingham, Ala., for the construction of 120,000 sq. yds. of bitulithic paving for $1.80 per sq. yd. Bids were opened December 7.

The Commissioners' Court of Elmore County, Wetumpka, Ala., has secured the services of the Solomon-Norcross Engineering Co., of Atlanta, Ga., to take charge of the work of constructing good roads in the county. Bonds were recently voted in the sum of $170,000 for this work.

Arizona.

It is reported from Tempe, Ariz., that V. S. Griffith, of Tucson, Ariz., will erect, near the smaller butte, a rock crusher to prepare crushed rock material for road work in anticipation of a great quantity of road work that will be done in the valley within the next few years.

California.

The County Commissioners of Tulare County, Viscalia, Cal., have been offered the right of way for a road extending across the estate lands of Henry Jacobs and forming the link that is to connect the two ends of the Sand Creek road that is proposed by the Fresno County people.

The Board of Trade of Placerville, Cal., has started a movement having for its purpose the securing of a part of the State's good roads bonds to build a road between Folsom and Placerville, to connect Sacramento County roads with the State road to Lake Tahoe. C. A. Swisler is interested.

The town trustees of Sausalito, Cal., are making arrangements to spend $50,000 on the improvements of local streets, using a system of road building known as oilcrete. The foundation of the roadbed will be built of concrete, 4 ins. deep and reinforced in the center with wire netting. On top of this will be placed a composition of which 90 per cent is asphalt.

At the December 5 session of the County Supervisors, held at Marysville, Cal., a committee from the Nevada County Board offered to buy the Freeman toll road.

The County Commissioners at Oakland, Cal., have adopted a resolution relative to the grading, draining and bridging of a portion of the county road leading from San Leandro to Havward, in the San Lorenzo road district. The County Surveyor has prepared plans and specifications for the work and has estimated that it will cost $3,180.

The Chamber of Commerce, of Oroville, Cal., has decided to boost for funds from the $18,000,000 state highway bond issue to build a wagon road up the Feather River canyon to Nevada, which will provide a shorter road from Oroville to Sierra County. Engineer S. J. Norris, who made a survey of a proposed short road from Oroville to LaPorte, reports that it would cost $20,000 to $30,000 to construct the road.

The City Council of Los Angeles, Cal., has passed an ordinance providing for the paving of San Pedro St., from Aliso to Fifth Sts. The specifications provide for leaving a strip 21 ft. wide from Aliso to Fourth down the center of the street without pavement, because it is expected the Pacific Electric Railroad will be granted a franchise for this distance. The uncovered strip is to be graded and graveled.

Colorado.

✣Bids will be received until 11 a. m. December 27, by Board of Public Works, Denver, Colo., for furnishing the materials, supplies, labor, etc., for grading, curbing and guttering and otherwise improving East Denver Improvement District No. 6. A certified check for $5,000 must be filed with each bid payable to the City Treasurer. Plans and specifications may be obtained from the Board of Public Works.

Louis Wyman, chairman of the Board of Commissioners of San Juan County, Silverton, Colo., at a recent meeting held in the Chamber of Commerce, Denver, Colo., it is reported, stated that his county has appropriated $20,000 toward the construction of a circle highway for automobiles through 23 counties of the state. Other counties through which the highway is to pass will probably appropriate a like amount.

Connecticut.

The city of Bridgeport, Conn., contemplates purchasing two street flushing machines. Frederick Schreiber is Supt. of Street Cleaning.

Florida.

✣Bids will be received until 11 a. m. December 28, by Constructing Quartermaster, Fort Barrancas, Fla., for constructing approximately 450 sq. yds. of macadam road with concrete curb and gutter at this post. A check for 10 per cent of the amount bid must be filed with each proposal. Plans and specifications, together with blanks and other information, can be obtained of the Quartermaster.

✣Bids will be received until December 22, by City Engineer, Jacksonville, Fla., for resurfacing Main St. from the city limits to Phoenix Park, a distance of two miles, more or less; Ortega Rd., from the city limits to McGirts Creek bridge, two and one-half miles, more or less, with rock, bituminous or asphalt binder (bidders to furnish their own specifications): Hendricks Ave. and Landon Ave., from St. Johns Ave., to connect with the Mandarin Rd., one mile, more or less, with vitrified brick; from Phoenix Park to Whittaker Ave., one-half mile, more or less, with vitrified brick; Sixty-fourth St., from Ortega Rd. to the old Orange Park Rd., three-quarters of a mile, more or less, with oyster shell foundation covered with Volusia shell and also the completion of the grading of Lake Shore Blvd., from Orange Park Rd. to Middleburg Rd.

✣Bids will be received until 7:30 p. m., January 5, by W. F. Divine, City Clerk, St. Petersburg, Fla., for grading, paving with brick and otherwise improving Second St. from First to Seventh Aves., including about 4,000 lin. ft. M. Spencer is Engineer.

✣Bids will be received until 2 p. m., January 3, by Board of County Commissioners, C. M. Knott, Clerk, Tampa, Fla., for furnishing road roller, scarifier and grader; also three wagons suitable for the housing of convicts.

The Duval County Commissioners, Jacksonville, Fla., have decided to build six miles of roadway in different parts of the county.

Georgia.

Mayor-elect Courtland S. Winn, of Atlanta, Ga., contemplates asking the City Council to pave Spring St., and construct a driveway in Grant Park.

Idaho.

The Commercial Club, of Lewiston, Idaho, has inaugurated a movement to secure a system of sidewalks and streets for the city. The report of the committee provides for the creation of an improvement district on Normal Hill, embracing the territory from Prospect Ave., east to and including 13th St., and from the boulevard north to and including 10th Ave., Eighth St., to be treated with a hard-surface pavement from the top of the Ninth St. grade to the entrance gates to the Lewiston orchards, and the remaining streets and avenues in the district to put to grade and 6-in. concrete curbs and 2-ft. concrete gutters to be constructed. The proposed improvements, it is estimated, will cost between $75,000 and $85,000.

Advices from Grangeville, Idaho, state that farmers and stock raisers in the Joseph and Dumacq plains region are building, by private subscription, a wagon road to Whitebird, on the Salmon River, about 15 miles. Fred Erkstine, of Grangeville, is Engineer in Charge.

Illinois.

The City Council of Rock Island, Ill., is considering the improvement of the Ninth St. road from the city limits to Rock River. The proposition is to obtain from the state the material for building a hard road.

Following are the low bids and bidders as received by the Board of Local Improvements, city of Chicago, Chas. A. V. Standish, Secretary, Room 302 City Hall, for constructing cinder sidewalks in the following streets; bids opened Dec. 16, 1910: Six-ft. cinder sidewalk, north side of Addison St., from southwest line of Milwaukee Ave., to east curb line of N. 47th Ave., 1,610 lin. ft. of walk, 1.6 average fill, 0.9 average cut, trees and underbrush in line of walk, $.43 per lin. ft., Quinn Construction Co., 3519 W. Chicago Ave.; 6-ft. cinder sidewalk on both sides Bishop St., from south line of W. 90th St. to north curb line of W. 91st St., 982 lin. ft. of walk to be built, 1.25 average fill, 982 lin. ft., 75-ft. cut, $.34½ per lin. ft., John Hickev, 1402 W. 59th St.; 6-ft. cinder sidewalk, both sides S. California Ave. from the southeast curb line of Archer Ave. to the north curb line of W. 47th St., 2,130 lin. ft. of walk to build, 1.5 ft. average fill, $.31 per lin. ft., Quinn Construction Co.: 6-ft. cinder sidewalk on both sides of Greenwood Terrace, from west line of N. 46th Ave. to east curb line of N. 48th Ave., 320 lin. ft. of walk to be built, 1½ ft. average fill, 95 lin. ft., 0.25 average cut, $.31 per lin. ft., Quinn Construction Co.; 6-ft. cinder sidewalk on the south side of W. Irving Park Blvd., from the west line of N. 66th to the east line of N. 68th Ave., 178 lin. ft. of walk to be built, 2.2 ft. average fill, ? per lin. ft., Quinn Construction Co. & Deinling & Wendt, 84 La Salle St. (tie); 6-ft cinder sidewalk both sides of

Laurence Ave., from west line of N. 56th Ave. to east curb line of N. 58th Ave., produced south, 1,840 lin. ft. of walk to be built, 1.2 average fill, 1,940 lin. ft., 7 ft. average cut, $.318, Steuart Callsen, [illegible] Milwaukee Ave.; 6-ft. cinder sidewalk on west side S. Morgan St., from a line parallel with and 200 ft. south of the south line of W. 89th St. to line parallel with and 300 ft. south of the south line of W. 89th St., 100 lin. ft. of walk to be built, 1.25 average fill, 100 lin. ft. average cut, .3 ft., $.38 per lin. ft., Chas. Chambers; 5248 S. Wood St.; 6-ft. cinder sidewalk on both sides W. 105th St., from the west curb line of S. Seeley Ave. to the east curb line of S. Leavitt St., 540 lin. ft. of walk to be built, 1.5 average fill, .242 lin. ft. average cut 1.25 ft., $.39 per lin. ft., Chas. Chambers; 6-ft. cinder sidewalk on south side W. 106th St., from the west curb line of S. Seeley Ave. to east curb line of S. Leavitt St., 670 lin. ft. of walk to be built, 1.7 ft average fill, 424 lin. ft. average cut .9 ft., $.39 per lin. ft., Chas. Chambers; 6-ft. cinder sidekalk on east side of Oak Ave., from the south curb line of W. 95th St. to the north curb line of W. 99th St., 1,205 lin. ft. average fill, 1.25 ft., 1,080 lin. ft., average cut .9 ft., $.39 per lin ft., Chas. Chambers; 6-ft cinder sidewalk on south side of W. 77th St., from west curb line of S. Center Ave. to east curb line of S. Ada St., 178 lin. ft. of walk to be built, average fill 1.3 ft., 178 lin. ft., average cut 1.0 ft., $.32 per lin. ft., B. Sullivan, 7020 Rhodes Ave.; 6-ft. cinder sidewalks on a system of streets as follows: North side of 92nd St., west curb line of Vincennes Ave. to a line parallel with and 210 ft. west of west line of Vincennes Ave. and on the west line of Vincennes Ave., from the south curb line of 91st St. to a line parallel with and 100 ft. south of the south line of 92nd St., 654 lin. ft. of walk to be built, average fill 1.7 ft., $.49¾ per lin. ft., Wathall Bros., 5146 Honore St.; 6-ft. cinder sidewalk on a system of streets as follows: Southeast side of Archer Ave., west curb line of S. 43rd Ave. to east curb line of S. 44th Ave., north side of W. 52nd St., west line of S. 42nd Ave. to east curb line of S. 44th Ave., west side of S. 42nd Ave., south line of W. 51st St. to north line of W. 52nd St., both sides of S. 43rd Ave., from south curb line of W. 51st St., produced west to north curb line of W. 52nd St., both sides south 43rd Ct., from southeast curb line of Archer Ave. to north curb line of W. 52nd St., and on east side of S. 44th Ave., from southeast curb line of Archer Ave. to north curb line of W. 52nd St., 4,675 lin. ft. of walk to be built, average fill 1.7 ft., 25 lin. ft. average cut .25 ft., $.35 per lin. ft., Quinn Construction Co.; 6-ft. cinder sidewalk on a system of streets as follows: South side of E. 76th St., west curb line of Ellis Ave. to east line of Ingleside Ave., north side of 77th St., west curb line of Ellis Ave. to east line of Ingleside Ave., south side of 77th St., west curb line of Ellis Ave. to east line of Cottage Grove Ave., both sides E. 78th St., west curb line of Ellis Ave. to east curb line of Cottage Grove Ave., north side of 79th St., west curb line of Ellis Ave. to east curb line of Cottage Grove Ave., west side of Ellis Ave., north curb line of 79th St. to south curb line of 76th St., east side of Ingleside Ave., south curb line of 77th St. to north curb line of 79th St., both sides Drexel Ave., south curb line of 77th St. to north curb line of 79th St., and east side of Cottage Grove Ave., south curb line of 77th St. to north curb line of 79th St., 614 lin. ft. of walk to be built, average fill 3.25 ft., $.42 per lin. ft., B. Sullivan, 7020 Rhodes Ave.; 6-ft. cinder sidewalk on a system of streets as follows: South side of W. 56th Pl., east curb line of S. Lawndale to a line parallel with and 50 ft. east of east line of S. Lawndale Ave., both sides of W. 57th Pl., west curb line of S. Lawndale Ave. to east line of S. Springfield Ave., south side of W. 58th St., west curb line of S. Lawndale Ave. to east curb line of S. Hamlin, north side of W. 58th Pl., west curb line of S. Lawndale Ave. to east curb line of S. Hamlin Ave., north side of W. 59th St., west curb line of S. Lawndale Ave. to east line S. Springfield Ave., east side of S. Lawndale Ave., south curb line of W. 56th Pl. to north curb line of 57th St., west side of S. Lawndale Ave., south curb line of W. 57th St. to north curb line of W. 59th St., and on east side of S. Hamlin Ave., from south curb line of W. 57th Pl. to north curb line of W. 59th St., 4,363 lin. ft. of walk to be built, average fill 1.7 ft., 3,863 lin. ft. average cut 1.7 ft., $.33 per lin. ft., Chas. Chambers; 6-ft. cinder sidewalk on a system of streets as follows: Both sides of west 97th St., west curb line of S. Butler St. to east line of S. Wallace St., both sides of W. 98th St., from west line of Butler St. to east curb line of Parnell Ave., and on both sides of south line of W. 96th St. to north line of W. 99th St., 1,543 lin. ft. of walk to be built, average fill 1.5 ft., 863 lin. ft. .75 ft. average cut, $.37 per lin. ft., Demling & Wendt, 84 La Salle St.; 6-ft. cinder sidewalk on a system of streets as follows: West side Dobson Ave., south line of 81st St. to north curb line of 82nd St., both sides of 82nd St., east curb line of Ellis Ave. to west line of I. C. R. of W., 150 lin. ft. of walk, 1.75 ft. average fill, $.60 per lin. ft., A. L. Strachan & Son, 5737 S. May St.; 6-ft. cinder sidewalks on a system of streets as follows: East side of S. Halsted St., south curb line of W. 95th St. to north curb line of W. 97th St., north side of W. 97th St., east curb line of S. Halsted St. to a line parallel with and 125.9 ft. east of east line of S. Halsted St., 630 lin. ft. of walk to be built, average fill 1.75 ft., $.38 per lin. ft., Chas. Chambers & Son; 6-ft. cinder sidewalk on a system of streets as follows: Both sides of W. 47th Pl., west curb line of S. Leavitt St. to east line of S. Western Ave. Blvd., both sides of W. 48th Pl., west curb line of S. Oakley Ave. to east line of S. Western Ave. Blvd., north side of W. 49th St., west curb line of S. Oakley Ave. to east line of S. Western Ave. Blvd., west side of S. Leavitt St., south line of W. 47th St. to north curb line of W. 47th Pl., both sides S. Oakley Ave., south curb line of W. 47th St. to north curb line of W. 49th St., 3,575 lin. ft. of walk to be built, average fill 1.7 ft., 200 lin. ft. average cut 1.0 ft., $.33 per lin. ft., Chas. Chambers & Son. The contracts have not yet been awarded.

Indiana.

✤Bids will be received until 10 a. m., January 3, by Board of County Commissioners, Daviess County, Washington, Ind., for the construction of two gravel roads in Barr township. Thomas Nuget is Auditor of the county.

✤Bids will be received until 2 p. m., January 3, by Board of County Commissioners, Martinsville, Ind., for the highway improvements, in Adams township. B. E. Thornburgh is Auditor of Morgan County.

✤Bids will be received until 1 p. m., January 3, by Board of County Commissioners Madison, Ind., for the construction of a road in Madison township. Gaylord F. Crozier is Auditor of Jefferson County, Ind.

✤Bids will be received until 1 p. m., January 3, by County Commissioners at Wabash, Ind., for the construction of two macadam roads in Chester township. J. P. Noftzger is Auditor of Wabash County.

✤Bids will be received until 2 p. m., January 2, by Board of County Commissioners, Bloomington, Ind., for the construction of a public highway in Van Buren Township. Horace Blakely is Auditor of Monroe County, Ind.

✤Bids will be received until noon, January 2, by County Commissioners at Delphi, Ind., for the construction of a gravel road in Jackson Township. M. G. Haun is Auditor of Carroll County.

⊙James L. Barnes and Samuel Grauel have secured the contracts for building the Charles Beckley road in Boone Township, Ind., for $10,998.

⊙Advices from Lafayette, Ind., state that Snyder & Barnett have been awarded the contract for the construction of the Phillips road in Wabash Township, for $4,448.

⊙The County Commissioners at Logansport, Ind., have awarded contracts for the construction of roads in Cass County to Barnes & Grau, Logansport; Walter Girton, Logansport; James Pierce, Delphi, Ind.

⊙The County Commissioners at Marion, Ind., have awarded new gravel road contracts as follows: Allen York road, to Bert Small, $5,315; W. H. Highley road, to Bert Small, [illegible], $9,549; W. A. Wimmer road, to Mackey & [illegible] Wimmer road, $6,095.

Iowa.

A resolution has been passed by the City Council of Maquoketa, Ia., empowering the street committee to employ an engineer and assistants to get the grade, etc., for 30 blocks of paving, which, if found layable, will be ordered for next year.

Advices from Amite City, Ia., state that an election was held at the Independence and Natalbany precincts to determine whether a special tax of two mills shall be levied for five years in the Sixth Ward for the purpose of building and maintaining the public roads.

It is proposed to construct a highway between Dubuque, Ia., and Sioux City, Ia., to be known as the Hawkeye Highway. Hon. H. W. Grout, of Cedar Falls, Ia., is interested.

Kansas.

The good roads committee of the Iola Booster Club, Iola, Kan., has prepared plans for the building of a macadam highway extending south to Tulsa and north to Kansas City. Frank Wood is Secretary of the club.

Within a few months the County Commissioners of Shawnee County, Topeka, Kan., intend to purchase a road roller at an estimated cost of $2,500.

The Board of County Commissioners of Reno County, Hutchinson, Kan., has accepted the plans and specifications for the Haston road in Walnut Township, as prepared by Engineer W. B. Harris. Bids for the improvement of the road will be advertised for shortly.

Kentucky.

✤Bids will be received until 3:30 p. m., January 16, by Board of Public Works, Paducah, Ky., for the improvement of the following streets: Broadway, from the I. C. R. R. to 15th St., including 14,325 sq. ft. concrete sidewalks, 820 sq. ft. of concrete driveway, 2,900 lin. ft. concrete gutters, 2,900 lin. ft. granite curbing; Jefferson St., from 11th to 14th Sts., including 23,000 sq. ft. concrete sidewalks, 800 sq. ft. concrete driveways, 3,940 lin. ft. concrete gutters, 3,940 lin. ft. granite curbing, 200 lin. ft. of cast iron drain pipe; North 10th St., from Trimble St. to Burnett St., including 13,300 sq. ft. concrete sidewalks, 380 sq. ft. concrete driveways, 2,520 lin. ft. concrete gutters, 2,500 lin. ft. granite curbing, 500 lin. ft. of cast iron drain pipe. L. A. Washington is City Engineer.

⊙W. O. Sweeney has been awarded the contract by the County Commissioners at Mount Sterling, Ky., for the construction of a five-mile free gravel road in Bethlehem Township for $7,400.

Maryland.

✤Bids will be received until 11 a. m., December 28, by Board of Awards, J. Barry Mahool, President, Baltimore, Md., for grading, curbing and paving with vitrified blocks or bitulithic, Patuxens St., from the north side of Fayette St. to the south side of Philadelphia Rd.

Advices from Baltimore, Md., state that Mayor Mahool will advocate the passage of the $15,000,000 paving loan in his message to the City Council, which is due Jan. 1. B. T. [illegible]

Michigan.

General Manager Freshney, of the Board of Public Works of Grand Rapids, Mich., will soon prepare specifications and secure bids on two street flushing wagons for use in that city next summer.

The Board of Supervisors of Baraga County, L'Anse, Mich., has been petitioned for the construction of a roadway from Munising to Marquette and from Marquette to Nestoria. The construction of this road would make a connecting link in the iron-copper country highway.

The city of Ludington, Mich., will lay 11 blocks of Westrumite asphalt paving next year at an estimated cost of $1.62 per sq. yd., not including curb and gutter. Portions of three streets will be paved and work will begin at the earliest possible moment next spring.

A resolution has been introduced in the City Council of Bay City, Mich., asking that the petitions received in 1907 and again in 1909 asking for a vitrified brick pavement on Madison Ave., from Columbus to Kosciuszko Aves., be further considered.

Mississippi.

✣Bids will be received until 1 p. m., January 4, by Board of Supervisors, Montgomery County, Winona, Miss., for the contract to work the following number links of the public roads of that county for a period of four years from January 1, 1911: Links Nos. 1, 2, 4, 6, 9, 10, 11, 12, 13, 14, 15, 16, 21, 25; 26, 27, 29, 30, 7, 18, 19, 20, 34 and 35 and 5, 32 and 33 in district No. 1, and links numbered 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18, 19; 2, 3, and 13 and 15, in district number 2, and links number 3, 4, 7, 13, 15, 16, 22, 24, and 25, in district number 5. The Board reserves the right to reject any or all bids. The contractor will be required to give bond in a sum equal to the aggregate amount of the contract for the whole period of 4 years. Joe T. Parks, Clerk.

The Board of Supervisors at Brookhaven, Miss., has adopted an order for a special election December 31 on the proposition to issue bonds for constructing permanent roads in District No. 1, of Lincoln County. It is proposed to build about 60 miles of road, which will cost from $100,000 to $150,000.

Missouri.

Ordinances have been introduced in the City Council of St. Joseph, Mo., providing for the resurfacing of the brick paving on Eighth St., Olive to Messanie St., and Messanie St., Eighth to Sixth Sts., with asphalt.

Following bids were received December 6 by the City Council of Springfield, Mo., for street improvement work: Rackliffe-Gibson Construction Co.—Paving with Hassam, patented, class B, on Commercial St., from Grant St. to Euclid Ave., $1.75 per sq. yd.; paving with Hassam on Mt. Vernon St., from Jefferson to Campbell Sts., $1.75 per sq. yd.; paving with Hassam on Commercial St., from Campbell to Lyon Sts., $1.75; on Commercial St., from Lyon to Grant Sts., $1.75 per sq. yd. Jarrett Construction Co.—For concrete curbing on Billings St., from Phillips St. to Grand Ave., $.40 per lin. ft.; four-ft. cement sidewalk on both sides of Calhoun St., from Broad St. to Frisco right-of-way, at $.45 per lin. ft., and $.35 per cu. yd. for grading. The Will F. Plummer Co.—For second class brick pavement on Commercial St., from Euclid Ave. to Broad St., at $1.73 per sq. yd. E. C. Hubbard—For first class cement sidewalk on both sides of Calhoun St., from Broad St. to Frisco right-of-way, at $.44 per lin. ft. and $.20 per cu. yd. for grading. J. Stahl—For concrete curbing on Billings St., from Phillips St. to Grand Ave., at $.42 per lin ft.; for first class four-ft. sidewalk on both sides of Calhoun St., from Broad to Frisco right-of-way, $.48 per lin. ft. and $.25 for grading. H. Proserpi—For concrete curbing on north side of East Elm St., from National Blvd. to Frisco right-of-way, at $.39 per lin. ft. F. C. Page—For concrete curbing on north side of East Elm St., from National Blvd., to Frisco right-of-way, at $.38 per lin. ft.; for first class five-ft. sidewalk on west side of Campbell St., from Olive to Mill Sts., at $.50 per lin. ft. and no cents per cu. yd. for grading T. L. Calloway—For five-ft. first class cement sidewalk on west side of Campbell St., from Mill St. to the south line of the Hodnett property, at $.45 per lin. ft. and $.25 per cu. yd. for grading.

Nebraska.

✣Bids will be received until 2 p. m., December 28, by H. E. Wells, County Clerk, Lincoln, Neb., for grading North 14th St., from the end of the paving to and extending north to Harris St. According to the plans and specifications on file at the office of the County Clerk, the estimate is as follows: Estimated amount of embankment 30 ft. roadway, slope 1½ to 1, 16,603.2 cu. yds. Estimated amount of excavation 30 ft. roadway, slope 1 to 1, 7,000.00 cu. yds. Estimated amount to be borrowed, 9,603.2 cu. yds. It is estimated that the amount of excavation from the cuts will fill from Garber Ave. to Oak St. The fill from Oak St. to the end of the paving to be taken from ditches along the sides.

New Jersey.

⊙O'Reilly Bros, 148 Ocean Ave., Jersey City, N. J., have been awarded the contract in that city for the construction of roadways in Bayside Park, N. J., for $4,278. The work includes 125 yds. of concrete walk at $1.44 per sq. yd., 160 lin. ft. of concrete curb at $0.45 per lin. ft., 2,000 sq. yds. of macadam, including excavation, etc., at $0.70 per sq. yd., 1,850 lin. ft. of concrete gutters at $0.72 per lin. ft., 12 manholes at $15 each, 20 catch-basins at $19 each, 1,350 lin. ft. of 8-in. sewer at $0.53 per lin. ft., and 12 8-in. Y's at $1.50 each. Total bid about $4,278. A. T. Hastings, Jr., Sec'y., Shade Tree Commission. Bids were opened Dec. 13.

New Mexico.

The city of Raton, N. Mex., is about to let contract for the completion of $60,000 of street improvements, authorized by the citizens of the first improvement district, comprising the business district and a portion of the more important residential district. The general plans for this undertaking complete the grading of all streets, the construction of sidewalks, street crossings, storm sewers for the avenues, the paving of street gutters and the parking of all streets and avenues of the district.

The Territorial Good Roads Commission, Santa Fe, N. Mex., has decided to complete El Camino road from Santa Fe to Albuquerque, this winter. The road is to be built from Algodones southward. The Good Roads Commission is at present building the scenic highway from Santa Fe to the Pecos River, and the new Santa Fe trail from Santa Fe to Las Vegas. The Albuquerque road will connect with both of these roads.

New York.

✣Bids will be received until 11 a. m., Dec. 23, by Cyrus C. Miller, President of Borough of the Bronx, New York, for five street improvement contracts, the largest being No. 3. For regulating, grading, setting curbstones, flagging the sidewalks, laying crosswalks, building approaches, and placing fences in Boston Road, from White Plains Road to north line of the city. The Engineer's estimate of the work is as follows: 103,000 cu. yds. of earth excavation, 60,200 cu. yds. of rock excavation, 120,500 cu. yds. of filling, 31,700 lin. ft. of new curbstone, furnished and set, 113,500 sq. ft. of new flagging, furnished and laid, 37,000 sq. ft. of new bridgestone, for crosswalks, furnished and laid, 3,200 cu. yds. of dry rubble masonry, in retaining walls, culverts and gutters, 300 cu. yds. of rubble masonry in mortar, 550 lin. ft. of vitrified stoneware pipe, 12 inches in diameter, 1,680 lin. ft. of vitrified stoneware pipe, 15 inches in diameter, 1,225 lin. ft. of vitrified stoneware pipe, 24 inches in diameter, 5,000 ft. B. M. of lumber, furnished and laid, 8,300 lin. ft. of new guard rail, in place, 340 cu. yds. of concrete, 20,500 pounds of steel bars, in place, 5,000 pounds of cast iron, in place, 17 inlets (Type "A"), complete, 13 inlets (Type "B"), complete. The time allowed for the completion of the work will be 350 working days. The amount of security required will be $80,000.

✣Bids will be received until noon, Dec. 23, by George Cromwell, President of the Borough of Richmond, Borough Hall, St. George, New Brighton, New York City, for furnishing all labor and materials required for one 15-gross ton steam road roller with equipment.

John Nelson of Herkimer, N. Y., will probably be awarded the contract by the town board of Inlet, N. Y., for the construction of a public highway from Sixth Lake Dam to Lime Kiln Lake, a distance of 2.05 miles, for $9,630. Bids were opened Dec. 10 by William E. Bill.

Advices from Lancester, N. Y., state that engineers have completed the survey of Broadway through that town and Cheektowaga, from which the plans and specifications for a state road will be made, which work will require about a month's time. As soon as completed, bids will be asked and the contracts subsequently let.

Advices from Voorheesville, N. Y., state that William Gordon, John Jahn, Fred Mosley and William Davis, of the State Engineer's office, are making surveys for the proposed state road, which will begin at the Joslin property at the southeast corner of the village and continue to New Salem through Maple Ave. The surveys have been made from New Salem to the village limits.

Surveyors from the State Highway Department have been in Akron, N. Y., surveying and making plans for the new state road to be built next year from the south part of the town on the Scharm road to the Tonawanda Creek on the north. The road will be built from the Grant Club down Buell, up Main to Cedar, down Cedar, and will connect with the Lewis Rd. The road will be surfaced with rock asphalt.

The Common Council of Rensselaer, N. Y., is considering the proposition of the State Highway Commission, to cover the Columbia turnpike, from the pavement at the end of Columbia St., to the State road, which begins at the eastern end of the bridge over the Boston & Albany Railroad, with a 16-ft. bituminous roadbed at the expense of the state.

North Carolina.

Plans have been prepared for the construction of 15,000 sq. yds. of Beach Island gravel cement roads in Whiteville, N. C., at an estimated cost of $0.59¼ per sq. yd. The roads will be constructed on a sand clay foundation. W. Ross Davies of Whiteville, is official in charge of the work.

Ohio.

✣Bids will be received until noon, January 3, by John W. Lowe, Director of Public Service, Circleville, O., for the construction of vitrified brick pavement on Court St.

✣Bids will be received until 11 a. m., Dec. 27, by Board of County Commissioners, Akron, O., for grading, draining, curbing and paving of county roads from the north line of the city of Akron through Portage, Cuyahoga Falls, Stow and Hudson townships, to a point in Twinsburg townships, petitioned for by H. B. Graham et al. A certified check for $1,000 payable to the Treasurer of Summit County must be filed with each bid.

⊙The trustees of Springfield Township, Lockland, O., have awarded a contract to Charles Hinkley at $.69 per yd., for furnishing gravel on Compton Rd. and a contract to Michael Dittmeyer at $.59 per yd., for furnishing gravel on Bank Lick Rd.

⊙N. Ruebel, Bridgetown, O., has been awarded the contract by the county commissioners at Cincinnati, O., for the improvement under Specifications No. 35, of the Hill Road, near the residence of Jacob Stephan in Colerain township, for $1,840. Bids were opened by Fred Dreihs, County Clerk, Dec. 9.

⊙Contract for the paving with brick of Herschel Ave., from Observatory Rd. to the old corporation line, Cincinnati, O., has been awarded to Moran & Springmeler, for $7,257. William Fogarly received the contract for improving Kerper Ave., from Melbourne to Ridgeway Avs., with macadam, for $1,472. J. M. Quill was awarded the contract for paving Plum St., from Court to South Canal Sts., with granite, for $5.618.

⊙The City Council of Gulfport, Miss., has

✣indicates work now open for bids. ⊙indicates a contract let recently.

let the contract for 10.000 sq. yds. of sidewalks to J. B. Silver & Son, of Alliance, O.

Edward J. Ryan, who recently was awarded the contract for the construction of Elberton Ave., from State Ave., to Bassett Rd. in Cincinnati, O., for approximately $200,000, has just started work on the same. The stretch of street to be improved is a mile and a half long. The work includes laying a 24-in. sewer, changing in a number of places the line of the street so as to take it out of reach of dangerous embankments, moving water and gas mains according to the new lines, widening the street to a uniform width, and paving it with granite blocks.

The Humane Society of Cincinnati, O., has petitioned the boards of public safety and service for the paving with granite of Reading Rd., from Shillito St. to Maple Ave.

City Engineer Shipley, of Cincinnati, O., has submitted the following estimates to Service Director Sundmaker for street paving: Cass Ave., with macadam, $19,749; Young St., with macadam, $5,110; Underwood Ave., with macadam, $6.438; Summer St., with granite, $15,621, and Rice St., with brick, $13,736.

The Board of County Commissioners at Canton, O., is planning to build another eight miles of permanent highway improvements in Stark County in 1911. It is estimated that the total cost will be $119,000. Bids for this improvement will be advertised for in April, so that work may begin in May. It is estimated that work in Lexington Township will cost $34,000; in Paris Township, $31,000, and in Caston, $17,000. Phil. H. Weber is City Engineer.

Advices from Akron, O., state that Twinsburg Township has sold bonds to the amount of $7,000 to do its part towards building the Akron-Hudson paved road. John W. Payne is City Engineer.

The City Council of Canton, O., has been petitioned by the Gilliam Manufacturing Co., of that city, to order the paving of Virginia Ave. Phil H. Weber is City Engineer.

The County Commissioners of Hancock County, Findlay, O., have prepared the annual application for the state aid for road repair from the State Highway Department A total of $49.729 is available for repair and maintenance of highways located in the county.

The County Commissioners at Wooster, O., have been petitioned for the improvement of the county road starting from the bridge over Apple Creek and leading up over Madison Hill past the experiment station for a distance of one mile.

The County Commissioners at Jefferson, O., have been petitioned for the construction of the Jefferson-Colebrook macadam road. The road will be a 9-ft. tar top road, with a dirt side road, and it will be about 12.5 miles long. This road will run from Colebrook center to the south of Jefferson Township line.

The County Commissioners at Jefferson, O., have been petitioned for a brick pavement to extend from Conneaut westward to Amboy on the main road. The petition calls for a 20-ft. roadway to extend from the present corporation line to the Kingsville Township line, just west of the Nickel Plate crossing above Amboy. The distance is about three miles.

Oregon.

A movement has been started in Douglas County, Roseburg, Ore., with a view of securing improved highways throughout the county. It is planned to issue bonds in the sum [illegible] road engineer to prepare plans and specifications.

The special committee authorized by the City Council of Altoona, Pa., to look over the paving methods in vogue in other municipalities and report as to their relative desirability, has recommended bitulithic and asphalt blocks for resurfacing in Altoona. Chas. D. Wierbach is City Engineer.

Pennsylvania.

⦿The contract for the construction of about 80,000 yds. of street paving in Portsmouth, Va., next spring, has been awarded to the Barber Asphalt Co., of Philadelphia, Pa. The bid was $1.73 per sq. yd., and the specifications require that an average of one and a half ins. of Trinidad lake asphalt shall form the surface of the pavement.

⦿The Norfolk County 'Permanent Road Commission of Norfolk, Va., has awarded a contract for grading the new road to be built from Tanner's Creek cross roads through the lands of J. D. Guy and others to a point about one mile this side of Ocean View, where it will join with a road already graded. The contract was awarded to the Southern States Engineering & Equipment Co., of Norfolk, for $2,395. Bids for macadamizing the new road are now being asked for.

The citizens of Fairfax, Va., have subscribed $41.500 for the extension of the macadamized road from Fairfax Courthouse to Washington.

A good roads club was organized in Tazewell, Va., Dec. 13, to urge the issuance of bonds in the sum of $500,000 for the construction of good roads in Tazewell County. Frank H. Moss, of Burkes Garden, was elected President of the club.

Texas.

⦿C. E. Johnson was recently awarded a contract by the county commissioners of Freestone County, Fairfield, Tex., for the construction of 35 miles of clay and sand roads for $50,000. The amount of excavation required is 150,000 cu. yds. J. Gibbons Browne of Houston, Tex., is the Engineer and J. T. Keys of Cotton Gin, Tex., has charge of the work.

The city of Canadian, Tex., voted Dec. 8, the issuance of bonds for grading streets and putting in crossings. H. Hoad is Mayor.

Mayor E. W. Brown, of Orange, Tex., who was recently awarded the contract for the construction of the Transcalcasieu Rd. through the Sabine River marsh from Orange to a point of high land near Vinton, has sublet the work. Final surveys are being made by Engineer L. T. Daniels, of Beaumont, Tex., for the work.

[illegible] road improvement bonds for precinct No. 1, Taylor County, including the city of Abilene, Tex., have been sold. The Commissioners Court plans to improve about 75 miles of road in precinct No. 1 at an estimated cost of $2,000 per mile.

The County Commissioners of Valverde County, Del Rio, Tex., have employed a road commissioner to map out a course of road improvement for the county.

The City Council of Austin, Tex., has adopted plans for the parking of University Ave. The street is 120 ft. wide, and the work planned is two 15-ft. sidewalks, two 27½-ft. streets and a 35-ft. park in the center.

Rapid progress is being made on the improvement of the macadam roads in the fourth Commissioners Precinct of Williamson County, Taylor, Tex., by the five crews of the Texas Building Co., of Dallas, Tex., and the two crews of Commissioner Sol. G. Yakey. The following roads are being improved: Taylor-Circleville-Granger Rd., north, nine miles; Taylor-Sandoval Rd., southeast, ten miles; Taylor-Elm Grove Rd., northeast, 13 miles; Taylor-Hutto Rd., west, 5 miles; Taylor-Thorndale Rd., east, 10 miles. This makes a total of 47 miles of macadamized roads now in course of construction, and does not include the city's macadamized street; $200,000 is being spent in the work.

Washington.

The City Council of North Yakima, Wash., plans for nearly eight more miles of paved streets, building of the West Side drain, extension of lighting, fire protection and sewers, building of sidewalks and curbings, new central fire station and remodeled City Hall. The School Board will build two new grade schools, an addition to another and buy three school sites.

The City Council of Prosser, Wash., contemplates paving 14 blocks of streets. Sixth St., from the Yakima River bridge to the high school block and the side streets in the business section are to be paved.

A petition will be presented to the City Council of Dayton, Wash., soon, asking that the question of issuing bonds be submitted to a vote. It is planned to pave the streets in the business section of the city. It is estimated that the cost of paving Main St. for five blocks and Front, First, Second, Third, Fourth and Fifth Sts. for two blocks will cost $20,000.

The Pacific Highway Association, which was organized to work for an international highway extending from Vancouver, B. C., to the border line of Mexico, is sending out circulars urging the good roads enthusiasts of the Pacific Coast to co-operate in persuading the Touring Club of America to send A. L. Westgard, of New York city, over the entire route this winter to map out the best route. Frank M. Fretwell is Secretary of the association, Seattle, Wash.

WATER-WORKS AND SEWERAGE

Arizona.

The city council of Phoenix, Ariz., called an election Dec. 17 to vote on the proposition of purchasing the sewer system of the Phoenix Sewer & Drainage Co., for $60,000.

California.

⦿Hutchinson Co. has been awarded the contract in Alameda, Cal., for the construction of a sewer in Grand St., between Clinton and Dayton Aves., for $.58 per lin. ft. for 6-in. pipe and $.60 per lin. ft., for 6-in. Y branches.

The Chamber of Commerce of Niles, Cal., is agitating the building of an outlet sewer to the bay from Niles through Centerville and Newark, a distance of nearly eight miles. The estimated cost of the main sewer, as computed by the county surveyor, would be about $50,000.

Definite steps have been taken toward the establishment of a municipal water system by the board of aldermen of Watsonville, Cal., which received an offer from the Watsonville Water Co., for the sale of its property and engaged the services of Engineer C. E. Moore of Santa Clara, Cal., to investigate conditions.

J. J. McNamara, president of the board of trustees of Martinez and City Attorney George F. Tormey, have obtained an option from the Houghton estate on 41 acres of water-front property. If the land is bought it is planned to establish a salt-water fire protection system, as well as municipal piers. The proposition will be submitted to the voters of Martinez in the near future.

The Pine Mountain Water Co. has been incorporated in Berkeley, Cal., with a capital stock of $3,000,000. The directors of the company are Duncan McDuffie, C. L. Cory, W. T. Vincent, Jr., and W. C. Crud, all of Berkeley.

City Engineer Steward of Anaheim, Cal., has submitted his plans for a sewer system for that city to the board of trustees. The board has accepted the plans and instructed the city attorney to take the necessary steps for a $90,000 bond issue to pay the costs.

Advices from Los Angeles, Cal., state that the Pasadena Lake Vineyard Land & Water Co. will lay all necessary pipes and build a

✣indicates work now open for bids. ⦿indicates a contract let recently.

3,000,000-gal. reservoir near Devil's Gate to furnish the northwestern part of the city of Pasadena, including what has been known as the "dry tract."

The Atchison, Topeka & Santa Fe Railway has planned to build a new pumping plant at Stockton, Cal., at a cost of $8,700.

Colorado.

⊙P. J. Ryan has been awarded the contract for constructing the sewer district No. 5 in Pueblo, Colo., for $.67 per ft., $44 for manholes, $44 for flush tanks and $107 for inspection pipe.

The city council of Golden, Colo., has taken action in the matter of establishing a sewer system on the north side of Clear creek. An ordinance has been passed creating the new district and arrangements have been made for issuing bonds for the entire cost.

An expenditure of $81,164, which will add 413,371,666 gals. storage capacity to the Colorado Springs water system, is planned by Mayor Avery of Colorado Springs. The work of improvement outlined for next year at mountain reservoirs is as follows: Concrete spillway at reservoir No. 8, with filling, at a cost of $562, to give an increased storage capacity of 44,200,000 gals. Raising dam of reservoir No. 2, 10 ft., at a cost of $19,059, to increase capacity 90,000,000. To complete No. 4, by fills, rip-rapping and puddling, at a cost of $17,225, to increase capacity by 244,089,146 gals. No. 5, constructing fill-back, at a cost of $3,667, to increase capacity by 32,582,520 gals. Lake Moraine, repairing and cleaning, at a cost of $40,650, to increase capacity by 2,500,000. Estimates were also furnished on the proposed Crater reservoirs, Nos. 1 and 2, and reservoir No. 1 of the original water system. These latter, however, will not be constructed next year. The estimated cost is $209,621.60.

District of Columbia.

✣Bids will be received until 2 p. m., January 3, by Commissioners of the District of Columbia, for the construction of sewers in the District of Columbia. Cuno H. Rudolph is one of the commissioners.

It is reported that the War Department, Washington, D. C., has made an appropriation of $62,000 for the construction of a new waterworks system at Fort Niagara, N. Y.

Florida.

⊙The Southern Contracting Co. has been awarded the contract by the city of Jacksonville, Fla., for sinking a new artesian well in Springfield Park for $3.49 per ft.

Georgia.

⊙Bids for the Peachtree creek disposal plant and the intercepting sewers to connect with the Butler St., and the Orme St., trunk sewers were received Dec. 12 by the bond commission and sewer committee of the city council of Atlanta, Ga. Seventeen bids were received in all, five for the disposal plant, as follows: Chester A. Dady of New York, $195,363; Haard & Wurm of New York, $200,105; Piedmont Construction Co., of Atlanta, $208,658; Nichols Construction Co., Atlanta, and Municipal Engineering Co., Chattanooga, Tenn. Twelve bids were received for the sewer work, the bidders being C. W. Lane & Co., of Atlanta; the Noll Construction Co., of Chattanooga, Tenn.; the Wright & Wadley Co., of Macon, Ga.; the Piedmont Construction Co., of Atlanta; the Nichols Construction Co., of Atlanta; Chester A. Dady, of Brooklyn, N. Y.; the Dyard Construction Co., of Atlanta; H. C. McBride, of Carlinsville, Ill.; F. J. McBride of Norfolk, Va.; the T. W. Rosser Engineering & Construction Co., of Wilkesbarre, Pa.; the B. C. Milner Sons Co., of Louisville, Ky.; James Ferry & Sons, of Pittsburg, Pa. Chester A. Dady of Brooklyn, N. Y., at $193,363, was lowest bidder on the disposal plant. The Nichols Construction Co., of Atlanta, at $44,399 for section 5, $43,327 for section 6, $33,851 for section 7 and $38,448 for section 8 was awarded contract for four sections of the sewers and the Dyard Construction Co., of Atlanta, at $35,548, was awarded contract for section 4 of the sewers.

The Fulton County Commissioners, Atlanta, Ga., have decided to assist in the construction of Atlanta's sewage system to the extent of building a half-acre sprinkling unit. The county is to do the excavating, put in the cement bottom and wall and put in place all crushed rock. The city is to furnish all pipe and other machinery.

As soon as the plans can be perfected according to the law, an election will be held in Macon, Ga., to determine whether the people shall own and operate the water system. The board of arbitration has fixed a price of $699,000 on the plant.

Plans will be prepared by Jan. 1 for the construction of a new water works for Douglasville, Ga., at an estimated cost of $20,000. The contract will be let shortly after Jan. 25. The J. B. McCrary Co., of Atlanta, Ga., is Engineer. J. R. Hutcheson of Douglasville has charge of the work.

Illinois.

✣Bids will be received until 3 p. m., December 24, by Joseph Burkart, Jr., City Clerk, La Salle, Ill., for the construction of a water supply well. Information can be obtained from the city engineer. Official ad will be found elsewhere in this issue.

✣Bids will be received until 8 p. m., December 22, by Board of Local Improvements, Waukegan, Ill., for the construction of sewers in a number of streets. Fred W. Buck is President of the Board and Alvah L. Rogers is Secretary.

⊙Jno. Mohr & Sons, 340 W. Illinois St., Chicago, Ill., have been awarded the contract for furnishing and delivering to the Chicago Ave. pumping station, Chicago Ave. & Lincoln Park Blvd., the 3½-in. boiler tubing for $.19 per lin. ft. B. J. Mullaney is commissioner of public works.

⊙Jno. Mohr & Sons have been awarded the contract for furnishing and delivering 3½-in. boiler tubing to the Chicago Ave. pumping station, Chicago Ave. & Lincoln Park Blvd., by B. J. Mullaney, Commissioner of Public Works, City of Chicago, Room 705 City Hall, at $.19 per lin. ft. Specifications published in Engineering-Contracting November 30th.

The city council of Aurora, Ill., has again been petitioned for the construction of a sewer system in Rosewood Ave., by residents of that avenue. The proposed sewer, which will follow the west side of the street, will begin at a point 427 ft. south of North Ave., and will drain south to Bluff St., where it will turn and empty into the river.

The Brady Foundry Co., 35th st. and Ashland ave., Chicago, was the low bidder for furnishing cast iron suction and gland to the Roseland pumping station, 104th st. & C. & W. I. R. R., Chicago, Ill. Bids were opened December 3d, 1910, by B. J. Mullaney, Commissioner of Public Works, Room 705 City Hall. The bid submitted was $.05¾ per lb.; the contract has not yet been awarded.

The Illinois Stoker Co., 204 Dearborn st., Chicago, has been awarded the contract for furnishing the chain grate stokers and stoker engines to the Roseland pumping station, 104th st. & C. & W. I. R. R., by B. J. Mullaney, Commissioner of Public Works, Room 705 City Hall. The contract price is $4,190.

The Western Valve Co., 179 Lake St., Chicago, at $1,494, was low bidder at Chicago, Ill., for furnishing and delivering two 42-in. gate valves to the Roseland pumping station, 104th St. & C. & W. I. R. R.

Following are the low bids received by the Board of Local Improvements, City of Chicago, Chas. A. V. Standish, Sec'y, Room 302 City Hall, for constructing sewers in the following streets (bids opened Dec. 12th, 1910.): E. 104th St., from 275 ft. E. of E. line of Wabash Ave., to S. State St., 645 lin. ft., 1 ft. tile pipe, average depth 10 ft., $1.50 per ft. S. Wabash Ave., from first Alley S. of E. 103rd Pl. to 1273 ft. N. of W. line of 107th St., 855 lin. ft. 12-in. tile pipe, average depth 8.5 ft., $1.25 per ft., 12 Manholes and 12 Catch Basins, total $2,036, Christina Fosco, 814 Des Plaines St.; Balmoral Av. from N. Robey St. to N. Winchester Av., 420 lin. ft. 20-in. tile pipe double strength, 9.6 ft. average depth, $2.50 per ft., Balmoral Av. from N. Winchester Av. to N. Lincoln St., 420 lin. ft. 18-in. tile pipe, double strength, 8 ft. average depth, $2.00 per ft., N. Lincoln St. from Balmoral Av. to 620 ft. North, 630 lin. ft. 15-in. tile pipe, 8 ft. average depth, $1.60 per ft., N. Lincoln St. from 620 ft. North to Bryn Mawr Av., 640 lin. ft. 1-ft. tile pipe, 8 ft. average depth, $1.40 per ft. Wing sewer, 15 lin. ft. 15-in tile pipe, 8 ft. average depth, $1.60 per ft., 16 Manholes and 12 Catch Basins, total $3,818, Jos. Savaiano; Manistee Av. from E. 83rd St. to E. 84th St., 670 lin. ft. 20-in. tile pipe, double strength, 10.5 ft. average depth, $2.65 per ft., Manistee Av. from E. 84th St. to E. 85th St., 670 lin. ft. 18-in. tile pipe, $2.00 per ft., Manistee Ave. from E. 85th St. to E. 86th St., 670 lin. ft. 15-in. tile pipe, 8 ft. average depth, $1.60 per ft., Manistee Ave., from E. 86th St. to E. 87th St., 670 lin. ft. 12-in. tile pipe, 6.5 ft. average depth, $1.20 per ft., 20 Manholes and 31 Catch Basins, total $4,991, Thos. Burke, 4648 McLean Ave.; Phillips Ave. from E. 90th St. to E. 91st St., 670 lin. ft. 15-in. tile pipe, 6.5 ft. average depth, $1.50 per ft., Phillips Ave from E. 91st St. to E. 92nd St., 630 lin. ft. 12-in. tile pipe, 7 ft. average depth, $1.50 per ft., 10 Manholes and 10 Catch Basins, total $3,438, Christina Fosco; N. 40th Ave. from Diversey Ave. to Schubert Ave., 669 lin. ft. 2-ft. brick sewer, single ring, 12 ft. average depth, $3,00 per ft., N. 40th Ave. from Schubert Ave to Wrightwood Ave., 670 lin. ft. 15-in. tile pipe, 10 ft. average depth, $1.43 per ft., Parker Ave., from N. 40th Ave. to N. 41st Ave., 671 lin. ft. 15-in. tile pipe, 8.5 ft. average depth, $1.35 per ft., Parker Ave. from N. 41st Ave to 320 ft. West, 360 lin. ft. 12-in. tile pipe, 8.5 ft. average depth, $1.23 per ft., Schubert Ave. from N. 40th Ave. to 210 ft. N. of 41st Ave., 910 lin. ft. 12-in. tile pipe, 9 ft. average depth, $1.23 per ft., Wing Sewers, 70 lin. ft. 12-in. tile pipe, 8.5 ft. average depth, $1.23 per ft., 25 Manholes and 31 Catch Basins, total $5,519, Christina Fosco; W. 40th St. from S. Western Ave. to S. Rockwell St., 1,325 lin. ft. 3-ft. double ring, brick sewer, 12.5 ft. average depth, $4.50 per ft., S. Rockwell St., from W. 40th St. to W. 39th St., 325 lin. ft. 3-ft. double ring brick sewer, 13.7 ft. average depth, $4.50 per ft., S. Rockwell St., from W. 39th Pl. to 110 ft. North, 150 lin. ft. 12-in. tile pipe, 8 ft. average depth, $1.25 per ft., W. 39th Pl. from S. Rockwell St. to Archer Ave., 480 lin. ft. 3-ft. double ring brick sewer, 12.7 ft. average depth, $4.50 per ft., W. 39th Pl. from Archer Ave. to S. California Ave., 915 lin. ft., 2-ft. single ring brick sewer, 12.8 ft. average depth, $3.10 per ft., W. 39th Pl. from S. California Ave. to S. Francisco Ave., 675 lin. ft. 15-in. tile pipe, 10.8 ft. average depth, $1.45 per ft., W. 39th Pl. from S. Francisco Ave. to S. Sacramento Ave., 680 lin. ft. 12-in. tile pipe, 9.5 ft. average depth, $1.25 per ft., W. 39th Pl. from S. Rockwell St. to alley W. of S. Campbell Ave., 525 lin. ft. 12-in. tile pipe, 8.5 ft. average depth, $1.25 per ft., W. 43rd St. from S. Western Ave. to S. Rockwell St., 1,325 lin. ft. 3½ ft. double ring brick sewer, 14.5 ft. average depth, $5.00 per ft., W. 43rd St. from S. Rockwell St. to S. California Ave., 1,325 lin. ft. 3-ft. double ring brick sewer, 13.5 ft. average depth, $4.50 per ft., W. 43rd St. from S. California Ave. to S. Francisco Ave, 675 lin. ft. 2½-ft. double ring brick sewer, 12.5 ft. average depth, $3.75 per ft., W. 43rd St. from S. Francisco Ave. to S. Richmond St., 335 lin. ft. 2-ft. single ring brick sewer, 11.7 ft. average depth, $3.10 per ft., Archer Ave. from W. 39th Pl. to W. 39th St., 475 lin. ft. 12-in. tile pipe, 10.7 ft. average depth, $1.25 per ft., Archer Ave. from W. 39th Pl. to S. California Ave., 1,125 lin. ft. 2½-ft. double invert brick sewer, 13.5 ft. average depth, $3.75 per ft., Archer Ave. from S. California Ave. to S. Sacramento Ave., 1,730 lin. ft. 2-ft. single ring brick sewer, 11.5 ft. average depth, $3.10 per ft., S. Artesian Ave. from W. 40th St. to Alley S. of W. 39th St., 510 lin. ft. 12-in. tile pipe, 9 ft. average depth, $1.25 per ft., S. Artesian Ave. W. 40th St. to a point 660 ft. S. of W. 40th St., 665 lin. ft. 15-in. tile pipe, average depth 10 ft., $1.45 per ft., S. Artesian Ave., 660 ft. S. of W. 40th St. to W. 42nd St., 665 lin. ft. 12-in. tile pipe, average depth 9 ft., $1.25 per lin. ft., S. Artesian Ave., W. 43rd St. to W. 42nd St., 665 lin. ft. 15-in. tile pipe, average depth 10.5 ft., $1.45 per ft., S. Campbell Ave., W. 40th St. to alley S. of W. 39th St., 505 lin. ft. 12-in. tile pipe, average depth 8.5 ft., $1.25 per ft., S. Campbell Ave., W. 40th St. to 660 ft. S., 665 lin. ft. 15-in. tile pipe, average depth 10.5 ft., $1.45 per lin. ft., S. Campbell Ave., 660 ft. S. to W. 42nd St., 665 lin. ft. 12-in. tile pipe, average depth 8 ft., $1.25 per ft., S. Campbell Ave., W. 43rd St. to W. 42nd St., 665 lin. ft. 15-in. tile pipe, average depth 10.5 ft., $1.45 per ft., S. Maplewood Ave., W. 40th St. to a point 660 ft. S., 660 lin. ft. 15-in tile pipe, average depth 10.5 ft., $1.45 per ft., S. Maplewood Ave., 660 ft. S. to W. 42nd St., 695 lin. ft. 12-in. tile pipe, average depth 8.5 ft., $1.25 per ft., S. Maplewood Ave., W. 43rd St. to W. 42nd St., 660 lin. ft. 15-in. tile pipe, average depth 10.5 ft., $1.45 per ft., S. Rockwell St., W. 40th St. to W. 40th Pl., 555 lin. ft. 18-in. double strength tile pipe, average depth 12 ft., $2.25 per ft., S. Rockwell St., W. 40th Pl. to Montgomery St., 385 lin. ft. 15-in. tile pipe, average depth 11 ft., $1.45 per ft., S. Rockwell St., Montgomery St. to W. 43rd St., 1,085 lin. ft. 12-in. tile pipe, average depth 10.5 ft., $1.25 per ft., S. Talman Ave., W. 43rd St. to W. 42nd St., 665 lin. ft. 12-in tile pipe, average depth 11.5 ft., $1.25 per ft., S. Washtenaw Ave., W. 43rd St. to W. 42nd St., 665 lin. ft., 12-in. tile pipe, average depth 10.5 ft., $1.25 per ft., S. Fairfield Ave., W. 43rd St. to W. 42nd St., 665 lin. ft. 12-in. tile pipe, average depth 10.5 ft., $1.25 per ft., W. 42nd St., 1st alley W. of Rockwell St. to 1st alley E. of California Ave., 970 lin. ft. 12-in. tile pipe, average depth 8.5 ft., $1.25 per ft., S. California Ave., W. 39th Pl. to W. 40th St., 320 lin. ft. 18-in. double strength tile pipe, average depth 11.7 ft., $2.25 per ft., S. California Ave., W. 40th St. to W. 40th Pl., 340 lin. ft. 12-in. tile pipe, average depth 11.7 ft., $1.25 per ft., S. California Ave., Archer Ave. to 655 ft. S., 655 lin. ft. 18-in. double strength tile pipe, average depth 10.7 ft., $2.25 per ft., S. California Ave., 655 ft. S. to W. 43rd St., 985 lin. ft. 12-in. tile pipe, average depth 10 ft., $1.25 per ft., S. Mozart St., W. 43rd St. to W. 42nd St., 660 lin. ft. 15-in. tile pipe, average depth 9.7 ft., $1.45 per ft., S. Mozart St., W. 42nd St. to 1st alley S. of Archer Ave., 515 lin. ft. 12-in. tile pipe, average depth 8 ft., $1.25 per ft., S. Francisco Ave., W. 43rd St. to 1st alley S. of Archer Ave., 900 lin. ft. 12-in. tile pipe, average depth 8.6 ft., $1.25 per ft., W. Richmond St., W. 43rd St. to W. 42nd St., 665 lin. ft. 12-in. tile pipe, average depth 8.9 ft., $1.25 per ft., W. 40th St., S. California Ave to S. Francisco Ave., 665 lin. ft. 15-in. tile pipe, average depth 9.7 ft., $1.45 per ft., W. 40th St., S. Francisco Ave. to S. Sacramento Ave., 680 lin. ft. 12-in. tile pipe, average depth 8 ft., $1.25 per ft., W. 40th Pl., Archer Ave to S. Francisco Ave., 710 lin. ft. 15-in. tile pipe, average depth 10.5 ft., $1.45 per ft., S. Francisco Ave., W. 40th Pl. to Archer Ave., 565 lin. ft. 12-in. tile pipe, average depth 9 ft., $1.25 per ft., W. 40th Pl., S. Rockwell St. to Talman Ave., 305 lin. ft. 15-in. tile pipe, average depth 10.8 ft., $1.45 per ft., Brighton Pl., Archer Ave., to W. 40th Pl., 785 lin. ft., average depth 10.5 ft., $1.25 per lin. ft., S. Talman Ave., W. 40th Pl. to a point 685 ft. N., 685 lin. ft. 12-in. tile pipe, average depth 8.5 ft., $1.25 per lin. ft., Montgomery St., Archer Ave. to S. Rockwell St., 1,435 lin. ft. 12-in. tile pipe, average depth 8.7 ft., $1.25 per ft., 268 Manholes and 332 Catch Basins, total $72,987, American Engineering & Construction Co., 59 S. Clark St., Chicago; contractors to take care of all water service pipes crossing their excavations. The contracts have not yet been awarded.

Indiana.

No bids were received Dec. 9 by the Marion, Ind., board of public works for the construction of the proposed sewer to be known as the Bundy sewer between Second and Third Sts.

Advices from South Bend, Ind., state that preliminary work on the proposed new sewer to drain the south end of the city is progressing rapidly under direction of City Engineer William S. Moore. Surveyors are at work getting a line on the land through which the route of the sewer will be. The cost will be in the neighborhood of $100,000. It will probably run from South Michigan St., diagonally southeast to the river, coming out at a point a short distance above the Sample St. bridge. The new sewer will be made of concrete with a diameter of probably 12 ft

Iowa.

✣Bids will be received until Deember 27, by B. S. McCully, City Clerk Jefferson, Ia., for furnishing survey with duplicate maps, profiles, detail drawings, specifications, estimates and reports for a sewerage system in that city.

✣Bids will be received until Dec. 30, by City Clerk of Pella, Ia., for the installation of approximately 280 ft. of 10-in. and 420 ft. of 8-in. sewer, four manholes and one flush tank. A. Kuyper is City Clerk.

⊙W. E. Rosecrans, of Ames, Ia., has been awarded the contract by the city of Hebron, Neb., for furnishing the material and the construction of lateral sewers for Sanitary Sewer District No. 1, for $8,888. The work includes 440 ft. of 8-in. sewer, one manhole, district No. 1, and 11,800 ft. of 8-in. pipe, 120 ft. of 8-in. cast iron pipe, 22 manholes, 500 ft. of half-in. service pipe and four flush tanks. Bids were opened by Mayor C. M. Smith, Dec. 12.

The city council of Sac City, Ia., has had plans and specifications prepared for the construction of a sanitary sewer. W. H. Townsend is Mayor and J. S. Shannon is City Clerk.

The Commercial Sewer Co., of LaPorte City, Ia., has been incorporated with a capital stock of $6,000. The incorporators are A. Van Valkenburg, H. B. Lizer, C. P. Herring, J. C. Graham, S. J. Tedford, H. J. Blanchaine, J. W. Herd and C. E. Ashley.

Kansas.

✣Bids will be received until 8 p. m., Jan. 3, by N. P. Reid, City Clerk, Stafford, Kan., for furnishing material and constructing a water works and electric light plant. J. S. Worley Co., 206 Reliance Bldg., Kansas City, Mo., Engineers.

✣Bids will be received until 7 p. m., January 10, by City Clerk Elmer E. Hines, Onaga, Kan., for furnishing the necessary labor and material for the construction of a system of water works. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engineers.

⊙Following bids were opened by the city council of Wichita, Kan., Dec. 5 for the construction of laterals D and H of sanitary sewer No. 12: For District D: E. M. Ebey, $5,128; John Strifler, $5,872; J. W. Chaney & Son, Enid, Okla., $4,464; District H: E. M. Ebey, $6,349; W. G. McKee, $6,519; John Strifler, $7,242; J. W. Chaney & Son, $5,748. The contract was awarded to the last named bidder.

The Atchison, Topeka & Santa Fe Railroad will soon erect a new steel tank at Emporia, Kan., at an estimated cost of $5,000.

The Atchison, Topeka & Santa Fe Railroad has planned to increase its water supply at Topeka, Kan., and has appropriated $15,000 for this purpose. Pumping machinery will be purchased and 12 additional wells sunk.

Kentucky.

The city of Dawson Springs, Ky., is planning the construction of one and one-half miles of new sewers, estimated to cost $10,000. The contract will be let about February.

Louisiana.

The sewerage and water board of New Orleans, La., has adopted a resolution authorizing the expenditure of a sum not exceeding $5,000 for the repair of the sheeting of the wood-lined canals.

The Baton Rouge Water Co., of Baton Rouge, La., has work under way on the construction of extensions to its system, which will cost $40,000. The company plans to construct a reservoir in the spring of reinforced concrete. Jno. H. Wood is manager.

Maryland.

Citizens of Cristfield, Md., have petitioned the mayor and city council to have a sewer system installed.

But one bid was received Nov. 30 by the sewerage commission of Baltimore, Md., Calvin W. Hendrick, Chief Engineer, for the construction of the office and laboratory building and transformer house at the Back River disposal works, and this was rejected as being too high. The work will be readvertised.

Following bids were opened by the Board of Awards of Baltimore, Md., Dec. 7, for Sanitary Contract No. 59, electric wiring at the sewage pumping station: Central Electric Co., 217 S. Central Ave., Baltimore, Md., $3,526; Eugene J. Rosenfeld & Co., 10 S. Howard St., Baltimore, Md., $3,958; John S. Dobler, 201 N. Calvert St., Baltimore, Md., $1,925; the McCay Engineering Co., 9 E. Lexington St., Baltimore, Md., $5,190; Malcolm W. Hill Co., 405 Courtland St., Baltimore, Md., $5,555.

Massachusetts.

⊙W. Rox Trap Rock Co. has been awarded the contract by the city of Boston, Mass., for the construction of pipe sewers and drains in Willow and Center Sts., West Roxbury, for $3,755. Bids were opened Dec. 9.

⊙Chas. J. Jacobs Co., 107 Terrance st., Roxbury, Boston, Mass., has been awarded the contract by that city for pipe surface drains in Litchfield st., between Western ave. and Lincoln st., Brighton, for $3,078. Bids were opened Dec. 9.. L. K. Rourke is Supt. of Streets.

⊙The water board of New Bedford, Mass., has awarded the contract for furnishing 1,500 tons of 16-in. to 6-in. straight cast iron pipe and 44 tons of special castings to the Standard Cast Iron Pipe & Foundry Co. of Bristol, Pa., for $32,070 and $2,024, respectively. The company bid $21.38 per ton for the cast iron pipe and $46 per ton for specials. Bids were opened Dec. 8.

City Engineer William F. Williams of New Bedford, Mass., has been notified by the state board of health that the board has approved the plan for the new intercepting sewerage system of New Bedford.

Engineer George W. Fuller of New York City has completed his report on the proposed $250,000 chemical mechanical filtration plant for the purification of the water supply of Lynn, Mass., and has submitted the same to the water board of that city. Mr. Fuller in his report advises the installation of the plant.

Michigan.

A petition has been submitted to the city council of Marquette, Mich., asking for the construction of a 6-in. tile sewer on Newberry St., from Division St., 100 ft. west.

Minnesota.

⊙Matt Holland of Cannon Falls, Minn., has been awarded the contract by the village council of Kenyon, Minn., for the sinking of a 10-in. well for $3.90 per ft.

City Engineer Rowat of Willmar, Minn., has completed plans for the construction of a sewer system in that city, and the same have been submitted to the state authorities at St Paul for approval.

City Engineer William Barneck of Albert Lea, Minn., has prepared plans and specifications for a lateral sewer along William, Euclid, [illegible] The estimated cost of the proposed sewer is $17,696. The sewer will be over 5,000 ft. in length and at some places will be 20 ft. under ground.

The attorney general of Minnesota has approved the $135,000 bond issue of Minneapolis for the construction of the east end sewer. The sewer will be 18 ins. in diameter, sanitary and will extend from the city limits near the fair grounds to the river. The estimated cost is $35,000. Superintendent Sands of the water department has recommended the following improvements: Centrifugal pump, $2,000; building for pump station, $5,000; boilers, $3,000; high pressure pump, $18,000; basins for reserve supply of water, $30,000; force lines.

$15,000; extensions, etc., $27,000. Total, $100,000.

Missouri.

✣Bids will be received until Noon, December 23, by Board of Public Improvements, St. Louis, Mo., for the construction of a sewer in North Harlem Joint District Sewer, First and Second Sections, according to plans and specifications on file at the office of the President of the Board, 300 City Hall.

✣Bids will be received until December 28, by Warrenton, Mo., for the construction of a water works system and sanitary sewer system for that place. Plans and specifications may be seen in the office of the City Clerk or at the office of the engineers, Fuller-Coult-Co., Chemical Bldg., St. Louis, Mo., or they may be obtained from the engineers upon payment of $3.00, to cover the cost of getting them out.

New Jersey.

⊙The common council of New Brunswick, N. J., has awarded the contract for laying a sewer in Richardson St., from Easton Ave., to a point near Wyckoff St., to Farley Bros., for $.54 for pipe, $.53 for branches and $93 for manholes.

⊙The city council of South River, N. J., has awarded the contract for constructing a sewerage system and disposal plant to Miele & Bruno of Newark for $50,000. Other bids received were John Hurley of Trenton, $40,603; J. F. Sweeten of Camden, $48,108, and Adolph Jofalla of Philadelphia, $50,147. The sewer system will cost $37,454, and the disposal plant will cost $12,546.

New York.

⊙The Watson Contracting Co., Aqueduct Ave. and Kingsbridge Road, New York City, has been awarded the contract by Cyrus C. Miller, President of the Borough of The Bronx, New York City, for six sewer contracts, the largest being No. 4, for regulating, grading, setting curbstone, flagging the sidewalks, laying crosswalks, building approaches and placing fences in Albany Road, from Van Cortlandt Park south to Bailey Ave.; Bailey Ave., from Albany Road to Sedgwick Ave.; Sedgwick Ave., from Bailey Ave. to Fordham Road. The Engineer's estimate of the work is as follows: 26,600 cu. yds. of earth excavation; 8,500 cu. yds. of rock excavation; 188,500 cu. yds. of filling; 16,000 lin. ft. of new curbstone, furnished and set; 2,300 lin. ft. of old curbstone, rejointed and set; 59,500 sq. ft. of new flagging, furnished and laid; 12,000 sq. ft. of old flagging, rejointed and relaid; 10,300 sq. ft. of new bridgestone for crosswalks, furnished and laid; 9,000 cu. yds. of dry rubble masonry, in retaining walls, culverts and gutters; 150 cu. yds. of concrete; 500 lin. ft. of vitrified stoneware pipe, 12 ins. in diameter; 200 lin. ft. of vitrified stoneware pipe, 18 ins. in diameter; 10,000 ft. (B. M.) of lumber, furnished and laid; 11,150 lin. ft. of guard rail, in place; 1,700 sq. ft. of old bridgestone for crosswalks, rejointed and relaid; 7,500 pounds of steel bars, furnished and in place; 1 receiving basin, complete; 6 receiving basins, to be rebuilt. The contract price is $157,976. Bids were opened Dec. 13.

Ohio.

✣Bids will be received until Noon, December 27, by Board of Control, City Hall, Akron, O., for the construction of a sewer in Water St., from State St. to Bowery St.; and in Brown St. from South St. to Baird St.; Allyn St. from South St. to Crosier St., and Sumner St. from South St. to Crosier St., together with laterals thereto for house connections, and for extending a sewer in Glenwood Ave. from Turner St. to Howard St., a distance of about 1,200 ft. Eact proposal must be accompanied by a certified check for $100, payable to the Director of Public Service of the city of Akron, Ohio, on a solvent bank in the city of Akron, Ohio, as surety that if the proposal be accepted a contract will be entered into.

✣Bids will be received until 11 a. m., December 31, by Board of County Commissioners, Cleveland, O., for laying sewer pipe on Independence Road No. 1 improvement. Each proposal must be accompanied by a certified check for 10 per cent the amount bid. Plans, descriptions, bills and specifications for the work can be seen and obtained at the office of Frank R. Lander, County Engineer New Court House, 3d St., Cleveland, O. John F. Goldenbogen is Clerk.

⊙The board of control of Niles, O., has awarded the contract for the construction of the Hartzell Ave. and Park Ave sewers to James McCracken of Warren, O., for $1,173 and $1,849 respectively.

Oklahoma.

✣Bids will be received until 8 p. m., January 16, by B. Huddleston, City Clerk, Checotah, Okla., for constructing approximately 11 miles of 8-in., 10-in. and 12-in. sewer together with manholes, disposal works, etc. W. W. Southard is City Engineer.

⊙N. S. Sherman, Jr., proprietor of the Sherman Iron Works of Oklahoma City, Okla., has been awarded a $40,000 contract to install the sewer system and modern sewage plant in Yukon, Okla.

⊙Plans have been prepared and contract let to the Southwestern Engineering Co., of Oklahoma City, Okla., for the construction of a new water works in Stilwell, Okla., for $45,000. W. O. Lee of Stilwell has charge of the work.

Oregon.

⊙The contract for the construction of the city water system for Jacksonville, Ore., has been let to James A. Mear of Portland, Ore., for $41,076. Water will be taken from the right fork of Jackson creek, where a dam 50 ft. high will be constructed. This will store 24,000,000 gals. of water. From there to the distributing system the water will be conducted in a large conduit.

Texas.

⊙Rees & Peters of San Antonio, Tex., have been awarded the contract by the city of Beeville, Tex., for the construction of a sewer system under the direction of the city engineer. The city recently voted bonds for this work.

⊙Hicks & Leland, El Campo, Tex., have been awarded the contract for the construction of 7,000 ft. of sewer in that city, for $3,650. The work includes 2,500 ft. of 12-in., 2,100 ft. of 8-in. and 3,000 ft. of 6-in. pipe and one septic tank. Bids were opened Dec. 13 by W. A. Hiddlen, City Clerk.

⊙The city council of Bryan, Tex., has awarded a contract to Lane & Bowler of Houston, Tex., to sink a test well, incident to the city beginning work on its own water and sewerage plants. If the well is a success it will be followed by three or four others, sufficient to insure an adequate water supply.

Washington.

✣Bids will be received until January 2, by City Council of Chehalis, Wash., for the construction of a sewer system for the eastern and southern parts of the city.

⊙The city council of Pasco, Wash., has awarded the contract for the construction of the $78,000 sewer system to the Newport Engineering Co., of Portland, Ore.

The city of Elma, Wash., contemplates the installation of water and sewer systems. J. H. Brewer, councilman.

TRADE NOTES.

Miller & Francis Co. has been incorporated as successor to C. E. Miller, dealers in railway and contractors' equipment. The offices of the company are at 50 Church street, New York City, and the yards and shops are at Newark, N. J.

The Contractors' Supply & Equipment Co., Denver, Colo., dealers and jobbers of earth moving and road building machinery, contractors' tools and supplies, has opened a branch office at 18 Kansas Ave., Kansas City, Kan. Messrs. Blue and O'Connell will be the representatives and selling agents at the Kansas City branch.

The Willis-Ladshaw Construction Co. has been organized and will engage in the manufacture of artificial stone, sewer pipe, fence posts, sidewalks and curbings, as well as trimmings for brick buildings, such as window sills, caps and water tables. The offices of the company are in the Cleveland building, Spartanburg, S. C. The company will operate the plant formerly occupied by the Spartanburg Hydraulic Pressed Stone Co.

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NOTICE TO BOND BUYERS.

ONE HUNDRED THOUSAND DOLLARS ($100,000.00) STREET PAVING BONDS OF THE CITY OF HOUSTON, TEX.

Sealed bids will be received by the City of Houston, Tex., until 12 o'clock noon, Monday, January 9, 1911, for the issue of one hundred thousand dollars ($100,000.00) four and one-half per cent (4½%) street paving bonds bearing date the 26th day of September, 1910. Interest payable semi-annually at the office of the Union Trust Company in the City of New York; said bonds to run thirty (30) years with an option reserved by the City of Houston to pay same at the expiration of twenty (20) years.

Each bid for the above issue of bonds must be accompanied by a certified check on a Houston bank, payable to H. B. Rice, Mayor, for one per cent (1%) of the face value of said issue as a guarantee of good faith; bonds to be delivered and money paid in Houston, Tex.

The City of Houston reserves the right to reject any and all bids.

H. B. RICE, Mayor.
DAN C. SMITH, JR., City Sec'y.

NOTICE TO CONTRACTORS.

Sealed proposals are invited and will be received by the City Clerk of the City of La Salle, at the City Clerk's office, City building, up until the hour of 3 o'clock p. m., Saturday, December 24, 1910, for the construction of a water supply well. For further information address City Engineer, La Salle, Ill.

JOS. BURKHART, JR.,
City Clerk.
La Salle, Ill., Dec. 12, 1910.

PROPOSALS FOR DREDGE. — U. S. ENGINEER OFFICE, Vicksburg, Miss., Dec. 15, 1910. Sealed proposals for steel hull, self-propelling hydraulic dredge, steel pontons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant, and evaporator, sand pump, suction pump and ladder, cutter head, gear and engine, winches and refrigerating plant, will be received at this office until 12 m., January 18, 1911, and then publicly opened. Information on application. CLARKE S. SMITH, Capt., Engrs.

(Proposal Advertisements Continued on Page 48.)

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It Costs $325 a Ton, or More Than 32 Cents Per Ton-Mile, to Carry the Mail—Should Not the Government Form a "Partnership" With the Express Companies to Operate the Postal Department?

The statistics in government reports are rarely reduced to unit costs. Instead, the practice is to talk of expenditures in millions of dollars. What does it mean to the average man when you tell him that it costs $210,000,000 to handle the American mail during one year? Is he a whit wiser when he sees [illegible] list of the various items that go to make the total? The great shortcoming of political economy in all times past is to be found in the fact that it has attempted to discuss "fundamental principles" before having investigated unit costs. Practically every effort at reducing the cost of government, whether in city, state or nation, has failed of any marked result because it has been based on "fundamental principles" that were not fundamental. The fundamental principle of engineering economics is to reduce all costs to unit costs, such as the cost per ton-mile for transportation or the cost per cubic yard for excavation, and so on. This unit cost analysis should also be the fundamental principle of all economics, political or otherwise.

We purpose analyzing certain data in the report of the Postmaster General for the year 1908. We also purpose analyzing certain express company statistics given in the Interstate Commerce Commission report on the case of Kindel vs. Adams Express Co. et al. in 1908. Incomplete though these data are, they serve to illuminate the subject of postal costs in a remarkable manner. We shall first reduce the postal costs to a unit that is intelligible, namely the ton, and from that we shall deduce the approximate cost per ton-mile.

In round numbers, the cost of carrying all mail was as follows in 1908:

Transportation	$[illegible]
Post car service	4,600,000
Railway mail service	17,370,000
Rural delivery	34,350,000
Total	$[illegible]
Clerks, postmen, etc.	86,390,000
Other expense	[illegible]
Grand total	$[illegible]

The mail weighed 645,000 short tons, hence the cost per ton was:

Item.	Per ton.
Transportation	$[illegible]
Post car service	7
Railway mail service	27
Rural delivery	[illegible]
Total	$174
Clerks, etc.	133
Other expense	17
Grand total	$325

Of the 645,000 tons there were 396,000 tons of second class mail (magazines, newspapers, and the like) carried at a rate of 1 ct. per lb., or $20 per ton. The postmaster general states that the cost of carrying this second class mail was:

Transportation	$[illegible]
Clerks, postmen, etc.	23,000,000
Total	$[illegible]

This is equivalent to the following cost per ton:

	Per ton.
Transportation	$125
Clerks, etc.	58
Total	$183

The average length of haul for this second class mail is as follows:

	Miles.
Magazines	1,050
Newspapers	290
Miscellaneous periodicals	1,130

It is evident that the average haul for second class mail is less than 1,000 miles. Therefore we cannot be far wrong in assuming that the average haul for all classes of mail is less than 1,000 miles. Since the average cost of carrying all mail is $325 per ton, we have a cost of 32½ cts. per ton-mile if the haul averages 1,000 miles, and more than 32½ cts. if the haul averages less than 1,000 miles, as it doubtless does.

For purposes of general comparison it is well to carry in mind the following facts: The average freight rate on American railways is ¾ ct. per ton-mile, and the average haul is 254 miles, or a total average of less than $2 per ton of freight. The average cost of hauling farm products over poor earth roads is not more than 25 cts. per ton-mile. Contractors using four to six horse teams frequently haul for a cost of 12 cts. per ton-mile. We see, therefore, that the cost of carrying the mails is fully 44 times as great per ton-mile as the average charge made by the railways for carrying freight.

It will be justly contended that mail costs necessarily exceed freight costs per ton-mile. However, there is no reason why mail costs should be so enormously in excess of freight costs per ton-mile. This fact is made particularly evident when we analyze the charges made by express companies for a service that is more directly comparable with that rendered by the post office.

In the instructive case of Kindel *vs.* Adams Express et al., before the Interstate Commerce Commission, the following facts were disclosed:

The "base rate" for express charges is [illegible] package. Small packages (under 7 lbs.) usually pay about double the "base rate" per pound. Thus the "base rate" on 100 lbs. from New York to San Francisco is $11, and the rate for a 1-lb. package is 30 cts., the rate for a 20-lb. package being $2.85.

The "base rate" from New York to Chicago is $2.50 per 100 lbs. Express rates west of the Missouri River average twice as great as rates east of that river. Express rates average about three times as great as first-class freight rates.

Since the distance from New York to Chicago is 1,000 miles, and the base rate is $2.50 per hundred, we have a rate of $50 per ton, or 5 cts. per ton-mile. This includes of course, the collection and delivery of the express matter, as well as its transportation by rail, and the profit made by the express company.

About half the expense of operating an express company consists in the sums paid to the railway companies for transportation. The contracts between the railways and the express companies generally provide for payment to the railways of a percentage of the express charges, and this is now about 50 per cent. The reports of the railways to the Interstate Commerce Commission show that in 1908 the railway revenue from express was $58,692,091, while from mail it was $48,517,563. There are only five important express companies in America, and their operating expenses per annum were as follows:

Express Co.	Oper. exp.
U. S. (report June [illegible])	[illegible]
Adams (11 months [illegible])	[illegible]
American (report June 30, 1907)	27,793,468
Pacific (report Dec. 31, 1906)	6,604,785
Wells, Fargo	16,138,073
Total	[illegible]

The income from operation of these companies for the same period was as follows:

Express Co.	Oper. inc.
U. S.	[illegible]
Adams (11 months)	25,105,126
American	29,100,784
Pacific	7,187,851
Wells Fargo	[illegible]
Total	[illegible]

The operating expense of the U. S. Express Co. for the year ending June 30, 1907, is fairly typical of the other companies, and is as follows:

Transportation	$ 8,083,141
Express [illegible]	[illegible]
General expense (legal, traveling, etc.)	172,337
Salaries (employes in local office)	680,802
Commissions	1,077,393
General salaries (other than local)	1,344,269
R[illegible]	[illegible]
St[illegible]	[illegible]
St[illegible]	[illegible]
Loss and damage	[illegible]
Personal property	294,667
Taxes	96,190
Insurance	16,066
Total operating expense	[illegible]

This was 97.05 per cent of the gross income from operation. It will be noted that "loss and damage" was a trifle more than 1 per cent. This was about the average for all express companies. Unfortunately, we have no data to show either the number or total weight of the packages handled by the U. S. Express Co.

During the year 1907, the Adams Express Co. handled 57,211,266 items, at an average charge of 44 cts. per item. The American Express Co. handled 48,290,310 items at a charge of 57.3 cts. per item. These figures show that the average "item," or package, was quite light. In July, 1907, the Wells Fargo Express Co. handled 2,697 items between Denver, New York, Chicago, Omaha and Kansas City, the weight and number of items being as follows:

[illegible]	[illegible]
Under 7 lbs...	[illegible]
[illegible]	[illegible]
Over 50 lbs...	[illegible]
[illegible]	[illegible]

[illegible] item weighed only 7 lbs. during the year 1907.

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Then the Adams Co. handled 7 times 57,211,266, or 400,478,862 lbs., or 200,000 tons. Then the American Co. handled 7 times 48,290,310, or 338,032,170 lbs., or 169,000 tons. Since these two companies did about half of all the express business, it is safe to say that the entire express amounted to much more than 738,000 tons. How much more can only be conjectured, but it is certain that 7 lbs. is too conservative an estimate of the average weight of express items. For carrying this tonnage the express companies received $98,000,000, in round numbers, or less than $140 per ton. We may be perfectly certain, therefore, that the postal cost of $325 per ton of mail is at least two and a quarter times as great as the express cost per ton with a strong probability that it may be three or four times as great.

Express companies carry 100-lb. items from New York to Chicago for $2.50, or $50 a ton. Yet the postmaster general states that the post office is losing 8 cts. per lb., or $160 per ton, on all magazines carried an equal distance, that is 1,000 miles. This may or may not be a fact. No careful analysis of the actual cost of handling second-class mail has yet come to our attention. We have merely the postmaster general's arbitrary prorating of expense to this class of mail. If it is a fact that the post office is losing $160 a ton on all magazines and newspapers, while express companies are making a profit when charging $50 a ton for an equal haul—1,000 miles—does it not appear that the real postal question before Congress is not a question of increasing any particular postal rate, but of finding how to make the post office approach in some degree, the economic efficiency of the express companies? In the final analysis, the public will pay all postage costs. If second-class postage rates are raised to eliminate a post office deficit, the public will ultimately pay for the deficite in the form of increased prices for the magazines and for the products advertised in them. The only true economy that can be effected in the postal department will be the economy resulting from reduced postal costs. This is clear. How can such economy be effected?

Take the post office out of politics by delivering its management to a board of direction consisting of men selected by the express companies and of men selected by the government. Let the postal and express business be operated jointly and for profit, half the profit going to the government and half to the express companies.

Applied to the post office department this scheme of management may sound extremely radical. A few years ago it appeared equally radical when it was proposed that the city of Chicago and the street railway companies should jointly operate the street railways and share the profits. But, today, in the light of three years' satisfactory experience with this "partnership system" of operating the traction system of Chicago, it is beginning to dawn upon the people that there is a practicable way of securing the aid of private enterprise in the management of public utilities without sacrifice to monopolistic control.

In a manner entirely analogous to that developed for the joint management of the Chicago street railways by representatives of the city and representatives of the street railway companies, will it be possible to unite the post office and the express companies. The latter already possess an express business aggregating half the gross income from the mails, and they are handling it with an economy that is marked indeed when contrasted with the carrying of mail. Nor is there the remotest possibility that any direct federal management of the postal department can ever approach the economic efficiency of the express companies. Again and again we have shown that the unit costs on the Panama Canal work far exceed similar costs for contract work, and this must continue to be the case, for no government can well apply the fundamental law of business management, namely, to pay both managers and employes in proportion to their output or performance. Even to a worse degree than on the Panama Canal is it true that lack of sufficient incentive exists to cut the costs of operating the post office. Nor can this condition be materially altered until some method is developed for managing the post office as a money making machine.

We submit to the earnest consideration of Congress the precedent established in Chicago for the joint operation of a public utility by representatives of the public and representatives of a corporation, with a division of the profits between the public and the corporation. In this way, as in no other that we have yet seen, can the benefits of private management, whose object is profit, be wedded to the benefits of public control, whose object is satisfactory service.

Studies of Reinforced Concrete Girderless Floors.

Flat plate or girderless reinforced concrete floors offer attractive features to the building owner. Building height is decreased by the elimination of beams without any loss in clear space between floors. Decrease in building height saves materials in walls and columns and lessens the travel of elevators and all other services. Construction cost is lessened by reduction in form work and decreased height of hoist for construction materials. A flat ceiling with its advantages of better lights, greater cleanliness and preferable appearance is obtained without recourse to false ceilings. These are telling advantages. The girderless floor, however, has not won its way to full approval. The reasons have been chiefly that engineers generally have hesitated to recommend a construction not lending itself to mathematical analysis and that building departments have imposed limitations in uses of concrete and steel which are obstructive.

Leaving conflicting claims to contest for the first use of girderless floor construction to be settled by the contestants for this honor we may safely assert that its persistent advocacy for and actual introduction extensively into building construction is due to one man—Mr. E. A. P. Turner. Other contractors following Mr. Turner's lead have within a year or two developed girderless floor constructions and used them in buildings so that now we have a considerable number of such structures. More important than this fact, but arising from it, there has been aroused among engineers an interest in working out an analysis of girderless floors. This latest movement may be said to have begun as a matter of record with the paper by Mr. Angus MacMillan, presented a year ago before the National Cement Users' Association. This paper was published in our issue of March 23, 1910, and a later discussion by Mr. Brayton in our issue of Sept. 21, 1910. Elsewhere in this issue we publish three further discussions bearing upon the same problem. These various papers are instructive as studies and not because they provide a final solution of this problem. Perhaps the most interesting of the lot is that describing a field test of an actual building. We believe this is the first test of this character to have been undertaken and that it opens a way to the discovery of numerous important data on the behavior of reinforced concrete in actual structures.

How Prof. Joseph Le Conte "Demonstrated" in 1888 that Flying Machines Could Never Fly.

One of the editors of ENGINEERING-CONTRACTING, while recently conversing with a scientific man in Pasadena relative to the theory of flying, made the remark that he recalled seeing an article written some years ago by Prof. Joseph Le Conte, wherein it was "demonstrated" that flight of machines heavier than air could never be accomplished. Upon inquiry the editor replied that he believed it was in the year 1888 that Prof. Le Conte's article was published. "Now that you have named the date," said the scientific man, "I will name you the magazine. It was the Popular Science Monthly." The combination of memories proved correct. Elsewhere in this issue we reprint Prof. Le Conte's original article in full, in the belief that it will prove interesting, in the light of aviation achievements of the recent past. The article should also serve as an excellent example of misapplied scientific reasoning.

At the very opening of his article on The Problem of a Flying Machine, Prof. Le Conte says:

> I am one of those who think that a flying machine is impossible, in spite of the testimony of the birds. * * * I wish now to give, very briefly, a reason for my faith. I can best do so with brevity and clearness by a series of propositions which I hope will lead us, step by step, to absolute demonstration. I believe this important to check baseless expectations and limit effort to right direction.

The world is fortunate that the Wright brothers did not read, or, reading, did not believe the "demonstration" that Prof. Le Conte gave in his article 22 years ago.

In brief, his "demonstration" was as follows:

The strength of a muscle increases as the square of any lineal dimension, while the weight of a muscle increases as the cube of the lineal dimension. Hence it is that the weight of an animal increases with far greater rapidity than its strength increases. A flea's muscles are not stronger than those of an elephant, as has been inferred, because it can leap farther in proportion to its size. The slight weight of the flea relative to its muscular strength accounts for its astonishing ability as an insect acrobat. Nature reached its possible limit in the evolution of a walking animal when it evolved the dinosaur of the Jurassic period. The whale probably passed this limit and was compelled to take to the sea in order to move about at all. In like manner, Nature reached her limit in flying machine size when she evolved the condor, and the bustard, whose weight is about 50 lbs. Larger birds, like the ostrich, are too heavy to fly. If Nature has reached her limit in developing a flying machine weighing 50 lbs., man cannot expect to do better. Man never has done better than Nature in point of efficiency even with his best steam engine. The animal body, in fact, is about twice as effective as the best Cornish engine. "No machine that we may hope to devise, for the same weight of machine, fuel and directing brain, is half so effective" as a bird.

Closing with mild exultation at the mathematical beauty of his proof, Prof. Le Conte inquired: "Is it not demonstrated that a true flying-machine, self-raising, self-sustaining, self-propelling, is physically impossible?"

Could he have seen one man fly 100 miles in 70 minutes, and another rise vertically over two miles, the other day, Prof. Le Conte would probably have scouted the logic of the logician who taught him how to "demonstrate."

It is interesting to note that Prof. Le Conte really thought he had proved that mechanical flying would be quite as impossible as perpetual motion, for he placed the two phenomena in the same category. Doubtless many readers of the Popular Science Monthly in 1888 saw the underlying fallacy in Prof. Le Conte's argument. It exists primarily in his assumption that Nature is necessarily superior to man both in perfecting a means for burning fuel efficiently and in perfecting a device for moving self-supported objects through the air. Neither of these assertions rested on experimental demonstration, yet neither could be safely affirmed or denied without experiments made with the greatest care and extending over many years if necessary—possibly over many hundreds of years. While the thermal efficiency of the most perfect steam boiler and reciprocating engine is less than 10 per cent, it is clearly evident that a far greater thermal efficiency is attainable. Even then, experiments with internal combustion engines using gas and gasoline had indicated possibilities greatly exceeding the efficiency of a steam boiler and engine.

As for the results of experiments on the resistance of air to bodies passing through it, there [illegible] made public, and we are scarcely better off now. We know that the pressure of air against a body increases as the square of its velocity, and from this it is easy to see that a slight increase in velocity of a body will result in a great increase in air pressure against it. Hence if the body is flat or slightly concave, like a wing, and tilted slightly upward in the direction of mo- [illegible] sure will serve to support the body if only it can be given sufficient horizontal velocity. We can also see that the horse-power required to effect a given horizontal velocity through the air varies as the cube of the velocity. All this was demonstrable at the time Prof. Le Conte wrote. His imagination, however, was not sufficient to enable him to picture a light and efficient engine capable of giving sufficient velocity for the purpose of mechanical flight; nor does he appear to have made an investigation of the then available scientific data on air resistance.

Ill logic and ignorance of existing scientific data on the subject under discussion led this eminent man to express positive convictions [illegible]

CONCRETE AND REINFORCED CONCRETE SECTION

The Calculation of Plates, Supported by Four Columns.[*]

The interest taken in the last few years in so-called girderless floor constructions, which were first introduced to any large extent by the author at the Proctor & Gamble plant in Armourdale, Kansas, in 1903 for high loads of [illegible] lb. per sq. ft. [illegible] many discussions in regard to the proper figuring of such constructions, caused the author to look through the books treating with the elastic theory, and as far as his researches allowed he found that the subject was solved by Prof. Winkler in his book, "Lehre von der Elasticitat und Festigkeit," Prag, 1867, and by Prof. Grashof in his book, "Theorie der Elasticitat und Festigkeit," Berlin, 1878. Inasmuch as the results are rather surprising, the author will compare the theory of plates supported by four columns with the theory, practice and tests of round and square plates.

In the following discussion let d be the span, which is to be taken in feet for the bending moment, and in inches for the deflections; p, the uniform load per square foot for the bending moments, and per square inch for deflections; h, the thickness of the plate in inches and E, the modulus of elasticity. The theory employed by Winkler and Grashof is similar to that which furnishes us the formulas for the deflection of a common beam, which is, however, rather too complicated for presentation.

Let us begin with the round plate uniformly loaded, and supported at its circumference. For this case Grashof gives the maximum bending moment in the center equals

$$\frac{3}{8}\,\frac{(m\ [illegible]\ 1)(3m-1)}{m^2}\,\frac{d^2p}{24}\ \ldots\ldots\ldots\ldots(1)$$

and the greatest deflection equals

$$\frac{3}{256}\,\frac{(m-1)(5m+1)}{m^2}\,\frac{pd^4}{Eh^3}\ \ldots\ldots\ldots(2)$$

in which equations m represents the so-called Poisson's ratio, which we may assume nearly as $= 10/3$. For those not familiar with the signification of Poisson's ratio, I wish to state that if two forces are acting on a plate element at right angles, elongations in each direction are produced, which are $\frac{1}{m} = \frac{3}{10}$ times less than the amount of elongations which would be produced if only forces in one direction be acting.

Introducing Poisson's ratio in the above equation the maximum bending moment equals

$$.708\,\frac{d^2p}{24}$$

and the greatest deflection equals

$$.0435\,\frac{pd^4}{[illegible]}\ \ldots(4)$$

If we consider the round plate like a common beam uniformly supported at its circumference, and assume that the plate breaks along the line of the diameter through the center, as shown by Fig. 1, the distance of the center of gravity of the reactions from $AB = \frac{d}{\pi}$ and the distance of the center of gravity [illegible]

The bending moment at AB equals

[illegible]

or the moment per lineal foot of AB equals [illegible]. On account Poisson's ratio, this bending moment will be diminished by 3/10, and will be equal $.7\,\frac{d^2p}{24}$, which perfectly agrees with the result given by Grashof. Prof. C. Bach tested round plates, made of cast iron and of steel, and found that, as long as the plate was uniformly supported at its circumference, the strength of such plates perfectly corresponds to the above formulas.

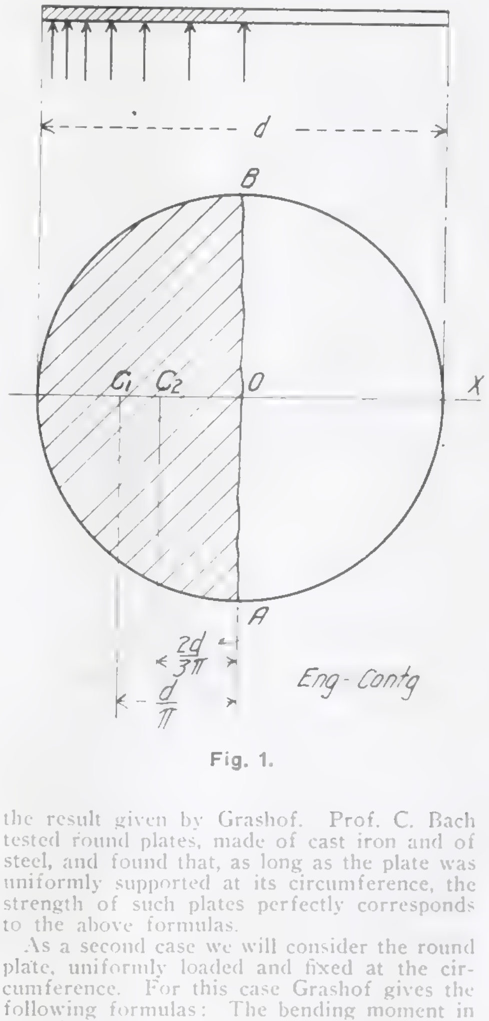

Fig. 1.

As a second case we will consider the round plate, uniformly loaded and fixed at the circumference. For this case Grashof gives the following formulas: The bending moment in the direction x at any point distant x from the origin equals:

[illegible]

For $x = o$. The bending moment in the center equals

$$[illegible]\ \ldots(6)$$

For [illegible] The maximum bending moment occurs at the circumference and equals

[illegible]

and the greatest deflection equals

$$[illegible]\ \ldots(8)$$

Introducing again Poisson's ratio, we have

$$M_{max} = .6824\,\frac{pd^2}{[illegible]}$$

$$\text{Deflection at center} = .0107\,\frac{pd^4}{Eh}\ \ldots(10)$$

whereof we can find that the fixature at the ends does not materially increase the strength of the plate. It, however, decreases the deflection to ¼ of that of a plate freely supported. We can find by comparing equations (6) and (7) that the stress in the center is just one-half of that at the circumference. Also this formula was tested by Prof. Bach for its accuracy, and he found that it perfectly agrees with the tests.

For the case of a plate supported by a great number of supports, arranged in corners of squares, Prof. Grashof gives the bending moment at any point distant x from the origin equals

$$\frac{1}{2}\,\frac{[illegible]1}{m_2}\,\frac{p}{6}\,[illegible]\frac{[illegible]}{4}\ \ldots(11)$$

The bending moment in the center equals

$$\frac{1}{2}\,\frac{m^2 1}{[illegible]}\,\frac{pd^2}{2[illegible]}\ \ldots(12)$$

The max. bending moment at the sides of the squares equals

$$\frac{[illegible]1}{[illegible]}\,\frac{[illegible]}{24}\ \ldots(13)$$

and the greatest deflection equals

$$\frac{1}{[illegible]}\,\frac{[illegible]1}{[illegible]}\,\frac{[illegible]}{[illegible]}\ \ldots(14)$$

Or, if we introduce Poisson's ratio

$$M\ [illegible]\ \ldots(15)$$

$$M_{max} = \frac{pd^2}{26.4}\ \ldots(16)$$

$$\text{The greatest deflection} = 0.281\,\frac{[illegible]}{Eh^3}\ \ldots(17)$$

If we compare these equations with the results of the round plate, fixed at the end, we find that the distribution of stresses is nearly identical and that the maximum bending moment and the maximum deflection is 2/3 of those of a circular plate, having a diameter equal to the diagonal of the square.

The distribution of stresses is shown in Fig. 2, requiring in concrete slabs two lines of reinforcement at the underside of the slab, running under right angles, and extending the full width of the squares, and shorter and heavier reinforcements at the top of the slabs, over the sides of the squares, and runing at right angles to the sides; hence, although the bending moment per lineal foot is comparatively small, the sum of all bending moments, which govern the amount of reinforcement, is larger than expected.

We shall try, also for this case, to solve the problem by the ordinary theory in a similar way as we did for the case of a round plate. If the plate is only supported by four columns without rigid connections with these columns, as shown in Fig. 3, we can assume that the center of gravity of the reactions is distant .07d from the center of the columns, and the bending moment at $EF =$

---

[*] A paper by L. J. Me[illegible] [illegible] National Association of Cement Users, Dec. 13-17, 1910.

$$\frac{d^2}{2}p\left(\frac{d}{2}-.07d\right)-\frac{d^2}{2}p\frac{d}{4}=.090d^3p$$

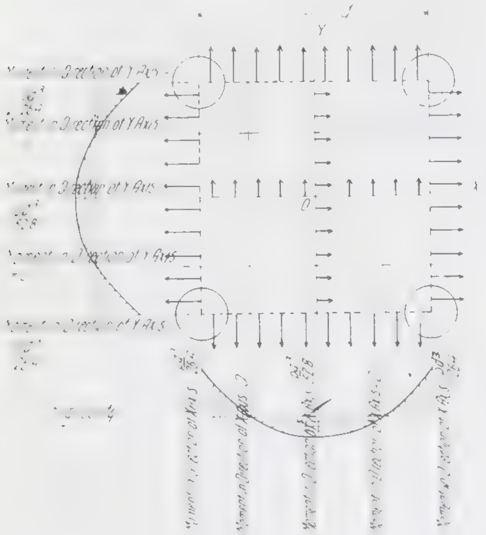

Fig. 2.

Or, inasmuch as the capitals of the columns take up about 4 per cent of the total area, this moment is 4 per cent less or .0864 $d^3p = \frac{d^3p}{11.6}$.

On account of Poisson's ratio this value will reduce to $\frac{d^3p}{16.5}$ ....(18)

This value may be considered acceptable, if we compare it with the formulas for the bending moment of a square plate supported at the four sides, which is generally taken at $\frac{pd^2}{20}$ or $\frac{pd^2}{24}$.

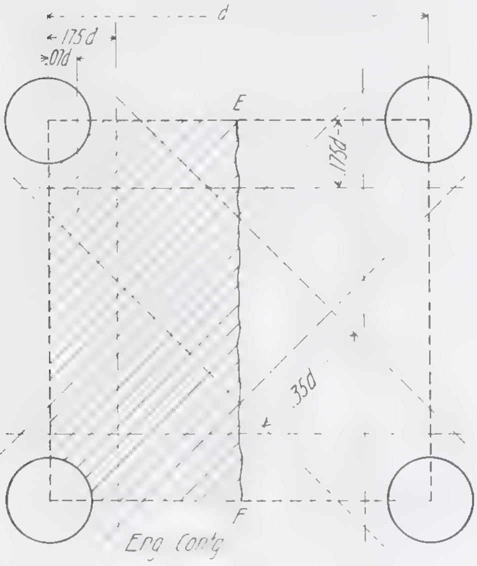

Fig. 3.

In case of a building these plates are supported by columns and rigidly connected, and we can assume that the four columns and the plate form a monolithic frame, and that the deflection of the plate will cause also a deflection in the columns and, inversely, that the deflection of the column will retard the deflection of the slab, as shown in Fig. 4.

Where the slab is uniformly loaded and would have a bending moment in the center $=\frac{pd^2}{8}$, if freely supported, we can find by the application of the theory of least work, the bending moment at B.

$$B=\frac{pd^2}{12}\cdot\frac{1}{1+\frac{n}{2}} \qquad (19)$$

$$\text{where } n=\frac{H}{d}\cdot\frac{I_1}{I} \qquad (20)$$

and wherein I_1 is the moment of inertia of the plate of the width d, and I the moment of inertia of *One* column.

In our case the moment in the center $=\frac{d^3p}{11.6}$ and the corresponding moment $M_b=$

$$\frac{pd^3}{17.4}\cdot\frac{1}{1+\frac{1}{2}n} \qquad (21)$$

The value of n is in most cases of the practice nearly one, hence

$M_b=\frac{pd^3}{26.1}$ and the moment in the center

$M_c=\frac{pd^3}{21.6}$.

Or on account of Poisson's ratio

$$M_c=\frac{pd^3}{30.9} \qquad (22)$$ and

$$M_b=\frac{pd^3}{37.3} \qquad (23)$$

If the plate is actually a single square and supported by four columns, then M_b is to be divided by two, to obtain the value for one column. However, if a number of plates in one row are loaded, then the bending moment at the column would be the value as given in (23), if we neglect the continuity of the slabs in one direction, which is evidently figuring to safely, and we can place the moment at one column

$$M_b=\frac{pd^3}{74.6} \qquad (24)$$

for every case.

As a rule the columns run through several stories, which increases the stiffness of the columns. Assuming, therefore, $n = \frac{1}{2}$, in equation (21), $M_b=\frac{pd^3}{31.1}$ and $M_c=\frac{pd^3}{34.6}$ Poisson's ratio considered.

On the other hand, if panels are alternately loaded, this favorable point will be lost, and the values of (22) and (24) should be acceptable to conservative designers.

If the columns are very heavy in comparison with the slabs, so that the slabs are immovably fixed at the columns, like in a continuous plate on many supports, n vanishes, and $M_b=\frac{pd^3}{17.4}$ and $M_c=\frac{pd^3}{34.8}$, or on account of Poisson's ratio

$M_c=\frac{pd^3}{49.8}$ and $M_b=\frac{pd^3}{24.9}$, which agrees with the values found by Grashof, and proves that the latter introduction of Poisson's ratio, when obtaining the principal stresses, is admissible, a point which may allow the solution of problems not yet solved.

Both according to Grashof's figuring, and the method here presented, a reinforced concrete slab should be reinforced in directions parallel to the sides of the squares. On account of the great shear values at the columns it is, however, desirable to run portion of the reinforcement in the direction of the diagonals, and we can count one diagonal band as corresponding to the X axis and the other band as belonging to the Y axis. The author gave in his pocket book the rule to make the width of each band of reinforcement $=.35\,d$. Then the width of the bands in the direction of the X axis, or Y axis $=.7\,d$, and the moment per lineal foot of the band of reinforcement $=$

$$\frac{pd^3}{30.9}\ .7\,d=\frac{pd^2}{21.6} \qquad (25)$$

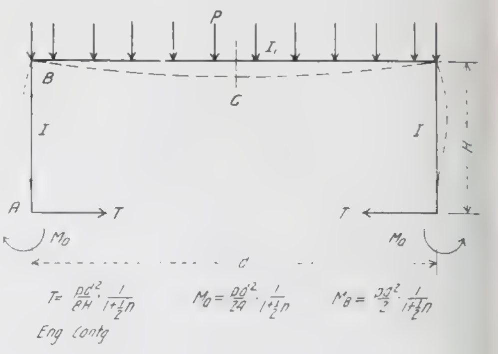

Fig. 4.

At the column the width of reinforcement in the direction of the X axis is only .35 d, and therefore, the moment per lineal foot $=$

$$\frac{pd^3}{74.6}\ .35d=\frac{pd^2}{26.1} \qquad (26)$$

We can evolve the following rule for the figuring of plates supported by columns in the corners of squares: for the dead loads the moment in the center of the slab per lineal foot of band is to be taken as $=\frac{Wd^2}{62.8}.7d^2=\frac{Wd^2}{36}$; over the entire sides of the squares is to be taken as $=\frac{Wd^2}{26.4}$ per lineal foot. For the live loads the moment in the center per lineal foot of bands of a width of .35d is to be taken as $=\frac{pd^2}{20}$. It is not advisable to assume a smaller bending moment for the top reinforcement over the columns than $\frac{pd^2}{20}$, as

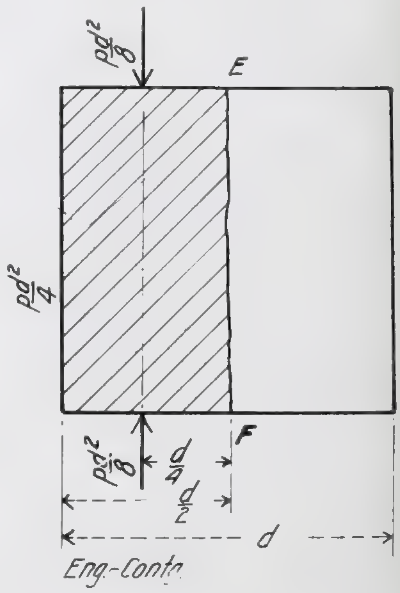

Fig. 5.

there are to be placed four layers of rods, which diminishes the effective depth of the slab.

As a rule the negative moments over the columns are taken care of by bending the bottom rods up, near the columns, which often produces eight layers of rods, instead of four, and only one-half of the rods, and even less, can be counted as effective to take up the negative moments. Safe practice requires special top rods as advocated above.

One designer places rings around the columns, which are invariably near the underside of the slab. They are useless there, but would be effective if placed at the very top of the slabs. The columns proper must be figured for a bending moment $= \frac{pd}{746}$, when p represents the live load per square foot. As a rule the additional strain on the columns is very small.

In the case of plates, supported along the sides of squares, Grashof found difficulties in solving the problem but thinks, that at a safe guess the greatest moment over the sides of the squares may be taken at $\frac{pd}{24}$ and that the moment in the center may be taken at $\frac{pd}{48}$ per lineal foot for continuous plates.

We shall try to solve the problem for noncontinuous plates by the author's method. We assume, see Fig. 5, that the reactions are uniformly distributed over the sides of the square and $= \frac{pd}{4}$ for each side.

The moment at

$$EF = \frac{pd}{4} \quad \frac{d}{2} \quad \frac{2pd}{8} \quad \frac{d}{4} \quad \frac{pd}{2} \quad \frac{d}{4} = \frac{pd}{16}$$

and on account Poisson's ratio M $C = \frac{pd^2}{24}$, which corresponds closely to practice and tests made by Prof. Bach on cast iron plates, and tests made in Paris on reinforced concrete slabs of the "Palais des Costumes."

A Test of a Flat Slab Floor in a Reinforced Concrete Building.*

The most important recent development in building construction is the introduction and rapid extension of the flat slab type of floor. The advantages of this construction, from the standpoint of both the occupant and the builder, are very generally admitted. It cannot, however, hope to receive the full confidence of engineers until the nature of the structural action in such floors is understood. Several attempts at analysis have been made but none has met with any general acceptance. Actual designs in this construction offer some of the most striking contrasts and disagreements to be found in engineering practise today. It would seem that, by common consent, we must classify this construction, along with the voussoir arch and the retaining wall, as subjects beyond the range of pure analysis. In the presence of so many unknown conditions as obtain in the flat slab floor no analysis can stand which is not supported by convincing test data. The question immediately arises as to the means by which such tests may be secured most effectively. It is evident that a really satisfactory test of such construction can be carried on in our present laboratories only at a very large expense and at a sacrifice of many of the conditions obtaining in building construction. We may say certainly that such a test as is practical under laboratory limitations would fail to carry the weight among practising engineers that would attach to a test of an actual structure, in which test laboratory methods and refinement prevailed. When we take our laboratory afield, however, we must recognize the disadvantage arising from the fact that the test may not be carried [illegible] to secure information on working stresses [illegible] solutely the weakest points in our design. We shall, however, obtain many data of great value in a hitherto unexplored field, and one of the most important features of the test described in this paper lies in the fact that it demonstrates the feasibility of making field tests with practically laboratory refinement. A test which shows that it is possible to take precise extensometers into a building and measure the actual deformations which occur in the component parts of the structure as the load is applied or removed has justified its undertaking. When the simple transformation of these deformations into stresses has been made, we shall have at hand most valuable information as a basis of future design. Questions regarding the flexidity of the slab at the column capitals, questions as to the extent of "arch" and "slab" action, and the other disturbing elements which separate our analysis assumptions and our actual conditions, are all overcome in the test of the actual structure and the true stresses present in the floor are observed directly.

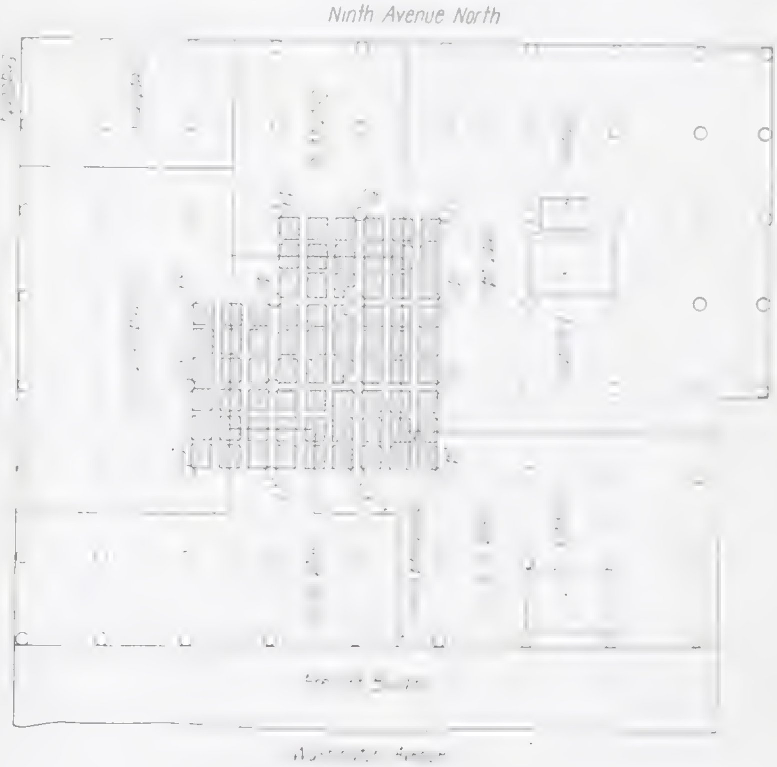

Fig. 1—Plan of Test Floor Showing Arrangement of Load.

In this paper such a test for actual stresses in a reinforced concrete building will be described. The full possibilities of the method have not, of course, been realized in this its first application to building construction. The attempt was made to cover a few of the most essential points thereby, leaving many other questions for consideration in future tests when the experience gained in this test may be available for use in determining the best methods. Measurements were taken on the deflection at several points, on the deformation of the steel at the center of the span, on the deformation of the steel over the column capital on the deformation of the concrete at the edge of the capital, and on the curvature of the elastic surface in two directions. Working without precedents, it was necessary to design new instruments for use on this test and new methods of attachment for other instruments, so that it must be expected that the accuracy of the results was not so great as may be obtained under the best laboratory conditions. As will be shown, however, the stresses were determined within quite narrow [illegible] troublesome than had been expected.

The test was made possible through the united action of the Leonard Construction Co. of Chicago, the Concrete Steel Products Co. of Chicago, and the Engineering Experiment Station of the University of Illinois. The building tested was an eleven story and basement warehouse now under construction at Minneapolis, Minn., for the Deere & Webber Co. of that city. Figure 1 shows the floor plan of the building and the location of the panels loaded. The dimensions of the panels are 18 ft. 8 ins. × 19 ft. 1 in. A 1, 2, and 4 mixture was used, the slab thickness measuring 9 3/16 ins. The floor was designed for a live load of 225 lbs. per sq. ft. and the details of the reinforcement, shown in Fig. 2, are typical of the standard practise of the Concrete Steel Products Co. The floor tested was the fourth from the ground and the conditions [illegible]ing of strength. Owing to a failure in the supply of aggregate during the construction of this floor an abnormal number of bulkhead separations occur in the slab as is shown in Fig. 1. Such separations occur in every panel under load except one. The concrete was only 40 days old at the beginning of the test. In general conditions were such as to give slightly higher stresses than we would expect were the slab well seasoned and normally poured. In applying the load care was taken that no serious arch action in the load be possible. In the earlier stages bricks were piled in piers, as shown in Fig. 1, with open aisles from 8 to 16 ins. wide between the piers. Later, cement was used as load, the piers being maintained separate as before. The load given in the tables is in all cases the total load on the panel divided by the area of the panel, the *intensity* of load under the pier area being greater.

A brief description of the instruments for measuring deformations may be of assistance in understanding the methods used and in judging the accuracy of the results. For deflection a polished steel ball was attached to the ceiling and another carried on an upright, and the instrument was inserted between them. Measurements were made in this manner to the nearest 0.001 in. with accuracy. For measuring the deformation in the steel at the center of the span a clamp was rigidly attached to the slab rod (the concrete being removed at one point for this purpose), and a Wissler dial was carried on the clamp. A fine, silk-covered, copper wire was attached to the rod at distance of exactly 15 ins. from the clamp and passed immediately below the rod, over an idler on the clamp, and then over the drum of the dial. This wire was 1/16 in. below the under surface of the slab rod, and the deformations observed were therefore slightly in excess of the actual deformation in the rod. The wire was placed in this position because experience in the laboratory has demonstrated that measurements taken below the slab, depending on the position of the neutral axis for corrections, are subject to considerable error. By this arrangement the deformation was measured to an indicated reading of 0.005 in. on a gage length of 15 ins. The instrument was less responsive to slight changes than were the other instruments used, and the stress in the steel may vary by as much as 800 to 1,000 lbs. per sq. in. from the value observed, which is much closer than we can design for on account of the many unknown factors entering into all design computations.

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*A paper by Arthur R. Lord, Research Fellow in the Engineering Experiment Station of the University of Illinois, Urbana, Ill., presented before the National Association of Cement Users at the annual convention in New York City on Dec. 13, 1910.

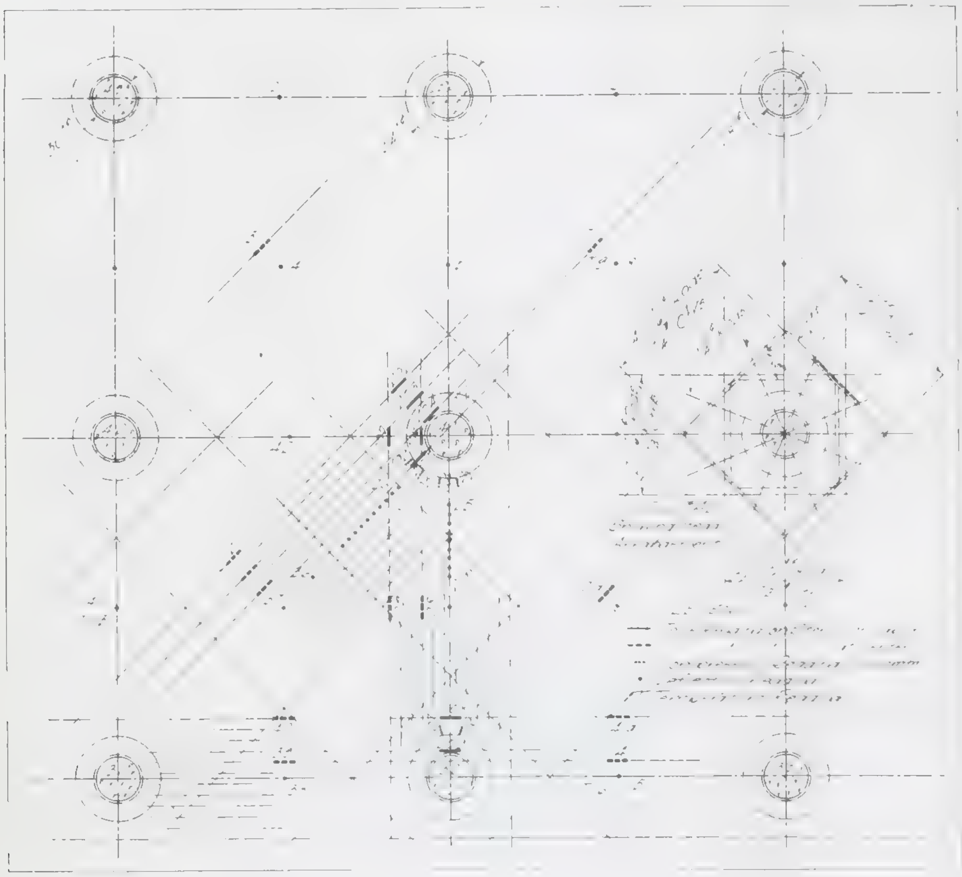

Fig. 2—Diagram Showing Location and Character of Test Observations.

For measuring the deformation in the steel over the column capital a modification of the Berry extensometer was made (with the permission of Professor H. C. Berry of the University of Pennsylvania). The slab rods were first bared at two points 15 ins. apart and very small holes drilled in them. The points of the instrument fit into these holes and any deformation within the 15 in. gage length is multiplied five times by the lever arrangement before being read on the dial attached to the frame. A slight variation is possible in manipulating this instrument and five readings were therefore taken at each observation and averaged. The stress is obtained within a range of less than 1,000 lbs. per sq. in. A regular Berry 6-in. extensometer was used to measure deformations in the concrete over 6 in. gage lengths. These observations are reliable certainly to the nearest 50 lbs per sq. in. of stress.

Figure 2 shows the distribution of points at which measurements were made over four of the panels. The numbers given are those used in recording and plotting the data in the subsequent graphs and tables. The diagram is believed to be self-explanatory. The total number of readings was in excess of 3,300. To correct for temperature variations one entire day was spent in observing effects due to temperature alone, and the larger Berry extensometer was read on a standard bar between each series of slab readings. Necessary corrections have been made in the tables accompanying this paper. In general temperature effects were much less serious than were anticipated. In the planning of the tests and the designing of the instruments the writer was assisted by Professors Arthur N. Talbot and Herbert F. Moore of the Engineering Experiment Station of the University of Illinois. It should be noted also, in passing, that the success attending the actual taking of the observations was due in large measure to the fact that all the observers on the test were men of wide testing experience, and thereby familiar with the instruments handled. This condition is essential to the successful conduct of such a test. Observations were taken by Professors H. F. Moore and W. A. Slater, and the writer, all of the station staff of investigators. Professor Talbot was present at the beginning of the test.

The test continued for six days from Oct. 30 to Nov. 5 inclusive. Eight panels were loaded as shown in Fig. 1. Readings were first taken on all instruments with the floor unloaded and a load equal to 75 lbs. per sq. ft. was then applied over the entire eight panels. Another set of readings was taken and the load increased to 150 lbs. per sq. ft. In this manner alternate readings and loadings were continued for three days.

Overnight readings were taken in the evening, at midnight, and in the morning. The maximum load of 350 lbs. was allowed to remain on floor about 22 hours, readings being taken at frequent intervals during that time. The floor was then unloaded, the outer panels being first cleared, and finally the load was removed from the center panel. Readings were taken at intervals during the progress of the unloading. The data obtained are presented in the tables and plotted in the graphs accompying this paper. In the limited time since the completion of the test, and under the pressure of other experimentation, it has not been possible for the writer to give the data as thorough study as they merit. A few indications may, however, be pointed out from the graphs.

Deflections.—Figures 3 and 4 show graphically the deflections at sixteen points, the same data being recorded in Table I. On the lower line in Fig. 3 note the comparison between readings 5 and 11, where bulkheads existed, and readings 17 and 42, where no bulkheads were present. Other instances of the marked effect of bulkheads on the stiffness of the slab may be seen in the plotted data.

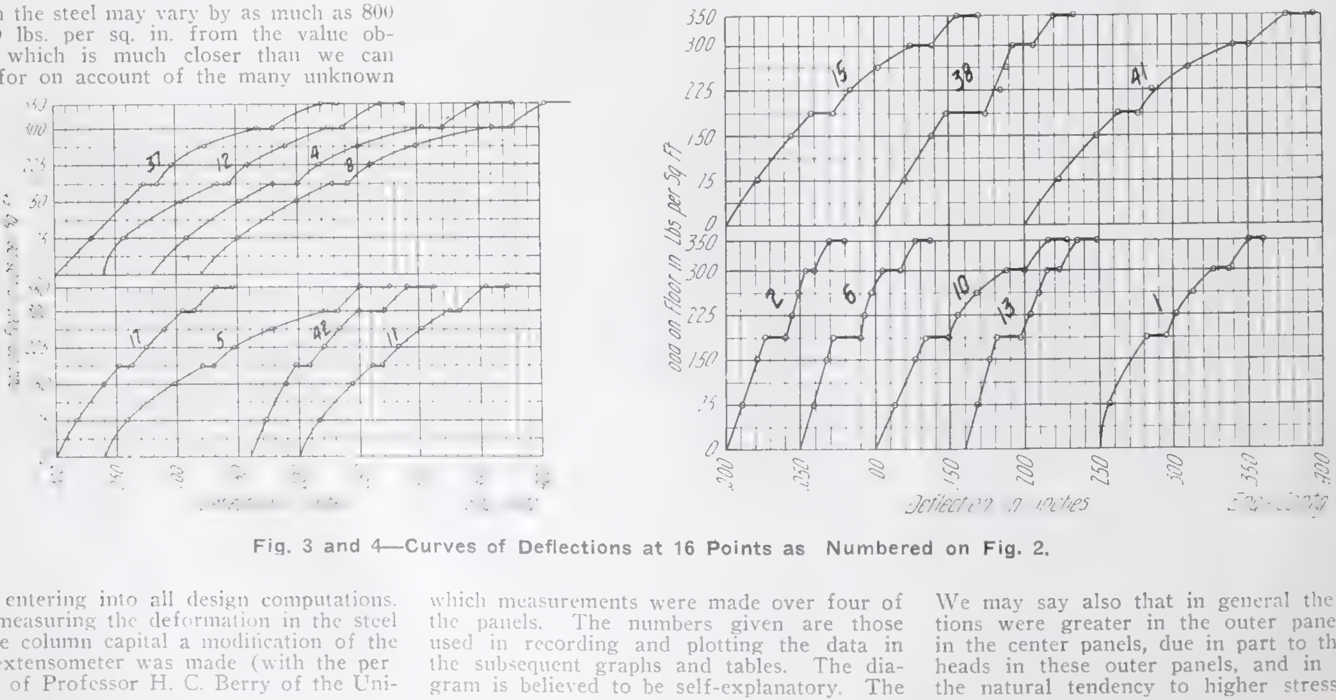

Fig. 3 and 4—Curves of Deflections at 16 Points as Numbered on Fig. 2.

We may say also that in general the deflections were greater in the outer panels than in the center panels, due in part to the bulkheads in these outer panels, and in part to the natural tendency to higher stresses and deflections in end panels. The deflections would probably have been smaller with well cured concrete and in considering deflections it must be remembered that the slab was only 43 days old when the maximum load was placed upon it. The maximum deflection found was 0.32 in., exactly one one-thousandth of the span. This was at a bulkhead in an outer panel. In the center panel the deflection, for all eight panels loaded, was 0.227 in., or 1/1400 of the span, which increased to 0.274 in. or 1/1200 of the span, when the load was removed from the outer panels.

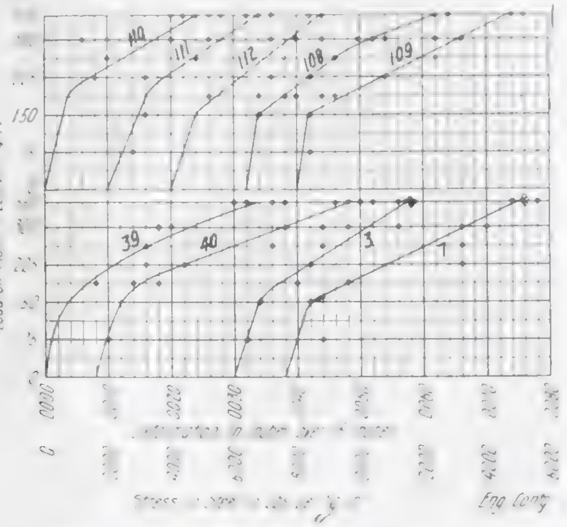

Fig. 5—Deformation of Steel at Span Center.

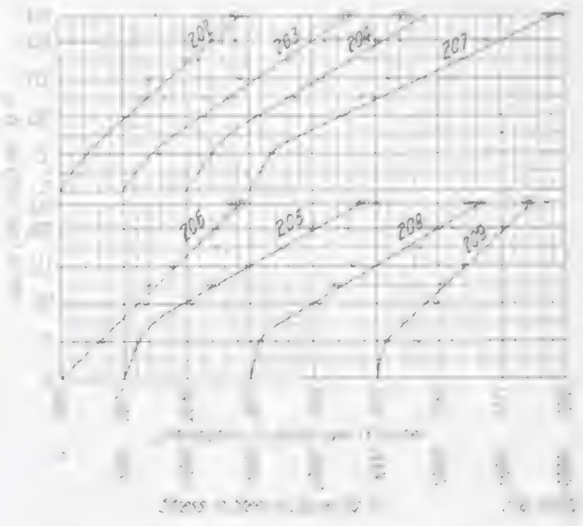

Fig. 7—Stress in Steel Over Column Head.

Stress in Steel at Center.—Figures 5 and 6 and Table II give the data on the measured deformations in the steel at the center of the spans. The table is reduced to unit deformations while the graphs show total deformation over the lengths gaged. On the upper line in Fig. 5 are shown deformations in the center panel and it is to be noted that these are, in general, smaller than those in the outer panels. This would lead us to believe that we should design the steel at the center of the span for one panel loaded, as this apparently gives a worse condition *at the center* than full loading. With reference to Fig. 6 it is of interest to point out that all three of these rods were not as high above the decking as the other rods in the band, and hence took a higher stress than the band as a whole. The embedment of the various rods is given in Table V. The stresses observed at the center were very low and show how marked is the effect of slab action in decreasing the stress at these points. It would seem that any attempt to arrive at the values of these stresses without a liberal allowance being made for this slab action must result in misrepresenting the actual conditions. The observed stresses indicate that the diagonal and cross band rods take practically the same stress.

Stress in Steel Over Head.—Table III and Fig. 7 give the data on this subject. The upper row are diagonal rods, the lower row cross band rods. Note that rods 205 and 208, which are outer rods in the cross bands, took much higher stresses than rods 206 and 209, which were near the center of the band. In the writer's opinion this is strong evidence against the assertion commonly made that these outer rods serve only to carry load to the rods which they intersect and which do pass over the column. Among the diagonal rods we may note that the stress in rod 207 was measured over the edge of the capital while that in 203 and 204 was measured opposite the center of the column. The higher stress in 207 would seem to indicate that the stress in these rods decreases as we pass from the critical section at the edge of the capital to any section near the center of the column. This is as we should expect. The stresses found from these readings indicate clearly that the slab should be designed for a maximum moment over the support, and not at the center as is quite commonly maintained. In the design of this building some 75 per cent more steel was provided over the support than was used at the center, and we easily imagine that the stress must be exceedingly high in many flat slab designs where this extra steel is not provided in anywhere near the same amount. Since the stress reached the allowable value of 16,000 lbs. per sq. in., we may conclude that the designers were not at fault in providing this additional steel over the support.

Stress in Concrete at Edge of Capital.—Figure 18 and Table IV give deformations observed in the concrete. Owing to the fact that no intention of testing existed when the slab was poured no specimens of the concrete were available from which to determine the modulus of elasticity. Hence we are obliged to assume a value for concrete about 40 to 45 days old cured in fall weather at Minneapolis. From experiments made at the University of Illinois concrete of the same age cured under laboratory conditions showed a modulus of 1,875,000 lbs. per sq. in., and in Table VI this value has been used as giving the very highest possible value for the concrete stress. It would probably be fairer to the construction to use a modulus of 1,500,000 lbs. per sq. in., resulting in stresses four-fifths as large. In Fig. 18 a stress of 100 lbs. per sq. in. corresponds to a deformation of 0.0004 in. with a modulus of 1,875,000, or to a deformation of 0.0005 in. with a modulus of 1,500,000. An interesting feature shown in the curves is the falling off in the concrete stress when the load was allowed to remain over night. The decrease is less marked at higher loads than at low loads, while readings taken at very frequent intervals while the maximum load was on the floor showed that at first the stress steadily increased and the decrease did not begin until some time after the load was applied. The phenomenon is of interest as showing the readjustment in stresses which takes place under load even in the least plastic constructions. In general the concrete stresses checked those found in the steel over the support. It would not seem that compressive reinforcement were needed at this point the maximum stress being from 650 to 750 lbs. per sq. in., which is permissible for concrete stressed in several directions and over a very short distance. If, however, a higher percentage* of steel had been used, resulting in a thinner slab, as is commonly done, it is evident that compressive reinforcement would be absolutely necessary for good design.

Summary of Stresses.—Table VI gives a summary of the stresses found at various points under the design load of 225 lbs. per sq. ft. and also under the maximum load applied of 350 lbs. per sq. ft. In every case where a choice has been possible the higher value has been given, as for instance in the concrete stresses the modulus has been assumed as 1,875,000 lbs. per sq. in. instead of the (probably) more just value of 1,500,000 lbs. per sq. in. The dead load stresses have been taken as one-half the live load stress at the design load (the dead weight of the slab.

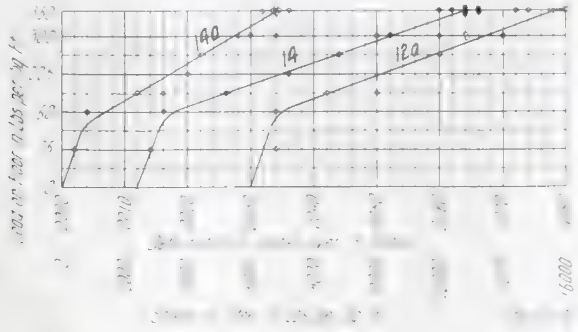

Fig. 6—Deformation of Steel at Span Center.

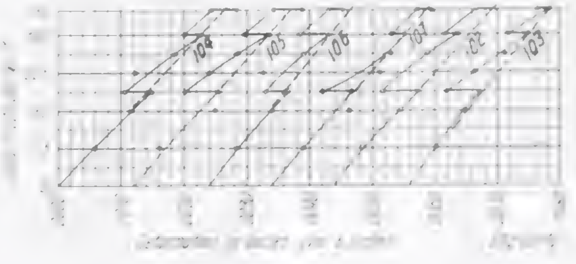

Fig. 8—Stress in Concrete at Edge of Column Capital.

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*[illegible] tion. The writer is informed that this is the standard practice of the company which designed the building, but the need of this pre- [illegible] recognized.

TABLE I DEFLECTION OF SLAB (IN INCHES) AT POINTS MIDWAY BETWEEN COLUMNS.

Load in lbs. per sq. ft. Center Panel.	Outer Panels.	Observation Number. 37	4	8	12	17	42	5	11	15	38	41	1	2	6	10	13
0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
75	75	29	29	32	16	16	13	18	18	22	20	24	7	11	11	15	10
150	150	61	73	79	66	39	30	57	45	44	38	49	22	22	17	27	17
187.5	187.5	71	101	111	95	52	35	81	63	58	57	64	33	26	19	34	20
187.5	187.5	0.085	0.121	0.123	0.105	0.063	0.049	0.089	0.070	6.072	0.076	0.077	0.046	0.041	0.041	0.050	0.038
225	225	98	139	143	119	74	61	107	82	83	83	86	52	45	43	56	45
262.5	262.5	124	173	180	149	89	75	138	103	103	93	111	64	48	45	69	50
300	300	168	225	242	186	105	101	183	128	126	93	140	78	48	57	88	57
300	300	177	234	252	193	110	109	189	132	135	99	148	80	52	62	96	62
300	300	0.180	0.242	0.258	0.198	0.113	0.112	0.193	0.134	0.139	0.106	0.152	0.087	0.059	0.068	0.101	0.064
350	350	224	272	293	231	133	132	218	157	156	121	178	97	70	77	117	76
350	350	217	281	301	235	135	131	224	161	161	123	182	102	71	79	121	81
350	350	220	285	306	240	137	138	227	163	162	125	186	101	73	79	122	80
350	350	223	288	309	242	138	143	229	163	162	125	186	102	73	80	121	80
350	350	224	...	...	244	139	137	231	165	163	126	188	102	73	81	123	81
350	350	227	..	..	246	141	140	235	167	165	128	191	103	74	82	125	83
350	350	0.234	0.299	0.321	0.250	0.146	0.146	0.238	0.169	0.170	0.134	0.196	0.107	0.078	0.88	0.130	0.090
350	187.5	246	223	241	188	138	134	172	124	125	127	181	80	63	70	104	73
350	0	226	115	114	97	124	112	72	50	54	115	156	34	58	41	58	43
350	0	274	116	111	96	126	117	68	47	54	122	160	36	42	46	61	48

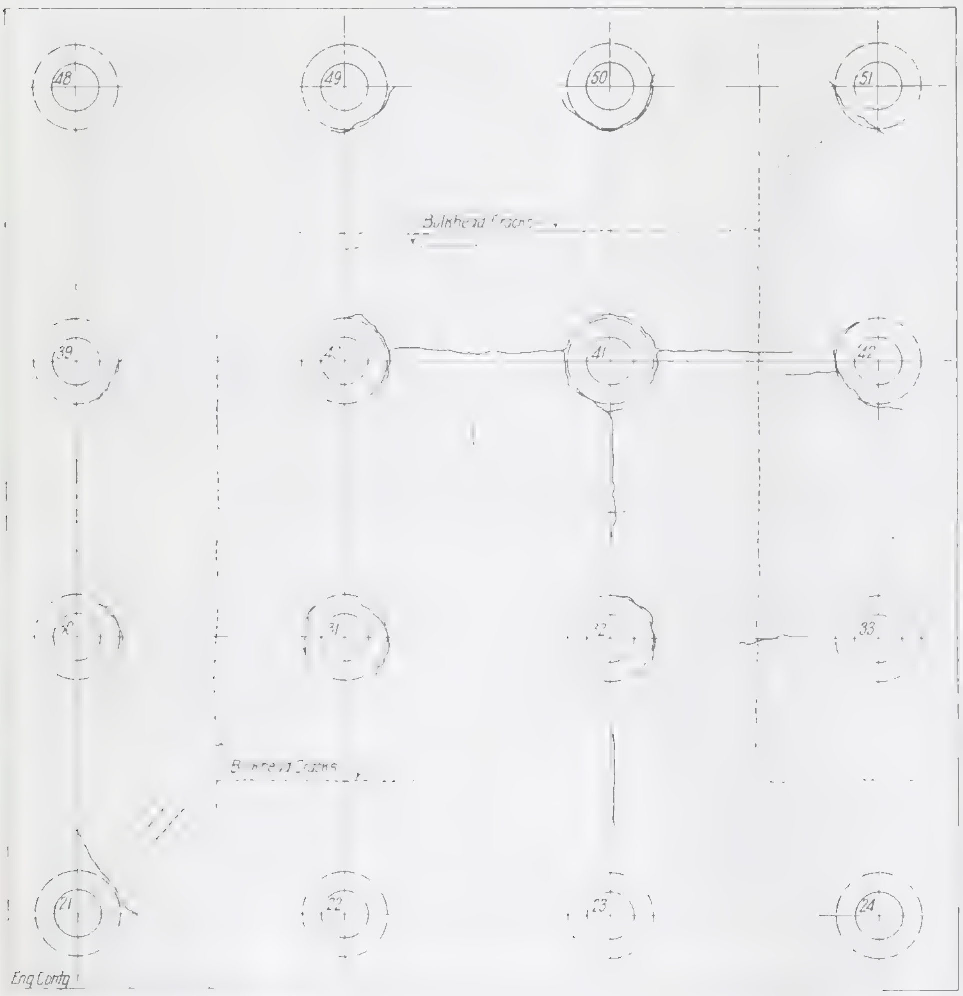

Fig. 9—Diagram Showing Location of Cracks in Test Panels.

being half this load). This, also, is a maximum assumption and probably somewhat in excess of the true value, as the concrete was not broken in tension until after a live load of 75 pounds per square foot was applied, and the tension in the concrete will undoubtedly account for a much higher percentage of the dead weight than of the live load.

Cracks.—Very careful observations were taken to discover and record all cracks. A powerful reading glass was used to aid the eye, and dust was removed by means of bellows. It is exceedingly easy *not* to discover cracks in such a test, and an ordinary observer would very likely have been aware of the existence of but few of these cracks. At a load of 262.5 lbs. per sq. ft. a crack was observed at the bulkhead where two days had elapsed between the pouring of the adjacent floor sections. At 300 pounds per sq. ft. cracks appeared at the other bulkheads. Suggestions of cracks were also found in the center panel where no bulkhead existed and over the edge of the capital at column No. 41, these being very faint and hard to trace for any distance. At 350 lbs. per sq. ft. we were able to trace out the cracks shown in Fig. 9, the dotted lines representing cracks in the ceiling below. The cracks about the column head are of interest as indicating the position of the critical section for which moments should be figured in analyses. These averaged about 2 or 3 ins. outside the edge of the capital below. At column No. 51 the position of the crack would seem to indicate that for a single panel loaded the critical section moves nearer the support resulting in higher stresses at the center. This crack and similar ones, as at columns Nos. 49, 39, and 21, were very faint, indicating a lower stress in the steel over the support at such points. The cracks shown running diagonally near Columns No. 21 and 51 were in all cases directly beneath slab rods. Another set of cracks which developed only under the maximum load of 350 pounds per sq. ft. possesses a peculiar significance. These cracks ran along the center of the cross bands, being easily traced at the center, growing fainter toward the columns, and disappearing entirely in most cases before reaching the crack over the edge of the capital. These cracks afford a most satisfactory evidence of

TABLE II.—UNIT DEFORMATION IN STEEL AT CENTER OF SPAN BETWEEN COLUMNS.

Load in lbs per sq. ft. Center Panel	Outer Panels.	Observation Number. 39	40	108	109	14	14a	110	111	112	7	3	12a
0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
75	75	— 1	1	[illegible]	1	0	1	5	3	— 3	— 1	1	— 3
150	150	— 1	[illegible]	1	1	1	3	— 5		4	3	3	— 3
187.5	187.5	0	4	4	[illegible]	8	8	3	1	1	1	7	3
187.5	187.5	0.00007	0.00007	0.00005	0.00004	0.00013	0.00011	—0.00001	0.00001	0.00007	0.00007	0.00007	0.00008
225	225	11	[illegible]	[illegible]	9	15	13	5	4	8	12	8	1
262.5	262.5	11	19	9	15	20	15	7	9	9	12	9	15
300	300	12	20	12	[illegible]	24	19	7	3	11	12	12	17
300	300	13	20	12	13	25	20	4	3	8	15	12	17
300	300	0.00021	0.00024	0.00015	0.00017	0.00031	0.00023	0.00013	0.00011	0.00013	0.00021	0.00017	0.00021
350	350	21	27	20	24	31	24	15	17	13	21	19	23
350	350	20	29	[illegible]	[illegible]	32	23	15	15	12	20	19	24
350	350	21	25	21	24	33	23	13	16	13	20	19	28
350	350	[illegible]	28	20	23	33	23	16	16	12	20	19	27
350	350	25	27	21	[illegible]	33	23	19	16	11	19	17	28
350	350	21	27	20	24	33	23	17	12	9	19	19	28
350	350	0.00020	0.00025	[illegible]	[illegible]	0.00035	0.00023	0.00016	0.00011	0.00009	0.00020	0.00019	0.00027
350	187.5	19	25	[illegible]	20	[illegible]	17	19	9	12	17	17	19
350	0	17	8	21	[illegible]	11	— 1	21	15	15	9	4	3

TABLE III UNIT DEFORMATION IN STEEL OVER CAPITAL.

Load in lbs. per sq. ft. Center Panel.	Outer Panels.	Observation Number. 202	203	204	207	205	206	208	209
0	0	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
75	75	14	8	7	6	4	11	2	2
150	150	24	[illegible]	19	25	[illegible]	22	[illegible]	14
187.5	187.5	29	[illegible]	30	33	[illegible]	26	[illegible]	18
187.5	187.5	[illegible]	.00022	.00028	.00030	.00022	.00023	.00022	.00018
225	225	30	31	38	37	26	29	28	23
262.5	262.5	[illegible]	44	48	58	42	42	45	52
300	300	47	[illegible]	50	63	50	42	50	50
300	300	49	54	54	63	50	42	49	54
300	300	[illegible]	.00058	.00057	.00067	.00059	.00047	.00054	.00040
350	350	[illegible]	60	58	72	62	48	[illegible]	39
350	350	[illegible]	[illegible]	56	73	62	47	61	[illegible]
350	350	[illegible]	60	58	75	61	47	[illegible]	40
350	350	[illegible]	58	[illegible]	[illegible]	62	[illegible]	58	40
350	350	[illegible]	[illegible]	57	72	68	47	59	40
350	350	[illegible]	61	56	76	67	48	61	41
350	350	[illegible]	.00061	.00056	.00078	.00064	.00049	.00063	.00041
350	187.5	[illegible]	[illegible]	54	80	64	48	60	41
350	0	50	48	51	77	62	48	55	39

TABLE IV UNIT DEFORMATION IN CONCRETE AT EDGE OF CAPITAL.

Load in lbs. per sq. ft Center Panel.	Outer Panels.	Observation Number 102	103	104	105	106	107
0	0	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
75	75	11	19	9	7	8	7
150	150	21	28	21	[illegible]	17	20
187.5	187.5	24	30	24	16	18	20
187.5	187.5	0.00015	0.00021	0.00018	0.00013	0.00015	0.00012
225	225	15	25	20	17	14	[illegible]
262.5	262.5	28	37	31	28	[illegible]	31
300	300	36	43	38	36	32	34
300	300	39	44	38	33	30	33
300	300	0.00032	0.00038	0.00033	0.00029	0.00024	0.00031
350	350	41	47	40	38	32	38
350	350	43	47	42	39	[illegible]	38
350	350	43	49	43	[illegible]	35	39
350	350	44	45	44	42	34	[illegible]
350	350	47	48	46	42	34	40
350	350	49	50	48	41	36	40
350	350	[illegible]	0.00045	0.00048	0.00040	0.00034	0.00040
350	187.5	47	49	44	36	31	37
350	0	44	44	[illegible]	23	22	30

TABLE V DATA ON POSITION OF RODS ON WHICH DEFORMATIONS WERE MEASURED.

Observation No.	Band.	Position in Band.	*Embedment.	Layer of Steel Over Column.
3	Diagonal	3d rod from center	11/16"	
7	Diagonal	3d rod from center	15/16"	
12a	Diagonal	2d rod from center	[illegible]	
14	Cross	2d rod from center	5/16"	
14a	Cross	Outer rod of band	[illegible]	
39	Cross	2d rod from center	[illegible]	
40	Cross	Outer rod of band	11/16"	
108	Cross	3d rod from center	15/16"	
109	Cross	Outer rod of band	13/16"	
110	Diagonal	3d rod from center	[illegible]	
111	Diagonal	5th rod from center	13/16"	
112	Diagonal	Outer rod of band	9/16"	
202	Diagonal	Outer rod of band	[illegible]	2d layer from top
203	Diagonal	5th rod from center	2 1/16"	2d layer from top
204	Diagonal	3d rod from center	[illegible]	d layer from top
207	Diagonal	1st rod from center	[illegible]	d layer from top
205	Cross	Outer rod of band	[illegible]	layer from top
206	Cross	3d rod from center	[illegible]	3d layer from top
208	Cross	Outer rod of band	2¾"	3d layer from top
209	Cross	3d rod from center	[illegible]	3d layer from top

*Measurement from surface to center of rod.

TABLE VI.—SUMMARY OF STRESSES.

		Design load—225 lbs. per sq. ft. L. L.	D. L.	Total.	Max. load—350 lbs. per sq. ft. L. L.	D. L.	Total.
Steel over head.							
Diagonal	Maximum	13,800	6,900	20,700	24,200	6,900	31,100
Band	Average	11,000	5,500	16,500	18,800	5,500	24,300
Cross	Maximum	10,000	5,000	15,000	18,800	5,000	23,800
Band	Average	9,000	4,500	13,500	17,200	4,500	21,700
Steel at center.							
Diagonal	Maximum	2,400	1,200	3,600	4,800	1,200	6,000
Band	Average	2,000	1,000	3,000	4,800	1,000	5,800
Cross	Maximum	2,800	1,400	4,200	8,000	1,400	9,400
Band	Average	2,500	1,300	3,800	6,600	1,300	7,900
Outer	Maximum	4,600	2,300	6,900	10,400	2,300	12,700
Panels	Average	3,800	1,900	5,700	8,000	1,900	9,900
Concrete at capital.							
Diagonal	Maximum	530	265	[illegible]	800	265	1,065
Direction	Average	500	250	[illegible]	750	250	1,000
Cross	Maximum	500	250	750	800	250	1,050
Direction	Average	468	234	700	[illegible]	234	981

Concrete stresses based on E_c = 1,875,000 lbs. per sq. in.

the presence of "slab action," and would be expected to occur if Professor Talbot's theory of such action is accepted. These cracks have, we believe, never been observed before, probably because other building tests have not been extensive enough to develop them to a marked degree, and because cracks have not ordinarily been very carefully observed.

General Conclusions.—One test does not permit of very conclusive deductions—we hope and believe that many such tests will be made in the near future, covering a sufficient range of panel sizes and live loads to afford conclusive design data. The most important result of the test, in the writer's opinion, lies in the demonstration that well equipped laboratories may undertake such tests with the reasonable expectation of securing reliable and useful data. The difficulties to be met are not greater than those encountered in experimental work in the laboratory. It is not believed, however, that inexperienced men would be warranted in undertaking such a test as the instruments used require the handling of trained observers.

The test gives certain well defined indications: It indicates positively that moments are much greater at the support than at the center of the span.

It indicates, by the position of the cracks, the section for which moments should be calculated at the support.

It indicates that the stresses at the center of the span are much lower than the computed stresses at this point would lead us to expect.

It indicates that bulkheads act to increase deflections and stresses.

The test shows that the design of this particular building is well balanced and that the stresses are safe. It does indicate, however, that serious questions may be entertained as to the stresses in many buildings of this type where higher percentages of steel have been used and very little additional strength provided at the support.

It indicates that the steel *at the center* receives its maximum stress for the condition of one panel only loaded.

A Discussion of the Basis of Design for Reinforced Concrete Floor Slabs.*

In this paper the writer desires to state briefly, without attempting to make connections or applications, the evidence presented by the building test described in a previous paper and also such confirming evidence from other tests made recently at the University of Illinois, as is applicable to a consideration of the basis of design for reinforced concrete floor slabs. In the limited time at his disposal it will be necessary simply to state many conclusions. Points on which a division of opinion may be expected will be discussed more fully.

The division of the slab into beams or beam strips gives a method of analyis which appeals to many as the logical manner of approach in undertaking the analysis of the reinforced concrete floor slab. It does not seem, however, that the *true* stresses may be so arrived at, but we may safely conclude that the stresses so found will represent the *maximum* value.

It must be recognized that the stresses indicated by the beam method of analysis are reduced by slab action and by arch action to a very considerable degree, but it is not possible to state coefficients for this reduction or to give it quantitative expression at present. The amount of this reduction probably depends on the depth of the slab and on the details of the head and slab reinforcement, and may be expected to vary considerably under different conditions.

Certain lines of approach do not seem to be tenable as a basis of analysis. Whatever the value of Grashof's analysis of homogeneous plates fixed on a system of equidistant points may be (and this value is not clearly established), the use of the ratios from Grashof does not seem to be warranted without advancing weighty supplementary evidence. Other writers have pointed out the important bearing which Poisson's ratio has on the value of the stress found by Grashof's equations. The writer would mention also that the expression found by Grashof is indeterminate for other than square panels, and that the maximum stress is located at the center of the cross band (as applied to the floor slab) and not at the support. This can hardly be said to represent the conditions in the reinforced concrete floor slab.

Treatments based on Dr. Eddy's analysis of the circular flat plate do not seem to apply for the same reasons. Dr. Eddy's analysis assumes certain relations in both shear and moment curves which, while tenable for the cases that he treats, do not seem to be applicable to a plate supported over a considerable area at its center. Dr. Eddy does not attempt to apply his analysis to any similar cases.

A study of stress conditions would indicate that certain limitations should be recognized in designing the flat slab. Beam analysis applied to the slab and the results of tests both indicate that the moment is greater over the support than at the center, and that the critical section is at or near the edge of the capital. If this be true, and we wish to adhere to the established practice of maintaining the same slab design for all floors, it is essential that the capital be also maintained at or above some minimum size, for which minimum size the moments have been figured. Common practice makes the capital size depend on the column size, when it should depend on the dimensions of the panel. The stresses in the steel and concrete due to moment and the shearing and diagonal-tension stresses are all increased rapidly by a decrease in the size of the capital. Over the small capitals in the upper floors of buildings of this type the stresses must be much higher than they are for the lower floors with their large capitals. From a study of shear and moment stresses in several buildings it is recommended that the capital be maintained at a diameter of at least two-tenths the dimension of the side of the panel, if the capital is square, or at an equivalent area if the capital be of different shape. Shearing and diagonal-tension stresses will be safe for this size of capital provided a proper percentage of steel is used in the slab design proper.

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*[illegible] in the Engineering Experiment Station, University of Illinois, presented before the National Association of Cement Users, Dec. 13-17, 1910.

It is quite commonly held that only the rods which pass over the capital may be taken into account in figuring the resistance to negative moments. Under this conception the strips containing the outer rods of a band serve only to carry load to other strips which they intersect and which do pass over the capital. In this conception it would seem that there is a confusion between transfer of weight and of stress. The weight or load follows the most direct path to the column, being transmitted in the form of shear in the concrete itself, and does not need to be transferred from strip to strip at their intersection. The wide beam while stressed very high at the support locally in shear, may be stressed over its entire width in moment. A series of tests made during the past year at the University of Illinois illustrates this lateral distribution of *stress* in wide beams. These beams were of various dimensions and proportions, and we may be permitted in advance of the full publication to present one particular set in which the proportions were very near to the conditions found in ordinary building design. The beams were 36 ins. wide, 4 ft. 10 ins. long, and 3 ins. deep to the steel. Thus the ratio of depth to width is 1/12 or somewhat in excess of the usual ratio of depth to steel to width of band in the flat slab. The beams were loaded across their full width at the ends, and were supported at the third points, in some cases for their full width, in others for one-half their width, and in still others for one-fifth of their width. The beams were made and tested in duplicate at approximately 60 days. Table I gives the loads carried.

TABLE I.

		Total Load Carried.		
Beam No.	Supported	Beam 1.	Beam 2	Av.
711.1 — 2	Full width	15 750	15 800	15 770
713.1 — 2	Half width	15 000	17 000	16 000
715.1 — 2	Fifth width	14 900	12 250	13 500
717.1 — 2	Fifth width	14 550	16 000	15 300

The 717 beams were provided with 0.4 per cent cross reinforcement.

All the beams had ten ⅜-in. round rods 3 ins. from the face, and beams 717.1-2 had ¼-in. round rods 4 ins. on centers crosswise of the beam. We may note that for one-half support there was no appreciable falling off in the load carried. The deflection curves showed also that the steel at the edges took the same stress as did the rods in the beam supported for its full width. The yield point of the steel used was 37,000-38,000 lbs. per sq. in., and computations show that all the steel present in both cases was stressed about 10 per cent beyond the yield point when the yielding of the steel caused the concrete to fail in compression. This is exactly the phenomena of the ordinary beam test where there is no question of lateral distribution involved. When the beam was supported for only one-fifth its width there was but a small falling off in the load carried. For all cases where the recommendation of this paper with regard to column size is followed the beams or bands will be supported for one-half of their widths, in which case the entire steel would seem to be effective.

The evidence of the wide beam tests is further confirmed by tests of footings. It may be pointed out that the portion of the slab inside the line of inflection is in effect an inverted footing loaded with a peripheral load at the line of inflection (reactions of the supported beams between the lines of inflection) and a uniform load over the base. The footings tested were of uniform depth throughout, being somewhat thicker in proportion than the cantilever slab about the column. From a consideration of all the results Professor Talbot has arrived at the conclusion that the width of the resisting section, as governing the stress in the steel, was composed of the width of the pier, plus the depth to the steel on each side of this, plus one-half of the remaining width of the footing. Applying this to several designs revealed the fact that this width includes all the steel in both the cross and diagonal bands in all ordinary designs. In other words, not the steel passing over the capital only, but the entire steel in both bands may be counted on to take its full resisting moment. Actually observed stresses found in the building test bear out this statement. The stress was found to be nearly constant across the entire band, the slight falling off in the case of the outer diagonal rod being accounted for in part at least by its lower position in the slab. To offset this the outer rods of the cross bands were observed to be taking slightly higher stress than those in the center of the bands.

The footing tests previously mentioned afford evidence also as to the position of the section at which negative moments should be figured for any band. The reinforcement in the footings was laid sometimes in two bands and sometimes in four bands without any noticeable effect on the strength or the stresses found in the specimen. The tests have been interpreted for a bulletin on footings now in manuscript form and the conclusion was reached that stresses figured for a section at the face of the pier would represent fairly the structural action involved. Additional evidence was afforded from the observation of cracks about the columns in the building tested. These cracks formed at a distance of about 2 ins. on the average outside of the edge of the capital below, and would seem to indicate that moments may safely be figured about a section at the edge of the capital as giving a maximum condition.

If we consider the bands as continuous wide beams we should expect to find that the moment at the support was twice that at the center of the span for uniform loading. The test indicated that this center moment was somewhat less in proportion, but it is possible under a single panel loaded that the stress at the center may reach as high a value as one-half that at the support under full load, and this fraction may be considered a maximum for design purposes. Much current practise is in direct contradiction to this conclusion. This objection to any adaptation of Grashof's analysis has been noted in a previous paragraph. Mr. Turner's formula, based as it apparently is on tests of single panels and without the determination of actual stresses, must be applied with caution. When a formula is to be derived from tests it is essential that the tests be so planned as to give as high stresses as may reasonably be expected under full load conditions. Certainly tests which from their nature predetermine low stresses at the critical section at the support do not constitute an acceptable basis for a design formula. Mr. Turner's contention that by the use of a uniform grade of open hearth steel it is possible to tell when the stress in the steel reaches the yield point, and that in this manner a basis of design may be arrived at, does not inspire one familiar with test phenomena with much confidence. It does not answer the objection to single panel loads at all. Again it is not clear that any noticeable change will occur in the slab when the steel at the support reaches the yield point. At this time the steel over the support starts to yield; simultaneously the deflection and hence stress at the center increased, and thus relief is afforded the steel at the support. The final failure may even occur at the center, and yet it is evident that this readjustment should not be necessary in good design, even if there is sufficient over-reinforcement at the center to safely carry the added stress (which is not always the case). After the readjustment has taken place there are present in the steel and concrete large permanent stresses and marked set, and against a repetition of the load the structure is even less secure than at first.

The test indicated that the line of inflection lay between a square having the column at its center and its inscribed circle. If the slab be considered as simply supported the least dimension of the line of inflection (in the cross band direction) would be approximately 0.44 L where L is the dimension of the panel. Owing to the fact that the slab is fixed for a considerable area at the column capital, the effective clear span is much reduced, and the least dimension of the line of inflection correspondingly increased. If we take the effective clear span as the distance between the critical sections already determined for negative moment, which seems a reasonable basis, and if we follow the recommendation as to size of capital stated previously in this paper, the least dimension of the line of inflection becomes $0.55\ L+2\ (0.2\ L+2\ (.22\times .8\ L)=0.55\ L$; the .8 L being the effective clear span). In the building tested at Minneapolis the capital size was 0.24 L and the observed least dimension of the line of inflection (in other words the dimension along the cross band) was about 0.56 L. On the basis given above it would figure at $0.24\ L+2\ (.22\times .76\ L)=0.57\ L$, which checks closely with the observed fact. It would seem that for the conditions found in practice, and if columns are not permitted to have unduly small capitals, the variation in this dimension of the line of in inflection would be small, and the value of 0.55 L here given may be quite generally applicable. The dimension of the line of inflection along the diagonal band was observed in the test to be about .64 L.

A question exists as to the value of the compressive stress in the concrete at the edge of the capital, and as to whether or not compressive reinforcement is needed. It is difficult to compute the stress at this point owing to the fact that the concrete is stressed not in one, but in several directions. In the test, however, the resultant stress was measured directly, ranging from 650 to 750 lbs. per sq. in., which is undoubtedly safe for concrete stressed in several directions and over a very short distance. In the design of this building a very low percentage of reinforcement was used at the center of the span, and it would seem as though the use of this low percentage were imperative to proper design unless compressive reinforcement is to be used. We may well ask what the stress in the concrete would have been had ½ per cent or 6/10 per cent reinforcement been used at the center as is frequently, I might say commonly, done. For such practise compressive reinforcement seems to be required.

The writer would like to add a word on the question of shearing stresses in flat slabs. To the designer of beam constructions these stresses have seemed high, and a proper consideration of shear, as well as of moment, makes it advisable to provide a larger capital than is ordinarily used on the upper floors of our present buildings. The recommended minimum size of capital of 0.2 L was selected with the shear computations of several buildings directly in mind. We should remember, however, that a sharp distinction should be made between so-called "punching" shear and shear which indicates the tendency to diagonal tension. Punching shear may properly be figured along the periphery of the capital giving a punching shear unit stress of

$$v=\frac{W\,(L^2-c^2)}{12\times 4\,cd}=0.1\,\frac{wL}{d}$$

the last simple equation applying only when the capital is 0.2 L on a side as recommended (or a circle of equivalent area).

In this formula

[illegible] = side of square panel in feet.

[illegible] = size of equivalent square capital in feet.

d = depth of slab in inches.

The unit shearing stress [illegible] recommended by the Joint Committee of 120 lbs. per sq. in. is certainly permissible.

In computing shear as indicating the tendency to diagonal tension, we should give to the flat slab the same treatment which we accord to beam design. In a restrained beam we fined that the failure in diagonal tension does not occur at the support but at some distance out from it. In like manner Professor Talbot has found in the tests of footings that the failure in diagonal tension took place some distance out from the pier, and he concludes that as an indication of the tendency to diagonal tension the *intensity* of shearing stress should be computed on a section at a distance out from the pier (or edge of capital) equal to the depth of the slab to the steel. Using the same notation as before

[illegible] diagonal [illegible]

tension [illegible]

12 [illegible] 167 [illegible]

In any particular case it is simpler to figure this stress directly than to use the formula. For this value the various limits specified by the Joint Committee should govern.

It is a simple matter to state the above conclusions and recommendations in the form of an analysis but it is not believed that analyses are profitable until some means is found for expressing quantitatively the amount of the reduction in stresses due to arch action and slab action. The amount of this reduction was observed in the test to be large.

ROADS AND STREETS SECTION

Notes on the Construction of Gravel Roads.*

A well graded and well drained earth road is necessary for the foundation of any kind of an improved road, therefore money expended on such work is not lost even though it be several years before the road receives a hard surface. In building any good road, the first essentials are a careful survey and suitable plans.

[illegible] The cost of grading depends upon the kind and amount of earth that must be handled and the distance it has to be moved. Where old roads have been regarded for the purpose of building state reward roads, the cost has usually run from $200 to $400 a mile—$300 being a fair average. A few hilly roads have been graded at a cost of more than $2,000 a mile.

Tools Required.—For rather low turnpikes no tool is so efficient as the road grader in skillful hands. For turnpikes with deep ditches, the flat, or Doan scraper, is excellent. This tool is not intended to move earth far but spreads it evenly over the road when rightly handled.

The drag scraper is good for hauls up to 150 ft. Between that distance and 700 ft., wheel scrapers are best, but to use them economically, there should be enough scrapers working, unless moving soft sand, to keep a snatch team busy, and where the soil is heavy another team on the plow. For hauls longer than 700 ft. it is cheaper to use wagons.

Drainage.—In most soils sufficient drainage is provided by building the ordinary turnpike with side ditches or gutters just large enough to provide for the free flow of water that naturally comes to the road. In clay soils the bottoms of the side ditches should be not less than 2 ft. below the crown of the road, unless supplemented by tile drains. Especial pains must be taken to make sure that the ditches have free outlets.

Tile drains are a necessity in all springy soils. A 4 in. land tile laid along the upper side of the road to cut off the spring water before it reaches the road bed will usually prove sufficient. A line of tile can be placed on the other side later if found necessary. It is always advisable to cover the tile to a depth of 6 ins. or more with gravel or cinders, and in very wet soils the drainage will be facilitated by filling the entire trench with some porous material.

In clay soils trenches should be cut through the shoulders described in the next paragraph, making outlets into the side ditches for water that may collect in the gravel bed during construction, and later before the surface becomes hard and water-proof. Such trenches should be 8 ins. or more in width and slightly deeper than the gravel bed. They should be placed at all low points in the grade and not farther than 100 ft. apart in retentive soils and filled with coarse gravel when the first layer of gravel is put on.

Gravel Bed and Shoulders.—After the rough grading and drainage above described have been completed the gravel bed should be [illegible] by placing shoulders of firm earth on each side and far enough apart to retain the proposed width of gravel, which the law provides, shall be not less than 9 ft. wide nor less than 6 ins. in depth. It may, however, be such greater width as the commissioner may specify and as deep as 12 ins. if necessary, but where any greater depth than 6 ins. is used the gravel should be put on in two or more layers as herein described.

Where the road grade is as high or higher than the finished road should be, the shoulders are best formed by scraping earth from the center to each side with the four wheeled grader. But first the road should be leveled by driving the grader back and forth on the center of the turnpike, with the blade set square across, so as to cut off the high places and deposit the earth in the hollows, using the grader as a planing tool. A double row of pickets set 1 ft. farther out on each side than the margins of the gravel bed, so as to clear the hubs and whiffletrees, is a convenient method of staking out the grader work.

If the old road grade is much too low, it is usually cheaper to regrade and turnpike before beginning to form the shoulders. But should the old bed be about the right height for subgrade, shoulders may be formed by bringing up earth from the sides with the grader provided it can be spared from the gutters or ditches. If not, earth should be brought with scrapers or wagons from other places where it can be spared. Many places will be found where the center can be notched out, leaving the undisturbed sides for shoulders, using the earth thus obtained to build up shoulders on slightly lower ground.

The shoulders thus formed should extend to the side ditches or gutters with the same grade and curvature as required for the finished road, viz.: an average rise of 1 in. for each foot of distance from the inner edge of the ditches or gutters to the center line of road. Thus, an 18 ft. roadway would have a 9 in. crown and a 24-ft. roadway a 12 in. crown.

After the machine work above described has been completed, lines should be set up on the margins of the gravel bed and enough hand trimming done with mattocks and shovels to bring the gravel bed to the exact subgrade, giving it the same width and curvature as required for the finished road. Gravel is too expensive a material to fill hollows with, for they can be filled with earth from the shoulders for less money than gravel can be shoveled into wagons at the pit, and every high point protruding into the gravel means a defective place in the finished road.

Graveling.—Next to proper drainage, the most important thing in building gravel roads is to secure a good quality of gravel. Authorities have differed as to the requirements of suitable road gravels, most of them in my opinion, placing too much stress on the immediate packing qualities. Indeed the average township commissioner and farmers generally have become so imbued with the idea that it is necessary to use a gravel that will pack quickly that they have almost lost sight of the fact that the only thing which makes a gravel road better than an earth road is the pebbles—real stones—that it contains and is dependent upon to bear up the traffic and resists wear.

[illegible] the binder in gravel roads is clay. But, considering all kinds of weather, it is probably the poorest cementing material we have. If present much in excess of 20 per cent of the mass it will make mud whenever there is a prolonged wet spell. Ideal clay gravels contain only enough clay to coat the pebbles, with no free lumps. Such gravels are excellent for the first layer on sandy soils, but sand gravels are much better for the first layer on clay and loamy soils.

Gravels that come from the pit with the pebbles cemented together, even though they contain no clay, will re-cement in the road and become harder than they were in the pit. Tests of specimens of this kind always show that there is much lime present and usually some iron, both of which are excellent cementing materials. Briefly, the experience of the State Highway Department warrants the statement that there are few, if any, bank gravels in Michigan that do not contain enough limestone and other soft pebbles which grind up under traffic and furnish sufficient binder to cause them to consolidate in a few months time, if separated from the surplus sand and earth, and properly treated after applying to the road.

Testing Gravel.—To insure a sufficient pebble content the State Highway Department's specifications require that the gravel for the first course shall be good clean bank gravel, not less than 60 per cent by weight, a larger per cent if possible, of which shall be pebbles that will be retained on a screen of ⅛ in. mesh and pass through a screen of 2½ in. mesh. The gravel for the top course must be the same, except that no pebbles are allowed in this course too large to pass through a screen of 1½ mesh.

Screening Gravel.—Michigan is full of gravel pits which are too sandy to use pit run. In most cases excellent gravel can be obtained from such pits by screening, the cost of which can be kept down to a little more than double the cost of shoveling pit run gravel into wagons if cheap power driven portable screening plants are used. As the screened gravel is delivered into elevated bins from which it is drawn by gravity into the wagons there is no further cost for loading. Next in order of cheapness comes the wagon screen. This is a long screen about the length of the wagon box and 3 ft. wide, which is attached to the far side of the box. The gravel is shoveled over the box against the screen, allowing the pebbles to slide back into the wagon while the sand falls through the screen onto the ground on the opposite side. Hand screening is more expensive, frequently costing as much as 40 cts. per cu. yd. for the screened product.

Wherever the screening of sandy gravel has been tried the quality of the roads has been so much improved that the people are satisfied that the extra cost is a good investment. Many roads in the vicinities of Millington and Mancelona have been built of screened gravel.

Applying the Gravel.—After the road has been graded and shoulders formed as above outlined gravel of the quality described should be put on the road in two courses and each course compacted separately.

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*From the Third Biennial Report of the Michigan Highway Department for the period ending June 30, 1910.

Gravel will compact to about 80 per cent of its depth, loose measure, as applied to the road, provided it is shouldered in and not allowed to waste away to the sides. If the compacted depth is to be 8 ins. and the width 9 ft. as required to secure state reward, it will take about 1,500 cu. yds. of gravel to the mile, and it is best to make the first layer 6 ins. deep loose measure, and the second layer 4 ins. deep loose measure.

To reduce the amount of spreading to the minimum it is advisable to place the gravel on the 9 ft. road bed by dumping two loads side by side, stringing them out just far enough to make the required depth. Thus, if two loads of gravel containing 1 yd. each are dumped on such a road bed, they will reach 12 ft. along the road and spread just 6 ins. deep. This requires only a very little drawing out of each load at the ends. Should the teams draw 1½ yd. loads, they would reach 18 ft. down the road and spread to the same depth, necessitating moving ahead about a wagon length to dump the second half of each load. The top layer would be dumped in the same manner, bearing in mind that to spread only 4 ins. deep the same sized loads will reach a half farther—making two 1 yd. loads each 18 ft. and two 1½ yd. loads reach 27 ft. The distance two loads should reach is best gaged by setting little stakes the proper distance apart in the shoulders along the margin of the gravel bed. These stakes can be moved ahead as the work progresses.

Harrowing and Rolling.—Usually the gravel should be placed on the road commencing at the end of the road nearest the gravel supply so that the teams will aid in packing. As soon as the 30 or 40 rods of gravel have been spread on the road it should be harrowed with a spike tooth harrow, preferably one of the lever type. If but few teams are hauling, the harrow may be used twice daily—just before quitting time at noon and again at night. If a 100 yds. or so of gravel are hauled to the road daily, one team should be working on the harrow all the time. The harrowing should be done the same for both courses. As soon as the gravel has been well wet by rains it should be rolled with the best roller available. For this purpose a weighted field roller may be used if one can be had that is strong enough to bear weighting to three or more tons. A heavier roller of larger diameter is preferable, and where possible it is better to use a regular road roller, either of concrete or cast iron, weighing not less than four tons. In some places such rollers have been hauled with traction engines, the engine wheels doing as much or more compacting than the roller. Where a power roller is obtainable, it is better and more efficient than any of the others.

Each course should be rolled separately, commencing at the sides, rolling lengthwise of the road, but gradually working towards the center. In the final rolling the whole surface of the roadway, including the shoulders, should be rolled and left in such perfect condition that water will flow without obstruction to the side ditches. The grader or float may have to be used at times to preserve the crown, but the harrow should be kept running until the rolling is completed, or until the gravel becomes so well compacted that the teeth refuse to penetrate the surface.

Maintenance.—Gravel roads completed in the prescribed manner may not become thoroughly compacted, no matter how well they are rolled, until after several months of travel—usually not until they have passed through one winter. During this formative period the road must be looked after and kept free from wheel ruts and hollows. It can usually be kept smooth by the systematic use of the plank float, the timber or angle iron drag, or sometimes by the careful use of the road grader. The last named tool often does much damage by digging up hard places, while the former tools only shove the loose gravel forward, gradually pushing enough of it towards the center of the road to preserve the crown, but always depositing it where there is a hollow. Wherever there is an extra deep wheel track or other evidence of rutting and not enough loose gravel to completely fill the depressions, a little new gravel of the best quality should be put on before the floating is done. This work should always be done immediately after rains, preferably when water is still standing in the little hollows, as then they can be seen more readily, and at such times the gravel is in the best possible condition for packing and uniting with the hardened road bed. Such treatment systematically followed up will preserve the gravel road in as good condition as when new until the surface has worn down so far that it needs a new top.

About 7,000 miles, or approximately one-tenth of the total road mileage of Michigan, have been reported as surfaced with gravel. Some of these are very good and some scarcely better than common earth roads. This is caused, first, by placing gravel on improperly graded and undrained roads and, second, by using gravel which contains too much sand or too much loamy clay. Since the state reward road law became operative there have been built about 350 miles of gravel road which have received a state bounty. These roads have ranged in cost from a little less than $1,000 upwards to $3,000 per mile, the average being not far from $1,500.

Road Treatment With Tar for Dust Prevention at Hull, England.

During the past season the City Engineer of Hull, England, has been treating some 50 miles of road with tar for the prevention of dust. In this work the following materials were used:

(1) Gas oil tar, applied in a fine spray by a large steam machine.

(2) Refined coal tar of comparatively low viscosity, applied in the same manner. This material was delivered to the machine direct from the still and applied while hot.

(3) A mixture of paving tar and pitch, heated in the street, and applied there by a small horse-machine or by cans and brushed in. By reason of delay in heating, etc., the City Engineer states that this process is too slow and expensive for general use, and it has only been applied in special cases where the stone in streets, otherwise in good condition, was losing its binding, and in danger of coming loose.

Except under very special circumstances, the whole width of the street has never been treated in one day, and it is proposed to make this an absolute rule in the future, except when the street can be closed from traffic.

As to the effects of this treatment the City Engineer states that while all the materials have given very good results as regards dust prevention and road preservation, the mixture of paving tar and pitch has proved the most efficient and the gas oil tar applied in a fine spray the least efficient. But on the other hand, states the City Engineer, it may be said that the cost of the work and the risk of trouble are greater under the second and third methods of application.

Some complaint was made as to the roads being rendered slippery for horses by the tarring and the City Engineer was instructed by the Corporation Works Committee of Hull to make a report on the matter. A copy of this report was transmitted to the U. S. Bureau of Manufactures by the U. S. Consul at Hull, and from this report we have taken the matter for this article.

That portion of the City Engineer's report regarding the slipperiness of the pavement resulting from the tarring is as follows:

> With regard to the streets treated with gas oil tar, which comprise about two-thirds of the total mileage, it does not appear that any complaint has arisen, although it is possible that trouble might occur if the tar was applied over a smooth non-absorbent patch.
>
> Probably most of the trouble has arisen from the use of coal tar from the large machine. It is the practice to follow up the machine when necessary with sand, but it travels over the ground at five miles per hour, and it is quite possible that small areas might either not be reached in time to prevent accidents, or might even be overlooked especially if a shower of rain follows the application. It does not appear that any trouble is likely to arise if the road is in a clean and absorbent condition, but the condition of macadam roads is, of course, far from uniform, and a small area which has been disturbed for a trench, or wetted in any way, or previously heavily tarred, might not absorb the new tar for many hours. The supply of this coal tar is somewhat limited, and it is proposed in future to use it only for the first journey in each day, so that it shall have as long as possible to absorb before dark, and no doubt drivers are now realizing the risk of traveling on wet tar.
>
> As regards the third method of treatment, it is confined to such a small area at one time, and the work is so obvious that there is no excuse for drivers going upon a dangerous area, especially as the tarred surface is sanded whilst still hot.
>
> The permanent effect on the surface has, of course, to be considered, and no doubt anything whatever of a tarry nature applied to a road surface will slightly impair the foothold. The City Engineer has communicated with a large number of firms and submits their replies. It may be said that the attitude of the cab proprietors varies from indifference to strong hostility, and that the heavy carters are apparently indifferent. Messrs. Greenwood Brothers state that although there are some disadvantages to horses by causing them to slip and detract from their power, they are outweighed by the benefit to the general public. Mr. Isaac Taylor, the secretary of the Cowkeepers' and Farmers' Association, states that there have been numerous complaints, but that in places where the tar has been thinly applied he thinks it a great benefit.
>
> Complaints have arisen from two other causes, namely, spray from the large machine having been blown on to property or persons' dress on a windy day, and in two instances through tar being splashed from puddles where water had been standing when the machine passed through the street. It is fair to say, however, that considering that the length of streets treated must be at least 50 miles, the complaints have been relatively few, and bear no proportion to the appreciation which has been expressed by the general public.
>
> Considering the area to be covered and the dependence of the work upon the weather, tar-treatment has now to be considered as high-speed emergency work, and some trouble must inevitably arise from work carried out under these conditions, but with the increasing experience of the men engaged upon it, it may be expected that complaints will become still fewer in number.

Notes on Road and Street Work.

Per Cent of Engineering and Inspection on Pennsylvania Road Work.—In a paper presented to the recent convention of the American Road Builders' Association at Indianapolis, Mr. Joseph W. Hunter, State Highway Commissioner of Pennsylvania, stated that the average cost of constructing state aid roads in Pennsylvania was $11,380 per mile, this cost including all charges. Of this cost $750 per mile is for bridges. The engineering cost was given as 1.95 per cent and the cost of inspection as 2.87 per cent.

Rim Wear of Road Roller Wheels.—Thomas Aitken, the English road engineer, states that the wear of road roller rims, which had been renewed by steel plating, is .02 in. for every 1,000 tons of macadam consolidated. On the basis that the roller consolidates 8,000 tons of stone per annum, the wear of the steel plated rims is about 1/6 in. per year. Mr. Aitken also states that the cast iron driving wheels of a 15-ton roller lasted seven years, during which time they consolidated 60,000 tons of macadam. In the Engineering Review (London), for October, M. L. Crouch gives the rim wear of road rollers as being ½ in. to ⅝ in. per year for the driving wheels and ¼ in. to 5/16 in. per year for the front wheels. It will be noted that, according to these figures, the wear on the driving wheels is about twice that on the front wheels. Mr. Crouch states that in average service the wheels themselves will last from 20 to 30 years, but new rear rims will be required every three to five years and new front rims every six to ten years.

Sand-Clay-Gravel Roads.—An adaptation of the sand-clay type of road is used in the construction of one class of the state reward roads in Michigan. This road is adapted for sandy soils having good natural drainage, and where the ground water is several feet below the surface. According to the requirements of the State Highway Department the finished road must not be less than 18 ft. between and exclusive of side ditches. The cross section must be oval in form, with an average size of 1 in. to the foot from the inner edge of the ditch to the center line of the road. In the construction of this type of road, shoulders of suitable material are formed not less than 9 ft. apart to retain the metal. This bed is 8 in. deep, 2 in. being allowed for the settling of the sub-grade. After the metal bed has been shaped, a good quality of clay is spread to a uniform depth of 3 in. The clay is then rolled sufficiently to crush the lumps, and is then harrowed until thoroughly pulverized. Immediately after the harrowing 3 ins. of sand, which may be scraped from the sides with the scraping grader, is spread upon the clay and carefully leveled. The road is then harrowed again, a disc harrow being preferable, until the sand is uniformly mixed with the clay. The road is then again rolled until thoroughly compacted and hard and everywhere 5 ins. below the grade at section of the completed road. It may be stated here that the mixing can be done much more easily when the clay is thoroughly wet. Immediately after a heavy rain is the best time. After the rolling has been completed, the clay course is covered with 6 in. of loose gravel, which is compacted to a uniform depth of 5 in. The gravel is required to be clean bank gravel, not less than 60 per cent by weight of which must be pebbles that will be retained on a screen of ⅛ in. and pass through a screen of 1½ in. mesh. If clay-gravel is used it should not contain more than 20 per cent of clay, owing to its tendency to make mud. After the gravel has been placed it is harrowed with a spike-tooth harrow and rolled until no further compacting is possible. The final rolling must be done when the road is wet from sprinkling or rains. Any hollows that develop in the gravel during the rolling are filled with the same kind of gravel.

Stone-Gravel and Gravel-Stone Roads.—Roads constructed with a macadam bottom and gravel top, and with a gravel base and macadam surface form two of the classes of state reward roads in Michigan. In the case of the stone gravel road the specifications of the State Highway Department require that the road shall be not less than 18 ft. wide between side ditches, that it shall have a cross section oval in form with an average rise of 1 in. to the foot from the inner edge of the ditch to the center line of the road. After road has been graded the metal bed is formed as follows: Shoulders of firm earth, or other suitable material, are placed not less than 9 ft. apart. Where the road grade is high the shoulders may be formed by moving earth from the center of the present road grade to the sides, or if the grade is low, by crowning the present road grade by scraping earth from the sides toward the center; or if sufficient suitable material cannot be had along the roadway, it can be brought from other places along the line of work. After the shoulders and the metal bed have been formed the whole roadway is rolled until no more compacting is possible. A layer of crushed stone or slag is then spread on the prepared bed to such uniform thickness as to be not less than 4 ins. deep after thorough rolling (5 ins. deep loose measure). The material for this bottom course may be of a suitable grade of crushed slag, limestone, cobbles or trap rock. It must consist only of that part of the crushed product passing over the ¾ in. section and through the 3 in. section of the crusher screen. It is required that this stone, or slag, be placed upon the road uniformly mixed, no patches of alternately large and small pieces being allowed. Unless automatic spreading wagons are used, this is usually best accomplished by making several dumps of each load, so that the least possible amount of handling with shovels and rakes will be required. In no case should this course be laid on a muddy subgrade. After the bottom course has been spread it is rolled two or three times with a roller weighing not less than 10 tons, and is then covered to a depth of ½ to ¾ in. with stone screenings or clean bank gravel and rerolled. The amount of binder used is somewhat less than enough to fill the voids in the stone. The rolling is then continued, water being applied in advance of the roller if so ordered, until the binder is worked into the interstices of the larger stones and the stones cease to sink or creep beneath the roller. The stone or slag course is then covered with a layer of gravel of such thickness as will make 3 ins. after compacting (4 in. loose mixture). The gravel is required to be clean bank gravel, 60 per cent by weight (a larger per cent if possible) of which shall be pebbles that will be retained on a screen of ⅛ in. mesh. If clay-gravel is used it should contain only enough clay to cover the pebbles. In no case should the clay exceed 20 per cent of the mass. After the gravel top course has been applied it is flooded until the surface is smooth and even, and then sprinkled and rolled until no farther compacting is possible. In the case of gravel-stone type of construction the method of procedure for the preparation of subgrade and metal bed is the same as for the stone-gravel type of road. The gravel bottom course is spread to such uniform thickness as to be not less than 4 in. deep after compacting (5 in. loose measure). The gravel course is then harrowed with a spike-tooth harrow and rolled until no further compacting is possible. This rolling must be done only when the road has been well wet by sprinkling or after rains. Ruts formed by hauling over the gravel are required to be kept filled by using the harrow twice or more every day, preferably just before quitting time both noon and night. In some cases a slag bottom is used instead of gravel. If slag is used it is required to be spread to such a uniform thickness as will make 4 ins. compacted. The slag must consist of only that part of the crusher product passing the 1 in. section and through the ¾ in. section of the crusher screen. It is further required that the slag be placed on the road uniformly mixed. The slag course is bonded with gravel or stone screenings, the amount of binder used being slightly less than enough to fill the voids in the slag. After the gravel course has been prepared the crushed stone is placed in a layer of such uniform thickness that it will be not less than 3 in. deep after compacting (4 in. loose measure). The stones for this course are required to be that part of the crusher product passing over the ¾ in. section and through the 2 in. section of the crusher screen. After the stone has been spread it is rolled two or three times, and covered with stone screenings to a uniform depth of ¾ in. The amount of screenings used is slightly more than enough to fill the voids in the larger stones. Water is then applied with a horse sprinkler and the road rolled and watered until it becomes so hard that a piece of rock will crush beneath the roller before penetrating the surface.

Experimental Section of Oil Concrete Pavement.—The State Highway Department of Pennsylvania recently laid as an experiment a few hundred feet of a new kind of street or road pavement known as oil concrete. The road in question was located near Harrisburg. The specifications under which the pavement was laid were supplied by the Office of Public Road Inquiries at Washington, D. C. This pavement consists of ordinary concrete, mixed in a mechanical mixer, to which was added during the process of mixing 15 per cent by weight of oil, the oil used being that furnished by the Standard Oil Co. under the name of No. 1 Standard Flux. The foundation of the road is of the telford type and the concrete surfacing is 5 ins. in depth. The concrete was proportioned as follows: One part by volume of cement, two parts sand and four parts stone; the stone was a hard, close grained sandstone, crushed to sizes ranging from ½ to ¾ in. The cement and sand were first placed in the mixer and enough water added to make a stiff mortar, after which the oil was inserted, followed closely by the stone, the latter having been first wetted; sufficient water was then added to produce a wet concrete, which was delivered to the road in dump carts. After being spread to approximately the desired depth the desired crown was obtained by drawing a templet over the surface of the concrete. The surface was then tamped until water flushed to the top, on which was then placed a thin coating of stone ranging from dust to ¼ in. size. The road surface was then kept damp by sprinkling for seven successive days, after which it was open to travel. The State Highway Department, which conducted this work, reports that it has been in use too short a time to permit of any definite conclusions as to its durability or merit as a road paving.

Concrete Piling at Gatun Locks.—The south or up stream center guide wall of the Gatun Locks will extend 1,500 ft. from the south guard gate into the lake. About 350 ft. of the wall nearest the lock will be of solid construction, and the remaining 850 ft. will be constructed as a reinforced concrete cellular wall supported by reinforced concrete piles driven to depths from 20 to 70 ft. About 3,500 piles will be needed in the construction of the foundations. One part of cement, 1½ parts of sand, and 3 parts of rock will be used in the construction of the piles, and they will be cast on two platforms about 80 ft. wide and 400 ft. long, located on the rock storage pile at New Gatun. The piles will be allowed to remain on the storage pile about six weeks before driving. Two steam pile drivers of the skid type, having a maximum height above the ground of approximately 93 ft., are under construction. They will be equipped with steam hammers weighing over 10,000 lbs., 5,000 lbs. of which will be in the driving or striking part of the hammer, which will fall 42 ins. and strike 60 blows a minute. In order that the piling may not be crushed by the impact of the hammer, a cast steel driving head has been designed to fit over the head of the pile. This driving head will contain a cushion of sand and manila rope.

Increase in Exports During 1910.—In a bulletin just issued by the Department of Commerce and Labor, the following comparative figures are given, showing in round numbers the exports of structural material and machinery during the first 11 months of 1909, and during the same period of 1910. The bulletin as a whole shows a marked increase in the exportation of manufactures and a decrease in the exportation of food stuffs.

	First 11 months of		
	1909.	1910.	Increase.
Boards and planks	[illegible]	[illegible]	[illegible]
Sheets and plates of iron and steel.	8,300,000	12,700,000	4,400,000
Sawed timber	[illegible]	[illegible]	[illegible]
Steel rail	[illegible]	[illegible]	[illegible]
Pipes and fittings	[illegible]	[illegible]	[illegible]
Wire	[illegible]	[illegible]	[illegible]
Electrical machin'y	5,500,000	6,900,000	1,400,000
Metal working machinery	[illegible]	[illegible]	[illegible]
Structural iron and steel	[illegible]	[illegible]	[illegible]

Economic Aspect of Tie Preservation.—In a paper relating to preservation of structural timbers, presented before the Engineers' Society of Western Pennsylvania, Mr. C. P. Winslow estimates the cost per year for creosoted and untreated ties in track. Assuming 2,800 red oak ties per mile, a five years' life for an untreated tie, 50 cts. for its initial cost, and 15 cts. for cost of labor in renewing, the average annual cost per mile is $364. If the tie is creosoted at a cost of 35 cts., the charge in place in the track will be $1. The cost for replacing one mile of untreated with creosoted ties will therefore be $560. Assuming 14 years of life for the creosoted tie, and allowing 5 per cent interest on investment in each case, the annual charge for the creosoted tie is found to be 10.1 cts., and for the untreated tie 15 cts.

WATER-WORKS AND SEWERS SECTION

Methods and Costs of the Construction of Pittsburg's Filtration Works.*

The cost of the contractor's plant for the construction of the Pittsburg Filtration Works was about $343,000 or 6½ per cent of the total cost of the work. The total over head charges distributed over all the work amounted to about 20 per cent of the actual cost of the work.

The cost of the work to the contractor is due, in a large measure, to the selection of the plant for the work, and to his ability to plan out the methods to be used for carrying out the work. It is (as the author of the paper says) much easier to pick out the faults of any method of handling work, after the work has been done. For this reason the methods on work under three of the contracts was very similar, these contracts alone are considered in this paper; only the main items of the work are considered, namely: (1) Earthwork; (2) concrete work; (3) filter material.

CONTRACT 1—FILTERS.

This contract was divided into the main parts, basins and filters and as the work was more or less distinct, was practically carried on as separate contracts. The material handled under each division was as follows:

Item.	Basins, cu. yds.	Filters, cu. yds.
Excavation	258,790	391,560
Embankment and filling	172,621	119,932
Concrete	40,428	174,007
Filter gravel	.	352,300
Filter sand	......	215,900
Total yardage	471,839	1,253,699

Tramway System.—In July, 1905, the Contractor erected the "Tramway" or "Trenton System" for the handling of concrete materials. This consisted of an over head rail supported by wooden trestles, extending from the dock and surrounding the first 24 filters, and carrying an endless cable, kept in motion by machinery at the dock. By this means, steel buckets, of about 1 cu. yd. capacity filled with sand, gravel or cement were drawn along the line of the tramway and emptied at the several concrete mixers placed beneath the cable where work was in progress.

The tramway system for local distribution about the work, proved to be a failure and after a month's trial was torn down and replaced by a central mixer and cableway system which was first operated in November, 1905.

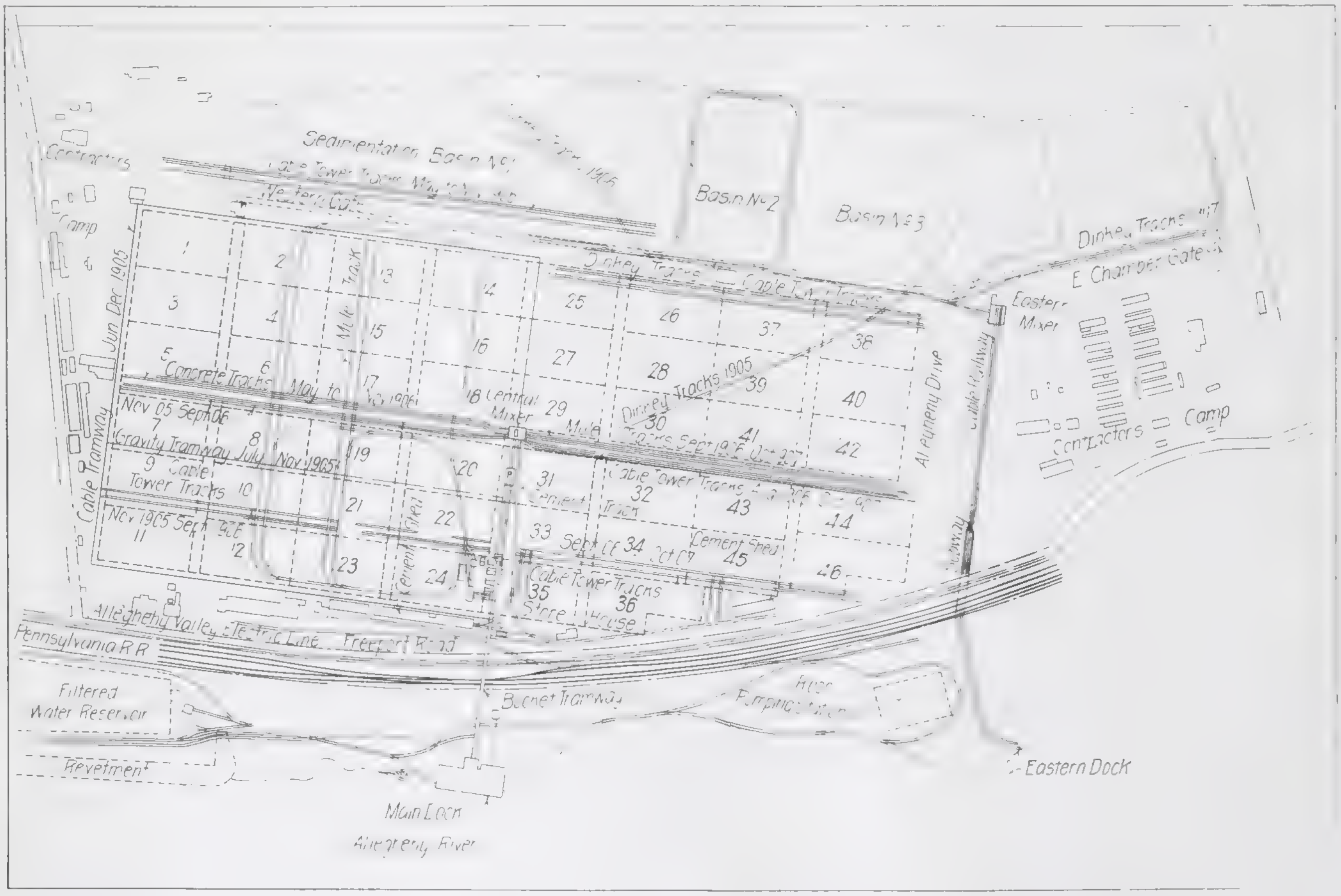

Fig. 1—General Layout of Contractor's Plant for Contracts Nos. 1 and 2. Pittsburg Filtration Works Construction.

the filtration plant were altered, from time to time, with the result that the last contract was carried out at a less cost than was the first.

The entire work described occupies a tract of approximately 200 acres, on the north bank of the Allegheny River near the Borough of Aspinwall. The river frontage included is about 3,700 ft. The Ross Pumping Station and Filtered Water Reservoir are on the low ground between the railroad and the river, and the Sedimentation Basins and Filters are north of the railroad, on higher ground, as shown by Fig. 1. The majority of the work was awarded in 1905 under a number of contracts amounting, altogether, to $5,663,797. As the

Camps, Stables, Shops and Dock.—The main camp for laborers, upon contracts awarded in 1905, was located at the east end of the city's property, upon the site of the ten additional filters built later, under Contract 11. At the extreme west end of the property, along the County Road, the contractors' stables were located. Nearly all of the available land south of the filters and north of the Freeport Road was occupied by the engineers' and contractors' offices, carpenter shop, machine shop, and cement sheds. The land south of the Freeport Road was largely low land, flooded at times, and therefore unsuitable for camps, shops or storage of material.

On the river bank directly opposite the center of the plant was erected the main dock, shown in Fig. 2, equipped with boilers, derricks, hoisting engines and other machinery for unloading and distributing sand and gravel dredged from the river bed.

Cableway System.—The central mixer, shown in Fig. 3, consisting of two Hains mixers, was located at the intersection of the main line of the tramway from the dock and the drive separating the north and south batteries of filters. Between this point and the dock the old tramway system was reconstructed so as to deliver sand and gravel to storage bins located south of the central mixer. Beneath these bins was a tunnel, in which was installed two endless belts for conveying sand and gravel to the small storage bins above the mixers. See Fig 4.

Three cableways were erected, two spanning those filters north of the central mixer and the third spanning a portion of those filters south of the mixer. The location of the tracks, upon which the cable towers operated, are clearly indicated in Fig. 1, and the design of the towers is shown by Fig. 6.

Filter Material.—The gravel plant for sizing and washing the filter gravel dredged from the river and unloaded at the dock, was located under the line of the tramway and east of Filter No. 24. The gravel screens were cylindrical, about 3½ ft. in diameter, with alternate sections of screens and plate. This was revolved about a horizontal axis and the screened material collected into bins below, from which it was raised by a clam-shell bucket and deposited into distributing bins, elevated above the roof of Filter No. 24. The gravel was transported from these bins to the filters by means of special steel hopper cars drawn by mules along a system of narrow gage tracks laid upon the completed filter roofs.

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*Rearranged from a paper by [illegible] F. Field, formerly Principal Division Engineer, Bureau of Filtration, Pittsburg, [illegible] 1910, before the Engineers' Society of Western Pennsylvania, and published in the October Proceedings.

The plant for the preparation of the filter sand was located on the main dock where the raw material was unloaded (see Fig. 2) and consisted of a large tank in which the sizing and washing was accomplished by an upward flow of water. The prepared sand was then carried by the tramway to a bin near the gravel screens from which it was removed by belt conveyors and placed in elevated distributing bins, erected on the roof of Filter No. 24, and was later transported to the filters by the same system of cars and tracks used for the filter gravel.

Earthwork.—For the filters, the excavation was uniformly about 4 ft. in depth, the material being river silt with little gravel. The top soil was first removed either by plow and scoop teams, or by grader and wagons and placed in storage piles for subsequent use. Much of the subsoil was handled in a like manner although after the first season considerable of the excavation was done by steam shovel. The price paid for excavation and placing the materials in embankment, 40 cts. per cu. yd., evidently did not contemplate but one handling of the material. The work was, however, so conducted that much of the excavated materials was first removed to storage piles and later re-excavated and placed in embankment or over filter roofs. This necessitated long hauls and rehandling of materials and resulted in the work costing more per yard than the price bid by the contractor. Part of this extra cost should be charged against the tramway system, as its arrangement and the work done by it, made the subsequent work of the cableway system, disjointed as to continuous and systematic progress. A different method of procedure, outlined as follows, might possibly have greatly reduced the cost of this work.

First: Complete excavation for 6 or 12 filters placing the excavated materials in temporary storage where it would be available for convenient rehandling and use as embankment or filling, if surplus material was required near the completion of the work.

Second: Carry on the concrete work continuously from north to south, or from east to west, completing all main structures as the work progressed.

Third: Carry on the rest of the excavation work parallel with the advance of the concrete work, placing the same directly in embankment or over the filters without rehandling, as the amount of excavation per filter was practically equal to that required about the walls or for over vaulting. The cost of excavation of the filters given later, in connection with the description of the work on the basins.

Concrete Work in Filter Chambers.—The tramway put into operation in July, 1905, had never been used on similar work and proved to be entirely unsuited for the work for the following reasons: (1) Operations were frequently at a standstill, due to cable troubles or to failure of the stringer supporting the track, upon which the buckets filled with cement, sand and gravel, traveled. These breakdowns usually occurred when two or more buckets were allowed to come, at one time, upon a single stringer. On one occasion between 300 and 400 lin. ft. of tramway fell to the ground like a pile of blocks. A break or other trouble along the 5,000 ft. length of the tramway entirely shut down all the concrete work at a moment's notice. The demoralizing effect of such accidents on the contractor's order of work and the resultant progress may be realized. (2) The output from the ½ cu. yd. individual mixers was small on account of their size and the inconvenient arrangements for proportioning the material by weight. (3) The wheel barrow method of transporting concrete 300 ft. to and from the mixer was slow and interfered with the erection of forms and other work. (4) Apparently the system for placing concrete in the vaulting had not previously been carefully studied out, for it was found upon first attempt, that the tramway was so low that the concrete could not be discharged from the mixer at a level convenient for its subsequent transportation over the roofs of the filters.

To overcome this difficulty various methods were tried. An endless belt supported on an inclined frame was installed for the conveyance of the mixed concrete from the discharge hopper of the mixer near the ground level to a point at such height above the filter roof as would allow it to be dropped into cars or wheel barrows for transportation to the work. This arrangement was entirely unsatisfactory as the mixed materials were separated in their passage up the belt, much of the liquid cement was lost and the concrete required remixing by hand before being placed in the work.

Later, arrangements were made for conveying the mixed concrete in cars to an elevator which lifted them to the level of the filter roof over which they were pushed by hand on a narrow gage track to the place of deposit.

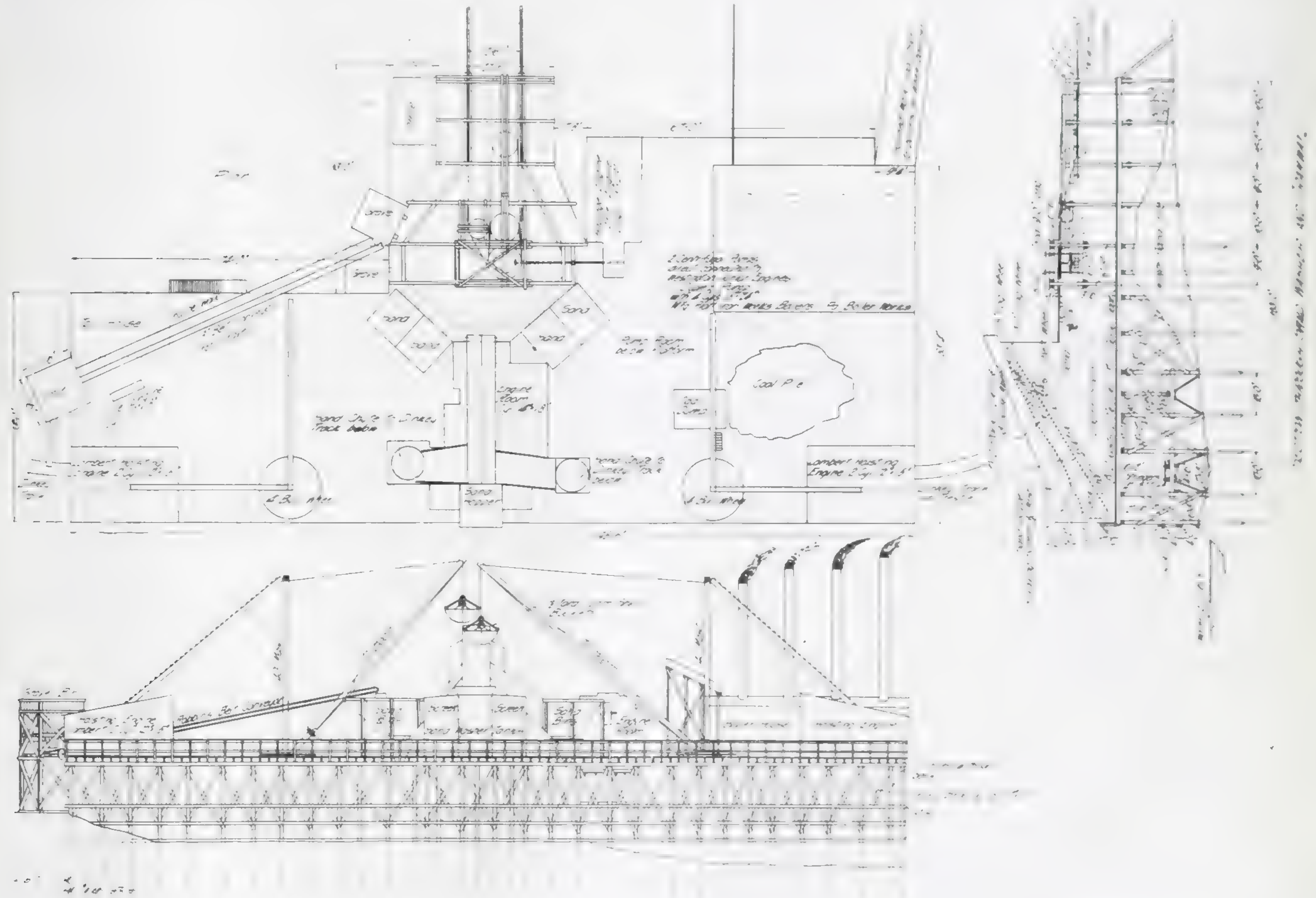

Fig. 2—Details of Central Dock for Unloading and Handling Sand and Gravel from the River Barges.

Under the tramway system, all forms were required to be transported and set in place almost entirely by hand labor and progress in this branch of the work was slow and tedious.

The tramway system was in operation less than two months before the contractor decided to abandon this system and at once replace it by a central mixer and cableway system.

When the cableway system was decided upon, the concrete work was well advanced upon filters No. 9, 10, 11, 12, 23 and 24, and the vaulting had been completed over the south half of filters No. 11 and 12.

The lay out of the cableway system was of necessity controlled by the location of buildings, plant, and tne work already completed, and the effective operations of this system was therefore seriously handicapped.

The tracks for the tail tower of one cable wav were laid on the completed floors of filter No. 9, 10, 21 and 22 and just north of the south row of filters. The head tower of the same cableway ran upon tracks between the north and south batteries of filters. The other two sets of cableways had their head towers on these tracks and their tail towers in the bottom of basin No. 1 It is thus seen that the location of these cableway tower tracks, within the lines of the work, could only result in splitting the work up in small units delaying and making inconvenient the completion of those sections of the work encroached upon by the cable tracks and thereby increasing the cost of the work to the contractor.

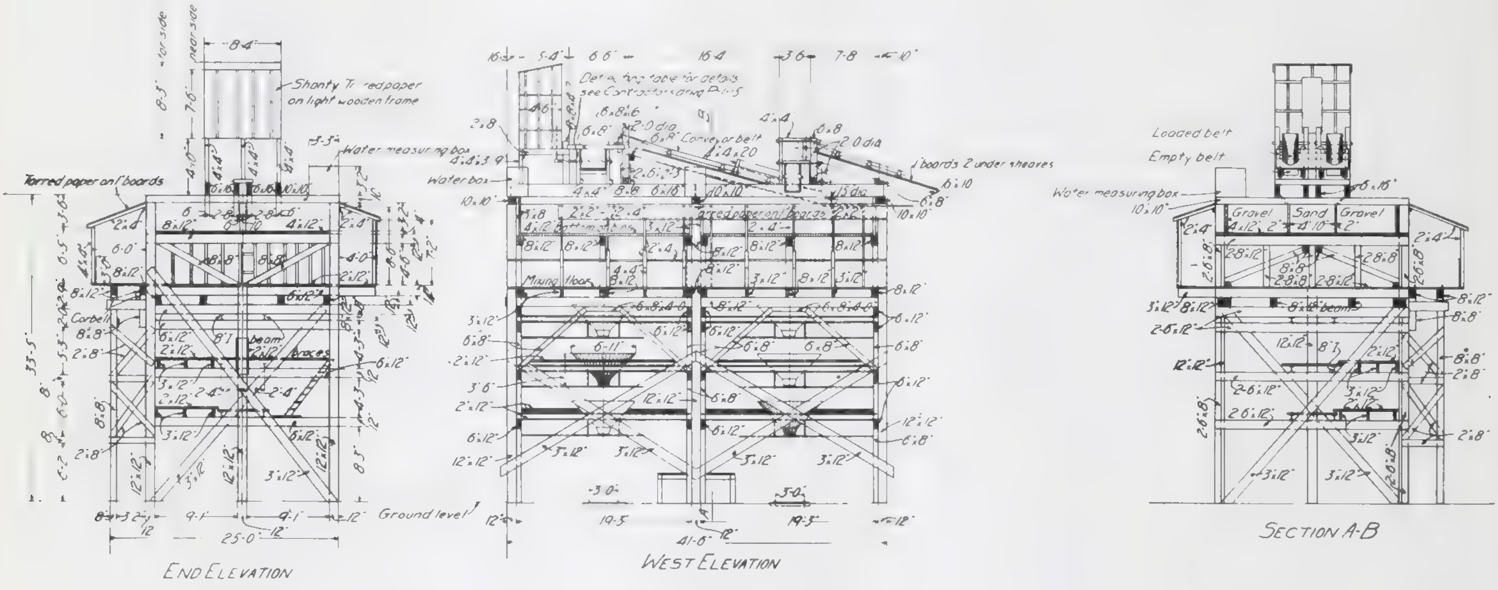

Fig. 3—Details of Central Mixing Plant.

Notwithstanding all the hindrances to the effective operation of the cableway system very good progress was made although at a cost to the contractor in excess of what would have obtained if the cableway system had been installed in the first place.

The mixed concrete from the central mixer was hauled in buckets upon flat cars along tracks parallel with the cable tower tracks in the Allegheny Drive to within reach of the cableway which then lifted and conveyed it where desired.

The following table shows a comparison in the number of cubic yards of concrete placed by the tramway in 1905 and by the cableways during the same period in 1906:

	1905, Tramway.		1906, Cableway.	
	Cu. yds.		Cu. yds.	
Month.	Total	Daily Av.	Total.	*Daily Av.
July	1,520	60	16,541	661
August	3,183	127	12,270	490
September..	5,192	207	12,143	485
October ...	4,416	177	12,969	518
Total	14,311		53,923	...
Daily avge.	..	143	.... .	539

*Daily average based on 25 days per month.

The records show that during 1905 under the tramway system, less than 10 per cent of the total amount of concrete to be placed by either system was handled, while in 1906 under the cableway system over 50 per cent or 5 times as much concrete was placed and in 1907, 35 per cent of the concrete was placed. The slowing up of the work in 1907 was largely due to conditions brought about by the early installation of the tramway system and the completion of small isolated portions of the work, this decreasing the number of places where operations could be carried on.

The sand and gravel for the concrete was brought to the work bv the same method in each case, namely, by the main tramway, which, after the abandonment of that system for the general work, was strengthened from the main dock to the central mixer and continued in use. The superiority of the cableway system over the tramway may be attributed to the following reasons: (1) The facilities for storing a large supply of sand and gravel near the central mixer and separate machinery for conveying the materials from these storage piles to the mixers; thus making the output of the mixer practically independent of any decrease of output of the sand and gravel from the river, or breakdowns of machinery on the dock or of the tramway, and, in fact, allowing the dock and tramway to be used for handling filter material for a considerable portion of the time without delaying the concrete work. (2) The central mixing plant had a capacity always more than adequate to the demand of the work, and, was able to produce a better and more uniformly mixed product than had been possible under the system of individual mixers located at various points throughout the plant. (3) The facilities for transporting the mixed concrete from the mixer to the place of disposal, sometimes a distance of 2,500 ft., within a few minutes, without stratification of the mixture, or loss of liquid cement, so that a minimum amount of labor was required to properly compact it within the forms. (4) The carrying of the buckets of concrete high in the air above all the other work and the large area covered by one cablewav allowed all other divisions of the work to proceed without interference and in an orderly and systematic manner, one class of work being kept at a sufficient distance from another to prevent delays or damage to "green" concrete. (5) The handling of forms, particularly arch centers, was done far more rapidly and at less cost by the cableway than was possible by the hand methods required under the tramway system. It was possible after all the concrete, which could be finished by quitting time, had been placed, to transport and set in place ready for final adjustment and bracing by the carpenter a sufficient number of forms for the next day's work, and if the concrete work was crowding the form work as frequently occurred towards the end of the week, it was entirely possible by using the cableways on Sunday, when concrete work was shut down, to again get the form work well in advance of the concrete work.

The handling and setting of pipes and sluice gates was also frequently done economically and conveniently by use of the cableways. The cost of concrete work on the filters is given in connection with the description of concrete work on the basins.

CONTRACT I—BASINS.

Excavation.—The excavation for the sedimentation basins varied from 1 to 5 ft. in depth, the material being either sandv clay or sandy gravel. The top soil was first removed by plow and scoop teams, or by a grader hauled either by horses or a traction engine, and placed in storage piles for subsequent use. The greater part of the subsoil was too heavy for this method of handling and was therefore excavated by steam shovel and hauled either to the embankment in bottom dump wagons or to a pile of surplus material in wagons, or in cars drawn by dinkey locomotives.

The drainage of the excavations was inadequate and this, together with a somewhat rainy season, resulted frequently in the entire cessation of operations or the carrying on of work at great disadvantage. Often the material excavated and placed in embankment was too wet to be satisfactorilly compacted without being allowed to dry out for a considerable time before rolling which made progress slow and the work expensive.

During the first season, 1905, the excavation and trimming was not pushed so that the concrete lining could not have been placed even if the concrete plant had been installed and even during the second and third seasons, delay and lack of system in excavation and embankment work often hampered progress in other operations.

The basin excavation amounting to 260,000 cu. yds. engaged the time of the contractor from April, 1905, to October, 1908. The average daily excavation during this period would therefore be less than 300 cu. yds. and as over 25 per cent of the total excavation was surplus material which could readily be handled during the winter months, greater progress was to have been expected.

The costs of the various items in excavation for both basins and filters are as follows:

General Excavation:

Quantity, cu. yds.	589,500
Engineer's estimate, per cu. yd.	$0.27
Bid price, per cu. yd.	0.27
Unit Costs:	Per cu. yd.
Wages	$0.351
Plant	0.061
General	0.026
Total	$0.438

Excavation in Trench:

Quantity, cu. yds.	[illegible]
Engineer's estimate, per cu. yd.	[illegible]
Bid price, per cu. yd.	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Materials	[illegible]
Plant	[illegible]
General	[illegible]
Total	$1.015

Disposal of Surplus Material:

Quantity, cu. yds.	3,000
Engineer's estimate, per cu. yd.	[illegible]
Bid price, per cu. yd.	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Plant	0.001
General	0.016
Total	$0.268

Embankment, Class A and B:

Quantity, Class A, cu. yds.	[illegible]
Quantity, Class B, cu. yds.	197,500
Engineer's estimate, Class A, cu. yds.	$0.15
Engineer's estimate, Class B, cu. yds.	0.12
Bid price, per cu. yd. (both classes)	0.16
Unit Costs:	Per cu. yd.
Wages	$0.138
Plant	0.013
General	0.011
Total	$0.162

the bottom and inside slopes and a 12-in. layer upon a bed of gravel on the inside slopes between low and high water. As the work was not complicated by other work and only amounted to 10,000 cu. yds. or about 15 per cent of the total amount of concrete in the filters, it would seem that this work could have been more economically done by the central mixer and cableway system and thus avoided the additional expense of a separate dock, surface cable, railroad and separate mixing plant. The basin work was started in April 1906, and was practically completed in April 1908.

Leaving out the four winter months there would remain about 25 months actual working time which gives an average daily output of concrete of 60 cu. yds. The concrete work was, however, not started until April, 1906, and to have finished the work at the same date, namely, April, 1908, would have required under the same conditions an average daily output of about 100 cu. yds. The capacity of the central mixer was sufficient to handle this additional amount and it was conveniently located for the work.

Concrete in Walls:

Quantity, cu. yds.	16,560
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	5.25
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	2.17
Plant	0.652
General	[illegible]
Total	$5.499

Concrete in Piers:

Quantity, cu. yds.	[illegible]
Engineer's estimate, per cu. yd.	[illegible]
Bid price, per cu. yd.	6.75
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	2.11
Plant	0.82
General	[illegible]
Total	[illegible]

Concrete in Vaulting:

Quantity, cu. yds.	55,790
Engineer's estimate, per cu. yd.	$6.25
Bid price, per cu. yd.	5.25
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	0.501
General	0.825
Total	[illegible]

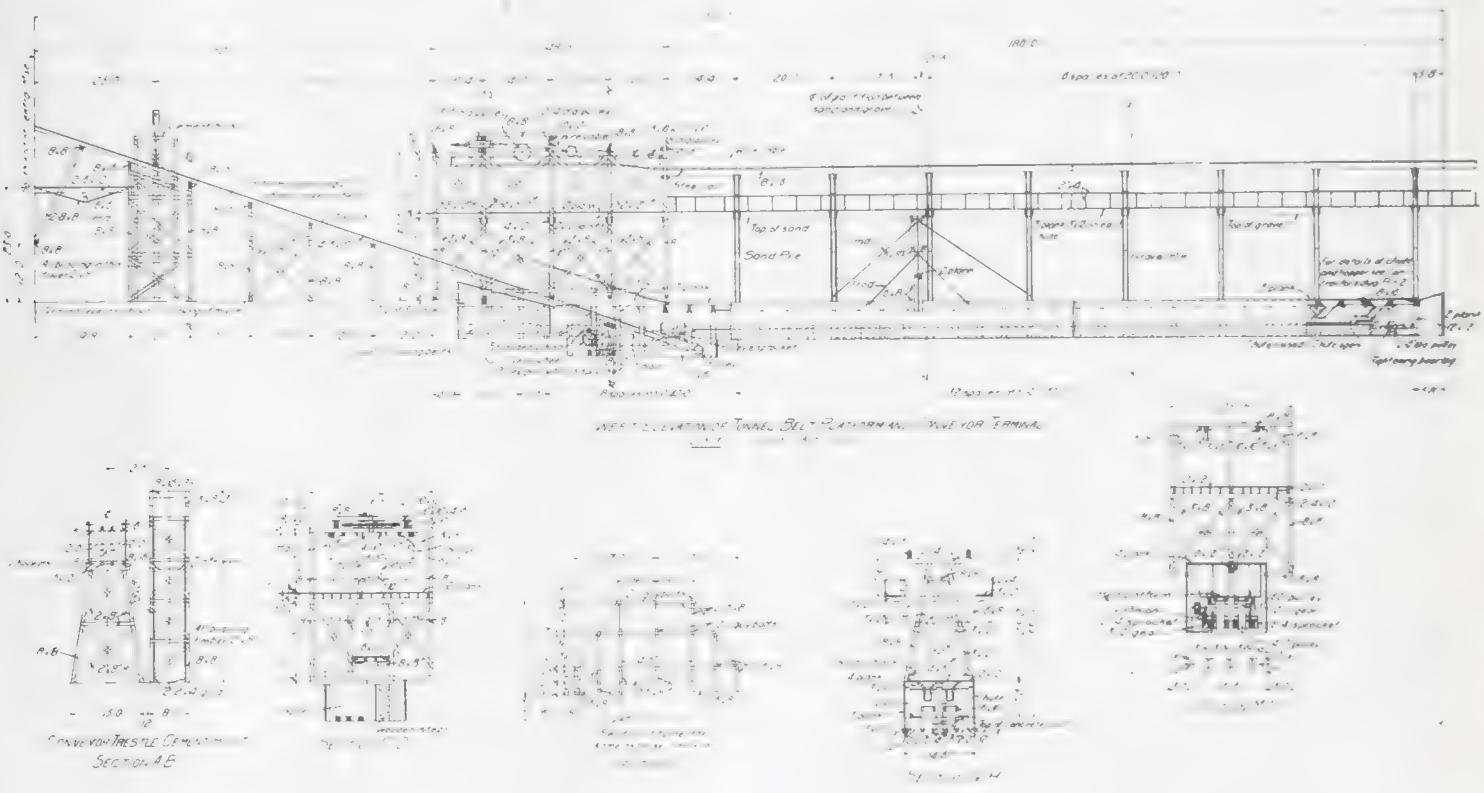

Fig. 4—Details of Tramway for Carrying Materials from Main Dock to Storage Bins Near Central Mixer.

Filling Over Vaulting:

Quantity, cu. yds.	253,400
Engineer's estimate, per cu. yd.	$0.20
Bid price, per cu. yd.	0.10
Unit Costs:	Per cu. yd.
Wages	$0.134
Plant	0.004
General	0.006
Total	[illegible]

Concrete Work.—For the concrete work in the sedimentation basins, the contractor built an entirely separate plant which was not ready for operation until April, 1906. A small dock, equipped with derrick, hoisting engine and receiving bins, was built on the river bank just east of Ross Pumping Station. From this point a surface cable, for conveying sand and gravel, led through the subway under the railway tracks, to the Eastern mixer. A drawing of this mixer is shown in Fig. 5. This mixer plant, which was located south of the center line of Basin No. 3, consisted of two Foote concrete mixers. The material for concrete was discharged by gravity into the machines from overhead bins. The cement was discharged into wooden side dump cars which were hauled by dinky locomotives to the work.

The concrete work in the sedimentation basins included the placing of a 6-in. lining on

Costs.—The costs of the concrete work on contract are shown below as distributed to the various parts designated.

Concrete in Floors, Class A:

Quantity, cu. yds.	23,640
Engineer's estimate, per cu. yd.	$6.25
Bid price, per cu. yd.	5.25
Unit Costs:	Per cu. yd.
Wages	$1.506
Material	2.18
Plant	[illegible]
General	[illegible]
Total	[illegible]

Concrete in Floors, Class B:

Quantity, cu. yds.	69,760
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	5.25
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

Concrete in Floors of Pipe Gallery:

Quantity, cu. yds.	10,180
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	$4.819

Concrete in Gate Chamber:

Quantity, cu. yds.	4,230
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	8.50
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	2.54
Plant	[illegible]
General	1.30
Total	$7.949

Unreinforced Concrete Conduit:

Quantity, cu. yds.	1,290
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	8.50
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

Reinforced Concrete Conduit:

Quantity, cu. yds.	[illegible]
Engineer's estimate, per cu. yd.	$10.00
Bid price, per cu. yd.	8.50
Unit Costs:	Per cu. yd.
Wages	$3.729
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

Miscellaneous Reinforced Concrete:

Quantity, cu. yds.	4,110
Engineer's estimate, per cu. yd.	$9.00
Bid price, per cu. yd.	8.50

Unit Costs:	Per cu. yd.
Wages	$7.107
Material	3.00
Plant	1.003
General	1.545
Total	$12.655

Concrete in Trench:

Quantity, cu. yds.	3,310
Engineer's estimate, per cu. yd.	$5.50
Bid price, per cu. yd.	4.50

Unit Costs:	Per cu. yd.
Wages	$1.516
Material	1.526
Plant	0.438
General	0.712
Total	$4.186

Steel Reinforcement in Conduits and Drains:

Quantity, lbs.	830,240
Engineer's estimate, per lb.	$0.045
Bid price, per lb.	0.0225

Unit Costs:	Per lb.
Wages	$0.008
Material	0.017
Plant	0.0001
General	0.012
Total	$0.0371

Unit Costs:	Per sq. ft.
Wages	$0.026
Material	0.01
Plant	0.002
General	0.006
Total	$0.044

CONTRACT II

Excavation.—The average depth of the excavation on this contract was about 12 ft., the material being a sandy gravel. After the removal of the top soil by plows and teams, the excavation of subsoil was made by steam shovel, the materials being placed either in the river and wall embankments or in a temporary storage pile east of the reservoir. The limited space between the reservoir proper, and the railroad and river bank prevented economical disposal of excavated material and after the cableway tracks were laid, the available space was still further cut down so that much of the excavated material was rehandled at additional expense to the contractor.

Excavation in Trench:

Quantity, cu. yds.	2,720
Engineer's estimate, per cu. yd.	$0.60
Bid price, per cu. yd.	0.70

Unit Costs:	Per cu. yd.
Wages	$0.902
Material	0.008
Plant	0.005
General	0.121
Total	$1.036

Embankment:

Quantity, cu. yds.	159,500
Engineer's estimate, per cu. yd.	$0.25
Bid price, per cu. yd.	0.25

Unit Costs:	Per cu. yd.
Wages	$0.236
Material	0.066
Plant	0.039
General	0.032
Total	$0.373

Filling Over Vaulting:

Quantity, cu. yds.	19,560
Engineer's estimate, per cu. yd.	$0.25
Bid price, per cu. yd.	0.30

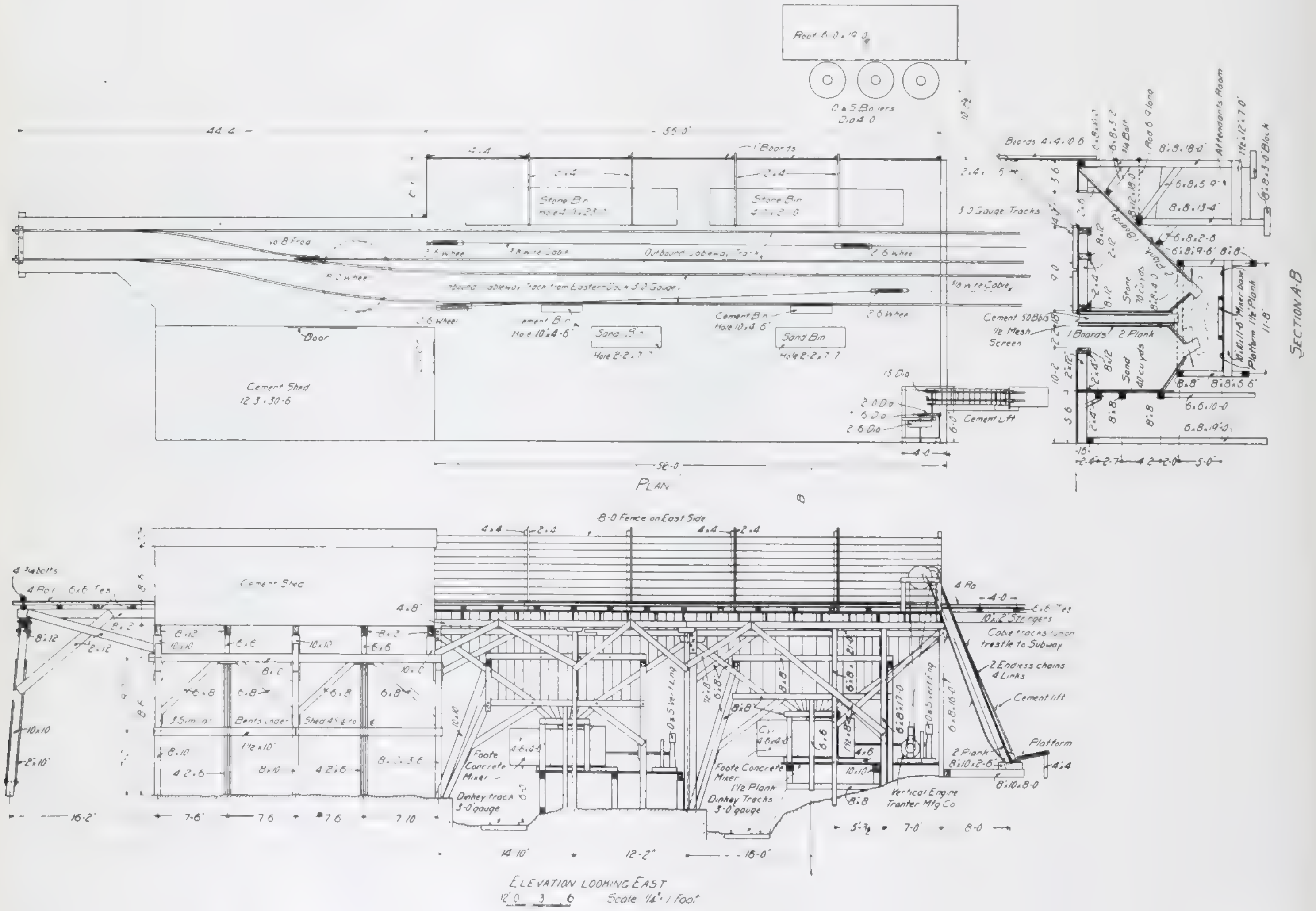

Fig. 5—Details of Eastern Mixing Plant.

Miscellaneous Steel Reinforcement:

Quantity, lbs.	608,800
Engineer's estimate, per lb.	$0.04
Bid price, per lb.	0.0225

Unit Costs:	Per lb.
Wages	$0.004
Material	0.017
Plant	0.0002
General	0.002
Total	$0.0232

For the arch centering, the contractor was required to build a certain number of forms, so that by using each form 10 times the entire filter roof would be constructed, or a total of 213,000 sq. ft. of arch would be actually made, in order to complete the 2,130,000 sq. ft. of roof.

Arch Centering:

Quantity, sq. ft.	2,130,000
Engineer's estimate, per sq. ft.	$0.06
Bid price, per sq. ft.	0.07

The following list shows the quantities of materials handled on contract II:

	Cu. yds.
Excavation	120,625
Embankment and fill	212,365
Concrete	38,347
Total yardage	371,337

The average plant cost per cu. yd. for this total yardage was $0.38.

Following is the itemized cost of the excavation work for contract II.

General Excavation:

Quantity, cu. yds.	117,900
Engineer's estimate, per cu. yd.	$0.20
Bid price, per cu. yd.	0.30

Unit Costs:	Per cu. yd.
Wages	$0.27
Plant	0.109
General	0.048
Total	$0.427

Unit Costs:	Per cu. yd.
Wages	$0.425
Material	0.001
Plant	0.006
General	0.018
Total	$0.450

General Fill:

Quantity, cu. yds.	17,940
Engineer's estimate, per cu. yd.	$0.10
Bid price, per cu. yd.	0.12

Unit Costs:	Per cu. yd.
Wages	$0.018
Plant	0.001
General	0.015
Total	$0.034

The puddle over the reservoir roof varied from 4 to 7 ins. in thickness and was made of 1 part clay and 2 parts sandy gravel, thoroughly rolled and tamped.

Puddle:

Quantity, cu. yds.	4,560
Engineer's estimate, per cu. yd.	$2.00
Bid price, per cu. yd.	1.75

Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

[illegible] the concrete materials were mixed in a cubical mixer on the [illegible] steel, side dumping cars, hauled by dinkey locomotives along tracks just outside the south line of the filtered water reservoir. These cars were emptied by means of chutes into smaller cars which were pushed by hand along temporary narrow gauge tracks to where work was in progress. After the first season, 1905, this method was abandoned. A Haines mixer was erected just west of the main dock from which the mixed [illegible] was conveyed in buckets [illegible] flat cars [illegible] within reach of a cableway system spanning a portion of the reservoir. The concrete in the revetment was transported along tracks laid parallel and close to the line of the work, in wooden side dumping contractor's cars and delivered by means of chutes where desired.

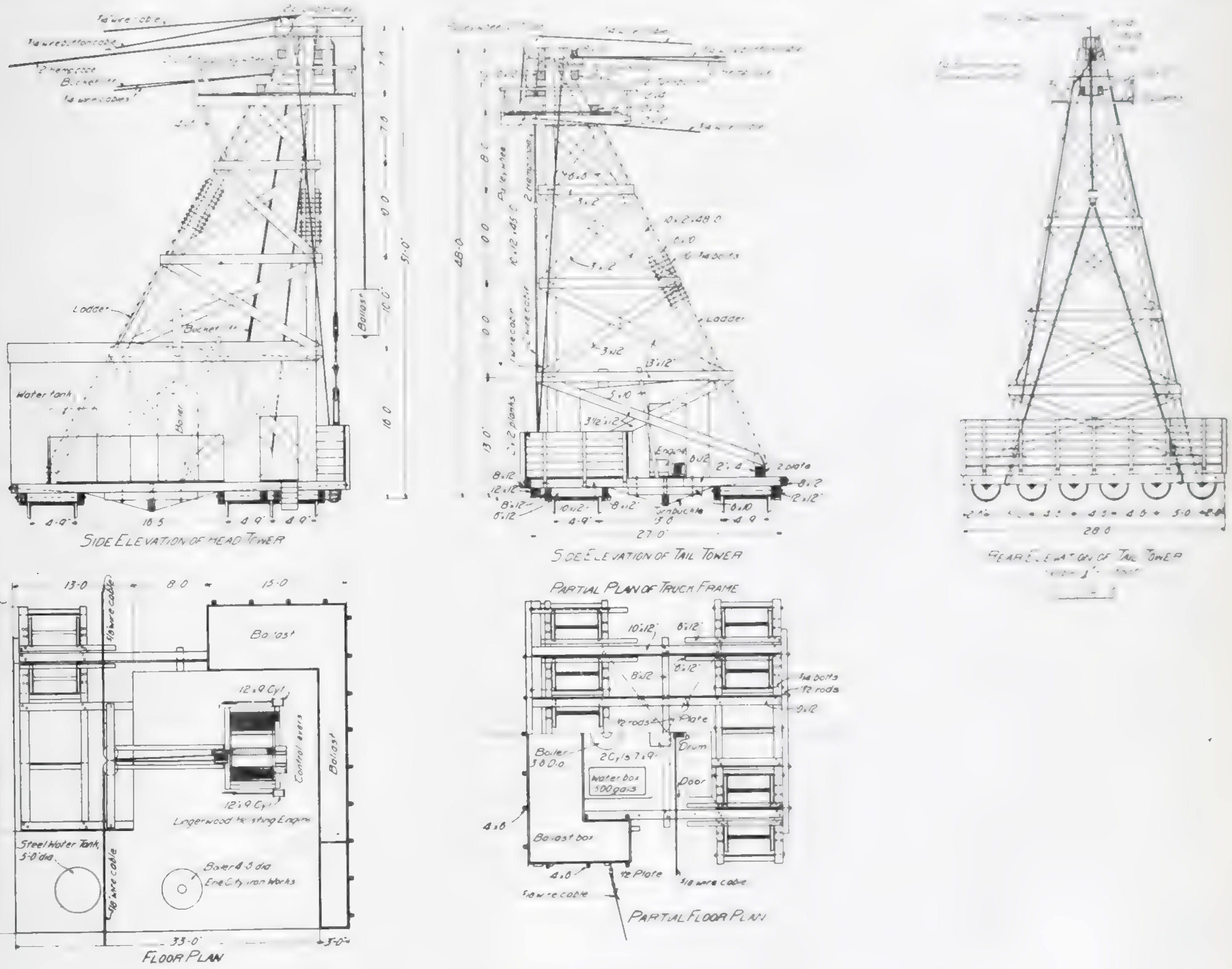

Fig. 6—Details of Head Towers and Tail Towers for the Cableways.

The costs of the concrete work on Contract II are given below, distributed to the various items of the work designated:

Concrete in Floors:	
Quantity, cu. yds	[illegible]
Engineer's estimate, per cu. yd	$6.50
Bid price, per cu. yd	5.40
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

[illegible]	
[illegible]	[illegible]
Engineer's estimate, per cu. yd.	[illegible]
Bid price, per cu. yd.	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	2.209
Plant	[illegible]
General	0.938
Total	$5.357

[illegible]	
Quantity, cu. yds.	[illegible]
[illegible]	[illegible]
Bid price, per cu. yd.	[illegible]
Unit Costs:	[illegible]
Wages	$3.42
Material	[illegible]
Plant	0.646
General	[illegible]
Total	$7.124

Concrete in Vaulting:	
Quantity, cu. yds.	6,180
Engineer's estimate, per cu. yd.	$6.50
Bid price, per cu. yd.	4.70
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

Concrete in Gate Chamber	
Quantity, [illegible]	1,580
Engineer's estimate, per [illegible]	$7.00
Bid price, per cu. yd.	7.00
Unit Costs:	Per cu. yd.
Wages	$2.361
Material	[illegible]
Plant	0.55
General	3.272
Total	$8.332

[illegible]	
[illegible]	[illegible]
Engineer's estimate, per cu. yd.	$9.50
[illegible]	[illegible]
Unit Costs:	[illegible]
Wages	[illegible]
Material	[illegible]
Plant	[illegible]
General	[illegible]
Total	[illegible]

[illegible]	
[illegible]	185
[illegible]	[illegible]
[illegible]	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	0.716
General	[illegible]
Total	[illegible]

Concrete in Revetment:	
[illegible]	[illegible]
Engineer's estimate, per cu. yd.	$5.50
[illegible]	[illegible]
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	[illegible]
Plant	0.671
General	[illegible]
Total	$5.502

[illegible]	
Quantity, lbs.	157,800
[illegible]	[illegible]
Bid price, per lb.	0.0225
Unit Costs:	Per cu. yd.
Wages	[illegible]
Material	0.017
Plant	[illegible]
General	[illegible]
Total	[illegible]

Miscellaneous Steel Reinforcement:	
Quantity, lbs.	20,750
Engineer's estimate, per lb.	$0.03
Bid price, per lb.	0.0225
Unit Costs:	Per cu. yd.
Wages	$0.006
Material	0.017
Plant	0.0002
General	0.002
Total	$0.0252

Arch Centering:	
Quantity, sq. ft.	243,390
Engineer's estimate, per sq. ft.	$0.10
Bid price, per sq. ft.	0.085
Unit Costs:	Per cu. yd.
Wages	$0.059
Material	0.024
Plant	0.002
General	0.014
Total	$0.099

Gravel Fill:	
Quantity, cu. yds.	3,430
Engineer's estimate, per cu. yd.	$0.60
Bid price, per cu. yd.	0.50
Unit Costs:	Per cu. yd.
Wages	$0.35
Material	0.20
Plant	0.01
General	0.037
Total	$0.597

Gravel on Revetment:	
Quantity, cu. yds.	7,380
Engineer's estimate, per cu. yd.	$0.35
Bid price, per cu. yd	0.50
Unit Costs:	Per cu. yd.
Wages	$0.458
Material	0.20
Plant	0.04
General	0.05
Total	$0.748

Much of the timber work given below was required below water level which explains the rather high cost.

Timber Piles:	
Quantity, lin. ft.	1,140
Engineer's estimate, per lin. ft.	$0.60
Bid price, per lin. ft.	0.40
Unit Costs:	Per Lin. Ft
Wages	$0.663
Material	0.12
Plant	0.073
General	0.066
Total	$0.922

Timber Footings:	
Quantity	20.4
Engineer's estimate	$50.00
Bid price	40.00
Unit Costs:	
Wages	$72.659
Material	27.901
Plant	6.409
General	4.723
Total	$111.692

CONTRACT XI.

Excavation.—As previously stated this contract was awarded late in the fall of 1908. The contractor first removed the top soil by plow and scoop teams and stored this material beyond the north line of the filters and against the south embankment of Basin No. 3 so as to provide sufficient width for the tracks of one cable tower. This material was also conveniently placed for later removal and spreading over the completed embankments and filling.

A steam shovel was then put into operation, first making a cut entirely across the work from west to east and on the line of the gallery, the excavated materials being loaded into trains of contractors side dump cars and hauled by dinkey locomotives to land reserved for the disposal of surplus material. The material was a sandy gravel and the average depth of excavation was about 12 ft. Excavation continued in the same manner during the winter so that when work opened in the spring of 1909, over 60 per cent of all the excavation work was completed, including the gallery and the five filters to the north. As this material was in excess of that required for embankment and filling for the filters it required no rehandling at a later date.

The subsequent rapid progress on the concrete work made it possible to move a large proportion of the remaining excavation directly into embankment and filling over vaulting, thus making the amount of material rehandled a minimum. As the price bid for excavation and placing the materials in embankment or filling was 75 cents compared with 40 cts. per cu. yd. on Contract 1, these items of work were, due to good management of the work as a whole, very profitable to the contractor.

A Haines mixer, similar in arrangement to those used on Contracts No. 1 and 2, was erected on the river bank near Ross Pumping Station. Cement was unloaded from cars on a railroad siding near by, conveyed by means of flat cars to the mixer and raised by an elevator to the mixing platform. Sand and gravel were unloaded from barges and placed in small storage bins above the mixer by a derrick and clam shell bucket. The mixed concrete was conveyed in 3½ cu. yd. special steel buckets, upon flat cars hauled by dinkey locomotives on a track laid through the subway to within reach of a cableway system spanning the filters from north to south.

For certain portions of the work which were out of reach of the cableway system, a stiff-leg derrick was employed to lift the buckets of concrete where desired.

The progress on concrete work was unhampered by excavation work, which had been 60 per cent completed before concrete concrete work by July 1, 1909, and the entire tractor was therefore able, by a well arranged and effective plant and by systematic methods, to complete over 50 per cent of the concrete work by July 1, 1909 and the entire concrete work for the ten one-acre filters and gallery by November 1st of the same year. One particular feature of this work was the handling of concrete in 3½ cu. yd. buckets so designed as to enable the concrete to be discharged, either all at once, or as desired, by means of a small circular gate in the bottom of the bucket. This allowed a bucket of concrete while suspended from the cableway, to be swung over and along the line of a wall thus depositing concrete in thin layers within the wall forms for a distance of 15 or 20 ft. and not only producing better construction results but decreasing the labor required to work up the concrete on account of its being spread with uniform consistency throughout the entire mass. Furthermore the depositing of a batch of concrete of such large size, made ample work for the concrete gang before the arrival of the next batch and tended to better progress at a less unit cost for labor. The order with which the gallery work was carried on differed from that on Contract No. 1 and was productive of better progress.

On Contract No. 11, after the concrete floor was completed, the installation of the piping systems was started and entirely completed before the filter concrete work had reached such a point as to interfere with the easy handling of the pipes. After the completion of the pipe work, the concrete gallery platform was placed and this was used as a foundation for supporting and bracing the forms for gallery walls and roof.

The amount of material handled on Contract 11 is listed as follows:

	Cu. yd.
Excavation	183,470
Embankment	186,346
Concrete	31,582
Filter gravel	16,000
Filter sand	30,000
Total yardage	447,398

Only one cableway was employed as compared with three cableways on the other two contracts. At the time of writing this paper the work on Contract 11 had progressed but five months and no complete costs are therefore available at this time.

Filter Material.—A sand digger, equipped with both a gravel and a sand washing plant, was able to prepare the filter sand and two sizes of the filter gravel directly on the boat. The other two sizes of filter gravel were sized and washed but not separated until brought to the receiving bins which were a part of the remodeled concrete mixer for this contract. Here the two mixed sizes were separated by passage through a revolving screen and dropped into distributing bins below. From these latter bins the several classes of filter material were hauled in trains of two cars, each of 2 cu. yd. capacity, by means of an electric locomotive on a double trolley system, up through the subway and over the tops of the filters and dropped through openings in the filter roofs into cars running upon the permanent filter track system and thus distributed within the filters.

PREPARATION OF FILTER MATERIAL.

Gravel—Contract No. 1.—The filter gravel was specified to be furnished in four sizes and placed on the concrete floor of the filters in the order and to the depths stated below:

No. 1 Gravel—3 in. to 1¾ in.—5 ins. deep.
No. 2 Gravel—1¾ in. to ⅝ in.—3½ ins. deep.
No. 3 Gravel—⅝ in. to ¼ in.—2 ins. deep.
No. 4 Gravel—¼ in. to coarse sand—1½ ins. deep.

The filter sand is placed over the No. 4 gravel to an average depth of 3 ft.

Both the sand and gravel used for filter material was obtained from the bed of the Allegheny River, adjacent to the work, by the ordinary sand diggers which separated the gravel from the sand and deposited it in barges which were towed to the main dock and unloaded by means of derrick and clam shell bucket. The mixed gravel was then carried by the tramway and emptied into the upper end of the gravel screens, previously mentioned.

As the gravel was pushed along within this revolving tube by means of paddles it was washed by jets of water from a pressure pipe parallel with the axis of the screens, and passed through the various sized screens to the receiving bins below.

The screens were so arranged as to remove, first, the No. 4 or fine gravel, second, the No. 3 gravel, third, the No. 2 gravel and finally the No. 1 or coarse gravel was discharged out of the end of the tube.

This gravel screening plant was unsatisfactory from the start. The heavy or large sizes of gravel dragged the finer gravel along with it and thus the separation into the required sizes was incomplete. Furthermore when the screens were revolved at a more rapid rate to increase the output, the separation of sizes was less perfect. Much if not all of this trouble could have been prevented if the gravel plant had been arranged as a series of concentric screens with the coarser in the center so that the coarse gravel would be removed first and the fine gravel last.

Notwithstanding the defects in this plant, the contractor later, when he realized that greater capacity was necessary, exactly duplicated the former plant. The imperfect work of these screens made it necessary to provide fixed inclined screens with washing facilities, at increased cost, on the outlets from the distributing bins and the amount of improper material thus removed, proved the ineffectiveness of the gravel screening plant. The transportation of the gravel from the distributing bins to the filters in hopper cars drawn by mules was reliable even if slow, but it possibly could have been done more expediently and at a less cost by means of trains of cars operated under electric or steam power.

Sand.—The specifications for filter sand required it to be clean with an effective size of from 0.28 to 0.36 mm. and contain no particles having a diameter of greater than 0.5 mm.

The plant for the preparation of filter sand furnished satisfactory material from the start. This was undoubtedly due to the foresight of the contractor in first building an experimental washer and this learning the methods for efficient and economical handling of this problem.

The sand when lifted from the river barges was dropped into an elevated receiving bin on the dock from which it passed through a revolving cylindrical screen which removed all gravel and allowed the sand to drop into the sand washing tank. This tank was about 8 ft. square and 8 ft. deep with a false bottom consisting of a perforated plate supported about 12 ins. above the bottom of the tank. Water pumped into this lower compartment by means of a centrifugal pump passed up through the perforated plate and the sand above, and overflowed a waste weir at the top. The upward pressure and velocity of the water not only washed out all dirt and fine material but also kept the sand in suspension and uniformly varying from coarse sand at the bottom to fine sand at the top. By the opening of gates or ports in the side of the tank, sand of the required size and cleanliness was drawn off into a bin from which it was removed and placed in elevated bins by means of an inclined conveyor. From these bins the sand was transported by the tramway to a bin near the gravel screens and later conveyed to the filters as described.

The means for regulating the washing of the sand in the washing tank to suit the different grades of material supplied were inadequate and frequently over 30 per cent of the sand was wasted over the overflow weir, 20 per cent of which was within the requirements of the specifications.

The hopper cars for the transporting of the sand to the filters were not sufficiently tight to prevent a leakage of material as the cars were hauled along the tracks, and consequently the contractor suffered a preventable delay and expense in removing this waste sand.

One, if not the greatest, defect in the methods for handling both filter sand and gravel was the location of all the screening and washing plants on shore and in the midst of the work. This resulted in the digging, transporting and rehandling of much improper material at great expense to the contractor which could have been almost entirely avoided if the sand diggers on the river had been fitted up to do the screening and washing.

The costs of the filter material on Contract No. 1 was as follows:

Filter Gravel:	
Quantity, cu. yds.	52,300
Engineer's estimate, per cu. yd.	$1.15
Bid price, per cu. yd.	1.00
Unit Costs:	Per cu. yd.
Wages	$0.755
Material	0.20
Plant	0.178
General	0.092
Total	$1.225

Filter Sand:	
Quantity, cu. yds.	215,900
Engineer's estimate, per cu. yd.	$1.00
Bid price, per cu. yd.	0.85
Unit Costs:	Per cu. yd.
Wages	$0.286
Material	0.28
Plant	0.158
General	0.072
Total	$0.796

Two other items of cost given for Contract No. 1 are as follows:

Broken Stone or Gravel Filling:	
Quantity, cu. yds.	13,480
Engineer's estimate, per cu. yd.	$1.00
Bid price, per cu. yd.	0.70
Unit Costs:	Per cu. yd.
Wages	$0.258
Material	0.20
Plant	0.014
General	0.054
Total	$0.526

Slope Paving:	
Quantity, sq. yds.	18,550
Engineer's estimate, per sq. yd.	$3.25
Bid price, per sq. yd.	2.30
Unit Costs:	Per cu. yd.
Wages	$0.463
Material	0.73
Plant	0.273
General	0.237
Total	$1.703

In the preparation of filter material for this contract, the contractor benefited by his previous experience, and simplified his plant and methods of work described above on Contract No. 1. Practically all the screening and washing of the sand and gravel was done on the boat where an abundant supply of water was available.

The material brought up by the buckets from the bed of the river is first thrown upon grate bars spaced 5 in. apart, which removes all the large stones. At this point a 4-in. stream from a pulsometer pump (600,000 gal capacity, per 24 hours) is played upon the material, washing it into a cylindrical screen, 3½ ft. in diam. Through the center of the cylindrical screen is a 4-in. perforated pipe supplied with water at 35 lb. pressure which furnishes the second and final washing of the gravel in the dredge. The [illegible] at 14 revolutions per minute. Its first section is 4½ ft. long, and has 3/16 in. mesh, which removes No. 4 gravel and sand. Outside of this screen is a screen with ⅛ in. mesh which separates the No. 4 gravel from the sand. The sand is carried by a belt conveyor to the rear of the boat where it is dropped into wheel barrows and there loaded into a barge. The sized and washed sand from the sand washing tank is lifted by buckets, and, by means of a chute, loaded into a barge on the left side of the boat.

The second section of the main screen is 4½ ft. long and consists of punched plate with 1½ in. square holes. This removes the mixed No. 2 and 3 gravel which is loaded directly into a barge on the right side of the boat.

The third and last section of the main screen is 3 ft. long, of punched plate with 3 in. square holes. This removes the No. 1 gravel which is loaded into a barge by means of a belt conveyor. All material not previously removed passes out the end of the screening tube and is wasted.

The capacity of the dredge as equipped is 4 barges of sand and 7 barges of gravel or a total of 1,000 cu. yds. in 24 hours, which, however, varies with the material met with. The loaded barges were then towed to the dock near Ross Pumping Station and unloaded into the receiving bins as already described.

Here the No. 1 and the No. 2 and No. 3 gravel is run through a 3½ ft. screen, 9 ft. long with 1½ in. mesh which is revolved at 18 rpm., and in this way dirt and fine material is removed. The No. 2 and No. 3 gravel is separated by passage through a similar screen with ½ in. mesh being washed by means of a 1 in. perforated pipe within the screen. After these processes are completed, the gravel drops into the distributing bins below.

The screening of material to obtain any particular size of gravel is dependent on: The character of the raw material; the dimensions of the screen openings and particularly whether wire mesh or punched plate with square or round holes are used, the speed of revolution of the screen tube, the length of the several screens, and the amount and pressure of water used for washing.

As the No. 1, 2 and 3 gravel is removed from the distributing bins into the cars by means of chutes, it passes over fixed inclined screens and there receives its final washing before being placed in the filters. The No 4 gravel and the filter sand are not washed or screened after leaving the boat.

The average distance from the dock to the filters is about equal to that from the gravel screens to the filters on Contract No. 1, but the speed of travel is greatly in excess of that upon Contract No. 1 on account of using electric haulage. There is little or no waste along the tracks as was the case on Contract No. 1 and the filter material is uniformly superior in cleanliness and correct sizing to that furnished under Contract No. 1. This is undoubtedly due to the more efficient plant and a less number of handlings. It is also worthy of mention that the plant from the first day of operation was able to furnish satisfactory material of all classes.

At the time of writing we have but five months' record for comparison of progress with that on Contract No. 1. During this period, [illegible] filter material has been placed. This on the basis of 25 actual working days per month gives an average daily output of 305 cu. yds. with but one electric locomotive for haulage against a daily average of 510 cu. yds. on Contract No. 1 where 22 mule cars were used for hauling material. [illegible] needed on Contract No. 11.

COST KEEPING.

The method of obtaining the costs in connection with this work was with a central force account organization. A man in charge, with clerks in the office, and field clerks obtained all the data and distributed it for obtaining the unit costs.

This central organization secured the data by going about at least twice a day and sometimes oftener. The inspectors themselves on the work had diaries in which they kept time account, material account, also the ordinary account of happenings like accidents and things of general interest. The man that went about had a card upon which he took down that information. He then posted the card on a larger card, and these larger cards were posted once a week, and once a month were posted on large sheets, on which the quantities were also posted. The clerk in going about secured the number of laborers and rates of pay, material, etc. The material was of course difficult to apportion, but so far as possible it was apportioned to those works upon which it was used. At the same time these clerks secured the freight bills and the list of materials that came in, the account of the plant charges, such as cableways, derricks, cement-houses, shops, etc. They obtained the general charges of repair accounts in the shop, the staff charges of the whole administrative force, and office expenses, estimated in some cases as could best be determined. These large general accounts were not distributed until the end of the work, when a full and complete cost was obtained, which included the distribution of these general charges.

The total plant charge on the nine contracts was $343,000, or 6.5 per cent of the cost of the work. The staff and administration charge was over $700,000. The total of general charges to be distributed to this work, costing over $5,000,000, was about $1,000,000, or 20 per cent of the whole cost.

"Grouting" Method of Sinking Shaft.—A method of sinking a shaft at the Victoria mine at Lünen, says the *Mining World*, was used in a case where the shaft had reached water bearing ground at the depth of 1,128 ft. The object of the method was to solidify or fill all cracks and pockets in the rock with cement grout around the area through which the shaft was to be sunk. Twenty-five bore holes were made to a depth of about 25 ft. They were slanted outward so that the ends of the holes came about 8 ft. outside of the circumference of the shaft. In this way any water in the vicinity of the shaft was encountered. When water was reached the hole was sealed. A larger hole, about 3 ins. in diameter, was then put down next to the former one. A standpipe was cemented into this and provided with a stop cock. Boring was continued through this pipe to the desired depth and then grout was poured in from a plant on the surface of the ground. After all crevices had been filled the cement was given time to set and the sinking of the shaft for 14 ft. in depth was prosecuted. This process was repeated for each 14 ft. in depth, and no trace of water was found. The crevices filled with cement required from 112 bags to 2,185 bags of cement. Lining the shaft with concrete followed. The sinking and timbering of this section of the shaft cost about $86,000. The number of lineal feet of shaft considered is 315. This took 194 working days at a cost of $273 per lineal ft.

Inventors' Guild.—This society has recently been incorporated in New York City "to further the interests and secure full acknowledgment and protection for the rights of inventors and to foster social relations among those who have made notable advance in the application of the useful arts and sciences." It is also the aim of the society to secure better conditions than those to which inventors are now subjected, such as delays and ineffectiveness in the Patent Office, expense due to litigation, the possibilities under which a rich corporation may render conditions prohibitive to the poor inventor, and many other conditions militating against the American inventor which need to be remedied.

GENERAL ARTICLES AND CLASSIFIED ITEMS

The Problem of a Flying-Machine.*

In "The Popular Science Monthly" for November, 1885 (vol XXVIII, p. 1), Mr. Mather closes an excellent article on flying machines with the following weighty remark: "These are the most important inventions of this class, i. e., self-raising, self-propelling machines. It must be confessed that the results are far from encouraging. *But, there are the birds; and they completely refute the argument of those who say that it is impossible to make a flying machine.*"

Now, I wish to take issue with Mr. Mather in this conclusion. I am one of those who think that a flying-machine, in the sense indicated above, i. e., self-raising, self-propelling, is impossible, in spite of the testimony of the birds. Of course, it is understood that I am speaking of *true flight*, like that of a bird or an insect, and not of *ballooning* nor any combination of ballooning with flying. This is sufficiently implied in the words "self-raising and self-propelling." I wish now to give, very briefly, a reason for my faith. I can best do so with brevity and clearness by a series of propositions which I hope will lead us, step by step, to absolute demonstration. I believe this is important, in order to check baseless expectations and limit effort to the right direction.

1. *Two Kinds of Impossibilities.*—On the very threshhold of my subject I am met by the objection that "many things far more wonderful, and, before their realization, seemingly far more impossible, than flying-machines, have, nevertheless, actually come to pass. Then why not this also? He is a bold man that declares anything impossible in this age of rapid progress and startling inventions." I answer: True enough, many wonderful and apparently impossible things have indeed come to pass; and that, too, in spite of the adverse predictions of some rash scientists. But there are two kinds of impossibles—the *seeming* and the *real*. The *seeming* impossibles we *believe* to be impossible, only because we do not yet understand the principles involved in the problem, and therefore can not conceive the conditions necessary for their successful application. Such are all the cases which most readily occur to the mind as triumphs of science—such, for example, as the locomotive, the telegraph, the telephone, etc. The *real* impossibles, on the contrary, we *know* to be such, because we see clearly through all the principles involved in the problem and the *limits* of their possible application. Of this kind are the *problem of a perpetual-motion machine, and of a self-supporting arch of indefinite length.* Now observe—that, of these two kinds of impossibles, to the unreflecting the *seeming* are far the more impossible and wonderful. In fact, to most people the *real* impossibilities do not seem impossible, or wonderful, or even difficult at all. Hence, in every age and country we find men who waste their lives in vain attempts to make perpetual-motion machines. So, also, in regard to the indefinite arch. Most people do not see at once why an arch of any length should not support itself if only it be big and strong in proportion to its length.

Let me stop a moment to illustrate this by an anecdote. I remember many years ago meeting a traveling agent of a Remington bridge (a wooden suspension bridge), who had with him for exhibition a small model which, when set up, was about 20 ft. long, and had stringers about as big as my finger. This little model not only sustained itself, but, in addition, the weight of a stout looker-on—"a fat and greasy citizen"—twenty times as heavy as the bridge itself. "Now," said the plausible agent, "if you increase the size and strength of the stringers in proportion as you increase the length of your bridge, it is evident that a bridge of this pattern, of *any length*, will not only sustain itself, but 20 times its own weight in the form of loaded wagons." Most of those who heard it accepted his reasoning as irrefutable. Of course, every engineer knows that this is not true. For, while the *weight* of the bridge increases as the *cube* of the diameter of all its parts, the *strength* of the stringers increases only as the *square* of their diameter. In increasing the size in all dimensions, therefore, the weight will quickly overtake the strength. There is a *limit*, therefore, beyond which it is impossible to make an arch of suspension bridge support itself. This fact is so well recognized that it is unnecessary to dwell upon it. I have brought it forward at all only because I wish to apply the principle to other cases where it is not so well recognized.

2. *Application to Walking.*—Now, this principle applies not only to bridges and arches, but to all kinds of structures, and therefore, also, to locomotive machines, whether natural or artificial. For example, there is a limit of size beyond which it is impossible to make a successful walking machine, and beyond which, therefore, a walking animal can not exist. Beyond that limit the supporting bones would crush beneath the weight of the animal. It is in vain to say that we will make the bones and muscles thick and strong in proportion to the increasing size of the animal; for, as the animal increases in size, its *weight* increases as its volume or as the cube, while the strength of bones and muscles increases only as the cross-section or as the square of the diameter. Therefore, as the animal increases in size, a larger and longer proportion of the whole strength is consumed in the support, and less and less is left over for motion, until, finally, the weight overtakes the utmost strength of bones to support or muscles to move. It is probable that the limit of an efficient walking-machine has actually been reached in the largest animals which have walked the earth; such, for example, as the huge dinosaurs of the Jurassic period, recently brought to light by the researches of Marsh and Cope. The whale has probably passed the limit, and therefore was compelled to change its form and to take to the water, and become a swimming machine. Or, to speak more definitely and also more truly, the whale family in times long ago, perhaps in earliest Tertiary times, before it became a true whale family, found it profitable, either for food or for safety, to take to the water; and this not only determined a change of form, but also allowed it to attain a greater size than was compatible with walking.

This principle explains many other things in nature which would otherwise be inexplicable. The marvelous vivacity and energy of insect motion, the arrowy swiftness of flight of many kinds of flies, the prodigious leaps of fleas, the immense weights dragged by ants, are familiar to all. In text books on natural history these are given as examples of the almost inconceivable nervous and muscular energy of insects, as compared with vertebrates. It is often said that if *our* nerve and muscle energy were as great as that of a flea we might easily leap a quarter of a mile. In that case we would have little use for railroads or for seven-league boots, or indeed for flying machines. Now, this is an entire misconception. There is no reason to believe that *our* muscular energy is any whit less than that of insects—that, taking a bundle of muscular fibers of equal cross-section, the contractile power is any less in *our* case than in theirs. The explanation is easily found in the principle above stated. These apparently wonderful feats of insects are simply the result of their small size. Weight *decreases* as well as *increases* as the volume, i. e., as the *cube*, while strength of muscle only as the cross-section, i. e., as the *square* of the diameter. Therefore, with decreasing size weight decreases far more rapidly than strength, and therefore the ratio of strength to size *increases;* and therefore, finally less and less energy is consumed in support, and more and more is left over for motion. If any one desires to pursue this subject further, he will find it fully treated in a previous number (April, 1883) of "The Popular Science Monthly," in an article by Delboeuf on "Dwarfs and Giants."

3. *Application to Natural Flying.*—Now, this same principle of limit applies with greatly increased force to flying. There is a limit of size and weight of a flying animal; and on account of the prodigious energy required for aerial locomotion *that limit is very low, not much more than fifty pounds, certainly much less than one hundred pounds.* The largest flying birds, such as the bustard, the turkey cock, and the condor, rise with difficulty. They are evidently near the limit. There are, indeed birds which are much larger, such as the ostrich, the emu, and especially the extinct *Dinornis* and *Epiornis*, but these are all flightless. They do not fly, not because their wings are aborted, but, on the contrary, their wings became aborted because they had grown too large. Nature could not make them fliers, and therefore did not try. Or rather, it might perhaps be said, she tried her best and failed. Their wings became aborted because their size had passed the limit of possibility of flight. I imagine that the history of their evolution was briefly something as follows: They sprang originally from large birds of heavy flight; but being somewhat isolated from severe competition, on islands with abundant food, natural selection took the direction of *size* and *strength* for victory in contest rather than *swiftness* of flight for escape from danger. They quickly passed the limit of size for flight, and their wings becoming useless were aborted.

4. *Relation of Rising to Propulsion in Flight.*—There is another principle involved in flight which must now be stated. There are two things to be considered, viz., *rising* and *propulsion*. We have already shown that the ratio of weight to strength, and therefore the *difficulty of rising, increases* as the size or weight. We now add that the resistance of the air to motion through it, and therefore the *difficulty of propulsion* of a flying animal, *decreases* in the same ratio. The one varies *directly*, the other *inversely*, as the size.

This is a principle of very wide application, and I stop to illustrate it by many familiar phenomena. The floating of dust and smoke, the suspension of clouds, the slow setting of fine sediments, are examples. As the particles become smaller, the resistance of the air or water to falling through it, decreasing as the surface, i. e., as the square of the diameter of the particle (d^2), while the force of motion or weight decreases as the volume, i. e., as the cube (d^3) of the diameter—evidently the force decreases much faster than the resistance, and therefore the ratio of force to resistance or the *effective force* of motion, becomes less and less, until in very small particles it is a vanishing quantity. For this reason it matters not how great the specific gravity of a substance may be, if the particles are only small enough they will float indefinitely in air or water. Particles of gold may be made so small by precipitation from solution that they will require months to settle. Krakatoa-dust (if that be the true cause of the after-glow and of Bishop's ring) remained suspended in the air for more than two years. The perennial blue of the sky and of mountain-lake water is due to suspended particles.

Now this principle applies not only to resistance of the air to the *force of gravity* in *falling bodies*, but also to resistance of the air to the *force of propulsion* in *flying bodies*. As a flying animal becomes smaller (as in the smaller birds and in insects), a larger and larger proportion of the whole flight-energy is consumed in *propulsion*, and a less and less proportion is necessary for *rising*. On the other hand, as a bird becomes larger, a progressively larger portion of the whole flight-energy is necessary for *rising*, and less and less is necessary for propulsion, until finally at the limit the whole is necessary for rising. Beyond this, of course, flight is impossible. This explains why large birds like the condor rise with difficulty; but once up they sail with ease and grace, while small birds and insects rise with ease, but require rapid and incessant fluttering in progressing.

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*An article by Joseph Le Conte, Professor of geology and natural history in the University of California, in the "Popular Science Monthly," November, 1888.

5. *Application to a Flying Machine.*—Many readers who have followed me thus far with entire assent will probably object right here that, while this may be true of *flying animals*, it may not be true at least to the same extent—i. e., the limit may not be so low—in *flying machines*. There are forces, they will say, such as steam, electricity, explosions, etc., which are far more powerful than muscular contraction. Especially is electricity looked to in a vague way to do for us many wonderful things, this of flying among the number. Now, this is again a great mistake. Nerve-energy acting through muscular contraction, and supplied by the combustion of foods, such as oils, fats, starch, sugar and fibrin, together form the most perfect and efficient engine that we know anything of, i. e., *will do more work with the same weight of machinery and fuel.*

There was much loose talk a few years ago about condensing and storing electricity in immense quantity, in small space, by the use of Faure's battery. Millions of foot-pounds, it was said, may be thus condensed and stored in a small box and carried about. To the unreflecting, millions of foot-pounds seems a very large quantity. Extravagant expectations were thus raised in the popular mind. I remember at that time talking with a very intelligent gentleman on this very subject of flying machines; and he, in rebuttal of my argument, suggested the use of stored electricity. "Why," said I, "there is more energy stored in a piece of coal that may be put in the vest pocket than can be stored in a Faure's battery weighing three hundred pounds!" Faure's battery is doubtless a good thing, but chiefly like a flying wheel, not for increasing the *amount* but regulating the flow of force. He then suggested the enormous force of explosives, such as the nitro-compounds. The feeding of these to the engine might, he rightly thought, be so regulated as to supply a continuous force. But here lurks a fallacy, the result again of a misconception. The force of such compounds is characterized by great *intensity* rather than great *quantity*. The whole force is compressed into an almost infinitely small space of time, and therefore very intense. But stretch it out as a continuous force and it becomes no greater, probably less, than that of an equal weight of burning coal. There is probably no greater available energy in the world than that produced by the burning of carbon and hydrogen. It is this form of energy that we use in steam engines; this we find most powerful and economical in making electricity; this, also, is what is used in the animal machine. The only question that remains, then, is the *relative economy of its use*. Now, I think it will be admitted on all hands that no known engine compares in this respect with the animal body. It is acknowledged by mechanical engineers that the animal machine, burning hydro-carbonaceous food, and acting through nerve and muscle, more nearly approaches the theoretical limit of possible work than any, even the best, steam engines. More accurately, the animal body is about twice as effective as the best Cornish engine.

The reason of this wonderful effectiveness of the animal machine is obvious. See how this machine has been gradually perfected throughout infinite ages, especially in birds. During the whole geological history of the earth this machine has been steadily improving in structure of skeleton, energy of muscle, and rapidity of combustion of fuel, by struggle for life and survival of only the swiftest, the most energetic, and the hottest-blooded, until an almost incredible intensity is reached in birds. Moreover, in them everything is sacrificed to the supreme necessity of flight. Viscera, skeleton, legs, head and all are made as small and light as possible to make room for the great pectoral muscles working the wings. And to this the exquisite structure of the wings and feathers, adapting them for the greatest effectiveness; and we must admit that a bird is an incomparable model of a flying machine. No machine that we may hope to devise, for the same weight of *machine, fuel* and *directing brain*, is half so effective. And yet, this machine thus perfected through infinite ages by a ruthless process of natural selection, reaches its limit of weight at about fifty pounds! I said "weight of machine, fuel, and *directing brain*." Here is another prodigious advantage of the natural over the artificial machine. The flying animal is its own engineer, the flying machine must *carry* its engineer. The directing engineer in the former (the brain) is perhaps an ounce, in the latter it is *one hundred and fifty pounds*. The limit of the flying animal is fifty pounds. The smallest possible weight of a flying machine, with its necessary fuel and engineer, even without freight or passengers, could not be less than three or four hundred pounds.

Now, to complete the argument, put these three indisputable facts together: 1. There is a low limit of weight, certainly not much beyond fifty pounds, beyond which it is impossible for an animal to fly. Nature has reached this limit, and with her utmost effort has failed to pass it. 2. The animal machine is far more effective than any we may hope to make; therefore the limit of the weight of a successful flying machine can not be more than fifty pounds. 3. The weight of any machine constructed for flying, including fuel and engineer, can not be less than three or four hundred pounds. Is it not demonstrated that *a true flying machine, self-raising, self-sustaining, self-propelling, is physically impossible?*

6. *Application to a Swimming Machine.*—But is there not a way of escape from the toils of this inexorable logic? We have said the limit of the weight of a flying animal is about 50 pounds. The limit for a walking animal is much higher, probably several tons. For a swimming animal there is *no limit of weight and size*, because the water sustains the weight, and therefore the whole energy may be used in propulsion alone. Now some may think they see in this a solution of the problem. They will say "Why not sustain the machine by gas, so that the whole energy may be expended in propulsion alone?" I answer, that in proportion as the balloon principle is added to the flying principle, in the same proportion is *size increased without corresponding increase in power;* and therefore in the same proportion is increased the resistance of the air to propulsion, and, what is worse, in the same proportion is our machine at the mercy of winds. But it will be objected: 'See the fishes, how they swim! *They* are not at the mercy of the currents. They float suspended in the water—they dart forward against currents—they ascend cascades and leap waterfalls; in a word, they are largely independent of water currents. Now, suppose we make a machine exactly the shape of a fish, tail and all; then, by the addition of gas, make it the same specific gravity as the air; then, by machinery, make it wiggle its tail in the manner of a fish. Where is the difference? Why may we not make an aerial swimming machine, if not a true flying machine?" Doubtless it is in this direction that we must seek the partial solution of the problem, not indeed of flying but of *aerial navigation*. Yet the answer to the extravagant expectation expressed above is plain. The fish—its bones, muscles, viscera, brain—the materials out of which are made machine, fuel, and engineer, are of the same specific gravity as the medium (water) in which it swims. Now, whenever we can find materials out of which to make our machine, fuel and engineer, which shall have the same specific gravity as the air, then, indeed, we may make a successful swimming machine which shall be independent of winds. But so long as our materials are six or seven hundred times (wood), or five or six thousand times (iron) as heavy as air, we shall not succeed, because of the enormous dead space filled with gas that we are compelled to use, which adds to resistance of the air and the power of the winds, without adding anything to the power of propulsion.

Therefore, we repeat, a pure flying machine is impossible. All that we can expect—all that true scientists do expect—is, by skillful combination of the balloon principle with the true flying principle, to make *aerial navigation* possible in moderately favorable weather, in other words, to make a *locomotive balloon;* or, if we choose so to call it, an *aerial swimming machine*. That something really useful of this kind will eventually be made, there can be no reasonable doubt.

LETTERS TO THE EDITOR.

Regulations for the Transportation of Explosives.

Sirs:—Through your valuable Journal I would like to bring to the attention of contractors generally a matter of great importance to them, and to the traveling public.

All shipments of explosives must be made strictly in accordance with federal laws for the violations of which the penalty is a fine not to exceed $2,000 and imprisonment not to exceed 18 months. These laws will be found in Sections 233 to 236, inclusive, of the Act of Congress of March 4, 1909, and in the regulations of the Interstate Commerce Commission for the transportation of explosives in interstate commerce promulgated in conformity with Section 233 of the Act cited. It is absolutely essential that all shippers of explosives should become thoroughly familiar with these regulations. A copy can be obtained from any railway agent, and information in regard to any doubtful point will be cheerfully furnished by the "Bureau of Explosives, American Railway Association, 24 Park Place, N. Y. City."

The rules prescribe in detail the qualities of boxes and kegs used for the shipment of high explosives and black powder, the markings that must be on these packages, the names that must be used in describing the shipments on shipping orders, and the certificate that the shipper must furnish on his shipping order. The explosives must be in proper condition for safe transportation and the packages must be in good order. Unless this be true, and unless all other rules are complied with, the shipper cannot truthfully sign the certificate required from him.

The manufacturers of explosives and the caretakers of storage magazines throughout the United States are now conversant with these rules and, as a rule, are complying with them. The principal danger of disastrous explosions in transit seems now to accompany the shipments of explosives offered by contractors. Many of these gentlemen obtain explosives in good condition from the factories, or storage magazines, and do not provide proper storage facilities for these explosives while in their possession. Exposure to dampness and to elevated temperatures is liable to cause deterioration in explosive packages and in their contents. The wood pulp and nitrate of soda used as an absorbent for nitroglycerin in dynamite are hygroscopic and will absorb moisture from the air readily. In proportion to this absorption, the nitroglycerin has a tendency to exude from the cartridges. When it does this, it will [illegible] and is liable to leak through the joints. There can be no more serious violation of the rules than to offer for shipment a box of dynamite in this condition. The same kind of exposure results in rusting of black powder cans and the [illegible] of black powder from one of these packages occurs in a car there are many ways in which ignition of the material can result. In one case loose powder from such leakage escaped through a crack, or nail hole, in the floor of a car in a freight train standing on a siding and the powder was blown by the wind toward the main track. Sparks from the fire box, or the brakes of a passing locomotive, ignited this train and the entire shipment of powder exploded while a passenger car was in the immediate vicinity. All of the passengers in the car were either killed or injured.

[illegible]

plied to the railway agent for billing to ship his outfit of five cars to another point on the road. He said nothing about having explosives in his outfit. One of his cars contained a large amount of both dynamite and black powder. The car was in bad condition and contained many holes and cracks through which hay, on the floor of the car, protruded and offered an excellent opportunity for ignition by sparks from locomotives. The packages were leaking and a large amount of loose powder was on the floor mixed with this hay. Upon arrival at destination no mention of the contents was made to the agent at that point, and the car was permitted to stand for a number of days on a siding near the main track where it was exposed to this constant danger of ignition from passing locomotives. Through carelessness of the contractor's representatives an explosion did finally occur during the unloading of this car which resulted in the deaths of two men and one child.

Two cases have been reported recently to the Bureau of Explosives showing the extreme carelessness of contractors that it is hoped this communication will help to remove. One of them shipped on a flat car miscellaneous materials, including a tin bucket containing 14 cartridges of dynamite of high strength. Another contractor shipped a box of tools and placed in this box three boxes containing 50 pounds each of dynamite together with a number of blasting caps. There was nothing in the marking of these packages to indicate the serious violations of the law involved in these shipments.

It is the intention of the Bureau of Explosives to prosecute vigorously violations of this kind and this letter is written in the hope that it will impress upon contractors generally their moral and legal responsibilities in making these shipments.

Very respectfully,
B. W. DUNN.
Chief Inspector.

New York, N. Y., Dec. 3, 1910.

Methods of Making Computations for Depreciation in Public Utility Plants.

Sirs:—In Engineering-Contracting No. 20, Vol. 34, of date Nov. 16, 1910, appeared an abstract of a paper read by Leonard Metcalf, before the New England Water Works Association. Practically the same material had been presented by Mr. John W. Alvord before the Convention of the American Water Works Association held at New Orleans during April 1910.

It is stated by Mr. Metcalf that there are two general methods in common use for making up depreciation, one known as the "sinking fund" method, and the other as the "straight line" method. I challenge the statement that the "sinking fund" method is in common use to provide for depreciation, either in water works plants, or plants of other public utilities. There are good and sufficient reasons why this method never can be used successfully for the purpose. To provide for depreciation by creating a striking fund might be a practicable method where a structure is completed before it is put into service, and remains the same thereafter during its entire life of service, but with water works and other public utilities the condition is very different. A plant of this kind is never completed, as extensions, betterments and additions are made every year, if not every month. Each part in such a system depreciates in its own way and has its own length of life. It begins to depreciate the moment it is completed and placed in service and continues to the end.

In estimating depreciation it is impossible to make an average percentage in advance, which will hold good during the future life of the plant, because no one knows of what the plant will ultimately consist, and what the depreciation will be can only be determined after the plant has been actually constructed, and so it is with the new additions after the first construction. What the depreciation will be on each cannot be known until after they have been made. In applying the "sinking fund" method it would therefore be necessary to open an account when the plant is first constructed, and therefore to open a new account every time anything is added to the system. It can readily be seen that such a method is not a practicable one, as it would involve endless confusion in bookkeeping, and a multiplicity of accounts covering depreciation.

In the "straight line" method this objection does not apply, as the actual depreciation is estimated each year, and a necessary amount provided in the rates fixed for that year to make good the depreciation. Again the parts of the plant wear out from time to time, and the operating company must have money to replace them as soon as they are gone. Some parts of a plant may have a life of 10 years, other parts 50 years. Between these limits the various parts are being consumed, and they must be replaced as soon as they are consumed, and it will not do to have the money available at the end of the average time. If the money to make good depreciation is tied up in a sinking fund it is not available until the entire plant is consumed, and replacements to cover wornout parts in the interim must either be made with new capital, or charged to operating expense. If new capital is introduced this must be allowed to earn interest, and depreciation begins as soon as it is added, and if replacements are charged to operating expense the burden on the rate payers becomes excessive.

In discussing these two methods of providing for depreciation another point must be remembered. If only sufficient is allowed annually for depreciation so that by placing this amount in the "sinking fund" it will earn the depreciation at the end of the life of the plant, the original cost of the water works plant, or other public utility system must be permitted to earn interest until the "sinking fund" has provided sufficient money to replace it. Any other method would be fair to the operating company. This is not the practice and never has been the practice in the fixing of rates. On the contrary the present value of the property devoted to the public use is taken as the capital on which the company shall earn interest, and its present value is determined by taking reproduction cost and deducting therefrom depreciation to date. It would, therefore, be necessary to entirely revise methods of rate fixing, and set aside decisions of the courts on this subject in order to apply the "sinking fund" method. If this is not done the operating company would suffer a loss as its allowance for "sinking fund" would only make it whole when the plant is gone, while during the interim the company would only earn interest on a part of its capital, which would decrease each year.

I think the above objections are sufficient to show that the "sinking fund" method of allowing for depreciation is not a practicable one, which is probably the reason it has not been adopted and used heretofore. But one more point may be stated, namely, the uncertainty as to what rate of interest a "sinking fund" can actually earn. Whatever the rate may be it will necessarily be a low one, because the money must be placed in such a way as to not endanger the principal, otherwise money may not be available to renew the plant when needed. Interest rates are continually changing, and for any one to state what would be the average rate, which may be earned for the next forty or fifty years, is an impossibility. The allowance for depreciation might be excessive if the rate of interest is assumed too low, or might be deficient if assumed too high. This makes the "sinking fund" method impossible of application except in a very approximate way, while the "straight line" method can be applied with certainty.

F. C. FINKLE,
Contracting Engineer.

Los Angeles, Cal., Dec. 16, 1910.

PERSONALS.

Mr. John Rogers Maxwell, who was president of the Atlas Portland Cement Co. until Oct. 20, 1910, died in Brooklyn on Dec. 12.

Mr. J. W. Ryder, city engineer of Granite, Okla., has been appointed superintendent of construction of the Oklahoma State Reformatory at that place.

Mr. Theodore Luble, one of the first civil engineers to engage in practice on the Pacific coast of Canada, and long identified with important construction in that country, died on Dec. 17.

Mr. Con M. Buck, Assoc. M. Am. Soc. C. E., has resigned as city engineer of Manhattan, Kan., to become chief engineer of the Manhattan City & Interurban Ry., a line building between that city and Fort Riley, Kan.

Dr. J. A. L. Waddell, consulting engineer, of Kansas City, Mo., recently delivered two lectures before the faculty and students of the College of Engineering of the University of Illinois, one a technical talk on "Materials of Bridge Engineering and Foundations" and the other a general lecture on bridge construction.

Mr. Charles H. Markham was elected president of the Illinois Central R. R. on Dec. 21, and will assume the duties of the office on Jan. 12. He was until 1905 vice-president and general traffic manager of the Southern Pacific Co., and in recent years has been identified with oil interests in Pittsburg. Mr. Harahan, the retiring president, has been in the service of the Illinois Central for twenty years, and his resignation is due to advanced age. He will be 70 years old on the day that he relinquishes the office.

Mr. Walter L. Pierce, who has been for the last twenty-nine years Secretary and General Manager of the Lidgerwood Manufacturing Co., died of heart failure in his apartments at the Hotel St. Andrews, New York City, on Dec. 10. He was born at Dorchester, Mass., on June 8, 1855. Mr. Pierce had been with the Lidgerwood Manufacturing Co. for thirty-two years, and in addition to his connection with this company, he was Treasurer of the Hayward Co. and of the Gorton-Lidgerwood Co. He was a member of the Engineers' Club of New York City, an associate member of the Naval Architects and Marine Engineers and of the American Society of Mechanical Engineers, and a past president of the National Metal Trades Association.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Coltrin Concrete Mixer.—Paper, 6½x9 ins., 32 pp. The Knickerbocker Co., Jackson, Mich.

This catalog contains a complete detailed description of a continuous mixer of a new type. Illustrations are given of the various sizes of machines and parts of machines, and also of actual operations.

Studebaker Wagons. 6¾x10 ins., 16 pp. Studebaker Bros. Mfg. Co., South Bend, Ind.

A bulletin giving the history and development of Studebaker vehicles of all classes.

Air Compressors.—Paper, 6x9 ins., 20 pp. Ingersoll-Rand Company, 11 Broadway, New York.

Bulletin form No. 3002, describing the Class A1 straight line, steam driven, single stage air compressor. With illustrations and tables of dimensions.

Calyx Diamondless Core Drills.—Paper, 6x9 ins., 48 pp. Ingersoll-Rand Company, 11 Broadway, New York.

Bulletin form No. 9001, issued by this company describes and illustrates the diamondless core drill which uses either a steel cutter or a bit employing chilled shot or crushed steel as a cutting agent. Bulletin describes the tools and principles of operation.

Electric Railway Equipment.—Paper, 8x10½ ins., 12 pp. The General Electric Company, Schenectady, N. Y.

Bulletin No. 4794 was recently issued by the General Electric Company, describing the 1200-volt lines of the Milwaukee Electric Railway and Light Company. This is a reprint of an article which appeared in the technical press.

Electric-Air Rock Drills.—Paper, 6x9 ins., 24 pp. Ingersoll-Rand Company, 11 Broadway, New York.

This catalog is punched for filing and contains a complete illustrated description of the electric-air drill. The descriptions cover the mechanical features of the machine, its field of usefulness, and tables of sizes and equipment.

Electric Mine Locomotives. — Paper, 8x10½ ins., 36 pp. The General Electric Co., Schenectady, N. Y.

The General Electric Company has recently issued Bulletin No. 4790 under the above title, which supersedes its previous bulletin on the same subject. This bulletin illustrates and describes in considerable detail two and three-motor mine locomotives of various capacities, arranged to operate either singly or in tandem. This publication also describes the company's gathering locomotive and the various devices, such as controllers, fuse blocks, headlights, etc., with which the locomotives are equipped.

CONTRACT NEWS SECTION

of

ENGINEERING-CONTRACTING

The Doings of the Week

Bids were opened Dec. 21 at Albany, N. Y., for the first contracts in connection with the construction of the Cayuga & Seneca Canal, an offshoot of the State Barge Canal. Scott Bros., Rome, N. Y., at $393,135 were low bidders for Contract A; the Crowell-Sherman-Stalter Co., Cleveland, O., at $1,448,550 was low bidder for Contract B, the latter contract calling for 17 miles of dredging work.

The State Board of Public Works of Ohio has asked appropriations of about $1,470,000 for 1911 and 1912 for reconstruction work on the Miami & Erie Canal.

Several large barge canal contracts were let last week at Albany, N. Y. These include Contract No. 18, more than five miles of canal, Crowell-Sherman-Stalter Co., Cleveland, O., $1,701,671; Contract No. 51, construction of a canal feeder between Trenton Falls and Nine-Mile Creek, George T. Cunningham, Utica, $389,842.50; Contract No. 76, nearly six miles of canal, T. A. Gillespie Co., New York, $1,494,657; Contract No. 77, nearly seven miles of canal, T. A. Gillespie Co., New York, $1,652,148; Contract No. 80, bulkhead and dam across the Oswego River at Phoenix, Walter Bradley, Fulton, $117,390.

The Porto Rico Irrigation service has postponed the opening of bids for its extensive irrigation work including the construction of the Cavite Dam, the Guayabal Dam and the Patillas Canal and appurtenant structures, from Jan. 3 to Feb. 7.

The world's record for altitude in an aeroplane was broken on Dec. 26 at Los Angeles by Arch Hoxsey of the Wright team. He attained a height of 11,474 ft. The previous record was 10,499 ft made recently by Le Gagneux at Pau, France.

Figures by the controller of railway statistics of the Dominion of Canada show that the railway mileage of the Dominion increased from 24,104 in 1909 to 24,731 in 1910, an addition of 627 miles. Of this increase, 519 miles were in the four western provinces. These figures do not include any mileage attaching to the Grand Trunk Pacific, which is officially regarded as "under construction," although over 1,000 miles were in actual operation during 1910. It is estimated that 14,500 miles of railway were under construction on June 30 last.

The commissioners of the Transcontinental Ry. of Canada, Ottawa, Ont., are calling for tenders for furnishing 61,200 gross tons of 80-lb. steel rails and necessary rail fastenings.

According to the records of the building department of the city of Chicago, Ill., the buildings erected in 1910 and the permits taken out for others soon to be erected, represent a total investment of $96,000,000.

Among the railroad construction contracts let recently are the following: C. H. Sharp Contracting Co., Longview, Tex. and Kansas City, Mo., for building the first 30 miles of the recently chartered Port Bolivar Iron Ore Ry. in Texas; George West, San Bernardino, Cal., a $75,000 contract for widening the roadway of the Santa Fe at points on the Valley division in Northern California; Palmer, McBride & Quayles, San Francisco, Cal., for constructing a 10-mile extension of the Los Angeles Pacific Ry., from Hollywood to Kester.

Bids are now being asked by the Newgate State Commissioners of Highways, Albany, N. Y., for 67 contracts for improvements of highways. The approximate length of highways under each contract runs from one-half mile to eight miles. Bids are to be opened Jan. 9 on 23 contracts, on Jan. 11 for 24 contracts, and on Jan. 13 for 20 contracts.

A new company has just been chartered in Arkansas, and from the fact that $750,000 of its capital stock of $6,000,000 has already been subscribed it is judged that immediate developments are planned. This company is the Kansas City & Memphis Ry., and it proposes a railroad 350 miles long starting from Rogers, Ark. Officials of the Arkansas, Oklahoma & Western Ry. now operating 37 miles of line are back of the new company.

Extensive trolley development work is planned for the coming year in the State of Connecticut. Five companies are to apply to the State Legislature for permission to build extensions and to make other improvements to their service.

Pioneer Road Building.

A humorist once stated that he believed the older streets in Boston, Mass., were originally the trail made by a lost calf. Any stranger in that city who has followed the devious windings and turnings of some of the streets, will be inclined to believe in the calf theory. In the Province of Saskatchewan, Canada, the buffalo takes the place of the Boston calf as the original locators of the public highways. In a paper presented at the recent convention of the American Road Builders' Association by Mr. F. J. Robinson, Deputy Minister of Public Works of the Province of Saskatchewan, it was stated that it would appear that the roads in that Province, parts of which in some places are the main roads of today, were located originally by the buffalo. These old trails were perpetuated by circumstances, serving in turn the Indian, the trader, the mounted police, the rancher, and the immigrant in search of a homestead, and later the same party to market his grain. Finally, the old trail even became the street of towns and cities. A notable instance of this, though in the Province of Manitoba, is the old Red River Trail, which is now the main street in the city of Winnipeg. In the early days of road building in Saskatchewan fencing was not carried on to any considerable extent, the grain growers being obliged to permit the public to continue by the shortest route to the nearest railway station. As the land became more thickly settled the increased traffic caused much damage to crops along the principal roads, so it was not long before the farmers began building fences and placing notices, and finally forced traffic to the road allowances. These road allowances are 66 ft. wide in the greater part of the Province. With the establishment of definite limits for the roads came a necessity for better grading, better culverts and better bridges. Public money for roads in the Province was first provided by a grant by the Dominion Government, the funds being placed under the control of the Lieutenant Governor of the Northwest Territory, whose advisory council distributed the money as best it could. The amounts available were necessarily small, and not much progress in road building could be made. Sometime later the advisory council developed into a legislature, the members of which were allotted equitable sums to distribute among their districts. Still later a Department of Public Works was organized with a staff of engineers and surveyors to supervise the expenditures on public improvements. When Mr. Robinson joined the staff of the department in 1901, the duty of a district engineer was to find a road to market for settlers in a colony of settlers who had gradually become hemmed in by fences or natural obstructions. Limited funds were available for the purpose, so that round about routes were often resorted to so that natural obstructions could be overcome by crossing at spots requiring the least expensive construction work. Surveys were run across private lands and the necessary area purchased for the right of way for the highway. With the evolution of the road system from the trail to the highway, the expenditures for road purposes became gradually systematized, from the first patching of bad spots and the subsequent improvement of colonization roads. Now the expenditures are concentrated in the main roads, the lateral roads being left to be improved by the efforts of local organizations with money collected by them

Optimism.

Optimism is a very fine thing, but it is not given to all of us to be as optimistic as the man Everybody's Magazine tells about, This man, an Oregon editor, Ed Eckley, was with a crowd en route to Wallowa Lake in Oregon. From the railroad station up to the lake is a stiff climb of perhaps two miles. After a quarter hour of going, Eckley hailed a man coming down. "How far is it to the lake?" he asked "About a mile and a half," was the reply. Another fifteen minutes of climbing brought him to a second pedestrian going in the opposite direction. Eckley again asked the distance. "M-m, 'bout a mile and a half," said the native. A third man was met a few moments later. "How far?" queried Eckley, who was now decidedly tired. "Mile and a half," replied the stranger. Eckley sat down on a rock despondently, but optimism got the upper hand. "Thank the Lord," exclaimed the editor, "we are holding our own!"

The Superintendress of Construction.

There are women draftsmen, women engineers and women contractors, and now comes the news from Chickasha, Okla., that there is also a woman superintendent of construction. A $60,000 storm sewer has just been completed in that city, the work on which has been superintended from start to finish by the young daughter of the contractor. Work on the sewer was begun in April, and for the past nine months a gang of 75 workmen have been busy under the sole direction of the woman [illegible] in the [illegible] and that was when [illegible] was struck, but this difficulty was quickly and skillfully handled.

Construction Prospects. There seems to be a belief among railroad contractors that the coming year will be an excellent one for construction work. Some of the contractors even go so far as to state that they believe that 1911 will be one of the biggest construction years in the history of the country. These contractors figure that the railroads have a vast amount of betterment work which cannot be put off any longer, and must be done during the coming season. They also figure that while it is possible that the [illegible] undertake much new extension work the coming season, there are enough new railroad projects already financed and ready for construction to more than make up the difference. And even as regards the extension work of the older railroads, many contractors are inclined to think that when spring comes this work will be resumed and pushed to a greater extent than it was in even this excellent year of 1910. Reports indicate that this optimistic belief in a big season of construction work in 1911 is not confined to the contractors in any particular section of the country. A contractor now in Denver writes that half a dozen big projects will open up near that city on Jan. 15. Another contractor reports excellent business prospects on the Pacific Coast. The head of one of the biggest construction companies in the country states that he is of the opinion that the year 1911 will be one of the biggest years in the history of the country, and he adds: "I feel very optimistic about the immediate future, though there is not a great amount of new work in sight at this moment for contractor to figure on; but it is going to be a big year in the line of betterments. The railroads cannot defer making betterments any longer, and there will be extensive operations of that character. There is an abundance of money in the country, and there is much work to be done. The year 1910 has been characterized by too much politics. The people need a rest from that sort of excitement and they should be given a chance to take it. I think that all of the larger interests of the country look for a good year in 1911."

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Atlanta, Birmingham & Atlantic R. R. has secured right of way through the properties of T. O. Smith, Birmingham, Ala., for the purpose of constructing a "Y" connecting the company's line with that of the St. Louis-San Francisco (Frisco) System.

The Birmingham, Demopolis & Pascagoula Ry. Co. has applied to the City Council of Demopolis for a franchise over certain streets for its projected lines. The franchise will probably be granted.

Arkansas.

Business men of Helena, Ark., headed by President Horner of the Business Men's League of that city, have offered to lease from the Yazoo & Mississippi Valley R. R. the branch from Trotter's Point to Jonesboro. If the offer is accepted, it is believed that the line will be electrified and trains run each hour.

It is reported here at Little Rock that the Chicago, Rock Island & Pacific R. R. will take over the Memphis, Dallas & Gulf R. R. The latter road is in operation from Ashdown, on the Kansas City Southern, via Nashville, Ark., crossing the Prescott & Northwestern at Tokio to Murfreesboro, and thence to Graysonia, where it crosses the Iron Mountain branch running north from Gurdon. From that point, it is said, the Rock Island will build a line to Arkadelphia, from which point the Ultimathule, Arkadelphia & Mississippi line, which is a part of the Memphis, Dallas & Gulf, will be used to Dalark. From Dalark the Rock Island will build the short gap through Dallas county, where it will strike its main line running from El Dorado to Little Rock.

The Kansas City & Memphis Ry. Co. has been chartered with a capital stock of $6,000,000, of which $750,000 has been subscribed, and [illegible] a line of a total length of [illegible] miles. As projected the road will start at Rogers, in Benton county, and will run south through Benton and Washington counties to Fayetteville, thence east into Madison County to Hindsville and Huntsville, thence southeast right through the southwest corner of Newton County, thence across the northeast corner of [illegible] in Pike County. From there the line extends down toward the southern line of Pope County, to the vicinity of Moreland, then turns eastward again, into Conway County, crossing the northern part of that county to a point in Van Buren County, near its southern boundary. From here the route lies through the northern part of Faulkner County, into White to Letona, where it veers toward the southeast, heading for Searcy. From this point it proceeds eastward, crossing the Iron Mountain at Kensett, into Woodruff, crossing the southern corner of Jackson County into Cross County, where it forms junctions with the Cotton Belt at Hickory Ridge and the Iron Mountain line at Cherry Valley. Thence across Crittenden County to Memphis, Tenn. Branches are also projected from Hindsville, in Madison County to Eureka Springs, in Carrol County, and westward from Rogers to Siloam Springs. The branch to Little Rock will probably extend from a point in northern Faulkner County, south through that county and Pulaski to Little Rock. A westerly line is projected from Siloam Springs to Wagoner, Okla. The stockholders of the company include W. R. Felker, J. E. Felker, Geo. D. Locke, F. F. Freeman, J. S. McLeod, J. W. Walker and R. C. Hobbs, all of Rogers, Ark. Most of the above are officials of the Arkansas, Oklahoma & Western Ry., which is now operating 37 miles of line.

A contract has been closed whereby the Fort Smith & Van Buren Ry. Co., a terminal line that is to connect Van Buren with the Kansas City Southern Depot in Fort Smith, will construct a line to the holdings of the North Fort Smith Improvement Co. in return for the right of way through that property. W. D. Pratt is President of the railway company.

California.

⊙George West, San Bernardino, Cal., has been awarded a $75,000 contract for widening the roadway of the Santa Fe at points on the valley division, in Northern California. The contract involves the placing of about 3,000 yds. of dirt to each mile to bring the roadbed up to the standard.

⊙Palmer, McBride & Quayle, 1st and Market Sts., San Francisco, Cal., have been awarded the contract for construction of a 10 mile extension of the Los Angeles Pacific Ry. from Hollywood to Lankershim, thence five miles west to Kester on the Van Nuys ranch. Construction is to begin at once and the extension is to be completed and ready for operation March 1.

Klippel & McLean, contractors who have the contract for the construction of the Northwestern Pacific near Byerville, Cal., mentioned in a recent issue of ENGINEERING-CONTRACTING, have a plan under consideration for transporting their supplies by means of boats or lighters up the Eel River. A gasoline power boat will be used to draw the tows which will be loaded with steam shovels, dump cars, etc.

Double tracking of the Santa Fe between Daggett and Cottonwood, Cal., a distance of about 25 miles, has been completed by the Sharp-Fellows Construction Co., Los Angeles, Cal.

The Hanford & Summit Lake R. R., which is now engaged in building a line of railroad from Hardwick to Hanford, Cal., has expressed a desire to build into Fresno from a point on the first line about Midway between the two terminals. At a recent meeting of the Chamber of Commerce and the Fresno [illegible] announced that providing the city could furnish the necessary right of way funds for the work could easily be secured. Such a line would provide connections with both the Southern Pacific and the Santa Fe system. John B. Rogers and Charles King are interested.

Officials of the Western Pacific, including Charles H. Schlacks, Vice President, recently held a meeting with the San Jose, Cal., committee to discuss the proposition of constructing a branch line from Niles to that city. T. J. Wyche, Mills Bldg., San Francisco, Cal., is Chief Engineer.

Citizens of the northwest section of San Bernardino are circulating petitions for funds to build a trolley line from the business section of town in a northwesterly direction to Rialto Terrace. This action is being taken as the result of a rumor that the acquisition of the Pacific Electric lines by the Southern Pacific meant the contemplated line east from Upland to San Bernardino would be abandoned.

Engineers of the Southern Pacific have submitted to the City Council of Riverside blue prints for the proposed subway to be constructed through North Main St. The tunnel will be built of concrete, and will be about 25 ft. wide. The cost is estimated at $9,288.

Funds are being secured from recent stock sales and it is planned to complete the Tidewater & Southern R. R. between Stockton and Modesto via Escalon early in the Summer. Practically all right of way in San Joaquin County, Cal., has been secured and all in Stanislaus excepting two pieces which are now being adjusted. The contract for the line to French Camp, it is said, has already been let, and it is the intention of the promoters to have the road extended to Newman and Turlock next year. John A. Mehling, Stockton, Cal., is promoter and Byron Bearce, General Manager and Treasurer.

The Southern Pacific, according to reports is planning the construction of a line into Bishop, Cal. No definite route has been decided for entrance into the valley.

The Southern Pacific Ry. Co. has placed a corps of engineers on the extension of the line between Vallejo and Benicia and it is rumored that the company intends to commence work at once. Two surveys were made some time ago but the activity of the company at this time is taken as a good indication that something definite will be done. William Hood, San Francisco, Cal., is Chief Engineer.

The Western Pacific Ry. Co. has submitted a proposition to the City Council of Nevada, Cal., offering to construct a line from Marysville to that place providing proper inducements would be offered. The Chamber of Commerce has taken the matter in hand and will decide as to what can be done. T. J. Wyche, Mills Bldg., San Francisco, Cal., is Chief Engineer.

✣ indicates [illegible] ⊙ indicates a contract let recently.

Colorado.

The Meeker R[illegible] placed an ord[illegible] west of New Castle [illegible] the Grand River, Meeker & Salt Lake R. R. The construction company has been awarded the contract for the entire 300 miles of the line. Funds are available for the first 50 miles, $2,000,000 having been subscribed a short time ago. The company has arranged the preliminaries for a bond issue of $1[illegible],000,000, enough to complete the entire line. For the present grading will [illegible] the 20 miles between the starting point, and the townsite of Chapman. The offices of the Grand River, Meeker & Salt Lake R. R. are Room 527, Ernest & Cranmer Bldg., Denver, Colo. John T. McClure is Secretary.

Attorneys of the Burlington System and the Colorado & Southern R. R. are preparing a bill for an ordinance designed to grant to these roads a revocable permit to lay and operate tracks on Walnut St. between 34th and 26th Sts. in Denver, Colo. The Burlington offers to make an expenditure of $500,000 for the improvement of the street in question in case the bill is passed.

The Denver, Enid & Gulf Ry. Co., which stopped construction work on its line last Summer, will begin building again, pushing from Texhoma southward toward Dallas and northward toward Lamar, Colo., which city has given a bonus of $100,000 to secure the line.

It has been announced that D. H. Moffat, President of the Denver, Northwestern & Pacific Ry., has succeeded in financing the great tunnel project through the Rocky Mountains at an elevation of 2,000 ft. below the present series of switchbacks. It is also believed that the road will now be pushed directly through to Salt Lake City, Utah. H. A. Sumner, Denver, Colo., is chief engineer of the company.

The fact that the Right of Way Agent has made a contract with the Water Committee for water for its shops in Fort Collins, Colo., gives rise to the report that the Union Pacific will soon construct its extension to that place.

Tracklaying was started Dec. 9 on the new double track railroad being built for the Denver & Rio Grande and Colorado & Southern between Pueblo and Walsenburg. During the past month the grading forces moved an average of 40,000 cu. yds. of earth a day. The average force early in December consisted of 1,200 men, 690 teams, 11 steam shovels and 25 grading machines. The laying of steel indicates that the line will be ready for operation between Walsenburg and Huerfano by Jan. 10. The entire line will be finished by September. The construction will cost in the neighborhood of $4,000,000 for the double track ready to be turned over to the two companies.

Connecticut.

The Shore Line Electric Ry. Co., 82 Church St., New Haven, Conn., now operating trolley lines in towns west of the Connecticut River, will petition the next Legislature for the right to use electrical power in a considerable group of towns including Chester, Essex, Old Saybrook, Saybrook, Lyme, Guilford, Branford, North Branford, Clinton, Madison and Westbrook and also to use its power in connection with the Connecticut River drawbridge. The company will also ask that its office be removed from New Haven to Old Saybrook, where its power plant is located.

Frank F. Hanford of Kensington, Charles F. Lewis of Berlin and E. Allen Moore will apply at the coming session of the Legislature for the right to build a trolley line from Chapel corner in Kensington to the American Paper Goods Co. plant, thence through Cat Hole pass to Meriden to meet the existing line between Meriden and Milldale, also to run a line down Kensington avenue to Colony St., Meriden to connect with the line there, and further to connect with the Meriden line at West Main St. They also wish to build a line from Kensington to New Britain to connect with the local line at the foot of Kensington St., and at the corner of South Main St. and Franklin Sq.

The Connecticut Co., New Haven, Conn., operating all electric railways in Connecticut for the New York, New Haven & Hartford R. R., which also owns a number of lines in Massachusetts, will petition the next session of the General Assembly for a charter for a trolley line from New Hartford along the west branch of the Farmington River through Pleasant Valley, Riverton, Colebrook River to New Boston, Mass. It is probable that this will be a part of the proposed line from Westfield, Mass., to Otis and Sandisfield, which includes the village of New Boston. The company will also make application for a charter for a trolley line from Canaan, northerly to the Massachusetts state line for the extension of the road now being built from Great Barrington, Mass.

The Danbury & New Milford Street Ry. Co., Frank S. Bishop, Secretary, New Milford, is to ask the next Legislature for an extension of time in which to build its road.

The Moodus & East Hampton Electric Ry. Co. is to apply to the legislature for permission to construct a line between Moodus and Marlborough, via East Hampton, a distance of about twelve miles. The route runs along the east side of Lake Pocotapaug, a summer resort in East Hampton and joins the Norwich, Colchester & Hartford at Marlborough Mills. Hartford capitalists are behind the project, which is in reality a continuation of a project for a trolley line between Moodus and East Hampton on which considerable work was done several years ago. Owing to lack of funds and legal entanglements the work was abandoned at that time.

The Bristol & Plainville Tramway Co. intends to ask the incoming General Assembly to continue its rights to build and extend its lines according to the provisions of its charter and of the amendments thereto, and that it may be authorized to lay its tracks and build lines on Agnew Ave., South Main St. and Eagle Sts. in the village of Terryville. G. E. Cockings, Bristol, Conn., is general manager and purchasing agent of the company.

Board of Directors of the New York, New Haven & Hartford, have approved plans for the construction of the proposed new stone and brick station at New Haven, Conn., located on Meadow St. The structure, which will be 1 000 ft. long and about 500 ft. wide, will cost $1,000,000 and will require about a year's time for completion. Edward Gagle, New Haven, Conn., is Chief Engineer of the company.

Florida.

Good progress is being made on the extension of the Ocala Northern Ry. of Ocala, to Palatka, and it is expected that trains will be in operation between Ocala and Palatka by July 1 next. Work will be started soon placing rails from a short distance the other side of Fort McCoy on to Palatka. This road will shorten the distance between Ocala and Palatka over 40 miles.

Georgia.

The Secretary of State has granted an extension of three years to the charter of the Atlanta, Stone Mountain & Lithonia R. R. Co., a line which is in process of construction from Lithonia to Atlanta by Venable Bros. of Atlanta.

The Southern Ry., W. H. Wells, Chief Engineer of Construction, Washington, D. C., is planning to increase its yard facilities at Atlanta, Ga., by the construction of 13 spur tracks and 10 wagonways. About $150,000 is to be expended.

Sufficient working capital has been secured to assure the completion of the Wrightsville, Adrian & Lyons R. R. Grading has been carried on for some time from both ends of the line and there is only a gap of about 10 miles in the middle unfinished. The terminial points of the line are Lyons and Wrightsville.

Idaho.

Surveys have been made by the engineers of the Southern Pacific Ry. Co., from Rogerson, Idaho, through Contract, Nevada, a distance of 40 miles and down to a point on the above railroad near Wells.

Illinois.

The Southern Street Ry. Co., Chicago, Ill., operated by the Chicago City Ry. Co., has certified to the Secretary of State to an increase of capital stock from $800,000 to $2,-[illegible]

D. O. Ward, 301 South Austin Ave., Chicago, has submitted to the Village Board of Oak Park a plan for a street car line through Oak Park, from Harrison St. on the south to Chicago Ave. on the north.

The Santa Fe System has planned to eliminate the grade crossing of the public road between mile post 167 and 168, Illinois division, and plans to construct a subway and an overhead bridge instead at a cost of $9,000.

Announcement has been made that construction work on the St. Louis & St. Libory R. R will be resumed at once. This line has been under construction from near Freebury to St. Libory for the past year and is built to tap the rich coal fields of Southern St. Clair County and place the coal on the St. Louis market. All of the grading for the road from Freeburg, where the line taps the Illinois Central, has been completed and the coal mine at St. Libory, owned by the promoters of the line, will resume the work of hoisting coal the early part of the new year. An extension from St. Libory & Nashville, Ill., is also to be built. Edward Thomas, a contractor of Belleville, Ill., is interested.

Plans are underway for the construction of extensions of the Central Illinois Traction Co.'s line so as to form a connection with the Illinois Traction system in Illinois and the McGowan system in Indiana. The plan proposes the construction of a line to Paris and then north to Chrisman, 14 miles, where a connection will be made with the Illinois Traction System line which will be built south from Ridge Farm. Connection with the McGowan system will be made at Paris. M. E. Sampsell, Chicago, Ill., is President of the Central Illinois Traction Co.

The Pekin and Pittsburg Interurban Ry., which projects six miles of city line at Pekin is now selling bonds for construction purposes. The road will be built by day labor. J. E. Melich, C. E., Springfield, Ill., is Chief Engineer and President.

Indiana.

The Lake Erie & Western R. R., W. G. Atwood, Chief Engineer, Indianapolis, Ind., is contemplating double tracking its line between Kokomo and Indianapolis.

The Northern Indiana Ry. Co., South Bend, is considering double tracking its Michigan St. line between the Lake Shore R. R. and Ohio St. at South Bend.

Iowa.

Final surveys have been made for a new line for the Chicago, Rock Island & Pacific R. R., from Des Moines to Allerton. Iowa press reports state that officials of the road say the line will be built next year providing the money market does not get too close.

Kansas.

Dr. H. L. Murlin, President of Baker University, Baldwin, Kan., is formulating plans for the construction of an electric railway from Baldwin to Olathe to connect with the Strang electric line to Kansas City. A company will probably be formed to build and operate the line.

The Manhattan City & Interurban Ry. Co., which projects a line between Manhattan and Fort Riley, Kan., has located the line between the former place and Ogden, a distance of 10 miles, and will begin construction work as soon as right of way is secured. The line will cost about $150,000. Manhattan City has voted $20,000 in bonds and Ogden Township has voted $10,000 in bonds for the line. Con. M. Beck, formerly City Engineer of Manhattan City, is Chief Engineer of the railway.

According to an announcement recently made by Charles Gray, Canton, Kan., and Dr. Bremen, Roxbury, a contract has been entered [illegible]pany providing for the construction of the proposed line of the Motor Grand R. R. Co. The contract provides that the promoters of the company must dispose of $350,000 worth of stock for the line between Newton and Salina.

Kentucky.

⊙Bunn & Co., Big Stone Gap, Va., have been awarded the contract for a 5-mile extension of the Roaring Fork branch of the Interstate R. R., a coal carrier, beyond the Kentucky border in the Virginia coal field.

Surveys have been completed for a line of railroad from Harlan Courthouse through Clover Fork Valley via Keokee, Lee county, Virginia, to Appalachia, in Wise county, where it connects with the Louisville & Nashville main line and the Virginia & Southwestern Ry. There are good grounds to believe that the Louisville & Nashville R. R. will let this road to contract at an early date in order to make connection with the rich coal deposits across the Cumberland Mountain in Eastern Kentucky.

The Chesapeake & Ohio Ry. has been making preliminary surveys between Brashears and Camtown for changing the roadbed in order to begin double tracking in the spring.

The Nashville, Chattanooga & St. Louis Ry., H. McDonald, Chief Engineer, Nashville, Tenn., has secured an option on the necessary land and will shortly have work started on rebuilding its tracks into Hickman, Ky.

Louisiana.

[illegible] issued the Shreveport & Memphis Ry. Co. to build a line from El Dorado southwest to Homer and Minden, La., a distance of 45 miles. Later it is believed that the line will be extended northward to Memphis. O. C. Ferguson, A. R. Johnson and others of Homer, La., are the incorporators. It is believed that the El Dorado & Wesson Ry. of Wesson, Ark., is behind the project.

Advices from Baton Rouge, La., state that the Southern Pacific has completed the Lafayette-Baton Rouge cut-off to that place. Early in the new year will be inaugurated through westbound freight and passenger service from the Illinois Central and other Eastern Harriman allied lines, via Hammond, Baton Rouge and Lafayette. The Baton Rouge, Hammond and Eastern link in this cut off has been graded and ballasted up to standard, and is ready now for the heaviest service. The Lafayette-Baton Rouge short line is finished in standard condition, and only waits settling under preliminary traffic before through service is inaugurated. The engineering feat of mastering the Atchafalays Swamp is said to be among the most notable accomplished in recent years in Southern railroading.

The Shreveport & Memphis Ry. Co., incorporated Dec. 23, at Shreveport, La., has completed surveys between Eldorado, Ark. and Minden, La., 45 miles. Capitalists of Chicago and St. Louis, Mo., are back of this project.

Maine.

Surveys have been made from Washington to New Sweden for the proposed electric railway of the Aroostook Valley R. R. Co., A. R. Gould, President, Presque Isle, Me. It is now proposed to run a branch line from some point on the survey to Caribou and from that [illegible]

Maryland.

A committee of citizens of Timonium has been appointed to urge upon officials of the United Railways of Baltimore that they extend either their Mount Washington or Tow- [illegible]

Residents of Perry Hall, Baltimore County, have petitioned the Baltimore & Belair Electric Ry. Co., Belair, Md., to extend its line to Belair through Perry Hall and Kingsville instead of through Fork and Reckord.

The Hagerstown & Clearspring Ry. Co. has been incorporated with a capital stock of $15,000 and proposes to build an electric railway from Hagerstown to Clearspring, a dis- [illegible] road ultimately to Mercersburg. The incorporators are Major L. N. Downs, of New York; Hugh I. Kirby, of Harpers Ferry; Alexander R. Hagner, Robert H. McCauley and James B. Kreps, of Hagerstown. The project has been promoted by Major L. N. Downs.

Massachusetts.

The promoters of the Worcester & Northern Street Ry. Co., who plan the construction of a direct line from Fitchburg to Worcester, have asked for an extension of the franchise. It is said that promotion work for this road is well along, and that preliminary construction will be started next spring.

The Grand Trunk Ry., H. G. Kelly, Chief Engineer, is reported to be making rapid progress with its surveys for the route of its subsidiary line, the Southern New England Ry., between Palmer and Southbridge, Mass. This line will connect with the Southern New England Ry. line to be built in Rhode Island, both constituting the southeastern extension of the Grand Trunk system. Officials of the company state that they expect the Massachusetts State requirements regarding the obtaining of the consent of the selectmen of the towns through which the road will pass, will be adjusted in a short time, as well as the paying in of the required 10 per cent of the capital. From the present outlook ground may be broken in the spring on the section from Southbridge to Palmer.

Michigan.

It is likely that the Detroit & Mackinac Ry., L. O. Pettyes, Chief Engineer, East Tawas, Mich., will have some construction work done this winter on the building of its Rogers City branch through to Calcite.

Minnesota.

Wick, O'Connel & Co., Houghton, Mich., now have six electrically driven drills at work on the 600-ft. tunnel for the Canadian Northern Ry. near Smithville. At the middle of this month the tunnel was into the rock about 50 ft. It is expected that the tunnel will be completed by June 1 next.

Work on the Minneapolis, St. Paul & Sault Ste. Marie R. R. cut-off between Chippewa Falls to St. Paul, Minn., is about completed shortening the distance between the two points by 12 miles. By the time the new high bridge over the St. Croix River is completed the line will be ready for operation. Thomas Green, Minneapolis, Minn., is Chief Engineer of the company.

It is reported that the Shevlin-Carpenter Lumber Interests, Minneapolis, Minn., are contemplating the construction of a railroad to open up their holdings in the vicinity of Red Lake. The line will run between Kelliher and Spooner connecting with the Funkley-Kelliher branch of the Minnesota & International Ry. It will be started from Kelliher across the Tamarac River not far from the eastern extremity of Upper Red Lake, following the high bridge through the big swamp northeast of the lake direct to Spooner.

The Great Northern and the Minneapolis, St. Paul & Sault Ste. Marie Railroads have purchased about 600 acres of land in the northeast part of Minneapolis for terminal purposes.

Missouri.

The Santa Fe System plan on constructing six new tracks and extending three old tracks at Lexington Junction, Mo., at an estimated cost of $2,800.

[illegible] appropriated $10,000 to cover the cost of making changes [illegible] Lexington Junction, Mo.

The Santa Fe System has planned to spend $4,000 to cover the cost of widening its banks and building a protection at mile post 435, Missouri Division.

The City Council Committee of Kansas City, Mo., at a recent meeting, took up for consideration the recommendation of the Utility Board to grant the Intercity Viaduct Freight Ry. Co. a franchise for an electrical switching system on several northside streets.

St. Louis Items.

By A. B. Koenig.

We wish all the readers of Engineering Contracting a happy and prosperous New Year.

Wm. Bates, Secretary and Treasurer of the McIntyre & Teese Construction Co., spent Christmas week here with his family. Bates says that their sewer and street paving contracts in Wichita are all getting along nicely.

A complete change of the Board of Local Improvements plans for the improvement of Ridge Ave. in East St. Louis, Ill., prevented the ordinance for that work from going to the City Council for approval last week, although the Council authorized the improvement of three other streets. Although it was at first intended to pave Ridge Ave. with Telford, from the Venice and Carondelet Belt Railroad tracks to Illinois Ave., the Board of Local Improvements has decided to use brick instead of the gravel and to improve the street all the way from 17th to 29th St. City Engineer William J. Crocken announced that he will immediately prepare plans for the improvement and that it will be ready for a public hearing about Jan. 1st. Because of the difference in cost between the Telford and brick, which is about 60 per cent, and the larger territory to be covered in the improvement, the cost of the work will be approximately $16,500, instead of $8,100 as intended under the original plan. The ordinances for the improvement of 18th St., 19th St. (best known as Gray Boulevard and 27th St.), which involve an expenditure of approximately $46,500, were approved by the Council as they were received from the Board of Local Improvements. The Telford style will be used in the paving of Gray Boulevard and 18th St., which will cost $17,300 and $14,200 respectively, while brick will be used in the 27th street work at a cost of about $15,000.

Fire destroyed part of Koenig's Labor Agency in Little Rock on the night of Dec. 21st. Business was not interrupted a minute, for Jack Gordner, the manager there, was doing business on the sidewalk until he got some new furniture in the office the next morning.

A message from Carlyle, Ill., says the coming year promises to be the banner twelve months for the promotion and building of interurban railroads in Southern-Central Illinois. The indications are unusually favorable for the efforts of the citizens to bring results. In this section interest is centered in the survey for an electric line, to be built by the Springfield & Central Illinois Traction Co. The work is being done under the supervision of Isaac A. Smith of St. Louis, president of the company. The corps of surveyors started at Centralia, followed the west side of the main line of the Illinois Central to Sandoval, thence west on the south side of the Baltimore & Ohio Southwestern to Carlyle, through Shattuc, Ferren and Huey. A crossing of the steam railroad was made in the western part of the city. The surveyors are now going north, and expect to reach Greenville by the middle of next week. From that city the proposed line passes through Hillsboro, making Springfield the northern terminus. From Greenville a branch road is to be built west to Alhambra and southwest to Edwardsville, connecting with the McKinley System. The proposed line is considered one of the best electric railroad propositions in the State. In addition to the above project, the owners of the Central City Electric system say they will extend their line north to Sandoval, and probably east to Salem, the county seat of that county. The stockholders of the Carlyle & St. Louis Electric Railroad Company are also getting ready to revive interest in their proposed line west from this city to Lebanon, through Beckemeyer, Breese, Aviston, Trenton and Summerfield. The survey was made several years ago. Another projected line is from Pana to Granite City, through Nokomis, Coffeen, Greenville and Highland. The backers of this project are the Decatur & Southern Railway Traction Co. It is claimed that actual work on this line will start within a few months. Since each of the proposed lines will serve different territory, one will derive benefit from the other. The McKinley System contemplates a line from Cairo to St. Louis. The Southern Traction Co. plans a line from St. Louis to Belleville.

Chas. C. Gentry, P. O. Box 418, Seattle, Wash., writes us that he has some of the finest team work on record in Canada to sub-let. Work will last from three to five years. Contractors wanting work in this part of the country should write Gentry at once.

Interurban cars equipped with storage batteries will be operated from St. Louis to Waterloo, Ill., by the East St. Louis, Columbia & Waterloo Railway, which is now under construction. Large cars of a special type will be built for the new railway in accordance with designs just drawn and submitted to the manufacturers. Edwin H. Conrades of the Donk Bros. Coal & Coke Co., president of the line, announced last week that he had reached an agreement with the East St. Louis & Suburban Co. whereby the through cars to and from Waterloo will cross the Eads Bridge and stop at Third street and Washington avenue. He said the line will run cars also over the municipal free bridge. The storage-battery car, invented by Thomas A. Edison, has been in service in New York City since March. This is a small, single-truck experimental coach. A large double-truck car is in operation at West Orange, N. J. One of the demonstration coaches will be shipped to East St. Louis within the next thirty days and tested by the East Side Suburban System. The East St. Louis, Columbia & Waterloo Railway will be the first line west of New York City to adopt the electric storage-battery car as the standard equipment. Trolley wire or the third rail will not be required. The cars will contain their motive power. The new railway will be the first interurban road south from East St. Louis, all the existing lines running east, north and northeast. It is planned to extend it down to Cairo, forming a new route from St. Louis, through Southern Illinois to the Ohio river. The road is completed in East St. Louis. Franchises have been obtained from Columbia, Waterloo and other towns on the line. Right-of-way has been acquired over the whole distance, and Mr. Conrades is now ready to receive proposals for the construction work. The engineers engaged to investigate the practicability of the storage-battery car have drafted suggestions for improving the equipment. Besides a new type of truck, the cars will be equipped with a hot-water heating system to be fired by the motorman. In other respects, the coaches will be on the same style as the largest interurban equipment, with smoking compartments and other distinctive features. Sheds will be constructed at each terminus for changing the batteries. The engineers have recommended the housing of each car during the charging process.

A. J. Manley, the Labor Agent of the Great Northern R. R., was in St. Louis last week making arrangements for the next season supply of labor for this road.

Robert W. Sikking, secretary of the East Side Levee and Sanitary District, last Tuesday delivered to the seven banks which bought them 450 $1,000 bonds. The bonds were authorized by the Levee Commissioners to provide money with which to carry on their work. The bonds are to be redeemed in one year from September 1, 1910, and bear 5 per cent interest. The coupons are dated March 1, and September 1, 1911. The entire proceeds of the bond issue will be used by the Levee Commissioners in their work on building a series of canals and levees to protect East St. Louis and the East Side from high water in future years. The seven banks which bought the bonds are: Illinois State Trust Company Bank, Southern Illinois National Bank, Union Trust & Savings Bank, Citizens' Savings & Trust Company, and the National Stock Yards National Bank of East St. Louis, the First National Bank and the Granite City National Bank of Granite City, Ill.

Capt. Jack Kelton after an illness of two years showed up in St. Louis the day before Christmas. With the exception of being a little weak he claims to be O. K. and as good as ever now.

The Board of Public Improvements through Commissioner of Supplies Boyce is advertising for bids for the wrecking of the six blocks between Seventh St. and the river and Chouteau, Lombard and Gratiot Sts., over which the west wagon approach of the Municipal Free bridge will pass. The work is to begin on Jan. 3, and must be completed by May 15. The buildings to be wrecked were condemned by a special commission, consisting of F. N. Judson, Charles Z. Tremley and W. A. Caulfield, at a cost to the city of more than $1,000,000. Among the structures are those of the National Lead Works and the Columbia Buggy Company. The bids advertised for demand that all debris be removed from the premises. A $5,000 bond and a cash deposit of the same amount are required of the successful bidder, who must pay the cash to the city upon the acceptance of the bid.

Charley Nagel is pushing his work on the electric line north of Alton, Ill., and expects to finish before spring.

Many of the old time sprinkling contractors were missing from the list of lowest bidders in the letting held by the Board of Public Improvements. The lowest bids are about 5 per cent higher than the present rate, and are higher than last year, but not quite as high as 1908. The total cost of sprinkling 590 miles of streets for 1911 will be about $272,500. Delay in the awarding of the contracts is expected to result from the concentration of the job into so few hands. One contractor, Wm. H. Redemeyer, is low bidder in 19 of the 40 districts. This would give him about 285 miles of the 590 miles of streets. There is doubt in the mind of the Street Commissioner Travilla that one contractor can handle so much work to the satisfaction of the city. Travilla is to lay the matter before the Board, and the latter is to call Redemeyer and the other big contractors in for a conference. Stephan Ratican has the low bid in seven of the forty districts giving him 115 miles and putting 400 miles in the hands of two contractors. If they can convince the Board, however, they can handle the work they will be given the contracts. About half dozen contractors whose names have become watch words in the sprinkling department disappear entirely from the work this year. Their names figured, as usual, in the bidding, but their bids were not low enough to get under Redemeyer and Ratican. Seven bids were received in each district. The contracts for the present year include 578 miles of street and aggregate in the forty districts $254,429, or an average of $40 a mile. The increase will make the cost about [illegible] tional miles increase the total by about $5,500.

Mike Conroy was in town the other day. Mike expects to shut down on his work until spring.

Montana.

S. W. Gebo, promoter of the interurban line from Lewistown, Mont., sailed on Dec. 21, for Europe to complete arrangements for the financing of the road.

The fact that Porter Bros. & Welch of Spokane, railroad contractors, who have for a long time been under the employ of the Hill interests, are reconnoitering in the Snake River district above Lewiston, Mont., gives rise to the rumor that the Hill interests are about to let a large railroad contract in that vicinity. As the Gilmore & Pittsburg R. R. has been for some time running lines along Salmon and Snake Rivers to Lewiston it is believed that the contractors are going over their surveys and that it will develop shortly that the G. & P. R. R. is being backed by Hill interests.

It is reported that the Canadian Pacific will build an extension to its Crow's Nest Pass line into Baynes Lake, Waldo and thence southwest through Roosville and connect with the Great Northern R. R. at Eureka, Mont.

Work has been started by Bates & Rogers Construction Co., 355 Dearborn St., Chicago, Ill., on its contract in the Bitter Root Mountains, which includes the lining of the Taft tunnel with concrete. The center portion of the tunnel will be lined at the present time. Gravel for the work will be secured at Frenchtown, Mont.

Nebraska.

The Chicago, Burlington & Quincy R. R. has completed three sections of the inbound freight house for its new $800,000 freight terminal at Omaha. Early next spring work on finishing the in-bound house and the completion of the out-bound house will be started. At the same time the terminal grading, which is being done on 8th St. will be finished, making it an easy grade from the freight house to the business parts of the city. The terminal consists of two freight houses, an out-bound and an in-bound, with three intermediate platforms and eight tracks, the tracks having space enough to accommodate 200 cars. The buildings are of brick construction with heavy concrete foundations.

Nevada.

The U. S. Mine Co., owning rich copper properties in both Ely and Ward, in order to secure a railroad for Ward to connect that camp with Ely and the Nevada Northern, has floated $300,000 in bonds for its construction. It is said that the work on the construction of the railroad will soon commence. The survey has already been made.

New York.

The Harlem River R. R. Co., New York City, is said to be considering a plan to extend its present electric terminal at North White Plains to Brewster. It is stated that the company intends next spring to double track its road from Pawling to Chatham to meet the increased traffic on that division.

The Buffalo, Lockport & Rochester Ry. (electric) has been purchased by a syndicate headed by Charles D. Beebe, Syracuse, President of the Rochester, Syracuse & Eastern R. R. The road will be operated separately by Mr. Beebe and several independent associates.

The Lehigh Valley R. R. is to construct a new transfer station at Manchester, N. Y where will be concentrated most of the transfer work now done at Sayre, Geneva and Eas Buffalo. The plan provides for three platforms, each 800 ft. long and 16 ft. wide. Ther will be 28,000 ft. of new track.

Estimates have been made showing that the cost of the proposed 13 mile trolley road from Rome to Oneida will be as follows: 125 tons of steel rails to the mile, weighing 80 lbs. to the yard, or 1,625 tons, at $25 per ton, $10,625; cost of ties, $8,540; cost of grading, $7,000; cost of labor, $8,000; extras, $5,000; total, $69,205. The gas-electric style of car is at present favored. D. C. Hadcock, Rome, N. Y., is the promoter.

North Carolina.

A tentative proposition has been made to the business men of Gastonia for the building of a branch line of the Isothermal Traction Co. [illegible] Isothermal Traction Co. was chartered some months ago to build from Gastonia to Asheville. M. L. Mauney, Gastonia, N. C., is interested.

The Charlotte Electric Railway, Light & Power Co., Charlotte, is reported to be considering plans for extending its Belmont car line to the property of the Mecklenburg Country Club on the old Rock plantation.

On December 15 [illegible] new line of the Winston Salem Southbound R. R. was formally opened. The route is from Winston Salem, North Carolina, to Wadesboro, 93 miles, and will be operated by the Atlantic Coast Line and Norfolk & Western. It forms a connecting link between the two larger systems and practically creates a new trunk line from Cincinnati to Charleston.

North Dakota.

The fact that the surveying crew of the Chicago, Milwaukee & St. Paul R. R. is working west of New England, N. Dak., to which city a line was recently completed, gives rise to the report that the company is planning to extend its line to a station called Ives east of the Bad Lands.

Business men of Enderlin, N. D., are discussing plans for the construction of an electric railroad line between Enderlin and Fort Ransom, an inland town.

Ohio.

The Kanauga Traction Co., J. S. Howard, President, Gallipolis, O., is planning to extend its line to Addison this spring. The company at present is operating five miles of line.

The Hocking Valley Ry., W. Michael, Engineer Maintenance of Way, Columbus, O., will in the spring have work started between Toledo and Columbus on double tracking its line. It is probable that several separate stretches will be improved simultaneously. Those most likely to be taken up first are from the B. & O. crossing at Fostoria to Longley; from Owens through Marion and from Lemoyne to Walbridge, on the eastern outskirts of Toledo.

During the past year the Cheasapeake & Ohio R. R. has put down about 60 miles of double track on the Kentucky grand division east of Cincinnati. It is reported that about 60 miles more of second track will have to be built before the line will have a double track between Cincinnati and the sea. The second track, which is yet to be laid, will cost the company approximately $30,000 a mile. Tunnels will have to be widened and grades made before the second track can be laid. At "Big Bend" tunnel much work will have to be done, as this is one of the longest tunnels on the line.

The Chesapeake & Ohio Ry. is reported to have bought of James N. Gamble the Westwood steam railroad, six miles long, connecting its yards at Bridgetown with the Cincinnati, Hamilton and Dayton and the Baltimore and Ohio Southwestern.

Oklahoma.

F. E. Farmer, Kansas City, Mo., and J. J. Reed, Paducah, Ky., have submitted a proposition to the chamber of commerce of Lawton to build a railroad line between Lawton and Weatherford. The proposition proposes [illegible] give a right-of-way through the city.

The Santa Fe System has planned to install [illegible]

The Oklahoma Short Line Electric Ry. Co. has been chartered with a capital stock of $100,000 and headquarters at Shawnee and proposes to build an electric interurban line from Oklahoma City to Joplin, Mo., 175 [illegible] The first line passes the Oklahoma counties of Pottawatomie, Seminole, Okfuskee, McIntosh, Muskogee, Wagoner, Cherokee, Mayes, Delaware, Craig and Ottawa; Cherokee county, Kas., and Jasper county Mo. The second line passes through the counties of McLain, Garvin, Murray [illegible] Bryan, and Grayson county, Texas. The incorporators are: C. C. Wright, Ada; M. J. Bentley, Tecumseh; Percy Paddock, Oklahoma City; Z. V. Sanders, Albemarle; S. C. and Thomas E. Armentrout, Kirkwood, Mo.

Arrangements are reported to have been partially completed for the construction of an interurban electric railway south from Enid through Waukemis and Kingfisher to El Reno, a distance of 70 miles. Col. J. S. Whittinghill, Enid, Okla., is interested.

Grading work has been started at Wapanucka on an extension of the Missouri, Oklahoma & Gulf from Wapanucka to Bromide, a distance of seven miles. The extension is being built in order to open extensive limestone quarries in the Bromide vicinity.

The Texas, Oklahoma & Eastern Ry. Co., recently chartered with a capital stock of $200,000 and headquarters at Valiant, Okla., proposes to build a line to serve as a lumber feeder to the Frisco, in eastern Oklahoma. The plans call for a 30 mile line east from Valiant, on the Frisco, through the pine timber country of McCurtain county, to Mountain Fork River. The incorporators are Hans Dierks, Harry L. Dierks, A. E. Hart and J. S. Kirkpatrick of Kansas City, Mo.

Citizens of Alva, Okla., are raising a $100,000 bonus to secure the southwest line of the proposed Winnipeg & Gulf, which was organized two years ago by Cincinnati and New York parties, together with Kansas captalists. The intention is to build at the present time a line south from Omaha, Neb., to Salina, Kas., and thence to Alva and Oklahoma City, in Oklahoma, with an extension from Salina to Kansas City and another from Alva almost directly west to Des Moines, N. M., and the coal fields of that locality. The surveys are now being completed and will be sent to London, England.

Oregon.

⊙The Mount Hood Railway & Power Co. has applied to the City Council of Portland for two franchises to operate electric lines and a lighting system in Portland. The franchises provide for a term of 25 years each and the cost of construction work within the city limits in accordance with the franchises, will exceed $250,000. The company has awarded the contract for an auxiliary power plant to C. E. Moore & Co., San Francisco. Construction work is already under way on a portion of the electric railway lines of the company.

The board of directors of the Southern Pacific has authorized the construction of a new railroad from Redmond, Ore., the terminus of the Deschutes line, to Odell, on the Klamath-Natron cutoff.

The street committee of the Portland, Ore., city council has recommended the city council to grant the petition of the board of directors of the Mount Hood Ry. for permission to construct tracks across Villa Ave. and other streets in Montavilla pending the application for a permanent franchise for a right of way over the streets.

The United States government officials have instructed the secretary of state at Salem, Ore., to remove three miles of the Portage Ry., operated and controlled by the state of Oregon around Celilo falls in the Columbia river. The section of the road in question lies [illegible] falls and is the property of the government. In order to move the road the state board will be compelled to purchase land adjoining the government property and reconstruct several miles of the road in order to properly connect with the upper and lower Columbia river steamer stations. State Engineer Lewis will leave for Celilo falls shortly and make arrangements to conform with the government's order in the event the locks will not be completed for operation in a very short time.

According to reports from Prineville, Ore., J. A. Kelley, formerly connected with the engineering department of the Oregon Trunk, has just completed the final survey for the [illegible] road connecting Prineville in Crook county with the Oregon Trunk and the [illegible] lines now [illegible] Oregon southward. Right of way is said to have been secured and the line will be 19½ miles long with a grade less than 1 per cent. A. H. Young, Spokane, Wash., and Prineville, is promoting the project.

Stockholders of the Nevada-California-Oregon Ry. on December 13, voted to extend the railroad immediately to Lakeview, Ore., and eventually to make the terminus of the road at The Dalles, Ore., making the road 500 miles in length. At present the company has 180 miles in operation. George S. Oliver, Reno, Nev., is chief engineer.

A valuation of $115,415,000 is placed upon the railroad property which was taken over on Dec. 23 by the Oregon-Washington Railroad & Navigation Co. Of this $78,380,000 is to be paid to the Oregon Railroad & Navigation Co. The Oregon & Washington R. R., Co. received $15,000,000 for its property, the Oregon, Washington & Idaho Ry. Co. $3,400,000, the Snake River Valley Railroad $2,265,000, the North Coast Railroad Co. $7,550,000 and the Northwest Railroad Co. $2,640,000. An amount aggregating about $6,000,000 will be paid to several smaller roads which form a portion of the system operated by the Oregon-Washington.

The Farmers' Electric Ry. Co. has completed surveys for its projected 16-mile line from Vale, Ore., to Malheur Canyon. J. E. Johnson, Vale, Ore., is Chief Engineer, and G. W. Thomas, Ontario, Ore., is President.

Panama.

The U. S. War Department has granted a license to Henry T. Cook of New York to construct and operate an electric street railway system between Panama City in the republic of Panama, and La Boca in the canal zone, touching Sebanus, the Hotel Tivoli and the Ancon hospital grounds.

Pennsylvania.

The Pennsylvania R. R. is planning to enlarge its Broad St. station at Philadelphia within the next two years at a cost of $6,000,000. The plans propose the construction of a new train shed and an extension to the north side as far as Cuthbert St. By this plan the number of tracks will be increased from 16 to 25. As a further measure of relief from the congestion that constantly interferes with the operation of trains, the company has decided to build a two-track bridge over the Schuylkill River bridges. This will be done because there is no other method available for increasing the trackage over the river.

The construction of an electric railway from Hershey to Lebanon is proposed by M. S. Hershey of Hershey. An ordinance has been introduced in the city council of Lebanon granting permission to the Lebanon & Campbelltown Street Ry. Co. to construct its tracks on Twelfth, Walnut and Ninth Sts.

Plans are about completed by the Pennsylvania Railroad Co., of which J. F. Murray, Lancaster, Pa., is assistant engineer of construction, for the construction of a new spur through southwestern Pennsylvania and the standardizing of the portion of the present narrow gage Waynesburg & Washington railroad between Waynesburg and Washington, Pa. A crew of surveyors of the Pennsylvania R. R. has been working on the proposition since last September, it is said, and their report states that the new spur will join with the Monongahela & Washington road, a branch of the P., V. & C., at Marianna. From the latter point it will be extended on practically a straight line to Hackney, a station on the Waynesburg & Washington narrow gage, a few miles south of Washington. From Hackney the narrow gage road will be standardized as far as Waynesburg, with the possibility that a regular standard gage line will eventually be extended to Washington from Hackney.

The Chamber of Commerce of Johnstown, Pa., has taken up the project for the construction of the proposed electric railway to Ebensburg and is endeavoring to raise $200,000 to complete the line.

Plans are reported under consideration for securing a direct line from Pittsburg into New

[illegible] work now open for bids. ⊙ Indicates a contract let recently.

York state. The plans [illegible] the purchase and reorganization of the Buffalo & Susquehanna R. R. and its control by the Delaware, Lackawanna & Western, together with the building of extensions that will connect the Buffalo and Susquehanna with Pittsburg through McKeesport and Versailles township. By securing the Shawmut road, which now is completed from Sagamore, Pa., to Addison, N. Y., on the Erie, and within a few miles of the Delaware, Lackawanna & Western main line, and also with a branch direct to Buffalo, the Susquehanna road would have but a few miles to build to place it in connection with the great freight district of Pittsburg and afford a feeder for the eastern systems which are at present cut off from any part of the Pittsburg tonnage. These plans, it is said, are being backed by J. P. Morgan and associates.

South Carolina.

The recent chartering in South Carolina by Wm. J. Oliver of Knoxville, Tenn., of the W. J. Oliver Construction Co. of Greenville, S. C., makes it seem likely that construction work will be started soon on the extension of the Knoxville, Sevierville & Eastern Ry., which is owned by Mr. Oliver, to the [illegible] of South Carolina.

Tennessee.

The Chattanooga & Atlanta Ry. Co. has completed part of its surveys for the proposed new construction work and contracts will be let in 60 days. This company was recently chartered for the purpose of securing a direct line between Chattanooga, Tenn., and Atlanta, Ga. The projected length is 137 miles and the route is from Chattanooga south to Harrisburg, Ga., thence via Trion, Ga., Rome and Northern R. R., to Rome and Rockmart. The new line to be constructed is between Harrisburg and Trion and Rome and Rockmart. C. H. Fish, Chattanooga, Tenn., is Chief Engineer and E. F. Blomeyer, Chattanooga, is President.

The Tennessee Rapid Transit Ry. Co. has completed surveys and has secured the capital in part for the construction of its proposed line. The projected length of this road is 50 miles, and its route takes in Nashville, Nolensville, Eagleville, Cottagegrove and Lewisburg. Construction contracts have been let. R. T. Wilson, Nashville, Tenn., is president.

The Queen & Crescent Route, Curtis Daugherty, chief engineer, Cincinnati, O., has awarded a contract for building a second track between Oakdale, Tenn., and Lancing, Tenn., a distance of twelve miles. Work on this improvement will be begun at once. The contract amounts to about $250,000.

Surveys have been completed for the upper line of the Birmingham & Northwestern Ry. by James George, chief engineer, Memphis, Tenn., and crew of assistants, and work will now be started running a line for the lower route. This is the second preliminary survey of the entire route from Jackson to Dyersburg, the first being completed recently and including the following towns: Rolen, Dyer county; Stakes, Friendship, Crockett, Mills, Alamo, Fruitvale, Bells, Crockett county, and Adair, Madison county, were included between Dyersburg and Jackson. Upon the lower survey, Bells, Johnson, Grove, Murray City, Chestnut Bluff, Crockett county, and Bonicord, Dyer county, will be included. Two separate routes are defined by the surveys and the final route will be determined upon shortly. It was stated that all the preliminary work would be finished by Jan. 1, and as soon as the final route is selected the actual construction will be begun.

Texas.

⊙The Port Bolivar Iron Ore Ry. mentioned in this column in our last issue has completed surveys and has secured the capital for the construction of its projected line. The company proposes a line 45 miles long, 30 miles of which are to be built at once to ore fields. The construction contract was let on Dec. 16 to the C. H. Sharp Contracting Co., Longview, Tex., of which C. H. Sharp, Kansas City, Mo., is President, F. P. James, Longview, Tex., is Chief Engineer of the railroad.

The Santa Fe System has decided to purchase a pile driver for use on the Gulf, Colorado & Santa Fe [illegible]

It is reported that the Santa Fe will continue [illegible] Lometa to Eden further west to Ozona, in Crockett county, an additional 100 miles. The route between Lometa and Eden is through the valley of the San Saba River for a considerable distance. The region between Eden and Ozona is devoted exclusively to cattle and sheep grazing. It was originally planned to make San Angelo the western terminus of the new line, but in view of the fact that the Santa Fe already has a line running east from that place it has been decided to adopt a more southern route for the proposed extension. The contract will soon be let for the erection of eight passenger and freight depots on the new line between Lometa and Eden.

Mass meetings are being held in the interest of the railroad proposed to be constructed from Rosenberg to Velasco via Damon's Mound. Over $11,000 has been subscribed to the project.

It is expected that the Santa Fe system will shortly announce whether or not it will build a line to San Antonio and will then build further south, making a connection with the Mexican Northwestern, which is now being constructed by the Pearson interests. The Pearson line is now being built from El Paso to Chihuahua, and it is known that a preliminary survey has been run out of northern Mexico and that the engineers have crossed the Rio Grande and entered Texas. The Santa Fe has also put a corps of engineers in the field, and they are now surveying south of San Antonio and working toward that place. It is believed in railroad circles that this activity intimates an endeavor on the part of the Santa Fe to amalgamate their interests with the Pearson interests to secure a direct line into Mexico.

In accordance with the recommendation of Engineer R. D. Parker the railroad commission, Austin, Texas, issued a special order directing improvements in the physical property of the Fort Worth and Rio Grande Ry.

The Galveston, Houston & San Antonio R. R., according to advices from Austin, Texas, has applied to the State Railroad Commission for permission to issue bonds for the improvement of its system.

The extension of the Fort Worth & Rio Grande R. R., in progress of construction from Brady to Menard, Texas, has been completed to the town of Callan, which for the time being will be the terminus. The road when completed will be through the San Saba valley. B. L. Winchell, St. Louis, Mo., is president of the company.

The Presidio County Club at Marfa, Texas, has appointed a committee to take up the matter of securing the construction of the proposed Pecos Valley R. R. branch from Balmorhea to Fort Davis, via Marfa instead of via Alpine. L. E. Cartwright is a member of the committee.

A contract has been signed by Sonora, Texas and W. W. Colpitts, Kansas City, Mo., chief engineer of the Kansas City, Mexico & Orient Ry. Co., whereby the road will operate trains into that town in less than two years. The road cost the town, which has about 1,500 inhabitants, $70,000, which was raised in sixty days. Sonora is located 75 miles south of San Angelo on the Del Rio extension of the Orient.

The city of Hico, Texas, has raised a bonus of $30,000 and has agreed to furnish right of way through Hamilton county for an extenson of the Templet Northwestern Ry. to that point instead of building the same to Hamilton as originally contemplated.

Utah.

The U. S. Land Office has approved the right of way of the proposed railway line to extend from Helper, on the main line of the Denver & Rio Grande, up Gordon creek, a distance of ten miles, to the coal fields recently located by a number of Utah men. The line will start at Helper and run southwest along Gordon [illegible] coal mines. The line is being financed by holders of coal lands in the district.

Surveys, according to advices from Salt Lake City, Utah, have been completed by the surveying crew of the Utah Midland R. R. for the construction of the proposed line into Cedar City and work is now centered on a branch line to the iron mines, a distance of 15 miles.

[illegible] R. R. Co. [illegible] the construction of their line in the vicinity of Cedar City and announce that the line will soon be built.

It has been announced by H. J. Doolittle, St. George, Utah, that construction work will be started in the spring on the proposed new railroad for the district around that city in Washington county.

Vermont.

According to statements made at a hearing before the state legislature the Central Vermont Ry. will build a new line from Windsor to Brattleboro, on the Vermont side of the Connecticut River, paralleling the tracks of the Boston & Maine R. R., if the legislature will grant it a reasonable charter. The Central Vermont at present operates between the above points over the tracks of the Boston & Maine R. R. The latter road as mentioned in previous issue is planning to build a line of track parallel with that of the Central Vermont between South Vernon and Brattleboro.

Virginia.

Surveys have been started by W. J. Dermotte, C. E., Roanoke, Va., for the proposed railroad from Mount Airy to Roanoke.

At a meeting recently held by the citizens of King William county, at Beulahville, Va., it was decided to offer the Richmond-Northern Neck R. R. Co. a bonus of $50,000 to secure the construction of a new road. The present plan is to build the road from Doswell, where the Chesapeake & Ohio crosses the Richmond, Fredericksburg & Potomac, down the ridge road via Mankolick and cross the Mattoponi River at Dunkirk and the Rappahannock at Tappahannock, thence down the north neck to some point on the Chesapeake Bay. Channing M. Ward, 5019 Washington Ave., Chicago, Ill., is consulting engineer.

Washington.

Work has been started by Bates & Rogers, 355 Dearborn St., Chicago, Ill., removing the embankment of rock and dirt on the north side of Front Ave., to the river, preparatory to constructing cement piers and abutments for the elevated tracks of the North Coast in Spokane. W. H. Davisson, assistant engineer of the railroad, is stated to have said that four or five tracks would probably be built to connect with the big river bridge. F. L. Pitman, Spokane, Wash., is chief engineer.

West Virginia.

S. D. Brady, Chief Engineer of the Buckhannon & Northern R. R., Parkersburg, W. Va,. is reported to be asking for bids for the grading and masonry work for about 35 miles of the above road, which is to extend from Riverside, W. Va., to the Pennsylvania state line.

It has been announced that the board of directors of the Little Kanawha Syndicate, owned by the Pittsburg & Lake Erie R. R., Pennsylvania and Baltimore & Ohio railroads, has authorized the construction of a line connecting all the lines which now tap the coal territory in West Virginia with the Pittsburg & Lake Erie. The cost of the new road is not [illegible] will be closed during the winter and that contracts will probably be let in the spring, making it possible to complete the road for operation in the near future. S. D. Brady, Parkersburg, W. Va., chief engineer of the syndicate, is in charge of the project. The new road will connect the Buckhannon & Northern and the State Line Southern railroads, both the property of the syndicate, with the Pittsburg &

Lake Erie, near Mastontown, Pa. Other roads owned by the syndicate are the Little Kanawha, Burnsville & Eastern, Bellington & Northern, Parkersburg Bridge & Terminal, Marietta, Columbus & Cleveland and the Zanesville, Marietta & Parkersburg railroads.

Wisconsin.

The status of construction work on Dec. 15 on the new Chicago & Northwestern line was about as follows: The new Sparta cut-off was 85 per cent completed so far as earthwork and concrete are concerned. The Wisconsin work was complete as far as Clyman on the Janesville-Fond du Lac line of the Northwestern, eight miles north of Watertown. Ten or a dozen steam shovels were at work on the line between Clyman and Sparta, where there is heavy work which can be done in winter as well as in summer. The heaviest work is near the new tunnel at Tunnel City. This may not be completed for about two years, until which time the new line can not be operated. The new line will join with the old at the passenger station at Sparta. The earthwork and the concrete work on the new belt line is 95 per cent complete and next month the steel bridge work will be put in, so that track laying from the southern end can be started. About 32 miles of steel or 16 miles of double track beginning about three miles north of Lindwurm and running six miles west, then turning south to Butler, has been laid.

The Gogebic & Iron Counties R. R. & Light Co. has increased its capital stock from $100,000 to $700,000. This is a new concern formed to operate street railways and electric light plants in various towns of the Gogebic Range. A. E. Appleyard, Ashland, Wis., is interested.

Plans have been made for the beginning of actual construction work on the proposed lines of the Chicago & Wisconsin Valley Street Ry. Co. The first work will be on the line between Madison and Stevens Point, beginning at Madison and Portage. Work will also be done on the local city lines in Portage and Madison, it is planned. As soon as the necessary changes and definite location of the Madison-Portage line are made by the final surveying party, the right-of-way deeds will be taken and grading contracts will be let by sections, to be completed before the first of September, next year. It is stated that no actual work of construction except delivering material to Madison and Portage will be commenced before next April. The Chicago & Wisconsin Valley Street Ry. Co. recently leased offices in the Washington Bldg. at Madison. The Western Indiana Construction Co., 6 Sherman St., Chicago, Ill., has the general contract for the engineering and construction work.

W. Frye, Chicago, Ill., is reported to be promoting a project for the construction of a new interurban line north from Manitowoc to Kewaunee at Sturgeon Bay.

Wyoming.

Business men of Rawlins, Wyo., have appointed committees to confer with the Union Pacific Ry. in an effort to have the railway establish its rolling mills at Rawlins, the plant at Laramie having been destroyed by fire recently. It is pointed out that Rawlins is tributary to one of the largest iron ore fields in the west and that the raw material lies right at her doors.

Canada.

✣Bids will be received by the commissioners of the Transcontinental Ry., P. E. Ryan, secretary, Ottawa, Ont., until noon, Jan. 24, for approximately 61,200 gross tons of 80 lb. steel rails, and the necessary rail fastenings. Tenders must be made on the forms supplied by the commissioners, which, with information with respect to the deliveries required, may be had on application to Gordon Grant, chief engineer, Ottawa, Ont.

According to the annual report of the controller of railway statistics, the railway mileage of the dominion increased from 24,104 in 1909 to 24,731 in 1910, an addition of 627 miles. Of this increase, 519 miles were in the four western provinces. These figures do not include any mileage attaching to the Grand Trunk Pacific, which is officially regarded as "under construction," although over 1,000 miles were in actual operation during 1910. It is estimated that 4,500 miles of railway were under construction on June 30 last.

William S. King, Winnipeg, Man., is promoting a project for the construction of a street railway for St. James, a suburb of Winnipeg.

Further information regarding the Imperial Traction Co. mentioned in these columns last week is now at hand. The incorporators of the company are L. B. Howland, Toronto; Roger Miller, Ingersoll; Geo. M. Reid, London; John M. Taylor, Guelph, and S. W. Hay, Listowel. It is said that construction work will be started in Hamilton next spring.

The City Council of South Vancouver has endorsed a petition asking that the British Columbia Electric Ry. Co., Vancouver, B. C., extend its tramway tracks along the Westminster Road from Earl's Road to the Boundary Road.

The Canadian Pacific Ry. is considering the construction of a new connecting line between Nepigon and Savanne, which will give a direct run across from the head of the lakes, 69 miles northeast of Fort William, to a point 72 miles to the northwest. It is estimated that this straightening of the track will save from 40 to 50 miles in the conveyance of coast to coast traffic, the present distance between these two points being 141 miles.

Mexico.

Construction work is now under way on the extension of the Guatemala Central R. R. from Las Cruces to a connection with the Pan-American railroad at Ayutla. The grading crews are now strung out over most of the route between Las Cruces and Ayutla. The distance is only 38 miles and it is expected that this connecting link will be finished and in operation shortly after the first of the coming year.

All bids received Dec. 15 by H. M. Taylor, director of construction, National Railways of Mexico, City of Mexico, for clearing, grading and masonry on 32 kilometers of change of line near Ortiz, Chihuahua, were considered too high and were rejected. As the work is important it is probable that new bids will be asked at once.

The National Railways of Mexico has let contracts totaling about $200,000 for the construction of new stations. Engineer Jose Mondragon was awarded the contract for three stations and Aguila & Hutchinson were awarded the contract for one station. The stations are to be erected at Cuernavaca, Iguala, Balsas and Colima.

DRAINAGE, IRRIGATION, LEVEES AND CANALS

California.

Surveys have been made for a dam and main canals for a large irrigation project in Southern Tehamore and Northern Glenn counties. [illegible] call for a rein[illegible] dam 175 feet wide at its base, 100 feet high and 400 feet long. This dam will flood between 10,000 and 12,000 acres to an average depth of 50 ft. Water is to be taken from Thomas Creek. L. W. Warmboth, Pasketa, filed on the water rights for this project last August.

James Newland of San Francisco, and J. Minturn and G. W. Goodfellow of Fresno, have purchased 3,808 acres of land on the west side of Tulare lake. Part of the land is submerged in the lake, and it is planned to reclaim this with extensive levees.

Colorado.

[illegible] been closed by the representatives of stockholders, creditors and fiscal agents of the Denver Reservoir Irrigation company, with French bankers in Paris, which insures the completion of the Stanley lake and Henrylyn irrigation systems in 1911. This project is one of the largest irrigation projects in Colorado, involving the construction of a large number of reservoirs and extensive distributing ditches and works for the reclamation of more than 200,000 acres of land, all of which is located within a radius of 50 miles from Denver. The construction work is largely completed.

Idaho.

The Black Canyon Irrigation District, J. B. Newport, Chairman Board of Directors, Caldwell, Idaho, has secured right of way through government land for its canal. The right of way extends from the point of diversion to the dam site, a distance of 15 to 20 miles. Surveys are about completed and construction bonds will be placed soon, with the idea of having work on the canal started in the spring.

Illinois.

Surveys are under way for a drainage system for the East Peoria Drainage and Levee District in Tazewell County, Ill. The Harman Engineering Co., Peoria, Ill., is the engineer. The Harman Engineering Co. at present has under construction work which includes tile drains, open ditches, levees and pumping stations in the following Drainage Districts: Des Moines County Drainage District, Des Moines County, Iowa, three 54-in. centrifugal pumps; Des Moines County Drainage District No. 1 Extension, Des Moines County, Iowa, one 24-in. centrifugal pump and one 18-in. centrifugal pump; Keithsburg Drainage District, Mercer County, Ill., one 18-in. centrifugal pump and one 12-in. centrifugal pump; Eldred Drainage and Levee District, Greene County, Ill., one 36-in. centrifugal pump and one 24-in. centrifugal pump. The company also has the following work, which is practically completed or nearing completion: Bay Island Drainage and Levee District, Mercer County, Ill., two 60-in. centrifugal pumps; Louisa-Des Moines Drainage District, No. 4, Louisa and Des Moines Counties, Iowa, two 50-in. centrifugal pumps; Spring Lake Drainage and Levee District, Tazewell County, Ill., two 48-in. centrifugal pumps, one 24-in. centrifugal pump; Nutwood Drainage and Levee District, Jersey and Greene Counties, Ill., one 48-in. centrifugal pump, one 36-in. centrifugal pump.

At a recent meeting at Golconda, Ill., a committee consisting of W. C. Holmes, I. E. Brown and A. L. Whittenberg was appointed to take steps for the organization of a drainage district to improve Bay Creek.

Indiana.

✣Bids will be received until 3 p. m., Dec. 31, by E. E. Huston, Ditch Commissioner, Noble County, Albion, Ind., for the construction of ditch in Elkhart township.

Surveys for the Bozeman levee mentioned in our last issue, are now under way and will be continued for several weeks. It is estimated that this levee will affect about 125,000 acres of land, and a rough estimate places its cost at $250,000. Jacob S. Spikes, C. E., Vincennes, Ind., is engaged on the survey.

Iowa.

Bids will be asked this month by C. W. Duke, County Auditor, Clarinda, Ia., for the construction of drainage ditch No. 8 in Page

County. The work will include 650,000 cu. yds. excavation. The average depth will be 15.3 ft., and the side slopes 1½ to 1. Map, profile and specifications may be had from Mr. Duke. A. S. Van Sandt is the engineer.

✣Bids will be opened at 1:30 p. m., Jan. 13, by J. L. Hanrahan, County Auditor, Fort Dodge, Ia., for the construction of Drain No. 49 for Webster County. Section 1, the main line, will require 37,300 cu. yds. of excavation, the bottom width being 6 ft., and the berm 8 ft. Section 2 will require 7,350 ft., 15 in. to 28 in. tile, the average cut running from 6.6 ft. to 9.7 ft. Section 3 will require 7,100 ft. of 18 in. to 30 in. tile, the average cut being 6.8 ft. to 7.9 ft. Sections 4. 5 and 6 will require 200 ft. of 30 in. tile and 2,015 ft. 28 in. tile. The work is located four miles northwest of Dayton, Ia., on the C. & N. W. and the M. & St. L. Rys., and four miles northeast of Harcourt, Ia., on the C. & N. W. Ry. The average tile haul is 4½ miles and the average coal haul is 4 miles. There will be no clearing. Estimated cost is $30,000. Work on open ditch is to be commenced on or before April 1, 1911, and to be completed on or before July 1, 1911. Tile work to be commenced when outlet is finished and to be completed on or before Jan. 1, 1912. G. P. Smith, Fort Dodge, Ia., is the engineer.

Louisiana.

✣Bids will be received until 2:30 p. m., Jan. 10, by Commissioners of Thornwell Drainage District No. 1, Lake Arthur, La., for the construction of drainage canal in Calcasieu parish; about 248,000 cu. yds. of earth will be included in the contract, the canal being about 13½ miles long and 4 ft. deep with a 20 ft. bottom. Bids will be received on the yardage basis and will cover entire contract. Elmer E. Baker is Secretary of the Commissioners.

The Sixth Ward and Crowley Drainage District will use the proceeds of a $75,000 bond issue to provide adequate drainage for the district, which is ten miles long by six miles wide. The work will consist of dredging from 10 to 14 miles of main channel 40 ft. wide and from 2 to 6 ft. deep, with smaller attending laterals and ditches sufficient to drain the district. The soil is fertile loam with clay subsoil. The present intention of the Commissioners of the District is to buy its own machinery and not let contracts. L. A. Williams, Crowley, La., is Secretary and Treasurer of the District; W. S. White is Engineer in Charge.

The Jefferson Parish Police Jury, Gretna, La., has adopted an ordinance authorizing the issuing of a call for an election creating a first drainage district and the levying of a special tax of 25 cts. an acre, also the issuing of bonds, and the appointment by the governor of two commissioners and three by the parish. It is understood that about $35,000 will be spent for machinery and other equipment. The Drainage Commissioners are W. Walter, A. Rouprich and J. B. Dauenhauer.

Minnesota.

⊙Schraeder, Zabel & Cronk, Delano, Minn., have been awarded the contract for constructing County Ditch No. 13 in Wright County. The contract price was $3,413. Bids were opened Dec. 17 at Buffalo, Minn.

Mississippi.

The North Alabama Construction Co., Oakchia, Ala., has been awarded the contract for constructing a drainage canal from Howard, Miss., to Tchula Lake from the Black Creek Drainage Commissioners. The contract price was 12½ cts. per cu. yd. Bids were opened Dec. 9, at Lexington, Miss. James Fontaine, Lyons, Miss., is Chief Engineer of the district.

New York.

•Bids were opened [illegible] Superintendent Public Works, Albany, for five large contracts for work on the barge canal. The contracts and low bidders were as follows: Contract No. 48, for the construction of the Canal from a point near the New York Central R. R. crossing in Lyons to a point near the West Shore Railroad crossing in East Newark, more than five miles. Crowell-Sherman-Stalter Co., Cleveland, O., $1,701,671, as against the State Engineer's estimate of $1,626,450. Contract No. 51, construction of a canal feeder between Trenton Falls and Nine-Mile Creek, north of Utica, George T. Cunningham, Utica, $389,842.50, the engineer's estimate being $424,710. Contract No. 76, construction of the canal from West Shore crossing in East Newark to a point near Port Gibson, nearly six miles, T. A. Gillespie Co., New York, $1,494,657.40, as compared with the engineer's estimate of $1,504,776. Contract No. 77, construction of the canal near Port Gibson to a point just west of Palmyra, nearly seven miles, T. A. Gillespie Co., New York, $1,652,148.20, as against the engineer's estimate of $1,790,672.50. Contract No. 80, construction of a bulkhead and dam across the Oswego River at Phoenix, Walter Bradley, Fulton, $117,390.64, as against the estimate of $134,340. The contracts were let to the above companies.

Bids were opened Dec. 21 by F. C. Stevens, State Superintendent of Public Works, Albany, for the first contracts for work on the Cayuga and Seneca Canal. Scott Brothers of Rome were the lowest bidders for Contract A, providing for the construction of locks and controlling works in the Seneca River, their bid being $393,135.50. For Contract B, providing for 17 miles of dredging work, the Crowell-Sherman-Stalter Co., of Cleveland, O., submitted the lowest bid, $1,448,550, as against the State Engineer's estimate of $1,832,550.

The Wells-Boughton Co. of Troy, was low bidder Dec. 21 for barge canal Contract No. 91, for the construction of a power house and equipment at the Crescent dam, their proposal being $42,940.50.

North Carolina.

Contracts will be let about Feb. 1 for the construction of a drainage system for the Juniper Bay Drainage District, located in Swan Quarter, Hyde County. The work will include about 80,000 cu. yds. of earth excavation, and 35x50 ft. 12-in. brick wall building, with three concrete pump rests and floor. Information can be obtained from E. B. Bell, Chairman Board of Commissioners, Swanquarter, N. C. W. K. Allen, Wilmington, N. C., is Engineer.

Ohio.

The State Board of Public Works, Columbus, O., has asked for appropriations aggregating $737,700 for 1911 and $732,500 for the following year. For the reconstruction of the Miami and Erie Canal, north and south of Dayton, $550,000 was asked for 1911 and $563,200 for 1912. To improve the northern division of the Ohio Canal, $123,000 for 1911 and $178,600 for 1912 was sought. For maintenance of this division, the receipts and balances, $15,000 for [illegible]

Oklahoma.

•[illegible] G. A. McWilliams, 39 Jackson Blvd., Chicago, Ill., have been awarded the contract by the Commissioners of Pottawatomie County, Okla., for excavating a drainage ditch in Little River Drainage District, consisting of one main ditch, [illegible] tom and 50 ft. top width. The total excavation is approximately 1,900,000 cu. yds., and the work is to be completed in 30 months. The approximate cost of construction is $190,000, and the contractors will take the bonds of the District, at par, in payment of work. This improvement will reclaim about 20,000 acres of very rich bottom land. This is the first drainage, of any importance, contracted for in that state, although there are a number of other drainage systems contemplated. The contractors will not sublet any of this work as they have the necessary plant with which to do same.

Oregon.

⊙W. H. Mason, Klamath Falls, Ore., has been awarded the contract at $63,607 for the construction of the Lost River diversion channel for the Klamath irrigation project for the U. S. Reclamation Service. The contract involves the excavation of 332,400 cu. yds. of earth and rock, and is to be completed within 15 months.

Porto Rico.

✣Bids will be received until Feb. 7, instead of Jan. 3, as formerly advertised, by J. W. Beardsley, Chief Engineer, Irrigation Service, Guayama, Porto Rico, for the construction of (1) Carite Dam, (2) Guayabal Dam and (3) Patillas Canal and Appurtenant Structures. Official advertisement of the work will be found elsewhere in this issue.

Virginia.

The Chamber of Commerce of Newport News, Va., is advocating a plan for draining the swamp back of the city. George W. Warren, an engineer of the Bureau of Drainage, U. S. Department of Agriculture, who has just completed a survey of the territory, estimates that the work can be done for about $27,000. About 5,000 acres of land would be reclaimed.

About 50 citizens interested in the drainage and reclamation of swamp lands in Virginia have formed a permanent organization to be known as the State Drainage Association. The organization meeting was held at Richmond and was opened by Charles O. Miller of the State Department of Agriculture, Richmond.

Wisconsin.

Stokes Bros. & Opitz dredging outfit, has closed its season's work and its horses have been put into winter quarters at Elkhorn, Wis. The crew has been at work in the Bass Lake district near Stoughton for several weeks, and will resume work there again next spring, having several contracts yet to be completed.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

The North American Dredging Co. was the only bidder, Dec. 9, for dredging 25,000 cu. yds. from Wilmington Harbor for the Board of Public Works of Los Angeles. The bid was 33 cts. per cu. yd.

Connecticut.

✣Bids will be received until 3 p. m., January 21 by Lieut. Col. Harry Taylor, U. S. Engineer, New London, Conn., for dredging in Stamford Harbor, Conn.

Connecticut.

The following bids were received Dec. 21, by Lt. Col. Harry Taylor, U. S. Engineers, for dredging 405,000 cu. yds. of material in New Haven Harbor, Conn.: P. Sanford Ross, Inc., 7 8-10 cts. cu. yd.; Coastwise Dredging Co., 9 95-100 cts. per cu. yd.; Morris & Cummings Dredging Co., 12 9-10 cts per cu. yd.; Taylor Dredging Co., 21 State St., New York, 7 60-100 cts. per cu. yd.; William Beard & Co., 13 4-10 cts. per cu. yd.

Delaware.

Bids were opened Dec. 17, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for jetty construction and repairs at the mouth of the Mississippi River, Delaware, Tatnall Brown Co., 109 King St., Wilmington, Del., being the low bidder at $10.45 per lin. ft. for jetty construction and $4 per cu. yd. for stone in place for jetty repairs. About 18,000 lin. ft. of jetty consisting of two parallel rows of piles will be constructed.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

✣[illegible] by [illegible] for rebuilding wharves, retaining walls, etc., at Edgemoor Light House Depot, Del.

District of Columbia.

✣[illegible] January 5, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for the furnishing of mechanical bond steel rods, turned bolts, rubber valves, cardboard and paper.

✣Bids will be received until 2 p. m., December 30, by Board of District Commissioners, Washington, D. C., for furnishing and installing two chemical laboratory tables with all necessary plumbing connections, in the Business High School.

✣Bids will be received until 11 a. m., Jan. 28, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Washington, D. C., for repairs and additions to the roof of building No. 23, United States Navy Yard, Washington, D. C.

Florida.

✣Bids will be received until noon, Jan. 7, by E. P. Fleming, Jacksonville, Fla., for the construction of the Engineering building to be erected at Gainesville, Fla. Each bid must be accompanied with a certified check $300, payable to P. K. Yonge, Chairman, Board of Control. Drawings and specifications may be seen at the offices of William A. Edwards, Architect, 632 Candler Bldg., Atlanta, Ga.

Georgia.

✣Bids will be received until Jan. 3, by L. C. Brinton, Jr., First Lieut. Quartermaster Fort Screven, Ga., for furnishing 1,300 ft. pipe, 180 elbows, 218 tees, 314 bushings, 180 reducers, 120 nipples, 156 unions, 276 plugs, 216 caps, 42 tees, 28 Fuller ball basin cocks, 12 hot water radiator air valves and 12 valve tees.

✣Bids will be received until Jan. 3, by Lieut. J. L. Brinton, Quartermaster, Fort Screven, Ga., for furnishing 1,068 pieces of Agrad heart, 50 lin. ft. copper wire, 5 screens 100 lbs. nails, and a small quantity of flooring.

✣Bids will be received until Jan. 3, by L. C. Brinton, Jr., First Lieut. Quartermaster, Fort Screven, Ga., for furnishing at the fort, 24 float valves, 12 ball valves, 1 scullery sink and 3 high closet tanks.

✣Bids will be received until noon, January 26, by Dan C. Kingman, Col. U. S. Engineers, Savannah, Ga., for bank protection of Savannah River at Augusta, Ga.

Illinois.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, Chicago, City Hall, until 11 a. m., Dec. 30, 1910, for furnishing and delivering 2,000 bbls. of Natural cement and 100 bbls. Portland cement. Cement to be delivered as per designated during the year 1911. Full specifications on file at the [illegible] Public Works.

✣Bids will be received by Wm. Carroll, city electrician, city of Chicago, until 11 a. m., Jan. 4, 1911, for furnishing the department of electricity with 3,000 ft. 50 pair No. 19 B. & S. G. silk on cotton insulated cable, 2,500 5 pair No. 19 B. & S. G. silk on cotton insulated cable and 66 dynamotors according to specifications on file at the Fire Alarm office, Room 35, 78 La Salle St.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, Chicago, City Hall, for furnishing and delivering 192 tons special castings for cast iron water pipe and 50 [illegible]. Full specifications as to material, etc., on file at [illegible] 11 a. m.) Jan. 3, 1911.

✣[illegible] for furnishing the department of electricity 15,000 ft [illegible] ductor, paper insulated, lead covered electric light cable according to specifications on file at the office of the city electrician, City of Chicago.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, City Hall, until [illegible] delivering cast iron water pipe as follows: 3,511 tons 48-in. water pipe, 516 tons 36-in water pipe, 1,333 tons 30-in. water pipe, 3,228 tons 24-in. water pipe, 748 tons 20-in. water pipe and 181 tons 12-in. water pipe, all to comply with specifications on file at the office of the Commissioner of Public Works.

✣Bids will be received by B. J. Mullaney, Commissioner of Public Works, Chicago, City Hall, until 11 a. m., Dec. 30, for furnishing and erecting in the Roseland pumping station, 104th St. and C. & W. I. R. R., smoke flues, the same to be built entirely below the main floor of the boiler room and to consist of 2 branches each to take care of 2 boilers and each branch to consist of 2 uptakes. The flues shall be constructed of No. 8 open hearth steel plates and of such dimensions as shown on plans attached to full specifications on file at the office of the Commissioner of Public Works.

✣Bids will be received until 2 p. m. Jan. 11, by Commanding Officer, Rock Island, Arsenal, Rock Island, Ill., for furnishing and delivering at the arsenal one standard 1-ton delivery wagon, with open top, screen express body, equipped with 6 cell A-6 Edison battery to be equal to the 1,000 lb. wagon manufactured by the [illegible]andden Co. of Newark, N. J.

⦿Max Fritsch, 1114 S. Robey St., Chicago, Ill., has been awarded the contract for electric wiring and fixtures in the new Morton Park and Grant Works schools, located in the town of Cicero, Ill., for $1,482. Bids were opened Dec. 15.

A plan has been announced for the construction of an underground tube from Chicago to New York in which all telephone and telegraph wires will be carried and which also will contain a pneumatic tube for the transmission of small packages between the two cities. The cost of laying the tube is placed at $12,000,000, exclusive of the cost of the tube, which will be of steel. It is said that a company to work the project has been formed and that sufficient capital has been secured to carry out the plans. George W. Jackson of Chicago, builder of the freight subway system in that city, is said to be interested.

Indiana.

✣Bids will be received until 10 a. m., Jan. 5, by Depot Quartermaster, Jeffersonville, Ind., for furnishing under Schedule No. 579 1,500 chairs folding, slat bottom with back.

Kansas.

✣Bids will be received until 3 p. m., January 26, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete including plumbing gas piping heating apparatus and electric conduits and wiring of the U. S. Post Office at Independence Kan.

The City Commissioners of Kansas City, Kan., have been considering an ordinance calling for a special election Feb. 7 to vote $600,000 in bonds for various municipal improvements. The propositions are: To build and equip an electric light plant, $350 000; to build auditorium annex to new city hall, $100,000; to build central fire headquarters, $50,000; to build two incinerating plants, $50,000; to build dikes and boat landing on levee, $50,000.

Kentucky.

✣Bids will be received until 3 p. m., January 21, by James Knox Taylor, Supervising Architect Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the United States Post Office and Court House at Bowling Green, Ky.

Massachusetts.

✣Bids will be received until noon, Jan. 3, by School House Commissioners, Boston, Mass., for building elementary school, Roger Wolcott District, Norfolk St., Mattapan, Boston, Mass. C. K. Cummings is Architect. A certified check for $2,000, payable to the city, must be filed with each bid.

✣Bids will be received until 4 p. m., Jan. 5, by School Committee of the City of Boston, Mass., for furnishing and delivering tools for [illegible] Arts High School, Belvidere St. William J. Porter is Auditor of the Committee.

Michigan.

✣Bids will be received until 2 p. m., January 27, by S. I. Kimball, General Superintendent Treasury Department, U. S. Life Saving Service, Washington, D. C., for the construction of a life saving station at Eagle Harbor, Mich.

Mississippi.

✣Bids will be received until noon, January 18, by Clarke S. Smith, Capt. U. S. Engineers, Vicksburg, Miss., for steel hull, self propelling hydraulic dredge, steel pontoons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine, condenser plant and evaporator, sand pump, suction pipe and ladder, cutter head, gear, engine winches and refrigerating plant.

Missouri.

✣Bids will be received until 8 p. m., January 18, by City Clerk, Chaffee, Mo., for $26,000 water works and city hall bond issue. J. M. Massengill is mayor. M. S. Murray, Sikeston, Mo., is engineer.

New York.

✣Bids will be received until noon, Jan. 10, by George Cromwell, President of Borough of Richmond, New York, for furnishing all the labor and materials required for the construction of furnaces, steam boilers and appurtenances of Clifton destructor, borough of Richmond.

Bids were opened Dec. 21 at the State Capitol, Albany, by George A. Glynn, secretary Trustees Public Buildings, for the construction of the new power house which is to supply the capitol and the new state education building with heat and light. For this building and its equipment the Legislature appropriated $500 000. The proposals received were for the plumbing work and for the construction of the concrete conduit, as well as the erection of the building. The bids received were as follows: R. T. Ford Co., Rochester, $346,287; Raymond A. Booth, Albany, $382,800; Feeney & Sheehan Building Co., Albany, $413,000; Morris Kantrowitz, Albany, $414,000; A. Pasquini, Albany, $366,888; Peter Keeler Building Co., Albany, $426,399; Hudson Valley Construction Co., Troy, $387,400; Conners Brothers Co., Lowell, Mass., $394,300; Luke A. Burke & Sons, New York, $439,750. The new power house will have a boiler room of sufficient size for 10 380-H. P. boilers, and an engine room of sufficient size to contain five engines and dynamos of 1,700 K. W. capacity. Only eight boilers and four engines and dynamos will be installed at present. Coal will be contained in vaults on either side of the boiler room, having a capacity of 7,000 tons. The plans also call for an overhead coal pocket containing 1,000 tons. The building will be of face brick with stone base and terra cotta trim, the roof work being of tile and copper. The vaults will be of reinforced concrete, the top being paved for driveways. A concrete conduit approximately 8 ft. square on the inside will be carried under Hawk St., Albany, from the corner of Sheridan avenue to a point opposite the present power house where it will connect with the present conduit. The conduit will be carried under the roadway and between the abutments of the Hawk Street viaduct. The specifications require that the building shall be ready in all its parts for the installation of apparatus by Nov. 1, 1911. Contracts for equipment probably will be awarded early next year.

North Carolina.

✣Bids will be received until noon, January 2, by W. J. Hales, City Clerk, Morehead City, N. C., for the construction of 2,000 ft. of concrete retaining wall at that place.

Ohio.

✣Bids will be received until noon, Jan. 3, by Board of Trustees of the Miami University, Oxford, O., for furnishing all labor and material for the erection of a women's dormitory for the Ohio State University. W. L.

Tobey is Chairman of the Special Building Committee.

Pennsylvania.

Edward M. Bigelow, Pittsburg, Pa., Consulting Engineer to the Commissioners of Allegheny County, has submitted final report, recommending the construction of three tunnels through the South Side hills at Pittsburg. One tunnel will be provided to take care of traffic to Brookline, West Liberty, Dormont, Mt. Lebanon and the immediate section; a second will provide an outlet to Crafton, Carnegie and that section, and the third will open up a new outlet to the hilltop, Knoxville, Mt. Oliver, Carrick and territory surrounding these boroughs.

Pennsylvania.

✣Bids will be received until noon, January 11, by the Board of Trustees of the Pennsylvania State Lunatic Hospital at Harrisburg, Pa., for the erection and completion of a nurses' home. Plans and specifications may be seen at office of J. A. Dempwolf, York, Pa., Architect. A certified check for $4,500 must accompany each bid filed. Dr. H. L. Orth is Superintendent.

Rhode Island.

Bids as follows were received Dec. 17, by Lt. Col. J. C. Sanford, U. S. Engineer, Newport, R. I., for dredging in the Providence River and Providence Harbor (1) standing for bid per cu. yd.; and (2) for bid per cu. yd. for removing boulders: Morris & Cummings Dredging Co., New York City, (1), 9.4 cts. (2) $5; Columbia Dredging Co., New York City, (1) 8.9 cts. (2) $5; Daly & Hannan Dredging Co., Ogdensburg, N. Y., (1) 10 cts. (2) $6; Taylor Dredging Co., Jersey City, N. J., (1) 14.8 cts. (2) $5; Eastern Dredging Co., Boston, Mass., (1) 10.6 cts. (2) $10; G. H. Braymann & Bros., Toledo, O., (1) 12 cts. (2) $12; P. Sanford Ross, Inc., Jersey City, N. J., (1) 8.4 cts. (2) $10; J. S. Packard Dredging Co., Providence, R. I., (1) 8.1 cts. (2) $10; Coastwise Dredging Co., Norfolk, Va., (1) 7.84 cts.

South Dakota.

✣Bids will be received until 10 a. m. (Mountain time), Jan. 10, by Capt. J. S. Parker, Constructing Quartermaster, Fort Meade, S. Dak., for furnishing wooden frame screens and installing same on windows of double set of officers' quarters at Fort Meade.

✣Bids will be received until 10 a. m., Jan. 14, by H. J. Hirsch, Captain and Quartermaster, Columbus Barracks, O., for furnishing, installing and connecting up in the post laundry at Columbus Barracks, O., ready for immediate use one steam collar and cuff ironer, 24-in motor attached, and one collar and cuff starcher complete for motor drive, less motor.

✣Bids will be received until noon, December 30, by Director of Public Service, Cleveland, O., for lighting, extinguishing, repairing, maintaining and furnishing current for electric lamps in the city of Cleveland for one year from January 1.

✣Bids will be received until 9 a. m., Jan. 13, by George U. Marvin, Secretary Board of Managers of the Ohio State Board of Managers of the Ohio State Penitentiary, Columbus, O., for a plenum system of heating and ventilation and changes in East Hall, necessary to install same. Marriott & Allen, Architects, and Osborn Engineering Co. prepared plans and specifications. Bids must be made out on blank forms, which will be furnished on application to the architects, and will include bids on labor and material on the following items: Wrecking, excavations, concrete and cement work, reinforced concrete work, cut stone work, brick work, structural and ornamental iron work, sheet metal work and roofing, carpentry, lathing and plastering painting, plumbing and sewerage, heating and ventilating apparatus and electric wiring.

✣Bids will be received until noon, January 2, by Board of Education, City Hall, Cincinnati, O., for the necessary labor and material for the construction of a new school building on the northeast corner of Freeman Ave. and Polar St. Plans and specifications are on file at the office of Tietig & Lee, 711 Lyric Thetaer Bldg., Cincinnati, O., Architects.

Texas.

✣Bids will be received until 11 a. m., Jan. 19, by P. W. Guiney, Constructing Quartermaster, Fort Sam Houston, Texas, for construction of three reinforced concrete watering troughs with water supply pipe lines and tile drains complete.

F. H. Lancashire of Dallas, Tex., has been retained by the City of Corpus Christi, Tex., to draw up the form of a gas franchise for the city. As soon as same is prepared it will be granted to the highest bidder. There are several applicants and work will probably start soon. Clark Pease, Mayor.

Virginia.

A joint meeting of the officials of every steamship and railroad line having water connections in Norfolk was held in that city on Dec. 21 for the purpose of arranging details of the Union terminal docks, construction of which will begin in the early spring. When the new docks are built on property purchased by the Old Dominion Steamship Co. and located between Atlantic City and Lamberts Point, docking facilities will be afforded for the following water lines: Old Dominion Steamship Co., Merchants & Miners Steamship Co., Clyde Line, Baltimore Steam Packet Co., Chesapeake Steamship Co., New York, Philadelphia & Norfolk Ry., Atlantic Coast Line, Seaboard Air Line, Norfolk Southern, Norfolk & Western, and Virginia Rys.

West Virginia.

Bids as follows were received Dec. 22 by Lieut. M. C. Tyler, U. S. Engineer, Wheeling, W. Va., for furnishing and erecting steel lock gates and furnishing and delivering Poiree-dam trestles, etc., for Dam No. 26, Ohio River, (1) standing for structural steel, Lot A, (2) for oak timber and (3) for structural steel Lot B: The Pennsylvania Steel Co., Philadelphia, Pa., (1) $0.0573 per lb., (2) $65 per M., (3) $0.0333 per lb; Independent Bridge Co., Pittsburg, Pa., (1) $0.0541 per lb., (2) $75 per M., (3) [illegible] per lb.; Penn Bridge Co., Beaver Falls, Pa., (1) $0.0595 per lb., (2) $70 per M., (3) $0.0318 per lb.; W. N. Kratzer & Co., Pittsburg, Pa., (1) $0.0573 per lb., (2) $98 per M., (3) $0.0313 per lb.; American [illegible] (3) $0.029 per lb.

The following unit bids were received Dec. 19 by Capt. F. W. Altstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and erecting leaves for two bear trap weirs of Dam No. 26, Ohio River, the work requiring 621,430 lbs. of structural steel: The Pennsylvania Steel Co., Philadelphia, Pa., $0.0473; W. N. Kratzer & Co., Pittsburg, Pa., $0.0453; Independent Bridge Co., Pittsburg, Pa., $0.0524; Penn Bridge Co., Beaver Falls, Pa., $0.0524.

Wisconsin.

✣Bids will be received until 3 p. m., January 25, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States Post Office at Stevens Point, Wis.

Canada.

✣Bids [illegible] 11, by R. C. Des Rochers, Secretary Department of Public Works, Ottawa, Ont., for the construction of a 15-in. suction dredge. A check for $8,000 must be filed with each bid. Plans, specification and form of contract can be seen and forms of tender obtained at this Department, at the offices of J. L. Michaud, Esq., District Engineer, Merchants Bank Building, St. James Street, Montreal; J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, Ont., and G. G. Scovil, Esq., Superintendent of Dredges, St. John, N. B.

✣Bids will be received until 4 p. m., January 16, by R. C. Des Rochers, Secretary, Department of Public Works, Ottawa, Ont., for the construction of a wharf and stone approach at Gravenhurst, township of Muskoka, District of Muskoka, Ont.

✣Bids will be received until noon, Feb. 15, by Alexander Johnston, Deputy Minister of Marine and Fisheries, Ottawa, Can., for the construction of a Twin Screw Steel Steamer for survey and inspection work in connection with the St. Lawrence River Ship Channel to be delivered at Quebec, P. Q., of the following leading dimensions, namely: Length, between perpendiculars, 130 ft., breadth moulded 27 ft., depth moulded 13 ft. 6 ins., draft mean 9 ft. 9 ins. Plans and specifications of this steamer can be seen at the Department of Marine and Fisheries, Ottawa, at the offices of the Collector of Customs, Toronto, Collingwood and Midland, and at the Agencies of the Department of Marine and Fisheries, Montreal, Quebec., St. John, N. B., Halifax, N. S., Charlottetown, P. E. I., and Victoria, B. C. Plans and specifications can be procured by application from the Department of Marine and Fisheries, Ottawa, and the Agent of this Department, Victoria, B. C. There are no special tender forms in connection with this work.

BRIDGES—STEEL AND CONCRETE

Alabama.

⊙Advices from Anniston, Ala., county seat of Calhoun County, state that the commissioners have awarded the contract for the construction of the concrete bridge over Cornhouse Creek in Beat 12, to W. F. Morris.

Arizona.

The Santa Fe System plans on expending $1,400 on Bridge No. B-265, Arizona Division, the work being principally reinforced concrete protection.

The Santa Fe System plans on extending its bridge and four sidings at Winslow, Ariz., estimated to cost $4,000.

California.

⊙The contracts for the construction of five bridges along the coast road between Oceanside, Cal., and the Orange County line, have been awarded by the Board of Supervisors to Knight & Hyde, San Diego, Cal. The contract prices are Santa Margarita, $7,763; Los Flores, $3,352; San Onofro, $6,016; South San Mateo, $5,310; San Mateo, $6,939. All the bidders were named in the last issue of [illegible]

⊙Board of Supervisors of Stanislaus County, at Modesto, Cal., has awarded the contract for the construction of two bridges to W. L. Gillham & Son, San Jose, Cal. The first structure is over Dry Creek at Gomes ranch, the bids being as follows: W. L. Gillham & Son, $6,633; Western Bridge Co., $8,571; Oakland Bridge Co., $9,720; Pacific Construction Co., $8,229; Clark & Henery Construction Co., $9,960. The second structure is across McDonald Creek, about ½ mile south of Le Grange, the bids being as follows: W. L. Gillham & Son, $9,891; Western Bridge & Construction Co., $9,963; Oakland Bridge Co., $10,100; Pacific Construction Co., $9,673; Clark & Henery Construction Co., $9,673; T. K. Beard, $9,120.

Delaware.

Property owners of the Ninth Ward, Wil- [illegible] the

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Levy Court, presented a petition asking for a new bridge across the Brandywine River.

Illinois.

✣Bids will be received until 8 p. m., December 30, by Commission of Public Works, Peoria, Ill., for the construction of the new bridge at Bridge St. to replace the old one which collapsed last year.

⊙Bridge Committee of City Council of Rock Island, Ill., has awarded the contract for the construction of the Melan bridge over the Rock River to the Clinton Bridge Co., Clinton, Ia. Bids received for the work appeared in last issue of ENGINEERING-CONTRACTING.

⊙Advices from Roadhouse, Ill., state that the Board of Supervisors and Highway Commissioners of Patterson Township have awarded the contract for the construction of the new steel bridge over Hurricane Creek at a point near Elmer Hudson's one mile east of Drake, to the Illinois Bridge Co., Jacksonville, at $1,150. J. L. Challacombe at $1,169 was the only other bidder for the structure which will be of steel 50 ft. long with 16-ft. steel approach.

Plans have been drawn by engineers of the Moline-Sterling Traction Co. for the construction of the proposed bridge across the Rock River at Prophetstown, Ill. The structure, which will be located alongside of the wagon bridge, will cost $55,000. Permission was granted the company a year or more ago to install this bridge.

All work has been completed by the contractors on the new $40,000 bridge at Streator, Ill., and the structure thrown open to traffic.

City Council of Joliet, Ill., is to take steps toward securing the construction of steel viaducts over the subways by the Chicago & Alton Ry. Co.

The Santa Fe System has planned to renew its bridge No. A-1127 pile trestle on the Valley Division with a 196-ft. ballast deck

Committee of the McDonough County Board of Supervisors, Macomb, Ill., have recommended the construction of the proposed bridge in that township.

Indiana.

✣Bids will be received by W. W. Mitchell, County Highway Engineer, Shelbyville, Ind., for the construction of a 90-ft. steel span bridge with 15-ft. steel approaches, across North River at what is known as Culbertson's ford.

Iowa.

✣Bids will be received until January 1, by City of Marshalltown, Ia., for the construction of three large concrete bridges costing about $10,000 or $11,000.

At a recent Cedar Rapids, Ia., City Council a resolution of necessity providing for the erection of the new concrete bridge at 3rd [illegible] passed.

Kansas.

✣Bids will be received until Jan. 16, by Jesse Leland, County Clerk, Wichita, Kan., for the construction of a pile bridge on the north line of Section 3 in Lincoln Township. The structure will be 46 ft. 6 in. in length and the cost will not exceed $400.

The County Commissioners recently inspected the proposed site of the bridge across the river north of Concordia, Kan., and it is planned to start work as originally contemplated. The structure will have two 80-ft. spans and two 16-ft. approaches.

Plans are being prepared by Hedrick & Cochrane, Consulting Engineers, 1118 McGee St., Kansas City, Mo., for the construction of the proposed bridge over the Cedar River in Cedar Rapids, Ia., mentioned in our last issue. The structure will be of reinforced concrete and will contain about 15,000 cu. yds of material

Kentucky.

Surveys are being made by J. M. Walker, City Engineer, Maysville, Ky., for the construction of a concrete and steel viaduct to connect the eastern end of the city with the business district. The structure as planned [illegible] the Louisville & Nashville Railroads, having wagon, street car and foot passages. The cost of the improvement is estimated at $150,000.

Maryland.

The contract for the reconstruction of the Black River bridge on Eastern Ave., Baltimore County, Md., was awarded Andrew Miller Co., by H. G. Shirley, County Roads Engineer, Towson, Md. The bids which were opened at noon, Dec. 8, are as follows: McLean Contracting Co., Baltimore, Md., $59,365; B. F. Sweeten & Son, Baltimore, Md., $54,800; Sanford & Brooks Co., $49,561; Frohee & Carozza, $45,271; Raymond Concrete Pile Co., $46,580; Andrew Miller Co., $34,923.

Massachusetts.

The Improvement Society of Prospect Hill, a suburb of Lawrence, Mass., is advocating the construction of a new bridge east of Duck bridge, and a committee has been appointed to push the movement.

City Engineer Timothy J. Sheehan, Fitchburg, Mass., recently inspected the bridge which spans the Nashua River at Nashua St. for the purpose of determining what repairs will be necessary. He recommended that the Council Finance Committee prepare estimates on the cost of an entirely new structure.

Mayor of Boston, Mass., has instructed Transit Engineer, George W. R. Harrison, to submit to the City Council and Chamber of Commerce, his plans and specifications for the $5,000,000 bridge over the Mystic River between Charlestown and Chelsea. Steps are to be taken toward learning the opinion of the public.

Michigan.

⊙Board of Delta County Road Commissioners, Escanaba, Mich., have awarded the contract for the construction of a concrete bridge over the Escanaba River at Wells to the Delta Contracting Co. at $39,200. Three bids for the work were filed as follows: Delta Contracting Co. submitted three separate propositions, 18 ft. bridge with 6-ft. walk on side with 40-ft. concrete girders, $39,200; same structure with two 6-ft. walks, $42,200; for 20-ft. bridge with a 6-ft. walk on either side, $48,450. Illinois Bridge Co., Chicago, Ill., for 32-ft. bridge with out walks, $47,900. Wynkoop-McGormley Co., Toledo, O., submitted two propositions, one for a 20-ft. bridge with 6-ft. walks on either side, $75,600; the other for 16-ft. bridge with 4-ft. walks, $67,200.

Minnesota.

At a special election held at Duluth, Minn., recently to vote on the matter of issuing $90,000 of bonds for the construction of a steel bridge, the proposition was turned down.

City Council of Stillwater, Minn., has now under consideration the matter of selecting the type of structure to replace the St. Croix River bridge mentioned in our last issue.

Advices from Fort Ripley state that Commissioners of Crow Wing and Morrison Counties, Minn., will construct jointly a 60-ft. steel bridge across the Nokay Seibie River at Daggett Brook.

Missouri.

City Council of St. Louis, Mo., is to pass a bill requiring the Missouri Pacific Ry. to build a bridge over its tracks at Chouteau Ave. This viaduct will be 56 ft. wide and will extend from a point 120 ft. west of the Frisco right of way to within a few feet of Vandeventer Ave. (Old Manchester Road). The cost of the proposed work is estimated at $200,000. The city will pay the damages to abutting property which have been estimated between $75,000 and $250,000.

⊙The Board of County Commissioners, Columbia, Mo., have awarded the Missouri Bridge & Iron Co., contract for two new bridges, one at Black's ford to have a 105-ft. span resting on concrete abutments, the other on the main Sturgeon-Columbia Road at the foot of Coats hill, 12 miles north of Columbia.

⊙The Court of Johnson County, according to advices from Warrensburg, Mo., has awarded the contract to the Midland Bridge Co., Kansas City, Mo., for the construction of 30 iron bridges in that county, 15 of which are to have concrete floors.

Nebraska.

The Missouri Pacific Ry. objects to constructing an $80,000 viaduct over its tracks at Dodge St., Omaha, Neb. The company alleges that an ordinary viaduct for wagon and pedestrian traffic can be constructed for $30,000, while if a bridge must be heavy enough to carry the street car lines $50,000 will have to be expended.

New Jersey.

A resolution has been passed directing the County Engineer, New Brunswick, N. J., to prepare an estimate of the cost and plans for the widening of the Albany St. bridge.

New York.

The Town of Webb, N. Y., is making preparations for the construction of a new bridge across the Mosse River at the southerly terminus of Old Forge-McKeever Road, at an estimated cost of $2,500.

Common Council of Fulton, N. Y., has passed a resolution to the effect that public necessity demands that a new bridge be constructed across the Oswego River, connecting E. and W. Broadway, and further resolving that a committee of three be appointed to investigate the cost of such an improvement.

It is understood that the State of New York will take over the Scotia Bridge from the town of Glenville and replace it with a new structure.

Work has been started by the Steel Storage & Elevator Construction Co., Buffalo, N. Y., which was recently awarded the contract for building the new Franklin St. bridge over the Erie Canal at Syracuse, N. Y.

Advices from Dolgeville, N. Y., state that Phillips & Turnbull, who have the contract for the construction of the new bridge across East Canada Creek at East Creek are making rapid progress on the structure which is composed of three 80-ft. spans and has a total length of 309 ft. with a 20-ft. roadway, the latter being covered with water bound asphalt. The cost of the work is about $22,000.

Taxpayers have voted to issue $6,000 for the construction of a new bridge to replace the old covered structure at Kenyonville, in the town of Carlton, N. Y.

Henry Tosh & Son, Port Byron, N. Y., were the lowest bidders for the construction of a bridge over the Erie Canal in S. Washington St., Rome, their bid being $14,777. F. C. Stevens, Albany, is Superintendent of Public Works.

North Carolina.

⊙Bids were opened and contract awarded Dec. 21 at Wilmington, N. C., to Blalock & Hartsfield, Newbern, N. C., for furnishing necessary labor and material for constructing 72 concrete piles and timber fenders for two piers of highway bridge over Core Creek. North Carolina. The contract price is $3,199.

Board of County Commissioners at a recent meeting at Durham, N. C., decided upon the construction of a steel structure over the Eno River to replace the bridge washed away two years ago.

Ohio.

✣Bids will be received until 1 p. m., Jan. 9, by Board of County Commissioners of Trubull County at Warren, O., for the necessary labor and material for the construction of a concrete culvert or bridge over Little Squaw Creek in Liberty Township. Fred Stone is County Auditor.

Robert Hoffman, City Engineer, Cleveland, O., is to represent the city on the Civic Commission which is to assist the County Commissioners in the selection of a site for the new High level bridge at that point.

William Mueser, Engineer of the New York Concrete & Steel Engineering Co., recently conferred with the City Engineer of Dayton, O., regarding the proposed changes in the plans for the new bridge, made necessary by the discovery of a bed of quick sand.

✣ [illegible] work now open for bids. ⊙ indicates a contract let recently.

The Trumbull County Commissioners, Warren, O., have authorized the county clerk to readvertise for bids for the concrete culverts of beam bridge for the proposed new Moster road.

Oklahoma.

⊙The Commissioners of Tillman County at Frederick, Okla., at a recent meeting awarded the Midland Bridge Co., Kansas City, Mo., the contract for the construction of a bridge across the Deep Red River between Sections 12 and 13. The contract price was $2,765.

⊙The Board of County Commissioners has awarded to the Tulsa Boiler & Manufacturing Co., Tulsa, Okla., the contract for the construction of bridges Nos. 68, 69 and 70 at a cost of $835, $1,326 and $835 respectively.

⊙The Canton Bridge Co., Canton, O., has been awarded the contract by the Board of County Commissioners, Tulsa, Okla., for building bridges No. 71, 72 and 73 at $900 each.

Oregon.

City Engineer of Portland, Ore., has plans nearly completed for the construction of the proposed bridge across the Willamette River at Ellsworth and Meade Sts. The drawings show a bridge of open work, similar to the spans across the Sullivan's Gulch, the framing and steel being underneath the deck.

Pennsylvania.

⊙Bids were opened Dec. 12 at Westernport, Md., and the contract for the construction of a concrete bridge was awarded Nelson-Merydith Co., Chambersburg, Pa., at $4,365. C. H. Bruce is Clerk.

Many plans have been submitted the County Commissioners for the construction of the new bridge at Penn St., Reading, Pa. The structure as far as known now will be of reinforced concrete and will be the same width as the street, 80 ft. It will be 1,400 ft. long and will have a clearance of 22 ft.

South Carolina.

✢Bids will be received until Jan. 4 by Board of County Commissioners, Spartanburg, S. C., for the construction of a wooden bridge over Macklewane Creek and another structure over Cane Creek in Glenn Springs township.

Citizens of Lexington, S. C., are advocating the construction of another steel bridge across the Saluda River, to be located at Amick's Ferry.

Tennessee.

⊙Bids were opened Dec. 20 by the City of Memphis, Tenn., J. H. Weatherford, City Engineer, for constructing a reinforced concrete culvert on Union Ave. and Bellevue Blvd., the contract being awarded to J. T. Alberts, Memphis, at the following bid:

[illegible] excavation	[illegible]
3 ft. by 3 ft. [illegible]	[illegible]
[illegible] pipe [illegible]	[illegible]
30-in. pipe, 6'-8' cut., approx. 100 lin. ft.....	0.70
[illegible] pipe [illegible]	[illegible]
24-in. pipe, 6'-8' cut., approx. 140 lin. ft.....	0.40
18-in. pipe, [illegible]	[illegible]
style A [illegible]	[illegible]
style B [illegible]	[illegible]
1 small inlet..............................	10.00
2 manholes	[illegible]
Total	[illegible]

Texas.

⊙The contract for the construction of the Oak Cliff Terminal of the Dallas-Oak Cliff viaduct was awarded H. H. Yorty, Fort Worth, Texas, at $15,970. The contract includes furnishing all labor and material except the cement. The other bidders for the work were Fred A. Jones & Co., $19,920; Dennis Fegin, $16,340; Lakrin & Good, $20,160; H. Cullom, $20,340.

At the annual meeting of the Houston, Texas, Bankers, Jobbers and Manufacturers Association resolution was adopted approving the project for building a viaduct on Main St. at the crossing of the Houston ship channel.

Utah.

At a meeting of the Moab, Utah, Commercial Club, a committee was appointed to arrange for a survey of the several proposed points for the bridge which is contemplated will be put across the Grand River at that place. Robert Woodruff, Green River, Utah, will probably be placed in charge of the preliminary work.

Washington.

Commercial Clubs of Pasco, Wash., and Kennewick, are to take united action toward securing the construction of a new bridge across the Columbia River. The matter will be brought up in the legislature.

A report has been filed with the Bridge Commission, by W. C. Raleigh, City Engineer, of Tacoma, Wash., recommending that the construction of the proposed 11th St. and Puyallup Ave. bridges, for which bonds amounting to $475,000 and $68,000 respectively were voted recently, be gotten under way as soon as possible. The report also contained the comparative costs of various structures as submitted by three bridge companies as follows: Scherzer Rolling Lift Bridge Co. of Chicago—Eleventh St. bridge, $444,000 without west approach. The west approach and other details not provided for will bring the cost up to $575,000. Puyallup bridge, $191,000, total [illegible]. The [illegible] also a 5 per cent royalty on the superstructure of the bridge. Strauss Bascule Bridge Co. of Chicago—Eleventh St. bridge, $566,000; Puyallup Ave. bridge, $207,000, total, $773,000. This includes a royalty of $15,000. This estimate is $158,000 in excess of the appropriation. Waddell & Harrington, Kansas City, Mo.—Eleventh St. bridge, vertical lift, $468,000; Puyallup Ave. bridge, $124,000; total, $592,000. There is no royalty. This estimate is $23,000 under the appropriation.

West Virginia.

The Secretary of State, Wheeling, W. Va., has issued a charter to Wellsburg Bridge, of Wheeling, W. Va., which is capitalized at $100,000 and proposes the construction of a bridge across the Ohio River at Wellsburg. The incorporators are Albert M. Schenk, J. J. Holloway, C. H. Copp, B. W. Peterson, G. O. Nagle, Wheeling and William Lipphardt, Martins Ferry, O.

Wisconsin.

Work will be started early in the Spring by L. J. Klug, Superintendent, Bridge Department, Milwaukee, Wis., on the construction of a concrete bridge over the Kinnickinnic River at Chicago Ave., near the flushing tunnel pumping station. The structure will cost about $7,000.

Advices from LaCrosse, Wis., state that an agreement has been reached by the officials of La Crosse and Trempealeau Counties, whereby they will reconstruct and maintain jointly the structure known as the McGillivray bridge.

City Councils of Marinette and Menomonie, Wis., according to advices from the first mentioned city, have agreed to reconstruct the upper bridge across the Menomonie River.

Canada.

Advices from Ottawa, Ont., state there is no truth in the report recently published that the government has decided to grant the contract for the construction of the Quebec bridge to the Canadian Syndicate which is composed of the Dominion Bridge Co., Montreal, Can., and the Imperial Bridge Co., Walkerville, Ont. The report of the engineering experts has been received by the Minister of Railways, but it will not be considered by the Council until after Jan. 1.

ROADS, STREETS AND PAVEMENTS

Alabama.

⊙Major J. B. Cavanaugh, U. S. Engineer, Montgomery, Ala., awarded Breiver & Jones of Birmingham, Ala., the contract for furnishing sand and gravel for $.65 and $.85 respectively. Bids were opened Dec. 21.

The Dallas County Good Roads Association has been organized in Selma, Ala., by Mayor V. B. Atkins and other to assist the State Good Roads Association in the construction of good roads in that county.

Ten representatives of Mobile County have been chosen by the County Commissioners, Mobile, Ala., to float the bonds for the permanent roadway improvement authorized by the people at the election on Nov. 8. The districts to be improved are outlined as follows: Grand Bay, Union Church, St. Elmo, Willmer, Semmes. Crichton, Spring Hill and Wheelersville. Coden, Bayou la Batre, Thomas' Store and Alabama Port. Theodore, Red Store, Lloyds, Holloman. Citronelle. Whistler. Beaver, Meadow, Oak Grove, Georgetown, Chunchula, Kushla. Mount Vernon, Saraland, Axis. Toulminville, Koster's Prichard.

The Court of County Commissioners of Dallas County, Selma, Ala., is considering plans for the building of a number of miles of road in different parts of the county. The work of making a survey of the route will be started at once, after which the estimated costs will be made up and submitted to the commissioners.

California.

The City Trustees of Sonoma, Cal., contemplate purchasing a municipal rock crushing plant.

The County Supervisors at Fresno, Cal., have ordered viewed and surveyed the roads petitioned for by A. L. Towne and Josiah Hall.

The Board of Trade of Placerville, Cal., has appointed a committee composed of Major C. A. Swisler and Secretary Bradner to forward the interests of the county in the construction of the proposed road from Placerville to Folsom, to come under the work to be done under the $18,000,000 state bond issue.

A plan is on foot in Santa Barbara, Cal., to pave a 30-ft. road through Santa Barbara at a cost of $200,000 to connect with the main road through from Montecito to Goleta.

Surveyor S. J. Norris, appointed by the Oroville, Cal., Chamber of Commerce recently to make a preliminary survey of the proposed Downieville-Oroville road, has submitted his preliminary report. The estimated cost of the road is $20,000 and an effort will be made to have the state build it.

Florida.

The County Commissioners at DeLand, Fla., have ordered the road from DeLeon Springs to the DeLand Daytona shell road surveyed, for the purpose of being opened and worked.

⊙The County Commissioners at Miami, Fla., have awarded the contract for furnishing a road roller, scarifier and scraper to the Western-Austin Co., for $2,500, $500 and $350 respectively.

⊙The County Commissioners at Miami, Fla., have awarded W. M. Goode the contract for building nine miles of road in the north end of the county at $2,000 per mile and $75 per mile for clearing. J. H. Tatum was awarded a contract for road building at Detroit and a contract was awarded M. S. Lanier for road building at Little River and one to C. M. Morgan for a road from 20th St., to the 12th St. extension.

The St. John's County Commissioners, St. Augustine, Fla., will construct a new road through from Elkton to Armstrong and Holy

✢ indicates work now open for bids. ⊙ indicates a contract let recently.

Branch. A committee has been appointed to have the route surveyed. Other roads are to be constructed soon.

⊙Walter B. Campbell has been awarded the contract for building three miles of hard road north toward Como from the northern limits of Crescent City, by the County Commissioners at Palatka, Fla. The contract calls for sand clay surfacing and the price agreed upon is $1,250 per mile.

The City Council of St. Petersburg, Fla., has ordered two miles of brick pavement laid on the waterfront.

Georgia.

A government road is to be constructed in Dodge County, Eastman, Ga., under the supervision of D. H. Winslow, U. S. Road Supervisor, at present located at Eastman.

Illinois.

The Committee of Aldermen appointed by the mayor of Rock Island, Ill., to take up the 9th St. improvement has requested the state engineering department for information upon the subject of cost, material, construction, etc., on the road.

⊙Contracts for constructing cinder sidewalks for the Board of Local Improvements, Chicago, bids for which were opened Dec. 16, have been let as follows: Quinn Construction Co., 3519 W. Chicago Ave., Chicago, sidewalk on Addison St., South California Ave. and Greenwood Terrace; John Hickey, 1402 W. 59th St., Chicago, sidewalk on Bishop St.; Demling & Wendt, 84 LaSalle St., Chicago, for sidewalk on W. Irving Park Blvd.; Siervert Callsen Co., 3865 Milwaukee Ave., Chicago, sidewalk on Lawrence Ave.; Chas. Chambers & Son, 5248 S. Wood St., Chicago, on S. Morgan St., on W. 105th St., W. 106th St. and on Oak Ave.; Beniamin Sullivan, 7020 Rhodes Ave., on W. 77th St.; Quinn Construction Co., sidewalk system of streets including S. 42nd Ave. and other streets; Benj. Sullivan, for sidewalks on system of streets including E. 76th St. and other streets; Chas. Chambers & Sons, for sidewalks on system of streets including W. 76th St. and other streets; Demling & Wendt, for sidewalks on a system of streets including W. 99th St. and other streets; A. L. Strachan & Son, 5737 S. May St., Chicago, for sidewalks on a system of streets including Dobson Ave. and other streets; Chas. Chambers & Son, for sidewalks on a system of streets including S. Halsted St. Unit bids of the low bidders on the above work were given in our issue of Dec. [illegible]

Following low bids were submitted Dec. 15 to the Board of Local Improvements, Chicago, Ill., Chas. A. V. Standish, Secy., Room 302, City Hall, for paving the following streets: the work including brick pavement on a 6-in. Portland cement concrete base with a 2-in. sand cushion; 12-in. sewer including manholes, catch basins and 125 yds. of rock excavation; number two granite block pavement on a Portland cement concrete base with a 2-in. sand cushion, coal tar joints and [illegible] granite [illegible] curbs and gutters on a [illegible] asphalt pavement on a 6-in. Portland cement concrete base, surface to be swept with natural hydraulic [illegible]

[illegible]	
[illegible]	
[illegible]	$0.20
[illegible]	.70
[illegible]	2.72
[illegible]	[illegible]
[illegible]	
[illegible]	$0.20
[illegible]	2.62
[illegible] Jno. A.	
[illegible]	
Granite concrete curb, 1,190 lin. ft...	$0.15
[illegible]	[illegible]
[illegible]	
Granite concrete curb, 1,200 lin. ft	$0.15
[illegible]	[illegible]
[illegible]	
[illegible]	[illegible]
Brick pavement, 630 sq. yds..........	[illegible]
[illegible]	
[illegible]	[illegible]
Alley, Evans Ave. and Cottage Grove Ave	
[illegible]	
[illegible]	
[illegible]	
[illegible]	$ 1[illegible]
[illegible]	[illegible]½
Alleys, Drexel Blvd. and Ellis Ave.	
Granite concrete curb, 2,110 lin. ft.	$0.15
[illegible]	[illegible]½
Alley, Ellis Ave. and Berkeley Ave.	
[illegible] curb, [illegible] lin. ft.	$0.15
[illegible] pavement, [illegible] sq. yds.......	[illegible]½
Alley, Vincennes Ave. and St. Lawrence Ave.	
Granite concrete curb, 1,100 lin. ft ..	$0.15
[illegible] pavement, 620 sq. yds	2.72
Alley, Prairie Ave. and Indiana Ave.	
Granite concrete curb, 800 lin. ft.....	$0.15
Brick pavement, 700 sq. yds..........	[illegible]½
Alley, Woodlawn Ave. and Lake Ave.	
Granite concrete curb, 1,400 lin. ft....	$0.15
[illegible] pavement, 1,170 sq. yds......	2.59½
Alley, Woodlawn Ave. and Kimbark Ave.	
Granite concrete curb, 890 lin. ft.....	$0.15
[illegible] pavement, [illegible] sq. yds......	2.70
Parker Washington Construction Co., [illegible] Chamber of Commerce Bldg.	
Alley, Grand Blvd. and Vernon Ave.	
Granite concrete curb, 2,510 lin. ft ..	$0.15
Brick pavement, 1,960 sq. yds. . .	2.49
R. T. Conway Co., 720 Chamber of Commerce Bldg.	
N. Campbell Ave., Austin Ave. and Grand Ave.	
Sandstone curb, 1,160 lin. ft..........	$ 0.67
Brick pavement, 2,500 sq. yds........	2.30
12-in. sewer, 365 lin. ft................	4.00
S. Center Ave., 21st St. and 22nd St.	
Granite block pavement, 1,800 sq. yds.	$ 3.19
Concrete sidewalks, 200 sq. ft....	.20
Catch basins, four..........	[illegible]
Adjusting old catch basins, two......	20.00
Adjusting old manholes, three........	5.00
Covers with iron lids, five............	10.00
9-in. tile pipe, 20 lin. ft...............	.75
Cast iron gratings, two...............	10.00
Cullom Ave., N. Clark St., Ashland Ave.	
Granite curb and gutters, 2,060 lin. ft.	$ 0.60
Asphalt pavement, 3,420 lin. ft........	1.80
Earth cutting, 1,900 sq. yds...........	.40
Concrete sidewalks, 400 sq. ft........	.20
Catch basins, four	[illegible]
Adjusting old catch basins, four......	20.00
Adjusting old manholes, eight......	5.00
Covers with iron lids, two............	10.00
9-in. tile pipe, 20 lin. ft...............	.75
Cast iron gratings, two...............	10.00
Evans Ave., E. 43rd St. and E. 47th St.	
Granite curb and gutter, 3,600 lin. ft..	$ 0.60
Granite concrete gutters, 1,250 lin. ft.	.35
Concrete sidewalks, 80 sq. ft..........	.20
Asphalt pavement, 8,400 sq. yds......	1.95
New catch basins, two..............	45.00
Adjusting old catch basins, 16........	20.00
Adjusting old manholes, 19............	5.00
Covers with iron lids, 20.............	10.00
9-in. tile pipe, 100 lin. ft..............	.75
Cast iron gratings, four..............	10.00
W. 52nd St., Loomis St., Ashland Ave.	
Granite curb and gutter, 2,660 lin. ft	$ 0.60
Concrete sidewalks, 300 sq. ft........	.20.
Asphalt pavement, 4,510 sq. yds.....	1.86
Adjusting old manholes, three.......	5.00
Adjusting old catch basins, 12.......	20.00
Covers with iron lids, three..........	10.00
9-in. tile pipe, 50 lin. ft...............	.15
Cast iron gratings, 12................	10.00
W. 53rd St., S. Ashland Ave. and S. Robey St.	
Sandstone curb, 4,540 lin. ft..........	$ 0.50
Concrete sidewalks, 20 sq. ft..........	.20
Earth filling, 1,500 cu. yds...........	.50
Brick pavement, 7,600 sq. yds........	2.12
Adjusting old manholes, 12...........	5.00
Covers with iron lids, 12.............	10.00
9-in. tile pipe, 40 lin. ft...............	.75
Cast iron gratings, four..............	10.00
Standard Paving Co., 145 La Salle St.	
N. 41st St., Hirsch St. and W. North Ave.	
Granite curb and gutter, 2,600 lin. ft.	$ 0.60
Asphalt pavement, 4,150 sq. yds......	1.77
Earth cutting, 200 cu. yds............	.40
Catch basins, four..................	45.00
Adjusting old catch basins, 11........	20.00
Adjusting old manholes, 10...........	5.00
Covers with iron lids, two............	10.00
9-in. tile pipe, 8 lin. ft...............	.75
Cast iron gratings, two...............	10.00
N. Hamlin Ave., Hamlin Ave., Fullerton Ave.	
Granite curb and gutter, 4,120 lin. ft.	$ 0.60
Asphalt pavement, 6,590 sq. yds......	1.79
Earth cutting, 2,300 cu. yds...........	.30
Catch basins, 10.....................	45.00
Adjusting old catch basins, 18........	20.00
Adjusting old manholes, 16...........	5.00
Covers with iron lids, four...........	10.00
9-in. tile pipe, 20 lin. ft...............	.75
Cast iron gratings, 10.................	10.00
Ready & Callahan, 47th St. and Halsted St.	
W. 50th St., Ashland Ave. and Robey St	
Sandstone curb, 4,560 lin. ft..........	$ 0.60
Resetting sandstone curb, 270 lin. ft..	.20
Concrete sidewalks, 650 sq. ft	.10
Earth filling, 2,000 cu. yds...	.05
Brick pavement, 9,110 sq. yds	2.10
Catch basins, two......	45.00
[illegible] old catch basins, [illegible]	20.00
[illegible] old manholes, [illegible]	5.00
Covers with iron lids, 34......	10.00
9-in. tile pipe, 300 lin. ft......	[illegible]
Cast iron gratings, 26............	10.00
Union Paving Co., 184 La Salle St.	
Fleetwood St., Hamlin Ave. and Fullerton Ave.	
Sandstone curb, 2,350 lin. ft.........	$ 0.70
Brick pavement, 4,860 sq. yds.......	2.30
Catch basins, one..................	45.00
Adjusting old catch basins, nine...	20.00
Adjusting old manholes, 12..	5.00
Covers with iron lids, four..........	10.00
9-in. tile pipe, 8 lin. ft.........	[illegible]
[illegible]	10.00

Indiana.

✣Bids will be received until 10 a. m., Jan. 4, by Board of County Commissioners of Huntington and Wells Counties at the office of John W. Weaver, Auditor Huntington County, Ind., for the construction of highway improvement.

✣Bids will be received until 2 p. m., Jan. 3, by Board of County Commissioners, Vincennes, Ind., for the construction of 5,564 ft. of gravel roads in Vincennes Township, Knox County. John T. Scott is County Auditor.

✣Bids will be received until 10 a. m., Jan. 4, by County Commissioners, for the construction of a public highway in Huntington and Wells Counties. John W. Weaver is Auditor of Huntington County.

✣Bids will be received until 2 p. m., Jan. 11, by Commissioners of Rush County at Rushville, Ind., for the construction of a macadam road in Anderson township. J. M. Stone is Auditor of the county.

✣Bids will be received until 2 p. m., Jan. 7, by Board of County Commissioners, Frankfort, Ind., for the construction of four gravel roads in Clinton County. Charles F. Cromwell is County Auditor.

✣Bids will be received until noon, Jan. 3, by Commissioners of Pulaski County, Winimac, Ind., for the improvement of two public highways. Ellis S. Rees is Auditor.

The County Commissioners at Logansport, Ind., have granted a petition for the construction of a mile of stone road running south and north on the west side of Galveston.

Iowa.

The City of Maquoketa, Ia., plans the paving of 20 more blocks of street next spring.

Kansas.

The Shawnee County Commissioners, Topeka, Kan., contemplate purchasing a motor road roller for use on gravel roads in that county. E. L. O'Neil, Commissioner; V. P. Parkhurst, County Engineer.

The Township Officers and Road Officials of Neosho County, Erie, Kan., are planning to organize a county roads association, and a meeting for that purpose is soon to be held in Erie. It is expected that a movement will be inaugurated for the systematic improvement and maintenance of the roads of the county.

Kentucky.

✣Bids will be received until 3:30 p. m., Jan. 16, by Board of Public Works, Paducah, Ky., for the construction of concrete sidewalks, granite curbing, concrete gutter and driveways and cast iron drain pipes on Broadway from the Illinois Central Railroad to 15th St.; Jefferson St. from 11th to 14th St. and N. 10th St. from Trimble to Burnett St.; work to begin as soon as weather will permit. Approximate quantities: Broadway, concrete sidewalks 14,325 sq. ft., concrete driveways 820 sq. ft., concrete gutters 2,900 lin. ft. and granite curbing 2,900 lin ft.; Jefferson St., concrete sidewalks 23,000 sq. ft., concrete driveways 800 sq. ft., concrete gutters 3,940 lin. ft., granite curbing 3,940 lin. ft. and cast iron drain pipe 200 lin ft.; N. 10th St., concrete sidewalks 13,300 sq. ft., concrete driveways 380 sq. ft., concrete gutter 2,520 lin. ft., granite curbing 2,500 lin. ft. and cast-iron drain pipe 500 lin. ft. Each bid to be accompanied by certified check for $250, payable to G. W. Walters, City Treasurer. L. A. Washington, City Engineer.

Louisiana.

The Finance Committee of the City Council of New Orleans, La., has directed that an ordinance be prepared instructing the City Engineer to prepare plans and specifications and the Comptroller to advertise for bids for the paving of Orleans St., from Californe to Broad Sts., with mineral rubber.

The City of Shreveport, La., is preparing to sell bonds for street paving. As soon as the bonds are disposed of bids will be asked for and the contracts let for the paving, which it is estimated will cost $500,000.

✣ [illegible] ⊙ [illegible]dicates a contract let recently.

Massachusetts.

The City Council of Quincy, Mass., has ıssed orders agregating $14,000 for rebuildg Brook, Crescent, Trafford, West, Pleasıt and Marsh Sts., Furnace Ave., and Merry ount Road.

Minnesota.

Hennepin County Commissioners, Minneolis, Minn., have decided to begin road ıilding in the county at once. The comissioners have ordered work begun on three iles of the Brooklyn Center trunk road nning from the city limits at 44th Ave., ırth to Brooklyn Center.

The County Commissioners at Duluth, inn., have been petitioned for the extension the highway system from Gordon to the wn of Summitt in the vicinity of the Chafy settlement. The proposed new county ad is about 29 miles in length and would nnect two main highways, one leading from e city to the town of Summitt, and the ıer from the city to the town of Gordon.

Mississippi.

The Board of Supervisors of Covington ounty, Collins, Miss., has decided to sell at regular meeting in January, bonds in the m of $25,000, to be used in the construction modern highways in District No. 3.

An election will be held in District No. 1 Lincoln County, Brookhaven, Miss., Dec. , to vote on the question of issuing bonds r the building of permanent highways in at district.

Missouri.

⦿It is reported that the following contracts ere awarded by the City Council of Springld, Mo.: Rackliffe-Gibson Construction Co., ssam pavement on W. Commercial St., om Grant St. to Euclid Ave.; on Commeral St., from Lyon to Grant Sts.; on Comercial St., from Campbell to Lyon Sts.; on t. Vernon St., from Jefferson to Campbell s., for $1.75 per sq. yd. Will F. Plummer onstruction Co., second-class brick paveent on W. Commercial St., from Euclid ve. to Broad St., for $1.75 per sq. yd. Jart Construction Co., concrete curbing on llings St., from Phillips St. to Grand Ave., r $.40 per lin. ft. F. C. Page, concrete rbing on the north side of Elm St., from National Blvd. to the Frisco R. R. for 8 per lin. ft. T. L. Calloway, first class, ft. cement sidewalk on the West side of mpbell St., from Olive St. to Mill St., for 5 per lin. ft., for walk and $.25 for grading. C. Page, first-class, 4 ft. sidewalk on both es of Calhoun St., from Broad St. to the isco R. R., for $.42 per lin. ft., for walk 1 $.25 for grading. H. G. Horton, City gineer.

The Board of Public Works of St. Joseph, ., has instructed the City Engineer to pree an ordinance for the grading of Mitchell e., from 28th St. to the east city limits, to vide an improved highway connecting with macadamized road which now extends to h St.

Nebraska.

petition has been presented to the City ıncil of Hastings, Neb., providing for the ing of St. Joe Ave., between 2nd and 12th . The city plans paving street intersecıs at a cost of $50,000.

New Jersey.

•Bids will be received until 10:30 a. m., 11, by Road Committee of the Board of sen Freeholders of the County of Salem, em, N. J., for grading and placing gravel oyster shell surface on the Mannington, sgrove and Woodstown road 5 miles in ıship of Mannington and Pilesgrove and ough of Woodstown, Salem, N. J. Harry Gray is Director.

he Town Council of Hammonton, N. J., awarded a Camden firm a contract for a ey for grades and curbs in a large part he town.

he Camden County Board of Freeholders, ıden, N. J., has instructed its Stone Road Committee to take up the matter of improving the Burlington turnpike east of 27th St.

New Mexico.

The City of Albuquerque, N. Mex., contemplates paving a number of streets in the business district with bitulithic. A. H. Johnson, president of the Texas Bitulithic Co., Dallas, Tex., estimates the cost at $4,000 per block. Felix H. Lester is Mayor.

The Territorial Good Roads Commission of New Mexico at a recent meeting promised representatives of Albuquerque, N. Mex., that the road from Santa Fe to Albuquerque would be completed this winter. The road is constructed as far as Algodones, but south from there, about two miles of heavy sand will have to be overcome. The commission will contribute $4,000, Bernalillo County and the city of Albuquerque will contribute $6,000, and the U. S. Indian service will contribute $500 to complete the road. Vernon L. Sullivan is Territorial Engineer.

New York.

✣Bids will be received by the State Commission of Highways, Albany, N. Y., until Jan. 9 at 1 p. m., for 23 roads; until 1 p. m., Jan. 11, 24 roads; until 1 p. m., Jan. 13, 20 roads in the State of New York. Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of Division Engineer Spencer J. Stewart, Columbus Hall, Poughkeepsie, N. Y., for the road in Dutchess County; at the office of Division Engineer Harry P. Willis, Humane Bldg., Albany, N. Y., for roads in the counties of Albany, Clinton, Columbia, Greene, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren and Washington; also at the office of Division Engineer Guy H. Miller, Cleveland Bldg., Watertown, N. Y., for roads in the counties of Franklin, Jefferson, Hamilton, Lewis, Oneida and St. Lawrence; also at the offices of Division Engineer Fred W. Sarr, South Clinton and West Jefferson Sts., Syracuse, N. Y., for roads in the counties of Cayuga, Chenango, Cortland, Madison, Onondaga, Ontario, Oswego, Seneca and Wayne; also at the office of Division Engineer M. W. Wilbur, 423 Cutler Bldg., Rochester, N. Y., for roads in the counties of Cattaraugus, Chautauqua and Genesee; and also at the office of Division Engineer Paul McLoud, Press Bldg., Binghamton, for roads in the counties of Broome and Otsego.

✣Bids will be received until 2 p. m., Jan. 5, by George McAneny, President of the Borough of Manhattan, New York, N. Y., for repairing and maintaining sheet asphalt pavements in the Borough of Manhattan. Engineer's estimate of amount of work to be done: 270,000 sq. yds. of asphalt pavement, including binder course, 500 cu. yds. of Portland cement concrete, 1,000 sq. yds. of old stone pavement, to relay. The time allowed for doing and completing the work will be from the date of contract until Dec. 31, 1911, or until the entire yardage called for is laid. The amount of security required will be $65,000.

✣Bids will be received until 11 a. m., Jan. 4 by Alfred E. Steers, President of the Borough of Brooklyn, N. Y., for five small paving contracts, the largest being No. 3, as follows: For regulating and paving with asphalt pavement on a concrete foundation the roadway of E. 28th St., from Foster Ave. to Flatbush Ave., together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 4,208 sq. yds. of asphalt pavement (five years' maintenance), 588 cu. yds. of concrete, for pavement foundation The time allowed for the completion of the work and the full performance of the contract is 25 working days. The amount of security required is $2,200.

⦿Cardo-Borgia Stone Co., 1133 Broadway, Manhattan, N. Y., has been awarded the contract by the department of parks, Arsenal Bldg., 5th Ave., New York City, for setting new blue stone coping and resetting old blue stone coping on a concrete foundation and erecting and completing brass rail fence in the Borough Hall Park, Borough of Brooklyn, for $3,634. Bids were opened Dec. 8.

⦿Norton & Garman Contracting Co., 303 Douglas St., Brooklyn, N. Y., has been awarded the contract by the Department of Parks, Arsenal Bldg., 5th Ave., Borough of Manhattan, New York City, for resurfacing of the speedway of Ocean Parkway, between Avenue J and Kings Highway, Borough of Brooklyn, for $6,890. Bids were opened Dec. 8.

The Board of Supervisors of Franklin County, Malone, N. Y., is agitating the construction of a macadam road from Saranac Lake, N. Y., to Montreal, Que. The roads will cost from $3,500 to $4,000 per mile and will provide Franklin County with 100 miles of macadam roadway. The entire cost of the road is to be paid by the county, by the issuance of bonds. In Canada the road would be constructed from Montreal to Trout River.

Ohio.

✣Bids will be received until noon, Jan. 16, by B. M. Cook, Clerk, Village of Lakewood, O., for furnishing labor and material necessary for paving Gladys, Rosewood Ave., Thoreau Road, Sloane Ave. Contract form, plans and specifications are on file at the office of the Village Clerk, Lakewood, Ohio, and at the offices of The Wm. H. Evers Engineering Co., 332 The Arcade, Cleveland, O.

✣Bids will be received until noon, Jan. 20, by Board of County Commissioners, Cincinnati, O., for the improvement under specifications No. 127 of the Dayton Pike, from Sharon to Butler County line in Sycamore township. All bids must be made on blank forms to be had at the office of the Board of County Commissioners and must be accompanied by a bond in the sum of $1,000. Fred Dreigs is Clerk.

Preparations are being made to open the new road between Bolivar and Zoar. The road will be known as the Lebold road and will follow the old Beaver and Sandy canal into Bolivar. It will necessitate the removal of an old bridge and the construction of a new one across the canal.

The Board of Control of Elyria, O., has decided to ask the city council to pass an ordinance forbidding property owners and corporations to repair paved streets that have been opened to dig sewer and water trenches.

Advices from Akron, O., states that Richfield Township residents have taken steps to have the Summit County Commissioners pave the main highway for 12 miles through Ghent, Hammand's corners and East Richfield.

The following improvements have been recommended to the city council of East-Liverpool, O.: Paving Vine St., from Pennsylvania Ave., to Ravine St., 300 ft.; paving of Pine St., from Pennsylvania Ave. to Ravine St., 345 ft.; paving Thompson Ave., from Vine to E. 6th St.; paving 4th St., from Vodrey's pottery to Pennsylvania Ave., 270 ft.; grading and paving of Bradshaw Ave., from Avondale to Ambrose Ave.; paving of Ambrose Ave., from Ida to Riley Sts.; widening Bradshaw Ave.; grading, paving and widening of Sheridan Ave., also the widening of the sidewalks on this thoroughfare from Fenton St., to Dresden Ave.; grading of Indiana Ave., from Avondale to Riverview St.; grading Oak St., from Indiana to Illinois Sts.

The County Commissioners at Dayton, O., will ask the state highway department for aid in the improvement of the Covington pike for a mile north of Englewood, and for the improvement of that section of the National road leading from Englewood to the bridge across Stillwater, a distance of about one-half mile.

The City Council of Canton, O., has passed ordinances providing for the paving of Shorn St., from Tuscarawas St. to Lake St., for improving Belleview Ave. from Cleveland Ave. to west corporation line; improving E. 4th St., from bridge to first alley east of Schwalm St.; improving S. Dewalt St., from 8th St. to Cedar St.; establishing a grade on High St., from Navarre St., to Pennsylvania R. R. crossing; improving Deal Ave., and

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Walker Ave., from Cleveland Ave., to corporation line.

Oregon.

Following bids have recently been received by the Executive Board of Portland, Ore., for public improvements: E. 38th St., from Stephens to Grant, grading and concrete curbs and walks, Giebisch & Joplin, $1,774. Sheridan St. from 1st to Front, bitulithic pavement, Pacific Bridge Co., $2,035. E. Harrison St. from E. 13th to Sunnyside, grading and concrete curbs and walks, Giebisch & Joplin, $1,926; Joplin & Meeks, $1,920; Stephens Bros., $1,869. E. Lincoln St., from E. 34th to Chestnut Hill, grading and concrete curbs and walks, Joplin & Meeks, $1.381. E. Harrison St., from E. 41st to E. 50th, grading and concrete curbs and walks, Giebisch & Joplin, $3,776; Joplin & Meeks, $3,929. E. Grant St., from Glenn to E. 13th, grading and concrete curbs and walks, Stephens Bros., $3,235; Joplin & Meeks, $3,237; Giebisch & Joplin, $3,195. Cora Ave., from Mill to 9th Sts., grading and concrete curbs and walks, T. A. Sweney, $1,024.

Advices from Hillsboro, Ore., states that 25 road districts have posted notices for an election for or against a special tax for rock road improvements. It is thought that the majority of them will vote from two to five mills for the purpose. If this result obtains, Washington County will next year build 20 or 30 miles of permanent roads.

Pennsylvania.

Plans have been perfected for the bonding of Springfield Township, Montgomery County, Norristown, Pa., to the extent of $20,000 to cover road construction the coming year.

Residents of Arch St., Philadelphia, Pa., have submitted a petition to the mayor asking that that street be paved with wood block.

Tennessee.

City Engineer Robert A. Hooke of Chattanooga, Tenn., is having the grades of Prospect, Arcade and Cameron Sts., ascertained for the construction of sidewalks along those streets from the car line at the head of W. 6th St., to Boynton park on the top of Cameron Hill.

Texas.

✣Bids will be received until noon, Dec. 29, by Commissioners of City of Galveston, Tex., for paving the following streets: Avenue P, from 23d to 19th St.; 19th St. and 21st st., from Avenue P to county's right of way. The work will include about 9,300 sq. yds. of vitrified brick. A. T. Dickey is City Engineer.

⊙The City Commissioners of Galveston, Tex., have awarded the contract for boulevard work, from Avenue H to 16th St., consisting [illegible] concrete curbing.

5,400 ft. of 18-in. concrete curbing, 39,300 sq. yds. of cement sidewalk and 300 ft. of vitrified piping for drains, to Kelso & Vautrin for approximately $15,518.

C. R. Thomas, government road expert, has prepared his report for the construction of macadamized roads in precinct No. 1, Taylor County, Abilene, Tex., and has submitted the same to Judge T. L. Blanton of the county commissioners' court. It is expected that within a short time actual work will be begun on the improvement of the roads.

The County Commissioners' Court at Bryan, Tex., is inspecting the roads of the county with a view of extensive road building and improvements with the county's steam road-making outfit during the coming year. The commissioners are considering the proposition of building all the small culverts throughout the county out of concrete.

Citizens of Houston, Beaumont and Port Arthur recently held a meeting in Liberty, Tex., to discuss the feasibility of constructing a road between Beaumont and Galveston. Frank Alvey and Col. W. S. Davidson of Beaumont and John W. Gates of Port Arthur are interested.

The City of Wichita Falls, Tex., will have $42,500, possibly $60,000 available for street improvements during the early part of next year. F. B. Noble is Mayor.

Houston, Tex., will sell bonds Jan. 9 to the amount of $100,000 for street paving. H. B. Rice is Mayor.

⊙The Texas Bithulithic Co. of Dallas, Tex., has been awarded the contract by that city for paving Houston St., between Elm and Main Sts., with vitrified brick for $2.70 per sq. yd.

Utah.

The Cache County Commissioners, Logan, Utah, have decided to open a new road from the Logan sugar factory to Millville.

Virginia.

Scott County, Gate City, Va., at a special election Dec. 14, voted against the issuance of bonds to the amount of $300,000 for the construction of good roads. J. F. Richmond is County Clerk.

⊙The contract for paving parts of Manteo St., Westover Ave., and Langley road with asphalt has been awarded by the board of control of Norfolk, Va., to Perry W. Ruth & Co., for $1.89 per sq. yd., total $10,773. F. J. McGuire has been awarded the contract for curbing on the same streets for $.46 per lin. ft.

Washington.

The Lewis County Commissioners, Chehalis, Wash., are in favor of building three and one-half miles more of state aid road, to be part of the Cowlitz-Olympia road, which is a section of the Coast highway, north and south, also a part of state road No. 5. The road, 16 ft. wide, will be hard surfaced and it is estimated will cost $58,522.

A movement has been started in Ritzville, Wash., to pave the principal streets in the business district.

N. D. Miller, engineer in charge of the state highway, which it is proposed to build from Blaine to Vancouver, Wash., in company with County Engineer Lindbery is securing data that will be used in selecting the route for the state road.

The Board of Public Works of Spokane, Wash., has transmitted to the city council plans and specifications for grading Stevens St., from 14th to 17th Ave., estimated cost, $4,750; paving with oileroid, 7th St., Division to Bernard Sts., estimated cost, $10,300; grading 16th Ave., Crestline to Perry Sts., estimated cost, $6,750.

Wisconsin.

The Commercial Club of Proctor, Wis., has passed a resolution asking the board of public works to construct a good highway into that suburb.

Julius Thielman of Merrill and R. C. Thielman of Tomahawk have started a movement for the construction of a macadamized road through the state from Ashland to Milwaukee. The Business Men's association of Ashland is also interested.

City officials of Eau Claire, Wis., are planning the macadamizing of Gilbert Ave., from the Chippewa river to Farwell St., Oxford Ave., from Lake St. to Fulton St., and the extension of Wisconsin St., through the Northwestern Lumber Co.'s lumber yard, with brick. Brick pavement is also to be laid on Railroad St., from N. Barstow St., west.

The common council of Burlington, Wis., has ordered the following streets paved next year, for which bids will be called next spring: P. J. Hurtgen, City Engineer: Pine St., from Mill to Kendall, 2,600 sq. yds. of cement pavement and 1,493 lin. ft. of cement curb and gutter; Pine St., from Madison to Adams, 2,438 sq. yds. of cement pavement and 1,060 lin. ft. of cement curb and gutter; Jefferson St., from Pine to Soo Line Ry., 1,888 sq. yds. of cement pavement and 1,016 lin. ft. of cement curb and gutter; Chestnut St., Mill to Kendall, 2,656 sq. yds. of cement pavement and 1,427 lin. ft. of cement curb and gutter; Pine St., Geneva to Mill, 1,269 sq. yds. of brick pavement and 500 lin. ft. of cement curb and gutter; Chestnut St., from Geneva to Mill, 1,458 sq. yds. of brick pavement and 580 lin. ft. of cement curb and gutter; McHenry St., from Geneva to a point 242 ft. south of Liberty St., 2,218 sq. yds. of brick pavement and 1,084 lin. ft. of cement curb and gutter.

WATER-WORKS AND SEWERAGE

Alabama.

Consulting Engineer Morris Knowles, employed by the city of North Birmingham, Ala., to examine the water works of that city, has submitted his report on the same to the city council. He estimates the value of the plant [illegible]

California.

✣Bids will be received after January 3, by City Council of Monrovia, Cal., for the construction of the new sewer system, estimated [illegible]

⊙The contract for the drilling of the proposed well on the Perris donation, near the Perris reservoir site in San Bernardino, Cal., has been awarded to J. William Smith by the water commissioners for $5,600.

The Imperial County Supervisors, El Centro, Cal., have granted the city trustees of Brawley, Cal., permission to lay a sewer line in [illegible] New River. The proposed sewer system will be installed before next summer.

The citizens of Sierra Madre, Cal., voted Dec. 13 the issuance of bonds in the sum of $40,000 to increase the water supply and establish a system of fire protection.

City Engineer F. C. Turner of Oakland, Cal., is preparing plans to put in an intercepting sewer system along the water front to collect the sewage from western flowing sewers.

Colorado.

City Engineer H. R. Oliver of Fort Morgan, Colo., has estimated the cost of the new sewer in Fulton Heights addition to the city at $7,328. Maps, specifications and other data have been prepared and accepted by the City Council. Bids will be advertised for on the specifications of the engineer.

Connecticut.

The water commissioners of Hartford, Conn., have made arrangements for establishing a pump at the Wild Cat Brook for pumping water into the Burlington pipe line.

Frank C., Robert J. and Watson S. Woodruff, all of Orange, Conn., have petitioned the legislature for the incorporation of the Orange Water Co.

Georgia.

⊙The sewerage and water board of Atlanta, Ga., has awarded the contract for supplying the 50,000 barrels of lime to the Lagarde Supply & Fertilizer Co., Ltd., for $4.48 per ton. S. T. Weedring is president of the company and J. W. Gardner of Lake Charles is vice president.

Kaig & Puryeor of Dalton, Ga., have been awarded the contract by the city of Dalton for the construction of a system of sanitary sewers. The work will include approximately 6 to 9 miles of pipe sewers from 8 to 15 in. in diameter and disposal plants complete. H. S. Jaudon Engineering Co., Box 582, Savannah, Ga., and Box 576, Atlanta, Ga., Engineers.

✣ [illegible] now open for bids ⊙ indicates a contract let recently.

Illinois.

✣Bids will be received until 11 a. m., Dec. 28, 1910, by the Board of Local Improvements, Chicago, Chas. A. V. Standish, for paving 28 streets and alleys and also for constructing ½ mile of house drains.

⦿Following contracts were awarded by the Board of Public Improvements, Chicago, Ill., Chas. A. V. Standish, Secy., in connection with sewer construction, for which bids were opened Dec. 12; itemized specifications appeared in Dec. 7 issue of ENGINEERING-CONTRACTING: East 104th St., Christino Tosco, 814 Des Plaines St., $2,036; Balmoral Ave., Jos. Daviaino, $3,818; Manistee Ave., Thos. Burke, 4648 McLean Ave., $4,992; Phillips Ave., Christino Tosco, $3,438; N. 40th Ave., Christino Tosco, $5,519; W. 40th St., American Engineering & Construction Co., 112 S. Clark St., $72,988. Low bidders and their itemized bids appeared in ENGINEERING-CONTRACTING of Dec. 21.

The village board of Upper Alton, Ill., has authorized the board of public improvements to proceed with the contracts for the construction of a sewer system. Four septic tanks will be installed. The entire system will cost between $50,000 and $60,000.

The city council of Hoopeston, Ill., has accepted plans as prepared by Civil Engineer Frank Payne of Danville for the construction of a drainage sewer system. Robert Rodman is city attorney.

Indiana.

✣Bids will be received by the Board of Public Works, Gary, Ind., for building the following sewers: 3,120 ft. 60-in. brick sewer, 3,160 lin. ft. of 54-in. brick sewer, 2,055 lin. ft. 36-in. brick sewer, 3,320 lin. ft. 20-in. pipe sewer, 6,540 lin. ft. 24-in. brick sewer, 3,900 lin. ft. of 8-in. pipe sewer, 12 manholes, 5 catch basins, 4 gutter inlets. Harry G. Moose is City Clerk.

The city of Jasper, Ind., contemplates the installation of a sewer system at an estimated cost of $25,000. The sewer board has had surveys and blue prints made for the system.

The Board of Public Works of Fort Wayne, Ind., has accepted a plat of Shawnee Place addition and arrangements have been made to construct sewers and generally improve the tract of ground, which is located between Webster St. and Hoagland Ave., and Killea St. and Wildwood Ave.

Iowa.

✣Bids will be received until Dec. 31, by City Clerk, Sutherland, Ia., for the construction of 850 ft. of sewer and four manholes along Pine St., in the incorporated town of Sutherland, Ia.

Property owners on Second St., Clinton, Ia., have petitioned the City Council for the construction of a sewer on that street.

Property owners of Ninth and Tenth Aves., in Clinton, Ia., have petitioned the City Council to construct a sewer in district No. 4.

An ordinance has been passed by the City Council of Grundy Center, Ia., for the building of a sewer in the business district.

Councilman G. B. Healy, of Sioux City, Ia., has been authorized by the City Council to advertise for bids for water pipe for use in 1911.

The citizens of Boone, Ia., on Dec. 12, voted voted the issuance of bonds in the sum of $105,000 to build a pipe line to the Verdigris River.

The town of Steamboat Rock, Ia., will soon install a water works system.

Kansas.

The citizens of Cherryvale, Kan., on Dec. 20, voted the issuance of bonds in the sum of $105,000 to build a pipe line to the Verdigris River.

The City Council of Scammon, Kan., has decided to extend the water mains in the north part of the city so that persons living on Perry and Keith Sts. will be provided with city water. It is estimated the extension will require 1,200 ft. of 2-in. pipe.

Kentucky.

State Sanitary Inspector Paul Hansen has approved the proposed sewer system for Winchester, Ky. The estimated cost of the system is $10,000.

Louisiana.

The city council of Napoleonville, La., has authorized the water works committee to make all necessary repairs to the water works plant. A new pump will be bought and a pipe line running to the bayou will also be started.

Massachusetts.

Bids were opened Dec. 14 at Pittsfield, Mass., for the construction of the Farmham dam and reservoir. Winston & Co., 290 Broadway, New York City, being the low bidder at the following bid:

10	acres clearing	$ 75.00
47	acres clearing and grubbing	125.00
10,000	cu. yds. earth excav., Class A	.90
11,500	cu. yds. earth excav., Class B	[illegible]
37,000	cu. yds. earth excav., Class C	[illegible]
12,500	cu. yds. earth excav., Class D	[illegible]
9,000	cu. yds. earth excav., Class E	[illegible]
3,200	cu. yds. earth excav., Class F	[illegible]
1,500	cu. yds. rock excav., Class A	2.00
2,900	cu. yds. rock excav., Class B	2.00
1,500	cu. yds. rock excav., Class C	4.00
700	cu. yds. rock excav., Class D	2.50
3,000	cu. yds. rock excav., Class E	2.50
60,000	cu. yds. overhaul, 100 ft.	.02
400	cu. yds. mass concrete, Class A	[illegible]
1,000	cu. yds. mass concrete, Class B	[illegible]
850	cu. yds. mass concrete, Class C	[illegible]
1,400	cu. yds. mass concrete, Class D	[illegible]
22,000	cu. yds. Cyclopean masonry, Class A	6.00
15,000	cu. yds. Cyclopean masonry, Class B	5.50
2,000	cu. yds. Cyclopean masonry, Class C	[illegible]
2,000	cu. yds. concrete blocks, Class A	12.50
1,300	cu. yds. concrete blocks, Class B	12.00
650	cu. yds. concrete blocks, Class C	11.50
600	sq. yds. granolithic surfacing	.75
1,300	cu. yds. paving	2.00
600	tons placing iron and other metal work	40.00
2,000	lin. ft. furnish. and lay. 12-in. vit. pipe	.70
500	lin. ft. furnish. and lay. 20-in. vit. pipe	1.10
1,500	lin. ft. furnish. and lay. 24-in. vit. pipe	1.60
27	M. ft. B. M. furn. and placing spruce lumber	[illegible]
	Gate house superstructure (lump sum)	[illegible]
	Total	$399,600

Maryland.

⦿The contract for wiring the sewerage pumping station, on East Falls Ave., in Baltimore, Md., has been awarded to the Central Electric Co., by the board of awards for $3,526.

Michigan.

⦿Johnson & Van Dyke of Kalamazoo, Mich., have been awarded the contract for the construction of the Fulford St. sewer by the City Council of that city, for $14,920, with $25 additional for each manhole.

Minnesota.

✣Bids will be received until 2 p. m., December 29, by Board of Public Works, St. Paul, Minn., for the construction of a sewer on Richmond St. from Seventh St. to the right of way of the Chicago, Milwaukee & St. Paul Ry. R. L. Gorman is Clerk of the Board.

✣Bids will be received until 2 p. m., Jan. 3, by the Board of Public Works, St. Paul, Minn., for the construction of a sewer in Park Ave., from Acker St. to Sycamore St. R. L. Gorman is Clerk of the Board.

Petition for a sewer on 23rd Ave., between Franklin and 22nd Ave., in Minneapolis, Minn., has been presented to the City Council.

The city of Minneapolis, Minn., will build two sewer tunnels after Jan. 1 at an expense of $8,500. One is to be at the foot of Lake St., and the other on Meeker's Island.

The City Council of Duluth, Minn., has been petitioned for sanitary sewers in [illegible] St., between 57th and 59th Aves., [illegible] alley between Elinor St. and Grand Ave., [illegible] alley between Ramsey and Wadena Sts. The Council has instructed the city engineer to prepare estimates of the cost of a sewer system in the vicinity of Eighth St., between 37th and 43rd Aves. west.

The citizens of North Mankato, Minn., voted Dec. 22 on the proposition of issuing bonds in the sum of $20,000 for the construction of a water works system for the village.

Missouri.

The board of public improvements of St. Louis, Mo., has introduced bills in the City Council to authorize the construction of the proposed [illegible] sewer in Forest Park. The sewer is to be in three sections, and will extend from the mouth of the Blackstone sewer to the River des Peres at Rosedale Ave., several thousand ft. through the world's fair section of the park. The cost, including a pumping station and building, is about $71,000.

The Board of Public Works of St. Joseph, Mo., has ordered an ordinance drawn for a sewer in district No. 199, beginning at 20th St., and Doniphan Ave., extending in 20th St., to Pacific St., and from 20th to 22nd. The estimated cost is $1,918.

The city of Hopkins, Mo., contemplates the construction of a municipal water works plant. G. E. Denlin is mayor.

Montana.

[illegible] has begun a preliminary examination of the [illegible] for the installation of a new sewerage system. The state board of health recently ordered this city to stop polluting Ashley Creek.

Nebraska.

City Engineer [illegible] of Lincoln, Neb., has been instructed by the city council to prepare plans and specifications and an estimate of cost for a sewer in district No. 107.

The village of Cortland, Gage County, Neb., is taking steps toward securing a system of water works and electric lights. A committee has been appointed by the city board to ascertain the probable cost of the system. A special election will probably be called to vote on bonds for this work.

The city of Fairbury, Neb., has purchased the water plant of the Fairbury Electric Light & Power Co., for a consideration of $92,500. Bonds were recently voted in the sum of $135,000 for this purpose. The balance of the bond issue will be spent in new improvements and extensions. G. W. [illegible] is superintendent of the plant.

New Jersey.

Mayor Louis M. Brock of Kearny, N. J., states that that town is almost ready to sign a contract with the Passaic Valley Sewerage Commission to sewer into the trunk flume.

The Nutley, N. J. town council has appropriated $1,200 to engage engineers to make a map of the town, with a view to ascertaining the cost of laying street sewers and getting at methods of collection and disposal.

City Engineer Harold Harder of West Paterson, N. J., is preparing plans for the proposed sewers that are to be placed in West Paterson. The main sewer is to run from Prospect St., through Spruce St., and up the turnpike to West 13th St. At this point it will be taken under the river by a tunnel in order that the Second ward may be drained. The main sewer will continue up the turnpike to the city line. All the side streets will have smaller sewers.

The state board of health of New Jersey has ordered the city of New Brunswick to cease polluting the Raritan River by emptying sewage therein on or before July 1, 1911. John J. Morrison is mayor.

The city of Camden, N. J., has been notified by the state health department to stop depositing its sewage in the Delaware River. According to the notice the city must have its sewage diverted before Sept. 1, 1912.

Mayor [illegible] of West Paterson, N. J., [illegible]

New York.

✣The plans and specifications for the Harbor brook intercepting sewer improvement work, prepared by Engineer Glenn D. Holmes and Secretary [illegible], have been approved by the [illegible] of Syracuse, N. Y. Bids for the work will be received until Jan. [illegible]

•[illegible] of Syracuse, N. Y., [illegible] by the sewer commissioners of East Syracuse,

✣ indicates work now open for bids. • indicates a contract let recently.

N. Y., for the construction of the intercepting sewer on the south side of the village for $4,371

⊙C. S. Miller & Sons, of Utica, N. Y., have been awarded the contract by the city of Lawrence, Mass., for furnishing to the water board 300 ft. of 4-in. pipe, 5,000 ft. of 6-in. pipe, 5,000 ft. of 8-in. pipe, 1,000 ft. of 12-in. pipe, 1,300 ft. of 12-in. pipe for $22.34 per net ton.

City Engineer John A. Giles of Binghampton, N. Y., and Sanitary Engineer George L. Robinson of New York City have completed the plans for the system of intercepting sewers for Binghampton. The whole system, including the disposal plant, it is estimated will cost $320,000.

The engineers of the bureau of sewers of the Borough of Queens, New York City, have prepared a comprehensive map for a proposed sewer system for the entire northerly half of the town of Newtown, north of Maspeth, Ridgewood and Glendale, and comprising 7,500 acres exclusive of streets, and including Corona, Elmhurst and Bowery Bay. Nelson P. Lewis is chief engineer of the board of estimate.

Albert R. Perkins of Albany, division engineer, has been engaged by the city of Auburn, N. Y., to inspect conditions and examine data collected by Supt. J. Walter Ackerman of the municipal water department with relation to the development of Owasco Lake water power.

The citizens of Fairport, N. Y., on Dec. 7 voted against the proposition of issuing bonds in the sum of $1,000 for the services of an engineer to draw up plans for the new sewer system.

The city of Corona, N. Y., contemplates the construction of a sewer system. D. W. Foley is interested.

The village trustees of Albion, N. Y., have entered into a contract with Witmer & Brown of Buffalo, N. Y., to examine the existing water works. The contract calls for the preparation of plans showing what improvements and extensions should be made to put the existing plant into modern and efficient condition and as to what it would cost to duplicate the plant new.

City Engineer John A. Giles of Binghamton, N. Y., has submitted the plans of the proposed intercepting sewer system which will serve a large section of the city, to the state department of health for its approval. Plans prepared by Engineer George L. Robinson for the sewage disposal plant have also been submitted to the health department.

The board of trustees of Yorkville, N. Y., has adopted a resolution directing Engineer W. G. Stone to readvertise for bids some time this month for the construction of a sewer [illegible]

North Carolina.

⊙Contract has been let to the Edwards Construction Co., of Hickory, N. C., for building a sewage disinfecting plant of 500,000 gal. capacity at Rocky Mount, N. C. White & Piatt of Durham, N. C., are engineers.

⊙J. W. Hass of Charlotte, N. C., has been awarded the contract by the city of Tarboro, N. C., for building a sewage disinfecting plant of 60,000 gal. capacity, and laying 2,000 ft. of 12-in. sewer, for which White & Piatt, consulting engineers of Durham, N. C., are engineers.

⊙The Clarendon Construction Co. of Wilmington, N. C., has been awarded the contract by the board of public works commission of Fayetteville, N. C., for furnishing and installing two filter units of 500,000 gals. per day each, with all machinery and appurtenances connected therewith; the construction of [illegible] basin, filtered water well, etc.; construction complete of a brick filter and power building The amount of the bid is $12,858. John K. Strange of Fayetteville is Engineer. Bids were opened Dec. 15.

Plans and specifications are being prepared by White & Piatt, consulting engineers of Durham, N. C., for the construction of electric light and sewer systems for Smithfield, N. C. [illegible] cludes an auxiliary pumping station, reinforced concrete filter and reservoir.

White & Piatt, Consulting Engineers, Durham, N. C., are preparing plans for the installation of a water works plant for Jonesboro, N. C., to cost about $25,000.

Ohio.

⊙The Board of control of Youngstown, O., has awarded the contract for the construction of a sewer in Poland Ave., between Cedar St. and Flint Hill Ave., to William Hynes for $1,116.

The water department of Cleveland, O., will construct a water main to a point 570 ft. above the lake level to the Warrensville farm. The pipe will be 16-in. in diameter.

Advices from Springfield, O., states that Chief Engineer M. J. Bahin and his corps of engineers have started running new lines and getting additional data on the proposed storm sewer, which is to relieve the southern section of the city. Sanitary and combined storm water sewers are to be laid in Sheridan, Belmont, Harrison, Clairmont, Douglas and Arlington Ave. Others sewers, which are to be worked out this winter and started next spring are: Fremont Ave., between Limestone and Clifton Ave.; Pearl, Fremont, Clifton Ave., Rose and Catherine Sts., in one chain of sewers; another chain in the west end—Walter, Snyder, Maiden Lane, Western Ave., and Cedar and Lawry Ave. drain; Innisfallen Ave., between Jackson and Yellow Springs St.

The City Council of Marietta, O., has passed an ordinance to proceed with the construction of a sanitary sewer in the northern part of the city on upper Fifth, Sixth, Seventh, Montgomery, Marion and Fulton Sts.

Work has just been started on 14 miles of sewer work in Bellefontaine, O., by Contractors W. A. McDowell & Son, of Cleveland and Elmer McConnell of Kenton. The work is being done under the supervision of Consulting Engineer H. E. Riggs of Toledo, O.

A bid of $110,000 per engine was received by the city of Cleveland, O., Dec. 12, on the contract for supplying the water works department with two pumping engines for use at the Kirtland pumping station. The bid was submitted by the Holly Manufacturing Co., of Buffalo, N. Y., and was the lowest of 10 bids received. The two engines will each have a capacity of 25,000,000 gals. per day.

The city of New Carlisle, O., has sold bonds to the amount of $20,000 for the construction of a water works.

The state board of health of Ohio has instructed the city of Bucyrus to prepare plans and specifications for the construction of a sewage disposal plant. The plant will probably be built next spring.

The city council of Springfield, O., is considering plans for the construction of the south side storm sewer. The sewer is to be laid through the Perrin land out to Mill creek. P. J. Ihrig is chairman of the council. William Mahoney is city clerk.

Oklahoma.

✣Bids will be received until Jan. 2 by C. A. Rees, 503 Flynn Ames Bldg., Muskogee, Okla., for 30,000 lin. ft. of sewer excavation; largest pipe 12-in.; average depth 5¾ ft.; 1,000 ft. between 9 and 11 ft. deep and 300 ft. between 11 and 14-ft.

✣Bids will be received until Jan. 2 by C. A. Rees, 503 Flynn-Ames Bldg., Muskogee, Okla., for furnishing and delivering the following material f. o. b. cars at Francis, Okla.: 10,260 ft. 4 in castiron pipe, weight 22 lbs. per ft.; 3,120 ft. 6 in. castiron pipe, weight 33 lbs. per ft.; 1,610 ft. 8 in. castiron pipe, weight 54 lbs. per ft., and all necessary castings; 4-6 in. gate valves; 4-8 in. gate valves; 30 double tap fire hydrants, for 2 ft. cover and connection with 4 in. pipe; 1 steel tower with 50,000 gal. tank, 100 ft. from top of foundation to top of tank. Also quote difference in price on 75 ft tower with 75,000 gal. tank; 2 compound Duplex, non-condensing pumps, 500,000 gals. each per day to work against a pumping pressure of 300 lbs.; 2 Duplex roller feed pumps.

✣Bids will be received by C. A. Rees, 503 Flynn-Ames Bldg., Muskogee, Okla., until Jan. 2 for the furnishing and delivering of the following material f. o. b. cars at Walter, Okla.: 14,000 ft. 4 in. castiron pipe, weight 22 lbs. per ft.; 8,500 ft. 6 in. castiron pipe, weight 33 lbs. per ft.; 3,000 ft. 8 in. castiron pipe, weight 45 lbs. per ft.; 324 ft. 10 in. castiron pipe, weight 60 lbs. per ft., and the necessary special castings; 18-4 in. gate valves and boxes complete; 8-6 in. gate valves and boxes complete; 4-8 gate valves and boxes complete; 2-8 in. check valves; 30 double tap fire hydrants for 2 ft. cover for connecting with 4 in. pipe; 1 steel tower with 60,000 gal. tank, 120 ft. from top of foundation to the top of tank; 1 125 H. P. Standard return tubular boiler and stack No. 10 and 12, 40 ft. with breeching; 1 250 H. P. open type feed water heater; 2 compound, non-condensing duplex water works pumping engines, 500 gals. per min. at 100 lbs. pressure at pump.

✣Bids will be received until Jan. 2 by C. A. Rees, 503 Flynn-Ames Bldg., Muskogee, Okla., until Jan. 2 for furnishing and delivering the following material f. o. b. cars at Ralston, Okla.: 5,300 ft. 4 in. castiron pipe, weight 22 lbs. per ft.; 1,500 ft. 6 in. castiron pipe, weight 33 lbs. per ft.; 600 ft. 8 in. castiron pipe, weight 45 lbs. per ft., and all necessary special castings; 4-6 in. gate valves; 4-8 in. gate valves; 27 double tap fire hydrants for 2 ft. covers and connection with 4 in. pipe; 1 steel tower and 50,000 gal. tank, 87 ft. from top of foundation to top of tank; 1 75 H. P. gasoline or solar oil engine. (Bids on engine must include a guarantee to trustees for the term of one (1) year for its efficiency and construction; also furnish man to set and adjust engine and operate same for a period of ten (10) days.
city clerk.

✣Bids will be received until 9 a. m., Jan. 3, by Bob Parman, City Clerk, Oklahoma City, Okla., for the construction of a lateral sewer in Block 8, of the Original Plat of Capi Hill, as described in Ordinance No. 140. In certain portions of Miller's Boulevard Addition: Shartel Boulevard Addition, West End Subdivision and Stanley Heights Addition, as described in Ordinance No. 1408. In certain portions of Northeast Highland Second; Rolane Addition; a portion of Barrow's Addition, and Madison Park Addition, as described in Ordinance No. 1409. In blocks 7 to 14, inclusive, of Schilling's Addition, as described in Ordinance No 1410. In blocks 2 and 3 of a subdivision of blocks 1 and 2, Dittmer Heights Addition, as described in Ordinance No. 1411. Certain portions of College Hill Addition and St. Mary's Academy Grounds as described in Ordinance No. 1412. In blocks 6, 7, 14, 15 of the Original Plat of Capitol Hill, as described in Ordinance No. 1413.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, has completed plans for the disposition of the sanitary sewage of Muskogee, Okla. The approximate cost of the improvement is $100,000.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, has furnished the city of Oklahoma City, Okla., with plans for an additional water supply by means of a 3,200-acre reservoir, seven miles from the city, and the same have been accepted by the city council. Mayor Lackeye has been authorized to call a special election to vote $1,200,000 in bonds for the system. The election will be called in January. The reservoir when full will contain 7,500,000,000 gals. Bob Parman,

The Attorney-General of Oklahoma, Guthrie, Okla., has approved the following bonds: Fort Townson waterworks bonds, $13,000; Yukon sewer bonds, $10,000; Yukon waterworks, $30,000, and Shawnee sewer system, $50,000.

The attorney general at Guthrie, Okla., has approved the following bond issues: El Reno, Okla., for high school purposes, $75,000; Bridgeport, Okla., for water works, $6,000; Hominy, Okla., for water works, $25,500; Hominy, for sewer system, $10,500.

The city of Manchester, Okla., contemplates the issuance of bonds for the installation of a water works system.

The citizens of Lamont, Okla., recently voted bonds in the sum of $17,000 for the purpose of erecting a city water works plant.

✣ indicates work now open for bids. • indicates a contract let recently.

Oregon.

✣Bids will be received until 4 p. m., Jan. 10, by Board of the City of Portland, Ore., for furnishing and delivering at Portland, Ore., the following approximate quantities of cast iron water pipe and special castings, viz: 700 lengths of 30-in. cast iron pipe, estimated weight, 1,383 tons; 1,000 lengths of 16-in. cast iron pipe, estimated weight, 745 tons; 1,000 lengths of 12-in. cast iron pipe, estimated weight, 485 tons; 300 lengths of 10-in. cast iron pipe, estimated weight, 114 tons; 10,000 lengths of 8-in. cast iron pipe, estimated weight, 2,875 tons; 1,000 lengths of 6-in. cast iron pipe, estimated weight, 190 tons; total weight, 5,792 tons. Special castings for cast iron pipe, 400,000 lbs. Specifications and form of proposal can be obtained at the office of D. D. Clarke, Engineer of the Water Board, City Hall, Portland, Ore. Bidders must state the price of pipe per ton of 2,000 lbs., and the price of special castings per pound, all delivered f. o. b. cars, Albina Yard, Portland, Oregon, and must also state the date when the delivery of pipe and specials to be commenced. Delivery of pipe and specials to continue at the rate of not less than 300 tons per month, and be completed on or before August 1, 1911. The several sizes named are to be delivered in the order designated by the Engineer.

✣Bids will be received until 4 p. m., Jan. 10, by Board of the City of Portland, Ore., for furnishing and delivering at Portland the following gate valves for cast iron water main: 20 4-in. valves, 350 6-in. valves, 250 8-in. valves, 15 10-in. valves, 10 12-in. valves, 8 30-in. valves, to operate horizontally with bevel gear and indicators. 1 32-in. valve, to operate horizontally with bevel gear and indicator. 1 52-in. valve, to operate horizontally with bevel gear and indicator. Bidders must state the weight and price per valve of each size specified all delivered f. o. b. cars or dock, Albina, Portland, Oregon. Delivery must be made at the rate of one carload per month, beginning within 50 days after date of contract and be completed on or before July 1, 1911. The engineer shall specify the number of the various sizes to be delivered with each shipment. Specifications and form of proposal can be obtained at the office of D. D. Clarke, Engineer of the Water Board, City Hall, Portland, Oregon.

⊙Contract for the construction of the Holgate St. extension of the south branch of the Brooklyn sewer in Portland, Ore., has been awarded by the executive board to Paquet, Giebisch & Joplin, Portland, for $104,353. This sewer will benefit a large section of the East Side and will connect with the mother sewer at East 17th and Holgate Sts., where it will be 60-in. in diameter.

The citizens of Ashland, Ore., voted Dec. 14 against the proposition of issuing bonds in the sum of $170,000 to rebuild the municipal water plant.

A special election will be held in Gladstone, Ore., to vote upon the incorporation of the town. If incorporated, a water works, sewer system, electric light plant and the establishment of grades of the different streets will be agitated.

The city of Albany, Ore., voted Dec. 5 in favor of the proposition of issuing bonds to the amount of $40,000 for additional sewers.

The city of Lebanon, Ore., held an election Dec. 5 to vote on the proposition of issuing bonds in the sum of $70,000 for the construction of a sewer system.

Civil Engineer Louis C. Kelsey, Dooly Bldg., Salt Lake City, Utah, has been engaged by the city of Gresham, Ore., to prepare plans and specifications for the construction of a sewerage and water system for that city.

The citizens of Ashland, Ore., voted last week on the proposition of issuing bonds in the sum of $170,000 for the improvement of the water works system.

Pennsylvania.

✣Bids will be received until noon, Jan. 17, by Charles Straughn, County Controller, Pottsville, Pa., for general contract, including increased water supply, sewage disposal plant, power plant, elevator, heating, ventilating, plumbing and electric wiring complete for the construction of a building for the insane at Schuylkill Haven, Pa.

The Borough Council of North East, Pa., has purchased a two-acre plot of ground west of the borough, and operations will be begun at once in completing the partly formulated plans for a sewerage disposal plant. The plans for the sewer system will be drawn up by Borough Engineer C. C. Hill.

The city of Pottstown, Pa., contemplates retaining an engineer to prepare plans and specifications for the construction of a sewer system.

The Borough Council of Charleroi, Pa., has instructed the borough engineers to proceed with the preparation of plans and specifications for a joint sewage disposal plant for Charleroi and North Charleroi.

The city council of Lebanon, Pa., has retained Civil Engineer James Fuertes, 140 Nassau St., New York City, as consulting engineer for the planning of the disposal plant. The city recently voted bonds in the sum of $110,000 for sewerage improvements.

West Brownsville, Pa., borough council has let the contract for drawing up a comprehensive sewerage plan to J. B. Hogg of Connellsville. It is stated that a plan is being drawn preparatory to a system for sewage disposal.

Advices from Reading, Pa., state that the Conewago Township Water Co., York County, has been incorporated with a capital stock of $5,000.

The state board of health has approved the plans and specifications prepared by Borough Engineer R. E. Neumeyer of South Bethlehem, Pa., for the completion of a sewage disposal plant.

Information received from Pottsville, Pa., states that the North Manheim Water Co., will build a new water dam above the two dams now at Tumbling Run. This dam will tap the other two.

South Carolina.

✣Bids will be received until Noon, December 30 (postponed from December 15), by town of Yorkville, S. C., for the mechanical gravity filtration plant with capacity of from 250 to 500 gals. per minute. Plant to be complete. Loss of head gages, controllers, pump and motor belts, pulleys, shafting ,hangers, ready for operation. A certified check for $250 must be filed with each bid. John G. Barnwell is superintendent of water works.

South Dakota.

✣Bids will be received until 8 p. m., January 9, by F. W. Raymond, City Auditor, Aberdeen, S. Dak., for the construction of sewer extensions amounting to approximately 2,900 ft. of 12-in.; 700 ft. of 15-in.; and 2,000 ft. of 20-in. pipe, and 14 manholes. Plans and specifications and forms for proposals can be obtained of city engineer.

Advices from Canton, S. Dak., state that plans are being perfected for a more complete sewerage system for the Indian asylum, located at that place.

The City Council of Aberdeen, S. Dak., has passed a resolution providing for a special election for Jan. 10, to vote on the proposition of issuing bonds to the amount of $100,000 for the extension of sewer disposal system of the city. R. B. Easton is city engineer.

The citizens of Madison, S. Dak., voted Dec. 7 in favor of issuing bonds for the construction of a complete sewerage system.

Petitions are being circulated in Aberdeen, S. Dak., asking the city council to call a special election for the purpose of issuing bonds to the amount of $200,000 for sewage disposal purposes. It is proposed to run the city sewage to septic beds situated on an 80 acre tract a mile south of town.

Tennessee.

The Park City council, Knoxville, Tenn., is considering profiles for additional sewer work which is to be done in the fifth ward, and which calls for an extension of the Washington Ave. main sewer and several laterals.

Texas.

✣Bids will be received until 6 p. m., Jan. 3, by Walter Burgess, City Secretary, Corsicana, Texas, for the construction of 13,200 ft. of additional sewer main, average depth 10 ft., for the city. A certified check for 10 per cent the amount bid must accompany each proposal.

⊙It is reported that A. C. Falligant has been awarded the contract by the city of Galveston, Tex., for the construction of a vitrified pipe sewer lateral in the alley between Avenue O½ and Avenue P from the present terminus on 20th St. to the center line of 19th St., and in the alley between Avenue P½ and Avenue Q from a point 60 ft. east of Tremont St. to a point 70 ft. west of the west line of 21st St. The bid was as follows: 1,300 lin. ft., of 8-in. pipe sewer, $.87½ per lin. ft.; 1,300 lin. ft. of 2-in. by 8-in. by 16-ft. running board, 3¾c per per lin. ft.; fifty-two 6-in. Y, branch T, curve or any special in addition to price of straight, if on 8-in. pipe, 70c each; four manholes for an 8-in. sewer, $37 each.

Consulting Engineer F. L. Dormant of Houston, Tex., is preparing plans for a storm water lateral along McGowen Ave., from Main St. to a connection with the Austin St. sewer.

The City Council of Honey Grove, Tex., has granted to Messrs. Whatley & Duff, of Greenville, Tex., a franchise to construct, operate and maintain a sewer system in that city.

Plans are on foot in Corpus Christi, Tex., for the installation of sewers in the downtown portion of the city. A bond issue to the amount of $140,000 was recently voted for this purpose.

The City Council of Paris, Tex., has retained F. H. Lancashire of Dallas, Tex., to make a detail report on ways and means of improving the water pumping plant and building a municipal street lighting plant. Ed. H. McCuistion is mayor.

The Royse Water Co., of Royse, Rockwall County, Tex., has been incorporated with a capital stock of $2,000. The incorporators are Fred Mercer, W. C. Weeden, C. E. Russell and others.

The city of Polytechnic, Tex., contemplates the construction of a municipal water works plant at an estimated cost of from $30,000 to $32,000. Civil Engineer John Mead has been retained as engineer.

The City Council of Georgetown, Tex., has retained F. H. Lancashire of Dallas, Tex., to make plans and specifications and advise as to the reconstruction of the old lighting and water plant. Bonds recently voted to the amount of $45,000 have been sold. R. E. Ward is mayor.

The San Antonio Water Co., of San Antonio, Tex., is preparing to add to its system of mains to give additional service and strengthen the present system. The company recently awarded a contract to J. H. Potopowitz for 1,500,000 lbs of mains, consisting of six, eight, ten, and twelve-inch piping, to be delivered at once.

The citizens of Rusk, Tex., at an election held Dec. 12 voted the issuance of bonds for the construction of a waterworks. The city will put in the waterworks, issue bonds and sink a deep well.

Owing to the water famine that has prevailed for several months in Dallas and other towns of North Texas, the municipal authorities of those towns have inaugurated a movement to obtain from the next legislature a large appropriation for the construction of water storage reservoirs in different parts of the state. It is estimated by the promoters that from $50,000,000 to $100,000,000 will be necessary to meet the demand for a all-the-year water supply.

The city of Pecos, Tex., will vote shortly on the proposition of issuing bonds to the amount of $25,000 for the construction of a sewer system. O'Neil Engineering Co., Dallas, Tex., is Engineer.

The city council of Bryan, Tex., has made arrangements to extend the water mains in the eastern part of the city more than 2,000

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ft. The extension includes Allen academy and furnishes protection for that institution.

According to an announcement made by the Commercial club of Stamford, Tex., that city will install a new reservoir, which will hold 314,000,000 gals. of water and drains an area of 2,214 acres.

The citizens of Princeton, Collin County, Tex., have organized the Princeton Waterworks Co., to sink a deep well. The following officers were elected: J. W. Godwin, president; J. H. Stinson, vice president; C. A. Wilson, secretary and treasurer. About $4,000 worth of stock has been sold to date.

Advices from Houston, Tex., state that Consulting Engineer F. L. Dormant is preparing plans for a storm water lateral sewer along McGowen Ave., from Main St. to a connection with the Austin St. sewer.

Utah.

✣Bids will be received until 7:30 p. m., December 30, by Board of Public Works, H. G. McMillan, Chairman, Salt Lake City, Utah, for the work of constructing pipe sewer in Sewer Extension No. 286 in Strong's Court north from Fourth South, between Eighth and Ninth East Sts. Plans and specifications are on file at the office of the city engineer.

Virginia.

✣Bids will be received until noon, Jan. 4, by R. T. Gordon, Clarksville, Va., for the construction of 13 miles of soil road near Clarksville.

The common council of Norfolk, Va., has started negotiations for the purchase of property required by the water department in Princess Anne county for a canal between Lake Bradford and the pumping station of the city works. The board of control at the same time purchased a dredge outfit to build the canal at a cost not exceeding $5,000.

Washington.

The Oregon-Washington Corporation has been organized in the state of Washington with a capital stock of $5,000,000, to take over the Vancouver Water Co., the Vancouver Gas Co., the Vancouver Railway Co., the Hillsboro Water and Light systems, the Forest Grove Lighting system, and several other similar properties in both states. The incorporators are: A. Welch of Portland, Ore.; E. W. Mall, Henry Fleischhaeur, R. M. Boykin, C. M. Berryman and A. J. Pitkin, also of Portland, and Isaac Anderson of Tacoma, Wash. Sinkler Bros. of Philadelphia, Pa., are interested.

The sinking fund board has been instructed by the City Commission of Tacoma, Wash., to advertise for the sale of $1,500,000 worth of Green river bonds. Bids will be received until February 11.

Dr. M. B. Grieve, city health officer, Spokane, Wash., has filed a communication to the city council recommending the construction of the Fifth ward sub-trunk sewer, No. 10.

The citizens of Ellensburg, Wash., voted Dec. 6 in favor of the proposition of issuing bonds to the amount of $300,000 to build a municipal water system. Plans prepared by City Engineer G. N. Miller call for the construction of a 16-in. pipe line from Lake CleElum, in the upper part of Klickitat County, to Ellensburg. This would furnish approximately 2,500,000 gals. daily. Surveys for the system have been completed. F. Craig is mayor.

The Sound Construction & Engineering Co., of Seattle, Wash., and Caughren & Woldson of Spokane, Wash., at $343,347 and $384,853, respectively, were the only bidders Dec. 6 at Tacoma, Wash., for the construction of the city's McMillian reservoir, which will have a capacity of 100,000,000 gals. The bids were rejected as being above the estimate of City Engineer W. C. Raleigh, which was $310,000. The following work would be necessary to complete the reservoir: Clearing, 53.09 acres; grubbing, 25.34 acres; excavation of earth [illegible] cu. yds.; concrete, B, 8,500 cu. yds.; puddling, 100 cu. yds.; steel reinforcing bars, 5,000 lbs.; structural steel, 15,128 lbs; refined asphaltum, 160,000 lbs. [illegible] waterproofing compound, 143,000 lbs.; iron, 100 lbs.; washout and regulating gates, 5; gate houses, 3; fish screens, 14 sections; circular sluice gates, 7; gauge boards, 3; steel pipe, 35.5 lin. ft.; cast iron pipe, 90 lin. ft.; reinforced concrete pipe, 860 lin. ft.; drain tile, 6-in., 11,700 lin. ft.; drain tile, 8-in., 1,300 lin. ft.; lumber, 8,000 ft. B. M.

Information is obtained that an option has been given by the present owners of the Olympia water works, Olympia, Wash., to George H. Tilden & Co., of Seattle, representing other parties.

Preliminary plans have been completed by City Engineer Morton Macartney of Spokane, Wash., for the proposed combination storm drain and sanitary sewer for Union Park. It is planned to divide the park into three districts. The proposed route is as follows: Beginning at the corner of Havana and Hartson, running east on Hartson to Smith, north on Smith to Fourth, east on Fourth to Madelia, north on Madelia to Third, east on Third to Perry, thence in a northwesterly direction to the corner of Sprague and Erie, crossing Second, Pacific, Ivory St. and First thence north on Erie to an outlet in the Spokane river. The estimated cost of the improvement is $314,000.

The board of public works of Spokane, Wash., has decided to readvertise for bids for the construction of the Lincoln Heights reservoir. Bids recently received were rejected on account of their wide difference in cost compared with the estimated cost of a reservoir built along the plans accepted by the city council. The estimated cost of the reservoir is $130,000.

The city of Vancouver, Wash., held an election Dec. 6 to vote on the proposition of issuing bonds to the amount of $314,000 for the installation of a municipal water system. It is proposed to bring the water from Lewis River, a distance of about 23 miles. J. P. Kiggins is mayor.

West Virginia.

✣Bids will be received until noon, January 2, by D. C. Griffin, Recorder of the City of Mannington, W. Va., for laying 18-in. sewer line from Burt Town Hill to Buffalo Creek. Plans and specifications are on file at the office of the city engineer.

Plans have been prepared by T. Chalkley Hatton of Wilmington, Del., for the construction of a new water works system for Romney, W. Va., at an estimated cost of $50,000. The work will include two pumps, gasoline engine, supply and distribution pipes of cast iron, valves, hydrants and concrete reservoir. City will hold an election Jan. 5 to vote on the proposition of issuing bonds for the construction of the system and if carried the contract will be let immediately. The water supply will be secured from springs about three miles from the city. John Linthicum is chairman of the water committee.

Wisconsin.

The Common Council of Stoughton, Wis., has adopted a resolution favoring the purchase of the Stoughton Mill Co. property for $18,700 for power purposes.

The city of Eau Claire, Wis., has under contemplation the construction of a trunk sewer for the Seventh ward.

The city of Rice Lake, Wis., has sold bonds to the amount of $13,000 for the construction of sewers.

The state railway commission of Wisconsin has issued an order fixing the valuation of the property of the Appleton Waterworks Co., Appleton, Wis., at $255,000. The city of Appleton contemplates purchasing the property.

The city council of Manitowoc, Wis., has declared its intention of appealing to the state railroad commission for condemnation of the water works plant for the purpose of purchasing the same.

Canada.

✣Bids will be received until noon, January 3, by City Clerk, North Vancouver, B. C., for supplying materials and constructing complete sanitary sewers on Esplanade, First, Second, Third Sts., Forbes Ave. main sewer from Keith road northerly to city limits, and on Eighth St. and Lonsdale Ave., from Forbes Ave. along Eighth to Lonsdale Ave., and along Lonsdale Ave. to 18th St. Plans and specifications can be obtained of George S. Hanes, City Engineer.

✣Bids will be received until 5 p. m., Jan. 5, by Canadian General Electric Company, Ltd., 212 King St., West, Toronto, Ont., for the construction of a power house on the water works dam, near Peterboro. Plans and specifications may be had at the office of the above mentioned company or the office of William Kennedy, Jr., Rooms 8 and 9 Y. M. C. A. Bldg., Montreal, Can.

⊙The Canada Foundry Co., of Toronto, Ont., has been awarded the contract by the board of control of Toronto for furnishing 303 ft. of rivetted steel pipe, 6-in. in diameter, for $4,378. Bids were opened Dec. 14.

Advices from Victoria, B. C., states that the committee appointed to report upon the cost of installing a sewage system between the city limits and Beaumont post office has reported the approximate cost of the work as outlined in the plans of Edward Mohun of the public works department, at $100,000.

The common council of Toronto, Ont., has decided to call a special election Jan. 2 to vote on the issuance of bonds to the amount of $824,400 for the construction of a system of storm overflow sewers.

TRADE NOTES.

The H. W. Clark Co., of Mattoon, Ill., manufacturers of the Clark meter box and water works appliances, contemplate the building of a new enlarged and modern factory, comprising both iron and brass machine shop and concrete works. The rapidly continuous increase of this company's business have made this move necessary in order to take care of its growing business and for providing for the manufacture of new appliances calling for special machinery and equipment. Building operations will commence in the early Spring.

The addition to the boiler shops of the J. I Case Threshing Machine Co., Inc., Racine, Wis., is just being completed. This is a building 60 ft. by 215 ft., which will be used exclusively for a stock room for the Case boiler shops. A boiler storage has been completed 230 ft. by 60 ft. This is equipped with a traveling crane for movement of boilers from one part of the building to another. Under the supervision of the architect for the Case Company, the above work has been undertaken and completed, also the remodeling of the Garfield warehouse, which is 100 ft. by 250 ft. and two stories high. This building, when the remodeling is completed, will be used as a machine shop. Machine shop facilities have not been adequate. As soon as the weather will permit other buildings will be put under construction by the Case architect and completed. The heavy business for the present year has necessitated all these changes.

Over 200 Eureka concrete mixers are now being used in New York City on construction work. Among the important jobs that the Eureka mixers have been used on exclusively are the new New York City Post Office at 8th Ave., 32nd to 33rd Sts., where three of these mixers were used for seven months under daily test. The Lehigh Valley R. R. Co. use Eurekas exclusively, and they are also used on Jackson Ave. station, of Central Railroad of New Jersey, in Jersey City, N. J. (W. A. L'Hommedieu & Co., contractors), and on McCoomb's Dam Park Sewer (E. A. Matthews, contractor), for the New York Central R. R. The machine on this work had to be approved by engineers of Borough of The Bronx, and engineers of the railroad company, who expressed themselves as being well satisfied of the tests that they made both of the mixing and measuring. The machines are manufactured by the Eureka Machine Co., Lansing, Mich., the eastern agents being W. V. Johnson & Co., 1 Madison Ave., New York.

PROPOSALS FOR DREDGE. — U. S. ENGINEER OFFICE, Vicksburg, Miss., Dec. 15, 1910. Sealed proposals for steel hull, self-propelling hydraulic dredge, steel pontons and pipe line, and also for the component groups thereof, including steel dredge hull, steel pontons and pipe line, upper works, steam plant, propelling machinery, electric plant, pumping engine condenser plant, and evaporator, sand pump, suction pump and ladder, cutter head, gear and engine, winches and refrigerating plant, will be received at this office until 12 m., January 18, 1911, and then publicly opened. Information on application. CLARKE S. SMITH, Capt., Engrs.

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